SCSD2613
System Analysis and Design

PART 1
Fundamentals of Systems Analysis & Design

Learning Objectives

- By the end of this lecture, you will be able to:
- Recall the basic types of computer-based systems that a systems analyst needs to address
- Understand how users working in context with new technologies change the dynamics of a system
- Realize what the many roles of the systems analyst are
- Know the steps of the SDLC as they relate to HCI and how to apply them to a real system
- Understand what CASE tools are and how they help a systems analyst
- Explore other methodologies such as object-oriented systems design and prototyping

Information – A Key Resource

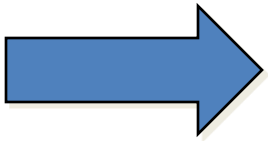
- Fuels business and can be the critical factor in determining the success or failure of a business
- Needs to be managed correctly
- Managing computer-generated information differs from handling manually produced data

What is Information Systems (IS)?

…Buckingham et al. (1987)

A system which assembles, stores, processes and delivers information relevant to an organization, in such a way that the information is accessible and useful to those who wish to use it, including managers, staff, clients and citizens. An IS is human activity (social system) which may or may not involve the use of computer systems

(in this case)



(Computerized) Information Systems

What and Why ISD ???

Systems analysis and design is a systematic approach to identifying problems, opportunities, and objectives; analyzing the information flows in organizations; and designing computerized (in this case) information systems to solve a problem

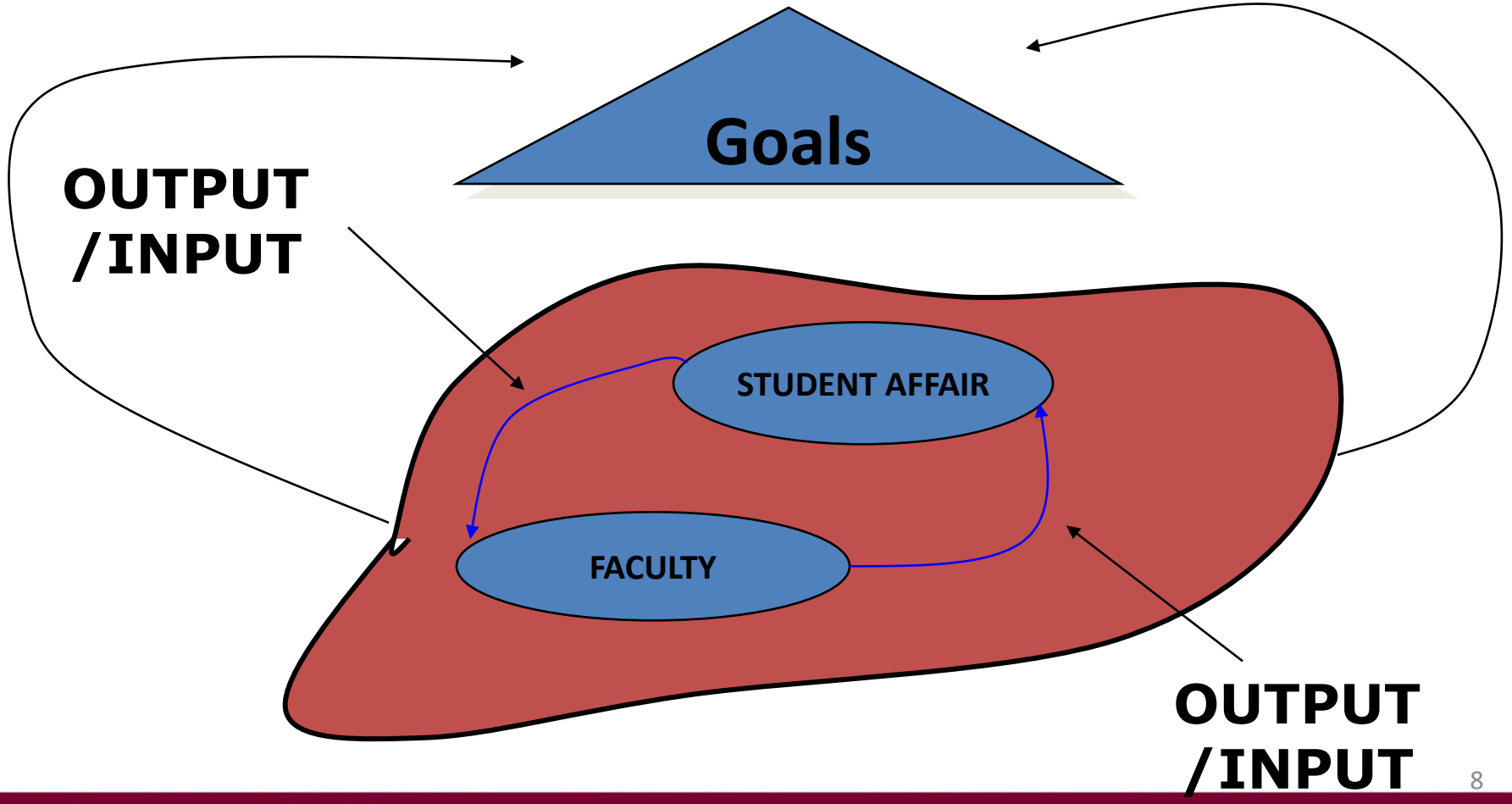
What and Why ISD ?

- System development needs proper planning.
- There is a cost in system development.
- It is time consuming and needs project management.
- SADM is about problem solving that needs to be creative, critical, and innovative.

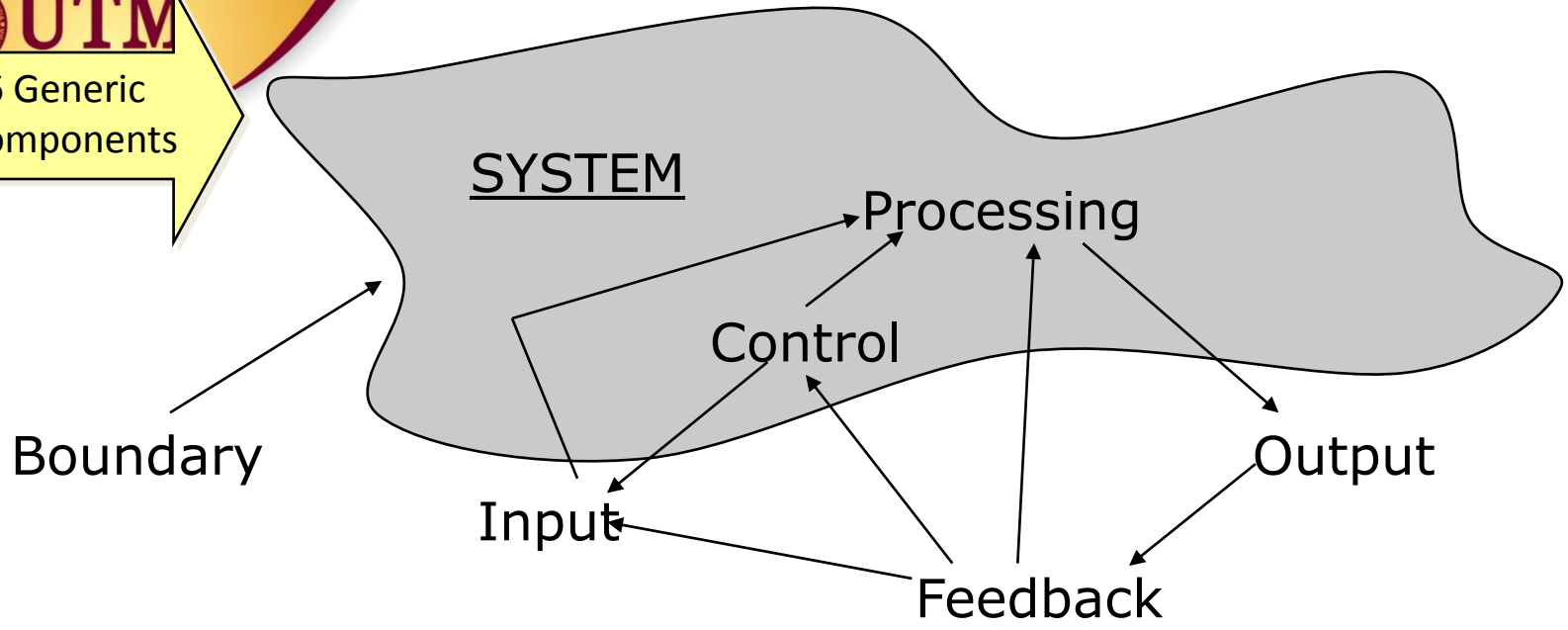
Organization as Systems

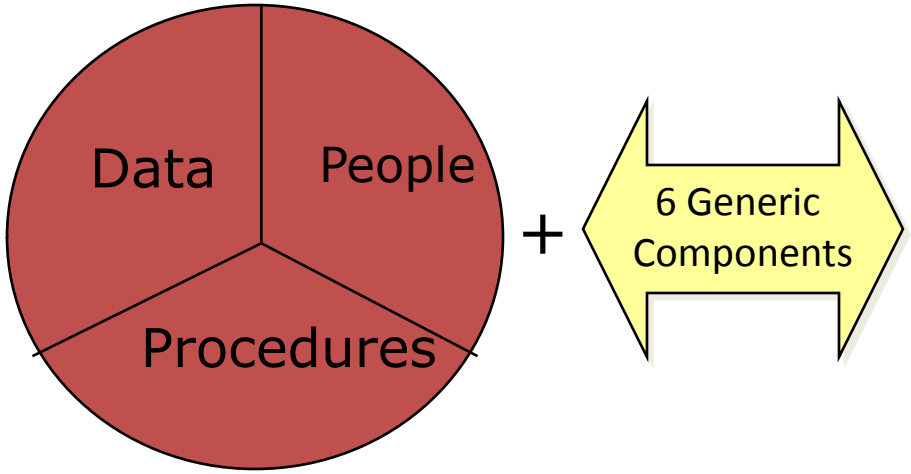
- Organization as systems, is composed of subsystems and so on.
- It is mainly involves levels of management and culture.
- These will impact the information system development.
- The different levels of management will produce the different levels of decisions.
- The culture influences the way people in subsystems interrelate.

