XVII. System Design

What is System Design?
The Outputs of System Design
The (Global) System Architecture
Classification of Applications
State of the Market

Major Tasks of System Design
- Identify major hardware and software subsystems and components
- Identify (usage, control or data) dependencies among subsystems.
- Decide on a hardware and software platform for the new system.
- Design the information system software, database, and user interfaces.

Other Elements of System Design
(...Not discussed in this course...)
- Plan control aspects of the application.
- Test plans.
- Code development standards.
- Priorities for design trade-offs.
- Implementation requirements (e.g., data conversion)

System Architecture
- System refers to both hardware and software.
- The system architecture describes the collection of inter-connected hardware nodes on which the software will eventually run.
- A system architecture consists of:
  - Hardware nodes, e.g., 486, 2MB RAM, 100MB disk
  - OS: DOS Windows.
  - The connectivity among nodes, e.g., length: <100ft, type: fiber optic, product: Novell 386 LAN, PC3270
  - The location of users, inputs and outputs;
    Key concern: Minimize data communication

Example
- To each hardware node, associate users (actors) and network interconnections

  Accounts Receivable
  -- 486, DOS Win
  -- 100MB disk
  -- <200ft, Ethernet, Novell 386 LAN

  Business Administrator
  -- 486, DOS Win
  -- 100MB disk
  -- <200ft, Twisted pair SNA
  -- 1,500ft, Twisted pair SNA
  -- OS/400, 5 trm
  -- 5GB disk
  -- IBM 3090, MVS
  -- 25 terminals
  -- Financial Managers
  -- VP Finance
  -- Purchasing Department

Distribution Issues: How Are Data Processed?
- Batch mode -- e.g., incoming/outgoing surface mail (purchase orders, invoices, cheques...)
- On-line mode -- can save data entry time, particularly if end user can do the input, clearly the way of the future.
- Remote batch -- data are input on-line on remote machines, then fed in batch to centralized database.
New Technologies for I/O and New Standards for Data Interchange

- **Keyless data entry** – bar coding, optical character recognition, special keyboards.
- **Pen input** – several products in the market.
- **Electronic data interchange (EDI)** – data are transferred through telephone lines from one location to another; e.g., credit card charging.
- **Image and Document Interchange** – like electronic data interchange, e.g., law enforcement, banking.
- **HTML/XML/SGML** – markup languages for documents; SGML is a general markup language for documents.

Choosing a System Architecture

Here is a series of issues that need to be addressed:

- Establish batch and on-line computer processes; e.g., on-site conference registration.
- Determine process cycles, i.e., when does each process need to run, e.g., end-of-month, end-of-project.
- Establish processing locations – identify user locations (and numbers).
- Distribute data to locations.
- Distribute software subsystems to locations.
- Assign technology – what hardware, software is going to run where?

Classification of Applications

<table>
<thead>
<tr>
<th>Span Type</th>
<th>Operational Support</th>
<th>Decision Support (providing analytics)</th>
<th>Real Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group/Dept</td>
<td>E.g., regional inventory control</td>
<td>E.g., regional marketing info system</td>
<td>E.g., video conferencing within group</td>
</tr>
<tr>
<td>Enterprise</td>
<td>E.g., enterprise-wide cash mgmt</td>
<td>E.g., corporate data warehouse</td>
<td>E.g., enterprise video-conference</td>
</tr>
<tr>
<td>Inter-Enterprise</td>
<td>E.g., B2B E-commerce</td>
<td>E.g., DBs for communities of interest</td>
<td>E.g., distributed multimedia over the internet</td>
</tr>
</tbody>
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State of the Market

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<tbody>
<tr>
<td>Group/Dept</td>
<td>PC, Windows, OLTP, OO products</td>
<td>ERPs, OLTP over private intranets</td>
<td>COTS (mainly SQL-based)</td>
</tr>
<tr>
<td>Enterprise</td>
<td>ERPs, Web-based products</td>
<td>Web-based technologies</td>
<td>Multimedia technology maturing</td>
</tr>
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- **OLTP** – On-Line Transaction Processing
- **ERPs** – Enterprise Resource Planning systems
- **COTS** – Components Off-The-Shelf

Data Management Issues

- Identify amount and type of data persistence needed:
  - Is simple file I/O sufficient?
  - Is a Database Management System (DBMS) required?
- A DBMS is typically needed when:
  - Data is accessed at a fine level of detail,
  - Sophisticated indexing is required,
  - There is a need to port data across multiple platforms,
  - Data needs to be accessible from multiple platforms.

Isolate persistence mechanisms from application!