Analysts in Action

Episode Two

SCENE

A conference room where Sandra Shepherd has called a project launch meeting. Sitting around the table are Bob Martinez (a teammate), Galen Kirchoff (vice president of Member Services), Steven Siemers (club director of the Audio Club), Susan Crane (club director of the Game Club), Steve Segal (interim club director of the Video Club), Monica Blair (director of Marketing), Oscar Mann (director of Customer Services), and Dick Krieger (director of Warehouse Operations).

SANDRA

Good morning! I see that you all found the coffee, juice, and rolls. Thank you for coming. As you know, we are launching a new systems project this morning. Our goal is simply to orient everyone so that we can assemble the team and establish a vision.

First, I'd like to introduce you to two new faces. On my left is Bob Martinez. Bob has just joined Information Services as a systems analyst and will be assigned to the project. On my right is Steve Segal who has joined us from our new Silver Screenings Video Club acquisition. He is acting club director of the Video Club. Welcome to both of you. Let's get started.

First, as required in our methodology, every project, must have an executive sponsor. I'd like to turn the floor over to our executive sponsor, Mr. Galen Kirchoff.

GALEN

Good morning! I'll make my remarks brief. This morning, it is my privilege to empower this steering body to begin a long-anticipated project, the reengineering of our member services information system.

[Galen distributes copies of an administrative memorandum, Figure A.]

This is a project charter given to us by Rebecca Todd, our executive vice president and chief operating officer, in her capacity as chairperson of the Strategic Information Technology Planning group. That group hired a consulting firm to help us develop a strategic plan for business process redesign and information strategy planning. As part of that plan, they documented management's business plan and then developed an overall information systems architecture for our future databases, networks, and applications. They also developed a prioritized list of information systems development projects based on perceived value to the business plan. The order fulfillment and member services system is first on the list. That's why you are all here.

I have personally committed this entire group at least one-quarter time to direct this project. This group will assemble a full-time project team to complete the project. Sandra and Bob have been committed full-time.

From Information Services, Sandra will serve as project manager. Bob and various other IS staff will provide technical services. The three club directors have agreed to appoint one experienced assistant director full-time to this project as a business analyst. That assistant director, Sarah Hartman, will serve a two-year appointment to Information Services as this business analyst. Additionally, I am asking that each of you designate one individual to work with the team one-quarter time as necessary, to complete various aspects of the project.

Folks, this project is important. The business plan suggested a major expansion of marketing and member services. The member services system must be completely overhauled to achieve our strategic business vision. I know that I can count on each of you for your full cooperation. Thank you, Sandra.

SANDRA

Thank you, Galen. Everybody except Bob should be somewhat familiar with our FAST methodology for continuous systems improvement. Bob, FAST is an acronym for *Framework for the Application of Systems Techniques*. We want a well-controlled FAST project on this one—it'll be a great learning experience for Bob. The strategic planning library includes several high-level system models that should provide us with existing documentation.

GALEN

In a nutshell, we want to see what you can do to improve our order fulfillment and member systems. As you know, our product mix is rapidly changing, especially with the addition of games and videos. As part of the business process redesign, we want to disband the current club membership structure that ties members to a particular medium such as discs, cassettes, or videotapes. In its place, we want a flexible membership club that is not dependent on a particular type of merchandise. Marketing has the details.

MONICA

Let's skip the details until later. Suffice to say we have developed a business model for an integrated club that would allow a member to purchase from a wide variety of our consolidated product lines and count them all toward fulfillment of the member agreements. We've even discussed eliminating the passive order fulfillment.

Project Charter

Information Services

SoundStage Entertainment Club

Project Name:	2002-003	Member Services Information System
Version Control:	v1.02	Last revised January 3, 2002
File Location:	H:\information services\strategic plan\projects\2001-002MSIS Charter.doc	

Project Objectives

This project will develop new business processes and supporting information system processes and services to support the strategic vision for SoundStage products and member services. It is anticipated that the resulting system will provide for highly integrated processes and services that cross many internal business functions and reach out directly to customers. It is anticipated that this project will result in one of the following (listed in order of expected likelihood).

1. Creation of an in-house information system that results in significant competitive advantage for SoundStage in a highly competitive market.
2. A partnership with an IT vendor that involves purchasing a software solution, installing that solution, and customizing that solution to create competitive advantage. It is recognized that this solution may require business processes to be redesigned to fit the solution. This alternative supposes that modifications to the package will be done in cooperation with the vendor and in such a way as to permit the vendor to fold these enhancements into their product; however, sale of that product to any competitor would have to be contractually restricted for a reasonable period of time.

Project Conception

This project was conceived during the Information Technology Strategy Planning (ITSP) project. That project established a strategic information systems plan and projects to support the corporate strategic business plan developed one year earlier. The information systems plan established priorities for applications, databases, and networks (including the use of the Internet as a strategic platform). Because our members (customers) are our lifeline, a cross-functional and highly integrated member services information system was identified as one of the most important projects. (It should be noted that this system would interface with another high priority system for inventory and supply chain management.)

Problem Statement

Member Services handles membership subscriptions and member orders. Subscription and order processing is, for the most part, based on a combination of manual and computerized processes that have remained largely unchanged for twenty years. Existing computer processes are based on dated batch processing that does not keep pace with the contemporary economy and industry in which we compete. Existing computer processes have been supplemented by rudimentary, user-developed PC database and spreadsheet applications that are not always fully compatible or consistent with their enterprise information system counterparts. Finally, the team conceded that most computerization was merely automating what appear to be outdated business processes. The following specific problems were discussed in a full-day meeting of the project team:

1. The constantly changing product mix has led to incompatible and often jury-rigged systems and procedures that have created numerous internal inefficiencies and customer relations' problems.
2. The changing product mix creates new opportunities to create new clubs and membership options that would appeal to prospective customers; however, the current system will not support such changes. This problem is amplified by the recent Silver Screenings Video Club acquisition.
3. Directives to increase membership and sales through aggressive advertising will soon overload the current system's ability to process transactions on a timely basis. Customer shipment delays and cash flow problems are anticipated.
4. Response times to orders have already doubled during peak periods from those measures just one year past.

FIGURE A

Project charter for Sound Stage case study

continued

5. Management has suggested a "Preferred Member Program" that cannot be implemented with current data.
6. Unpaid orders have increased from 2%, only two years ago, to 4%. The current credit checking process has contributed significantly to the problem.
7. Member defaults on contracts have increased 7% in three years. It is believed that the current system inadequately enforces contracts.
8. Members have begun to complain about automatic cancellation of memberships after too brief periods of inactivity. This problem has been traced to a data integrity problem in current files.
9. Competition from other companies has led management to propose dynamic contract adjustments to retain members. The current system cannot handle this requirement.
10. Backorders are not receiving proper priority. Some backorders go for as long as three months, with many cancellations and refused deliveries. New orders frequently deplete inventory before backorders can be processed.
11. Customers have expressed dissatisfaction with the passive response order entry model, as well as current club agreements that limit flexibility of members to easily purchase products outside of a narrowly defined media or product type.
12. Existing systems look dated prompting employee complaints that those systems are not as easy to learn and use as the personal computing applications to which they have become accustomed.
13. Management is concerned that SoundStage is not exploiting the Internet as a marketing and service channel.

Initial Scope of the Project

This cross-functional project will support or impact the following business functions and external parties:

1. Marketing
2. Subscriptions
3. Sales and order entry (all sales offices)
4. Warehousing (all distribution centers)
5. Inventory control and procurement
6. Shipping and receiving (all distribution centers)
7. Accounts receivable and payable
8. Member services for all clubs
9. External parties
    a. Prospective members
    b. Current members
    c. Former members
    d. Suppliers
    e. Merchandisers

It is recognized that project scope may need to be refined over the course of the project. Project scope should be defined as explicitly as possible in the first phase of the project. Any significant deviation of functionality, cost, or timetable must be reported promptly to the appropriate director. That director must promptly request and facilitate a scope change consensus meeting of the Information Systems Steering Committee. The Friedlander scope management framework will be used to adjust scope.

Project Vision

The strategic IS plan recommended a system that will:

1. Expedite the processing of subscriptions and orders through improved data capture technology, methods, channels, and decision support. Management would like a system that extends to the Internet and World Wide Web.
2. Interface to the new bar-coding automatic identification system currently being implemented in the warehouse.
3. Reduce unpaid orders to 2% by the end of fiscal year 2004.
4. Reduce contract defaults to 5% by the end of fiscal year 2004 and 3% by the end of fiscal year 2005.
5. Support constantly changing club and agreement structures, including dynamic agreement changes during the term of an agreement.
6. Triple the order processing capacity of the unit by the end of fiscal year 2004.
7. Reduce order response time by 50% by the end of fiscal year 2004. Management has changed the definition of order response from 'order receipt-to-warehouse' to 'order-receipt-to-member-delivery'.

FIGURE A

Continued

8. Rethink any and all underlying business processes, procedures, and policies that have any visible impact on member satisfaction and complaints.
9. Provide improved marketing analysis of subscription and promotion programs.
10. Provide improved follow-up mechanisms for orders and backorders.

Business Constraints

1. The initial version of the system must be operational in nine months. Subsequent versions should be released in six-month increments.
2. The system cannot alter any existing file or database structures in the Accounts Receivable Information System without approval of Accounting.
3. The system may be required to interface with an Enterprise Resource Planning software package that is being considered for inventory control, procurement, and warehousing.
4. As part of SoundStage's strategic goal to become ISO 9000 certified, all business processes are subject to business process redesign to improve total quality management and support continuous improvement.
5. The system must conform to the approved technology architecture approved as part of the IS strategic plan. Exceptions must be preapproved by both the Technology Architecture Committee and the Information Services Steering Committee. The system should harness the recent plan to invest in state-of-the-art desktop computing and client/server network technology.