Organization as Systems

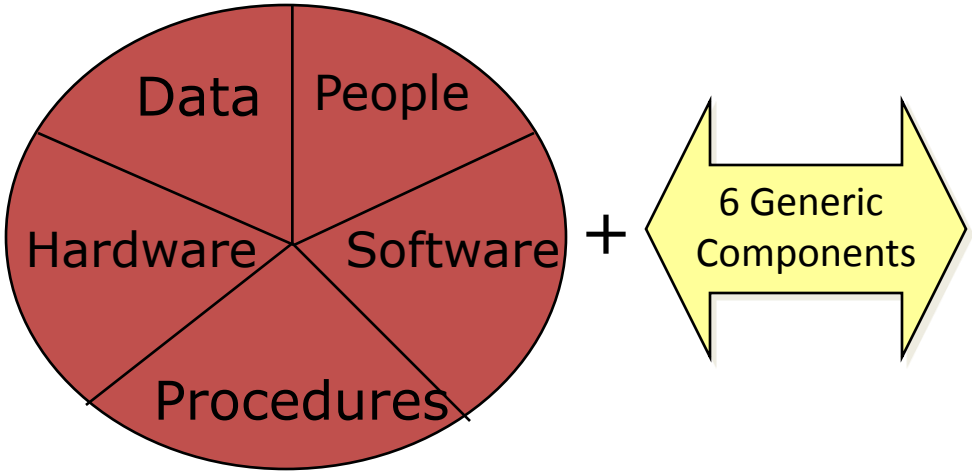


6 Generic Components





Information Systems



Automated Information Systems

Organizations as Systems> Levels of Management

What ?

Strategic Mgt

Tactical Mgt

How ?

Operations Mgt

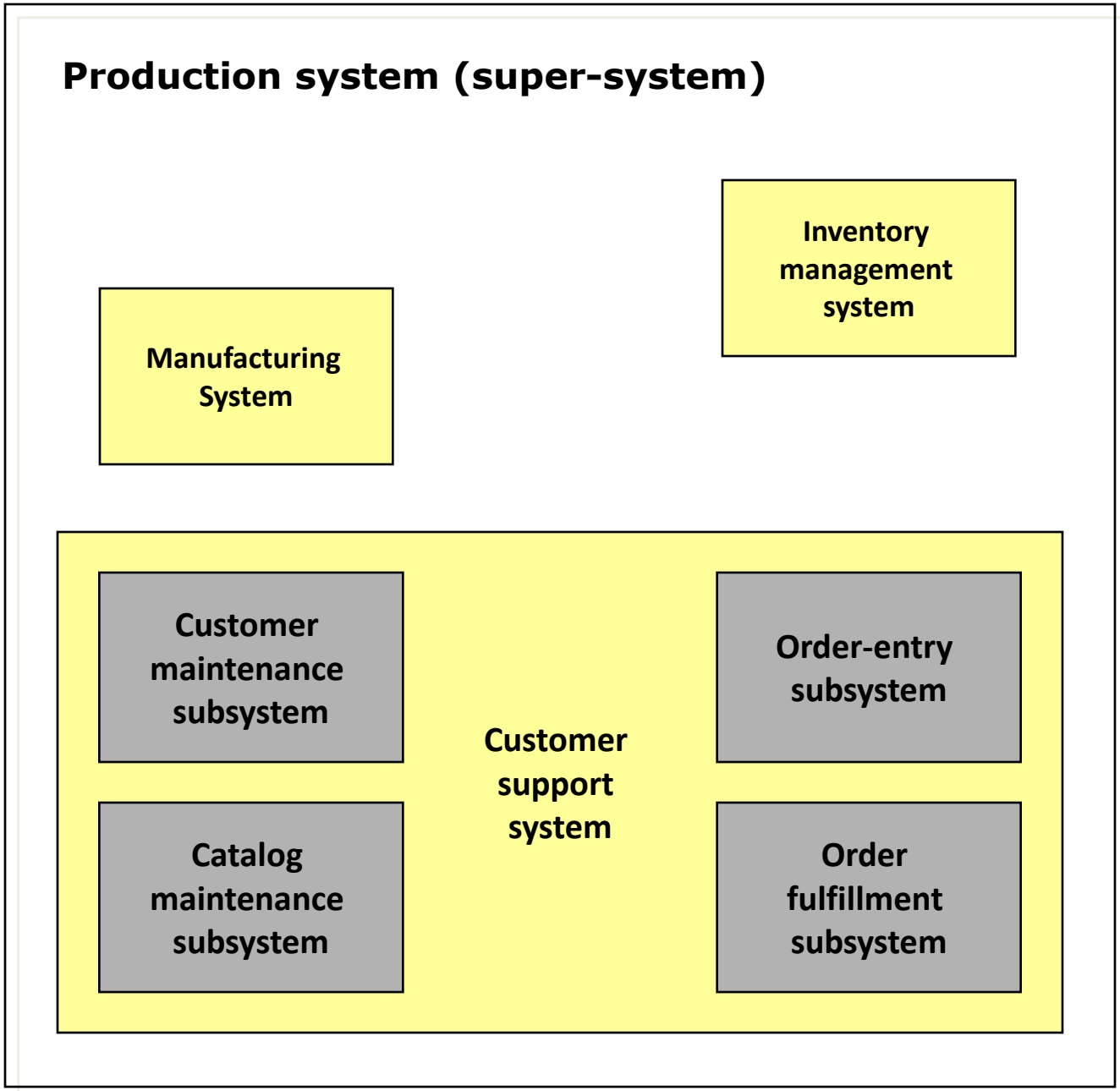
Implement ?

System: a collection of interrelated components that function together to achieve some outcome

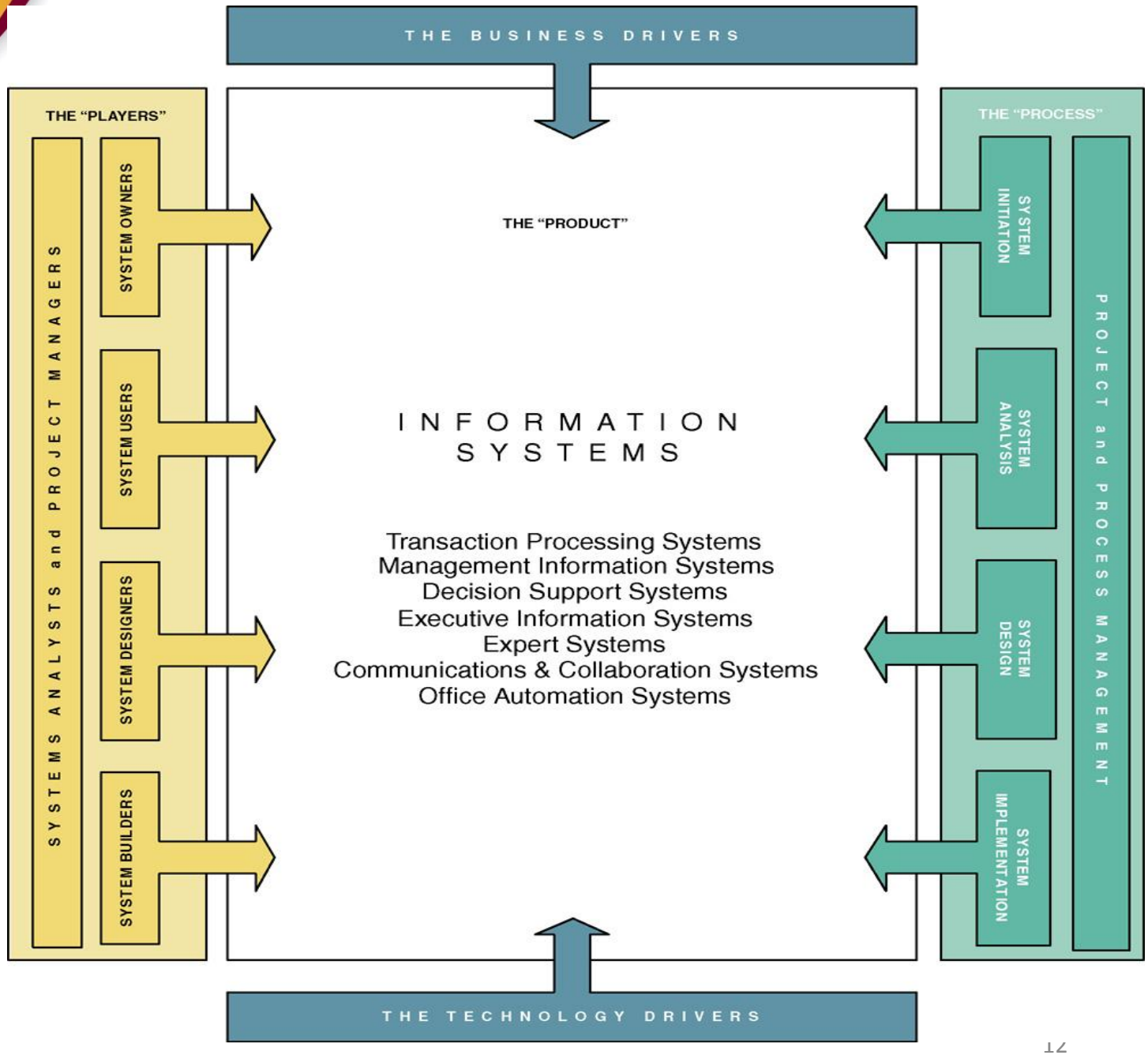
Information System: a collection of interrelated components that collect, process, store, and provide as output the information needed to complete business tasks.

