# UNIT – V

**Some Internet Application:** E-mail-WWW-Information Browsing Services.

**Business Information System:** Types of information needed by organization Computer and Business- System life cycle.

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## Introduction

Internet is a communication network which bridges all the small computer networks worldwide as a whole. Internet is based upon Internet technology, in particular World Wide Web (WWW), to build Information System within organization or enterprise to accomplish standardization and automation.

## 5.1 INTERNET APPLICATION

The Internet has grown from a small project to today's biggest network of computers. Due to this growth , the Internet has become the biggest domain of information. Nowadays, an Internet user has access to a wide variety of services such as electronic mail, file transfer, vast information resources, interest group membership, interactive collaboration, multimedia displays, real-time broadcasting, shopping opportunities, and much more.

Some of the internet application are :

Network applications span a wide range, such as:
- ✓ email
- ✓ file transfer
- ✓ web browsing
- ✓ voice telephone calls (VoIP)
- ✓ distributed databases
- ✓ audio/video teleconferencing

- ➢ Each application offers a specific service to the user using a Specific user interface.
- ➢ But all applications can communicate over a single, shared network.
- ➢ To write the application software one must learn about one interface to network.

✦ Distributing and Sharing Scientific Data: Share scientific information (data, papers, databases) among scientists around the world.

✦ E-Commerce: Electronic marketing and advertising, online shopping (order/purchase, payment), online trading, online customer services.

✦ Online Education and Training: On-line courses, training program and information, distance learning

✦ Organization and Public Service: Distributing public service information for organizations and government offices.

- Online Publishing: Online books, magazines and journals, newspapers, Video, CD .

- Online Banking and Trading: Support online bank transactions for banks and stockbrokerages

## 5.2 E MAIL

Electronic Mail (E_Mail): It is the process of exchanging messages electronically, via communications network, using the computer. E_mail (electronic mail) is the exchange of computer stored messages by telecommunication. E_mail can be distributed to lists of people as well as to individuals. However, you can also send non-text files, such as graphic images and sound files, as attachments sent in binary streams.

The high demand for Gmail email address was also because the service offered 1GB (gigabyte) storage space for emails at a time when all the others were providing only a fraction of that email providers have such as composing and sending messages.

**How E_mail Works:** To send e_mail, one needs a connection to the Internet and access to a mail server, which forwards the mail. The standard protocol used for sending Internet e_mail is called SMTP (Simple Mail Transfer Protocol). It works in conjunction with POP (Post Office Protocol) and IMAP (Internet Mail Access Protocol) servers.

- **E_mail Address Structure:** A typical e_mail address would look like:
  username@website.com

- **Checking E_mails:** One can read received e_mails by opening his/her e_mailaccount.

- **Sending E_mails:** One of the important functions of an e_mail service is to provide aplatform to send e_mails. A user can reply to the received e_mail or send a new e_mail.

- **E_mail Attachments:** To send or receive files like compressed (.ZIP) files or anyexecutable (.EXE) files you need to 'attach' them in your e_mails.

**Unique Feature**

➔Priority Inbox - Gmail automatically sorts your mail by moving the important messages to the top and separates them from everything else in your inbox.
Manage your Gmail inbox with these features:
➔Labels - A Gmail label is similar to an email folder, butyou can apply multiple labels to a single message.
➔Filters - Create filters to sort and manage all yourincoming mail. Gmail filters can automatically applylabels, forward messages or delete emails.

➜Stars - Starred messages get pushed to the top of yourinbox and can be marked as priorities.

➜Tabs - Tabs separate your emails by category, tabs include 'Primary', 'Social', 'Promotions', 'Updates' and 'Forums'.

**Inbox:** When you sign in to Gmail, you'll see a list of any messages you've received in your Inbox. Unread messages are in bold. To open a message, simply click it in your message list.

**Compose a message**

1. In the pane on the left, click COMPOSE.

2. A new message opens near the lower rightof your Gmail window. To minimize the new message click .Click to pop out the message into a new window. You can resize the message window and move it around the screen this way.

3. In the To field, type the first letter or letters of a recipient's name to look up their email address in your corporate directory. (When you are not adding addresses, the "To" field is labelled Recipients.)

4. To add a Cc or a Bcc, simply click Cc or Bcc that shows up when you're entering addresses. You can also drag and drop email addresses between To, Cc, and Bcc.

5. Enter a subject and the message text. Your email pane will grow as you type to fit your message.

**Send a message**

At the bottom of the message window, click Send. A message appears at the top of the mail window, confirming that your message was sent.

