

## Information System Building Blocks

### Objectives

- Differentiate between *front-* and *back-office* information systems.
- Describe the role of information systems architecture in systems development.
- Identify three high-level goals that provide system owners and system users with a perspective of an information system.
- Identify three technologies that provide system designers and builders with a perspective of an information system.
- Identify three areas of focus for an information system
- Describe four building blocks of the KNOWLEDGE goal for an information system.
- Describe four building blocks of the PROCESS goal for an information system.
- Describe four building blocks of the COMMUNICATIONS goal for an information system.
- Describe the role of network technologies as it relates to Knowledge, Processes, and Communications building blocks.

Systems analysis and design methods are used to develop information systems for organizations. Before learning the process of building systems, you need a clear understanding of the *product* you are trying to build. This topic takes an architectural look at information systems and applications.

### The Product-Information Systems

- Organizations are served not by a single information system but instead, by a federation of information systems that support various business functions.

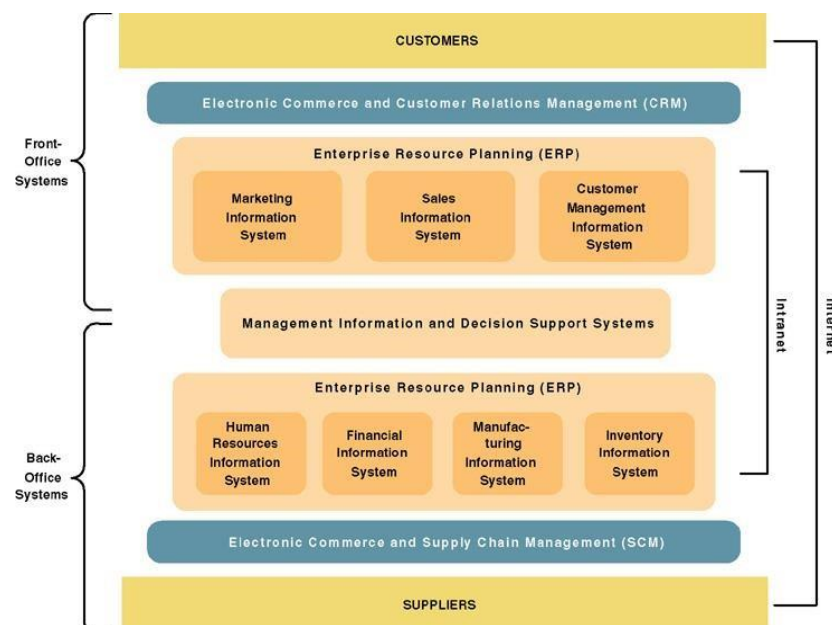


Figure 1 Federation of information systems

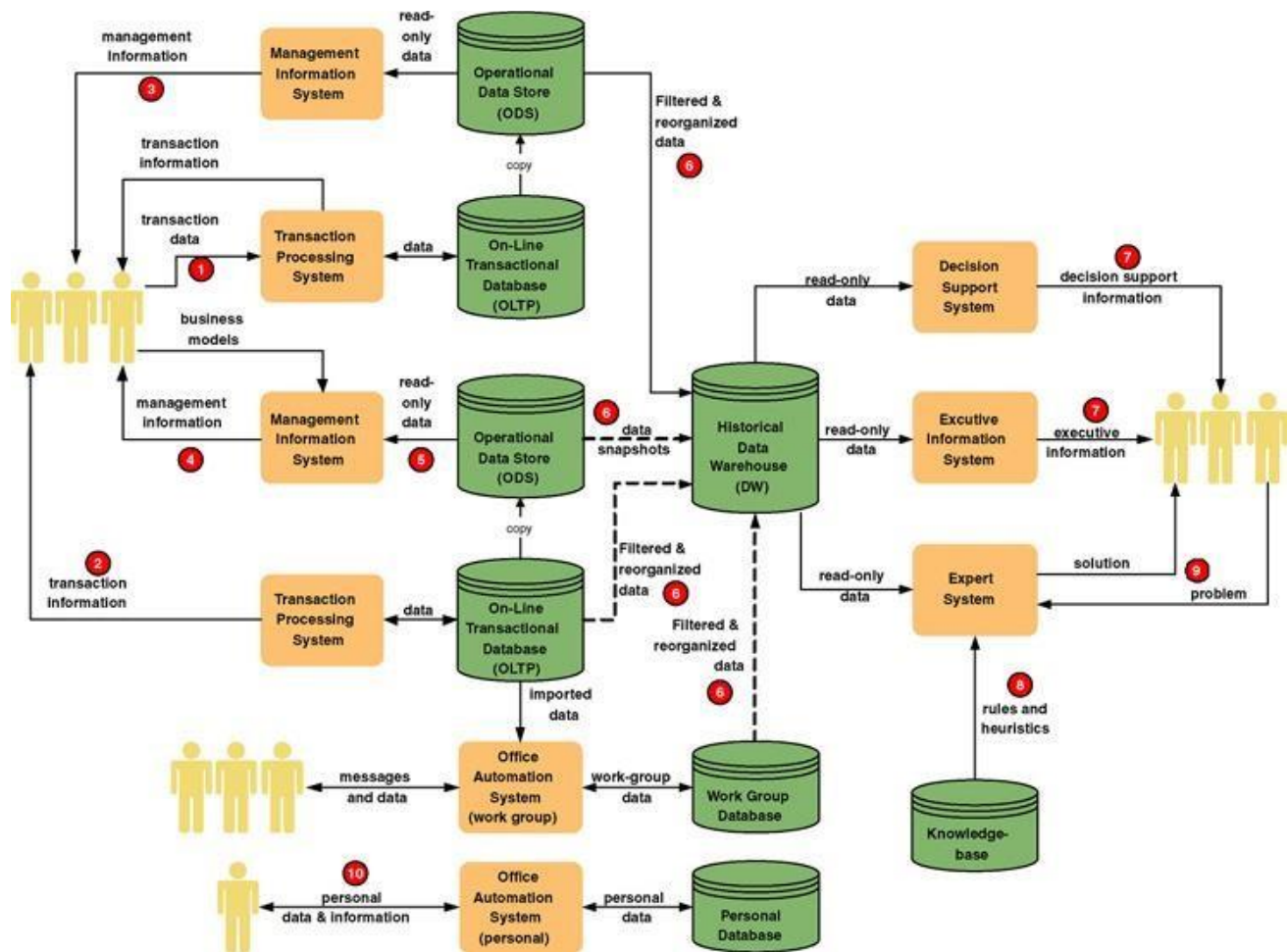
Most businesses have both **front-office** information systems that support business functions that reach out to customers (or constituents) and **back-office** information systems that support internal business operations as well as interact with suppliers.

- These front- and back-office information systems feed data to management Information systems and decision support systems that support management needs of the business.
- Contemporary information systems are interfacing with customers and suppliers using electronic commerce technology, customer relations management (CRM), and supply chain management (SCM) over the Internet.