Sub-system: a system that is part of a larger system

Super-system: a larger system that contains other systems



A Framework For ISD



Business Drivers for Today's Information Systems

- Globalization of the Economy
- Electronic Commerce and Business
- Security and Privacy
- Collaboration and Partnership
- Knowledge Asset Management
- Continuous Improvement and Total Quality Management
- Business Process Redesign

Business Drivers for Today's Information Systems

- Networks and the Internet
- Mobile and Wireless Technologies
- Object Technologies
- Collaborative Technologies
- Enterprise Applications

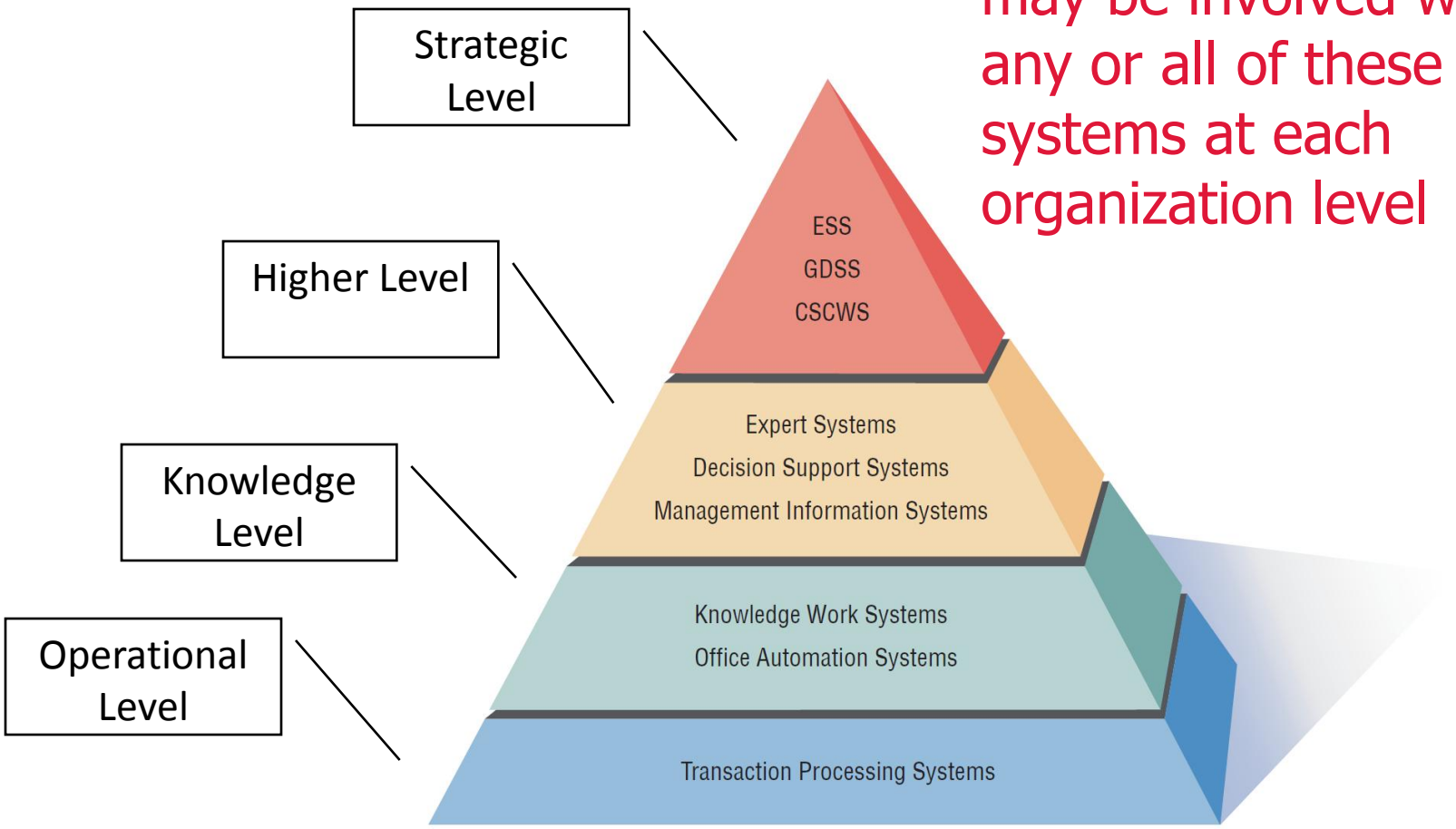
Major Topics

- Fundamentals of different kinds of information systems
- Roles of systems analysts
- Phases in the systems development life cycle as they relate to Human-Computer Interaction (HCI) factors
- Computer-Aided Software Engineering (CASE) tools

Systems Analysts Recommend, Design, and Maintain Many Types of Systems for Users

- Transaction Processing Systems (TPS)
- Office Automation Systems (OAS)
- Knowledge Work Systems (KWS)
- Management Information Systems (MIS)
- Decision Support Systems (DSS)
- Expert Systems (ES)
- Executive Support Systems (ESS)
- Group Decision Support Systems (GDSS)
- Computer-Supported Collaborative Work Systems (CSCWS)

A systems analyst may be involved with any or all of these systems at each organization level

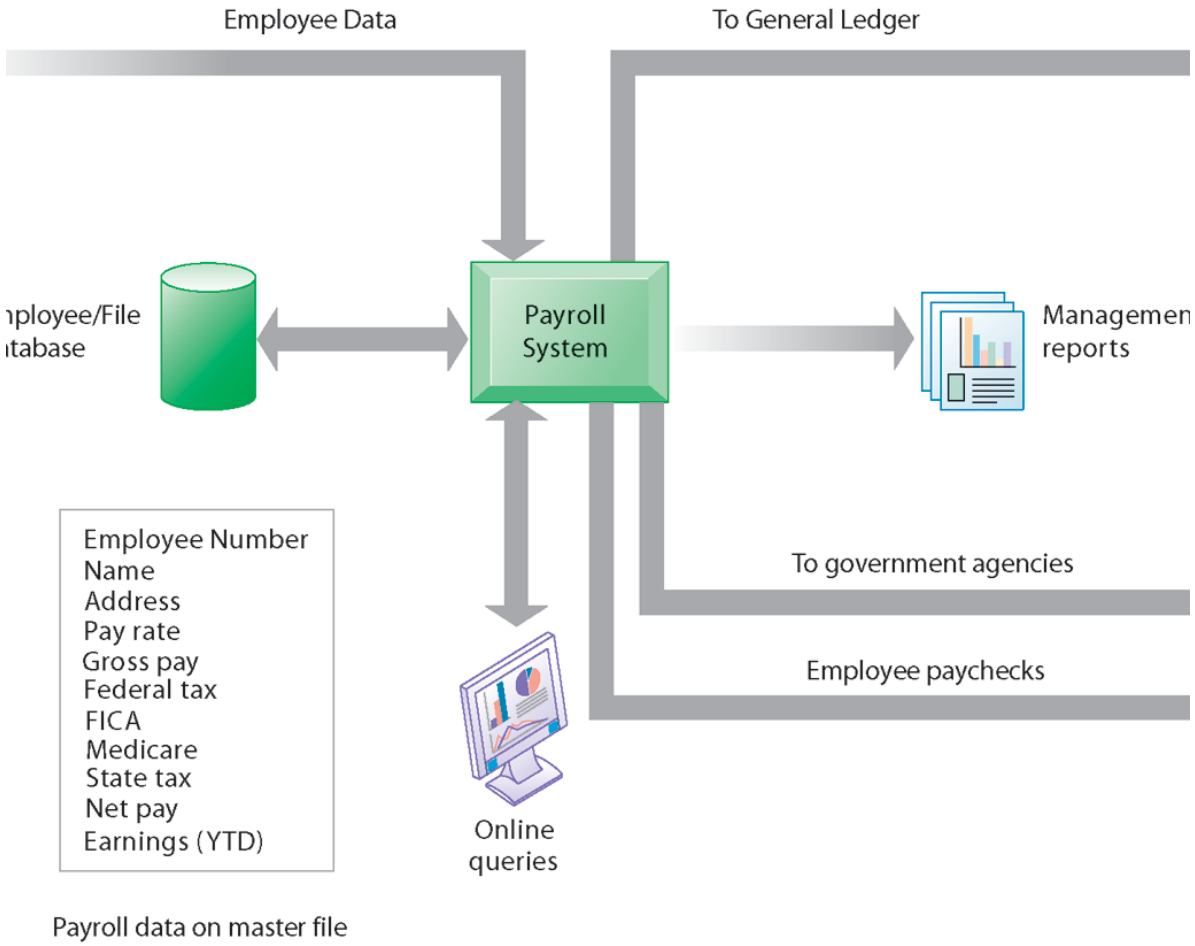


Operational Level

- Transaction Processing System (TPS)
  - Process large amounts of data for routine business transactions
  - Boundary-spanning
  - Support the day-to-day operations of the company
  - Examples: Payroll Processing, Inventory Management

A Payroll TPS

A TPS for payroll processing captures employee payment transaction data (such as a time card). System outputs include online and hard-copy reports for management and employee paychecks.