<div style="background-color: yellow; padding: 20px; display: inline-block;">

Your message has been sent

</div>

Note: When you exit the message, a draft is automatically saved to your Drafts folder. (While composing your message, Gmail updates drafts automatically and notifies you by writing Saved next to the trash can.) If you decide to discard your message instead of sending it at a later time, click the trash can to delete it.

**Reply to a Message**

1. Open the message. If the message is part of a conversation, open the conversation and select the messageyou want to reply to.

2. At the bottom of the message, click Reply (to reply to just the sender) or Reply to all (to reply to all recipients). The Reply to all option won't appear if the email was only sent to you.

3. Optionally, you can change your reply format by clicking the arrow next to the Recipients field, or add new email addresses to the conversation by clicking directly in the Recipients field.

4. Enter your reply in the message field.

5. At the bottom of the message, click Send.

**Forward a Message**

1. Open the message. If the message is part of a conversation, open the conversation and select the message to forward.
2. At the bottom of the message, click Forward.
3. Enter the email addresses to which to forward the message, and add any notes in the message field.
4. If the message has an attachment that you don't want to forward, uncheck the box next to the attachment's file name, below the Subject field.
5. At the bottom of the message, click Send.

## 5.3 World Wide Web (WWW)

World Wide Web (WWW): It is a subset of the Internet and it presents text, images, animation, video, sound, and other multimedia in a single interface. The operation of the Web relies primarily on hypertext, as it is a means of information retrieval.

A technical definition of the World Wide Web is: all the resources and users on the Internet that are using the Hypertext Transfer Protocol (HTTP).

**Description**

• The WWW provides a hypertext-hypermedia interface to information resources in the Internet. So WWW is a distributed hypermedia system.

• The basis of the WWW was developed at CERN (the European Laboratory for Particle Physics) in Switzerland by Tim Berners-Lee and co-workers.
The WWW is an application of Internet

• The World-Wide Web (WWW) is a service, an application of Internet.

• It is based on the Internet infrastructure.

• So the WWW is newer than the Internet.

The concept of the WWW was created at the end of the 1980s when the Internet was already well established.

**URL (Universal Resource Locator)**
• draft standard for specifying an object on the Internet
• the structure is in most case protocol://computer_address[/path_name/file_name]

• examples:

»telnet://biblio.vub.ac.be

»ftp://ftp.vub.ac.be/

»gopher://gopher.vub.ac.be/

»http://www.vub.ac.be/BIBLIO/index.html

»news://news.server.edu/comp.infosystems.www format / structure

1. The first part of a URL, before the colon ":", specifies the access method = protocol

2. The second part of the URL, after the colon ":", is interpreted specific to the access method.In general, two slashes after the colon indicate a machine /computer name.

## *Essential elements*

• Information delivery and access using hypertext/hypermedia documents/objects

»html documents

»http protocol:    http clients ⟷ http servers

• Integration of protocols in the Internet:

»http servers offering html documents including links to other http servers, telnet servers, ftp servers, nntp servers, gopher servers...

## *Function*

• The WWW works by establishing hypertext/hypermedia links between documents anywhere on the network.

• A document might include many links to other documents held on many different servers.

• Selecting any one of those links will take you to the related document wherever it is. e.g. the references at the end of a paper might have hypertext links to the actual documents held elsewhere.

## *Protocols*

### - Gopher:

- A campus information service protocol invented at the university of Minnesota.

- A protocol supports multiple document types, executable scripts, external viewers, and fill-out forms.

- The main difference visible to the casual user is that its interface is a series of nested menus rather than hypertext documents.

- WAIS (Wide Area Information Search):

- A protocol that allows high speed remote searchers of document databases over the network.

## *Tools*

- Web Browsers and Web Servers:

HTTP is the original Web Communication protocol which supports the connectionless communications between a Web server and its clients above TCP layer.

To support the client-server communications on the Web,
->web browsers and web servers

## Web Browser:
A web browser is used as a client on the Web to support the following functions:
- to process users requests
- to connect to a web server using URL information
- to send the request to the sever
- to format the responding information (from the server)
- to display the formatted information as a document

## Web Sever:
A web server plays as a server on the web:
- to listen for incoming requests from the browser
- to find the requested document, and transmit to the browser or
- to find the corresponding CGI program and execute it
- to send the responding information back to the browser

## Hyperlinks
Hyperlinks can link a part of a hypermedia document to
• another part of the same document file
• another document file on the same server computer
• another document file on a server computer located elsewhere in the world

## Hypertext mark-up language ( HTML)
•Hypertext mark-up language : the system of codes used by authors to build the hypertext-pages/files in WWW, for instance to create a title or an anchor.  The codes are invisible / transparent for the user / reader.

