Class Announcements

- The second batch of readers is at the bookstore!
- Makeup quiz available for those that were unable to take the last quiz because of not being able to get reader
  - Honor system - please don’t retake unless you were unable to get the reader
    - Monday April 25 (4:00-4:30) E2 room 194.

Class Announcements

- Assignment 3 out
  - (due today!!)
- Reading for next class
  - Messerschmitt Ch 6,
- Student Presentations Monday
  - Bao Tran (News Article)
  - Amrita Singh (News article)

Midterm April 27

- Midterm April 27
  - 1 week from today
  - Covers up to Sun Case and Messerschmitt Ch5
  - Study:
    - Terms & Concepts
    - NO ROI calculations!!!
    - Small Error in the formula I gave you for Assignment 2
    - We will review this after the midterm
  - Case Studies
  - Study guide Available
The Internet

by
David G. Messerschmitt

What is the Internet

- An internet is a "network of networks"
  - Interconnect standard for LAN's, MAN's, and WAN's
- Internet = the major global internet
- A private internet is called an intranet
- An extranet is an interconnection of intranets through the Internet

Intranet

Private internet
May be connected to Internet
- Firewall creates a protected enclave

Extranet

Intranets connected through an unprotected domain (typically the Internet)
Encryption and other security technologies used to
- protect proprietary information
- prevent imposters, vandals, etc
**Extranet**

Consumers, field workers, etc.

Intranet

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**Client Server Example**

Client

'I want to see www.google.com'

Server

Certificate is the server’s credential

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**Client Server Example - Layers Revealed**

Client

Application:

Infrastructure

Packet

Internet

Packet

Server

Application

Infrastructure

Packet

Packet

---

**Email application**

Client

Email client sends message to server

Message is stored on POP server

Later, recipient’s email client retrieves message from server

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Chat application

Chat clients send user's typing to server
Chat server aggregates typing from all users and sends to all clients
Other user's clients display aggregated typing from chat server

3-Tier Client Server Architecture example

Client
Application Server
Web Server
Common Gateway Interchange
Application Logic

Client
Web Server
Application Logic
Common Gateway Interchange

Web Server
Java Servlet
JDBC
Database Management System (DBMS)
Database

In some implementations, Application Logic and Web Server can be put on different machines.

Relational Database

<table>
<thead>
<tr>
<th>Customer</th>
<th>Balance</th>
<th>Customer Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alice</td>
<td>$527</td>
<td>Silver</td>
</tr>
<tr>
<td>Bob</td>
<td>$0.50</td>
<td>Bronze</td>
</tr>
<tr>
<td>Shiv</td>
<td>$100000</td>
<td>Gold</td>
</tr>
</tbody>
</table>
**DBMS Responsibilities**

- Hide Changes in the Database hardware from the Application
- Standard operations on the data, including searches, such a search is called a **query**.
- Separate Database Management from Applications, so that many applications can access the same data.
- Security, Integrity, Backup, fault tolerance, etc..

**3-Tier Client Server Architecture in General**

- Takes inputs from client
- Decides what to be done next
- Decides what shared data to access and manipulates it
- Processes shared data
- Supports multiple applications with common data
- Protects critical data
- Decouples data administration and application administration

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**Book merchant**

- Web browser
- Web server
- Databases
- Acquirer
- Book
- Bank
- Distributors

**Consumer logic**

- Inter-enterprise e-commerce

**Customer logic**

- Inter-enterprise e-commerce

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**Web server**

- Accept instructions from user
- Make requests of server
- Display responses of server

- Shared data

**Application Server**

- Takes inputs from client
- Decides what to be done next
- Decides what shared data to access and manipulates it
- Processes shared data

**Shared data**

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**Financial institution**

**Book distribution centers**

**Customer**

**Enterprise**

**Inter-enterprise**

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**Customer logic**

**Fulfillment logic**

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**Clients**

**Acquirer bank**

**Fulfillment logic**

**Databases**

**Merchandise**

**Orders**

**Book distributors**
Peer to peer

Client

Server

Peer

Server

Client

Peer

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Peer to Peer

- What is peer to peer good for?

Sun N-tier case

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

How Successful had Sun been up to 1998?

- Founded in 1982
- Open Standards Workstation
  - Unix Operating System (Solaris)
  - TCP/IP networking
- 1988 - Revenues $1 billion
- 1993 - Market value $3.0 billion
- 1997 - Jumped from 3rd to 1st in Unix Server Market.

How Successful had Sun been up to 1998?

- 1993 - "The network is the computer."
- 1994 - Internet explodes in popularity

Microsoft mid to late 90s

- Dominated Desktop software
  - Users familiar with Windows, Office, etc.
- NT servers
  - Fine for small intranets, "not industrial strength"
Sun N-Tier Case

- What is Java?
  - Programming Language
  - Portable between computers with different operating systems
  - Easy to write programs in
  - Easier re-use
  - But, programs are slow

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!

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
  - 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.

Another term from that era...

- A NetPC was a PC introduced by Microsoft and Intel in 1996
  - 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 of windows.

Microsoft Vision

- Keep "fat-client" model
- Add some features to Windows to reduce administration costs
Sun's Vision

- Thin Client model.
- Application Servers with Applications written in Java.
- 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

Sun's Performance

Sun N-Tier

Today

- 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

- 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
    - Office Suite in Java not popular
  - Microsoft is still in business...