

Illustrated Handbook of Information and Knowledge Systems



ILLUSTRATED HANDBOOK OF
INFORMATION AND KNOWLEDGE SYSTEMS

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Information and Knowledge Systems



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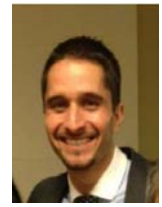
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GLOSSARY
OF SELECTED TERMS

Animation is a dynamic medium in which images or objects are manipulated to appear as moving images.

Application programming interface is a set of subroutine definitions, communication protocols, and tools for building software.

Automation can be defined as a technology concerned with performing a process by means of programmed commands combined with automatic feedback control to ensure proper execution of the instructions.

Big data analytics is the often complex process of examining large and varied data sets -- or big data -- to uncover information including hidden patterns, unknown correlations, market trends and customer preferences that can help organizations make informed business decisions.

Big data is a term used to refer to the study and applications of data sets that are too complex for traditional data-processing application software to adequately deal with.

Blog is a discussion or informational website published on the World Wide Web consisting of discrete, often informal diary-style text entries.

Business intelligence (BI) comprises the strategies and technologies used by enterprises for the data analysis of business information.

Business performance management is a set of performance management and analytic processes that enables the management of an organization's performance to achieve one or more pre-selected goals.

Capital flows refer to the movement of money for the purpose of investment, trade or business production, including the flow of capital within corporations in the form of investment capital, capital spending on operations and research and development (R&D).

Cloud computing is shared pools of configurable computer system resources and higher-level services that can be rapidly provisioned with minimal management effort, often over the Internet.

Cloud network is referred to a computer network that exists within or is part of a cloud computing infrastructure.

Computer system is a set of integrated devices that input, output, process, and store data and information.

Cryptojacking is a form of cyber attack in which a hacker hijacks a target's processing power in order to mine cryptocurrency on the hacker's behalf.

Cyberattack is any type of offensive maneuver that targets computer information systems, infrastructures, computer networks, or personal computer devices.

Cybercrime is crime that involves a computer. The computer may have been used in the commission of a crime, or it may be the target.

Cyberextortion is a crime involving an attack or threat of an attack coupled with a demand for money or some other response in return for stopping or remediating the attack.

Data hierarchy refers to the systematic organization of data, often in a hierarchical form.

Data management is the practice of organizing and maintaining data processes to meet ongoing information lifecycle needs.

Data modeling in software engineering is the process of creating a data model for an information system by applying certain formal techniques.

Database is an organized collection of data, stored and accessed electronically.

Database management system (DBMS) is system software for creating and managing databases. The DBMS provides users and programmers with a systematic way to create, retrieve, update and manage data.

Decision support system is an information system that supports business or organizational decision-making activities.

E-commerce is the activity of buying or selling of products on online services or over the Internet.

Electronic data interchange is the concept of businesses electronically communicating information that was traditionally communicated on paper, such as purchase orders and invoices.

Enterprise information management is a field of interest within information technology. It specializes in finding solutions for optimal use of information within organizations, for instance to support decision-making processes or day-to-day operations that require the availability of knowledge.

Enterprise resource planning is the integrated management of core business processes, often in real-time and mediated by software and technology.

Entity is something that exists as itself, as a subject or as an object, actually or potentially, concretely or abstractly, physically or not. It need not be of material existence.

Executive management is generally a team of individuals at the highest level of management of an organization who have the day-to-day tasks of managing that organization — sometimes a company or a corporation.

Graphical user interface, is a form of user interface that allows users to interact with electronic devices through graphical icons and visual indicators such as secondary notation, instead of text-based user interfaces, typed command labels or text navigation.

Hadoop is an open source distributed processing framework that manages data processing and storage for big data applications running in clustered systems.

Infographics are graphic visual representations of information, data or knowledge intended to present information quickly and clearly.

Information system (IS) is an organized system for the collection, organization, storage and communication of information.

Information technology is the use of computers to store, retrieve, transmit, and manipulate data, or information, often in the context of a business or other enterprise.

Infrastructure as a service refers to online services that provide high-level APIs used to dereference various low-level details of underlying network infrastructure like physical computing resources, location, data partitioning, scaling, security, backup etc.

Internet of things is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect, collect and exchange data.

Internet Protocol (IP) is the principal communications protocol in the Internet protocol suite for relaying datagrams across network boundaries.

Key performance indicator is a type of performance measurement. KPIs evaluate the success of an organization or of a particular activity in which it engages.

Local area network (LAN) is a computer network that interconnects computers within a limited area such as a residence, school, laboratory, university campus or office building.

Networking is the practice of transporting and exchanging data between nodes over a shared medium in an information system.

Online analytical processing is an approach to answering multi-dimensional analytical queries swiftly in computing. OLAP is part of the broader category of business intelligence, which also encompasses relational databases, report writing and data mining.

Platform as a Service (PaaS) is a category of cloud computing services that provides a platform allowing customers to develop, run, and manage applications without the complexity of building and maintaining the infrastructure typically associated with developing and launching an app.

Proprietary software is non-free computer software for which the software's publisher or another person retains intellectual property rights—usually copyright of the source code, but sometimes patent rights.

Ransomware is a type of malicious software from cryptovirology that threatens to publish the victim's data or perpetually block access to it unless a ransom is paid.

Relational Database is a set of formally described tables from which data can be accessed or reassembled in many different ways without having to reorganize the database tables.

Retention refers to employees' abilities to not only absorb and retain training or specialized skills, but to apply the learned skills to their job.

Software as a service is a software licensing and delivery model in which software is licensed on a subscription basis and is centrally hosted.

Standard operating procedure (SOP) is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations.

Statement of work (SoW) is a document routinely employed in the field of project management. It defines project-specific activities, deliverables and timelines for a vendor providing services to the client.

Supply chain management is the management of the flow of goods and services and includes all processes that transform raw materials into final products.

Tag is a keyword or term assigned to a piece of information (such as an Internet bookmark, digital image, database record, or computer file). This kind of metadata helps describe an item and allows it to be found again by browsing or searching.

Vendor is a party in the supply chain that makes goods and services available to companies or consumers.

Web 2.0 is the term given to describe a second generation of the World Wide Web that is focused on the ability for people to collaborate and share information online.

Web browser is a software application for accessing information on the World Wide Web.

Website is a collection of related web pages, including multimedia content, typically identified with a common domain name, and published on at least one web server.

Wide area network is a telecommunications network or computer network that extends over a large geographical distance/place. Wide area networks are often established with leased telecommunication circuits.

Wiki is a website on which users collaboratively modify content and structure directly from the web browser.

Wireless access point (WAP) is a networking hardware device that allows a Wi-Fi device to connect to a wired network.

PREFACE

Information is generated from organized structured and processed data in a particular format, "information can be recorded as signs, or transmitted as signals. Information is any kind of event that affects the state of a dynamic system that can interpret the information. In simply terms, therefore, information is 'knowledge communicated or received concerning a particular fact or circumstance". The information system is very important for the internet technology and the traditional business concerns and is really the latest phase in the ongoing evolution of business. All the companies need to update their business, infrastructure and change way they work to respond more immediately to customer need. Technology is used to augment some mechanistic concept of "efficiency", such as, the volume or the speed of processed transactions. Typically the model is used to predict that Information Technology will lead to the deskilling of managers as their work becomes rule based and more routinized. As more integrated information systems develop the role of the human resource manager certainly becomes degraded. Their role contracts progressively until eventually it disappear altogether.

Illustrated Handbook of Information and Knowledge Systems focuses on fundamental technical and engineering issues, including the principles of building and using knowledge systems from the conceptual standpoint as well as the practical.

The rapid development of new Information Infrastructure including with the augmented user needs in different fields of Information Technology (specially associated to Web applications) has created the need for designing new modeling techniques more innovative and focused on particular fields of Information Systems that effectively model the rapidly changed environment, together with the newly introduced concepts and user requirements.

This *Illustrated Handbook of Information and Knowledge Systems* is intended to introduce readers to a number of innovative Information modeling techniques. Information system and technology including E-business and E-commerce technology and application has become vital component of successful business and organization. It is vital need for a business manager or a business professional to have basic understanding of information system or any other functional area.

CHAPTER 1

INFORMATION SYSTEMS AND DIGITAL TECHNOLOGY



INTRODUCTION

An information system is designed to collect, process, store and distribute information. Although information systems need not be computerized, Information Technology (IT) plays an increasingly important role in organizations due to the fast pace of technological innovation. Today most information systems beyond the smallest are IT-based because modern IT enables efficient operations as well as effective management in organizations of all sizes.

Emerging changes and advances in global technology have led to a more connected world where people can share information, photos and conversations simply and quickly. Information technology (IT), information systems (IS) and digital media have paved the way in enabling this to occur. Retrieving, processing, receiving, transmitting, protecting and storing information are all elements of information and communication technology.



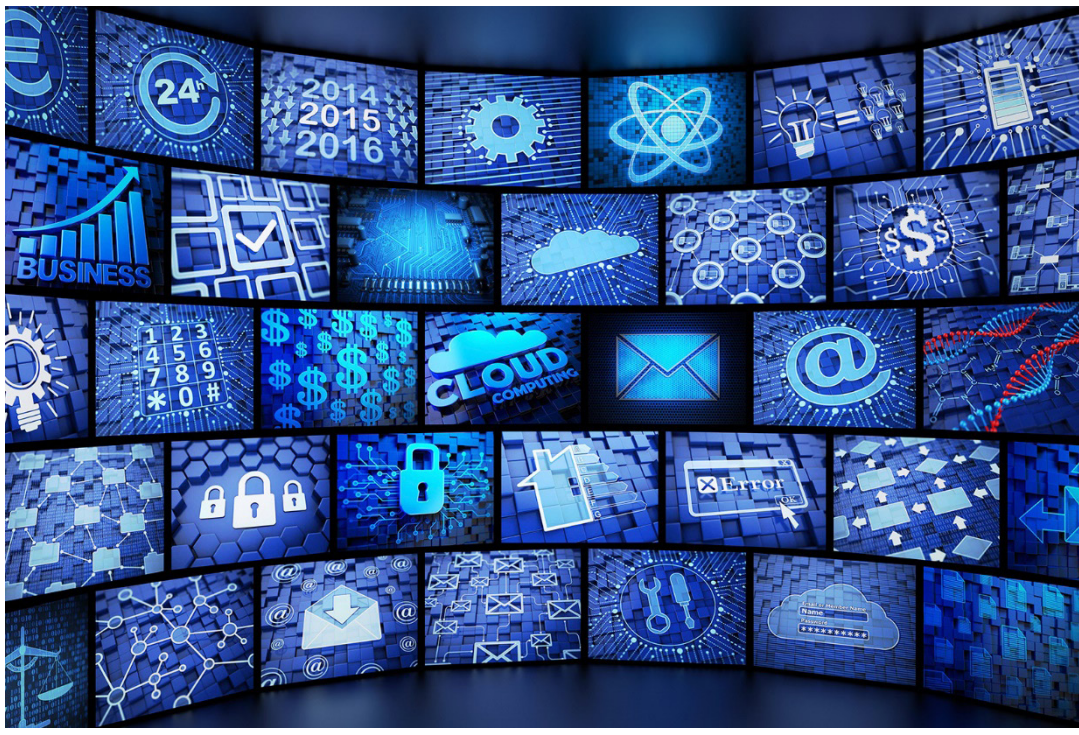
Source: http://ecc.sjtu.edu.cn/uploadfiles/2015/4/2/10471350050475.jpg

The study of IT and IS is aligned, however there are differences within the two areas. IT is a combination of tools, processes and methodologies that are used to collect, process and present information. IS focuses on the use of technology and how it can assist with the organization of people through the use of databases, networks, the internet, and personal computers.

Digital media refers to text, graphics, animation, audio and video content that has been digitally encoded, allowing it to be manipulated and rendered by computers, and transmitted over computer networks. Digital photos, music, movies, web sites, social media, mobile applications and computer games are all examples of digital media. Most digital media production environments are multidisciplinary, requiring collaboration between people with diverse technical and creative skills. The study of digital media encompasses many of these skills, including graphic design, web design, web application development, video production and post-production, interaction design, photography, journalism, illustration, 3D modelling and animation, game design, social media management, mobile application development, project management and more.

THE CONCEPT OF INFORMATION SYSTEMS

Many organizations work with large amounts of **data**. Data are basic values or facts and are organized in a database. Many people think of data as synonymous with information; however, information actually consists of data that has been organized to help answers questions and to solve problems. An information system is defined as the software that helps organize and analyze data. So, the purpose of an information system is to turn raw data into useful information that can be used for decision making in an organization.

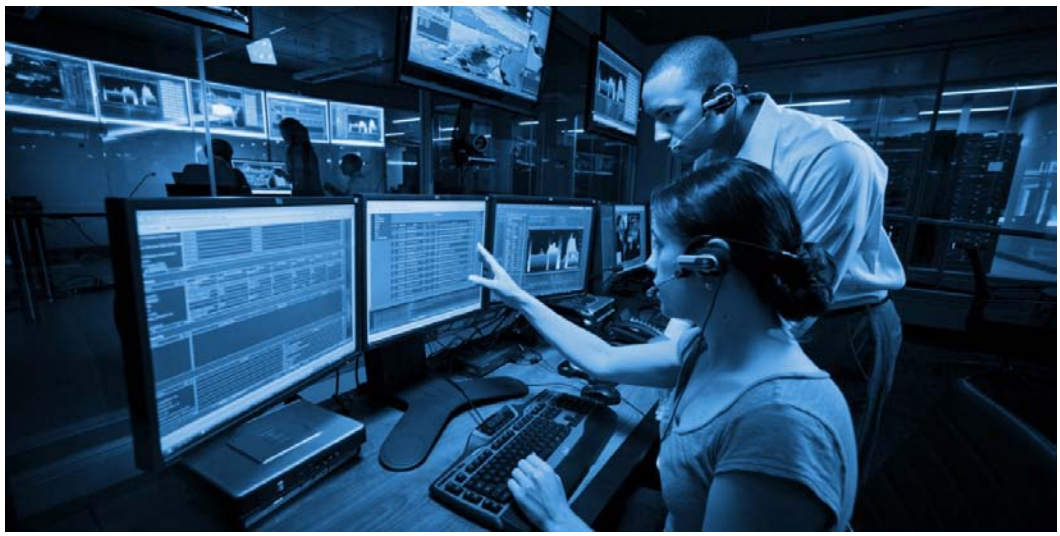


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Defining Information Systems

Almost all programs in business require students to take a course in something called *information systems*. But what exactly does that term mean? Let's take a look at some of the more popular definitions,:

- "Information systems (IS) is the study of complementary networks of hardware and software that people and organizations use to collect, filter, process, create, and distribute data."
- "Information systems are combinations of hardware, software, and telecommunications networks that people build and use to collect, create, and distribute useful data, typically in organizational settings."
- "Information systems are interrelated components working together to collect, process, store, and disseminate information to support decision making, coordination, control, analysis, and viualization in an organization."



Source: https://static1.squarespace.com/static/55c83a55e4b030368e53b079/55c8486be4b0f3bb52e8e0d3/5809a2a0e4fcb5ec7f0e7536/1477529552226/MissionControla.jpg?format=1500w

As you can see, these definitions focus on two different ways of describing information systems: the *components* that make up an information system and the *role* that those components play in an organization. Let's take a look at each of these.

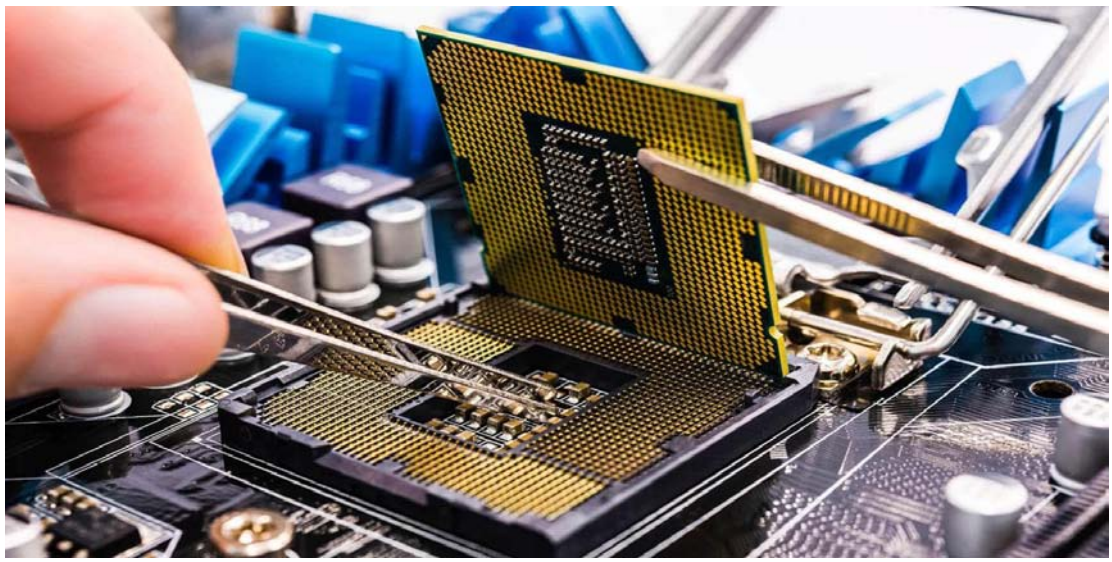
Components of Information Systems

The main components of information systems are computer hardware and software, telecommunications, databases and data warehouses, human resources, and procedures. The hardware, software, and telecommunications constitute information

technology (IT), which is now ingrained in the operations and management of organizations.

Computer Hardware

Today throughout the world even the smallest firms, as well as many households, own or lease computers. Individuals may own multiple computers in the form of smartphones, tablets, and other wearable devices. Large organizations typically employ distributed computer systems, from powerful parallel-processing servers located in data centres to widely dispersed personal computers and mobile devices, integrated into the organizational information systems. Sensors are becoming ever more widely distributed throughout the physical and biological environment to gather data and, in many cases, to effect control via devices known as actuators. Together with the peripheral equipment—such as magnetic or solid-state storage disks, input-output devices, and telecommunications gear—these constitute the hardware of information systems.



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The cost of hardware has steadily and rapidly decreased, while processing speed and storage capacity have increased vastly. This development has been occurring under Moore's law: the power of the microprocessors at the heart of computing devices has been doubling approximately every 18 to 24 months. However, hardware's use of electric power and its environmental impact are concerns being addressed by designers. Increasingly, computer and storage services are delivered from the cloud—from shared facilities accessed over telecommunications networks.

Computer Software

Computer software falls into two broad classes: system software and application software. The principal system software is the operating system. It manages the hardware, data and program files, and other system resources and provides means for the user to control the computer, generally via a graphical user interface (GUI). Application software is programs designed to handle specific tasks for users. Smartphone apps became a common way for individuals to access information systems. Other examples include general-purpose application suites with their spreadsheet and word-processing programs, as well as "vertical" applications that serve a specific industry segment—for instance, an application that schedules, routes, and tracks package deliveries for an overnight carrier. Larger firms use licensed applications developed and maintained by specialized software companies, customizing them to meet their specific needs, and develop other applications in-house or on an outsourced basis. Companies may also use applications delivered as software-as-a-service (SaaS) from the cloud over the Web. Proprietary software, available from and supported by its vendors, is being challenged by open-source software available on the Web for free use and modification under a license that protects its future availability.



Source: http://abouttechinfo.com/wp-content/uploads/2018/01/why-you-need-custom-software-development-and-how-your-business-can-benefit-from-it.jpg

Telecommunications

Telecommunications are used to connect, or network, computer systems and portable and wearable devices and to transmit information. Connections are established via

wired or wireless media. Wired technologies include coaxial cable and fibre optics. Wireless technologies, predominantly based on the transmission of microwaves and radio waves, support mobile computing. Pervasive information systems have arisen with the computing devices embedded in many different physical objects. For example, sensors such as radio frequency identification devices (RFIDs) can be attached to products moving through the supply chain to enable the tracking of their location and the monitoring of their condition. Wireless sensor networks that are integrated into the Internet can produce massive amounts of data that can be used in seeking higher productivity or in monitoring the environment.



Source: https://simplecore.intel.com/itpeernetwork/wp-content/uploads/sites/38/2017/09/Transitioning-Telecommunications-to-Cloud-Native-Faster-1.png

Various computer network configurations are possible, depending on the needs of an organization. Local area networks (LANs) join computers at a particular site, such as an office building or an academic campus. Metropolitan area networks (MANs) cover a limited densely populated area and are the electronic infrastructure of "smart cities." Wide area networks (WANs) connect widely distributed data centres, frequently run by different organizations. Peer-to-peer networks, without a centralized control, enable broad sharing of content. The Internet is a network of networks, connecting billions of computers located on every continent. Through networking, users gain access to information resources, such as large databases, and to other individuals, such as coworkers, clients, friends, or people who share their professional or private interests. Internet-type services can be provided within an organization and for its exclusive use by various intranets that are accessible through a browser; for example, an intranet may be deployed as an access portal

to a shared corporate document base. To connect with business partners over the Internet in a private and secure manner, extranets are established as so-called virtual private networks (VPNs) by encrypting the messages.

A massive "Internet of things" has emerged, as sensors and actuators have been widely distributed in the physical environment and are supplying data, such as acidity of a square yard of soil, the speed of a driving vehicle, or the blood pressure of an individual. The availability of such information enables a rapid reaction when necessary as well as sustained decision making based on processing of the massive accumulated data.



Source: https://cdn-images-1.medium.com/max/1600/1*l7tj3iutKElySHuTzPZHiQ.png

Extensive networking infrastructure supports the growing move to cloud computing, with the information-system resources shared among multiple companies, leading to utilization efficiencies and freedom in localization of the data centres. Software-defined networking affords flexible control of telecommunications networks with algorithms that are responsive to real-time demands and resource availabilities.

Databases and Data Warehouses

Many information systems are primarily delivery vehicles for data stored in databases. A database is a collection of interrelated data organized so that individual records or groups of records can be retrieved to satisfy various criteria. Typical examples of databases include employee records and product catalogs. Databases support the operations and management functions of an enterprise. Data warehouses

contain the archival data, collected over time, that can be mined for information in order to develop and market new products, serve the existing customers better, or reach out to potential new customers. Anyone who has ever purchased something with a credit card—in person, by mail order, or over the Web—is included within such data collections.



Source: https://www.betterbuys.com/wp-content/uploads/2015/01/Data-Warehouse-Graphic.png

Massive collection and processing of the quantitative, or structured, data, as well as of the textual data often gathered on the Web, has developed into a broad initiative known as "big data." Many benefits can arise from decisions based on the facts reflected by big data. Examples include evidence-based medicine, economy of resources as a result of avoiding waste, and recommendations of new products (such as books or movies) based on a user's interests. Big data enables innovative business models. For example, a commercial firm collects the prices of goods by crowdsourcing (collecting from numerous independent individuals) via smartphones around the world. The aggregated data supplies early information on

price movements, enabling more responsive decision making than was previously possible.

The processing of textual data—such as reviews and opinions articulated by individuals on social networks, blogs, and discussion boards—permits automated sentiment analysis for marketing, competitive intelligence, new product development, and other decision-making purposes.

Human Resources and Procedures

Qualified people are a vital component of any information system. Technical personnel include development and operations managers, business analysts, systems analysts and designers, database administrators, programmers, computer security specialists, and computer operators. In addition, all workers in an organization must be trained to utilize the capabilities of information systems as fully as possible. Billions of people around the world are learning about information systems as they use the Web.



Source: https://sacsconsulting.com/wp-content/uploads/2014/03/policy-and-procedures.jpg

Procedures for using, operating, and maintaining an information system are part of its documentation. For example, procedures need to be established to run a payroll program, including when to run it, who is authorized to run it, and who

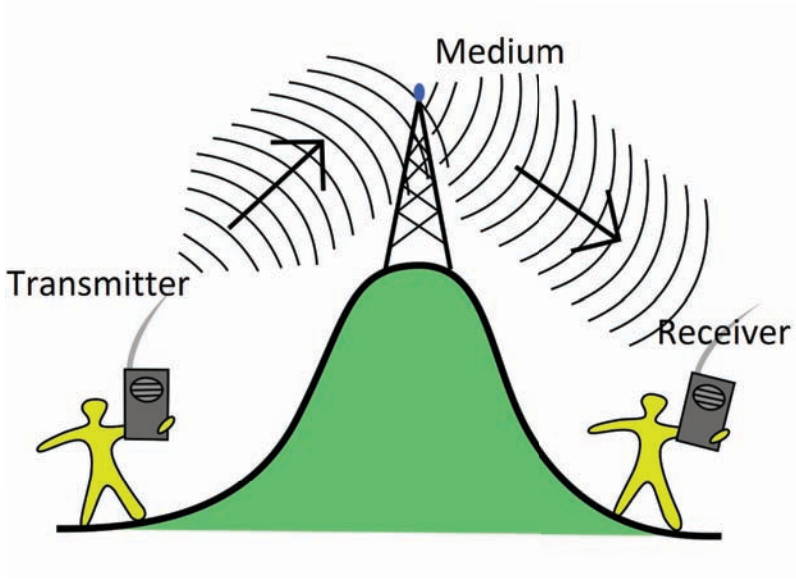
has access to the output. In the autonomous computing initiative, data centres are increasingly run automatically, with the procedures embedded in the software that controls those centres.

Importance of Information Systems in an Organization

To gain the maximum benefits from your company's information system, you have to exploit all its capacities. Information systems gain their importance by processing the data from company inputs to generate information that is useful for managing your operations. To increase the information system's effectiveness, you can either add more data to make the information more accurate or use the information in new ways.

Communication Systems

Part of management is gathering and distributing information, and information systems can make this process more efficient by allowing managers to communicate rapidly. Email is quick and effective, but managers can use information systems even more efficiently by storing documents in folders that they share with the employees who need the information. This type of communication lets employees collaborate in a systematic way. Each employee can communicate additional information by making changes that the system tracks. The manager collects the inputs and sends the newly revised document to his target audience.



Source: https://cdn1.byjus.com/physics/wp-content/uploads/2015/12/communication.png

Operations Management

How you manage your company's operations depends on the information you have. Information systems can offer more complete and more recent information, allowing you to operate your company more efficiently. You can use information systems to gain a cost advantage over competitors or to differentiate yourself by offering better customer service. Sales data give you insights about what customers are buying and let you stock or produce items that are selling well. With guidance from the information system, you can streamline your operations.



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Decision-Making

The company information system can help you make better decisions by delivering all the information you need and by modeling the results of your decisions. A decision involves choosing a course of action from several alternatives and carrying out the corresponding tasks. When you have accurate, up-to-date information, you can make the choice with confidence. If more than one choice looks appealing, you can use the information system to run different scenarios. For each possibility, the system can calculate key indicators such as sales, costs and profits to help you determine which alternative gives the most beneficial result.



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Record-Keeping

Your company needs records of its activities for financial and regulatory purposes as well as for finding the causes of problems and taking corrective action. The information system stores documents and revision histories, communication records and operational data. The trick to exploiting this recording capability is organizing the data and using the system to process and present it as useful historical information. You can use such information to prepare cost estimates and forecasts and to analyze how your actions affected the key company indicators.



Source: https://cdn.lynda.com/course/639059/639059-636536841095438611-16x9.jpg

The Role of Information Systems

Now that we have explored the different components of information systems, we need to turn our attention to the role that information systems play in an organization. So far we have looked at what the components of an information system are, but what do these components actually do for an organization? From our definitions above, we see that these components collect, store, organize, and distribute data throughout the organization. In fact, we might say that one of the roles of information systems is to take data and turn it into information, and then transform that into organizational knowledge. As technology has developed, this role has evolved into the backbone of the organization. To get a full appreciation of the role information systems play, we will review how they have changed over the years.



IBM 704 Mainframe

Source: https://upload.wikimedia.org/wikipedia/commons/thumb/2/20/IBM_Electronic_Data_Processing_Machine_-_GPN-2000-001881.jpg/1200px-IBM_Electronic_Data_Processing_Machine_-_GPN-2000-001881.jpg

The Mainframe Era

From the late 1950s through the 1960s, computers were seen as a way to more efficiently do calculations. These first business computers were room-sized monsters,

with several refrigerator-sized machines linked together. The primary work of these devices was to organize and store large volumes of information that were tedious to manage by hand. Only large businesses, universities, and government agencies could afford them, and they took a crew of specialized personnel and specialized facilities to maintain. These devices served dozens to hundreds of users at a time through a process called time-sharing. Typical functions included scientific calculations and accounting, under the broader umbrella of "data processing."



Registered trademark of International Business Machines

Source: http://bizfriend.ly/wp-content/uploads/2017/06/IBM-SWOT-ANALYSIS.jpg

In the late 1960s, the Manufacturing Resources Planning (MRP) systems were introduced. This software, running on a mainframe computer, gave companies the ability to manage the manufacturing process, making it more efficient. From tracking inventory to creating bills of materials to scheduling production, the MRP systems (and later the MRP II systems) gave more businesses a reason to want to integrate computing into their processes. IBM became the dominant mainframe company. Nicknamed "Big Blue," the company became synonymous with business computing. Continued improvement in software and the availability of cheaper hardware eventually brought mainframe computers (and their little sibling, the minicomputer) into most large businesses.

The PC Revolution

In 1975, the first microcomputer was announced on the cover of *Popular Mechanics*: the Altair 8800. Its immediate popularity sparked the imagination of entrepreneurs everywhere, and there were quickly dozens of companies making these "personal computers." Though at first just a niche product for computer

hobbyists, improvements in usability and the availability of practical software led to growing sales. The most prominent of these early personal computer makers was a little company known as Apple Computer, headed by Steve Jobs and Steve Wozniak, with the hugely successful "Apple II." Not wanting to be left out of the revolution, in 1981 IBM (teaming with a little company called Microsoft for their operating-system software) hurriedly released their own version of the personal computer, simply called the "PC." Businesses, who had used IBM mainframes for years to run their businesses, finally had the permission they needed to bring personal computers into their companies, and the IBM PC took off. The IBM PC was named *Time* magazine's "Man of the Year" for 1982.



Source: https://austincomputertipsandtricks.files.wordpress.com/2015/01/1981-ibm-pc5150_a.jpg

Because of the IBM PC's open architecture, it was easy for other companies to copy, or "clone" it. During the 1980s, many new computer companies sprang up,

offering less expensive versions of the PC. This drove prices down and spurred innovation. Microsoft developed its Windows operating system and made the PC even easier to use. Common uses for the PC during this period included word processing, spreadsheets, and databases. These early PCs were not connected to any sort of network; for the most part they stood alone as islands of innovation within the larger organization.

Client-Server

In the mid-1980s, businesses began to see the need to connect their computers together as a way to collaborate and share resources. This networking architecture was referred to as "client-server" because users would log in to the local area network (LAN) from their PC (the "client") by connecting to a powerful computer called a "server," which would then grant them rights to different resources on the network (such as shared file areas and a printer). Software companies began developing applications that allowed multiple users to access the same data at the same time. This evolved into software applications for communicating, with the first real popular use of electronic mail appearing at this time.



Registered trademark of SAP

Source: https://www.dituniversity.edu.in/sap-erp

This networking and data sharing all stayed within the confines of each business, for the most part. While there was sharing of electronic data between companies, this was a very specialized function. Computers were now seen as tools to collaborate internally, within an organization. In fact, these networks of computers were becoming so powerful that they were replacing many of the functions previously performed by the larger mainframe computers at a fraction of the cost. It was during this era that the first Enterprise Resource Planning (ERP) systems were developed and run on the client-server architecture. An ERP system is a software application with a centralized database that can be used to run a company's entire business. With separate modules for accounting, finance, inventory, human

resources, and many, many more, ERP systems, with Germany's SAP leading the way, represented the state of the art in information systems integration.

The World Wide Web and E-Commerce

First invented in 1969, the Internet was confined to use by universities, government agencies, and researchers for many years. Its rather arcane commands and user applications made it unsuitable for mainstream use in business. One exception to this was the ability to expand electronic mail outside the confines of a single organization. While the first e-mail messages on the Internet were sent in the early 1970s, companies who wanted to expand their LAN-based e-mail started hooking up to the Internet in the 1980s. Companies began connecting their internal networks to the Internet in order to allow communication between their employees and employees at other companies. It was with these early Internet connections that the computer truly began to evolve from a computational device to a communications device.

In 1989, Tim Berners-Lee developed a simpler way for researchers to share information over the network at CERN laboratories, a concept he called the World Wide Web. This invention became the launching point of the growth of the Internet as a way for businesses to share information about themselves. As web browsers and Internet connections became the norm, companies rushed to grab domain names and create websites.



Registered trademark of Amazon Technologies, Inc.

Source: https://bus206.pressbooks.com/chapter/chapter-1/

In 1991, the National Science Foundation, which governed how the Internet was used, lifted restrictions on its commercial use. The year 1994 saw the establishment of both eBay and Amazon.com, two true pioneers in the use of the new digital marketplace. A mad rush of investment in Internet-based businesses led to the dot-com boom through the late 1990s, and then the dot-com bust in 2000. While much can be learned from the speculation and crazy economic theories espoused during that bubble, one important outcome for businesses was that thousands of miles of Internet connections were laid around the world during that time. The world became truly "wired" heading into the new millenium, ushering in the era of globalization.

As it became more expected for companies to be connected to the Internet, the digital world also became a more dangerous place. Computer viruses and worms, once slowly propagated through the sharing of computer disks, could now grow with tremendous speed via the Internet. Software written for a disconnected world found it very difficult to defend against these sorts of threats. A whole new industry of computer and Internet security arose.

Web 2.0

As the world recovered from the dot-com bust, the use of technology in business continued to evolve at a frantic pace. Websites became interactive; instead of just visiting a site to find out about a business and purchase its products, customers wanted to be able to customize their experience and interact with the business. This new type of interactive website, where you did not have to know how to create a web page or do any programming in order to put information online, became known as web 2.0. Web 2.0 is exemplified by blogging, social networking, and interactive comments being available on many websites. This new web-2.0 world, in which online interaction became expected, had a big impact on many businesses and even whole industries. Some industries, such as bookstores, found themselves relegated to a niche status. Others, such as video rental chains and travel agencies, simply began going out of business as they were replaced by online technologies. This process of technology replacing a middleman in a transaction is called disintermediation.



Source: https://www.thewebomania.com/blog/wp-content/uploads/2017/03/web-2.0.png

As the world became more connected, new questions arose. Should access to the Internet be considered a right? Can I copy a song that I downloaded from the Internet? How can I keep information that I have put on a website private? What information is acceptable to collect from children? Technology moved so fast that policymakers did not have enough time to enact appropriate laws, making for a Wild West–type atmosphere.

The Post-PC World

After thirty years as the primary computing device used in most businesses, sales of the PC are now beginning to decline as sales of tablets and smartphones are taking off. Just as the mainframe before it, the PC will continue to play a key role in business, but will no longer be the primary way that people interact and do business. The limited storage and processing power of these devices is being offset by a move to "cloud" computing, which allows for storage, sharing, and backup of information on a massive scale. This will require new rounds of thinking and innovation on the part of businesses as technology continues to advance.

Table 1: The Eras of Business Computing

Era	Hardware	Operating System	Applications
Mainframe (1970s)	Terminals connected to mainframe computer.	Time-sharing (TSO) on MVS	Custom-written MRP software
PC (mid-1980s)	IBM PC or compatible. Sometimes connected to mainframe computer via expansion card.	MS-DOS	WordPerfect, Lotus 1-2-3
Client-Server (late 80s to early 90s)	IBM PC "clone" on a Novell Network.	Windows for Workgroups	Microsoft Word, Microsoft Excel
World Wide Web (mid-90s to early 2000s)	IBM PC "clone" connected to company intranet.	Windows XP	Microsoft Office, Internet Explorer
Web 2.0 (mid-2000s to present)	Laptop connected to company Wi-Fi.	Windows 7	Microsoft Office, Firefox
Post-PC (today and beyond)	Apple iPad	iOS	Mobile-friendly websites, mobile apps

Information Technology and Information Systems

Information technology broadly defined as the collection of computer systems used by an organization. Information technology, in its narrow definition, refers to the technological side of an information system. It includes the hardware,

software, databases, networks, and other electronic devices. It can be viewed as a subsystem of an information system. Sometimes, though, the term information technology is also used interchangeably with information system.

The term IT in its broadest sense used to describe an organization's collection of information systems, their users, and the management that oversees them.

A major role of IT is being a facilitator of organizational activities and processes. That role will become more important as time passes. Therefore, it is necessary that every manager and professional staff member learn about IT not only in his or her specialized field, but also in the entire organization and in inter-organizational settings as well.



Source: https://edge.alluremedia.com.au/m/l/2016/07/iStock_85271847_MEDIUM.jpg

Obviously, you will be more effective in your chosen career if you understand how successful information systems are built, used, and managed. You also will be more effective if you know how to recognize and avoid unsuccessful systems and failures. Also, in many ways, having a comfort level with information technology will enable you, off the job and in your private life, to take advantage of new IT products and systems as they are developed. (Wouldn't you rather be the one explaining to friends how some new product works, than the one asking about it?) Finally, you should learn about IT because being knowledgeable about information technology can also increase employment opportunities. Even though computerization eliminates some jobs, it also creates many more.

The demand for traditional information technology staff—such as programmers, systems analysts, and designers—is substantial. In addition, many excellent opportunities are appearing in emerging areas such as the Internet and e-commerce,

m-commerce, network security, object-oriented programming, telecommunications, multimedia design, and document management.

EVOLUTION OF INFORMATION SYSTEMS

This section discusses the evolution of information systems, levels of management decision-making and information systems that enhance the value of information.

From EDP to MIS

Until the 1960s, the role of most information systems was simple. They were mainly used for electronic data processing (EDP), purposes such as transactions processing, record-keeping and accounting. EDP is often defined as the use of computers in recording, classifying, manipulating, and summarizing data. It is also called transaction processing systems (TPS), automatic data processing, or information processing.

Transaction processing systems – these process data resulting from business transactions, update operational databases, and produce business documents. Examples: sales and inventory processing and accounting systems.



Source: http://i.nextmedia.com.au/Blogs/180152187.jpg

In the 1960s, another role was added to the use of computers: the processing of data into useful informative reports. The concept of management information systems (MIS) was born. This new role focused on developing business applications that provided managerial end users with predefined management reports that would give managers the information they needed for decision-making purposes.

Management information systems – provide information in the form of prespecified reports and displays to support business decision-making. Examples: sales analysis, production performance and cost trend reporting systems.

By the 1970s, these pre-defined management reports were not sufficient to meet many of the decision-making needs of management. In order to satisfy such needs, the concept of decision support systems (DSS) was born. The new role for information systems was to provide managerial end users with ad hoc and interactive support of their decision-making processes.

Decision support systems – provide interactive ad hoc support for the decision-making processes of managers and other business professionals. Examples: product pricing, profitability forecasting and risk analysis systems.

In the 1980s, the introduction of microcomputers into the workplace ushered in a new era, which led to a profound effect on organizations. The rapid development of microcomputer processing power (e.g. Intel's Pentium microprocessor), application software packages (e.g. Microsoft Office), and telecommunication networks gave birth to the phenomenon of end user computing. End users could now use their own computing resources to support their job requirements instead of waiting for the indirect support of a centralized corporate information services department. It became evident that most top executives did not directly use either the MIS reports or the analytical modelling capabilities of DSS, so the concept of executive information systems (EIS) was developed.



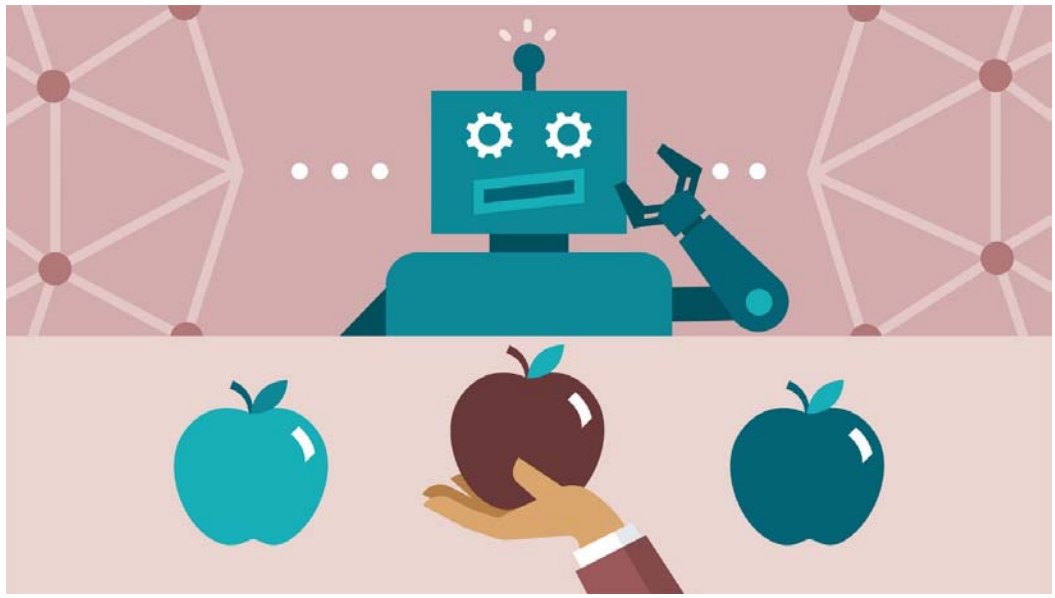
Source: http://edpservices.co.in/wp-content/uploads/2018/08/cloud-computing.jpg

Executive information systems – provide critical information from MIS, DSS and other sources, tailored to the information needs of executives. Examples: systems for easy access to analysis of business performance, actions of all competitors, and economic developments to support strategic planning.

Moreover, breakthroughs occurred in the development and application of artificial intelligence (AI) techniques to business information systems. With less need for human intervention, knowledge workers could be freed up to handle more complex tasks. Expert systems (ES) and other knowledge management systems (KMS) also forged a new role for information systems. ES can serve as consultants to users by providing expert advice in limited subject areas.

Expert systems are knowledge-based systems that provide expert advice and act as expert consultants to users. Examples: credit application advisor, process monitor, and diagnostic maintenance systems.

Knowledge management systems are knowledge-based systems that support the creation, organization and dissemination of business knowledge within the enterprise. Examples: intranet access to best business practices, sales proposal strategies and customer problem resolution systems.



Source: https://cdn.lynda.com/course/667369/667369-636586115100976090-16x9.jpg

The mid- to late 1990s saw the revolutionary emergence of enterprise resource planning (ERP) systems. This organization-specific form of a strategic information system integrates all facets of a firm, including its planning, manufacturing, sales, resource management, customer relations, inventory control, order tracking, financial management, human resources and marketing – virtually every business function. The primary advantage of these ERP systems lies in their common

interface for all computer-based organizational functions and their tight integration and data sharing needed for flexible strategic decision making.

From MIS to e-commerce

The rapid growth of the Internet, intranets, extranets and other interconnected global networks in the 1990s dramatically changed the capabilities of information systems in business. Internet-based and web-enabled enterprise and global electronic business and commerce systems are becoming commonplace in the operations and management of today's business enterprises.

Indeed today's information systems are still doing the same basic things that they began doing over 50 years ago. We still need to process transactions, keep records, provide management with useful and informative reports, and provide support to the accounting systems and processes of the organization. However, what has changed is that we now enjoy a much higher level of integration of system functions across applications, greater connectivity across both similar and dissimilar system components, and the ability to reallocate critical computing tasks such as data storage, processing, and presentation to take maximum advantage of business and strategic opportunities. With increasing capabilities, future systems will focus on increasing both the speed and reach of our systems to provide even tighter integration combined with greater flexibility.



Source: https://ecommerceguide.com/wp-content/uploads/2017/06/laptop_1498098644.jpg

The Internet and related technologies and applications have changed the way businesses operate and people work, and how information systems support business processes, decision-making and competitive advantage. Today many

businesses are using Internet technologies to web-enable business processes and to create innovative e-business applications.

E-business is the use of Internet technologies to work and empower business processes, electronic commerce and enterprise collaboration within a company and with its customers, suppliers and other business stakeholders. The Internet and Internet-like networks – those inside the enterprise (intranet) and those between an enterprise and its trading partners (extranet) – have become the primary information technology infrastructure that supports the e-business applications of many companies. These companies rely on e-business applications to (i) reengineer internal business processes, (ii) implement electronic commerce systems with their customers and suppliers, and (iii) promote enterprise collaboration among business teams and workgroups.

Level of Management Decision-making

Information systems can support a variety of management decision-making levels and decisions. These include the three levels of management activity: strategic management, tactical management, and operational management.



Source: http://www.carlodamico.com/portfolio/articles/img/Supply_Chain_Management/carlo_damico-strategical_tactical_operational.png

Strategic Management

It is typical for a board of directors and an executive committee of the CEO and top executives to develop the overall organization goals, strategies, policies and objectives as part of a strategic planning process. They also monitor the strategic performance of the organization and its overall direction in the political, economic and competitive business environment.



Source: https://i2.wp.com/securitythinkingcap.com/wp-content/uploads/2018/01/Essential-Tasks-of-Strategic-Management.jpg?fit=1170%2C780&ssl=1

Tactical Management

Increasingly, business professionals in self-directed teams as well as business unit managers develop short- and medium-range plans, schedules and budgets and specify the policies, procedures and business objectives for their subunits of the company. They also allocate resources and monitor the performance of their organizational sub-units, including departments, divisions, process teams and other workgroups.



Source: https://eventopediacdn.azureedge.net//content/smm-starter-kit-513446326.jpg

Operational Management

The members of self-directed teams or operating managers develop short range plans such as weekly production schedules. They direct the use of resources and the performance of tasks according to procedures, and within budgets and schedules they establish for the teams and other workgroups of the organization.



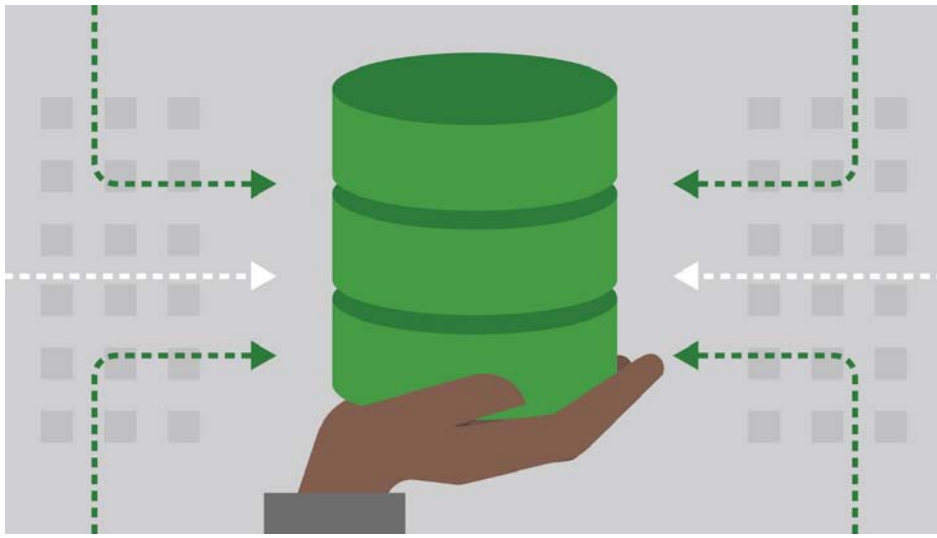
Source: https://i2.wp.com/www.mauriziopittau.it/wp-content/uploads/2018/04/Marketing-Operations-Management.jpg?fit=1654%2C945

Information Systems that Enhance Value of Information

The information systems that enhance the value of information are:

Data Warehouse (DW)

A data warehouse stores data that have been extracted from the various operational, external and other databases of an organization. It is a central source of the data that have been cleaned, transformed and catalogued so they can be used by managers and other business professionals for data mining, online analytical processing and other forms of business analysis, market research and decision support.



Source: https://cdn.lynda.com/course/385663/385663-636256201577864789-16x9.jpg

Data Mining (DM)

Data mining is a major use of DW databases and the static data they contain. In data mining, the data in a DW are analyzed to reveal hidden patterns and trends in historical business activity. This can be used to help managers make decisions about strategic changes in business operations to gain competitive advantages in the marketplace. DM software analyzes the vast stores of historical business data that have been prepared for analysis in corporate DW and tries to discover patterns, trends, and correlations hidden in the data that can help a company improve its business performance.



Source: http://www.angoss.com/wp-content/uploads/2017/05/blogentry-may8.jpg

Online Analytical Processing (OLAP)

Online analytical processing enables managers and analysts to interactively examine and manipulate large amounts of detailed and consolidated data from many perspectives. OLAP involves analyzing complex relationships among thousands or even millions of data items stored in data marts, DW and other multi-dimensional databases to discover patterns, trends and exceptional conditions. An OLAP session takes place online in real time, with rapid responses to a manager's or analyst's queries, so that their analytical or decision-making process is undisturbed.



Source: https://www.acterys.com/wp-content/uploads/2018/07/olap2-1288x724.png

TYPES OF INFORMATION SYSTEM

A typical organization is divided into operational, middle, and upper level. The information requirements for users at each level differ. Towards that end, there are number of information systems that support each level in an organization.

Pyramid Diagram of Organizational Levels and Information Requirements

Understanding the various levels of an organization is essential to understand the information required by the users who operate at their respective levels.

The following diagram illustrates the various levels of a typical organization.



Source: https://www.guru99.com/mis-types-information-system.html

Operational Management Level

The operational level is concerned with performing day to day business transactions of the organization.

Examples of users at this level of management include cashiers at a point of sale, bank tellers, nurses in a hospital, customer care staff, etc.

Users at this level use make structured decisions. This means that they have defined rules that guides them while making decisions.

For example, if a store sells items on credit and they have a credit policy that has some set limit on the borrowing. All the sales person needs to decide whether to give credit to a customer or not is based on the current credit information from the system.

Tactical Management Level

This organization level is dominated by middle-level managers, heads of departments, supervisors, etc. The users at this level usually oversee the activities of the users at the operational management level.

Tactical users make semi-structured decisions. The decisions are partly based on set guidelines and judgmental calls. As an example, a tactical manager can check the credit limit and payments history of a customer and decide to make an exception to raise the credit limit for a particular customer. The decision is partly structured in the sense that the tactical manager has to use existing information

to identify a payments history that benefits the organization and an allowed increase percentage.



Source: https://www.thebalancesmb.com/thmb/qZRjbbXXc243xhGG3c4TcnA7ajo=/2121x1414/filters:fill(auto,1)/GettyImages-875110490-5b9ea85fc9e77c0050b86841.jpg

Strategic Management Level

This is the most senior level in an organization. The users at this level make unstructured decisions. Senior level managers are concerned with the long-term planning of the organization. They use information from tactical managers and external data to guide them when making unstructured decisions.

Transaction Processing System (TPS)

Reports revealed that in the decade of 1950s, computers have been used to do common business applications. Many of these early systems were designed to decrease costs by automating routine, labour-intensive business transactions. A transaction is any business-related exchange such as payments to employees, sales to customers, or payments to suppliers. Processing business transactions was the first computer application developed for most organizations. A transaction processing system (TPS) is a planned way of collection of people, procedures, software, databases, and devices used to perform and record business transactions. If personnel understand a transaction processing system, then they can well recognise

basic business operations and functions. Example of transaction processing system includes payroll system and production instructions. There are Five Stages of Transaction Processing

- Data Entry
- Processing
- Database Maintenance
- Document And Report Generation
- Inquiry Processing

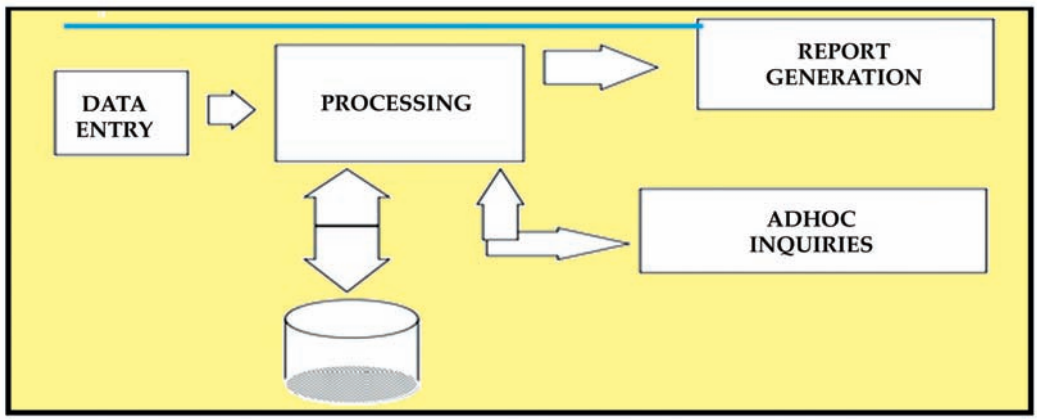


Figure 1: Transaction Processing System.

Source: https://www.civilserviceindia.com/subject/Management/notes/types-of-information-system.html

Transaction processing systems are used to record day to day business transactions of the organization. They are used by users at the operational management level. The main objective of a transaction processing system is to answer routine questions such as;

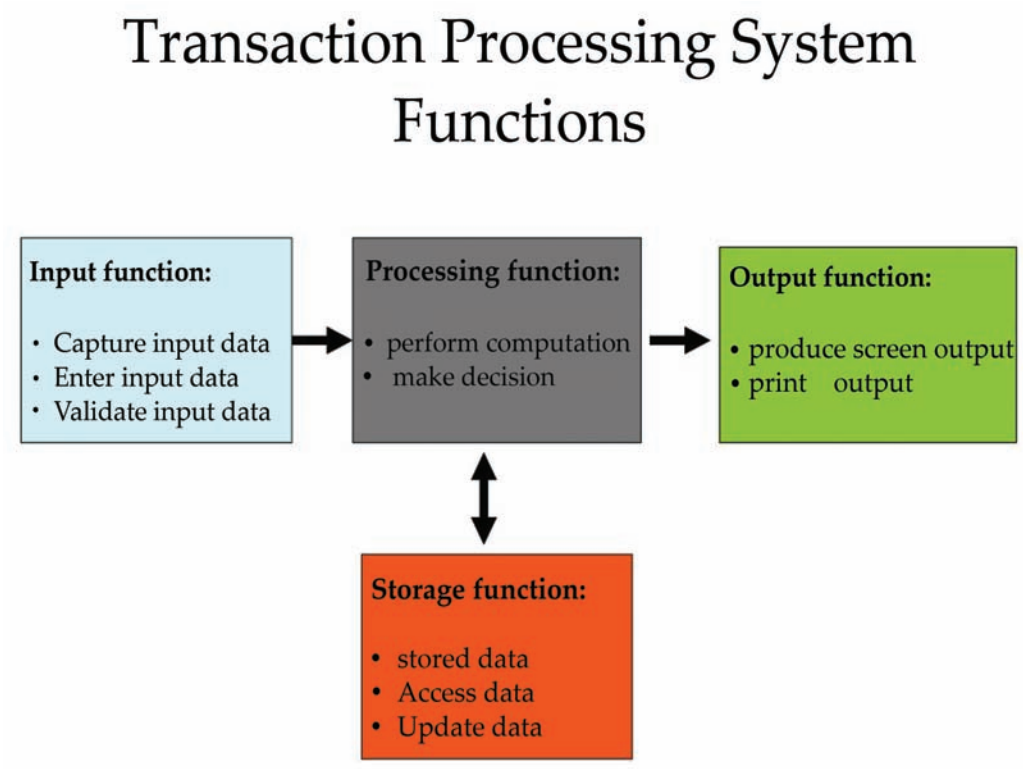
- How printers were sold today?
- How much inventory do we have at hand?
- What is the outstanding due for John Doe?

By recording the day to day business transactions, TPS system provides answers to the above questions in a timely manner.

- The decisions made by operational managers are routine and highly structured.
- The information produced from the transaction processing system is very detailed.

For example, banks that give out loans require that the company that a person works for should have a memorandum of understanding (MoU) with the bank.

If a person whose employer has a MoU with the bank applies for a loan, all that the operational staff has to do is verify the submitted documents. If they meet the requirements, then the loan application documents are processed. If they do not meet the requirements, then the client is advised to see tactical management staff to see the possibility of signing a MoU.



Source: http://image.slideserve.com/665762/transaction-processing-system-functions-l.jpg

Examples of transaction processing systems include;

- Point of Sale Systems – records daily sales
- Payroll systems – processing employees salary, loans management, etc.
- Stock Control systems – keeping track of inventory levels
- Airline booking systems – flights booking management

Management Information System (MIS)

A management information system (MIS) is a systematized collection of people, procedures, software, databases, and devices that provides routine information to managers and decision makers. It provides information to successfully manage an organization such as

- Extract and summarize data from TPSs
- Allow managers to monitor & direct the organization
- Provide accurate feedback
- Provide pre-specified reports on a scheduled basis

Top managers make strategic decisions like Middle managers make tactical decisions, Line managers make operations decisions, Knowledge workers create and integrate knowledge, clerical workers use and manipulate information.



Source: http://business.uic.edu/sites/default/files/content/fields/program_intro_image/mis-heroimg_0.jpg

An MIS mainly concentrates on operational efficiency. Manufacturing, marketing, production, finance, and other functional areas are supported by MISs and are linked through a common database.

Decision Support System (DSS)

Decision support systems are used by senior management to make non-routine decisions. Decision support systems use input from internal systems (transaction processing systems and management information systems) and external systems.

The main objective of decision support systems is to provide solutions to problems that are unique and change frequently. Decision support systems answer questions such as;

- What would be the impact of employees' performance if we double the production lot at the factory?
- What would happen to our sales if a new competitor entered the market?

Decision support systems use sophisticated mathematical models, and statistical techniques (probability, predictive modeling, etc.) to provide solutions, and they are very interactive.

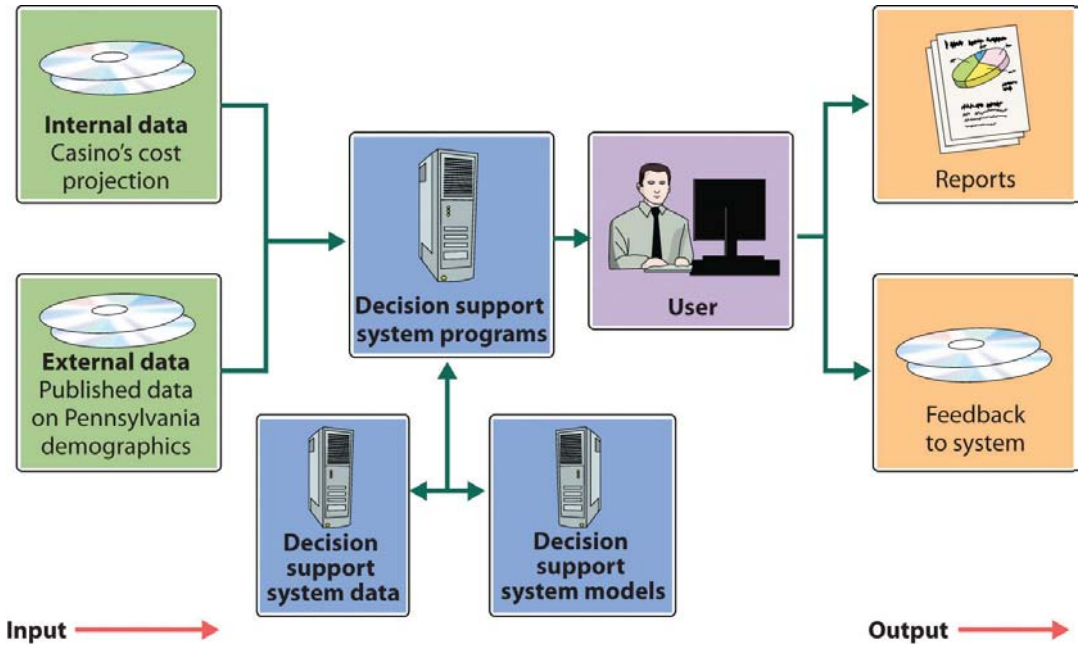


Figure 2: Decision Support System.

Source: https://open.lib.umn.edu/exploringbusiness/chapter/15-3-types-of-information-systems/

Examples of decision support systems include;

- Financial planning systems – it enables managers to evaluate alternative ways of achieving goals. The objective is to find the optimal way of achieving the goal. For example, the net profit for a business is calculated using the formula Total Sales less (Cost of Goods + Expenses). A financial planning system will enable senior executives to ask what if questions and adjust the values for total sales, the cost of goods, etc. to see the effect of the decision and on the net profit and find the most optimal way.

- Bank loan management systems – it is used to verify the credit of the loan applicant and predict the likelihood of the loan being recovered.

Artificial Intelligence Techniques in Business

Artificial intelligence systems mimic human expertise to identify patterns in large data sets. Companies such as Amazon, Facebook, and Google, etc. use artificial intelligence techniques to identify data that is most relevant to you.

Let's use Facebook as an example, Facebook usually makes very accurate predictions of people that you might know or went with to school. They use the data that you provide to them, the data that your friends provide and based on this information make predictions of people that you might know.

Amazon uses artificial intelligence techniques too to suggest products that you should buy also based on what you are currently getting.



Source: https://blogs-images.forbes.com/louiscolumbus/files/2018/04/Sizing-The-Market-Value-Of-Artificial-Intelligence-image-.jpg

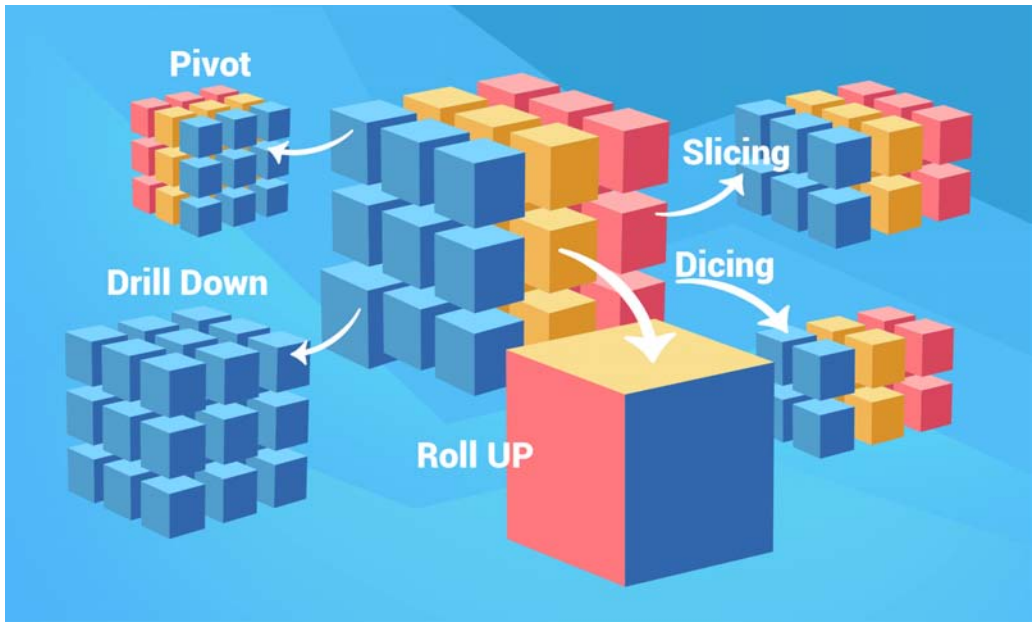
Google also uses artificial intelligence to give you the most relevant search results based on your interactions with Google and your location.

These techniques have greatly contributed in making these companies very successful because they are able to provide value to their customers.

Online Analytical Processing (OLAP)

Online analytical processing (OLAP) is used to query and analyze multi-dimensional data and produce information that can be viewed in different ways using multiple dimensions.

Let's say a company sells laptops, desktops, and Mobile device. They have four (4) branches A, B, C and D. OLAP can be used to view the total sales of each product in all regions and compare the actual sales with the projected sales.



Source: https://galaktikasoft.com/wp-content/uploads/2017/12/olap_operations-min.png

Each piece of information such as product, number of sales, sales value represents a different dimension

The main objective of OLAP systems is to provide answers to ad hoc queries within the shortest possible time regardless of the size of the datasets being used.

DIGITAL TECHNOLOGY AND INFORMATION SYSTEMS FOR BUSINESS

Digital technology includes all types of electronic equipment and applications that use information in the form of numeric code. This information is usually in *binary code*—that is, code that can be represented by strings of only two numeric characters. These characters are usually 0 and 1. Devices that process and use digital information include personal computers, calculators, automobiles, traffic light

controllers, compact disc players, cellular telephones, communications satellites, and high-definition television sets.

