TIM 50 - Business Information Systems
Lecture 11

Instructor: Terry Allen
UC Santa Cruz
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Outline

- Announcements
- Review Layering
- Student Presentation
- Client-Server Computing
- Student Presentation
- SUN Case

Announcements

- News Folio 2 DUE 11/9
  - Include printouts/hardcopies of the articles
- Midterm 11/9
- Homework 3 will be posted Wednesday and will be due is due 11/14/2011
- For next time read:
  - Chapter 6 Messerchmitt

Sources for business paper

- You should cite at least 5 non-web sources
  - Ideally a lot more!
  - A list of sources is included in slides for Lecture 1

- If an article is available on-line and also in print, you should cite the print version!!!!

- Only cite a website if you are sure there is no print version of the material available.
  - Your citation of the print version may also indicate a website where the same article is available.

- Wikipedia is a nice source for gaining some background knowledge on your research or find links to other sources BUT is not always 100% accurate/true, particularly on matters of opinion.

Citing Sources

- More than thirty words verbatim must be cited.

- Any facts or figures that are not your own must be cited in the body of the text!!!!. For example:
  - Ebay's revenues in US Revenues in 2002 were $1.39 billion [1].

- Any Tables of figures must be cited!!
  - You can create tables/charts based on your findings
**Citing Sources**

`Companies that have deployed Internet technology have been confused by distorted market signals, often of their own creation.\(^1\)`


**References:**


**Student Talks**

- **Case presentation (Alibris)**
  - Alex Chan

**Client-Server Computing**

- Two host Architecture
- Three Tier Client Server Architecture
- N-Tier Client Server Architecture (Sun)

**Two Host Architectures**

- **Client-Server**
  - Attractive for information access and organizational applications

- **Peer-to-Peer (P2P)**
  - Appropriate for direct/immediate applications where no centralized application logic is needed

**Two-tier client/server**

- Desktop computer
- Local-area network
- File service

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Review: Simplified infrastructure layering

<table>
<thead>
<tr>
<th>Application</th>
<th>Distributed object management</th>
<th>Database management</th>
<th>Middleware</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network software</td>
<td>File system</td>
<td>Operating system</td>
<td>Equipment</td>
</tr>
<tr>
<td>Network equipment</td>
<td>Storage peripherals</td>
<td>Storage</td>
<td></td>
</tr>
</tbody>
</table>

*Communications* | *Storage* | *Network equipment* | *Network software* | *Database* | *Middleware* | *Operating system* | *Equipment* |
Peer to Peer (P2P)

Each peer provides the same functionality
- A P2P Network relies on
  - computing power
  - bandwidth of each peer
- Ad-hoc connections: Each peer joins/leaves the network at any time

What is P2P good for?
- File sharing
- Video Conferencing
- Internet telephony
- Etc.

3-tier Client/Server Architecture

- Many organizational applications incorporate mission-critical databases
- Need to separate data from the applications that access them
  - Centralized storage
  - Security
  - Fault tolerance
  - Data shared across many applications

Scalability

- Need to serve multiple customers at the same time
- Customer base can grow large
- Many identical application servers
  - Each user session carried by a single server
  - Each server can handle a limited number of clients
- More than one databases
  - Storing different kinds of data (e.g. customers, orders, products, etc.)
**C/S vs. P2P**

<table>
<thead>
<tr>
<th>Types of computers:</th>
<th>Powerful computers used as servers. Different machines from clients.</th>
<th>Each peer is both a client and a server.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of network:</td>
<td>Predefined number/topology of servers. Clients can connect/leave any time.</td>
<td>Ad-hoc connections.</td>
</tr>
<tr>
<td>Communication:</td>
<td>To and from the server.</td>
<td>Among peers.</td>
</tr>
<tr>
<td>Network relies on:</td>
<td>Computing power/availability of a limited number of servers.</td>
<td>Computing power/Bandwidth of each peer.</td>
</tr>
</tbody>
</table>

- Most P2P applications also have a C/S part
  - E.g. Napster, IRC
  - P2P File sharing/Transfer
  - C/S searching

**Sun Case**

(N-tier C/S)

**What does Sun make?**
- Workstations
- Servers
- Software

**Java**

- 1995 - Sun introduces Java
- Programming Language
  - Portable between computers with different hardware/operating system platforms
  - JVM: Java Virtual Machine
  - Easy to write programs in
  - Easier re-use: "Write once, run everywhere"
  - Also somewhat portable ("Learn once, work anywhere"), but that objective was less well met.
  - And, programs were slow
  - Constant updates on JDK library
  - Programmers had to update to current versions
  - Some felt that language was not yet mature

