SEVENTH EDITION

Systems Analysis AND Design

IN A CHANGING WORLD

Chapter 7

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Defining the System Architecture

Chapter 7

Systems Analysis and Design in a Changing World 7th Ed
Satzinger, Jackson & Burd

Chapter 7: Outline

- Anatomy of a Modern Information System
- Architectural Concepts
- Interoperability
- Architectural Diagrams
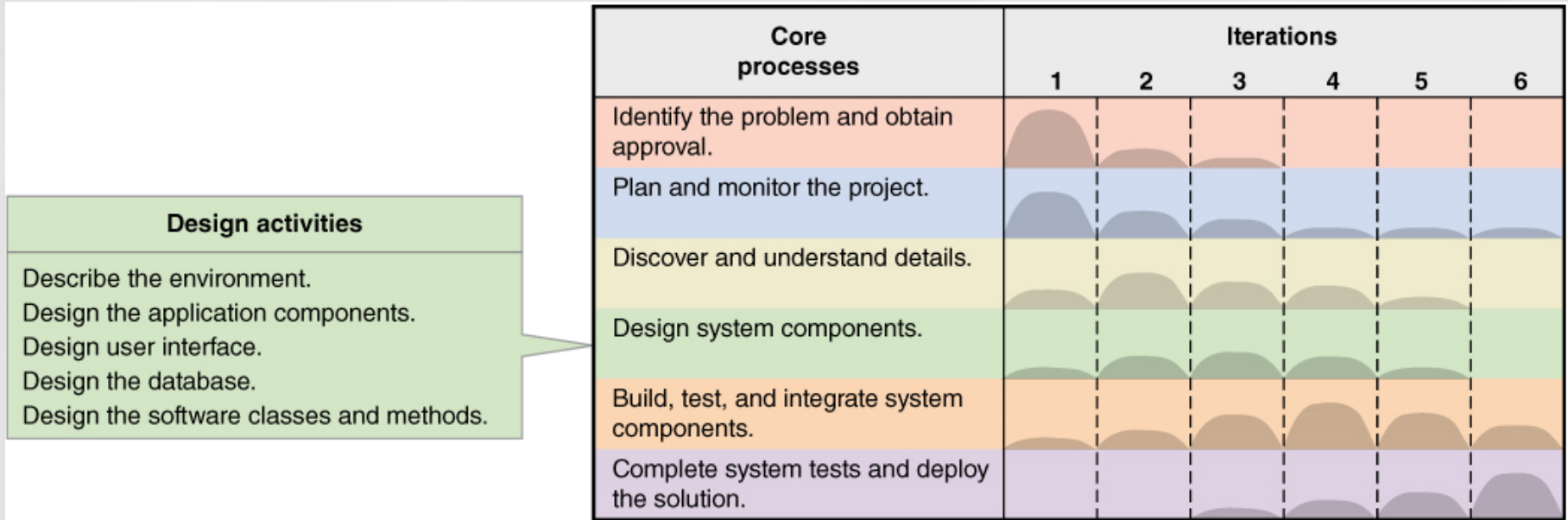- Describing the Environment
- Designing Application Components

Learning Objectives

- Explain architectural concepts that influence system design, including ubiquitous computing and software, components, protocols, interoperability, and distributed architectures

- Describe and draw location, network, and deployment diagrams

- Describe a system's environment by drawing architectural diagrams and answering key questions

- Design larger application components based on use cases and other analysis models

Overview

- An important part of new system development is choosing appropriate technologies

- Explain and provide a summary of technology and architectural concepts

- describe the details for the activity – *Describe the Environment*

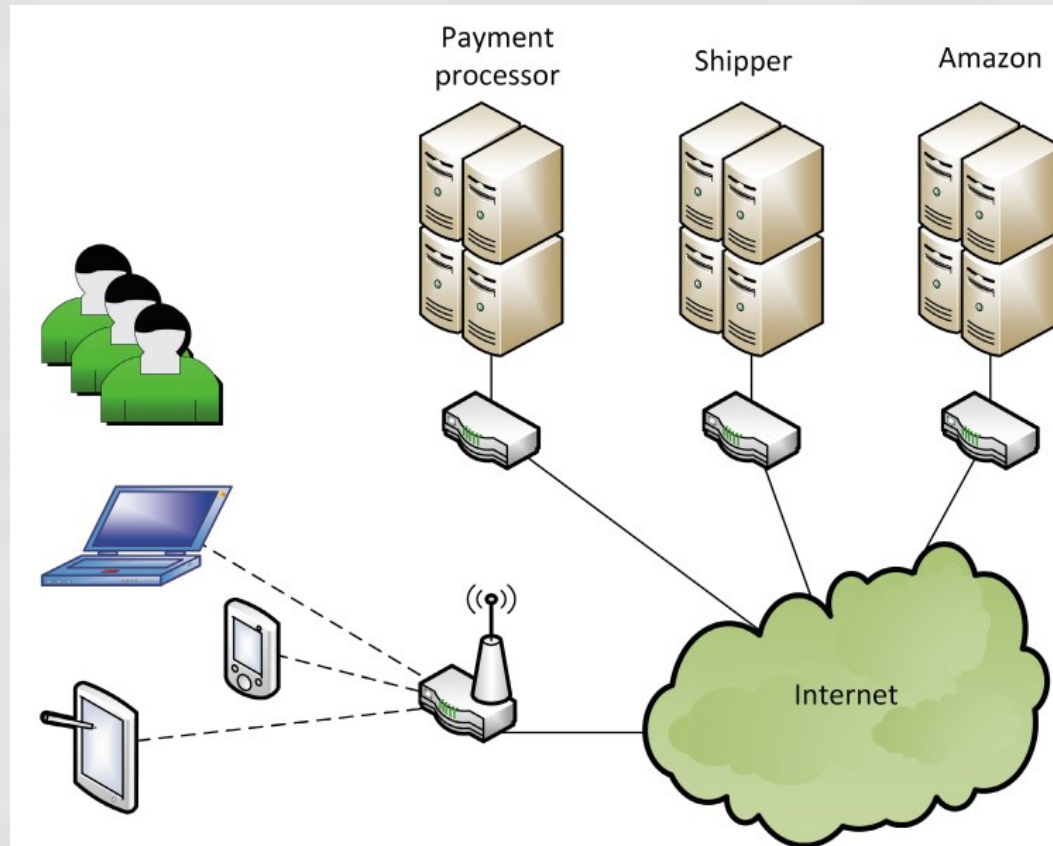- Describe the details for the activity – *Design the application components*

Activities of "Design System Components"

Design activities

Describe the environment.
Design the application components.
Design user interface.
Design the database.
Design the software classes and methods.

Core processes	Iterations					
	1	2	3	4	5	6
Identify the problem and obtain approval.						
Plan and monitor the project.						
Discover and understand details.						
Design system components.						
Build, test, and integrate system components.						
Complete system tests and deploy the solution.						

Anatomy of a Modern System – Computing Devices

- Server – manages shared resources and enables users and other computers access to these resources

- Personal computing devices or clients
    - Desktops, laptops, tablets, smartphones...

