

Foundations for Systems Design

Chapter 6

Systems Analysis and Design in a Changing World 7th Ed

Satzinger, Jackson & Burd

Chapter 6 Outline

- What Is Systems Design?
- Design Activities
- System Controls and Security (Extra)

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

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

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Overview

- Analysis says “what” is required and design tells us “how” the system will be configured and constructed
- Chapters 2, 3, 4 and 5 covered systems analysis activities (requirements)
- This chapter introduces system design and the design activities involved in systems development
- Design bridges the gap between requirements to actual implementation

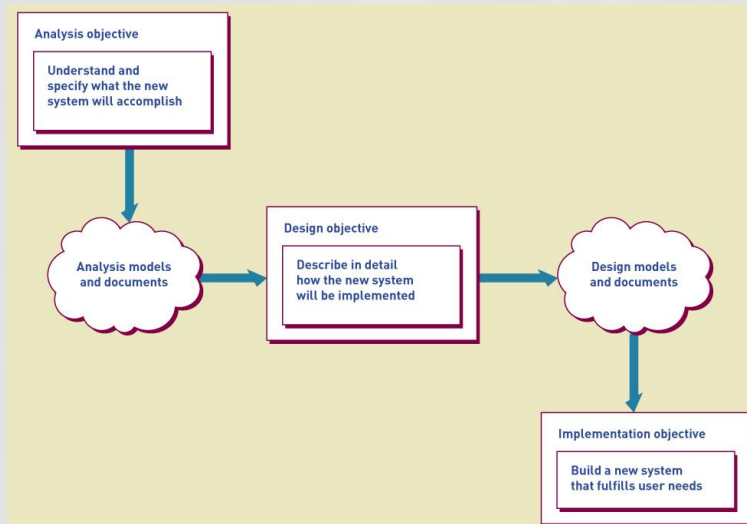
Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

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
- Objective of design is to define, organize, and structure the components of the final solution to serve as a blue print for construction

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Analysis to Design to Implementation



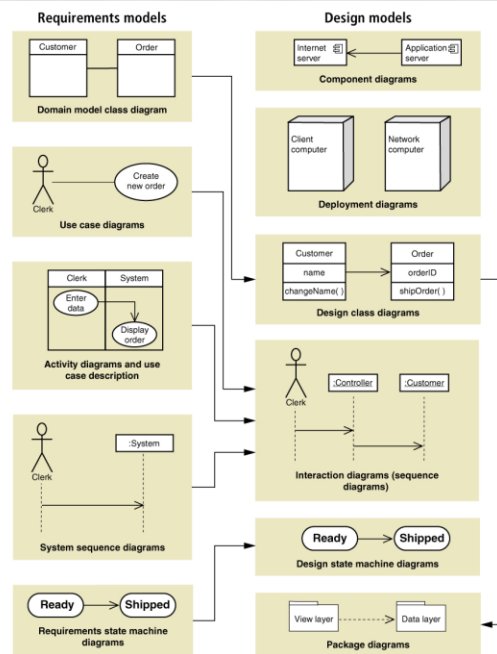
Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Design Models

- Design is a model building activity
- The formality of the project will dictate the type, complexity, and depth of models
- Agile/iteration projects typically build fewer models, but models are still created
- Jumping to programming without design often causes less than optimum solutions and may require rework

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Analysis Models to Design Models



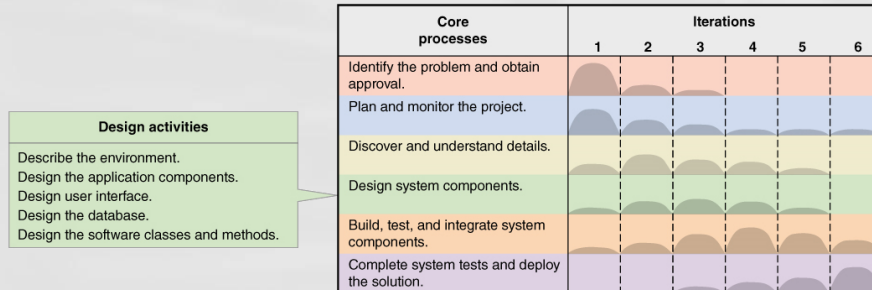
Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Design Activities

- Design activities correspond to components of the new system
 - The environment
 - Application components
 - User interface
 - Database
 - Software classes and methods

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Design Activities and Iterations



Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

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?

