INTRODUCTION TO SYSTEMS ANALYSIS AND DESIGN:

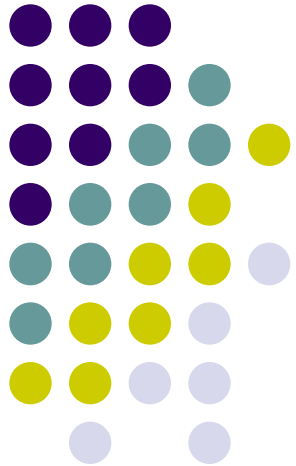
AN AGILE, ITERATIVE APPROACH

SATZINGER | JACKSON | BURD

CHAPTER 6

Essentials of Design and the Design Activities

Chapter 6



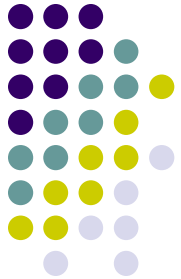
Introduction to Systems Analysis and Design:
An Agile, Iteractive Approach
6th Ed

Satzinger, Jackson & Burd

Chapter 6 Outline

- The Elements of Design
- Inputs and Outputs for Systems Design
- Design Activities
- Design Activity: Design the Environment

Learning Objectives

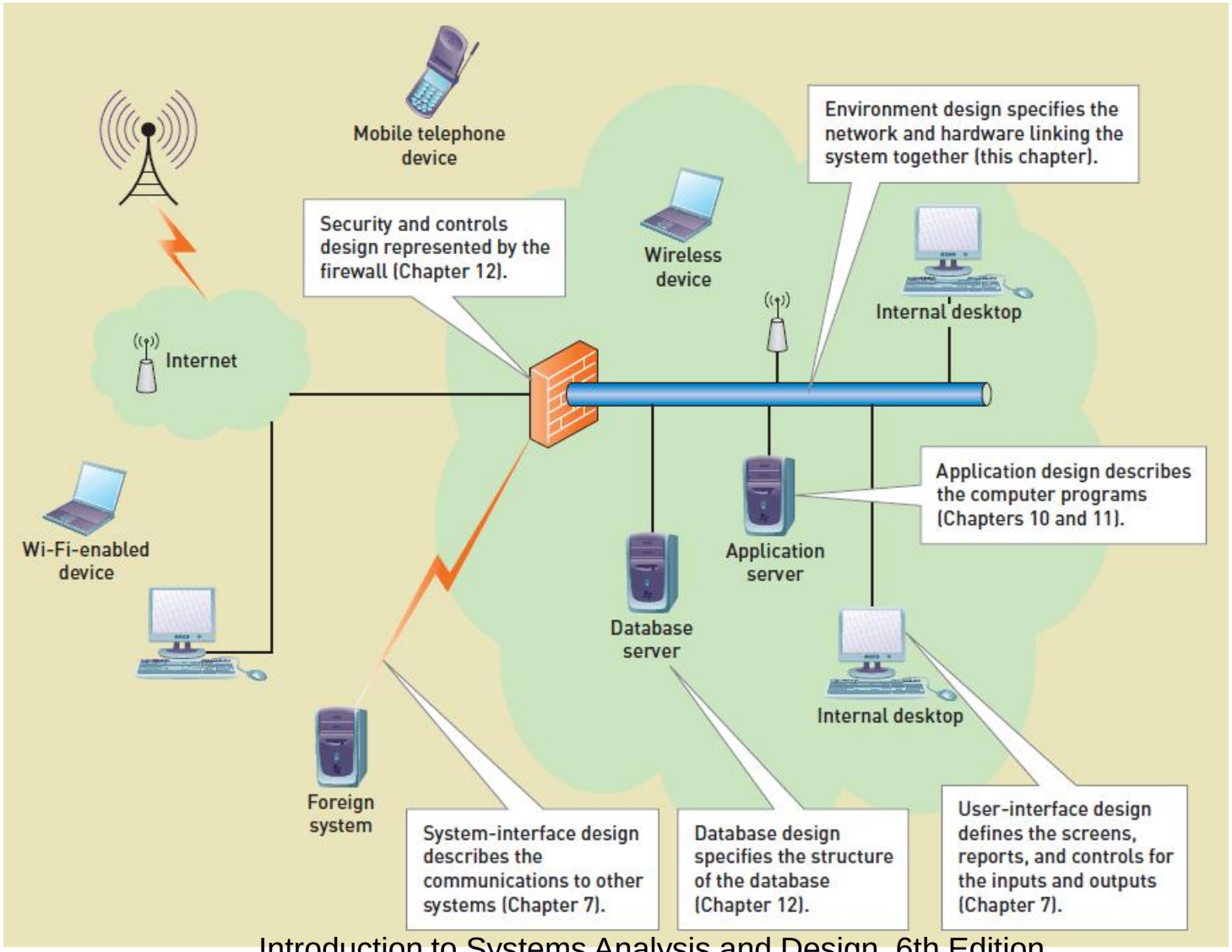


- Describe the difference between systems analysis and systems design
- Explain each major design activity
- Describe the major hardware and network environment options
- Describe the various hosting services available