Most of the information people sense is *analog* in nature—that is, it varies constantly, and an infinite number of values can be assigned to the information. For example, the brightness of a light bulb dimmed gradually from on to off could be considered analog information. This infinite number of brightnesses can be *quantized* (broken up into ranges). If the possible brightnesses are broken into two ranges, then the values 0 and 1 can hold digital information relating to the brightness of the bulb. However, each of the two digits still represents a countless number of analog values. The ranges of brightnesses can be divided again and again, until there are thousands of ranges of values, each of which can be represented by a numerical value.



Source: https://cdn.thinglink.me/api/image/796620296831369216/1240/10/scaletowidth

Once analog information has been quantized into digital information, it is impossible to perfectly reverse the process and re-create all of the possible analog signals from the corresponding digital signals. This is why most analog signals are represented by a great number of digital information levels. For example, the sound stored as digital information on a compact disc (CD) is broken down into 65,536 levels. A CD player translates the digital information into analog information so that a speaker can convert it into sound waves.

Some devices process digital information using a tiny computer called a *microprocessor.* It performs calculations on digital information and then makes decisions based on the results. In such devices, computer chips called *memory chips* store digital information while it is not being processed. Software, which

consists of instructions in the form of digital information, is used to control the sequence of operations in many devices that use digital technology.

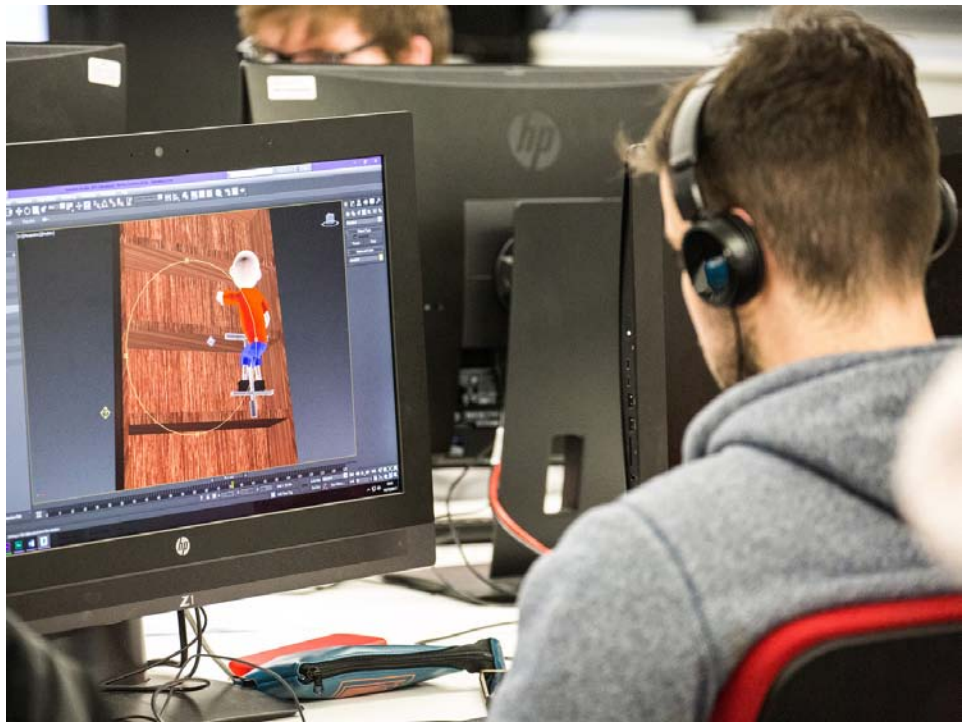


Source: https://www.sentinelassam.com/wp-content/uploads/2018/07/technology.jpg

The advent of digital technology is traced back to the time when semiconductors were in use, during the late nineteenth century. *Technology* has always been a pre-dominant factor towards the embodiment of change, such as that of, devices, culture, or people. In the seventeenth-century German mathematician, Gottfried Wilhelm Leibniz went ahead and proposed the idea of a binary computing system. As opposed to analogue technology, the binary computing system is based on notation of signals–sounds, data, or pictures in combinations of 0 and 1, also called as bits. In other words, information recorded in a binary computing system in the form of digits 0 and 1, is called digital information or digital technology.

Information Technology and Business Intelligence

After 1990s there was a major transformation in the commercial world. All the organizations across industry sectors have started using information technologies to maximize their productivity and profitability. Organizations started using technologies like mainframes, PCs, telecommunications and the internet along with the goods and services which they offered to the consumers. This process has become the backbone of evolution of information technology. There has been manifold increase in investments in information technology sector.



Source: https://www.rgu.ac.uk/images/Facility_Hero_Images/Dedicated-IT-provision-_1090-ZF-9537-66107-1-008.jpg

A Driving Force of Productivity

The US economy has seen impressive growth in Gross Domestic Product in the past few years and it is in a state of expansion. There has been increased demand for labour and low inflation. The lack of increase in price has also flummoxed many economists. The traditional theories suggest that whenever there is growth in economy and decline in unemployment rate, there is an increased probability of price pressures.

"Productivity" means the process of utilizing the productive inputs to generate output. If all the input resources like men, machine/technology and materials are effectively used, then the costs can be better managed and the organizations can offer goods and services at moderate prices to the end users.

By combining the state-of-art information technology with business strategies, organizations can achieve increased productivity. Business strategy addresses various like identifying the target markets, consumer preferences and managing the process by which goods and services are produced/delivered to the end user.



Source: http://transforming.com/wp-content/uploads/2014/09/bigstock-Data-110242871-e1454017091903.jpg

Information technology makes it possible for the business leaders and decision makers to devise various business strategies based on economic theories. This is done with the flow of information to decision makers and employees throughout an organization. By implementing effective IT, the following operations can be easily analyzed by the managers. They are:

- Production
- Marketing/advertising
- Customer relationship management
- Distribution
- Finance
- Human Resource
- Telecomm and network processes

Organizations have already started experiencing the enhancement of business efficiency through the use of information technology. Significant breakthroughs have also happened in information technology like increase in speed and memory of computers. This in-turn has opened the doors for high-powered, state-of-art software applications. The latest developments in the telecommunications technology is a value addition to the internet. The combination of all these technology has created a vast information network and this has become information pulse of an organization.

Business Intelligence

Business Intelligence (BI) refers to the tools and technique which is used to convert raw data into meaningful and useful information. Using these techniques, large amount of unstructured data is handled to identify and create new business opportunities.

The main aim of business intelligence is to make the user easily interpret the data. Based on the insights provided by tools of business intelligence, organizations gain competitive market advantage and long-term stability.



Source: https://www.mojix.com/wp-content/uploads/2018/09/Operational-Intelligence.jpg

When these unstructured or raw data is transformed into value-added information, it increases the knowledge of business to individuals of all categories in an enterprise. These data are used by decision makers to implement various business strategies based on economic theory. Resources also can be easily managed to cater the needs of the ultimate consumer.

Functions of Business Intelligence

Common functions of BI are:-

- Reporting
- Online analytical processing
- Analytics
- Data mining
- Process mining
- Business performance management
- Predictive analysis; &
- Prescriptive analysis

Impact of Internet Revolution in Business

Worldwide influence of the internet is well-established and acknowledged. Penetration rate of the internet has been phenomenal; almost 1/3rd of Human population are accessing the internet. The way business is conducted in this digital age has changed due to so many people logged on to the internet.



Source: http://designyournewlife.com/wp-content/uploads/2015/10/World-Wide-Web1-1200x800-Dollarphotoclub.jpg

Advancement in communication and information technology has further strengthen the role of the internet in business. The internet is widely used in organization for marketing and promotion of products and services. The internet is used to deliver customer support, share information and provide training to employees.

With the internet becoming a powerful tool for employees, the impact on business is undeniable.

Internet and Porter's Five Force Model

Porter's five force model is a framework for industry analysis, business strategy development and study competition. The five forces of the model are the threat from upcoming and future competition, threat from existing substitute, bargaining power of consumers, negotiating power of suppliers and threat of competition. Internet has great Impact on all five force of the model:

- **Threat of new entrants:** The internet has considerably lowered entry barrier in setting up new enterprise. The setting up of a new company does not require much capital investment, for example, online retail sites, etc. Ever increasing competition has lowered the margins.
- **Threat of new substitute:** The Internet has reduced the product life cycle; shelf life of products and encouraged innovation is customer serving.



Source: https://websprout.in/wp-content/uploads/2017/01/37890956_xxl-1-2048x1444.jpg

- **Bargaining power of customers:** The internet has made the customer well informed about products and available substitute. Companies have to be careful in presenting differentiation and pricing.
- **Bargaining power of suppliers:** Suppliers are well informed about happening in the industry thanks to the internet.
- **Threat of competition:** The internet has made transparency and honest important factor in success of the company. Customers tend to know more about the company. The internet has lowered the cost of searching new available products.

Internet and the Way Business is Conducted

The internet has changed the face of business. It has opened up new avenues of conducting business. Below are some impacts of the internet on business:

- **Communication:** communication technology combined with the internet has given a new dimension to connectivity and dispersion of information. Employees are in constant touch through email, instant messaging, office intranet, etc.
- **Collaboration:** The internet has facilitated collaboration among employees of organization. Geographical boundaries no longer hamper project work and sharing of information.
- **Business Transaction:** The internet has encouraged the culture of online business or e-commerce. In recent years many players have opened shops through e-commerce. Internet banking, payment gateways, etc. are part of normal supply chain transaction.



Source: https://www.agenciaeplus.com.br/wp-content/uploads/2017/08/pop.png

- **Work Flexibility:** The internet has enabled workers to log in from remote location and home. It has helped on the move employees by remaining in touch with happenings of work.
- **Web based application:** The internet has facilitated the development of concept like cloud computing, which has enabled process and storing of data in large proportion. The internet has helped reduce infrastructure cost of the company.

The internet thus has made a big impact in the way the business gets conducted in both positive as well as a negative way. The internet has made many business

obsolete example post offices. Online security issues like hacking, identity theft, etc. are a constant threat to internet users.

Digital Technology in Daily Life

The day to day devices such as mobile phones, computers, laptops, and other such machines operate through a binary computational code, therefore, storing, processing, and generating data as and when required. The application of binary computational code is additionally extended to social media, multi-media, *cloud computing*, productivity applications and other similar electronic tools. The digitization of technology provides operational and executable information, in order to reduce man-hours of labor. Digital technology has enabled volumes of information to be compressed on compact storage devices, so as to be easily contained and delivered, minimizing the time taken for data transmission speed.



Source: https://rebeccamoore82.files.wordpress.com/2015/04/picture1.jpg

Digital technology has immensely changed the pattern of working as well as learning of new concepts, including communication. Moreover, organizations have also started introducing digitized paper processes, electronic transfers, e-signatures, and many other processes that have completely transformed the work culture, promoting differentiating factor to an organization. *The telecommunications*, for instance, went under absolute transformation with technology becoming digitalized, especially with the cable systems and the cellular phones.

Advancement in Digital Technology

Digital technology is in the midst of a significant period of transformation, reaching its fourth wave of evolution. The first wave was of digital technology which was witnessed with the introduction of Internet, giving a variety access to information. The second wave of transformation came in with mobile internet, with the advancement of mobile phones having operating systems from Google, Apple, and other such companies. The third wave of digital technology is the present day application of *Internet of Things (IoT)*; wherein machines and equipment are embedded with tiny sensors, linked to virtual devices (cloud), creating value on a global level.



Source: https://i0.wp.com/acme-ug.org/wp-content/uploads/computer-2786081_1920.jpg?fit=1920%2C1174&ssl=1

Lastly, the approaching fourth wave of digital technology refers to the involvement of robotics and artificial intelligence (AI), aimed at assisting with decision making and creating knowledge with help of machines. The advancements in digital technology are at an unstoppable momentum, paving the way for enhanced competitiveness, increased customer satisfaction, scalability, and improved productivity. It has been reported that approximately 70-75 percent of business-houses globally are working towards digitalization. Organizations are on the constant look-out for flourishing and developing prospective business ideas, in order to grow globally.

Furthermore, the key element to be considered in digital technology is the employee empowerment. Any company or organization can transform its working parameters to the digital environment, but if it fails to empower its employees with the same, *the digital transformation* will not be able to provide profound and lasting insights for the overall development of the organization.

Advantages of Digital Technology

Digital technology has transformed nearly every aspect of modern life. Travel, work, shopping, entertainment, and communications are just some of the areas that have been revolutionized in recent decades. It's now rare to find an electronic device or piece of machinery that doesn't incorporate digital technology in some way.

Digital technology means that devices can be more compact, faster, lighter, and more versatile. Huge amounts of information can be stored locally or remotely and moved around virtually instantaneously. Even the term "information" has expanded to include media such as photos, audio, and video, and no longer refers to just words and numbers.

The advantages of digital technology are many, these are listed below.

Social Connectivity

Digital technology makes it easy to stay in touch with friends, family, and work remotely, even if you are in another part of the world. You can communicate by words, video, audio, and exchange other media. Websites, apps, and software have all been created to help users to socialize. With social media, messaging, texting, laptops, tablets, and mobile phones, nobody need feel isolated in the digital world. News and local events update users regularly.



Source: http://ceelo.org/wp-content/uploads/2013/12/PLC1.jpg

Communication Speeds

Internet speeds have increased exponentially since the early days of dial-up. Ever faster broadband enables the transfer of large amounts of information across the web almost instantaneously, making it possible to stream video and audio in real time, send large data files, and access data from virtually anywhere in the world. Traditional media generally takes much longer.

Versatile Working

The nature of work has been transformed by digital technology. Increased connectivity options mean that many people now have far more opportunities for working from home, as remote working becomes increasingly common. Many jobs can now be done from hundreds, or even thousands of miles away without difficulty. Without the need for all workers to be present in the same building, many other flexible working practices are now possible.



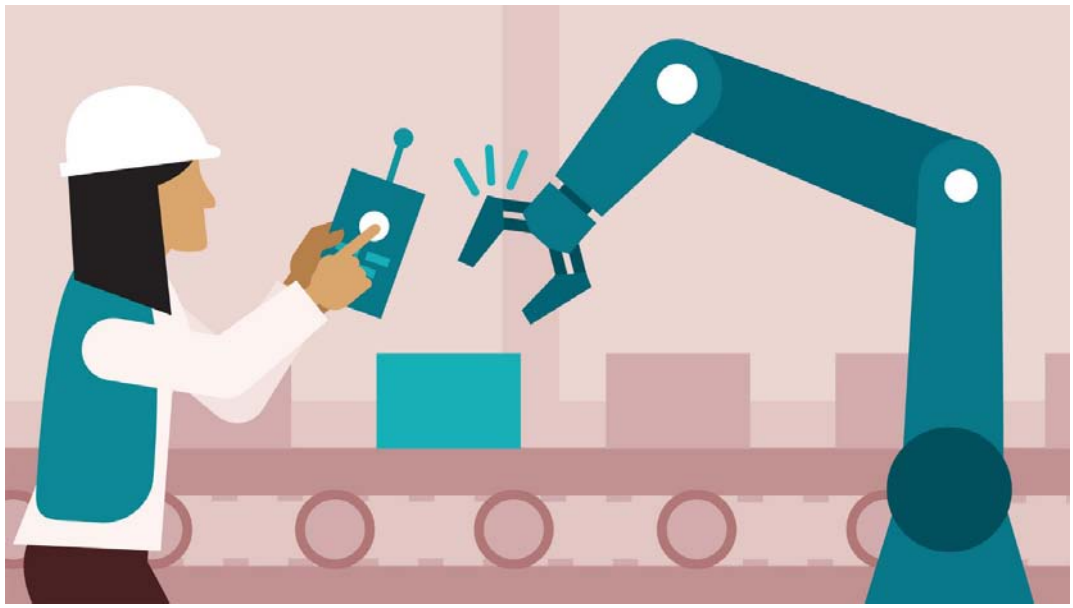
Source: http://israelforever.org/interact/blog/Social_Media_Israel_Connection.png

Learning Opportunities

Anybody with access to the internet now has access to a huge proportion of the world's knowledge over the web. Lessons and courses can now be delivered virtually online. Communication advances mean that you can now easily communicate with most of the world's population and learn directly from sources, for example if you are trying to understand foreign events, or learning a new language. Digital technology can also be easier to use for people with disabilities and often give them equal access.

Automation

Digital technology is increasingly making machines smarter. In some cases, the machines no longer need humans to operate them, freeing up workers from often boring tasks for more interesting pursuits. In other cases, smarter machines mean better standards of safety, or a better experience for the user. Products and services drop in price as the technology develops and becomes more common. Many tasks can now be done directly by customers, rather than having to be done through another person acting as an intermediary, for instance, booking a holiday.

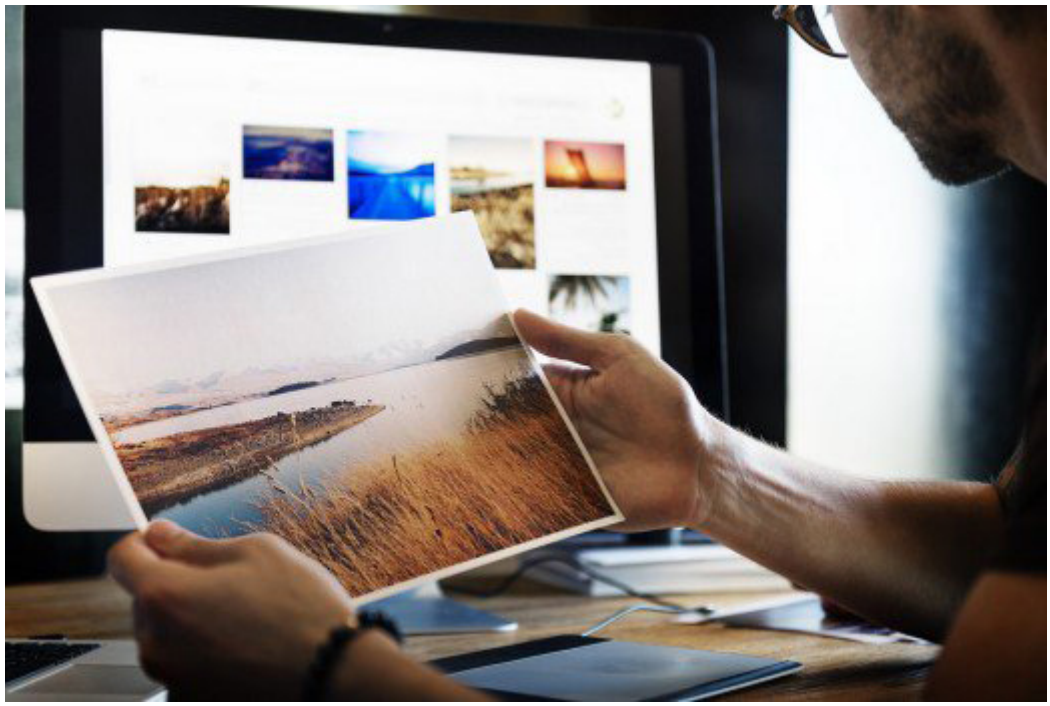


Source: https://cdn.lynda.com/course/661768/661768-636555165684068294-16x9.jpg

Information Storage

Digital technology enables the storage of massive amounts of information in relatively small spaces. Large amounts of media, such as photos, music, videos,

contact information, and other documents can be carried around on small devices like mobile phones. As well as physical locations, data can also be stored online, enabling it to be accessed from any device which has internet access.



Creative options for editing videos and photos have increased exponentially with the advent of digital technology. The technology is more affordable and easier to use too, what used to require a studio with expensive equipment can now be done at home.

Source: https://turbofuture.com/computers/Advantages-of-Digital-Technology

Editing

One of the great advantages of digital technology over traditional media is that the information can be easier to edit or manipulate. Word processing has brought about a revolution in the editing of text. Video editing, which used to require expensive studios and equipment, can now be done on a laptop in a bedroom. All sorts of photographic effects are now available, as well as the ability creatively alter images.

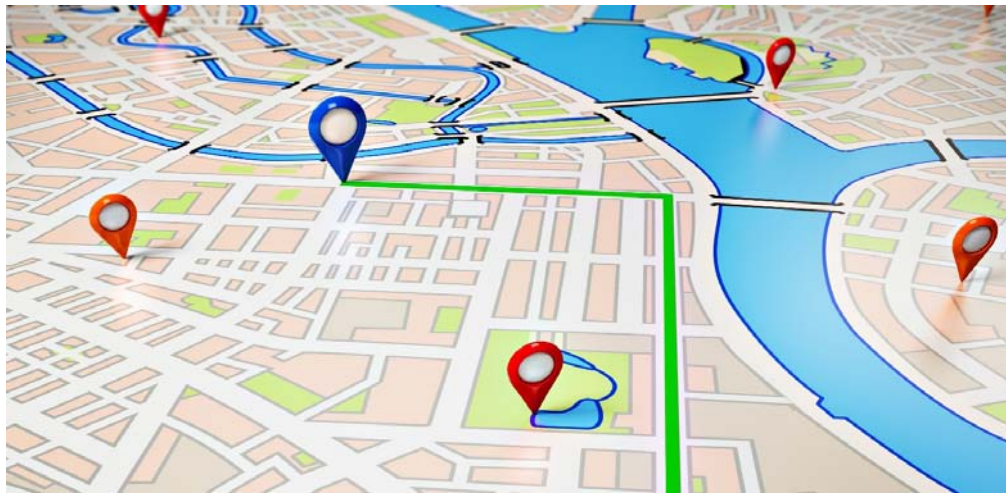
Accurate Duplication

One of the great things about digital technology is that it enables the exact duplication of media. For instance, you can write a work report and email it to multiple recipients, or you can distribute multiple copies of photos to family

and friends. Breakthroughs in technology are now happening in the field of 3D printing, which looks set to radically transform our world.

GPS and Mapping

Finding your way around used to involve referring to a paper map, but digital combined with satellite technology has transformed travel. GPS services can now pinpoint your position accurately, update you on traffic jams and road closures in real time, and give you lots of up-to-date information such as time of arrival at your destination, as well as alternative routes. If you want to find a gas station or drugstore that's open, that's easy too.



Source: https://thenextweb.com/wp-content/blogs.dir/1/files/2014/02/OpenMaps.jpg

Transportation

Many trains and airplanes already rely to an extent on digital technology. Road vehicles, such as cars and trucks, will become fully automated in the not too distant future. Accessing timetables, as well as booking planes and trains now often takes place online. Passports contain digital chips that hold information, enabling self service machines to speed up the process of checking in and passing through customs.

Low Cost

Aside from paying for an internet service and the basics like a modem, much of what the digital world offers can be accessed for free. Sending an email, communicating via a video link-up with family, and surfing the internet generally cost nothing. It can provide opportunities for low cost self-education, setting up a business, buying and selling items, or earning money online.

Entertainment

The entire entertainment industry and the way that people amuse themselves has been radically transformed. Many people get their fun from online social media, or playing computer games. Traditional media has evolved too, as televisions and broadcasting have become digitalized, along with radio.



Traditional sources of news such as newspapers have seen a dramatic decline in recent years, as digital media takes over. Many people now get their news via social media, as well as directly from news websites.

Source: https://turbofuture.com/computers/Advantages-of-Digital-Technology

News

Increasing numbers of people get their news online, either via a website or social media. Even traditional news media, such as TV and radio, have been digitalized. People have more options for news sources than ever, and most of it is available 24 hours per day. Independent and do-it-yourself journalism is now very common, as well as ordinary people taking photos and videos on their phones at locations where a news event is taking place.

Warfare

Advances in technology mean that wars can increasingly fought remotely, avoiding the risks associated with having soldiers physically present on or above the

battlefield, where they are prone to injury or death. Drones and missile technology are particularly reliant on digital technology to work effectively, but most machinery is being gradually becoming increasingly automated.

Banking and Finance

There's no doubt that digitalization has led to a revolution in financial matters. Online banking done either through a laptop, tablet, or phone app is now the norm. Bank users can now check their incoming and outgoing payments remotely, as well as arrange money transfers and bill payments. Outside of banking, other financial matters, such as buying and selling currency and shares can be dealt with online. Transferring money between accounts both nationally and internationally has also seen a great deal of innovation in recent years.



Source: https://www.megri.com/wp-content/uploads/Online-Banking.jpg

Smaller Sized Devices

One general effect of digital technology that is almost taken for granted is that devices can be made much smaller. The phones that we carry around are mini-computers, for example, capable of surfing the net, working as calculators, planning journeys, capturing and playing photos, audio, and videos, providing games for our amusement, as well as operating as phones and having other functions. Smaller devices generally means more portability and less space used up in living spaces.

REFERENCES

1. Compaine, Benjamin M., ed. *The Digital Divide: Facing a Crisis or Creating a Myth?* Cambridge, Mass.: MIT Press, 2001.
2. Couch, Leon W., II. *Digital and Analog Communication Systems.* 5th ed. Upper Saddle River, N.J.: Prentice Hall, 1997.
3. Gordon, David T., ed. *The Digital Classroom: How Technology is Changing the Way We Teach and Learn.* Cambridge, Mass.: Harvard Education Letter, 2000.
4. http://www.hkiaat.org/images/uploads/articles/AAT_Paper8_Oct09.pdf
5. http://www.umsl.edu/~joshik/msis480/chapt02.htm
6. http://www.uotechnology.edu.iq/ce/Lectures/SarmadFuad-MIS/MIS_Lecture_3.pdf
7. https://bus206.pressbooks.com/chapter/chapter-1/
8. https://smallbusiness.chron.com/importance-information-systems-organization-69529.html
9. https://whatis.ciowhitepapersreview.com/definition/digital-technology/
10. https://www.civilserviceindia.com/subject/Management/notes/types-of-information-system.html
11. https://www.guru99.com/mis-types-information-system.html
12. https://www.managementstudyguide.com/information-technology-and-business-intelligence.htm
13. Jurgen, Ronald, ed. *Digital Consumer Electronics Handbook.* New York: McGraw-Hill, 1997.
14. Kiesler, Sara, ed. *Culture of the Internet.* Mahwah, N.J.: Lawrence Erlbaum Associates, Publishers, 1997.
15. Mansell, Robin, ed. *Inside the Communication Revolution: Evolving Patterns of Social and Technical Interaction.* Oxford and New York: Oxford University Press, 2002.
16. Mollenhoff, Clark R. *Atanasoff: Forgotten Father of the Computer.* Ames, Iowa: Iowa State University Press, 1988.
17. Wheeler, Paul. *Digital Cinematography.* Boston: Focal Press, 2001.
18. Williams, Gerald E. *Digital Technology.* 3rd ed. Chicago: Science Research Associates, 1986.

CHAPTER 2

KNOWLEDGE MANAGEMENT



INTRODUCTION

Knowledge management is essentially about getting the right knowledge to the right person at the right time. This in itself may not seem so complex, but it implies a strong tie to corporate strategy, understanding of where and in what forms knowledge exists, creating processes that span organizational functions, and ensuring that initiatives are accepted and supported by organizational members. Knowledge management may also include new knowledge creation, or it may solely focus on knowledge sharing, storage, and refinement.



Source: https://wac-cdn.atlassian.com/dam/jcr:91b7e2a5-35e3-4163-a4f9-69689f57b29c/km_02.png?cdnVersion=kc

It is important to remember that knowledge management is not about managing knowledge for knowledge's sake. The overall objective is to create value and leverage and refine the firm's knowledge assets to meet organizational goals.

FRAMEWORK FOR INFORMATION AND KNOWLEDGE MANAGEMENT

Knowledge Management Mechanisms are organizational or structural means used to promote knowledge management. They enable knowledge management systems, and they are themselves supported by the knowledge management infrastructure. Knowledge Management Mechanisms may (or may not) utilize technology, but

they do involve some kind of organizational arrangement or social or structural means of facilitating knowledge management.

Examples of Knowledge Management Mechanisms include:

- learning by doing,
- on-the-job training,
- learning by observation, and
- face-to-face meetings.

More long-term knowledge management mechanisms include the hiring of a Chief Knowledge Officer, cooperative projects across departments, traditional hierarchical relationships, organizational policies, standards, initiation process for new employees, and employee rotation across departments.



Source: https://i.ytimg.com/vi/pXEIyhwdsjQ/maxresdefault.jpg

Knowledge management involves data mining and some method of operation to push information to users. A knowledge management plan involves a survey of corporate goals and a close examination of the tools, both traditional and technical, that are required for addressing the needs of the company. The challenge of selecting a knowledge management system is to purchase or build software that fits the context of the overall plan and encourages employees to use the system and share information.

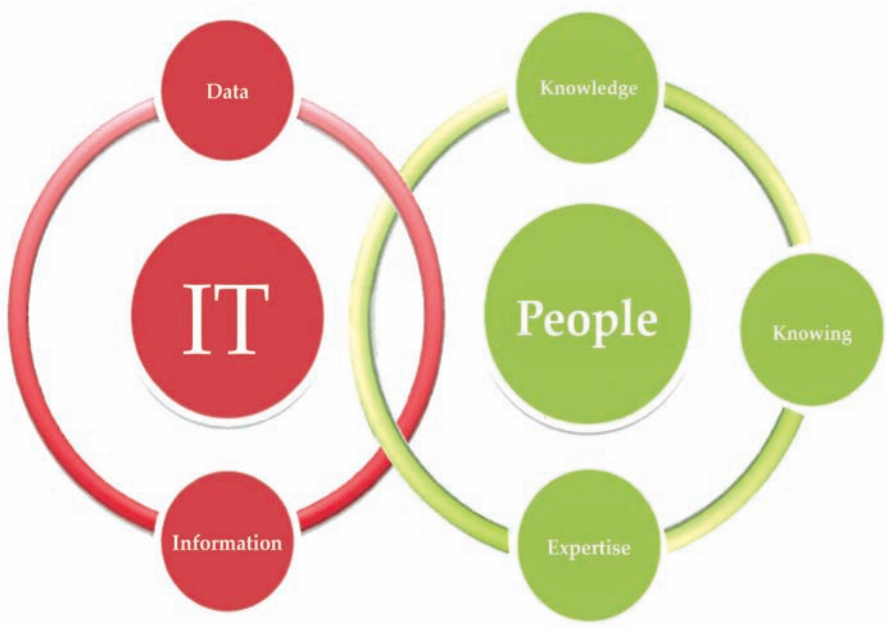
The goal of a knowledge management system is to provide managers with the ability to organize and locate relevant content and the expertise required to address specific business tasks and projects. Some knowledge management systems can analyze the relationships between content, people, topics and activity and produce a knowledge map report or knowledge management dashboard.

A four-process view of knowledge management that we have put into a table is:

This major process...	Includes these activities....
Gathering	• Data entry • OCR and scanning • Voice input • Pulling information from various sources • Searching for information to include
Organizing	• Cataloging • Indexing • Filtering • Linking
Refining	• Contextualizing • Collaborating • Compacting • Projecting • Mining
Disseminating	• Flow • Sharing • Alert • Push

Evolution of Knowledge Management

The emergence of the term 'explicit knowledge' and the introduction of KM in the 1980s were new. It was a natural evolution brought about by the confluence of many factors. The developments that have led to present perspective on KM come from many areas. Some are intellectually based, while others are pragmatic and rooted in the need to innovate to secure real-life performance. KM can be described as the most recent phase of an evolution from a managerial focus on data management than information management and finally KM. The three practices that have brought the most contents and energy to KM are information management, the quality movement and the human factors/human capital movement.



Source: https://i.pinimg.com/originals/67/31/28/673128bf47da5619fa0e40aa7fedab56.jpg

Information management developed during the seventies and eighties and is usually understood as a subset of the larger information technology and information science world. IT is a body of thought and cases that focus on how information itself is managed independent of the technologies that house and manipulate it. It deals with information issues in terms of valuation, operational techniques, governance, and incentive schemes. Information, in this context, generally means documents, data, and structured messages. In broad terms, KM shares information management's user perspective, a focus on value as a function of user satisfaction rather than the efficiency of the technology that houses and delivers the information.

Principles of Knowledge Management

Knowledge management is a political topic.

After all, knowledge underlies everything your business does. Your strategies, programs, projects, processes and communications depend on knowledge.

Your knowledge management program needs the support of executive management to have any chance of success. Knowledge management principles define your high level approach to managing your organization's knowledge.

They make a clear policy statement that align your organization around a knowledge management approach.

Definition: Knowledge Management Principles

Knowledge management principles are an enduring set of guidelines for managing knowledge that are established by an organization, program or team.

Establishing principles is one of the most effective actions management can take to support your knowledge management program.



Source: https://i2.wp.com/blog.smu.edu.sg/wp-content/uploads/2016/04/smu_blog_msc_innovation_knowledge_management_banner.jpg?resize=1200%2C800

Your knowledge management principles will be unique to your organization. The following examples are a starting point.

Knowledge is a Valuable Asset

Knowledge management is based on the idea that knowledge is an asset that should be managed (just as capital assets are managed).

Explicitly stating that knowledge is a valued asset makes it clear that teams are expected to manage and protect knowledge.

Knowledge is Stored in A Central Repository

One of the biggest problems that knowledge management programs face is islands of knowledge. Teams and individuals have a tendency to horde knowledge in their own makeshift repositories.

This principle makes it clear that everything goes into one central repository. Your knowledge repository (e.g. enterprise content management system) should allow teams and users to create their own knowledge spaces.



Source: https://assets.entrepreneur.com/content/3x2/2000/20170202064615-featuredd.jpeg

Knowledge is Retained

Knowledge is retained according to organizational retention policies. Retention may be managed with a set health check criteria for knowledge. For example, knowledge that is old, unreferenced and unused may be pruned.

Knowledge is Quality Controlled

Set the expectation that knowledge is quality controlled. For example, quality guidelines may state that document authorship (who contributed to knowledge) be captured.

Knowledge is Sustained

A sustainable approach to knowledge management. For example, minimizing the resources used by knowledge repositories.

Knowledge is Decentralized

Most knowledge management responsibilities lie with those teams closest to the knowledge. It's a bad idea to centralize all knowledge management processes.

Knowledge is Social

Knowledge that sits on a shelf has no value. The value of knowledge depends on communication and socialization. The creation, assessment, improvement and use of knowledge is largely a social process.



Source: http://fsd.servicemax.com/wp-content/uploads/social-learning.jpg

Knowledge is Shared

A primary goal of knowledge management is to facilitate the sharing of knowledge. Encourage your organization to share (e.g. lunch and learn sessions).

Knowledge is Accessible

Knowledge is more valuable when it's accessible to a wide audience. Privacy and confidentiality prevent most organizations from sharing all knowledge. However, it's important to set the expectation that a valid reason is required to restrict access.

The concept of accessibility also addresses access to knowledge for individuals with disabilities or special needs.

Knowledge is Secured

Knowledge is your most valuable information. It's critical that information security best practices be followed for knowledge management processes and tools.



Source: https://timesknowledge.wwmindia.com/content/2018/sep/image-2018-09-2181537520383.jpg

Knowledge is Searchable

Search is a critical tool for knowledge discovery. Executive management may choose to make search a priority.

Work Produces Knowledge

Set the expectation that every program, project, process and initiative is expected to generate knowledge. In some organizations, every meeting is expected to generate knowledge.

Knowledge is Measured

Require teams to measure their knowledge management processes and knowledge assets.



Source: https://riskcenter.wharton.upenn.edu/wp-content/uploads/2018/08/adult-agreement-business-1089549.jpg

Knowledge is Improved

Knowledge that isn't improved quickly loses its value. Knowledge management is a process of continual improvement.

Knowledge Management Tools

The development of IT for organizations has produced many successful ERP-type systems that manage well-defined processes. But systems to manage ill-defined, knowledge intensive processes have met with less success. KM practitioners use a wide range of IT tools to share, create, codify, and share knowledge. The trend in the development of IT for organizations is toward more communication and collaboration tools.

Requirement of Knowledge Management Tools

The tools for KM are focused on assimilation, comprehension, and learning of the information by individuals who will then transform data and information into knowledge. Knowledge is strictly linked and connected to the individual (or group) who creates it, which may cast doubts on the availability of information systems tools to effectively support KM. Thus the visible part of knowledge, what the literature calls explicit as opposed to the tacit dimension of knowledge, is only

information regardless of the amount of the other individual knowledge embedded into it. Therefore, there is requirement of KM tools, which can collect, catalogue, organize, and share knowledge or transfer information (the explicit knowledge) embedded in various forms and types of documents and media. These reasons are:



Source: https://geomarketing.com/wp-content/uploads/2016/08/What-The-Latest-Google-My-Business-Update-Means-For-Local-Marketers.jpg

- Facilitate information contextualization: To facilitate information contextualization, metadata on its characteristics and integration within a specific environment must be attached to it before storing. This facilitates better retrieval and management for the knowledge seeker.
- Intelligently transfer information: Information transfer must occur by taking into account the user, the content, and the time of transfer. A tool that can optimize these three aspects can truly provide information according to the needs of the users, respecting one of the key functional foundations of KM.
- Facilitate social interactions and networking: Direct communication and verbal knowledge transfer through social interactions among individuals is the most natural aspect of knowledge sharing. A KM tool supports this social aspect and facilitates searching.
- Present a customized human-computer interface: The tools also support interface customization and ease of use. The human-computer interface, ease of use and usability will drive intention to use and reuse the tools.

Tools Available for Knowledge Management

A number of tools are available to support the functionalities and processes of KM, which are listed below:

Tools to Access Knowledge

These tools provide access to explicit knowledge that can be shared and transferred through the enterprise information systems. For example, Convera is a tool used for retrieval ware. It works on powerful indexing systems to classify expertise based on both content and collaboration dynamics and networks within the enterprise.



Source: http://www.fabricatingandmetalworking.com/wp-content/uploads/2017/01/SAN990-HR-image.jpg

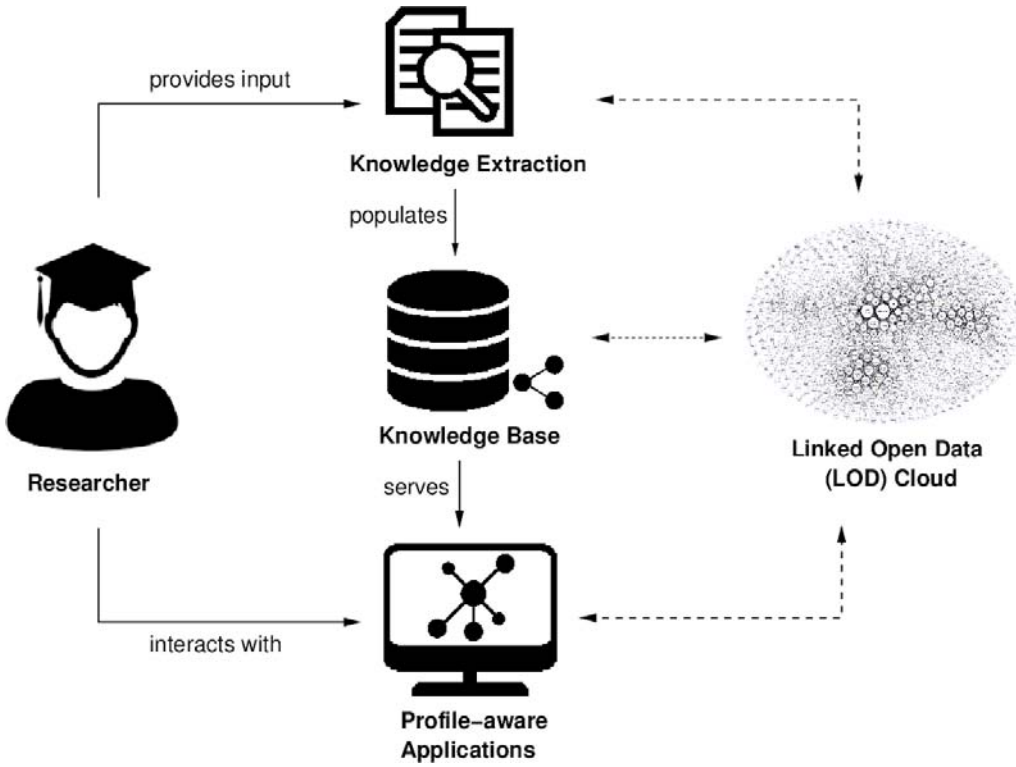
Tools for Semantic Mapping

These tools are meant to quickly support presentation of information, analysis, and decision making. Ontology tools are also part of this category as they enable users to organize information and knowledge by groups and schemata that represent the organizational knowledge base. For example, Anacubis is a ground-breaking visual research and analysis software for corporate researchers, analysts, and intelligence professionals. It supports the visual discovery and analysis of intelligence in both online and enterprise information. Information is represented in the Anacubis

Desktop by icons and links. Users can also import, create, analyze, and distribute visual representations of their research and analysis.

Tools for Knowledge Extraction

These tools support structured queries and replies. They help mining text by interpreting relationships among different elements and documents. For example, ClearForest Text Analysis Suite is an advanced text driven business intelligence solutions which apply intelligent mark-up to key entities such as person, organization, location, as well as detailed facts or events embedded within free-form text such as news articles, web surveys, and HTML documents.



Source: https://dfzljdn9uc3pi.cloudfront.net/2017/cs-121/1/fig-1-full.png

Tools for Expertise Localization

These tools enable quick location of the knowledge holders in the enterprise and facilitate collaboration and knowledge exchange. For example, ActiveNet maintains a continuous, real-time view of organizational activities. ActiveNet continuously discovers each person's work activity and business relationships by processing communications from such sources as documents, discussion databases, e-mail, instant messaging and digital workspaces.

Tools for Collaboration Work

These tools enable teams to globally share dedicated spaces for managing the project lifecycle; editing and publishing materials; conducting live discussions and interactions; and maintaining a repository of materials associated with every step of the process. For example, QuickPlace is a Lotus's web-based shared workspace software for realtime collaboration among geographically dispersed participants. Using QuickPlace, coworkers, suppliers, partners, and customers can communicate online immediately within a structured workspace created for that purpose. An online workspace can make it possible for people to work together more easily and less expensively.

Evolution of IT Tools in Knowledge Management

Some categories of IT tools commonly associated with KM are shown in Table 1.

Table 1: IT Tools commonly associated with knowledge management

Technology	Description/examples
AI technology	Expert systems, learning systems.
Communication and collaboration systems group	E-mail, teleconference, video conference, chat, IM, forum, Listserv, groupware calendar, log, shared information spaces workflow management system, group decision support system.
Documents management system	Management of electronic documents, a system to search, edit, distribute, retrieve, archive and otherwise mange the complete lifecycle of documents.
Content management system	Management of electronic content including multimedia files.
Intranet	A network contained within the enterprise. It is used to share information and computing resources among employee as well as to facilitate group working.
Search engine	Tool that searches the contents of a web.
Learning system	Distance learning, e-learning and computer-based training.
Knowledge mapping tools	Any resource that locates people by their knowledge; human resources skill set inventory system.

Categorization of Tools Based on Different Types of Knowledge

Four different types of knowledge and the different types of KM tools that can be used to manage or facilitate knowledge transfer are shown in Table 2:

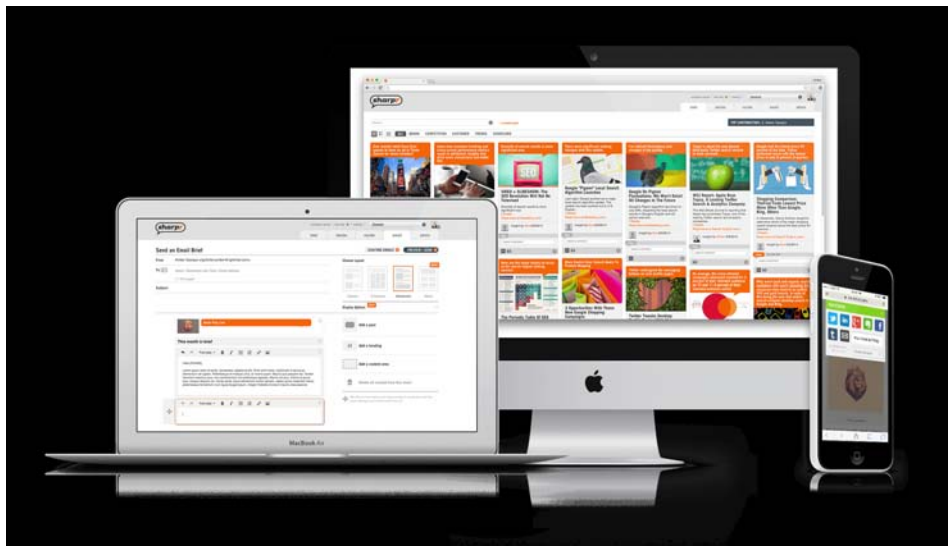
Table 2: Types of knowledge and different types of knowledge management tools

Explicit knowledge	Know how	Know who	Tacit knowledge
System tools	Collaboration tools	CRM tools	Video conferencing
DBMS	E-mail	Social network analysis	Face-to-face facilitation
Data warehousing	Groupware	Knowledge portals	Other technologies

Web-based Information Technology Tools for Knowledge Management

Web offers a very powerful platform for tools supporting all stages of KM. The web allows for an unprecedented degree of integration of different representational and communicational media.

- *Traditional Database Tools:* These tools attempt to allow users to create general data properties implicitly within a database. They allow for the creation of objects that have certain properties, can communicate with other objects and so on.
- *Process Modelling and Management Tools:* Processes that involve the transformation of physical material have been the focal metaphor. Tools have been built to support these processes encode considerable knowledge of the process.
- *Workflow Management Tools:* These are the process management tools for information-intensive organizations. Workflow tools allow for the specification of the movement of documents in information processes.

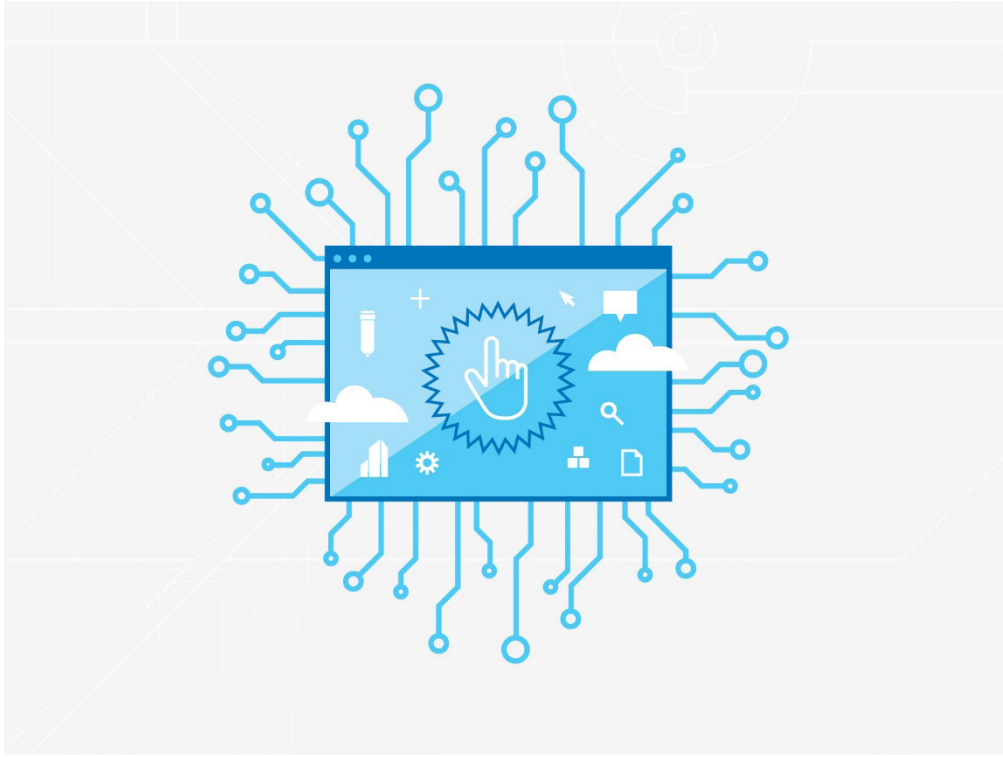


Source: http://wp.sharpr.com/wp-content/uploads/2015/12/shr-homepagehero.png

- *Enterprise Resource Management Tools:* Enterprise modelling tools are being developed to provide all the modelling capabilities of ERP/ERM systems along with the explicit representation of organizational and environmental knowledge.
- *Agent Tools:* These tools rely on agents, relatively autonomous programs that can perform a variety of tasks. Agents may be provided with the specifications of the information that the user is interested in and these will then search the web and specified other databases to find the information.
- *Search Engines, Navigation Tools and Portals:* Some of the search engines perform automatic text-only searches while others relied on human 'interpreters' who would access web pages and then analyze and classify them.
- *Visualizing Tools:* These tools have been developed to investigate the structure of knowledge domain and knowledge within domains. These tools have been used for data visualization in the areas of financial market to molecular biology.
- *Collaborative Tools:* These types of tools are provided for setting of bulletin board and for real-time video conferencing, whiteboards, and chat rooms.

New Tools for Information Management

A new group of web-based information management tools has emerged based on freeform social software that enhances individual knowledge work, group communication, and collaboration. Information management tools for knowledge work and communication are not new. The new tools open up one-to-one and group communication to be viewed by many users if not the public. They differ fundamentally from the old suite of tools in that they are based on user participation and are mostly characterized by participatory services, where users create content. They usually allow users to manage and modify their own data within a given system - information that is usually made public for others' benefit. Thus the services get better the more people use them. Organization or knowledge is drawn out of user actions like tagging or visiting sites. But by far the most dominant characteristic is that of participation. Participation is built into the actual architecture of the tool or service offering.



Source: https://reprodux.com/wp-content/uploads/sites/4/2015/06/information-management-collaboration-markup-tools-image.jpg

Web 2.0

Web 2.0 is also (perhaps most) often described as a group of people-driven tools that allow collaboration. These include blogs, tags, mash-ups and, wikis.

- Blog: Blogs are most commonly used as an online version of a personal journal. Essentially, a blog is simply a web page that contains periodic, chronological ordered posts, additionally grouped by categories. Users visiting the blog can often add comments to posts. Administering a blog (updating it by adding new posts, creating links to other web pages, adding pictures, categorizing posts, etc.) is extremely simple. Setting up a blog can be more complicated but keeping it updated and posting end-user comments to it is very easy. User settings are typically highly configurable. Because of the emphasis on reverse chronological posting, blogs are often characterized as promoting form over content. Blogs are most commonly used as an online daily journal or personal KM tool. For example, teenagers may post photos, poetry, game scores and other content to share with their friends. Others have used it as a log file, to record chronological data like system updates.



Source: http://smarterware.org/wp-content/uploads/2016/09/blogging.jpg

- Tags: Tagging is essentially a form of social book marking. It allows users to tag or categorize web pages with words they create. When tagging a particular page, one can see words others have used to categorize the page, thereby synchronizing our own categories with others to create an overall order. We can also see how many others have tagged the same page, any notes they wrote about that page, what other pages they have tagged, add them to a network of contacts and contact them. Tagging is also present in services like Flickr, YouTube and Yahoo's MyWeb. Tagging is a way to let structure emerge.



Source: https://dmi-uploads.imgix.net/general/How-to-Use-Hashtags-in-Social-Media_blog.gif?fm=jpg&ixlib=php-1.1.0&q=60&w=2060&s=3c9fb2d72e1e7aeacb225be0c3a27698

- Wiki: A wiki is fundamentally a web of interlinked pages where each page typically contains a concept (a name) and a description of that concept (an article). Users are allowed to edit any part of the article, modify the description, add new names, add external links and add links to names (and their corresponding articles) that do not exist yet (so that another user can fill in the description of the new concept). They are extremely easy to navigate in and add content to. User security is usually set low, giving users as much power as possible to change the content. Page changes, old versions of pages and recent changes of pages are all well documented and manageable by users and/or administrators. Wikis, have become a tool for online collaboration and community building. They are the best suited for building a knowledge base from a variety of users' input. The most well-known example of a successful wiki is Wikipedia.org, a free online encyclopedia composed of articles written by the general public.



Source: https://upload.wikimedia.org/wikipedia/commons/4/4e/Wiki-black.png

Dimensions and Strategies of Knowledge Management

There are several dimensions to Knowledge Management (KM) and the most popular framework distinguishes between "tacit" knowledge and "explicit" knowledge. Tacit knowledge refers to the internalized knowledge that individuals in an organization possess and where he or she might not be aware that they have

the knowledge about how they accomplish particular tasks. On the other hand, explicit knowledge is the knowledge that individuals in organizations know that they have and are conscious of it.

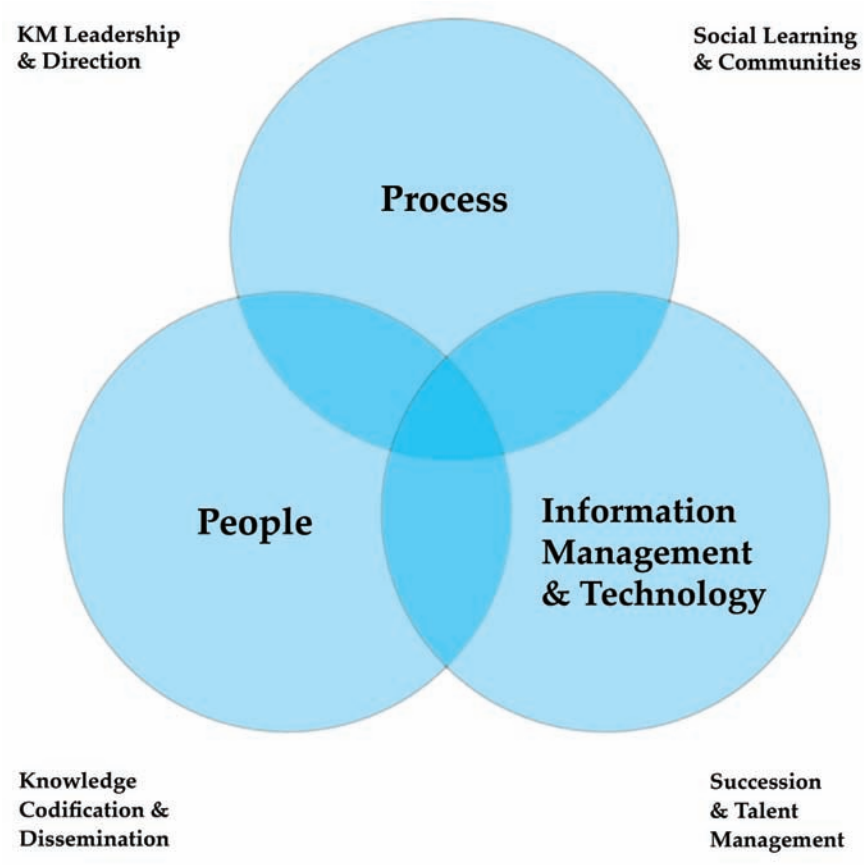


Source: https://static1.squarespace.com/static/546f54ede4b06090ee7979d5/t/57dfef57ff7c5017de11bc47/1474293593673/km-services.jpg?format=2500w

The crucial element in any Knowledge Management system is to ensure that tacit knowledge is captured and converted to explicit knowledge. Moreover, it has been hypothesized that even explicit knowledge needs to be converted into information that is meaningful and useful. After all, mere data is not useful and only when data is transformed into information and codified as knowledge is it useful.

Strategies of Knowledge Management

There are different strategies to capture knowledge and they include the "push" and the "pull" strategies. First, it must be made clear that knowledge can be captured before, during, and after the processes actualize. Hence, there need to be incentives for employees to contribute to the knowledge base. The push strategy focuses on making employees contribute to the Knowledge Management system in a proactive manner wherein individuals strive to contribute to the Knowledge Management system and the knowledge base without any prodding or persuasion. This approach is also known as the codification approach to Knowledge Management.



Source: http://sites.spypondpartners.com/kmdemo/img/implementing/strategies.png

Another strategy is the pull strategy wherein individuals who need knowledge make explicit requests to those who possess knowledge. In this case, the experts are called upon request and hence the knowledge seeker pulls the information rather than the expert pushing the information. This approach is known as the personalization approach to Knowledge Management.

Motivations for Knowledge Management

There are several motivations that drive organizations to implement Knowledge Management systems. As discussed earlier, the need to have a Knowledge Management system has become mandatory for certifications as well as to have sources of competitive advantage. The most compelling motivation for having a Knowledge Management system is that organizations do not have to reinvent the wheel and subsequent iterations of the same process can be done in a more efficient and productive manner. Indeed, the reuse of knowledge leads to synergies between the different processes and helps in solving intractable problems.

Apart from these imperatives, Knowledge Management helps organizations to manage the organizational arteries better as increased exchanges of information between different individuals' results in greater connectivity and more network effects. In other words, Knowledge Management systems help in managing innovation and organizational learning. This is a direct and beneficial effect of Knowledge Management and one, which is driving more and more companies to have working and efficient Knowledge Management systems.



Source: https://pubext.dir.texas.gov/portal/internal/about-dir/data-center/ImageLibrary/iStock_000046922240_Small.jpg

It is no longer the case that having a Knowledge Management system is a luxury or an afterthought. Indeed, the business landscape is now characterized by companies that leverage human capital and knowledge capital and hence, a Knowledge Management system is necessary for any large organization.

Benefits of Knowledge Management

While it may not seem directly related to the tactics of knowledge management, the primary goal is to increase company efficiency to improve business decision-making. The idea is that building expertise into your organization - and dispersing it amongst employees - empowers you to make more informed, faster, and ultimately more profitable decisions.



Source: https://elearningindustry.com/wp-content/uploads/2015/06/5-benefits-of-integrating-knowledge-management-systems-into-corporate-elearning-platforms.jpg

Of course, there are several secondary benefits. Successful KM will enable you to:

- Increase collaboration and idea generation
- Optimize a culture of knowledge sharing
- Protect intellectual capital
- Treat human capital as an asset (which makes employees feel respected for their knowledge)
- Capture and store knowledge for the future workforce

The Challenges of Knowledge Management

There are many challenges that businesses face when implementing knowledge management. Here is a list of some of the most common ones:

- Creating a culture of flexibility and collaboration: This is one of the most significant and enduring challenges of KM. Companies already struggle to implement new policies, because people naturally tend to resist change. However, KM can be especially difficult because employees might want to protect their skills and knowledge, or be reluctant to learn from their peers.

- Security: You have to design a knowledge transfer system that makes it easy for the appropriate people to access information, while protecting sensitive or private intelligence from outsiders.
- Measuring knowledge: It can be difficult to define metrics to measure the knowledge within your organization, especially for tacit knowledge that cannot be easily quantified. To overcome this, some experts recommend focusing on the purpose of knowledge, rather than the efforts or results (which are often also unquantifiable).



Source: https://www.timg.com/wp-content/uploads/2016/06/Knowledge-Sharing-Now.jpg

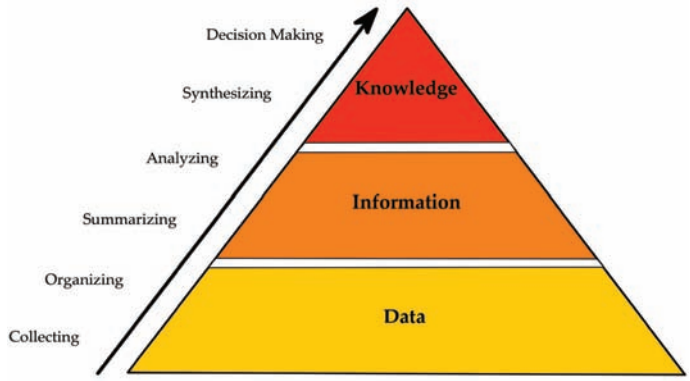
- Identifying an expert: There won't always be a single "keeper" of every knowledge type, but you will still have to identify who within the company possesses certain knowledge, and use them as the base level of knowledge from which you want to build. This process is difficult tactically, but can also be delicate among employees who might feel competitive about their skill levels.
- Document storage and management: While not all knowledge makes for straightforward documentation, it will have to be stored and organized in some form. Document management is a challenge for many companies, but organization is a vital aspect of KM - otherwise, it will be impossible to locate and use the knowledge you have stored. Consider using a dedicated document management system to keep everything organized.
- Disseminating knowledge throughout an organization: You'll need to devise a process where, once you store the knowledge, other team members can access it. This is complicated both theoretically and tactically, so many organizations opt for a software system designed specifically for this purpose. We'll take a closer look at KM systems later on.

- Continual improvement: Like most process-driven strategies, you should continually improve upon the knowledge management system you implement. Stage periodic reviews or, if possible, dedicate resources to continually optimize your process.
- Determining where KM is housed: If KM serves your entire organization, decide which department will "own" the strategy. Companies most commonly house KM in HR or IT. Remember, this department is not only responsible for effectively managing the knowledge itself, but also for maintaining the community of knowledge sharing and organizational learning.

THE KNOWLEDGE MANAGEMENT PROCESS

The process of knowledge management is universal for any enterprise. Sometimes, the resources used, such as tools and techniques, can be unique to the organizational environment.

The Knowledge Management process has six basic steps assisted by different tools and techniques. When these steps are followed sequentially, the data transforms into knowledge.



Step 1: Collecting

This is the most important step of the knowledge management process. If you collect the incorrect or irrelevant data, the resulting knowledge may not be the most accurate. Therefore, the decisions made based on such knowledge could be inaccurate as well.

There are many methods and tools used for data collection. First of all, data collection should be a procedure in knowledge management process. These procedures should be properly documented and followed by people involved in data collection process.

The data collection procedure defines certain data collection points. Some points may be the summary of certain routine reports. As an example, monthly sales report and daily attendance reports may be two good resources for data collection.



Source: https://d3ayyz93zozlya.cloudfront.net/uploaded-images/articlemainimage/collecting-data-to-measure-your-organizations-outcomes-588a3268d2530.jpeg

With data collection points, the data extraction techniques and tools are also defined. As an example, the sales report may be a paper-based report where a data entry operator needs to feed the data manually to a database whereas, the daily attendance report may be an online report where it is directly stored in the database.

In addition to data collecting points and extraction mechanism, data storage is also defined in this step. Most of the organizations now use a software database application for this purpose.

Step 2: Organizing

The data collected need to be organized. This organization usually happens based on certain rules. These rules are defined by the organization.

As an example, all sales-related data can be filed together and all staff-related data could be stored in the same database table. This type of organization helps to maintain data accurately within a database.

If there is much data in the database, techniques such as 'normalization' can be used for organizing and reducing the duplication.



Source: http://datadrivenaid.org/wp-content/uploads/2017/09/tablet-graphs.jpg

This way, data is logically arranged and related to one another for easy retrieval. When data passes step 2, it becomes information.

Step 3: Summarizing

In this step, the information is summarized in order to take the essence of it. The lengthy information is presented in tabular or graphical format and stored appropriately.

For summarizing, there are many tools that can be used such as software packages, charts (Pareto, cause-and-effect), and different techniques.



Source: https://melbournechapter.net/images/collecting-data-clipart-1.png

Step 4: Analyzing

At this stage, the information is analyzed in order to find the relationships, redundancies and patterns.

An expert or an expert team should be assigned for this purpose as the experience of the person/team plays a vital role. Usually, there are reports created after analysis of information.



Source: https://www.northeastern.edu/levelblog/wp-content/uploads/2017/08/photodune-19088615-business-people-meeting-data-analysis-planning-concept-xxl.jpg

Step 5: Synthesizing

At this point, information becomes knowledge. The results of analysis (usually the reports) are combined together to derive various concepts and artefacts.

A pattern or behavior of one entity can be applied to explain another, and collectively, the organization will have a set of knowledge elements that can be used across the organization.

This knowledge is then stored in the organizational *knowledge base* for further use.

Usually, the knowledge base is a software implementation that can be accessed from anywhere through the Internet.



Source: https://cdn.lynda.com/course/546777/546777-636283651065687008-16x9.jpg

You can also buy such knowledge base software or download an open-source implementation of the same for free.

Step 6: Decision Making

At this stage, the knowledge is used for decision making. As an example, when estimating a specific type of a project or a task, the knowledge related to previous estimates can be used.

This accelerates the estimation process and adds high accuracy. This is how the organizational knowledge management adds value and saves money in the long run.

Knowledge management is an essential practice for enterprise organizations. Organizational knowledge adds long-term benefits to the organization in terms of finances, culture and people.



Source: https://mocdstudio.com/wp-content/uploads/2016/04/5-important-data-analysis-and-presentation-tools-within-Microsoft-Excel.jpg

Therefore, all mature organizations should take necessary steps for knowledge management in order to enhance the business operations and organization's overall capability.

STEPS TO BUILD A KNOWLEDGE MANAGEMENT CULTURE

Knowledge management (KM) is now one of the key processes in IT sector, and the payoff of an effective KM process is huge. When fully implemented, a common KM system that is available to all stages in the services lifecycle improves decision making; reduces duplication of effort and rediscovery of knowledge; reduces costs; and empowers customers, users, and all of IT.



Source: https://d3an9kf42ylj3p.cloudfront.net/uploads/2017/11/Knowledge_sharing_examples-01.png?x38402

So why have so few IT service organizations been able to implement KM successfully? They lack a successful strategy to overcome the cultural barriers that stand in their way. A knowledge-driven culture is possible. With the right vision, strategies, and tactics, behavior can change and with it, the culture of a services organization. Let's consider how six steps can help your organization overcome barriers to successful KM implementation.