Simplified architecture for application (Amazon.com)

Server Farm –

- Very large databases and very high use

Anatomy - Networks

- Computer network – hardware, software, transmission media

- Internet backbone –
  - High-capacity with high-bandwidth trunk lines and large high-speed computers
  - Owned by governments and telecom companies

- Local area network (LAN) –
  - Small network for a single site
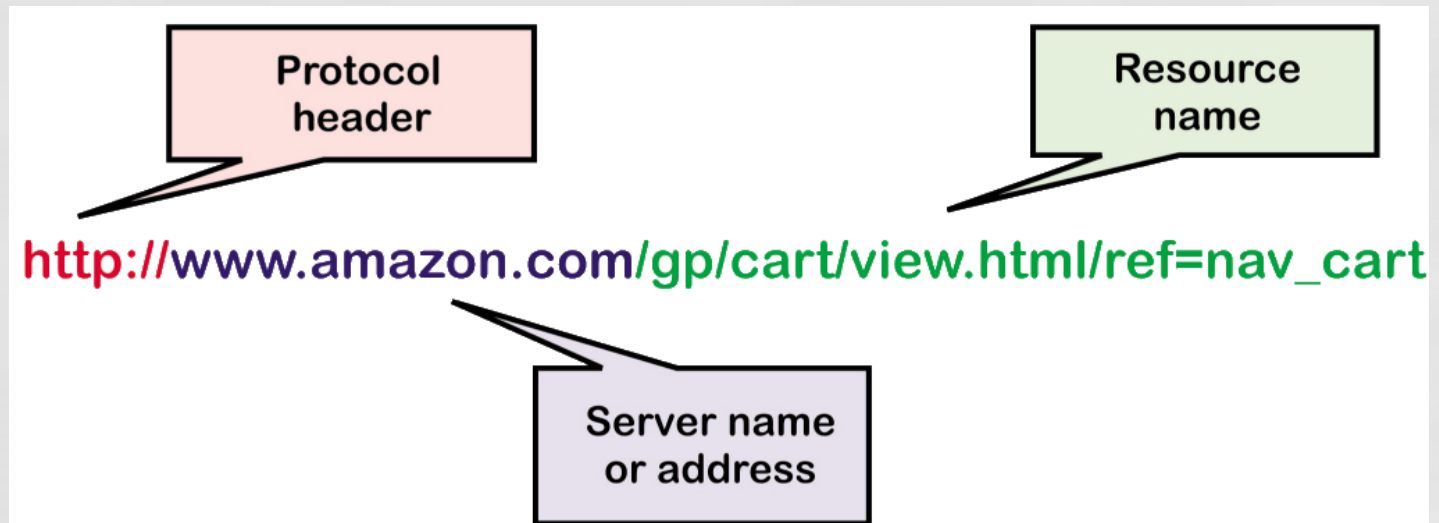
- World Wide Web (WWW)
  - All the interconnected resources accessed through the Internet

Anatomy - Networks

- Uniform Resource Locator (URL)
  - The identifier for the Web to locate a particular resource
- Hyperlink –
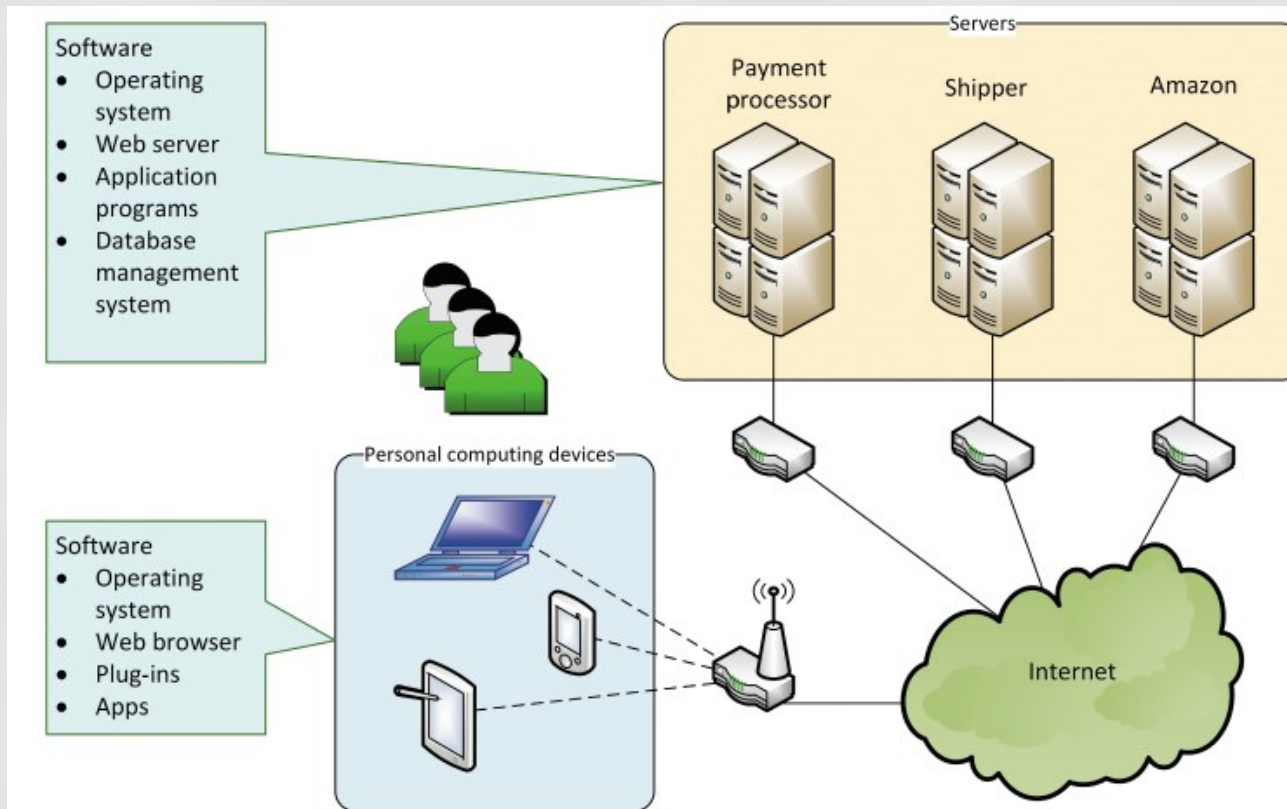 - The URL of a resource embedded within another resource

Anatomy – Software

- Application software – programs that perform work for users
  - Either a custom app or a Web-based application
- App –
  - A custom program usually for a laptop or smartphone
- System Software –
  - Behind the scene software, works as glue to hold everything together

