Chapter 6
Essentials of Design and the Design Activities

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Topics

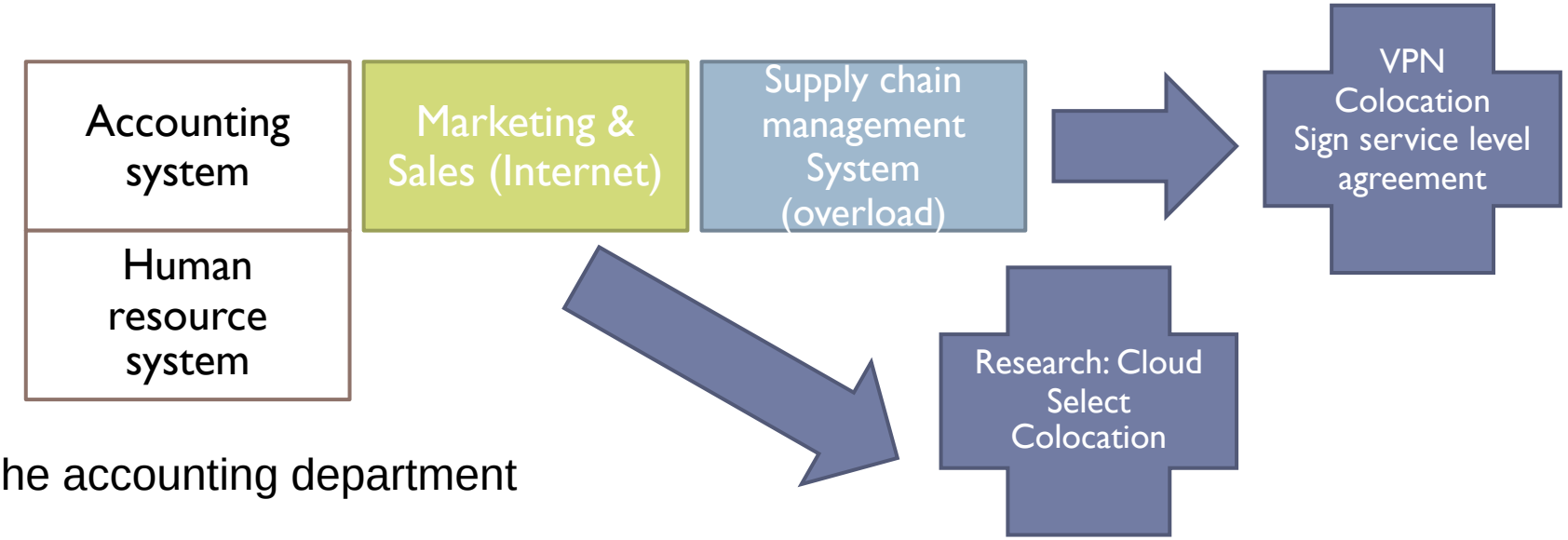
- The element of design
- Input and Output for system design
- Design activities
- Design the environment

Objective

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

6.0 Company case study: Technology Decisions

- Jame Schultz
  - Vice president and chief information officer
  - Supplier electronic components
  - The infrastructure was a hodgepodge of disjointed computer and networks

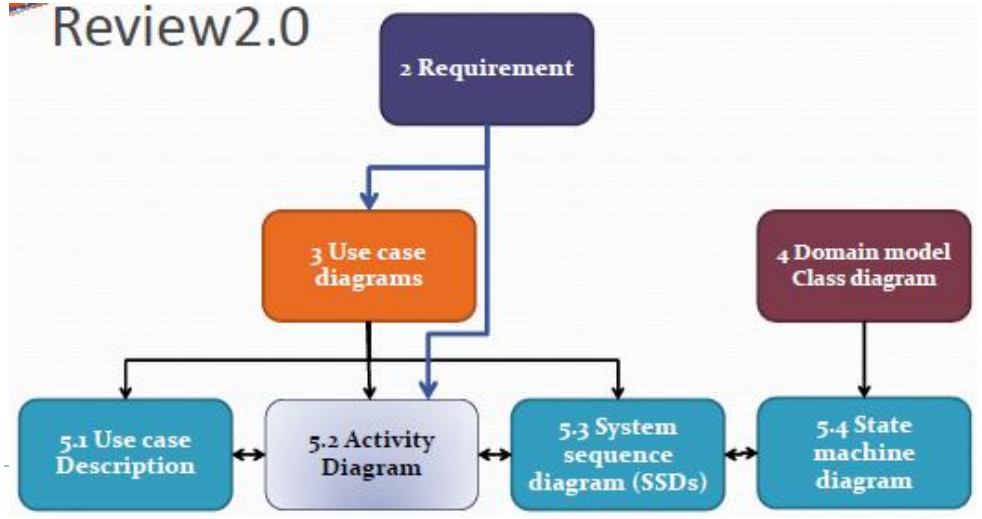


The accounting department

6.1 The element of design

- The analysis activities is focus on "*understanding **what** the system should do*"

- The design is focus on "*solution **how** the system will be build*"



6.1 The element of design

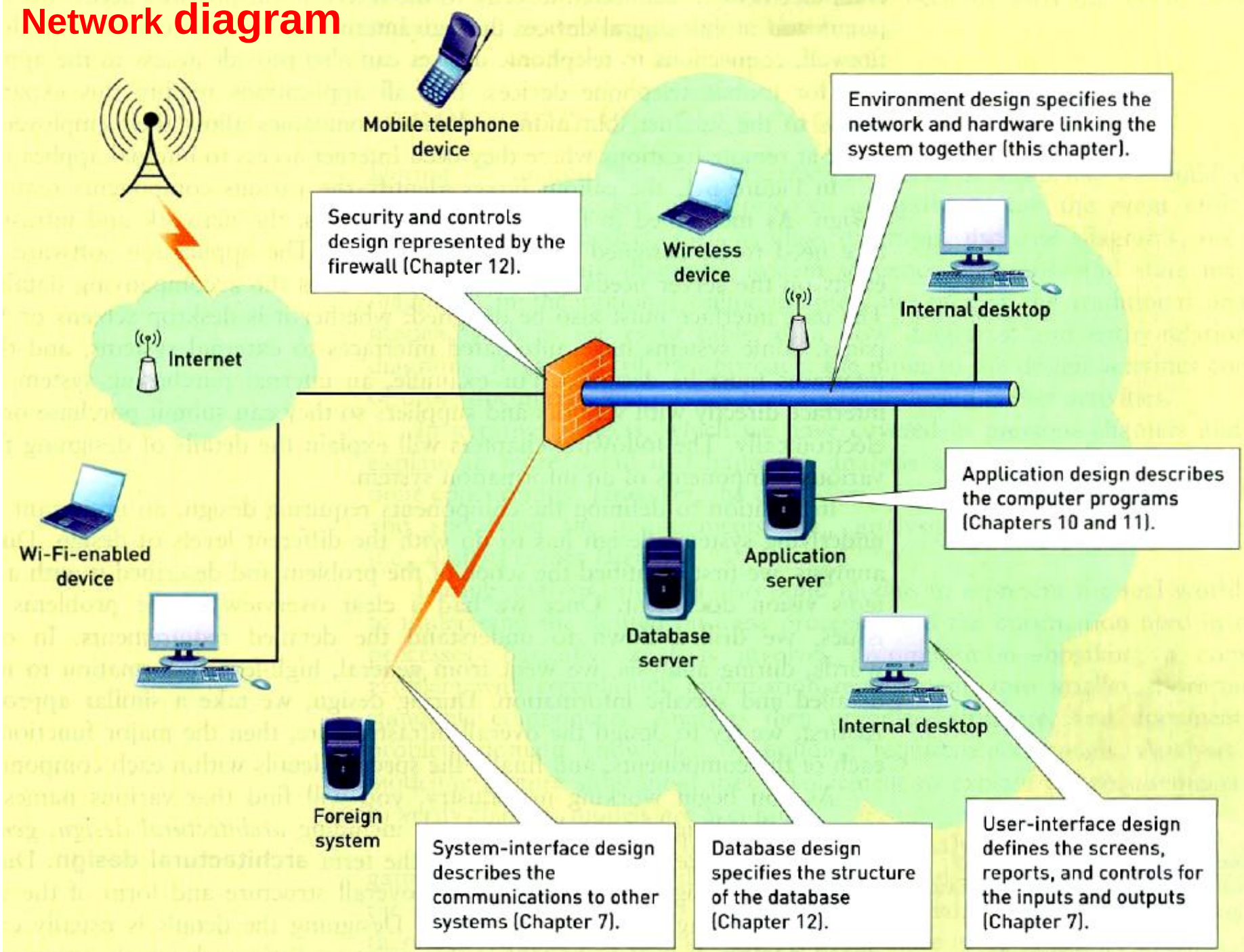
- Major components and Level of design
  - Information system today
    - Web-based system.
    - Connect to Internet or Intranet
    - Stand-alone, offline application, WinApp
      - Registration via internet
      - Update via internet
    - Database
    - Web services