Step 1: Recognize that Implementing KM Must be a Strategic Initiative

Taking a tactical or operational approach, and not recognizing that implementing effective KM must be a strategic initiative, ignores the need for behavioral change. Implementing KM is one of those big changes that requires a well-thought-out organizational change plan, to change the organization's culture over time as you implement the process.



Source: https://images.techhive.com/images/article/2016/10/entrepreneurial-hands-work-as-a-team-managing-business-and-technology-gears-and-symbols-to-create-innovation-thinkstockphotos-100687125-primary.idge.jpg

To realize effective KM throughout an organization, all support groups should feel they have a "piece of the action." All IT support managers and practitioners, from the frontline service desk to executive management, should feel as though they are contributors to, and beneficiaries of, the KM process. Use an organizational change model, such as Kotter's 8-Step Process of organizational change, to guide and facilitate the shift to a knowledge-centered services organization over time. Follow these steps to guide your initiative to success:

- Establish a sense of urgency to move to KM. Start with your team! Let them know that a move to a KM culture is strategically important to your organization.
- Form a powerful guiding coalition to lead the effort. Getting the right people on your KM planning and implementation project team, with the right skills and talent, is critical. Include members from various IT teams—technical management, applications support, operations, and the service desk—to get participation and "buy-in" across the organization.
- Create a compelling vision for transitioning to knowledge management. Your vision and mission statements for realizing a new, knowledge-driven service and support organization are fundamental cornerstones to your strategic plan.
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- Communicate the vision—initially and continually. Having a well-thought-out communications plan is fundamental to the success of this major organizational change effort. It's important that you tailor your message to each of your target audiences—support staff, technical and application teams, customers, and users.



Source: https://realkm.com/wp-content/uploads/2015/11/dreamstime_l_47450085.jpg

- Empower others to act on the vision. Make it easy for contributors, reviewers, and consumers to participate. When your implementation requires practitioners and managers to take several extra steps to submit

a knowledge article, or to retrieve information from the knowledge base, you are creating roadblocks to adoption and usage. Remove the roadblocks.

- Plan for and create short-term wins! One of the challenges to overcome when launching a major initiative such as the adoption of KM is the initial resistance and ongoing doubt about the likelihood of success. Plan for early, visible improvements that will create enthusiasm and a sense that the initiative will indeed succeed as it moves forward.
- Consolidate improvements, and produce still more change! Once you have been able to demonstrate these quick wins, your KM initiative will begin to pick up momentum. People will realize their jobs are actually easier and they are becoming more productive. Use this increased credibility to change and improve other supporting systems, tools, and processes.

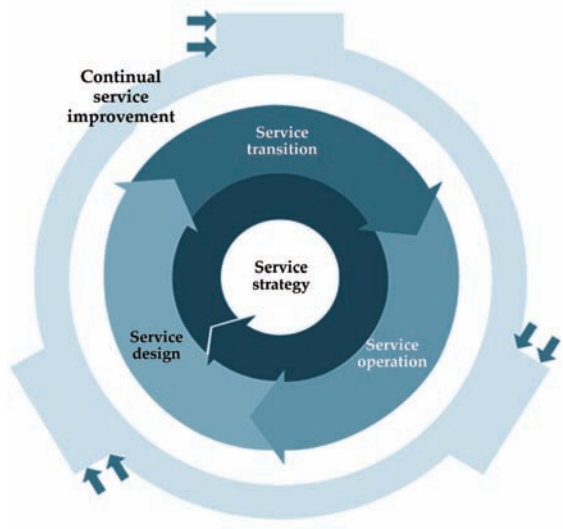


Source: https://www.mckinsey.com/~/media/McKinsey/Not%20Mapped/Making%20time%20management%20the%20organizations%20priority/mati13_frth.ashx

- Finally, institutionalize the new approach! The goal is to make knowledge sharing and re-use "just the way you work." In order for this to happen, you must build it into everything that people do as a part of their daily tasks For example, include it in your core values; embed knowledge contribution and re-use in core procedures; include contributing in your job descriptions; make KM part of monthly reporting, and recognize regular contributors.

Step 2: Take a Lifecycle Approach to Implementation

Trying to implement KM as a short-term, tactical project would be a mistake. Instead, consider KM as an organization-wide process, requiring a service lifecycle approach to implementation. View KM as a process, not a tool or system—one that must be strategically initiated and adopted across teams in a cultural sense—so that sharing knowledge becomes an integral part of the work culture. KM becomes a way of working, but one that uses a tool and/or systems to capture, store, and effectively share knowledge. Follow the ITIL Service Lifecycle approach:



Source: https://www.thinkhdi.com/library/supportworld/2016/6-steps-build-knowledge-management-culture

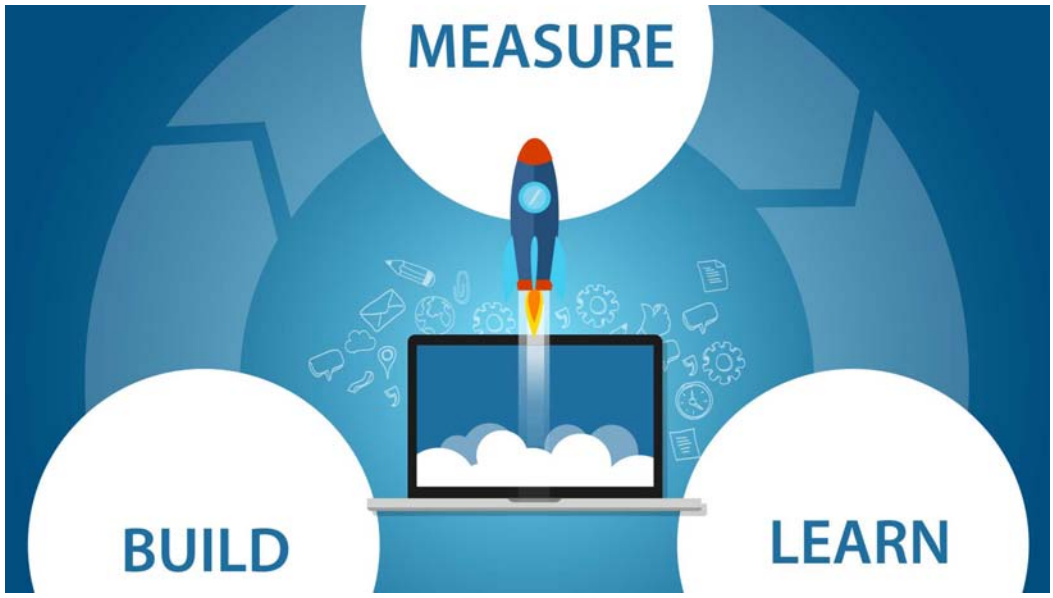
- Start with a **Service Strategy**: Establish your compelling vision for transforming your organization to a knowledge-centered service provider, along with a supporting mission, goals, and objectives. Include "knowledge" in your strategy statements. Add "sharing knowledge" to your list of core values, underscoring its importance to the organization.
- Develop a holistic approach to implementation with **Service Design**: Design your KM process, along with supporting systems, tools, metrics, and other elements, and produce a master plan for KM.
- Implement KM using a **Service Transition** approach: Using your master plan as input, begin implementing the various components over time—people, process, and supporting technology (it will take all three, plus your organizational change plan). And don't neglect to communicate the "quick wins" and the success of your KM initiative repeatedly to all stakeholders as it moves forward!
- Your design should be to embed it within your **Service Operation** processes: Make knowledge capture and reuse an integral part of every

production support process—for example, during the monitoring of events, while resolving an incident, and when troubleshooting a problem. The idea is to either access and put captured knowledge to work, or capture knowledge while in the workflow.

- Keep it going with **Continual Improvement**: Having designed metrics and reporting for your KM process, make the monitoring and reporting on KM performance and value part of your monthly IT management meeting. Assess performance to goals, and look for ways to improve the KM process, people aspects, and supporting tools and systems.

Step 3: Realize that There Are Silos to Overcome

Traditional IT organizations are organized along technology lines. For example, there will generally be a set of technical management teams that provide planning, transition, and operation support for the technology infrastructure. An applications management group will support the applications that are a key part of services delivered to customers, providing support during design, transition, and operations. As a by-product of this organizational structure, supporting systems—including knowledge bases—are formed, also organized along these same organizational boundaries.



Source: https://supplychainbeyond.com/wp-content/uploads/2018/10/data-siloes-and-business-agility-1920x1080.jpg

To overcome these KM silos, start with a compelling vision and mission that all groups can "buy into"; plan and deploy an initial and ongoing communications plan that will set the right expectations with all groups and continue to reinforce the value and benefits of the new KM approach; tear down barriers to participating

in knowledge capture and submission, making it easy for all service and support groups to participate; make it an integral part of everyone's job, from frontline support, to tier 2 support teams, to management; build it into your performance management and compensation program, so that people realize knowledge sharing is expected; and make it a part of being recognized and rewarded.

As service and support staff begin to see and experience how fundamental this is to their daily job, and when they begin to experience that it is actually working and making their jobs more productive and enjoyable, the barriers between the silos will fade, and they will begin to rally around the new approach. A new knowledge culture will gradually begin to take shape!

Step 4: Focus on the Strategy and Process First, not the KM Tool

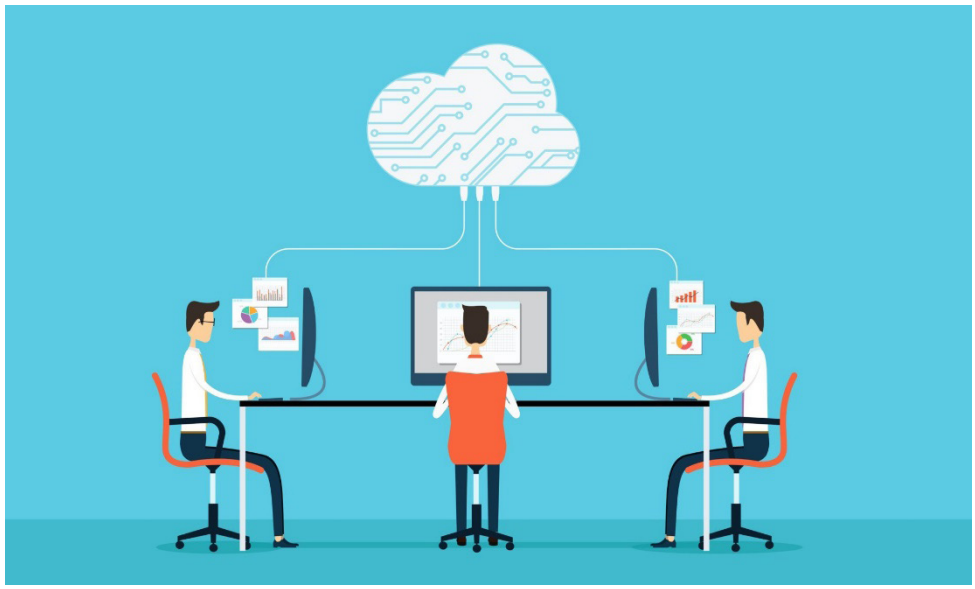
All too often, management mistakes KM as a tool or system, instead of an organization-wide process. This is a common phenomenon, since IT managers and practitioners typically have an implementation/support technology background. Compounding this problem, vendors want nothing more than to sell lots of KM tools, systems, and databases. But a KM tool will not produce a KM process. As discussed, start with a solid strategy. Then define and document the process, along with the appropriate tools and technology.



Source: https://sdtimes.com/wp-content/uploads/2015/06/AUG15-0625-OPINION-GUESTVIEW-BHATIA.jpg

Once you've defined how KM will play an integral role in your core processes, pick the best systems and tools that fit your requirements. You might choose to use a Wiki to store shared information, or a database, or a collection of repositories. But without well-designed processes that provide a framework for the way people ought to do their work using knowledge, your tools and databases will soon go unused—and rapidly fall out of date. KM needs a process owner and manager, defined inputs and outputs, triggers to initiate the capturing and sharing of knowledge, defined metrics and measurements, supporting policies and procedures, and enabling people and technology.

Integrate your KM systems and tools into your processes so they are simple, fast, and effective. Google sets the bar when it comes to search, and your KM process should follow industry-leading examples. The search engine should allow for natural-language search, as well as search by phrase/keywords. The search engine—along with supporting databases—should be fully indexed to enable quick results sorted in relevance order. Attention should be paid to supporting structured as well as unstructured data in databases and linked repositories.



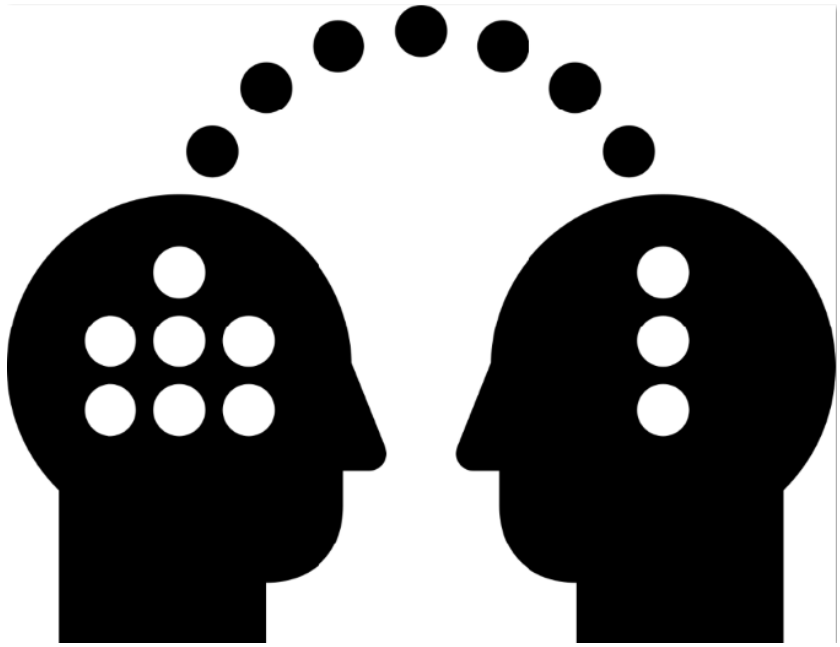
Source: https://i0.wp.com/www.ilearnlot.com/wp-content/uploads/2017/08/What-is-KMS-Knowledge-Management-Systems.jpg?resize=2010%2C1206&ssl=1

Don't forget to establish a set of metrics and key performance indicators (KPIs) to measure, monitor, and report on the adoption and success of your KM initiative. People pay attention to things that are measured and reported. Set realistic targets for your core KM metrics, and make the reporting on KM part of your monthly management IT scorecard. This will raise the visibility of KM in everyone's eyes, and also enable you to assess the growth, impact, and value of KM. Sample metrics might include:

- Number of articles added—per day, week, month
- Knowledge base contributions by support team member
- Number and percentage of solutions reused
- Number and percentage of incidents resolved where a knowledge article was instrumental
- User-satisfaction level with the KM capability

Step 5: Make It Easy to Capture Knowledge as a By-Product of Work

Supporting systems and tools should support KM embedded in the workflow, so that a submission is a by-product of the work effort. For example, during incident management, a search should be automatically invoked after classifying the incident. Extra steps or navigation should not be required. A match report should return the most likely solutions/workarounds at the top of the list. If no solution is applicable, and the analyst ends up devising and documenting a new solution, submitting to the KM process should be just a few keystrokes.



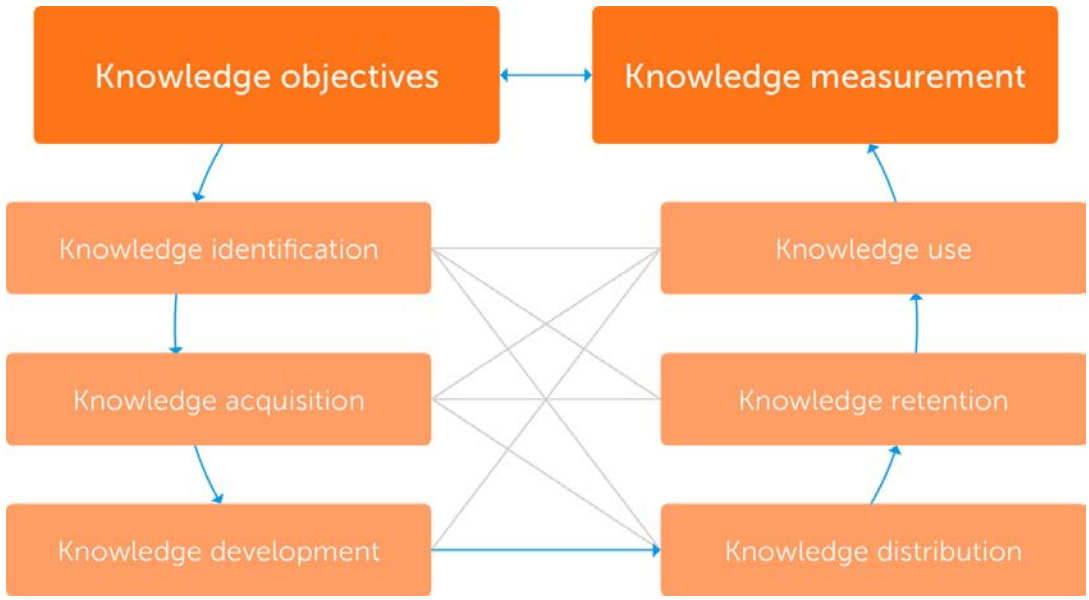
Source: https://upload.wikimedia.org/wikipedia/commons/thumb/a/ad/Knowledge_transfer.svg/1200px-Knowledge_transfer.svg.png

Include an embedded QA sub-process to expedite solution review and processing. Once the submission has been made, direct these electronic records to an appropriate SME for that area of knowledge. SMEs might be technical or application management

specialists in back-line support groups. They should have as a daily responsibility the review, editing, and approval of submitted KM articles, so these can be incorporated into the KM system in a timely fashion. This also ensures that knowledge added is accurate, complete, and published only to the proper audiences (for example, internal use only or user-ready).

Step 6: Build It into the Way People Work

Revise your service operations standard operating procedures (SOPs), such as incident management, request fulfillment, and problem management, to embed searching and contributing to the KM system. In this way, searching and contributing to your KM system does not become added steps, but is an integral part of the in-line mainstream workflow process. No extra steps required; roadblocks removed.



Source: https://www.tt-s.com/fileadmin/tts/01-images/graphics/tts-knowledge-management.png

Revise your job descriptions and appraisal process so that contributing to the KM system is required by operations personnel, such as service desk staff and other IT support groups. For example, support staff might be required to contribute three KM articles per quarter. Periodic appraisals would reinforce the importance of participation.

Make the contribution to KM, and its use, an integral part of rewards and recognition. For example, no awards for outstanding performance should be given where the team member failed to meet his or her contribution requirement for the quarter.

MODELS OF KM CYCLE

Knowledge management cycle is a process of transforming information into knowledge within an organization. It explains how knowledge is captured, processed, and distributed in an organization. In this section, we will discuss the prominent models of knowledge management cycle.

Till date, four models have been selected based on their ability to meet the growing demands. The four models are the Zack, from Meyer and Zack (1996), the Bukowitz and Williams (2000), the McElroy (2003), and the Wiig (1993) KM cycles.

Zack	Bukowitz & Williams	WIIG	McElroy
Acquisition	Get	Creation	Learning
Refinement	Use	Sourcing	Validation
Store	Learn	Compilation	Acquisition
Distribution	Contribute	Transformation	Integration
Presentation	Assess	Application	Completion

Zack Knowledge Management Model

The Zack model is extracted from work on the design and development of information products. In Meyer and Zack's approach, the network between each stage is designed to be logical and standardized.

In this cycle, the major developmental stages of a knowledge repository are analyzed and mapped to the stages of a KM cycle.

The stages are acquisition, refinement, storage/retrieval, distribution, and presentation/use. This cycle is also known as the "refinery."

Acquisition of Data or Information

Acquisition deals with issues regarding origin of raw materials such as scope, breadth, depth, credibility, accuracy, timeliness, relevance, cost, control, and exclusivity.

The guiding principle is the well- known proverb of "garbage in, garbage out." That is, highest quality source data is required, else the intellectual products produced downstream will be lower.

Refinement

Refinement may be physical (like migrating from one medium to another) or logical (like restructuring, relabeling, indexing, and integrating.)

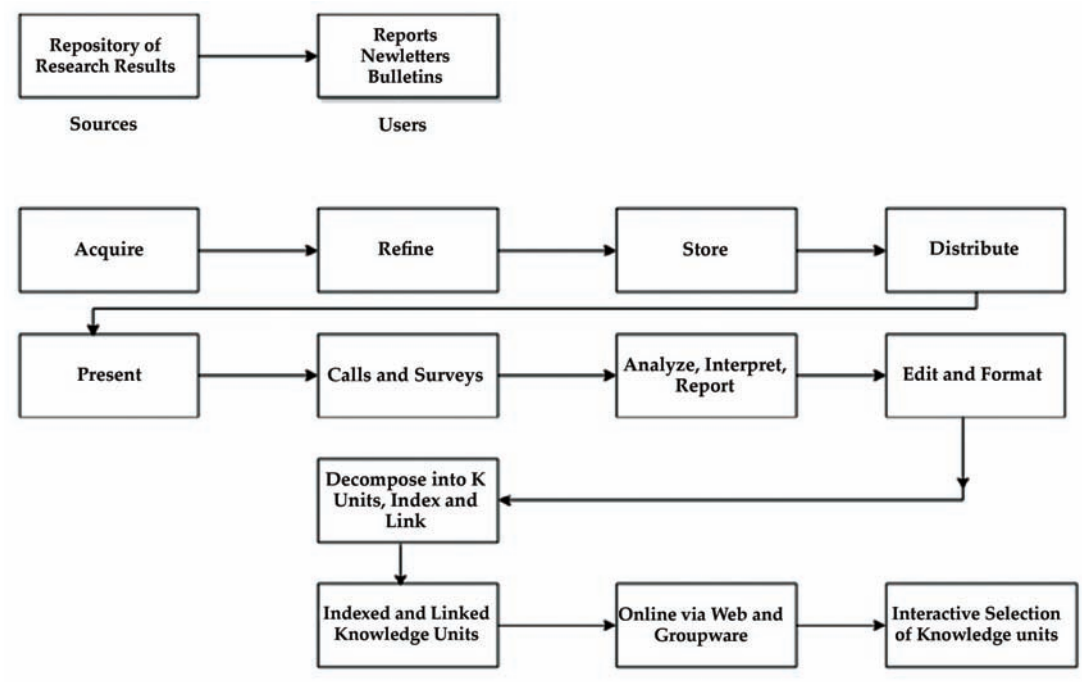


Figure 1: Zack Model.

Source: https://www.tutorialspoint.com/knowledge_management/models_of_km_cycle.htm

Refining also defines cleaning up (like sanitizing content so as to ensure complete anonymity of sources and key players involved) or standardizing (like conforming to templates of a best practice or lessons learned as used within that particular organization).

This stage also adds up to the value by creating more readily usable knowledge objects and by storing the content more flexibly for future use.

Storage / Retrieval

Storage or Retrieval forms a bridge between the upstream addition and refinement stages that feed the repository and downstream stages of product generation. Storage can be physical (file folders, printed information) as well as digital (database, knowledge management software).

Distribution

Distribution defines how the product is to be delivered to the end-user (like fax, print, email) and encloses not only the medium of delivery but also its timing, frequency, form, language, and so on.

Presentation

Context plays an important role in Presentation or Application stage. The performance of each of the preceding value-added steps is evaluated here – for example, does the user have enough context to be able to make use of this content? If not, the KM cycle has failed to deliver value to the individual and ultimately to the company.

The repository and the "refinery" combined enable the management of valuable knowledge of a firm. In this cycle, there is also an impression of having to continually renew the repository and the refinery in order to avoid elimination.

The Meyer and Zack model is one of the most complete picture of the key elements engaged in the knowledge management model. To be specific the notion of refinement is a crucial stage in the KM cycle and one that is often neglected.

Bukowitz & Williams Model

Bukowitz and Williams portray a knowledge management process framework that outlines "how organizations generate, maintain and expand a strategically correct stock of knowledge to create value".

In this framework, knowledge includes knowledge repositories, relationships, information technologies, communications infrastructure, functional skill sets, process know-how, environmental responsiveness, organizational intelligence, and external sources.

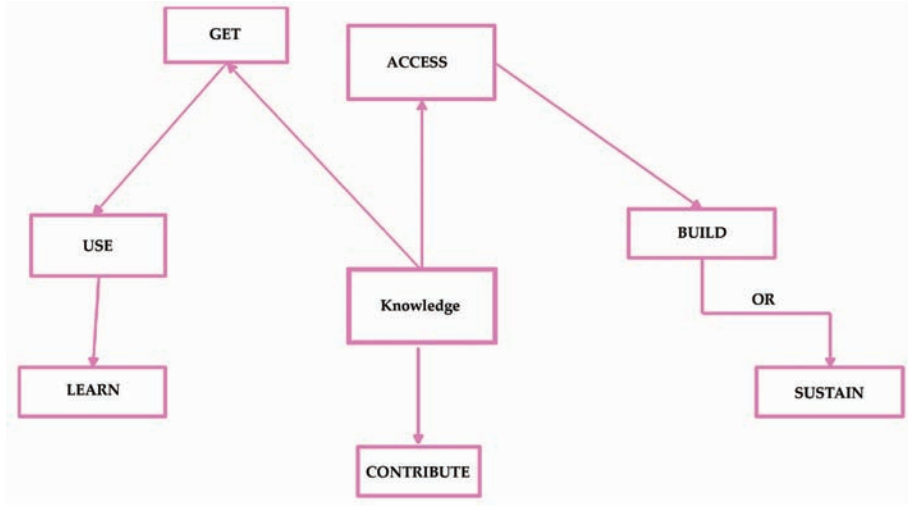


Figure 2: Bukowitz & Williams Model.

Source: https://www.tutorialspoint.com/knowledge_management/models_of_km_cycle.htm

These stages aim on more long-range processes of matching intellectual capital to strategic needs.

- Get Stage is the first stage, it consists of seeking out information required in order to make decisions, solve problems, or innovate.
- Use Stage is the next stage, and it deals with how to combine information in new and interesting ways in order to foster organizational innovation. The spotlight is primarily on individuals and then on groups.
- The Learn Stage points to the formal process of learning from experiences as a means of creating competitive gain. Learning in enterprises is important because it serves the transition step between the application of ideas and the generation of new ones.
- The Contribute Stage of the Knowledge Management cycle deals with encouraging employees to post what they have learnt to the communal knowledge base (like a repository). Only in this way, can individual knowledge be made visible and available to the entire organization, where and when appropriate.

McElroy Model

McElroy outlines a knowledge life cycle that consists of the processes of knowledge production and knowledge integration, with a series of feedback loops to organizational memory, beliefs, and claims and the business-processing environment.

- Problem claim formulation is an attempt to learn and state the specific nature of the detected knowledge gap.
- Knowledge claim formulation acts as a response to approved problem claims via information acquisition and individual and group learning.
- New knowledge claims are tested and examined through knowledge claim evaluation processes.
- Evaluation of knowledge claims results in surviving knowledge claims that will be integrated as new organizational knowledge or falsified/ undecided knowledge claims.

Experience gained from the application of knowledge in the organizational knowledge base leads to new claims and resulting beliefs, triggering the cycle to begin all over again.

In knowledge production, the primary processes are individual and group learning. Knowledge claim formulation, information acquisition; codified knowledge claim and knowledge claim evaluation.

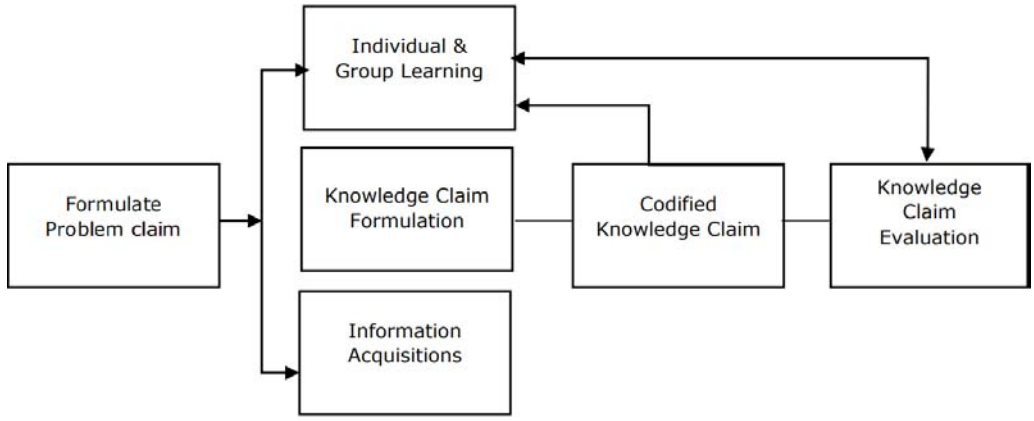


Figure 3: McElroy Model.

Source: https://www.tutorialspoint.com/knowledge_management/knowledge_management_tutorial.pdf

These knowledge production processes can be briefed as −

- Individual and group learning marks the first step in organizational learning.
- Knowledge claim validation includes codification at an organizational level.
- A formalized procedure is essential for the receipt and codification of individual and group innovations.
- Information addition is the process by which an organization deliberately or serendipitously acquires knowledge claims or information produced by others, usually external to the company. This stage plays a basic role in formulating new knowledge claims at the organizational level.

Knowledge integration is the process by which an organization announces new knowledge claims to its operating environment and retires old ones. It includes all knowledge transmission such as teaching, knowledge sharing, and other social activities that either connects an understanding of previously produced organizational knowledge to knowledge workers or accommodate newly minted knowledge.

One of the advantages of the McElroy cycle is the clear description of how knowledge is examined and a conscious decision is made as to whether or not it will be included into the organizational memory. The authorization of knowledge is a step that clearly differentiates knowledge management from document management. The KM cycle aims at processes to identify knowledge content that is of value to the organization and its employees

WIIG Model

WIIG highlights the three conditions that need to be present for an organization to conduct its business successfully.

- It must have a business (commodities/services) and customers.
- It must have resources (people, budget, and facilities).
- It must have the strength to act.

WIIG marks the major purpose of KM as an effort "to make the organization intelligent-acting by facilitating the creation, accumulation, deployment and use of quality knowledge." WIIG's KM cycle shows how knowledge is built and used as individuals or as organizations.

The following figure shows the four major steps of the WIIG model.

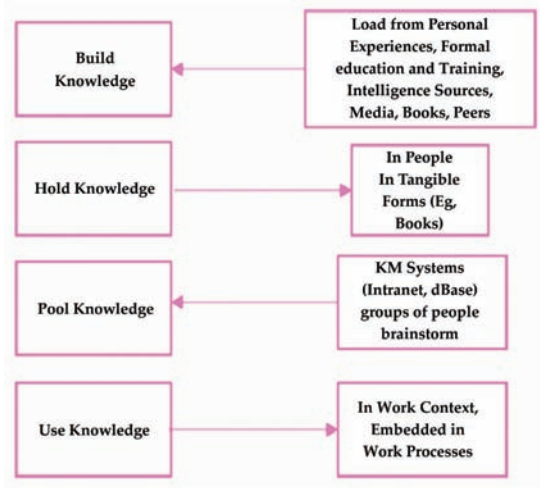


Figure 4: WIIG Model.

Source: https://www.tutorialspoint.com/knowledge_management/models_of_km_cycle.htm

- Building knowledge – From external and internal knowledge sources
- Holding knowledge – Storing the information in a particular form
- Pooling knowledge – Through intranets and knowledge management portals
- Applying knowledge – In the context of work embedded in process

Integrated Cycle

The following are the three major stages of integrated cycles of knowledge management strategy when introduced in any organization –

- Knowledge capture and/or creation
- Knowledge sharing and dissemination
- Knowledge acquisition and application

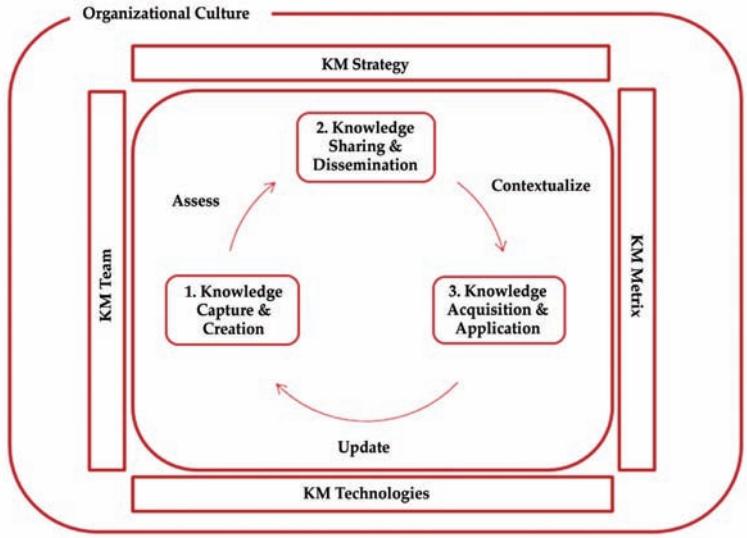


Figure 5: Integrated KM Cycle.

Source: https://www.tutorialspoint.com/knowledge_management/models_of_km_cycle.htm

Knowledge Capture

Knowledge Capture states the identification and frequent codification of existing (usually previously unnoticed) internal knowledge and know-how within the organization and/or external knowledge from the environment.

Knowledge Creation

Knowledge Creation is the advancement of new knowledge and know-how innovations that did not have a previous existence within the organization.

Once, it is clear that the newly identified content is of sufficient value, the next step is to contextualize this content. This involves maintaining a connection between the knowledge and those knowledgeable about that content.

Contextualization

Contextualization also indicates identifying the key elements of the content in order to better match to a variety of users. Finally, contextualization succeeds to when the new content is firmly, precisely yet seamlessly, embedded in the business processes of the enterprise.

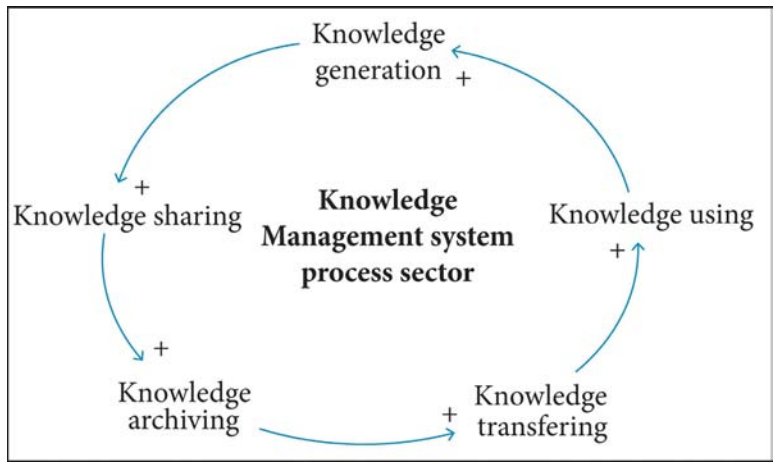
The knowledge management cycle is then rechecked as users understand and decide to make use of content.

The users will update usefulness, and they will signal when it becomes out of date or when this knowledge is not applicable.

KNOWLEDGE MANAGEMENT SYSTEM

A knowledge management system is any technology that is used to store and manage knowledge - essentially, a tool to oversee knowledge management. However, a successful knowledge management system also taps into the underlying goals of KM: codifying knowledge, retrieving knowledge, improving collaboration, and stimulating overall organizational learning.

Knowledge management systems have evolved from a useful tool to optimize KM processes to an integral component of KM itself. Today, organizations rely on KM systems to perform many of the functions of knowledge management - data storage is an obvious example, but technology systems can also help foster collaboration and group learning, among other objectives.



Source: http://www.scielo.br/img/revistas/jatm/v8n3//1984-9648-jatm-8-3-0263-gf05.jpg

There are several emerging features in contemporary knowledge management systems. Here's a look at some of the most prominent ones:

- **Content and document management:** This is a critical component because codifying knowledge almost always results in documentation (or another form of created content). When choosing a KM system, make sure the platform can support the file size, type(s), and volume that you need. This is especially important for enterprise companies who will need to store massive amounts of data, and scale regularly. (For this functionality, look for enterprise portals.)

- **Lessons learned databases:** These are systems that aim to make intangible (often tacit) knowledge clear and available to other users. The focus with lessons learned databases is as the name implies: on lessons learned by experts that others should follow (think of it as best practices). The key here is to find a database that can house this kind of qualitative information and make it accessible.
- **Groupware:** As we've discussed, collaboration is a key component of KM. Groupware refers to any collaborative work platform, and is usually intended for workers who need to communicate remotely. Groupware is broken down into two categories: synchronous groupware (collaborate and update in real time) and asynchronous groupware.
- **Artificial Intelligence (AI):** The adoption of AI (as telepresence) into KM systems replaces the human consultants that had been analyzing the data and monitoring the KM processes. Today, cognitive computing, adaptive technology, and intelligent filtering tools, in particular, have huge implications for codifying knowledge, and will likely be adopted by more KM systems. However, the importance of human quality assurance (QA) in much of today's data work has raised concerns about AI's ability to fully take over this space.

Although KM systems can help automate and standardize knowledge management, there are several challenges when implementing a system. Security, data accuracy, and changes in technology (cost, implementation, usability) are focused difficulties that you should keep in mind from the get-go. A much more pervasive and ongoing challenge, however, is creating a culture of collaboration and knowledge sharing via technology. People may already be reluctant to share information with their peers, and technology can create even more barriers for doing so. Therefore, you'll need to build in processes that support and stimulate this type of knowledge transfer.



Source: http://blog.zingtree.com/wp-content/uploads/getvoip-img.png

Four key things to look for when choosing a KM system:

- **Security:** Information is valuable. Like any other valuable, there are people who will steal it.
- **Accountability:** Information is valuable only when it is accurate. Limit access. Log intensively. Test for accuracy.
- **Backup:** Everyone knows the value of backing up. Not everyone knows how to do it. Hiding a backup drive in the CEO's desk won't help if the building floods or burns. Creating, maintaining, and correctly storing back-ups should be an automatic functionality.
- **Ease of Use:** If the system is too difficult or demanding to use, people will take shortcuts. Shortcuts usually reduce security and the integrity of the information you're managing.

When discussing the future of KM systems, many critics claim that knowledge management itself is a fad. However, others think that KM and KM systems will simply evolve to meet the demands of today's business world - likely incorporating more AI-driven systems. Murray agrees with the latter camp.

"It's no fad. It's an imperative. The amount of information being created grows each year. It has to be managed, if you want it to be useful," he says. "KM systems will continue to increase in popularity, functionality, and ease-of-use, just like the evolution of typewriters and word processing software. Artificial Intelligence (AI) will blend into the mix even more."

Advantages of a Knowledge Management (KM) System

Many advantages accrue to organizations that have efficient knowledge management systems. These include reducing the iterations in subsequent projects, leveraging existing knowledge to improve on the processes, achieving synergies between processes and functions, and generally improving productivity because of the convergence of all these aspects. The key aspect about having an efficient knowledge management system is that one need not reinvent the wheel. In other words, organizations can derive benefits from the knowledge that is present in the system and hence, reduce the work needed to do the same or similar tasks again.



Source: https://www.eleapsoftware.com/wp-content/uploads/2018/04/plan-creative-class-library-student-teacher-ideas-concept-e1524505556110.jpg

For instance, if a particular organization has stored knowledge about previous projects in the KM system, then subsequent projects having the same or similar kind of tasks or deliverables can benefit from the existing knowledge by reusing the artifacts, documents, and knowledge units that are there in the KM system. This reduces iterations for projects as the similar deliverables can be submitted without having to redo the same thing repeatedly. This is one of the most important reasons why corporates go in for KM systems as having an efficient KM system results in quantum jumps in productivity.

KM Systems reduce Rework and Result in Synergies

The next aspect is to do with achieving synergies between the processes and functions. For instance, if a particular project needs inter-function execution, the KM system can be mined for knowledge about previous projects that have artifacts related to processes that are inter-disciplinary. In other words, managers can simply take the knowledge units from the existing data store and reuse them. When other functions are involved in the project, an integrated KM system that has details of cross-functional expertise can come in handy. This means that functional and Processual knowledge can be combined leading to synergies between them. Many organizations also store knowledge related to optimizing the existing processes and improving the existing processes. These are requirements under the capability maturity models like SEI-CMM where the certification depends on how well the organizations engage and indulge in continuous improvement. This is the reason

why many organizations in their quest to be certified under the capability maturity models often have put in place KM systems that are comprehensive and integrated.



Source: http://abhinavpmp.com/wp-content/uploads/knowledgemanagement.jpg

Productivity Leaps because of KM Systems

The third aspect about having a KM system is that the reduction in the number of iterations, the optimization of existing processes, reuse of artifacts, and cross functional expertise available for the other projects all result in productivity leaps. Productivity is the ratio of the time taken to do a particular task to the magnitude and scope of the task. Therefore, when the first iteration happens, one is doing the task for the first time and hence, one would take more time. However, when the task is repeated, one has gained expertise in performing the task, and hence, one takes lesser time to do it the second time or the subsequent times. This is the productivity improvement that happens with expertise and knowledge.

How a Well-Oiled KM System is beneficial to the Organizations

Similarly, when organizations leverage on the existing knowledge and expertise available in the KM system when other projects have similar tasks to do, the resulting productivity leap is because of the reuse of the existing knowledge that reduces the time and the effort it takes to do the same task the next time around. This is the key aspect that anyone who is interested in how a KM system improves efficiency must know about the advantages of a well-oiled KM system. This is also the reason why many organizations reward employees who contribute Knowledge Units (KU's) to the KM system as by doing so they are contributing to the efficiency of the overall organization. Finally, KM systems also help in creating an open working environment where the culture is geared towards sharing knowledge instead of hoarding knowledge.



Source: https://www.kochartech.com/blog/wp-content/uploads/2017/05/Knowledge-Management-System.jpg

KNOWLEDGE MANAGEMENT TECHNOLOGIES

Creating a learning/knowledge-based organization can be done with the help of a new wave of ICT. Some of the main technologies are:

Case-based Reasoning Systems

Case-based Reasoning Systems (CBRS) essentially consist of a case library and a software system for retrieving and analyzing the 'similar case' and its associated information. The case library has cases covering a broad range of ideas across different industries and business functions. Each case contains a description of the underlying competitive situation, the environmental conditions, management priorities, experience, values that allow a certain strategy to succeed, and moments of learning. A software system helps index each case such a way that a search yields modest number of 'similar cases.' The system can provide a complete explanation if the reasoning that has lead to each recommendation. If there is no case that exactly matches the given situation, then it selects the most ′similar′ case. An adaptation procedure can be encoded in the form of adaptation rules. The result of the case adaptation is a completed solution but it also generates a new case that can be automatically added to the case library.



Source: https://brighterion.com/wp-content/uploads/2016/07/shutterstock_107763344.jpg

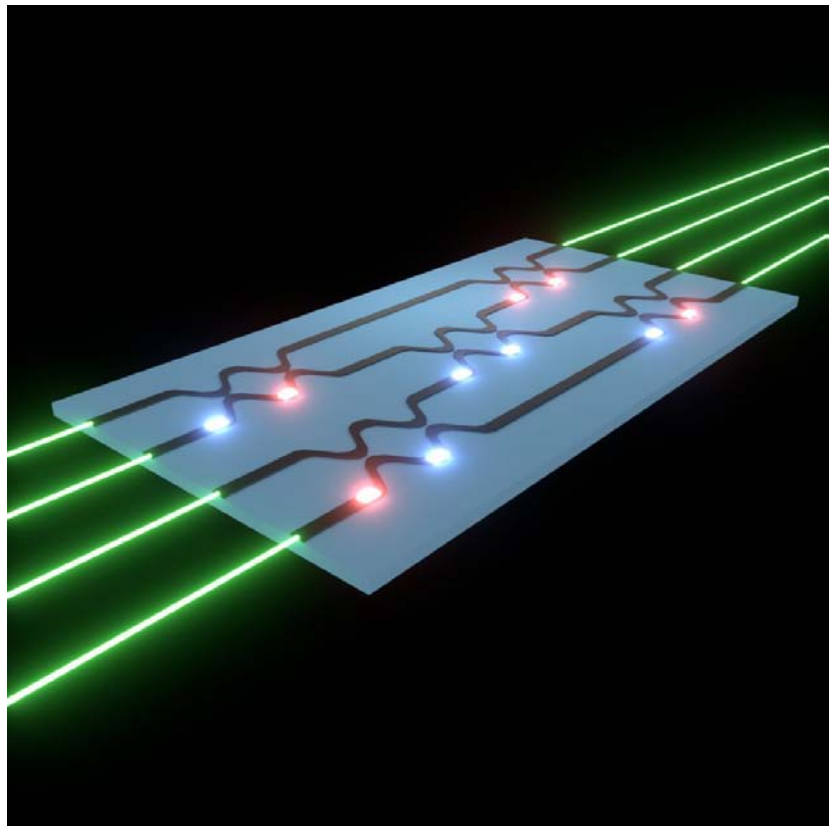
Group Decision Support System

On a group level, the act of sharing and exchange allows learning as a group as well, but it also gives further input in the sense that experiences lived by others are used as input data for the creation of an individuals mental model. One can see the immediate application with sharing ideas and therefore in the creation

of groups shared mental model. This process of group learning involves the individual, and is therefore a useful tool for individual learning, but it does not focus solely on individual learning. A GDSS enables a group to work interactively using the networked hardware and software to complete the various aspects of the business process.

Artificial Neural Networks

Artificial Neural Networks (ANNs) are tools derived from artificial intelligence. They are also part of the new information processing paradigm that simulates the human brain. They are very strong tools in the pattern finding and structuring, without any prior information. They allow for the structuring of tacit knowledge, without making it explicit, but nevertheless making it accessible. ANNs are vehicles for creating 'best principles' out of 'best practices.'



Source: https://3c1703fe8d.site.internapcdn.net/newman/gfx/news/2018/27-researchersm.jpg

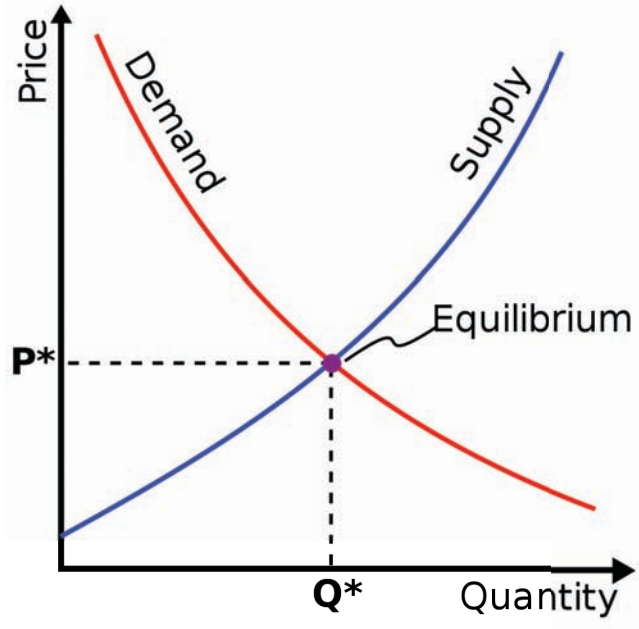
Semantic Search Engines and Link Machines

A semantic search engine uses a kind of an overlay of organization, based on keywords that are commonly used together. The search engines scan the text that is available and that is stored using a format that allows this kind of search. The search engine creates a semantic network of keywords, which allows translation of any given natural language query in a number of most probably related keywords. Then those keywords can be related to pieces of text where they appear dominantly. Once those keywords are identified, the text is codified with the keywords, and the semantic table is made. The system is then reading for both semantic queries and semantic linking.

KNOWLEDGE MANAGEMENT – METRICS

Intellectual assets are generally categorized as human capital (like the know-how of knowledge workers that is "rented" by an organization), structural capital (like the policies, procedures, and applications that the organization "owns"), and customer or relationship capital (like the value of customer relationships and loyalty that has been built up over the years).

A variety of fairly sophisticated KM measurement techniques are available now that can help assess how well an organization is progressing. These involve benchmarking, the balanced scorecard method, and the house of quality matrix.



Source: https://upload.wikimedia.org/wikipedia/commons/thumb/8/8c/Supply-demand-equilibrium.svg/1024px-Supply-demand-equilibrium.svg.png

Before introducing any metric-based system, we have to be clear regarding what we want the metrics to answer. Metrics generally helps us to answer several questions, such as –

- Is Knowledge management working as required? And if not, what needs to be fixed?
- Is execution on track, and if not, what needs to be fixed?
- Are people doing what they are assigned to do? Who is doing well, who is not doing well?
- Are we delivering value? If we aren't, let's stop, or find a better way.

Measuring KM Implementation

The first thing to be done is probably wanting to measure, and how well we are managing to implement KM.

When we run your assessment at the start of KM implementation, we will develop some baseline metrics which you can measure the improvement against.

A KM assessment protocol measures various aspects of knowledge flow within an organization, and allows you to identify blockers and obstacles to knowledge flow. Rerunning the assessment later allows you to measure progress.

Measuring KM Compliance

Let us assume that an employee named Steve has introduced a knowledge management framework to the organization, with some clear accountabilities and clear expectations in the form of KM policies and standards.

At this stage, Steve might want to measure whether people are complying with these expectations, by using dashboarding and analytical tools to track his project members in an organization. Similar dashboards will be required in other functions of an organization.

Measuring KM Activity

It is also useful to introduce some activity based metrics to track different elements of your Knowledge management system.

Measuring Business Outcome

It is generally believed that, knowledge management leads to continuous performance improvement. As knowledge improves, so does the efficiency and results of an organization. Therefore, the more we deploy these methods and implement them, the better will be business performance.



Source: https://hbr.org/resources/images/article_assets/2018/06/Key-to-Agile-outcome-HBR-article-2.jpg

Benchmarking

Benchmarking is the hunt for industry wide best practices that leads to superior performance. It is a fairly straightforward Knowledge Management metric that represents a good starting point.

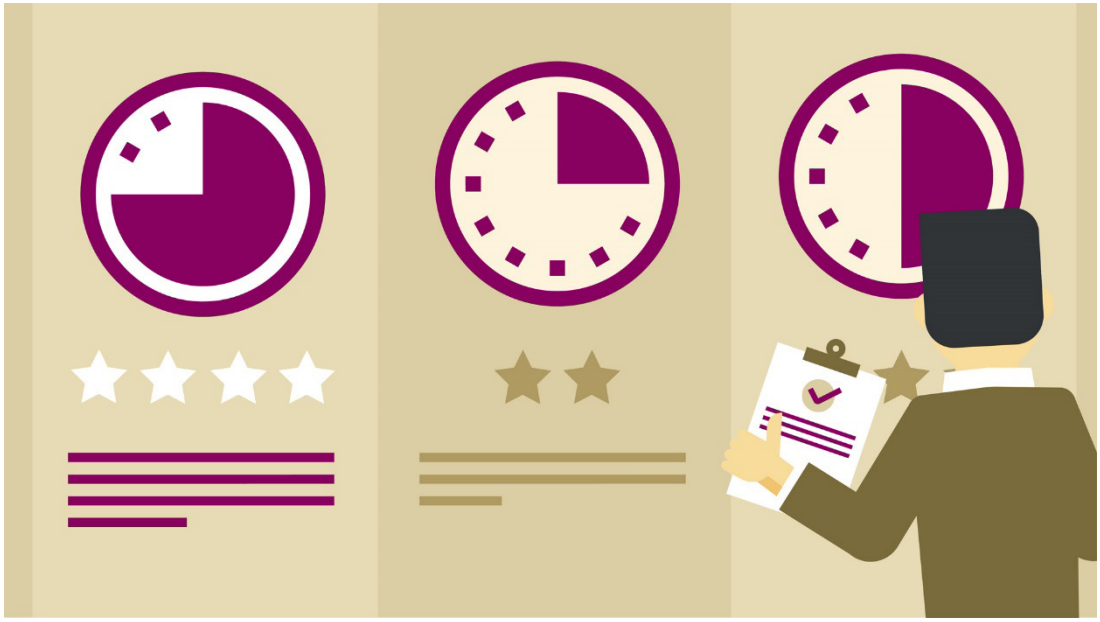
Benchmarking basically consists of a study of similar companies to determine how things are done best in order to adapt these methods for their own use. This approach is best summed up by the Hindu proverb – "know the best to become the best."

There are two general types of benchmarking –

- Internal benchmarking – Comparisons against other units within the same company or a comparison of a single unit over different time periods.
- External benchmarking – Comparison with other companies.

Balanced Scorecard

A Balanced Scorecard method (BSC) is a judgment and management system that enables enterprises to clarify their vision and strategy and which translates them into action. It offers feedback on both the internal business processes and external results in order to continuously improve strategic performance and results.



Source: https://cdn.lynda.com/course/428726/428726-636247544012681672-16x9.jpg

Balanced Scorecard is a conceptual framework for converting an organization's vision into a set of performance indicators distributed among four dimensions −

- Financial Dimension − Involves measures such as operating income, return on capital employed, and economic value added.
- Customer Dimension − It is associated with such measures as customer satisfaction, retention, and market share in targeted segments.
- Internal Business Processes − Consists of measures such as cost, throughput, and quality.
- Learning and Growth − addresses measures such as worker's satisfaction, retention, and skill sets.

Through BSC, an enterprise can monitor both its current performance (finances, customer satisfaction, and business process results) and its efforts to improve processes, motivate and educate employees, and enhance information systems − its ability to learn and improve.

The balanced scorecard method is applicable to both profitable and non-profitable enterprises as well as to both private and public sector companies. It provides a number of significant advantages, including the translation of abstract goals into action items that can be continuously monitored. In addition, the balanced scorecard method provides objective measures of the current scenario, and helps initiate the changes required to move from the current to the desired future state of the company.

The House of Quality Method

The house of quality method was discovered to show the links between true quality, quality characteristics, and process characteristics. It was done using the Fishbone Diagram, with true quality in the heads and quality and process features in the bones.

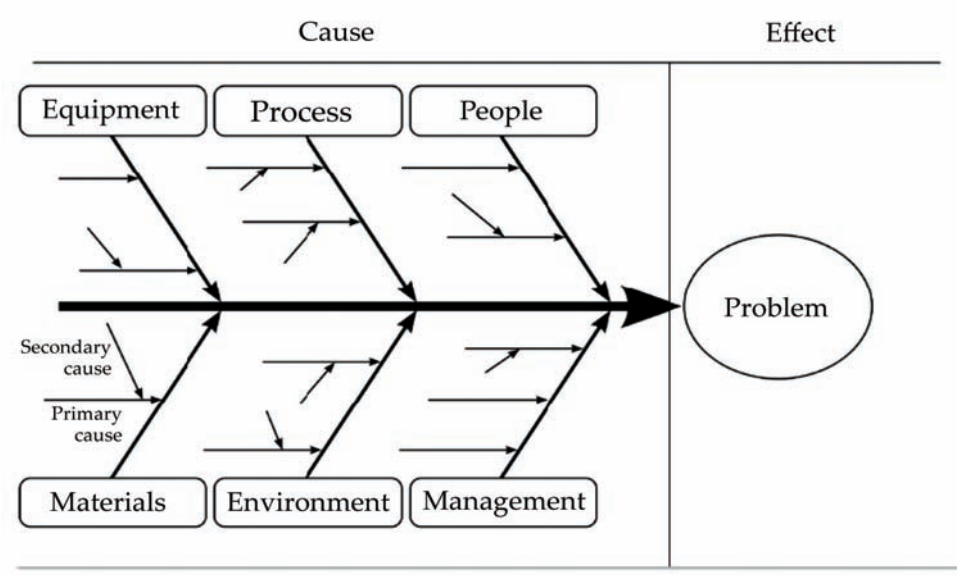


Figure 6: Fishbone Diagram.

Source: http://www.iso9001qualitysystem.com/wp-content/uploads/2011/01/cause-and-effect.png

This technique was also known as Quality Function Deployment (QFD), as it links the customer's needs with marketing, design, development, engineering, manufacturing, and service functions. It can be used for service as well as software products.

QFD is the only comprehensive quality system that aims specifically at satisfying the customer. It concentrates on maximizing customer satisfaction (positive quality), measured by metrics, such as repeat business and market share.

It focuses on delivering value by seeking out both spoken and unspoken needs, converting these into design targets, and communicating the targets throughout the organization.

In addition to this, it allows customers to prioritize their requirements, tells us how we are doing compared to our competitors, and then directs us to optimize those features that will bring the greatest competitive advantage.

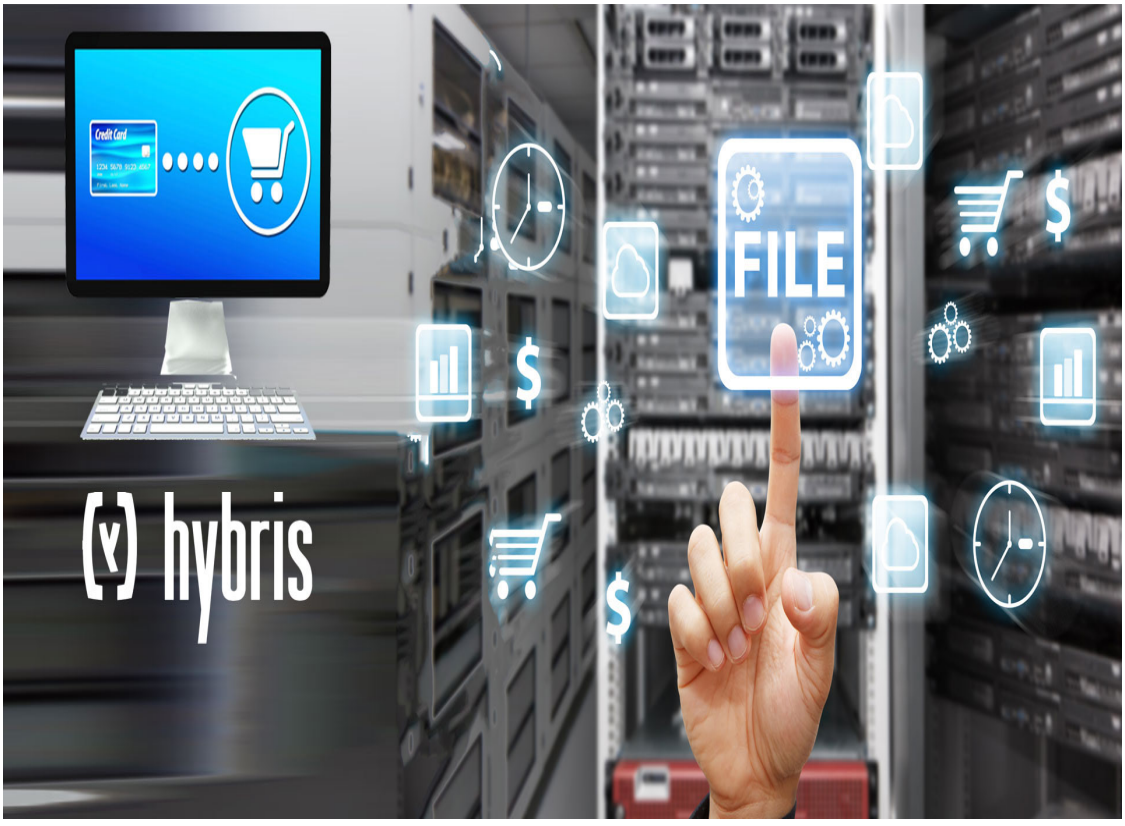
REFERENCES

1. Abrahamson, E. & Fairchild, G. (1999). Management fashion: lifecycles, triggers, and collective learning processes. Administrative Science Quarterly, 44, 708-740.
2. Davenport, Thomas H. (1994), Saving IT's Soul: Human Centered Information Management. Harvard Business Review, March-April, 72 (2)pp. 119-131. Duhon, Bryant (1998), It's All in our Heads. Inform, September, 12 (8).
3. Durham, Mary. (2004). Three Critical Roles for Knowledge Management Workspaces. In M.E.D. Koenig & T. K. Srikantaiah (Eds.), Knowledge Management: Lessons Learned: What Works and What Doesn't. (pp. 23-36). Medford NJ: Information Today, for The American Society for Information Science and Technology.
4. https://management.simplicable.com/management/new/14-principles-of-knowledge-management
5. https://pdfs.semanticscholar.org/b2c0/c62be521dbeb2c8153cd52cf4b54c7224d88.pdf
6. https://searchdomino.techtarget.com/definition/knowledge-management
7. https://www.managementstudyguide.com/dimensions-and-strategies-of-knowledge-management.htm
8. https://www.smartsheet.com/knowledge-management-101
9. https://www.thinkhdi.com/library/supportworld/2016/6-steps-build-knowledge-management-culture
10. https://www.tutorialspoint.com/management_concepts/knowledge_management.htm
11. Koenig, M, E. D. (2000), The Evolution of Knowledge Management, in T. K. Srikantaiah and M. E. D. Koenig, Knowledge Management for the Information Professional. (pp. 23-26), Medford N.J., Information Today, for the American Society for Information Science.
12. Koenig, M.E.D. (1990) Information Services and Downstream Productivity. In Martha E. Williams (Ed.), Annual Review of Information Science and Technology: Volume 25, (pp. 55-56). New York, NY: Elsevier Science Publishers for the American Society for Information Science.
13. Koenig, M.E.D. (1992). The Information Environment and the Productivity of Research. In H. Collier (Ed.), Recent Advances in Chemical Information, (pp. 133-143). London: Royal Society of Chemistry. Mazzie, Mark. (2003). Personal Communication.
14. McInerney, Claire, and Koenig, Michael E. D., (2011), Knowledge Management (KM) Processes in Organizations: Theoretical Foundations and Practice, Morgan and Claypool.

15. Nonaka, I. & Takeuchi, H. (1995). The knowledge creating company: How Japanese Companies Create the Dynamics of Innovation. New York: Oxford University Press.
16. Ponzi, L., & Koenig, M.E.D. (2002). Knowledge Management: Another Management Fad?", Information Research, 8(1). Retrieved from http://informationr.net/ir/8-1/paper145.html
17. Ponzi, Leonard., & Koenig, M.E.D. (2002). Knowledge Management: Another Management Fad?" Information Research, 8(1). Retrieved from http://informationr.net/ir/8-1/paper145.html
18. Prusak, Larry. (1999). Where did Knowledge Management Come From?. Knowledge Directions, 1(1), 90-96. Prusak, Larry. (2004). Personal Communication.
19. Senge, Peter M.. (1990). The Fifth Discipline: The Art & Practice of the Learning Organization. New York, NY: Doubleday Currency.
20. Wenger, Etienne C. & Snyder, W. M. (1999). Communities of practice: The organizational frontier. Harvard Business Review, 78(1), 139-145.
21. Wenger, Etienne C. (1998). Communities of practice: Learning, meaning and identity. Cambridge: Cambridge University Press.

CHAPTER 3

ELECTRONIC COMMERCE AND ENTERPRISE SYSTEM



INTRODUCTION

Building their companies into successful e-businesses has become an important objective for today's enterprises. Conceptually, it embodies the enabling of the business with such capabilities as global networking, streamlining business processes, sharing information, agility in responding to the market, and intelligent decision making.

The new economic development characterized by e-commerce has accelerated the globalization of the economy. In face of increasingly fierce market competition, for enterprises, the constructions of ERP and e-commerce are necessary ways to enhance the core competitiveness of enterprises. At present, most of the internal ERP systems and external e-commerce systems are in relatively independent state. However, with the increasing fierce market competition, a single mode of operation has been unable to meet the requirements of enterprise development. Accordingly, the effective integration of ERP and e-commerce in the new era has become one of the most important topics for enterprise development.



Source: https://searchengineland.com/figz/wp-content/seloads/2015/02/ecommerce-shopping-cart-keyboard-ss-1920.jpg

Increasingly enterprise systems have extended beyond the traditional business functions and include such new features as supply-chain management, customer relationship management and electronic commerce. The shifting focus is driven by the adoption of the Web as a new channel for product distribution, marketing, and interacting with customers. The integration of the traditional as well as the Web-oriented functions is the cornerstone for a successful e-business.

AN INTRODUCTION TO ELECTRONIC COMMERCE

Ecommerce, also known as electronic commerce or internet commerce, refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions. Ecommerce is often used to refer to the sale of physical products online, but it can also describe any kind of commercial transaction that is facilitated through the internet.



Source: https://mediaindia.eu/wp-content/uploads/2017/07/Ecommerce-BTL.jpg

Whereas e-business refers to all aspects of operating an online business, ecommerce refers specifically to the transaction of goods and services.