**Hypertext transfer protocol (HTTP) :** the software conventions used by client and server programs for WWW to request and transfer hyper media documents. The protocol must not be known by he user / reader = the protocol is invisible / transparent for the user. Analogous with the telnet, ftp and gopher protocol.

## Pages and forms
• Pages
Many documents developed for WWW are kept small and nare named "pages".
These often refer to several other "pages".
• Forms = gateways to services and databases on server computers in WWW
Some pages contain electronic forms, to be filled in by the user.

## Applications
Analogous to gopher applications:
          • Access to online public access catalogues

- Campus-wide information systems
- Access to subject-oriented information
- Access to computer file archives
- Traveling / navigating through the Internet via linked html-pages
- Access to intranets within institutes / companies

**Browsers for Windows, in historical order:**
»Netscape
»Microsoft Internet Explorer
»Opera
»Mozilla Firefox

## 5.4 INFORMATION BROWSING SERVICES

A **web browser** is a software application for retrieving, presenting, and traversing information resources on the World Wide Web. An information resource is identified by a Uniform Resource Identifier (URI) and may be a web page, image, video, or other piece of content. Hyperlinks present in resources enable users easily to navigate their browsers to related resources. A web browser can also be defined as an application software or program designed to enable users to access, retrieve and view documents and other resources on the Internet.

A web search engine is designed to search for information on the World Wide Web and FTP servers. The search results are generally presented in a list of results often referred to as SERPS, or "search engine results pages". The information may consist of web pages, images, information and other types of files. Some search engines also mine data available in databases or open directories. Unlike web directories, which are maintained only by human editors, search engines also maintain real-time information by running an algorithm on a web crawler.

**Browser download addresses**
Firefox http://www.mozilla.org/en-US/firefox/new/
Chromehttps://support.google.com/chrome/bin/answer.py?hl=en&answer=95346
Safari http://www.apple.com/safari/download/
Opera http://www.opera.com/

**Browsing web pages requires:**
- An Internet connection;
- A computer system with a web browser;
- Knowing the address of a website.

### Internet Connection

Today, computers are rarely used without a connection to a network. Browsing websites has become a part of our daily lives. To use web-based services and browse web pages, an Internet connection is required.

The connection is usually provided by special companies – Internet Service Providers (ISP). ISPs ensure exchange of data between your computer and the Internet. Internet Service Providers have special technical equipment – communication channels, hardware; they can maintain additional network services to ensure the connection. Many ISPs offer additional services, such as free e-mail accounts, data storage space, website hosting.

Internet Service Providers use various technologies to ensure a connection, such as:

### Direct connection to the Internet:

Mobile connection: Connection by using a mobile telephone network;

Connection by using a public or private telecommunications network;

Wireless connection: Special devices called modems are often used for a connection.

There are various kinds of web browsers. Some of the most frequently used browser in Linux environment are:

**Mozilla Firefox**. Installed on Linux Ubuntu by default;

**Chrome**. A browser developed by Google;

**Flock**. Developed for integration with social networking sites;

**Opera**. A fast browser; .

### Web Address

To view a web page, it is necessary to know its address. Usually, a website consists of large number of interlinked pages. One of them is set as the main page and opens when the site's address is entered in the browser.

The full website address also contains the networking protocol, and is called the Uniform Resource Locator (URL).



A – Protocol; B – Site address

Image No. 1. The URL of a website

The Uniform Resource Locator can also point to a specific web resource – a page on a site:



Web addresses are allocated and registered by special services that are part of the overall Internet information system; these functions can also be performed by an Internet Service Provider.

A special Domain Name System has been established. Parts of the address are separated with dots in site names. There are top-level domains registered at an international level, such as:

**.lv**; **.lt**; **.ee**; **.ie**; **.de** – Latvia, Lithuania, Estonia, Ireland, Germany, respectively;

**.com** – commercial sites;

**.eu**– European Union.

A site owner can register his or her domain name by adding text to the top-level domain, for example, **sitename.eu**, followed by the computer name or the prefix **www**:

www.sitename.eu

## 5.5 BUSINESS INFORMATION SYSTEM

**Introduction**

Most information systems can be grouped into three broad classifications—enterprise systems (ES), knowledge management/collaboration systems, and business intelligence (BI) systems. These collectively comprise the information systems architecture for an enterprise.

Enterprise systems are used to manage the day to day business processes. Supply chain management (SCM) controls inbound and outbound logistics. Customer relationship management (CRM) manages communications and marketing initiatives direct data customers.

