Chapter 8. Using Technology to Manage Information

This chapter focuses on the role of information technology (IT) in business, examining the details of MIS organization, as well as the challenges companies encounter in an increasingly technological world. Harnessing the power of information technology gives a company a significant competitive advantage.

Transforming Businesses through Information

How has information technology transformed business and managerial decision-making?

Information technology (IT) includes the equipment and techniques used to manage and process information. Information is at the heart of all organizations. Without information about the processes of and participants in an organization—including orders, products, inventory, scheduling, shipping, customers, suppliers, and employees—a business cannot operate. In less than 70 years, we have shifted from an industrial society to a knowledge-based economy driven by information. Businesses depend on information technology for everything from running daily operations to making strategic decisions. Computers are the tools of this information age, performing extremely complex operations as well as everyday jobs such as word processing and creating spreadsheets. The pace of change has been rapid since the personal computer became a fixture on most office desks. Individual units became part of small networks, followed by more sophisticated enterprise-wide networks. Table 2 and Table 3 summarize the types of computer equipment and software, respectively, most commonly used in business management information systems today.

Tablo 1 Equipments

Business Computing Equipment		
Computer Type	**Description**	**Comments**
Tablets	Self-contained computers in which applications (apps) can reside. These devices can also be linked into a network over which other programs can be accessed.	Increasing power, speed, and memory accessed via the cloud make these tablets the dominant computer for many business processes.
Desktop personal computers (PC)	Self-contained computers on which software can reside. These PCs can also be linked into a network over which other programs can be accessed.	Increasing power, speed, memory, and storage make these commonly used for many business processes. Can handle text, audio, video, and complex graphics.
Laptop computers	Portable computers similar in power to desktop computers.	Smaller size and weight make mobile computing easier for workers.
Minicomputers	Medium-sized computers with multiple processors, able to support from four to about 200 users at once.	The distinction between the larger minicomputers and smaller mainframes is blurring.
Mainframe computers	Large machines about the size of a refrigerator; can simultaneously run many different programs and support hundreds or thousands of users.	Extremely reliable and stable, these are used by companies and governments to process large amounts of data. They are more secure than PCs.
Servers	Greatest storage capacity and processing speeds.	These are not subject to crashes and can be upgraded and repaired while operating.
Supercomputers	Most powerful computers, now capable of operating at speeds of 280 trillion calculations per second.	Companies can rent time to run projects from special supercomputer centers.

Tablo 2 Applications Types and Usage

Application Type	Description
Spreadsheet software	Used for preparation and analysis of financial statements, sales forecasts, budgets, and similar numerical and statistical data. Once the mathematical formulas are keyed into the spreadsheet, the data can be changed and the solution will be recalculated instantaneously.
Database management programs	Serve as electronic filing cabinets for records such as customer lists, employee data, and inventory information. Can sort data based on various criteria to create different reports.
Graphics and presentation programs	Create tables, graphs, and slides for customer presentations and reports. Can add images, video, animation, and sound effects.
Desktop publishing software	Combines word processing, graphics, and page layout software to create documents. Allows companies to design and produce sales brochures, catalogs, advertisements, and newsletters in-house.
Communications programs	Translate data into a form for transmission and transfer it across a network to other computers. Used to send and retrieve data and files.
Integrated software suites	Combine several popular types of programs, such as word processing, spreadsheet, database, graphics presentation, and communications programs. Component programs are designed to work together.
Groupware	Facilitates collaborative efforts of workgroups so that several people in different locations can work on one project. Supports online meetings and project management (scheduling, resource allocation, document and e-mail distribution, etc.).
Financial software	Used to compile accounting and financial data and create financial statements and reports.

Although most workers spend their days at powerful desktop computers, other groups tackle massive computational problems at specialized supercomputer centers. Tasks that would take years on a PC can be completed in just hours on a supercomputer. With their ability to perform complex calculations quickly, supercomputers play a critical role in national security research, such as analysis of defense intelligence; scientific research, from biomedical experiments and drug development to simulations of earthquakes and star formations; demographic studies such as analyzing and predicting voting patterns; and weather and environmental studies. Businesses, too, put supercomputers to work by analyzing big data to gain insights into customer behavior, improving inventory and production management and for product design.