- Finally, most companies have some sort of Intranet (internal to the business) to support communication between employees and the information systems.
- **Front-office information systems** support business functions that extend out to the organization's customers (or constituents).
  - Marketing
  - Sales
  - Customer management
- **Back-office information systems** support internal business operations of an organization, as well as reach out to suppliers (of materials, equipment, supplies, and services).
  - Human resources
  - Financial management
  - Manufacturing
  - Inventory control

### Information System Applications

- In topic one, we learned that there are several classes of information system applications. Each class serves the needs of different types of users. In practice, these classes overlap such that it isn't always easy to differentiate one from another. The various applications should ideally interoperate to complement and supplement one another. Figure 2, illustrates typical roles of Information systems in an organization. The rounded rectangles represent various information systems. Notice that an organization can and will have multiple transaction-processing systems, office automation systems, etc. The drum shapes represent stored data. Notice that an organization has multiple sets of stored data, and only some of them work together. From the diagram:
  1. The first transaction processing system responds to an input transactions data (e.g., an order). It produces transaction information to verify the correct processing of the input transaction.
  2. The second transaction processing system merely produces an output transaction (e.g., an invoice). Such a system may respond to something as simple as the passage of time (it is the end of the month therefore, generate all invoices).
  3. The first management information system simply produces reports or information (e.g., sales analysis reports) using data stored in transactional databases (maintained by the aforementioned transaction processing systems).

