西安电子科技大学
XIDIAN UNIVERSITY

02

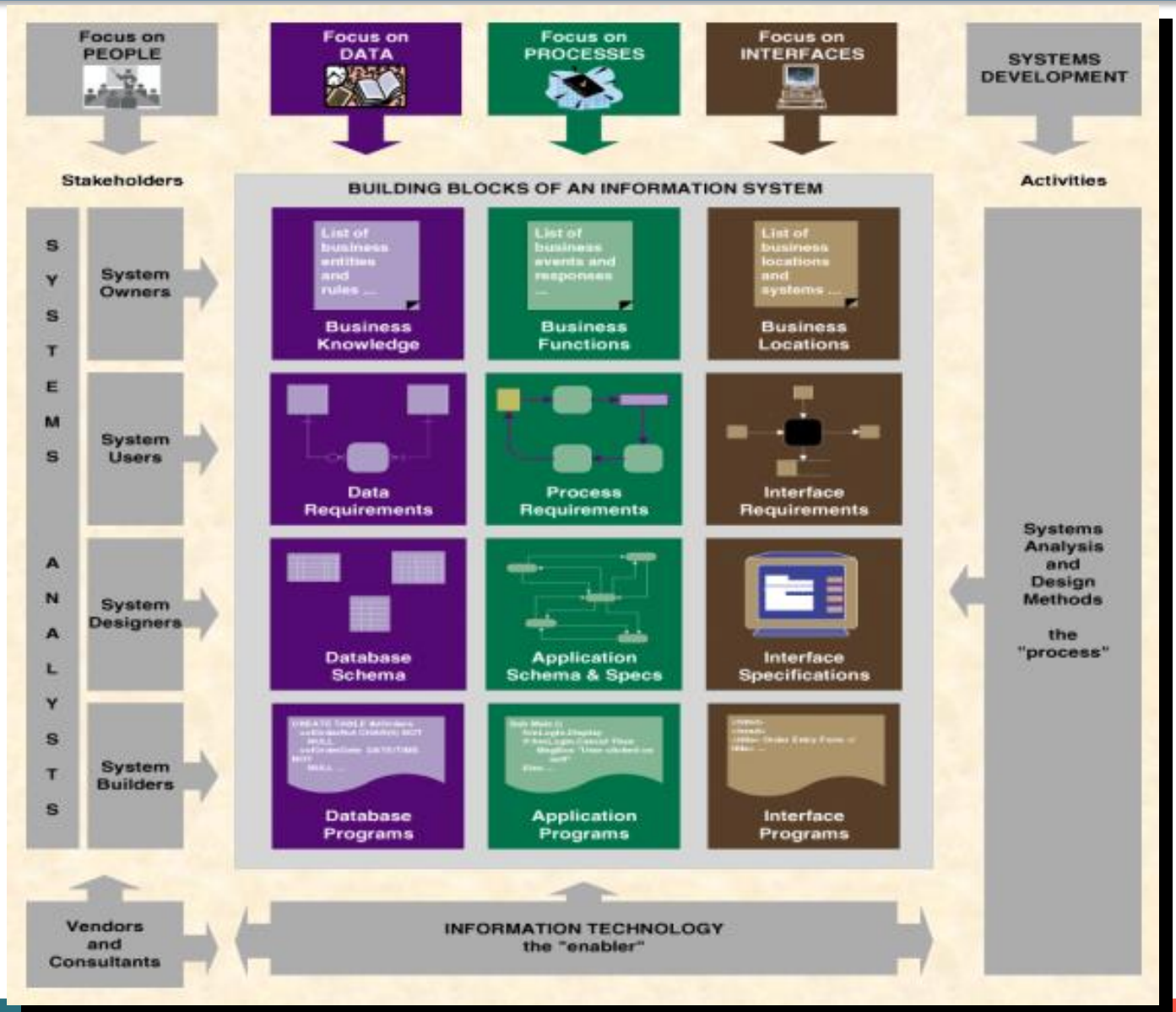
系统分析与设计
(System Analysis and Design)

Information System Building Blocks

Content Structure

- **The Product – Information Systems**
  - 数据与信息的区别与联系；
  - 前台系统与后台系统；
  - 信息系统的主要种类。
- **A Framework for Information Systems Architecture**
  - 信息系统的组成部件与体系结构；
  - 三种组成部件：数据、处理、界面 / 接口；
  - 与三种组成部件相关的通信；
  - 不同的角色在关注这些组成部件和通信时，有不同的结果。

Chapter Map


Focus on PEOPLE
Focus on DATA
Focus on PROCESSES
Focus on INTERFACES
SYSTEMS DEVELOPMENT
Stakeholders
BUILDING BLOCKS OF AN INFORMATION SYSTEM
Activities
SYSTEMS ANALYSTS
System Owners
System Users
System Designers
System Builders
Business Knowledge
Business Functions
Business Locations
Data Requirements
Process Requirements
Interface Requirements
Database Schema
Application Schema & Specs
Interface Specifications
Database Programs
Application Programs
Interface Programs
Systems Analysis and Design Methods
the "process"
Vendors and Consultants
INFORMATION TECHNOLOGY
the "enabler"

The Product – Information Systems

Data and Information

- **Data** are raw facts about the organization and its business transactions. Most data items have little meaning and use by themselves.
- **Information** is data that has been refined and organized by processing and purposeful intelligence. The latter, purposeful intelligence, is crucial to the definition—People provide the purpose and the intelligence that produces true information.

Data and Information

- **Data** are raw
transactions. Mc
themselves.
- **Information**
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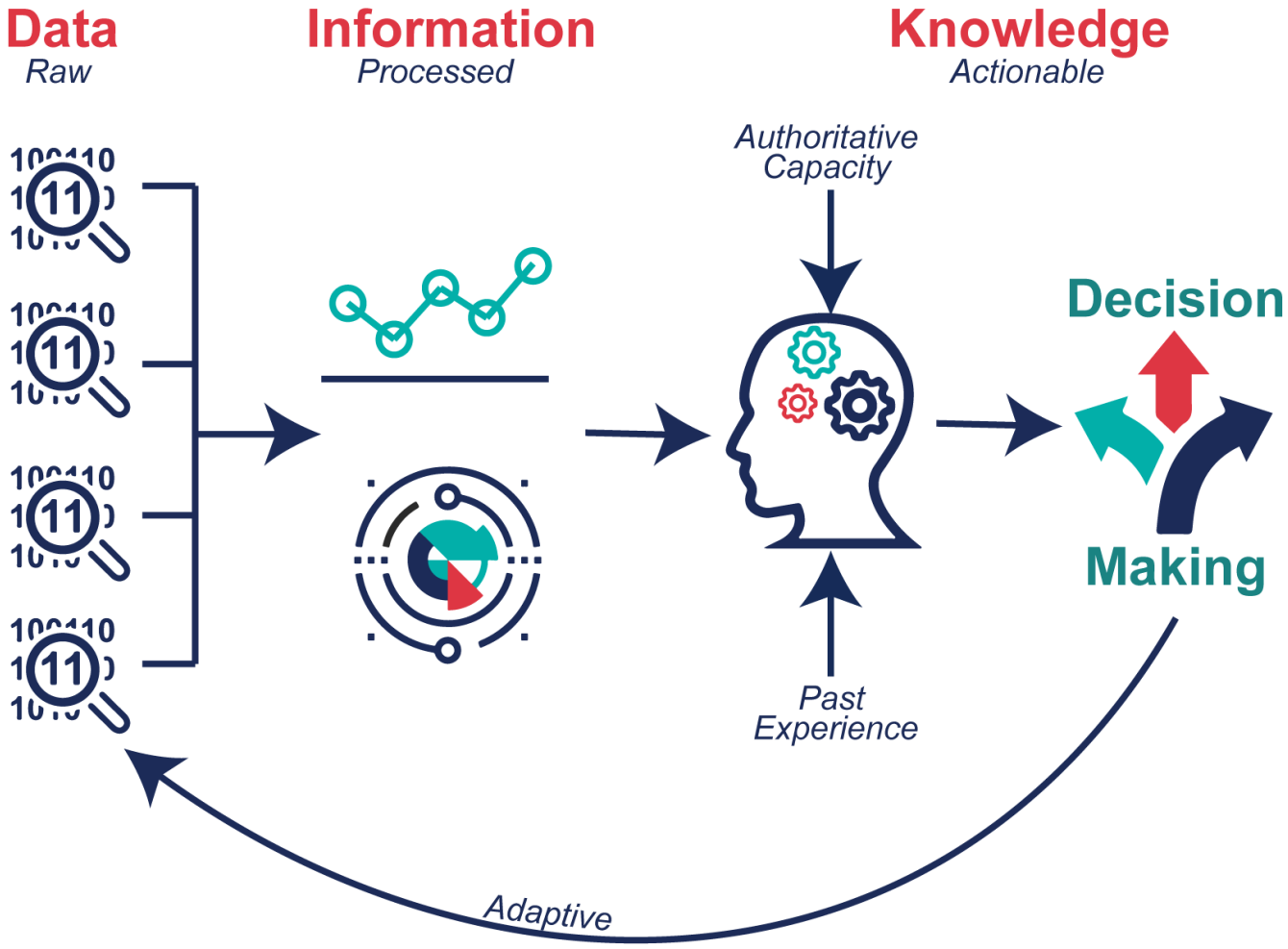
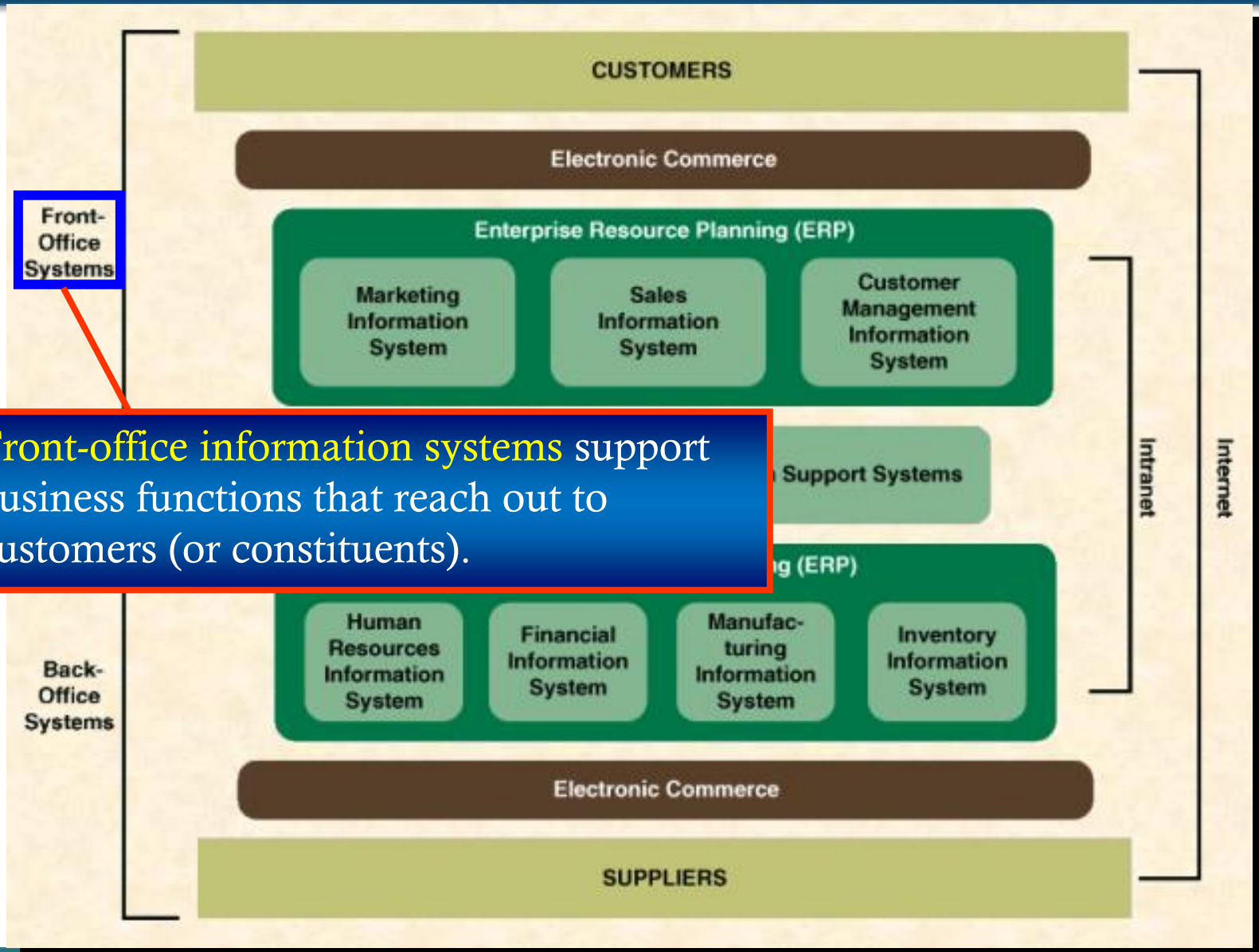
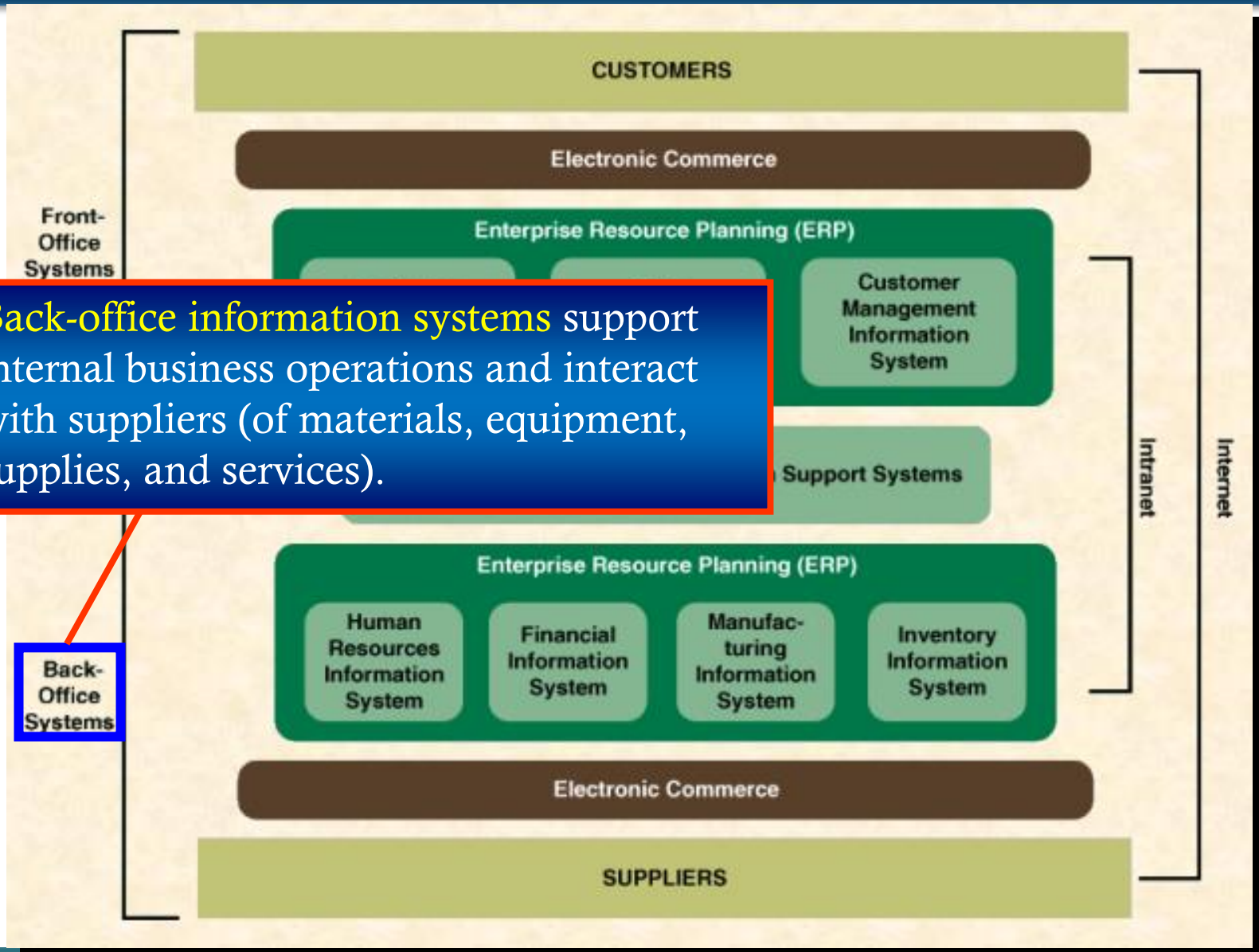


A Federation of Information Systems



- Front-office information systems support business functions that reach out to customers (or constituents).

A Federation of Information Systems



- Back-office information systems support internal business operations and interact with suppliers (of materials, equipment, supplies, and services).

Classes of Information Systems

- Transaction processing systems
- Management information systems
- Decision support systems
- Expert systems
- Office automation systems

Transaction Processing Systems

- **Transaction processing systems** are information system applications that capture and process data about business transactions (events that sever the mission of the business).

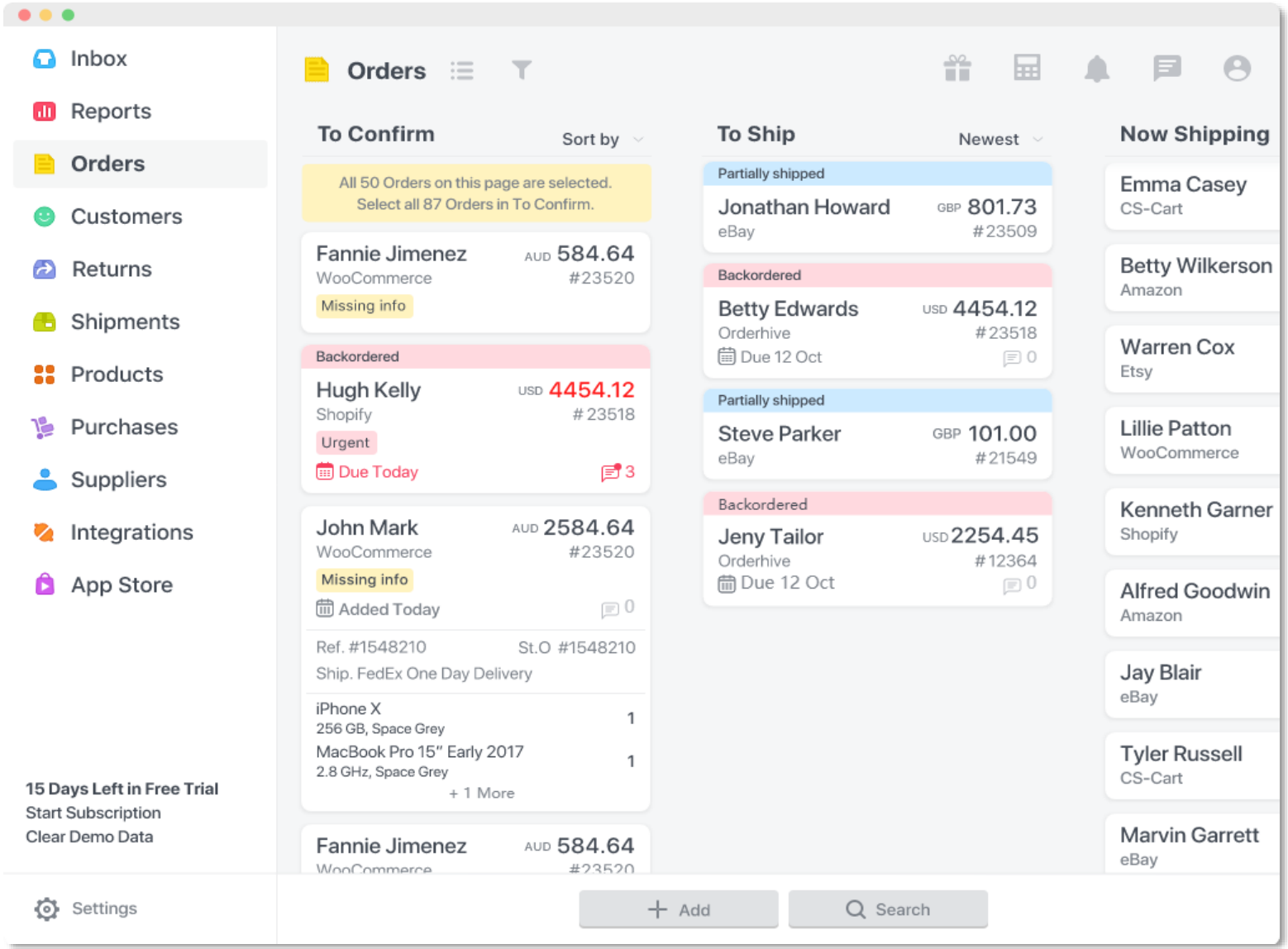
Transaction Processing Systems

- Transaction processing systems are information system applications that c
transactions (even

Examples

- Airline reservations（航班预订）
- Bank deposits and withdrawals（银行存取款）
- Course registration（课程注册）
- Customer returns（客户统计表）
- Hotel check-in/check-out（宾馆入住与结帐）
- Inventory procurement（库存采购）
- Invoicing or billing（开发票或报帐）
- Order processing（订单处理）
- Payroll（工资表）
- Retail point-of-sale（ POS零售）
- Supplies procurement（补给品采购）

Transaction Processing Systems



Management Information Systems

- A **management information system** (MIS) is an information system application that provides for management-oriented reporting. These reports are usually generated on a predetermined schedule and appear in a prearranged format.
- MIS can present detailed information, summary information and exception information.