The speed of these special machines has been rising steadily to meet increasing demands for greater computational capabilities, and the next goal is quadrillions of computations per second, or petaflops. Achieving these incredible speeds is critical to future scientific, medical, and business discoveries. Many

countries, among them the United States, China, France, and Japan, have made petascale computing a priority.

In addition to a business's own computers and internal networks, the internet makes it effortless to connect quickly to almost anyplace in the world. As Thomas Friedman points out in his book The World Is Flat, "We are now connecting all of the knowledge centers on the planet together into a single global network, which . . . could usher in an amazing era of prosperity and innovation."3 The opportunities for collaboration on a global scale increase daily. A manager can share information with hundreds of thousands of people worldwide as easily as with a colleague on another floor of the same office building. The internet and the web have become indispensable business tools that facilitate communication within companies as well as with customers.

The rise of electronic trading hubs is just one example of how technology is facilitating the global economy. Electronic trading hubs are not reserved for large companies of developed economies, however. Alibaba is piloting an e-hub called eWTP in Malaysia that will provide access to small businesses. As Jack Ma, Alibaba cofounder, said at eWTP's launch, "There are a lot of free-trade zones for efficient trade facilitation, but only for big companies. There is no free-trade zone designed for small companies. I have been shouting everywhere, screaming, that every government should do it."

Data and Information Systems

Information systems and the computers that support them are so much a part of our lives that we almost take them for granted. These management information systems methods and equipment that provide information about all aspects of a firm's operations provide managers with the information they need to make decisions. They help managers properly categorize and identify ideas that result in substantial operational and cost benefits.

Businesses collect a great deal of data—raw, unorganized facts that can be moved and stored—in their daily operations. Only through well-designed IT systems and the power of computers can managers process these data into meaningful and useful information and use it for specific purposes, such as making business decisions. One such form of business information is the database, an electronic filing system that collects and organizes data and information. Using software called a database management system (DBMS), you can quickly and easily enter, store, organize, select, and retrieve data in a database. These data are then turned into information to run the business and to perform business analysis.

Databases are at the core of business information systems. For example, a customer database containing name, address, payment method, products ordered, price, order history, and similar data provides information to many departments. Marketing can track new orders and determine what products are selling best; sales can identify high-volume customers or contact customers about new or related products; operations managers use order information to obtain inventory and schedule production of the ordered products; and finance uses sales data to prepare financial statements. Later in the chapter, we will see how companies use very large databases called data warehouses and data marts.

Companies are discovering that they can't operate well with a series of separate information systems geared to solving specific departmental problems. It takes a team effort to integrate the systems described and involves employees throughout the firm. Company-wide enterprise resource planning (ERP) systems that bring together human resources, operations, and technology are becoming an integral part of business strategy. So is managing the collective knowledge contained in an organization, using data warehouses and other technology tools. Technology experts are learning more about the

way the business operates, and business managers are learning to use information systems technology effectively to create new opportunities and reach their goals.

Enterprise Portals Open the Door to Productivity

Intranets that take a broader view serve as sophisticated knowledge management tools. One such intranet is the enterprise portal, an internal website that provides proprietary corporate information to a defined user group. Portals can take one of three forms: business to employee (B2E), business to business (B2B), and business to consumer (B2C). Unlike a standard intranet, enterprise portals allow individuals or user groups to customize the portal home page to gather just the information they need for their particular job situations and deliver it through a single web page. Because of their complexity, enterprise portals are typically the result of a collaborative project that brings together designs developed and perfected through the effort of HR, corporate communications, and information technology departments.

More companies use portal technology to provide:

• A consistent, simple user interface across the company

• Integration of disparate systems and multiple sets of data and information

• A single source for accurate and timely information that integrates internal and external information

• A shorter time to perform tasks and processes

• Cost savings through the elimination of information intermediaries

• Improved communications within the company and with customers, suppliers, dealers, and distributors

Wireless Technologies

Wireless technology has become commonplace today. We routinely use devices such as cellular phones, mobile devices, garage door openers, and television remote controls—without thinking of them as examples of wireless technology. Businesses use wireless technologies to improve communications with customers, suppliers, and employees.