All of these enterprise systems communicate and share information as needed. They also store each of their activities in databases. At regular intervals these databases are copied into a centrally located data warehouse. The copying process is called **extract, transform and load** (ETL). Data is extracted from the multiple databases, transformed to a common format, and then loaded into the data warehouse.

The data warehouse then becomes a gold mine of data about the business. The beauty of the data warehouse is that it can be queried offline without interrupting operations of the business. However, the data warehouse is only as useful as the systems that query it for information. These are called business intelligence (BI) systems. One of the most well-known types of BI systems is for advanced reporting or data mining. BI systems look to spot trends in the data and then convey that information to the appropriate management level. For example, BI systems discovered years ago that diapers and beer were often purchased in the same supermarket visit.

Knowledge management and collaboration systems are ways that members of the organization capture and institutionalize organizational knowledge. The most familiar types of systems are internal websites for the company as well as blogs and wikis. However, leading organizations will also require that reports be filed in a systematic way to allow for easy retrieval in case the organization encounters a similar business problem in the future.
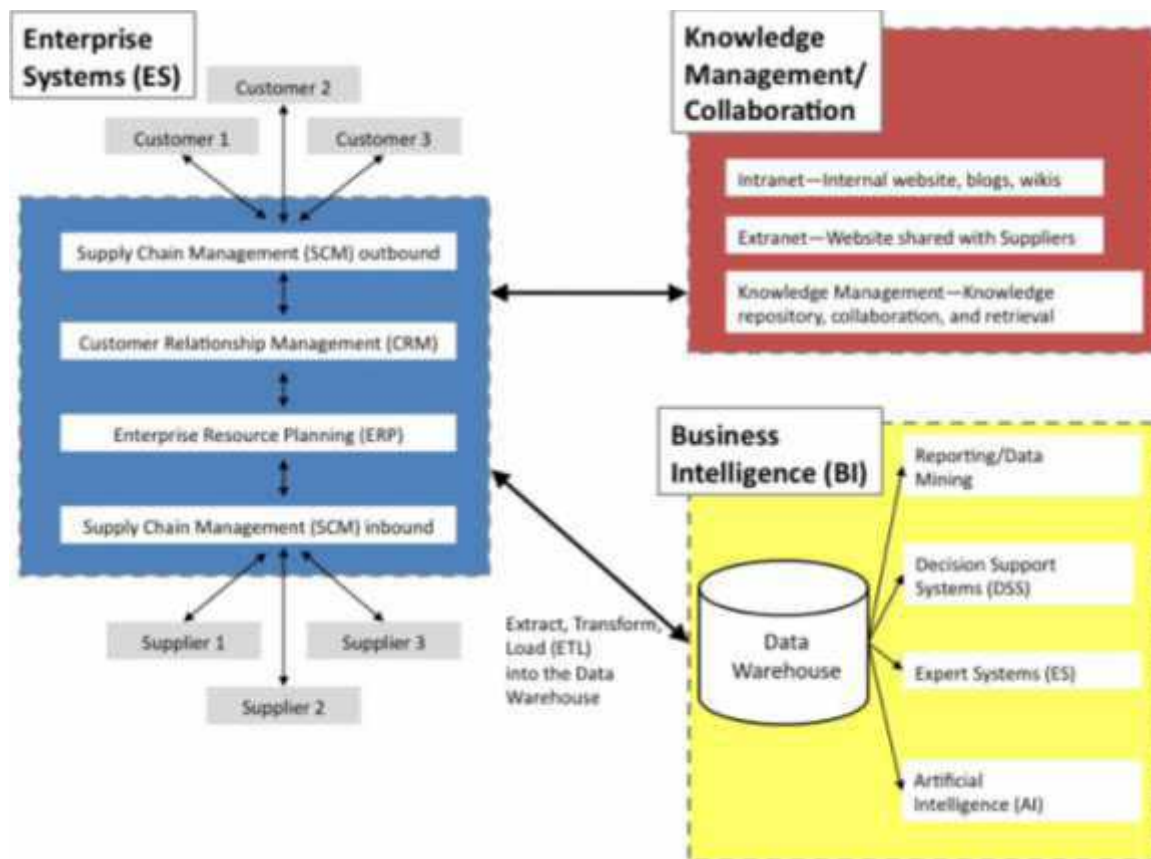
The big picture of information systems architecture. We will touch all these systems—albeit at a surface level. We will create a store that handles customer relationship management (CRM).Blackboard and similar systems are examples of collaboration systems. Finally, we will analyse our sales data as a form of business intelligence.