Difference levels of design

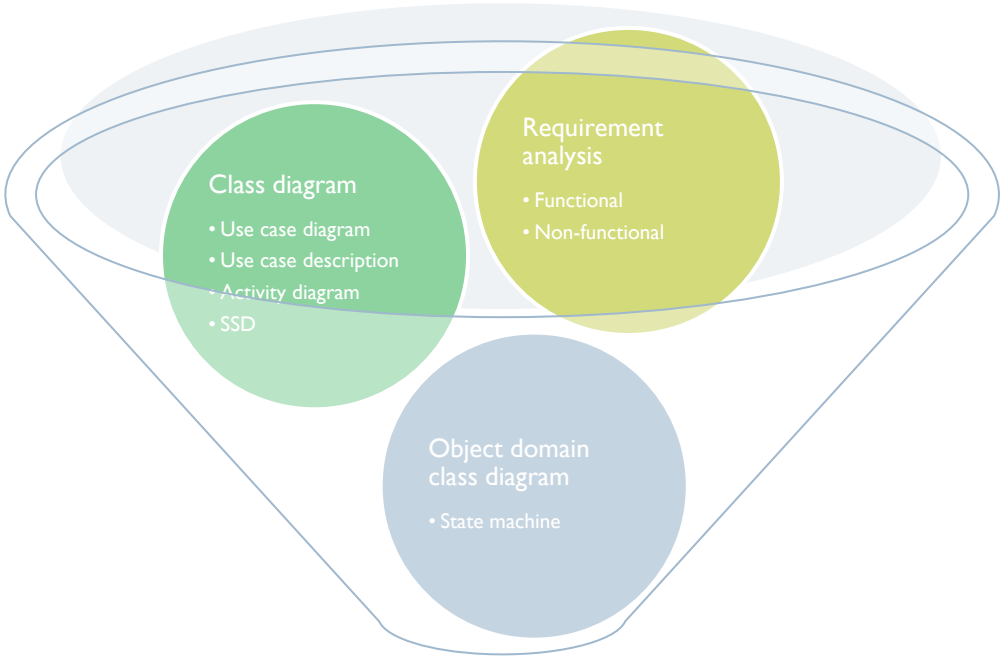
- **Architectural design**, **general design**, and **conceptual design** are the overall system and form of the system before trying to design the details.

- **Detail design** is low-level design that include the design of the specific program.