4. The second management Information system uses business models (e.g., MRP) to produce operational management Information (e.g., a production schedule).
5. Notice that an MIS may use data from more than one transaction database.
6. Notice that snapshots of data from the transactional databases populate a data warehouse. The snapshots may be taken at various time intervals, and different subset of data may be Included in various snapshots. The data in the data warehouse will be organized to and inquiry by managers.



**Figure 2 Information systems applications**

7. Decision support and executive Information systems applications will typically provide read-only access to the data warehouses to produce decision support and executive management Information.
8. An expert system requires a special database that stores the expertise in the form of rules and heuristics.
9. An expert system either accepts problems as inputs (e.g., Should we grant credit to a specific customer?), or senses problems in the environment (e.g., Is tile lathe producing parts within acceptable specifications?), and then responds to a problem with an appropriate solution based on the system's expertise.

10. Personal office automation systems tend to revolve around the data and business processing needs of an individual. Such systems are typically developed by the users themselves (and run-on personal computers).

11. Work group office automation systems are frequently message-based (e.g., e-mail based) and are smaller-scale solutions to departmental needs. As shown in the figure, they can access or import data from larger, transaction processing systems.

- In the average business, there will be many instances of each of these different applications.

### **Information Systems Architecture**

- Information technology professionals speak of data architectures, application architectures, network architectures, software architectures etc.

**Information systems architecture** serves at a higher-level framework for understanding different views of the fundamental building blocks of an information system.

- Essentially, information systems architecture provides a foundation for organizing the various components of any information system you can develop.
- **Information systems architecture** is a unifying framework into which various stakeholders with different perspectives can organize and view the fundamental building blocks of information systems.

### **High-Level Goals of System Owners and System Users**

- Different stakeholders have different perspectives on or views of an information system.
- System owners and system users tend to focus on three common business goals of any Information system. These goals are typically established in response to one or more of the business drivers.
- These goal-oriented perspectives of an Information system include:
  - The goal to improve business **knowledge**. Knowledge is a product of information and data.
  - The goal to improve business **processes** and **services**.
  - The goal to improve business **communications** and **people collaboration**.

### **Technology Perspectives of System Designers & System Builders**

- The role of the system designers and builders is more technical. As such, their focus tends to be placed more on the technologies that may be used by the Information system in order to achieve the business goal.
- The system designers and builders' perspectives of an Information system tend to focus more on:
  - Database technologies that support business accumulation and use of business **knowledge**
  - Software technologies that automate and support business **processes** and **services** - Interface technologies that support business **communication**

## **Focuses for Information Systems**

□ Focuses for information systems are:

- **Knowledge** - the raw material used to create useful information.
- **Process** - the activities (including management) that carry out the mission of the business.
- **Communication** - how the system interfaces with its users and other information systems

## **Information System Building Blocks**

- The Information system building blocks do not exist in isolation. They must be carefully synchronized to avoid inconsistencies and incompatibilities within the system. For example, a database designer (a system designer) and a programmer (a system builder) have their own architectural views of the system; however, these views must be compatible and consistent if the system is going to work properly.

## **KNOWLEDGE Building Block**

- Improving business knowledge is a fundamental goal of an Information system.

## **Views of Knowledge**

### **System owners' view**

- The average system owner is not interested in raw data. The system owner is interested in information that adds new business knowledge.
- Business knowledge and information help managers make intelligent decisions that support the organization's mission, goals, objectives, and competitive edge.
- Business knowledge may initially take the form of a simple list of business entities and business rules. Examples of business entities might include CUSTOMERS, PRODUCTS, EQUIPMENT, BUILDINGS, ORDERS), and PAYMENTS. What do business entities have to do with knowledge? Information is produced from raw data that describe this business entities.

### **System users' view**

- Information system users are knowledgeable about the data that describe the business. As Information workers, they capture, store, process, edit, and use that data every day.
- They view data as something recorded on forms, stored in file cabinets, recorded in books and spreadsheets, or stored on computer.
- They focus on business issues as they pertain to data.
- The challenge in systems development is to correctly identify and identify users' business data requirements.
- Data requirements are an extension of the business entities and rules that were initially identified by the system owners.
- System users may identify additional entities and rules because of their greater familiarity with the data.