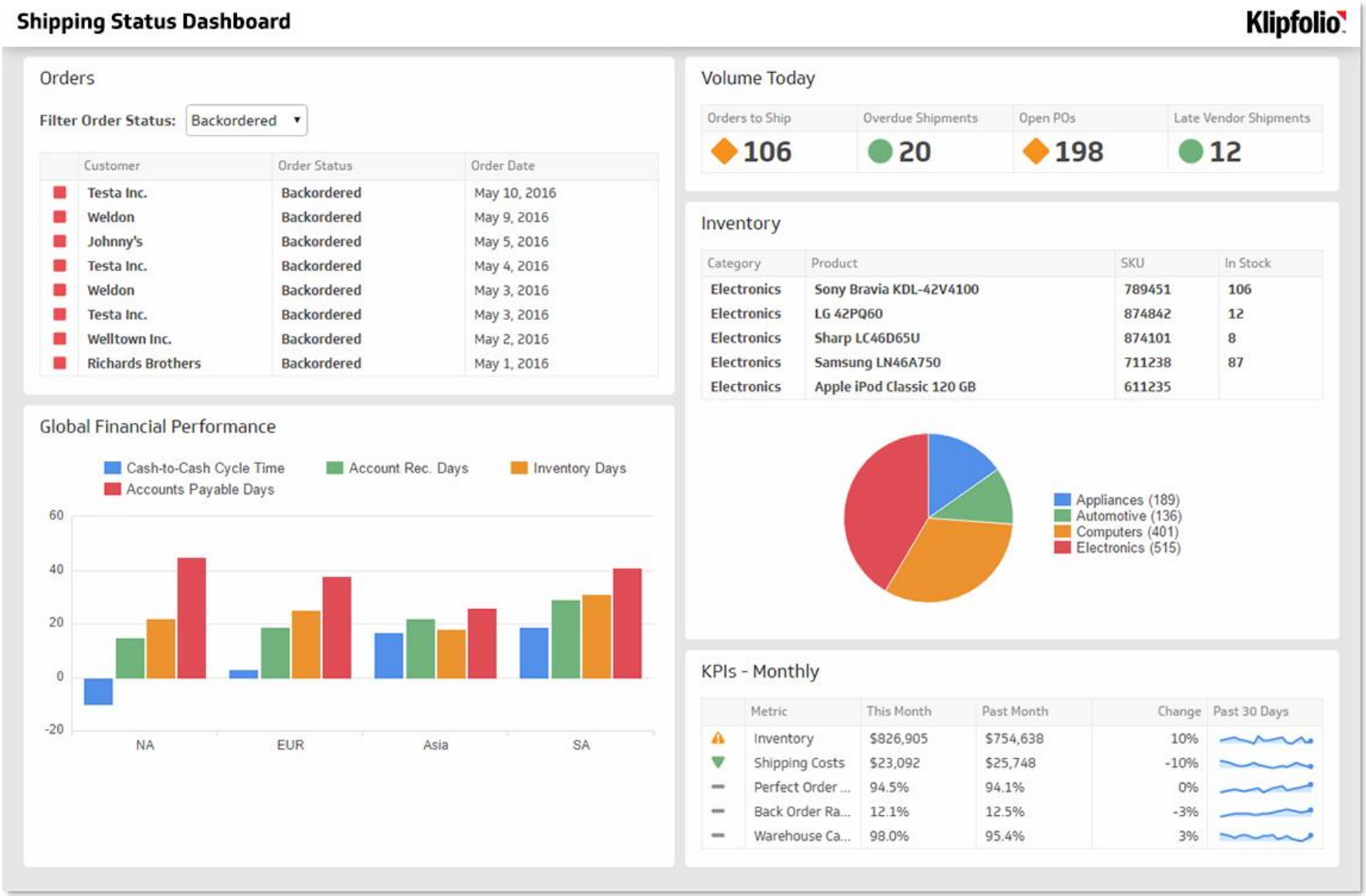
Management Information Systems

- A **management information system** (MIS) is an information system applicati… reporting. These r… schedule and appe…
- MIS can prese… and exception info…

Examples

- Budget forecasting and analysis（预算预测与分析）
- Financial reporting（财务报告）
- Inventory reporting（库存报告）
- Materials requirements planning（材料需求计划）
- Production scheduling（生产调度）
- Salary analysis（薪金分析）
- Sales forecasting（销售预测）
- Sales reporting（销售报告）
- Schedule of classes（排课）

Management Information Systems



Decision Support Systems

- A **decision support system** (DSS) is an information system application that provides its users with decision-oriented information whenever a decision-making situation arises. When applied to executive managers, these systems are sometimes called executive information systems (EIS).
  - A **data warehouse** is a read-only, informational database that is populated with detailed, summary, and exception data and information generated by other transaction and management information systems. The data warehouse can then be accessed by end-users and managers with DSS tools that generate a virtually limitless variety of information in support of unstructured decisions.

Decision Support Systems

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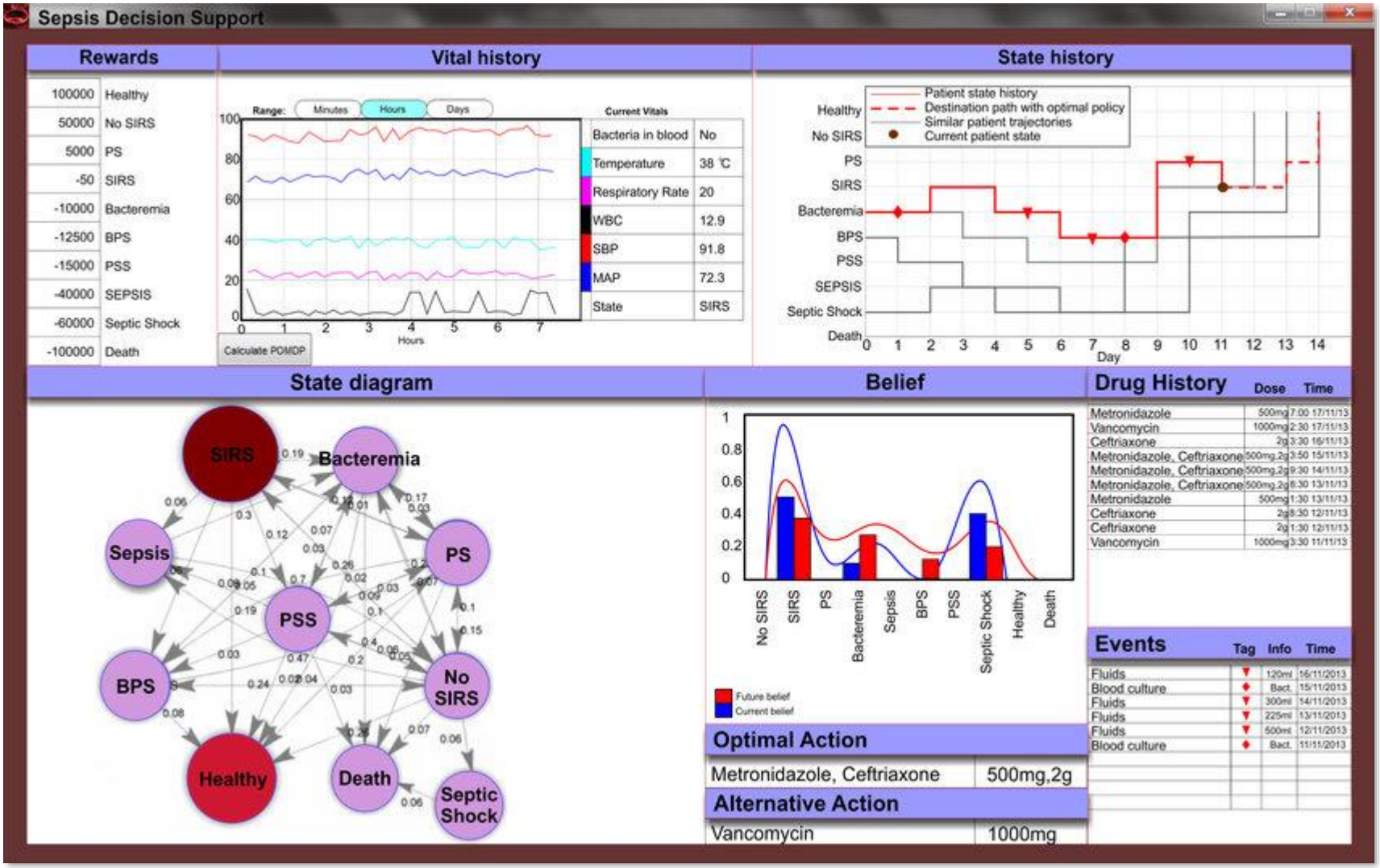
  - A **data wareh** onal database that ception data and infor management un then be accessed by at generate a vir port of unstructured

Types of support to the decision maker

- Identification of problems or decision-making opportunities.
- Identification of possible solutions or decisions.
- Access to information needed to solve a problem or make a decision.
- Analysis of possible decisions or of variables that will affect a decision.
- Simulation of possible solutions and their likely results.

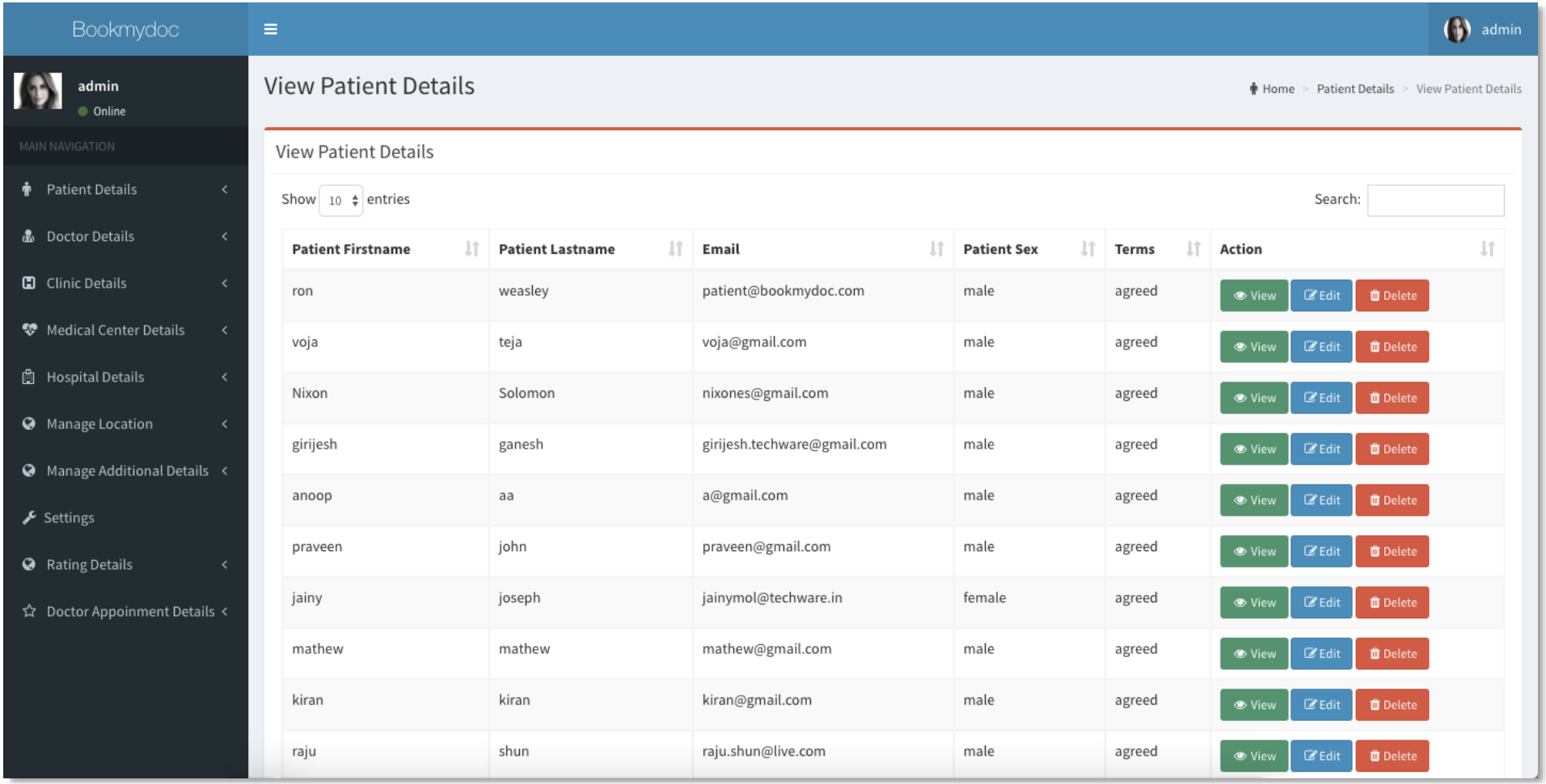
Decision Support Systems



Expert Systems

- An **expert system** is a programmed decision-making information system that captures and reproduces the knowledge and expertise of an expert problem solver or decision maker and then simulates the "thinking" or "actions" of that expert.

Expert Systems



Office Automation Systems

- **Office automation** (OA) systems support the wide range of business office activities that provide for improved work flow and communications between workers, regardless of whether or not those workers are located in the same office.

Office Automation Systems

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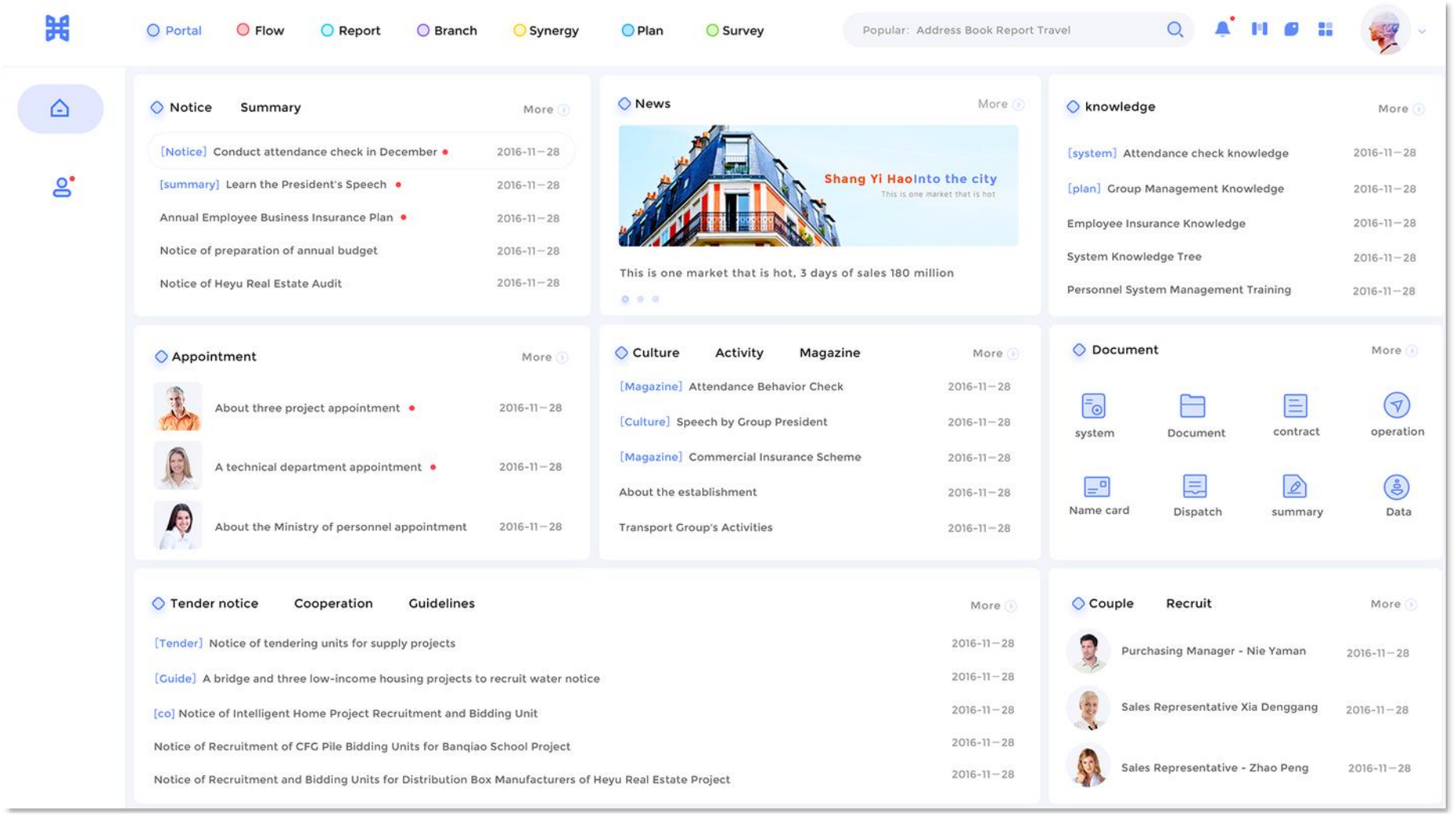
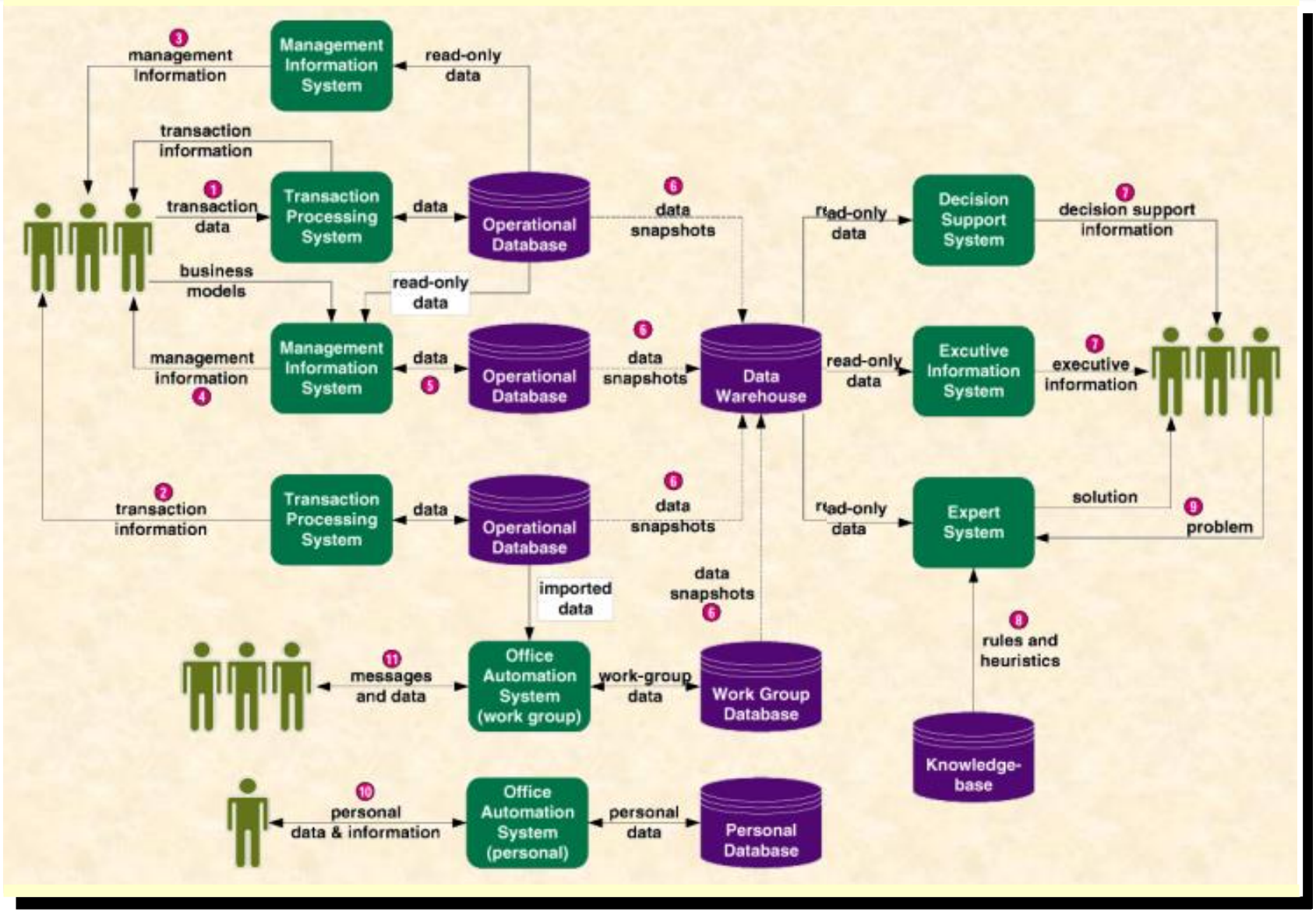
To support both individuals and work groups

- Personal information systems are those designed to meet the needs of a single user. They are designed to boost an individual's productivity.
- Work group information systems are those designed to meet the needs of a work group. They are designed to boost the group's productivity.