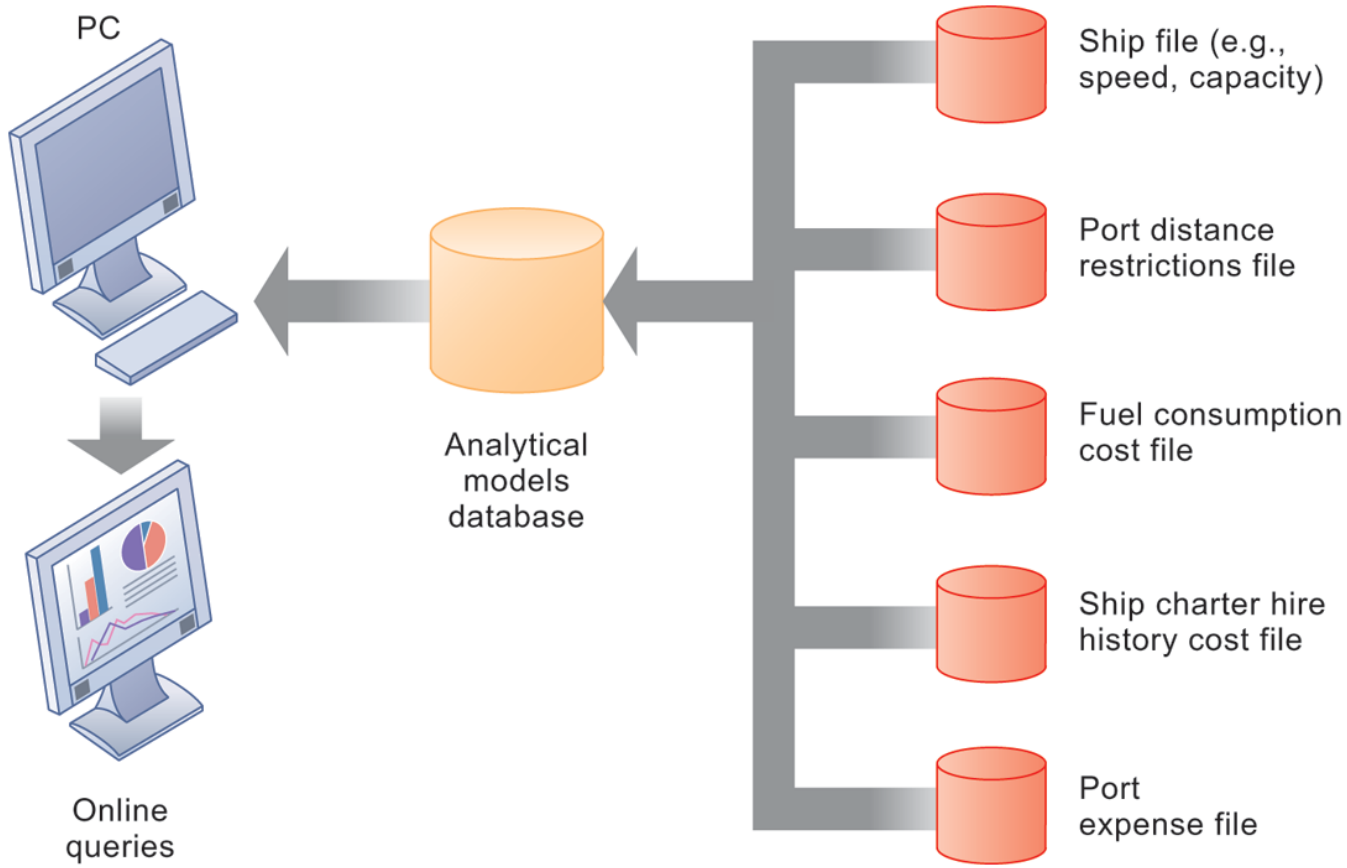
Knowledge Level

- Office Automation System (OAS)
  - Supports data workers who share information, but do not usually create new knowledge
  - Examples: Word processing, Spreadsheets, Desktop publishing, Electronic scheduling, Communication through voice mail, Email, Video conferencing
- Knowledge Work System (KWS)
  - Supports professional workers such as scientists, engineers, and doctors
  - Examples: computer-aided design systems, virtual reality systems, investment workstations

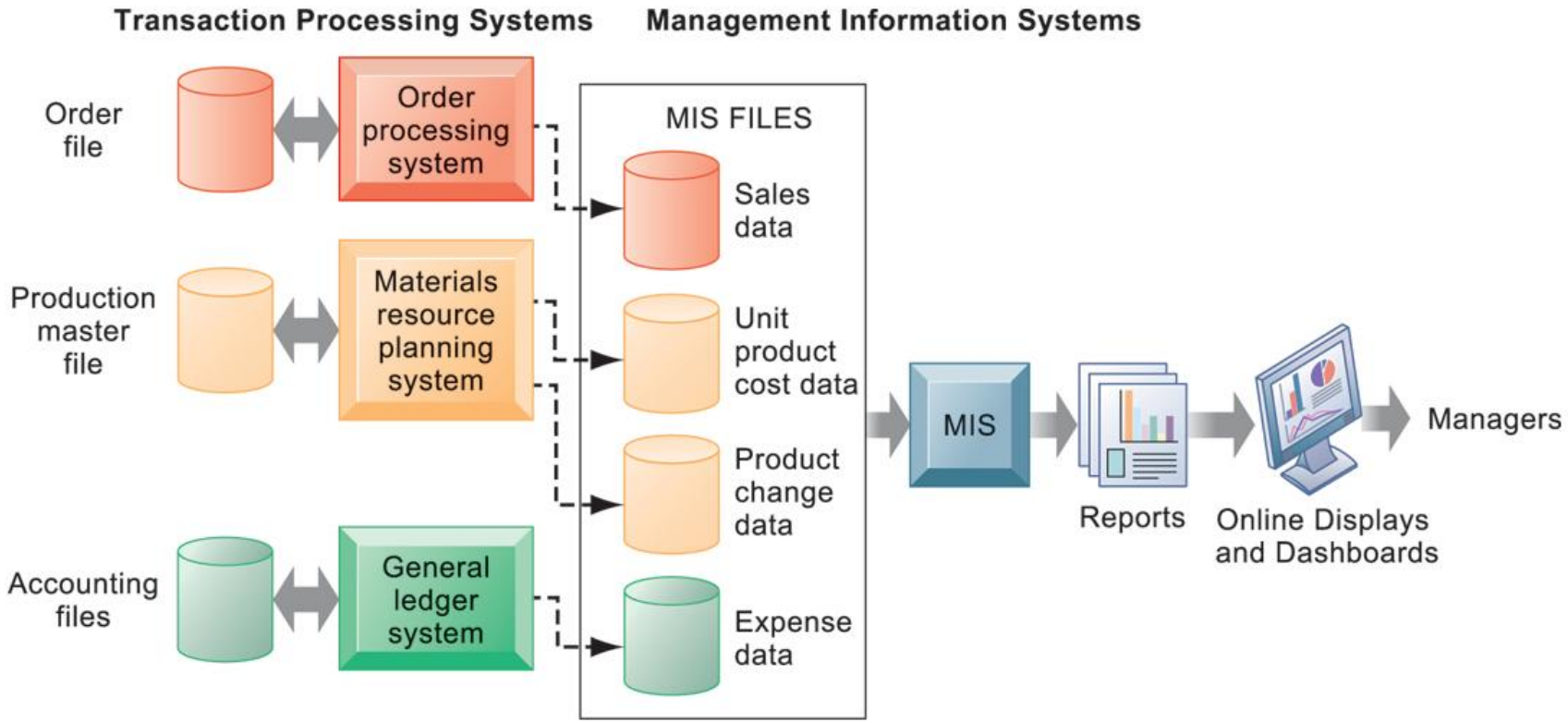
Higher Level

- Management Information System (MIS)
  - Support a broad spectrum of organizational tasks including decision analysis and decision making
  - Examples: profit margin by sales region, expenses vs. budgets
- Decision Support System (DSS)
  - Aids decision makers in the making of decisions
  - Examples: financial planning with what-if analysis, budgeting with modeling
- Expert System (ES)
  - Captures and uses the knowledge of an expert for solving a particular problem which leads to a conclusion or recommendation
  - Examples: MYCIN, XCON

Decision Support System (DSS)



Management Information System (MIS)



Strategic Level

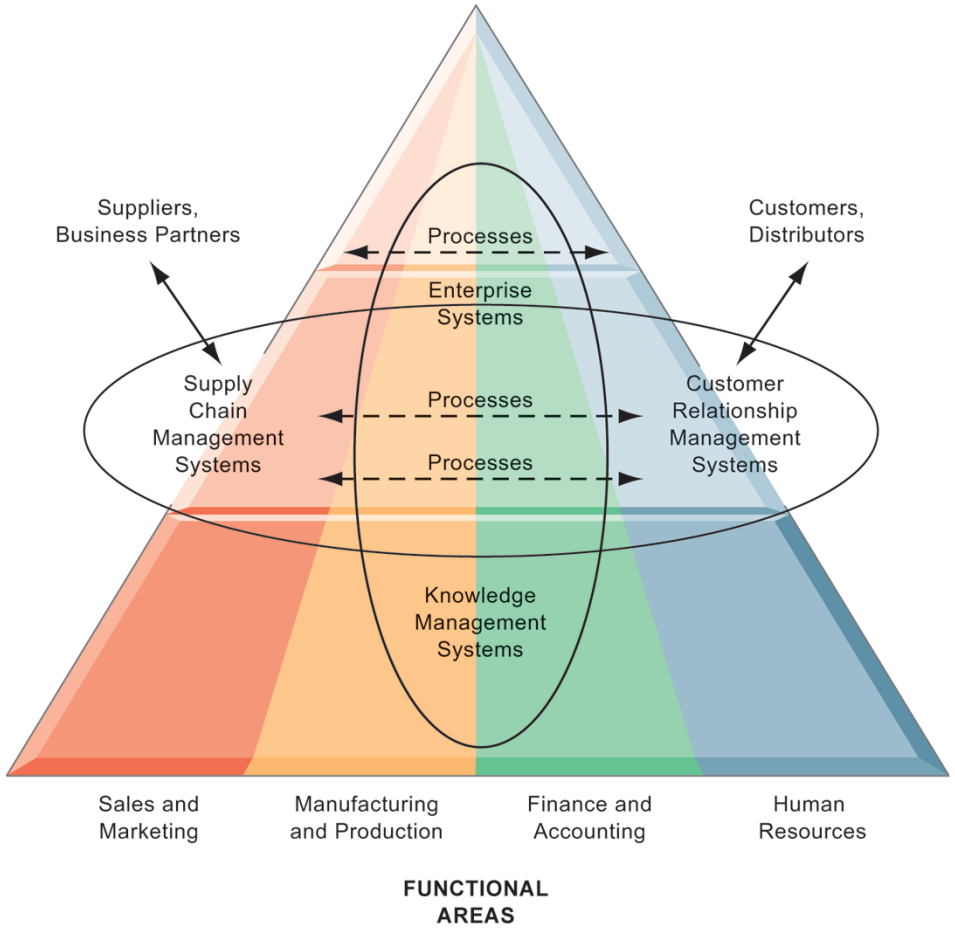
- Executive Support System (ESS)
  - Helps executives to make unstructured strategic decisions in an informed way
  - Examples: drill-down analysis, status access
- Group Decision Support System (GDSS)
  - Permit group members to interact with electronic support
  - Examples: email, Lotus Notes
- Computer-Supported Collaborative Work System (CSCWS)
  - CDCWS is a more general term of GDSS
  - May include software support called "*groupware*" for team collaboration via network computers
  - Example: video conferencing, Web survey system