Technology Constraints

The new system must conform to the following information technology architectural standards:

1. The current LAN architecture is client/server based on *Windows* clients running on an Ethernet and TCP/IP network using *Windows 2000* and *Windows 2000 Terminal Server* servers.
2. The current messaging architecture is based on Outlook clients (for e-calendar and e-mail) running on a Microsoft *Windows 2000*-based *Exchange Server*.
3. This project will require the development of one or more enterprise databases. The corporate database server standard is Microsoft *SQL Server* running on a *Windows 2000* server. Because the project may include Internet/intranet database access, the information technology architecture group has approved Microsoft *InterDev* as a candidate database access technology.
4. The project will require the development of one or more applications. The corporate application development environment must be chosen from Microsoft *Visual Basic* or Microsoft *Visual C++*. *Visual Basic* is preferred for most applications, deferring to *Visual C++* when performance becomes an issue. Because this project will be the most significant foray into electronic business and commerce undertaken at SoundStage, the information technology architecture group has also approved Java-based application development environment.
5. Internet and intranet Web servers will be implemented using Microsoft *Internet Information Server* (IIS) running on a *Windows 2000* server.
6. Internally, all client workstations will run the *Windows XP* or *Windows 2000* desktop operating system including the *Internet Explorer* Web browser.
7. Externally, for members, any solution developed must run equally well on either the Microsoft *Internet Explorer* or AOL *Navigator* Web browsers (multiple versions) running on *Windows, Macintosh,* or *Linux* clients.
8. The project team is empowered to explore and recommend intranet and extranet technologies as appropriate to the information system requirements; however, all technologies should be approved by the information technology architecture group prior to purchase or installation.

Project Strategy

All IS development projects are subject to the following process strategies:

1. In support of the strategic goal for Information Services to achieve Level III on the Software Engineering Institute's *Capability Maturity Model,* the system must be developed in accordance with the *FAST* (Framework for Systems Techniques) development process/methodology. It is anticipated that one or more of the following *FAST* routes will be used: a combination of (a) Model-Driven Development and (b) Rapid Application Development, or (c) Commercial Off-the-Shelf System Integration.
2. Any and all model-driven documentation will be developed with the CASE tool, *System Architect 2001*.

FIGURE A

Continued

Project Documentation and Communication

The following guidelines should be used for communication:

1. The project team will hold weekly status meetings, chaired by the project manager. All project status meetings minutes and reports will be shared with all IT directors.
2. Team members will utilize electronic mail, dialogue, and written completion criteria on a regular basis as vehicles for project communication.
3. The following directory folder shall be used to store this charter and all subsequent documentation and work-in-progress components.

   H:\information services\repository\projects\2002–003 MSIS Charter\ ...

   This directory should be managed using the Intersolv *PVCS* version control software.

Project Organization and Staffing Approach

The Information Services Steering Committee is responsible for:

- Naming the project manager.
- Naming the project team upon recommendation from the project manager.
- Reviewing and approving project deliverables.
- Ensuring the project follows the management vision.
- Approving any scope, budget, and schedule changes.
- Developing tactical strategies for implementing the management vision.

FIGURE A
Concluded

BOB
What is passive order fulfillment?

MONICA
That's where a member's lack of response to a promotion triggers the automatic placement of an order . . . not one of our more popular business practices according to a recent survey of our members.

GALEN
The business plan suggested developing cross-functional information systems. The goal is to design systems across multiple organization boundaries according to common data needs and functional efficiency. Clearly, Marketing, each club's order entry services, and the Customer Services functions need to be integrated, regardless of where we place them in the organization chart. I would think we want Inventory Control, Warehousing, Purchasing, and Shipping and Receiving to be involved as well. Monica, why don't you describe the marketing dimensions?

MONICA
Galen has only touched the tip of the iceberg in describing the marketing business plan to you. We're looking to new markets, new marketing strategies, new membership and sales goals, even new order technologies. We want you to explore phone-based touch-tone response technology and voice recognition as part of this project. We definitely want to implement electronic commerce options using our Internet website. We also want to solve some of the existing system's problems while we're at it.

SANDRA
I take it this project doesn't go through the project steering committee?

GALEN
The steering committee only evaluates user-initiated system requests to assess feasibility and priority. This project comes from the strategic planning committee, which has already assessed its importance and feasibility—it was assigned top priority for new systems development.

SANDRA
Let's establish some vision for this project.

STEVEN
The way I see it, the system should provide several essential functions. First, the system should generate and process two kinds of orders: primary and secondary orders for each club.

BOB
Could you differentiate between those types of orders?

STEVEN
Sure. Primary orders are for our main products, namely audio, video, and game titles. Secondary orders are for other types of merchandise we market such as T-shirts, posters, magazines, blank tapes, supplies, and so forth. These secondary products are marketed through SoundStage, but we don't actually stock the merchandise or fill the orders. Instead we provide a marketing and order fulfillment channel for those who do sell the merchandise. We get a percentage profit based on the merchandiser's sales through our channel. Bob, you probably get such secondary merchandise offers every month with your credit card statements.

BOB
Yes, but I didn't know how that worked. Interesting!

SANDRA
What kinds of problems exist in the current system, Steven?

STEVEN
I have a big problem coming. I had a meeting with Rebecca Todd yesterday. I was told to expect an aggressive new marketing program over the next three years . . . TV, radio, newspapers, magazines, and the Web. Also, as Monica suggested, a single integrated member agreement structure will replace existing clubs' current agreement structures. Instead of tying members to an agreement based on a certain number of purchases over some time period, they will be tied to agreements based on a certain number of purchase credits over a period of time. This will allow members to purchase different types of products with various levels of credit toward fulfilling the purchase agreement.

SUSAN
I'm not sure I see the difference.

STEVEN
All right. Let's say you join the compact disc club today. You must buy six discs in the next two years. You can also purchase cassettes and videotapes, but those don't count toward fulfilling your membership agreement. Under the new approach, you will still join the club, and each compact disc you buy will establish a certain number of purchase credits toward fulfilling your membership agreement, but so will cassettes, videotapes, videodiscs, and computer games—in any combination! And when you fulfill your membership agreement, you'll receive SoundStage Dollars, which are credits that are good toward subsequent purchases.

BOB
Wow! Where do I sign up?

STEVEN
You can't! That's the problem. The current system cannot handle any of this. To give customers this new level of service, and to give Marketing the go-ahead to start advertising the service, we have to totally redesign the supporting information systems, in both Marketing and the clubs.

The second essential function is to fully integrate marketing into order entry and all the way through order fulfillment and billing. That means we must extend the system into the warehouse and purchasing functions. We have to recognize that the members are not satisfied when their order is processed. They are only satisfied when the ordered products are delivered to their homes—that means shipping is involved too. The integration with our secondary merchandise partnerships may be complicated, but we have to deal with that angle as well.

The essential function is to provide management with faster and more reliable information to support Marketing and Member Services decision making.

SANDRA
Dick, what's the warehouse angle?

DICK
Yeah, we're not used to working so closely with you Marketing and Order Entry people. Basically, I think I'm here because of the new auto-ID system.

SUSAN
Auto-ID system?

DICK
Bar coding. We are in the middle of converting all inventory over to a common bar-coding scheme. It should eliminate order-filling errors when we finish. For some period of time, most products will have their existing product numbers and a new bar code number. Also, the acquisition of Silver Screenings requires that all video titles will have to be renumbered to match SoundStage product numbering standards.

SANDRA
Whew! That's news to me! We'll need to gather some more facts about this bar code system. We should talk with you and your staff very soon.

STEVE
That's why I'm here. A couple of years ago I was working for Silver Screenings Video Club. I'm at least somewhat familiar with their current products and inventory schemes. We now have a good grasp of which Silver Screenings employees will transfer to SoundStage as part of the merger. I intend to assign one of the staff directly to the project team to represent their interests.

SUSAN
Can I change the subject? While I concur with the basic functions that Steven has outlined, from my perspective, the biggest problem we currently have is with the data—it's out of control. My top priority would be to get control of the data.

SANDRA
Please explain.

SUSAN
Order management requires us to bring together data from various sources. Marketing provides us with promotion and product data. Warehouse and Purchasing provide inventory data. The clubs provide data about agreements and members, and now we have three clubs with different management approaches. I'm probably missing someone, but the problem is coordinating all this data in an organized fashion. If we get control of that data, all of Steven's functions could be built around that data.

BOB
We can do that. Sandra and I can work with the DA to design and implement an SQL Server database that consolidates all this data into a highly organized database. We'll write SQL programs to properly maintain that data and provide users with 4GLs to. . . .

SUSAN
Hold on! You're speaking a foreign language to me! DA? SQL? 4GL?

STEVE
Can I interrupt? I think we might be missing the big picture here. We now have at least three warehouses in different cities. We have regional membership offices in five cities. I'm sure that we all do things somewhat differently, but we all do a lot of the same things. Shouldn't our system communicate with each site, or duplicate itself at each site? Why reinvent the wheel at each operating location?

GALEN
I think Steve has a good point. I'm a novice at this network stuff, but the Internet presumably gives us the potential of taking the store directly to members and prospective members. I'd like to think that we should try to creatively exploit Internet technology, both at and between our current operating locations and direct to our members, and even our suppliers.

BOB
We can do that too! We can LAN each operating site and create a WAN to other sites and use the Web to reach our members.

SUSAN

More technology terms. Ugh! But I do like the idea. While we're on the subject of technology, why can't you guys make our homegrown systems look and act like my PC applications? I use *Word, Excel,* and *PowerPoint,* and I really like the way they all put the commands and buttons in the same place. If companies like Microsoft and Lotus can do it, why not us?