Office Automation Systems



Putting It All Together

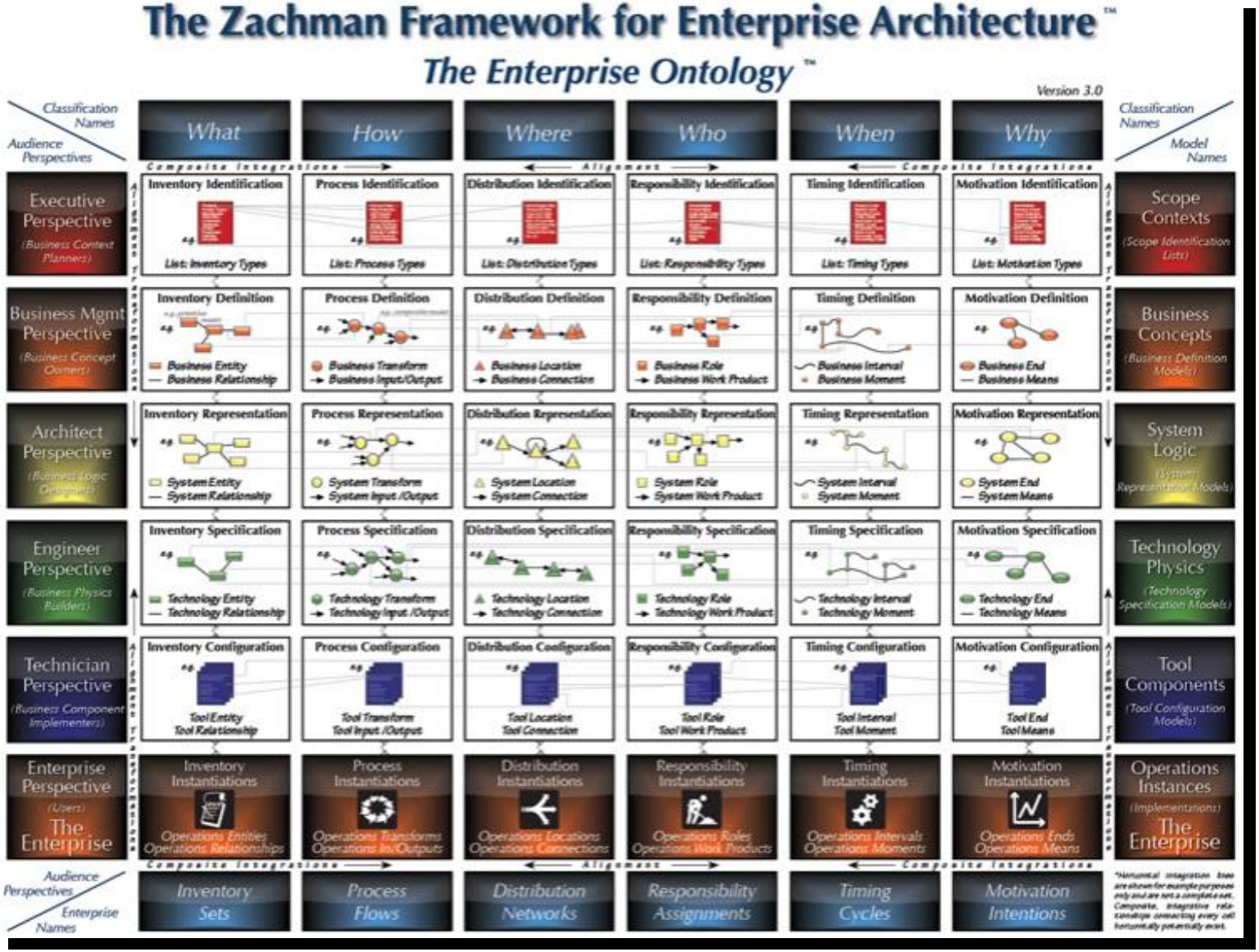


A Framework for Information Systems Architecture

Information Systems Architecture

- Information Systems Architecture
  - **Information systems architecture** provides a unifying framework into which various people with different perspectives can organize and view the fundamental building blocks of information systems.
- The ***Zachman*** Framework
  - This framework is a matrix.
  - The rows correspond to perspectives of different people involved in systems development and use.
  - The columns correspond to focuses on different aspects of the information system.

Zachman Framework



Perspectives or Stakeholders

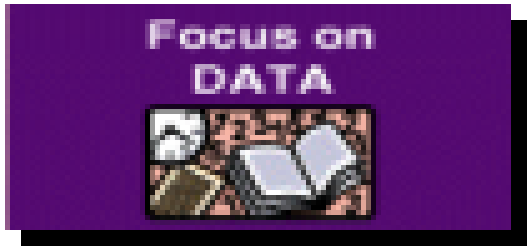
- **System owners** pay for the system to be built and maintained. They own the system, set priorities for the system, and determine policies for its use. In some cases, system owners may also be system users.
- **System users** actually use the system to perform or support the work to be completed. System users define the business requirements and performance expectations for the system to be built.
- **System designers** are the technical specialists who design the system to meet the users' requirements. In many cases, system designers may also be system builders.

Perspectives or Stakeholders

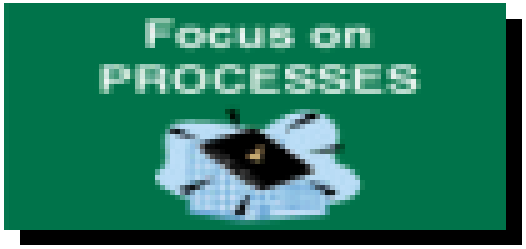
- **System builders** are the technical specialists who construct, test, and deliver the system into operation.
- **Systems analysts** facilitate the development of information systems and computer applications by bridging the communications gap that exists between nontechnical system owners and users and technical system designers and builders.
- **IT vendors and consultants** sell hardware, software, and services to businesses for incorporation into their information systems.

Note: These are roles, not positions or job titles.

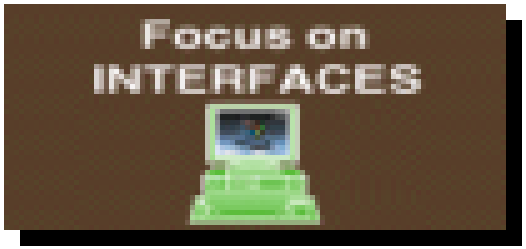
Focuses for Information Systems



- **Data** — the raw material used to create useful information.

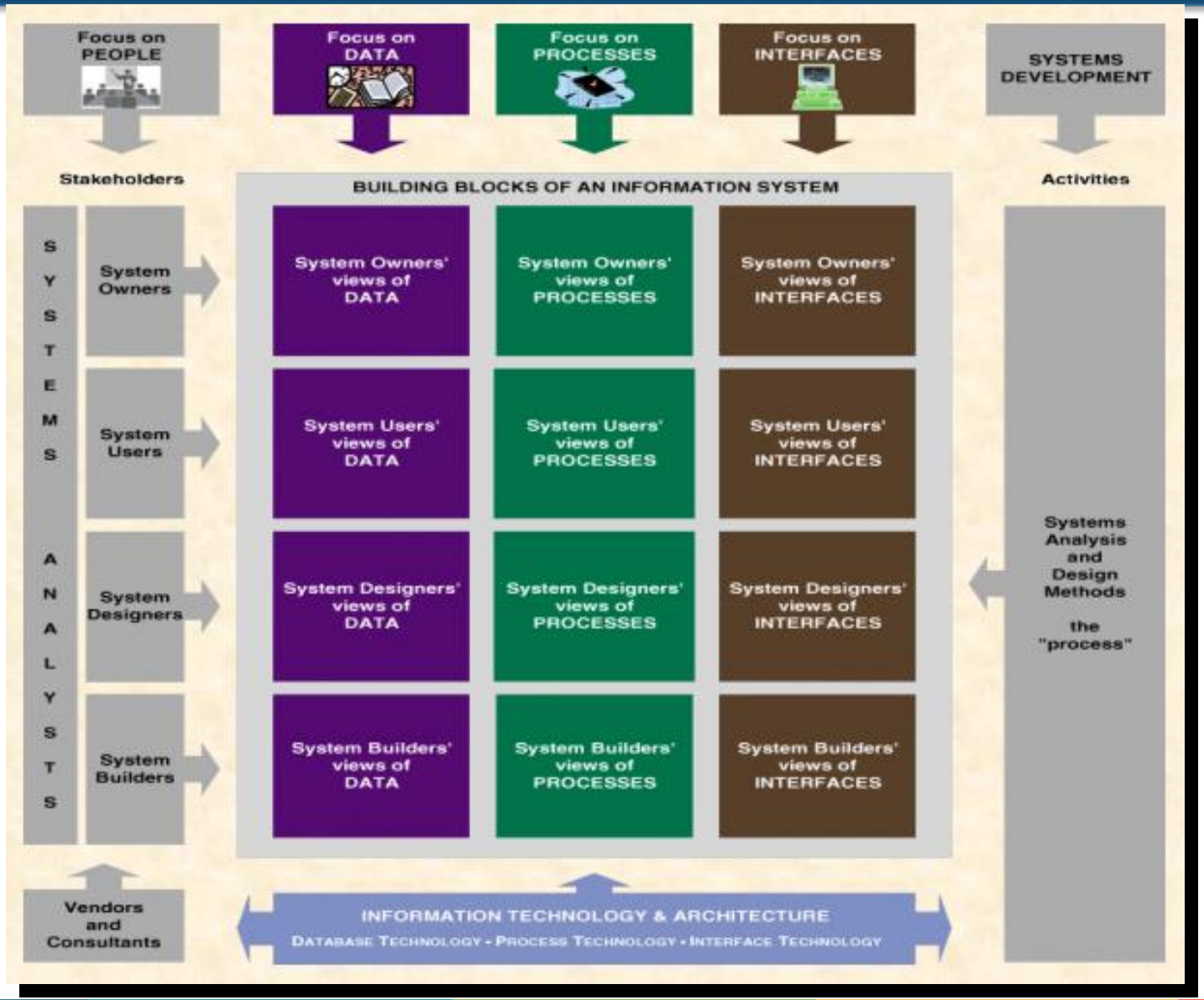


- **Processes** — the activities (including management) that carry out the mission of the business.

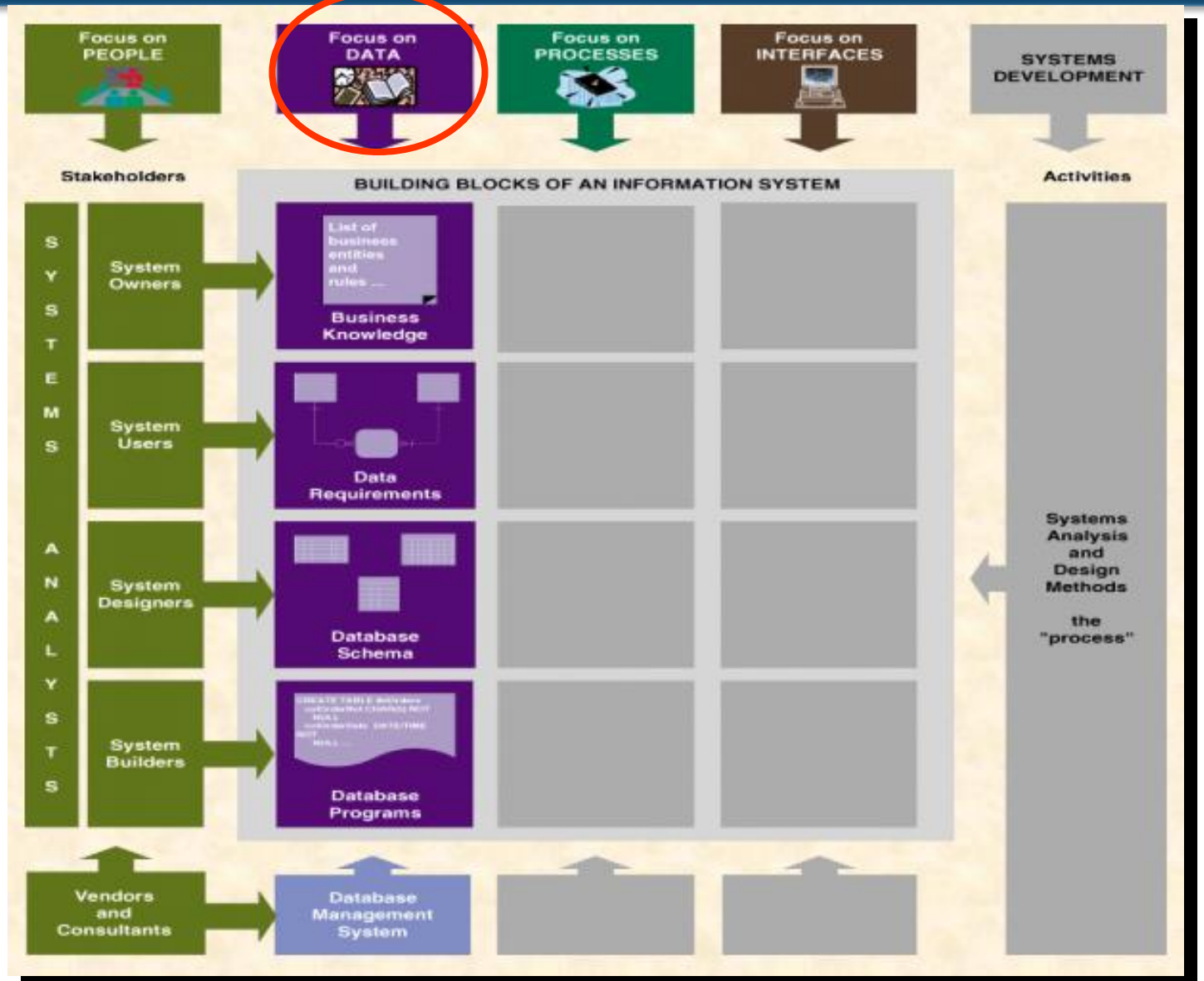


- **Interfaces** — how the system interfaces with its users and other information systems.

Information System Building Blocks



The DATA Focus



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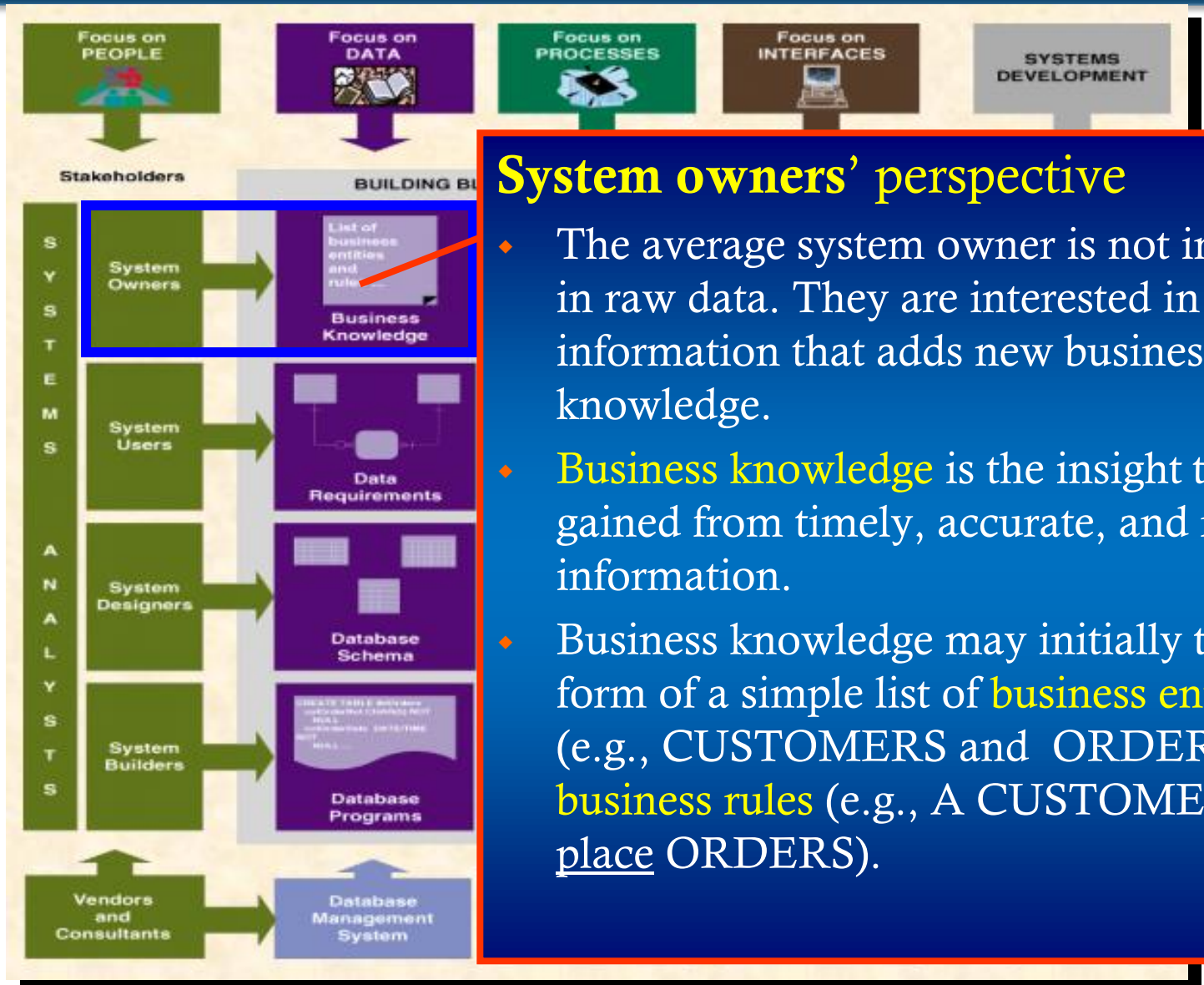
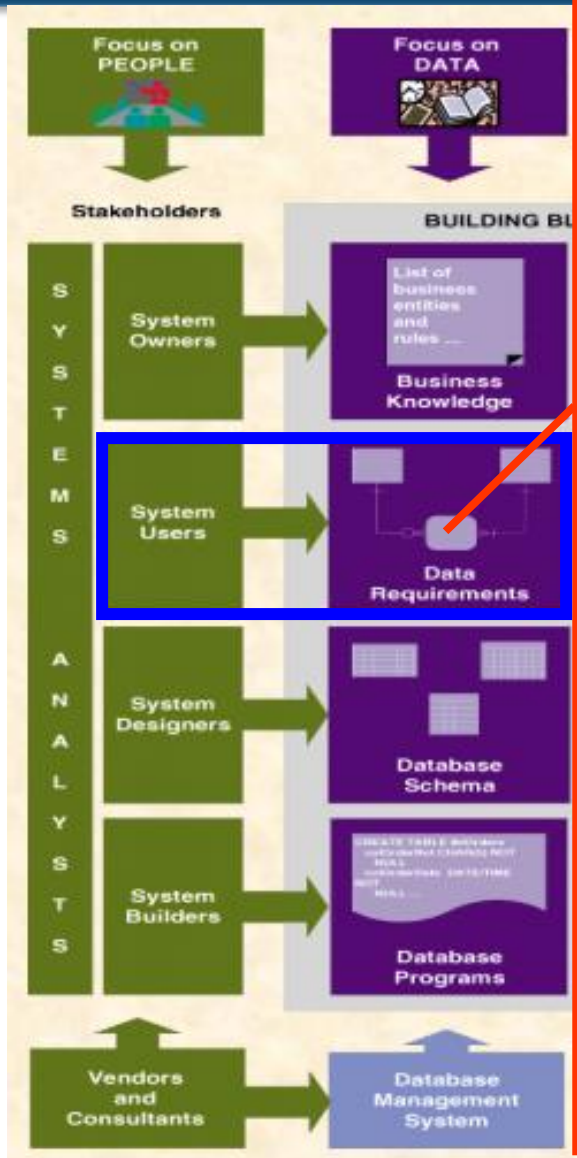


System owners' perspective

- The average system owner is not interested in raw data. They are interested in information that adds new business knowledge.
- Business knowledge is the insight that is gained from timely, accurate, and relevant information.
- Business knowledge may initially take the form of a simple list of business entities (e.g., CUSTOMERS and ORDERS) and business rules (e.g., A CUSTOMER can place ORDERS).