Network diagram



6.2 Input and Output for system design



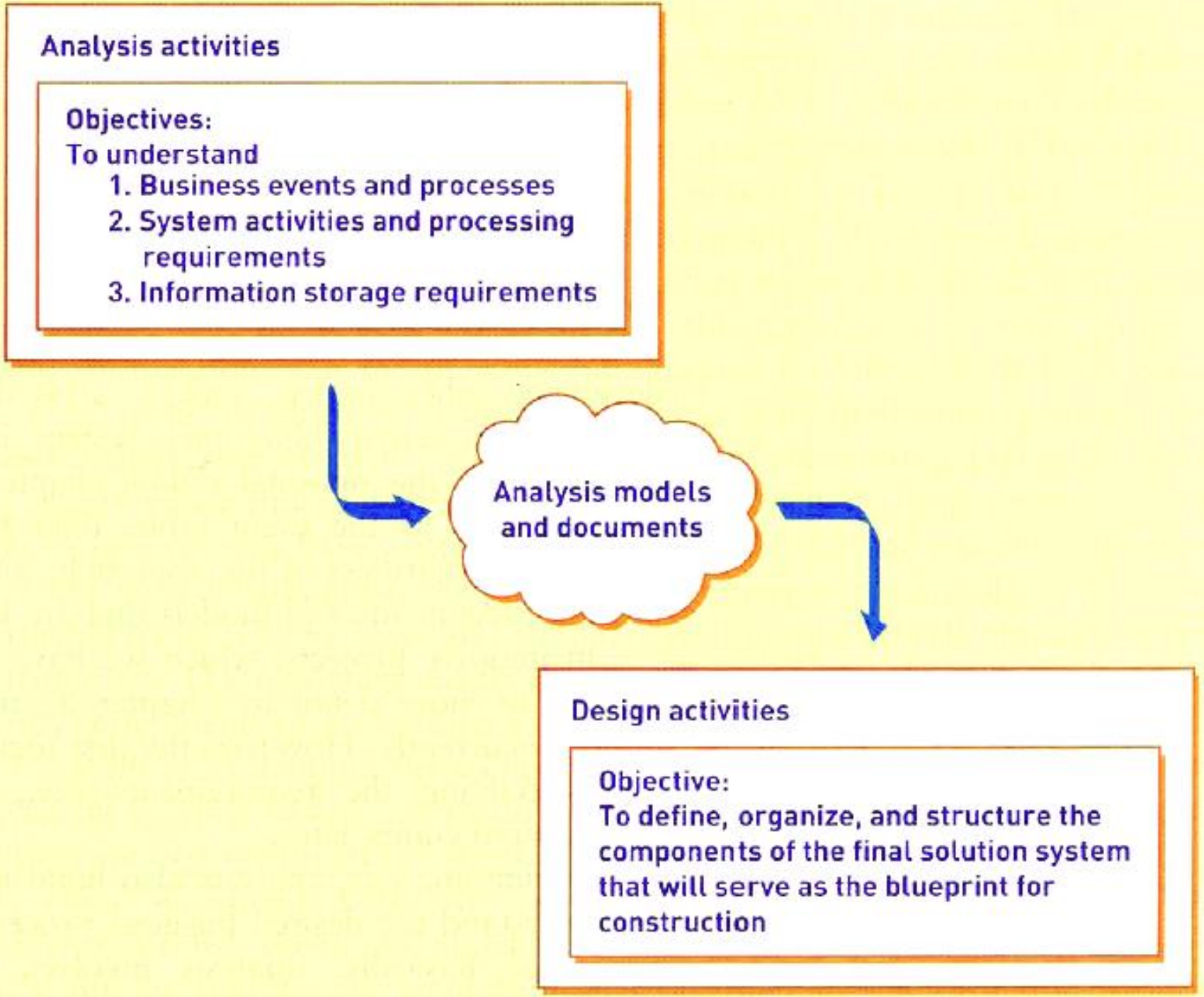
The input of the design

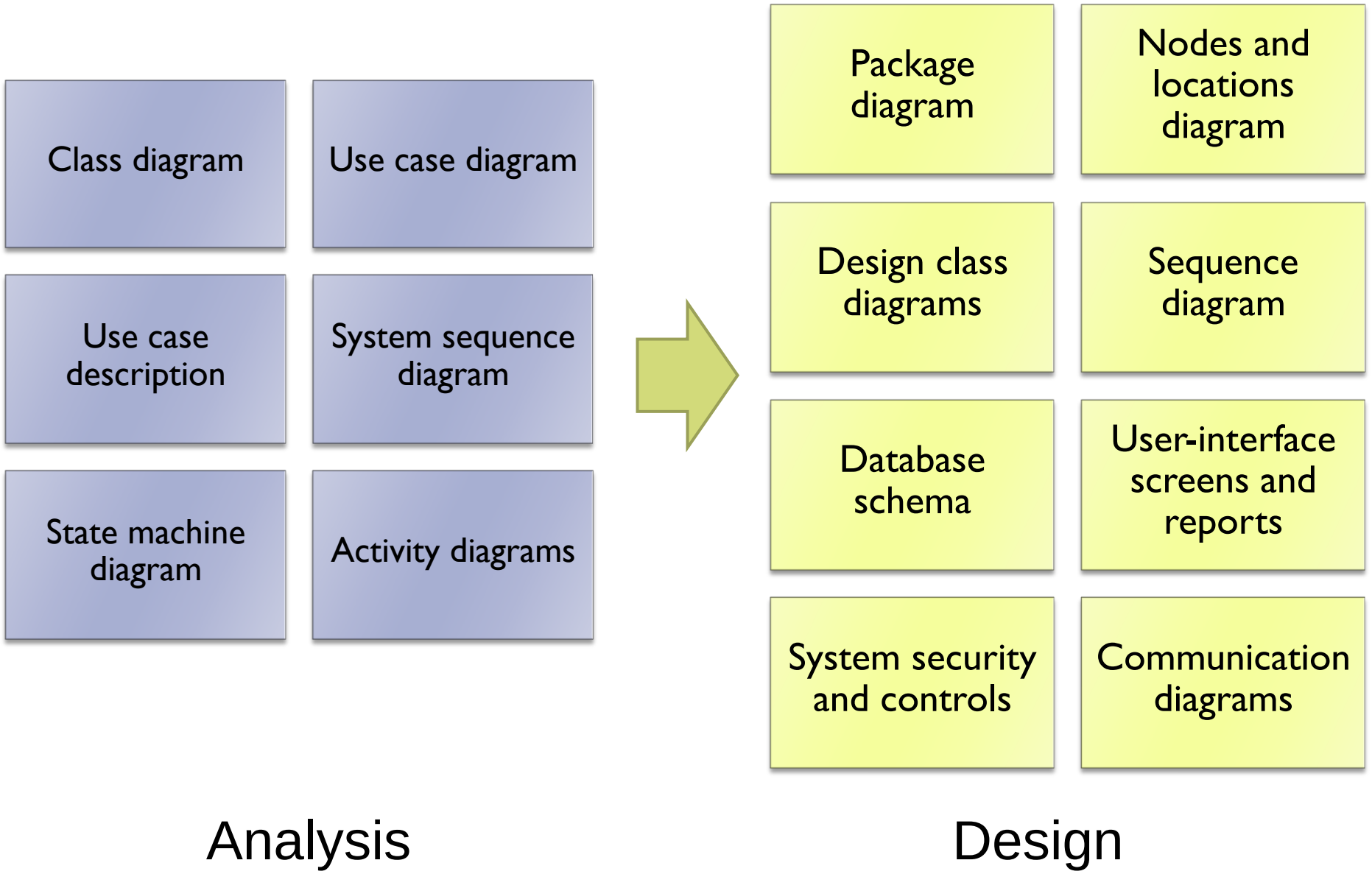
- To understand the business process
- To know the information in the system

6.2 Input and Output for system design

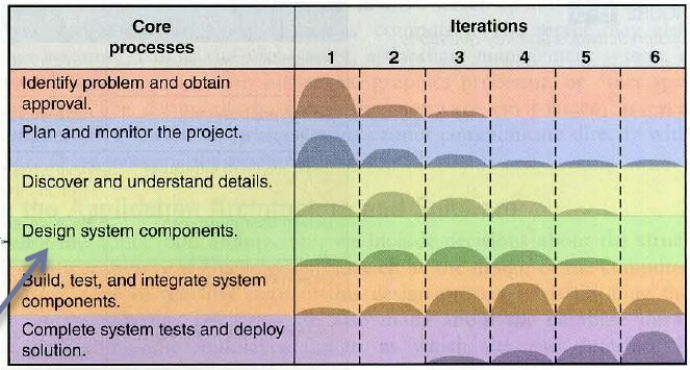
- The output of the design activities
  - Create the blueprint for construction
  - The diagram model
    - State sequence diagram
    - The database schema
  - The design document
    - Flow control
    - System security
  - Etc..

