

COMP CO835

Object-Oriented Systems

Week 6

Foundations for Systems Design

Professor: Dr. Stanley Ukah
Email: Stanley.ukah@mohawkcollege.ca

Outline

- What is Systems Design?
- Design Activities
- Designing System Controls and Security

Learning Objectives

- Describe systems design and contrast it with systems analysis
- List the documents and models used as inputs to, or output from systems design
- Explain each major design activity
- Describe security methods and controls
- Understand Systems Analysis & Design Concepts for Software Projects

System Development Life Cycle (SDLC)

Six core processes are:

The process consists of all activities required to build, launch, and maintain an information system.

1. Identify the problem or need and obtain approval
2. Plan and monitor the project
3. Discover and understand the details of the problem or need
4. Design the system components that solve the problem
5. Build, test, and integrate system components
6. Complete system tests and then deploy the solution

Overview

- Analysis says “what” is required, and design tells us “how” the system will be configured and constructed
- Weeks 2, 3, 4, and 5 materials covered systems analysis activities (requirements) in details
- This week introduces system design and the design activities involved in systems development

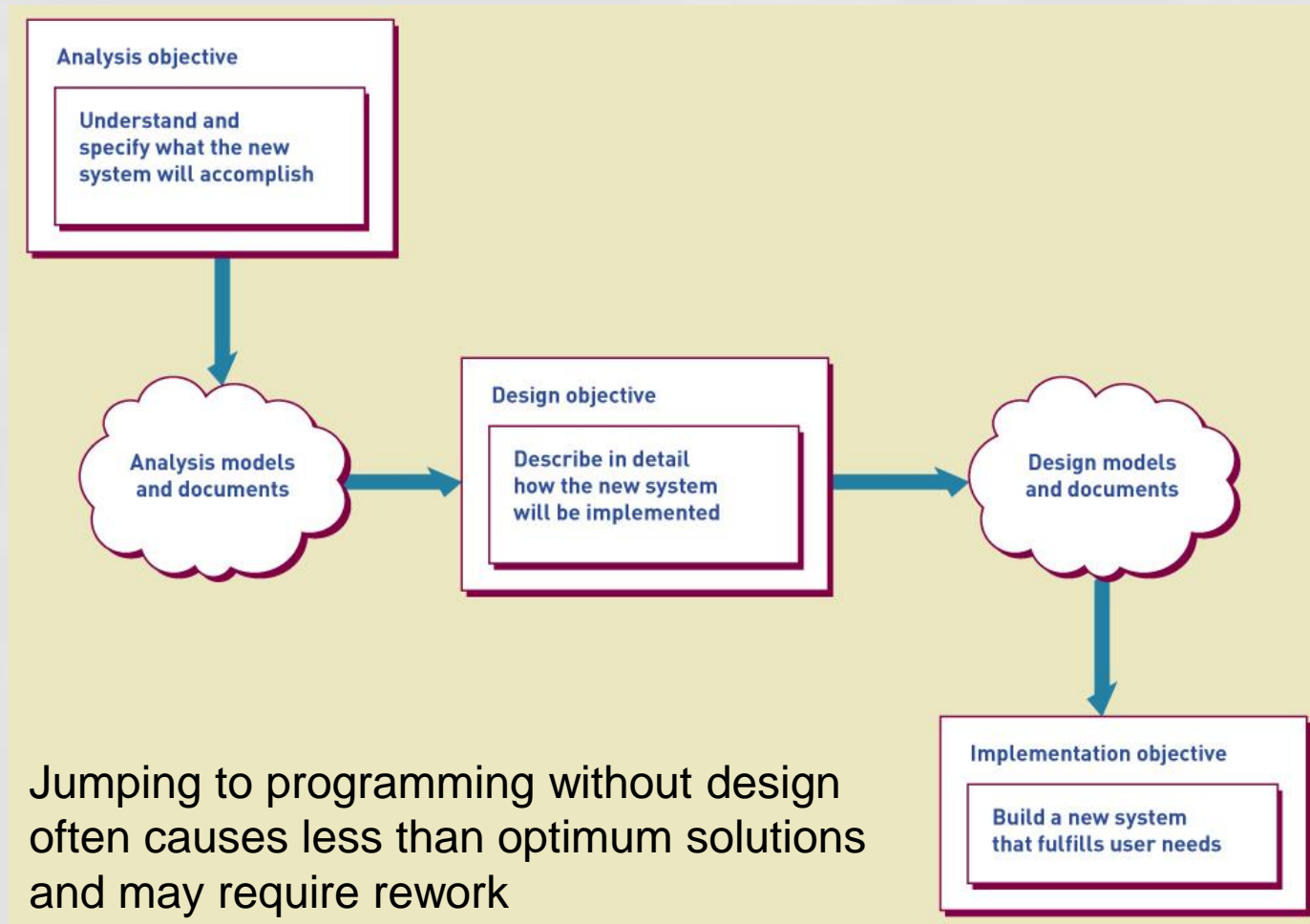
What is Systems Design?