Integrating New Technologies into Traditional Systems

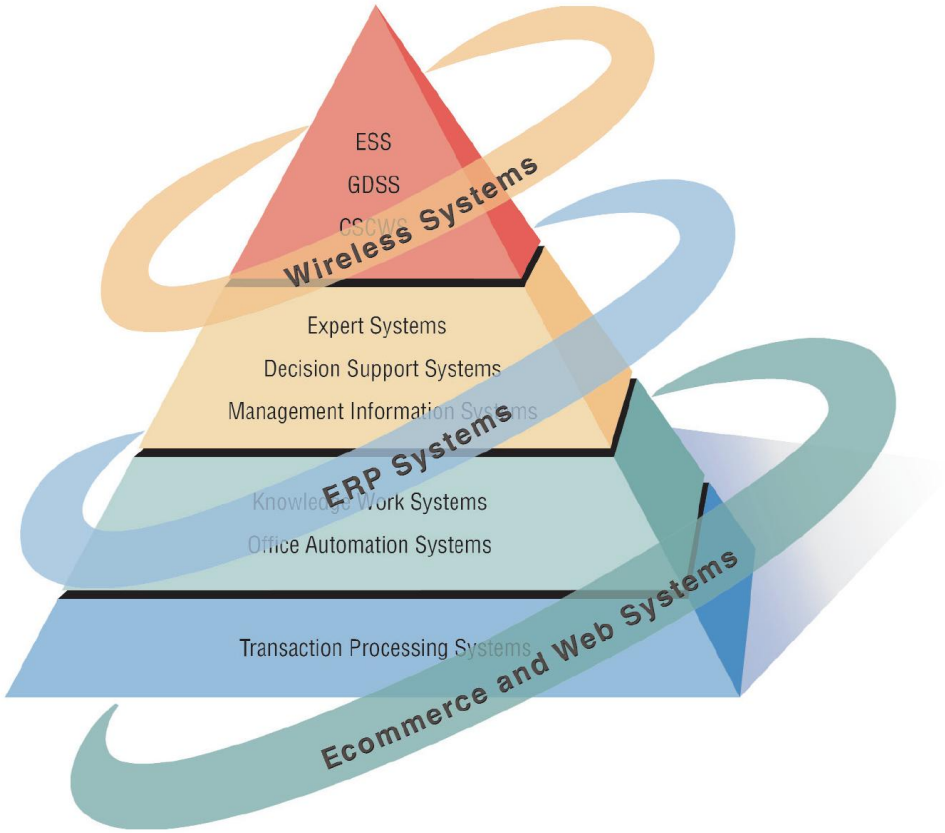
- Ecommerce and Web Systems
- Enterprise Resource Planning Systems
- Wireless Systems
- Open Source Software
- Need for Systems Analysis and Design

Enterprise Application Architecture

Enterprise applications automate processes that span multiple business functions and organizational levels and may extend outside the organization.



Systems analysts need to be aware that integrating technologies affects all types of systems



Ecommerce and Web Systems

- Benefits
  - Increasing user awareness of the availability of a service, product, industry, person, or group
  - The possibility of 24-hour access for users
  - Improving the usefulness and usability of interface design
  - Creating a system that can extend globally rather than remain local, thus reaching people in remote locations without worry of the time zone in which they are located

Enterprise Resource Planning Systems (ERP)

- Performs integration of many information systems existing on different management levels and within different functions
- Example: SAP, Oracle

Wireless Systems

- System analyst may be asked to design standard or wireless communication networks that integrate voice, video and email into organizational intranets or industry extranets
- System analyst may also be asked to develop intelligent agents
- Example: Microsoft's new software based on Bayesian statistics
- Wireless communication is referred as m-commerce (mobile commerce)

Open Source Software

- An alternative of traditional software development where proprietary code is hidden from the users
- Open source software is free to distribute, share and modify
- Characterized as a philosophy rather than simply the process of creating new software
- Example: Linux Operating System, Apache Web Server, Mozilla Firefox Web browser

Need for Systems Analysis and Design

- Installing a system without proper planning leads to great user dissatisfaction and frequently causes the system to fall into disuse
- Lends structure to the analysis and design of information systems
- A series of processes systematically undertaken to improve a business through the use of computerized information systems

System Analyst>Roles & Environment

System analyst (SA) studies the problems and needs of an organization to determine how people, data, process, communications and information technology can best accomplish improvements for the business (organizations)

(Computerized) Information Systems

Roles of the Systems Analyst

- The analyst must be able to work with people of all descriptions and be experienced in working with computers
- Three primary roles:
  - Consultant
  - Supporting Expert
  - Agent of change

Qualities of the Systems Analyst

- Problem solver
- Communicator
- Strong personal and professional ethics
- Self-disciplined and self-motivated

System Analyst>Roles & Environment

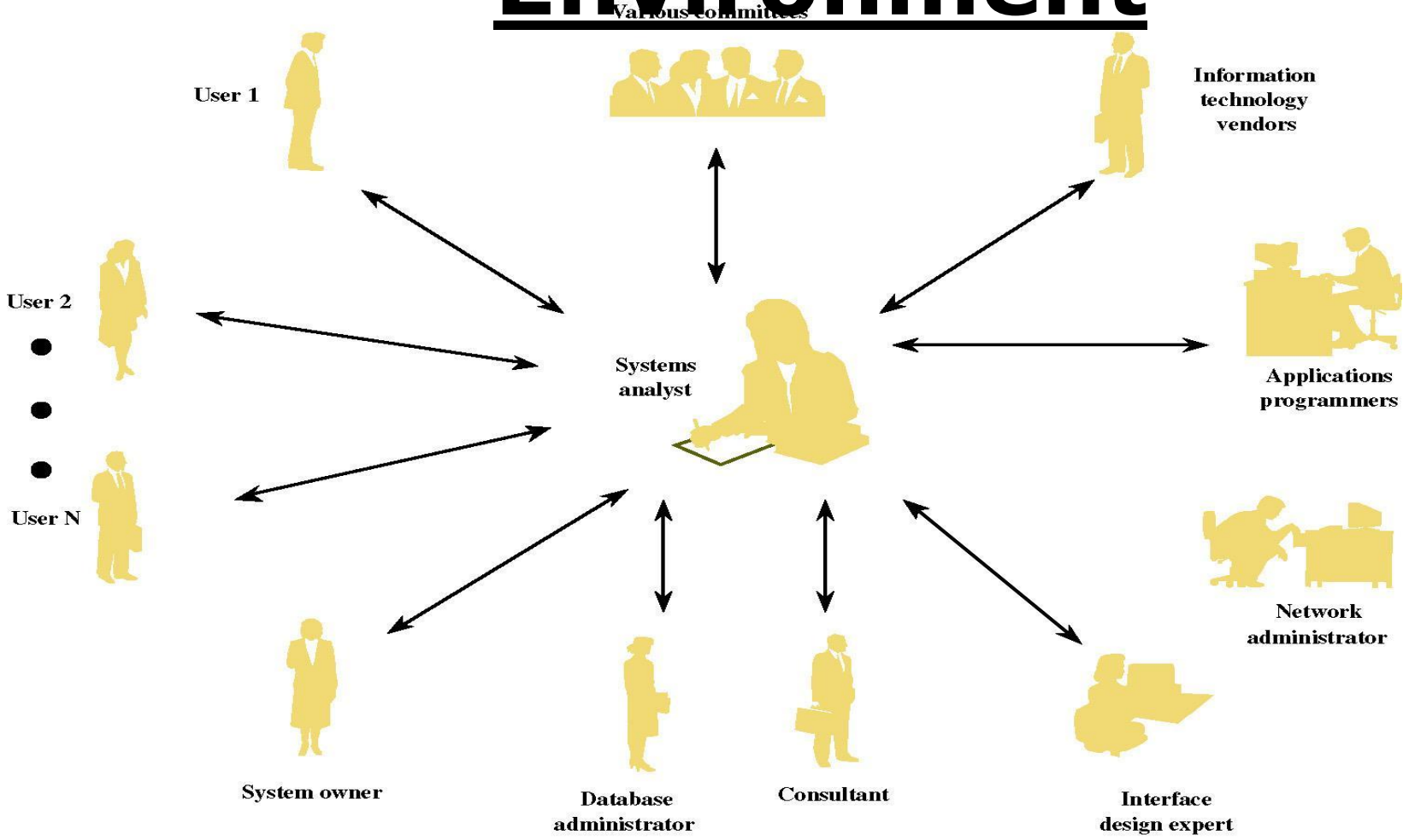
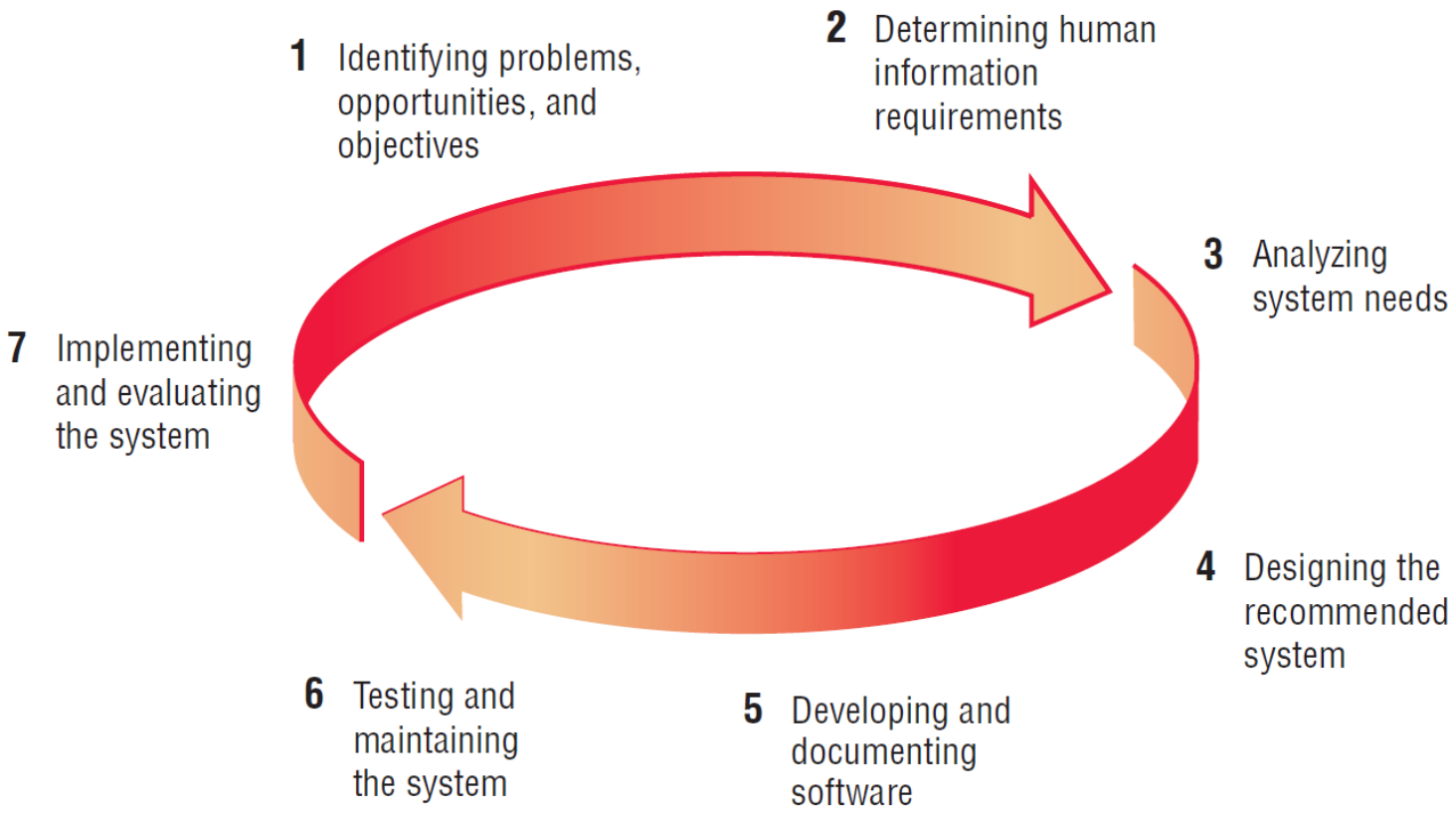


