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Chapter 9: Moving to Design

Systems Analysis and Design in a Changing World, 3rd Edition

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Learning Objectives

- Discuss the issues related to managing and coordinating the design phase of the SDLC
- Explain the major components and levels of design
- Describe each design phase activity
- Describe common deployment environments and matching application architectures
- Develop a simple network diagram and estimate communication capacity requirements

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Overview

- This chapter:
  - Completes the transition from analysis to design
  - Discusses issues related to design of new system
  - Describes all design phase activities
  - Describes network and architecture design
- Analysis focuses on what system should do – business requirements
- Design is oriented toward how system will be built – defining structural components

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Understanding the Elements of Design

- Design is process of describing, organizing, and structuring system components at architectural design level and detailed design level
  - Focused on construction
  - Like developing blueprints
- Three questions:
  - What components require systems design?
  - What are inputs to and outputs of design process?
  - How is systems design done?

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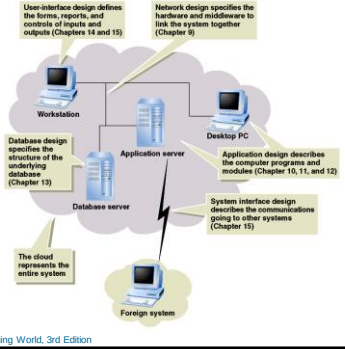
Components Requiring Systems Design

FIGURE 9-1
System components requiring systems design.



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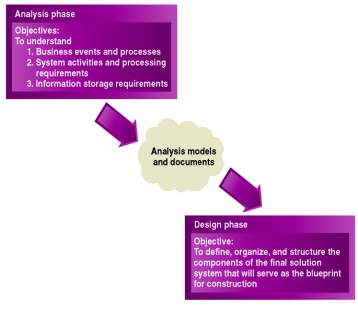
Analysis Objectives to Design Objectives

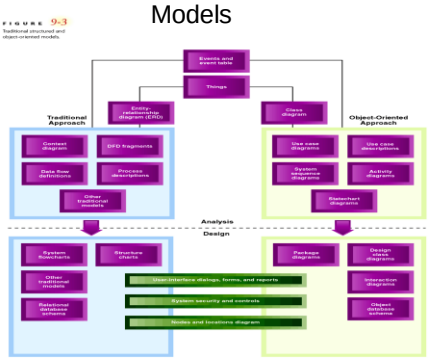
FIGURE 9-2
Analysis objectives to design objectives.



Moving from Analysis to Design

- Design:
  - Converts functional models from analysis into models that represent the solution
  - Focused on technical issues
  - Requires less user involvement than analysis
- Design may use structured or OO approaches
  - Database can be relational, OO or hybrid
  - User interface issues

Traditional Structured and Object-Oriented Models



SDLC Phases with Design Phase Activities

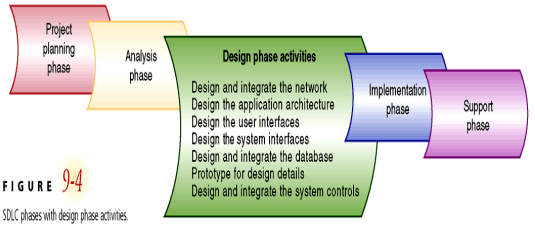


FIGURE 9-4
SDLC phases with design phase activities.

Design Phase Activities and Key Questions

FIGURE 9-5
Design phase activities and key questions.

Design phase activity	Key question
Design and integrate the network	*Have we specified in detail how the various parts of the system will communicate with each other throughout the organization?*
Design the application architecture	*Have we specified in detail how each system activity is actually carried out by the people and computers?*
Design the user interface(s)	*Have we specified in detail how all users will interact with the system?*
Design the system interface(s)	*Have we specified in detail how the system will work with all other systems inside and outside our organization?*
Design and integrate the database	*Have we specified in detail how and where the system will store all of the information needed by the organization?*
Prototype for design details	*Have we created prototypes to ensure all detailed design decisions have been fully understood?*
Design and integrate the system controls	*Have we specified in detail how we can be sure that the system operates correctly and the data maintained by the system are safe and secure?*