## 5.6 Types of information needed by organization Computer and Business

What is an information system?
The field of information systems (IS) comprises the following:

* a number of types of computer-based information systems
* objectives
* risks
* planning and project management
* organization
* IS development life cycle
* tools, techniques and methodologies
* integrative models

**Types of information systems :**

**1. Informal**

* evolve from patterns of human behaviour (can be complex)

- ✦ not formalized (i.e., designed)
- ✦ rely on \word of mouth" (\the grapevine")

2. **Manual**
   - ✦ formalized but not computer based
   - ✦ historical handling of information in organizations, before computers (i.e., human\clerks" did all the work)
   - ✦ some organizations still use aspects of manual IS (e.g., because computer systems are expensive or don't exist to replace specialized human skills)

**3. Computer-based**
   - ✦ automated, technology-based systems
   - ✦ typically run by an \IT" (information technology) department within a company or organization (e.g., ITS at BC)computer-based information systems
   - ✦ data processing systems (e.g., accounting, personnel, production)
   - ✦ automation systems (e.g., document preparation and management, database systems, email, scheduling systems, spread sheets)
   - ✦ management information systems (MIS) (e.g., produce information from data, data analysis and reporting)
   - ✦ decision support systems (DSS) (e.g., extension of MIS, often with some intelligence, allow prediction, posing of \what if" questions)
   - ✦ executive information systems (e.g., extension of DSS, contain strategic modelling capabilities, data abstraction, support high-level decision making and reporting, often have fancy graphics for executives to use for reporting to non-technical/non-specialized audiences)

**Enterprise Resource Planning Systems** An *enterprise resource planning* (ERP) *system* is an information system that supports the main business processes of an organization—for example, human resource management, sales, marketing, management, financial accounting, controlling, and logistics. In the past, each business process was encapsulated in a separate information system. As most of these business processes use related data, much redundant data had to be stored within the respective information systems. The increasing number and complexity of information systems forced organizations to spend much effort in synchronizing the data of all information systems.

ERP systems run typically in a three-tier client/server architecture consisting of a user interface (or presentation) tier, an application server tier, and a database server tier. ERP systems provide multi-instance database management, configuration management, and version (or customization) management for the underlying database schema, for the user interface, and for the many application programs associated with them. As ERP systems are typically designed for multinational companies, they have to support multiple languages, multiple currencies, and country-specific business practices. The sheer size and the tremendous complexity of these software systems make them complicated to deploy and maintain.

ERP systems are large and complex software systems that integrate smaller and more focused applications; for example, most ERP systems include functionality that is also present in other

enterprise information systems, such as procurement systems, manufacturing systems, sales and marketing systems, delivery systems, finance systems, and workflow management systems.

**Procurement Systems** A *procurement system* is an information system that helps an organization automates the purchasing process. The aim of a procurement system is to acquire what is needed to keep the business processes running at minimal cost. With the available inventory, the expected arrival of ordered goods, and forecasts based on sales and production plans, the procurement system determines the requirements and generates new orders. At the same time, it tracks whether ordered goods arrive. The key point is to order the right amount of material at the right time from the right source. If the material arrives too early, money for buying the material and warehouse space to store the material will be tied up. If, in contrast, the material arrives too late, then production is disrupted. Hence, the goal is to balance reducing inventory costs with reducing the risk of out-of-stock situations.

Procurement is related to *electronic data interchange* (EDI), the electronic exchange of information based on a standard set of messages. EDI can be used to avoid delays and errors in the procurement process as a result of rekeying information. In the classical (pre-EDI) situation, a purchase order is entered into the procurement system of one organization, it is printed, and the printed purchase order is sent to the order processing department or to another organization. The information on the printed purchase order is then re-entered into the procurement system. By using EDI or technology such as Web services, organizations can automate these parts of the procurement process. The purchase order is electronically sent to the processing department or to the other organization. This automation makes the overall procurement process faster and less error-prone, thereby reducing the costs for each purchase order.

**Manufacturing Systems** *Manufacturing systems* support the production processes in organizations. Driven by information, such as the bill of materials (BOM), inventory levels, and available capacity, they plan the production process. With increasing automation of production processes, manufacturing systems have become more and more important. For example, most steps in the production line of a car, such as welding the auto body, are performed by robots. This requires precise scheduling and material movement and, hence, a manufacturing system that supports these processes.

*Material requirements planning* (MRP) is an approach to translate requirements (i.e., the number of products for each period), inventory status data, and the BOM into a production plan without considering capacities. Successors, such as *manufacturing resources planning* (MRP2), also take capacity information into account. Software based on MRP and MRP2 has been the starting point for many ERP systems.