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

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

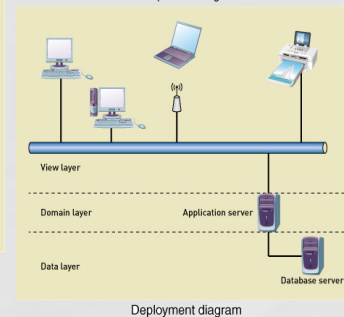
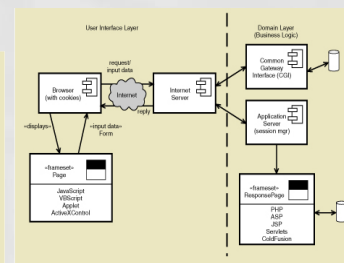
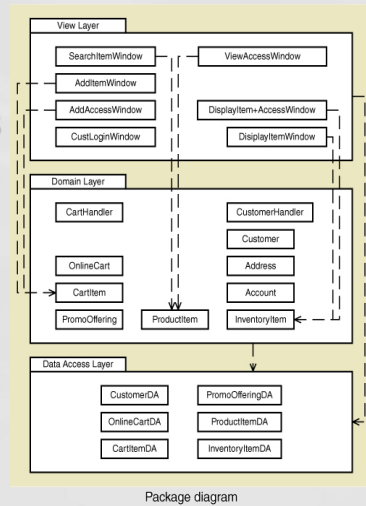
Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

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?

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Typical models for defining application components



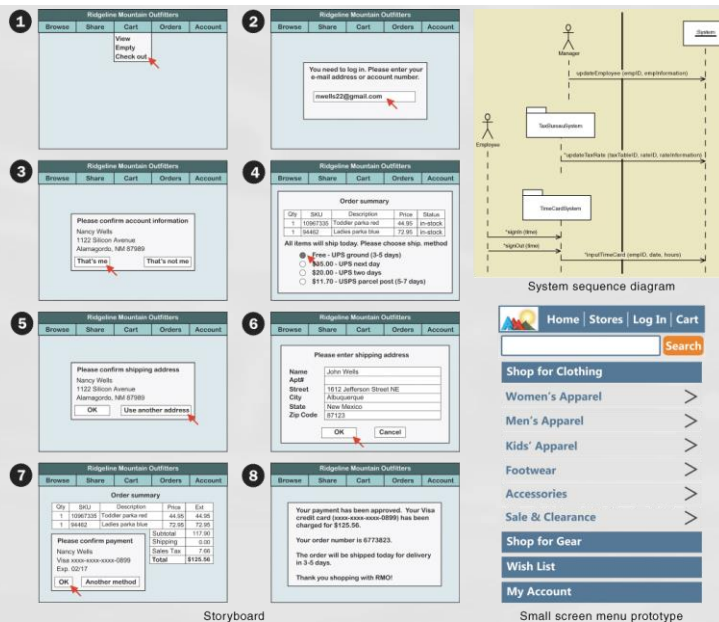
Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

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

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Typical models for user interface design



Storyboard

Small screen menu prototype

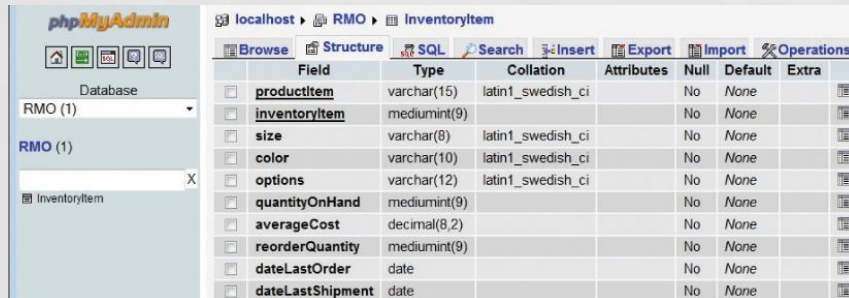
Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

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

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Typical Table Definition as part of Database Schema