Figure 1.3 The Systems Analyst as a Facilitator

Systems Development Life Cycle (SDLC)

- The systems development life cycle is a phased approach to solving business problems
- Developed through the use of a specific cycle of analyst and user activities
- Each phase has unique user activities

The seven phases of the systems development life cycle



Incorporating Human-Computer Interaction (HCI) Considerations

- The demand for analysts who are capable of incorporating HCI into the systems development process keeps increasing, as companies begin to realize that the quality of systems and the quality of work life can be improved by taking a human-centered approach at the outset of a project

Identifying Problems, Opportunities, and Objectives

- Activity:
  - Interviewing user management
  - Summarizing the knowledge obtained
  - Estimating the scope of the project
  - Documenting the results
- Output:
  - Feasibility report containing problem definition and objective summaries from which management can make a decision on whether to proceed with the proposed project (come out with your system proposal)

Determining Human Information Requirements

- Activity:
  - Interviewing
  - Sampling and investing hard data
  - Questionnaires
  - Observe the decision maker's behavior and environment
  - Prototyping
  - Learn the who, what, where, when, how, and why of the current system
- Output:
  - Analyst understands how users accomplish their work when interacting with a computer; and begin to know how to make the new system more useful and usable. The analyst should also know the business functions and have complete information on the people, goals, data and procedure involved

Analyzing System Needs

- Activity:
  - Create data flow diagrams
  - Complete the data dictionary
  - Analyze the structured decisions made
  - Prepare and present the system proposal
- Output:
  - Recommendation on what, if anything, should be done

Designing the Recommended System

- Activity:
  - Design procedures for data entry
  - Design the human-computer interface
  - Design system controls
  - Design files and/or database
  - Design backup procedures
- Output
  - Model of the actual system

Developing and Documenting Software

- Activity:
  - System analyst works with programmers to develop any original software
  - Works with users to develop effective documentation
  - Programmers design, code, and remove syntactical errors from computer programs
  - Document software with help files, procedure manuals, and Web sites with Frequently Asked Questions
- Output:
  - Computer programs
  - System documentation

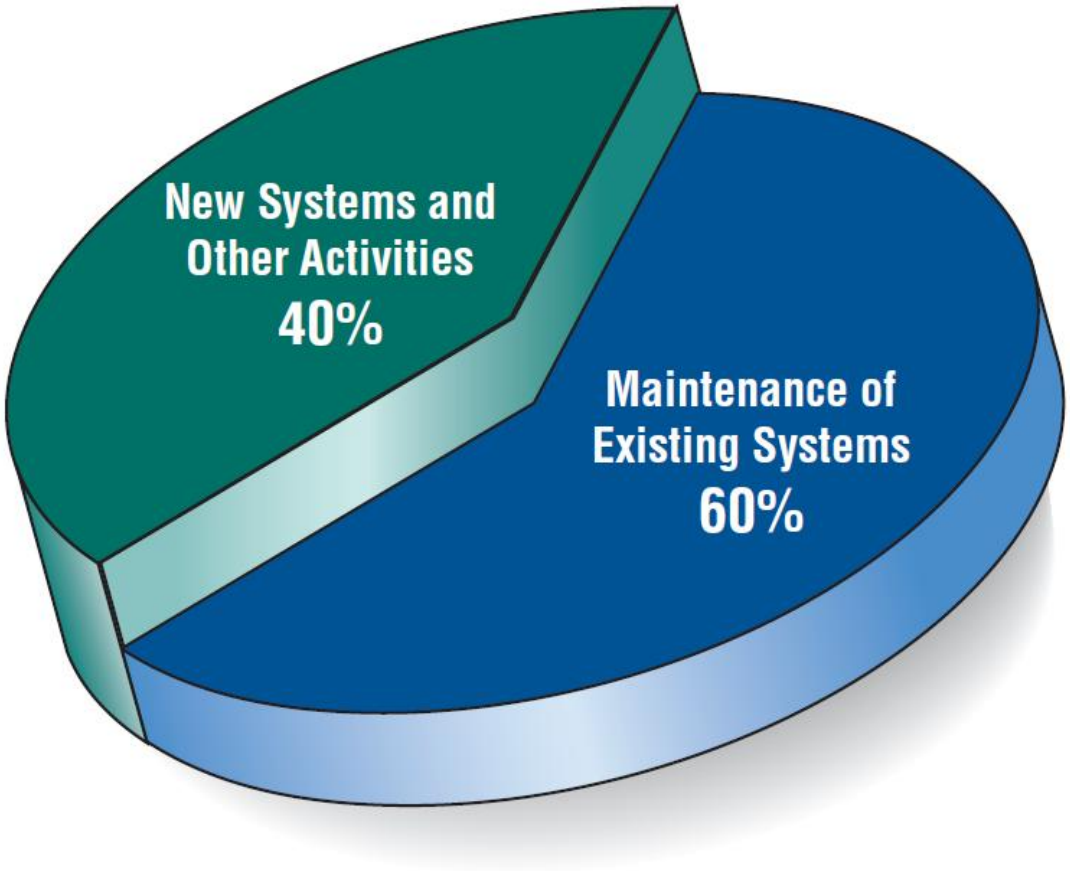
Testing and Maintaining the System

- Activity:
  - Test the information system
  - System maintenance
  - Maintenance documentation
- Output:
  - Problems, if any
  - Updated programs
  - Documentation

Implementing and Evaluating the System

- Activity:
  - Train users
  - Analyst plans smooth conversion from old system to new system
  - Review and evaluate system
- Output:
  - Trained personnel
  - Installed system