**Sales and Marketing Systems** *Sales and marketing systems* need to process customer orders by taking into account issues such as availability. These systems are driven by software addressing the four *p*'s: product, price, place, and promotion. Organizations undertake promotional activities and offer their products at competitive prices to boost sales, but a product that is not

available or not at the right location cannot be sold. One prominent example of a promotional activity is a bonus card in supermarkets.

Customers who register for a bonus card get a discount or a voucher. Bonus cards are an instrument for organizations to obtain personal data about their customers (e.g., age, address) and data about the buying behavior of customers (i.e., what they buy and when they buy it). These data are collected and processed by an information system. The information extracted from these data can help to improve marketing and to determine the range of products to offer. New technologies are increasingly used to support sales over the Internet. *Electronic commerce* uses the Internet to inform (potential) customers, to execute the purchase transaction, and to deliver the product. Again, this functionality is typically embedded in an ERP system. To manage the contact with their customers, organizations use dedicated *customer relationship management* (CRM) *systems*. A CRM system has a database to store all customer-related information, such as contact details and past purchases. This information helps tailor the marketing efforts to expected customer needs. As an example, a car dealer does not need to send information about a new expensive sports car to customers who recently bought a van or a compact car.

**Delivery Systems** A *delivery system* is an information system that supports the delivery of goods to customers. The task of these systems is to plan and schedule when and in what order customers receive their products. Consider, for example, a transportation company with hundreds of trucks. The planning of trips, the routing of these trucks, and reacting to on-the-fly changes require dedicated software. Creating an optimal schedule is a complex optimization problem. As circumstances—for example, traffic jams and production problems—may force rescheduling, contemporary delivery systems aim to find a good solution rather than a theoretical optimum solution. More and more delivery systems offer tracking-and-tracing functionality; for example, customers of package delivery companies, such as UPS, can track down the location of a specific parcel via the Internet.

**Finance Systems** Among the oldest information systems are *finance systems*. These systems support the flow of money within and between organizations. Finance systems typically provide accounting functionality to maintain a consistent and auditable set of books for reporting and management support. Another important application of finance systems is the stock market. At a stock market, dedicated information systems are essential to process the operations. Again, the functionality of finance systems is absorbed by ERP systems. The origin of the SAP system, for example, was in finance rather than production planning.

**Product Design Systems** Enterprise information systems not only support the production of products, they also support the design of products. Examples are *computer-aided design* (CAD) *systems* and *product data management* (PDM) *systems*. CAD systems support the graphical representation and the design of product specifications. PDM systems support the design process in a broader sense by managing designs and their documentation. Typically, there are many versions of the same design, and designs of different components need to be integrated.

To support such complex concurrent engineering processes, PDM systems offer versioning functionality.

**Workflow Management Systems** Many organizations aim to automate their business processes. To this end, they have to specify in which order the activities of a business process must be executed and which person has to execute an activity at which time. A *workflow* refers to the automation of a business process, in whole or in part. Each activity of the workflow is implemented as software. The workflow logic specifies the order of the activities. A *workflow management system* (WfMS) is an information system that defines, manages, and executes workflows. The execution order of the workflow's activities is driven by a computer representation of the workflow logic. The ultimate goal of workflow management is to make sure that the proper activities are executed by the right people at the right time .Not every business process corresponds to a single workflow. Workflows are casebased; that is, every piece of work is executed for a specific case. One can think of a case as a workflow instance, such as a mortgage, an insurance claim, a tax declaration, a purchase order, or a request for information.

**Data Warehouses** A *data warehouse* is a large database that stores historical and up to- date information from a variety of sources. It is optimized for fast query answering. To allow this, there are three continuous processes: The first process extracts data at regular intervals from its information sources, loads the data into auxiliary tables, and then cleans and transforms the loaded data to make it suitable for the data warehouse schema. Processing queries from users and from data analysis applications is the task of the second process. The third process archives the information that is no longer needed by means of tertiary storage technology.

Nowadays, most organizations employ information systems for financial accounting, purchasing, sales and inventory management, production planning, and management control. To efficiently use the vast amount of information that these operational systems have been collecting over the years for planning and decision-making purposes, the information from all relevant sources must be merged and consolidated in a data warehouse.

Whereas an operational database is accessed by *online transaction processing* (OLTP) applications that update its content, a data warehouse is accessed by ad hoc user queries and by special data analysis programs, referred to as *online analytical processing* (OLAP) applications. In a banking environment, for example, there may be an OLTP application for controlling the bank's automated teller machines (ATMs). This application performs frequent updates to tables storing current account information in a detailed format.