Design and Integrate the Network

- Network specialists establish network based on strategic plan
- Project team typically integrates system into existing network
- Technical requirements have to do with communication via networks
- Technical issues handled by network specialists:
  - Reliability, security, throughput, synchronization

Design the Application Architecture

- Specify how system activities are carried out
- Described during system analysis as logical models
- After design alternative is selected, detailed computer processing is designed as physical models such as: physical data flow diagrams, structure charts, interaction diagrams
- Approach varies depending on development and deployment environments

Design the User Interfaces

- User interface quality is critical aspect of system
- Design of user interface defines how user interacts with system
  - GUI: windows, dialog boxes, mouse interaction
  - Sound, video, voice commands
- To user of system, user interface is the system
- User interface specialists: interface designers, usability consultants, human factors engineers

Design the System Interfaces

- Systems interfaces enable systems to share and exchange information
  - Internal organization systems
  - Interfaces with system outside organization
  - New system interfacing with package application that organization has purchased and installed
- System interfaces can be complex
- Organization needs very specialized technical skills to work on these interfaces

Design and Integrate the Database

- System analysis data model used to create physical database model
- Collection of traditional computer files, relational database, and/or object-oriented databases
- Technical requirements, such as response times, determine database performance needs
- Design work might involve:
  - Performance tuning
  - Integration between new and existing databases

Prototype for Design Details

- Continue to create and evaluate prototypes during design phase
- Prototypes confirm design choices:
  - Database
  - Network architecture
  - Controls
  - Programming environment
- Rapid application development's (RAD) design prototypes evolve into finished system

Design and Integrate the System Controls

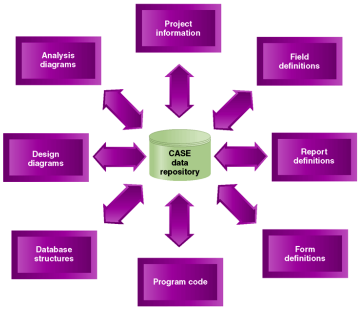
- Final design activity to ensure system has adequate safeguards (system controls) to protect organizational assets
- Controls are needed for all other design activities
  - User interface – limit access to authorized users
  - System interface – protect from other systems
  - Application architecture – record transactions
  - Database – protect from software/hardware failure
  - Network design – protect communications

Project Management: Coordinating the Project

- Coordinating Project Teams
  - Project schedule - coordinating ongoing work
- The Project Team at RMO
  - As project team grows – structure may change
- Coordinating Information
  - CASE tools and central repository
  - Team communication and information coordination
  - Track open items and unresolved issues

System Development Information Stored in the CASE Repository

FIGURE 9-6
System development information stored in the CASE repository.

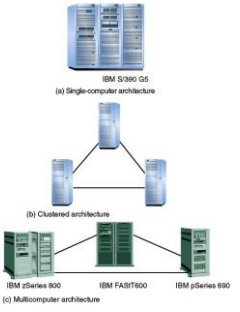


Deployment Environment

- Deployment environment definition bridges analysis and design
  - Hardware
  - System software
  - Networking
- Common deployment environments in which system will operate
- Related design patterns and architectures for application software

Single, Clustered, and Multicomputer Architectures

FIGURE 9-7
Single-, clustered, and multicomputer architectures.



Single-Computer and Multitier Architecture

- Single-computer architecture
  - Mainframe-based
  - Limited by single machine capacity
- Clustered and multi-computer architecture
  - Group of computers to provide processing and data storage capacity
  - Cluster acts as a single system
  - Multicomputer hardware/OS can be less similar than clustered

Centralized and Distributed Architecture

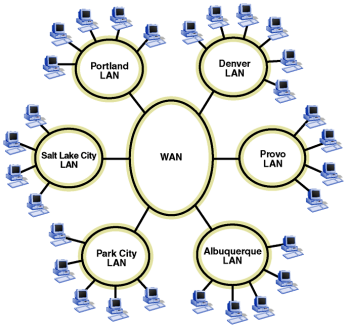
- Distributes system across several computers and locations
- Relies on communication networks for geographic connectivity
- Client-server architecture dominant model for distributed computing

Computer Networks

- Set of transmission lines, specialized hardware, and communication protocols
- Enables communication among different users and computer systems
- Local area network (LAN) less than one kilometer long – connects computers within single building
- Wide area network (WAN) over one kilometer long – implies much greater, global, distances
- Router – directs information within network

A Possible Network Configuration for RMO

FIGURE 9-8
A possible network configuration for RMO.