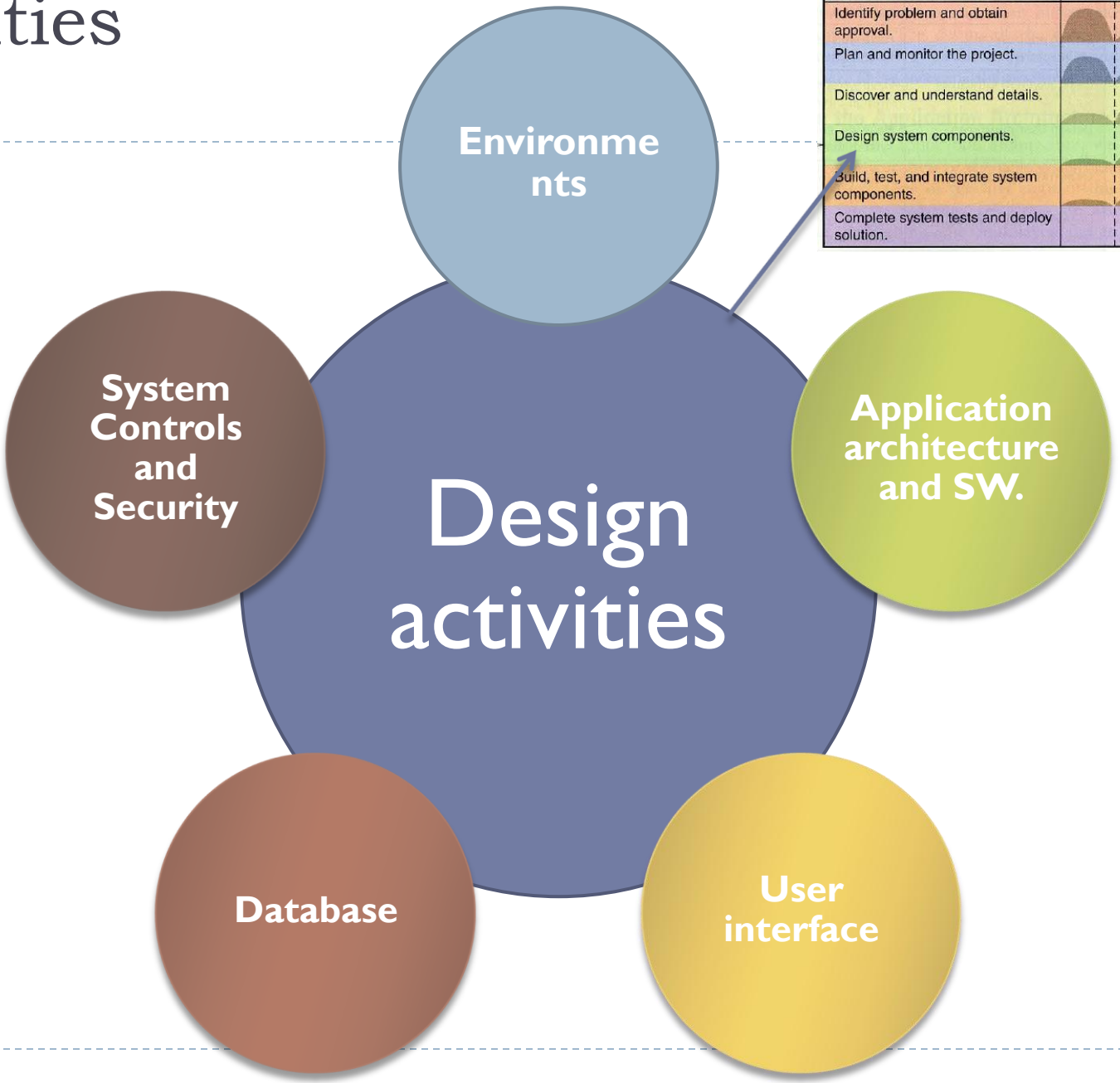
A programmer who is "**cowboy coding**" usually end up with error, patches, and poorly structured system.


Analysis activities
Objectives:
To understand
1. Business events and processes
2. System activities and processing requirements
3. Information storage requirements
Analysis models and documents
Design activities
Objective:
To define, organize, and structure the components of the final solution system that will serve as the blueprint for construction


Class diagram
Use case diagram
Use case description
System sequence diagram
State machine diagram
Activity diagrams
Package diagram
Nodes and locations diagram
Design class diagrams
Sequence diagram
Database schema
User-interface screens and reports
System security and controls
Communication diagrams
Analysis
Design

6.3 Design activities





6.3 Design activities (2)

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

6.3.1 Design the environment

- The environment is all the technology required to support the software application that is being developed.
  - Computers: server, desktop, mobile, small devices
  - Operating systems: Windows, Linux, MacOS, ..
  - Communications: Internet, Intranet, Speed, …

6.3.2 Design the application architecture and software

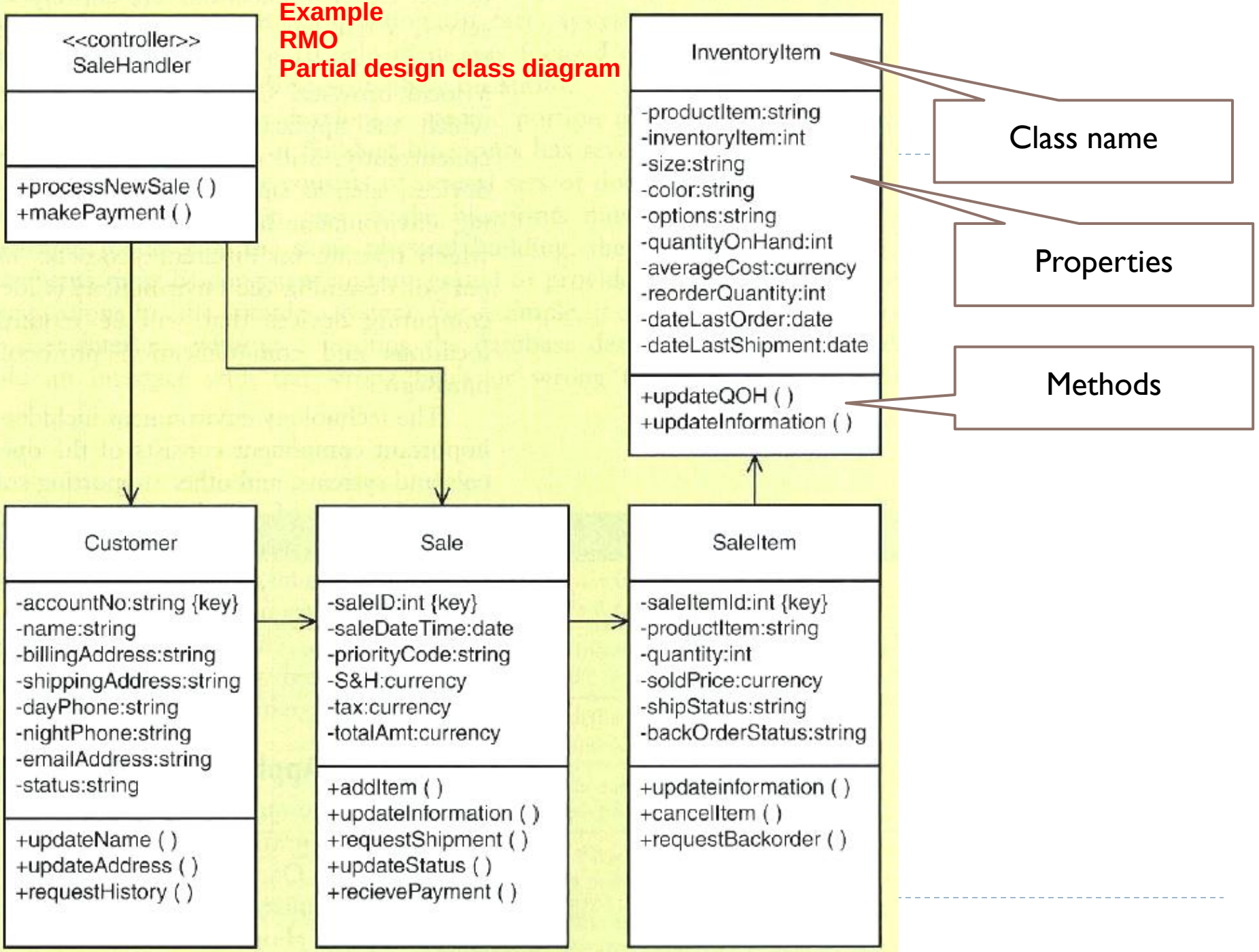
- The application architecture is decisions about the structure and configuration of the new system.
  - Use Top-down process
  - Partition the software into sub systems
    - Database processing
    - Business logic
    - Interface (Screen)
  - Check size of information on the new system
    - Volume and number of transaction
    - Access time
    - Concurrency