History of e-commerce

The beginnings of e-commerce can be traced to the 1960s, when businesses started using Electronic Data Interchange (EDI) to share business documents with other companies. In 1979, the American National Standards Institute developed ASC X12 as a universal standard for businesses to share documents through electronic networks.



Source: https://www.iqlect.com/blog/wp-content/uploads/2017/11/139441-OSZFGN-6081.jpg

After the number of individual users sharing electronic documents with each other grew in the 1980s, the rise of eBay and Amazon in the 1990s revolutionized the e-commerce industry. Consumers can now purchase endless amounts of items online, from e-tailers, from typical brick-and-mortar stores with e-commerce capabilities, and from one another.

Types of Ecommerce Models

There are four main types of ecommerce models that can describe almost every transaction that takes place between consumers and businesses.

Business to Consumer (B2C)

When a business sells a good or service to an individual consumer (e.g. You buy a pair of shoes from an online retailer).



Source: https://cdn.lynda.com/course/624265/624265-636459009178212802-16x9.jpg

Business to Business (B2B)

When a business sells a good or service to another business (e.g. A business sells software-as-a-service for other businesses to use).

Consumer to Consumer (C2C)

When a consumer sells a good or service to another consumer (e.g. You sell your old furniture on eBay to another consumer).

Consumer to Business (C2B)

When a consumer sells their own products or services to a business or organization (e.g. An influencer offers exposure to their online audience in exchange for a fee, or a photographer licenses their photo for a business to use).

Examples of Ecommerce

Ecommerce can take on a variety of forms involving different transactional relationships between businesses and consumers, as well as different objects being exchanged as part of these transactions.

- Retail: The sale of a product by a business directly to a customer without any intermediary.
- Wholesale: The sale of products in bulk, often to a retailer that then sells them directly to consumers.

- Drop shipping: The sale of a product, which is manufactured and shipped to the consumer by a third party.



Source: http://bdshikkha.com/wp-content/uploads/2017/11/Screenshot-from-2017-11-11-01-20-16.png

- Crowd funding: The collection of money from consumers in advance of a product being available in order to raise the startup capital necessary to bring it to market.
- Subscription: The automatic recurring purchase of a product or service on a regular basis until the subscriber chooses to cancel.
- Physical products: Any tangible good that requires inventory to be replenished and orders to be physically shipped to customers as sales are made.
- Digital products: Downloadable digital goods, templates, and courses, or media that must be purchased for consumption or licensed for use.
- Services: A skill or set of skills provided in exchange for compensation. The service provider's time can be purchased for a fee.

The Enlightenment of E-Commerce

At present, it is known that E-commerce is the business of commercial transaction which turns the function of passing information using high-speed electronic into the multiple-function network. E-commerce is comprised of the two key contents: Internet as a carrier, and its customers done business online.



Source: https://media.dhakatribune.com/uploads/2017/02/Online-Ecommerce-Customer-Small.png

Internet is a network consisted of many physical network, its function is a wide, dynamic zone with the following characteristics:

First, it is a virtual network based on protocol online. Network technologies use Internet protocol (IP) which contacts all networks in some layer to arrive at protocol end-to-end continuously and create mutual environment among systems. This network belongs to virtual mutual environment built by protocol system logically.

Second, it is a whole network with complicated structure. On the whole individual network is dynamic. Permitted by some management institution and abided by the related stipulation, any user's network could become a part of Internet to connect Internet. Disconnected with Internet, any network will be more timely and freely. The whole mutual network of a dynamic layout will be formed because the types of individual network are not confined which leads to complexity and change of Internet internal structure.



Source: https://rees46.com/blog-en/wp-content/uploads/2016/10/8-ecommerce-trends.jpg

Third, it is the high protocol system that has overall and independent individual network. Different structures among individual Internet is confined below Internet layer, forming overall environment which the user's applied system reaches and independent of next layer's individual network of different structures.

So, Internet is the fundamental source by which the enterprise enters and does Ecommerce business.

The Role of E-commerce on Enterprise's Production and Management

The development of Internet has resulted a new-economic revolution all over the world. The model of profit and economic operation of industry economics have been over-all changed the common consumables production and trade. As a result, the time of E-commerce has arrived, which has large influence on production operation of the industry –Enterprise and exert positive effect. Lots of enterprises want eagerly to enter Internet.

Theoretically, E-commerce gives great convenience to the- Enterprise production operation and promotes the work efficiency and reduces the cost and liberates the Enterprise from traditional complicated operation.

- Reducing the cost of Enterprise production-operating and raising sale profit. After the enterprises are online, their marketing model on the Internet tends to be flattened. Buyer and seller will contact directly and all kinds of transaction costs will be reduced during the circulation.

The buyer enjoys the wholesale preferential prices, if one purchases raw materials, the product costs could be lower. And the seller spends less time on bargaining with more customers and raises the sale profit greatly. Traditionally, the time of price information reflecting the end-user needs 6 days, while the processing of information transformation is calculated by every minute online, which reduces 13-38% costs estimated by American institution.



Source: https://marketingland.com/wp-content/ml-loads/2014/08/ecommerce-retail-ss-1920.jpg

- Widening Enterprise market and strengthening the fair of Enterprise competition. Internet is wide and its organization structure is complicated. It's an opening market. Whatever the customer is near or far, enterprise can negotiate online and reach agreement at last. It can widen enterprise's market and increase the fair competition. In fact, enjoying E-commerce is the marketing strategy for the modern enterprises.
- Quickening communication and innovation of the technology and improving product the quality. On the Internet, commercial private secrets, customer groups, high technology will appear in your brain. It is uses enterprise's technology innovation and raising products quickly.
- Realizing zero-inventory and speeding up Enterprise capital turnover. Ecommerce operating model is the processing of "individual order----- limit produce --- -----sending goods" which is the customer as a center. Enterprise can buy material as a plan and organize production as a purpose, sale goods as a goal and recover capital as a plan, so it quickens capital turnover and the development of the enterprise.

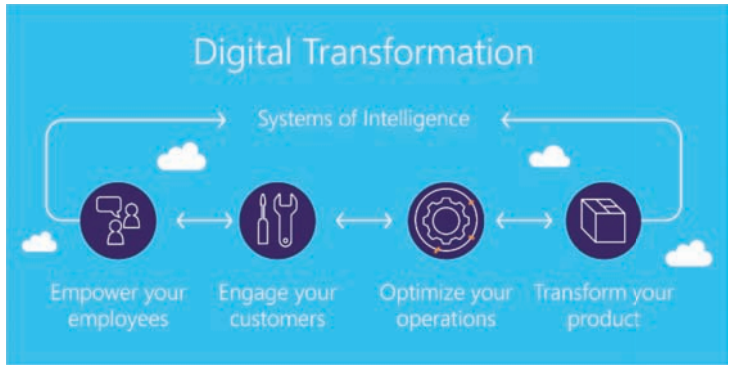
- Simplifying the operating structure and function of Enterprise that includes raw material supply and products sale. Traditionally, the two departments cover 5-30% staffs in the enterprise, which has a large quantity of labor cost. Moreover, the structure model of enterprise organization is matrix-type, especially in the large-scale enterprise, the staff has to accept the double leaders. Entering E-commerce, department function will be simplified and online data will be very important. And the system runs quickly and efficiency is raised on the Internet.

The Fundamental Condition of Enterprise Entering E-Commerce

Internet has the characteristics based on virtual network of protocol-network according to E-commerce. In order to adapt to system and living environment, virtual enterprise will realize digital management. That is to say, Enterprise's management activity will realize virtualization and information based on computer and network technology. It is the fundamental condition of Enterprise entering E-commerce.

Transformation of Enterprise Operation Model

Before Enterprise's entering E-commerce, the olive-type operation model, which emphasizes products management among traditional R&D and products production and marketing, will be changed into the dumbbell-type one which emphasizes R&D and marketing of products at present.



Source: https://blogs.partner.microsoft.com/mpn/wp-content/uploads/sites/11/2016/09/image1_9.15.png

E-commerce is a new operating model of "individual order ----- production --- sending goods "Under this model, products capacity and scales is not a key point for the development of an enterprise. Direct communication between customer and enterprise will be more important in order to let customers make orders according to their needs and obtain goods on time. Enterprise can entrust others to produce if their production capacity is not enough. All orders and transportation need large scales system traditionally, while they will use Internet to let other enterprise

supervise the whole processing of order, material purchases, production, delivery and payment. So the emphasis on enterprise operating is R&D of products and marketing, also is R&D of E-commerce. Its goal is how to produce new products which satisfy customer's needs.

Transformation of Enterprise Management System

The first is the transformation of enterprise management system. General manager responsible for the enterprise will be turned into CEO----Entrusting-acting system. It's known that Internet has characteristics of overall and independent high protocol system. To adapt to this environment, structure of internal logic system has to be arranged to restrict and stimulate managers in order to satisfy the cooperator's benefit and realize cooperator's goal. Entrusting-acting is a system arrangement of responsibility, authority and benefit, which includes stockers, board of directors, managers and staffs, that is to say, it is the organization structure of legal owner of property. It is necessary for the operation of E-commerce.



Source: https://www.northstarsg.com/wp-content/uploads/2017/07/Content_Management_System-e1500901069580.jpg

The second is the transformation of enterprise operating system. Economic responsible system or contract responsible system will be changed into E-commerce operating. Under entrusting-acting system, what entruster cares is how to choose, supervise, and encourage the operating staff, especially CEO. Miller had said, "how to ensure the manager to gain the capital enough and to reach the goal? What is the standard for the manager to operate the enterprise? Who evaluates the managers whether they use the source reasonably? Or else, who will decide to substitute?" It seems that E-commerce operating can resolve two internal basic questions. One is how to stimulate the staff to increase output under the given output which the collective endeavour and individual contribution is difficult to measure. The other is to choose what system can guarantee the excellent person as a manager. The third is to create a highly flexible design management structure

of designer because of individual order. Whether product design or organizing production or sending goods, the challenge of the environment changes to the enterprise management and it should be considered. Management structure should be quickly adjusted with environment change and create the new one which is adapt to the new environment and exert the market's advantages, such as enterprise technology center, economic development center, the user's service office, etc. The flexible management structure will ensure the enterprise's ability to keep the flexible change and producing the customer's service and to defend the market's risk.

Creating Enterprise's Integrated Information System

Internet information system is the necessary condition for the enterprise entering Ecommerce. Internet depends on each other, especially in the same product making chain. Related enterprise production and service is named as highly cooperated system. Unity and competition of different enterprise management standards and technology standards promote and strengthen product liaison. On the contrary, it perhaps weakens and destroys the liaison. So enterprise penetrates its kinds of standards and marketing strategy and integrate the management through creating their own information system. Under the good support of information system, the enterprise's business model will be protected and utilized.



Source: https://banner2.kisspng.com/20180610/bux/kisspng-cloud-computing-system-integration-information-tec-infrastructure-as-a-service-5b1d81a47207e5.309792831528660388467 1.jpg

Main Points of Enterprise System Reforming in E-commerce Time

According to the analysis of E-commerce on Enterprise system, the first task is creating characteristic modern Enterprise system. Why does the modern enterprise system need characteristics? Because it exists the coordinated question between "the old three member" and "the new three member" in enterprise system. The three corresponding relationship is the union party and supervising board, the staff representative committee and the stockholder representative congress, Party committee and Board of directors. How to coordinate and integrate the three aspects is the key point. In any case, it must observe the Ecommerce law and request reforming to the traditional enterprise.

Creating CEO System

CEO is the highest executor of enterprise management and the core acting of enterprise management structure, who owns the supreme power. Who will hold it? Board of director, general manager or Party committee? It depends on enterprise situation. In a word, reforming principle is that only one person to take on CEO who is the conductor of E-commerce web which allows one order. Restraint between Board of director and general manager cannot be strengthened by marketing control. Theoretically, legal representative should be cancelled instead of Board of director and general manager. It is suitable for general manager to act.



Source: https://www.liveperson.com/assets/img/about-us-team.jpg

Creating Entrusting-acting, Leader System

For the state-owned enterprise, the entruster is the state government and the state asset management, while the acting is the CEO. At present, reforming has taken many times in our country but relationship between power and liability is still ambiguous. President of the board is the supreme leader appointed by government, who has no risk for enterprise operating. The general manager takes the specific production operating activity, supervising and stimulating system to the enterprise leader, such as the supervising structure, the supervisor, the staff congress exist only in name. Although "year – salary system" is tested in the enterprise, it is no stimulation but result in conflict between manager and staff. So, in the E-commerce age, the key is completely taking the reforming of enterprise leader system which is also a property right revolution, which the state-owned enterprises fear to do. Entrusting-acting leader system must be created. A set of law, culture and system of enterprise control power and resident demand power will be created. Different managers, especially CEO, can be chosen, supervised and stimulated. Under the given output which collective endeavor and individual contribution is difficult to measure, everyone will be encouraged to try to raise the enterprise output and struggle for the enterprise mission. So the enterprise will replace the market, substitute organization behavior and market control for the internal source of price system to reduce transaction cost. Its cost is based on the cost of the acting appearance and restraining stimulation. Apparently, the cost of stimulation is far less than that of transaction. Its reforming is reasonable.



Source: https://thumbor.forbes.com/thumbor/1280x868/https%3A%2F%2Fblogs-images.forbes.com%2Fthumbnails%2Fblog_2291%2Fpt_2291_5265_o.jpg%3Ft%3D1523358029

Creating Operating Management Model Based On Customers

The establishment of customer-centered operating management model requires enterprise to set flexible production and management structure based on the Internet to keep the high adaptation to the customers. Enterprise reforming is spreading out all over the word in the age of E-commerce. Although it is not confined to one or several models, some basic principles and technology methods are comparatively clear. So the enterprise must take overall and coordinated reformation to create customer centered operation management system and realize its plan relying on Internet.

Enterprise Development Based On Its Market Advantage

Advantages should be distinguished. In other words what can provide valuable service for the customers? For example, what kind of products, packaging, specification, quality, trademark, reputation, technology, transportation, organization management, etc. Based on these, all reformation based on customers will be practiced.



Source: https://web-material3.yokogawa.com/d9b948e1c0dedf61e98980d40dbcb8fc9484f25c.jpg

Analyzing Enterprise Existing and Potential Source Advantages

By analyzing the Enterprise existing source advantages will be found. Extension of the existing source will be the potential one. To enlarge the market advantages to gain attraction to the customer. All reformation based on customers should be practiced.

Choosing the Enterprise E-Commerce System That's Best For You

There are hundreds of e-commerce systems to choose from. However, that list quickly weakens if you are looking for an enterprise level platform.



Source: https://thumbor.forbes.com/thumbor/960x0/https%3A%2F%2Fspecials-images.forbesimg.com%2Fdam%2Fimageserve%2F1069074806%2F960x0.jpg%3Ffit%3Dscale

Make A List Of Requirements

Do your homework and create a Statement of Work (SOW) prior to embarking on an e-commerce migration process. E-commerce business tends to humble you every time you get too comfortable and/or cocky, which is why it's critical that you pay close attention. If you don't, it's likely that you will go through some scalability pain in the months following an e-commerce migration or a systems upgrade.

The Importance of Assessing Your Overall Operation

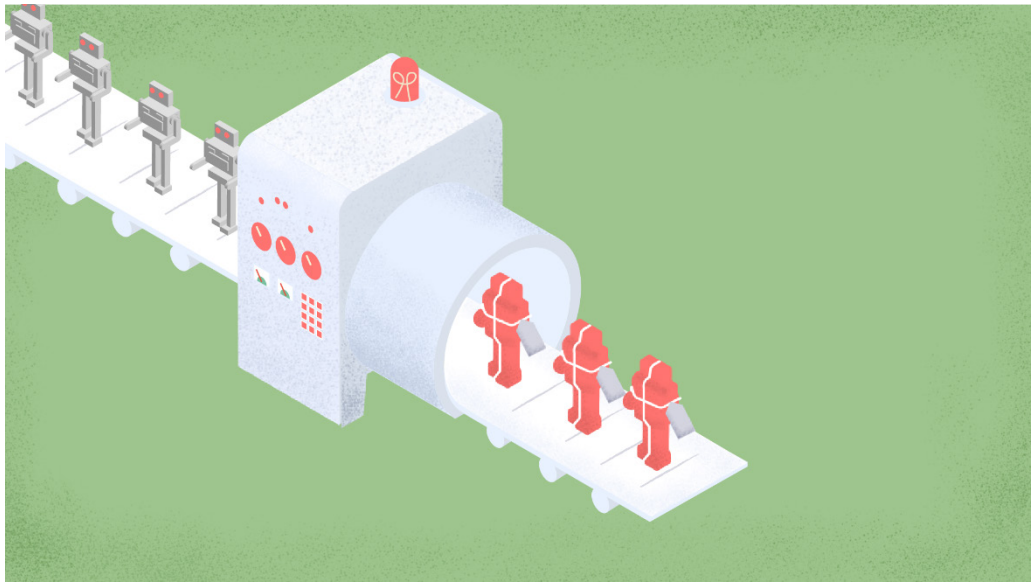
Hold multiple internal meetings and get feedback and/or suggestions from different departments such as IT, logistics, supply chain, operations, marketing, design, etc., to assess your overall operation. This is where you should come up with a drafted list of necessities such as:

- Do you have the right kind of software management system to process all of your orders and keep up with inventory? If you have repetitive processes that bottleneck the workflow, chances are you don't.
- What is your warehouse inventory? How many locations do you have? Which one of those warehouses would you use based on the zip-code of the order?
- Are you restocking your inventory as orders are filled?

Don't put too much thought into creating this document. You will get to amend it later in the process.

Assessing the Type of Product You're Selling

Are you selling one coffee cup or are you selling a coffee cup that's available in 10 different colors? If the latter is the case, you're selling 10 different items. It tends to get a little more complicated if you're selling clothes, as you have to keep track of colors and sizes. These types of details are crucial in determining the selling and upsell options you want to provide on your site. You can also set up a recurring sales option for repeat orders.



Source: https://www.ponoko.com/blog/wp-content/uploads/2017/08/Holiday-Sales-Guide-Part-1.png

Digital Products Versus Physical Products

You might have product(s) that you sell with a one-time license or a subscription-based digital product. You will need different payment systems and a secure license or software delivery method. Make sure that you identify all the following necessities prior to choosing a system:

- Functionalities: Based on the type of product that you sell and how customizable your products need to be online, you might need multiple custom functionalities on top of your e-commerce system. For instance, if your e-commerce platform isn't meeting your internal workflow's needs 100 percent, then you will need to implement some custom functionality to supplement the work process.
- Integration options: Identify the percentage of products you stock versus what you drop-ship. Drop shipping requires deep integrations. Make a list of all requirements needed based on the number and location of suppliers and the systems they use.
- Location of suppliers: Some suppliers have more than one warehouse location and will ship their products from the location that is closest to the ordering zip code. Update and relay the inventory for all of these locations to your e-commerce store so that you are not selling items that are out of stock.
- Systems used: Every business uses its own preferred software management system. Your e-commerce platform must be compatible with these platforms in order to provide a well-operated system.

The more suppliers and the more systems those suppliers use, the more difficult and costly an integration can be. If you have a lot of suppliers, then you just need to make sure that your e-commerce platform has the scalability to connect with other systems.

Sales and Marketing Channels

Your website shouldn't be the only way shoppers are able to purchase your product. When you migrate platforms, it's imperative that all of your sales and marketing channels remain intact. Some marketing channels may work with the type of product you're selling much better than others. Here's a short list of some of the channels we work closely with where you can sell goods: Amazon, eBay, Etsy, Walmart, Jet, Overstock, Google Shopping, Facebook.



Source: https://needo.com/wp-content/uploads/2018/01/marketing-channels-which-help-you-grow.jpg

Data, Set Up and Migration

Along with the total number of products, product option and images that are all migrated to your new platform, you'll also need to make sure that the images, as well as the integration with suppliers, are all successfully transferred. Simply keep up with all your new products, products that are going out of stock and those that are seasonal. Your e-commerce platform will be able to provide this information for you. It is your responsibility to review it on a regular basis. This makes the automated migration process go much smoother as everything can be transferred over swiftly and efficiently.

Platforms and Maintenance

The type of platform you choose depends on the type of products you're selling as well as the quantity amount and, of course, affordability. We have used VTEX, Bigcommerce Enterprise, Shopify Plus, SAP Hybris, Oracle ATG, Episerver, Sitecore and Magento Enterprise.



Source: https://i1.wp.com/empresa-journal.com/wp-content/uploads/2016/06/bnr_content-marketing.jpg?zoom=2.625&fit=1038%2C405&ssl=1

Most of these platforms include online customer service for maintenance. However, if you've chosen to add functionalities to enhance your e-commerce store, some of these platforms will not be able to assist you because every platform is different and all functionalities are compatible to every e-commerce platform. That said, it is possible to do it yourself!

Advantages and Disadvantages of Starting up an E-commerce Shop

Why e-commerce has flooded the Internet and has become a standard so quickly?

Advantages

Because the advantages of e-commerce compared to traditional commerce are really powerful.

- More clients. There is no local store or company with sufficient offices in different cities that compares with e-commerce's reach. The possibility of selling and buying from any part of the world expands the target public and allows the company to gain more clients.
- No schedule: E-commerce does not run on schedules, whereas it is nearly impossible to find a traditional store that is open 24/7. Websites are open all day long and clients can buy whatever they want whenever they want it.
- Less costs: not needing a physical store reduces the costs of running a traditional business. In addition, when e-commerce brings suppliers together with consumers there are not even production costs.
- Bigger profit margin: cost reduction and market extension mean that, even with lower prices, a bigger profit margin can be obtained than with a traditional store. More products are sold and more money is made.



Source: https://blog.ipleaders.in/wp-content/uploads/2017/06/BV-Acharya-1.jpg

- Scalability: This means that you can sell to either one or to a thousand people at the same time. In a physical store there is always a limit to the number of clients that you can assist at the same time. On the other hand, with e-commerce, the only limit is your ability to attract clients. Well, that and your server.

After having read this you may think that starting an e-commerce shop the cure-all, e-commerce does not come with only advantages.

That is why it is also advisable to analyze the challenges that you will have to face when you begin your online adventure.

Disadvantages (Challenges)

We wanted to call them challenges more than disadvantages to avoid showing a distorted picture.

Of course there are some disadvantages, as with everything in life, but if there were none, starting an e-commerce would be too easy and there wouldn't be any perks to it at all. ;)

- Lack of trust: Although payment platforms have evolved to the point of being as secure as any physical business, or even more so, a lot of people still think that less payment security, lack of trust. This means mistrust. We can help solve it by adding an SSL (https) certificate that encrypts the transferred information as well as by adding other stamps that transmit the necessary trust.

- Products and services that "cannot be seen or touched": Everyone likes the feeling of making a good investment. A way of making that feeling real is by seeing and touching the products with our hands. That tangible feeling is missing in an e-commerce shop. How can we solve it? With very thorough product cards and by adding images, videos, and very detailed descriptions of the products.
- Requiring access to the Internet: This is obvious, but to be able to buy and sell, you need a connected device. Nowadays, the large majority of people have this kind of access, but there are some sectors in which the target audience is either older or less "techy", which could be a problem.
- Technical problems: Any type of entrepreneurship, whether it is offline or online, implies dealing with unfamiliar issues. In the specific case of an e-commerce shop, the technological part requires a minimum knowledge that not everyone has. The best way to solve this is by outsourcing that part, although, of course, that carries a cost.



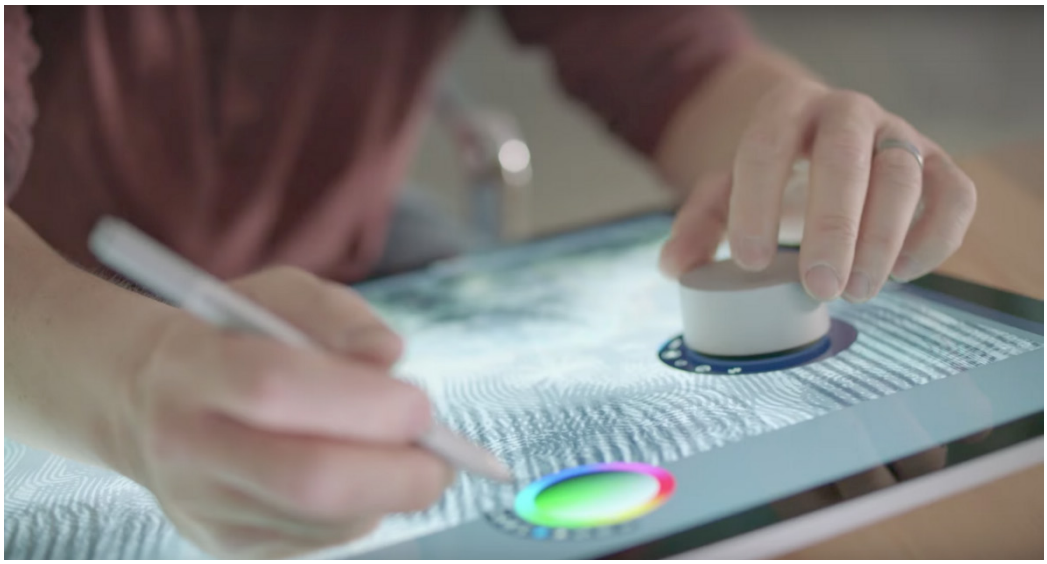
Source: https://images.dazeinfo.com/wp-content/uploads/2018/06/mobile-ecommerce-shopping.jpg

- Competitors: The initial investment in order to start an e-commerce is not as high as the initial cost of a physical business. This means more competitors.
- It takes time to get results: When a physical store is opened, the products are being shown to potential clients right from the very first minute. For an e-commerce, gaining visibility is more difficult than most people may think. You could have a great product and a great platform, but if you don't work on your visibility, nobody will see them.

Nevertheless, we think there are significantly more advantages than disadvantages. In fact, improving the return policies and the evolution of the security system will end up eliminating these disadvantages.

DIGITAL WORLD, DIGITAL HUMAN BEINGS, AND THE DIGITAL ENTERPRISE

The word "digital" directly refers to the Latin term digitalis that means "of or belonging to a finger", from which comes the first definition given by the Oxford English Dictionary. The word "digital" is initially used to characterize the recording mode of sounds, images or videos as opposed to "analog". The example of the sounds can help us to better understand the meaning of this notion - particularly in relation to the introduction of the compact disc (CD) in the 1980s as popular goods and the gradual replacement of vinyl.



Source: https://cdn-images-1.medium.com/max/2000/1*CI1JuvDA0nfxph6tdzmHTw.png

The analog recording is based on sound reproduction in a way very close to reality i.e. by reproducing on a medium – for example, a vinyl. In contrast, the digital principle is to discretize the continuous sound - or image or any other information. This process of digitizing is the basis of all electronic technologies that work with discrete numbers in base 2, i.e. from a series of 0 and 1. In practice, 0 and 1 are represented by an electrical circuit where passes the electric power (digit 1) or where it does not pass (digit 0). This technical description is clearly not sufficient to understand the pervasive use of digital devices. Especially it does not emphases the value they have acquired in these recent years through concepts such as "digital world", "digital human beings", and "the digital enterprise".

Digital World: How is the World transformed by Using Digital Devices?

It is reasonable to say that the development of Internet and of Web technologies in the 1990s primarily induced a transformation of the world and of its social and cultural values. The Web is more than the interconnection of computers; it has determined a major change in our practices and our relationships with the surrounding world, as it has created new models of production, distribution and reception of information in general.

As a result of the ubiquity of the Web in our lives, what is digital is everywhere. A few decades, we expected the information technology to be mainly a powerful tool with multiple functions capable of helping human in many fields. Today, this view is obviously reductionist, if not completely false: The digital is becoming a full environment in which we are immersed, it determines and shapes our world representations and action modes. The digital is not just a set of tools: Not just a set of technical devices to better do what we did before. It can't be considered as a car that allows us to do the same road more rapidly than on foot. The digital changes our practices and enables new possibilities.



Source: https://www.wns.com/Portals/0/Images/Articles/DesktopImages/600/159/Digital_ROI_HD-1.jpg

Let us try to illustrate this statement with two simple examples. The first one can be the use of Twitter during a conference, seminar or a university course. This tool profoundly changes the way to participate to this event, because: not only (1) it allows people who are not in the room to be informed on or to comment what is said there, but also (2) it induces a different way to understand the conference, seminar or course. While the speaker is talking, someone from the

audience reacts to what he says. This reaction is read by the others – physically present or not - and this often creates multiple layers of discussion. Someone is following what the speaker says, someone is to deepen what he has just said - for example by seeking references on the Internet or by requesting clarification from another participant who knows more. In short, Twitter changes the form and content of the debate, but also the form of intelligence itself. As a second example, let us examine the impact of a popular device, Global Position System (GPS) on our daily life: Using a GPS alters our relationship to space and we perceive space differently. We always know where we are and how to reach our place without being lost creating a sense of confidence. Besides, it is no longer necessary to remember the road and to know how to read a map, even if it may be a problem in the case of hardware or network failure.



Source: https://changeworkscom.co.uk/web-cont1001/uploads/digital-globe.jpg

These two examples show that we no longer understand the same things in the same way; our relationships in knowledge transfer and acquisition is dramatically changing. The digital devices generate practices and also new implications of these practices, it changes our way of being in the world and also our cognitive approaches how we manage our attention considered as a scarce resource and consequently our way of thinking and perceiving time and space. These important facts force us to question a naive conception of the nature of human and his place in this digital world.

Digital Human Beings: Are "Digital Human Beings" Going Towards A Whole Dependency Of Digital Devices?

The tools change our physiology and therefore our way of inhabiting the world. Individual is not simply a human being who uses digital tools, but a human being who works differently, who has a different relationship with his surrounding: space, time, memory and information source of knowledge, etc. He is becoming a "digital human being".

The individual in everyday life is paired up with digital devices. He lives surrounded with technical devices: computers, mobile phones, connected objects, etc. These digital devices have the main particularity to be the core of his activities. They stand between individual and the world. They slip between people, to the core of their practices, they help them and more radically, they transform their way of being.

The "Digital Enterprise": How is the Enterprise Transformed by the Digital World?

As we mentioned in the previous section, the digital world driven by new technologies is changing the habits of humans and thus changing also business: Organizations, processes, researches and innovation, governance, communications, customer relationships, skills and career management.



Source: https://i.ytimg.com/vi/9KiJDaPhlEY/maxresdefault.jpg

The great transformations are well known: the Cloud Computing, which allows businesses to overcome infrastructure constraints, adapts their Information and Communication Technologies (ICT) tools to their activity; the high speed networks and mobility, which break the limitations of the physical boundaries of the

organization. The enterprise was a pyramid structure of resources management. It becomes a network of competencies and means, which adapts according to the objectives and the environment. Further changes are also beginning to emerge. We will mention three; First the spread of social networks as a tool in the enterprise and a main channel of the customer relationship. The aim is to make the enterprise a collaborative organization. Social networks create a direct relationship between the enterprise and its clients, by giving them the power. As soon as the most customers form a community to follow a trademark or complain, the enterprise can no longer ignore it. It must listen, propose and adapt. Then, this marketing transformation is also commercial: mobile applications and web services. They become a mandatory channel of distributing for the enterprise's products. We must not underestimate the magnitude of this transformation: The ability to provide the best possible customer experience is at least as important as the quality or price of the products. Finally, the connected objects are one of the most important growth drivers for our economy. It is the ability to equip all objects which surround us daily with simple and automatic functions to simplify our lives. The scope of application is endless. Our cars are already able to report problems to a service center or guide us as a function of traffic, our homes monitor themselves, etc. The production and logistics cycles are also beginning to be completely redesigned to take advantage of digital world. We are only at the beginning of what will become as common as to have a phone in the pocket today.

ANALYSIS ON THE INTEGRATION OF ERP AND E-COMMERCE

Time and tide wait for none, they say; and so does technology. Reminiscences of not long ago remind us of the dotcom uproar in the nineties as a turning point for the internet-based economy. The gradual seeping in of the internet into the way we work and live is a discussion held more than many times.

The evolution of technology right from the basic internet enabled computers to the smartphones, to the wearables and almost everything connected to the internet of things points out a fact. Businesses and enterprises have no choice but to keep evolving their ERP software system development approaches to remain in sync with the expectations and technologies of the day.

e-Commerce services conceptualized with an aim to make shopping easy by including online shopping as an option to the brick and mortar stores; soon included other tasks like banking, booking, paying bills and the list is endless. Businesses can no longer keep their e-Commerce approaches isolated from the ERP systems to function. Enterprises then combine the powers of e-Commerce to fuse with the abilities of the ERP systems and we have a power-packed system on hand leading all enterprises including startups to fortune.



Source: https://www.spec-india.com/blog/takes-two-tango-e-commerce-enterprise-resource-planning/

ERP systems have an increasing significance because of the integrated and centralized approach to facilitate business functioning in core areas like Finance, Production, Procurement, Sales & Marketing, Customer Relation, Human-Resource Management and so on. A mature ERP system combines solutions to a huge number of requirements into one.

When e-Commerce is folded into the solution, Sales & Marketing gets a completely new meaning and the way of doing business becomes a combination of on-field to off the field from the buyer's devices directly. Synergy is a vital part of these contemporary solutions which fuse comfortably into each other.

The Relationship between ERP and E-commerce

ERP (Enterprise Resource Planning) is the enterprise internal resource management system, it is concerned about corporate finance, human resources, project management, etc. It involves some parts of CRM (Customer Relationship Management) and SCM (Supply Chain Management) such as product development and design, job control, production planning, raw material procurement, inventory, personnel management and other modules (see figure 1 below).

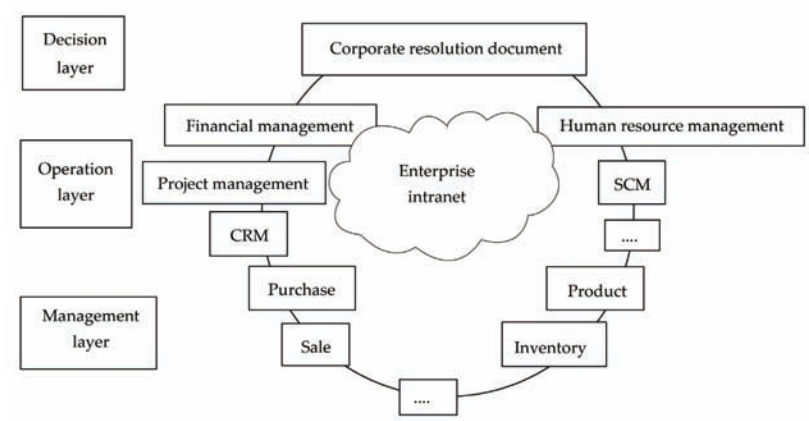


Figure 1: The parts that ERP involves.

Source: https://aip.scitation.org/doi/pdf/10.1063/1.4992954

E-commerce is the enterprise external resource management. It is concerned about the business process with the upstream and downstream partners, as well as online sales, brand marketing and other business. It involves CRM, SCM and product development management (see figure 2 below).

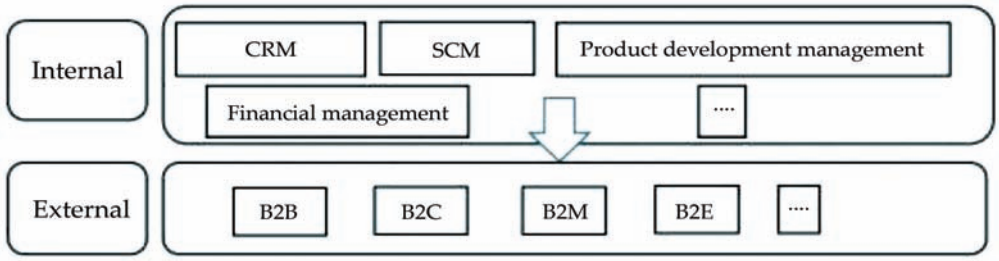


Figure 2: The parts that e-commerce involves.

Source: https://aip.scitation.org/doi/pdf/10.1063/1.4992954

E-commerce is built on the basis of ERP applications, in other word, ERP is the supporting system of e- commerce. But from another point of view, e-commerce and ERP can be attributed to the same level of application, ERP and e-commerce are the necessary supporting platform for enterprise development which are essential parts of enterprise information construction. ERP is concerned with the internal production scheduling, logistics resources and other resources distribution. Electronic commerce is the connection between the enterprise and the outside network world, it is based on the internet which can more easily contact with customers, get sales orders and improve corporate profits. The two systems are closely connected and functionally complementary. Therefore, due to the close

relationship between e-commerce and ERP, we cannot simply regard them as two independent objects, but should use the contact point of view to understand and study them.

The Necessity of the Integration of ERP and E-Commerce

For enterprises, the relationship between e-commerce and ERP is external and internal which are closely related. And a successful enterprise information system, in the actual operation, any changes in the external or internal links even if some very subtle changes will be directly passed to other related links. When electronic commerce is out of touch with ERP, many key data information will be enclosed in a relatively independent system. It can lead to a very bad situation that enterprise information flow, capital flow, logistics cannot be organic unity and data consistency, data completeness, data accuracy in the invoicing software cannot be guaranteed as well. Moreover, redundant work is repeated within the enterprise, which lead to work efficiency decreased and operating costs increased. Therefore, the state of ERP and e-commerce running alone has been unable to meet the requirements of enterprise development.



Source: https://i1.wp.com/www.vulosoft.com/wp-content/uploads/2018/05/erp_maxwell.png?fit=1200%2C749&ssl=1

After the integration of ERP and e-commerce, supply chain management, customer relationship management, business intelligence, e-commerce and office automation will be fully integrated together. This will achieve resource sharing and data sharing. What's more, leaders at all levels can quickly and accurately get the information they need and make the most effective decisions in the shortest possible time. Therefore, the integration of e-commerce and ERP is imperative.

The Feasibility of the Integration of ERP and E-Commerce

It can be obtained from the relationship between ERP and e-commerce that e-commerce is based on the establishment of ERP. ERP has been the support system of e-commerce. Therefore, the specific relationship between ERP and e-commerce can be described as: Based on the compatibility of the supply chain, based on the relevance of customer relationship management, etc. The relationship between ERP and e-commerce makes them to face the reorganization of business process, but also requires the ERP and e-commerce application software to be re-divided and integrated. The integration of ERP and e-commerce is putting forward under the new market competition environment, so the enterprise management has been aware of the integration`s impact on the core competitiveness of enterprises. Therefore, from the integrated demand view, the integration of ERP and e-commerce is completely feasible. Advanced information technology provides technical support for the integration, some scholars have studied the integration based on XML and SOAP. Therefore, from the technical point of view, the integration of ERP and ecommerce is feasible.



Source: http://abouttmc.com/wp-content/uploads/2016/08/E-commerce-ERP-and-the-Challenge-of-Integration.jpg

The Strategies of the Integration of ERP and E-Commerce

In order to make a better integration of them, the following integration strategies should be considered.

Organic Integration of Application Software Modules

To achieve the integration of these two aspects. In the aspect of ERP, priorities should be given to modules like procurement, production plan, marketing, sales, and inventory and finance, which are closely related to logistics and capital flow; in the aspect of electronic commerce, consideration should be given to the website management module, the online sales module, the online purchasing module and the online payment module. The two modules should be integrated together to form a new application system.



Source: https://pbs.twimg.com/media/DV9DGbAVoAANrVv.jpg

Organizational Innovation and the Optimization and Reorganization of Various Departments

The integration of ERP and e-commerce needs the coordinated operation of the whole enterprise. Enterprises must continue to improve the existing business model and restructuring, adjust staffing and change the traditional mode of work, so as to build a new business philosophy. Meanwhile, any change in the business model will have a profound impact on the e-commerce architecture, thereby promoting the continued development of e-commerce structure to better serve the enterprise. Such a restructuring of enterprises will form a virtuous circle between ERP and e-commerce, it will promote the coordinated development of the two sides, as well as the healthy development of enterprises.

Change Traditional Views

The integration of ERP and e-commerce is bound to affect the overall situation, involving all aspects of the enterprise that will be a profound change in the enterprise, in other words, this will inevitably affect the current management ideas, management systems and management methods. And more importantly, this transformation will cause the redistribution of the benefits of many people, so it is bound to encounter many obstacles. The top decision-makers need to fully promote the business leaders, managers and employees to change their ideas, and then accept the advanced management concepts. Employees need to accept the advanced management philosophy and have a correct understanding of the ideology.



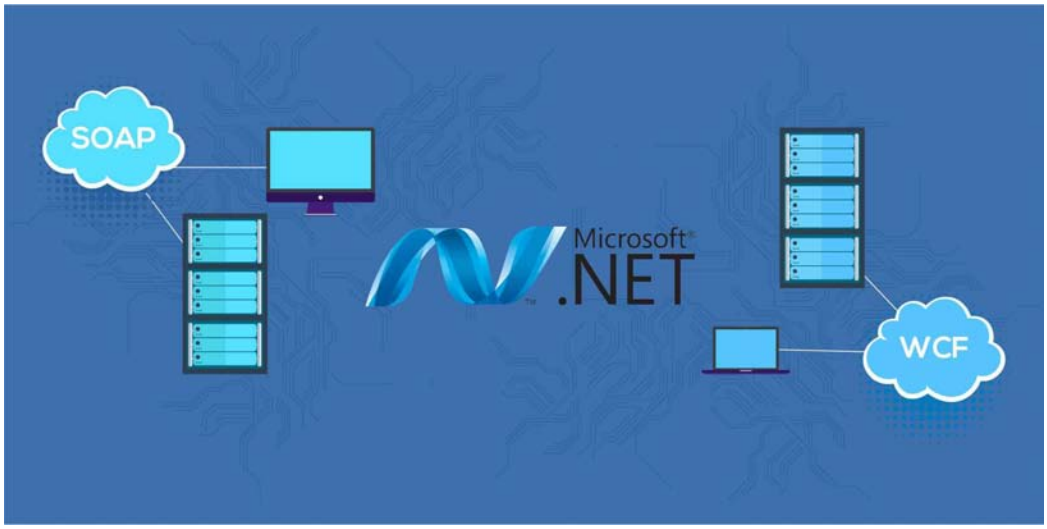
Source: https://www.systemsvalley.com/wp-content/uploads/2018/08/Odoo-your-open-source-application-to-grow-your-business-Odoo-ERP-solutions-systems-valley-1.jpg

The Technologies in the Integration of ERP and E-Commerce

ERP and e-commerce are complex systems, both are usually developed independently of each other, and the two systems are heterogeneous and technically incompatible. Therefore, it is necessary to use some technologies which are distributed, open, cross platform support and interactive. At present, the industry in the integration of e-commerce and ERP systems mainly use XML technology and SOAP technology

XML (eXtensible Markup Language). In February 1998, the W3C formally approved the standard definition of the Extensible Markup Language, which allows users to structurize documents and data so that it can be exchanged between departments,

customers, and suppliers for dynamic content generation, enterprise integration and application development. It combines the rich features of SGML and the ease of use of HTML to the application of Web, the biggest advantage of XML is that its data storage format is not restricted by the display format. XML has the characteristic of self-description, which is very suitable for data switching between different application systems, and this kind of data switching is not defined as a set of data structures.



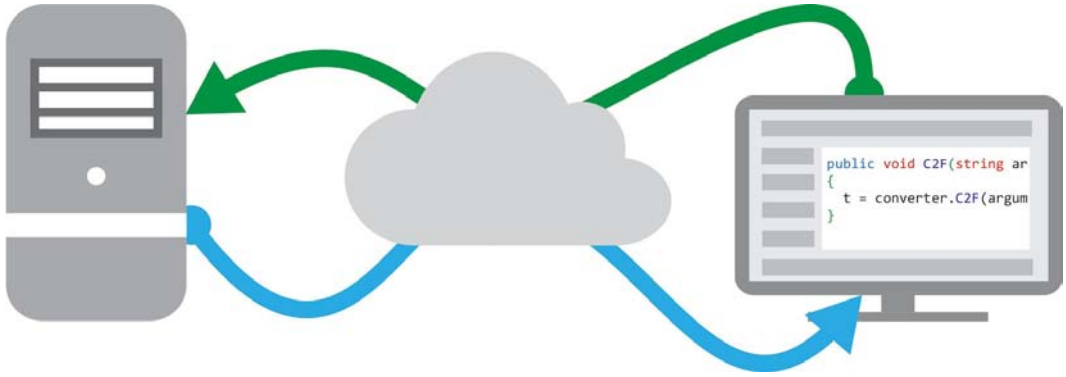
Source: https://stackify.com/wp-content/uploads/2017/09/NET_CORE-SOAP.jpg

SOAP (Simple Object Access Protocol) is a XML based data switching protocol specification. It is designed to exchange structured and solidified information on the Web. SOAP can be used in conjunction with many existing internet protocols and formats, including Hypertext Transfer Protocol (HTTP), Simple Mail Transfer Protocol (SMTP), and Multipurpose Internet Mail Extensions (MIME). It also supports a large number of applications from message systems to remote procedure calls (RPCs). SOAP can be written in most programing languages, and can be run in most operating systems.

The main idea of using XML and SOAP to integrate e-commerce and ERP is:

E-commerce releases product information on the network and saves the information to the e-commerce database after receiving order information, and then the data will be generated in the XML document with a specified format. The XML document is then packaged into a message, which is transmitted to the ERP side by the message middleware SOAP. After receiving the message, the ERP system

automatically processes the XML document in the message, and updates the database of the ERP side according to the information of the document; On the contrary, if some of the information are changed when the ERP system is running, they will also be packaged into a message, and the message will be transferred to e-commerce database by SOAP, so as to ensure real-time unity.



Source: https://3.bp.blogspot.com/-aAEKpOfVRMc/WTix5ML98qI/AAAAAAAAAvE/Cnl8HCRczhwcCLYyUWzeQjp1ChHWfnCVwCLcB/s1600/Test-Web-Services-With-Ranorex.jpg

XML and SOAP set up a bridge of data transmission between the ERP and e-commerce, these two technologies solve the problem of data sharing between two different data structure systems. The integration of ERP and ecommerce can be realized by using XML and SOAP, which realizes the real cross platform operation of the system. The system has the advantages of high integration, high modularization, high reliability and security.

Technologies for the Impeccable Performance

Contemporary technologies give a boost to the power unleashed by the combination of e-Commerce and ERP.

Mobile Technologies

The new age users are equipped with the savvy and cool mobile devices. The combo of ERP & e-Commerce gears up to be available and compatible with diverse devices with contrasting operating systems and sizes. Availing the benefits of concepts like mobile app personalization helps to engage the users better.



Source: http://blogs.ubc.ca/technut/files/2018/07/5-Ways-Mobile-Technology-will-Grow-in-2016.jpg

Cloud

Putting the business on Cloud Vs keeping it On-Premise is a raging debate. But, the flexibility and scalability offered by the Cloud is an accepted fact and the duo of ERP and e-Commerce certainly has an edge when on a Cloud. Scaling up and down in terms of services and storage is a cost-effective solution desired by most.

IoT

The IoT approach binds every device, every medium that exists today. It facilitates practical combinations like ERP and e-Commerce and offers better and reliable data capture and relay mechanisms.

7 Benefits of Integrating Ecommerce with ERP

E-commerce is a modernized way of selling products at relatively lower costs. It has changed the way in which enterprises do business and communicate with their consumers. For almost every type of retailer, putting an online store has become a need. The online stores offer various benefits for retailers, as well as customers. However, maintaining an online storefront can become a huge, and arduous stress for retailers, if the storefront is not integrated with their Enterprise Resource Planning (ERP) system.



Source: https://akela-partners.com/wp-content/uploads/2017/05/e-commerce.jpg

Usually, businesses overlook the need for integrating e-commerce with ERP due to cost or business interruption caused by having to modify current systems. However, when you see the effect of this integration on your operations, as well as customer experience, the costs seem to be worth it.

When you integrate e-commerce sales channels with your ERP system, it enables you to function even more competently as a business. The key types of data, such as shipping/tracking, order, customer, item, and inventory are all linked to your independent systems.

There are some types of integration, which pass this data between your systems automatically, thus eliminating the need to enter data from one system to another, manually.

Hand-keying the sales orders into ERP is a painful and time consuming process. It involves a lot of hassles in updating product data in Excel, and then uploading to the web store. If you are dependent on reducing inventory in your systems manually, or not able to do it all, then it can cause you to oversell. There are a lot of chances to make mistakes as these processes are not automated. Some of the common mistakes include:

- Wrong shipping addresses
- Incorrect inventory levels
- Missing, incomplete, or incorrect product information

In short, when you don't integrate e-commerce with ERP, you put your consumers experience, and your business at stake.

Here are the seven major benefits of integrating your e-commerce storefront with ERP system:

Reduces Data Redundancy, Human Involvement, and Error

With the integration of e-commerce storefront, the payment & shipping information, web orders, and web customer details are integrated to ERP system. In the similar way, it helps to upload the details of item and inventory from ERP to the e-commerce portal. Thus, in any way, the integration helps eliminate the requirement of re-entering the data. In turn, this helps reduce data redundancy, human involvement, and error.



Source: https://www.futurismtechnologies.com/blog/wp-content/uploads/2016/12/2.jpg

Reduces Operation Costs

The real-time data, which is available from the ERP system on to the storefront, enables consumers to view latest order status, available inventory, as well astrack shipments with tracking numbers. Automated data inputs help save on errors, re-works, and order backfires. All these benefits help reduce operational costs.

Increases Internal Productivity

Integrated systems play a vital role in streamlining several business processes. This has helped lessen the involvement of human resource in the processes. The web sales orders are integrated to the ERP system in real-time, and this helps a back office ERP user to track the order instantly and start with the further processing. Thus, integration reduces the order fulfillment cycle.



Source: http://linkites.com/wp-content/uploads/2018/07/Post106-1.jpg

Reduces Inventory Cost

All the information about web sales appears in your ERP system promptly. Based on these web transactions, ERP item inventory will also get updated. Thus, with up to date information about inventory and web sales, an ERP user can plan the purchase in a proper way, thus reducing inventory costs.

Increases Customer Satisfaction

With an ease of getting up to date product information, order tracking details, and inventory availability detail from ERP system, increases the satisfaction level of a consumer.



Source: https://cdn-images-1.medium.com/max/1600/1*xjwQ7Zw_mXshUUTEpG1WYg.jpeg

Generates Financial Reports in ERP

Financial reports of sales are generated by e-commerce applications. By integrating of e-commerce with ERP, it helps the business to produce trial balance, balance sheet, cash flow, and P/L Statement, which gives the required clarity in financial information.



Source: https://www.futurismtechnologies.com/blog/wp-content/uploads/2016/12/1.jpg

Better Control of your Business

By integrating e-commerce storefront with ERP business processes, it helps business owners to get better control of their business, thus giving competitive gains.



Source: https://www.futurismtechnologies.com/blog/wp-content/uploads/2016/12/6.jpg

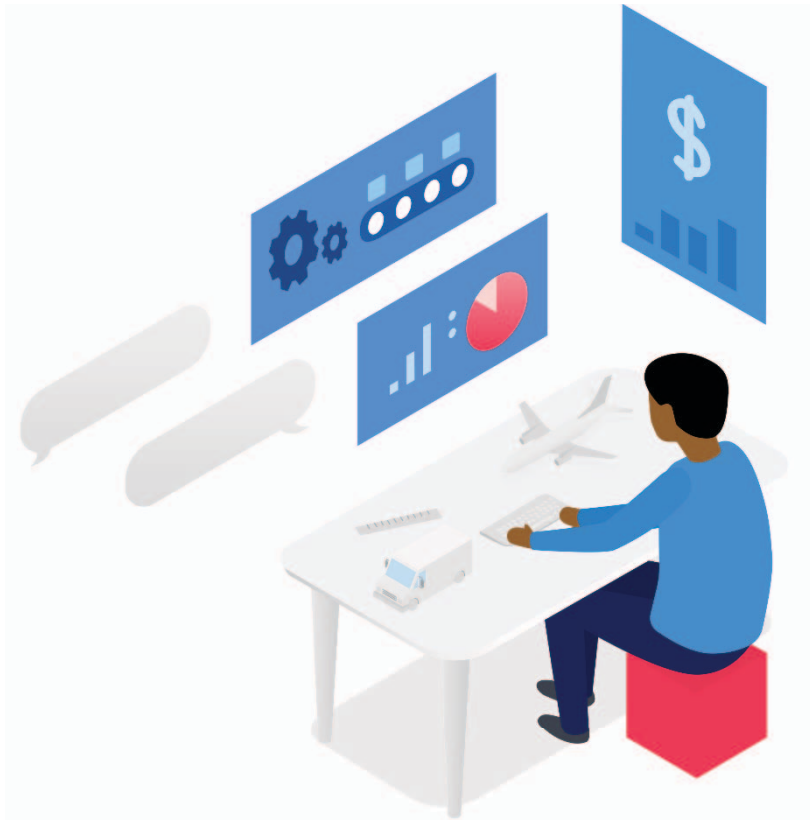
The main benefits of integrating e-commerce store front with your ERP are as above. Now, it is time that you comprehend these benefits and adopt them for the success of your business. As a whole, availability of precise, and up to date order and consumer information makes it easier to deliver a good customer service.

ENTERPRISE RESOURCE PLANNING

Have you ever heard of the acronym ERP? If not, it's time we take a look into it, because ERP could turn your business into a more effective and efficient organization. To start, the acronym ERP stands for Enterprise Resource Planning. Sounds somewhat generic, right? Well, let's take a look at what it means and how ERP helps you out in the ecommerce world.

Meaning of Enterprise Resource Planning

Enterprise Resource Planning refers to a software that brings together all facets of an operation. These tools integrate functions like marketing, HR, logistics, and customer service, all with the intention to make processes more efficient.



Source: https://www.aptean.com/assets/client_files/images/illustrations/1_Enterprise-Resource-Planning-Solutions-(ERP).png

An ERP software automates the core processes by collecting orders, delivering reports on these orders and gathering and storing information to make each of your departments effective.

In short, an Enterprise Resource Planning software has the ability to cut out unnecessary tasks and jobs, essentially minimizing the amount of work each person in your organization has to complete. This saves you money in the long run.

The Components of an ERP System

Think about all of the current software for your company. You might have a customer relationship management tool, a website, accounting software, supply chain management modules, HR systems and email marketing tools. Wouldn't it be nice if one system brought all of these processes together?

That's what Enterprise Resource Planning does for a business.



Source: https://www.cronomagic.com/Content/img/erp.png

And after all of that, ERP delivers information after accumulating it into a large database. For example, a CEO may go into the software to obtain data or information on the following:

- Payments made by customers
- Outstanding payments
- Shipment statuses
- Products and inventory
- Supplier relationships
- Details on customers and how your company targets them

What Types of Companies Generally Use ERP?

Large corporations take advantage of ERP far more frequently than mid-sized and small businesses. Why is this the case? Most small businesses could benefit from these tools, but it generally comes down to money. Enterprise Resource Planning requires a significant amount of cash, since the majority of software options are designed for organizations that have the means to spend large sums on a monthly basis.

Overall, your best bet is to wait until you scale up and accumulate more income to support the spending on. After all, even articles focused on sharing small business ERP options stick to the same pricey solutions.

The Primary Reason Businesses Utilize ERP

Although connecting all processes and tools in an organization seems interesting, the primary reason companies turn to this is for the automation. After all, automation launches several opportunities for saving money, becoming more efficient and even allowing you to reallocate your labor force elsewhere.



Source: http://assets.inoutput.io/images/how-an-enterprise-resource-planning-erp-system-will-help-your-business-grow/How-an-Enterprise-Resource-Planning-ERP-system-will-help-your-business-grow.jpg

How ERPs Come Into Play for Ecommerce Organizations

ERP for ecommerce comes into play far more frequently than one might assume. Building off the previous section, we should look into an example of what we mean by automation.

Let's say Company ABC sells gardening products through an online shop. Initially, the company owns several software modules for completing various tasks throughout the sales and supply chain process. For example, a customer comes to the store and checks out. The website sends them a receipt and captures

their email. Company ABC has both shipping and marketing processes in place, but none of them connect with each other.

Therefore, an employee must check to see if the product is in stock, then mark the item as bought so the warehouse or supplier can go and package it up.

Then, someone must notify the shipping company and send out a shipping confirmation email with a tracking code.

Finally, your company wants to bring the customer back to the store, so they have an email marketing person who sends promotions to the list of emails in the database.

How Enterprise Resource Planning Does a Better Job

Now let's say that our hypothetical Company ABC implements an Enterprise Resource Planning software. The tool integrates all of the processes, from marketing to shipping.

A customer stops by your gardening supply store and throws a few items into the shopping cart: a shovel, gloves and work boots. She clicks through to the checkout page and makes the purchase. With the integrated software, a receipt gets sent to the customer, and no one has to check to see if the items are in stock or not.



Source: https://i.ytimg.com/vi/a5yp7LdEoOU/maxresdefault.jpg

The warehouse automatically receives a notice to package the products. All of the packaging and shipping supplies are printed and ready to go. When the package

departs from the warehouse, an email automatically goes to the customer to give them a shipment tracking code and maybe a few links to related products. The system handles the majority of email marketing that doesn't need to be customized.

Not to mention, all customer support interactions before and after the purchase get logged into the software, showing the customer history and other information about the user. HR taps into this flow as well, since the software displays all of the interactions each customer support rep has had. Therefore, HR goes back to evaluate which of the people they should give promotions to.

Like we said, the whole key behind Enterprise Resource Planning is automation. In the end, a company gains efficiency and hopefully more money.

Does Your Company Need to Take Advantage of Enterprise Resource Planning?

Like we talked about above, the majority of small business owners either don't know about Enterprise Resource Planning, or they have no interest in paying the large sums of money. That said, a few options exist out there, and when you utilize integration tools like Zapier and Automate, your ecommerce resource planning becomes much easier to manage.

So, does your company need to take advantage of Enterprise Resource Planning? Yes, it most certainly does. However, we recommend looking for affordable solutions so you don't end up breaking the bank in the infancy stages of your store. Go for an Enterprise software when you have the means.

TRANSACTION PROCESS SYSTEM

A transaction process system (TPS) is an information processing system for business transactions involving the collection, modification and retrieval of all transaction data. Characteristics of a TPS include performance, reliability and consistency.

TPS is also known as transaction processing or real-time processing.

A transaction process system and transaction processing are often contrasted with a batch process system and batch processing, where many requests are all executed at one time. The former requires the interaction of a user, whereas batch processing does not require user involvement. In batch processing the results of each transaction are not immediately available. Additionally, there is a delay while the many requests are being organized, stored and eventually executed. In transaction processing there is no delay and the results of each transaction are immediately available. During the delay time for batch processing, errors can occur. Although errors can occur in transaction processing, they are infrequent and tolerated, but do not warrant shutting down the entire system.



Source: http://www.renotech.co.id/wp-content/uploads/2017/11/RTPS.jpg

To achieve performance, reliability and consistency, data must be readily accessible in a data warehouse, backup procedures must be in place and the recovery process must be in place to deal with system failure, human failure, computer viruses, software applications or natural disasters.

Features of Transaction Processing Systems

The success of commercial enterprises depends on the reliable processing of transactions to ensure that customer orders are met on time, and that partners and suppliers are paid and can make payment. The field of transaction processing, therefore, has become a vital part of effective business management, led by such organizations as the Association for Work Process Improvement and the Transaction Processing Performance Council.



Source: https://farm7.staticflickr.com/6211/6355836713_0fbe511113_o.jpg

Transaction processing systems offer enterprises the means to rapidly process transactions to ensure the smooth flow of data and the progression of processes throughout the enterprise. Typically, a TPS will exhibit the following characteristics:

Rapid Processing

The rapid processing of transactions is vital to the success of any enterprise – now more than ever, in the face of advancing technology and customer demand for immediate action. TPS systems are designed to process transactions virtually instantly to ensure that customer data is available to the processes that require it.

Reliability

Similarly, customers will not tolerate mistakes. TPS systems must be designed to ensure that not only do transactions never slip past the net, but that the systems themselves remain operational permanently. TPS systems are therefore designed to incorporate comprehensive safeguards and disaster recovery systems. These measures keep the failure rate well within tolerance levels.

Standardization

Transactions must be processed in the same way each time to maximize efficiency. To ensure this, TPS interfaces are designed to acquire identical data for each transaction, regardless of the customer.

Controlled Access

Since TPS systems can be such a powerful business tool, access must be restricted to only those employees who require their use. Restricted access to the system ensures that employees who lack the skills and ability to control it cannot influence the transaction process.



Source: http://thebyron.com/wp-content/uploads/2017/04/byron-peachtree-perennial-properties-atlanta-apartment-luxury-living-amenities-controlled-access.jpg

Transactions Processing Qualifiers

In order to qualify as a TPS, transactions made by the system must pass the ACID test. The ACID tests refers to the following four prerequisites:

Atomicity

Atomicity means that a transaction is either completed in full or not at all. For example, if funds are transferred from one account to another, this only counts as a bone fide transaction if both the withdrawal and deposit take place. If one account is debited and the other is not credited, it does not qualify as a transaction. TPS systems ensure that transactions take place in their entirety.

Consistency

TPS systems exist within a set of operating rules (or integrity constraints). If an integrity constraint states that all transactions in a database must have a positive value, any transaction with a negative value would be refused.



Source: https://info.zimmercommunications.com/hubfs/BrandsFormation-Consistency.jpg?t=1538158278234

Isolation

Transactions must appear to take place in isolation. For example, when a fund transfer is made between two accounts the debiting of one and the crediting of another must appear to take place simultaneously. The funds cannot be credited to an account before they are debited from another.

Durability

Once transactions are completed they cannot be undone. To ensure that this is the case even if the TPS suffers failure, a log will be created to document all completed transactions.

These four conditions ensure that TPS systems carry out their transactions in a methodical, standardized and reliable manner.

Types of Transactions

While the transaction process must be standardized to maximize efficiency, every enterprise requires a tailored transaction process that aligns with its business strategies and processes. For this reason, there are two broad types of transaction:

Batch Processing

Batch processing is a resource-saving transaction type that stores data for processing at pre-defined times. Batch processing is useful for enterprises that need to process large amounts of data using limited resources.



Sources: http://musicentrepreneurhq.com/wp-content/uploads/2014/05/batch-processing.jpg

Examples of batch processing include credit card transactions, for which the transactions are processed monthly rather than in real time. Credit card transactions need only be processed once a month in order to produce a statement for the customer, so batch processing saves IT resources from having to process each transaction individually.

Real Time Processing

In many circumstances the primary factor is speed. For example, when a bank customer withdraws a sum of money from his or her account it is vital that the transaction be processed and the account balance updated as soon as possible, allowing both the bank and customer to keep track of funds.

Transaction Processing

Consider for a moment all the events that take place on a daily basis in an organization. Let's take an electronics store as an example. A single store can easily carry 10,000 different items. Throughout the day, customers come into the store, select a product and pay for it at the checkout counter. Staff is continuously taking items from the stock room and placing them on the shelves. When the stock runs low, new shipments are ordered. Other customers come in to exchange items and deal with warranty issues.



Source: http://cdn.knewsodisha.com/wp-content/uploads/2018/09/credit-and-debit.jpg

All of these events are referred to as transactions, and keeping track of them requires a transaction processing system. A transaction processing system, or TPS, is a system to capture and process the detailed information necessary to update data on the fundamental operations of an organization.

A transaction is essentially a single event that changes something. There are many different types of transactions. For example, customer orders, receipts, invoices, payments, etc. The actual processing of transactions includes the collection, editing, manipulation and storage of data. The result of processing a transaction is that the records of an organization are updated to reflect the new conditions at the time of the last processed transaction.

Consider the example of the electronics store. A customer buys a video game and pays for it with cash at the register. This event is recorded as a sale transaction. However, it also triggers other transactions.

First, the amount of cash at the register has just gone up. Second, the inventory of the particular video game has gone down by one. These transactions are logically linked - they occur on the same day at the same time and involve the same item. Linking the transactions provides improved data consistency since one cannot exist without the other. The amount of cash in the register cannot go up unless some transaction makes this happen.



Source: https://www.shandbookkeeping.com.au/wp-content/uploads/2017/05/Xero-Training-Gold-Coast-Transaction-Processing-Payments.jpg

There are many different types of transaction processing systems, such as payroll, inventory control, order entry, accounts payable, accounts receivable and others. Transaction processing produces valuable input into many other systems in an organization, such as management information systems and decision support systems. A TPS serves as the foundation for these other systems. A TPS tracks routine operations but does not provide much support for decision making.

For example, in the case of a bank account, a TPS keeps track of all the events associated with a single account: deposits, withdrawals, transfers, fees, interest paid, etc. This provides a good description of the account activity.

Now let's say the customer comes into the bank and requests a car loan. The account activity is useful information but not enough for the bank to make a decision on the car loan. This requires combining information from different sources and analyzing the financial profile of the customer.

