Outline For Today

- Class Announcements
- Student Presentations
- Alibris
- Messerschmitt Ch4
Class announcements

- Assignment 3 due today!

- Reading for next class
  - Messerschmitt Ch 5, Sun Case
  - Suggestion: Read Messerschmitt Ch5 first.

- Student Presentations Wed.
  - Scott Welch: news article
  - Peter Yao: Sun-N Tier case
Class announcements

- **Business Paper Proposal due October 20**
  - 1-2 pages
  - Discuss:
    - What you plan to include in your paper
    - How you plan to organize it.
  - Include a list of some references you plan to cite.
  - Check out class webpage for more details.
  - Come to office hours this week if needed

- **Midterm October 25**
  - Next week!
  - Study:
    - Terms
    - ROI calculations
    - Case Studies
  - Study guide on website.
Student Presentations

- Brandi Carter
- Lilian Nguyen
Recall, Alibris

- A start-up to sell used books on the Internet.
- Interloc, Alibris’ predecessor, functioned like a classified ads page for book dealers
- Alibris changing Interloc’s model
  - Actually sell the books
  - Charge a fee per sale (instead of per listing)
  - Intermediary strategy
    - Buy books from dealers
    - Ship to warehouse
    - Re-pack, consolidate order, ship to customer
If Interloc is so successful, why change it?

What will change as Interloc becomes Alibris?
Alibris

- Why did Manley feel they needed the Sparks facility?

- How does the Sparks facility keep them from becoming disintermediated?
Should Alibris actually buy books and fill up the Sparks facility?
Alibris

- What problems is Alibris having with its e-commerce capabilities?

- Why is Alibris having so much trouble setting up simple e-commerce capabilities?

- Is this really that hard??

- Is it rare for a new-software product from an established, reputable vendor not to work properly?
Alibris

- Should Alibris stick with Oracle? Or switch back to Thunderstone?
Should Manley take the “white knight’s” offer and fire the whole IT staff??!
Alibris

- Rejects “white knight” offer
- Manley secures another bridge loan
- Goes Live 1998
- Thunderstone’s software works ok
- 1 million books at Sparks warehouse by 2000
  - Originally all on consignment from dealers
  - Later, purchases books
- 2002 – Revenue $31 million, loss $7.2 million
- 2003 – Revenue $45.5 million, loss $4.8 million
- March 2004 files for “auction based” IPO
  - May 2004, withdraws IPO after price too low
  - Still Relying on Private Financing
Data and information

by
David G. Messerschmitt
©Copyright David G. Messerschmitt, 2000. This material may be used, copied, and distributed freely for educational purposes as long as this copyright notice remains attached. It cannot be used for any commercial purpose without the written permission of the author.
Key concept

The key commodity manipulated by information technology is information. To be manipulated in a computing/networking environment, information must be represented by data.

What is information?
Information

From a user (human) perspective...
....recognizable patterns that influence you in some way
(perspective, understanding, behavior...)

In the computing infrastructure, information has a somewhat different connotation as structure and interpretation added to data
Data

A bit is “0” or “1” — the atom of the information economy

Data is a collection of bits, like

- “0101110111010110”
- “0000011”
- “11101110101101101101111011011010”

Note: the terms data and information are not always used consistently!
Representation

- Take the place of the original
- Equivalent to, in the sense that the original can be reconstructed from its representation
- Often the original can only be approximately reconstructed, although it may be indistinguishable to the user
  - e.g. audio or video
### ASCII

<table>
<thead>
<tr>
<th>Alphabet</th>
<th>Hex</th>
<th>Binary</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;7&gt;</td>
<td>/x37</td>
<td>00110111</td>
</tr>
<tr>
<td>&lt;8&gt;</td>
<td>/x38</td>
<td>00111000</td>
</tr>
<tr>
<td>&lt;9&gt;</td>
<td>/x39</td>
<td>00111001</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>/x3A</td>
<td>00111100</td>
</tr>
<tr>
<td>&lt;=</td>
<td>/x3B</td>
<td>00111101</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>/x3C</td>
<td>00111100</td>
</tr>
<tr>
<td>&lt;=</td>
<td>/x3D</td>
<td>00111101</td>
</tr>
<tr>
<td>&lt;/&gt;</td>
<td>/x3E</td>
<td>00111110</td>
</tr>
<tr>
<td>&lt;</td>
<td>&gt;</td>
<td>/x3F</td>
</tr>
<tr>
<td>&lt;At&gt;</td>
<td>/x40</td>
<td>01000000</td>
</tr>
<tr>
<td>&lt;A&gt;</td>
<td>/x41</td>
<td>01000001</td>
</tr>
<tr>
<td>&lt;B&gt;</td>
<td>/x42</td>
<td>01000010</td>
</tr>
<tr>
<td>&lt;C&gt;</td>
<td>/x43</td>
<td>01000011</td>
</tr>
<tr>
<td>&lt;D&gt;</td>
<td>/x44</td>
<td>01000100</td>
</tr>
</tbody>
</table>