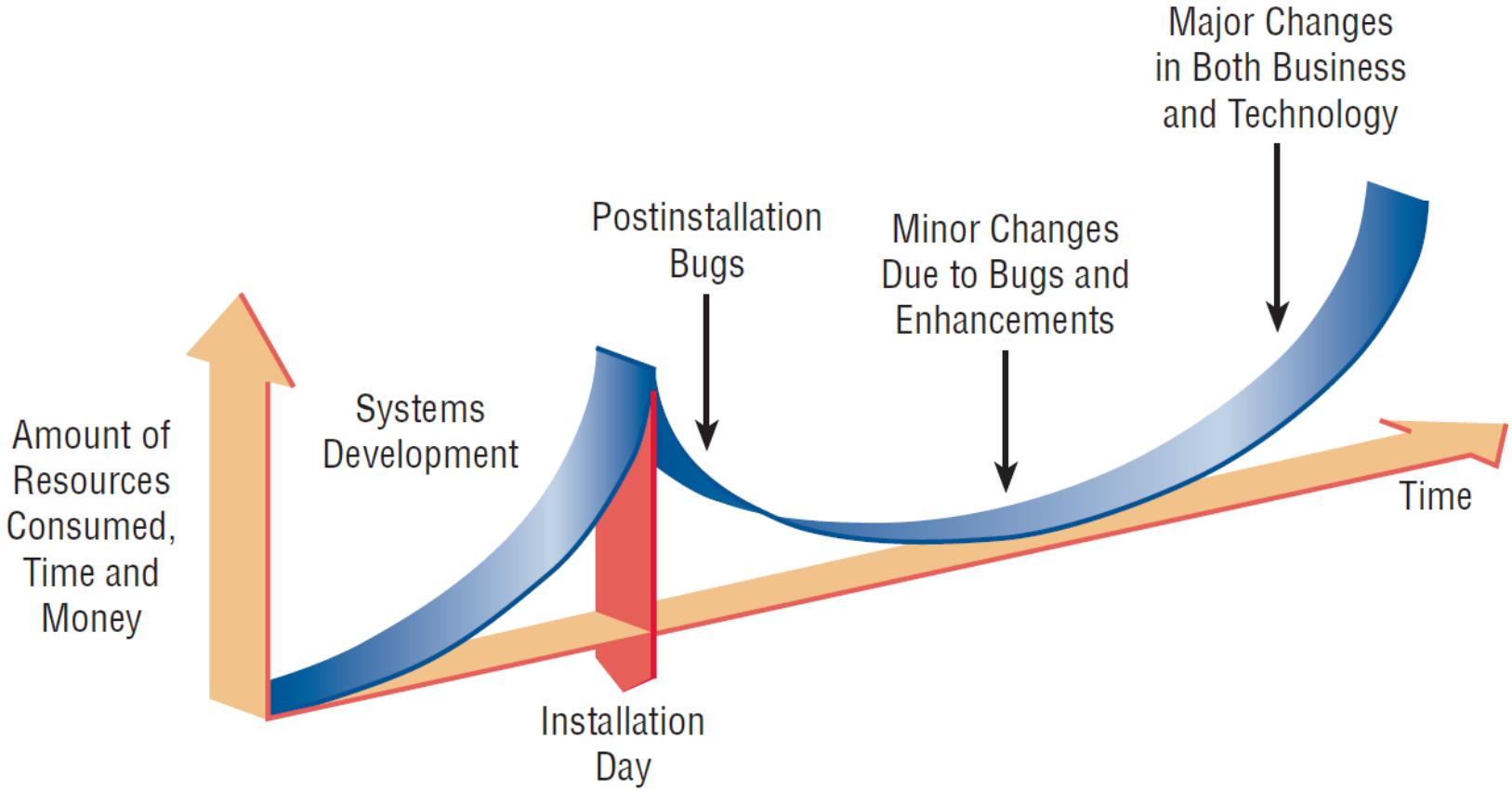
Figure 1.4 Some researchers estimate that the amount of time spent on systems maintenance may be as much as 60 percent of the total time spent on systems projects



The Impact of Maintenance

- Maintenance is performed for two reasons
  - Removing software errors, and
  - Enhancing existing software
- Over time the cost of continued maintenance will be greater than that of creating an entirely new system. At that point it becomes more feasible to perform a new systems study

Resource consumption over the system life



IS Development Methodologies

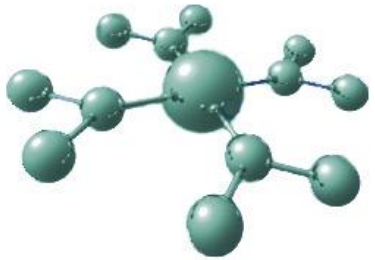
"Comprehensive guidelines to follow for completing every activity in the systems development life cycle, including specific models, tools and techniques"

Process-Oriented	Blended	Object-Oriented	Rapid	People-Oriented	Organizational-Oriented	Framework
STRADIS Methodology - Gane & Sarson's Methodology	Structured System Analysis & Design Method (SSADM)	Booch Method	James Martin's RAD	CommonKADS	Soft-System Methodology (SSM)	Multiview
Yourdon System Method (YSM)	…	OOSE	Extreme Programming (XP)	ETHICS	IS work and analysis of changes (ISAC)	Strategic options development and analysis (SODA)
Jackson System Development (JSD)		OMT	Web IS development methodology (WISDM)	KADS	Process Innovation (PI)	Capability Maturity Model (CMM)
…		Unified Approach Methodology	…	…	Project in controlled environments (PRINCE)	…
		Rational Unified Process			…	
		…				

Two General Approaches to IS Development

Traditional Approach

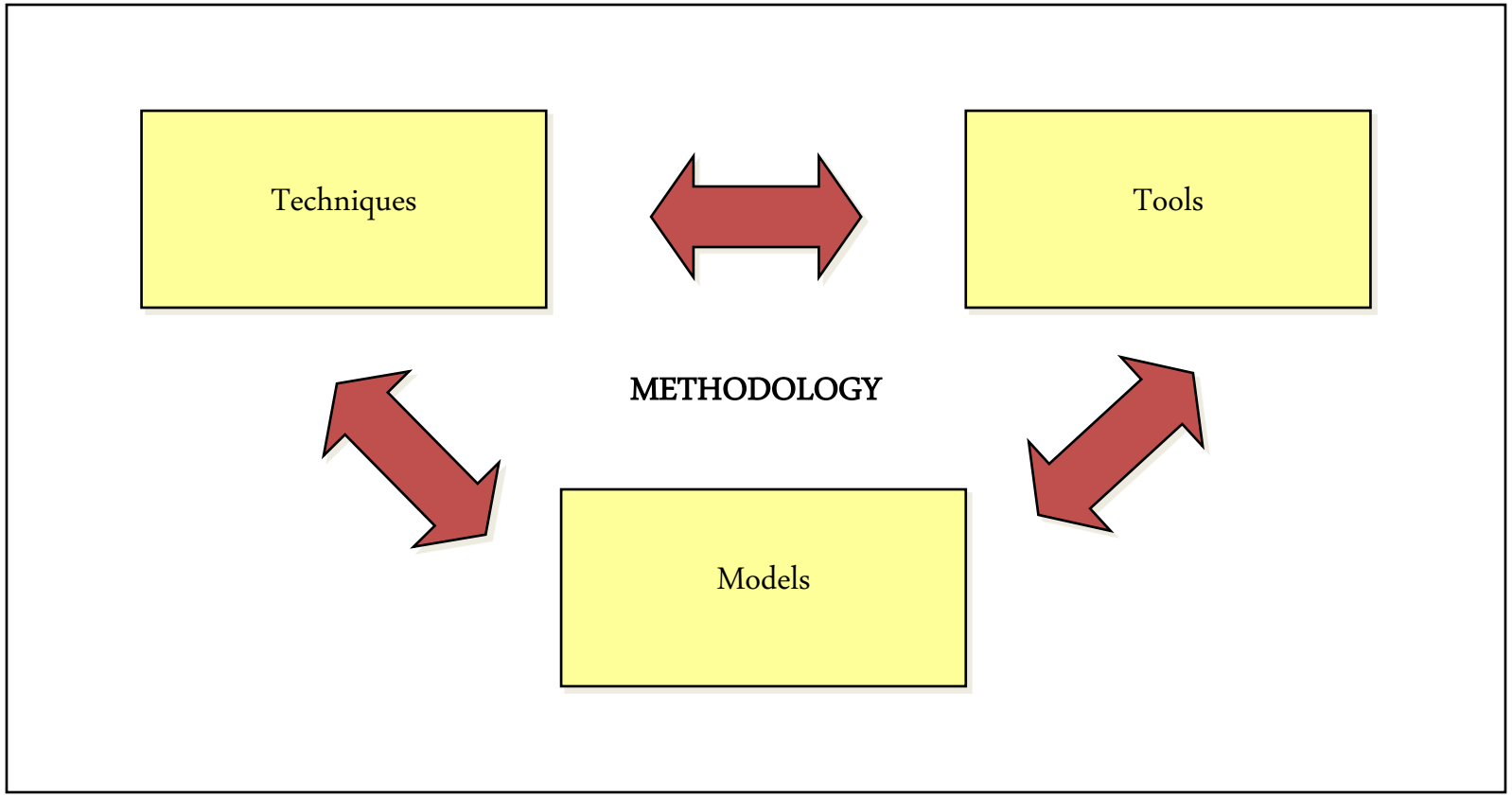
Object-Oriented Approach



Structured Approach

"...All system developers should be familiar with two very general approaches (structured, OO) to system development, because they form the basis of virtually all methodologies..."

The Main Components of Methodology (MCM)



MCM>Techniques, Models, Tools (TMT)

- Techniques is a collection of guidelines that help an analyst complete a system development.
- Model is a representation of some important aspect of the real world
- Tool is software tool that helps create models or other components required in the project

MCM>TMT>Samples

1. Flowchart
2. **Data Flow Diagram (DFD)**
3. Entity-Relationship Diagram (ERD)
4. **Structure Chart**
5. Class diagram
6. Sequence diagram

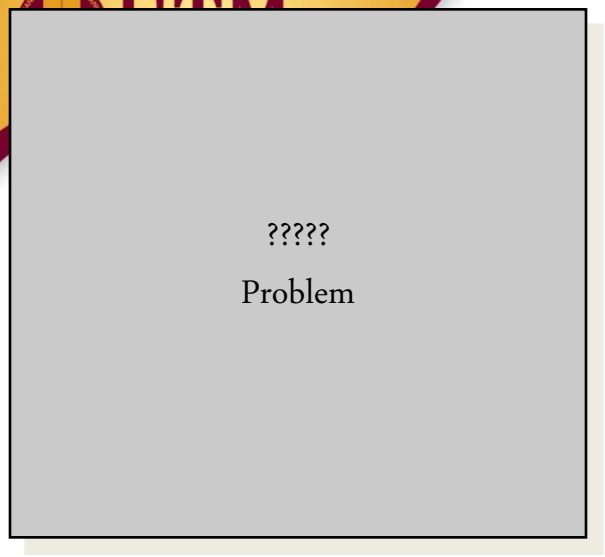
1. Strategic Planning
2. **User interviewing techniques**
3. Data-Modeling techniques
4. Software-testing techniques
5. Project Mgt techniques
6. **Structured analysis & design techniques**