Field	Type	Collation	Attributes	Null	Default	Extra
<input type="checkbox"/> productItem	varchar(15)	latin1_swedish_ci		No	None	
<input type="checkbox"/> inventoryItem	mediumint(9)			No	None	
<input type="checkbox"/> size	varchar(8)	latin1_swedish_ci		No	None	
<input type="checkbox"/> color	varchar(10)	latin1_swedish_ci		No	None	
<input type="checkbox"/> options	varchar(12)	latin1_swedish_ci		No	None	
<input type="checkbox"/> quantityOnHand	mediumint(9)			No	None	
<input type="checkbox"/> averageCost	decimal(8,2)			No	None	
<input type="checkbox"/> reorderQuantity	mediumint(9)			No	None	
<input type="checkbox"/> dateLastOrder	date			No	None	
<input type="checkbox"/> dateLastShipment	date			No	None	

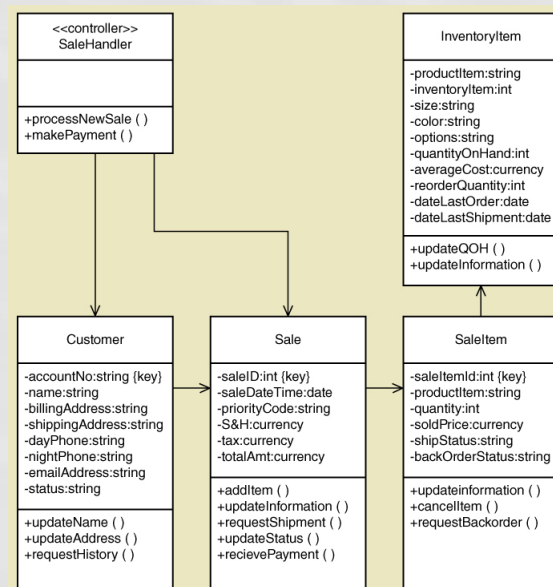
Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Design Software Classes and Methods

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

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Typical Design Class Diagram with attributes and methods



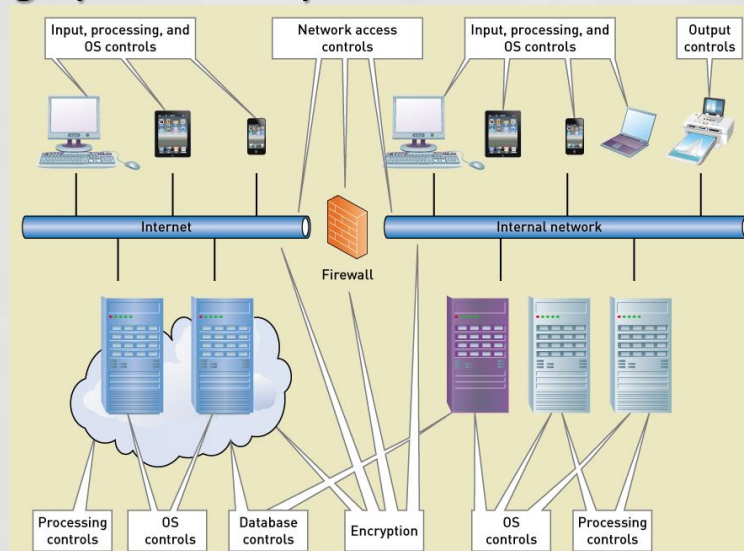
Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

System Controls and Security

- Integrity Controls
 - Controls that maintain integrity of inputs, outputs and data and programs
- Security Controls
 - Controls that protect the assets from threats, internal and external

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Integrity and Security Controls



Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Designing Integrity Controls

- Integrated into application programs and DBMS
- Objectives of Integrity Controls
 - Ensure that only appropriate and correct business transactions are accepted
 - Ensure that transactions are recorded and processed correctly
 - To protect and safeguard assets such as the database

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Input Controls

- Prevent invalid or erroneous data from entering the system
- Value Limit Controls
 - Check the range of inputs for reasonableness
- Completeness Controls
 - Ensure all the data has been entered
- Data Validation Controls
 - Ensure that specific data values are correct
- Field Combination Controls
 - Ensure data is correct based on relationships between fields

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Output Controls

- To ensure that output arrives at proper destination (for authorized eyes) and is accurate, current, and complete
- Examples
 - Physical access to printers and display devices
 - Discarded data – protect from “dumpster diving”
 - Labels on printed and electronic output to correctly identify source of data