Anatomy – Software

Anatomy – Software

- Web-Based Applications
    - Uses a web browser
    - Accessed through a URL
    - Resides on a Web server
    - Uses standard IP protocols
- Embedded Software
    - Software apps or functions embedded within another app, such as within a browser or O/S
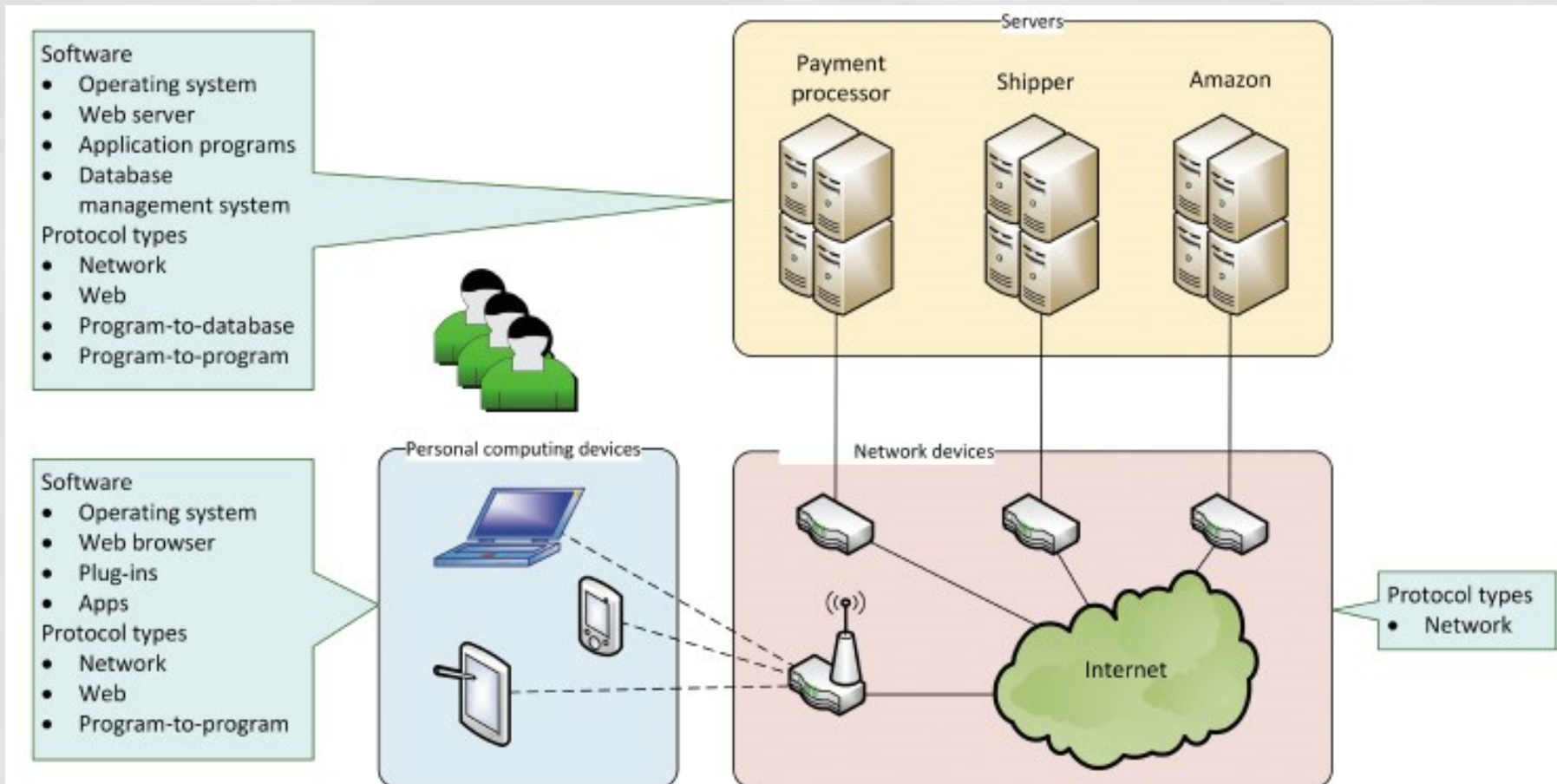   - Toolbars, Plug-ins, Widgets

Anatomy – Protocols

- Protocol
  - A set of languages and rules to ensure communication and data exchange between hardware and software
- Network protocols
  - Virtual Private Network (VPN)
    - Creates a private network but on the Internet by using secure technologies and encryption

Anatomy – Software and Protocols

Anatomy – Web Protocols

- HTML (hypertext markup language)
    - Protocol for the structure and content of a Web page
- XML (extensible markup language)
    - An extensions of HTML that enables defining semantics of tags
- HTTP (hypertext transfer protocol)
    - Defines format and content for transfer of Web documents
- HTTPS (hypertext transfer protocol secure)
    - Encrypted and secure http transfers

Architectural Concepts

- Technology architecture
  - Computers, network computers and hardware, and system software
- Application architecture
  - The software programs and their configuration

Software as a Service (SaaS)

- SaaS
  - No software is installed on the user's device
  - Application services is accessed remotely
  - User data is isolated and stored on common servers
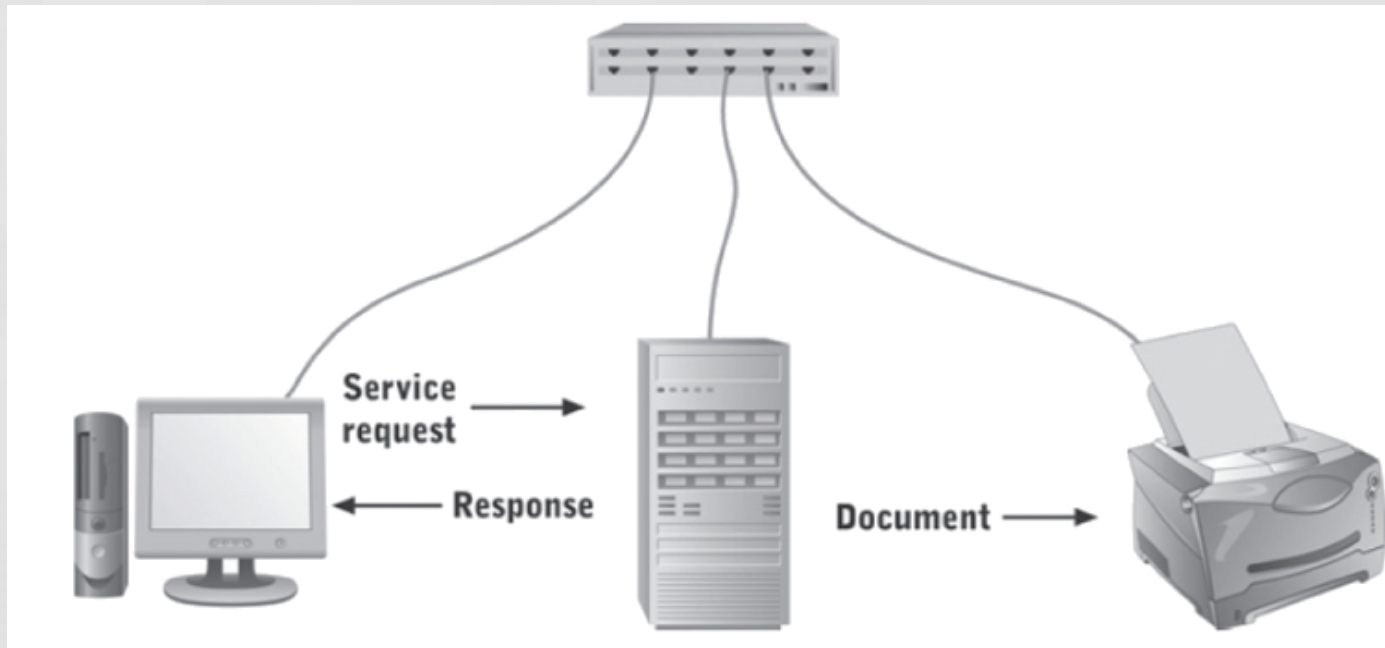
Web Services