SANDRA

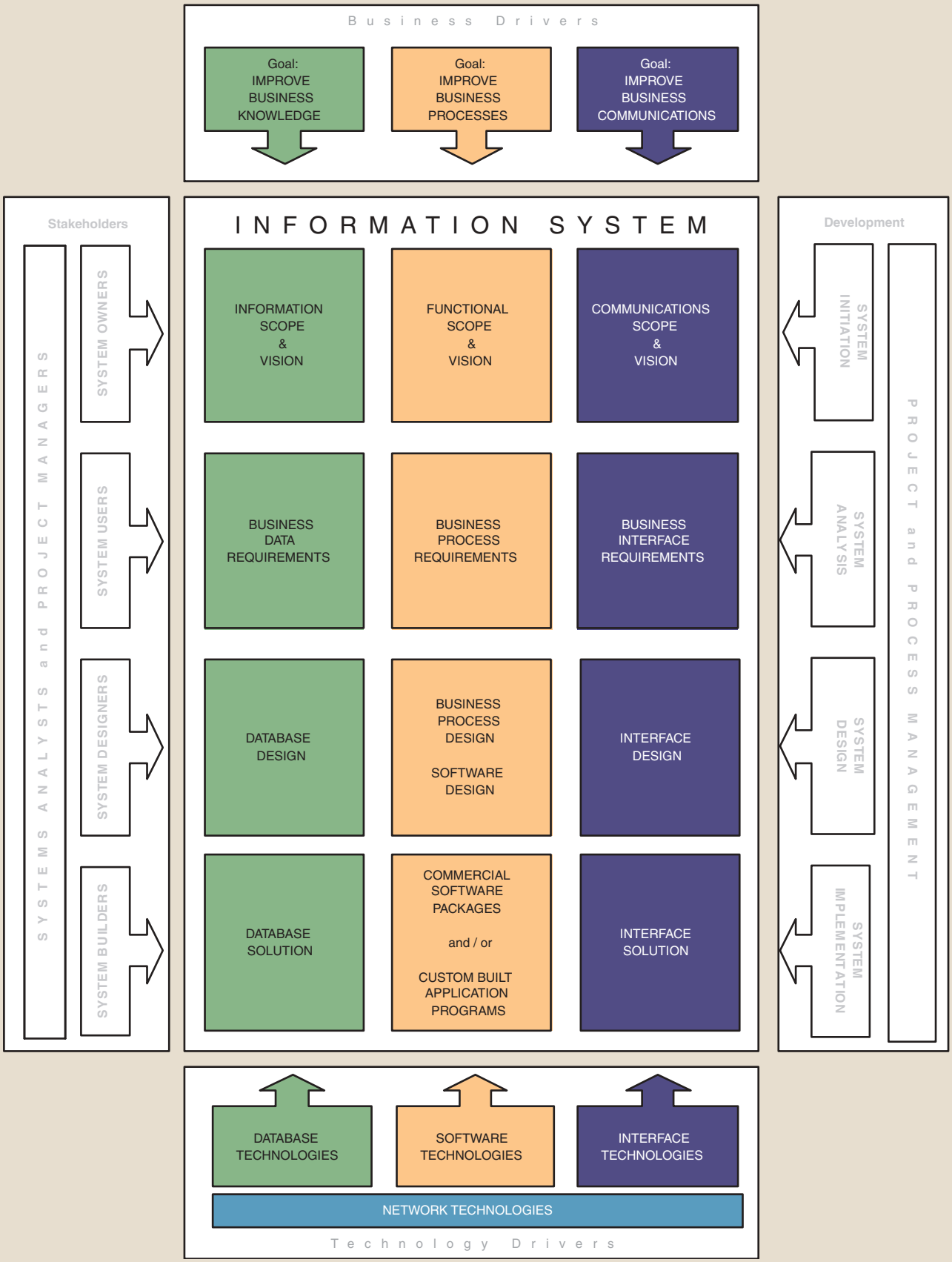
We can, and we will. Bob and I both have a tendency to speak the jargon because it is part of what we do everyday. Everybody here should feel free to stop us, just like Susan did.

It seems like we have a lot of opinions. Believe it or not, I think you have helped start to establish our project vision. To sum up, you want a system that (1) provides various functional capabilities, (2) integrates and coordinates a wide variety of data and information, (3) takes into consideration multiple operating locations including direct-to-member commerce, and (4) is as easy to learn and use as your PC applications.

Let's take a 10-minute break. When we return, we'll try to formalize some of these ideas and establish a project vision.

Discussion Questions

1. Why did the different participants in this meeting have entirely different views of the same basic system?
2. Each of the different participants was concerned with different aspects of the system. Briefly organize their concerns into two or three categories.
3. Why did Bob's view of the system cause communications problems with Susan? How could Bob have better communicated with Susan and the group?
4. How do the different views of the system affect Sandra's job? How should she deal with such diverse perspectives?


Business Drivers
Goal: IMPROVE BUSINESS KNOWLEDGE
Goal: IMPROVE BUSINESS PROCESSES
Goal: IMPROVE BUSINESS COMMUNICATIONS
Stakeholders
SYSTEMS ANALYSTS and PROJECT MANAGERS
SYSTEM OWNERS
SYSTEM USERS
SYSTEM DESIGNERS
SYSTEM BUILDERS
INFORMATION SYSTEM
INFORMATION SCOPE & VISION
FUNCTIONAL SCOPE & VISION
COMMUNICATIONS SCOPE & VISION
BUSINESS DATA REQUIREMENTS
BUSINESS PROCESS REQUIREMENTS
BUSINESS INTERFACE REQUIREMENTS
DATABASE DESIGN
BUSINESS PROCESS DESIGN
SOFTWARE DESIGN
INTERFACE DESIGN
DATABASE SOLUTION
COMMERCIAL SOFTWARE PACKAGES
and / or
CUSTOM BUILT APPLICATION PROGRAMS
INTERFACE SOLUTION
Development
SYSTEM INITIATION
SYSTEM ANALYSIS
SYSTEM DESIGN
SYSTEM IMPLEMENTATION
PROJECT and PROCESS MANAGEMENT
DATABASE TECHNOLOGIES
SOFTWARE TECHNOLOGIES
INTERFACE TECHNOLOGIES
NETWORK TECHNOLOGIES
Technology Drivers

2 Information System Building Blocks

Chapter Preview and Objectives

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 chapter takes an architectural look at information systems and applications. We will build a framework for information systems architecture that will subsequently be used to organize and relate all of the chapters in this book. The chapter will address the following areas:

- Differentiate between *front-* and *back-office* information systems.
- Describe the different classes of information system applications (*transaction processing, management information, decision support, expert, communication and collaboration,* and *office automation systems*) and how they interoperate to supplement one another.
- 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.
- Name three goal-oriented perspectives for any information systems.
- Identify three technologies that provide system designers and builders with a perspective of 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.

The Product—Information Systems

In Chapter 1 you were introduced to information systems from four different perspectives, including stakeholders, business drivers, technology drivers, and the process of systems development. As suggested by the *home page* (see previous pages), this chapter will more closely examine the information system "product."

Organizations are served not by a single information system but, instead, by a federation of information systems that support various business functions. This idea is illustrated in Figure 2-1. Notice that 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) applications over the Internet. Finally, most companies have some sort of intranet (internal to the business) to support communications between employees and the information systems.

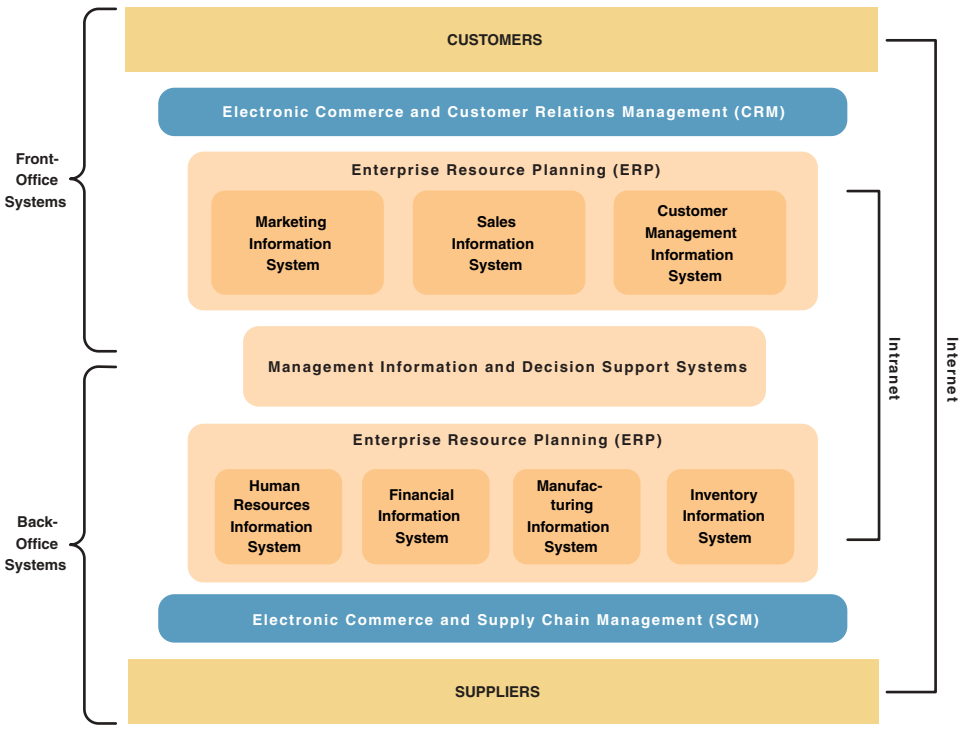
front-office information system an information system that supports business functions that extend out to the organization's customers

back-office information system an information system that supports internal business operations of an organization, as well as reaches out to suppliers.