- Analysis provides the starting point for design
- Design provides the starting point for implementation
- Analysis and design results are documented to coordinate the work
- The objective of system design is to define, organize, and structure the components of the final solution to serve as a blueprint for construction/implementation
- Design bridges the gap between requirements and actual implementation

System design

- System design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements.
- It is a critical phase in the software development or engineering process and can apply to various types of systems
- It is where the solution domain for a software project begins

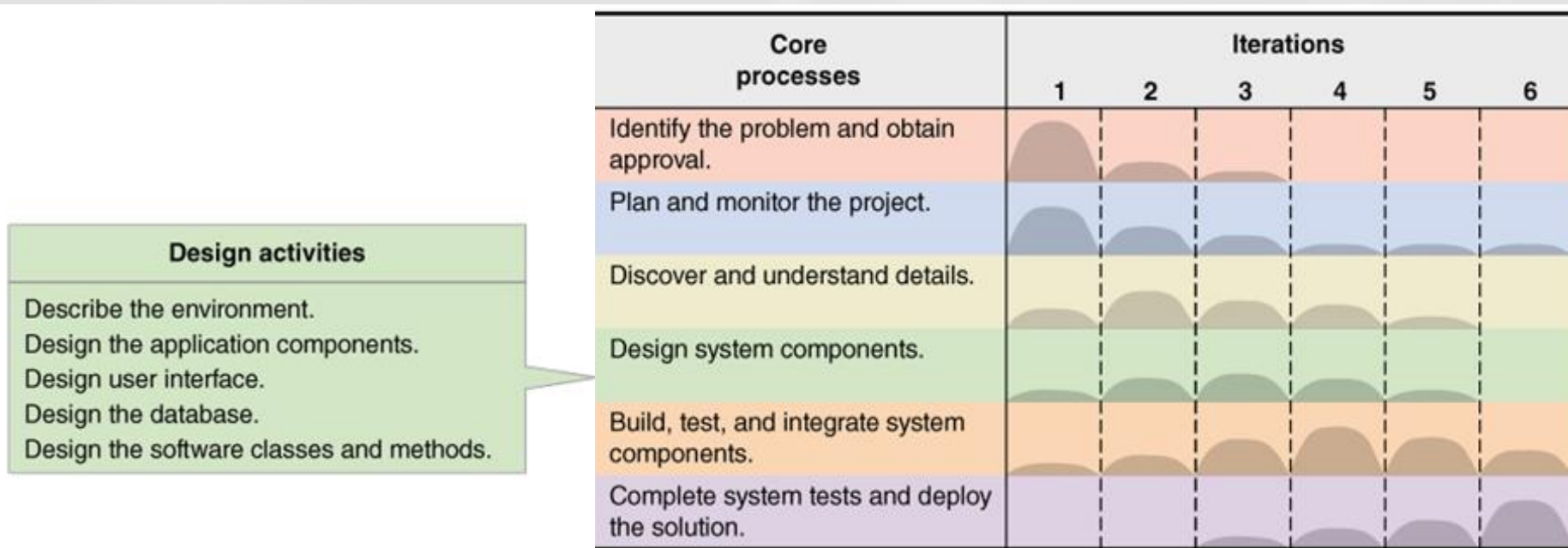
Analysis to Design to Implementation



System Design Activities

- Describe the Environment
- Design the Application Components
- Design the User Interface
- Design the Database
- Design the software classes and methods

Design Activities and Iterations



Describe the Environment

- Two key elements in the environment
 - Communications with External Systems
 - Message formats
 - Web and networks
 - Communication protocols
 - Security methods
 - Error detection and recovery
 - Conforming to an existing Technology Architecture
 - Discover and describe existing architecture
 - Chapter 7 provides more details

