Chapter 6
Essentials of Design and the Design Activities

Asst.Prof.Dr. Supakit Nootyaskool
Faculty of Information Technology
King Mongkut’s Institute of Technology Ladkrabang
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 of major activity in design.
- Describe the major of hardware and network in system environment.
- Express each of the hosting services.
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

![Diagram](image-url)
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 built”
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
    - Registration via internet
    - Update via internet
  - Database
  - Web services
Difference levels of design

- **Architectural design =**
- **General design =**
  **Conceptual design** are the overall system and sketch design before increasing the detail design.

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

Cowboy coding
- Jumping right into writing code
- No standard way of coding
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
6.3.1 Design the environment

Have you specified in detail of the environment and an options in which the system will execute?
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 Architecture

Have you specified in detail of all software element and how each use case is executed?
6.3.2 Design Architecture

- The application architecture is decisions about the structure and configuration of the new system.
  - Use Top-down process

- Divide the software into sub systems
  - Database processing
  - Business logic
  - Interface (Screen)

- Check information size
  - Volume, size of data
  - Number of transaction in a second/minute/hour
  - Response time = Transport latency + Processing 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 from the list below to design class diagram
    - Activity diagram
    - Sequence diagram
    - Other physical models
6.3.3 Design User Interface

Have you specific in detail of system communicate with other system inside and outside the organization?
6.3.3 Design the user interfaces

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

- **Conceptual design**: การออกแบบแนวคิด
- **Perceptual**: การรับรู้
- **Physical**: การสร้างร่างกาย
6.3.3 Design the user interfaces

- 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 System Interface

Have we specified in detail of user interact with the system to carry out their tasks (use case)?
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 other systems**
- **Data encryption**
- **Web service**
  - Soap
  - Restful
Example of the eXtensible Makeup Language (XML)

```xml
<inventoryRecord>
    <productItem>WS39448-7</productItem>
    <inventoryItem>48763920</inventoryItem>
    <itemCharacteristics>
        <size>large</size>
        <color>blue</color>
        <options>with zippers</options>
    </itemCharacteristics>
    <orderRules>
        <quantityOnHand>54</quantityOnHand>
        <averageCost>38.27</averageCost>
        <reorderQuantity>25</reorderQuantity>
    </orderRules>
    <dates>
        <dateLastOrder>06/04/2012</dateLastOrder>
        <dateLastShipment>08/07/2012</dateLastShipment>
    </dates>
</inventoryRecord>
```
6.3.5 Design Database

Have you specified in detail of data store?
6.3.5 Design the database

The design database

- Uses the data model (the domain model) from system analysis to create the database diagram

- Many importance should be considered
  - **Performance** (Response time)
  - **Security** and encryption
  - The multiple database (installation on various location)
6.3.6 Design System Control & Security

Have you specified in detail of the secure and protected?
6.3.6 Design the security and system controls

- The final design is to ensure the system having safeguard protects organization assets.

- The security design and system control should include the design:
  - 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
Have you specified in detail of the design environment and an options in which the system will execute?
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, …

- **Focus on deployment and location**
  - Design for internal deployment
  - Design for external deployment
  - Design for remote, distributed environment
Hardware details
6.4.1 Design for internal deployment

- Two types of internally deployed software system
  - a) Stand-alone software systems means
    - Software executes on a single computer
    - Software no need to connect Internet or network
    - Read and write data to files
    - Example applications (MS-office, Game, Utility software...)
6.4.1 Design for internal deployment (2)

- **b) Internal network-based systems** means
  - Client-Server architecture
    - Server computer
    - Client computer
  - Local area network (LAN)
- **Software types**
  - Desktop application system
  - Browser-based application (Web App) system
6.4.1 Design for internal deployment (3)

- **c) Three-layer client-server architecture** is designed 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

- **View layer**
- **Domain layer**
- **Data layer**

**Software on application server**
- View layer logic—format screens/reports
- Domain layer logic—implement business rules
- Data layer logic—formulate queries

**Diagram**

- View layer connected to domain layer via application server
- Domain layer connected to data layer via 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 consider:
  - Server computer
  - Reliability (backup, recover, redundancy)
  - Security (hardware encryption)
  - Physical facilities (security, special rooms, electrical power backup, air-conditioner)
  - Staff
  - Growth