- Web service
  - Software function that is executed with Web standards
    - Access via a URL
    - Inputs sent via the URL
    - Executes remotely
    - Data returned within a Web page

Distributed Architectures
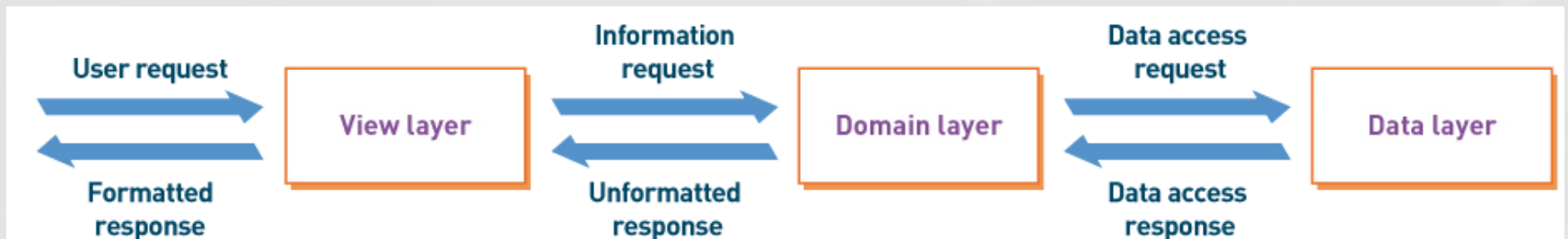
- Client/Server architecture
  - Software design with part of the application on a server and part on the client
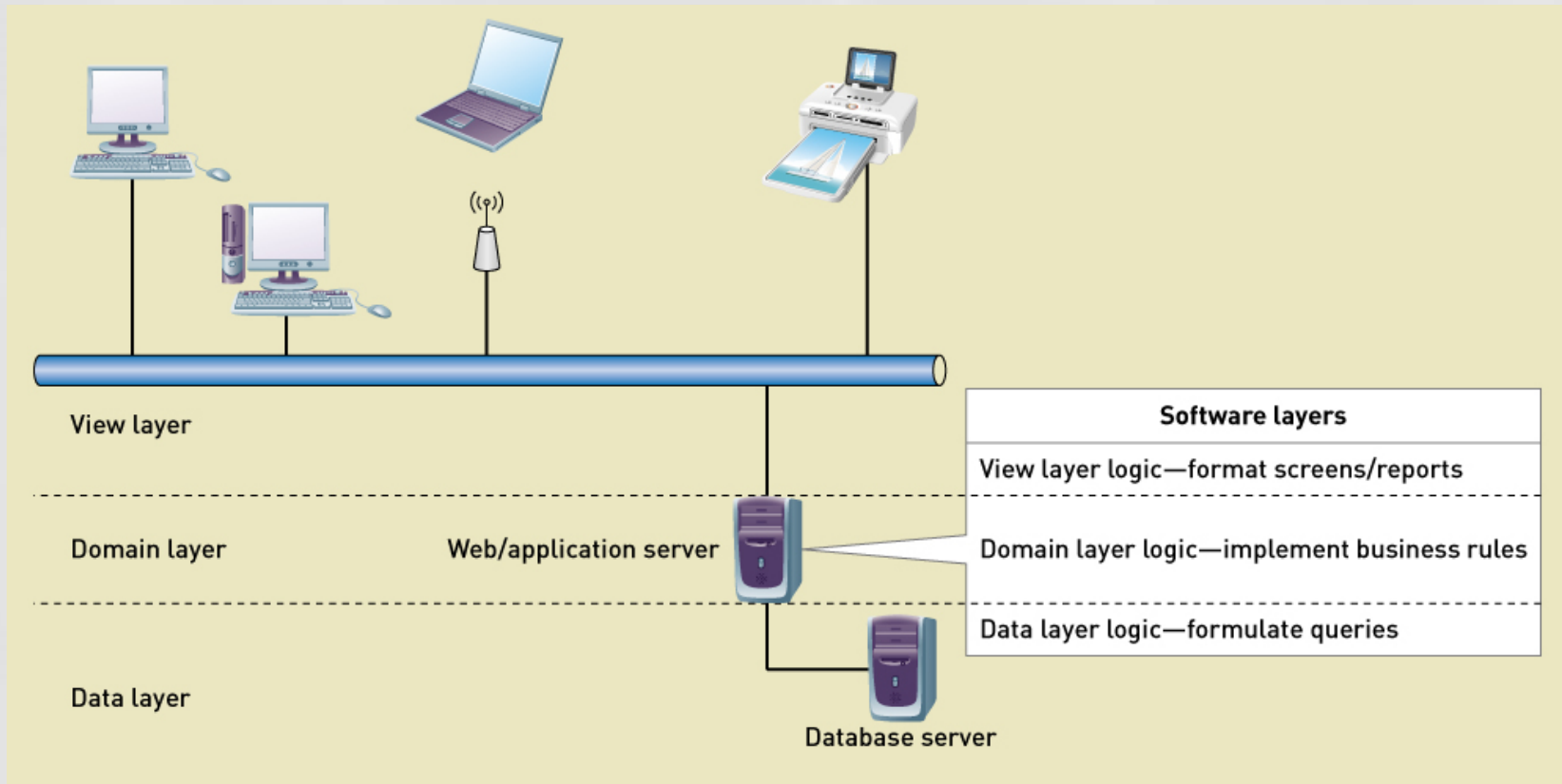
Distributed Architecture

- Three-Layer architecture
  - Client/server architecture with application divided into view layer, logic layer, and data layer
  - View layer – the user interface
  - logic layer – program logic to implement the functions
  - data layer – the functions to access the data

Three Layer Architecture

Software layers

Software layers
View layer logic—format screens/reports
Domain layer logic—implement business rules
Data layer logic—formulate queries