Companies in the package delivery industry, such as UPS and FedEx, were among the first users of wireless technology. Delivery personnel use handheld computers to send immediate confirmation of package receipt. You may also have seen meter readers and repair personnel from utility and energy companies send data from remote locations back to central computers. Bluetooth short-range wireless technology is a global standard that improves personal connectivity for users of mobile phones, portable computers, and stereo headsets, and Bluetooth wirelessly connects keyboards and mice to computers and headsets to phones and music players. A Bluetooth-enabled mobile phone, for example, provides safer hands-free phone use while driving. The technology is finding many applications in the auto industry as well. Bluetooth wireless technology is now standard in many vehicles today. Many car, technology, and cell phone companies—among them Amazon, Apple, Audi, BMW, DaimlerChrysler, Google, Honda, Saab, Toyota, and Volkswagen—already offer Bluetooth hands-free solutions. Other uses include simplifying the connection of portable digital music players to the car's audio system and transferring downloaded music to the system.

Management Information Systems

Whereas individuals use business productivity software such as word processing, spreadsheet, and graphics programs to accomplish a variety of tasks, the job of managing a company's information needs falls to management information systems: users, hardware, and software that support decision-making. Information systems collect and store the company's key data and produce the information managers need for analysis, control, and decision-making.

Factories use computer-based information systems to automate production processes and order and monitor inventory. Most companies use them to process customer orders and handle billing and vendor payments.

Banks use a variety of information systems to process transactions such as deposits, ATM withdrawals, and loan payments. Most consumer transactions also involve information systems. When you check out at the supermarket, book a hotel room online, or download music over the internet, information systems record and track the transaction and transmit the data to the necessary places.

Companies typically have several types of information systems, starting with systems to process transactions. Management support systems are dynamic systems that allow users to analyze data to make forecasts, identify business trends, and model business strategies. Office automation systems improve the flow of communication throughout the organization.

Decision Support Systems

A decision support system (DSS) helps managers make decisions using interactive computer models that describe real-world processes. The DSS also uses data from the internal database but looks for specific data that relate to the problems at hand. It is a tool for answering "what if" questions about what would happen if the manager made certain changes. In simple cases, a manager can create a spreadsheet and try changing some of the numbers. For instance, a manager could create a spreadsheet to show the amount of overtime required if the number of workers increases or decreases. With models, the manager enters into the computer the values that describe a particular situation, and the program computes the results. Marketing executives at a furniture company could run DSS models that use sales data and demographic assumptions to develop forecasts of the types of furniture that would appeal to the fastest-growing population groups. Companies can use a predictive analytics program to improve their inventory management system and use big data to target customer segments for new products and line extensions.

Protecting Computers and Information

Have you ever lost a term paper you worked on for weeks because your hard drive crashed or you deleted the wrong file? You were upset, angry, and frustrated. Multiply that paper and your feelings hundreds of times over, and you can understand why companies must protect computers, networks, and the information they store and transmit from a variety of potential threats. For example, security breaches of corporate information systems—from human hackers or electronic versions such as viruses and worms—are increasing at an alarming rate. The ever-increasing dependence on computers requires plans that cover human error, power outages, equipment failure, hacking, and terrorist attacks. To withstand natural disasters such as major fires, earthquakes, and floods, many companies install specialized fault-tolerant computer systems.

Disasters are not the only threat to data. A great deal of data, much of it confidential, can easily be tapped or destroyed by anyone who knows about computers. Keeping your networks secure from

unauthorized access—from internal as well as external sources—requires formal security policies and enforcement procedures. The increasing popularity of mobile devices—laptops, tablets, and cell phones—and wireless networks requires new types of security provisions.

In response to mounting security concerns, companies have increased spending on technology to protect their IT infrastructure and data. Along with specialized hardware and software, companies need to develop specific security strategies that take a proactive approach to prevent security and technical problems before they start.