In Chapter 1 you learned that there are several classes of information system applications (see opposite page). 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. Take a few moments to study Figure 2-2. We call your attention to the following number annotations on the diagram:

1. The first transaction process responds to an input transaction's data (e.g., an order). It produces transaction information to verify the correct processing of the input transaction.

Figure 2-1
A Federation of Information Systems



2. The second transaction process merely produces an output transaction (e.g., an invoice). Such a system may respond to something as simple as the passage of time (e.g., 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 transactional 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 subsets of data may be included in various snapshots. The data in the warehouse will be organized to ensure easy access and inquiry by managers.
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.

Classes of Information System Applications

- Transaction Processing System (TPS)
- Management Information System (MIS)
- Decision Support System (DSS)
- Executive Information System (EIS)
- Expert System
- Communication and Collaboration System
- Office Automation System

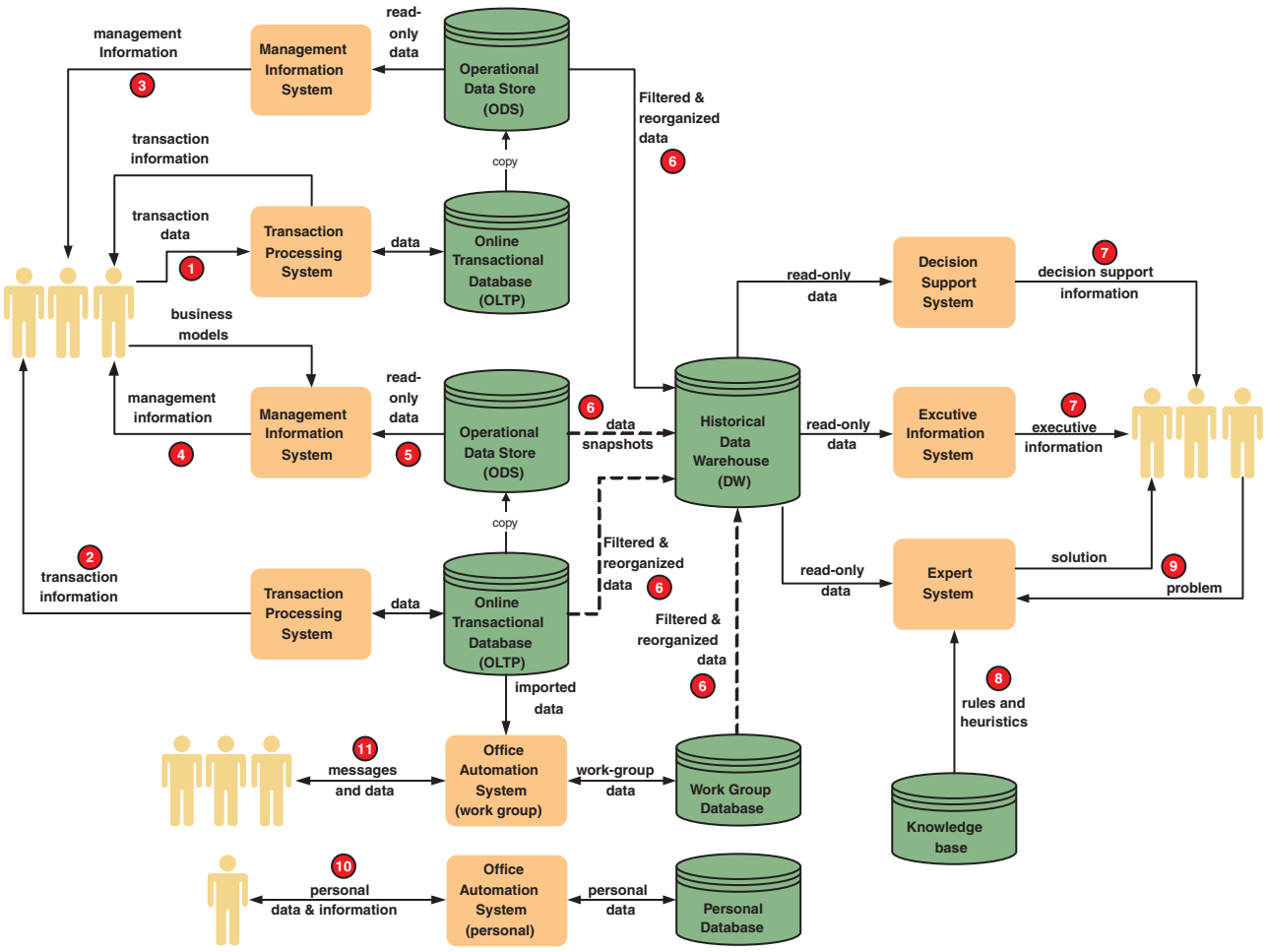


Figure 2-2 Information Systems Applications

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 the 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.

A Framework for Information Systems Architecture

information systems architecture a unifying framework into which various stakeholders with different perspectives can organize and view the fundamental building blocks of information systems.

It has become fashionable to deal with the complexity of modern information systems using *architecture*. Information technology professionals speak of data architectures, application architectures, network architectures, software architectures, and so forth. An **information systems architecture** serves as 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 care to develop.

Different stakeholders have different perspectives 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 you read about in Chapter 1. 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.

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:

- The *database technologies* that support business accumulation and use of business knowledge.
- The *software technologies* that automate and support business processes and services.
- The *interface technologies* that support business communications and collaboration.

As shown in Figure 2-3, the intersection of these perspectives (rows and columns) defines *building blocks* for an information system. In the next section, we will describe all these information system building blocks.

NOTE: Throughout this book, we use a consistent color scheme for both the framework and the various tools that relate to, or document, the building blocks. The color scheme is based on the building blocks as follows:

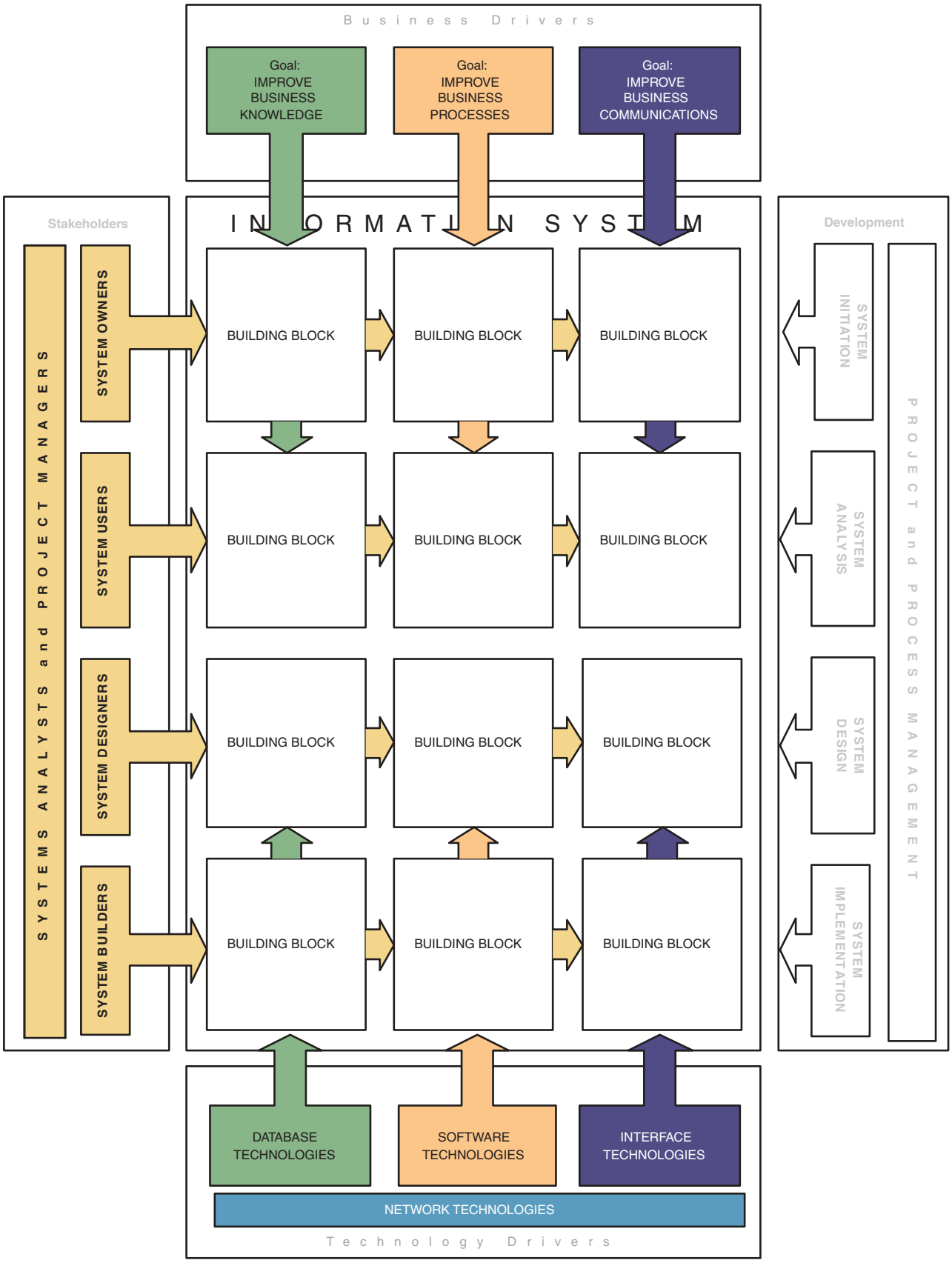


Figure 2-3 Information System Perspectives and Focuses

represents something to do with KNOWLEDGE
represents something to do with PROCESSES
represents something to do with COMMUNICATIONS

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. Synchronization occurs both horizontally (across any given row) and vertically (down any given column).