View layer

Domain layer — Web/application server

Data layer — Database server

Interoperability

- Interoperability
  - The ability of an application to interact with other software
- Important characteristic in current development projects
  - Understand the environment
  - Reuse software existing components (purchased or in-house)
  - Build components considering interoperability
  - Combine all components into a solution system
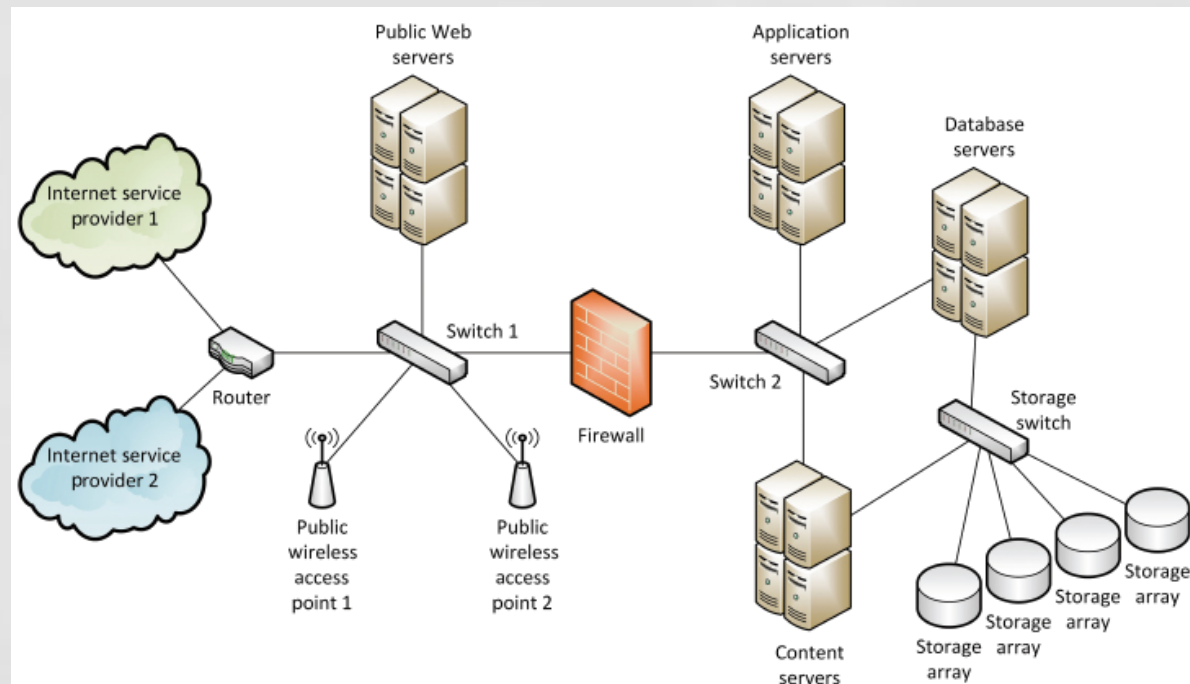
Diagrams for System Architectures

- Location Diagrams
  - Identify geographical placement of hardware, software, and users
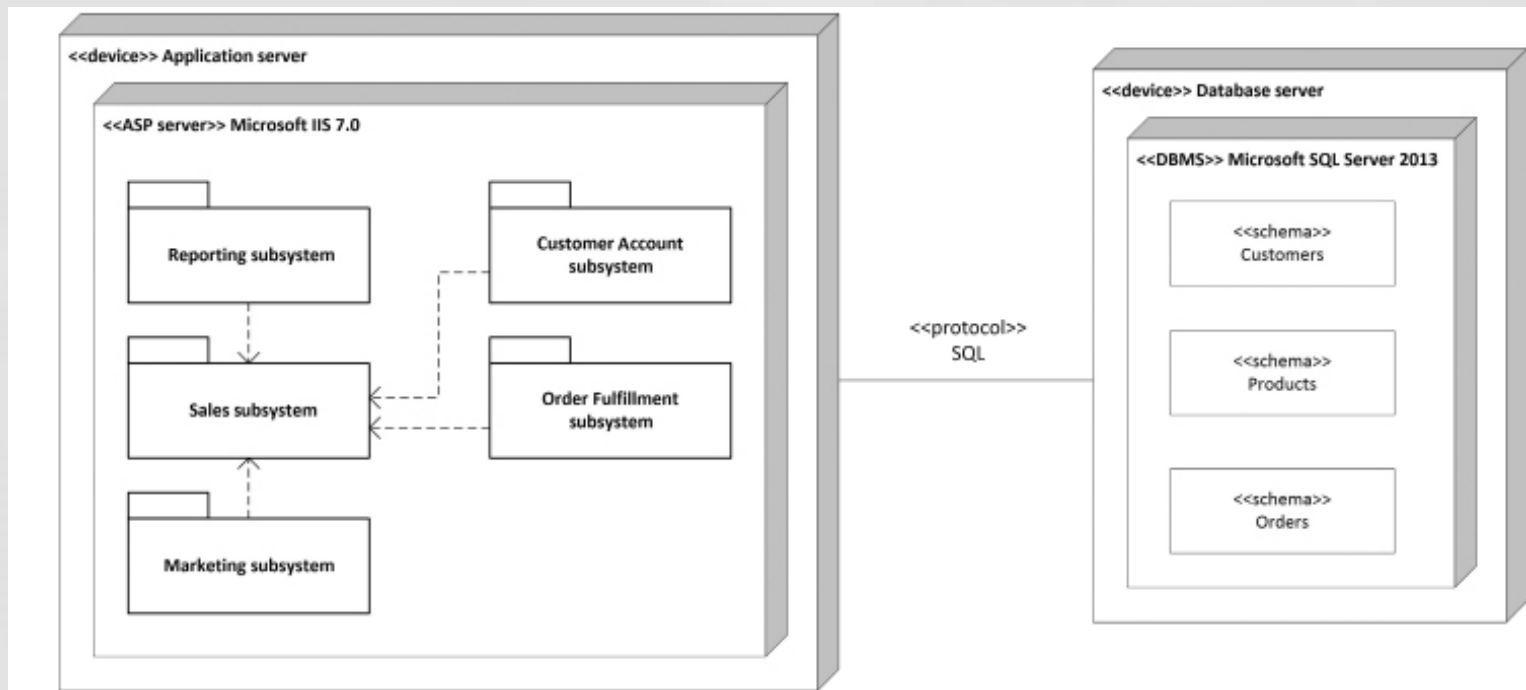
Diagrams for System Architecture

Network Diagrams

- How the application software is deployed across the hardware and system software