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Redundancy, Backup and Recovery

- Protect data and systems from catastrophes
 - Databases
 - Hardware
 - Software applications
 - Networks
- On-site versus off-site copies

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Designing Security Controls

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

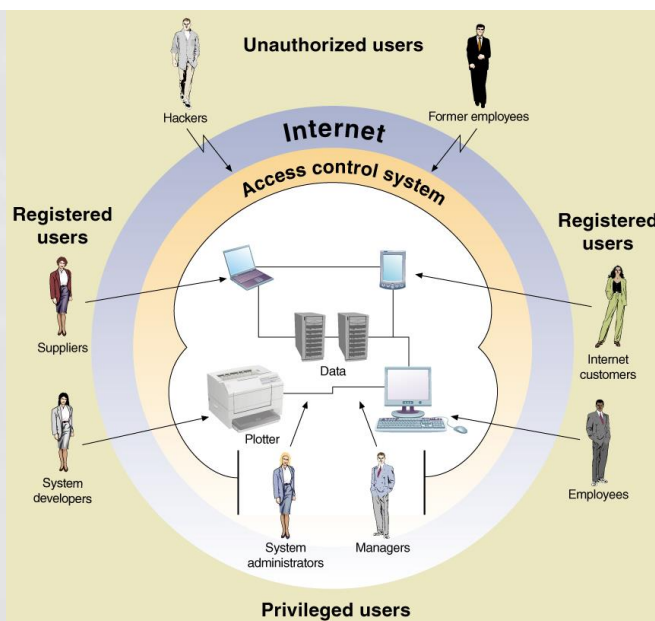
Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Designing Security Controls

- 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
- Privileged Users – those that maintain lists and systems

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Types of users



Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

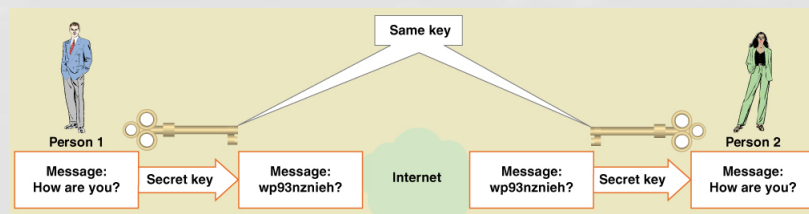
Data Encryption

- 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 the data
- Encryption Key – a long data string that allows the same algorithm to produce unique encryptions

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Symmetric Key Encryption

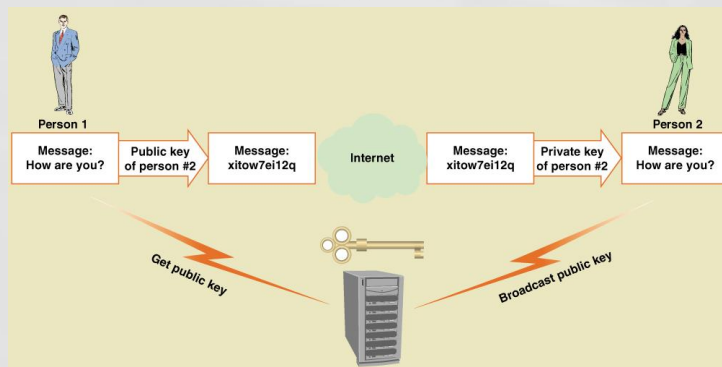
- Encryption method that uses the same key to encrypt and decrypt



Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Asymmetric Key Encryption

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



Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Digital Signatures and Certificates

- Digital Signature – technique where a document is encrypted using a private key
 - Note – implements previous slide, but in reverse
 - Document is encrypted with private key, but then can only be decrypted with correct public key
- Digital Certificate – An organizations name and public that is encrypted and certified by an authorized third party
- Certifying Authority – the authorized third party
 - Widely known and accepted – built into Web browsers

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

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 Web pages

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Summary

- 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

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Summary (continued)

• Activities of Systems Design

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

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.

Summary (continued)

• 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

Systems Analysis and Design in a Changing World, 7th Ed - Chapter 6
©2016. Cengage Learning. All rights reserved.