- More importantly, system users must specify the exact data attributes to be stored and the precise business rules for maintaining that data.
- For example, a system owner may identify the need to store data about a business entity called customer. System users might tell us that we need to differentiate between PROSPECTIVE CUSTOMERS, ACTIVE CUSTOMERS), and INACTIVE CUSTOMERS because they know that slightly different types of data describe each type of customer.

### **System Designers' View**

- The system designer's KNOWLEDGE perspective differs significantly from the perspectives of system owners and system users.
- The system designer is more concerned with the DATABASE TECHNOLOGY that will be used by the Information system to support business knowledge.
- System designers translate the system users' business data requirements into database designs that will subsequently be used by system builders to develop computer databases that will be made available via the information system.
- The system designers' view of data is constrained by the limitations of whatever database management system (DBMS) is chosen.

### **System Builders' View**

- System builders are closest to the actual database management system technology.
- They must represent data in precise and unforgiving languages.  
The most commonly encountered database language is SQL (Structured Query Language). Alternatively, many database management systems, such as Access and Visual FoxPro include proprietary languages or facilities for constructing a new database.

### **PROCESS Building Blocks**

- Improving business and services processes is fundamental goal of an Information system.
- **Processes** deliver the desired functionality of an information system.
- Processes represent the work in a system. People may perform some processes, while computers and machines perform others.

### **Views of PROCESS**

#### **System Owners' View**

- System owners are generally interested in the big picture. They tend to focus not so much on work flow and procedures as on high level business functions.
- **Business function** is a group of related processes that support the business. Functions can be decomposed into other sub-functions and eventually into processes that do specific tasks.

- Typical business functions include Sales, Service, Manufacturing, Shipping, Receiving, and Accounting
- Organizations are often organized around these business functions with a manager overseeing each function. Unlike business events (such as CUSTOMER SUBMITS ORDER) that have a definite beginning and end, a business function has no starting time or stopping time.
- Historically, most information systems were (or are) function-centered meaning the system supported one business function. An example would be a SALES INFORMATION SYSTEM that supports only the initial processing of customer orders. Today, many of these single-function information systems are being redesigned as **cross-functional information systems** that support several business functions.
- A **cross-functional information system** is a system that supports relevant business processes from several business functions without regard to traditional organizational boundaries such as divisions, departments, centers, and offices.

### System users' view

- Users are concerned with the business processes, or 'work that must be performed in order to provide the appropriate responses to business events.
- System users specify the **business process** (activities that respond to business events) in terms of process requirements for a new system.
- **Process requirements** (a user's expectation of the processing requirements for a business process and its information systems) are often documented in terms of activities, data flows, or **work flow** (the flow of transactions through business processes to ensure appropriate checks and approvals are implemented).
- Process requirements are frequently specified in terms of work flow.
- These process requirements must be precisely specified, especially if they are to be automated or supported by software technology.
- Business process requirements are defined in terms of **policies** (set of rules that govern a business process) and **procedures** (a step-by-step set of instructions and logic for accomplishing a business process).
- Policies are explicit rules that must be adhered to when completing a business process.
- Procedures are the precise steps to be followed in completing the business process.

### System designers' view

- The system designer's view of business processes is constrained by the limitations of specific application development technologies such as Java, Visual Basic.NET, C++, and C#.
- Sometimes the analyst is able to choose the software technology; however, often the choices are limited by software architecture standards that specify which software and hardware technologies must be used. In either case, the designer's view of processes is technical.
- Given the business processes from the system users' view, the designer must first determine which processes to automate and how to best automate those processes.

- Models are drawn to document and communicate how selected business processes are, or will be, implemented using the software and hardware.

### **System builders' view**

- System builders represent PROCESSES using precise computer programming languages or application development environments (ADEs) that describe Inputs, outputs, logic, and control. Examples Include C++, Visual Basic.NET, C# and Java
- Additionally, some applications and database management systems provide their own internal Languages for programming. Examples Include Visual Basic for Applications (In Access) and PLSQL (in Oracle). All these languages are used to write custom-built application programs that automate business processes.