There may also be an OLAP application for analysing the behavior of bank customers. A typical query that could be answered by such a system would be to calculate the average amount that customers of a certain age withdraw from their accounts by using ATMs in a certain region. To minimize response times for such complex queries, the bank would maintain a data warehouse into which all relevant information (including historical account data) from other databases is loaded and suitably aggregated. Queries in data warehouses typically refer to

business events, such as sales transactions or online shop visits that are recorded in event history tables (i.e., fact tables) with designated columns for storing the time and the location at which the event occurred. An event record usually has numeric parameters (e.g., an amount, a quantity, or a duration) and additional parameters (e.g., references to the agents and objects involved in the event).

**Business Intelligence Systems** A *business intelligence system* provides tools to analyse the performance—that is, the efficiency and the effectiveness—of *running* business processes. These tools extract information on the business processes from the data available in an organization. Different tools and techniques exist, among them business performance management, business activity monitoring, querying and reporting, data mining, and process mining.

*Business performance management* concentrates on improving the performance of business processes. The goal is to extract information from the history of running business processes and to display this information on a management dashboard. For example, one could monitor a credit approval process to get insight into the length of time required to make the decision.

In contrast to business performance management, *business activity monitoring* aims at providing real-time information on business processes and the activities in these business processes. The goal is to support decision making at runtime. Such a tool may monitor inventory levels, response times, or queues and take action whenever needed.

*Querying and reporting* tools explore data (e.g., stored in a data warehouse) to provide insight into efficiency and effectiveness of business processes and trends in the environment. Typically, statistical analysis is applied to the data to distinguish between trends and isolated events.

## 5.7 SYSTEM LIFE CYCLE

The System Development Life Cycle (SDLC) process applies to information system development projects ensuring that all functional and user requirements and agency strategic goals and objectives are met. The SDLC provides a structured and standardized process for all phases of any system development effort. These phases track the development of a system through several development stages from feasibility analysis, system planning and concept development; to acquisition and requirements definition; design; development; integration and testing; deployment and acceptance; though deployment and production; and finally to system retirement.

The Records Management (RM) Profile1 recommends that agencies embed records management requirements in the earliest stages of the SDLC. The following document is a checklist to assist agencies to integrate RM into the SDLC. The checklist identifies certain points in the SDLC process where the agency may propose to establish records management review and approval to ensure that sound RM practices are incorporated into the development of its proposed IT systems. While the attached SDLC diagram demonstrates these stages in a linear "waterfall"

systems development methodology, the checklist can be used with other systems development methodologies as well, such as "spiral," "parallel," "rapid application development (RAD)" and "prototyping" by modifying the checklist to fit the phases of the preferred SDLC method used. The checklist provides three to five basic questions about records management and recordkeeping for each phase of the SDLC lifecycle process.

The checklist questions are intended to begin a more detailed discussion with agency records managers, IT and CPIC staff, and program managers and staff that will help identify recordkeeping requirements in each phase, with a great emphasis on identifying records management requirements at the earliest stages of project planning, initiation and requirements gathering. Because individual agency SDLC processes and policies vary widely, the checklist is not designed to be used as the only checklist an agency might need, or even a "one size fits all" approach to identifying record keeping requirements within an individual agency's SDLC policies. Rather, the checklist demonstrates a widely used methodology to plan and develop new IT systems that can be used as a model or template that individual agencies can revise or tailor to their own unique SDLC process, IT and systems development policies and procedures to identify their unique records management and recordkeeping requirements. For instance, some agencies use a five-step SDLC process, and others use a ten-step process, and they should revise or modify checklist to meet their specific SDLC policy and business needs.