Diagrams for System Architecture

- Deployment Diagrams
  - How the components of a network are interconnected
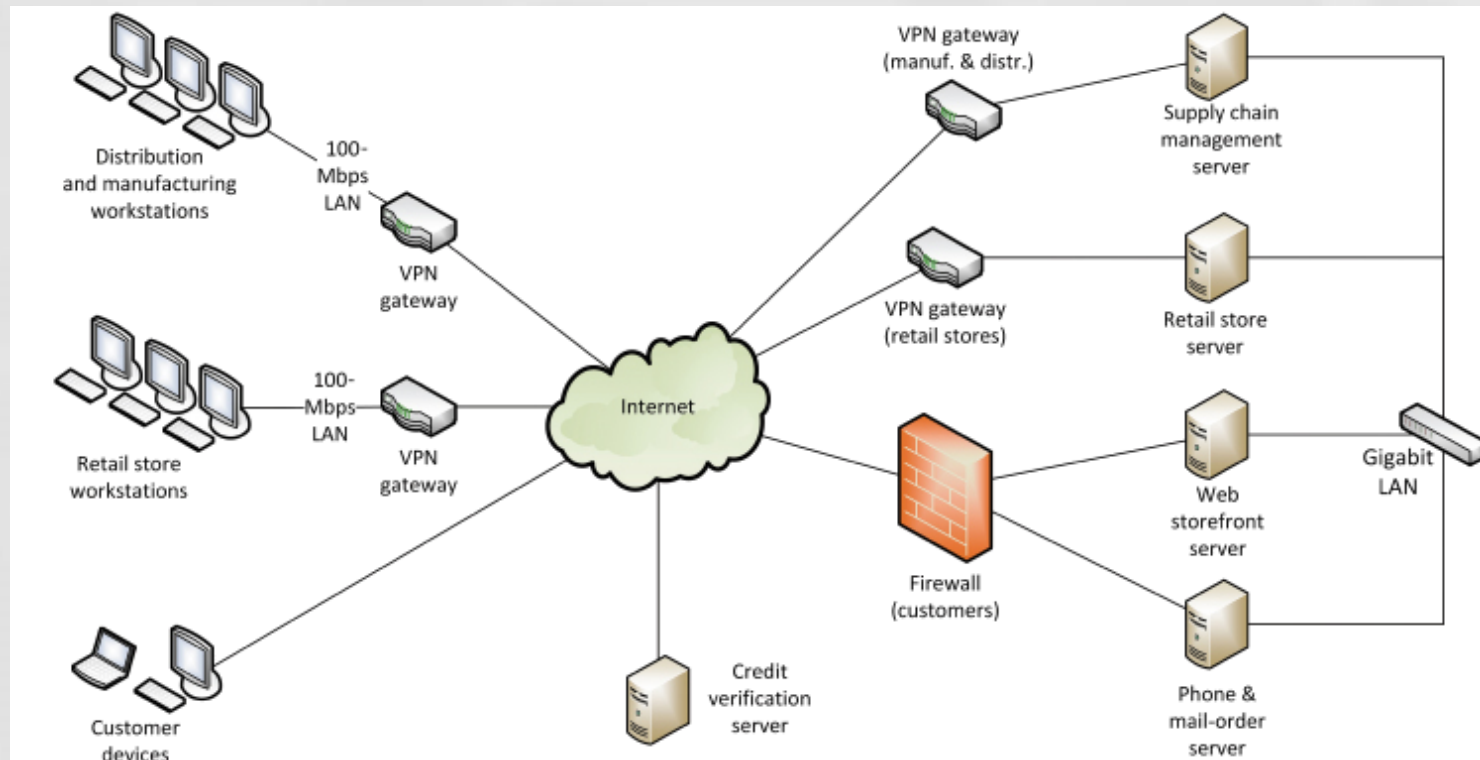
Describing the Environment (1 of 2)

- Key Questions to help describe accurately
  - What are the key features of existing or new environment
    - O/S, system software, networks, tools
  - What are the external systems or DBMSs
    - What kind of interaction
    - What is the data
    - What are the protocols
    - What kind of security

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Describing the Environment (2 of 2)

- Key Questions to help describe accurately
  - What devices will be required
    - Protocols for devices
    - Security
    - What APIs
  - What user-interface technology will be used
    - Where and who are users, and what skills
    - What hardware and devices
    - What client O/S will be used
    - Security requirements
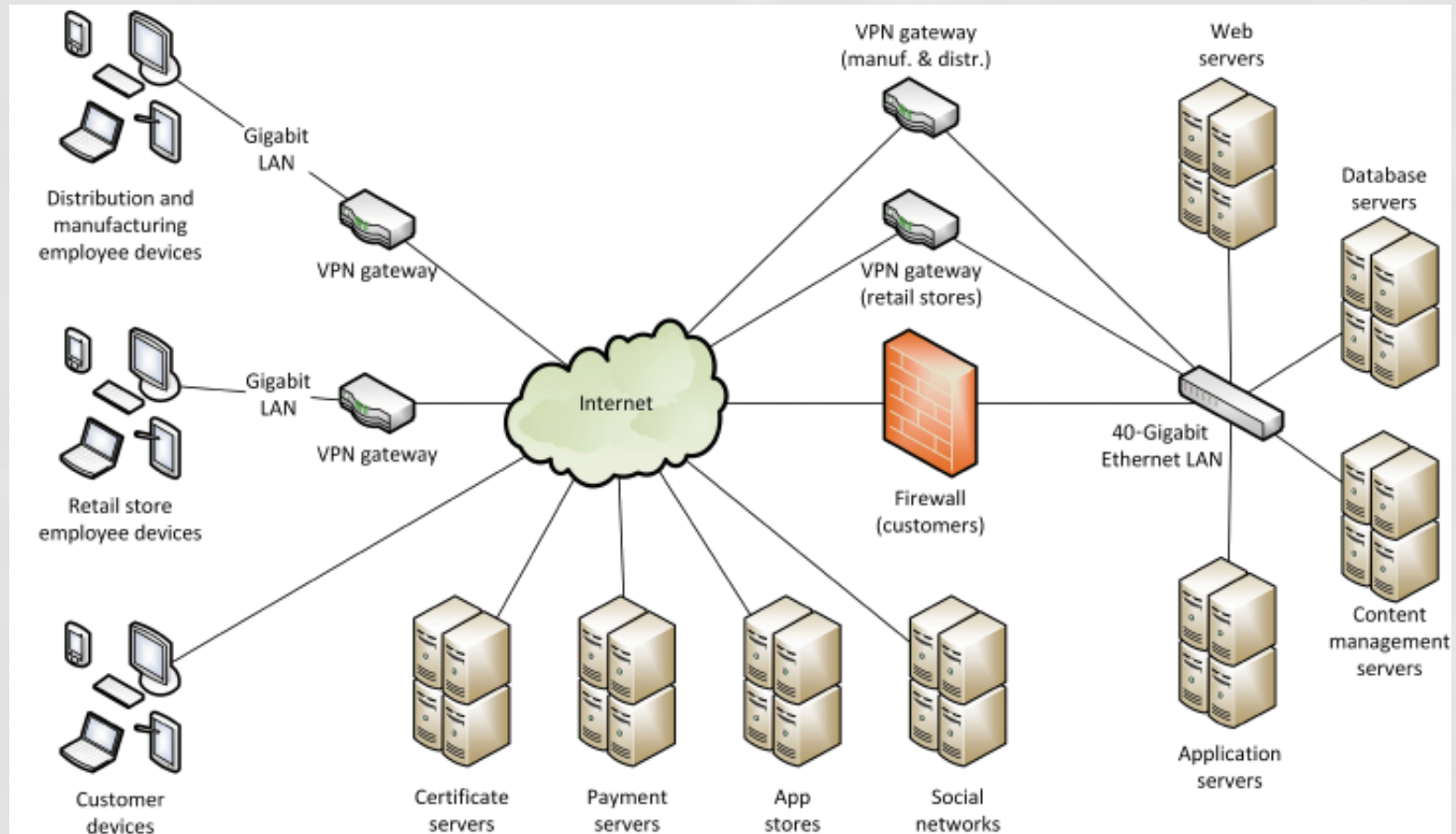   - What APIs are needed