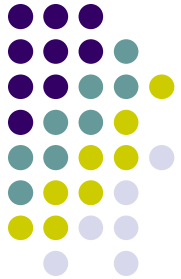
Overview

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

Major Components of Design

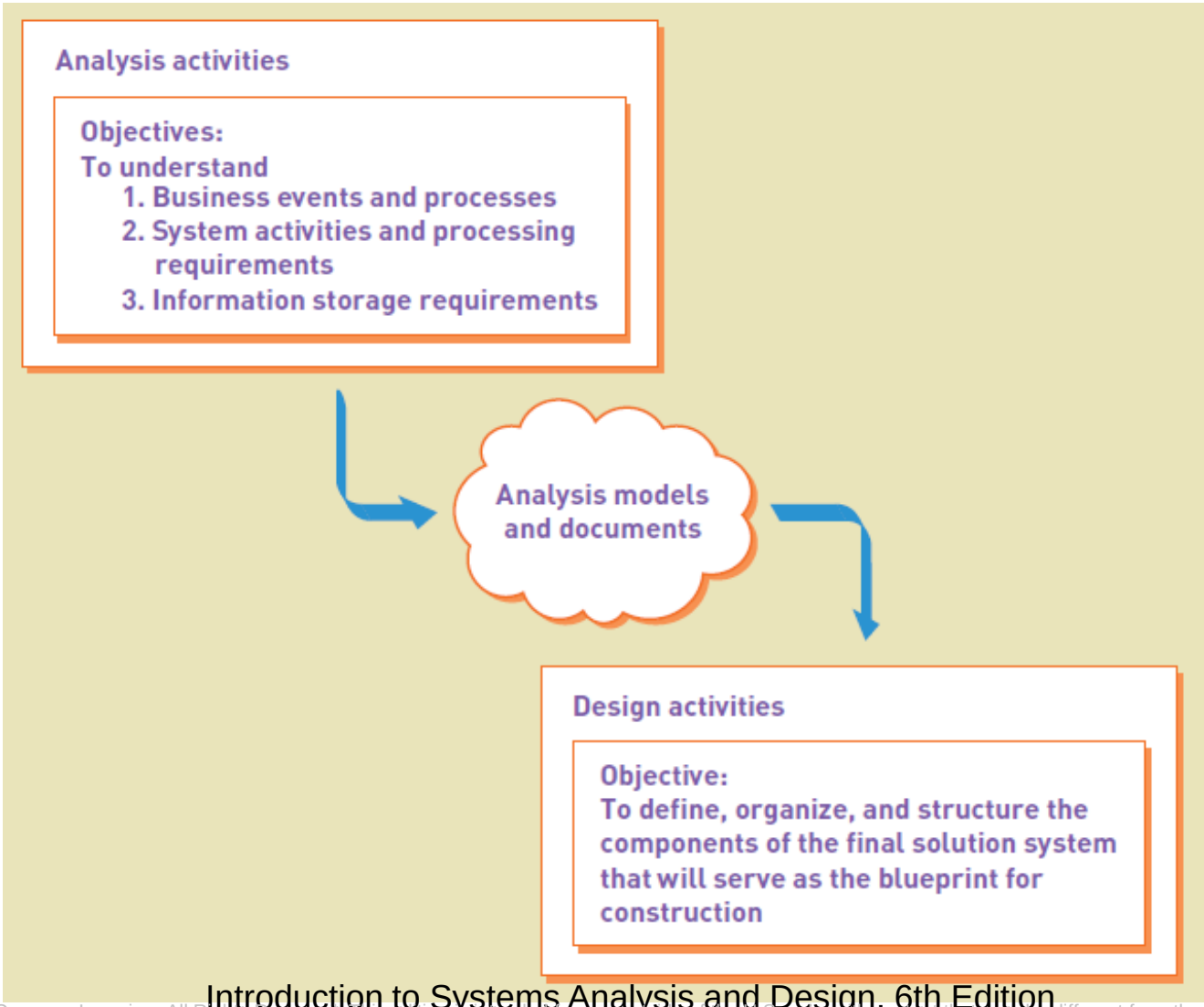


Two Levels of Design

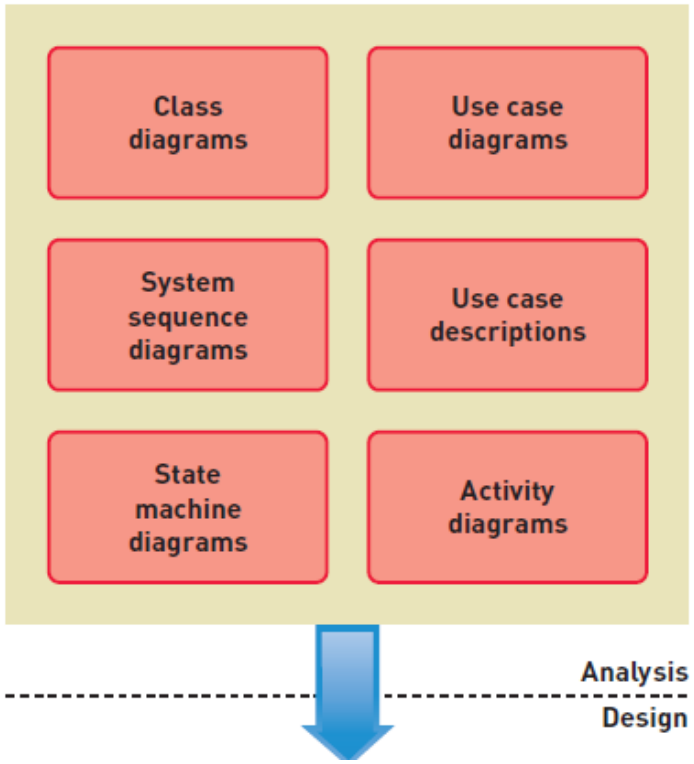


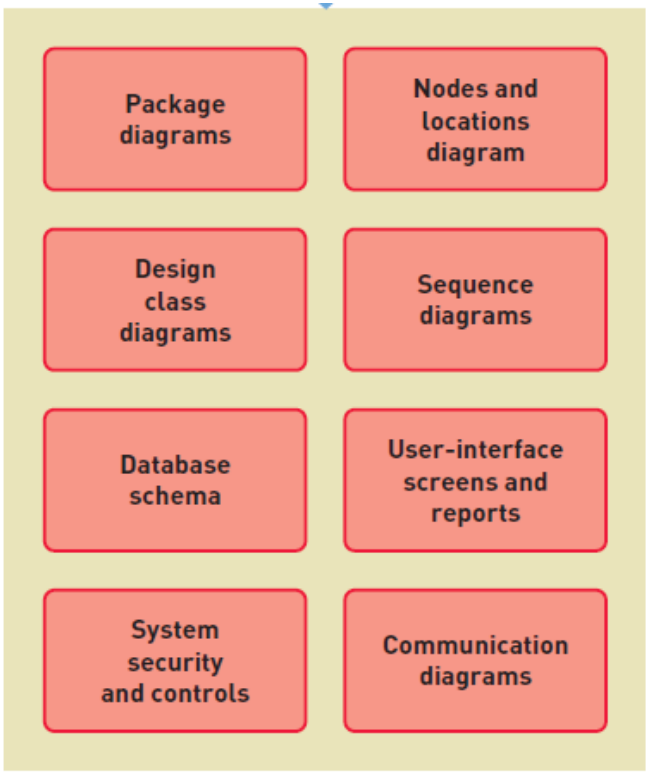
- Architectural Design
  - Broad design of the overall system structure
  - Also called General Design and Conceptual Design
- Detailed Design
  - Low level design that includes the design of the specific program details
    - Design of each use case
    - Design of the database
    - Design of user and system interfaces
    - Design of controls and security

Analysis Objectives versus Design Objectives



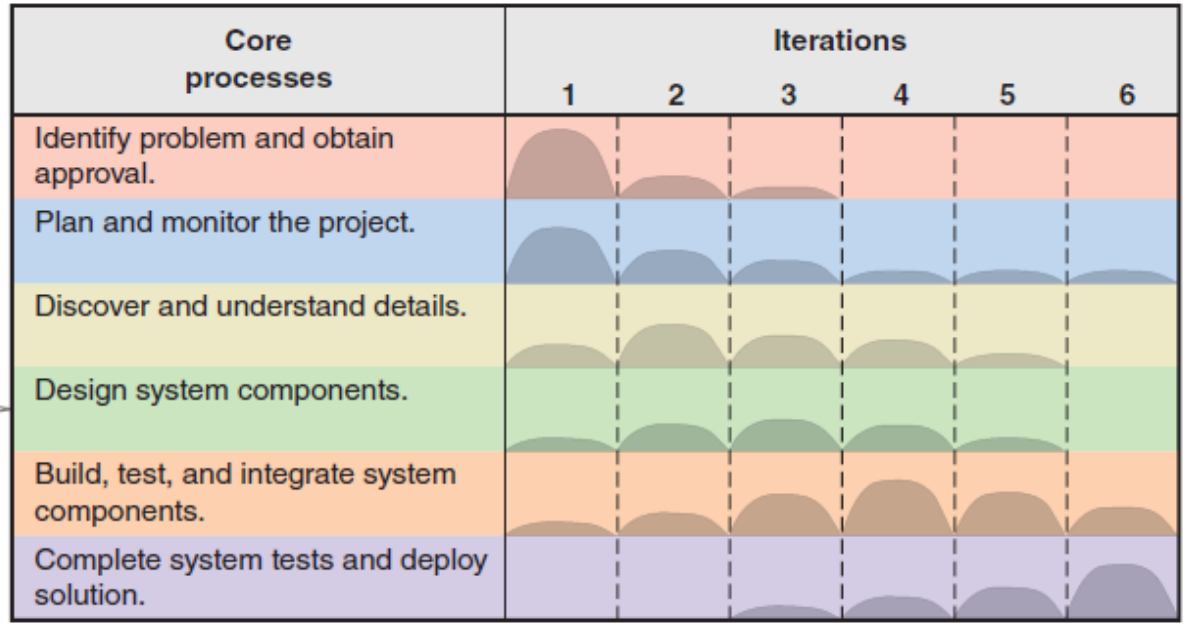
Analysis vs. Design Models



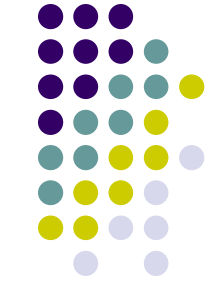


Design Activities

Design activities
Design the environment.
Design application architecture and software.
Design user interfaces.
Design system interfaces.
Design the database.
Design system controls and security.