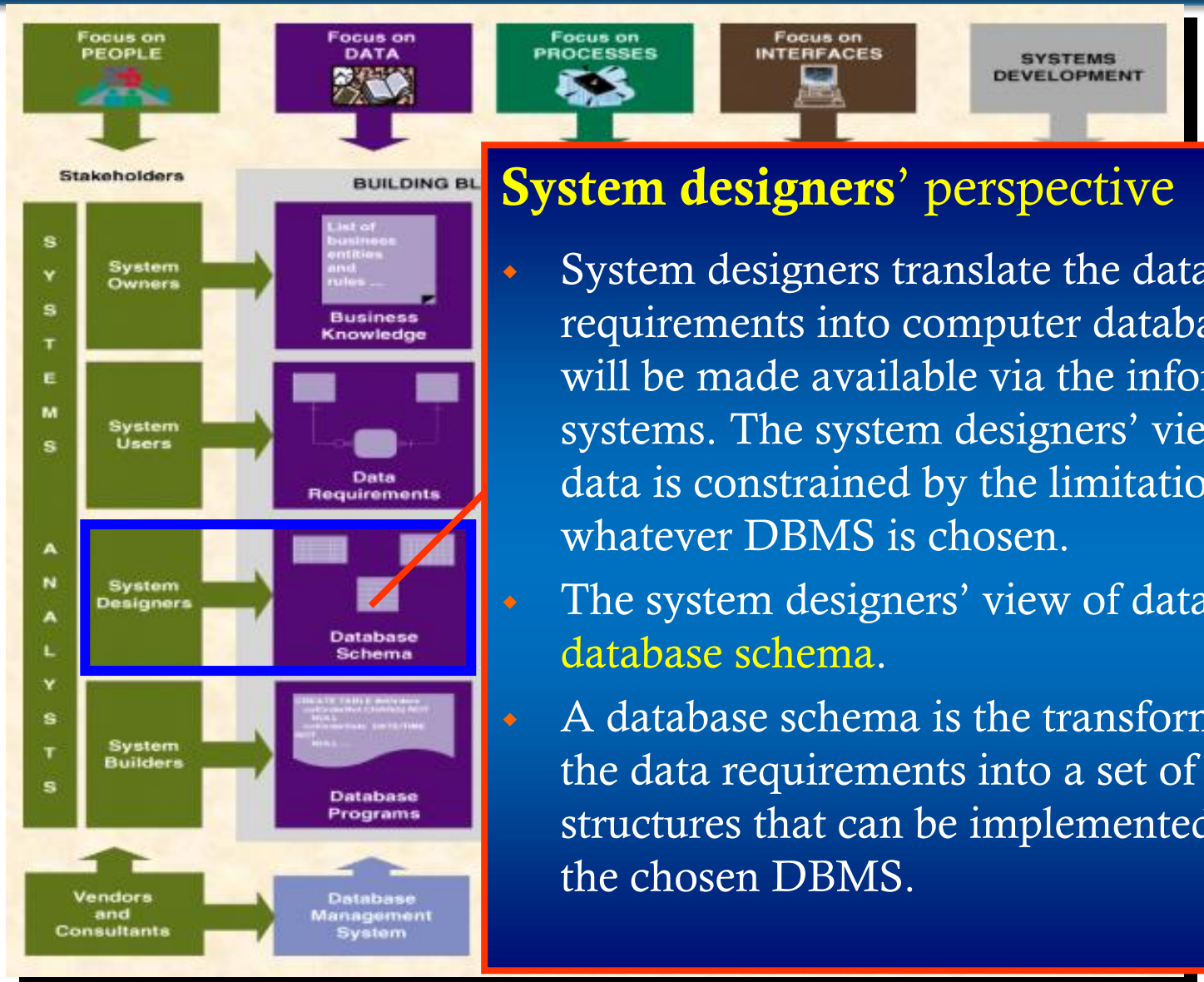
The DATA Focus



System users' perspective

- The users of an information system are the experts about the data that describe the business. Unfortunately, they frequently see the data only in terms of how data are currently stored or how they think data should be stored.
- The challenge in systems development is to correctly identify and verify users' business data requirements.
- Data requirements are a representation of users' data in terms of entities, attributes, relationships, and rules. Data requirements should be expressed in a format that is independent of the technology that can or will be used to store the data.
- Data requirements are an extension of the business entities and rules.

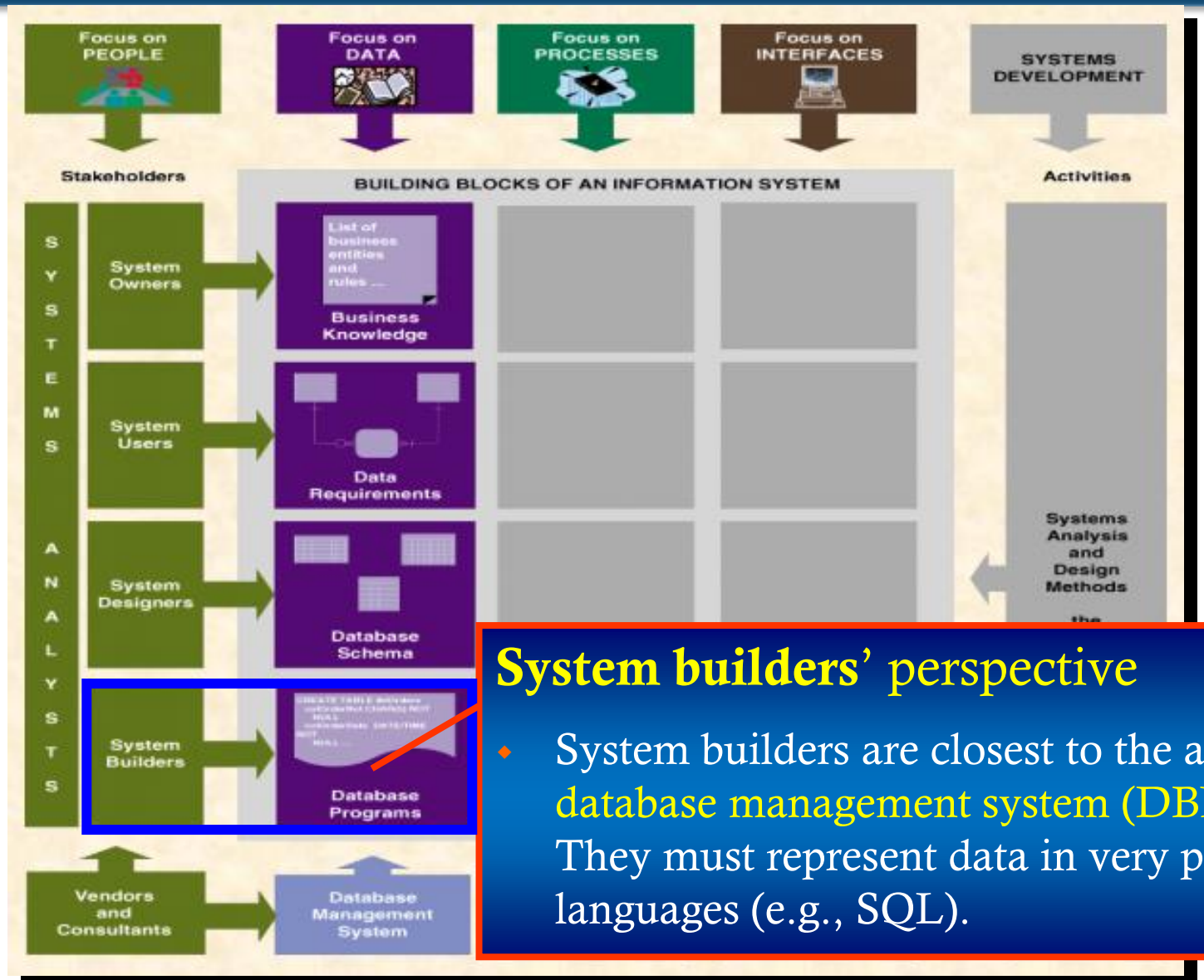
The DATA Focus



System designers' perspective

- System designers translate the data requirements into computer databases that will be made available via the information systems. The system designers' view of data is constrained by the limitations of whatever DBMS is chosen.
- The system designers' view of data is a database schema.
- A database schema is the transformation of the data requirements into a set of data structures that can be implemented using the chosen DBMS.

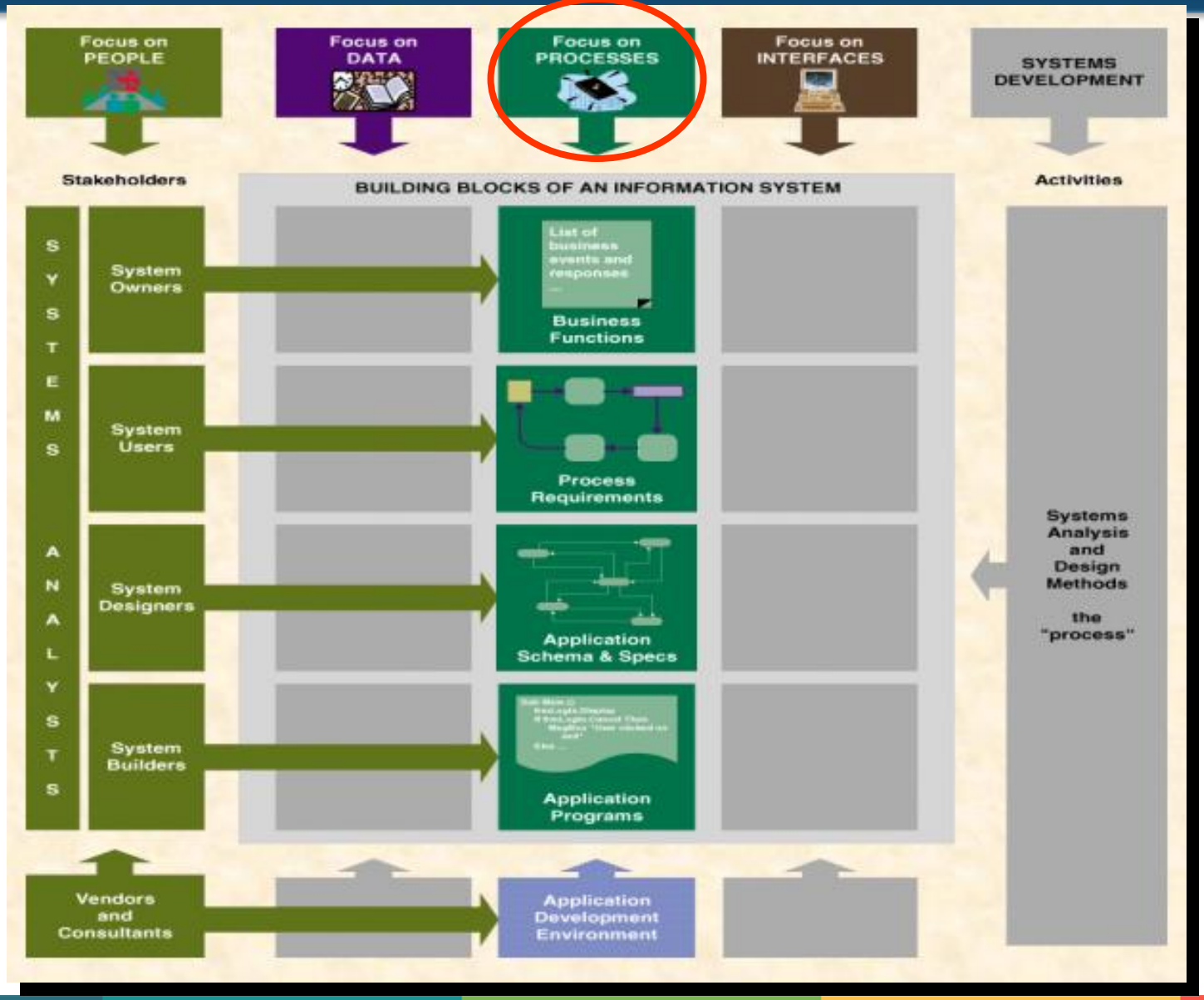
The DATA Focus



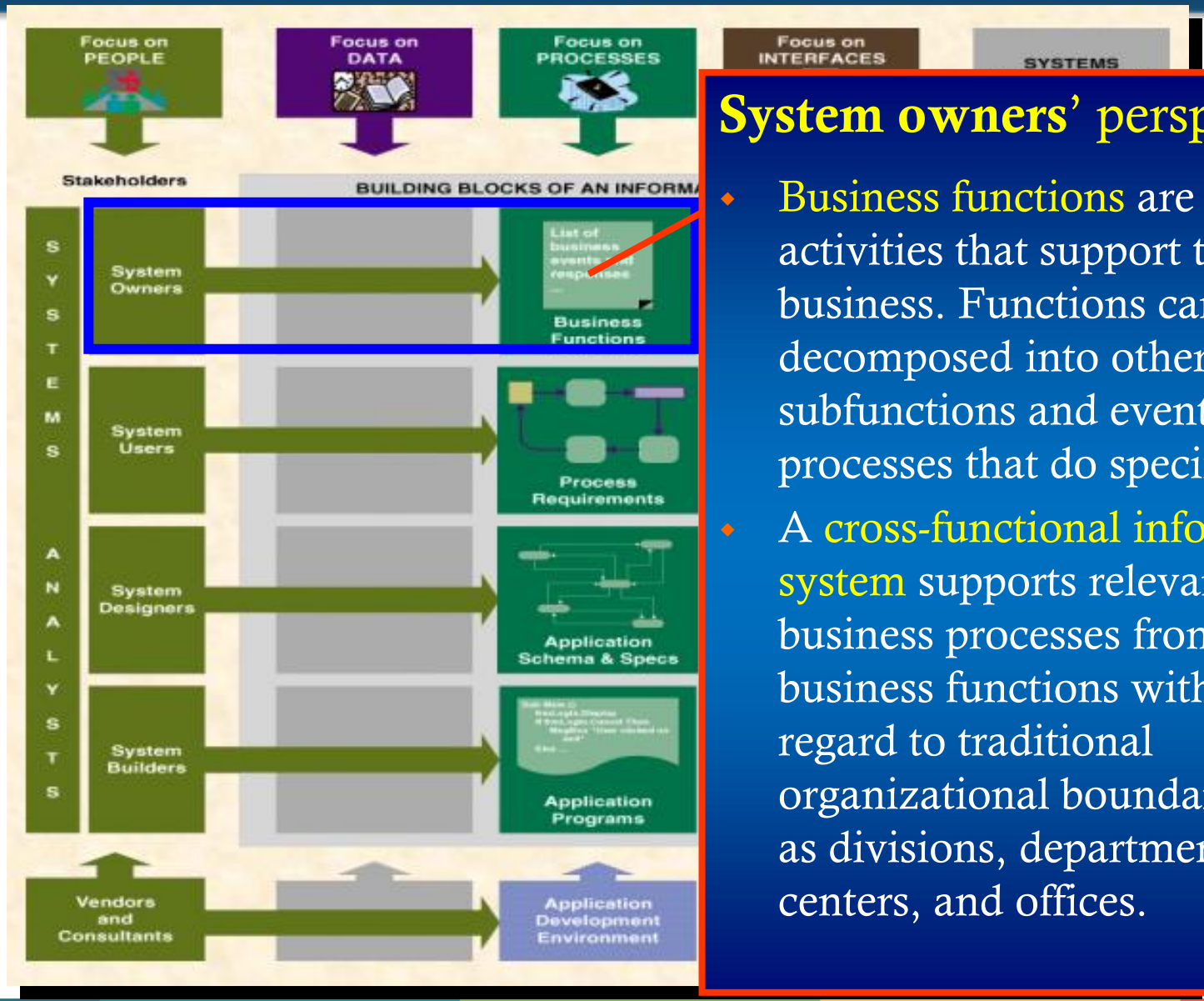
System builders' perspective

- System builders are closest to the actual database management system (DBMS). They must represent data in very precise languages (e.g., SQL).

The PROCESS Focus



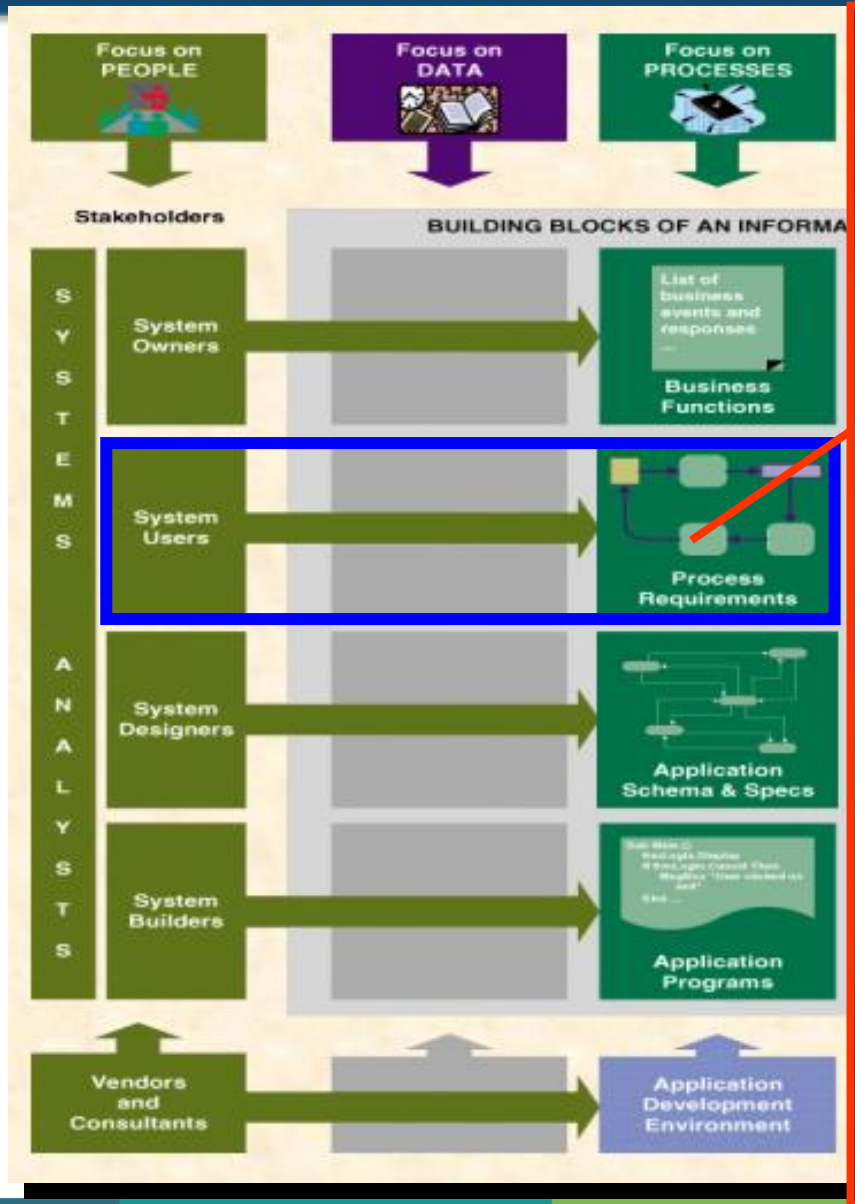
The PROCESS Focus



System owners' perspective

- Business functions are ongoing activities that support the business. Functions can be decomposed into other subfunctions and eventually into processes that do specific tasks.
- A cross-functional information system supports relevant business processes from several business functions without regard to traditional organizational boundaries such as divisions, departments, centers, and offices.

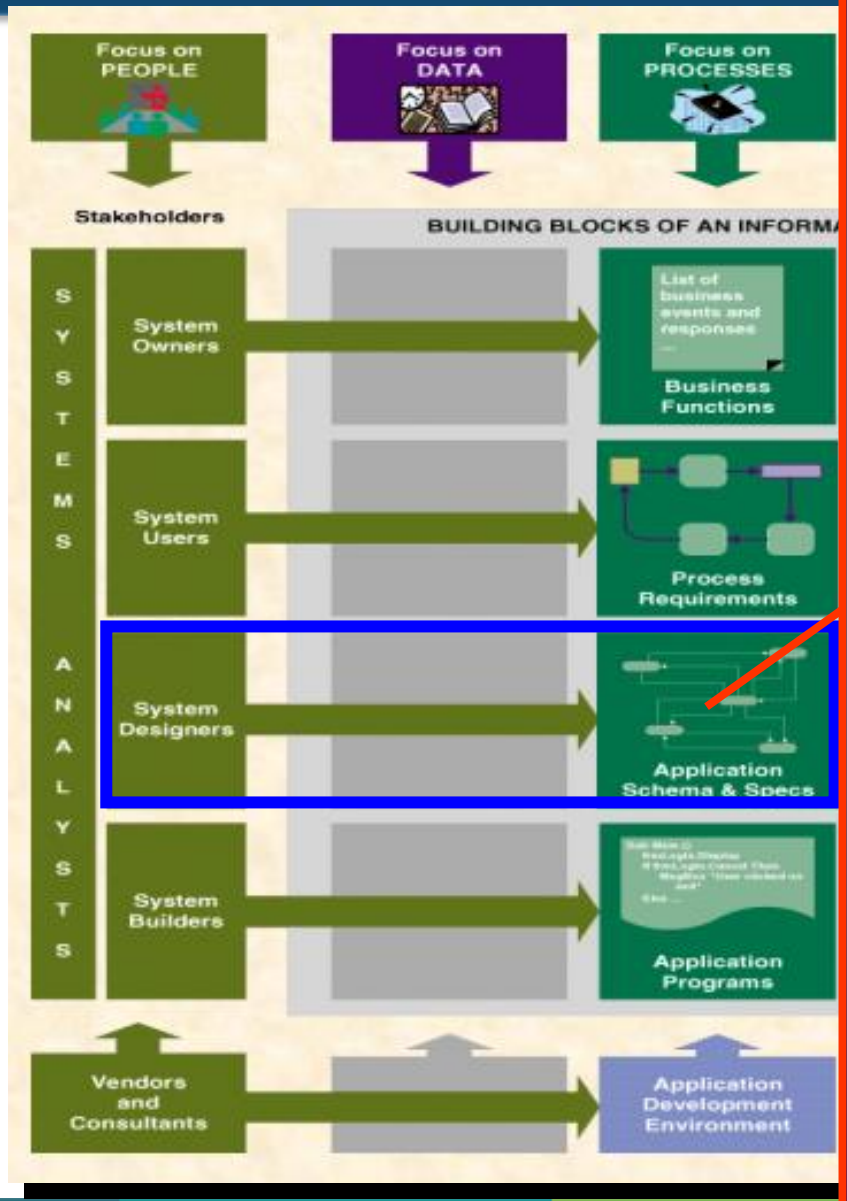
The PROCESS Focus



System users' perspective

- Business processes are activities that respond to business events. Business processes are the "work" performed by the system.
- Process requirements are a representation of the users' business processes in terms of activities, data flows, or work flow.
- A policy is a set of rules that govern a business process.
- A procedure is a step-by-step set of instructions and logic for accomplishing a business process.