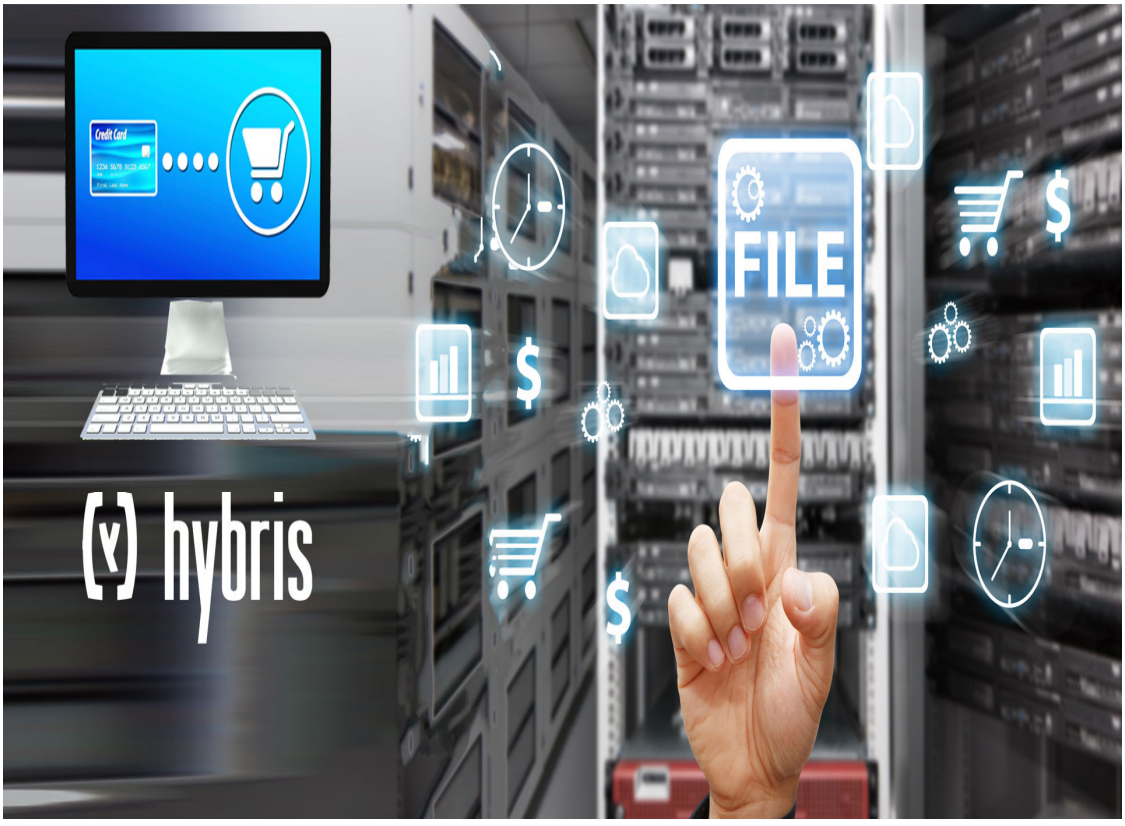
REFERENCES

1. Adams, F. G. 2003. *The E-Business Revolution and The New Economy: E-conomics After the Dot-Com Crash*. South-Western Educational Publishing.
2. Adjei, M. T., C. H. Noble and S. M. Noble. 2012. Enhancing relationships with customers through online brand communities. *MIT Sloan Management Review* (Summer): 22-24.
3. Afterman, A. B. 2015. The issue of cyber risk disclosures. *The CPA Journal* (November): 52-64.
4. Aral, S. 2014. The problem with online ratings. *MIT Sloan Management Review* (Winter): 47-52.
5. Arnold, V. 2006. Behavioral research opportunities: Understanding the impact of enterprise systems. *International Journal of Accounting Information Systems* 7(1): 7-17.
6. Bagby, J. W. 2003. *Cyberlaw Handbook for E-Commerce (Cyperlaw Handbook for E Commerce)*. South-Western Educational Publishing.
7. Bapna, R., P. Goes and A. Gupta. 2005. Pricing and allocation for quality-differentiated online services. *Management Science* (July): 1141-1150. (JSTOR link).
8. Bell, D. R., C. Jeonghye and L. Lodish. 2012. What matters most in internet retailing. *MIT Sloan Management Review* (Fall): 27-33.
9. Bernoff, J. and C. Li. 2008. Harnessing the power of the oh-so-social web. *MIT Sloan Management Review* (Spring): 36-42.
10. Boritz, J. E. and W. G. No. 2011. E-commerce and privacy: Exploring what we know and opportunities for future discovery. *Journal of Information Systems* (Fall): 11-45.
11. Cheung, C. M. K., G. W. W. Chan and M. Limayem. 2005. A critical review of online consumer behavior. *Journal of Electronic Commerce in Organizations* 3(4): 1-19.
12. Choi, J., D. R. Bell and L. M. Lodish. 2012. Traditional and IS-enabled customer acquisition on the internet. *Management Science* (April): 754-769.
13. Chuang, H. H., G. Lu, D. X. Peng and G. R. Heim. 2014. Impact of value-added service features in e-retailing processes: An econometric analysis of web site functions. *Decision Sciences* 45(6): 1159-1186.
14. Clyman, J. 2002. Content management: From chaos to control. *PC Magazine* (September 17): 125-133.
15. Collier, J. E. and C. C. Bienstock. 2006. How do customers judge quality in an e-tailer? *MIT Sloan Management Review* (Fall): 35-40.
16. Gordon, L. A. and M. P. Loeb. 2001. Distinguishing between direct and indirect costs is crucial for internet companies. *Management Accounting Quarterly* (Summer): 12-17. (Summary).

17. Gordon, S. and P. Mulligan. 2002. Delivering personal financial services electronically. *Strategic Finance* (June): 44-49.
18. Gosline, R. R., J. Lee and G. Urban. 2017. The power of consumer stories in digital marketing: New research finds that sharing consumers' positive stories about a brand can be a highly effective online marketing strategy. *MIT Sloan Management Review* (Summer): 10-13.
19. http://www.bestpricecomputers.co.uk/glossary/transaction-processing-systems.htm
20. https://aip.scitation.org/doi/pdf/10.1063/1.4992954
21. https://ecommerce-platforms.com/articles/enterprise-resource-planning-useful-ecommerce
22. https://hal.archives-ouvertes.fr/hal-01194840/document
23. https://searchcio.techtarget.com/definition/e-commerce
24. https://www.doofinder.com/en/blog/what-is-e-commerce
25. https://www.forbes.com/sites/theyec/2018/05/11/choosing-the-enterprise-e-commerce-system-thats-best-for-you/#68ef1f646bb6
26. https://www.futurismtechnologies.com/blog/7-benefits-integrating-ecommerce-erp/
27. https://www.spec-india.com/blog/takes-two-tango-e-commerce-enterprise-resource-planning/
28. https://www.techopedia.com/definition/707/transaction-process-system-tps
29. https://zdoc.site/e-commerce-and-enterprise-system.html

CHAPTER 4

DATABASE SYSTEM AND BIG DATA

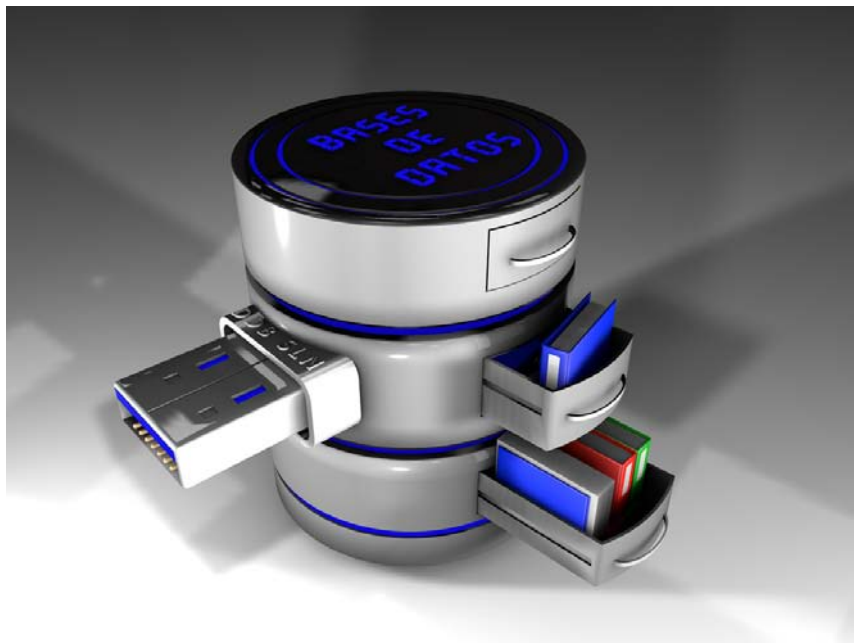


INTRODUCTION

A database is simply an organized collection of related data, typically stored on disk, and accessible by possibly many concurrent users. Databases are generally separated into application areas. For example, one database may contain Human Resource (employee and payroll) data; another may contain sales data; another may contain accounting data; and so on. Databases are managed by a DBMS.

A database management system stores data in such a way that it becomes easier to retrieve, manipulate, and produce information.

For organizations of all sizes, data management has shifted from an important competency to a critical differentiator that can determine market winners and has-beens. Fortune 1000 companies and government bodies are starting to benefit from the innovations of the web pioneers. These organizations are defining new initiatives and reevaluating existing strategies to examine how they can transform their businesses using Big Data. In the process, they are learning that Big Data is not a single technology, technique or initiative. Rather, it is a trend across many areas of business and technology.



Source: http://www.sabersmartblog.com/uploads/9/7/5/8/97580564/big-data-2103091-1920_orig.png

Big Data refers to technologies and initiatives that involve data that is too diverse, fast-changing or massive for conventional technologies, skills and infra- structure to address efficiently. Said differently, the volume, velocity or variety of data is too great.

But today, new technologies make it possible to realize value from Big Data. For example, retailers can track user web clicks to identify behavioral trends that improve campaigns, pricing and stockage. Utilities can capture household energy usage levels to predict outages and to incent more efficient energy consumption. Governments and even Google can detect and track the emergence of disease outbreaks via social media signals. Oil and gas companies can take the output of sensors in their drilling equipment to make more efficient and safer drilling decisions.

'Big Data' describes data sets so large and complex they are impractical to manage with traditional software tools.

DATA FUNDAMENTALS

In general, data is any set of characters that has been gathered and translated for some purpose, usually analysis. It can be any character, including text and numbers, pictures, sound, or video. If data is not put into context, it doesn't do anything to a human or computer.



Source: http://news.statii.co.uk/wp-content/uploads/2018/02/Big-data-analytics-solutions.jpg

Within a computer's storage, data is a collection of numbers represented as bytes that are in turn composed of bits (binary digits) that can have the value one or zero. Data is processed by the CPU, which uses logical operations to produce new data (output) from source data (input).

Data Defined

Data are basic values or facts. Note that the term 'data' is considered plural in the scientific community, as in 'the data are collected', not 'the data is collected'; however, not everyone follows this, so sometimes you'll see data used as singular.

Every task a computer carries out works with data in some way. Without data, a computer would be pretty useless. It is, therefore, important to understand how to represent and organize data.

Analog vs. Digital Data

There are two general ways to represent data: analog and digital. Analog data are continuous - it is 'analogous' to the actual facts it represents. Digital data are discrete and broken up into a limited number of elements. Nature is analog, while computers are digital.

Many aspects of our natural world are continuous in nature. For example, think of the spectrum of colors. This is a continuous rainbow of an infinite number of shades. Computer systems, on the other hand, are not continuous but finite. All data is stored in binary digits, and there is a limit to how much data we can represent. For example, a color image on a computer has a limited number of colors - the number might be very large, but it is still finite.

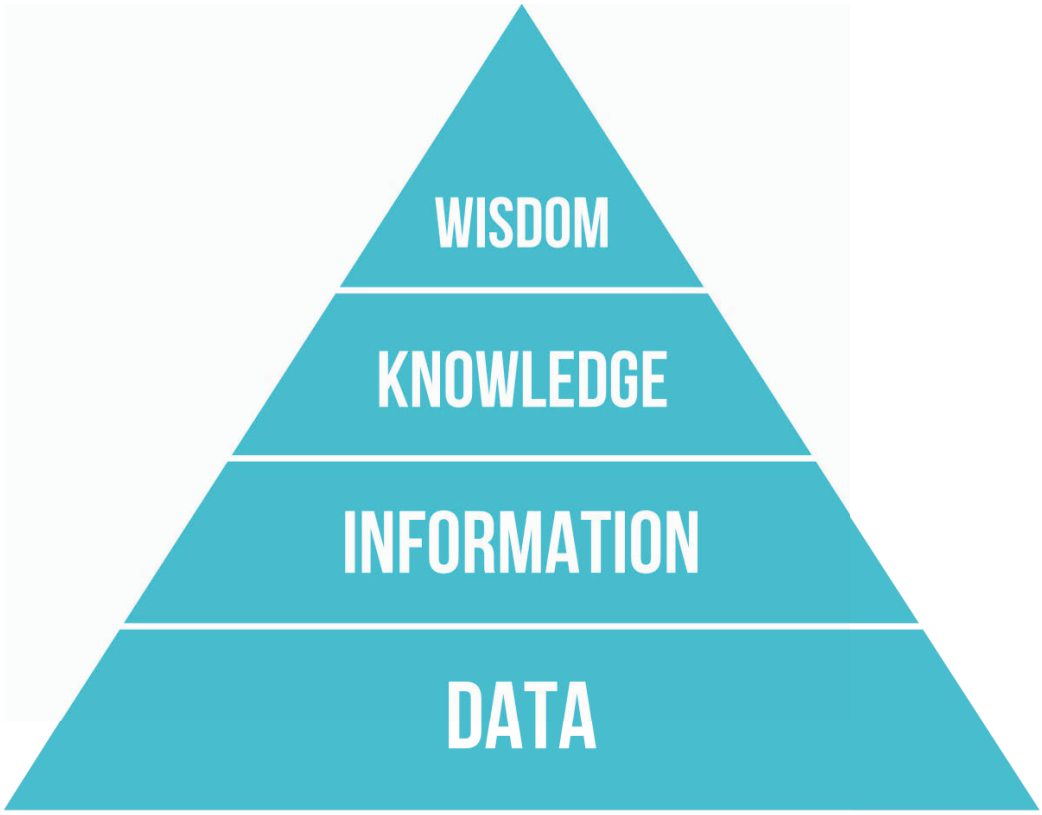


Source: https://media.wired.com/photos/59cc3b6126af8b6db42f23ad/master/w_2400,c_limit/OpenGov-TopArt.jpg

Consider the example of color in a bit more detail. The very first monitor displays were essentially text terminals with only a single color. White or light-green text appeared on a black background. Newer monitors used more colors, enough to represent basic images, but still were quite limited. Modern displays have millions of colors and look much more natural. Still, the number of colors is finite.

Hierarchy of Data

Data Hierarchy refers to the systematic organization of data, often in a hierarchical form. Data organization involves fields, records, files and so on.



Source: https://upload.wikimedia.org/wikipedia/commons/thumb/0/06/DIKW_Pyramid.svg/1200px-DIKW_Pyramid.svg.png

BIT

All data is stored in a computer's memory or storage devices in the form of binary digits or bits. A bit can be either 'ON' of 'OFF' representing 1 or 0.

BYTE

BYTE is a group of 8 bits. One byte can represent one character or, in different contexts, other data such as a sound, part of a picture etc.

FIELD

FIELD is a group of characters. e.g. data held about a person may be split into many fields including ID Number, Surname, Initials, Title, Street, Town, etc.

RECORD

RECORD is a group of fields holding all the information about one person or item.

FILE

FILE a collection of records. A stock file will contain a record for each item of stock, and so on.

DATABASE

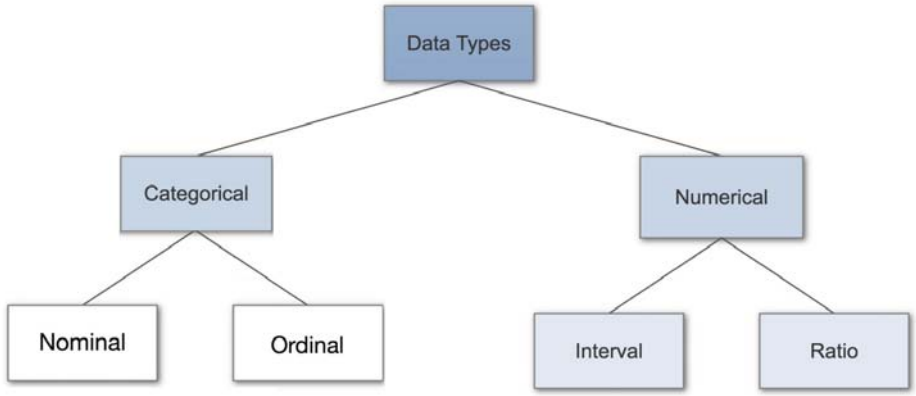
DATABASE may consist of many different files, linked in such a way that information can be retrieved from several files at once.

Types of Data

Growth of the web and smartphones over the past decade led to a surge in digital data creation. Data now includes text, audio and video information, as well as log and web activity records. Much of that is unstructured data.

The term big data has been used to describe data in the petabyte range or larger. A shorthand take depicts big data with 3Vs -- volume, variety and velocity. As web-based e-commerce has spread, big data-driven business models have evolved which treat data as an asset in itself. Such trends have also spawned greater preoccupation with the social uses of data and data privacy.

Data has meaning beyond its use in computing applications oriented toward data processing. For example, in electronic component interconnection and network communication, the term data is often distinguished from “control information,” “control bits,” and similar terms to identify the main content of a transmission unit. Moreover, in science, the term data is used to describe a gathered body of facts. That is also the case in fields such as finance, marketing, demographics and health.



Source: https://cdn-images-1.medium.com/max/1600/1*dvvxoZTdewLFs3RyZTJreA.png

Database Approach to Data Management

Database approaches to data storage support the sharing of data across multiple applications with multiple users. Databases are structured in a way that is meaningful to an organization. For example, if an organization maintains information on suppliers and the geographic areas they service, there would be a link in the database between the suppliers and geographic areas. Databases reduce data redundancy.

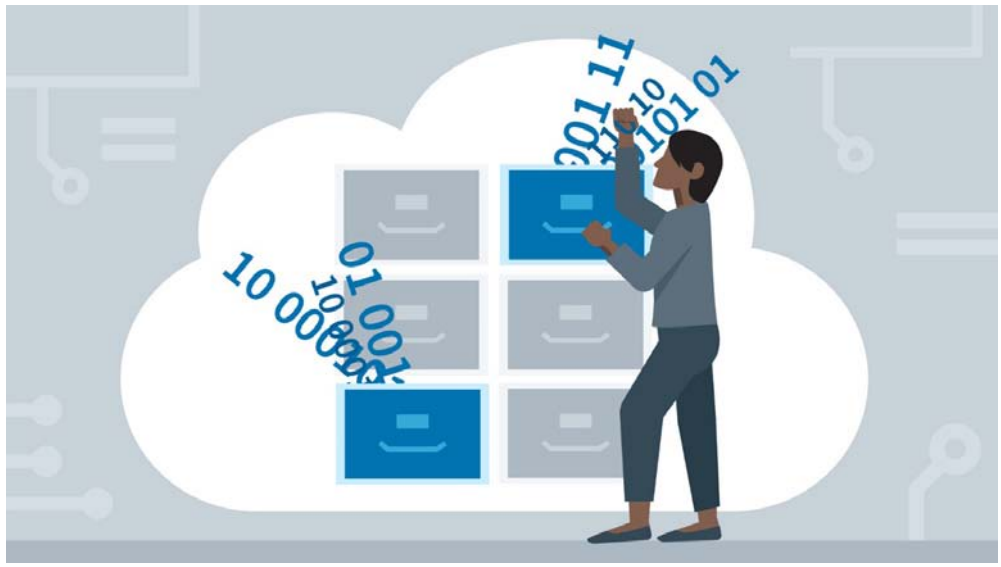


Source: https://www.imperva.com/blog/wp-content/uploads/2018/07/Database-Security.jpg

A Database Management System (DBMS) is the software that handles all database accesses. A DBMS presents a logical view of the data to the users. How this data is stored and retrieved is hidden from the users. A DBMS ensures that the data is consistent across the database and controls who can access what data.

Data Management and Use

With the proliferation of data in organizations, added emphasis has been placed on ensuring data quality by reducing duplication and guaranteeing the most accurate, current records are used. The many steps involved with modern data management include data cleansing, as well as extract, transform and load (ETL) processes for integrating data. Data for processing has come to be complemented by metadata, sometimes referred to as "data about data," that helps administrators and users understand database and other data.



Source: https://cdn.lynda.com/course/616728/616728-636461720916536255-16x9.jpg

Analytics that combine structured and unstructured data have become useful, as organizations seek to capitalize on such information. Systems for such analytics increasingly strive for real-time performance, so they are built to handle incoming data consumed at high ingestion rates, and to process data streams for immediate use in operations.

Over time, the idea of the database for operations and transactions has been extended to the database for reporting and predictive data analytics. A chief example is the data warehouse, which is optimized to process questions about operations for business analysts and business leaders. Increasing emphasis on finding patterns and predicting business outcomes has led to the development of data mining techniques.

DATA MODELING AND DATABASE CHARACTERISTICS

Data modeling is the process of creating a data model for the data to be stored in a Database. This data model is a conceptual representation of

- Data objects
- The associations between different data objects
- The rules.

Data modeling helps in the visual representation of data and enforces business rules, regulatory compliances, and government policies on the data. Data Models ensure consistency in naming conventions, default values, semantics, security while ensuring quality of the data.



Source: https://cdn.lynda.com/course/721905/721905-636619964658452508-16x9.jpg

Data model emphasizes on what data is needed and how it should be organized instead of what operations need to be performed on the data. Data Model is like architect's building plan which helps to build a conceptual model and set the relationship between data items.

Characteristics and Benefits of a Database

There are a number of characteristics that distinguish the database approach from the file-based system or approach. This section describes the benefits (and features) of the database system.



Source: https://blog.crgroup.com/wp-content/uploads/2017/01/Cross-Database-Joins-in-Tableau.jpeg

Self-describing Nature of a Database System

A database system is referred to as *self-describing* because it not only contains the database itself, but also *metadata* which defines and describes the data and relationships between tables in the database. This information is used by the DBMS software or database users if needed. This separation of data and information about the data makes a database system totally different from the traditional file-based system in which the data definition is part of the application programs.

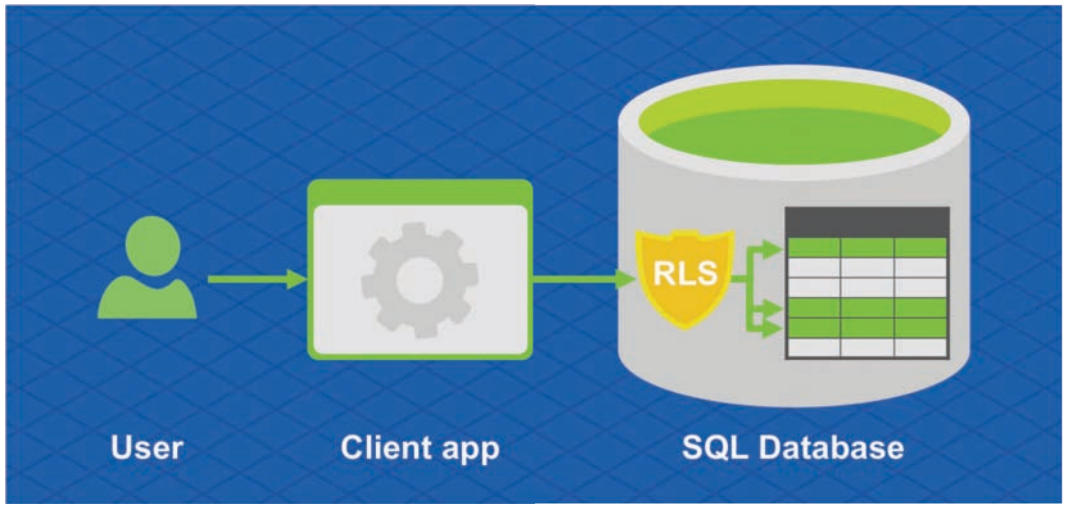
Insulation between Program and Data

In the file-based system, the structure of the data files is defined in the application programs so if a user wants to change the structure of a file, all the programs that access that file might need to be changed as well.

On the other hand, in the database approach, the data structure is stored in the system catalogue and not in the programs. Therefore, one change is all that is needed to change the structure of a file. This insulation between the programs and data is also called program-data independence.

Support for Multiple Views of Data

A database supports multiple views of data. A *view* is a subset of the database, which is defined and dedicated for particular users of the system. Multiple users in the system might have different views of the system. Each view might contain only the data of interest to a user or group of users.



Source: https://cloudblogs.microsoft.com/uploads/prod/2018/03/RLS20Diagram.png

Sharing of Data and Multiuser System

Current database systems are designed for multiple users. That is, they allow many users to access the same database at the same time. This access is achieved through features called *concurrency control strategies*. These strategies ensure that the data accessed are always correct and that data integrity is maintained.

The design of modern multiuser database systems is a great improvement from those in the past which restricted usage to one person at a time.

Control of Data Redundancy

In the database approach, ideally, each data item is stored in only one place in the database. In some cases, data redundancy still exists to improve system performance, but such redundancy is controlled by application programming and kept to minimum by introducing as little redudancy as possible when designing the database.

Data Sharing

The integration of all the data, for an organization, within a database system has many advantages. First, it allows for data sharing among employees and others

who have access to the system. Second, it gives users the ability to generate more information from a given amount of data than would be possible without the integration.



Source: https://policyhubscotland.co.uk/wp-content/uploads/2015/08/Data-Sharing-seminars-image-700.jpg

Enforcement of Integrity Constraints

Database management systems must provide the ability to define and enforce certain constraints to ensure that users enter valid information and maintain data integrity. A *database constraint* is a restriction or rule that dictates what can be entered or edited in a table such as a postal code using a certain format or adding a valid city in the City field.

There are many types of database constraints. *Data type*, for example, determines the sort of data permitted in a field, for example numbers only. *Data uniqueness* such as the primary key ensures that no duplicates are entered. Constraints can be simple (field based) or complex (programming).

Restriction of Unauthorized Access

Not all users of a database system will have the same accessing privileges. For example, one user might have *read-only access* (i.e., the ability to read a file but not make changes), while another might have *read and write privileges*, which is the ability to both read and modify a file. For this reason, a database management system should provide a security subsystem to create and control different types of user accounts and restrict unauthorized access.



Source: https://blog.printfleet.com/hubfs/Licensed%20Images/iStock/Network%20Security.jpg?t=1537982864112

Data Independence

Another advantage of a database management system is how it allows for data independence. In other words, the system data descriptions or data describing data (metadata) are separated from the application programs. This is possible because changes to the data structure are handled by the database management system and are not embedded in the program itself.

Transaction Processing

A database management system must include concurrency control subsystems. This feature ensures that data remains consistent and valid during transaction processing even if several users update the same information.

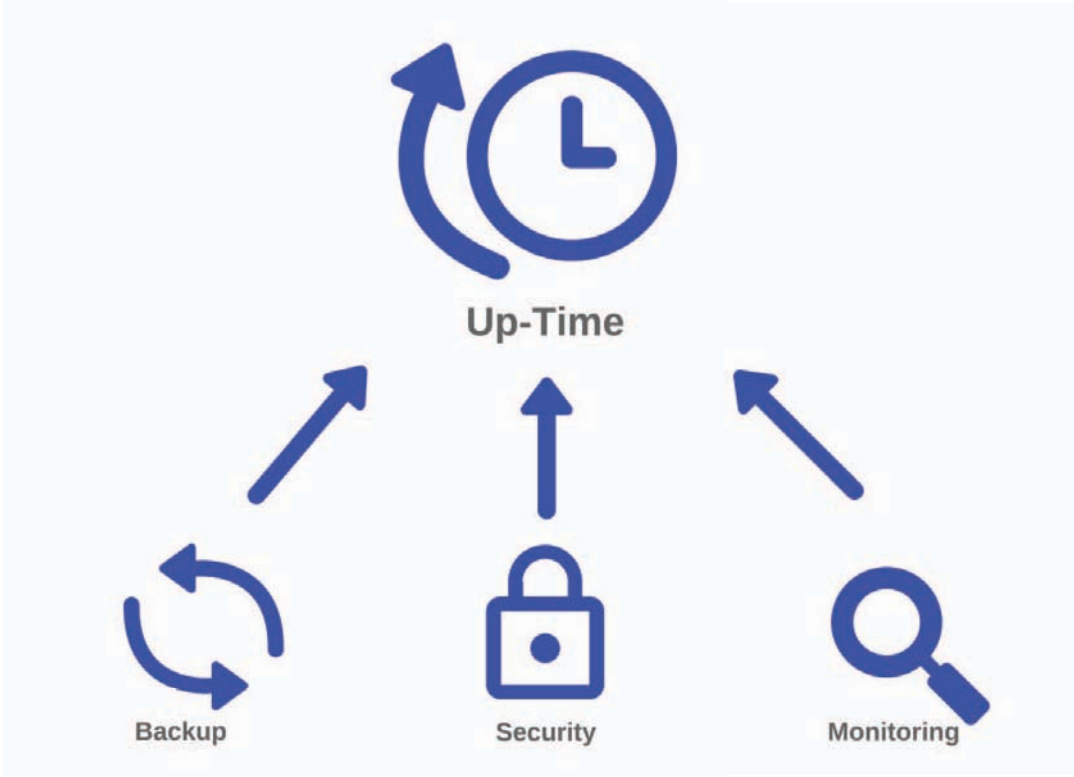
Provision for Multiple Views of Data

By its very nature, a DBMS permits many users to have access to its database either individually or simultaneously. It is not important for users to be aware of how and where the data they access is stored.

Backup and Recovery Facilities

Backup and recovery are methods that allow you to protect your data from loss. The database system provides a separate process, from that of a network backup, for

backing up and recovering data. If a hard drive fails and the database stored on the hard drive is not accessible, the only way to recover the database is from a backup.



Source: https://infotelsystems.com/wp-content/uploads/Up-Time-Graphic.png

If a computer system fails in the middle of a complex update process, the recovery subsystem is responsible for making sure that the database is restored to its original state. These are two more benefits of a database management system.

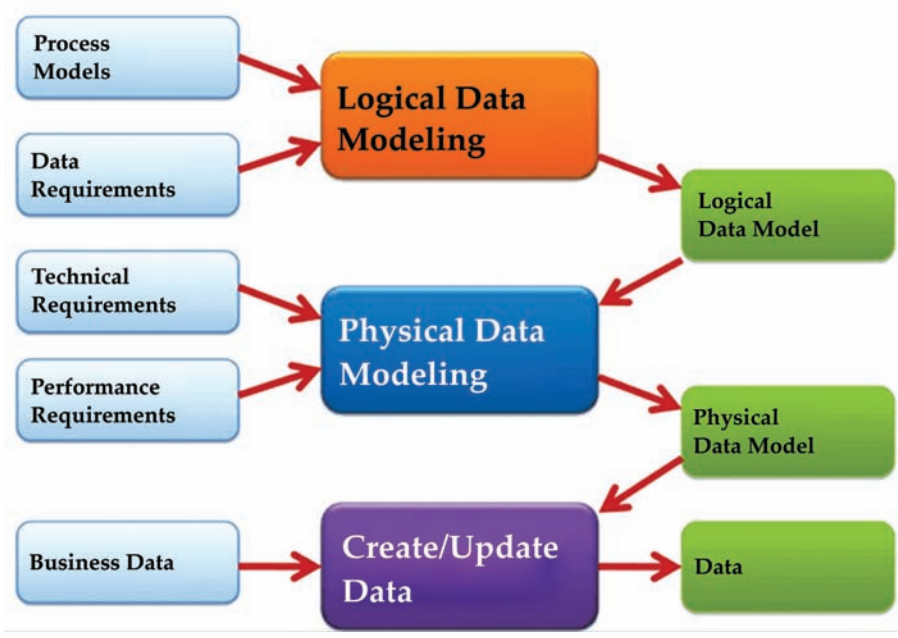
Types of Database Models

There are many kinds of data models. Some of the most common ones include:

- Hierarchical database model
- Relational model
- Network model
- Object-oriented database model
- Entity-relationship model
- Document model
- Entity-attribute-value model
- Star schema

- The object-relational model, which combines the two that make up its name

You may choose to describe a database with any one of these depending on several factors. The biggest factor is whether the database management system you are using supports a particular model. Most database management systems are built with a particular data model in mind and require their users to adopt that model, although some do support multiple models.



Source: https://www.guru99.com/images/1/022218_0657_WhatisDataM1.png

In addition, different models apply to different stages of the database design process. High-level conceptual data models are best for mapping out relationships between data in ways that people perceive that data. Record-based logical models, on the other hand, more closely reflect ways that the data is stored on the server.

Selecting a data model is also a matter of aligning your priorities for the database with the strengths of a particular model, whether those priorities include speed, cost reduction, usability, or something else.

Let's take a closer look at some of the most common database models.

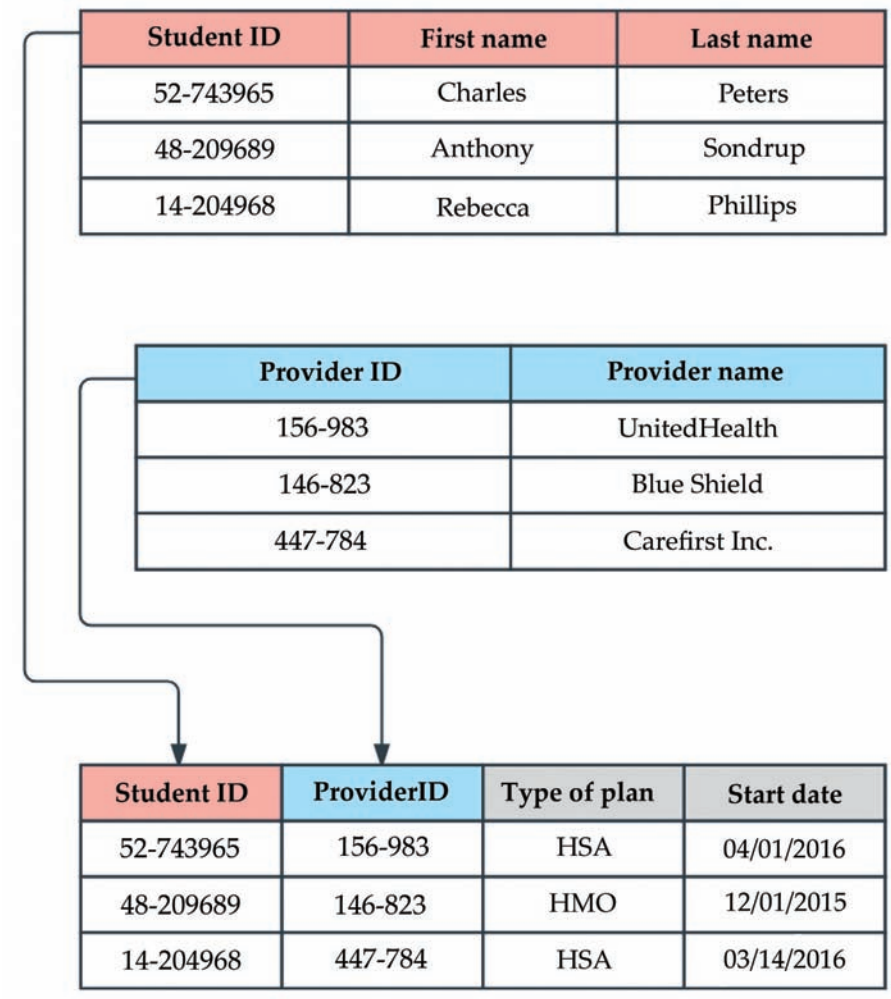
Relational Model

The most common model, the relational model sorts data into tables, also known as relations, each of which consists of columns and rows. Each column lists an attribute of the entity in question, such as price, zip code, or birth date. Together, the attributes in a relation are called a domain. A particular attribute or combination

of attributes is chosen as a primary key that can be referred to in other tables, when it's called a foreign key.

Each row, also called a tuple, includes data about a specific instance of the entity in question, such as a particular employee.

The model also accounts for the types of relationships between those tables, including one-to-one, one-to-many, and many-to-many relationships. Here's an example:



Student ID	First name	Last name
52-743965	Charles	Peters
48-209689	Anthony	Sondrup
14-204968	Rebecca	Phillips

Provider ID	Provider name
156-983	UnitedHealth
146-823	Blue Shield
447-784	Carefirst Inc.

Student ID	ProviderID	Type of plan	Start date
52-743965	156-983	HSA	04/01/2016
48-209689	146-823	HMO	12/01/2015
14-204968	447-784	HSA	03/14/2016

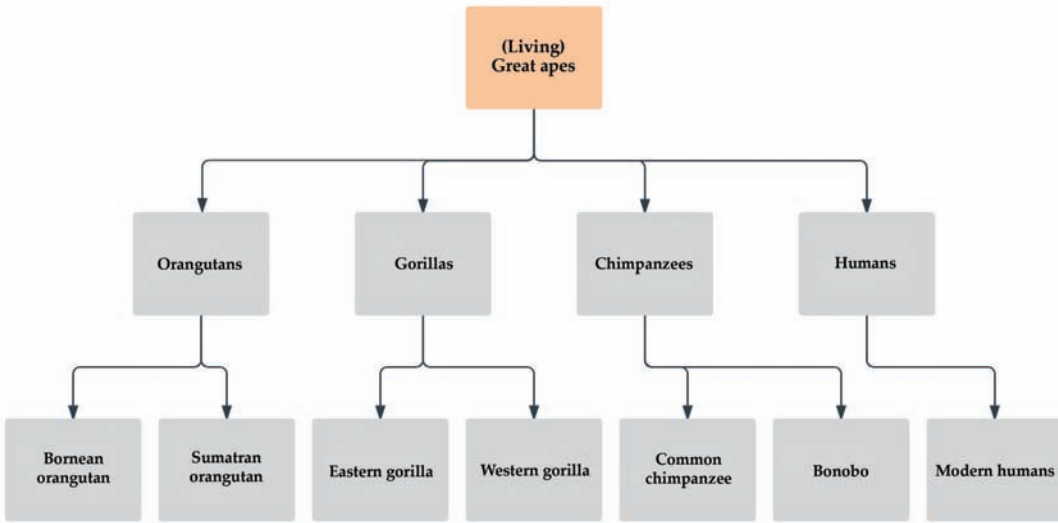
Source: https://d2slcw3kip6qmk.cloudfront.net/marketing/pages/chart/seo/database/discovery/relational-model.svg

Within the database, tables can be normalized, or brought to comply with normalization rules that make the database flexible, adaptable, and scalable. When normalized, each piece of data is atomic, or broken into the smallest useful pieces.

Relational databases are typically written in Structured Query Language (SQL). The model was introduced by E.F. Codd in 1970.

Hierarchical Model

The hierarchical model organizes data into a tree-like structure, where each record has a single parent or root. Sibling records are sorted in a particular order. That order is used as the physical order for storing the database. This model is good for describing many real-world relationships.



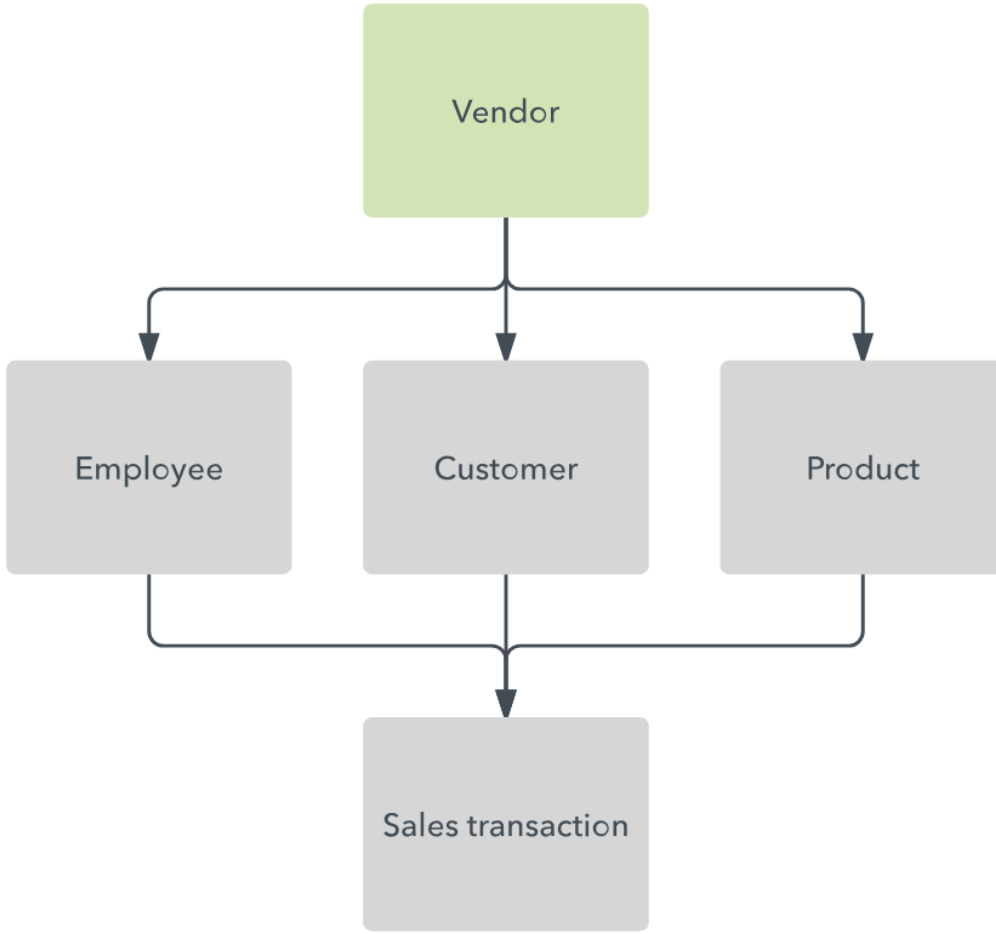
Source: https://d2slcw3kip6qmk.cloudfront.net/marketing/pages/chart/seo/database/discovery/hierarchical-model.svg

This model was primarily used by IBM's Information Management Systems in the 60s and 70s, but they are rarely seen today due to certain operational inefficiencies.

Network Model

The network model builds on the hierarchical model by allowing many-to-many relationships between linked records, implying multiple parent records. Based on mathematical set theory, the model is constructed with sets of related records. Each set consists of one owner or parent record and one or more member or child records. A record can be a member or child in multiple sets, allowing this model to convey complex relationships.

It was most popular in the 70s after it was formally defined by the Conference on Data Systems Languages (CODASYL).



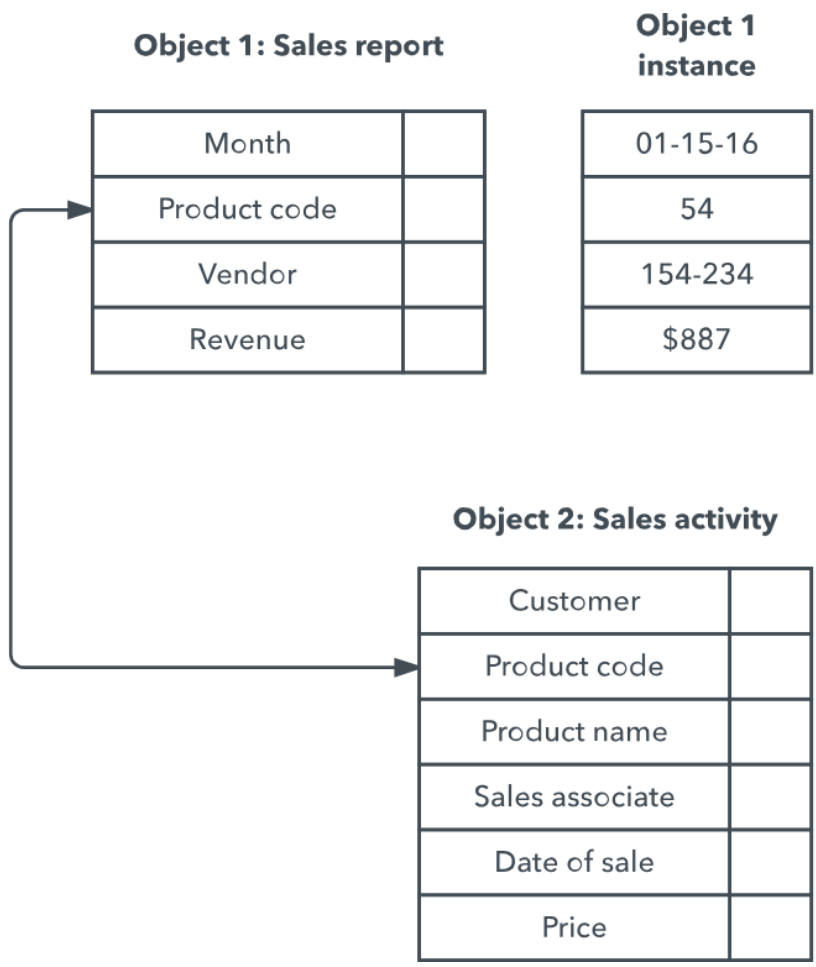
Source: https://d2slcw3kip6qmk.cloudfront.net/marketing/pages/chart/seo/database/discovery/network-model.svg

Object-oriented Database Model

This model defines a database as a collection of objects, or reusable software elements, with associated features and methods. There are several kinds of object-oriented databases:

- A multimedia database incorporates media, such as images, that could not be stored in a relational database.
- A hypertext database allows any object to link to any other object. It's useful for organizing lots of disparate data, but it's not ideal for numerical analysis.

The object-oriented database model is the best known post-relational database model, since it incorporates tables, but isn't limited to tables. Such models are also known as hybrid database models.



Source: https://d2slcw3kip6qmk.cloudfront.net/marketing/pages/chart/seo/database/discovery/object-oriented-model.svg

Object-relational Model

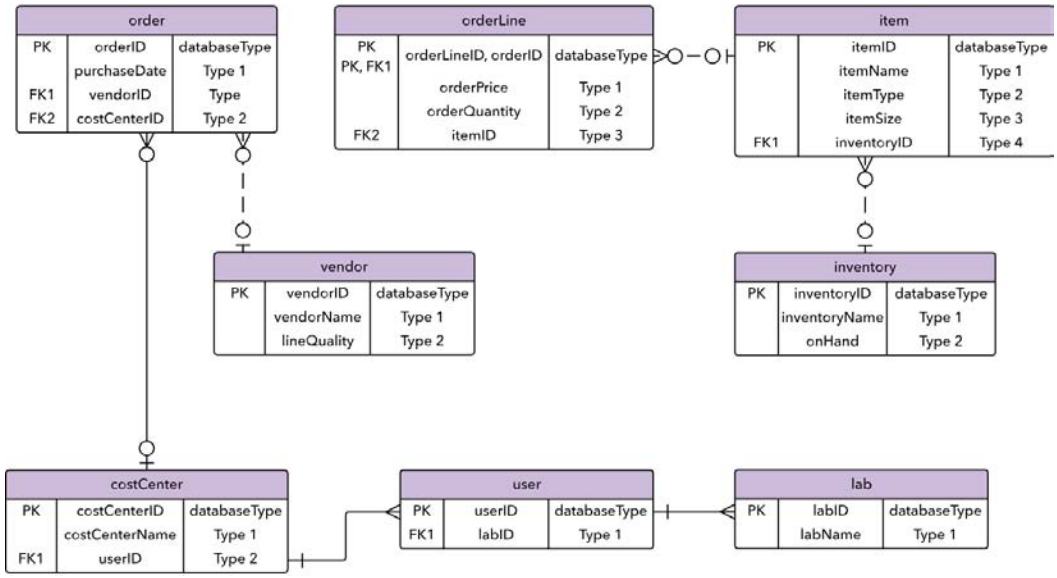
This hybrid database model combines the simplicity of the relational model with some of the advanced functionality of the object-oriented database model. In essence, it allows designers to incorporate objects into the familiar table structure.

Languages and call interfaces include SQL3, vendor languages, ODBC, JDBC, and proprietary call interfaces that are extensions of the languages and interfaces used by the relational model.

Entity-relationship Model

This model captures the relationships between real-world entities much like the network model, but it isn't as directly tied to the physical structure of the database. Instead, it's often used for designing a database conceptually.

Here, the people, places, and things about which data points are stored are referred to as entities, each of which has certain attributes that together make up their domain. The cardinality, or relationships between entities, are mapped as well.



Source: https://d2slcw3kip6qmk.cloudfront.net/marketing/pages/chart/seo/database/discovery/er-diagram.svg

A common form of the ER diagram is the star schema, in which a central fact table connects to multiple dimensional tables.

Other Database Models

A variety of other database models have been or are still used today.

Inverted File Model

A database built with the inverted file structure is designed to facilitate fast full text searches. In this model, data content is indexed as a series of keys in a lookup table, with the values pointing to the location of the associated files. This structure can provide nearly instantaneous reporting in big data and analytics, for instance.

This model has been used by the ADABAS database management system of Software AG since 1970, and it is still supported today.

Flat Model

The flat model is the earliest, simplest data model. It simply lists all the data in a single table, consisting of columns and rows. In order to access or manipulate

the data, the computer has to read the entire flat file into memory, which makes this model inefficient for all but the smallest data sets.

Multidimensional Model

This is a variation of the relational model designed to facilitate improved analytical processing. While the relational model is optimized for online transaction processing (OLTP), this model is designed for online analytical processing (OLAP).

Each cell in a dimensional database contains data about the dimensions tracked by the database. Visually, it's like a collection of cubes, rather than two-dimensional tables.

Semistructured Model

In this model, the structural data usually contained in the database schema is embedded with the data itself. Here the distinction between data and schema is vague at best. This model is useful for describing systems, such as certain Web-based data sources, which we treat as databases but cannot constrain with a schema. It's also useful for describing interactions between databases that don't adhere to the same schema.

Context Model

This model can incorporate elements from other database models as needed. It cobbles together elements from object-oriented, semistructured, and network models.

Associative Model

This model divides all the data points based on whether they describe an entity or an association. In this model, an entity is anything that exists independently, whereas an association is something that only exists in relation to something else.

The associative model structures the data into two sets:

- A set of items, each with a unique identifier, a name, and a type
- A set of links, each with a unique identifier and the unique identifiers of a source, verb, and target. The stored fact has to do with the source, and each of the three identifiers may refer either to a link or an item.

Other, less common database models include:

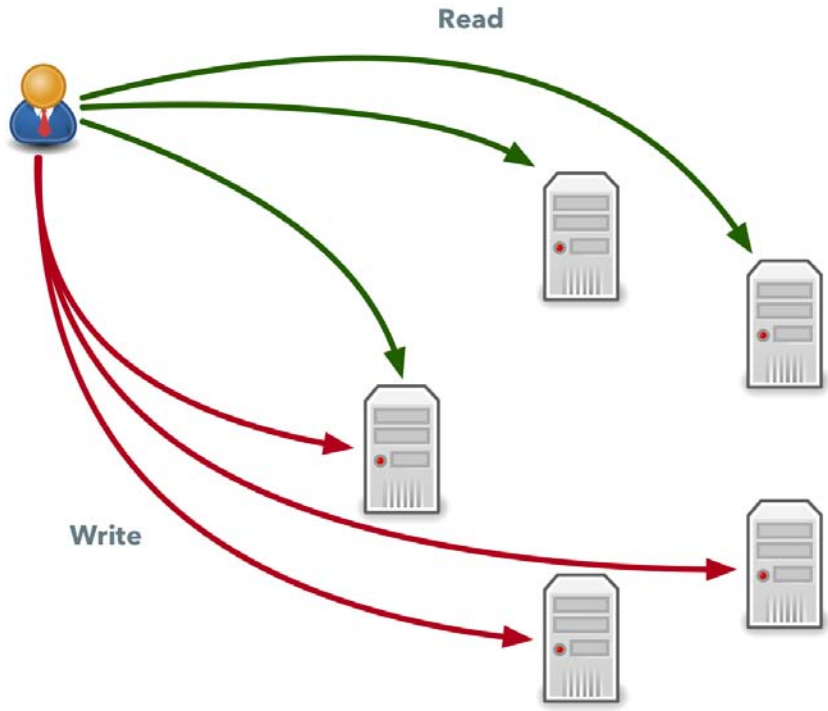
- Semantic model, which includes information about how the stored data relates to the real world
- XML database, which allows data to be specified and even stored in XML format

- Named graph
- Triplestore

NoSQL Database Models

In addition to the object database model, other non-SQL models have emerged in contrast to the relational model:

- The graph database model, which is even more flexible than a network model, allowing any node to connect with any other.
- The multivalue model, which breaks from the relational model by allowing attributes to contain a list of data rather than a single data point.
- The document model, which is designed for storing and managing documents or semi-structured data, rather than atomic data.



Source: https://spzone-simpleprogrammer.netdna-ssl.com/wp-content/uploads/2017/10/W3_R3.png

Databases on the Web

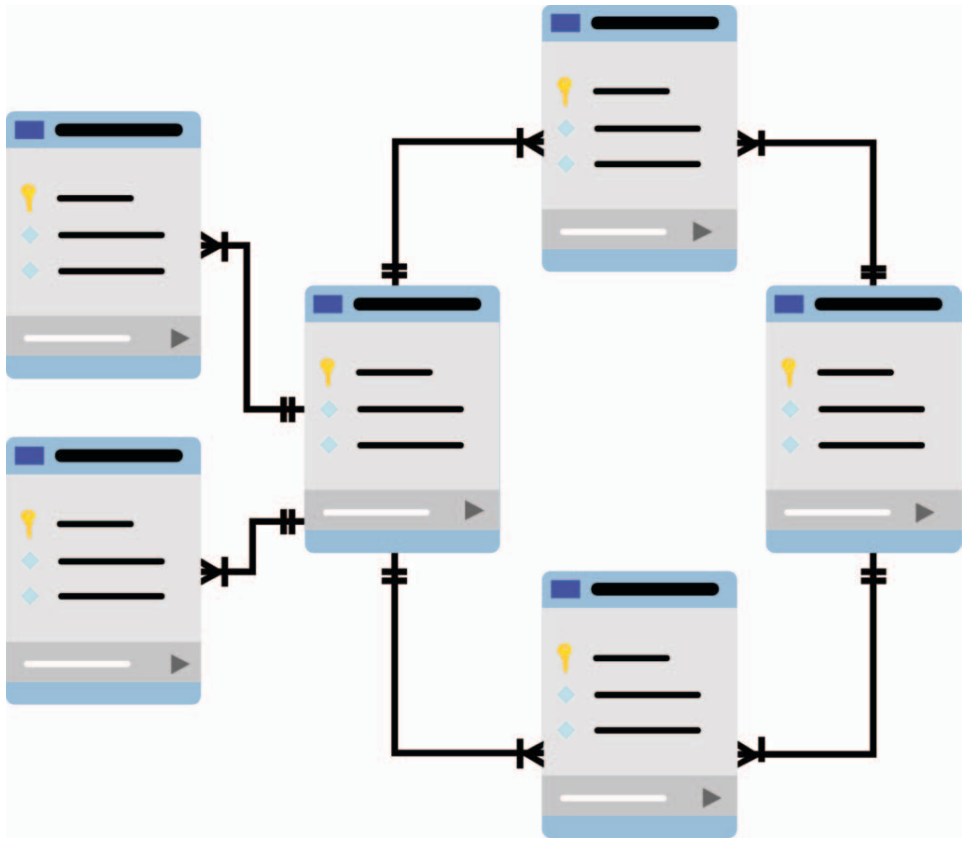
Most websites rely on some kind of database to organize and present data to users. Whenever someone uses the search functions on these sites, their search terms are converted into queries for a database server to process. Typically, middleware connects the web server with the database.

The broad presence of databases allows them to be used in almost any field, from online shopping to micro-targeting a voter segment as part of a political campaign. Various industries have developed their own norms for database design, from air transport to vehicle manufacturing.

RELATIONAL DATABASE MANAGEMENT SYSTEMS (RDBMS)

A relational database management system (RDBMS) is a database engine/system based on the relational model specified by Edgar F. Codd--the father of modern relational database design--in 1970.

Most modern commercial and open-source database applications are relational in nature. The most important relational database features include an ability to use tables for data storage while maintaining and enforcing certain data relationships.



Source: https://png2.kisspng.com/20180330/rwe/kisspng-relational-database-management-system-database-sch-database-5abe2d1b472559.172666801522412827291 4.png

In 1970, Edgar F. Codd, a British computer scientist with IBM, published "A Relational Model of Data for Large Shared Data Banks." At the time, the renowned paper attracted little interest, and few understood how Codd's groundbreaking work would define the basic rules for relational data storage, which can be simplified as:

- Data must be stored and presented as relations, i.e., tables that have relationships with each other, e.g., primary/foreign keys.
- To manipulate the data stored in tables, a system should provide relational operators - code that enables the relationship to be tested between two entities. A good example is the WHERE clause of a SELECT statement, i.e., the SQL statement SELECT * FROM CUSTOMER_MASTER WHERE CUSTOMER_SURNAME = 'Smith' will query the CUSTOMER_MASTER table and return all customers with a surname of Smith.

Codd later published another paper that outlined the 12 rules that all databases must follow to qualify as relational. Many modern database systems do not follow all 12 rules, but these systems are considered relational because they conform to at least two of the 12 rules.

Most modern commercial and open-source database systems are relational in nature and include well-known applications, e.g., Oracle DB (Oracle Corporation); SQL Server (Microsoft) and MySQL and Postgres (open source).

Functions of Relational Database Management Systems

Elements of the relational database management system that overarch the basic relational database are so intrinsic to operations that it is hard to dissociate the two in practice.

The most basic RDBMS functions are related to create, read, update and delete operations, collectively known as CRUD. They form the foundation of a well-organized system that promotes consistent treatment of data.

The RDBMS typically provides data dictionaries and metadata collections useful in data handling. These programmatically support well-defined data structures and relationships. Data storage management is a common capability of the RDBMS, and this has come to be defined by data objects that range from binary large object (blob) strings to stored procedures. Data objects like this extend the scope of basic relational database operations and can be handled in a variety of ways in different RDBMSes.

The most common means of data access for the RDBMS is via SQL. Its main language components comprise data manipulation language (DML) and data definition language (DDL) statements. Extensions are available for development efforts that pair SQL use with common programming languages, such as COBOL (Common Business-Oriented Language), Java and .NET.



Source: https://articles.informer.com/articles_uploads/1/1172/RDBMS_MIDDLE.jpg

RDBMSes use complex algorithms that support multiple concurrent user access to the database, while maintaining data integrity. Security management, which enforces policy-based access, is yet another overlay service that the RDBMS provides for the basic database as it is used in enterprise settings.



Source: http://www.haktechnology.com/pg_img/slider_img3.jpg

RDBMSes support the work of database administrators (DBAs) who must manage and monitor database activity. Utilities help automate data loading and database backup. RDBMSes manage log files that track system performance based on selected operational parameters. This enables measurement of database usage, capacity and performance, particularly query performance. RDBMSes provide graphical interfaces that help DBAs visualize database activity.

While not limited solely to the RDBMS, ACID compliance is an attribute of relational technology that has proved important in enterprise computing. Standing for *atomicity*, *consistency*, *isolation* and *durability*, these capabilities have particularly suited RDBMSes for handling business transactions.

Relational database management systems are central to key applications, such as banking ledgers, travel reservation systems and online retailing. As RDBMSes have matured, they have achieved increasingly higher levels of query optimization, and they have become key parts of reporting, analytics and data warehousing applications for businesses as well. RDBMSes are intrinsic to operations of a variety of enterprise applications and are at the center of most master data management (MDM) systems.

RDBMS Product History

Many vying relational database management systems arose as news spread in the early 1970s of the relational data model. This and related methods were originally theorized by IBM researcher E.F. Codd, who proposed a database schema, or logical organization, that was not directly associated with physical organization, as was common at the time.

Codd's work was based around a concept of data normalization, which saved file space on storage disk drives at a time when such machinery could be prohibitively expensive for businesses.

File systems and database management systems preceded what could be called the RDBMS era. Such systems ran primarily on mainframe computers. While RDBMSes also ran on mainframes -- IBM's DB2 being a pointed example -- much of their ascendance in the enterprise was in UNIX midrange computer deployments. The RDBMS was a linchpin in the distributed architecture of client/server computing, which connected pools of stand-alone personal computers to file and database servers.

Numerous RDBMSes arose along with the use of client/server computing. Among the competitors were Oracle, Ingres, Informix, Sybase, Unify, Progress and others. Over time, three RDBMSes came to dominate in commercial implementations. Oracle, IBM's DB2 and Microsoft's SQL Server, which was based on a design originally licensed from Sybase, found considerable favor throughout the client/server computing era, despite repeated challenges by competing technologies.



Source: https://cdn.lynda.com/course/412845/412845-636216276027450220-16x9.jpg

As the 20th century drew to an end, lower-cost, open source versions of RDBMSes began to find use, particularly in web applications. Such systems included MySQL and PostgreSQL.

Eventually, as distributed computing took greater hold and as cloud architecture became more prominently employed, RDBMSes met competition in the form of NoSQL systems. Such systems were often especially designed for massive distribution and high scalability in the cloud, sometimes forgoing SQL-style full consistency for so-called *eventual consistency* of data. But, even in the most diverse and complex cloud systems, the need for some guaranteed data consistency requires RDBMSes to appear in some way, shape or form. Moreover, versions of RDBMSes have been significantly restructured for cloud parallelization and replication.

Popular Relational Database Management Systems

SQL syntax may differ slightly depending on which RDBMS you are using. Here is a brief description of popular RDBMSs:

SQLite

SQLite is a popular open source SQL database. It can store an entire database in a single file. One of the most significant advantages this provides is that all of the data can be stored locally without having to connect your database to a server.

SQLite is a popular choice for databases in cellphones, PDAs, MP3 players, set-top boxes, and other electronic gadgets. The SQL courses on Codecademy use SQLite.



Source: https://www.mathworks.com/matlabcentral/mlc-downloads/downloads/submissions/58433/versions/4/screenshot.jpg

MySQL

MySQL is the most popular open source SQL database. It is typically used for web application development, and often accessed using PHP.

The main advantages of MySQL are that it is easy to use, inexpensive, reliable (has been around since 1995) and has a large community of developers who can help answer questions.

Some of the disadvantages are that it has been known to suffer from poor performance when scaling, open source development has lagged since Oracle has taken control of MySQL, and it does not include some advanced features that developers may be used to.



Source: http://sqlbackupandftp.com/blog/wp-content/uploads/2015/01/mysql-logo_2800x2800_pixels1.png

PostgreSQL

PostgreSQL is an open-source SQL database that is not controlled by any corporation. It is typically used for web application development.

PostgreSQL shares many of the same advantages of MySQL. It is easy to use, inexpensive, reliable and has a large community of developers. It also provides some additional features such as foreign key support without requiring complex configuration.

The main disadvantage of PostgreSQL is that it is slower in performance than other databases such as MySQL. It is also less popular than MySQL which makes it harder to come by hosts or service providers that offer managed PostgreSQL instances.



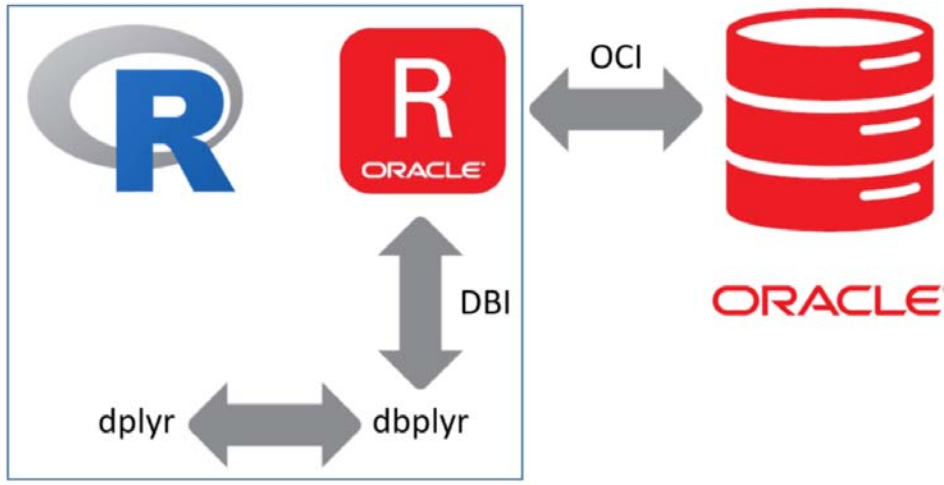
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Oracle DB

Oracle Corporation owns Oracle Database, and the code is not open sourced.

Oracle DB is for large applications, particularly in the banking industry. Most of the world's top banks run Oracle applications because Oracle offers a powerful combination of technology and comprehensive, pre-integrated business applications, including essential functionality built specifically for banks.