## **COMMUNICATION Building Blocks**

### **Views of COMMUNICATION**

- A common goal of most organizations is to improve business communication and collaboration between employees and other constituents.
- Communication improvements in information systems are typically directed toward two critical interface goals for an information system:
  - Information systems must provide effective and efficient communication interfaces to the system users. These interfaces should promote teamwork and coordination of activities.
  - Information systems must interface effectively and efficiently with other Information systems both with those within the business and increasingly with other businesses' information systems.

### **System owners' view**

- The system owners' view of **communication** is simple. The system owner is concerned with:
  - Which business units, employees, customers, and external businesses must the new system interact with?
  - Where these business units, employees, customers, and external businesses are located
  - Whether the system will have to interface with any other information, computer, or automated systems

### **System users' view**

- System users' view of COMMUNICATION is more in terms of the information system's inputs and outputs.
- Those inputs and outputs can take many forms; however, the business interface requirements are more important than the technical format.
- The inputs and outputs represent how the proposed system would interact with users, employees, business with, customers, and other businesses.



- The details of those inputs and outputs are important system users might specify the details in the form of a list of fields (and their values) that make up the inputs or outputs.

### System Designers' View

- The designers must be concerned with the technical design of both the user and the system-system communication interfaces. These interfaces are called **specifications**.
- Users and designers can be involved in interface design. But while system users are interested in requirements and format, system designers have other interests such as consistency, compatibility, completeness, and user dialogues.
- The **user dialogue** (sometimes called interface navigation) specifies how the user will navigate through an application to perform useful work.
- The trend toward **graphical user interfaces** (GUIs) such as **Windows** and **Web browsers** has simplified life for system users but complicated the design process for system designers. In a typical Windows application, there are many different things users can do at any given time e.g., type something, click the left mouse button on a menu item or toolbar icon, press the F1 key for help, maximize the current window, minimize the current window, switch to a different program, and many others.
- Accordingly, the system designer views the interface in terms of various system states, events that change the system from one state to another, and responses to those events.
- Today, there are many more design decisions and considerations the system designer must address to document the dialogue of a graphical user interface solution.

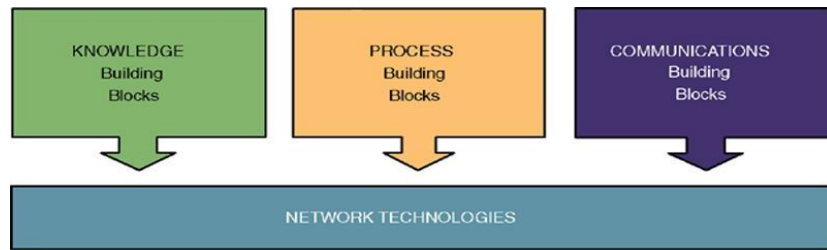
### System builders' view

- System builders construct, install test, and implement both user and system-to-system interface solutions using interface technology.
- For user Interfaces, the Interface technology is frequently embedded into the application development environment (ADE) used to construct software for the system.

### Network Technologies and the Information System Building Blocks □

Today's information systems are built on networks.

- Figure 3 shows a modern high-level information systems framework that demonstrates the
- Contemporary layering of an Information system's KNOWLEDGE, PROCESSES, and COMMUNICATIONS building blocks on NETWORK TECHNOLOGIES. Today's best designed Information systems tend to separate these layers and force them to communicate across the network.
- This **clean-layering** approach allows any one building block to be replaced with another while having little or no impact on the other building blocks. For example, the DATABASE TECHNOLOGY, SOFTWARE TECHNOLOGY, or INTERFACE TECHNOLOGY could be changed without impacting the other building blocks.