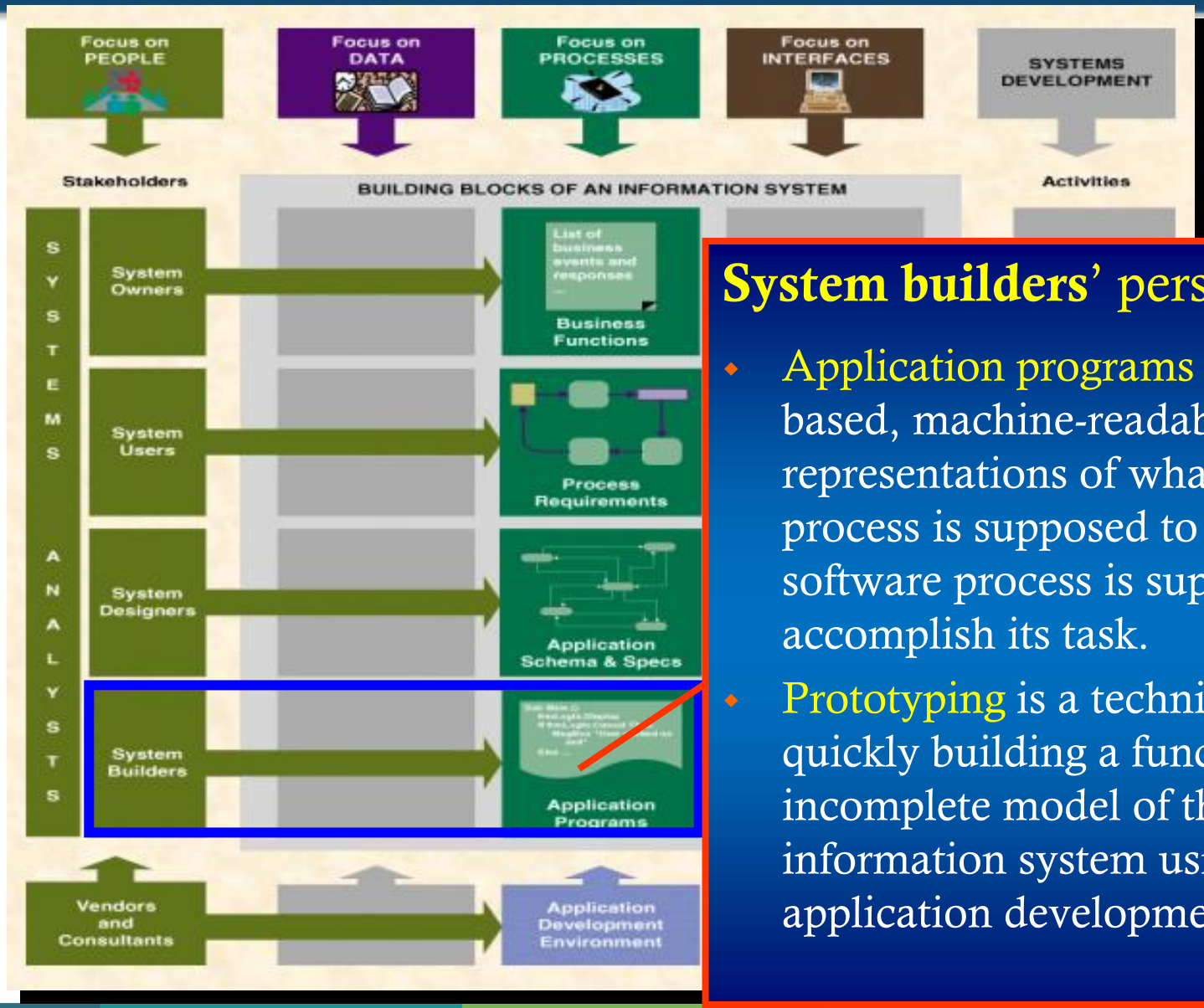
The PROCESS Focus



System designers' perspective

- An application schema is a model that communicates how selected business processes are, or will be, implemented using the software and hardware.
- Today many business purchase commercial off-the-shelf software instead of building that software in-house. In this scenario, the application schema specifies how the software package will be integrated into the enterprise.
- Software specifications represent the technical design of business processes to be automated or supported by computer programs to be written by system builders.
- Examples of software specifications include state transition diagrams, flowcharts, structure charts, or unified modeling language diagrams.

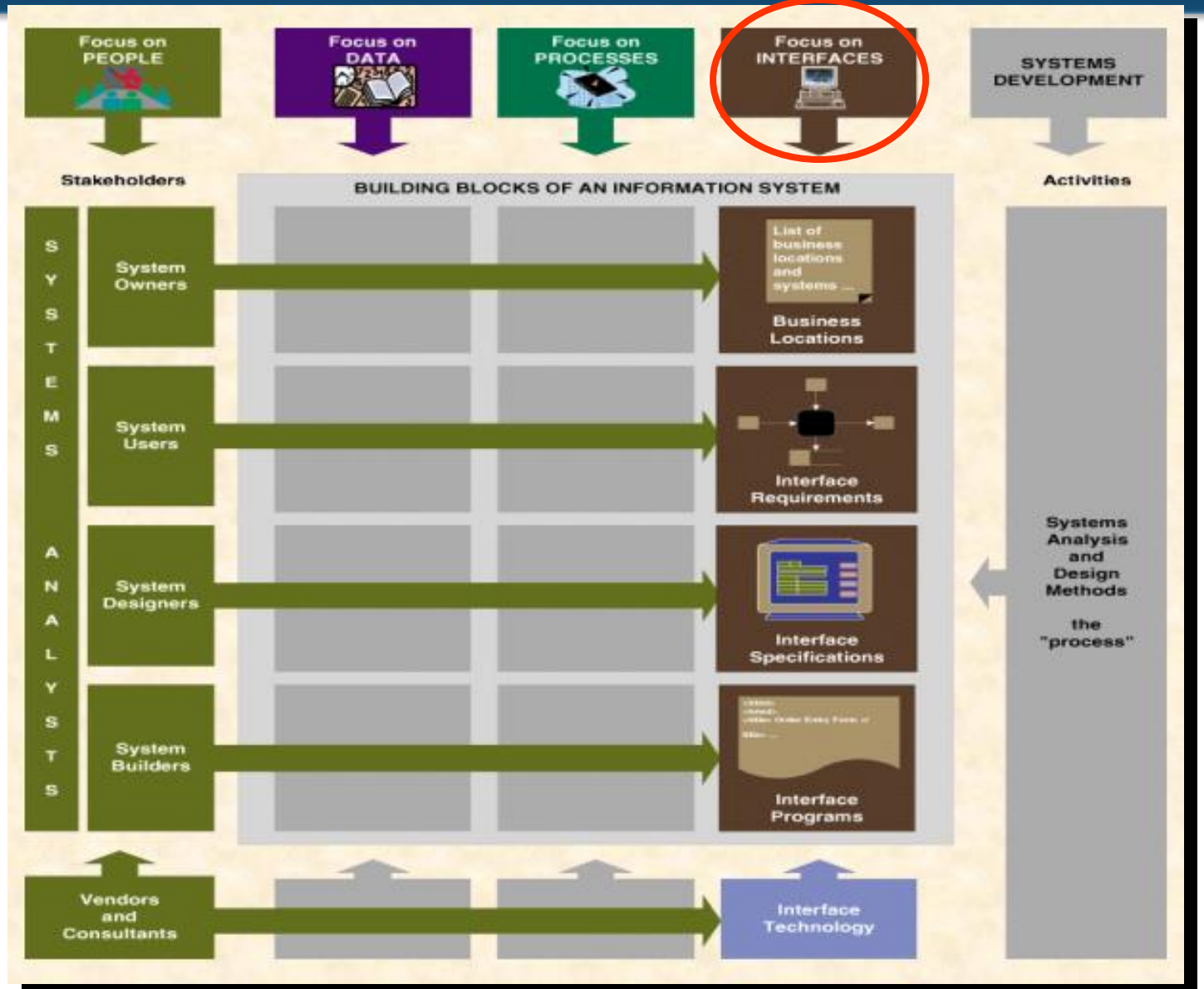
The PROCESS Focus



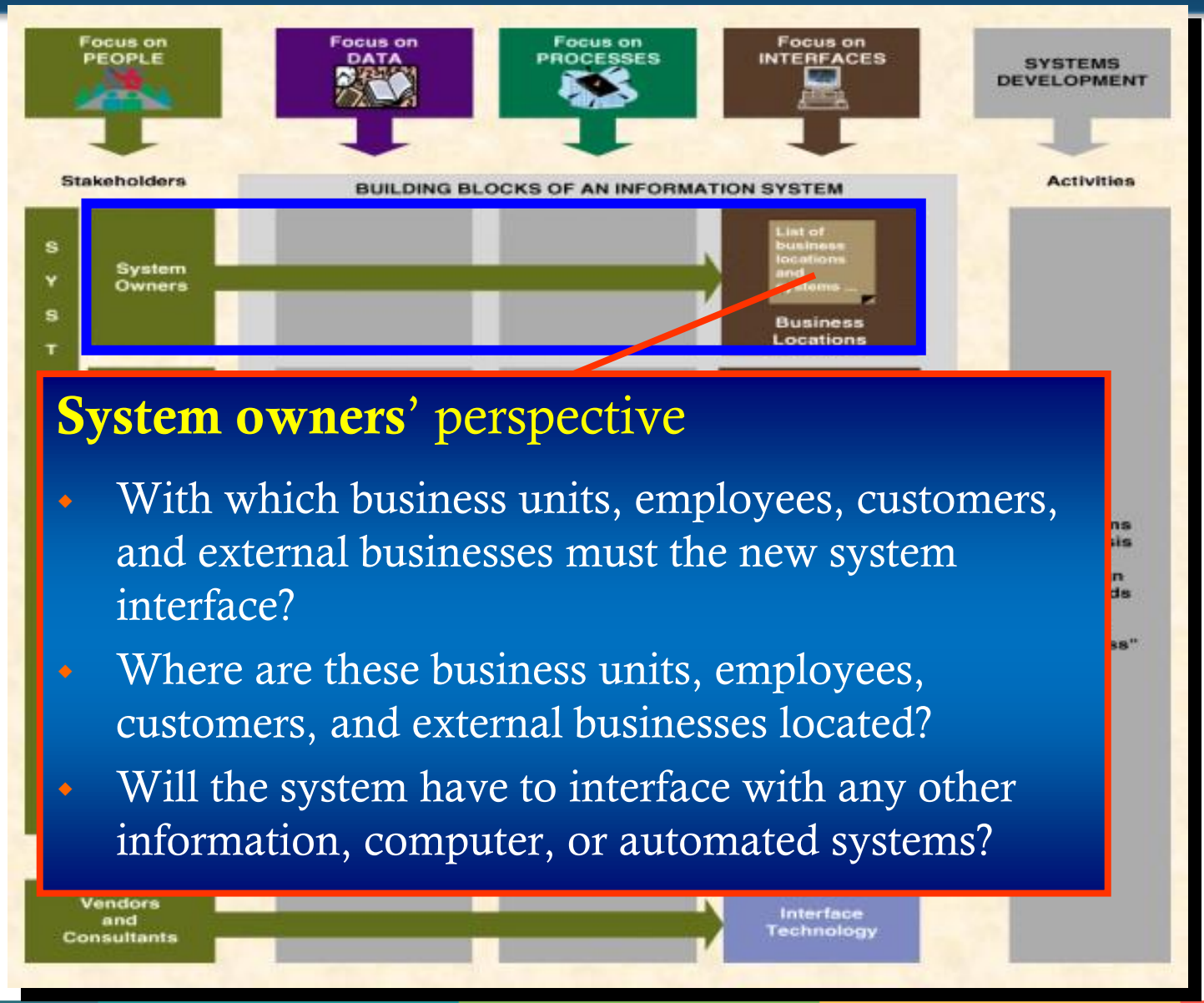
System builders' perspective

- Application programs are language-based, machine-readable representations of what a software process is supposed to do, or how a software process is supposed to accomplish its task.
- Prototyping is a technique for quickly building a functioning, but incomplete model of the information system using rapid application development tools.

The INTERFACE Focus



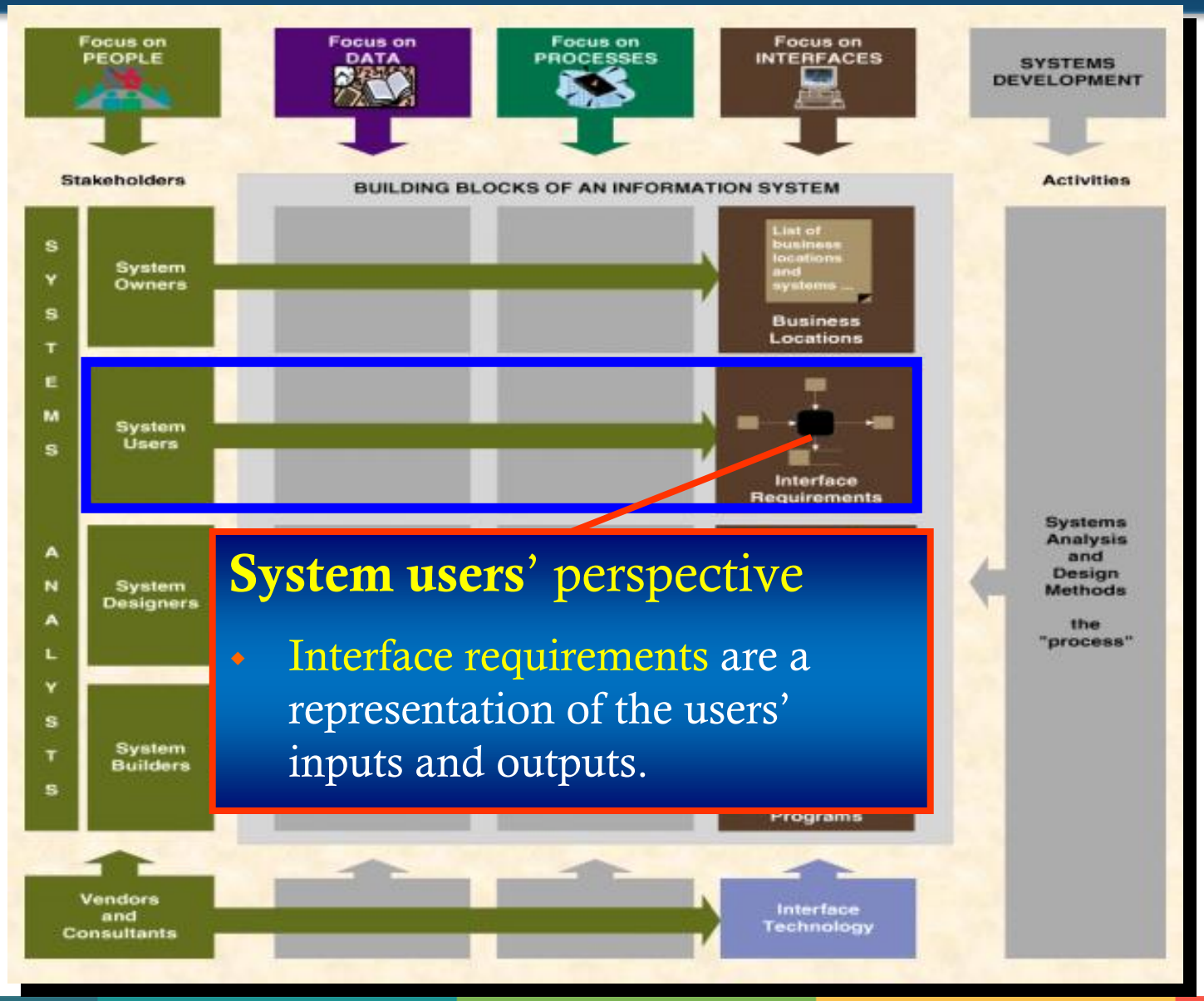
The INTERFACE Focus



System owners' perspective

- 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?

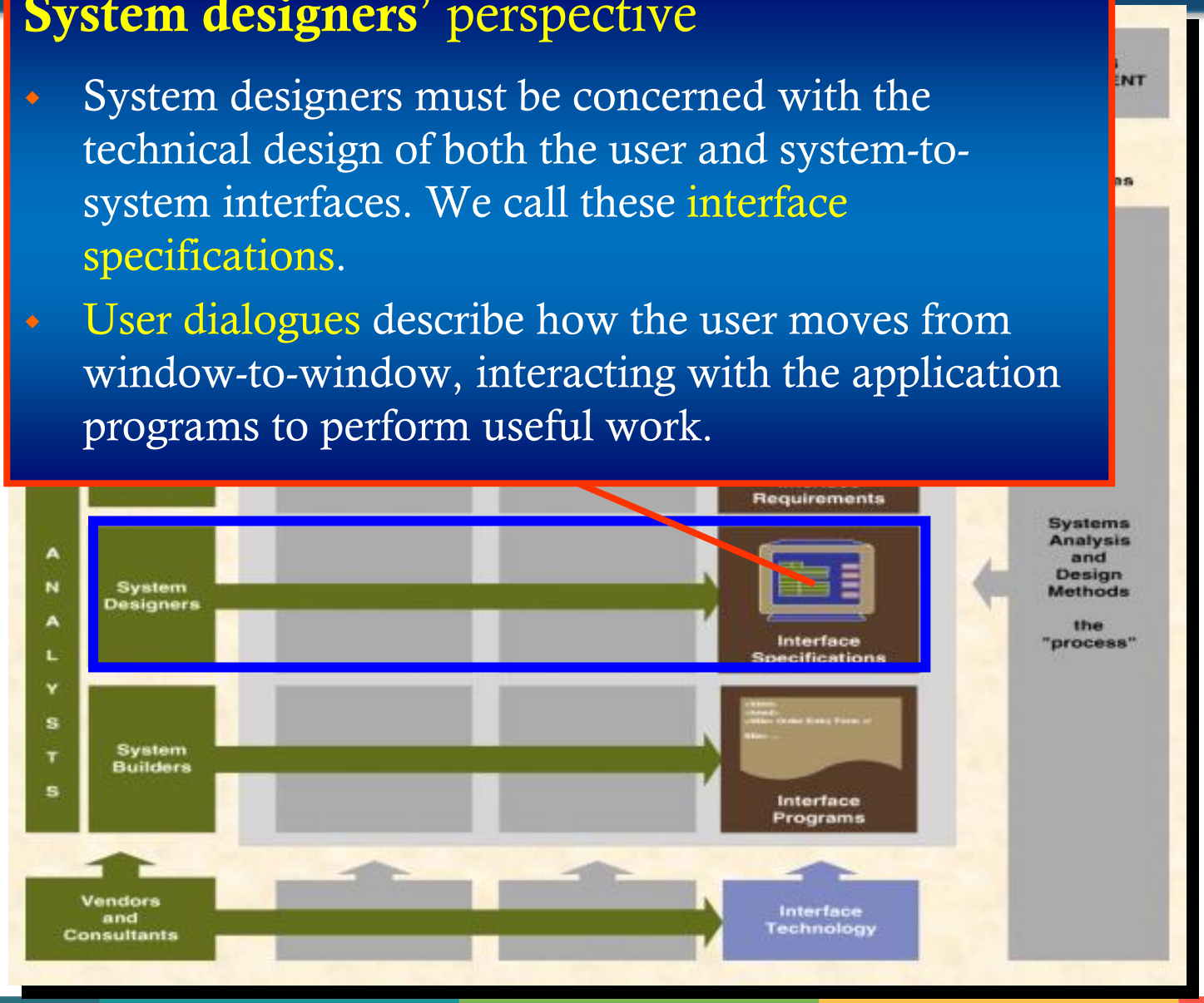
The INTERFACE Focus



The INTERFACE Focus

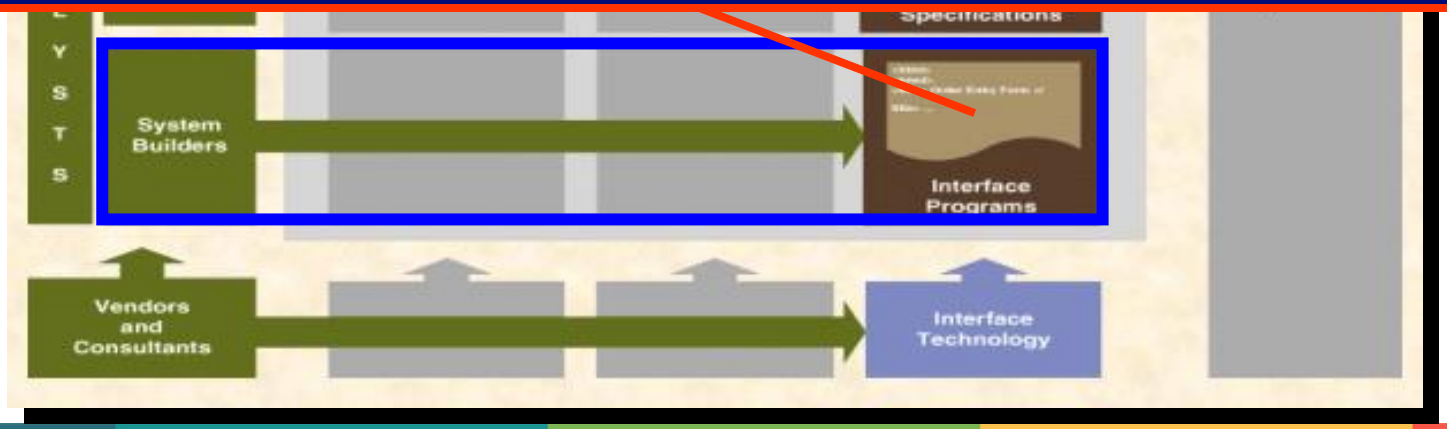
System designers' perspective

- System designers must be concerned with the technical design of both the user and system-to-system interfaces. We call these interface specifications.
- User dialogues describe how the user moves from window-to-window, interacting with the application programs to perform useful work.