In the remainder of this chapter, we'll briefly examine each focus and perspective—the building blocks of information systems.

>KNOWLEDGE Building Blocks

Improving business knowledge is a fundamental goal of an information system. As you learned in Chapter 1, business knowledge is derived from data and information. Through processing, data is refined to produce information that results in knowledge. Knowledge is what enables a company to achieve its mission and vision.

The KNOWLEDGE column of your framework is illustrated in Figure 2-4. Notice at the bottom of the KNOWLEDGE column that our goal is to capture and store business data using DATABASE TECHNOLOGIES. Database technology (such as *Access, SQL Server*, *DB2*, or *Oracle*) will be used to organize and store data for all information systems. Also, as you look down the KNOWLEDGE column, each of our different stakeholders has different perspectives of the information system. Let's examine those views and discuss their relevance to the KNOWLEDGE column.

System Owners' View of KNOWLEDGE 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 describes these business entities. Therefore, it makes sense that we should quickly identify relevant business entities about which we need to capture and store data.

It is also useful to understand simple business associations or rules that describe how the business entities interact. Examples of useful business rules for a sales system might include the following:

- A CUSTOMER can place ORDERS—an ORDER must be placed by a CUSTOMER.
- An ORDER sells PRODUCTS—a PRODUCT may be sold on an ORDER.

Intuitively, a system's database needs to track these business entities and rules in order to produce useful information (for example, "Has CUSTOMER 2846 placed any unfilled ORDERS?").

System owners are concerned with the big picture. They are generally not interested in details (such as what fields describe a CUSTOMER or an ORDER). The primary role of system owners in a systems development project should be to define the scope and vision for the project. For KNOWLEDGE, scope can be defined in simple terms such as the aforementioned business entities and rules. System owners define project vision and expectations in terms of their insight into problems, opportunities, and constraints as they relate to the business entities and rules.

System Users' View of KNOWLEDGE Information system users are knowledgeable about the data that describe the business. As information workers, they capture,

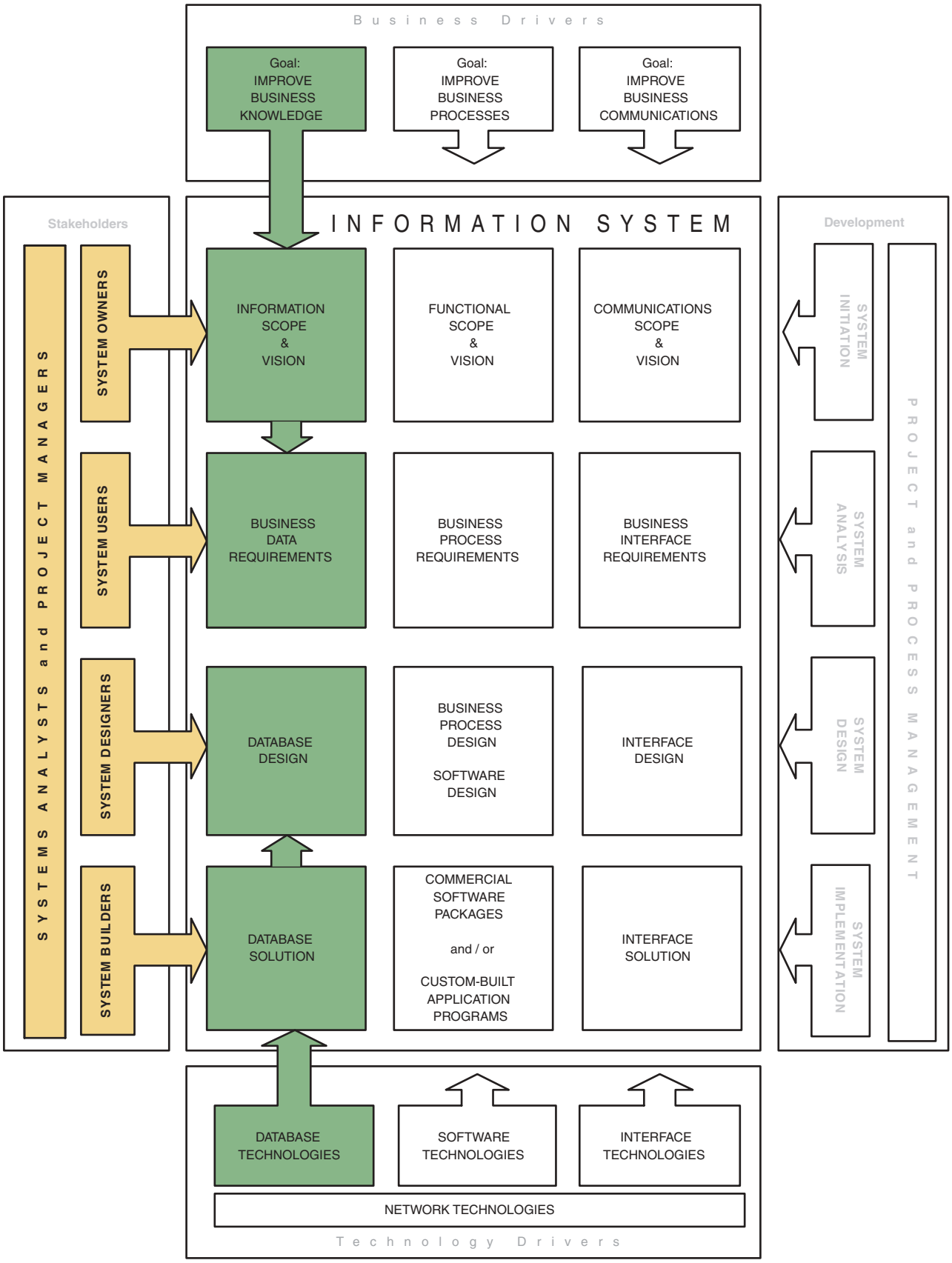


Figure 2-4 A BUSINESS KNOWLEDGE Perspective of Information Systems

store, process, edit, and use that data every day. They frequently see the data only in terms of how data is currently stored or how they think data should be stored. To them, the data is recorded on forms, stored in file cabinets, recorded in books and binders, organized into spreadsheets, or stored in computer files and databases. The challenge in systems development is to correctly identify and verify 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. Consider the following example:

data requirement a representation of users' data in terms of entities, attributes, relationships, and rules.

> 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 users can also tell us precisely what data must be stored about each type of customer. For example, an ACTIVE CUSTOMER might require such data attributes as CUSTOMER NUMBER, NAME, BILLING ADDRESS, CREDIT RATING, and CURRENT BALANCE. Finally, system users are also knowledgeable about the precise rules that govern entities and relationships. For example, they might tell us that the credit rating for an ACTIVE CUSTOMER must be PREFERRED, NORMAL, or PROBATIONARY and that the default for a new customer is NORMAL. They might also specify that only an ACTIVE CUSTOMER can place an ORDER, but an ACTIVE CUSTOMER might not necessarily have any current ORDERS at any given time.

Notice from the above example that the system user's data requirements can be identified independently of the DATABASE TECHNOLOGY that can or will be used to store the data. System users tend to focus on the "business" issues as they pertain to the data. It is important that the system users provide data requirements that are consistent with and complementary to the information scope and vision provided by the system owners.

System Designers' View of KNOWLEDGE 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. Often, the choice has already been made and the developers must use that technology. For example, many businesses have standardized on an enterprise DBMS (such as *Oracle, DB2*, or *SQL Server*) and a work group DBMS (such as *Access*).

In any case, the system designer's view of KNOWLEDGE consists of data structures, database schemas, fields, indexes, and other technology-dependent components. Most of these technical specifications are too complex to be reasonably understood by system users. The systems analyst and/or database specialists design and document these technical views of the data. This book will teach tools and techniques for transforming business data requirements into database schemas.

System Builders' View of KNOWLEDGE The final view of KNOWLEDGE is relevant to the system builders. In the KNOWLEDGE column of Figure 2-4, system builders are closest to the actual database management system technology. They must represent data in very precise and unforgiving languages. The most commonly encountered database language is *SQL (Structured Query Language)*. Alternatively, many database management systems, such as *Access* and *FoxPro,* include proprietary languages or facilities for constructing a new database.

Not all information systems use database technology to store their business data. Many older legacy systems were built with *flat-file* technologies such as VSAM. These flat-file data structures were constructed directly within the programming language used to write the programs that use those files. For example, in a *COBOL* program the flat-file data structures are expressed as PICTURE clauses in a DATA DIVISION. It is not the intent of this book to teach either database or flat-file construction languages, but only to place them in the context of the KNOWLEDGE building block of information systems.

>PROCESS Building Blocks

Improving business and services processes is another 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.

The PROCESS building blocks of information systems are illustrated in Figure 2-5. Notice at the bottom of the PROCESS column that SOFTWARE TECHNOLOGIES will be used to automate selected processes. As you look down the PROCESS column, each of our different stakeholders has different perspectives of the information system. Let's examine those views and discuss their relevance to the PROCESS column.

System Owners' View of PROCESSES As usual, system owners are generally interested in the big picture—in this case, groups of high-level processes called **business functions.** Think of functions as groups of related processes. Typical business functions are listed in the margin. Recognize that a function is ongoing; it has no starting time or stopping time.