Data Security Issues

Unauthorized access into a company's computer systems can be expensive, and not just in monetary terms. Juniper Networks estimates that cybercrime will cost businesses more than $3 trillion in 2020, compared to just $2 trillion in 2019. The most costly categories of threats include worms, viruses, and Trojan horses (defined later in this section); computer theft; financial fraud; and unauthorized network access. The report also states that almost all U.S. businesses report at least one security issue, and almost 20 percent have experienced multiple security incidents.

Computer crooks are becoming more sophisticated all the time, finding new ways to get into ultra-secure sites. "As companies and consumers continue to move towards a networked and information economy, more opportunity exists for cybercriminals to take advantage of vulnerabilities on networks and computers," says Chris Christiansen, program vice president at technology research firm IDC.17 Whereas early cybercrooks were typically amateur hackers working alone, the new ones are more professional and often work in gangs to commit large-scale internet crimes for large financial rewards. The internet, where criminals can hide behind anonymous screen names, has increased the stakes and expanded the realm of opportunities to commit identity theft and similar crimes. Catching such cybercriminals is difficult, and fewer than 5 percent are caught.

Internet of Things (ioT) [1]

"The IoT can be viewed as a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies)."

Things are objects of the physical world (physical things) or of the information world (virtual world) which are capable of being identified and integrated into communication networks. Things have associated information, which can be static and dynamic.

Physical things exist in the physical world and are capable of being sensed, actuated and connected. Examples of physical things include the surrounding environment, industrial robots, goods and electrical equipment.

Virtual things exist in the information world and are capable of being stored, processed and accessed. Examples of virtual things include multimedia content and application software.
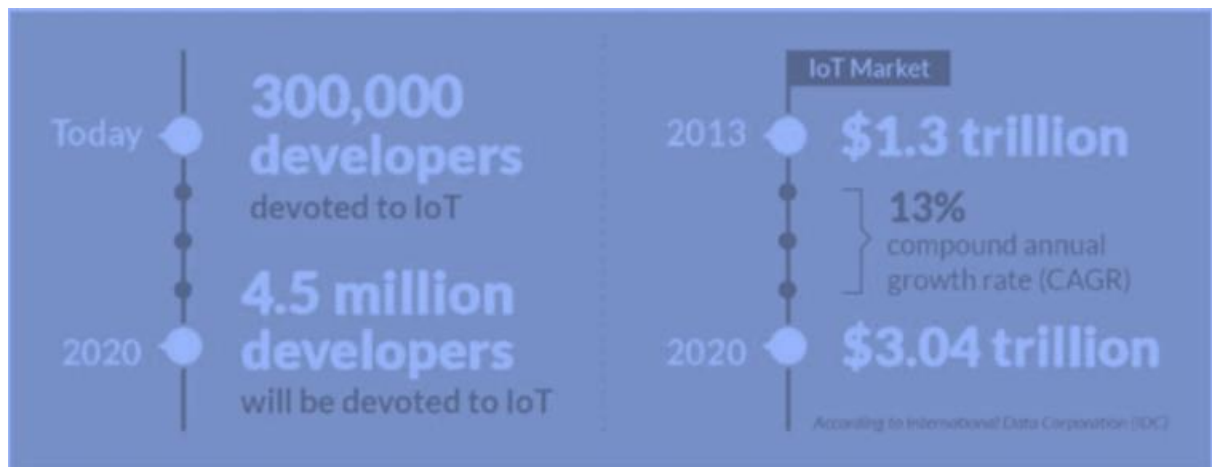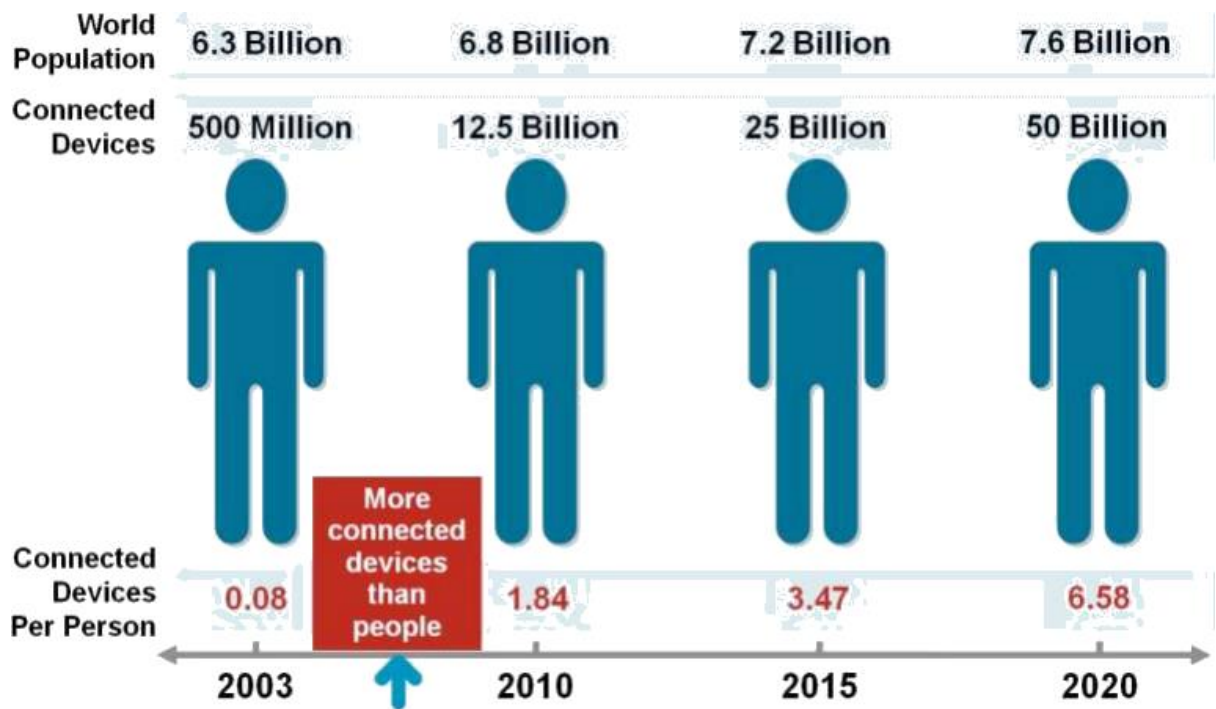