RMO Environment - Existing

 Current environment prior to new development

RMO Environment – Proposed

- More mobile devices and apps
- Web application software and content
- Social networking applications
- Security issues
- External hosting of portions

RMO Environment – Proposed

Designing Application Components

- Application Component Boundaries
  - Which components perform which functions
  - How to group functions to build components
    - Actors – what functions to particular actors use
    - Shared data – what functions use the same data
    - Events – what functions occur in common business events

RMO CSMS Application Architecture

⚫ Grouping by customer actor – part 1

Use case	User/actor	Domain class(es)	Event(s)	Group
Create phone sale	Phone sales representative	ProductItem, InventoryItem, saleItem, Sale, SaleTrans	Customer request while shopping by phone	A
Create store sale	Store sales representative	ProductItem, InventoryItem, saleItem, Sale, SaleTrans	Customer request while shopping in store	B
Create/update customer account	Customer, phone or store sales representative	Customer, Account, Address	Customer request or sale to a new customer	C
Look up order status	Shipping, customer, management, phone or store sales representative	ProductItem, InventoryItem, SaleItem, Sale, SaleTrans, Shipment, ReturnItem	Customer, representative, shipping, or management request	C
Track shipment	Shipping, customer, management, phone or store sales representative	Shipment, Shipper, SaleItem	Customer, representative, shipping, or management request	C
Create item return	Customer, phone or store sales representative	SaleItem, ReturnItem	Customer requests return	C
Search for item	Customer, phone or store sales representative	ProductItem	Customer request while shopping online, by phone, or in store	C
View product comments and ratings	Customer, phone or store sales representative	ProductItem, ProductComment	Customer request while shopping online, by phone, or in store	C
View accessory combinations	Customer, phone or store sales representative	ProductItem, AccessoryPackage	Customer request while shopping online, by phone, or in store	C

⬤ Grouping by customer actor – part 2

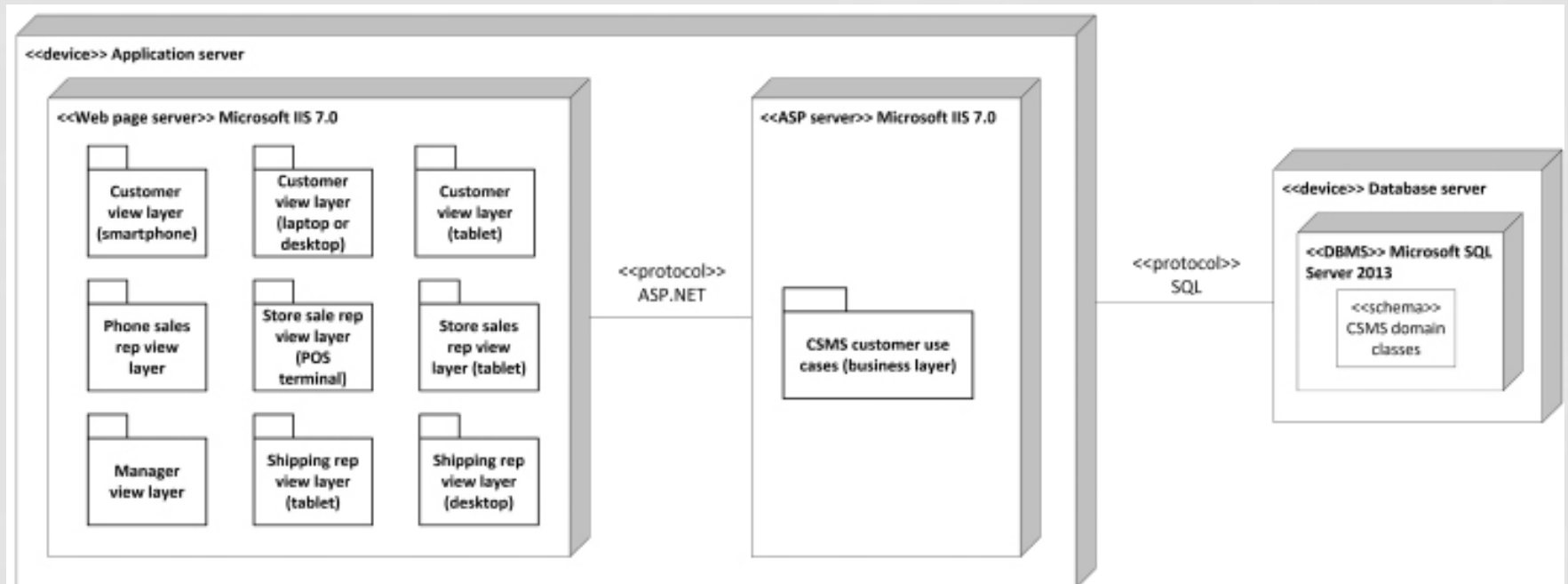| Use case	User/actor	Domain class(es)	Event(s)	Group
Fill shopping cart	Customer	ProductItem, InventoryItem, CartItem, OnlineCart	Customer request usually after sale completed	D
Empty shopping cart	Customer	ProductItem, InventoryItem, CartItem, OnlineCart	Customer request while shopping online	D
Check out shopping cart	Customer	ProductItem, InventoryItem, CartItem, OnlineCart, saleItem, Sale, SaleTrans	Customer request while shopping online	D
Fill reserve cart	Customer	ProductItem, InventoryItem, CartItem, OnlineCart	Customer request while shopping online	D
Empty reserve cart	Customer	ProductItem, InventoryItem, CartItem, OnlineCart	Customer request while shopping online	D
Convert reserve cart	Customer	ProductItem, InventoryItem, CartItem, OnlineCart	Customer request while shopping online	D