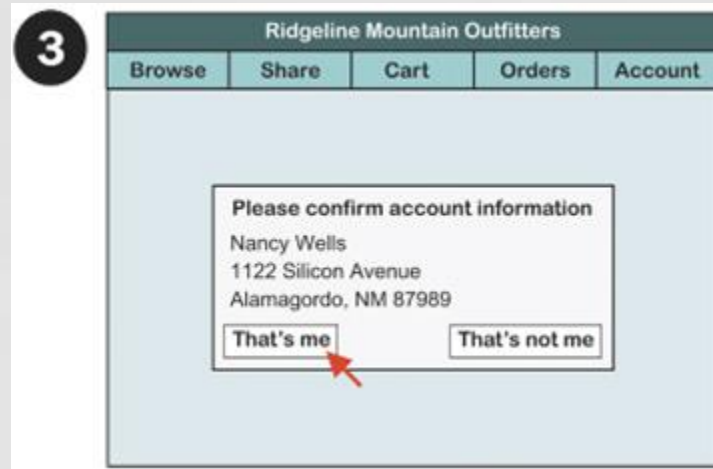
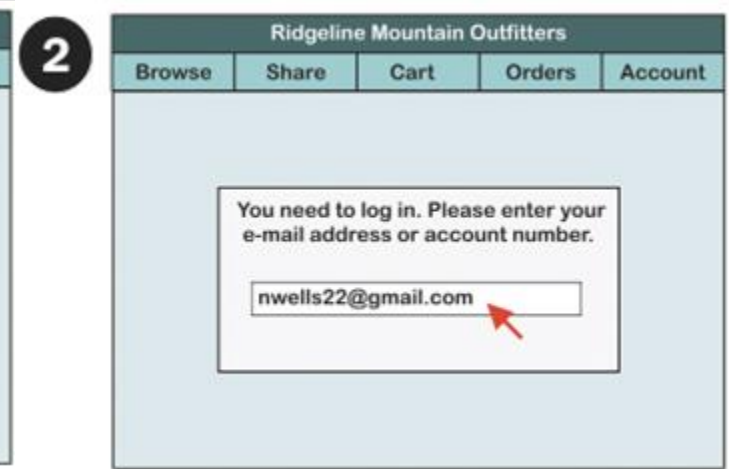
Design the Application Components

- Application component is a well defined unit of software that performs some function(s)
- Issues involve how to package components including
 - Scope and size – what are the functions, boundaries, interfaces?
 - Programming language – what are the accepted languages?
 - Build or buy – is an acceptable version available to purchase?

Design the User Interface

- To the user, the User Interface **is** the system.
- The user interface has large impact of user productivity
- Includes both Analysis and Design tasks
 - Requires heavy user involvement
- Current needs require multiple user interfaces
 - Many different devices and environments

Typical models for user interface design



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Nancy Wells
1122 Silicon Avenue
Alamagordo, NM 87989

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6

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Please enter shipping address

Name

John Wells

Apt#

Street

1612 Jefferson Street NE

City

Albuquerque

State

New Mexico

Zip Code

87123

OK

Cancel

7

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Order summary

Qty	SKU	Description	Price	Ext
1	10967335	Toddler parka red	44.95	44.95
1	94462	Ladies parka blue	72.95	72.95
			Subtotal	117.90
			Shipping	0.00
			Sales Tax	7.66
			Total	\$125.56

Please confirm payment

Nancy Wells
Visa xxxx-xxxx-xxxx-0899
Exp. 02/17

OK

Another method

8

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Your payment has been approved. Your Visa credit card (xxxx-xxxx-xxxx-0899) has been charged for \$125.56.

Your order number is 6773823.

The order will be shipped today for delivery in 3-5 days.

Thank you shopping with RMO!

Design the Database

- By definition, an Information System requires data – usually in a database
- Current technology frequently use Relational Database Management Systems (RDBMS)
- Requires converting the data model to a relational database
- Requires addressing of many other technical issues
 - Throughput and response time
 - Security

Design Software Classes and Methods

- AKA Detailed Design
- A model building activity
 - Design Class Diagram
 - Sequence Diagrams
 - State-Machine Diagrams

Design Software Classes and Methods

- Due to the complexities involved in developing information systems, analysts need to create instructions and guidelines for programmers
 - The instructions need to clearly describe what the system must do.
- It communicates how the system needs to be coded.
- It passes clear information from analysis phase to implementation
- What are the internal structures for each application component that will ensure the system is developed properly and that it will operate in accordance with specifications.