6.3.2 Design the application architecture and software

After complete divide into sub system

- The detailed level (Detail design)
  - Design from small and non-complex part (Partial design)
  - Uses information to design class diagram
    - Activity diagram
    - Sequence diagram
    - Other physical models

Example
RMO
Partial design class diagram

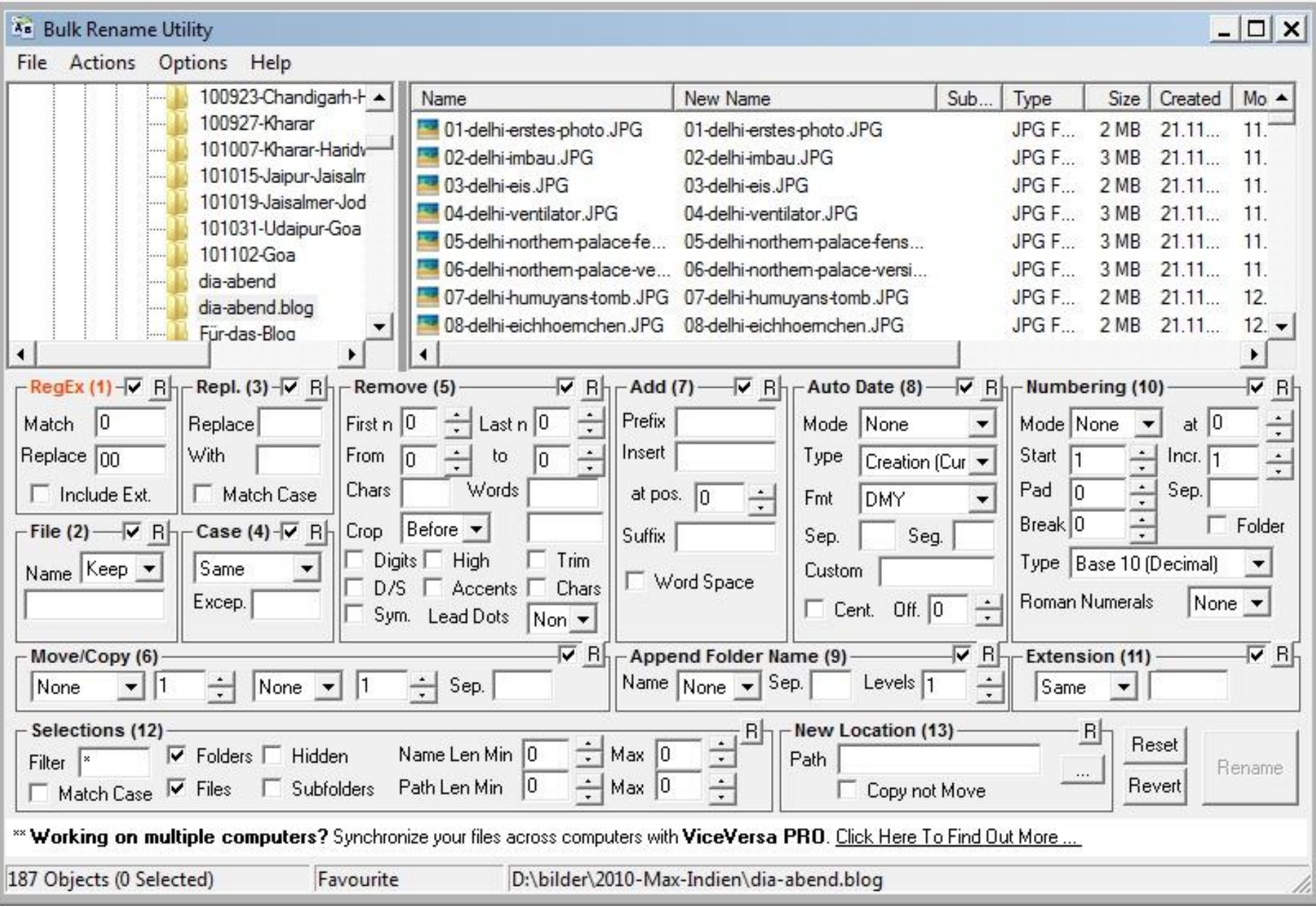


6.3.3 Design the user interfaces

The user interfaces is more than just the screen – it is

- Conceptually
- Perceptually
- Physically

- The user interface is consideration.
  - Screen (display)
  - Sound
  - Touch screen
  - Ergonomically efficient
  - Single / Multiple user interface
  - Etc..



Picture from: http://blog.ideaday.de/max/2010/11/example-for-a-bad-user-interface/

6.3.4 Design the system interfaces

The system interface considers

- Exchange information / Sharing information
- Standard of information name
- Format of interchange
  - Binary data
  - Text base data
- Real time
- Services from another system
- Encryption data
- Web service
  - Soap
  - Restful

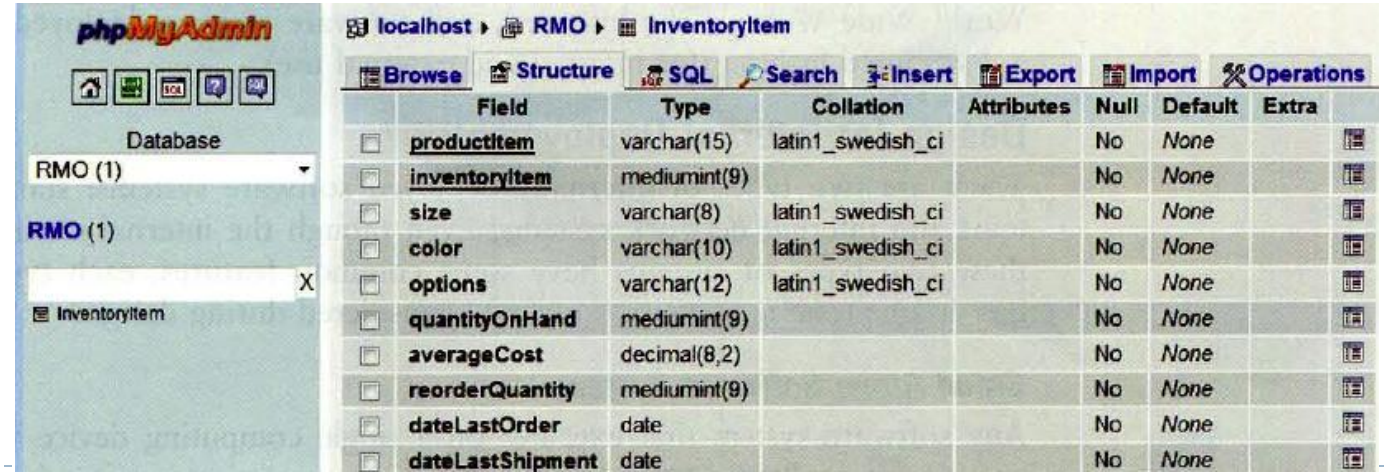
Example of the eXtensible Makeup Language (XML)

```
<inventoryRecord>
            <productItem>WS39448-7</productItem>
            <inventoryItem>48763920</inventoryItem>
            <itemCharacteristics>
                <size>large</size>
                <color>blue</color>
                <options>withzippers</options>
            </itemCharacteristics>
            <orderRules>
                <quantityOnHand>54</quantityOnHand>
                <averageCost>38.27</averageCost>
                <reorderQuantity>25</reorderQuantity>
            </orderRules>
            <dates>
                <dateLastOrder>06042012</dateLaseOrder>
                <dateLastShipment>08072012</dateLastShipment>
            </dates>
</inventoryRecord>
```

