Comp 320 – Computer Systems Analysis and Design

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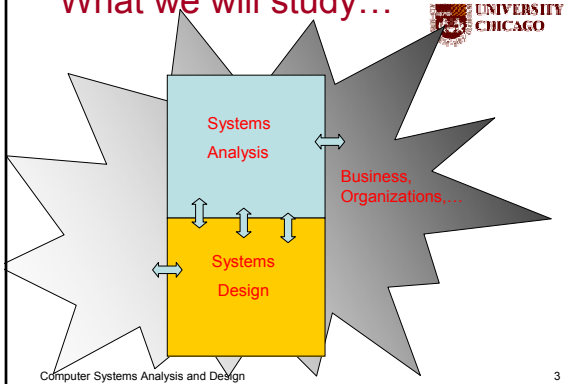
Why?

- Programming in the Large
  - Requires
    - More Time
    - More People
    - More Work
  - Different (additional) Skills
- Jobs and Careers
  - Architects, Systems Specialists, Designers, Systems Analysts, "Software and System Gods"

What we will study…



A little about me…

- Industry Background
  - Voice and data telecommunications, wireless systems and applications, packet switching, network applications, satellite systems
  - Research and Development
  - Leading large teams of software developers
  - Creating new systems (sometimes)
  - Global experience (Europe, Asia)
  - Hired hundreds of new college graduates
- Bell Laboratories, ITT, GTE, USWEST, Motorola

Introduction to Systems Design and Analysis

- Chapter One in Text
  - Systems Thinking
  - Why We Do It
  - Key Concepts
- Begin the transformation from
  - Programming a simple, small exercise
  - To development of large, complex, long-lived systems

Overview
(continued)

Humans cope with complexity by thinking in terms of systems. A system organizes its components into a structure and is separated from its environment by a system boundary.

Overview
(continued)

System analysts work with abstract models in order to:

- Understand existing systems
- Simulate system behavior
- Describe the requirements for a new system

Overview
(continued)

In general, information systems perform three functions:

- Transmission of information
- Storage of information
- Transformation of information

Overview
(continued)

The important overall function of an information processing system is to respond to what happens in the outside world by transforming inputs into the desired outputs.

Overview
(continued)

System analysts help solve business problems by applying information technology not only to production and service functions but also to improved monitoring, control, and decision support.

What Is a System?

A system is an interrelated set of components which are viewed as a whole.

It has:

- Components – its basic parts
- Structure – how the components are organized
- Function – what the system does
- Objectives – the human purposes served by the system

Show Off Time

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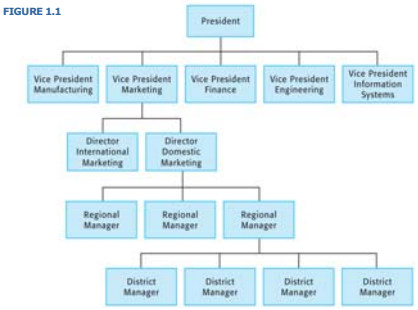
- Who here is a good programmer?
  - Willing to answer a few questions
- What kind of project have you done successfully?
  - Can be work, play, class…

System Structures

- **Hierarchical (Tree)**
  - Each component is subordinate to exactly one other component.
  - Components can be nested.
- **Matrix (Grid)**
  - Each component, or cell, is determined by a combination of two or more factors.
- **Network**
  - **Nodes** or **points** connected by **arcs** or **links.**
  - Arcs may permit **flows**, as in a transportation or telecommunication network.

Hierarchical System Structure

FIGURE 1.1



Matrix System Structure

FIGURE 1.4

DISCIPLINE	Project 1	Project 2	Project 3	Project 4	Project 5
Architecture					
Structural					
Mechanical					
Electrical					
Interiors					

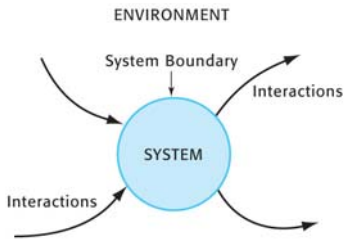
Network System Structure

FIGURE 1.5

A System and Its Environment

A system has a **boundary** which separates it from its **environment.**

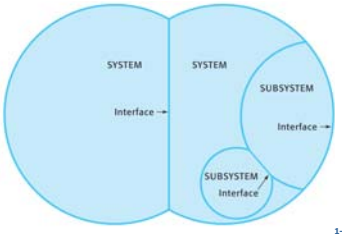
FIGURE 1.6



Interfaces

An **interface** describes an **interaction** or **connection** between a **system and its environment,** or between **subsystems**.

FIGURE 1.7



System Descriptions

- **Implementation Descriptions**
  - Dependent on a specific implementation or technology
  - Sometimes called **physical** descriptions
- **Essential Descriptions**
  - Independent of a specific implementation or technology
  - Sometimes called **logical** descriptions

System Descriptions
(continued)

Implementation Description	Essential Description
Non-essential	Essential
Shows form	Shows content
Concrete	Abstract
Implementation-dependent	Implementation-independent
Technology-dependent	Technology-independent

Summary

System analysts apply information technology to business problems and systems in order to improve production and services as well as provide improved monitoring, control, and managerial decisions.

Basic systems concepts and models help analysts succeed in addressing the complexity of real-world systems.