The preservation data as value of data
<table>
<thead>
<tr>
<th>Service options</th>
<th>Colocation</th>
<th>Managed services</th>
<th>Virtual servers</th>
<th>Cloud computing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosting service provides building and infrastructure</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Client owns computer</td>
<td>Yes</td>
<td>Perhaps</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Client manages computer configuration</td>
<td>Yes</td>
<td>No</td>
<td>Possible</td>
<td>No</td>
</tr>
<tr>
<td>Scalability</td>
<td>Client adds more computers</td>
<td>Client adds more computers</td>
<td>Client buys larger or more virtual servers</td>
<td>Client adds small increments of computing power</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Client provides</td>
<td>Host provides</td>
<td>Host provides</td>
<td>Host provides</td>
</tr>
<tr>
<td>Backup and recovery</td>
<td>Client provides</td>
<td>Host provides</td>
<td>Available</td>
<td>Available</td>
</tr>
</tbody>
</table>
- **Shared CPU, Shared Hosting**
  - Lesser cost
  - Low traffic web servers
  - Blogs
  - Content Management Systems (CMS)
  - Small databases
  - Dev/test servers
  - Microservices

- **Dedicated CPU**
  - Medium-to-high-traffic web servers
  - No-impact from other sites
  - Medium-sized databases
  - Enterprise Software as a Service (SaaS)

- **Virtual Private Server (VPS) hosting**
  - high-traffic
  - Zero downtime
  - Easy scale customization
# Virtual servers

<table>
<thead>
<tr>
<th>Linux/Unix</th>
<th>Windows</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3.50 USD/mo</td>
<td></td>
</tr>
<tr>
<td>512 MB Memory</td>
<td>1 GB Memory</td>
</tr>
<tr>
<td>1 Core Processor</td>
<td>1 Core Processor</td>
</tr>
<tr>
<td>20 GB SSD Disk</td>
<td>40 GB SSD Disk</td>
</tr>
<tr>
<td>1 TB Transfer*</td>
<td>2 TB Transfer*</td>
</tr>
<tr>
<td>$5 USD/mo</td>
<td></td>
</tr>
<tr>
<td>2 GB Memory</td>
<td>1 Core Processor</td>
</tr>
<tr>
<td>40 GB SSD Disk</td>
<td>60 GB SSD Disk</td>
</tr>
<tr>
<td>3 TB Transfer*</td>
<td>4 TB Transfer*</td>
</tr>
<tr>
<td>$10 USD/mo</td>
<td></td>
</tr>
<tr>
<td>4 GB Memory</td>
<td>2 Core Processor</td>
</tr>
<tr>
<td>80 GB SSD Disk</td>
<td>80 GB SSD Disk</td>
</tr>
<tr>
<td>5 TB Transfer*</td>
<td>6 TB Transfer*</td>
</tr>
<tr>
<td>$20 USD/mo</td>
<td></td>
</tr>
<tr>
<td>8 GB Memory</td>
<td>2 Core Processor</td>
</tr>
<tr>
<td>160 GB SSD Disk</td>
<td>160 GB SSD Disk</td>
</tr>
<tr>
<td>6 TB Transfer*</td>
<td>7 TB Transfer*</td>
</tr>
<tr>
<td>$40 USD/mo</td>
<td></td>
</tr>
<tr>
<td>16 GB Memory</td>
<td>4 Core Processor</td>
</tr>
<tr>
<td>320 GB SSD Disk</td>
<td>320 GB SSD Disk</td>
</tr>
<tr>
<td>7 TB Transfer*</td>
<td>8 TB Transfer*</td>
</tr>
<tr>
<td>$80 USD/mo</td>
<td></td>
</tr>
<tr>
<td>32 GB Memory</td>
<td>8 Core Processor</td>
</tr>
<tr>
<td>640 GB SSD Disk</td>
<td>640 GB SSD Disk</td>
</tr>
<tr>
<td>8 TB Transfer*</td>
<td>9 TB Transfer*</td>
</tr>
<tr>
<td>$160 USD/mo</td>
<td></td>
</tr>
<tr>
<td>64 GB Memory</td>
<td>16 Core Processor</td>
</tr>
<tr>
<td>1280 GB SSD Disk</td>
<td>1280 GB SSD Disk</td>
</tr>
<tr>
<td>9 TB Transfer*</td>
<td>10 TB Transfer*</td>
</tr>
</tbody>
</table>
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

- Pin on the retail store and the warehouse
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