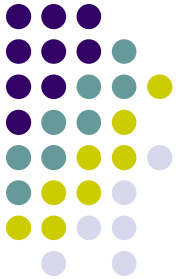


Design Activities and Key Question



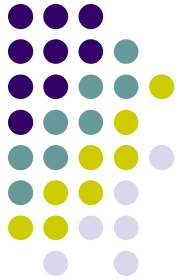
Design activity	Key question
Design the environment	Have we specified in detail the environment and all the various options in which the software will execute?
Design application architecture and software	Have we specified in detail all the elements of the software and how each use case is executed?
Design system interfaces	Have we specified in detail how the system will communicate with all other systems inside and outside the organization?
Design user interfaces	Have we specified in detail how users will interact with the system to carry out all their tasks (use cases)?
Design the database	Have we specified in detail all the information storage requirements, including all the schema elements?
Design system controls and security	Have we specified in detail all the elements to ensure the system and the data are secure and protected?

Design Activities:
Design the environment



- The environment is all of the technology required to support the software application
  - Servers, Desktop computers
  - Mobile devices, Operating systems
  - Communication capabilities, Input and output capabilities
- In Chapter 2 this was called the Technology Architecture
- This activity is discussed in more detail later in the chapter

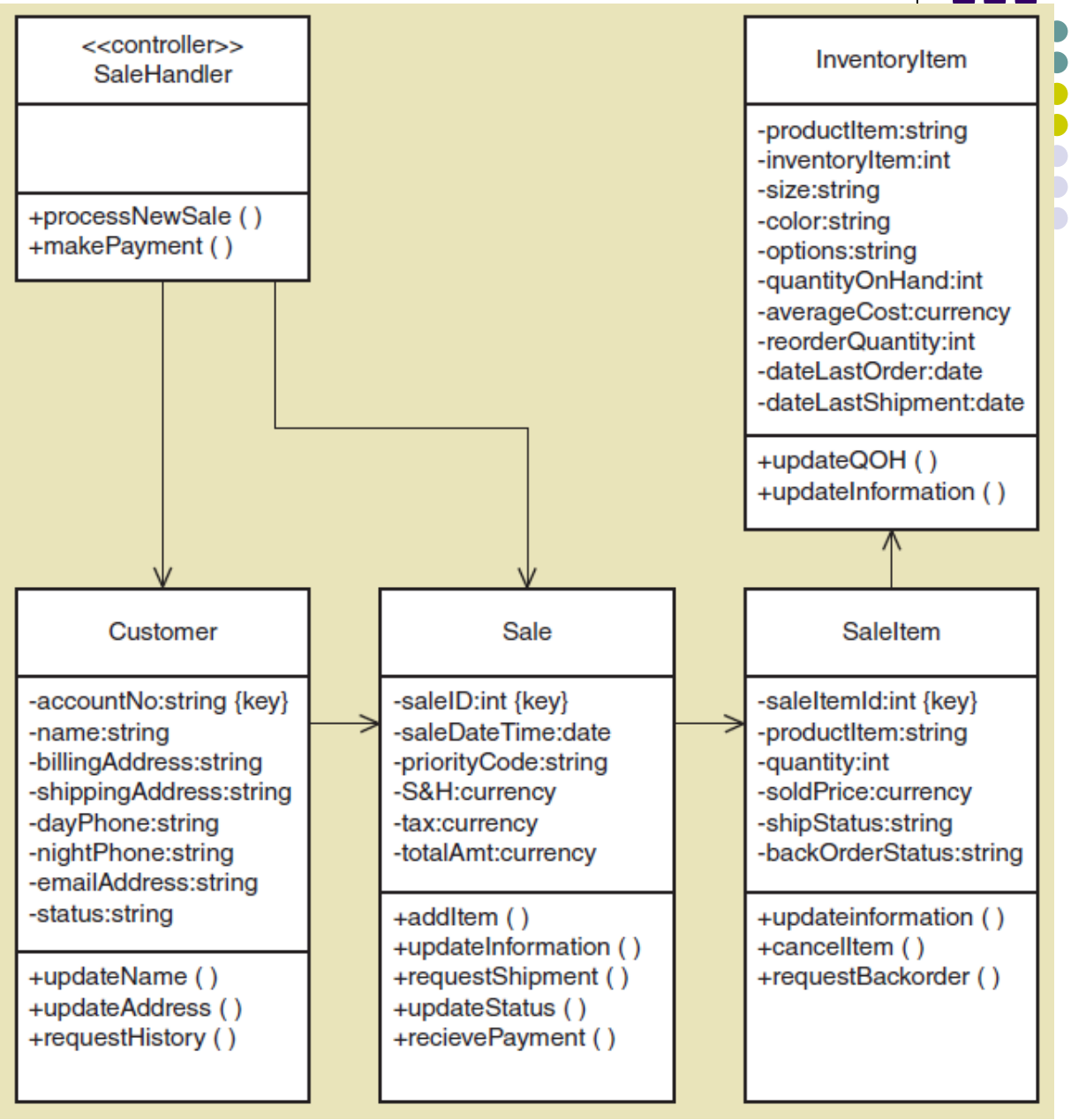
Design Activities:
Design the application architecture and software



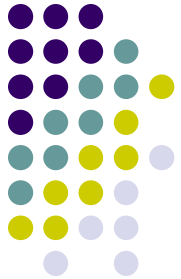
- Partition system into subsystems
- Define software architecture
  - Three layer or model-view-controller
- Detailed design of each use case
  - Design class diagrams
  - Sequence diagrams
  - State machine diagrams

Design Class Diagram

Detail design for two use cases:
Process New Sale
Make payment

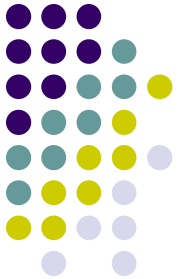


Design Activities:
Design the user interfaces



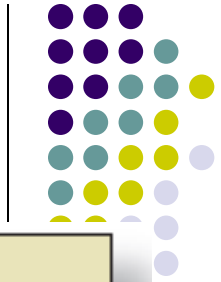
- Dialog design begins with requirements
  - Use case flow of activities
  - System sequenced diagram
- Design adds in screen layout, look and feel, navigation, user experience
- Now we require interface design for many different environment and devices
  - Smart phone
  - Notebooks, tablets, iPads

Design Activities:
Design the system interfaces



- Information system interacts with many other systems, internal and external
  - Much more integration now
- System interfaces connect with other systems in many different ways
  - Save data another system uses
  - Read data another system saved
  - Real time request for information
  - Software services