The following figure is a graphical representation of the various stages of a typical SDLC.
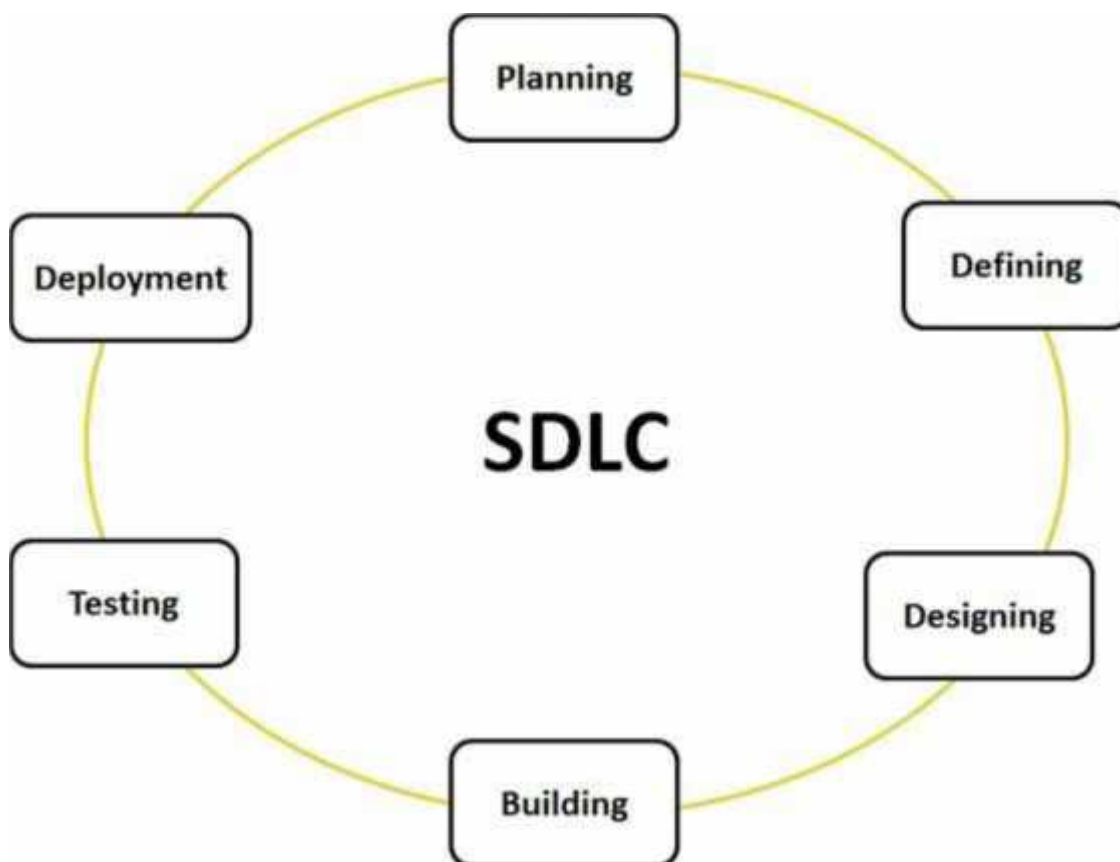
A typical Software Development life cycle consists of the following stages:

**Stage 1:** *Planning* **and Requirement Analysis :** Requirement analysis is the most important and fundamental stage in SDLC. It is performed by the senior members of the team with inputs from the customer, the sales department, market surveys and domain experts in the industry. This information is then used to plan the basic project approach and to conduct product feasibility study in the economical, operational, and technical areas.
Planning for the quality assurance requirements and identification of the risks associated with the project is also done in the planning stage. The outcome of the technical feasibility study is to define the various technical approaches that can be followed to implement the project successfully with minimum risks.

**Stage 2:** *Defining* **Requirements :** Once the requirement analysis is done the next step is to clearly define and document the product requirements and get them approved from the customer or the market analysts. This is done through 'SRS' – Software Requirement Specification document which consists of all the product requirements to be designed and developed during the project life cycle.

**Stage 3:** *Designing* **the product architecture :** SRS is the reference for product architects to come out with the best architecture for the product to be developed. Based on the requirements specified in SRS, usually more than one design approach for the product architecture is proposed and documented in a DDS - Design Document Specification. This DDS is reviewed by all the important stakeholders and based on various parameters as risk assessment, product robustness, design modularity , budget and time constraints , the best design approach is selected for the product.
A design approach clearly defines all the architectural modules of the product along with its communication and data flow representation with the external and third party modules (if any).

**Stage 4:** *Building* **or Developing the Product :** In this stage of SDLC the actual development starts and the product is built. The programming code is generated as per DDS during this stage. If the design is performed in a detailed and organized manner, code generation can be accomplished without much hassle.
Developers have to follow the coding guidelines defined by their organization and programming tools like compilers, interpreters, debuggers etc are used to generate the code. Different high level programming languages such as C, C++, Pascal, **Java**, and PHP are used for coding. The programming language is chosen with respect to the type of software being developed.

**Stage 5:** *Testing* **the Product :**This stage is usually a subset of all the stages as in the modern SDLC models, the testing activities are mostly involved in all the stages of SDLC. However this stage refers to the testing only stage of the product where products defects are reported, tracked, fixed and retested, until the product reaches the quality standards defined in the SRS.

**Stage 6:** *Deployment* **in the Market and Maintenance :**Once the product is tested and ready to be deployed it is released formally in the appropriate market. Sometime product deployment

happens in stages as per the organizations' business strategy. The product may first be released in a limited segment and tested in the real business environment (UAT- User acceptance testing).

Then based on the feedback, the product may be released as it is or with suggested enhancements in the targeting market segment. After the product is released in the market, its maintenance is done for the existing customer base.