The main disadvantage of using Oracle is that it is not free to use like its open source competitors and can be quite expensive.



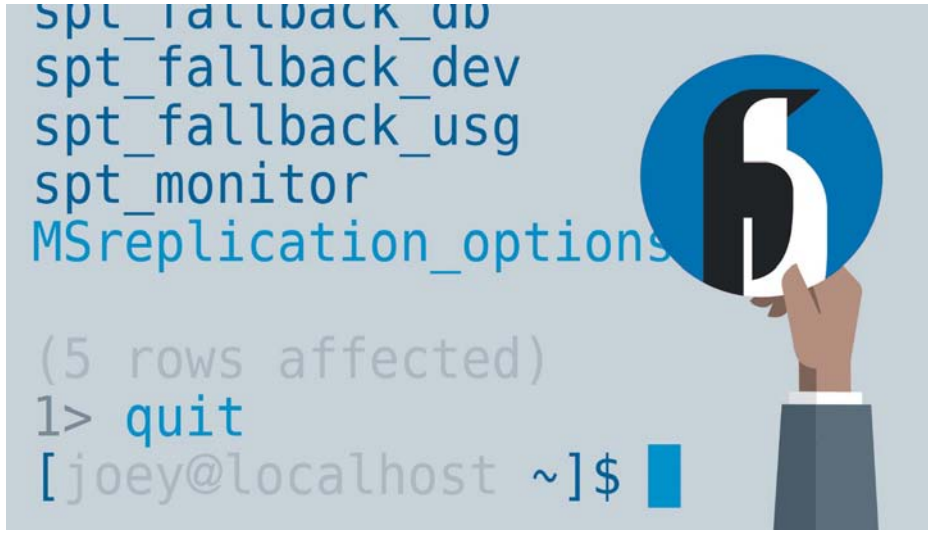
Source: https://i1.wp.com/technology.amis.nl/wp-content/uploads/2017/08/oracloe-and-r-sized.png?fit=1404%2C672&ssl=1

SQL Server

Microsoft owns SQL Server. Like Oracle DB, the code is close sourced.

Large enterprise applications mostly use SQL Server. The key difference between Oracle and SQL Server is that SQL Server only supports the Windows Operating System.

Microsoft offers a free entry-level version called *Express* but can become very expensive as you scale your application.



Source: https://cdn.lynda.com/course/688529/688529-636600772961855452-16x9.jpg

Benefits of Relational Databases

If you want to design a data storage system that makes it easy to manage lots of information, and is scalable and flexible, the relational database is a good bet.

- Manageability: for starters, an RDB is easy to manipulate. Each table of data can be updated without disrupting the others. You can also share certain sets of data with one group, but limit their access to others – such as confidential information about employees.
- Flexibility: if you need to update your data, you only have to do it once – so no more having to change multiple files one at a time. And it's pretty simple to extend your database. If your records are growing, a relational database is easily scalable to grow with your data.
- Avoid Errors: there's no room for mistakes in a relational database because it's easy to check for mistakes against the data in other parts of the records. And since each piece of information is stored at a single point, you don't have the problem of old versions of data clouding the picture.

Challenges of Relational Databases

- Scalability: Because relational databases are built on a single server. This means, in order to scale, you'll need to purchase more expensive hardware with more power, storage, and memory.
- Performance: Rapid growth in volume, velocity, variety, and complexity of data creates even more complicated relationships. Relational databases tend to have a hard time keeping up, which can slow down performance.
- Relationships: Relational databases don't actually store relationships between elements, which makes understanding connections between your data reliant on other joins.

BIG DATA

Big data is a term defined for data sets that are large or complex that traditional data processing applications are inadequate. Big Data basically consists of analysis zing, capturing the data, data creation, searching, sharing, storage capacity, transfer, visualization, and querying and information privacy.



Source: https://www.hochschule-heidelberg.de/fileadmin/user_upload/Big-Data-Blog-Image.jpg

Definition

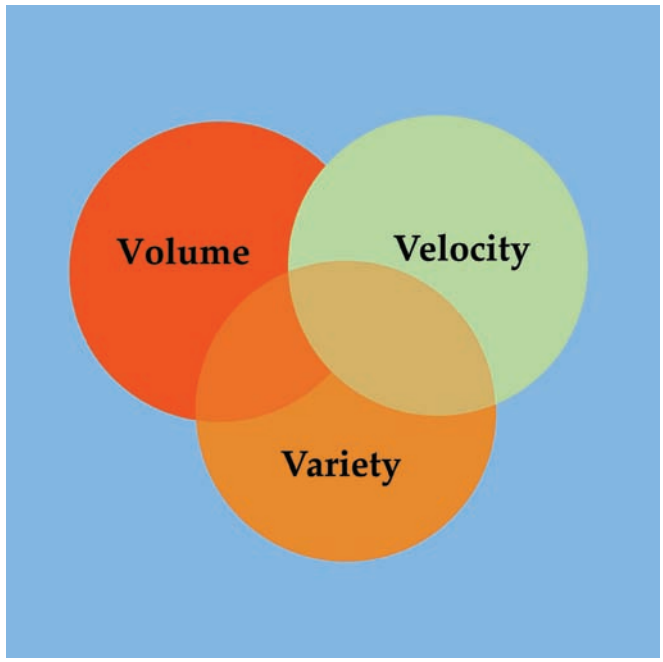
- Big Data is a collection of large datasets that cannot be adequately processed using traditional processing techniques. Big data is not only data it has become a complete subject, which involves various tools, techniques and frameworks.
- Big data term describes the volume amount of data both structured and unstructured manner that adapted in day-to-day business environment. It's important that what organizations utilize with these with the data that matters.
- Big data helps to analyze the in-depth concepts for the better decisions and strategic taken for the development of the organization.

The Evolution of Big Data

While the term "big data" is the new in this era, as it is the act of gathering and storing huge amounts of information for eventual analysis is ages old. The concept came into existence in the early 2000s when Industry analyst Doug Laney the definition of big data as the three categories as follows:

- **Volume:** Organizations collects the data from relative sources, which includes business transactions, social media and information from sensor or machine-to-machine data. Before, storage was a big issue but now the advancement of new technologies (such as Hadoop) has reduced the burden.

- **Velocity**: Data streams unparalleled speed of velocity and have improved in timely manner. RFID tags, sensors and smart metering are driving the need to deal with torrents of data in real time operations.



Source: https://cdn.intellipaat.com/mediaFiles/2015/07/1.jpg

- **Variety**: Data comes in all varieties in form of structured, numeric data in traditional databases to unstructured text documents, email, video, audio, stock ticker data and financial transactions.

In SAS, we consider two additional dimensions with respect to big data:

The Categories Which Come Under Big Data

Big data works on the data produced by various devices and their applications. Below are some of the fields that are involved in the umbrella of Big Data.

- Black Box Data: It is an incorporated by flight crafts, which stores a large sum of information, which includes the conversation between crew members and any other communications (alert messages or any order passed)by the technical grounds duty staff.
- Social Media Data: Social networking sites such as Face book and Twitter contains the information and the views posted by millions of people across the globe.



Source: http://eduardomagrani.com/wp-content/uploads/2018/04/conheca-os-4-maiores-desafios-do-uso-do-big-data-analytics-em-uma-empresa.jpeg

- Stock Exchange Data: It holds information (complete details of in and out of business transactions) about the 'buyer' and 'seller' decisions in terms of share between different companies made by the customers.
- Power Grid Data: The power grid data mainly holds the information consumed by a particular node in terms of base station.
- Transport Data: It includes the data's from various transport sectors such as model, capacity, distance and availability of a vehicle.
- Search Engine Data: Search engines retrieve a large amount of data from different sources of database.

Big Data for the Enterprise

With Big Data databases, enterprises can save money, grow revenue, and achieve many other business objectives, in any vertical.

- Build new applications: Big data might allow a company to collect billions of real-time data points on its products, resources, or customers – and then repackage that data instantaneously to optimize customer experience or resource utilization. For example, a major US city is using MongoDB to cut crime and improve municipal services by collecting and analyzing geospatial data in real-time from over 30 different departments.
- Improve the effectiveness and lower the cost of existing applications: Big data technologies can replace highly-customized, expensive legacy systems with a standard solution that runs on commodity hardware. And because

many big data technologies are open source, they can be implemented far more cheaply than proprietary technologies. For example, by migrating its reference data management application to MongoDB, a Tier 1 bank dramatically reduced the license and hardware costs associated with the proprietary relational database it previously ran, while also bringing its application into better compliance with regulatory requirements.



Source: https://rickscloud.com/wp-content/uploads/2017/08/Moving-big-data-to-the-cloud.jpg

- Realize new sources of competitive advantage: Big data can help businesses act more nimbly, allowing them to adapt to changes faster than their competitors. For example, MongoDB allowed one of the largest Human Capital Management (HCM) solution providers to rapidly build mobile applications that integrated data from a wide variety of disparate sources.
- Increase customer loyalty: Increasing the amount of data shared within the organization – and the speed with which it is updated – allows businesses and other organizations to more rapidly and accurately respond to customer demand. For example, a top 5 global insurance provider, MetLife, used MongoDB to quickly consolidate customer information from over 70 different sources and provide it in a single, rapidly-updated view.

The Importance of Big Data

The importance of big data is how you utilize the data which you own. Data can be fetched from any source and analyze it to solve that enable us in terms of

- Cost reductions
- Time reductions,
- New product development and optimized offerings, and
- Smart decision making.

Combination of big data with high-powered analytics, you can have great impact on your business strategy such as:

- Finding the root cause of failures, issues and defects in real time operations.
- Generating coupons at the point of sale seeing the customer's habit of buying goods.
- Recalculating entire risk portfolios in just minutes.
- Detecting fraudulent behavior before it affects and risks your organization.



Source: https://cdn-images-1.medium.com/max/1200/0*g6iz_58h1sB6wMqq.jpg

Banking

Large amounts of data streaming in from countless sources, banks have to find out unique and innovative ways to manage big data. It's important to analyze customers needs and provide them service as per their requirements, and minimize risk and fraud while maintaining regulatory compliance. Big data have to deal with financial institutions to do one step from the advanced analytics.

Government

When government agencies are harnessing and applying analytics to their big data, they have improvised a lot in terms of managing utilities, running agencies, dealing with traffic congestion or preventing the affects crime. But apart from its advantages in Big Data, governments also address issues of transparency and privacy.

Education

Educator regarding Big Data provides a significant impact on school systems, students and curriculums. By analyzing big data, they can identify at-risk students, ensuring student's progress, and can implement an improvised system for evaluation and support of teachers and principals in their teachings.

Health Care

When it comes to health care in terms of Patient records. Treatment plans. Prescription information etc., everything needs to be done quickly and accurately and some aspects enough transparency to satisfy stringent industry regulations. Effective management results in good health care to uncover hidden insights that improve patient care.

Manufacturing

Manufacturers can improve their quality and output while minimizing waste where processes are known as the main key factors in today's highly competitive market. Several manufacturers are working on analytics where they can solve problems faster and make more agile business decisions.

Retail

Customer relationship maintains is the biggest challenge in the retail industry and the best way to manage will be to manage big data. Retailers must have unique marketing ideas to sell their products to customers, the most effective way to handle transactions, and applying improvised tactics of using innovative ideas using BigData to improve their business.

UTILIZING BIG DATA IN BUSINESSES

Big Data is being converted into nuggets of information and then it becomes very straightforward for most business enterprises as we now know what their customers want, what are the products are rapidly fast moving, what are the expectations of the end users from the customer service, speed up the time sequence for marketing, methods on cost reduction, and methods to build economies of scale in a highly

efficient manner. Hence Big Data leads to big time benefits for organizations and hence there exists a demand about it in the IT world.

Big Data Technologies:

- Accurate analysis carried out based on big data which helps to increase and optimizes operational efficiencies, enable cost reductions, and reduce risks for the business operations.
- In order to capitalize on big data one should require infrastructure that manages and processes huge volumes of structured and unstructured data in real-time and can ensure data privacy and security.
- Many technologies are available in the market from different vendors which includes Amazon, IBM, Microsoft, etc., to approach big data. To pick up a particular technology one must examine its classes, which areas are as follows



Source: http://www.theimpulsedigital.com/blog/wp-content/uploads/2016/09/importance-of-big-data.jpg

Operational Big Data:

- It includes the applications such as MongoDB which provides operational capabilities for interactive and real time workloads where data is generally captured and stored.
- NoSQL Big Data systems are designed in such a way it capitalizes on new cloud computing architectures, to permit access on massive computations to be run reasonably and efficiently. Hence this builds operation on big data workloads much easier to manage, cheaper and faster to implement.

Analytical Big Data:

- It owns the systems like Massively Parallel Processing database systems and MapReduce which provides the analytical capabilities for re collective and complex analysis.
- MapReduce provides a new method for analyzing the data that flaunts its capabilities provided by SQL, and based on a system called MapReduce that can be scaled up from single servers to thousands of high and low end machines.

Selecting a Big Data Technology: Operational vs. Analytical

The Big Data landscape is dominated by two classes of technology: systems that provide operational capabilities for real-time, interactive workloads where data is primarily captured and stored; and systems that provide analytical capabilities for retrospective, complex analysis that may touch most or all of the data. These classes of technology are complementary and frequently deployed together.



Source: https://www.raconteur.net/wp-content/uploads/2013/04/Watching-big-data-1280x721.jpg

Operational and analytical workloads for Big Data present opposing requirements and systems have evolved to address their particular demands separately and in very different ways. Each has driven the creation of new technology architectures. Operational systems, such as the NoSQL databases, focus on servicing highly concurrent requests while exhibiting low latency for responses operating on highly selective access criteria. Analytical systems, on the other hand, tend to focus on high throughput; queries can be very complex and touch most if not all of the

data in the system at any time. Both systems tend to operate over many servers operating in a cluster, managing tens or hundreds of terabytes of data across billions of records.

Operational Big Data

For operational Big Data workloads, NoSQL Big Data systems such as document databases have emerged to address a broad set of applications, and other architectures, such as key-value stores, column family stores, and graph databases are optimized for more specific applications. NoSQL technologies, which were developed to address the shortcomings of relational databases in the modern computing environment, are faster and scale much more quickly and inexpensively than relational databases.

Critically, NoSQL Big Data systems are designed to take advantage of new cloud computing architectures that have emerged over the past decade to allow massive computations to be run inexpensively and efficiently. This makes operational Big Data workloads much easier to manage, and cheaper and faster to implement.

In addition to user interactions with data, most operational systems need to provide some degree of real-time intelligence about the active data in the system. For example in a multi-user game or financial application, aggregates for user activities or instrument performance are displayed to users to inform their next actions. Some NoSQL systems can provide insights into patterns and trends based on real-time data with minimal coding and without the need for data scientists and additional infrastructure.

Analytical Big Data

Analytical Big Data workloads, on the other hand, tend to be addressed by MPP database systems and MapReduce. These technologies are also a reaction to the limitations of traditional relational databases and their lack of ability to scale beyond the resources of a single server. Furthermore, MapReduce provides a new method of analyzing data that is complementary to the capabilities provided by SQL.

As applications gain traction and their users generate increasing volumes of data, there are a number of retrospective analytical workloads that provide real value to the business. Where these workloads involve algorithms that are more sophisticated than simple aggregation, MapReduce has emerged as the first choice for Big Data analytics. Some NoSQL systems provide native MapReduce functionality that allows for analytics to be performed on operational data in place. Alternately, data can be copied from NoSQL systems into analytical systems such as Hadoopfor MapReduce.

Table 1: Overview of Operational vs. Analytical Systems

	Operational	Analytical
Latency	1 ms - 100 ms	1 min - 100 min
Concurrency	1000 - 100,000	1 - 10
Access Pattern	Writes and Reads	Reads
Queries	Selective	Unselective
Data Scope	Operational	Retrospective
End User	Customer	Data Scientist
Technology	NoSQL	MapReduce, MPP Database

Considerations for Decision Makers

While many Big Data technologies are mature enough to be used for mission-critical, production use cases, it is still nascent in some regards. Accordingly, the way forward is not always clear. As organizations develop Big Data strategies, there are a number of dimensions to consider when selecting technology partners, including:

- Online vs. Offline Big Data
- Software Licensing Models
- Community
- Developer Appeal
- Agility
- General Purpose vs. Niche Solutions



Source: https://pbs.twimg.com/media/DjrzSZPWsAAVMR9.jpg

Big Data can take both online and offline forms. Online Big Data refers to data that is created, ingested, trans- formed, managed and/or analyzed in real-time to support operational applications and their users. Big Data is born online. Latency for these applications must be very low and availability must be high in order to meet SLAs and user expectations for modern application performance. This includes a vast array of applications, from social networking news feeds, to analytics to real-time ad servers to complex CRM applications. Examples of online Big Data databases include MongoDB and other NoSQL databases.

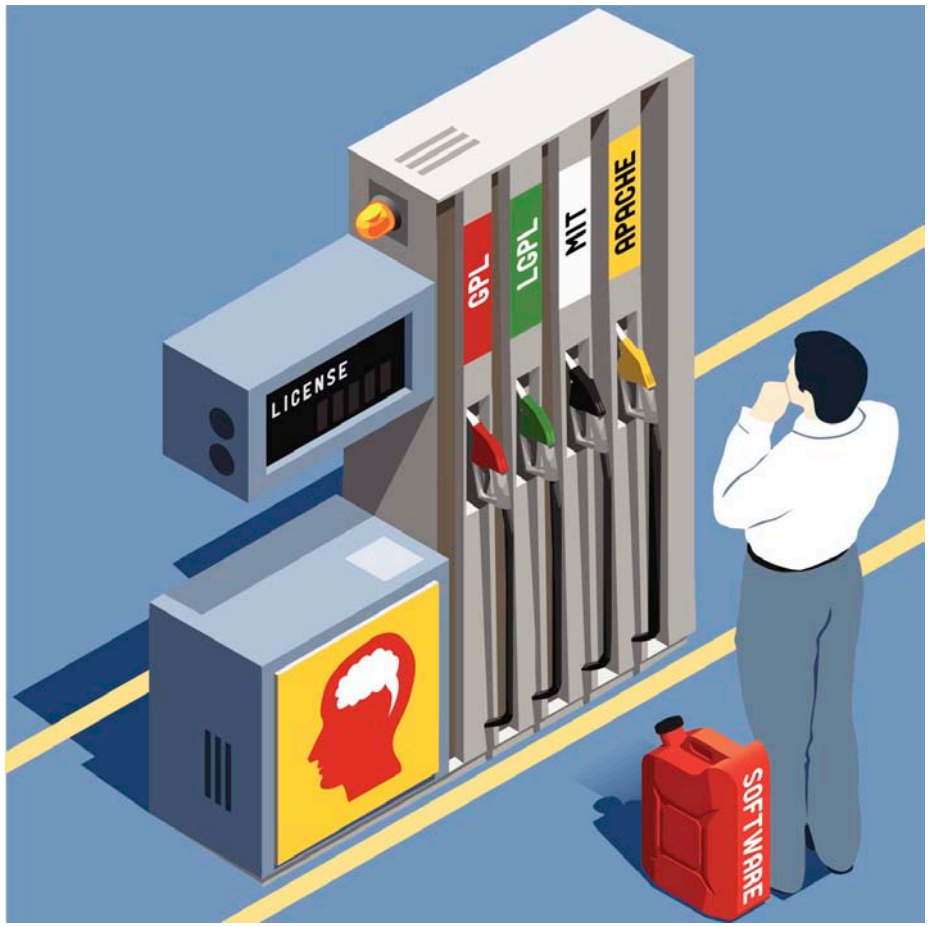
Offline Big Data encompasses applications that ingest, transform, manage and/or analyze Big Data in a batch context. They typically do not create new data. For these applications, response time can be slow (up to hours or days), which is often acceptable for this type of use case. Since they usually produce a static (vs. operational) output, such as a report or dashboard, they can even go offline temporarily without impacting the overall goal or end product. Examples of offline Big Data applications include Hadoop-based workloads; modern data warehouses; extract, transform, load (ETL) applications; and business intelligence tools.

Organizations evaluating which Big Data technologies to adopt should consider how they intend to use their data. For those looking to build applications that support real-time, operational use cases, they will need an operational data store like MongoDB. For those that need a place to conduct long-running analysis offline, perhaps to inform decision-making processes, offline solutions like Hadoop can be an effective tool. Organizations pursuing both use cases can do so in tandem, and they will sometimes find integrations between online and offline Big Data technologies. For instance, MongoDB provides integration with Hadoop.

Software License Model

There are three general types of licenses for Big Data software technologies:

- Proprietary. The software product is owned and controlled by a software company. The source code is not available to licensees. Customers typically license the product through a perpetual license that entitles them to indefinite use, with annual maintenance fees for support and software upgrades. Examples of this model include databases from Oracle, IBM and Terradata.
- Open-Source. The software product and source code are freely available to use. Companies monetize the software product by selling subscriptions and adjacent products with value-added components, such as management tools and support services. Examples of this model include MongoDB (by MongoDB, Inc.) and Hadoop (by Cloudera and others).
- Cloud Service. The service is hosted in a cloud- based environment outside of customers' data centers and delivered over the public Internet. The predominant business model is metered (i.e., pay-per-use) or subscription-based. Examples of this model include Google App Engine and Amazon Elastic MapReduce.



Source: https://i2.wp.com/www.teknoids.com/wp-content/uploads/2016/08/gettyimages-473045750.jpg?fit=1400%2C1398

For many Fortune 1000 companies, regulations and internal policies around data privacy limit their ability to leverage cloud-based solutions. As a result, most Big Data initiatives are driven with technologies deployed on-premise. Most of the Big Data pioneers are web companies that developed powerful software and hardware, which they open-sourced to the larger community. Accordingly, most of the software used for Big Data projects is open-source.

Community

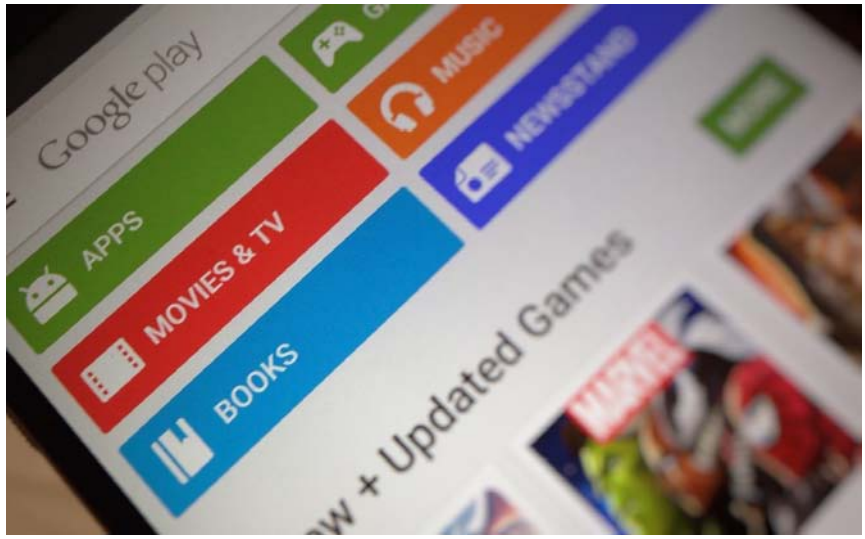
In these early days of Big Data, there is an opportunity to learn from others. Organizations should consider how many other initiatives are being pursued using the same technologies and with similar objectives. To understand a given technology's adoption, organizations should consider the following:

- The number of users
- The prevalence of local, community-organized events

- The health and activity of online forums such as Google Groups and StackOverflow
- The availability of conferences, how frequently they occur and whether they are well-attended

Developer Appeal

The market for Big Data talent is tight. The nation's top engineers and data scientists often flock to companies like Google and Facebook, which are known havens for the brightest minds and places where one will be exposed to leading edge technology. If enterprises want to compete for this talent, they have to offer more than money.



Source: https://i.pinimg.com/originals/b9/ab/8e/b9ab8e92f70835dc449d2fd1b1c9987e.jpg

By offering developers the opportunity to work on tough problems, and by using a technology that has strong developer interest, a vibrant community, and an auspicious long-term future, organizations can attract the brightest minds. They can also increase the pool of candidates by choosing technologies that are easy to learn and use — which are often the ones that appeal most to developers. Furthermore, technologies that have strong developer appeal tend to make for more productive teams who feel they are empowered by their tools rather than encumbered by poorly-designed, legacy technology. Productive developer teams reduce time to market for new initiatives and reduce development costs, as well.

Agility

Organizations should use Big Data products that enable them to be agile. They will benefit from technologies that get out of the way and allow teams to focus on

what they can do with their data, rather than how to deploy new applications and infrastructure. This will make it easy to explore a variety of paths and hypotheses for extracting value from the data and to iterate quickly in response to changing business needs.

In this context, agility comprises three primary components:

- Ease of Use. A technology that is easy for developers to learn and understand -- either because of the way it's architected, the availability of tools and information, or both -- will enable teams to get Big Data projects started and to realize value quickly. Technologies with steep learning curves and fewer resources to support education will make for a longer road to project execution.
- Technological Flexibility. The product should make it relatively easy to change requirements on the fly—such as how data is modeled, which data is used, where data is pulled from and how it gets processed as teams develop new findings and adapt to internal and external needs. Dynamic data models (also known as schemas) and scalability are capabilities to seek out.
- Licensing Freedom. Open-source products are typically easier to adopt, as teams can get started quickly with free community versions of the software. They are also usually easier to scale from a licensing standpoint, as teams can buy more licenses as requirements increase. By contrast, in many cases proprietary software vendors require large, upfront license purchases, which make it harder for teams to get moving quickly and to scale in the future.

General Purpose vs. Niche Solutions

Organizations are constantly trying to standardize on fewer technologies to reduce complexity, to improve their competency in the selected tools and to make their vendor relationships more productive. Organizations should consider whether adopting a Big Data technology helps them address a single initiative or many initiatives. If the technology is general purpose, the expertise, infrastructure, skills, integrations and other investments of the initial project can be amortized across many projects. Organizations may find that a niche technology may be a better fit for a single project, but that a more general purpose tool is the better option for the organization as a whole.

Barriers

Barriers that are imposed on big data are as follows:

- Capture data
- Storage Capacity
- Searching

- Sharing
- Transfer
- Analysis
- Presentation

Enterprise servers are using the above measures to overcome the barriers mentioned above.

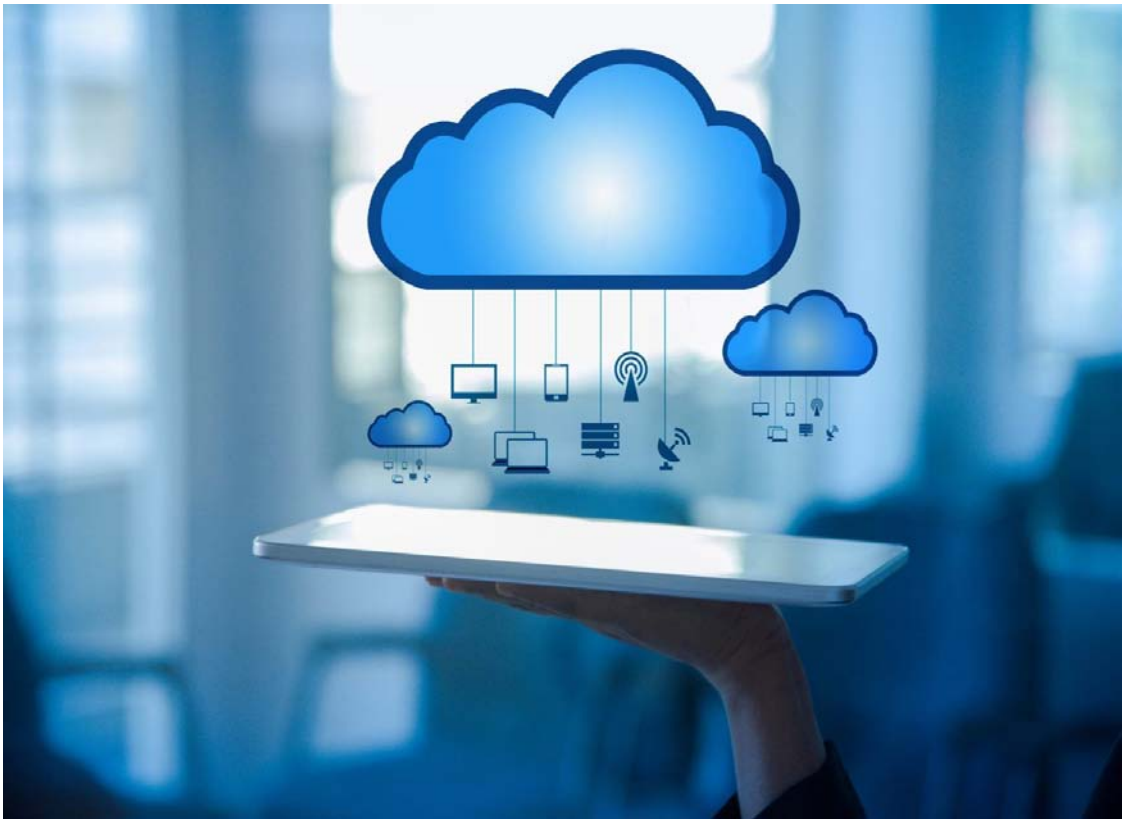
REFERENCES

1. Cheng, H., Rong, C., Hwang, K., Wang, W., & Li, Y. (2015). Secure big data storage and sharing scheme for cloud tenants. Communications, China, 12(6), 106-115.
2. Dou, W., Zhang, X., Liu, J., & Chen, J. (2015). Hiresome-ii: towards privacy-aware cross-cloud service composition for big data applications. IEEE Transactions on Parallel & Distributed Systems, 26(2), 455-466.
3. Douzgou, S., Pollalis, Y. A., Vozikis, A., Patrinos, G. P., & Clayton-Smith, J. (2015). Collaborative Crowdsourcing for the Diagnosis of Rare Genetic Syndromes: The DYSCERNE Experience. Public health genomics, 19(1), 19-24.
4. Fabian, B., Ermakova, T., & Junghanns, P. (2015). Collaborative and secure sharing of healthcare data in multi-clouds. Information Systems, 132–150.
5. He, S., Wu, Q., Qin, B., Liu, J., & Li, Y. (2015). Efficient group key management for secure big data in predictable large-scale networks. Concurrency and Computation: Practice and Experience.
6. Hou, S., Huang, X., Liu, J. K., Li, J., & Xu, L. (2015). Universal designated verifier transitive signatures for graph-based big data. Information Sciences.
7. https://intellipaat.com/tutorial/hadoop-tutorial/big-data-overview/
8. https://opentextbc.ca/dbdesign01/chapter/chapter-3-characteristics-and-benefits-of-a-database/
9. https://searchdatamanagement.techtarget.com/definition/data
10. https://searchdatamanagement.techtarget.com/definition/RDBMS-relational-database-management-system
11. https://www.codecademy.com/articles/what-is-rdbms-sql
12. https://www.computerhope.com/jargon/d/data.htm
13. https://www.guru99.com/data-modelling-conceptual-logical.html
14. https://www.lucidchart.com/pages/database-diagram/database-models
15. https://www.mongodb.com/big-data-explained
16. https://www.techopedia.com/definition/1235/relational-database-management-system-rdbms
17. Hussain, R., Rezaeifar, Z., Lee, Y. H., & Oh, H. (2015). Secure and privacy-aware traffic information as a service in VANET-based clouds. Pervasive and Mobile Computing, 24, 194-209.
18. Kang, J., Kim, K., & Suk, S. (2015). Personal Information Access Control Scheme for Secure NFC Integrated Payment. In Computer Science and its Applications (pp. 263-268). Springer Berlin Heidelberg.
19. Li, X., & Yang, T(2015). Signal Processing Oriented Approach for Big Data Privacy. In 16th International Symposium on High Assurance Systems Engineering on (pp. 1149 - 1176)

20. Montgomery, K. C. (2015). Youth and surveillance in the Facebook era: Policy interventions and social implications. Telecommunications Policy.
21. Müller, H., & Hanbury, A. (2015). [Research applications in digital radiology: Big data and co]. Der Radiologe.

CHAPTER 5

NETWORKS AND CLOUD COMPUTING



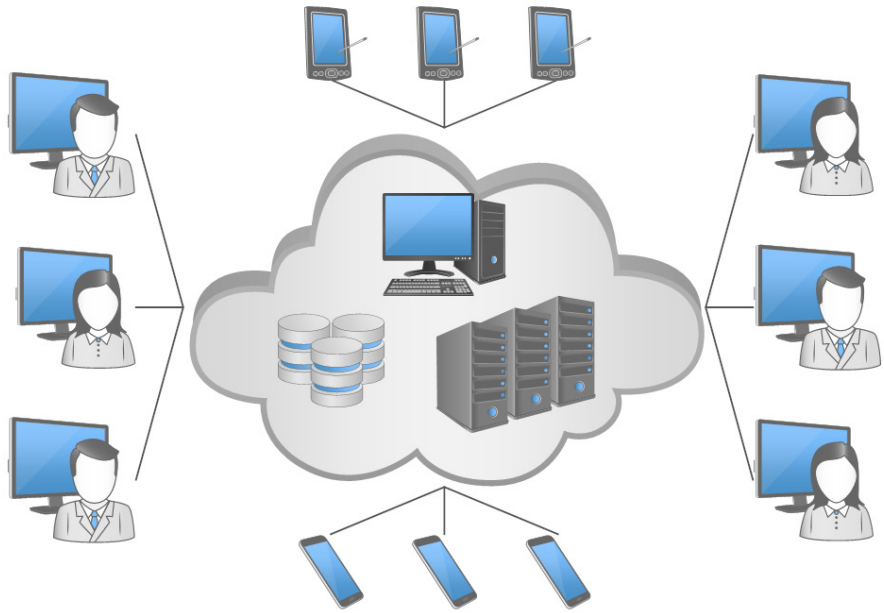
INTRODUCTION

The network can be the conduit to reliability, security and compliance in the cloud, or it can be a roadblock that obstructs all three.

That's the dilemma weighing heavily on the minds of many IT professionals today. A cloud computing service can provide enterprises with the agility needed to respond to ever-changing business demands, but IT pros often can't shake the fear that it can also go horribly wrong.

A well-designed network can help overcome these barriers.

Cloud network is referred to a computer network that exists within or is part of a cloud computing infrastructure. It is a computer network that provides network interconnectivity between cloud based or cloud enabled application, services and solutions. Cloud network can be cloud based network or cloud enabled network.



Source: https://wcs.smartdraw.com/network-diagram/examples/cloud-computing-1.png?bn=1510011136

Cloud network primarily enables a cloud computing infrastructure / solution, its associated components and external users/ application /services to communicate with each other. Typically, cloud network works similar to a standard computer network but its components / devices / operations are centered on cloud computing. For example, a cloud network will enable connecting a remote user with a cloud application (SaaS) or cloud infrastructure (IaaS). User queries from a web browser/

internet are delivered to and from the remote/backend cloud infrastructure. Similarly, cloud network also enables the network communication between virtual machines.

NETWORK FUNDAMENTALS

A network, in computing, is a group of two or more devices that can communicate. In practice, a network is comprised of a number of different computer systems connected by physical and/or wireless connections. The scale can range from a single PC sharing out basic peripherals to massive data centers located around the World, to the Internet itself. Regardless of scope, all networks allow computers and/or individuals to share information and resources.



Source: http://globalaffinityalliance.com/wp-content/uploads/2016/07/5.jpg

Computer networks serve a number of purposes, some of which include:

- Communications such as email, instant messaging, chat rooms, etc.
- Shared hardware such as printers and input devices
- Shared data and information through the use of shared storage devices
- Shared software, which is achieved by running applications on remote computers

Defining a Network

A network is a group of two or more computer systems or other devices that are linked together to exchange data. Networks share resources, exchange files and electronic communications. For example, networked computers can share files or multiple computers on the network can share the same printer.

Types of Networks

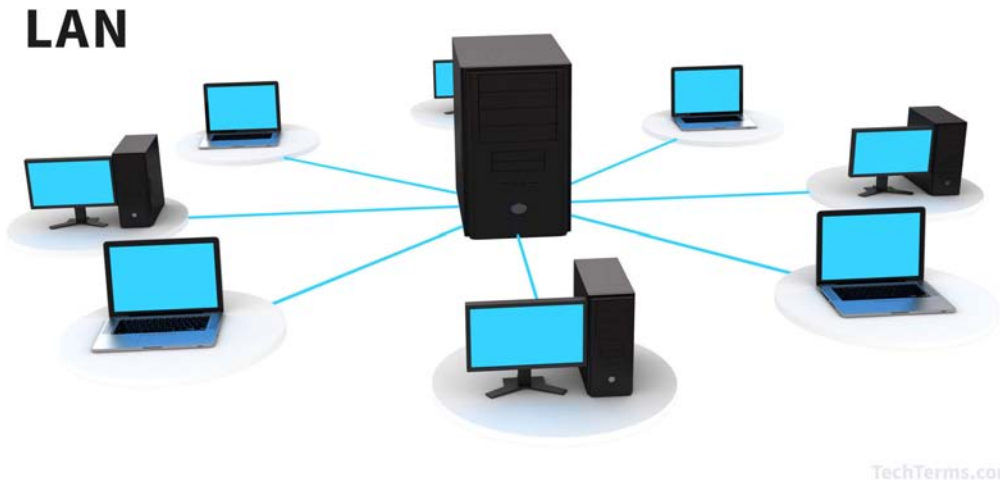
Two very common types of networks include:

- Local Area Network (LAN)
- Wide Area Network (WAN)

Local Area Network

A Local Area Network (LAN) is a network that is confined to a relatively small area. It is generally limited to a geographic area such as a writing lab, school, or building.

Computers connected to a network are broadly categorized as servers or workstations. Servers are generally not used by humans directly, but rather run continuously to provide "services" to the other computers (and their human users) on the network. Services provided can include printing and faxing, software hosting, file storage and sharing, messaging, data storage and retrieval, complete access control (security) for the network's resources, and many others.



Source: https://cdn.techterms.com/img/lg/lan_79.jpg

Workstations are called such because they typically do have a human user which interacts with the network through them. Workstations were traditionally considered a desktop, consisting of a computer, keyboard, display, and mouse, or a laptop, with with integrated keyboard, display, and touchpad. With the advent of the tablet computer, and the touch screen devices such as iPad and iPhone, our definition of workstation is quickly evolving to include those devices, because of their ability to interact with the network and utilize network services.

Servers tend to be more powerful than workstations, although configurations are guided by needs. For example, a group of servers might be located in a secure area, away from humans, and only accessed through the network. In such cases, it would be common for the servers to operate without a dedicated display or keyboard. However, the size and speed of the server's processor(s), hard drive, and main memory might add dramatically to the cost of the system. On the other hand, a workstation might not need as much storage or working memory, but might require an expensive display to accommodate the needs of its user. Every computer on a network should be appropriately configured for its use.

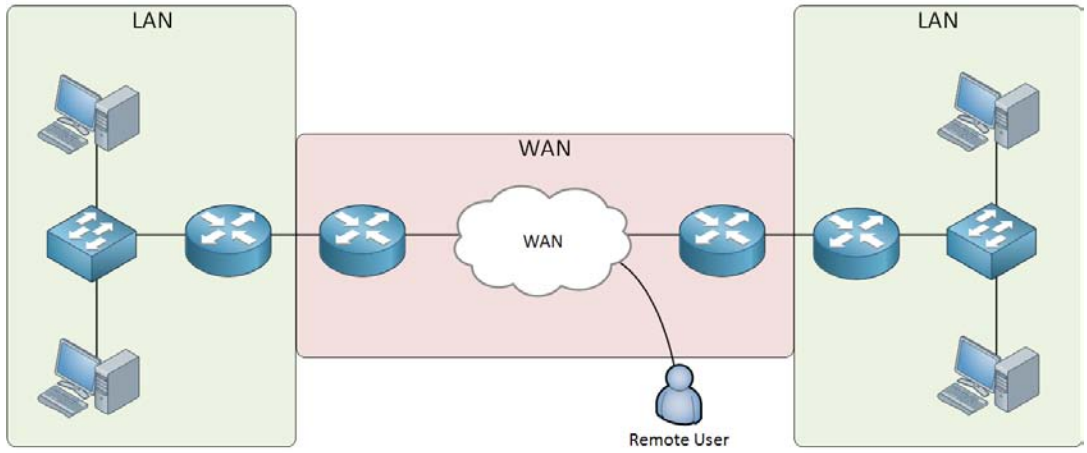
On a single LAN, computers and servers may be connected by cables or wirelessly. Wireless access to a wired network is made possible by wireless access points (WAPs). These WAP devices provide a bridge between computers and networks. A typical WAP might have the theoretical capacity to connect hundreds or even thousands of wireless users to a network, although practical capacity might be far less.

Nearly always servers will be connected by cables to the network, because the cable connections remain the fastest. Workstations which are stationary (desktops) are also usually connected by a cable to the network, although the cost of wireless adapters has dropped to the point that, when installing workstations in an existing facility with inadequate wiring, it can be easier and less expensive to use wireless for a desktop.

Wide Area Network

Wide Area Networks (WANs) connect networks in larger geographic areas, such as Florida, the United States, or the world. Dedicated transoceanic cabling or satellite uplinks may be used to connect this type of global network.

Using a WAN, schools in Florida can communicate with places like Tokyo in a matter of seconds, without paying enormous phone bills. Two users a half-world apart with workstations equipped with microphones and a webcams might teleconference in real time. A WAN is complicated. It uses multiplexers, bridges, and routers to connect local and metropolitan networks to global communications networks like the Internet. To users, however, a WAN will not appear to be much different than a LAN.



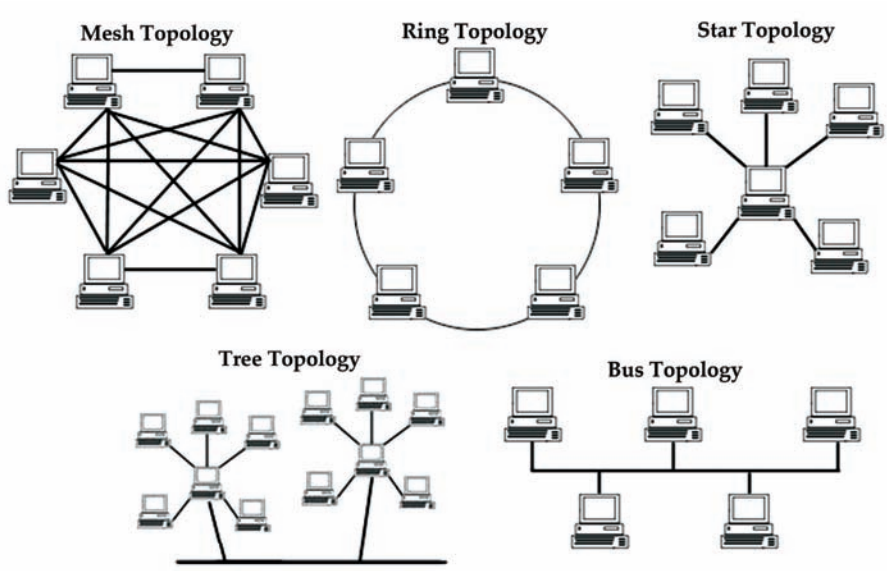
Source: https://networklessons.com/wp-content/uploads/2017/01/local-area-network-connected-to-wide-area-network.png

Computer Network Topologies

The term network topology describes the relationship of connected devices in terms of a geometric graph. Devices are represented as vertices, and their connections are represented as edges on the graph. It describes how many connections each device has, in what order, and it what sort of hierarchy.

Network topologies represent the physical or logical structure of a network, with common topologies that include the following major types:

- Full mesh networks, in which all nodes are connected to each other and can exchange data.
- Partial mesh networks, in which some of the nodes are connected to each other in a full mesh scheme, but others are only connected to one or two other nodes in the network.
- Point to point networks, which is a connection between only two endpoints.
- Network fabric, in which endpoints transfer data to each other through interconnecting switches and can connect to any other by taking a path through a criss-cross pattern of connections.
- A tree network, which is a combination of two or more star networks connected together.
- A star network, in which the nodes are connected to a common central computer.
- A Bus, a circuit arrangement where all network devices are attached directly to a transmission line directly, and while all signals pass through all devices, each device has a unique identity and recognizes signals intended for it.



Source: https://www.computerhope.com/jargon/n/nettopo.gif

The Importance of Network Standards

Network standards are important to ensure that hardware and software can work together. Without standards you could not easily develop a network to share information. Networking standards can be categorized in one of two ways: formal and de facto (informal).

Formal standards are developed by industry organizations or governments. Formal standards exist for network layer software, data link layer, hardware and so on. Formal standardization is a lengthy process of developing the specification, identifying choices and industry acceptance.

There are a several leading organizations for standardization including The International Organization for Standardization (ISO) and The American National Standards Institute (ANSI). The most known standards organization in the world is the Internet Engineering Task Force (IETF). IETF sets the standards that govern how much of the Internet operates.

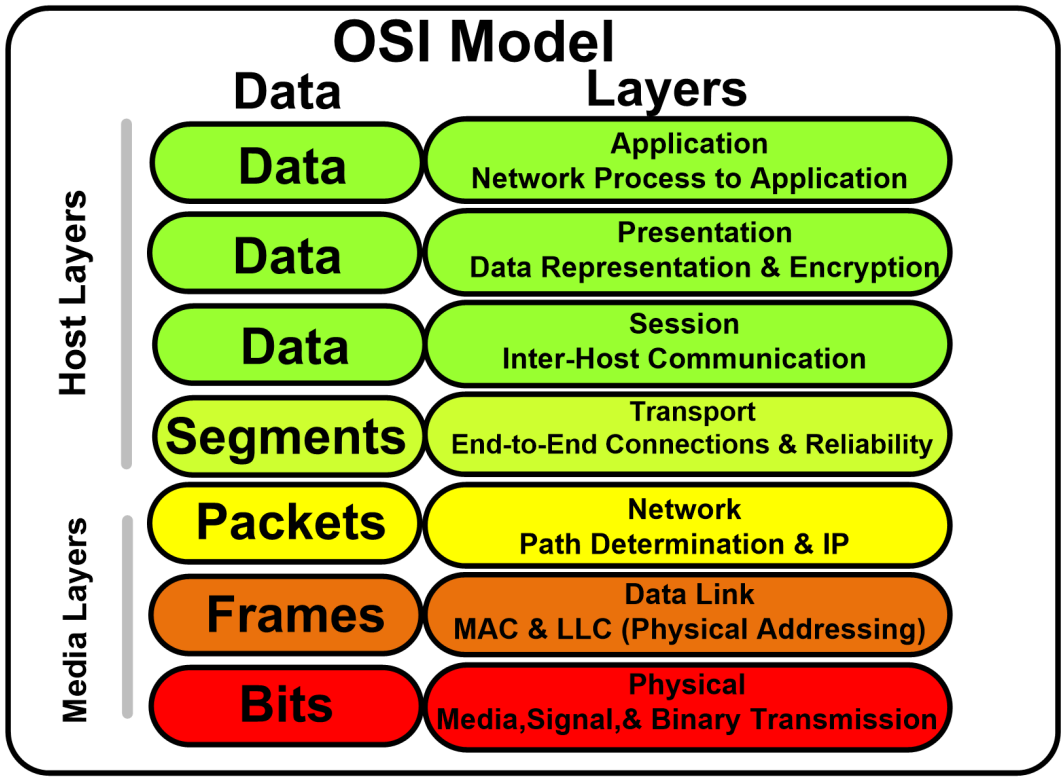
The second category of networking standards is de facto standards. These standards typically emerge in the marketplace and are supported by technology vendors but have no official backing. For example, Microsoft Windows is a de facto standard, but is not formally recognized by any standards organization. It is simply widely recognized and accepted.

Network Models

To simplify networks, everything is separated in layers and each layer handles specific tasks and is independent of all other layers. Control is passed from one layer to the next, starting at the top layer in one station, and proceeding to the bottom layer, over the channel to the next station and back up the hierarchy. Network models are used to define a set of network layers and how they interact. The two most widely recognized network models include the TCP/IP Model and the OSI Network Model.

The 7 Layers of the OSI Model

The Open System Interconnect (OSI) is an open standard for all communication systems. The OSI model defines a networking framework to implement protocols in seven layers.



Source: http://electricala2z.com/wp-content/uploads/2017/10/osi-model.gif

Physical Layer

This layer conveys the bit stream - electrical impulse, light or radio signal -- through the network at the electrical and mechanical level. It provides the hardware means of sending and receiving data on a carrier, including defining cables, cards and

physical aspects. Examples include Ethernet, FDDI, B8ZS, V.35, V.24, RJ45.

Data Link Layer

At this layer, data packets are encoded and decoded into bits. It furnishes transmission protocol knowledge and management and handles errors in the physical layer, flow control and frame synchronization. The data link layer is divided into two sub layers: The Media Access Control (MAC) layer and the Logical Link Control (LLC) layer. Examples include PPP, FDDI, ATM, IEEE 802.5/802.2, IEEE 802.3/802.2, HDLC, Frame Relay.

Network Layer

This layer provides switching and routing technologies, creating logical paths, known as virtual circuits, for transmitting data from node to node. Routing and forwarding are functions of this layer, as well as addressing, internetworking, error handling, congestion control and packet sequencing. Examples include AppleTalk DDP, IP, IPX.

Transport Layer

This layer provides transparent transfer of data between end systems, or hosts, and is responsible for end-to-end error recovery and flow control. It ensures complete data transfer. Examples include SPX, TCP, UDP.

Session Layer

This layer establishes, manages and terminates connections between applications. The session layer sets up, coordinates, and terminates conversations, exchanges, and dialogues between the applications at each end. Examples include NFS, NetBios names, RPC, SQL.

Presentation Layer

This layer provides independence from differences in data representation (e.g., encryption) by translating from application to network format, and vice versa. This layer formats and encrypts data to be sent across a network, providing freedom from compatibility problems. Examples include encryption, ASCII, EBCDIC, TIFF, GIF, PICT, JPEG, MPEG, MIDI.

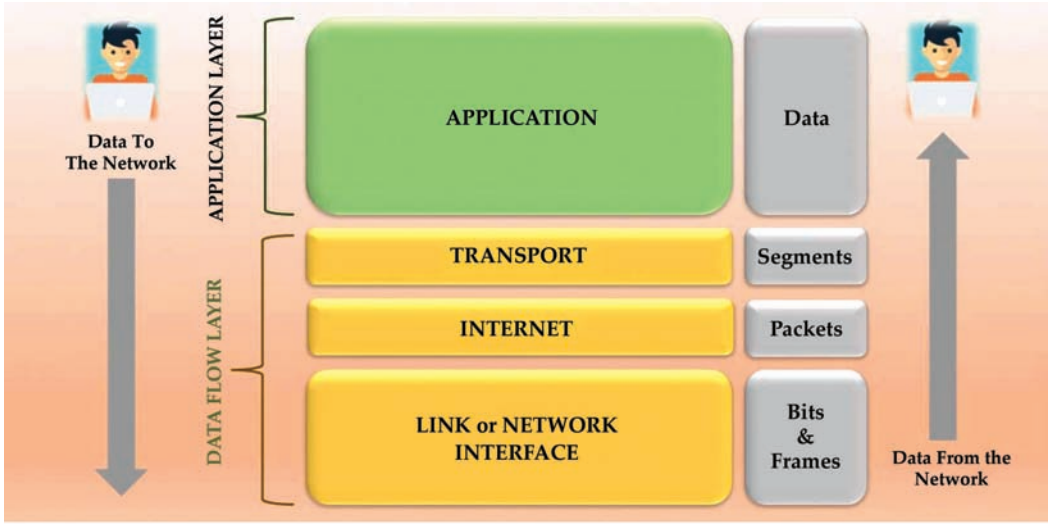
Application Layer

This layer supports application and end-user processes. Communication partners are identified, quality of service is identified, user authentication and privacy are considered, and any constraints on data syntax are identified. Everything at

this layer is application-specific. This layer provides application services for file transfers, e-mail, and other network software services. Examples include WWW browsers, NFS, SNMP, Telnet, HTTP, FTP

The TCP/IP Model

The TCP/IP network model is a four-layer reference model. All protocols that belong to the TCP/IP protocol suite are located in the top three layers of this model.



Source: https://www.stemjar.com/wp-content/uploads/2017/12/TCP-IP-Reference-Model-4-Layers-of-Communication-1280x640.jpg

Application

Defines TCP/IP application protocols and how host programs interface with transport layer services to use the network. Protocol examples include HTTP, Telnet, FTP, TFTP, SNMP, DNS, SMTP.

Transport

Provides communication session management between host computers. Defines the level of service and status of the connection used when transporting data. Protocol examples include TCP, UDP, RTP.

Internet

Packages data into IP datagrams, which contain source and destination address information that is used to forward the datagrams between hosts and across networks. Performs routing of IP datagrams. Protocol examples include IP, ICMP, ARP, RARP.

Network interface

Specifies details of how data is physically sent through the network, including how bits are electrically signaled by hardware devices that interface directly with a network medium, such as coaxial cable, optical fiber, or twisted-pair copper wire. Protocol examples include Ethernet, Token Ring, FDDI, X.25, Frame Relay, RS-232, v.35.

Each layer of the TCP/IP model corresponds to one or more layers of the seven-layer Open Systems Interconnection (OSI) reference model.

THE INTERNET AND WORLD WIDE WEB

The internet is a globally connected network system that uses TCP/IP to transmit data via various types of media. The internet is a network of global exchanges – including private, public, business, academic and government networks – connected by guided, wireless and fiber-optic technologies.

The terms internet and World Wide Web are often used interchangeably, but they are not exactly the same thing; the internet refers to the global communication system, including hardware and infrastructure, while the web is one of the services communicated over the internet.

The World Wide Web (WWW) is a network of online content that is formatted in HTML and accessed via HTTP. The term refers to all the interlinked HTML pages that can be accessed over the Internet. The World Wide Web was originally designed in 1991 by Tim Berners-Lee while he was a contractor at CERN.



Source: https://cryodragon.ca/wp-content/uploads/2018/03/CryoDragon-Internet-vs-World-Wide-Web.jpg

The World Wide Web is most often referred to simply as "the Web."

The World Wide Web is what most people think of as the Internet. It is all the Web pages, pictures, videos and other online content that can be accessed via a Web browser. The Internet, in contrast, is the underlying network connection that allows us to send email and access the World Wide Web. The early Web was a collection of text-based sites hosted by organizations that were technically gifted enough to set up a Web server and learn HTML. It has continued to evolve since the original design, and it now includes interactive (social) media and user-generated content that requires little to no technical skills.

Internet Facilities

The Internet is similar in some ways to the global telephone system: Each allows the establishment almost instantly of 2-way connections between sites anywhere in the world. However, unlike a telephone conversation, the Internet allows us to communicate in a variety of ways. Most importantly, we are not limited to verbal interactions with other people--in many cases, it is possible to gain access to information stored in their computers. The basic facilities available over the Internet are described below and include e-mail, list servers, USNET/Newsgroups, File Transfer Protocol, Internet Relay Chat, Gopher facility, and the WWW.



Source: https://www.mojix.com/wp-content/uploads/2018/04/Facilities-Management.jpg

E-mail

E-mail, the Internet equivalent of postal mail, is the most widely used facility on the Internet. E-mail messages routed across the Internet can reach an overseas destination in seconds. You never receive a busy signal and you never play "telephone tag." A variety of e-mail programs offer features allowing you to

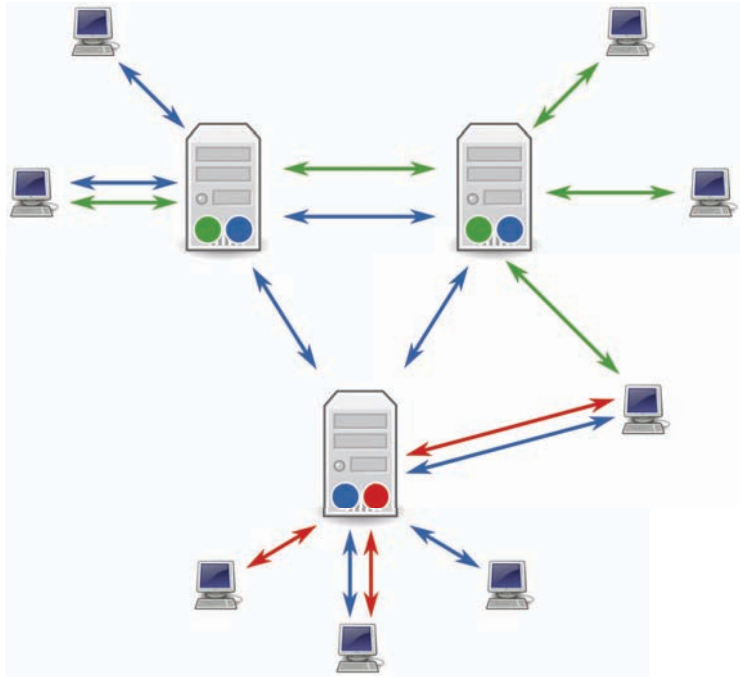
print, forward, save, and/or reply to another's message. Some include advanced features allowing you to attach a word processing document, spreadsheet, software program, video, or image file.

List Servers

The list server facility allows for the creation of discussion groups to share information about common interests. LISTSERV, the most common list server program, copies incoming messages sent to the list and forwards them to everyone whose e-mail address is on the list (the subscribers). Only subscribers can submit messages to the group, which is monitored by the list manager. A user (the initiator) typically joins a list by sending it an appropriately worded e-mail message, which automatically prompts the LISTSERV program to extract the initiator's e-mail address, add it to the list, and send the initiator an e-mail message of confirmation and information regarding use of the list.

USNET/Newsgroups

Internet newsgroup servers generally provide access to groups that are much less selective than those provided by list servers. Free and unrestricted access to thousands of topic-based newsgroups can be obtained by using specific newsreader software to contact a local computer that acts as a news server. This software allows users to post messages or articles to any newsgroup for other users to read and possibly attach their comments.



Source: https://upload.wikimedia.org/wikipedia/commons/thumb/f/f4/Usenet_servers_and_clients.svg/2000px-Usenet_servers_and_clients.svg.png

File Transfer Protocol

Using the File Transfer Protocol facility, Internet users can transfer software programs, product upgrades, and other types of computer files between computer systems connected to the Internet.

Internet Relay Chat

With Internet Relay Chat, small numbers of users meet in on-line chat groups and "talk" to each other by typing messages on their keyboards.

Gopher

The Gopher facility, created at the University of Minnesota and named after its golden gopher mascot, is one of the first "user-friendly" Internet facilities for obtaining information over the network. Using Gopher, users can connect to thousands of different computers, known as information servers or "gopher holes," via a menu-driven "point and click" program. Hierarchically organized information is stored at each gopher hole. Users click on a descending list of individual topics to retrieve information, which might include text, sound, or images.

World Wide Web

The WWW is such an immensely popular Internet facility that for many users, it has become synonymous with the Internet. Developed in 1992 at the European Laboratory for Particle Physics at Cern, Switzerland, the WWW links users to Internet sites. The basic unit of WWW communication is the page, similar to this printed page. Within a Web page are "links" on which users can click and be automatically connected to related pages at the same or other Internet Websites. With its ease of use and its multimedia ability to transmit text, graphics, audio, and video to retrieve detailed information from anywhere in the world in seconds, the WWW has quickly become the interface of choice for Internet users.

Components of the WWW

Key to the success of the WWW is its powerful system of links, allowing users to explore related sets of data stored in different computers on the Internet. This system of embedding links in the text of a Web page, called "hypertext," allows any sort of data to be accessed from a Web page by clicking on highlighted and/or underlined links that point to other pages. Users are automatically routed to the selected Web page even if it resides in a distant computer. This web of interconnected pages gives the WWW its name.

Every Web page has its own unique title, known as the Uniform Resource Locator (URL). A URL contains both the Internet address of the computer on which a Web page is stored and the name of the computer file that actually contains the page.

More than 1/2 million WWW sites exist on the Internet, and each may contain numerous URLs. The result is tens of millions of Web pages!



Source: https://media.buzzle.com/media/images-en/photos/internet/1200-254435-world-wide-web-work.jpg

So that users may view and retrieve Web pages without having to know and type the URL each time, a special type of program, known as a "browser," was developed. A browser program operates on a personal computer, interfacing it with the Internet and allowing users to "surf" the WWW. Browsers are inexpensive and typically available without cost to educators. All browsers allow Internet users to (1) retrieve Web pages from other computers; (2) display these pages on the user's screen, using formatting commands that were specified by the author of the page; and (3) make the Web pages active, progressing to the referenced file or URL by pointing and clicking on a hypertext link embedded in a page. Browsers are very easy to use, and even a computer novice can become accustomed to navigating the Internet within minutes. The new user will soon realize, however, that navigating effectively through millions of Web pages requires skill in searching. To deal with this abundance of information, Internet users take advantage of WWW software tools known as "search engines."

A search engine is a powerful program for finding Websites that contain information about key words. Search engines scan Web pages, Gopher sites, File Transfer Protocol sites, newsgroup articles, and so forth. Many of these programs are currently available, and their designs differ in subtle ways. Readers can select among the popular search engines offered by their Web browser simply by clicking on the relevant button of the browser's opening page. Users generally try several until they find those that seem easier to use and more productive. Skilled Web surfers typically use a search engine to launch a search and then use

the hypertext links embedded in the Web pages found by the search engines to jump from page to page across the Web.

Web Programming Languages

Many technologies have emerged to facilitate browser-based development. Here, we look at those technologies in an effort to identify the best web programming languages of today.



Source: https://www.mitrodigitalmarketing.com/wp-content/uploads/2017/12/Top-5-Programming-Languages-featured.png

PHP

When PHP debuted in the mid-1990s, many devotees called it the best web programming language around, because it revolutionized how you could develop internet software. PHP made it practical for the first time to build dynamic websites and so transformed the web from a collection of mostly static content into an interactive medium.

Two decades after PHP's first release, its popularity has waned somewhat. A strong anti-PHP coalition exists today. The complaints center on PHP's poor design and the fact that simple tasks require a lot of code.

Yet, say what you will about PHP, the fact remains it's still by far the most widely used, though probably not the best language, for web development. For that reason alone, PHP is a must-know language for web developers.

Java

Java was designed as an all-purpose programming language. It was never intended for web applications in particular -- anymore than it was conceived for writing, say, a smartwatch app. But while Java wasn't created with the sole purpose of browser-based development in mind, many still consider it one of the best web programming languages to learn and use.

In other words, Java is a language an average developer already knows. If you need to build a web app and don't want your developers (or the people who will have to maintain your code in the future) to learn a new language to do it, Java might fit the bill well.

Go

If you're looking for a general-purpose programming language that is easier on web apps than Java, Golang -- better known as just Go -- may be what you're looking for.

Introduced in 2009, Go is a flexible, extensible language with a strong community behind it. It makes it easy for developers to build applications that take advantage of parallel processing. That gives Go an advantage if you use it to build high-performance web apps. Go is not as widely popular as Java, but its following will likely increase over time.

Go can, therefore, be a great choice if you want an up-to-date programming solution that works well for web applications, as well as other types of apps.

Ruby on Rails

You can't discuss general-purpose programming languages useful for web development without a mention of Ruby on Rails. For developers who program with Ruby, a general-purpose language, Ruby on Rails provides an easy way to build server-side web applications.

There's a fair amount of debate swirling about whether Ruby and Ruby on Rails are dying. Advocates of the framework, though, will enthusiastically argue that this is still one of the best web programming languages to build apps quickly. Folks have been predicting Ruby's demise for several years now, and while Ruby is not as popular as it once was, it is unlikely to disappear.

In fact, in March 2018, the Tiobe index, which tracks the popularity of programming languages, reported Ruby had returned to its top 10 list. If Ruby is back in vogue, Ruby on Rails skills are a valuable asset.

Python

Python is a scripting language that developers can use in a broad variety of contexts. While Python wasn't designed specifically for web development, frameworks like Django make it easy to use it as the basis for web programming. You could also use plain old Python for writing web apps, too, if you wanted.

Whether Python and Django are the best web programming languages in a technical sense is an impossible question to answer objectively.

One argument, however, you can make in favor of Python -- but can't make for most other languages on this list -- is that it lends itself to so many use cases. In other words, if you learn Python in order to use it for web development, you also learn a language you can use for everything from system administration to mobile development.

JavaScript (and Node.js)

JavaScript is also a must-have language for web app development. That's true not only because JavaScript dominates the world of client-side programming languages for websites, but also because it can be extended to server-side environments using Node.js.

JavaScript and Node.js are not quite as extensible as Python. You probably wouldn't use Node.js for system administration, for example -- although it has been done. But put together, these two languages cover pretty much any kind of web-related programming use case you might face.