6.3.5 Design the database

The design database

- Uses the data model (the domain model) from system analysis to create model of database
- Many importance techniques consider
  - Performance (Response time)
  - Security and encryption
  - The multiple database (installation on various location)



Field	Type	Collation	Attributes	Null	Default	Extra
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	

6.3.6 Design the security and system controls

- The final design is ensuring that the system has adequate safeguard to protect organization assets.

- The security design and system control should be include in all other design activities
  - User interface
    - Limit access by show data only authorized user
  - System interface
    - Ensuring other system cause no harm to this system
  - Application architecture
    - Transaction control, log data keeping
  - Database
    - Password, encryption, and protect unauthorized access during software or hard failure.
  - Network design

6.4 Design environment

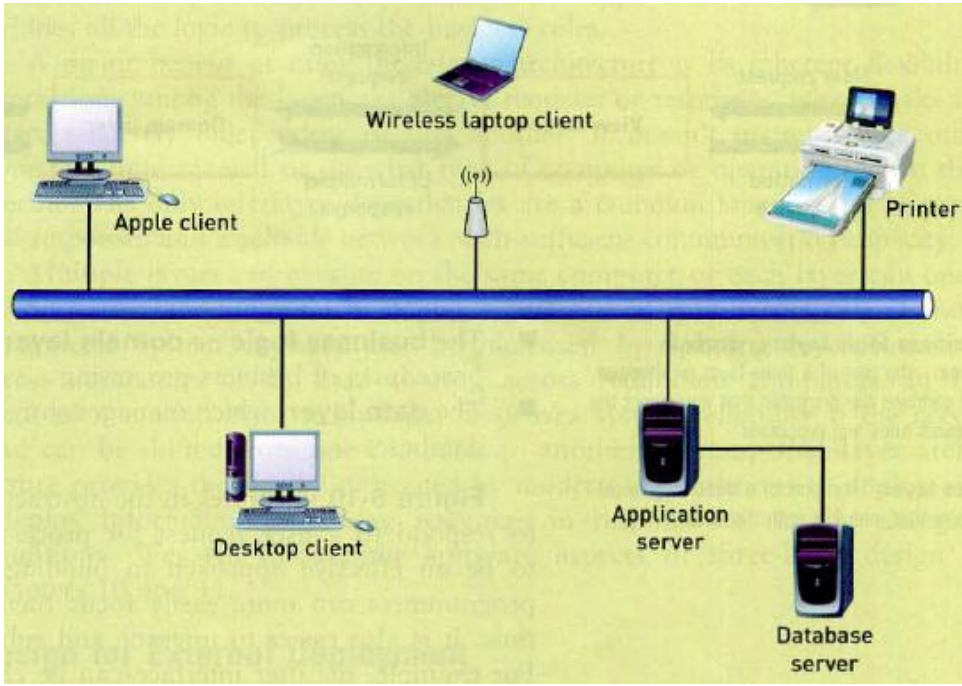
- Focus on deployment and location
  - Design for internal deployment
  - Design for external deployment
  - Design for remote, distributed environment

6.4.1 Design for internal deployment

- Two types of internally deployed software system
  - Stand-alone software systems
    - Single computer
    - No internet / software don't connect internet
    - Example applications (MS-office, Game, Utility software…)
    - Save data to file without database access.

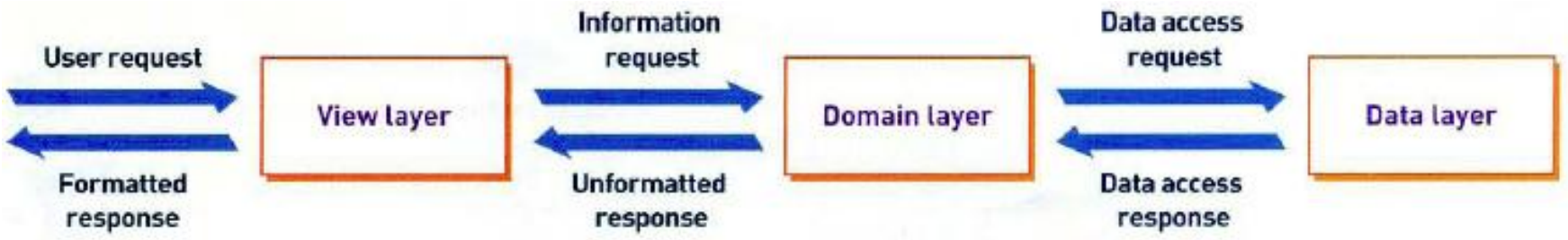
6.4.1 Design for internal deployment (2)

- Internal network-based systems
  - Client-Server architecture
    - Server computer
    - Client computer
  - LAN
  - Software types
    - Desktop application system
    - Browser-based application system