RMO CSMS Application Architecture

🔵 Grouping by customer actor – part 2

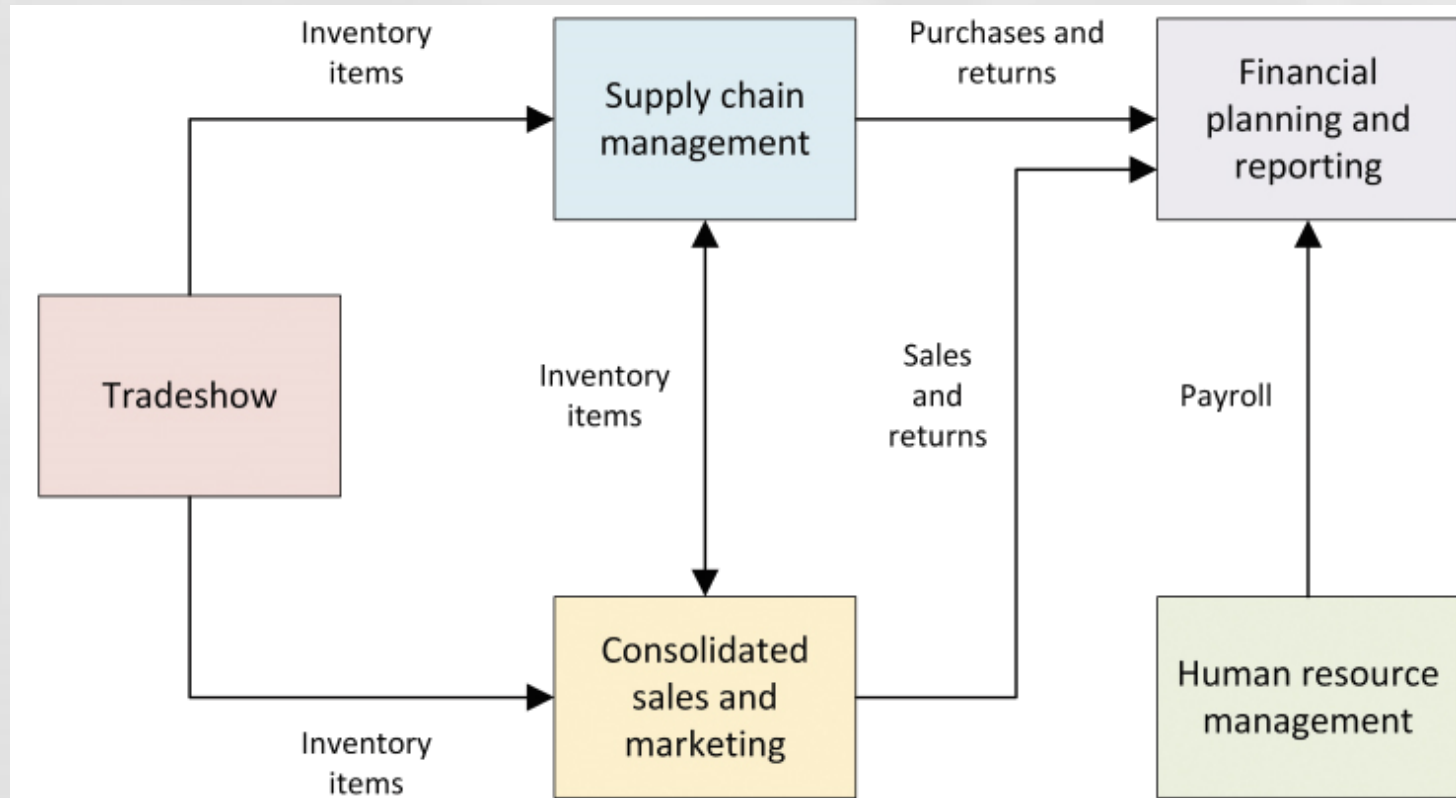| Use case	User/actor	Domain class(es)	Event(s)	Group
Rate and comment on product	Customer	Customer, ProductComment, ProductItem	Customer request usually after sale completed	E
Provide suggestion	Customer	Customer, Suggestion	Customer request while shopping online	E
Send message	Customer	Customer, Message	Customer request while shopping online	E
Browse messages	Customer	Customer, Message	Customer request while shopping online	E
Request friend linkup	Customer	Customer, FriendLink	Customer request while shopping online	E
Reply to linkup request	Customer	Customer, FriendLink	Customer request while shopping online	E
Send/receive partner credits	Customer	Customer, CustPartnerCredit, PromoPartner	Customer request while shopping online	E
View "mountain bucks"	Customer	Customer, Sale	Customer request while shopping online	E
Transfer "mountain bucks"	Customer	Customer, Sale	Customer request while shopping online	E

RMO CSMS Deployment Diagram

- Three-layer design with user components grouped by user functions

RMO CSMS Component Integration
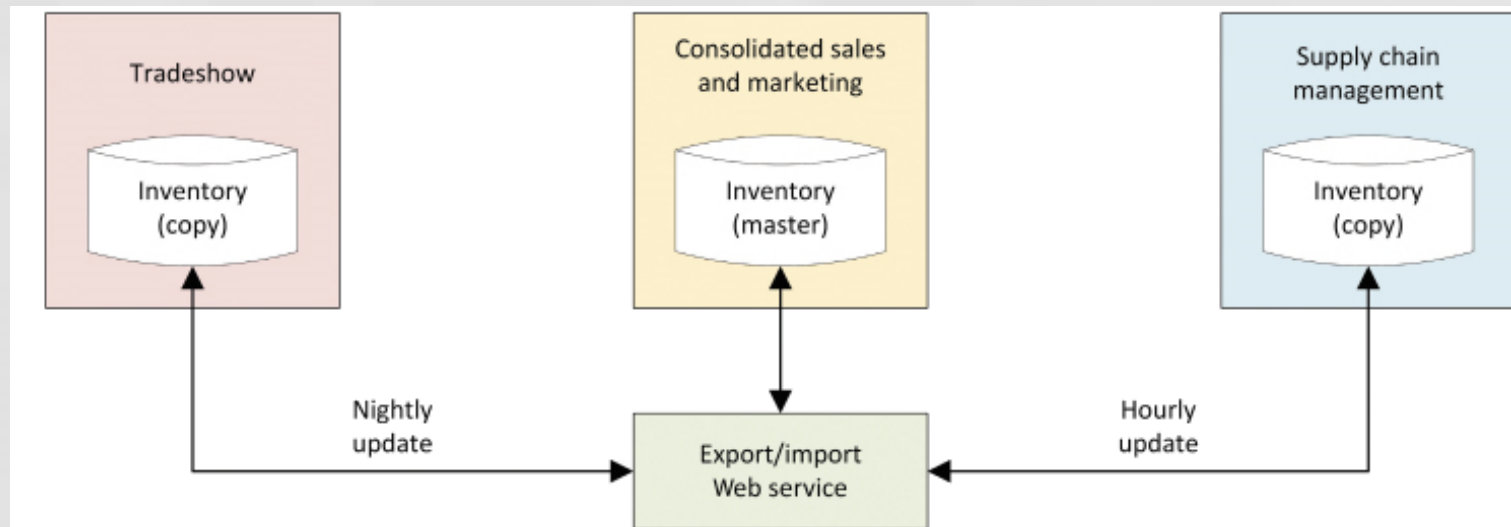
🔵 Subsystem integration and data flows

RMO CSMS Data Ownership

- Who "owns" the data
  - System of record
    - What system is responsible to maintain the data
    - What system has a copy or can access the data

Summary

- Anatomy of a Modern Information System
  - Consist of computing devices, networks, software, and protocols
  - Deployed as stand-alone software, network based, Web based
- Architectural Concepts
  - SaaS – software as a service
  - Web services
  - Distributed architectures
    - Client/server and three-layer architecture

Summary

- Interoperability
  - Getting all the components to work together
- Architectural diagrams
  - Location diagrams
  - Network diagrams
  - Deployment diagrams

Summary

- Describing the Environment
  - External systems
  - Technology architecture
  - Key questions requiring answers
- Designing Application Components
  - Application component boundaries
  - Grouping functions into components
  - System of record – who owns the data