The Internet, Intranets, and Extranets

- Internet – Global collection of networks that use TCP/IP networking protocols
- Intranets
  - Private networks using same TCP/IP protocol as the Internet
  - Limited to internal users
- Extranets
  - Intranet that has been extended outside the organization

Application Architecture

- Consists of standards and tools used in an organization
- Important components
  - Language environment and expertise
  - Existing CASE tools and methodologies
  - Required interfaces to other systems
  - Operating system environment
  - Database management system environment

Client-Server Architecture

- Client-Server divides programs into two types
- Server – manages information system resources or provides well defined services for client
- Client – communicates with server to request resources or services
- Advantage – Deployment flexibility
  - Location, scalability, maintainability
- Disadvantage – Potential performance, security, and reliability issues from network communication

Interaction among Client, Server, and a Service-Related Data Store

FIGURE 9-10
Interaction among client, server, and a service-related data store.

Client-Server Architectural Process

- Decompose application into client and server programs, modules, or objects
  - Identify resources or services that can be centrally managed by independent software units
- Determine which clients and servers will execute on which computer systems
- Describe communication protocols and networks that connect clients and servers

Three-Layer Client-Server Architecture

- Layers can reside on one processor or be distributed to multiple processors
- Data layer – manages stored data in databases
- Business logic layer – implements rules and procedures of business processing
- View layer – accepts user input and formats and displays processing results

Three-Layer Architecture

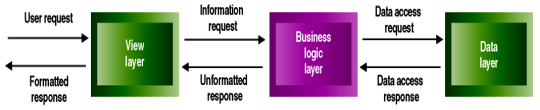


FIGURE 9-12
Three-layer architecture.

Middleware

- Aspect of distributed computing
- Connects parts of an application and enables requests and data to pass between them
- Teleprocessing monitors, transaction processing modules, object request brokers (ORBs)
- Designers reply on standard frameworks and protocols incorporated into middleware

Internet and Web-based Application Architecture

- Web is complex example of client-server architecture
- Can use Web protocols and browsers as application interfaces
- Benefits
  - Accessibility
  - Low-cost communication
  - Widely implemented standards

Negative Aspects of Internet Application Delivery

- Breaches of security
- Fluctuating reliability of network throughput
- Slow, throughput speeds to home users
- Volatile, changing standards

Network Design

- Integrate network needs of new system with existing network infrastructure
- Describe processing activity and network connectivity at each system location
- Describe communications protocols and middleware that connects layers
- Ensure that network capacity is sufficient
  - Data size per access type and average
  - Peak number of access per minute or hour

Network Diagram for RMO Customer Support System

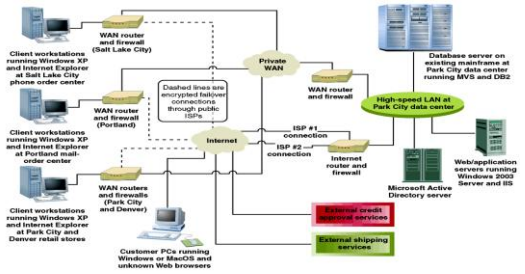


FIGURE 9-13
A network diagram for the RMO customer support system.

Summary

- Systems design is process of organizing and structuring components of system to allow construction (programming) of new system
- Design phase of project consists of activities that relate to design of components of new system
  - Application architecture, user interfaces, system interfaces, database, network diagram, system controls
  - Prototyping may be required to specify any part or all of the design

Summary (continued)

- Inputs to design activities are diagrams, or models, built during analysis
- Outputs of design are also set of diagrams, or models, to describe architecture of new system and detailed logic of programming components
- Inputs, design activities, and outputs are different depending on whether a structured approach or an object-oriented approach is used
- Architectural design adapts to development environment and decomposes design into layers