System to system interface using XML



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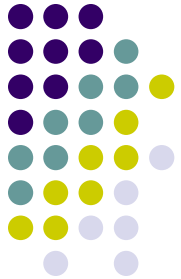
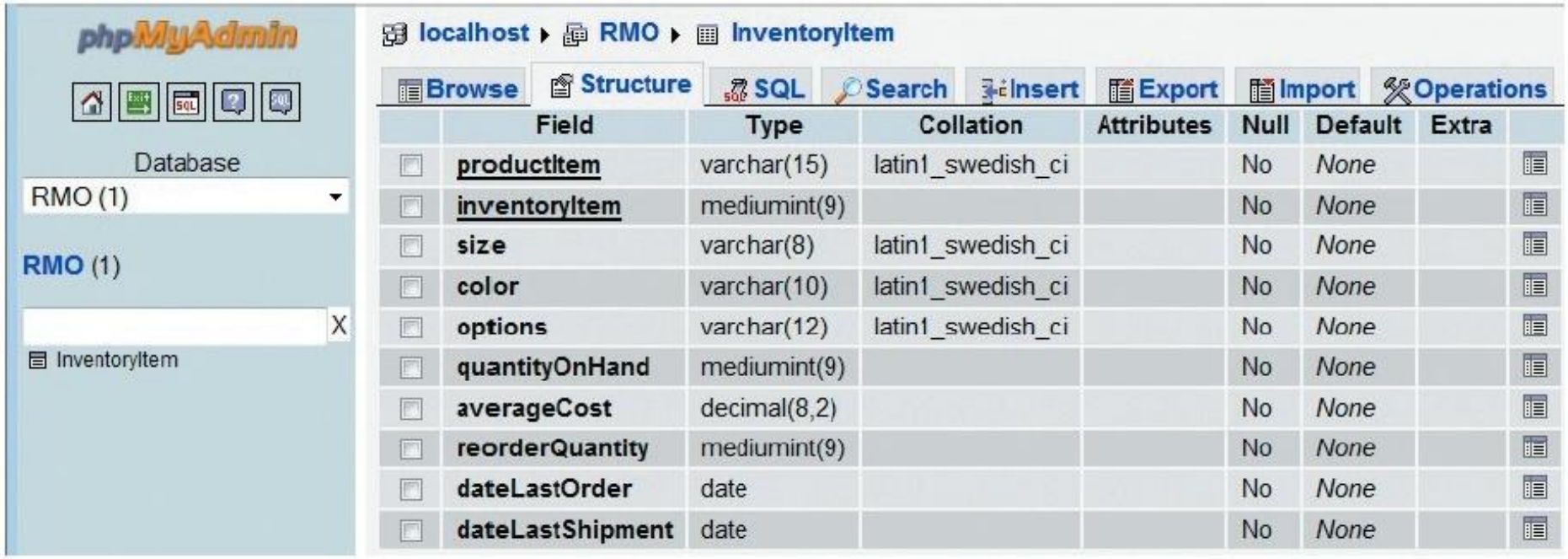
          </dates>
</inventoryRecord>
```

Design Activities:
Design the database



- Starting with the domain model class diagram (or ERD)
- Choose database structure
  - Usually relational database
  - Could be ODBMS framework
- Design architecture (distributed, etc.)
- Design database schema
  - Tables and columns in relational
- Design referential integrity constraints
  - Foreign key references

Database Table Definition
Using mySQL



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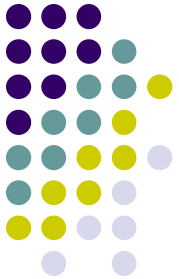
	productItem	varchar(15)	latin1_swedish_ci		No	None		
	inventoryItem	mediumint(9)			No	None		
	size	varchar(8)	latin1_swedish_ci		No	None		
	color	varchar(10)	latin1_swedish_ci		No	None		
	options	varchar(12)	latin1_swedish_ci		No	None		
	quantityOnHand	mediumint(9)			No	None		
	averageCost	decimal(8,2)			No	None		
	reorderQuantity	mediumint(9)			No	None		
	dateLastOrder	date			No	None		
	dateLastShipment	date			No	None		

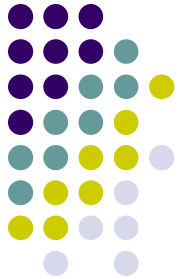
Design Activities:
Design the security and system controls



- Protect the organization's assets
- Becomes crucial in Internet and wireless
- User interface controls
- Application controls
- Database controls
- Network controls

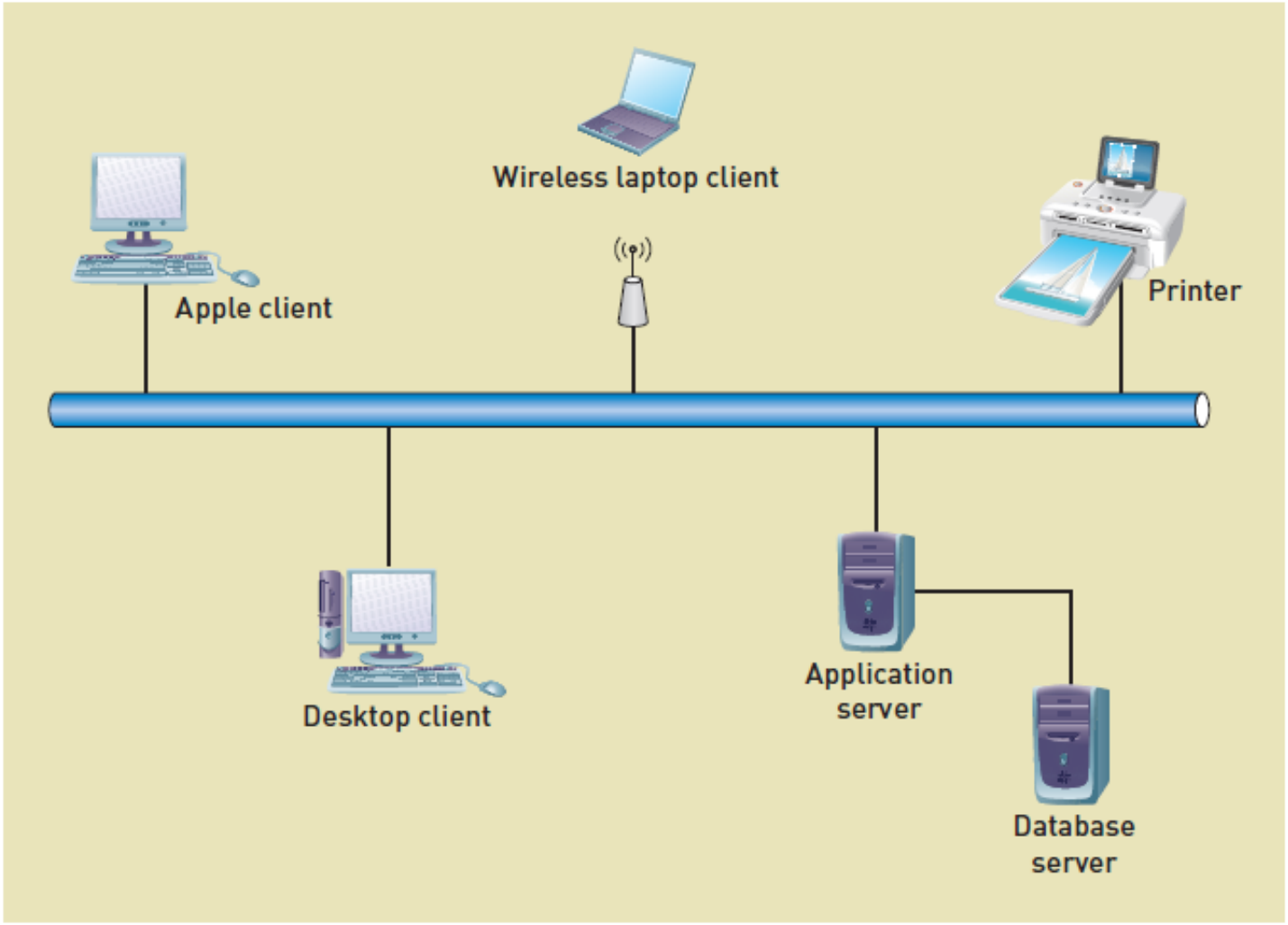
Design the Environment

The design activity now in more detail

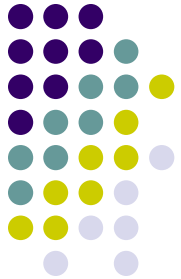


- Design for Internal Deployment
  - Stand alone software systems
    - Run on one device without networking
  - Internal network-based systems
    - Local area network, client-server architecture
    - Desktop applications and browser-based applications
  - Three-layer client server architecture
    - View layer, domain layer, and data layer
    - Desktop and browser based applications

Network Diagram
Internal Network System



Internal Network Terminology



- Local area network
  - a computer network in which the cabling and hardware are confined to a single location
- Client-server architecture