Historically, most information systems were (or are) *function-centered.* That means 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. As a contemporary alternative to the traditional SALES INFORMATION SYSTEM, a cross-functional ORDER FULFILLMENT INFORMATION SYSTEM would also support all relevant processes subsequent to the processing of the customer order. This would include filling the order in the warehouse, shipping the products to the customer, billing the customer, and providing any necessary follow-up service to the customer—in other words, all business processes required to ensure a complete and satisfactory response to the customer order, regardless of which departments are involved.

business function a group of related processes that support the business. Functions can be decomposed into other subfunctions and eventually into processes that do specific tasks.

cross-functional information system a system that supports relevant business processes from several business functions without regard to traditional organizational boundaries such as divisions, departments, centers, and offices.

As shown in Figure 2-5, the system owners view a system's business PROCESSES with respect to the functional scope being supported by the systems and to a vision or expectation for improvements. The system's business functions are frequently documented by systems analysts in terms of simple lists of business events and responses to those events. Some examples of business events and responses are as follows:

- Event: CUSTOMER SUBMITS ORDER
  Response: CUSTOMER RECEIVES ORDERED PRODUCTS
- Event: EMPLOYEE SUBMITS PURCHASE REQUISITION FOR SUPPLIES
  Response: EMPLOYEE RECEIVES REQUESTED SUPPLIES
- Event: END OF MONTH
  Response: INVOICE CUSTOMERS AGAINST ACCOUNTS

With respect to each event and response identified, system owners would identify perceived problems, opportunities, goals, objectives, and constraints. The costs and benefits of developing information systems to support business functions would

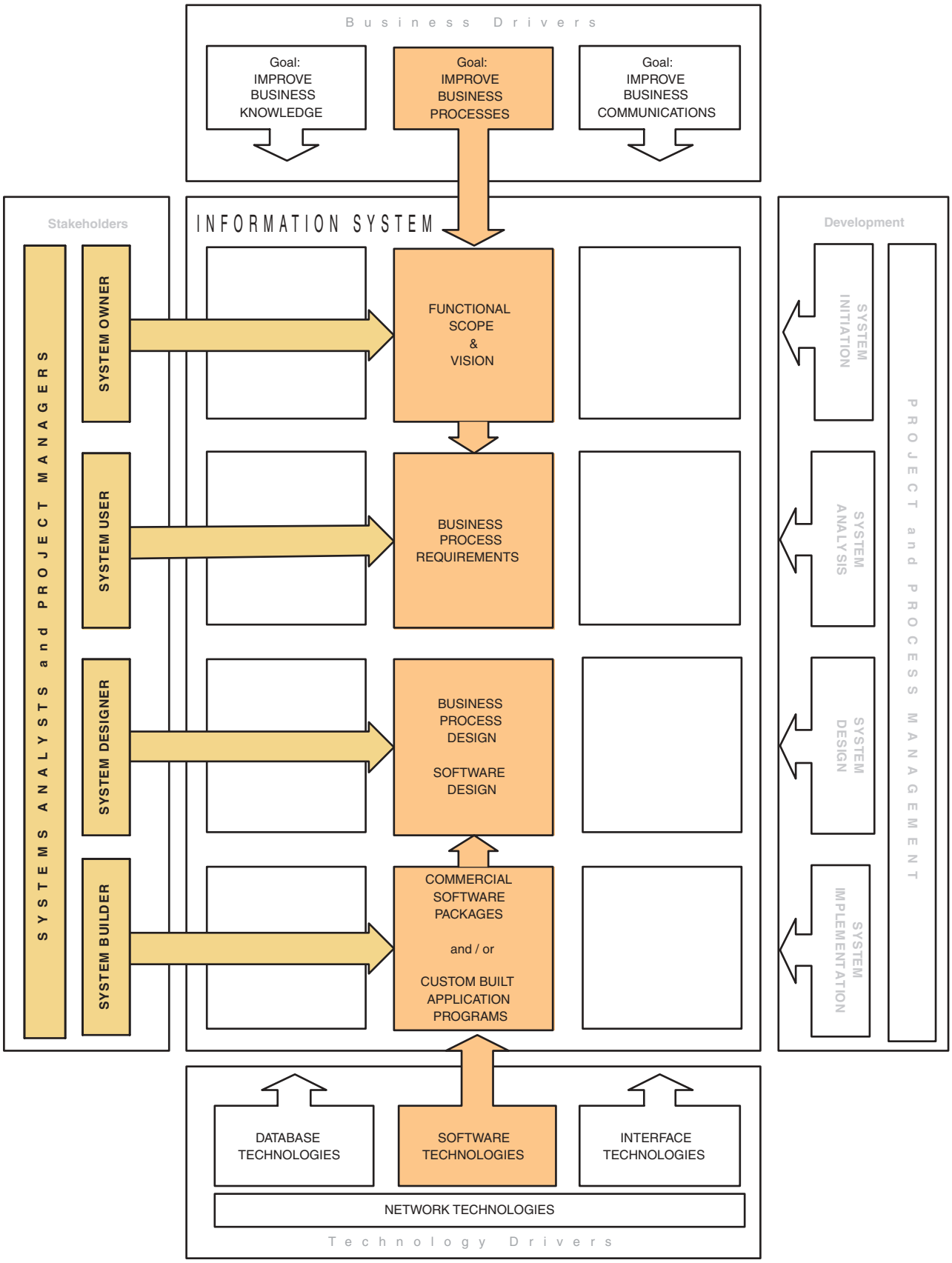


Figure 2-5 A BUSINESS PROCESS Perspective of Information Systems

also be discussed. As was the case with KNOWLEDGE, system owners are not concerned with PROCESS details. That level of detail is identified and documented as part of the system users' view of processes.

System owners also frequently identify services and levels of service that they seek to provide to customers, suppliers, and employees. A popular example is customer, supplier, or employee *self*-service. Human resource systems, for example, increasingly provide employees with the ability to enter their own transactions such as change of address, medical claims, and training requests. System owners also identify needs for information systems to improve service by reducing errors and improving service.

This book will teach you how to identify and document project scope in terms of relevant business functions, business events, and responses.

process requirements a user's expectation of the processing requirements for a business process and its information systems.

System Users' View of PROCESSES Returning again to Figure 2-5, we are ready to examine the system users' view of processes. 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 in terms of **process requirements** for a new system. Process requirements are often documented in terms of activities, data flows, or work flow.

policy a set of rules that govern a business process.

These process requirements must be precisely specified, especially if they are to be automated or supported by software technology. Business process requirements are frequently defined in terms of **policies** and **procedures.** 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. Consider the following example:

procedure step-by-step set of instructions and logic for accomplishing a business process.

> CREDIT APPROVAL is a policy. It establishes a set of rules for determining whether or not to extend credit to a customer. That credit approval policy is usually applied within the context of a specific CREDIT CHECK procedure that established the correct steps for checking credit against the credit policy.

Process requirements are also frequently specified in terms of **work flow.** Most businesses are very dependent on checks and balances to implement work flow. For example, a purchase requisition may be initiated by any employee. But that requisition follows a specific work flow of approvals and checks before it becomes a purchase order transaction that is entered into an information processing system. Of course, these checks and balances can become cumbersome and bureaucratic. Systems analysts and users seek an approproriate balance between checks and balances and service and performance.

work flow the flow of transactions through business processes to ensure appropriate checks and approvals are implemented.

Once again, the challenge in systems development is to identify, express, and analyze business process requirements exclusively in business terms that can be understood by system users. Tools and techniques for process modeling and documentation of policies and procedures are taught extensively in this book.

System Designers' View of PROCESSES As was the case with the KNOWLEDGE building block, 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#.net*. 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.

Today, many businesses purchase commercial off-the-shelf (COTS) software instead of building that software in-house. In fact, many businesses prescribe that software that can be purchased should never be built—or that only software that

provides true competitive advantage should be built. In the case of purchasing software, business processes must usually be changed or adapted to work with the software. Hence, in this scenario the business process design specifications must document how the software package will be integrated into the enterprise.

Alternatively, in the case of building software in-house, business processes are usually designed first. And the business process specifications must then be supplemented with **software specifications** that document the technical design of computer programs to be written. You may have encountered some of these software specifications in a programming course. As was the case with KNOWLEDGE, some of these technical views of PROCESSES can be understood by users but most cannot. The designers' intent is to prepare software specifications that (1) fulfill the business process requirements of system users and (2) provide sufficient detail and consistency for communicating the software design to system builders. The systems design chapters in this book teach tools and techniques for transforming business process requirements into both business process design and software design specifications.

software specifications the technical design of business processes to be automated or supported by computer programs to be written by system builders.

System Builders' View of PROCESSES 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#.net* (part of the Microsoft *Visual Studio.net* ADE), and *Java* (available in ADEs such as IBM *WebSphere* and BEA *WebLogic*). Additionally, some applications and database management systems provide their own internal languages for programming. Examples include *Visual Basic for Applications* (in *Access*) and *PL-SQL* (in *Oracle*). All these languages are used to write custom-built **application programs** that automate business processes.

application program a language-based, machine-readable representation of what a software process is supposed to do or how a software process is supposed to accomplish its task.

This book does not teach application programming. We will, however, demonstrate how some of these languages provide an excellent environment for rapidly developing a system using prototyping software. **Prototyping** has become the design technique of choice for many system designers and builders. Prototypes typically evolve into the final version of the system or application.

prototyping a technique for quickly building a functioning but incomplete model of the information system using rapid application development tools.

As mentioned earlier, sometimes decisions may involve purchasing a commercial software package as a system solution. In this scenario, the system builder may need to focus on customization that must be done to the software package. The system builder may also be expected to develop application programs that must be integrated with the commercial package to extend the package's functional capabilities. Finally, the system builder must also focus on program utilities that must be written to help with the conversion and integration of the commercial program and existing systems.

>Communications Building Blocks

Let's examine our final building block—COMMUNICATIONS. A common goal of most organizations is to improve business communications 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's 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.