Key Design Questions for each Activity

Design activity	Key question
Describe the environment	How will this system interact with other systems and with the organization's existing technologies?
Design the application components	What are the key parts of the information system and how will they interact when the system is deployed?
Design the user interface	How will users interact with the information system?
Design the database	How will data be captured, structured, and stored for later use by the information system?
Design the software classes and methods	What internal structure for each application component will ensure efficient construction, rapid deployment, and reliable operation?

Designing System Controls and Security

- Security Design is critically Important in software development projects for several key reasons
- It helps protect sensitive data, maintain trust with users, prevent vulnerabilities and reduce overall business risk
- It's a proactive approach that ultimately saves time, money, and reputation in the long run

Designing System Controls and Security

● **Security Requirements:**

- These are the specific security-related needs and constraints that the system must address. They can include authentication, authorization, encryption, and data integrity requirements.

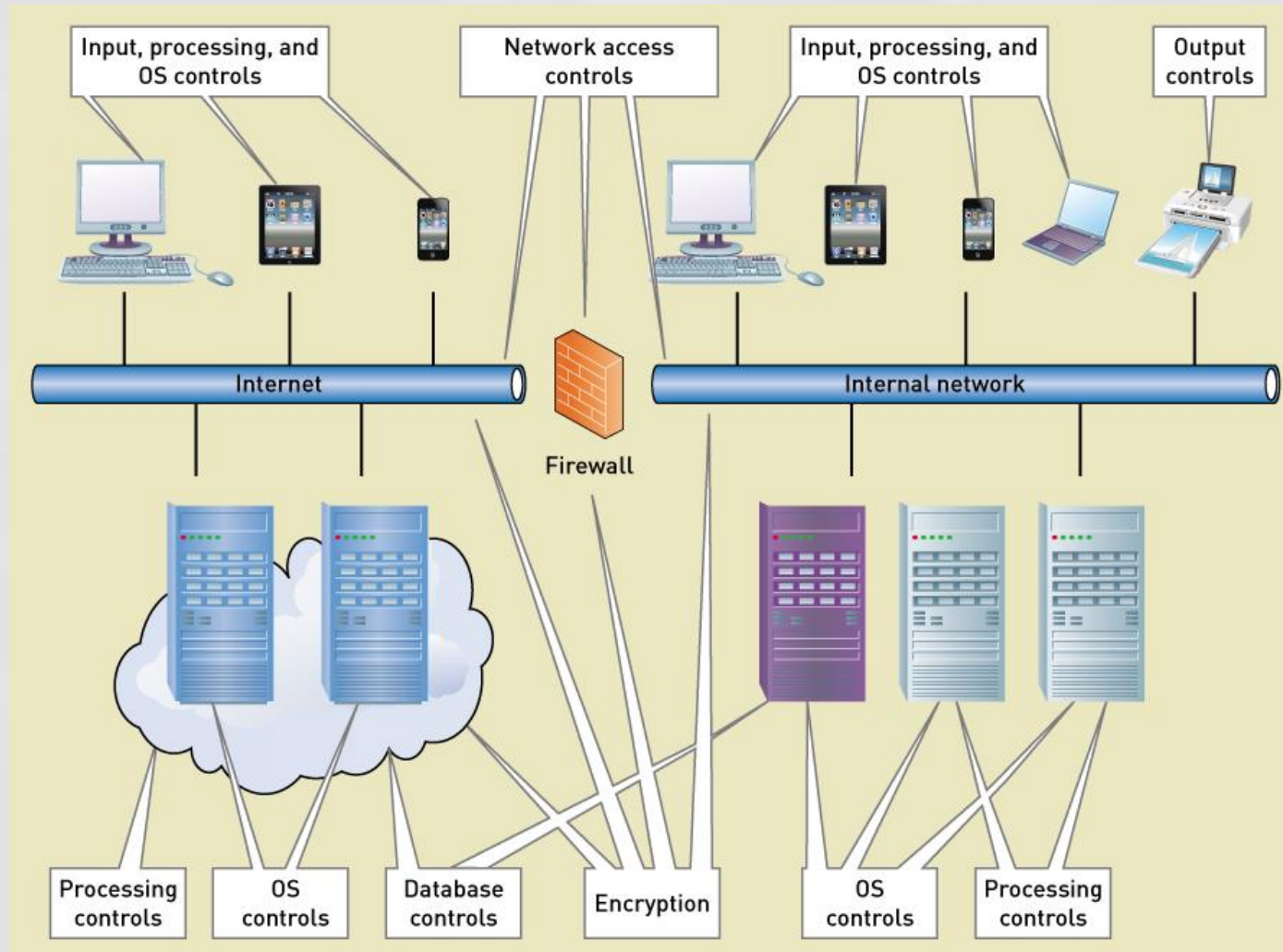
● **Threat Assessment:**

- Threats to the system should be identified and assessed. Common threats include hacking, data breaches, and denial of service attacks.

● **Security Controls:**

- Controls that protect the assets from threats, internal and external. These can include firewalls, intrusion detection systems, access controls, and encryption protocols.

Integrity and Security Controls



Designing System Controls and Security

- **The CIA Controls (Confidentiality, Integrity, & Availability)**
 - Controls that maintain confidentiality, integrity and availability of system and data.
 - Required for overall security measures in the system.



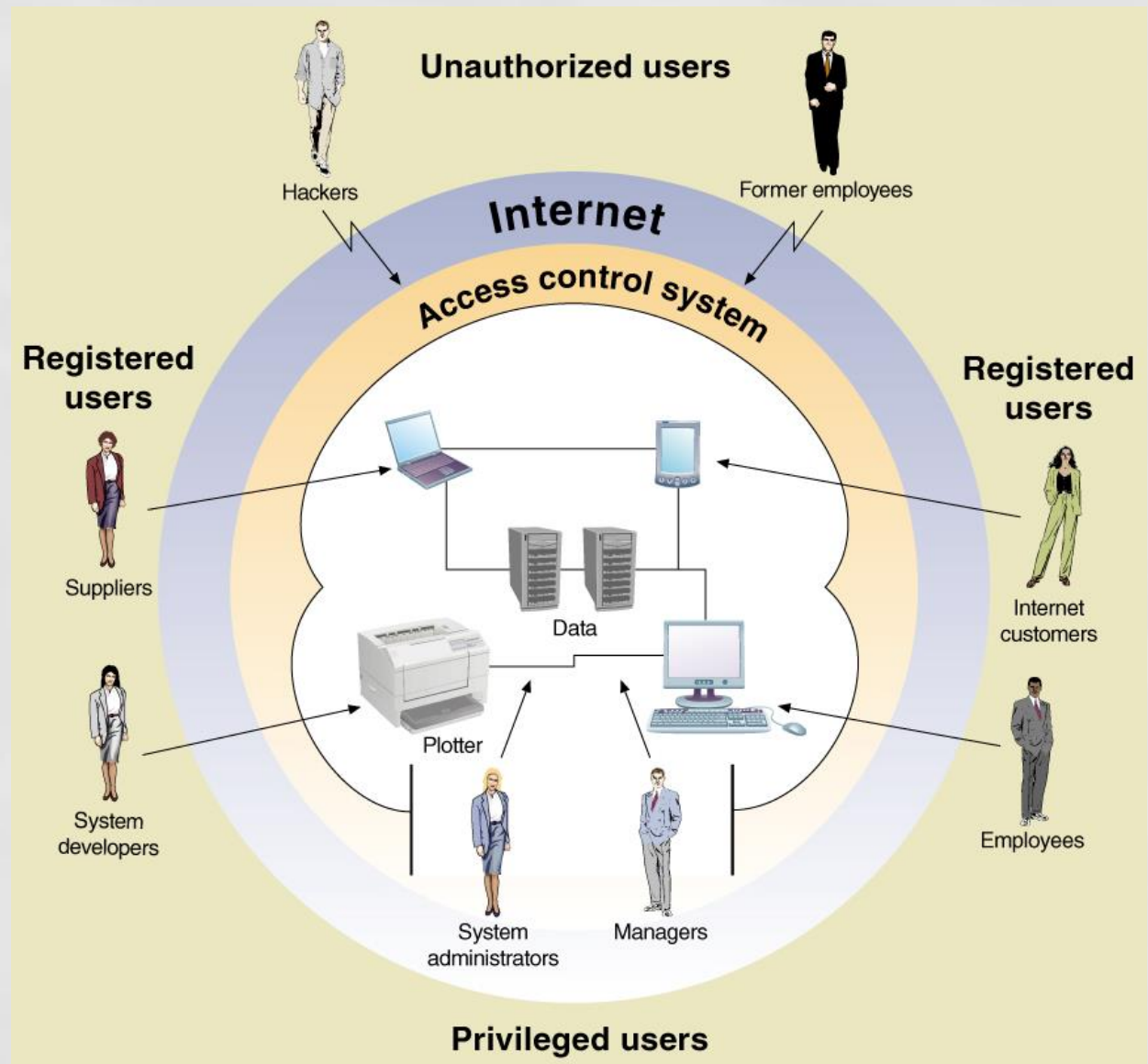
Designing Security Controls (1 of 2)