  - a computer network configuration with user's computers and central computers that provide common services
- Client computers
  - the computers at which the users work to perform their computational tasks
- Server computer
  - the central computer that provides services (such as database access) to the client computers over a network

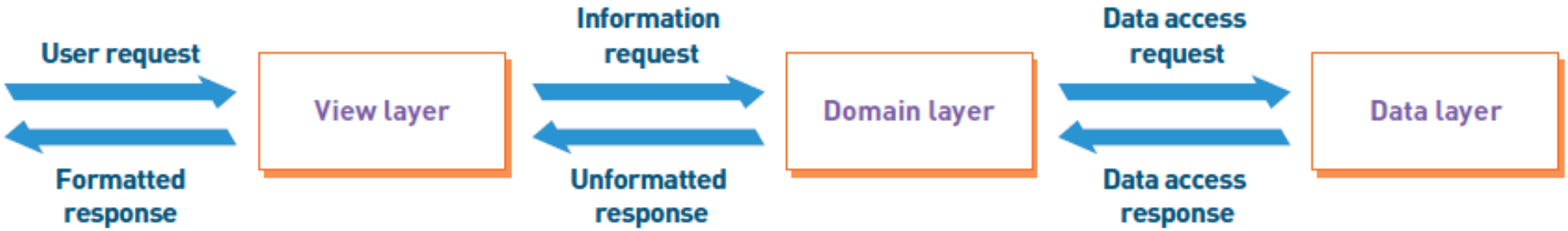
Internal Network Terminology

- Browser-based internal network
  - Hypertext markup language (HTML)
    - the predominant language for constructing Web pages and which consists of tags and rules about how to display pages
  - Transmission Control Protocol/Internet Protocol (TCP/IP)
    - The foundation protocol of the Internet; used to provide reliable delivery of messages between networked computers

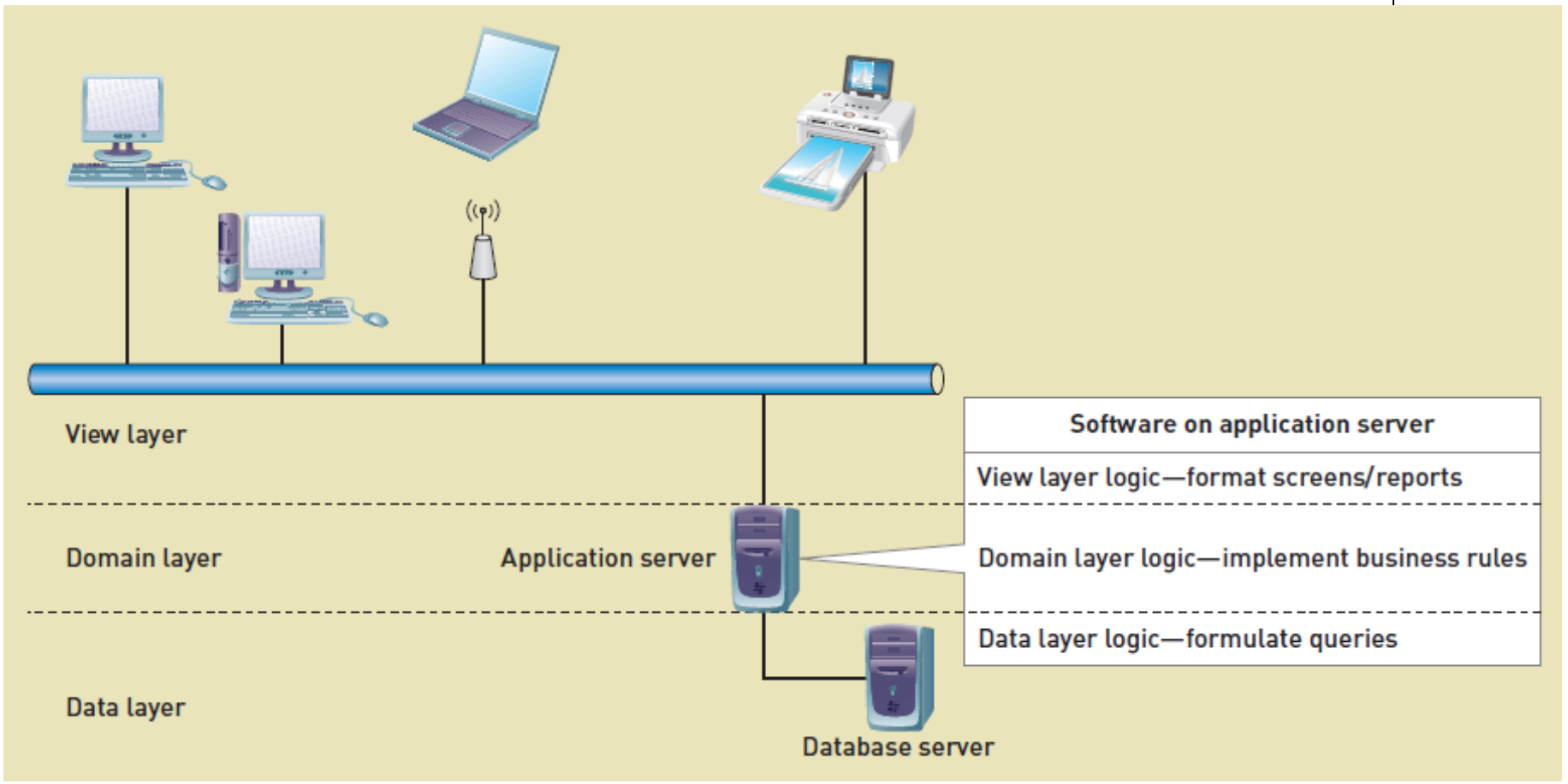
Three Layer Architecture

- Three Layer Client-Server Architecture
  - a client/server architecture that divides an application into view layer, business logic layer, and data layer
- View layer
  - the part of the three-layer architecture that contains the user interface
- Business logic layer or domain layer
  - the part of a three-layer architecture that contains the programs that implement the business rules and processes
- Data layer
  - the part of a three-layer architecture that interacts with the data

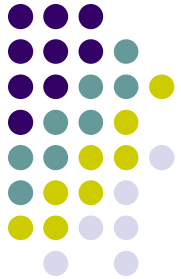
Abstract Three Layer Architecture



Internal Deployment with Three Layer Architecture

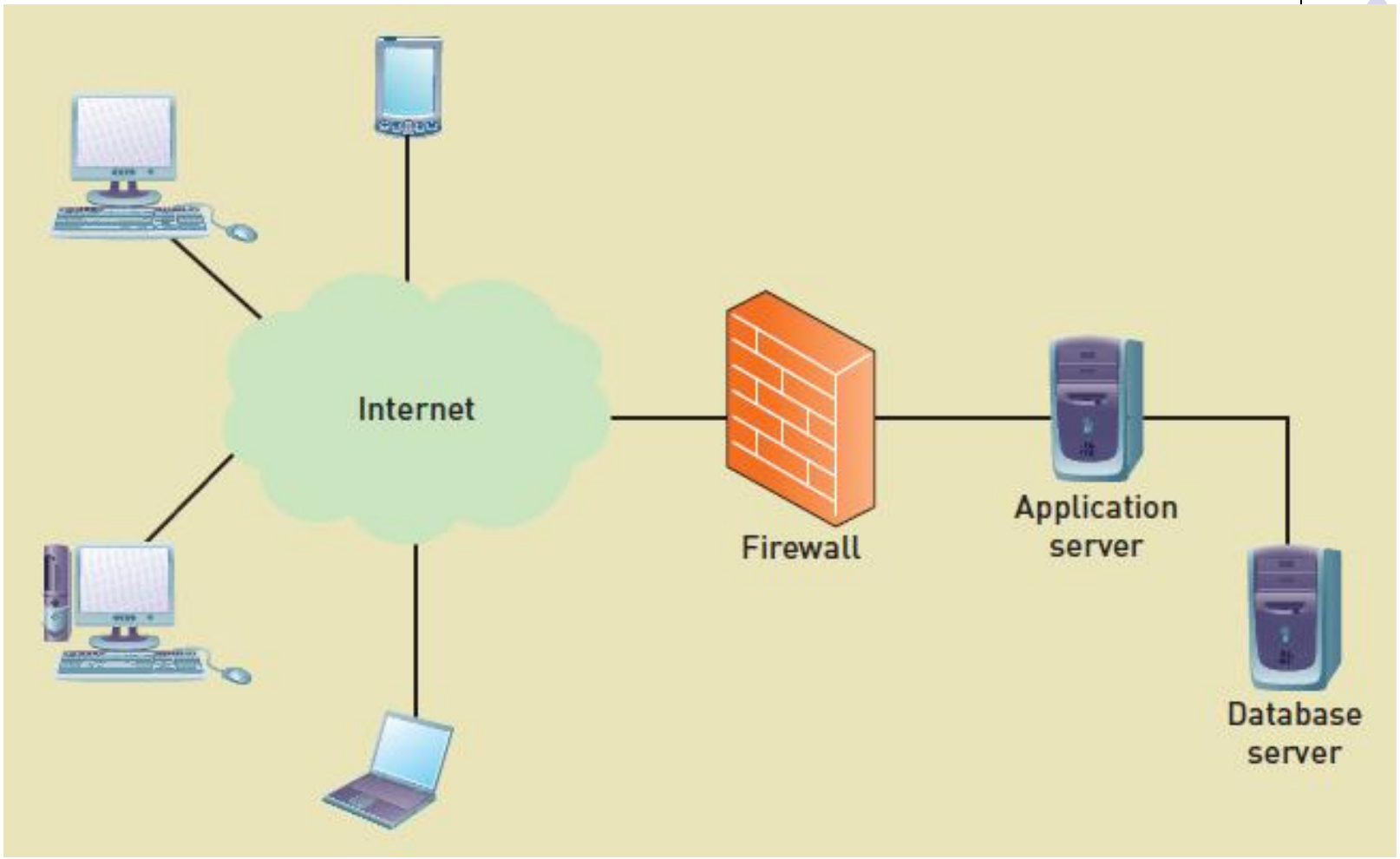


Design the Environment (continued)

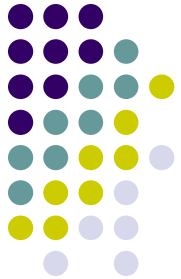


- Design for External Deployment
  - Configuration for Internet deployment
    - Advantages and risks
  - Hosting Alternatives for Internet deployment
    - Colocation
    - Managed services
    - Virtual Servers
    - Cloud computing
  - Diversity of Client Devices with Internet deployment
    - Full size, tablets and notebooks, smart phones

Configuration for Internet Deployment

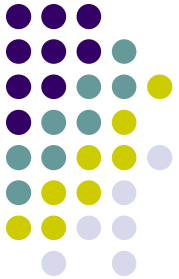


Configuration for Internet Deployment



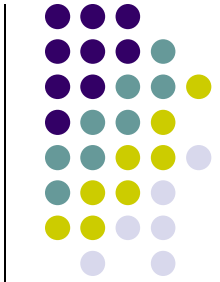
- Advantages
  - **Accessibility**—Web-based applications are accessible to a large number of potential users (including customers, suppliers, and off-site employees).