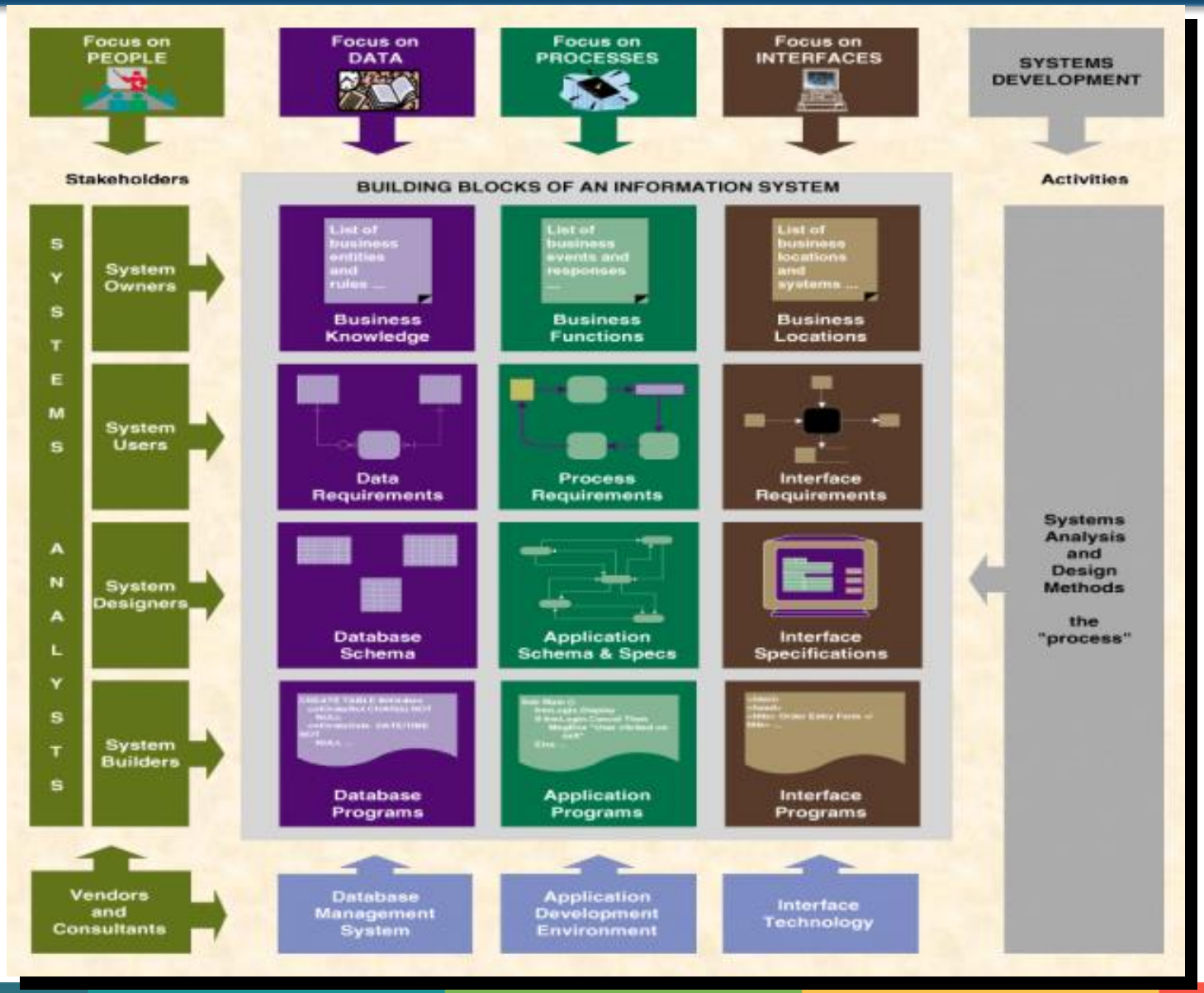


System builders' perspective

- System builders construct, install, test, and implement both user and system-to-system interfaces using interface technology.
- The application development environments (ADE) (e.g., VB, Java, or PB) or markup languages (e.g., XML or HTML) are frequently used to develop user interfaces.
- System-to-system interfaces are considerably more complex than user interfaces to construct or implement. A technology that is currently popular is middleware.
- Middleware（中间件） 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 (e.g., ODBC, COBAR, or J2EE).

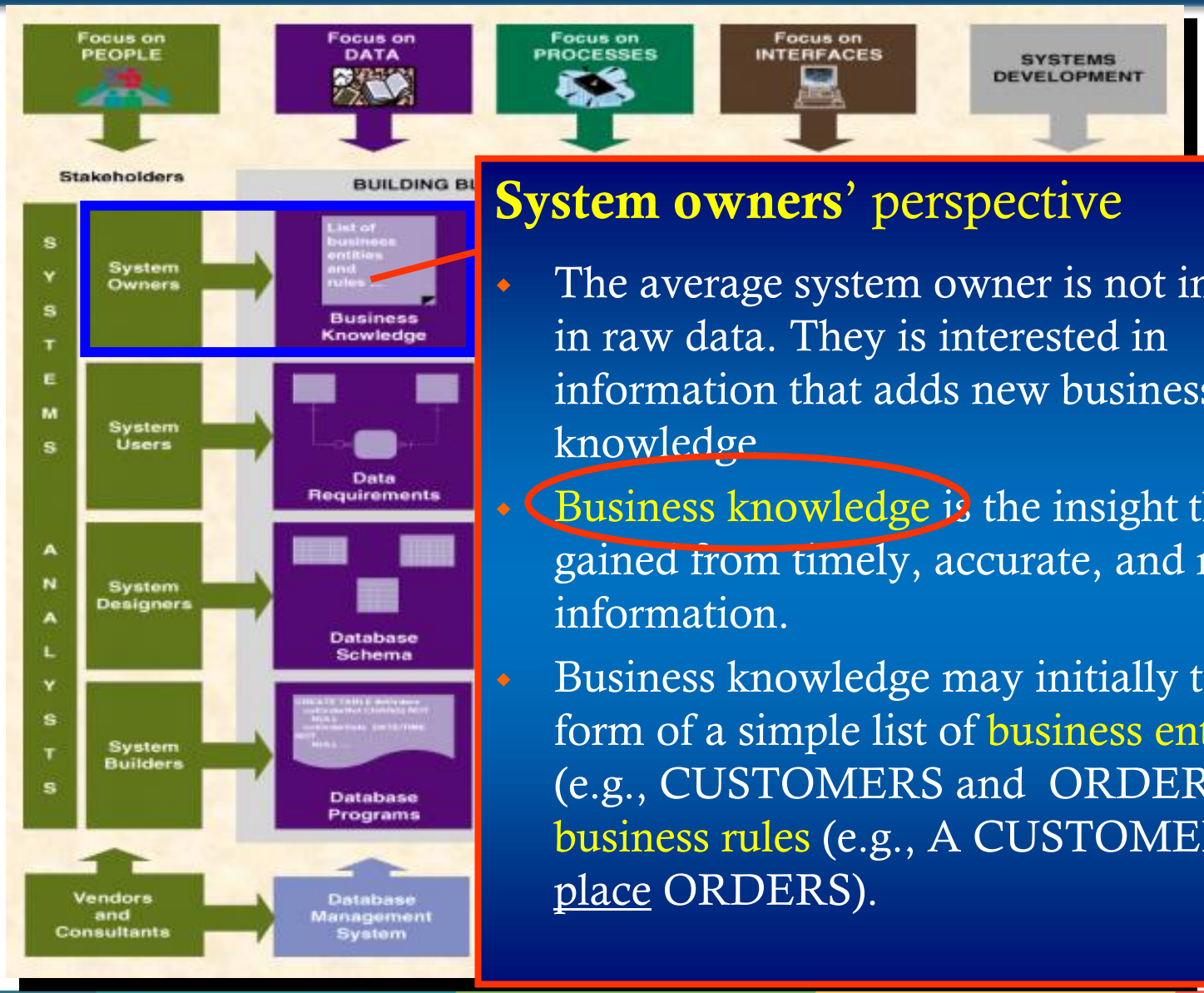


Information System Building Blocks



Let’s consider the framework again in different perspectives:

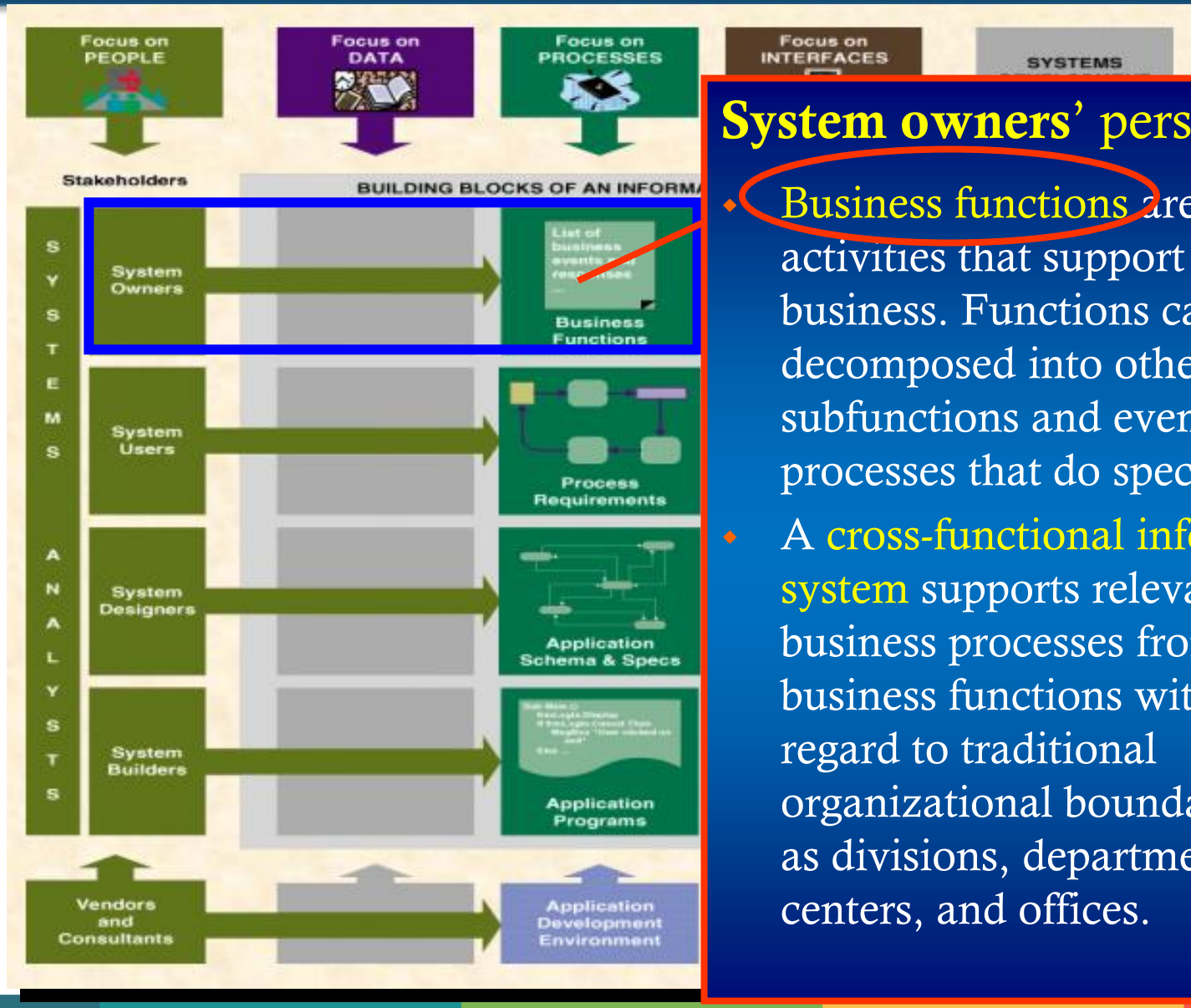
System Owners' Perspective



System owners' perspective

- The average system owner is not interested in raw data. They is interested in information that adds new business knowledge.
- Business knowledge is the insight that is gained from timely, accurate, and relevant information.
- Business knowledge may initially take the form of a simple list of business entities (e.g., CUSTOMERS and ORDERS) and business rules (e.g., A CUSTOMER can place ORDERS).

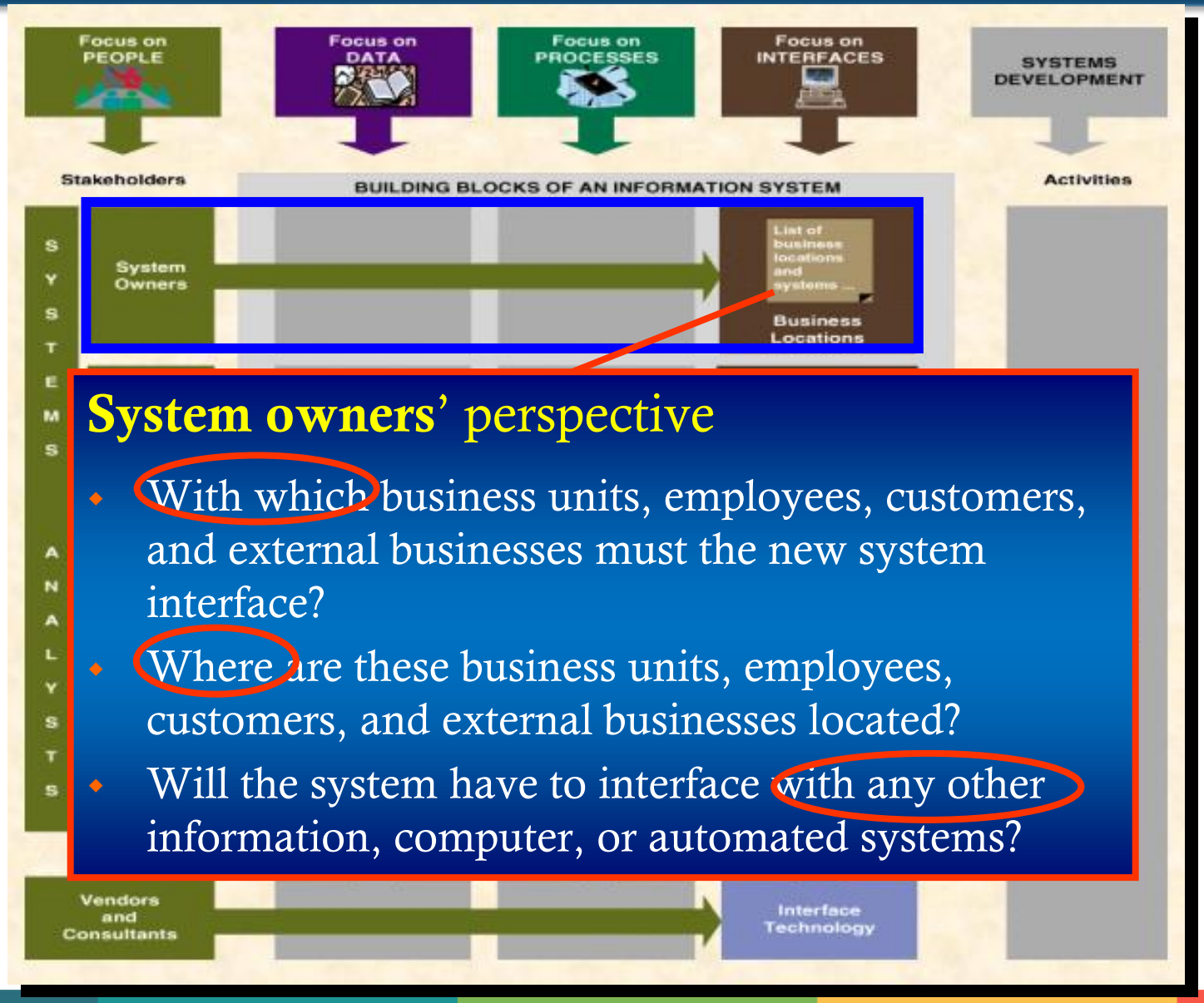
System Owners' Perspective



System owners' perspective

- Business functions are ongoing activities that support the business. Functions can be decomposed into other subfunctions and eventually into processes that do specific tasks.
- A cross-functional information system supports relevant business processes from several business functions without regard to traditional organizational boundaries such as divisions, departments, centers, and offices.

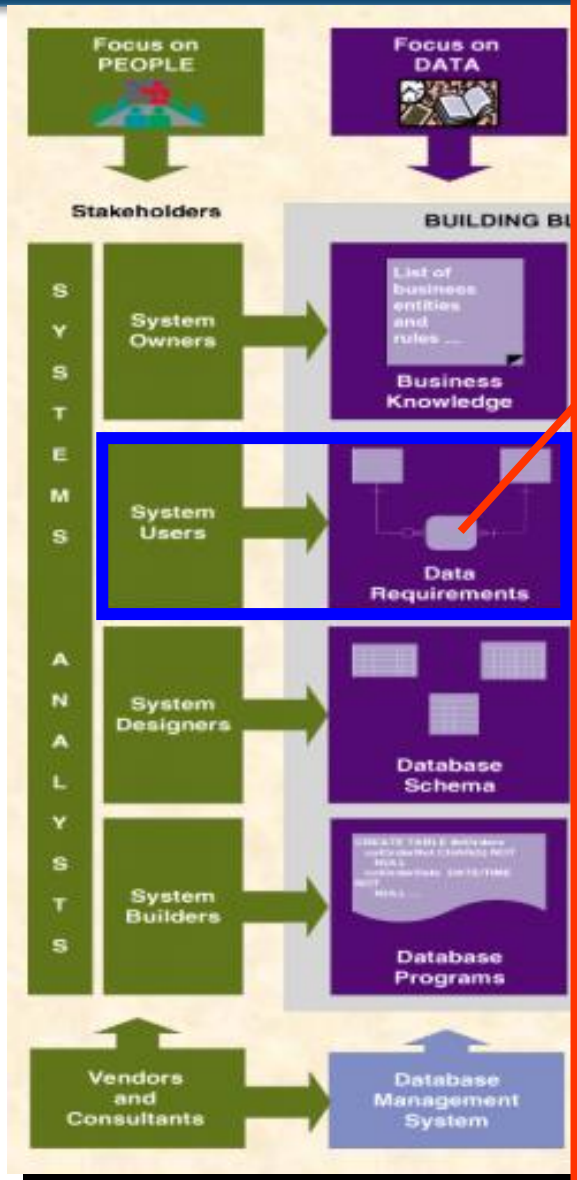
System Owners' Perspective



System owners' perspective

- 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?

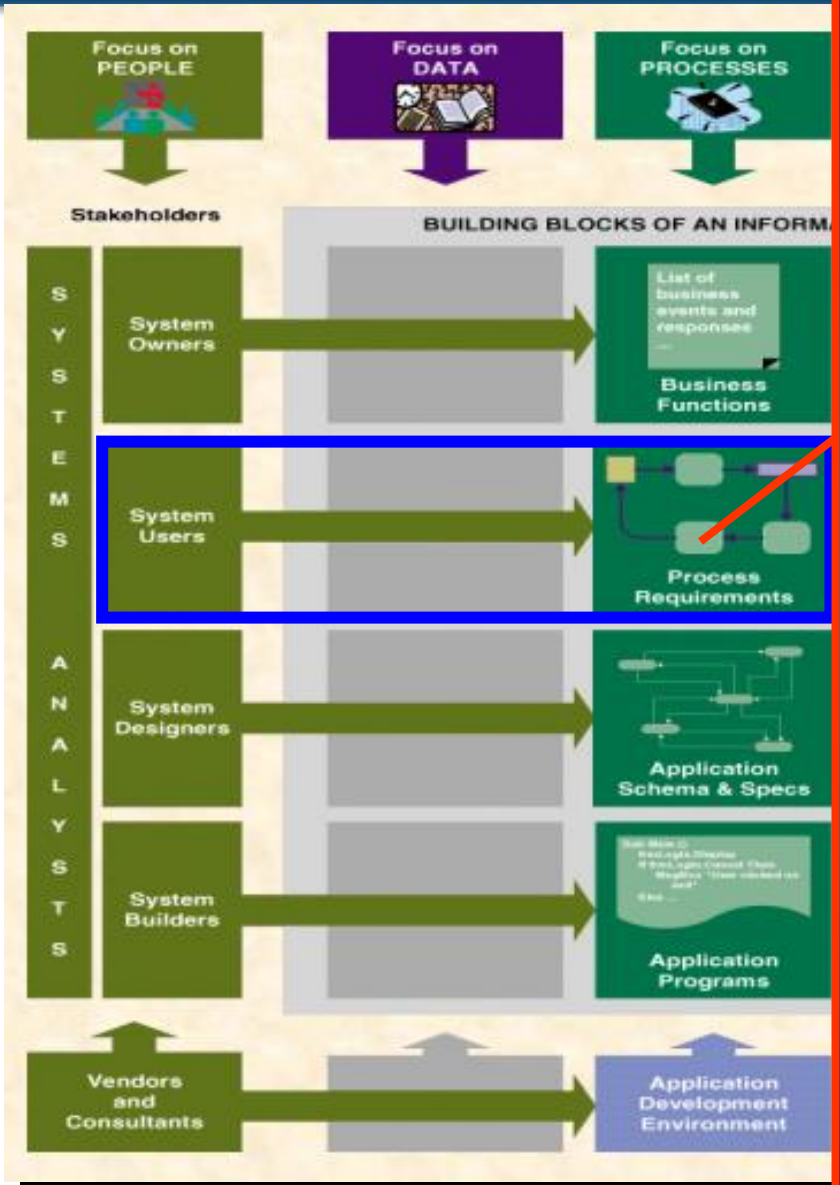
System Users' Perspective



System users' perspective

- The users of an information system are the experts about the data that describe the business. Unfortunately, they frequently see the data only in terms of how data are currently stored or how they think data should be stored.
- The challenge in systems development is to correctly identify and verify users' business data requirements.
- Data requirements are a representation of users' data in terms of entities, attributes, relationships, and rules. Data requirements should be expressed in a format that is independent of the technology that can or will be used to store the data.
- Data requirements are an extension of the business entities and rules.