The COMMUNICATIONS building blocks of information systems are illustrated in our framework in Figure 2-6. Notice at the bottom of the COMMUNICATION column that it utilizes INTERFACE TECHNOLOGY to implement the communication interfaces.

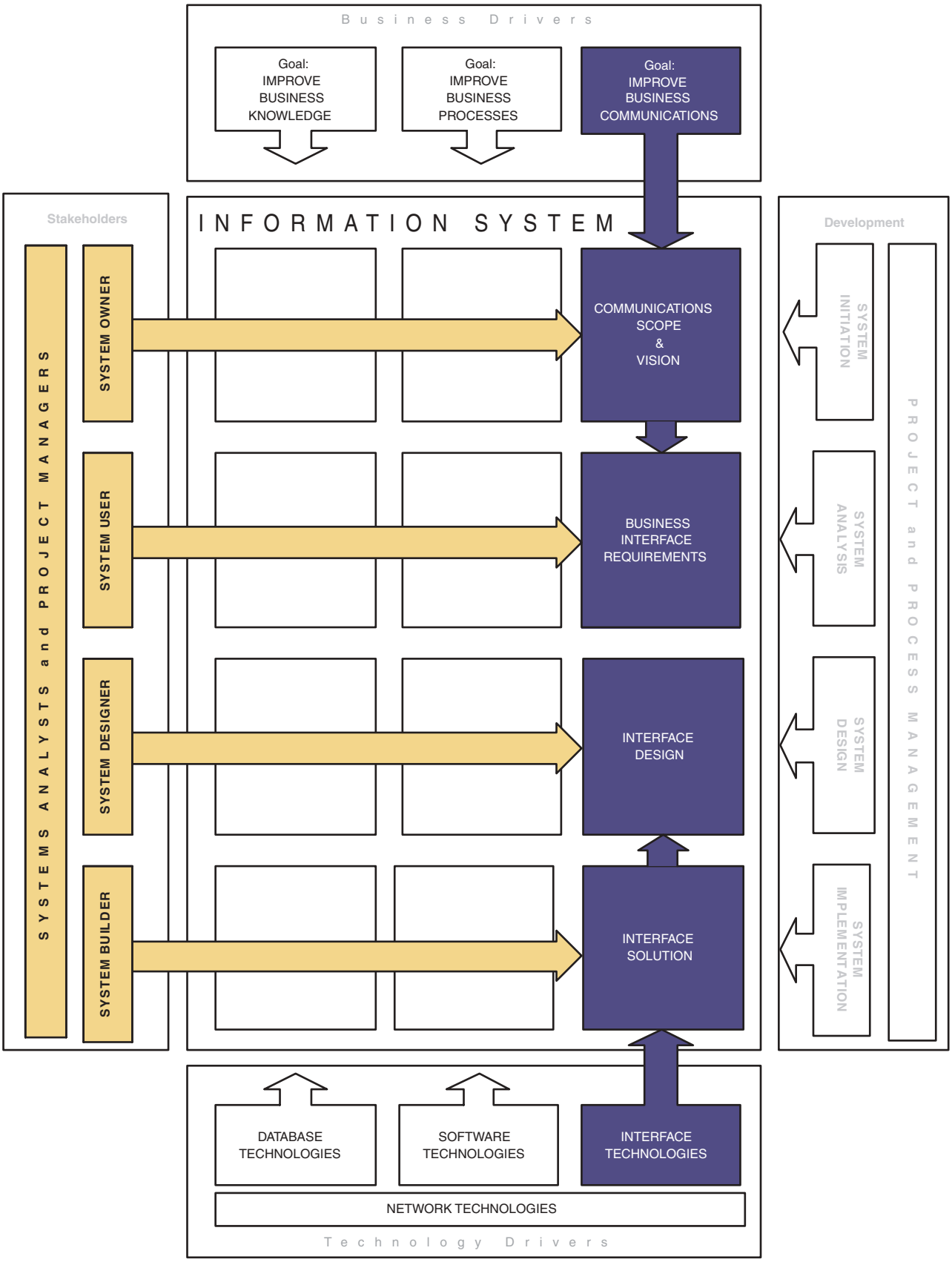


Figure 2-6 A BUSINESS COMMUNICATIONS Perspective of Information Systems

And once again, as you look down the COMMUNICATION column, each of our different stakeholders has different views of the system. Let's examine those views and discuss their relevance to systems development.

System Owners' View of COMMUNICATION The system owners' view of COMMUNICATION is relatively simple. Early in a systems development project, system owners need to specify:

- With which business units, employees, customers, and external businesses must the new system interface?
- Where are these business units, employees, customers, and external businesses located?
- Will the system have to interface with any other information, computer, or automated systems?

Answers to these questions help to define the communications scope of an information systems development project. Minimally, a suitable system owners' view of information system communication scope and vision might be expressed as a simple list of business locations or systems with which the information system must interface. Again, relevant problems, opportunities, or constraints may be identified and analyzed.

System Users' View of COMMUNICATION 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 units, 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. Alternatively, and because system users have become comfortable with the graphical user interface (e.g., *Windows* or web browsers) for the system, the details might be specified in the form of prototypes. System users are increasingly demanding that their custom-built information system applications have the same "look and feel" as their favorite PC tools such as word processors and spreadsheets. This common graphical user interface makes each new application easier to learn and use.

Both list and prototype approaches to documenting the system users' view of COMMUNICATION will be addressed in various chapters of this book.

System Designers' View of COMMUNICATION System designers must be concerned with the technical design of both the user and the system-to-system communication interfaces. We call these **interface specifications.** Let's begin with the user interface.

interface specifications technical designs that document how system users are to interact with a system and how a system interacts with other systems.

Users and designers can be involved in interface design. But whereas 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.

user dialogue a specification of how the user moves from window to window or page to page, interacting with the application programs 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—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. Tools used to document user dialogues will be discussed in the design unit of this book.

Web interfaces have further complicated the designer's activities. Society has come to expect more glitz in web interfaces. For that reason, it is not at all uncommon for the design team to include graphical design specialists and human-computer interface specialists to ensure that the interface for a web server is both compelling and easy to use.

Although not depicted in Figure 2-6, modern system designers may also design *keyless interfaces* such as bar coding, optical character recognition, pen, and voice or handwriting recognition. These alternatives reduce errors by eliminating the keyboard as a source of human error. However, these interfaces, like graphical user interfaces, must be carefully designed to both exploit the underlying technology and maximize the return on what can be a sizable investment.

Finally, and as suggested earlier, system designers are also concerned with system-to-system interfaces. Increasingly, system interfaces are the most difficult to design and implement. For instance, consider a procurement information system that is used to initiate and purchase everything from supplies to equipment. A procurement system must interface with other information systems such as Human Resources (to determine authority to purchase and approve orders), Accounting (to determine if funds are available against an account), Receiving (to determine if ordered goods were received, and Accounts Payable (to initiate payment). These interfacing systems may use very different software and databases. This can greatly complicate system interface design. System interfaces become even more complex when the interface is between information systems in different businesses. For example, in the aforementioned system, we might want to enable our procurement system to directly interface with a supplier's order fulfillment system.

Legacy information systems in most businesses were each built with the technologies and techniques that represented the best practices at the time when they were developed. Some systems were built in-house. Others were purchased from software vendors or developed with consultants. As a result, the integration of these heterogeneous systems can be difficult. Consequently, the need for different systems to interoperate is pervasive. Accordingly, the time system designers spend on system-to-system integration is frequently as much as or more than the time they spend on system development. The system designer's mission is to find or build interfaces between these systems that (1) do not create maintenance projects for the legacy systems, (2) do not compromise the superior technologies and design of the new systems, and (3) are ideally transparent to the system users.

System Builders' View of Communication System builders construct, install, test, and implement both user and system-to-system interface solutions using INTERFACE TECHNOLOGY (see Figure 2-6). For user interfaces, the interface technology is frequently embedded into the *application development environment (ADE)* used to construct software for the system. For example, ADEs such as those for *Visual Basic,* and *Powerbuilder* include all the interface technology required to construct a *Windows* graphical user interface (GUI). ADEs such as those for *Java* and *Cold Fusion* provide similar functionality for web interfaces. Alternatively, the user interface could be constructed with a stand-alone interface technology that supports *xHTML* (e.g., Macromedia's *Dreamweaver*).

System-to-system interfaces are considerably more complex than user interfaces to construct or implement. One system-to-system interfacing technology that is currently popular is middleware. **Middleware** is a layer of utility software that sits in between application software and systems software to transparently integrate differing technologies so that they can interoperate.

middleware utility software that allows application software and systems software that utilize differing technologies to interoperate.

One common example of middleware is the open database connectivity (ODBC) tools that allow application programs to work with different database management systems without having to be rewritten to take into consideration the nuances and differences of those database management systems. Programs written

with ODBC commands can, for the most part, work with any ODBC-compliant database (which includes dozens of different database management systems). Similar middleware products exist for each of the columns in our information system framework. System designers help to select and apply these products to integrate systems.

At the time of this writing, *XML* (*eXtensible Markup Language*) has emerged as an evolving standard for system to system communication. *XML* is unique in its ability to share data between systems through data streams that not only include the data but also include the meaning and structural definitions for that data. *XML* capabilities are the new frontier for software that implements electronic data exchange over the Web.

Once again, this book is not about system construction; however, we present the system builder's view because the other COMMUNICATION views lead to the construction of the actual communication interfaces.