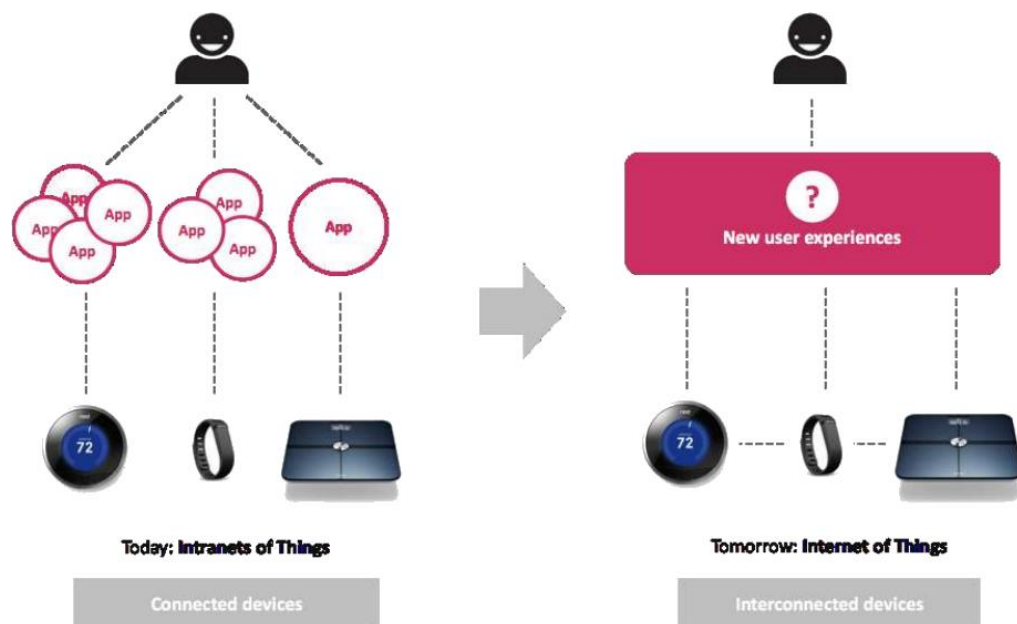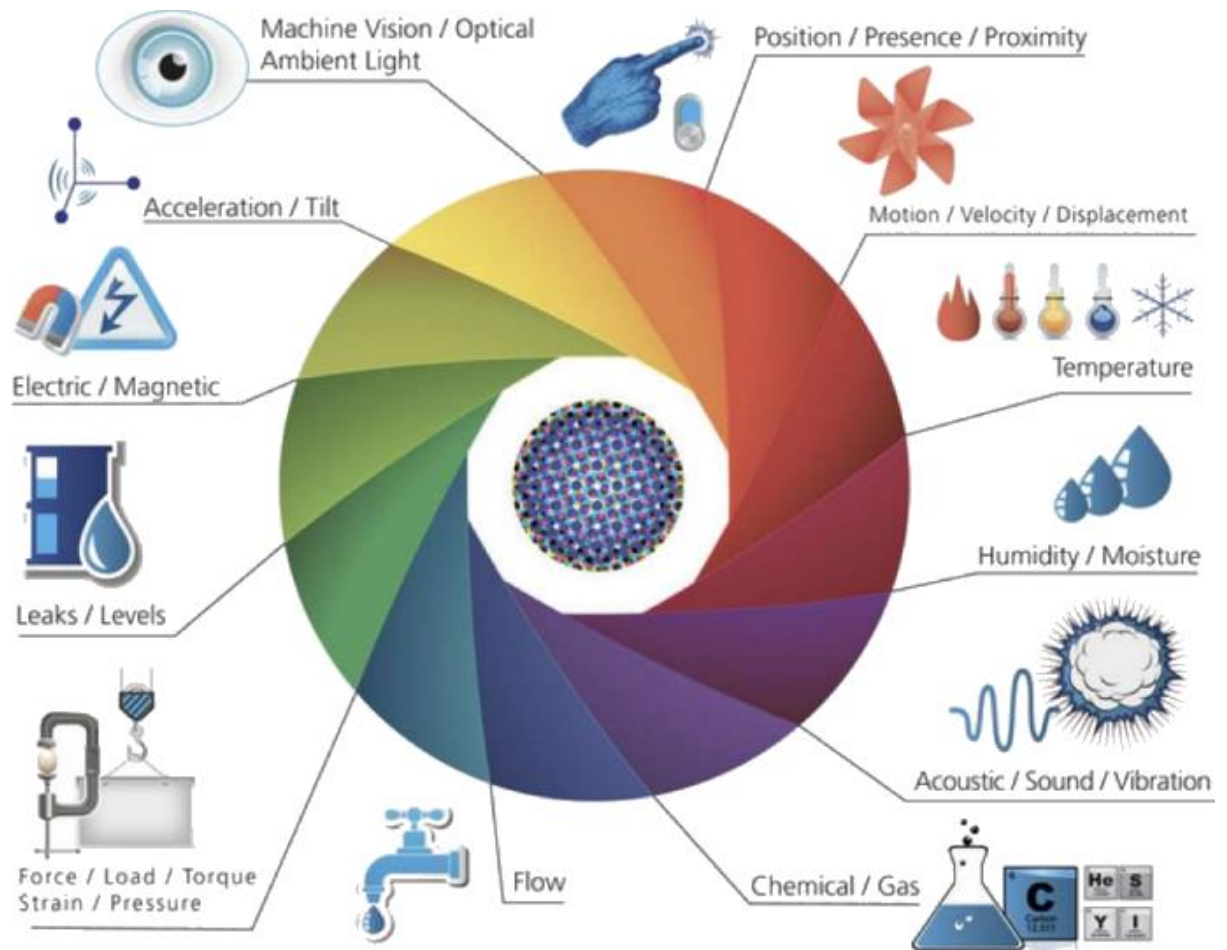[1] Marco Zennaro, "Introduction