Web Services

Web services are client and server applications that communicate over the World Wide Web's (WWW) HyperText Transfer Protocol (HTTP). As described by the World Wide Web Consortium (W3C), web services provide a standard means of interoperating between software applications running on a variety of platforms and frameworks. Web services are characterized by their great interoperability and extensibility, as well as their machine-processable descriptions, thanks to the use of XML. Web services can be combined in a loosely coupled way to achieve

complex operations. Programs providing simple services can interact with each other to deliver sophisticated added-value services.



Source: https://cdn.lynda.com/course/530461/530461-636173085707893925-16x9.jpg

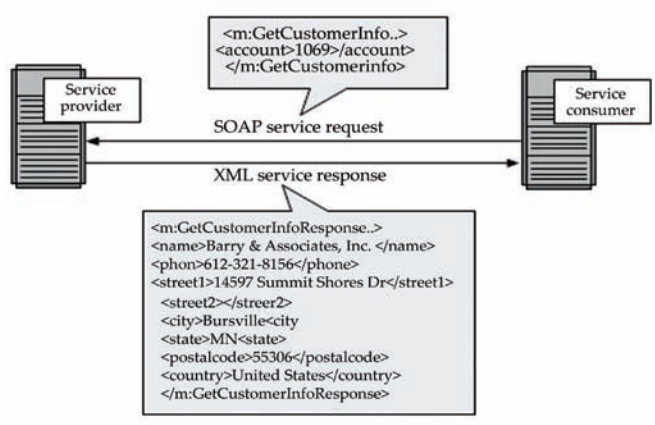
Components of Web Services

The basic web services platform is XML + HTTP. All the standard web services work using the following components −

- SOAP (Simple Object Access Protocol)
- UDDI (Universal Description, Discovery and Integration)
- WSDL (Web Services Description Language)

SOAP

SOAP was originally part of the specification that included the Web Services Description Language (WSDL) and Universal Description, Discovery, and Integration (UDDI). It is used now without WSDL and UDDI. Instead of the discovery process described in the History of the Web Services Specification section below, SOAP messages are hard-coded or generated without the use of a repository. The interaction is illustrated in the figure below.



Source: https://www.service-architecture.com/images/web_services/soap_messages.jpg

SOAP is an XML-based protocol for exchanging information between computers.

- SOAP is a communication protocol.
- SOAP is for communication between applications.
- SOAP is a format for sending messages.
- SOAP is designed to communicate via Internet.
- SOAP is platform independent.
- SOAP is language independent.
- SOAP is simple and extensible.
- SOAP allows you to get around firewalls.
- SOAP will be developed as a W3C standard.

WSDL

WSDL is an XML-based language for describing web services and how to access them.

- WSDL stands for Web Services Description Language.
- WSDL was developed jointly by Microsoft and IBM.
- WSDL is an XML based protocol for information exchange in decentralized and distributed environments.
- WSDL is the standard format for describing a web service.
- WSDL definition describes how to access a web service and what operations it will perform.
- WSDL is a language for describing how to interface with XML-based services.
- WSDL is an integral part of UDDI, an XML-based worldwide business registry.

- WSDL is the language that UDDI uses.
- WSDL is pronounced as 'wiz-dull' and spelled out as 'W-S-D-L'.

UDDI

UDDI is an XML-based standard for describing, publishing, and finding web services.

- UDDI stands for Universal Description, Discovery, and Integration.
- UDDI is a specification for a distributed registry of web services.
- UDDI is platform independent, open framework.
- UDDI can communicate via SOAP, CORBA, and Java RMI Protocol.
- UDDI uses WSDL to describe interfaces to web services.
- UDDI is seen with SOAP and WSDL as one of the three foundation standards of web services.
- UDDI is an open industry initiative enabling businesses to discover each other and define how they interact over the Internet.

How Does a Web Service Work?

A web service enables communication among various applications by using open standards such as HTML, XML, WSDL, and SOAP. A web service takes the help of −

- XML to tag the data
- SOAP to transfer a message
- WSDL to describe the availability of service.

You can build a Java-based web service on Solaris that is accessible from your Visual Basic program that runs on Windows.

You can also use C# to build new web services on Windows that can be invoked from your web application that is based on JavaServer Pages (JSP) and runs on Linux.

Example

Consider a simple account-management and order processing system. The accounting personnel use a client application built with Visual Basic or JSP to create new accounts and enter new customer orders.

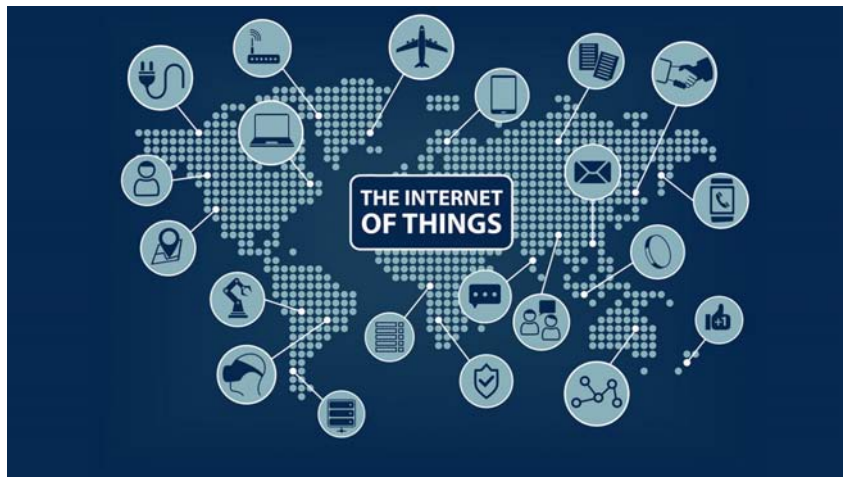
The processing logic for this system is written in Java and resides on a Solaris machine, which also interacts with a database to store information.

The steps to perform this operation are as follows −

- The client program bundles the account registration information into a SOAP message.
- This SOAP message is sent to the web service as the body of an HTTP POST request.
- The web service unpacks the SOAP request and converts it into a command that the application can understand.
- The application processes the information as required and responds with a new unique account number for that customer.
- Next, the web service packages the response into another SOAP message, which it sends back to the client program in response to its HTTP request.
- The client program unpacks the SOAP message to obtain the results of the account registration process.

THE INTERNET OF THINGS

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.



Source: http://cdn2.itpro.co.uk/sites/itpro/files/2017/09/internet_of_things_iot.jpg

A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an IP address and is able to transfer data over a network.

Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business.

History of IoT

Kevin Ashton, co-founder of the Auto-ID Center at MIT, first mentioned the internet of things in a presentation he made to Procter & Gamble (P&G) in 1999. Wanting to bring radio frequency ID (RFID) to the attention of P&G's senior management, Ashton called his presentation "Internet of Things" to incorporate the cool new trend of 1999: the internet.

IoT has evolved from the convergence of wireless technologies, microelectromechanical systems (MEMS), microservices and the internet. The convergence has helped tear down the silos between operational technology (OT) and information technology (IT), enabling unstructured machine-generated data to be analyzed for insights to drive improvements.

Although Ashton's was the first mention of the internet of things, the idea of connected devices has been around since the 1970s, under the monikers *embedded internet* and *pervasive computing*.

The first internet appliance, for example, was a Coke machine at Carnegie Mellon University in the early 1980s. Using the web, programmers could check the status of the machine and determine whether there would be a cold drink awaiting them, should they decide to make the trip to the machine.



Source: http://www.sciencefriday.com/wp-content/uploads/2016/10/iot.png

IoT evolved from machine-to-machine (M2M) communication, i.e., machines connecting to each other via a network without human interaction. M2M refers to connecting a device to the cloud, managing it and collecting data.

Taking M2M to the next level, IoT is a sensor network of billions of smart devices that connect people, systems and other applications to collect and share data. As its foundation, M2M offers the connectivity that enables IoT.

The internet of things is also a natural extension of SCADA (supervisory control and data acquisition), a category of software application program for process control, the gathering of data in real time from remote locations to control equipment and conditions. SCADA systems include hardware and software components. The hardware gathers and feeds data into a computer that has SCADA software installed, where it is then processed and presented it in a timely manner. The evolution of SCADA is such that late-generation SCADA systems developed into first-generation IoT systems.

The concept of the IoT ecosystem, however, didn't really come into its own until the middle of 2010 when, in part, the government of China said it would make IoT a strategic priority in its five-year plan.

How IoT works

An IoT ecosystem consists of web-enabled smart devices that use embedded processors, sensors and communication hardware to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data.

The connectivity, networking and communication protocols used with these web-enabled devices largely depend on the specific IoT applications deployed.

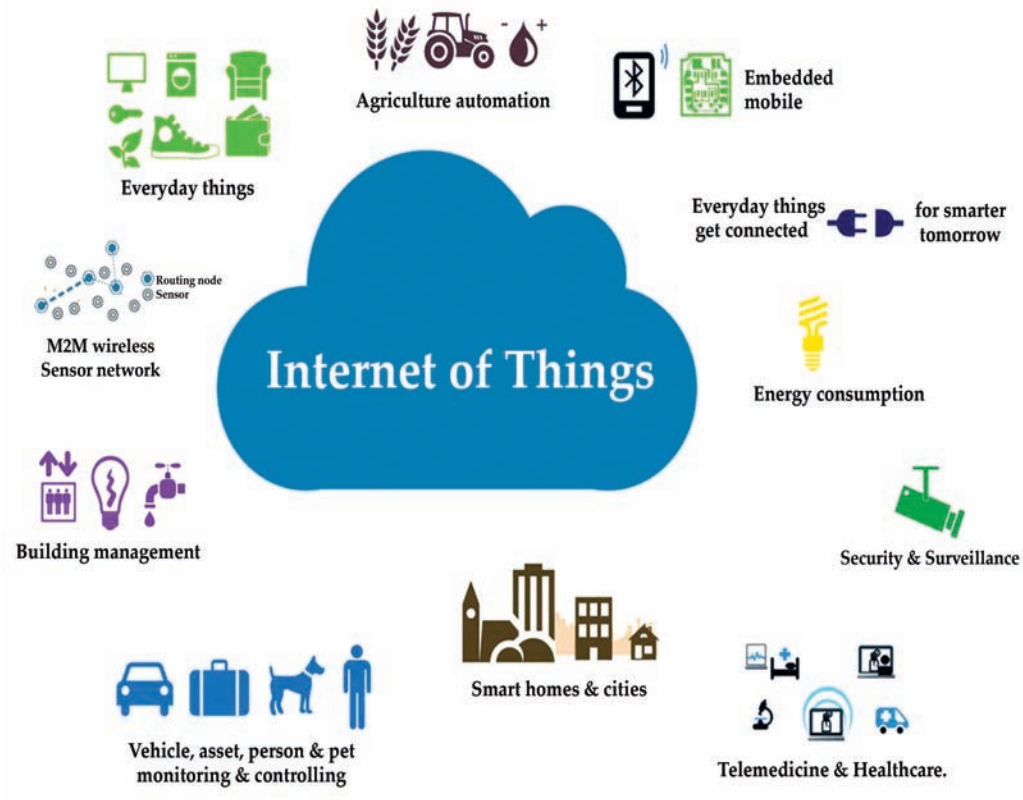
Applications of the Internet of Things

The benefits of the IoT are first and foremost found in industry. In a way its manufacturing that has led the charge here, as letting machines talk to each other directly rather than through humans has brought about a serious uptick in production across the board. So now some factories basically run themselves, with machines telling each other what they need and when.

Though that specter may make chills run down the spine of union organizers, it's been positively great for the people that run those businesses, allowing them to turn out more products for a lower cost. The rise of the robots that is going

to influence the labor market quite strongly over the next few decades is in large part due to IoT technology.

For regular people the changes are slightly less obvious — except for the resulting unemployment, of course — but we can expect more and more everyday things to be controllable remotely, usually through your phone. After all, why bother with a TV remote when you have a digital device capable of broadcasting over WiFi in your pocket (and hands) all the time?



Source: https://www.xtendiot.com/wp-content/uploads/2017/09/iot-application-areas.jpg

Since control chips are the size of pinheads these days, almost every imaginable object could become part of the Internet of Things, all you need is to think up a reason why a table or chair should have a chip and all you need to do is build it. The chips are also getting smaller, too, as the machines take over in the factories: right now a form factor (think of it as size) of 10 nanometer is the cutting edge, but Samsung is working on 8nm processes as you read this (note: that's really frickin' small).

So, if you think the phone-controlled thermostat and the fridge with a memory are cool, wait till you see self-controlling diabetes pumps that feed you extra insulin when the pantry tells it that you just unwrapped a chocolate bar. How about a

store that has no human personnel, yet does all its stock taking perfectly? The possibilities are, to coin a phrase, endless.

Since the elements necessary are so small — and thanks to the revolution in chip manufacturing, not to mention DIY circuit boards like Raspberry Pi so very, very cheap — pretty much anyone can get some parts together and put an IoT device together in their basement. It's a real sea change in computing and the way we interact with the digital world.

Consumer and Enterprise IoT Applications

There are numerous real-world applications of the internet of things, ranging from consumer IoT and enterprise IoT to manufacturing and industrial IoT (IIoT). IoT applications span numerous verticals, including automotive, telco, energy and more.

In the consumer segment, for example, smart homes that are equipped with smart thermostats, smart appliances and connected heating, lighting and electronic devices can be controlled remotely via computers, smartphones or other mobile devices.

Wearable devices with sensors and software can collect and analyze user data, sending messages to other technologies about the users with the aim of making users' lives easier and more comfortable. Wearable devices are also used for public safety -- for example, improving first responders' response times during emergencies by providing optimized routes to a location or by tracking construction workers' or firefighters' vital signs at life-threatening sites.



Source: https://thumbor.forbes.com/thumbor/1280x868/https%3A%2F%2Fblogs-images.forbes.com%2Fjanakirammsv%2Ffiles%2F2017%2F07%2FCloud-IoT.jpg

In healthcare, IoT offers many benefits, including the ability to monitor patients more closely to use the data that's generated and analyze it. Hospitals often use IoT systems to complete tasks such as inventory management, for both pharmaceuticals and medical instruments.

Smart buildings can, for instance, reduce energy costs using sensors that detect how many occupants are in a room. The temperature can adjust automatically -- for example, turning the air conditioner on if sensors detect a conference room is full or turning the heat down if everyone in the office has gone home.

In agriculture, IoT-based smart farming systems can help monitor, for instance, light, temperature, humidity and soil moisture of crop fields using connected sensors. IoT is also instrumental in automating irrigation systems.

In a smart city, IoT sensors and deployments, such as smart streetlights and smart meters, can help alleviate traffic, conserve energy, monitor and address environmental concerns, and improve sanitation.

IoT Security and Privacy Issues

The internet of things connects billions of devices to the internet and involves the use of billions of data points, all of which need to be secured. Due to its expanded attack surface, IoT security and IoT privacy are cited as major concerns.

One of the most notorious recent IoT attacks was Mirai, a botnet that infiltrated domain name server provider Dyn and took down many websites for an extended period of time in one of the biggest distributed denial-of-service (DDoS) attacks ever seen. Attackers gained access to the network by exploiting poorly secured IoT devices.

Because IoT devices are closely connected, all a hacker has to do is exploit one vulnerability to manipulate all the data, rendering it unusable. And manufacturers that don't update their devices regularly -- or at all -- leave them vulnerable to cybercriminals.

Additionally, connected devices often ask users to input their personal information, including names, ages, addresses, phone numbers and even social media accounts -- information that's invaluable to hackers.

However, hackers aren't the only threat to the internet of things; privacy is another major concern for IoT users. For instance, companies that make and distribute consumer IoT devices could use those devices to obtain and sell users' personal data.



Source: https://www.mckinsey.com/~/media/McKinsey/Industries/Semiconductors/Our%20Insights/Security%20in%20the%20Internet%20of%20Things/Insights-MoSC-Security-in-the-Internet-of-Things-1536x1536-300_Standard.ashx

Beyond leaking personal data, IoT poses a risk to critical infrastructure, including electricity, transportation and financial services.

The Future of IoT

There is no shortage of IoT market estimations. For example:

- Bain & Company expects annual IoT revenue of hardware and software to exceed $450 billion by 2020.
- McKinsey & Company estimates IoT will have an $11.1 trillion impact by 2025.
- IHS Markit believes the number of connected IoT devices will increase 12% annually to reach 125 billion in 2030.
- Gartner assesses that 20.8 billion connected things will be in use by 2020, with total spend on IoT devices and services to reach $3.7 trillion in 2018.

CLOUD COMPUTING

Cloud computing is a method for delivering information technology (IT) services in which resources are retrieved from the Internet through web-based tools and applications, as opposed to a direct connection to a server. Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it.



Source: https://www.advantageservices.net/photos/articles/correct/205.jpg

It's called cloud computing because the information being accessed is found in "the cloud" and does not require a user to be in a specific place to gain access to it. This type of system allows employees to work remotely. Companies providing cloud services enable users to store files and applications on remote servers, and then access all the data via the internet.

Cloud Computing Basics

Whether you are running applications that share photos to millions of mobile users or you're supporting the critical operations of your business, a cloud services platform provides rapid access to flexible and low cost IT resources. With cloud computing, you don't need to make large upfront investments in hardware and spend a lot of time on the heavy lifting of managing that hardware. Instead, you can provision exactly the right type and size of computing resources you need to power your newest bright idea or operate your IT department. You can access as many resources as you need, almost instantly, and only pay for what you use.

How Does Cloud Computing Work?

Cloud computing provides a simple way to access servers, storage, databases and a broad set of application services over the Internet. A Cloud services platform such as Amazon Web Services owns and maintains the network-connected hardware required for these application services, while you provision and use what you need via a web application.

Cloud Computing Characteristics and Benefits

Cloud computing boasts several attractive benefits for businesses and end users. Five of the main benefits of cloud computing are:

- **Self-service provisioning:** End users can spin up compute resources for almost any type of workload on demand. This eliminates the traditional need for IT administrators to provision and manage compute resources.
- **Elasticity:** Companies can scale up as computing needs increase and scale down again as demands decrease. This eliminates the need for massive investments in local infrastructure, which may or may not remain active.
- **Pay per use:** Compute resources are measured at a granular level, enabling users to pay only for the resources and workloads they use.



Source: http://www.net2source.com/wp-content/uploads/2017/10/cloud-computing-1024x855.jpg

- **Workload resilience:** Cloud service providers often implement redundant resources to ensure resilient storage and to keep users' important workloads running -- often across multiple global regions.
- **Migration flexibility:** Organizations can move certain workloads to or from the cloud -- or to different cloud platforms -- as desired or automatically for better cost savings or to use new services as they emerge.

Cloud Computing Deployment Models

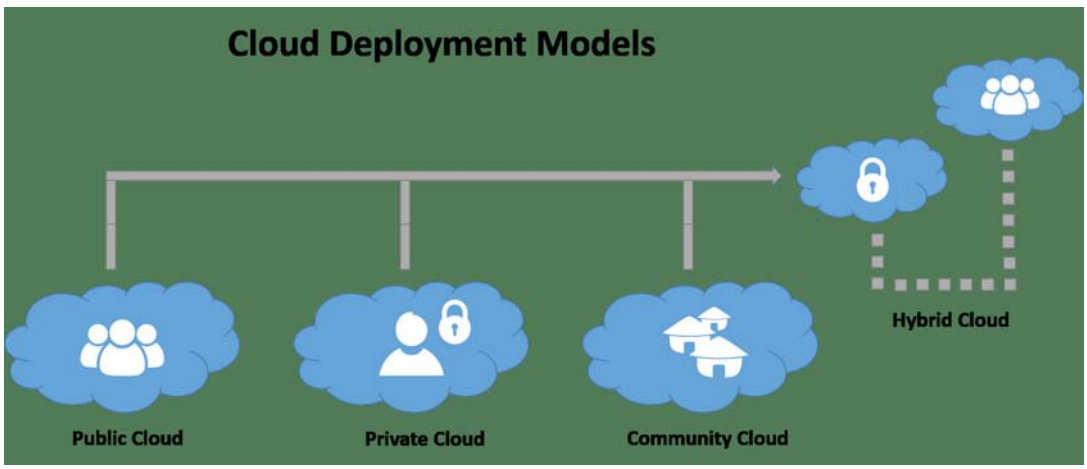
Cloud computing services can be private, public or hybrid.

Private cloud services are delivered from a business's data center to internal users. This model offers the versatility and convenience of the cloud, while preserving the management, control and security common to local data centers. Internal users may or may not be billed for services through IT chargeback.

Common private cloud technologies and vendors include VMware and OpenStack.

In the public cloud model, a third-party cloud service provider delivers the cloud service over the internet. Public cloud services are sold on demand, typically by the minute or hour, though long-term commitments are available for many services. Customers only pay for the CPU cycles, storage or bandwidth they consume.

Leading public cloud service providers include Amazon Web Services (AWS), Microsoft Azure, IBM and Google Cloud Platform.



Source: https://www.uniprint.net/wp-content/uploads/2017/05/Cloud-deployment-structures-diagram.png.pagespeed.ce.vkA8qJuES4.png

A hybrid cloud is a combination of public cloud services and an on-premises private cloud, with orchestration and automation between the two. Companies can run mission-critical workloads or sensitive applications on the private cloud and use the public cloud to handle workload bursts or spikes in demand.

The goal of a hybrid cloud is to create a unified, automated, scalable environment that takes advantage of all that a public cloud infrastructure can provide, while still maintaining control over mission-critical data.

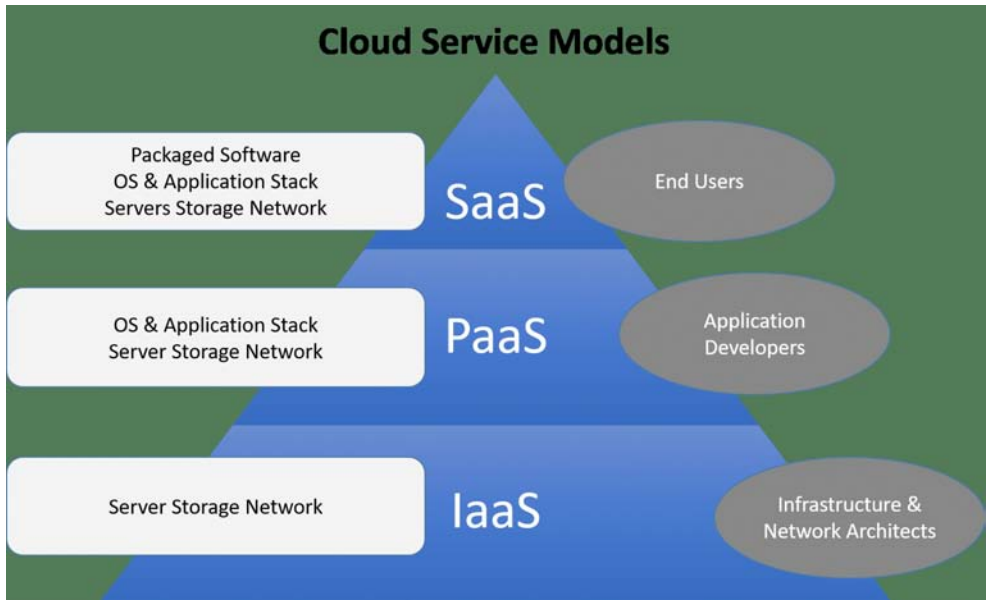
In addition, organizations are increasingly embracing a multicloud model, or the use of multiple infrastructure-as-a-service providers. This enables applications to migrate between different cloud providers or to even operate concurrently across two or more cloud providers.

Organizations adopt multicloud for various reasons. For example, they could do so to minimize the risk of a cloud service outage or to take advantage of more competitive pricing from a particular provider.

Multicloud implementation and application development can be a challenge because of the differences between cloud providers' services and application program interfaces (APIs). Multicloud deployments should become easier, however, as providers' services and APIs converge and become more homogeneous through industry initiatives such as the Open Cloud Computing Interface.

Different Types of Cloud Computing

Cloud computing is not a single piece of technology, like a microchip or a cell phone. Rather, it's a system, primarily comprised of three services: infrastructure as a service (IaaS), software as a service (SaaS)+ and platform as a service (PaaS). SaaS is expected to experience the fastest growth, followed by IaaS.



Source: https://www.uniprint.net/wp-content/uploads/2017/05/Cloud-service-models-diagram.png

- **Software as a Service (SaaS):** SaaS involves the licensure of a software application to customers. Licenses are typically provided through a pay-as-you-go model or on-demand. This rapidly growing market could provide an excellent investment opportunity, with a Goldman Sachs report projecting that by 2018, 59% of the total cloud workloads will be SaaS.
- **Infrastructure as a Service (IaaS):** Infrastructure as a service involves a method for delivering everything from operating systems to servers and storage through IP-based connectivity as part of an on-demand service. Clients can avoid the need to purchase software or servers, and instead procure these resources in an outsourced, on-demand service.
- **Platform as a Service (PaaS):** Of the three layers of cloud-based computing, PaaS is considered the most complex. PaaS shares some similarities with SaaS, the primary difference being that instead of delivering software online, it is actually a platform for creating software that is delivered via the internet. A report by Forrester indicates that PaaS solutions are expected to generate $44 billion in revenues by the year 2020.

Emerging Cloud Technologies and Services

Cloud providers are competitive, and they constantly expand their services to differentiate themselves. This has led public IaaS providers to offer far more than common compute and storage instances.

For example, serverless, or event-driven computing is a cloud service that executes specific functions, such as image processing and database updates. Traditional cloud deployments require users to establish a compute instance and load code into that instance. Then, the user decides how long to run -- and pay for -- that instance.

With serverless computing, developers simply create code, and the cloud provider loads and executes that code in response to real-world events, so users don't have to worry about the server or instance aspect of the cloud deployment. Users only pay for the number of transactions that the function executes. AWS Lambda, Google Cloud Functions and Azure Functions are examples of serverless computing services.

Public cloud computing also lends itself well to big data processing, which demands enormous compute resources for relatively short durations. Cloud providers have responded with big data services, including Google BigQuery for large-scale data warehousing and Microsoft Azure Data Lake Analytics for processing huge data sets.

Another crop of emerging cloud technologies and services relates to artificial intelligence (AI)and machine learning. These technologies build machine understanding, enable systems to mimic human understanding and respond to changes in data to benefit the business. Amazon Machine Learning, Amazon Lex,

Amazon Polly, Google Cloud Machine Learning Engine and Google Cloud Speech API are examples of these services.

Cloud Computing Security

Security remains a primary concern for businesses contemplating cloud adoption -- especially public cloud adoption. Public cloud service providers share their underlying hardware infrastructure between numerous customers, as public cloud is a multi-tenant environment. This environment demands copious isolation between logical compute resources. At the same time, access to public cloud storage and compute resources is guarded by account login credentials.



Source: https://outcoding.com/wp-content/uploads/2018/10/Cloud-Security-1.jpg

Many organizations bound by complex regulatory obligations and governance standards are still hesitant to place data or workloads in the public cloud for fear of outages, loss or theft. However, this resistance is fading, as logical isolation has proven reliable, and the addition of data encryption and various identity and access management tools has improved security within the public cloud.

Advantages of Cloud Computing

The rise of cloud-based software has offered companies from all sectors a number of benefits, including the ability to use software from any device, either via a

native app or a browser. As a result, users are able to carry over their files and settings to other devices in a completely seamless manner. Cloud computing is about far more than just accessing files on multiple devices, however. Thanks to cloud-computing services, users can check their email on any computer and even store files using services such as Dropbox and Google Drive. Cloud-computing services also make it possible for users to back up their music, files and photos, ensuring that those files are immediately available in the event of a hard drive crash.

Cloud computing offers big businesses some serious cost-saving potential. Before the cloud became a viable alternative, companies were required to purchase, construct and maintain costly information management technology and infrastructure. Now, instead of investing millions in huge server centers and intricate, global IT departments that require constant upgrades, a firm can use "lite" versions of workstations with lightning fast internet connections, and the workers will interact with the cloud online to create presentations, spreadsheets and interact with company software.



Source: https://www.roarsinc.com/wp-content/uploads/2018/06/technology-consulting-firm.jpg

Individuals find that when they upload photos, documents, and videos to the cloud and then retrieve them at their convenience, it saves storage space on their desk tops or laptops. Additionally, the cloud-like structure allows users to upgrade software more quickly – because software companies can offer their products via the web rather than through more traditional, tangible methods involving discs or flash drives. In 2013, Adobe Systems announced all subsequent versions

of Photoshop, as well as other components of its Creative Suite, would only be available through an internet-based subscription. This allows users to download new versions and fixes to their programs easily.

Disadvantages of Cloud Computing

With all of the speed, efficiencies and innovations of cloud computing come risks.

Initially, security was seen as a detractor from using the cloud, especially when it came to sensitive medical records and financial information. While regulations are forcing cloud computing services to shore up their security and compliance measures, it remains an ongoing issue. Media headlines are constantly screaming about data breaches at this or that company, in which sensitive information has made its way into the hands of malicious hackers who may delete, manipulate or otherwise exploit the data (though, according to some reports, most of the data breeches have been with on-site systems, not those in the cloud). Encryption protects vital information, but if the encryption key is lost, the data disappears.

Servers maintained by cloud computing companies can fall victim to a natural disasters, internal bugs and power outages, too. And unfortunately, the geographical reach of cloud computing cuts both ways: A blackout in California could paralyze users In New York; a firm in Texas could lose its data if something causes its Maine-based provider to crash.

Ultimately, as with any new technology, there is a learning curve for employees and managers. But with many individuals accessing and manipulating information through a single portal, inadvertent mistakes can transfer across an entire system.

REFERENCES

1. Barrie JM Presti DE . 1996 . The World Wide Web as an instructional tool . Science 274 : 371 – 372 . Available at http://science-mag.aaas.org/science/scripts/display/full/274/5286/371.html
2. Best Price Computers, "Infrastructure as a Service," Best Price Computers, http://www.bestpricecomputers.co.uk/glossary/infrastructure-as-a-service.htm (accessed November 15, 2011).
3. Dictionary.com, "Cloud," Dictionary.com, http://dictionary.reference.com/browse/cloud (accessed November 15, 2011).
4. Eve, J., "Cloud Computing as a Security Asset," Indian Gaming, www.indiangaming.com/istore/Apr11_JosephEve.pdf (accessed November 16, 2011), 60-61.
5. Gil, P., "What Is Cloud Computing?," About.com, http://netforbeginners.about.com/od/c/f/cloudcomputing.htm (accessed November 15, 2011).
6. https://academic.oup.com/ilarjournal/article/38/4/162/656416
7. https://fcit.usf.edu/network/chap1/chap1.htm
8. https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT
9. https://searchcloudcomputing.techtarget.com/definition/cloud-computing
10. https://searchnetworking.techtarget.com/definition/network
11. https://www.cloudwards.net/what-is-the-internet-of-things/
12. https://www.investopedia.com/terms/c/cloud-computing.asp
13. https://www.techopedia.com/definition/5217/world-wide-web-www
14. https://www.techopedia.com/definition/5537/network
15. https://www.theserverside.com/feature/The-best-web-programming-languages-for-development
16. https://www.tutorialspoint.com/webservices/what_are_web_services.htm
17. https://www.webopedia.com/quick_ref/network-fundamentals-study-guide.html
18. Lohr, S., "Amazon's Trouble Raises Cloud Computing Doubts," *The New York Times*, April 22, 2011, http://www.nytimes.com/2011/04/23/technology/23cloud.html?_r=1 (accessed November 16, 2011).
19. Pinola, M., "What Is Cloud Computing?," About.com, http://mobileoffice.about.com/od/workingontheroad/f/cloudcomputing.htm (accessed November 15, 2011).
20. Salesforce.com, "Caesars Entertainment Hits the Efficiency Jackpot with Force.com," Salesforce.com, http://www.salesforce.com/showcase/stories/caesars.jsp (accessed November 16, 2011).

21. Thrive Networks, "Software as a Service/ Infrastructure as a Service," Thrive Networks, March 2009, http://www.thrivenetworks.com/resources/march-2009-software-as-a-service.html (accessed November 15, 2001).

CHAPTER 6

BUSINESS INTELLIGENCE AND ANALYTICS



INTRODUCTION

BI (Business Intelligence) is a set of processes, architectures, and technologies that convert raw data into meaningful information that drives profitable business actions. It is a suite of software and services to transform data into actionable intelligence and knowledge.

BI has a direct impact on organization's strategic, tactical and operational business decisions. BI supports fact-based decision making using historical data rather than assumptions and gut feeling.

BI tools perform data analysis and create reports, summaries, dashboards, maps, graphs, and charts to provide users with detailed intelligence about the nature of the business.



Source: http://greenbookblog.org/wp-content/uploads/2015/03/Business-Intelligence.jpg

Business intelligence and analytics (BI&A) describes the technologies, systems, practices, methodologies, and applications used to analyze large amounts of diverse business data to help organizations make sound and timely business decisions. A variety of BI&A tools exist to transform raw data into valuable information that can be used at all levels of organizations to help make business decisions. These Decision Support Systems (DSS) use computer power and analytical algorithms to convert immeasurable amounts of raw data into meaningful information to support enterprise-wide decision-making. Visual Business Intelligence or simply 'Data Visualization' helps users quickly make sense of mass data by presenting it in visual form.

BASICS OF BUSINESS INTELLIGENCE

The term Business Intelligence (BI) refers to technologies, applications and practices for the collection, integration, analysis, and presentation of business information. The purpose of Business Intelligence is to support better business decision making. Essentially, Business Intelligence systems are data-driven Decision Support Systems (DSS). Business Intelligence is sometimes used interchangeably with briefing books, report and query tools and executive information systems.



Source: https://www.btelligent.com/fileadmin/_processed_/0/0/csm_business-intelligence_b137e16154.jpg

Business Intelligence vs. Data Analytics

Sporadic use of the term *business intelligence* dates back to at least the 1860s, but consultant Howard Dresner is credited with first proposing it in 1989 as an umbrella phrase for applying data analysis techniques to support business decision-making processes. What came to be known as BI tools evolved from earlier, often mainframe-based analytical systems, such as decision support systems and executive information systems.

Business intelligence is sometimes used interchangeably with business analytics; in other cases, business analytics is used either more narrowly to refer to advanced data analytics or more broadly to include both BI and advanced analytics.

Importance of Business Intelligence Tools or Software Solutions

Business Intelligence systems provide historical, current, and predictive views of business operations, most often using data that has been gathered into a data warehouse or a data mart and occasionally working from operational data.

Software elements support reporting, interactive "slice-and-dice" pivot-table analyses, visualization, and statistical data mining. Applications tackle sales, production, financial, and many other sources of business data for purposes that include business performance management. Information is often gathered about other companies in the same industry which is known as benchmarking.

Types of BI Tools

Business intelligence combines a broad set of data analysis applications, including ad hoc analytics and querying, enterprise reporting, online analytical processing (OLAP), mobile BI, real-time BI, operational BI, cloud and software-as-a-service BI, open source BI, collaborative BI, and location intelligence.

BI technology also includes data visualization software for designing charts and other infographics, as well as tools for building BI dashboards and performance scorecards that display visualized data on business metrics and key performance indicators in an easy-to-grasp way.



Source: https://www.mojix.com/wp-content/uploads/2018/09/Operational-Intelligence.jpg

Data visualization tools have become the standard of modern BI in recent years. A couple leading vendors defined the technology early on, but more traditional BI vendors have followed in their path. Now, virtually every major BI tool incorporates features of visual data discovery.

BI programs may also incorporate forms of advanced analytics, such as data mining, predictive analytics, text mining, statistical analysis and big data analytics.

In many cases, though, advanced analytics projects are conducted and managed by separate teams of data scientists, statisticians, predictive modelers and other skilled analytics professionals, while BI teams oversee more straightforward querying and analysis of business data.

Business intelligence data is typically stored in a data warehouse or in smaller data marts that hold subsets of a company's information. In addition, Hadoop systems are increasingly being used within BI architectures as repositories or landing pads for BI and analytics data -- especially for unstructured data, log files, sensor data and other types of big data.

Before it's used in BI applications, raw data from different source systems must be integrated, consolidated and cleansed using data integration and data quality tools to ensure that users are analyzing accurate and consistent information.

Business Intelligence Trends

Currently organizations are starting to see that data and content should not be considered separate aspects of information management, but instead should be managed in an integrated enterprise approach. Enterprise information management brings Business Intelligence and Enterprise Content Management together. Currently organizations are moving towards Operational Business Intelligence which is currently under served and uncontested by vendors. Traditionally, Business Intelligence vendors are targeting only top the pyramid but now there is a paradigm shift moving toward taking Business Intelligence to the bottom of the pyramid with a focus of self-service business intelligence.



Source: https://www.nextecgroup.com/wp-content/uploads/2016/12/BI-Trend_iStock-519261614.jpg

Self-Service Business Intelligence (SSBI)

Self-service business intelligence (SSBI) involves the business systems and data analytics that give business end-users access to an organization's information without direct IT involvement. Self-service Business intelligence gives end-users the ability to do more with their data without necessarily having technical skills. These solutions are usually created to be flexible and easy-to-use so that end-users can analyze data, make decisions, plan and forecast on their own. Companies such as PARIS Technologies have taken an approach to making Business Intelligence an easily integrated tool for other end-user tools such as Microsoft Excel, Access, Web browsers and other vendors.

BI for Big Data

BI platforms are increasingly being used as front-end interfaces for big data systems. Modern BI software typically offers flexible back ends, enabling them to connect to a range of data sources. This, along with simple user interfaces, makes the tools a good fit for big data architectures. Users can connect to a range of data sources, including Hadoop systems, NoSQL databases, cloud platforms and more conventional data warehouses, and can develop a unified view of their diverse data.

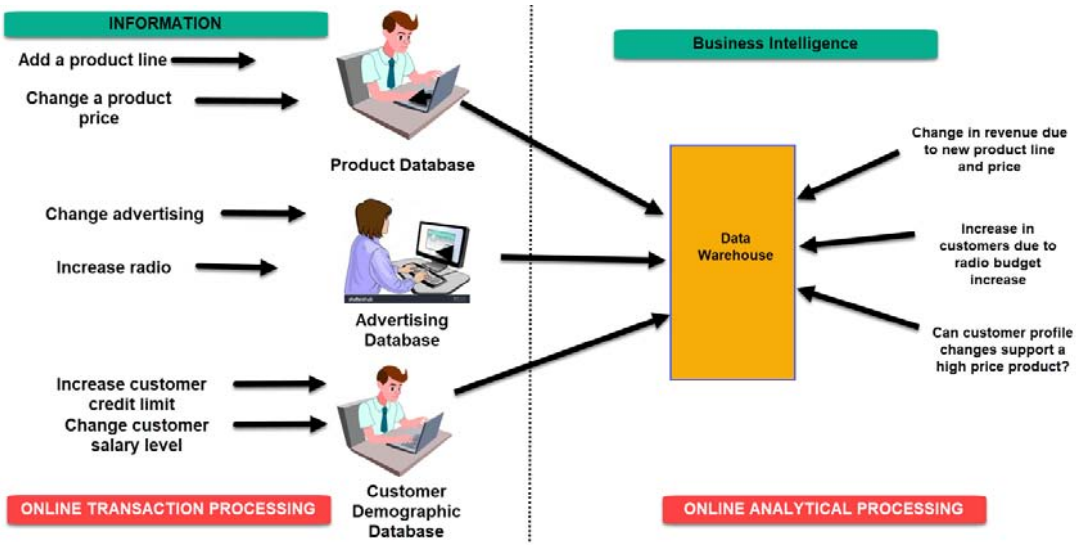


Source: http://frontierconnect.me/wp-content/uploads/2017/05/big_data.jpg

Because the tools are typically fairly simple, using BI as a big data front end enables a broad number of potential users to get involved rather than the typical approach of highly specialized data architects being the only ones with visibility into data.

Examples of Business Intelligence System used in Practice

Example 1:



Source: https://www.guru99.com/business-intelligence-definition-example.html

In an Online Transaction Processing (OLTP) system information that could be fed into product database could be

- add a product line
- change a product price

Correspondingly, in a Business Intelligence system query that would be executed for the product subject area could be did the addition of new product line or change in product price increase revenues

In an advertising database of OLTP system query that could be executed

- Changed in advertisement options
- Increase radio budget

Correspondingly, in BI system query that could be executed would be how many new clients added due to change in radio budget

In OLTP system dealing with customer demographic data bases data that could be fed would be

- increase customer credit limit
- change in customer salary level

Correspondingly in the OLAP system query that could be executed would be can customer profile changes support higher product price

Example 2:

A hotel owner uses BI analytical applications to gather statistical information regarding average occupancy and room rate. It helps to find aggregate revenue generated per room.

It also collects statistics on market share and data from customer surveys from each hotel to decides its competitive position in various markets.

By analyzing these trends year by year, month by month and day by day helps management to offer discounts on room rentals.

Example 3:

A bank gives branch managers access to BI applications. It helps branch manager to determine who are the most profitable customers and which customers they should work on.

The use of BI tools frees information technology staff from the task of generating analytical reports for the departments. It also gives department personnel access to a richer data source.

Four Types of BI Users

Following given are the four key players who are used Business Intelligence System:

- The Professional Data Analyst: The data analyst is a statistician who always needs to drill deep down into data. BI system helps them to get fresh insights to develop unique business strategies.
- The IT users: The IT user also plays a dominant role in maintaining the BI infrastructure.
- The head of the company: CEO or CXO can increase the profit of their business by improving operational efficiency in their business.



Source: https://edkentmedia.com/wp-content/uploads/2017/08/web-marketing-analytics.jpg

- The Business Users: Business intelligence users can be found from across the organization. There are mainly two types of business users
  - Casual business intelligence user
  - The power user.

The difference between both of them is that a power user has the capability of working with complex data sets, while the casual user need will make him use dashboards to evaluate predefined sets of data.

Advantages of Business Intelligence

Here are some of the advantages of using Business Intelligence System:

- Boost productivity: With a BI program, It is possible for businesses to create reports with a single click thus saves lots of time and resources. It also allows employees to be more productive on their tasks.
- To improve visibility: BI also helps to improve the visibility of these processes and make it possible to identify any areas which need attention.
- Fix Accountability: BI system assigns accountability in the organization as there must be someone who should own accountability and ownership for the organization's performance against its set goals.



Source: https://static1.squarespace.com/static/55a525afe4b0db2c664c9401/t/5661caa7e4b089980fd092c3/1449249451238/Triage_Difference-03-Business_Intelligence.jpg?format=1500w

- It gives a bird's eye view: BI system also helps organizations as decision makers get an overall bird's eye view through typical BI features like dashboards and scorecards.
- It streamlines business processes: BI takes out all complexity associated with business processes. It also automates analytics by offering predictive analysis, computer modeling, benchmarking and other methodologies.
- It allows for easy analytics: BI software has democratized its usage, allowing even nontechnical or non-analysts users to collect and process data quickly. This also allows putting the power of analytics from the hand's many people.

BI System Disadvantages

Here are some of the disadvantages of using Business Intelligence System:

- Cost: Business intelligence can prove costly for small as well as for medium-sized enterprises. The use of such type of system may be expensive for routine business transactions.
- Complexity: Another drawback of BI is its complexity in implementation of data warehouse. It can be so complex that it can make business techniques rigid to deal with.
- Limited use: Like all improved technologies, BI was first established keeping in consideration the buying competence of rich firms. Therefore, BI system is yet not affordable for many small and medium size companies.

- Time Consuming Implementation: It takes almost one and half year for data warehousing system to be completely implemented. Therefore, it is a time-consuming process.

UNDERSTANDING BUSINESS INTELLIGENCE AND ANALYTICS

One of the most common questions asked is: what is the difference between Business Intelligence and Business Analytics (BA)? Are the two invariably the same? Are they? Are BI and BA overlapping concepts?

Well, the answer is both yes and no. Business Intelligence and Analytics are two related terms, which are invariably related.

Business Intelligence is analyzing organizational raw data to support decision-making processes.

Business Analytics uses quantitative data for predictive modeling and forecasting.

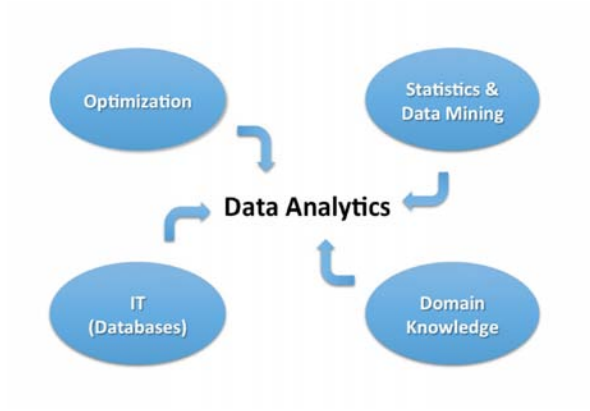
Business Intelligence is a generic term which means using data (both structured and unstructured) from various sources and then analyzing it. Business Analytics, on another hand, is responsible for defining KPIs and building the reporting platforms that deliver them. Business Analysts often perform ad hoc analyses on specific scenarios for a product or functional groups. Most organizations have dedicated Business Analysts sitting in product groups or working in close liaison with the product and management layers in the company hierarchy.

Business Analytics and Business Intelligence are two inter-linked concepts. Business Intelligence is an umbrella term that encompasses BA. Business Analytics lies at the heart of BI that does not include the actual business decision making, but the steps that lead up to the decision making.

The raw data of an organization is analyzed to extract meaningful information. At this point, a Business Analyst's work begins. He uses his data insights to access and data and gives out predictive analyses for future improvements. Business Intelligence, on the other hand, helps a company apply the key metrics to huge raw and unstructured datasets to further analyze and deduce predictive performances.

Business Intelligence Architecture

Business Intelligence Architecture is defined as a framework for organizing the data, information management and technology components that are used to build Business Intelligence systems for reporting and data analytics.

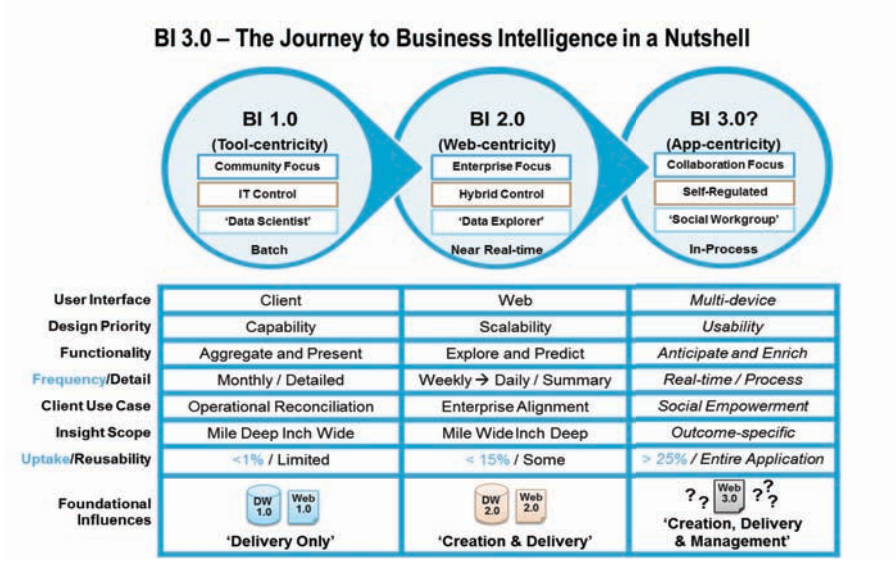


Source: http://www.dataanalytics.ugent.be/DataAnalytics_Graphic2.jpg

The data components of a BI architecture include the data sources that company executives and other business stakeholders need to access and analyze to meet their business requirements. Some of the important criteria in the source selection process include data currency, data quality and the level of detail in the data. Both structured and unstructured data are required as part of a Business Intelligence architecture, just as information from both internal and external sources.

BI&A Evolution: Key Characteristics and Capabilities

The term intelligence has been used by researchers in artificial intelligence since the 1950s. Business intelligence became a popular term in the business and IT communities only in the 1990s.



Source: https://www.capgemini.com/wp-content/uploads/2017/07/BI-3.01.png

In the late 2000s, business analytics was introduced to represent the key analytical component in BI. More recently big data and big data analytics have been used to describe the data sets and analytical techniques in applications that are so large (from terabytes to exabytes) and complex (from sensor to social media data) that they require advanced and unique data storage, management, analysis, and visualization technologies.

BI&A 1.0

As a data-centric approach, BI&A has its roots in the longstanding database management field. It relies heavily on various data collection, extraction, and analysis technologies. The BI&A technologies and applications currently adopted in industry can be considered as BI&A 1.0, where data are mostly structured, collected by companies through various legacy systems, and often stored in commercial relational database management systems (RDBMS). The analytical techniques commonly used in these systems, popularized in the 1990s, are grounded mainly in statistical methods developed in the 1970s and data mining techniques developed in the 1980s.

Data management and warehousing is considered the foundation of BI&A 1.0. Design of data marts and tools for extraction, transformation, and load (ETL) are essential for converting and integrating enterprise-specific data. Database query, online analytical processing (OLAP), and reporting tools based on intuitive, but simple, graphics are used to explore important data characteristics. Business performance management (BPM) using scorecards and dashboards help analyze and visualize a variety of performance metrics. In addition to these well-established business reporting functions, statistical analysis and data mining techniques are adopted for association analysis, data segmentation and clustering, classification and regression analysis, anomaly detection, and predictive modeling in various business applications. Most of these data processing and analytical technologies have already been incorporated into the leading commercial BI platforms offered by major IT vendors including Microsoft, IBM, Oracle, and SAP.

Among the 13 capabilities considered essential for BI platforms, the following eight are considered BI&A 1.0: reporting, dashboards, ad hoc query, search-based BI, OLAP, interactive visualization, scorecards, predictive modeling, and data mining. A few BI&A 1.0 areas are still under active development based on the Gartner BI Hype Cycle analysis for emerging BI technologies, which include data mining workbenchs, column-based DBMS, in-memory DBMS, and realtime decision tools. Academic curricula in Information Systems (IS) and Computer Science (CS) often include well-structured courses such as database management systems, data mining, and multivariate statistics.

BI&A 2.0

Since the early 2000s, the Internet and the Web began to offer unique data collection and analytical research and development opportunities. The HTTP-based Web

1.0 systems, characterized by Web search engines such as Google and Yahoo and e-commerce businesses such as Amazon and eBay, allow organizations to present their businesses online and interact with their customers directly. In addition to porting their traditional RDBMS-based product information and business contents online, detailed and IP-specific user search and interaction logs that are collected seamlessly through cookies and server logs have become a new gold mine for understanding customers' needs and identifying new business opportunities. Web intelligence, web analytics, and the user-generated content collected through Web 2.0-based social and crowd-sourcing systems have ushered in a new and exciting era of BI&A 2.0 research in the 2000s, centered on text and web analytics for unstructured web contents.

An immense amount of company, industry, product, and customer information can be gathered from the web and organized and visualized through various text and web mining techniques. By analyzing customer clickstream data logs, web analytics tools such as Google Analytics can provide a trail of the user's online activities and reveal the user's browsing and purchasing patterns. Web site design, product placement optimization, customer transaction analysis, market structure analysis, and product recommendations can be accomplished through web analytics. The many Web 2.0 applications developed after 2004 have also created an abundance of user-generated content from various online social media such as forums, online groups, web blogs, social networking sites, social multimedia sites (for photos and videos), and even virtual worlds and social games. In addition to capturing celebrity chatter, references to everyday events, and socio-political sentiments expressed in these media, Web 2.0 applications can efficiently gather a large volume of timely feedback and opinions from a diverse customer population for different types of businesses.

Many marketing researchers believe that social media analytics presents a unique opportunity for businesses to treat the market as a "conversation" between businesses and customers instead of the traditional business-to-customer, one-way "marketing". Unlike BI&A 1.0 technologies that are already integrated into commercial enterprise IT systems, future BI&A 2.0 systems will require the integration of mature and scalable techniques in text mining (e.g., information extraction, topic identification, opinion mining, question-answering), web mining, social network analysis, and spatial-temporal analysis with existing DBMS-based BI&A 1.0 systems.

Except for basic query and search capabilities, no advanced text analytics for unstructured content are currently considered in the 13 capabilities of the Gartner BI platforms. Several, however, are listed in the Gartner BI Hype Cycle, including information semantic services, natural language question answering, and content/text analytics. New IS and CS courses in text mining and web mining have emerged to address needed technical training.

BI&A 3.0

Whereas web-based BI&A 2.0 has attracted active research from academia and industry, a new research opportunity in BI&A 3.0 is emerging. The number of mobile phones and tablets (about 480 million units) surpassed the number of laptops and PCs (about 380 million units) for the first time in 2011. Although the number of PCs in use surpassed 1 billion in 2008, the same article projected that the number of mobile connected devices would reach 10 billion in 2020. Mobile devices such as the iPad, iPhone, and other smart phones and their complete ecosystems of downloadable applications, from travel advisories to multi-player games, are transforming different facets of society, from education to healthcare and from entertainment to governments. Other sensor-based Internet-enabled devices equipped with RFID, barcodes, and radio tags (the "Internet of Things") are opening up exciting new steams of innovative applications. The ability of such mobile and Internet-enabled devices to support highly mobile, location-aware, person-centered, and context-relevant operations and transactions will continue to offer unique research challenges and opportunities throughout the 2010s. Mobile interface, visualization, and HCI (human–computer interaction) design are also promising research areas. Although the coming of the Web 3.0 (mobile and sensor-based) era seems certain, the underlying mobile analytics and location and context-aware techniques for collecting, processing, analyzing and visualizing such large-scale and fluid mobile and sensor data are still unknown.

No integrated, commercial BI&A 3.0 systems are foreseen for the near future. Most of the academic research on mobile BI is still in an embryonic stage. Although not included in the current BI platform core capabilities, mobile BI has been included in the Gartner BI Hype Cycle analysis as one of the new technologies that has the potential to disrupt the BI market significantly. The uncertainty associated with BI&A 3.0 presents another unique research direction for the IS community Table 1 summarizes the key characteristics of BI&A 1.0, 2.0, and 3.0 in relation to the Gartner BI platforms core capabilities and hype cycle.

Table 1: BI&A Evolution: Key Characteristics and Capabilities

	Key Characteristics	**Gartner BI Platforms Core Capabilities**	**Gartner Hype Cycle**
BI&A 1.0	DBMS-based, structured content • RDBMS & data warehousing • ETL & OLAP • Dashboards & scorecards • Data mining & statistical analysis	• Ad hoc query & search-based BI • Reporting, dashboards & scorecards • OLAP • Interactive visualization • Predictive modeling & data mining	• Column-based DBMS • In-memory DBMS • Real-time decision • Data mining workbenches

BI&A 2.0	Web-based, unstructured content • Information retrieval and extraction • Opinion mining • Question answering • Web analytics and web intelligence • Social media analytics • Social network analysis • Spatial-temporal analysis		• Information semantic services • Natural language question answering • Content & text analytics
BI&A 3.0	Mobile and sensor-based content • Location-aware analysis • Person-centered analysis • Context-relevant analysis • Mobile visualization & HCI		• Mobile BI

The decade of the 2010s promises to be an exciting one for high-impact BI&A research and development for both industry and academia. The business community and industry have already taken important steps to adopt BI&A for their needs. The IS community faces unique challenges and opportunities in making scientific and societal impacts that are relevant and long-lasting. IS research and education programs need to carefully evaluate future directions, curricula, and action plans, from BI&A 1.0 to 3.0.

BI&A Research Framework: Foundational Technologies and Emerging Research in Analytics

The opportunities with the abovementioned emerging and high-impact applications have generated a great deal of excitement within both the BI&A industry and the research community. Whereas industry focuses on scalable and integrated systems and implementations for applications in different organizations, the academic community needs to continue to advance the key technologies in analytics.



Source: http://www.analyticsinsight.net/wp-content/uploads/2017/09/BIs.jpg

Emerging analytics research opportunities can be classified into five critical technical areas—(big) data analytics, text analytics, web analytics, network analytics, and mobile analytics—all of which can contribute to to BI&A 1.0, 2.0, and 3.0. The classification of these five topic areas is intended to highlight the key characteristics of each area; however, a few of these areas may leverage similar underlying technologies. In each analytics area we present the foundational technologies that are mature and well developed and suggest selected emerging research areas (see Table 2).

Table 2: BI&A Research Framework: Foundational Technologies and Emerging Research in Analytics

	(Big) Data Analytics	**Text Analytics**	**Web Analytics**	**Network Analytics**	**Mobile Analytics**
Foundational Technologies	• RDBMS • data warehousing • ETL • OLAP • BPM • data mining • clustering • regression • classification • association analysis • anomaly detection • neural networks • genetic algorithms • multivariate statistical analysis • optimization • heuristic search	• information retrieval • document representation • query processing • relevance feedback • user models • search engines • enterprise search systems	• information retrieval • computational linguistics • search engines • web crawling • web site ranking • search log analysis • recommender systems • web services • mashups	• bibliometric analysis • citation network • co-authorship network • social network theories • network metrics and topology • mathematical network models • network visualization	• web services • smartphone platforms
Emerging Research	• statistical machine learning • sequential and temporal mining • spatial mining • mining high-speed data streams and sensor data • process mining • privacy-preserving data mining • network mining • web mining • column-based DBMS • in-memory DBMS • parallel DBMS • cloud computing • Hadoop • MapReduce	• statistical NLP • information extraction • topic models • question-answering systems • opinion mining • sentiment/affect analysis • web stylometric analysis • multilingual analysis • text visualization • multimedia IR • mobile IR • Hadoop • MapReduce	• cloud services • cloud computing • social search and mining • reputation systems • social media analytics • web visualization • web-based auctions • internet monetization • social marketing • web privacy/ security	• link mining • community detection • dynamic network modeling • agent-based modeling • social influence and information diffusion models • ERGMs • virtual communities • criminal/dark networks • social/political analysis • trust and reputation	• mobile web services • mobile pervasive apps • mobile sensing apps • mobile social innovation • mobile social networking • mobile visualization/HCI • personalization and behavioral modeling • gamification • mobile advertising and marketing

(Big) Data Analytics

Data analytics refers to the BI&A technologies that are grounded mostly in data mining and statistical analysis. As mentioned previously, most of these techniques rely on the mature commercial technologies of relational DBMS, data warehousing, ETL, OLAP, and BPM. Since the late 1980s, various data mining algorithms have been developed by researchers from the artificial intelligence, algorithm, and database communities. In the IEEE 2006 International Conference on Data Mining (ICDM), the 10 most influential data mining algorithms were identified based on expert nominations, citation counts, and a community survey. In ranked order, they are C4.5, k-means, SVM (support vector machine), Apriori, EM (expectation maximization), PageRank, AdaBoost, kNN (k-nearest neighbors), Naïve Bayes, and CART. These algorithms cover classification, clustering, regression, association analysis, and network analysis. Most of these popular data mining algorithms have been incorporated in commercial and open source data mining systems. Other advances such as neural networks for classification/prediction and clustering and genetic algorithms for optimization and machine learning have all contributed to the success of data mining in different applications.



Source: https://cdn-images-1.medium.com/max/1440/1*_SntDHfN27PbWQZGjuvEtg.png

Two other data analytics approaches commonly taught in business school are also critical for BI&A. Grounded in statistical theories and models, multivariate statistical analysis covers analytical techniques such as regression, factor analysis, clustering, and discriminant analysis that have been used successfully in various business applications. Developed in the management science community, optimization techniques and heuristic search are also suitable for selected BI&A problems such as database feature selection and web crawling/ spidering. Most of these techniques can be found in business school curricula.

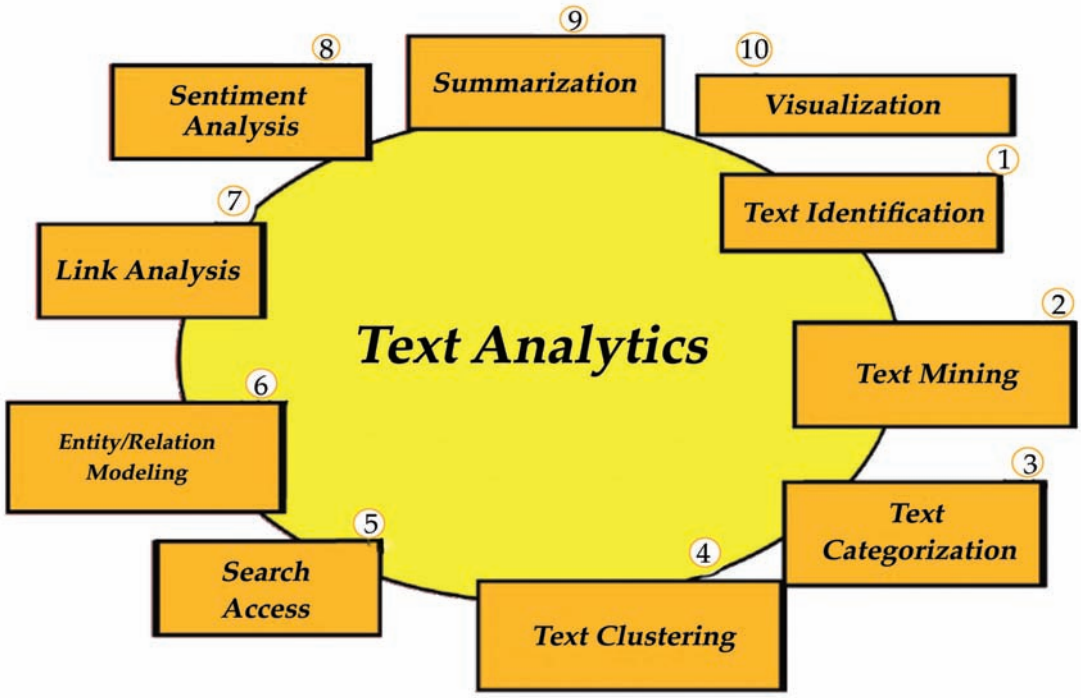
Due to the success achieved collectively by the data mining and statistical analysis community, data analytics continues to be an active area of research. Statistical machine learning, often based on well-grounded mathematical models and powerful algorithms, techniques such as Bayesian networks, Hidden Markov models, support vector machine, reinforcement learning, and ensemble models, have been applied to data, text, and web analytics applications. Other new data analytics techniques explore and leverage unique data characteristics, from sequential/temporal mining and spatial mining, to data mining for high-speed data streams and sensor data. Increased privacy concerns in various e-commerce, e-government, and healthcare applications have caused privacy preserving data mining to become an emerging area of research. Many of these methods are data-driven, relying on various anonymization techniques, while others are process driven, defining how data can be accessed and used. Over the past decade, process mining has also emerged as a new research field that focuses on the analysis of processes using event data. Process mining has become possible due to the availability of event logs in various industries (e.g., healthcare, supply chains) and new process discovery and conformance checking techniques. Furthermore, network data and web content have helped generate exciting research in network analytics and web analytics, which are presented below.

In addition to active academic research on data analytics, industry research and development has also generated much excitement, especially with respect to big data analytics for semi-structured content. Unlike the structured data that can be handled repeatedly through a RDBMS, semi-structured data may call for ad hoc and one-time extraction, parsing, processing, indexing, and analytics in a scalable and distributed MapReduce or Hadoop environment. MapReduce has been hailed as a revolutionary new platform for large-scale, massively parallel data access. Inspired in part by MapReduce, Hadoop provides a Java based software framework for distributed processing of data intensive transformation and analytics. The top three commercial database suppliers—Oracle, IBM, and Microsoft— have all adopted Hadoop, some within a cloud infrastructure. The open source Apache Hadoop has also gained significant traction for business analytics, including Chukwa for data collection, HBase for distributed data storage, Hive for data summarization and ad hoc querying, and Mahout for data mining.

Text Analytics

A significant portion of the unstructured content collected by an organization is in textual format, from e-mail communication and corporate documents to web pages and social media content. Text analytics has its academic roots in information retrieval and computational linguistics. In information retrieval, document representation and query processing are the foundations for developing the vector-space model, Boolean retrieval model, and probabilistic retrieval model, which in turn, became the basis for the modern digital libraries, search engines, and enterprise search systems (Salton 1989). In computational linguistics, statistical natural language processing (NLP) techniques for lexical acquisition, word sense

disambiguation, part-of-speech-tagging (POST), and probabilistic context-free grammars have also become important for representing text. In addition to document and query representations, user models and relevance feedback are also important in enhancing search performance.



Source: http://oralhistory.eu/images/tech/textanalytics.png

Since the early 1990s, search engines have evolved into mature commercial systems, consisting of fast, distributed crawling; efficient inverted indexing; inlink-based page ranking; and search logs analytics. Many of these foundational text processing and indexing techniques have been deployed in text-based enterprise search and document management systems in BI&A 1.0.