  - **Low-cost communication—**The high-capacity networks that form the Internet backbone were initially funded primarily by governments. Traffic on the backbone networks travels free of extra charges to the end user. Connections to the Internet can be purchased from a variety of private Internet service providers at relatively low costs.
  - **Widely implemented standards—**Web standards are well known, and many computing professionals are already trained in their use.

Configuration for Internet Deployment



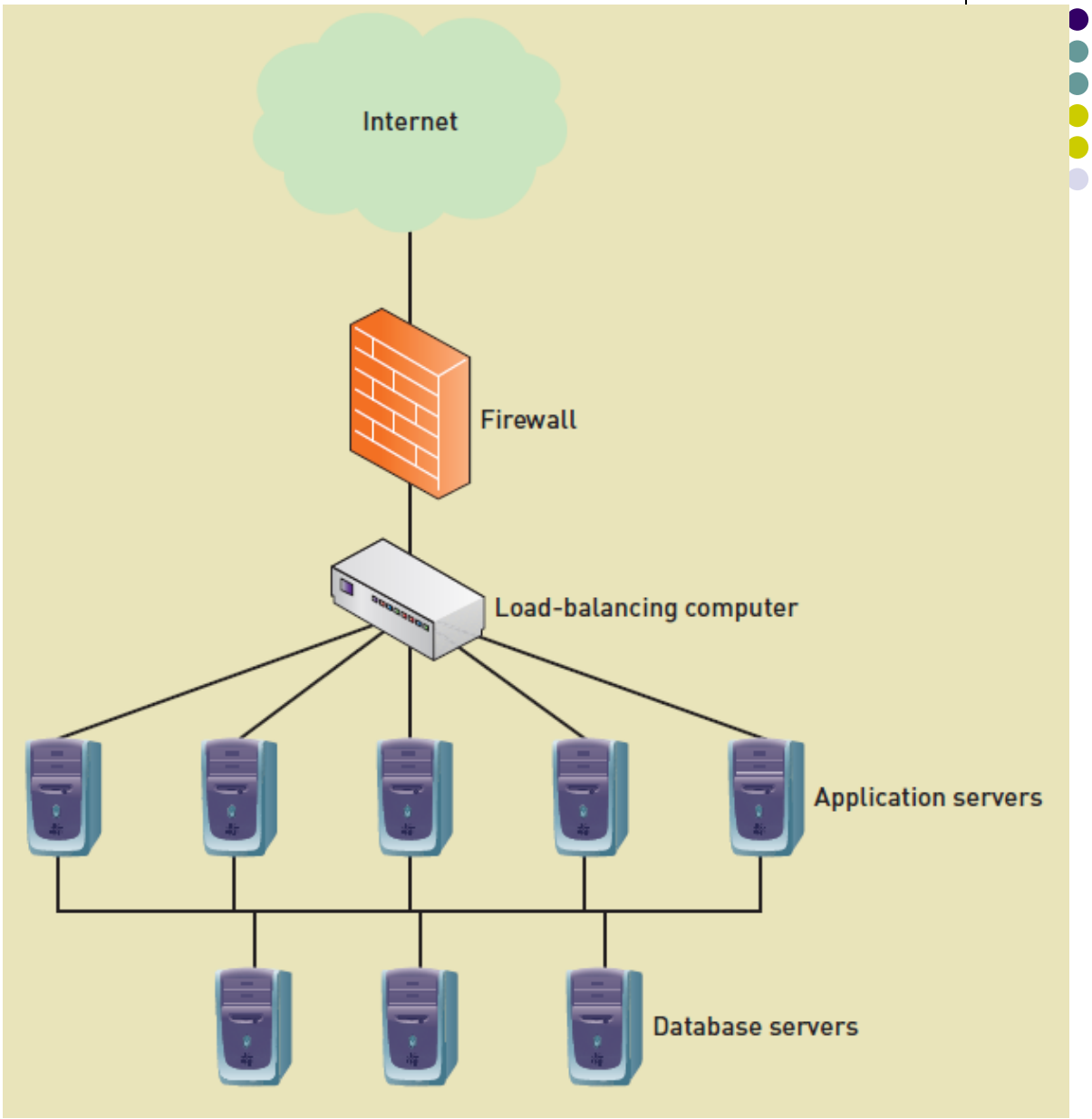
- Potential Problems
  - **Security**—Web servers are a well-defined target for security breaches because Web standards are open and widely known. Wide-scale interconnection of networks and the use of Internet and Web standards make servers accessible to a global pool of hackers.
  - **Throughput**—When high loads occur, throughput and response time can suffer significantly. The configuration must support not only daily average users but also a peak-load number of users.
  - **Changing standards—**Web standards change rapidly. Client software is updated every few months. Developers of widely used applications are faced with a dilemma: Use the latest standards to increase functionality or use older standards to ensure greater compatibility with older user software.

Configuration for Internet Deployment

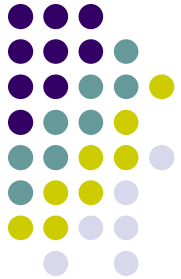


- Security improved by:
  - Hypertext Transfer Protocol Secure (HTTPS)
    - an encrypted form of information transfer on the Internet that combines HTTP and TLS
  - Transport Layer Security (TLS)
    - An advanced version of Secure Sockets Layer (SSL) protocol used to transmit information over the Internet securely

- Performance improved by multiple server configurations

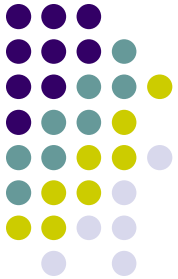


Hosting Alternatives for Internet Deployment



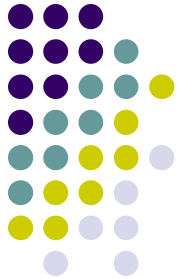
- Hosting:
  - Running and maintaining a computer system on someone's behalf where the application software and the database reside
  - The process of providing physical servers at a secure location and selling those services to other businesses that wish to deploy Web sites