to the Internet of Things",
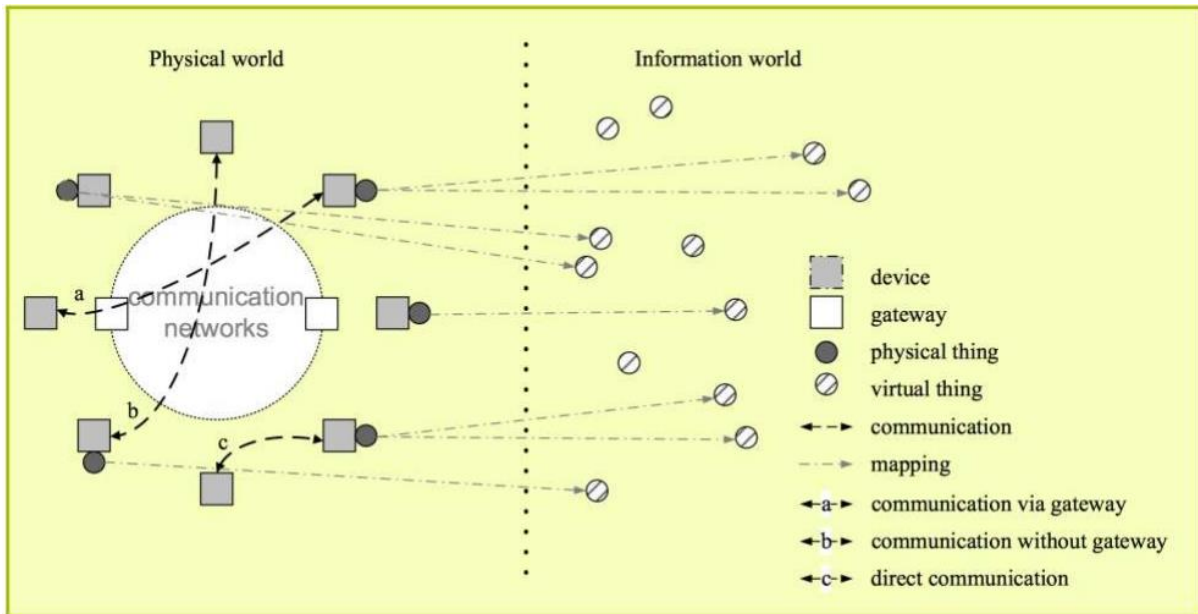
Fundamental characteristics of IOT