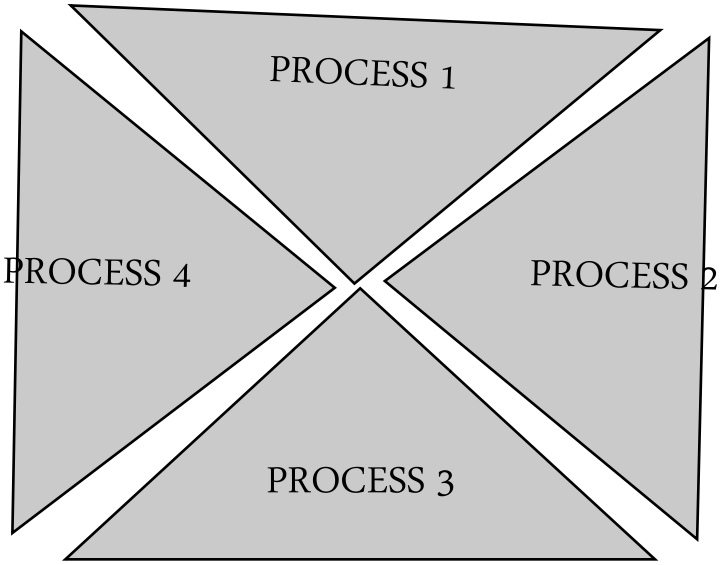
1. CASE
2. Drawing/graphic applications
3. Reverse-engineering tool
4. Code generator tool
5. Database management application
6. Word processor

Structured & O-O Methodologies

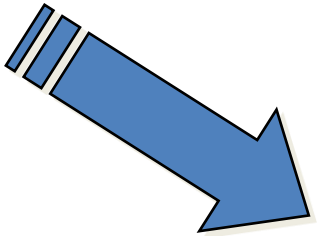
Structured Methodologies
1. STRADIS
2. SSADM
3. JSD
4. YSM
5. More…

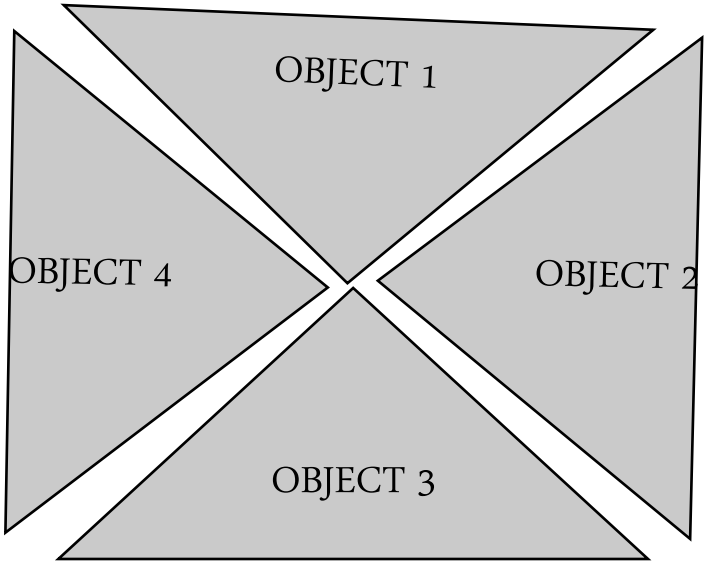
O-Oriented Methodologies
1. Booch
2. OMT
3. OOSE
4. Unified Approach
5. Rational Unified Process
6. More…





"Structured"





"OO"

Approaches to Structured Analysis and Design and to the Systems Development Life Cycle

- Traditional systems development life cycle
- CASE systems development life cycle
- Object-Oriented Systems Analysis and Design

Case Tools

- CASE tools are productivity tools for systems analysts that have been created explicitly to improve their routine work through the use of automated support
- Reasons for using CASE tools
  - Increasing Analyst Productivity
  - Improving Analyst-User Communication
  - Integrating Life Cycle Activities
  - Accurately Assessing Maintenance Changes

Case Tool Classifications

- Upper CASE tools perform analysis and design (mainly for analyst & designers)
- Lower CASE tools generate programs from CASE design (use by programmers)
- Integrated CASE tools perform both upper and lower CASE functions

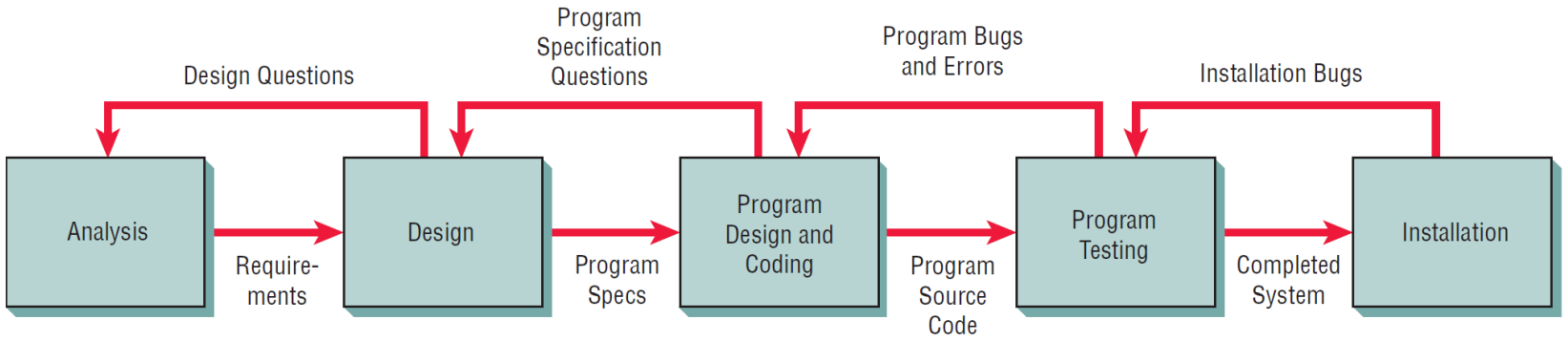
Upper CASE Tools

- Create and modify the system design
- Help in modeling organizational requirements and defining system boundaries
- Can also support prototyping of screen and report designs

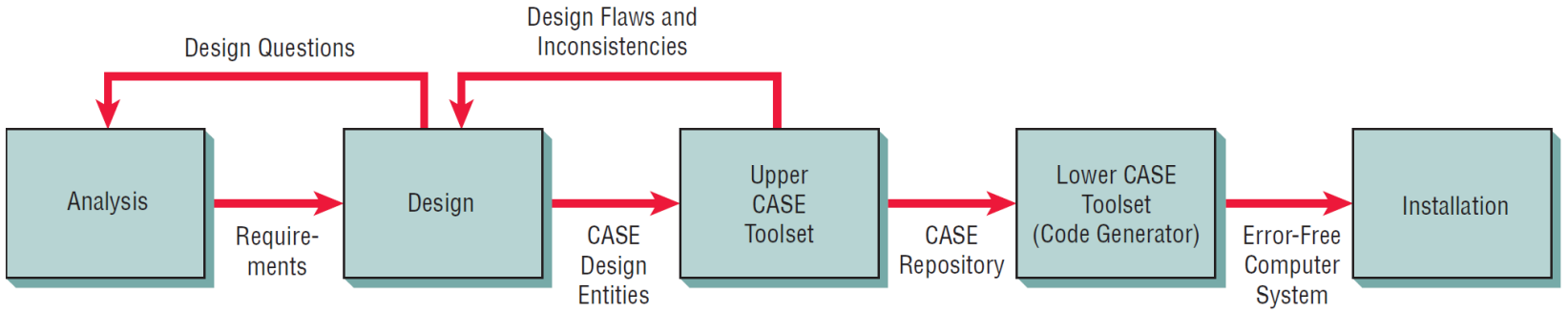
Lower CASE Tools

- Lower CASE tools generate computer source code from the CASE design
- Source code is usually generated in several languages

Traditional versus CASE systems development life cycle



Traditional Systems Development Life Cycle



CASE Systems Development Life Cycle

Object-Oriented Systems Analysis and Design

- Alternate approach to the structured approach of the SDLC that is intended to facilitate the development of systems that must change rapidly in response to dynamic business environments
- Analysis is performed on a small part of the system followed by design and implementation. The cycle repeats with analysis, design and implementation of the next part and this repeats until the project is complete

Alternate Approaches to Structured Analysis and Design and to the Systems Development Life Cycle

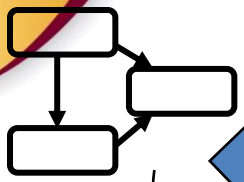
- Agile approach
- Prototyping
- ETHICS
- Project champion
- Soft Systems Methodology
- Multiview

Summary

- Information is a key resource
- Systems analysts deal with many types of information systems
- Integration of traditional systems with new technologies
- Roles and qualities of the systems analyst
- The systems Development Life Cycle
- CASE tools
- Alternatives to structured analysis and design and to the SDLC

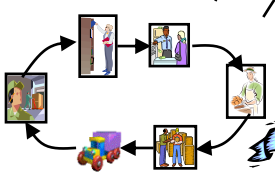
OVERALL PICTURE OF SYSTEMS ANALYSIS & DESIGN

SYS. ANALYSIS



Information Gathering

Project Mgt

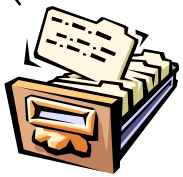


Process Models

- Logical DFD current & new system
- Decision table, decision trees, etc

Analyze Information

- WFD, AD, etc



Data Model

SYS. PLANNING

Feasibility

Probl. Definition Report – first mile stone

Process Design (Convert DFD to Str. Chart

Output Design

Input Design

Program Design

Database Design

SYS. DESIGN

SYS. IMPLEMENTATION

final output (present the system)

Design spec Report 2nd milestone

References

- Kendall, K.E. & Kendall, J.E., 2014. *System Analysis and Design*. 9th Ed. Essex:Pearson.