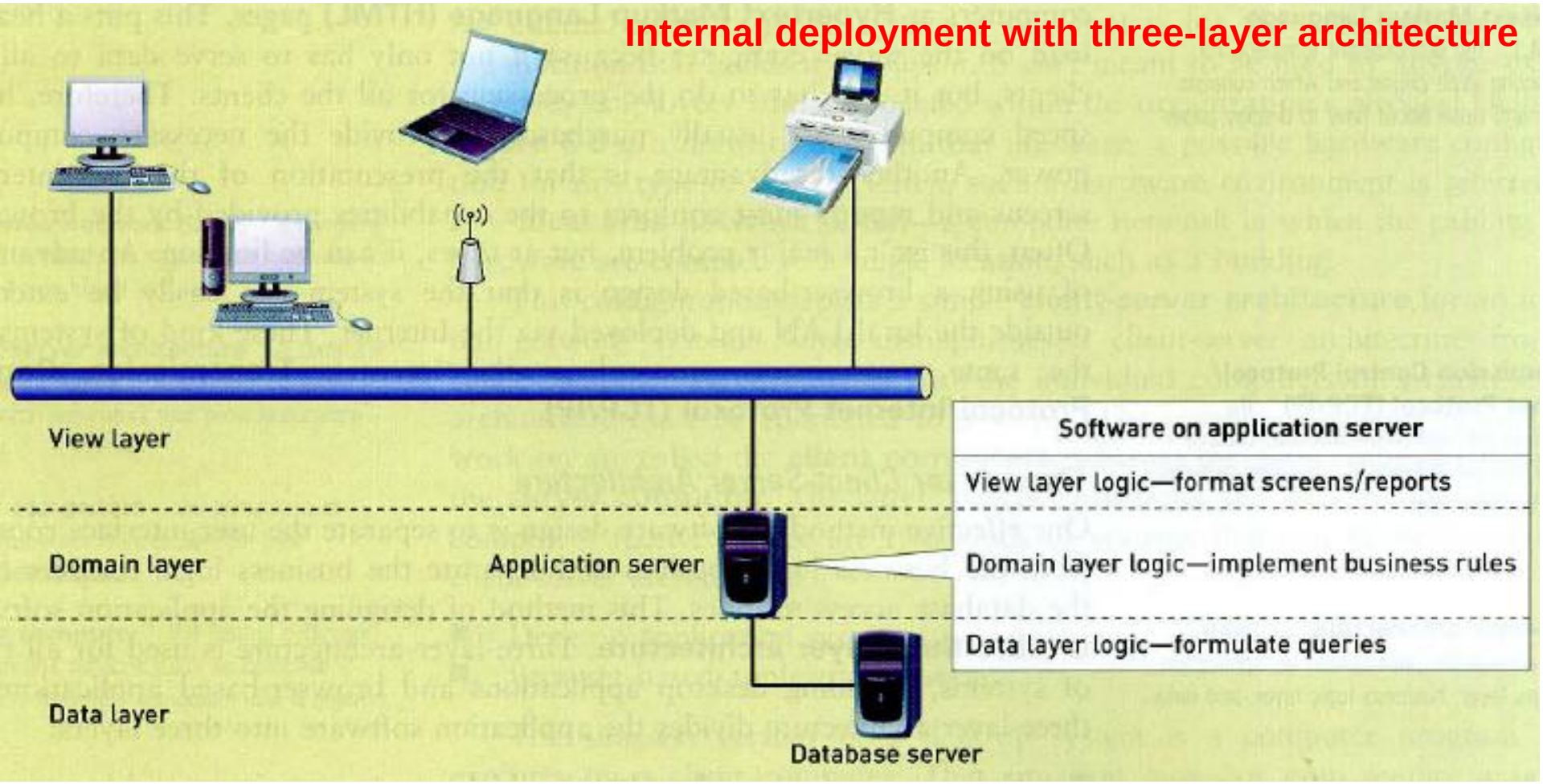


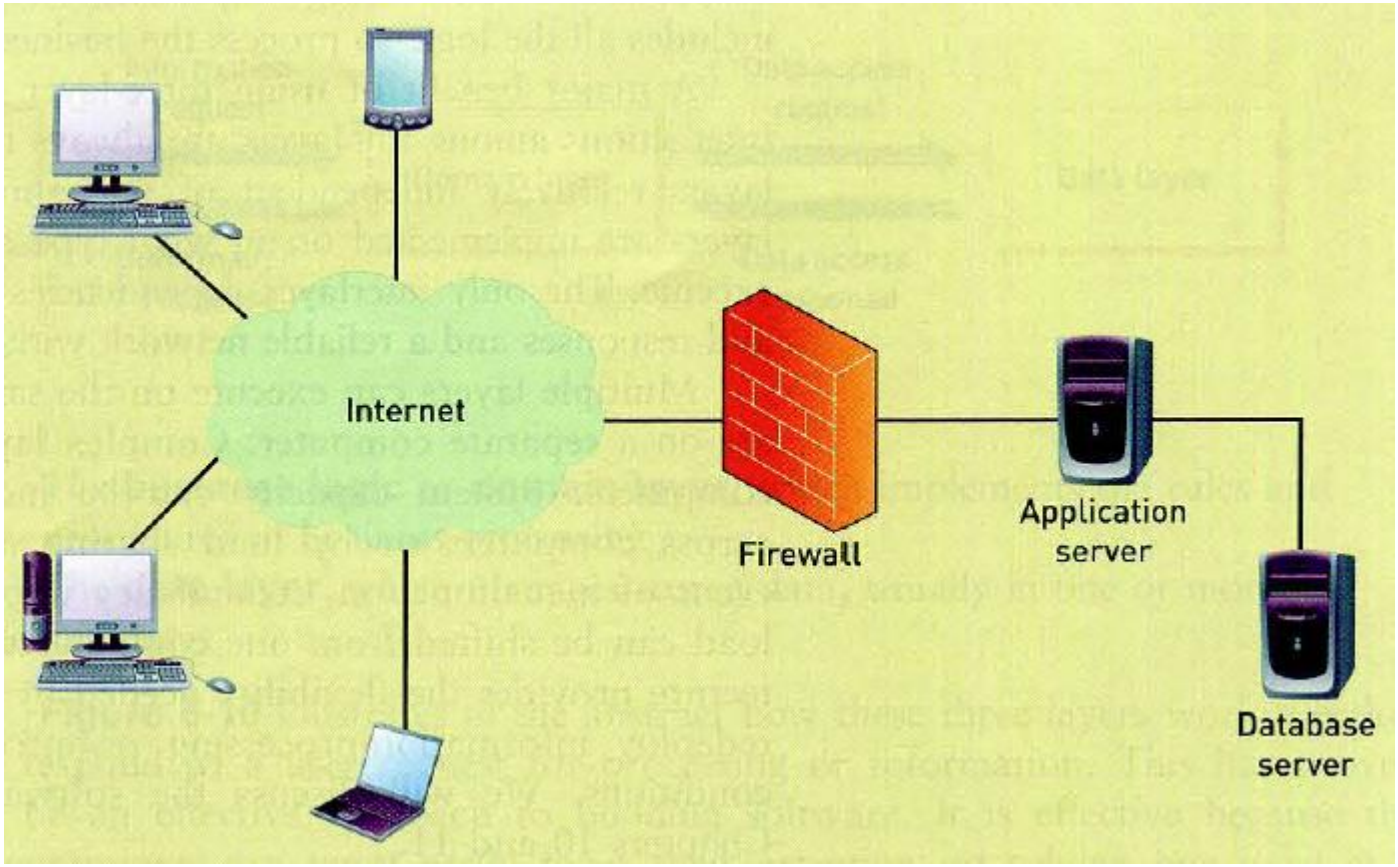
6.4.1 Design for internal deployment (3)

- Three-layer client-server architecture is design separately.
  - The user-interface (called view layer)
  - The business logic (called domain layer)
  - The database access (called data layer)



Internal deployment with three-layer architecture

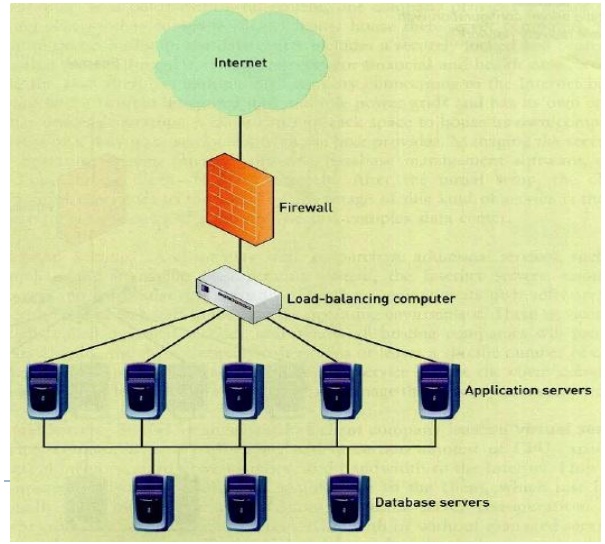



Internet
Firewall
Application server
Database server

6.4.2 Design for external deployment

- New software most rapidly growing area is the external system using on Internet.
  - Small to large business use Internet service