Web Analytics

Over the past decade, web analytics has emerged as an active field of research within BI&A. Building on the data mining and statistical analysis foundations of data analytics and on the information retrieval and NLP models in text analytics, web analytics offers unique analytical challenges and opportunities. HTTP/HTML-based hyperlinked web sites and associated web search engines and directory systems for locating web content have helped develop unique Internet-based technologies for web site crawling/spidering, web page updating, web site ranking, and search log analysis. Web log analysis based on customer transactions has subsequently turned into active research in recommender systems. However, web analytics has

become even more exciting with the maturity and popularity of web services and Web 2.0 systems in the mid-2000s.

Based on XML and Internet protocols (HTTP, SMTP), web services offer a new way of reusing and integrating third party or legacy systems. New types of web services and their associated APIs (application programming interface) allow developers to easily integrate diverse content from different web-enabled system, for example, REST (representational state transfer) for invoking remote services, RSS (really simple syndication) for news "pushing," JSON (JavaScript object notation) for lightweight data-interchange, and AJAX (asynchronous JavaScript + XML) for data interchange and dynamic display. Such lightweight programming models support data syndication and notification and "mashups" of multimedia content (e.g., Flickr, Youtube, Google Maps) from different web sources—a process somewhat similar to ETL (extraction, transformation, and load) in BI&A 1.0. Most of the e-commerce vendors have provided mature APIs for accessing their product and customer content. For example, through Amazon Web Services, developers can access product catalog, customer reviews, site ranking, historical pricing, and the Amazon Elastic Compute Cloud (EC2) for computing capacity. Similarly, Google web APIs support AJAX search, Map API, GData API (for Calendar, Gmail, etc.), Google Translate, and Google App Engine for cloud computing resources. Web services and APIs continue to provide an exciting stream of new data sources for BI&A 2.0 research.



Source: http://gssind.in/blog/wp-content/uploads/2017/12/7-1.jpg

A major emerging component in web analytics research is the development of cloud computing platforms and services, which include applications, system software, and hardware delivered as services over the Internet. Based on service oriented architecture (SOA), server virtualization, and utility computing, cloud computing can be offered as software as a service (SaaS), infrastructure as a service (IaaS), or platform as a service (PaaS). Only a few leading IT vendors are currently positioned to support high-end, high-throughput BI&A applications using cloud computing.

For example, Amazon Elastic Compute Cloud (EC2) enables users to rent virtual computers on which to run their own computer applications. Its Simple Storage Service (S3) provides online storage web service. Google App Engine provides a platform for developing and hosting Java or Python-based web applications. Google Bigtable is used for backend data storage. Microsoft's Windows Azure platform provides cloud services such as SQL Azure and SharePoint, and allows .Net framework applications to run on the platform. The industry-led web and cloud services offer unique data collection, processing, and analytics challenges for BI&A researchers.

Network Analytics

Network analytics is a nascent research area that has evolved from the earlier citation-based bibliometric analysis to include new computational models for online community and social network analysis. Grounded in bibliometric analysis, citation networks and co-authorship networks have long been adopted to examine scientific impact and knowledge diffusion. The h-index is a good example of a citation metric. Since the early 2000s, network science has begun to advance rapidly with contributions from sociologists, mathematicians, and computer scientists. Various social network theories, network metrics, topology, and mathematical models have been developed that help understand network properties and relationships (e.g., centrality, betweenness, cliques, paths; ties, structural holes, structural balance; random network, small-world network, scale-free network).



Source: https://3c1703fe8d.site.internapcdn.net/newman/gfx/news/hires/2016/towardtheiot.jpg

Mobile Analytics

As an effective channel for reaching many users and as a means of increasing the productivity and efficiency of an organization's workforce, mobile computing is viewed by respondents of the recent IBM technology trends survey as the second most "in demand" area for software development. Mobile BI was also considered by the Gartner BI Hype Cycle analysis as one of the new technologies that have the potential to drastically disrupt the BI market. According to eMarketer, the market for mobile ads is expected to explode, soaring from an estimated $2.6 billion in 2012 to $10.8 billion in 2016.

Mobile computing offers a means for IT professional growth as more and more organizations build applications. With its large and growing global install base, Android has been ranked as the top mobile platform since 2010. This open source platform, based on Java and XML, offers a much shorter learning curve and this contributes to its popularity with IT professionals: 70 percent of the IBM survey respondents planned to use Android as their mobile development platform, while 49 percent planned to use iOS and 35 percent planned to use Windows 7.



Source: https://www.kumulos.com/wp-content/uploads/2016/05/20057104_ml.jpg

The ability to collect fine-grained, location-specific, context-aware, highly personalized content through these smart devices has opened new possibilities for advanced and innovative BI&A opportunities. In addition to the hardware and content advantages, the unique apps ecosystem developed through the volunteer

community of mobile app developers offers a new avenue for BI&A research. The Apple App Store alone offers more than 500,000 apps in almost any conceivable category as of August 2012; the number of Android apps also reached 500,000 in August 2012. Many different revenue models have begun to emerge for mobile apps, from paid or free but ad-supported apps to mobile gamification, which incentivizes participants (e.g., users or employees) by giving rewards for contributions. For mobile BI, companies are considering enterprise apps, industry-specific apps, e-commerce apps, and social apps (in ranked order) according to the IBM survey.

The lightweight programming models of the current web services (e.g., HTML, XML, CSS, Ajax, Flash, J2E) and the maturing mobile development platforms such as Android and iOS have contributed to the rapid development of mobile web services (e.g., HTML5, Mobile Ajax, Mobile Flash, J2ME) in various mobile pervasive applications, from disaster management to healthcare support. New mobile analytics research is emerging in different areas (e.g., mobile sensing apps that are location-aware and activity-sensitive; mobile social innovation for m-health and m-learning; mobile social networking and crowd-sourcing; mobile visualization/HCI; and personalization and behavioral modeling for mobile apps). In addition, social, behavioral, and economic models for gamification, mobile advertising, and social marketing are under way and may contribute to the development of future BI&A 3.0 systems.

Implications of BI&A as Capability Monitoring

Capability-focused Design of BI&A

The capability dynamization view of BI&A implies that, on one hand, capability monitoring via BI&A need to be focused on specific organizational capabilities, and, on the other hand involves monitoring of the internal and external environments. This puts conflicting demands on BI&A architecture. The five elements of BI&A outlined herein point to potential approaches towards BI&A architecture design. Centralization of internal and external data collection management, as well of identification of discontinuities in the internal and external environments offers synergistic benefits. However, identification of maladjustments and corresponding requests for change require capability specific expertise and focus.

The need for having capability specific BI&A activities raises an issue of resource allocation. It is widely acknowledged that capability dynamization is expensive and needs to be implemented selectively. Having a dynamic capability and never exercising it equates to carrying a cost burden without a respective payoff. On the other hand, an aggressive search for occasions to change "in a deliberate effort to exercise the dynamic capability" can results in costs and disruptions that outweigh the strategic benefits of the capability renewal. This implies that, in allocation of BI&A resources, one must consider the likelihood of the need for change in underlying capabilities, as well as the costs and benefits of change.

Assessment of BI&A Success

The capability dynamization view suggests that requests for change in existing capabilities are the key outcomes of BI&A. This is a marked departure from existing conceptualizations of BI&A which view managerial insight as its goal. In the light of the capability dynamization view of BI&A, success of BI&A initiatives needs to be measured by the production of requests for change, the extent to which the requests for change are acted upon, and by the outcomes of the resultant changes. This requires that information on how requests for change are implemented and whether the results of such changes are positive or negative, is fed back into the BI&A process. Understanding the role of feedback in the management of BI&A activities can be viewed as a fruitful direction for future research.



Source: http://www.businessofapps.com/wp-content/uploads/2017/10/top_mobile_analytics_tools_2017.jpg

Alignment with Change Management

The proposed view of BI&A as a capability monitoring mechanism implies that requests for change are implemented. Such implementation, however, is not trivial and requires significant change management capabilities, also referred to as adaptive agility. This calls for a close alignment between BI&A and organizational change management practices. Business Process Management (BPM) has emerged

as a holistic approach to delivering business value through the improvement of organizational effectiveness and agility. As such BPM is related to organizational ability to successfully execute the change, which is complementary to the use of BI&A for capability dynamization. Although process analytics and process mining have been acknowledged as an important element of both BI&A and BPM, more extensive research on the intersection of BI&A and BPM is necessary.

The Key Advantages of Business Intelligence and Analytics

With the help of business intelligence solutions, organizations can implement corrections and take necessary measures to improve efficiency in various areas of their operations. An organization may also identify new business opportunities and expand accordingly to accommodate its best interests.

Business intelligence software tools are highly dependent on rapidly evolving technologies like big data, predictive analytics and data mining. Many technology consultants provide specialized business intelligence tools, technology consulting, and implementation support with extensive industry expertise to help organizations assess their business intelligence needs. Below are highlights key advantages for using business intelligence tools:

Faster Decision Making

Key executives are involved in making decisions that guide business direction and strategy. In the absence of business intelligence solutions, this decision making process often involves making a considerable amount of presumptions. Without the availability of detailed reports and analysis, executives may have to make decisions based on limited information like sales figures and market demand. Business intelligence eliminates this guesswork and presents new information like real-time production stats and customer feedback for various product lines that is backed by hard data. Some predictive BI techniques also allow for "what if" analysis to see how a decision would affect the company in the future. All this information provides key insights and a wider perspective, which enables faster decision making at the right time.

Real-time Performance Measurement

Business intelligence tools continuously monitor large amounts of data generated by an organization and carefully analyze it for several performance metrics such as efficiency, sales figures and marketing costs related to the business - in real time. This helps keep top management informed about the status and performance of various critical components within the organization and the collaboration between business units. It also enables business executives to detect market opportunities and take advantage of them.



Source: https://nowconsulting.co.nz/media/1165/now-consulting.png?anchor=center&mode=crop&width=1680&height=945&rnd=131392729100000000

Improved Reporting Speed

BI users can access large amounts of unprocessed data in the form of organized and readable reports that present information in an interactive manner within a short amount of time. This eliminates the need to sift through loads of data and printing a pile of various reports.

Greater Insights into Customer Behavior

BI can analyze sales figures and customer feedback to represent facts that tell a business a great deal about their customer's preferences and needs. Using IT products as an example, logged customer information can be sent back to a company's servers to be analyzed to get an idea of how the customers are responding to the design of a particular software product. Products such as Google Chrome, Microsoft Windows and others are continuously monitored and updated to keep up with the demands of customers. Analyzing this information can also help a company detect what the customer is buying and what his/her needs are enabling decisions that allow the company to retain or grow their customer base.

Identify New Business Opportunities

If a business has a numerous products, BI can help detect customer touch points where a customer buys multiple products produced by the same company on an individual basis. Such touch points can provide a company with new business opportunities to sell a group of products together as a single integrated package to

retain and grow a particular customer base. Thus, by using business intelligence, opportunities, which were previously undetected, can be put used to maximize profits.



Source: https://cdn.buttercms.com/5ijKUqR7Kih8KsFTQkQJ

Role of Organizations in Making BI Projects a Success

There are a couple important changes an organization should take to facilitate easy adoption of BI solutions and to get the most from their BI investment:

Operational Changes

Business intelligence has transformed some businesses into highly efficient and more profitable ventures. However, BI is a very powerful tool and this tool cannot be used efficiently with insufficient data. The amount and the quality of data that is available within an organization plays a crucial role in the success of a BI project. If an organization wants to undertake a business intelligence project, then it has to incorporate several changes into its operations. Some of these changes include upgrading the legacy reporting techniques to modern ones, enforcing the use of a specific standard for reporting and data storage across the entire organization, providing and insisting on data access in every segment of business operations, and identifying the specific areas in which the business intelligence is needed.

Usability Support

A business intelligence tool should also have comprehensive usability support to be effective. Usability refers to the ease with which a user can access and add data to the system. When business intelligence and an analytics tool is integrated, it should be able to improve the quality of business operations. This is possible only if every employee; customer and other stakeholders of the company have an understandable interface through which they can add the necessary data to the business intelligence system. BI should be made a part of the company's work culture and it should be streamlined with the existing systems and policies. This will greatly improve the performance of a BI system and its output.



Source: https://instabug.com/blog/wp-content/uploads/2015/09/QVKE96OD36-e1442144283588.jpg

When used appropriately, business intelligence is a powerful tool to improve efficiency. With the support of an experienced technology consultant, a powerful BI system can be successfully integrated in to its core architecture. Apart from this, the organization should also enforce fixed standards to store and record data and information. A BI system is sure to help the organization reap expected benefits if it can assure efficient selection and implementation, right integration and active participation from key business entities.

REFERENCES

1. Aberdeen Group. 2007, December. Operational BI: Getting Real Time About Performance. Retrieved September 3, 2008, from www304.ibm.com/jct03004c/tools/cpeportal/fileserve/download0/140686/AberdeenOperationBIperf.pdf?contentid=140686
2. Alavi, M., and D.E. Leidner. 2001, March. Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly* 25, no. 1, pp. 107–36.
3. Alter, S.L. 1975. A Study of Computer Aided Decision Making in Organizations. Unpublished doctoral dissertation, Massachusetts Institute of Technology.
4. Alter, S.L. 1980. *Decision Support Systems: Current Practice and Continuing Challenge*. Reading, MA: Addison-Wesley.
5. *Analytics at Work: Smarter Decisions, Better Results Thomas Davenport, Jeanne G Harris, Robert Morison*. Harvard Business Review Press 2010.
6. BARDOLIWALLA, N. 2009. The top 10 trends for 2010 in Analytics, Business Intelligence, and Performance Management. [Online]. Available: http://www.enterpriseirregulars.com/5706/the-top10-trends-for-2010-in-analytics-business-intelligence-and-performance-management [Cited 16 September 2010].
7. *Building the Data Warehouse, 4e, W H Inmon*. New York: John Wiley & Sons; 2005.
8. DAVENPORT, T.H. 2006. Competing on analytics. Harvard business review, vol. 84, no. 1, p. 98-107, 134. Available: http://www.ncbi.nlm.nih.gov/pubmed/20929194 [Cited 11 January 2011].
9. DAVENPORT, T.H. and HARRIS, J.G. 2007. Competing on analytics. The new science of winning. Harvard Business School Press. Harvard, Boston, Massachusetts, USA.
10. ECKERSON, W. 2011. Analytic architectures: approaches to supporting analytics users and workloads. [Online]. Available: http://www.b-eye-network.com [Cited 16 December 2011].
11. FEW, S. 2009. Malcolm Gladwell, modern problems, and the analytics age. [Online] Available: http://www.perceptualedge.com [Cited 28 March 2010].
12. http://olap.com/learn-bi-olap/olap-bi-definitions/business-intelligence/
13. http://www.idc-online.com/technical_references/pdfs/data_communications/The_Key_Advantages_of_Business_Intelligence_and_Analytics.pdf
14. https://pdfs.semanticscholar.org/f5fe/b79e04b2e7b61d17a6df79a44faf358e60cd.pdf

15. https://searchbusinessanalytics.techtarget.com/definition/business-intelligence-BI
16. https://www.digitalvidya.com/blog/what-is-business-intelligence/

CHAPTER 7

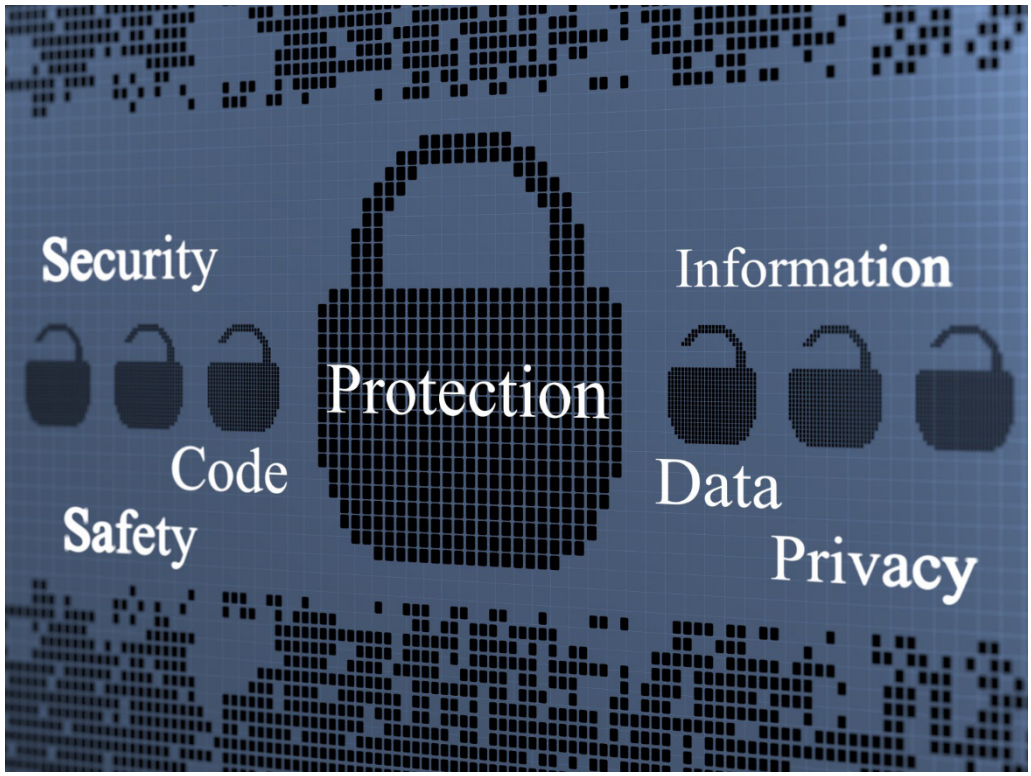
CYBERCRIME AND INFORMATION SYSTEM SECURITY



INTRODUCTION

Due to the growth of the Internet and digital forms of media, cyber crime has become a growing problem. Cyber crime comes in many different forms. Some of these include identity theft, auction fraud, hacking, and the spreading of viruses and malicious software. Almost everyone has access to the Internet. Therefore, cyber crime is becoming increasingly popular for many reasons. Since the Net is a completely open arena, it is difficult to stop this type of crime from affecting the masses. However, there are certain procedures that, if followed, can reduce the risk of becoming a victim.

When dealing with the Internet, the two types of modes that affect security are hackers and viruses. Such examples that will be identified are cyberattacks, worms, the Pop Star virus and Ads and Spam through email. There are two places where every individual using the Internet needs to be protected. The first is at the workplace. The second place is at home. Another major factor of Internet security is protecting oneself with online purchases. Online shopping, the scams and the methods of protection will all be explained.



Source: http://cyberintelligence.in/wp-content/uploads/2014/08/information-security.jpg

In information bases society, how fast your employees and customers receive information can mean the difference between success and failure. Information has become widely accessible through the use of information systems. It is essential for a company's employees to be able to access information, but it could also be damaging if that same information got into the wrong hands. To prevent information from getting into the wrong hands there must be some type of information system security implemented. But, having the correct IS security system is tricky. For a company to have good IS security their system must not have so much security it hinders employees for using it, but it also cannot have so little that the security can be breached by anyone with minimal computer knowledge. A company having a balance between these two can mean the difference between a good or bad system. There may never be a perfect IS security system but firms are always working to make a system that it right for their company.

CYBER CRIME & CYBER SECURITY

Cybercrime is any criminal activity that involves a computer, networked device or a network. While most cybercrimes are carried out in order to generate profit for the cybercriminals, some cybercrimes are carried out against computers or devices directly to damage or disable them, while others use computers or networks to spread malware, illegal information, images or other materials. Some cybercrimes do both -- i.e., target computers to infect them with viruses, which are then spread to other machines and, sometimes, entire networks.



Source: http://2.bp.blogspot.com/-L5e4Rx77DRs/VBt_buIdBZI/AAAAAAAAAD8/SbMio916sZ4/s1600/cyber-crime.jpg

A primary impact from cybercrime is financial, and cybercrime can include many different types of profit-driven criminal activity, including ransomware attacks, email and internet fraud and identity fraud, as well as attempts to steal financial account, credit card or other payment card information. Cybercriminals may target private personal information, as well as corporate data for theft and resale.

Defining Cybercrime

The U.S. Department of Justice divides cybercrime into three categories: crimes in which the computing device is the target, for example, to gain network access; crimes in which the computer is used as a weapon, for example, to launch a denial-of-service (DoS) attack; and crimes in which the computer is used as an accessory to a crime, for example, using a computer to store illegally obtained data.

The Council of Europe Convention on Cybercrime, to which the United States is a signatory, defines cybercrime as a wide range of malicious activities, including the illegal interception of data, system interferences that compromise network integrity and availability, and copyright infringements. Other forms of cybercrime include illegal gambling, the sale of illegal items, like weapons, drugs or counterfeit goods, as well as the solicitation, production, possession or distribution of child pornography.



Source: https://www.michalsons.com/wp-content/uploads/2017/07/castle-2070777_1280.jpg

The ubiquity of internet connectivity has enabled an increase in the volume and pace of cybercrime activities because the criminal no longer needs to be physically present when committing a crime. The internet's speed, convenience, anonymity and lack of borders make computer-based variations of financial crimes, such as ransomware, fraud and money laundering, as well as hate crimes, such as stalking and bullying, easier to carry out.

Cybercriminal activity may be carried out by individuals or small groups with relatively little technical skill or by highly organized global criminal groups that may include skilled developers and others with relevant expertise. To further reduce the chances of detection and prosecution, cybercriminals often choose to operate in countries with weak or nonexistent cybercrime laws.

Origins of Cyber Crime

It may be hard to believe, but the term "hack" was not originally associated with cybercrime, or computers at all. In the 1960s, students who were model train enthusiasts at MIT coined the term to describe the act of modifying a product or procedure to alter its normal function, or to fix a problem. Simply put, hacking is the process of changing certain functions without re-engineering the entire device. A hacker is someone who finds a clever way to fix a problem with a product or seeks an easy way to improve its function.



Source: https://johannesdrooghaag.com/wp-content/uploads/2016/09/cyber-crime.jpg

However, hacking became intermingled with malicious intent in the 1970s with a phenomenon known as phreaking, where tech-savvy people sought to subvert early computerized phone systems. These "phreakers" discovered the correct codes and tones that would result in free long distance service. They impersonated operators, dug through Bell Telephone company garbage to find secret information,

and performed countless experiments on early telephone hardware in order to learn how to exploit the system. Law enforcement had difficulty with this sort of criminal activity, due in part to lack of legislation to aid in criminal prosecution, and a shortage of investigators skilled in the technology that was being hacked. These incidents made clear that computer systems were open to criminal activity, and as the technology became more sophisticated, so did the crime.

By the mid-1980s, cybercrime was an established channel to control and destroy computer systems, acquire information, and steal millions in cash. Action was needed, and in 1986 the first cybercrime legislation was passed—the Federal Computer Fraud and Abuse Act—making harmful computer activity a felony crime punishable by jail time and fines.

Since those days, cybercrime has evolved and grown. Criminals range from single-minded hackers to complex networks of agents working in unison to state-sponsored attacks across nations. Threats are ever present as the world becomes more and more interconnected and with more connected devices every year, coupled with the emerging sector of the Internet of Things, the opportunities for cybercrime persist for the inventive and daring hacker.

How Cybercrime Works

Cybercriminals use a number of attack vectors to carry out their cyberattacks and are constantly seeking new methods and techniques for achieving their goals, while avoiding detection and arrest. Here are common types of attacks cybercriminals have been known to use:

- Distributed DoS attacks (DDoS) are often used to shut down systems and networks. This type of attack uses a network's own communications protocol against it by overwhelming its ability to respond to connection requests. DoS attacks are sometimes carried out simply for malicious reasons or as part of a cyberextortion scheme, but they may also be used to distract the victim organization from some other attack or exploit carried out at the same time.
- Infecting systems and networks with malware is used to damage the system or harm users by, for example, damaging the system, software or data stored on the system. Ransomware attacks are similar, but the malware acts by encrypting or shutting down victim systems until a ransom is paid.
- Phishing campaigns are used to infiltrate corporate networks by sending fraudulent email to users in an organization, enticing them to download attachments or click on links that then spread viruses or malware to their systems and through their systems to their company's networks.



Source: https://www.sentryo.net/wp-content/uploads/2016/07/cyber-security-concept-open-and-closed-locks.jpg

- Credentials attacks, where the cybercriminal aims to steal or guess user IDs and passwords for the victim's systems or personal accounts, can be carried out through the use of brute force attacks by installing key sniffer software or by exploiting vulnerabilities in software or hardware that can expose the victim's credentials.
- Cybercriminals may also attempt to hijack a website to change or delete content or to access or modify databases without authorization. For example, an attacker may use an SQL injection exploit to insert malicious code into a website, which can then be used to exploit vulnerabilities in the website's database, enabling a hacker to access and tamper with records or gain unauthorized access to data, such as customer passwords, credit card numbers, personally identifiable information (PII), trade secrets, intellectual property and other sensitive information.

Cybercriminals often carry out their activities using malware and other types of software, but social engineering is often an important component for executing most types of cybercrime. Phishing email is an important component to many types of cybercrime, but especially so for targeted attacks, like business email compromise (BEC), in which the attacker attempts to impersonate, via email, a business owner in order to convince employees to pay out bogus invoices.

Types of Cybercrime

There are many different types of cybercrime; most cybercrimes are carried out with the expectation of financial gain by the attackers, though the ways cybercriminals aim to get paid can vary. For example:

- Cyberextortion is crime involving an attack or threat of attack coupled with a demand for money to stop the attack. One form of cyberextortion is the ransomware attack, in which the attacker gains access to an organization's systems and encrypts its documents, files -- anything of potential value -- making the data inaccessible until a ransom is paid, usually in some form of cryptocurrency, such as bitcoin.
- Cryptojacking attacks use scripts to mine cryptocurrencies within browsers without the user's consent. Such attacks may involve loading cryptocurrency mining software to the victim's system. However, many attacks depend on JavaScript code that does in-browser mining as long as the user's browser has a tab or window open on the malicious site; no malware needs to be installed as loading the affected page executes the in-browser mining code.



Source: https://www.pandasecurity.com/mediacenter/src/uploads/2018/07/types-of-cyber-crime-hero.jpg

- Identity theft occurs when an attacker accesses a computer to glean a user's personal information that they can then use to steal that person's identity or access bank or other accounts. Cybercriminals buy and sell identity information on darknet markets, offering financial accounts, as well as other types of accounts, like video streaming services, webmail, video and audio streaming, online auctions and more. Personal health information is another frequent target of identity thieves.
- Credit card fraud occurs when hackers infiltrate retailers' systems to get the credit card and/or banking information of their customers. Stolen payment cards can be bought and sold in bulk on darknet markets, where hackers who have stolen mass quantities of credit cards profit by selling to lower-level cybercriminals who profit through credit card fraud against individual accounts.
- Ransomware is a form of cyberextortion in which the victim device is infected with malware that prevents the owner from using the device or the data stored on it. To regain access to the device or data, the victim has to pay the hacker a ransom. Ransomware can be inadvertently downloaded by opening an infected email attachment, visiting a compromised website or clicking on a pop-up ad.
- Cyberespionage occurs when a cybercriminal hacks into systems or networks to gain access to confidential information held by a government or other organization. Attacks may be motivated by profit or by ideology, and cyberespionage activities can include every type of cyberattack to gather, modify or destroy data, as well as using network-connected devices, like webcams or closed-circuit TV (CCTV) cameras, to spy on a targeted individual or groups and monitoring communications, including email, text messages and instant messages.

The State of Cybercrime Today

In a recent US State of Cybercrime Survey, three out of four respondents detected a security event during the past 12 months, yet at the same time many organizations report that they are suffering from technology debt, estimated to exceed one trillion dollars. This means that companies are effectively spending IT budgets on emerging business technologies while allowing IT infrastructure to age into obsolescence until they cannot provide effective security functions.



Source: https://www.gadgetbytenepal.com/wp-content/uploads/2016/04/hacker-downloading-information-off-a-computer.jpg

Common security deficiencies have been found in organizations most susceptible cybercrime:

- Reactive or unplanned cybersecurity spending
- No assessments of the security capabilities of their third-party providers
- Lack of understanding and/or assessment of supply-chain risks
- Inadequate or nonexistent mobile device management and security
- Insider threats and risk not adequately addressed
- Lack of thorough employee security and awareness training

Despite these challenges, cybercrime is increasing at a geometric rate. There's roughly 900 phishing attempts detected per financial institution, and more than 9,000 attempts detected per technology company on average. Phishing sites are mimicking all the major technology players as well. Google, Apple, Facebook, and Yahoo, are all phishing targets, as well as Dropbox, where insidious phishing sites could actually dupe users into uploading their files to cybercriminals.

On average, 85,000 malicious IPs are launched every day, bringing the average reputation score of all URLs worldwide to 65 percent. It is a worldwide endeavor, with large concentrations in the United States, Russia, and throughout Asia. The result is that in one year, users have a 30% chance of falling for a zero-day phishing attack.

Cybercrime is not restricted to the desktop alone; Mobile devices have proliferated in recent years, and with them viruses, malware, and phishing scams. Because of its open marketplace, the Android platform is home to a variety of malware in particular. In a recent survey, 72% of all apps for the OS were regarded as suspicious, unwanted, or malicious, with Trojans making up the majority of threats.



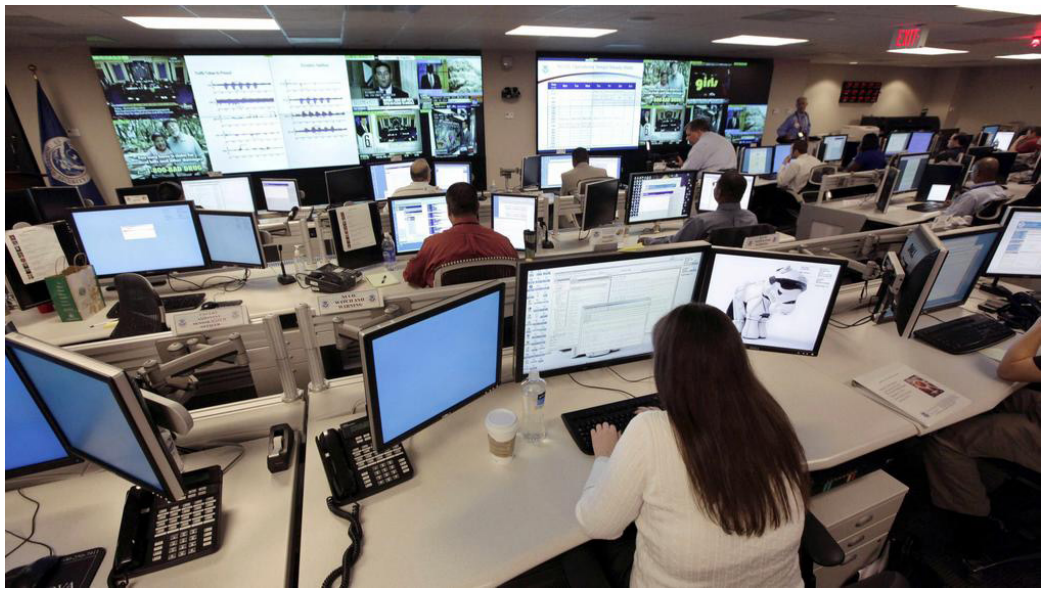
Source: https://d.ibtimes.co.uk/en/full/1529826/brexit-cybersecurity-experts-predict-rise-cybercrime-advent-possible-changes-security-laws.jpg

External cybercrime is bad enough, but many experts agree that internal attacks pose as great or greater risk to businesses and organizations, due to the sensitive information gained from employment. Insider risk can be mitigated with robust employee awareness and security training; however, the tragic reality is that a vast amount of organizations do not conduct this training at all. Insider cybercrime risk typically has precursors with IT policy violations; awareness and scrutiny of these trends can help prevent crimes that would otherwise go unnoticed until after the fact.

Why does this behavior among organizations persist? Data suggests that many decision makers at organizations do not have a full understanding of the extent or seriousness of threats, do not believe they are at risk, or have become desensitized to the warnings. Over the course of one year, businesses that have fallen victim to cybercrime tend to take security more seriously, and with good reason. Businesses with more than one thousand employees also take cybercrime more seriously and have more processes in place to mitigate risk internally as well as externally.

Impact

Attacks on American businesses and organizations increased by 176 percent in 2014—that's 138 successful attacks each week. These attacks are also taking more time to resolve as well, with the worldwide average to detect an attack at 170 days, the longest average time at 259 days and the average time to resolve an incident at 45 days. Virtually every US industry deals with the impact of cybercrime, with the highest annual costs in the energy & utilities and defense industries.



Source: https://www.thenational.ae/image/policy:1.241937:1499339566/image/jpeg.jpg?f=16x9&w=1200&pf$w=dfa40e8

Cybercrime threatens the critical infrastructure of businesses and government around the globe, and can harm civilians in myriad ways. It is estimated hundreds of billions of dollars have been lost from the global economy due to cybercrime, and unfortunately there is no sign of it slowing down.

Cybercrime impact can take many forms, including

- Direct financial loss
- Damage to company and brand reputation
- Loss of sensitive data and intellectual property
- Mitigation and recovery costs
- Regulatory penalties
- Customer compensation
- SLA breaches
- Job loss

Cyber Security

Cyber security is a potential activity by which information and other communication systems are protected from and/or defended against the unauthorized use or modification or exploitation or even theft.

Likewise, cyber security is a well-designed technique to protect computers, networks, different programs, personal data, etc., from unauthorized access.



Source: https://www.electronicsb2b.com/wp-content/uploads/2018/05/3.jpg

All sorts of data whether it is government, corporate, or personal need high security; however, some of the data, which belongs to the government defense system, banks, defense research and development organization, etc. are highly confidential and even small amount of negligence to these data may cause great damage to the whole nation. Therefore, such data need security at a very high level.

How to Secure Data?

Let us now discuss how to secure data. In order to make your security system strong, you need to pay attention to the following −

- Security Architecture
- Network Diagram
- Security Assessment Procedure
- Security Policies
- Risk Management Policy
- Backup and Restore Procedures
- Disaster Recovery Plan
- Risk Assessment Procedures

Once you have a complete blueprint of the points mentioned above, you can put better security system to your data and can also retrieve your data if something goes wrong.

How can Cybercrime be Prevented?

MSPs face a unique challenge in combatting cybercrime; not only must they ensure their clients' endpoints are secure, they must also safeguard their own servers, systems, and devices as well. Therefore, they must have fast, effective and easily deployable antivirus and anti-malware tools in place that will optimize efficiency and keep their users safe at the same time.

Further, MSPs need to be sure that the proper backup and disaster recovery systems are in place on servers and on user endpoints should the unthinkable happen as a result of a cybercrime attack. Downtime can decimate a business and damage the reputation as well as the clientele of an MSP, so systems need to be prepared, secure, and easily restorable in the event that a user clicks on a phishing link and unleashes malicious code.



Source: https://www.ccplus-usa.com/wp-content/uploads/2016/02/C.jpg

MSPs today are not only limited to securing SMB computers—the explosion of devices, from smartphones to tablets, have created an increasing demand for mobile device management (MDM) to unsure password policies are enforced, anti-malware tools are up to date, and attacked and viruses are thwarted. SMBs are increasingly looking to the MSP to be at the forefront of combatting cybercrime so they can focus on moving their business forward.

INFORMATION SYSTEMS SECURITY

Information systems security, more commonly referred to as INFOSEC, refers to the processes and methodologies involved with keeping information confidential, available, and assuring its integrity.

It also refers to:

- Access controls, which prevent unauthorized personnel from entering or accessing a system.
- Protecting information no matter where that information is, i.e. in transit (such as in an email) or in a storage area.
- The detection and remediation of security breaches, as well as documenting those events.



Source: https://its.informatik.htw-aalen.de/wp/wp-content/uploads/2013/10/esigelec-iss-logo.jpg

The Information Security Triad: Confidentiality, Integrity, Availability (CIA)

As computers and other digital devices have become essential to business and commerce, they have also increasingly become a target for attacks. In order for a company or an individual to use a computing device with confidence, they must first be assured that the device is not compromised in any way and that all

communications will be secure. Several different measures that a company can take to improve security will be discussed. We will then follow up by reviewing security precautions that individuals can take in order to secure their personal computing environment.

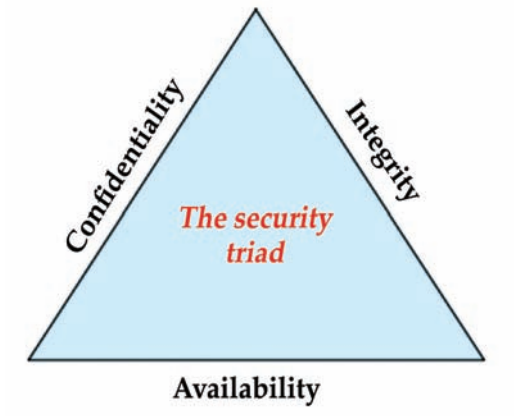


Figure 1: The security triad.

Source: https://pressbooks.com/app/uploads/sites/10536/2013/06/Security-Triad-300x244.png

Confidentiality

When protecting information, we want to be able to restrict access to those who are allowed to see it; everyone else should be disallowed from learning anything about its contents. This is the essence of confidentiality. For example, federal law requires that universities restrict access to private student information. The university must be sure that only those who are authorized have access to view the grade records.

Integrity

Integrity is the assurance that the information being accessed has not been altered and truly represents what is intended. Just as a person with integrity means what he or she says and can be trusted to consistently represent the truth, information integrity means information truly represents its intended meaning. Information can lose its integrity through malicious intent, such as when someone who is not authorized makes a change to intentionally misrepresent something. An example of this would be when a hacker is hired to go into the university's system and change a grade.



Source: https://d2v9y0dukr6mq2.cloudfront.net/video/thumbnail/1809Tdj/videoblocks-technical-controller-working-at-his-workstation-with-multiple-displays-hes-alone-in-system-control-center-shot-on-red-epic-w-8k-helium-cinema-camera_bvxgkajae_thumbnail-full01.png

Integrity can also be lost unintentionally, such as when a computer power surge corrupts a file or someone authorized to make a change accidentally deletes a file or enters incorrect information.

Availability

Information availability is the third part of the CIA triad. *Availability* means that information can be accessed and modified by anyone authorized to do so in an appropriate timeframe. Depending on the type of information, *appropriate timeframe* can mean different things. For example, a stock trader needs information to be available immediately, while a sales person may be happy to get sales numbers for the day in a report the next morning. Companies such as Amazon.com will require their servers to be available twenty-four hours a day, seven days a week. Other companies may not suffer if their web servers are down for a few minutes once in a while.

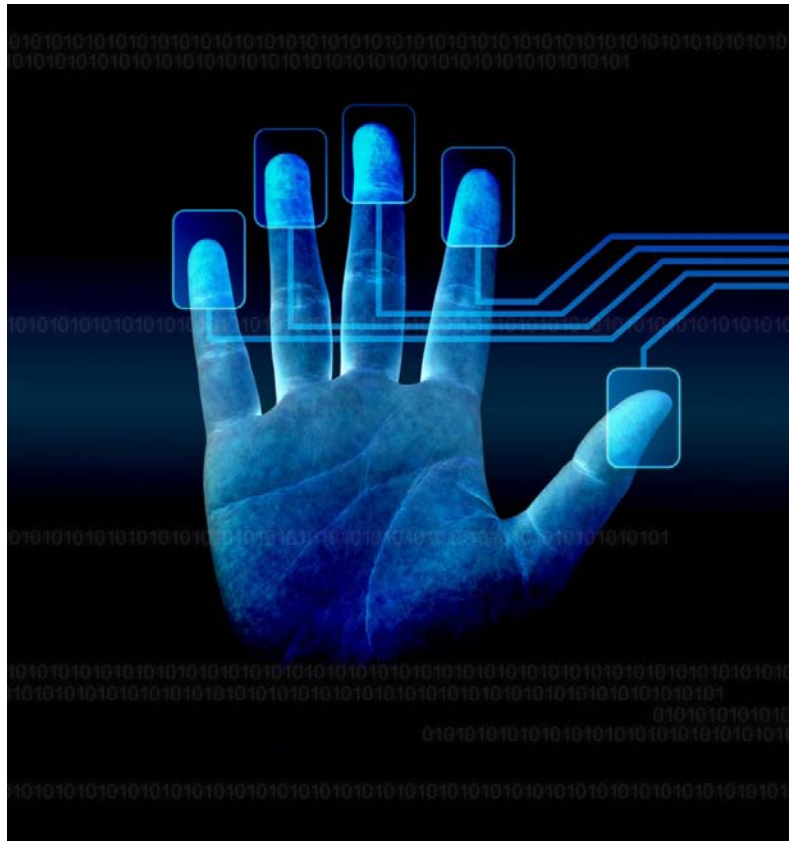
Tools for Information Security

In order to ensure the confidentiality, integrity, and availability of information, organizations can choose from a variety of tools. Each of these tools can be utilized as part of an overall information-security policy.

Authentication

The most common way to identify someone is through their physical appearance, but how do we identify someone sitting behind a computer screen or at the ATM? Tools for authentication are used to ensure that the person accessing the information is, indeed, who they present themselves to be.

Authentication can be accomplished by identifying someone through one or more of three factors: something they know, something they have, or something they are. For example, the most common form of authentication today is the user ID and password. In this case, the authentication is done by confirming something that the user knows (their ID and password). But this form of authentication is easy to compromise and stronger forms of authentication are sometimes needed. Identifying someone only by something they have, such as a key or a card, can also be problematic. When that identifying token is lost or stolen, the identity can be easily stolen. The final factor, something you are, is much harder to compromise. This factor identifies a user through the use of a physical characteristic, such as an eye-scan or fingerprint. Identifying someone through their physical characteristics is called biometrics.



Source: http://evdbt.com/wp-content/uploads/2016/04/authentication.jpg

A more secure way to authenticate a user is to do multi-factor authentication. By combining two or more of the factors listed above, it becomes much more difficult for someone to misrepresent themselves. An example of this would be the use of an RSA SecurID token. The RSA device is something you have, and will generate a new access code every sixty seconds. To log in to an information resource using the RSA device, you combine something you know, a four-digit PIN, with the code generated by the device. The only way to properly authenticate is by both knowing the code *and* having the RSA device.

Access Control

Once a user has been authenticated, the next step is to ensure that they can only access the information resources that are appropriate. This is done through the use of access control. Access control determines which users are authorized to read, modify, add, and/or delete information. Several different access control models exist. Here we will discuss two: the access control list (ACL) and role-based access control (RBAC).



Source: https://cdn-images-1.medium.com/max/1600/1*l4Eih_NXOD9zGf6i6XzD9A.jpeg

For each information resource that an organization wishes to manage, a list of users who have the ability to take specific actions can be created. This is an access control list, or ACL. For each user, specific capabilities are assigned, such as *read*, *write*, *delete*, or *add*. Only users with those capabilities are allowed to perform those functions. If a user is not on the list, they have no ability to even know that the information resource exists.

ACLs are simple to understand and maintain. However, they have several drawbacks. The primary drawback is that each information resource is managed separately, so if a security administrator wanted to add or remove a user to a large set of

information resources, it would be quite difficult. And as the number of users and resources increase, ACLs become harder to maintain. This has led to an improved method of access control, called role-based access control, or RBAC. With RBAC, instead of giving specific users access rights to an information resource, users are assigned to roles and then those roles are assigned the access. This allows the administrators to manage users and roles separately, simplifying administration and, by extension, improving security.

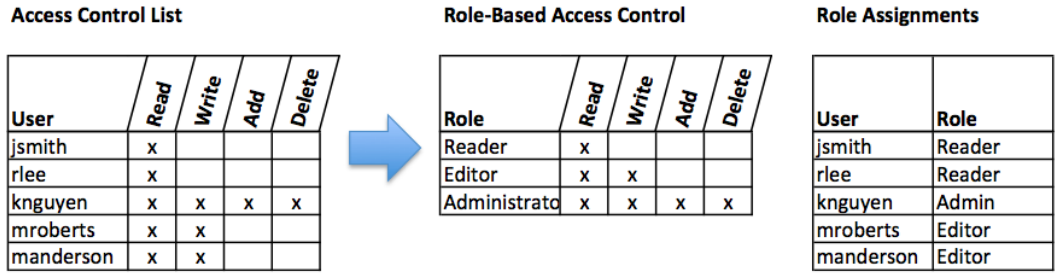


Figure 2: Comparison of ACL and RBAC.

Source: https://bus206.pressbooks.com/app/uploads/sites/10536/2013/06/ACL-RBAC.png

Encryption

Many times, an organization needs to transmit information over the Internet or transfer it on external media such as a CD or flash drive. In these cases, even with proper authentication and access control, it is possible for an unauthorized person to get access to the data. Encryption is a process of encoding data upon its transmission or storage so that only authorized individuals can read it. This encoding is accomplished by a computer program, which encodes the plain text that needs to be transmitted; then the recipient receives the cipher text and decodes it (decryption). In order for this to work, the sender and receiver need to agree on the method of encoding so that both parties can communicate properly. Both parties share the encryption key, enabling them to encode and decode each other's messages. This is called symmetric key encryption. This type of encryption is problematic because the key is available in two different places.

An alternative to symmetric key encryption is public key encryption. In public key encryption, two keys are used: a public key and a private key. To send an encrypted message, you obtain the public key, encode the message, and send it. The recipient then uses the private key to decode it. The public key can be given to anyone who wishes to send the recipient a message. Each user simply needs one private key and one public key in order to secure messages. The private key is necessary in order to decrypt something sent with the public key.

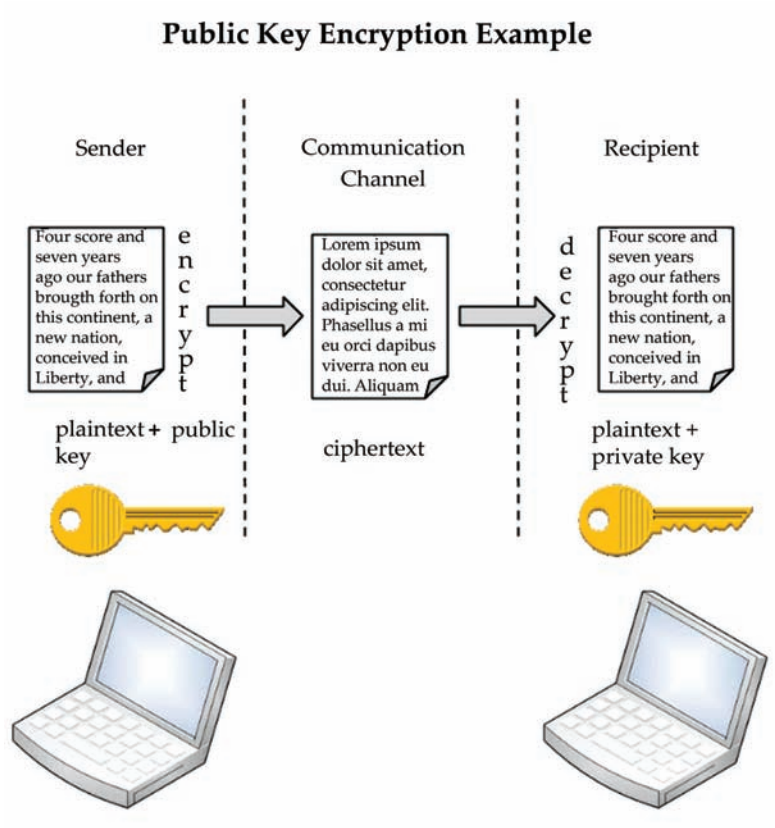


Figure 3: Public key encryption.

Source: https://pressbooks.com/app/uploads/sites/10536/2013/06/Encryption-diagram2.png

Major Challenges to Information Systems Security

The Challenges in information security varies geographically as come countries are at more risks and has more challenges. The general problem revolves around People, Process and Technology and the integration between these three elements.

PPT: People are the ultimate owners of the data centers or information visibility so it is very important to have right skills in place. However the objective cannot be ache-vied without having a right technology in place as well. Technologies used to keep security process in track in form of hardening, Vulnerability assessment etc. Then there is in turn of processes which tells us how to handle an incident if something bad happens, what steps needs to take during any disaster, how to handle access, authorization and revoking of access etc.



Source: https://myupdatesystems.com/wp-content/uploads/2018/03/Information-Technology-challenges-1-1170x707-3.jpg

If we are missing one of these elements or we are not using these elements in conjunction then there is a problem. Attackers are smart, they have smart tools to attack, smart methods to lure end users however we do have smart tools as well to protect these kind of attacks. But are we really using these tools optimally, Do we have sufficient resource to manage these tools or to monitor traffic regularly.

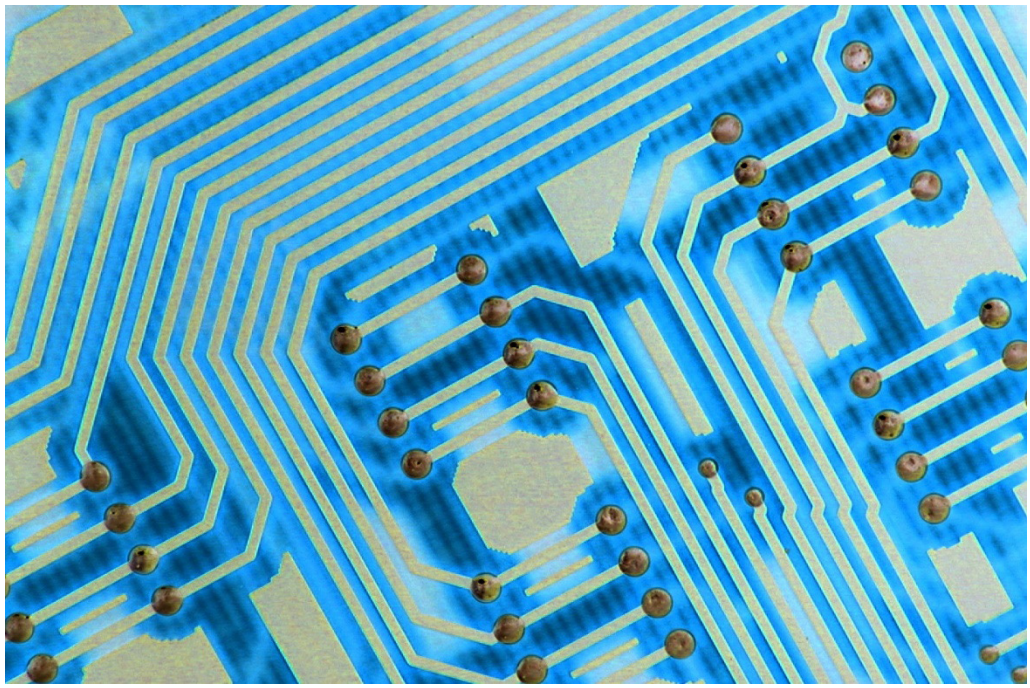
We do have traditional tools like IPS, Firewall etc. and we do have latest tools to protect 0-day attack or APT attacks like SIEM, APT Solution, analytic s Solution But the question is, do we really care about the traffic / logs /alerts that these tools generate. Do we really respond to these alerts. Because these tools needs manual intervention. These tools are smart enough to tell that something suspicious is happening but we also need to provide them an intelligence to detect.

Someone is selling, someone is buying, someone is getting protected, hackers has the chance to gain advantage once he gets into the systems. This is a circle and we are into it at any stage. If we use our tools to maximum with right skills and have focus on security, our most of the problems will get solved.

Networked Systems

The utility of an information or C4I system generally increases as the number of others systems to which it is connected increases. On the other hand, increasing the number of connections of a system to other systems also increases its vulnerability to attacks routed through those connections. The use of the Internet to connect C4I systems poses special vulnerabilities. It is desirable to use the Internet because

the Internet provides lower information transport costs compared to the public switched telephone network or dedicated systems. But the Internet provides neither quality-of-service guarantees nor good isolation from potentially hostile parties.



Source: http://necs.inrialpes.fr/media/images/website/research-1.jpg

The Asymmetry between Defense and Offense

Information systems security is fundamentally a defensive function, and as such suffers from an inherent asymmetry. A successful defender must be successful against all attacks, regardless of where the attack occurs, the modality of the attack, or the time of the attack. A successful attacker has only to succeed in one place at one time with one technique. Furthermore, information systems security has several interrelated dimensions that make it particularly difficult.

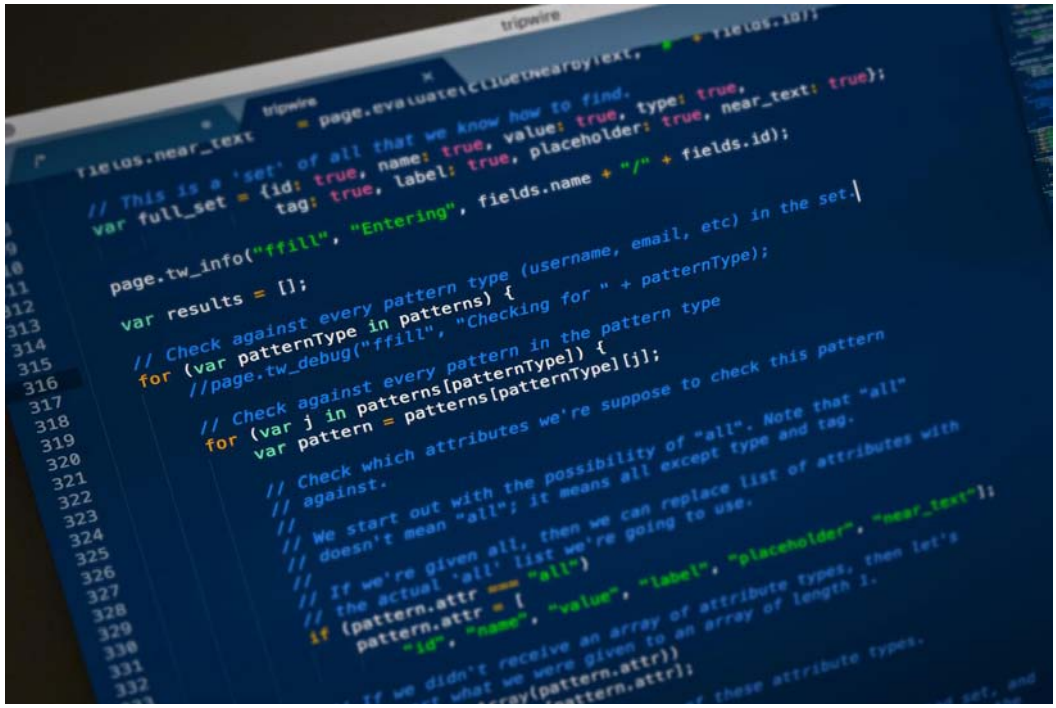
Ease-of-use Compromises

Compromises arise because information systems security measures ideally make the system impossible to use by someone who is not authorized to use it while considerations of system functionality require that the system be easy to use by authorized users. From the perspective of an authorized user, a system with information systems security features should look like the same system without those features. In other words, security features provide no direct functional benefit to the authorized user. At the same time, measures taken to increase the information security a system almost always make using that system more difficult or cumbersome. The result in practice is that all too often (from a security

standpoint) security features are simply omitted (or not turned on) to preserve the ease-of-use goal.

Perimeter Defense

Today's commercially available operating systems and networks offer only weak defensive mechanisms, and thus the components that make up a system are both vulnerable and hard to protect. One approach to protecting a network is then to allow systems on the network to communicate freely (i.e., without the benefit of security mechanisms protecting each individual network transaction) while allowing connection to the larger world outside the network only through carefully defined and well-protected "gateways". The result is an arrangement that is "hard on the outside" against attack but "soft on the inside." Thus, it is today very common to see "enclaves" hiding from the Internet behind firewalls, but few defensive measures within the enclaves themselves.



Source: http://cns.ucsd.edu/wp-content/uploads/2017/12/tripwire-code.jpg

A perimeter strategy is less expensive than an approach in which every system on a network is protected (a "defense-in-depth" strategy) because defensive efforts can be concentrated on just a few nodes (the gateways). But the major risk is that a single success in penetrating the perimeter compromises everything on the inside, and a perimeter can be compromised by the addition of a single unauthorized modem connected to the network inside the perimeter. Once the perimeter is

breached, the attacker need not expend additional effort to increase the number of targets that he may attack. The limitations of a perimeter defense are issues that should be redressed by C4I architecture – the paradigm of perimeter defense is an implicit element of today's C4I architecture that needs to be made explicit and changed.

One alternative to perimeter defenses is defense-in-depth, a strategy that requires the adversary to penetrate multiple independently-vulnerable obstacles to have access to all of his targets. The property of "independent vulnerabilities" is key; if the different mechanisms of defense share common-mode vulnerabilities, e.g., all use an operating system with easily exploited vulnerabilities, even mutiple mechanisms of defense will be easily compromised. When the mechanisms are independently vulnerable and deployed, the number of accessible targets becomes a strong function of the effort expended by the attacker. The problem of perimeter defense is made worse by the tendency to let one's guard down within the protection of the firewall (believing that the inside is secure) and thus to not take full advantage of even the (relatively weak) protections afforded by the security built into the network components.

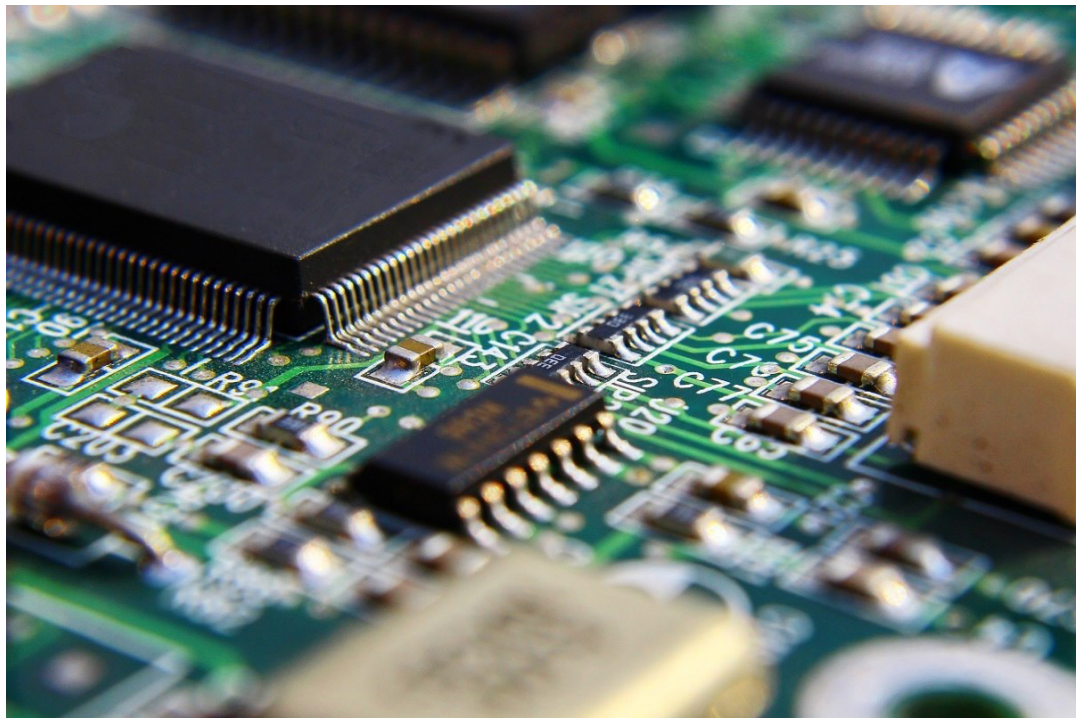
Threats Posed by Insiders

Insiders are those authorized to access some part or parts of a network. When security depends on the defenses built into the perimeter, the coercion or subornation of a single individual on the inside leaves the entire network open to attack to the extent that internal protections are lacking. Controlling the privileges of authorized individuals more finely (i.e., enabling such an individual to use some system resources or capabilities but not others) is only a partial solution, because abuse of the enabled resources is possible.

Passive Defense

Legal and technical constraints preclude retaliation against the perpetrator of an information systems attack (a cyber attack). Thus, the attacker pays no penalty for failed attacks. He or she can therefore continue attacking unpunished until he or she succeeds or quits.

The following example from physical space illustrates the futility of passive defense. Imagine a situation in which truck bombers in a red truck attempt entry to a military base. The bomb is discovered and they are turned away at the front gate of a military base, but allowed to go away in peace to refine their attack. They return later that day with a bomb in a yellow truck, are again turned away, and again go away in peace to refine their attack. They return still later with a stolen military truck. This time the bomb is undetected, they penetrate the defenses, and they succeed in their attack. A base commander taking this approach to security would be justly criticized and held accountable for the penetration.



Source: https://www.armytimes.com/resizer/K9fWJklp5JWq6aORC-LHQXrKyXc=/1200x0/filters:quality(100)/arc-anglerfish-arc2-prod-mco.s3.amazonaws.com/public/76KY3CPPJJFUNJEY4OGMLCMUFI.jpg

Yet in cyberspace passive defense is standard operating procedure. For example, an attacker can use an automatic telephone dialer to dial every number on a military post's telephone exchange looking for modem tones. An attacker probing the defenses of a computer system in which an IP connection can test one port number after another without penalty. In a phone probe looking for modem tones, all 10,000 phone numbers may be tested. No sane commander would allow a truck bomber 10,000 unchallenged, penalty-free attempts to drive on base. But the same commander today is constrained to routinely allow 10,000 unchallenged, penalty-free attempts to find modems attached to base systems. Passive defense in cyberspace represents both the tradition and the standard operating practice. But it is a losing proposition, and inadequate for protection of military operations in cyberspace.

REFERENCES

1. "Born to be breached" by Sean Gallagher on Nov 3 2012. Arstechnica. Retrieved from http://arstechnica.com/information-technology/2012/11/born-to-be-breached-the-worst-passwords-are-still-the-most-common/ on May 15, 2013.
2. <http://postmaster.aol.com/guidelines/bulk_email.html>.
3. <www.identity-theft-help.us>
4. America Online Canada Inc. Top Ten Tips to Avoid Phishing Scams. 2000. 5 Mar. 2005. <http://webmania.ctv.ca/AOLphishingtips.htm>.
5. America Online, Inc. AOL Postmaster.Info 22 June 2004. 3 Mar. 2005
6. Computer Security Resource Center, National Institute of Standards and Technology (NIST). "Engineering Principles for IT Security (EP-ITS) (A technical baseline for achieving security capabilities)." Draft document. URL:
7. Fadia, Ankit. New Order. New Order Team and Box Network ltd. 2005. 15 April 2005. http://neworder.box.sk/newsread.php?newsid=3825
8. Federal Information Systems Security Educators' Association (FISSEA). 17 March 2005. 28 Mar. 2005 <http://csrc.nist.gov/organizations/fissea/index.html>.
9. https://searchsecurity.techtarget.com/definition/cybercrime
10. https://www.continuum.net/resources/mspedia/cybercrime-and-security-overview
11. https://www.tutorialspoint.com/fundamentals_of_science_and_technology/cyber_crime_and_cyber_security.htm
12. https://www.microsoft.com/en-us/research/wp-content/uploads/2016/11/Acrobat-5.pdf
13. Jupiter Images. "IP spoofing." Webopedia.com 10 Sept. 2004. 4 Mar. 2005. <http://www.webopedia.com/TERM/I/IP_spoofing.html>.
14. Klaus, Christopher. "Computer-security/sniffers FAQ." Online posting. 28 June 1997. FAQS.org. 9 Mar. 2005 <http://www.faqs.org/faqs/computer-security/sniffers/>.
15. Laudon, Jane P., and Laundon, Kenneth C., Management Information Systems. New Jersey: Pearson Education, Inc., 2004.
16. Manor, James. "Hackers Attack: Jamming and its Effects." Computer Culture Today 13.8 (2004) : 32 pars. 5 Mar. 2005. <http://www.saiensu.co.jp/CT/fraud/start.htm>.
17. *Maximum Security: A Hacker's Guide to Protecting Your Internet Site and Network*, 2nd edition, Sams, 1998.
18. Microsoft Network. MSN E-mail Solutions. 2005. 4 Mar. 2005 <http://join.msn.com/?page=hotmail/gbb&pgmarket=en-us&ST=1&xAPID=1983&DI=1402>.

19. Mueller, Scott Hazen. Fight Spam on the Internet. 2005. 15 April 2005 http://spam.abuse.net/spam/
20. SANS Institute. "A Short Primer for Developing Security Policies." Accessed from http://www.sans.org/security-resources/policies/Policy_Primer.pdf on May 31, 2013.
21. Sherman, Robert. Identity Theft Prevention and Victim Help. 2003-2005. 15 April 2005.
22. Taken from SANS Institute's Mobile Device Checklist. You can review the full checklist at http://www.sans.org/score/checklists/mobile-device-checklist.xls.
23. United States. Federal Trade Commission. Welcome to the Federal Trade Commission: Your National Resource for Identity Theft. 3 Mar. 2005 <http://www.consumer.gov/idtheft/>.
24. Whitney, Johnson L. "Existing and Emerging Laws on Junk E-mail." Online Posting. 3 March. 2005 <http://www.tigerden.com/junkmail/laws.html>.

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