- Interconnectivity: With regard to the IoT, anything can be interconnected with the global information and communication infrastructure.

- Heterogeneity: The devices in the IoT are heterogeneous as based on different hardware platforms and networks. They can interact with other devices or service platforms through different networks.

- Dynamic changes: The state of devices change dynamically, e.g., sleeping and waking up, connected and/or disconnected as well as the context of devices including location and speed. Moreover, the number of devices can change dynamically.

- Enormous scale: The number of devices that need to be managed and that communicate with each other will be at least an order of magnitude larger than the devices connected to the current Internet. The ratio of communication triggered by devices as compared to communication triggered by humans will noticeably shift towards devicetriggered communication.

Predictions of IOT Devices

World Population	6.3 Billion	6.8 Billion	7.2 Billion	7.6 Billion
Connected Devices	500 Million	12.5 Billion	25 Billion	50 Billion
Connected Devices Per Person	0.08	1.84	3.47	6.58
	2003	2010	2015	2020

More connected devices than people

Today — 300,000 developers devoted to IoT

2020 — 4.5 million developers will be devoted to IoT

IoT Market

2013 — $1.3 trillion

13% compound annual growth rate (CAGR)

2020 — $3.04 trillion

According to International Data Corporation (IDC)

Iot Capabilities

An IOT Scenario

These things are starting to talk to each other and develop their own intelligence. Imagine a scenario where................

...your meeting was pushed back 45 minutes.

This is communicated to your alarm clock, which allows you 5 extra minutes of sleep.

...your car knows it will need gas to make it to the train station. Fill-ups usually take 5 minutes.

...there was an accident on your driving route causing a 15 minute detour.

...your train is running 20 minutes behind schedule.

And signals your car to start in 5 minutes to melt the ice accumulated in overnight snow storms.

And signals your coffee maker to turn on 5 minutes late as well.