- Importance issue related for external deployment
  - **Configuration for Internet** deployment
    - Web technologies
    - Security on Web
    - Throughput
    - Changing Web standards



6.4.2 Design for external deployment

- **Hosting alternative** for Internet deployment must considers server computer
  - Reliability (backup, recover, redundancy)
  - Security (hardware encryption)
  - Physical facilities (security, special rooms, electrical power backup, air-condition)
  - Staff
  - Growth

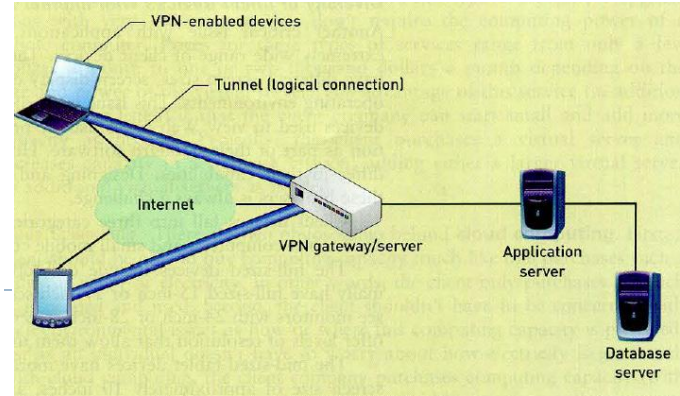
The preservation data as value of data

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

6.4.2 Design for external deployment

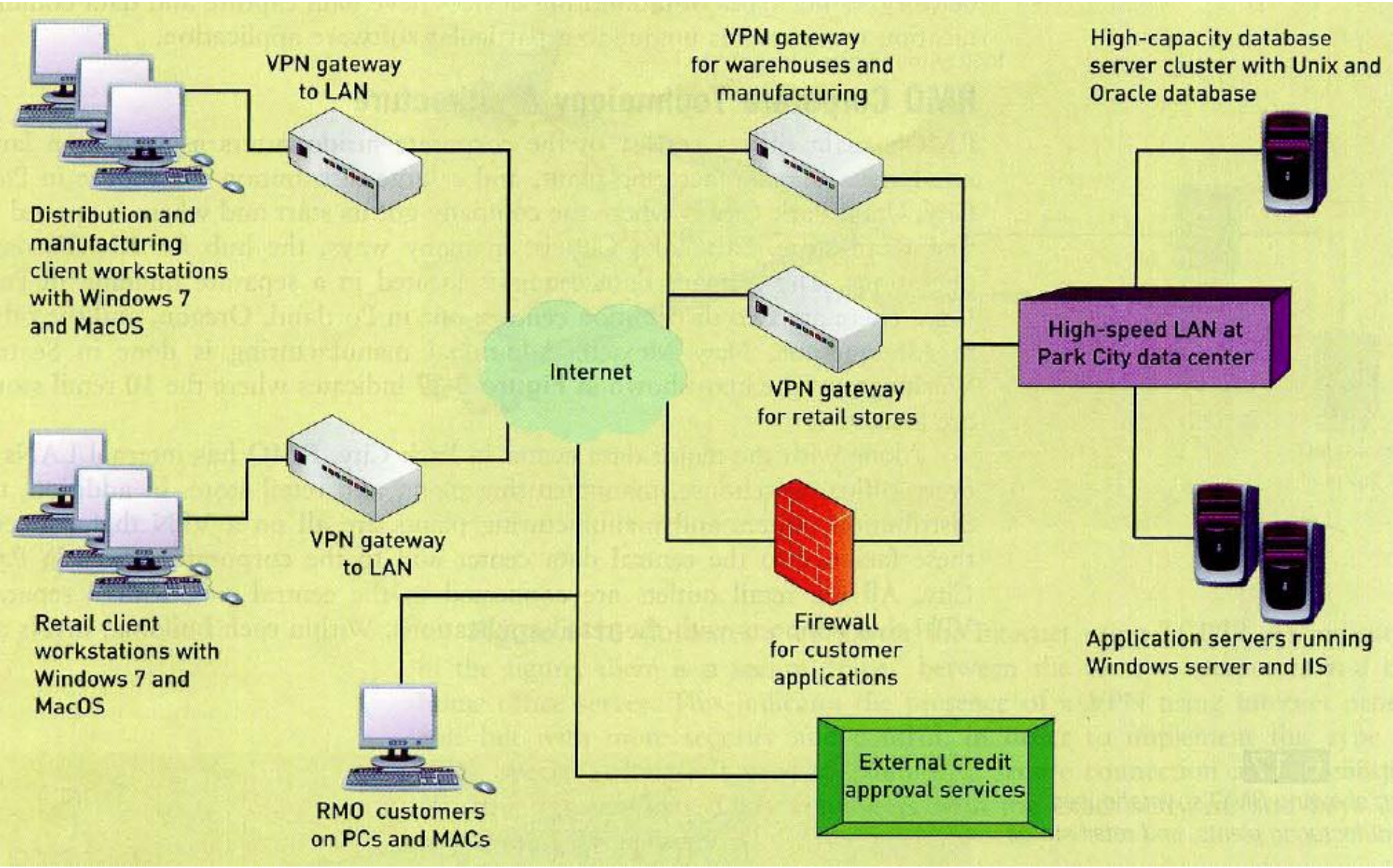
- **Diversity of client devices** with Internet deployment is the extremely wide range of client devices.
  - Desktop and laptop computer, screen size >12" inches
  - Tablet, ipad, screen size >7" inches
  - Mobile computer, smart phone.

- Design for remote, distributed environment
  - Remote via virtual private network
  - Peer-to-peer connection



Example RMO


Seattle
Washington
Portland
Oregon
Montana
Billings
Boise
Idaho
Wyoming
Sacramento
Salt Lake City
Reno
Nevada
Park City
Utah
Denver
Colorado
California
Albuquerque
Arizona
New Mexico


VPN gateway
to LAN
Distribution and
manufacturing
client workstations
with Windows 7
and MacOS
VPN gateway
for warehouses and
manufacturing
High-capacity database
server cluster with Unix and
Oracle database
Internet
VPN gateway
for retail stores
High-speed LAN at
Park City data center
VPN gateway
to LAN
Retail client
workstations with
Windows 7 and
MacOS
Firewall
for customer
applications
Application servers running
Windows server and IIS
RMO customers
on PCs and MACs
External credit
approval services

Summary

- The element of design
  - Network diagram
  - Architectural design
  - Detail design
- Input and Output for system design
  - SA: Understanding / SD: Solution
- Design activities
  - Design environment
  - Design application architecture and software
  - Design system interface
  - Design user interface
  - Design database
  - Design system control and security
- Design the environment
  - Internal deployment
  - External deployment
  - Remote access