Learning Objectives

- Explain how systems thinking helps address the complexity of developing an information processing system.
- Define a system and identify the function, components, and structure of familiar systems.
- Understand the relationship between a system and its environment or context.
- Explain the role of an interface.
- Give examples of information system components which perform the functions of transformation, transmission, and storage.

Learning Objectives
(continued)

- Explain the difference between essential and implementation descriptions of a system.
- Describe some of the major roles of information in a business organization.
- Explain the major steps in a problem-solving or decision-making process and how systems analysis can be understood as problem solving.

Review Questions

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- See text Review Questions:
  - 1-1, 1-3,1-5,1-6,1-8, 1-18 in particular
- Key Ideas (Deep Knowledge):
  - System – wdim?
  - Design / Analysis – why needed?

Goals and Feeling

You remember…

1/3 of what you read,

½ of what people tell you,

But 100% of what you feel

Source: Raytheon CEO Bill Swanson, The CEO's Secret Handbook, Business 2.0, July 2005, pg 69-74.

Systems Development Process and Key Parts

- Chapter Two in Text
  - Brief Overview of Rational Unified Process
  - Introduction to models and UML

Participants in Systems Analysis and Design

- **Users**
- **Analysts**
- **Designers**
- **Programmers**
- **Quality Assurance Specialists**

Overview
(continued)

There are two principal groups of participants in systems analysis – users and analysts.

In planning for system development, analysts must take into consideration the different interests of different types of users.

Overview
(continued)

Systems analysts are responsible primarily for understanding, modeling, and communicating the requirements for a new system. Successful systems analysts possess interpersonal and communication skills as well as analytical and technical skills.

Overview
(continued)

System designers are responsible for the technical quality of the system design. They must assure that the system is designed to satisfy all the requirements.

Programmers are responsible for construction of the system.

Overview
(continued)

Quality assurance staff monitor the development process and provide measurements and tests which are independent of the development team.

The business case for a proposed development project incorporates an analysis of the project's feasibility – incorporating technical, resource, organizational, schedule, and economic perspectives.

Show Off Time

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- Who here is a good designer?
  - Willing to answer a few questions
- Let's talk about a system you all know:
  - University with courses, professors, departments,..
  - A system to register for classes

Responsibilities of Users

FIGURE 2.10

1. Deciding to incorporate the automated system into their way of doing business
2. Relating the need for the system and its functions to the goals, policies, and objectives of the organization
3. Knowing and understanding the business functions supported by the information processing system
4. Serving as a reliable information source
5. Establishing priorities and resolving conflicts among system objectives and among users' requirements
6. Reviewing, understanding, and approving the system development documents which define users' objectives and requirements
7. Reviewing the system at milestones and making abort or continue decisions
8. Allocating the necessary resources to the system development process
9. Deciding among alternatives, making trade-offs, and evaluating relative costs and benefits
10. Providing support for desired change and continuing pressure for change

Responsibilities of Analysts

FIGURE 2.11

1. Assuring the technical quality of the products and procedures of systems analysis (as described in Part II)
2. Determining (with the aid of other participants in the process) the implications – technical, economic, psychological, and organizational – of decisions about the scope and kind of automation
3. Facilitating communication and understanding among the other participants in the process
4. Providing effectively organized information to support user decisions leading to the development of the best computer information system for the organization
5. Acting as an advocate or ombudsman for the users, especially during design and acceptance testing, to ensure that users' requirements stated in the system specifications are satisfied in the later stages of system development
6. Acting as a conscience for the development effort

Responsibilities of Designers

FIGURE 2.12

1. Reviewing the requirements specification to verify its completeness and consistency
2. Notifying users and analysts of any deficiencies found in the requirements specification
3. Assuring the technical quality of the products and procedures of system design
4. Facilitating communication and understanding among the participants in design
5. Defining design alternatives and selecting the best
6. Assuring that the design can comply with the performance standards of the requirements specification as well as those of the system acceptance tests
7. Coordinating the design with decisions about the hardware and system software environment
8. Determining the implications of their designs for system performance and construction
9. Assuring that the system as designed is still technically, economically, and operationally feasible

Responsibilities of Programmers

FIGURE 2.13

1. Notifying designers of any deficiencies found in the design
2. Assessing the realizability of a design in differing hardware or software environments
3. Evaluating the flexibility and reusability of the software components
4. Predicting system performance

Responsibilities of Quality Assurance Staff

FIGURE 2.14

1. Establishing standards and policies for quality assurance throughout the system development process
2. Monitoring compliance with software quality standards
3. Obtaining measurements of the quality of the software and of the performance of the development teams
4. Conducting independent tests of the completed software

Summary

Best practice in system development uses a process which is iterative and incremental, such as the Rational Unified Process.

The major participants in the process are: users, systems analysts, system designers, programmers, and quality assurance specialists.

First UML Diagram

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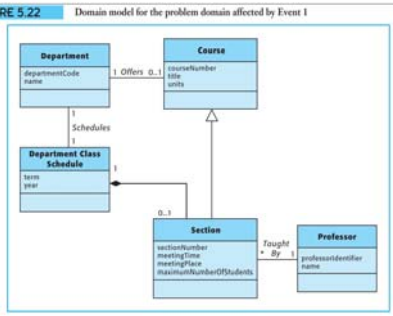
FIGURE 5.22 Domain model for the problem domain affected by Event 1



- Example of design before coding
- What does it say to you?
- Can you see some key parts?
- Can you see any errors?