- Protect all assets against external threats
- Other objectives
 - Protect and maintain a stable, functioning operating environment 24/7 (equipment, operating systems, D B M S s)
 - Protect information and transactions during transmission across networks and Internet

Designing Security Controls (2 of 2)

- Access Controls – Limit a person's ability to access servers, files, data, applications
 - Authentication – to identify users
 - Multifactor Authentication
 - Access control list – list of valid users
 - Authorization – authenticated user's list of permission level for each resource
- Registered Users – those with authorization
- Unauthorized Users – anyone not registered or authorized
- Privileged Users – those that maintain lists and systems

Types of users

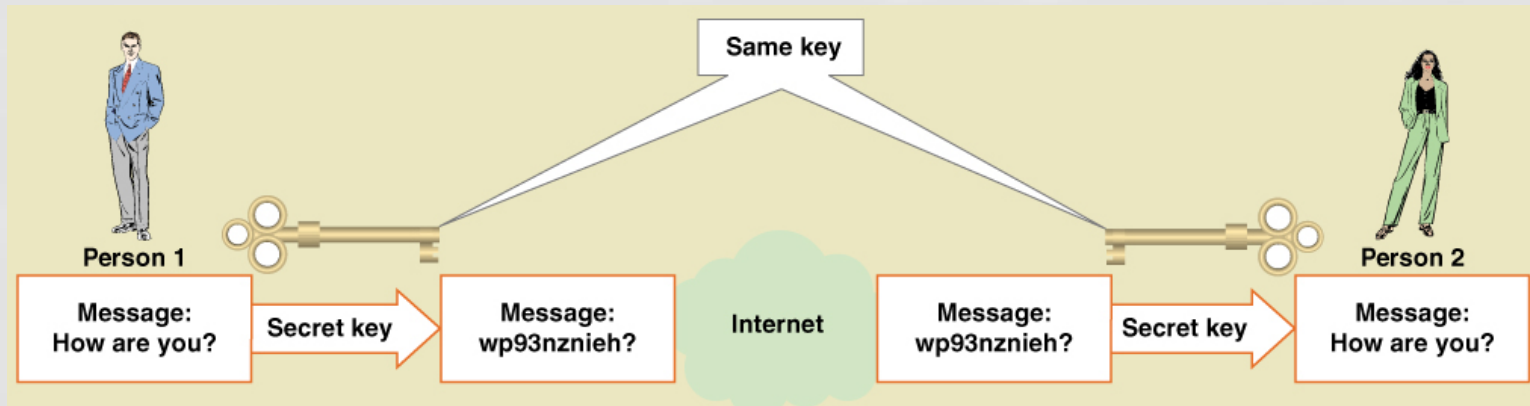


Data Encryption

- Method to secure data – stored or in transmission
- Encryption – alter data so it is unrecognizable
- Decryption – converted encrypted data back to readable format
- Encryption Algorithm – mathematical transformation of data
- Encryption Key – a long data string that allows the same algorithm to produce unique encryptions