- Issues when considering hosting alternatives
  - Reliability, security, physical facilities, staff, potential for growth

Hosting Alternatives for Internet Deployment (continued)



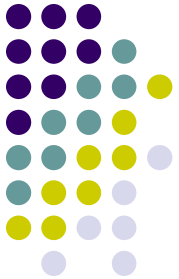
HOSTING OPTIONS				
Service options	**Colocation**	**Managed services**	**Virtual servers**	**Cloud computing**
Hosting service provides building and infrastructure	Yes	Yes	Yes	Yes
Client owns computer	Yes	Perhaps	No	No
Client manages computer configuration	Yes	No	Possible	No
Scalability	Client adds more computers	Client adds more computers	Client buys larger or more virtual servers	Client adds small increments of computing power
Maintenance	Client provides	Host provides	Host provides	Host provides
Backup and recovery	Client provides	Host provides	Available	Available

Hosting Alternatives for Internet Deployment (continued)



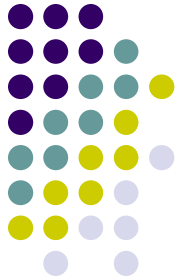
- Colocation
  - a hosting service with a secure location but in which the computers are usually owned by the client businesses
- Managed Services
  - a client owns software but may want to purchase additional services, such as installing and managing the operating system, the Internet servers, database servers, and load balancing software
- Virtual servers
  - the client company leases a virtual server that is configured as a real server, with a certain amount of CPU capacity, internal memory, hard drive memory, and bandwidth to the Internet

Hosting Alternatives for Internet Deployment (continued)



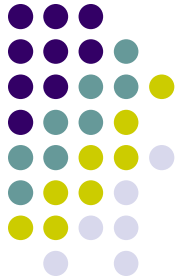
- Cloud Computing
  - an extension of virtual servers in which the resources available include computing, storage, and Internet access and they appear to have unlimited availability
  - a client should be able to buy computing capacity much like one purchases such a utility as water or electricity
  - the client shouldn't have to be concerned with such environmental issues as how or where this computing capacity is provided, just as an individual doesn't have to worry about how electricity is generated
- Service Level Agreement