**Java Applets**

- Key feature of Java
  - Applets: chunks of Java code
    - Usually embedded in other applications, e.g. Web Pages
    - Initially enabled animations on web pages
    - Later used to facilitate e-commerce applications, in cellular phones, etc.
  - Applets are downloaded through the browser
    - Only what and when was needed
    - No need to keep a copy on client!
  - Servlets
    - One can think of them as server-side applets

**In the meantime, Microsoft...**

- Dominated Desktop software (mid 90's)
  - Users familiar with Windows, Office, etc.
- Windows NT servers
  - Fine for small intranets, but "not industrial strength" (Microsoft would disagree...)

*Stands for Transfer Control Protocol / Internet Protocol*
What problems did the micro era produce?

- Desktops are expensive to maintain
  - TCO for windows PC $9900!
- Every PC had a lot of software that had to be maintained
  - Office, Windows, etc...
- Small differences, like the order in which software is installed, could make different PCs behave differently!
- Keep all PCs in organization updated with current/same software releases
  - Compatibility issues

In the Networking Era...

- These “bloated” PCs are networked and termed fat clients.
- But networking of PCs offered the possibility of
  - putting most of the functionality into servers
  - getting rid of much of the software on the client
- These clients would be called thin clients.
  - Sun, Oracle, and others saw it as the future.

Hardware for thin clients

- A Network Computer (NC) - a computer with minimal hardware that depends on a network connection to a server to function
  - Trademark of ORACLE, used by ORACLE, SUN, IBM, Acorn (ORACLE brand)
  - Be careful not to confuse it with the phrase “networked computer”
  - Example: Sun’s JavaStation (1996-2000)
- It is the hardware one would use to implement a thin-client computing model:
  - Store desktop on the network
  - Typically diskless (!)
  - Send desktop via browser to the client
  - Fewer unique “instances” of working environment

In the meantime...

- NetPC was a PC introduced by Microsoft and Intel in 1996 to compete with NC (which often didn’t use an Intel CPU)
  - Same software as a normal PC
  - Did not allow users to install their own software
  - NetPC died out
  - Features of it, and Microsoft’s Zero Administration Kit, live on in today’s version(s) of Windows.

Microsoft Vision

- Keep “fat-client” model
- Add some features to Windows to reduce administration costs

Microsoft vs. Java

- Announced that will “embrace and extend” promising technologies and emerging open standards
- 1996: Sun licenses Java to Microsoft to integrate into Explorer
  - Microsoft downplays Java’s importance
  - Did not deliver compatible implementation of Java in its products
  - Customers were frustrated since the Java-components would not work
- Includes Java in its programming platform
  - BUT incorporates proprietary components making it impossible to run on different OS
Sun’s Vision

- "Thin Client" model
- Application Servers with Applications written in Java
  - Applets/Servlets
- NCs could retrieve applications from application server as needed
- Applications compatible with any NC hardware and OS
- Applications could be fixed, added, updated at the server level, rather than maintaining each PC

Sun N-tier

- 3-tier model common.
- Sun’s version of 4-tier model not-common.
- N-tier model where Webserver and Application Server on separate equipment also common.
- Sun’s hardware business not strong.
  - Linux on cheap PCs most common servers
  - Microsoft desktops replacing Sun workstations
Today

- Oracle bought Sun (and incidentally, Java)
- Java
  - Common in Server implementations
    - Example: Java Servlet implementing application logic in a banking application.
  - Often used to push simple applets onto client
  - Not common
    - For "big" desktop applications
    - Other languages, e.g. C/C++ still faster
  - Microsoft is still in business...

Modularity and Layering

Application Architecture Design

- The most important step
  - Hardest to change
  - Influences everything that follows
- Conceptualization
  - What is it you are trying to do?
- Example Concept:
  - Small HHC for flight attendants.
  - HHC tells flight attendants which passengers are higher priority:
    - Who paid the highest fares
    - Who has been a more valuable customer in past
  - Flight attendant discriminates based on this
    - Free drinks, meals, and pillows to valuable customers

Architecture

- What is the complexity of such a problem?
- How do you begin to architect a solution for a problem like this?
- Break it into modules!
- What is a "good" architecture?
When a module is composed of sub-modules, the architecture is hierarchical.

Properties of Modularity

- Functionality
- Hierarchy
- Separation of concerns
- Interoperability
- Reusability

We are using a layered architecture as well. Allows reuse of previously built infrastructure.