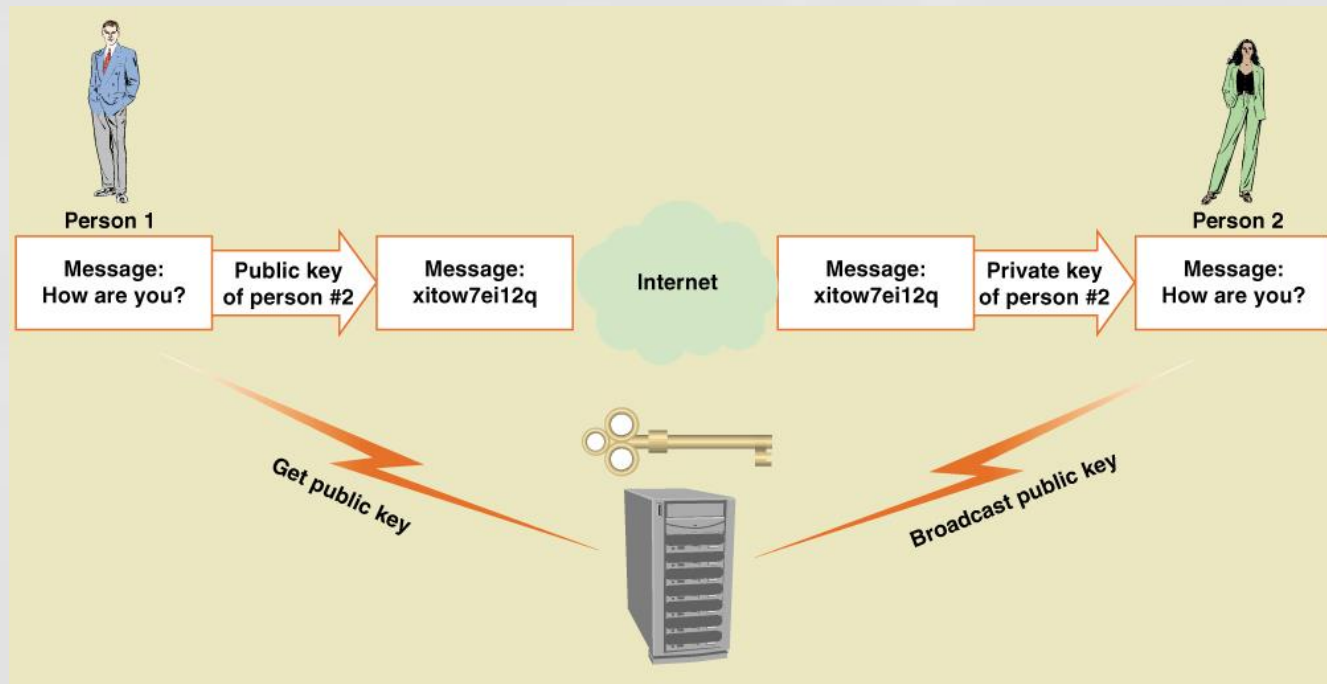
Symmetric Key Encryption

- Encryption method that uses the same key to encrypt and decrypt



Asymmetric Key Encryption

- Encryption method that uses different keys to encrypt and decrypt
 - AKA Public Key Encryption



Secure Transactions

- Secure Sockets Layer (SSL) – standard set of protocols for authentication and authorization
- Transport Layer Security (TLS) – an Internet standard equivalent to SSL
- IP Security (IPSec) – Internet security protocol at a low-level transmission
- Hypertext Transfer Protocol Secure (HTTPS) – Internet standard to transmit in Web pages

Summary (1 of 3)

- This chapter introduces the concept of Systems Design
 - Analysis is fact finding and modeling
 - Design is modeling to specify how system will be implemented
 - Design is bridge between analysis and implementation

Summary (2 of 3)

- Activities of Systems Design
 - Describe the environment
 - Design the application components
 - Design the User Interface
 - Design the database
 - Design the software classes and methods

Summary (3 of 3)

- System Controls and Security
 - Integrity Controls
 - Input controls
 - Output controls
 - Backup and recovery
 - Fraud prevention
 - Security Controls
 - Access controls
 - Data encryption
 - Digital signatures and certificates
 - Secure transactions

Summary

- Systems Analysis provides the starting point for design, Design provides the starting point for implementation
- Design bridges the gap between requirements to actual implementation
- Confidentiality, Integrity, & Availability (the CIA triad) are Required for overall security measures in the system.
- A user interface is the space where interactions between humans and the systems occur, and its design is crucial for a successful software development effort.

Questions?