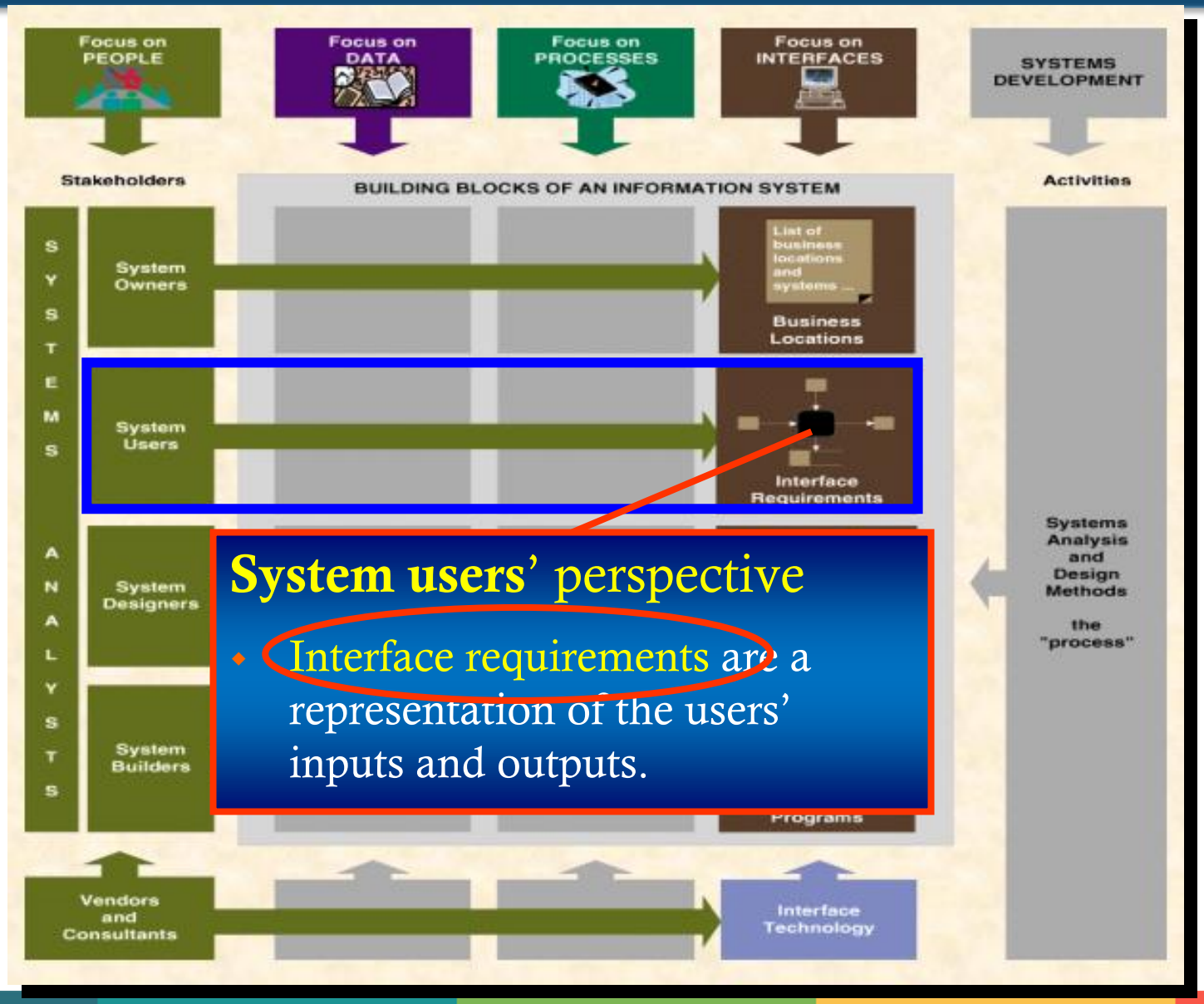
System Users' Perspective



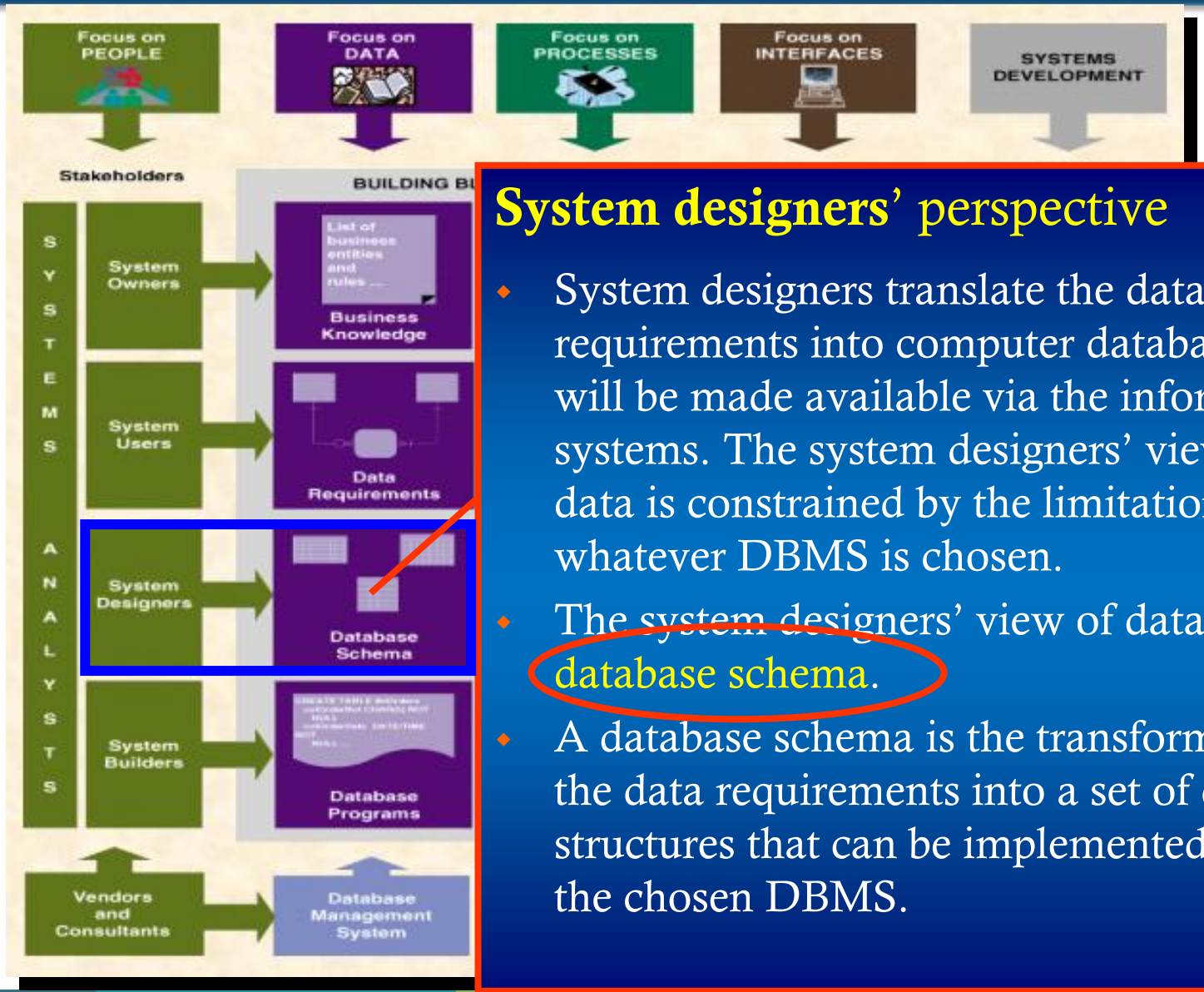
System users' perspective

- Business processes are activities that respond to business events. Business processes are the "work" performed by the system.
- Process requirements are a representation of the users' business processes in terms of activities, data flows, or work flow.
- A policy is a set of rules that govern a business process.
- A procedure is a step-by-step set of instructions and logic for accomplishing a business process.

System Users' Perspective



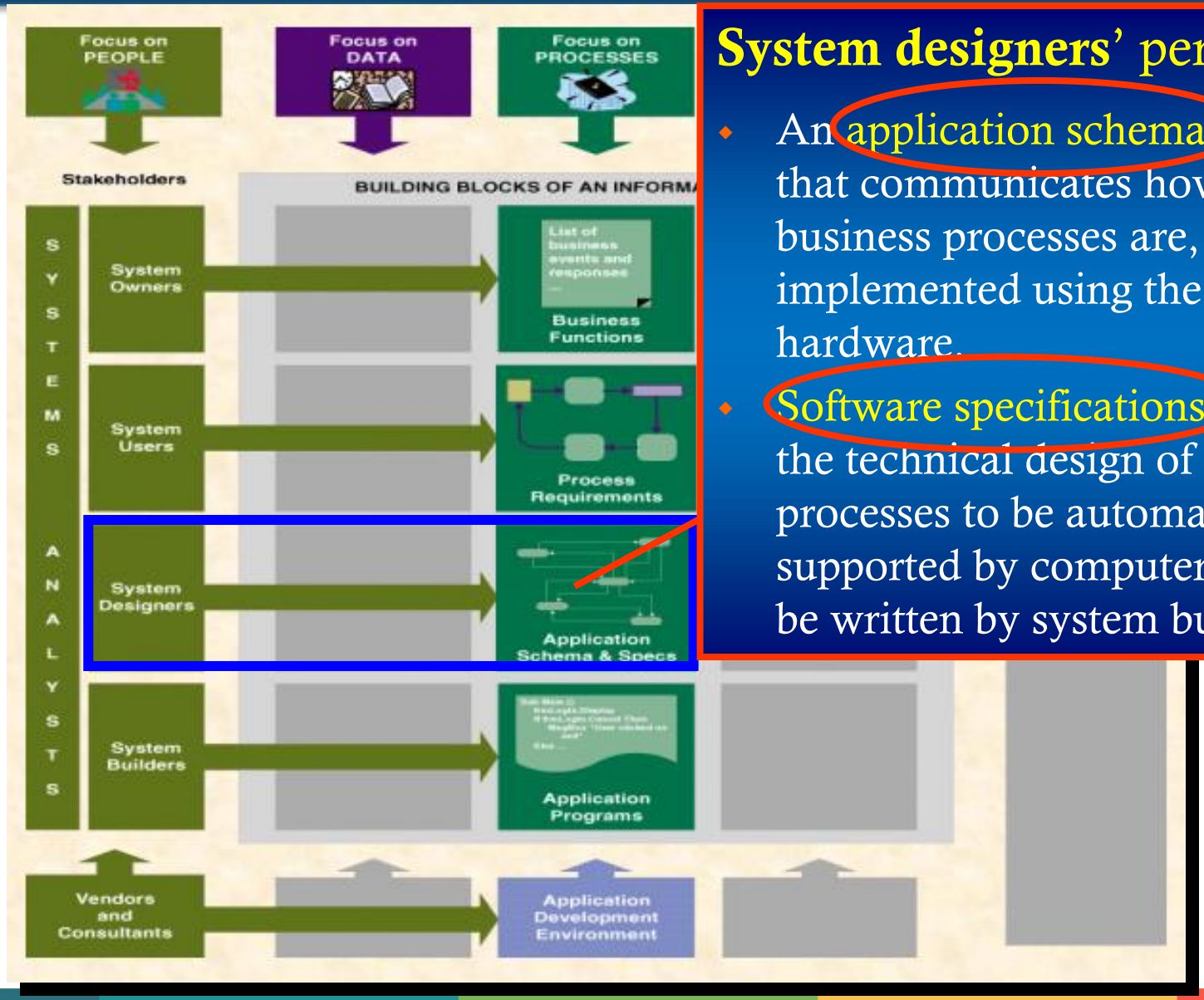
System Designers' Perspective



System designers' perspective

- System designers translate the data requirements into computer databases that will be made available via the information systems. The system designers' view of data is constrained by the limitations of whatever DBMS is chosen.
- The system designers' view of data is a database schema.
- A database schema is the transformation of the data requirements into a set of data structures that can be implemented using the chosen DBMS.

System Designers' Perspective



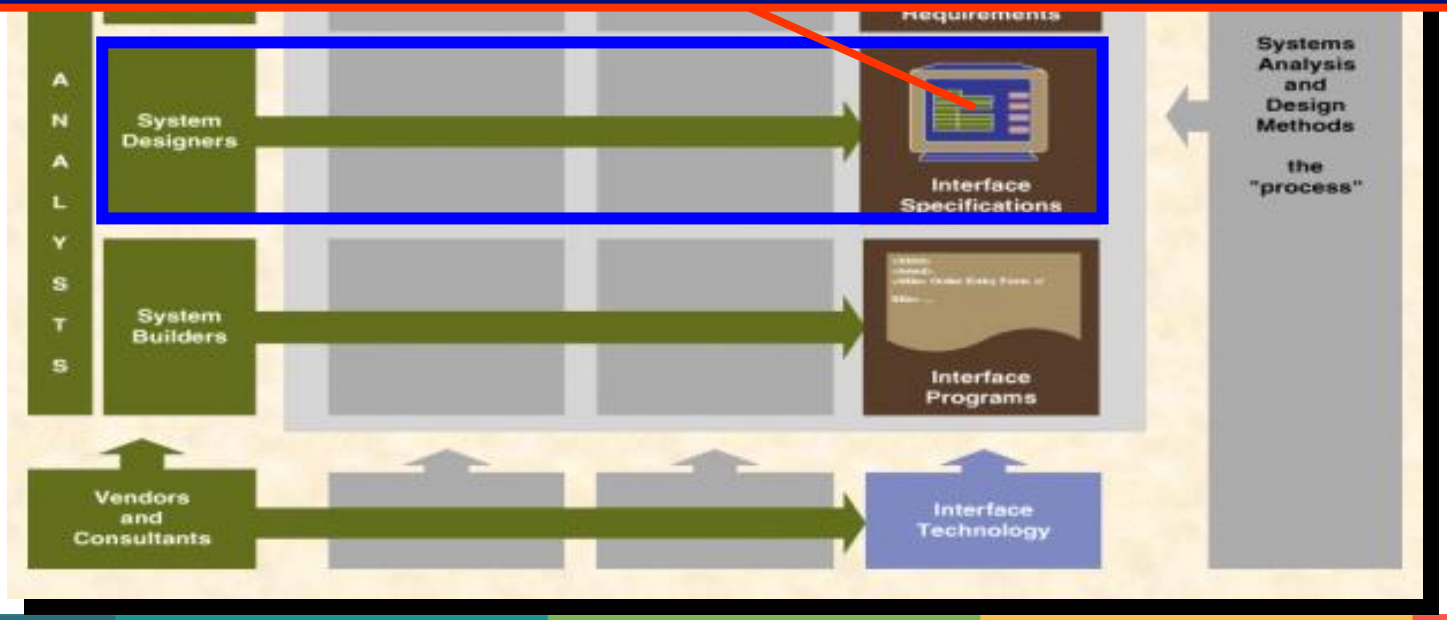
System designers' perspective

- An application schema is a model that communicates how selected business processes are, or will be, implemented using the software and hardware.
- Software specifications represent the technical design of business processes to be automated or supported by computer programs to be written by system builders.

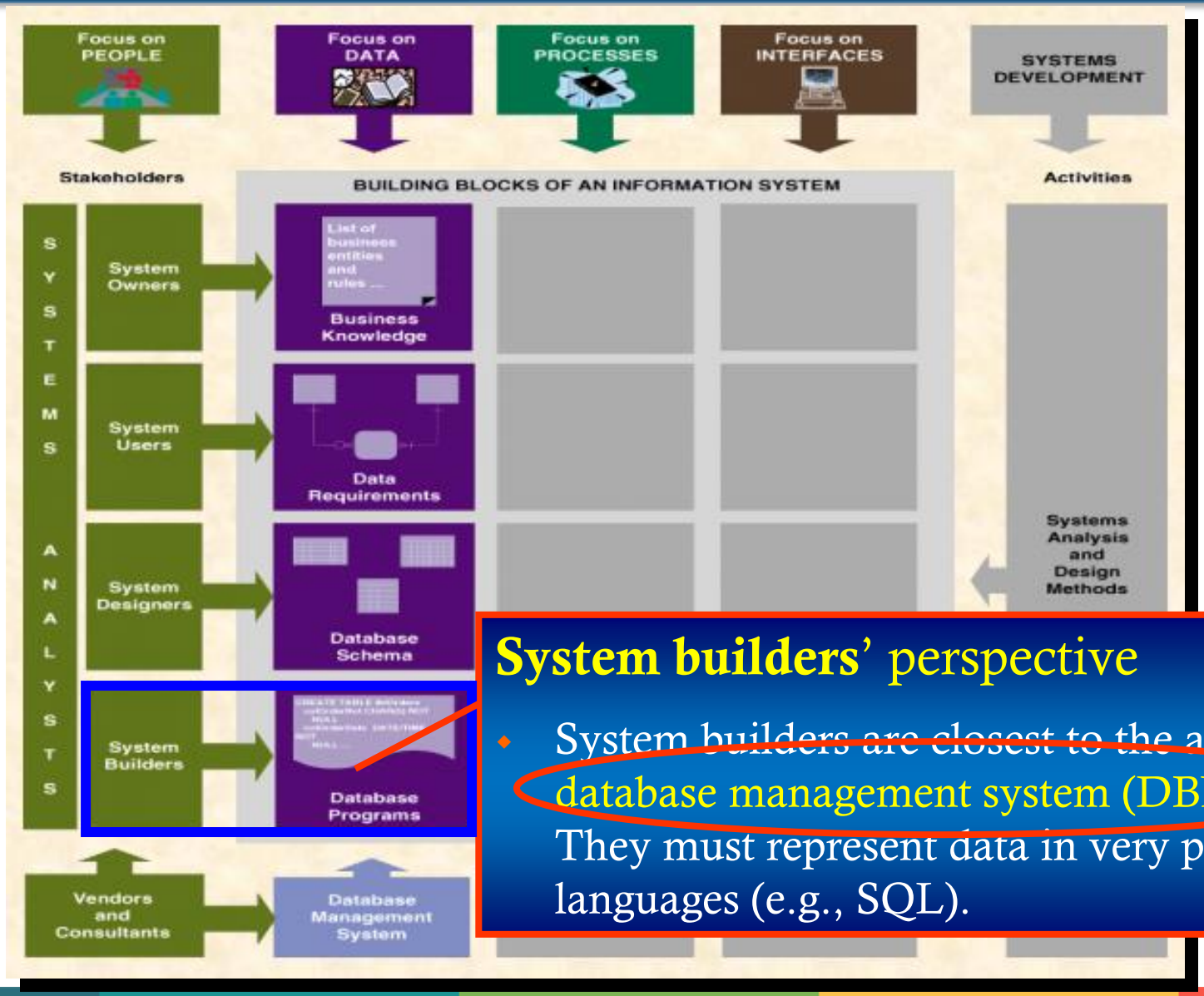
System Designers' Perspective

System designers' perspective

- System designers must be concerned with the technical design of both the user and system-to-system interfaces. We call these interface specifications.
- User dialogues describe how the user moves from window-to-window, interacting with the application programs to perform useful work.