  - For all alternatives, part of the contract between a business and a hosting company that guarantees a specific level of system availability

Diversity of Client Devices with Internet Deployment



- Full size devices
  - Desktops, laptops, 15-27” high resolution
- Mid level tablet devices
  - Tablets 8-10 inches, landscape or portrait mode, lower resolution, might need specific view layer
- Small mobile computing devices
  - Very small screens, regular web sites hard to read, really need specific view layer for mobile web viewing

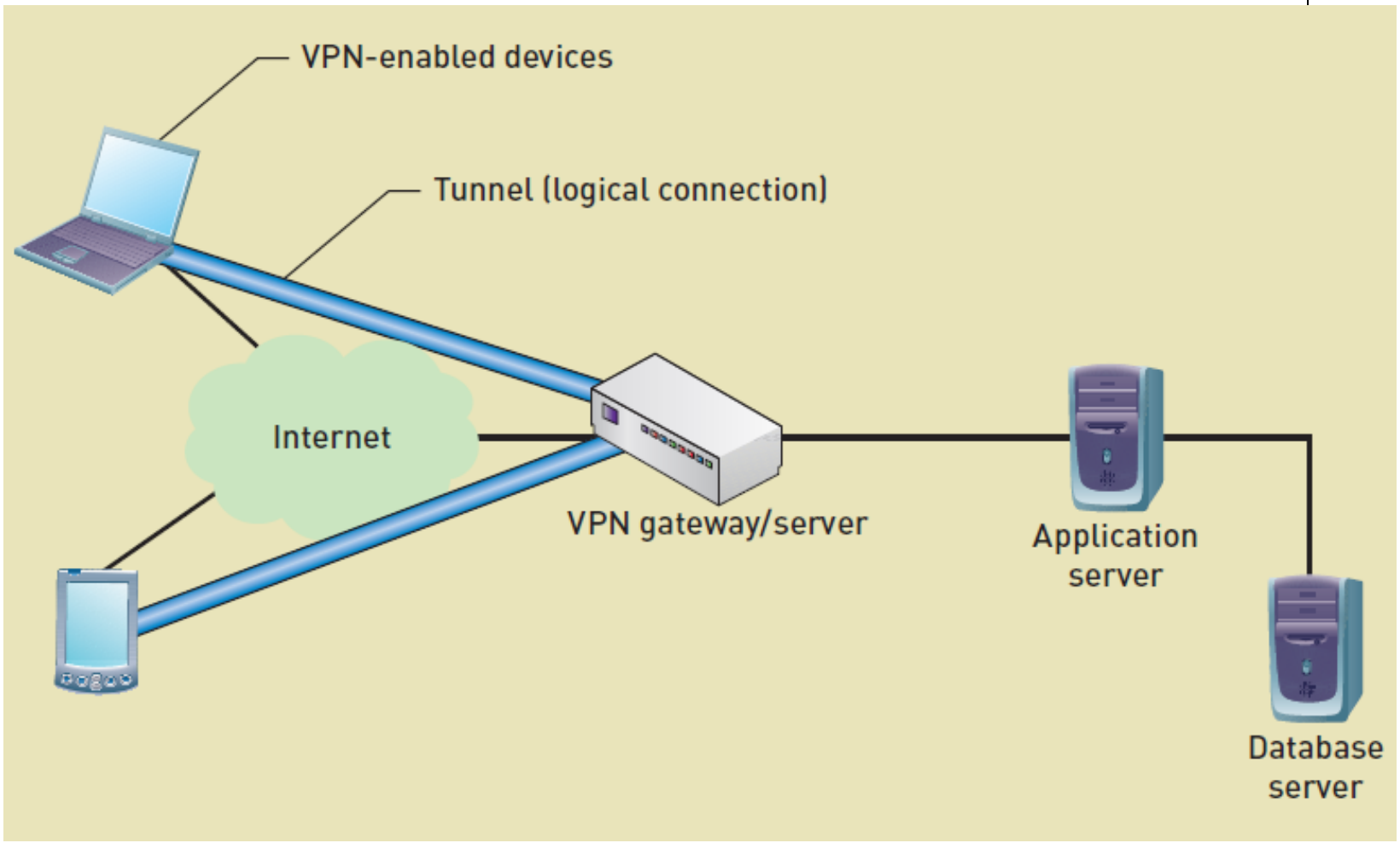
Design for Remote, Distributed Environment



- Two interfaces to same Web app for internal vs. external access
  - Back end, Front end UI to same Web app
  - Not as secure

- Virtual private network (VPN)
  - Closed network with security and closed access built on top of a public network (Internet)

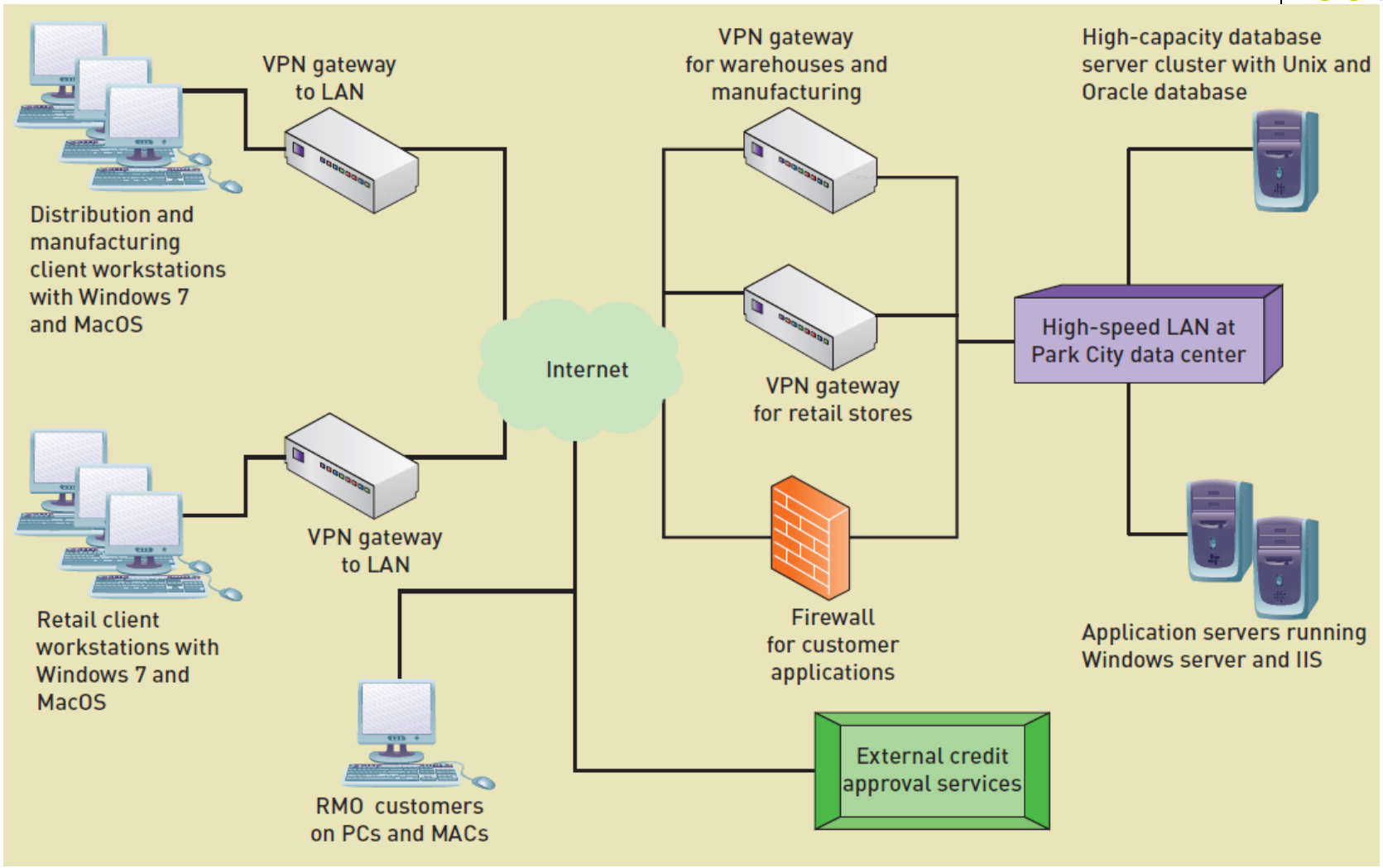
Virtual Private Network (VPN)



RMO Technology Architecture:

Lots of locations: Need carefully designed remote access

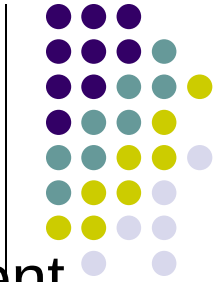
RMO's Current Technology Architecture



Summary

- This chapter discussed system design, the six design activities, and designing the environment.
- System design is he bridge between requirements and implementation—a blue print for what needs to be built.
- Design occurs at two levels: architectural design and detail design.
- Models of the functional requirements (domain model class diagrams, use case diagrams, system sequence diagrams, use case descriptions, state machine diagrams, and activities diagrams) are used as the basis for creating design models.

Summary (continued)



- There are six design activities: design the environment, design the application architecture and software, design user interfaces, design system interfaces, design the database, and design system controls and security.
- The first activity, Design the environment, is covered in detail. This includes designing for internal deployment and design for external deployment.
- Important issues are three layer architecture, deploying using the Internet, and hosting alternatives.
- Hosting alternatives include colocation, managed services, virtual servers, and cloud computing.