**Figure 3 the role of network in information systems**

## Summary



1. Organizations are served by a federation of information systems that support various business functions. Businesses have front-office information systems that support business functions that extend out to their customers and back-office information systems that support internal business operations and interact with suppliers.
2. The many classes of information system applications overlap and interoperate to complement and supplement one another.
3. Information systems architecture provides a unifying framework into which various stakeholders with different perspectives can organize and view the fundamental building blocks of information systems:
  - a. System owners and system users tend to focus on three common business goals of any information system—improvements in business knowledge, business processes, and business communications.
  - b. System designers and builders tend to focus on technologies used by the information system in order to achieve the business goals. They focus on the database technologies that support business knowledge, software technologies that support business processes, and interface technologies that support business communications.
4. The three views represented in the model are:
  - a. **KNOWLEDGE**—the business knowledge that helps managers make intelligent decisions.
  - b. **PROCESSES**—the activities (including management) that carry out the mission of the business.
  - c. **COMMUNICATIONS**—how the system interfaces with its users and other information systems.
5. Improving business knowledge is a fundamental goal of an information system:
  - a. The system owner is interested in information that adds new business knowledge.
  - b. Information system users are knowledgeable about the data that describes the business. This data is used to create information and subsequent business knowledge.
  - c. System designers are concerned with the database technology that will be used by the information system to support business knowledge.
  - d. System builders focus on the actual database management system technology used to store the business data that will support business knowledge.
6. Improving business processes is a fundamental goal of an information system:
  - a. System owners are interested in the business functions the groups of related processes, that support a business.
  - b. System users specify the business process in terms of process requirements for a new system. Business process requirements are frequently defined in terms of policies and procedures. Policies are explicit rules that must be adhered to when completing business processes. Procedures are the precise steps to be followed in completing business processes.
  - c. System designers view business processes in terms of the application development environment and the software technology used to develop the system. Many businesses purchase commercial off-the-shelf software solutions instead of building the software in-house.
  - d. System builders focus on custom-built applications programs that automate business processes.
7. A common goal of most organizations is to improve business communications:
  - a. System owners define the communications scope of an information system development project.
  - b. System users view communications in terms of the information system's inputs and outputs.
  - c. System designers are concerned with the technical design of both user and system-to-system communication interfaces.
  - d. System builders are concerned with the interface technology they use to implement user and system-to-system communication interfaces.
8. Today's information systems are built on networks. Network technology allows properly designed information systems to separate the **KNOWLEDGE, PROCESS, and COMMUNICATION** building blocks and force them to communicate across the network.

## Review Questions

1. Explain the difference between front-office information systems and back-office information system
2. Explain how transaction processing systems (TPSs), management information systems (MISs) and decision support systems (DSSs) interact with each other.

3. "It important to identify system architecture". Discuss.
4. Describe the three goal-oriented perspectives or views of an information system that system owners and system users tend to focus on.
5. Describe the three technological perspectives of information systems that system designers and builders tend to focus on.
6. Explain how business perspectives and the technology perspectives of an information system are related.
7. In any given building blocks of an information system, the views of four groups of stakeholders need to be taken into account during the development of the system. Identify these four stakeholder groups.
8. Explain how system designers and system builders tend to view KNOWLEDGE in a system.
9. Understanding business functions is essential in the process building block of an information system. Describe six high-level business functions typical of many organizations.
10. If you were the owner of an online store selling computers and accessories, identify two business functions of the online store in terms of business events and responses to those events.
11. Give an example of a policy and the procedures needed to implement the policy
12. What is prototyping?
13. Explain the need of prototyping technique in systems development.
14. Describe the two most critical goals in the communication building block.
15. What is a user dialogue?
16. "The increasing use of graphical user interface (GUI) complicated the design process for designers". Discuss.
17. Discuss the role of network technology plays in developing information systems.
18. Companies generally need to use more than one information system to support all their different business functions. These functions are frequently referred to as either front office information systems or back-office information systems. Distinguish between the two and identify some of the typical business functions supported by them.
19. As a systems analyst, designer, or builder, you will frequently be involved with your organization's information system architecture. Describe information systems architecture and explain its purpose.
20. Although system owners and system users generally have different perspectives of their organization's information system, both groups tend to focus on three business goals that are common to any information system. Identify these goal-oriented perspectives and explain their importance.
21. In an information system, the process building blocks represent the work that occurs in a system, which may be performed by people or by computers and machinery. Stakeholders tend to have different view or perspectives of these building blocks. What are these different stakeholder perspectives regarding processes, and how they differ from each other?

22. Assume you are designing a retail point-of-sale (POS) system for your company. What are the typical systems interfaces of a point-of-sale system that needs to be taken into account in designing the POS system?
23. At times, an organization may choose to purchase a commercial off-the-shelf (COTS) software package. Explain the pros and cons of using off-the-shelf applications compared to custom-built applications.
24. If an organization chose a COTS package as their solution, would the view of the system builders be the same as for a custom-built application? If not, how would it be different?