Network Technologies and the IS Building Blocks

In this chapter, we unveiled a framework for information systems architecture that was initially inspired by the work of John Zachman.[1] The Zachman "Framework for Information Systems Architecture" achieved international recognition and use. The Zachman framework is a matrix (similar to the chapter map at the beginning of this chapter). The rows correspond to what Zachman calls *perspectives* of different people involved in systems development and use. The columns correspond to *focuses* on different aspects of the information system. Zachman's architecture includes a separate column that closely equates to what our framework recognizes as NETWORK TECHNOLOGIES. (We have chosen to omit that column because network frameworks are more typically covered in data communications and networking textbooks—and those textbooks tend to focus on the Open Systems Interconnect (OSI) framework as opposed to Zachman's.)

But unquestionably, today's information systems are built on networks. Figure 2-7 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.

It is not the intent of this book to teach network technology. Most information systems and technology programs offer courses that can expand your understanding of network technology.

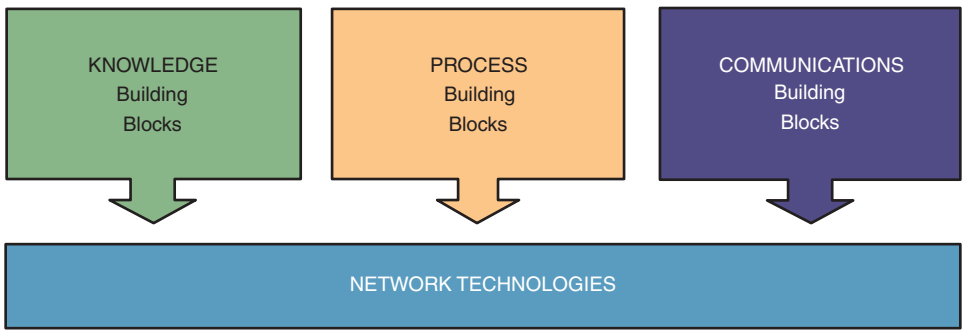


Figure 2-7
The Role of the Network in Information Systems

[1]John A. Zachman, "A Framework for Information Systems Architecture," *IBM Systems Journal* 26, no. 3 (1987), pp. 276–292.

Learning Roadmap

So where are we now? If you have already read Chapter 1, you learned about information systems development projects with a focus on the stakeholders, the process, and the business and technical drivers that influence the need for new systems. If you haven't already done so, you should at least skim Chapter 1 to learn about the *context of systems analysis and design methods.*

In Chapter 2, you learned about the product itself—information systems—in terms of basic building blocks. This architectural perspective focused on the different information system views of the various stakeholders. You learned that system owners and users view information systems from the standpoint of achieving goals—improving business knowledge, processes, and communications—whereas system designers and builders view information systems in terms of technology that supports the achievement of goals.

Most readers should proceed directly to Chapter 3, which introduces you to the process of information system development. You'll learn about information systems problem solving, methodologies, and development technology as you expand your education in the fundamentals for systems analysis and design methods.

Chapter Review

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.
    e. 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. Differentiate between front- and back-office information systems.
2. What is information systems architecture?
3. List three goal-oriented perspectives of an information system.
4. List three technology-oriented perspectives of an information system.
5. Define data requirements.
6. What is a database management system?
7. Differentiate between business functions and business processes.
8. Give several examples of business functions.
9. What are cross-functional systems?
10. Why are businesses interested in cross-functional systems?
11. What are process requirements?
12. Differentiate between business policies and business procedures.
13. What are software specifications?
14. What are application programs?
15. Define prototyping.
16. Identify two critical interface goals for an information system.
17. Differentiate between user and system interfaces. With respect to user interfaces, what phenomena are driving the trend toward graphical user interfaces?
18. What is the role of network technology in information systems (as it relates to the building blocks)?

Problems and Exercises

1. The system owner's view of business knowledge is primarily concerned with entities. If the owner of a course-scheduling information system is the registrar, brainstorm the entities this registrar might identify.
2. Explain why system users are more capable of identifying data requirements than are system owners.
3. Will system designers select the database technology to use for an information system? Explain your answer.
4. Differentiate between business functions and processes. Give an example of a business function and its processes.
5. How have traditionally function-centered information systems evolved today?
6. Give several examples of business events and responses to those events.
7. Differentiate between entities and rules. Using the course registration example in problem 1, give examples of each.

8. Differentiate between policy and procedure. Give an example.
9. Why are process design specifications important when an information system solution involves purchasing a software package that will be integrated into the enterprise?
10. Identify some inputs and outputs that a system user at a video rental store might identify as part of the store's rental information system.
11. For a programming assignment you completed in a programming course, describe how each of the four PROCESS building blocks was either presented to you or developed by you.
12. Explain the difference between user interfaces and user dialogues. Why are user dialogues more difficult to design than user interfaces?

Projects and Research

1. Make an appointment to visit a systems analyst at a local information system organization. Discuss information system projects the analyst has worked on. What were some of the applications (e.g., transaction processing, management information, decision support, expert system, and office automation) being supported? Explain how these systems interoperate to support or supplement one another.
2. Conduct research to identify at least three supply chain management (SCM) vendors and products.
3. Conduct research to identify at least three customer relations management (CRM) vendors and products.
4. Obtain an organization chart for a business. (Your instructor may provide one.) Study that organization chart and try to list as many transaction processing, management information, and decision support systems as you can envision supporting the units illustrated in the chart.
5. Information systems are all around you. Consider one of your previous employers. Describe an information system that you used from the perspectives of a system owner, a system user, and a system designer.
6. *Build Your Own Case Project:* As part of a personalized, custom semester project, we encourage you to apply the concepts and techniques we will teach you to an information system, real or hypothetical, that is based on your current or prior work background, a serious hobby, a student organization to which you belong, or the like. We can think of no better way to master the material than to apply it to something with which you are very familiar. A team experience would better simulate the true nature of systems analysis and design; however, we realize this may not be possible since you may not be able to find another classmate who is familiar with the business, organization, or subject area you choose.
   a. For what business, organization, or subject area do you intend to design your system?
   b. Try to describe the system in terms of the KNOWLEDGE, PROCESS, and COMMUNICATION building blocks.
   c. Does your business or organization have an existing information technology environment? Most do. If so, briefly describe that environment in terms of computers, networks, database management systems, and application development tools.

Minicases

1. Knowledgeable University plans to support course registration and scheduling on a computer. The following client community has been designated:
   a. Curriculum deputy—one per department, responsible for estimating demand by that department's own students for each course offered by the university. This person may revise demand estimates from time to time.
   b. Department chair—determines which courses will be offered by a department and which faculty will teach which courses.
   c. Schedule deputy—one per department, responsible for deciding at what times courses will be offered and with what enrollment limits. These parameters may change during the registration period. This is the only person who can increase or decrease enrollment limits for a course.
   d. Space deputy—in charge of allocating classroom and lecture hall space and time to departments. Also prints the schedule of classes to show students what will be offered and when.

e. Students—submit course requests and revisions and receive schedules and fee statements.
f. Counselors—advise students and approve all course requests and revisions. They also help students resolve time conflicts (where student has registered for two courses that meet at the same time).

This is the cast of characters or constituents (which may be revised or supplemented by your instructor to more closely match your school). For each, brainstorm and describe the constituent's likely perspectives with respect to KNOWLEDGE, PROCESSES, and COMMUNICATIONS.

2. Liz, an account collection manager for the bankcard office of a large bank, has a problem. Each week, she receives a listing of accounts that are past due. This report has grown from a listing of 250 accounts (two years ago) to 1,250 accounts (today). Liz has to go through the report to identify the accounts that are seriously delinquent. A seriously delinquent account is identified by several different rules, each requiring Liz to examine one or more data fields for that customer. What used to be a half-day job has become a three-days-per-week job. Even after identifying seriously delinquent accounts, Liz cannot make a final credit decision (such as a stern phone call, cutting off credit, or turning the account over to a collection agency) without accessing a three-year history of the account. Additionally, Liz needs to report what percentages of all accounts are past due, delinquent, seriously delinquent, and uncollectible. The current report doesn't give her that information. What kind of report does Liz have—detail, summary, or exception? What kind of reports does Liz need? What kind of decision support aids would be useful?

Suggested Readings

Galitz, Wilbert O. *The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques,* 2nd ed. New York: John Wiley & Sons, 2002.

Goldman, James E.; Phillip T. Rawles; and Julie R. Mariga. *Client/Server Information Systems: A Business-Oriented Approach.* New York: John Wiley & Sons, 1999. For students who are looking for a student-oriented introduction to information technology architecture and data communications, we recommend our colleagues' book because it was written for business and information systems majors to provide a comprehensive survey of the technology that supports today's information systems.

Inmon, W. H. *Building the Data Warehouse,* 3rd ed. New York: John Wiley & Sons, 2002.

Sethi, Vikram, and William R. King. *Organizational Transformation through Business Process Reengineering*. Upper Saddle River, NJ: Prentice-Hall, 1998.

Taylor, David, and Alyse D. Terhune. *Doing E-Business: Strategies for Thriving in an Electronic Marketplace.* New York: John Wiley & Sons, 2000.

Zachman, John A. "A Framework for Information System Architecture." *IBM Systems Journal* 26, no. 3 (1987). We adapted the matrix model for information system building blocks from Mr. Zachman's conceptual framework. We first encountered John Zachman on the lecture circuit, where he delivers a remarkably informative and entertaining talk on the same subject as this article. Mr. Zachman's framework has drawn professional acclaim and inspired at least one conference on his model. His framework is based on the concept that architecture means different things to different people. His framework suggests that information systems consist of three distinct "product-oriented" views—data, processes, and technology (which we renamed *communications*)—to which we added a fourth view, "interface." The Zachman framework offers six different audience-specific views—for each of those product views—the ballpark and owner's views (which we renamed as *owner's* and *user's views,* respectively), the designer's and builder's views (which we combined into our *designer's view*), and an out-of-context view (which we called the *builder's view*).