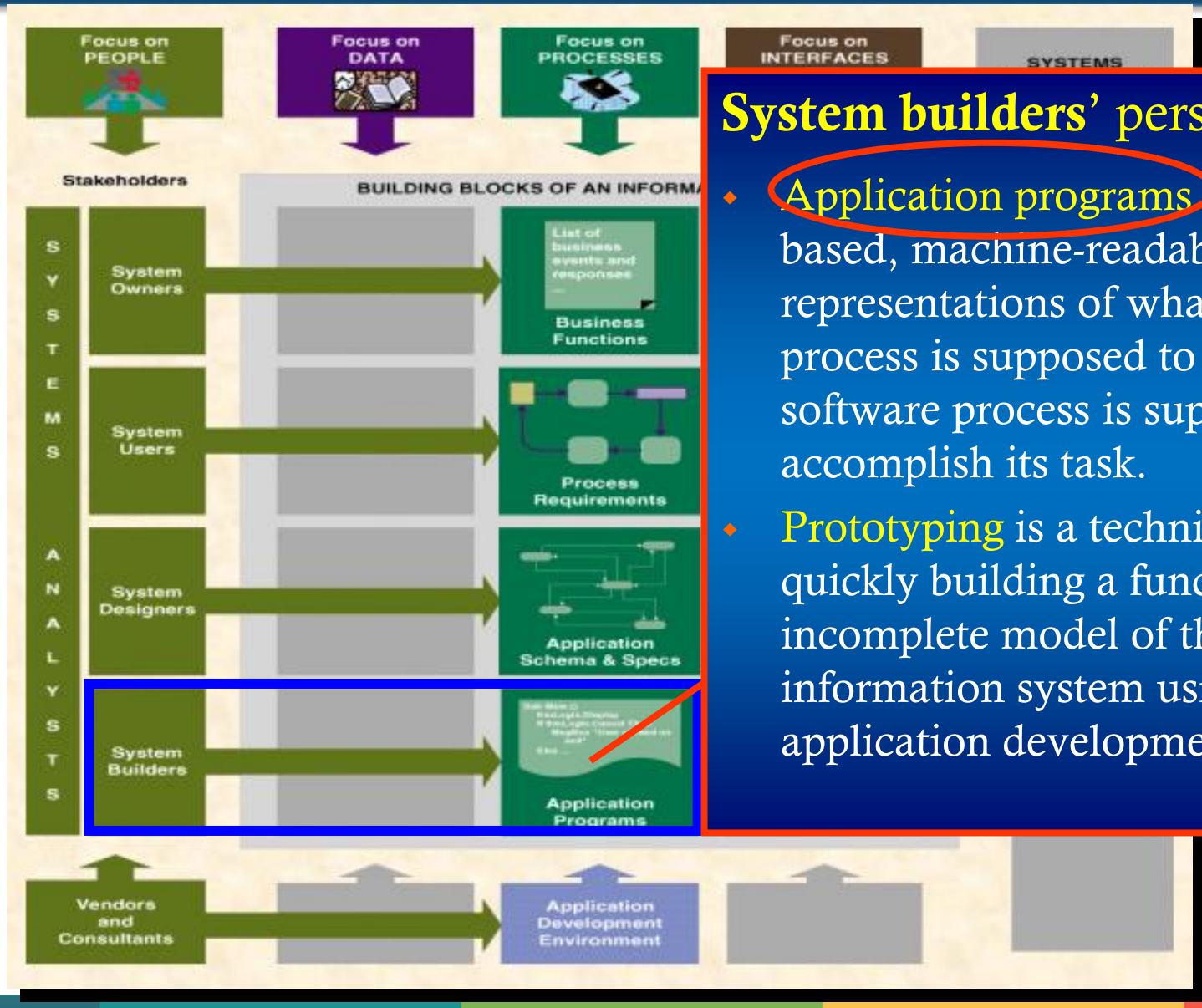
System Builders' Perspective



System builders' perspective

- System builders are closest to the actual database management system (DBMS). They must represent data in very precise languages (e.g., SQL).

System Builders' Perspective



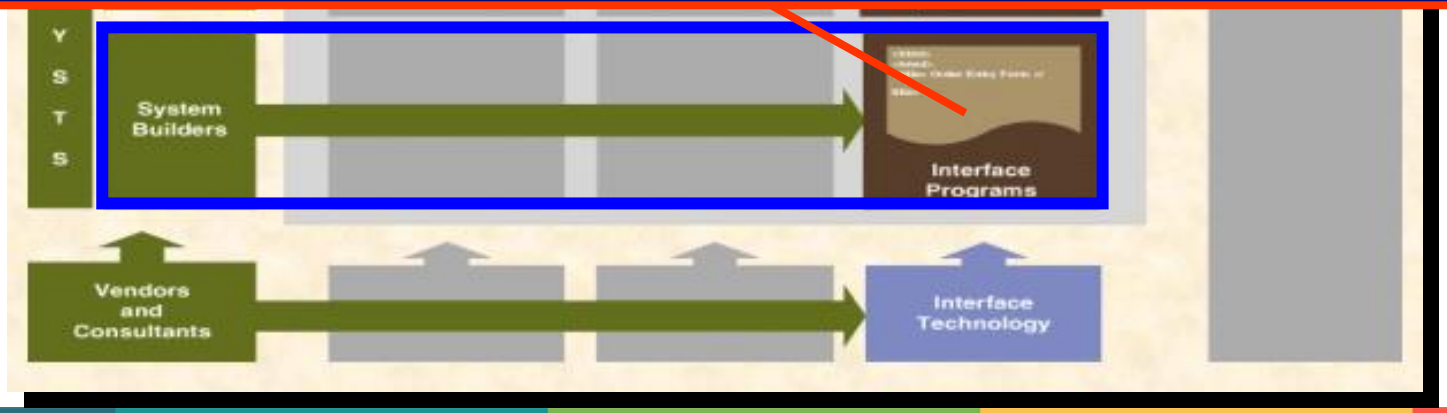
System builders' perspective

- Application programs are language-based, machine-readable representations of what a software process is supposed to do, or how a software process is supposed to accomplish its task.
- Prototyping is a technique for quickly building a functioning, but incomplete model of the information system using rapid application development tools.

Sy

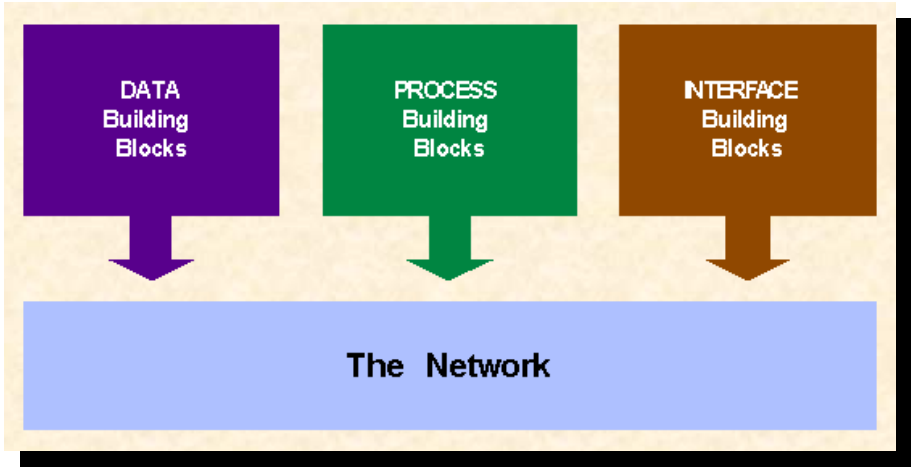
System builders' perspective

- System builders construct, install, test, and implement both user and system-to-system interfaces using interface technology.
- The application development environments (ADE) (e.g., VB, Java, or PB) or markup languages (e.g., XML or HTML) are frequently used to develop user interfaces.
- System-to-system interfaces are considerably more complex than user interfaces to construct or implement. A 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 (e.g., ODBC, COBAR, or J2EE).

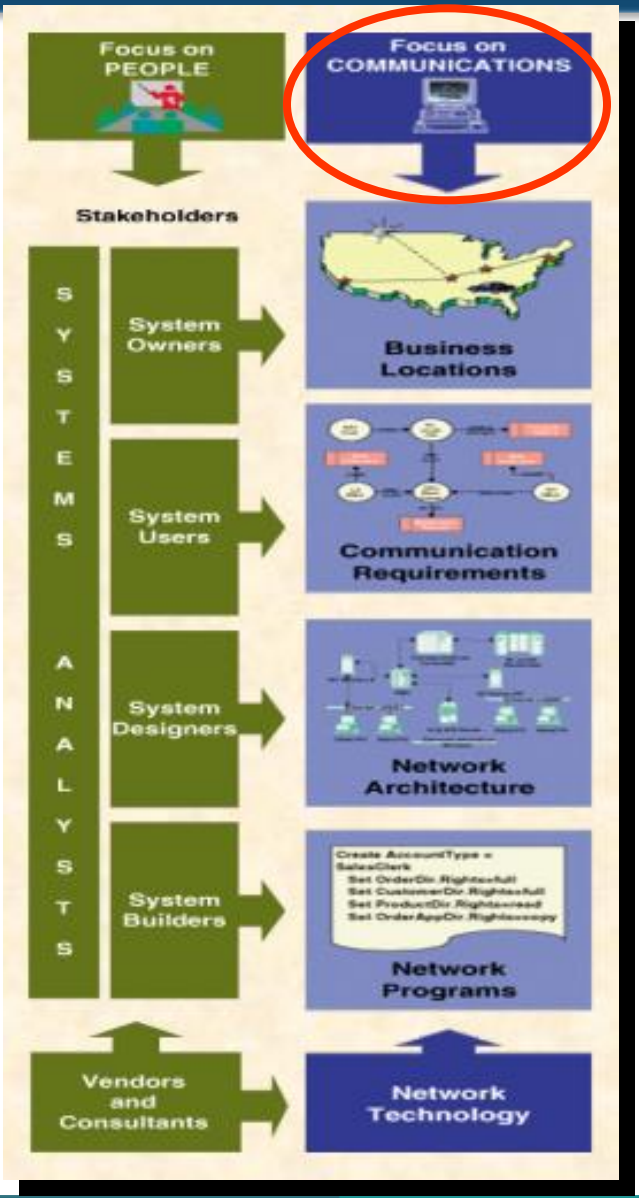


The Role of the Network in IS

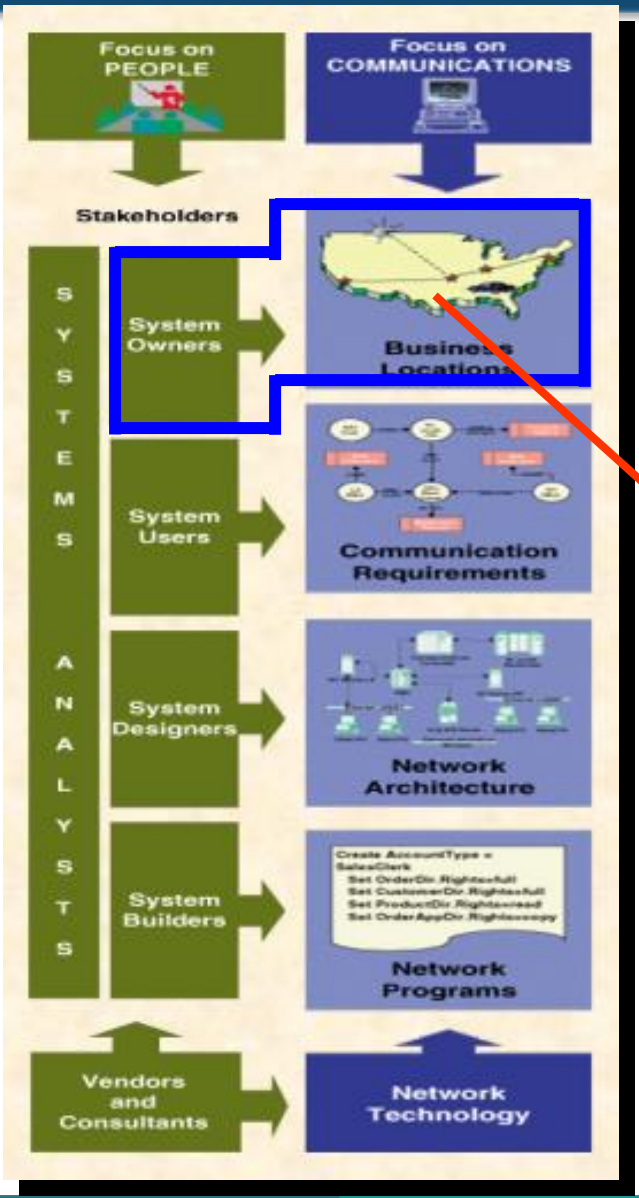
- Today's information systems are built on networks.
- A modern high-level information systems framework has the contemporary layering of an information systems' Data, Process, and Interface building blocks upon a Network. This clean layering approach allows any one building block to the replaced with another while having little or no impact on the other building blocks.



A COMMUNICATIONS Focus in IS



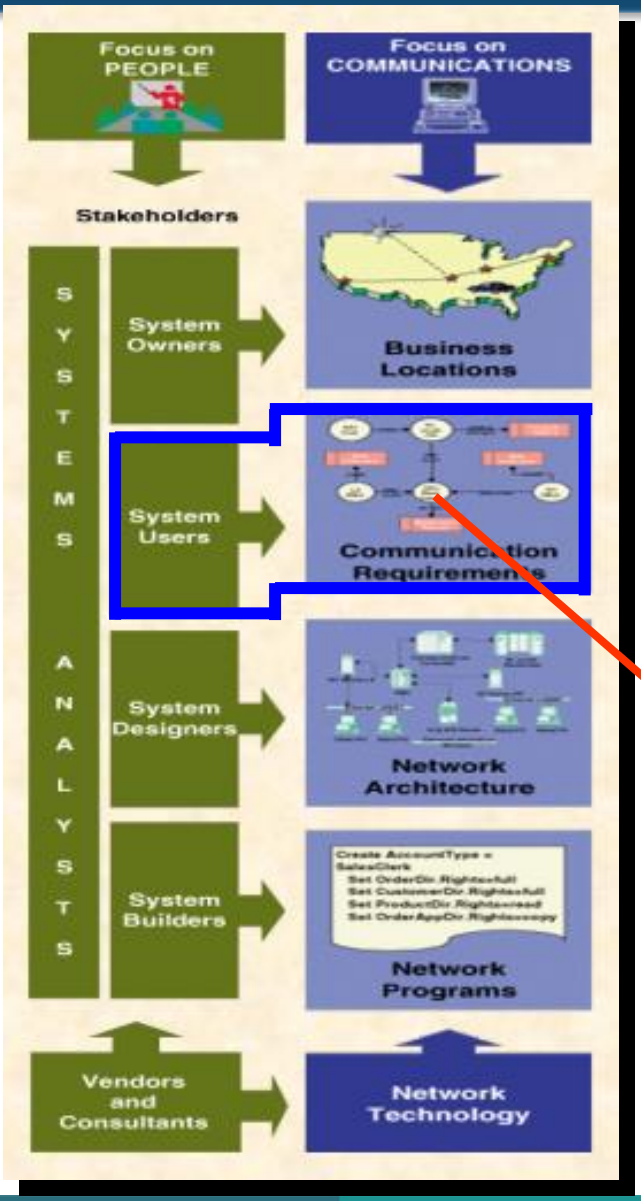
A COMMUNICATIONS Focus in IS



System owners' perspective

- To the system owner, communications is not a technical or networking issue. It is merely a business reality.
- The system owner views communications in terms of geography. Geography includes such as locations as cities, states, and countries. It also includes locations such as campuses, sites, buildings, floors, and rooms.

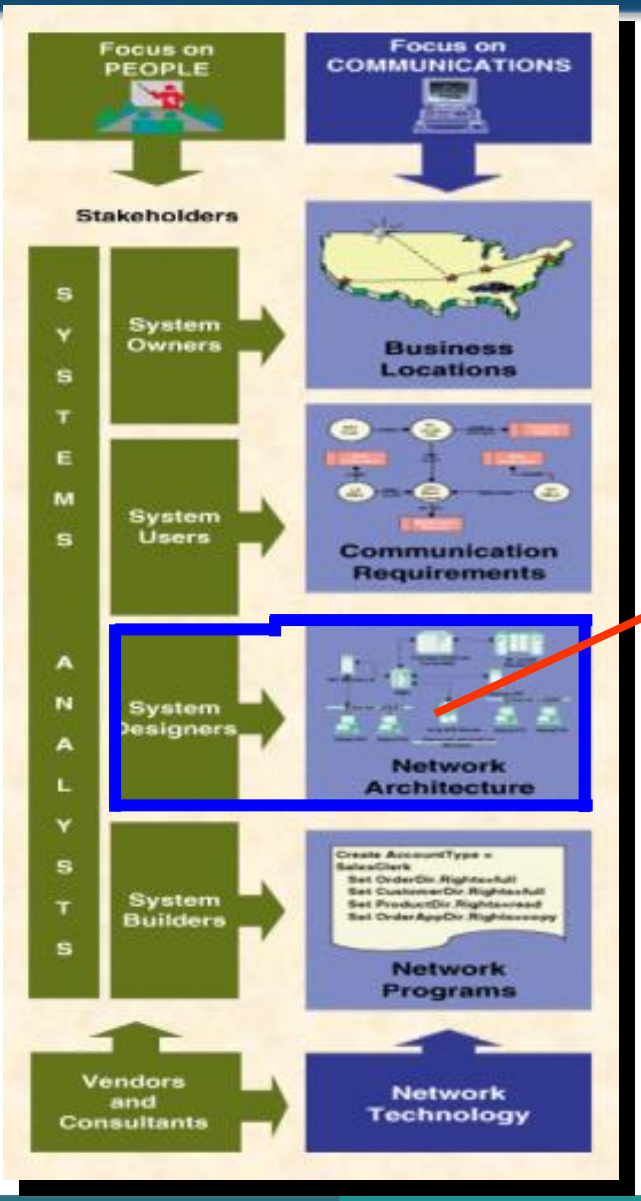
A COMMUNICATIONS Focus in IS



System users' perspective

- System users are the experts about the communication requirements between and within business locations.
- The communication requirements are frequently expressed in terms of location-to-location data flows and the volume and frequency of those data flows.

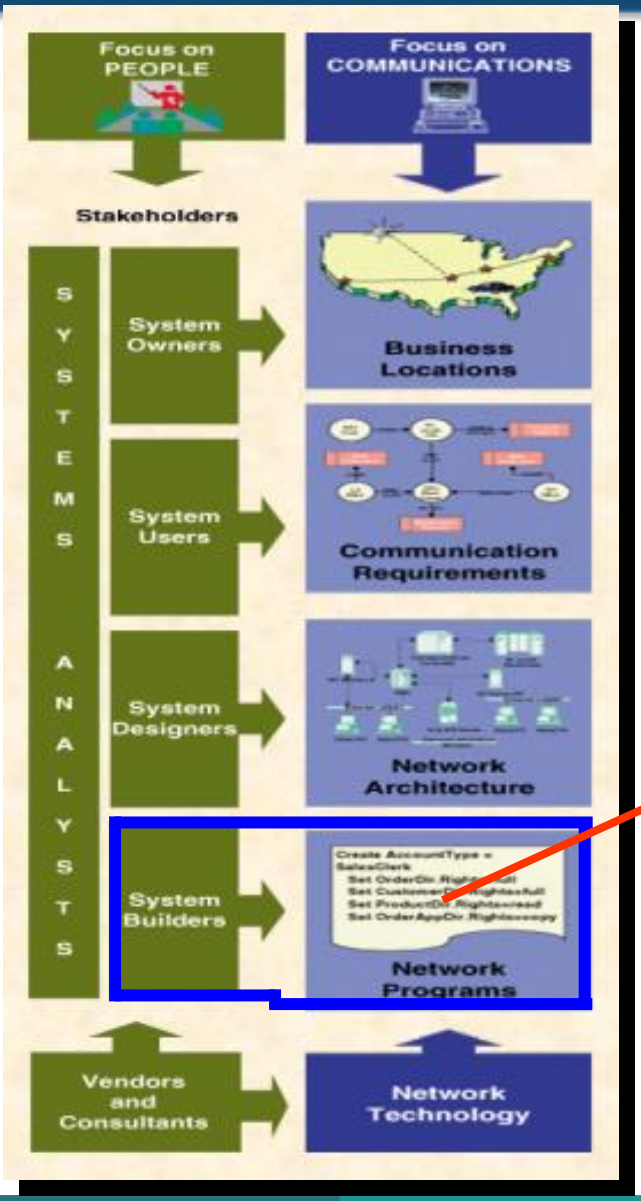
A COMMUNICATIONS Focus in IS



System designers' perspective

- System designers' view of communications is influenced and/or constrained by the limitations of specific telecommunications and network technologies. The emphasis shifts to specifying a network architecture that can support the communications requirements.
- The system designers' view is expressed in terms of physical locations for workstations, terminals, servers, and peripherals and the interconnections between those devices.

A COMMUNICATIONS Focus in IS



System builders' perspective

- System builders use networking software to customize and optimize networks including node address, protocols, line speeds, flow controls, security, privileges, and other complex, networking parameters. This software is usually purchased and installed, but it must also be configured and tuned for performance.

要点与引申

- 信息系统之间的种类差异在于应用职能不同，这是第一位的。
- 同一行业中同种信息系统，其体系结构之间是有规律可循的。
- 本章主要强调了从数据、处理和界面／接口等几个角度来分别关注信息系统的组成部件，其主要用意是用系统部件的观点来认识信息系统的构成，以利于信息系统的工业化开发与建设。
- 但是，这并不意味着这几类组成部件之间是不相关的（它们之间的相关性不是只涉及到通信）。能够在系统部件的边界上体现这样的相关性，是形成系统组成部件的前提。

西安电子科技大学
XIDIAN UNIVERSITY

03 系统分析与设计

（System Analysis and Design）

Information Systems Development

Content Structure

- **Process of Systems Development**
  - 系统开发过程的概念；对系统开发过程的管理和控制；系统生存周期；系统开发的方法论和原理。
- A **Systems Development Methodology**
  - 一种系统开发方法论 – FAST；一种问题求解框架 – PIECES；系统开发过程主要阶段的划分，以及一些跨阶段的开发活动。
- **Alternative Route and Methods**
  - 几种系统开发路线：模型驱动；快速原型；购置可用商品软件；混合路线；维护与再工程。
- Automated Tools and Technology
  - CASE： ADE工具；过程与项目管理工具。