Note that this representation is not unique…

…this one happens to be a standard (ANSI X3.110-1983)
A picture

This picture conveys information

This information is represented in this computer, but how?
Representation of picture: image

Expanding a small portion of the picture, we see that it is represented by square pixels….

….300 tall by 200 wide…..

….with a range of 256 intensities per pixel

300 • 200 • 8 bits = 480,000 bits (but it can be compressed)
A color picture can be represented by three monochrome images…

At the expense of three times as many bits
**Terminology**

Diagram:
- Information → Representation → Data → Communicate data to another user or organization → Data → Information

*Slide adapted from slides for Understanding Networked Applications by David G Messerschmitt. Copyright 2000. See copyright notice.*
Representation needs to be standardized

If the representation is not standardized, the information is garbled!

Communicate data to another user or organization

Slide adapted from slides for *Understanding Networked Applications* by David G Messerschmitt. Copyright 2000. See copyright notice.
Regeneration

- Make a precise copy of the data (copy bit by bit)
- If you know the representation, this is equivalent to making a precise copy of the information
- Each such precise copy is called a generation
- process is called regeneration
Replication of information

Anything that can be regenerated can be replicated any number of times.

This is a blessing and a curse.
Analog information cannot be regenerated

We will never know exactly what the original of this Rembrandt looked like
Discrete information can be regenerated

Regeneration can preserve data (but not its original physical form)

Regeneration is possible for information represented digitally (which is tolerant of physical deterioration)

0 + noise \( \approx \) 0

1 + noise \( \approx \) 1
Replication of information requires knowledge of representation.

- Replication of information also presumes knowledge of its representation.
- Replication preserves the integrity of the data, but that is not sufficient.
- Every .xxx DOS file is a representation.

Slide adapted from slides for *Understanding Networked Applications* by David G Messerschmitt. Copyright 2000. See copyright notice.
Implications

Digitally represented information can be preserved over time or distance in its precise original form by occasional regeneration

- digital library
- digital telephony

Replication of data is easy and cheap
Implications (con’t)

- Replication of information requires knowledge of the structure and interpretation
  - Standardization or some other means
- Extreme supply economies of scale
- You can give away or sell and still retain
- Unauthorized replication or piracy relatively easy
Architecture

by

David G. Messerschmitt
Copyright notice

©Copyright David G. Messerschmitt, 2000. This material may be used, copied, and distributed freely for educational purposes as long as this copyright notice remains attached. It cannot be used for any commercial purpose without the written permission of the author.
A system is decomposed into interacting subsystems. Each subsystem may have a similar internal decomposition.
Three elements of architecture

Slide adapted from slides for *Understanding Networked Applications*
By David G Messerschmitt. Copyright 2000. See copyright notice
System examples

Let’s quickly look at some system decomposition examples

- Quick tour of information technology systems
Time sharing

ASCII terminal (no graphics)

Point-to-point wire (no network)

Mainframe (database and application server)
Two-tier client/server
Three-tier client/server

Client

Application server

Enterprise data server
Inter-organizational computing

Global internet
Consumer access
System integration

Architecture -> subsystem implementation -> system integration

Bring together subsystems and make them cooperate properly to achieve desired system functionality

- Always requires testing
- May require modifications to architecture and/or subsystem implementation
Emergence

Subsystems are more specialized and simpler functionality

Higher-level system functionality arises from the interaction of subsystems

**Emergence** includes capabilities that arise purely from that interaction (desired or not)

- e.g. airplane flies, but subsystems can’t
Why system decomposition?

- Divide and conquer approach to containing complexity
- Reuse
- Consonant with industry structure (unless system is to be supplied by one company)
- Others?
Networked computing infrastructure

by

David G. Messerschmitt
Major subsystems

- Presentation
- Application software
- Logic Data
- Infrastructure software
- Infrastructure equipment
- Network
- Client host
- Server host
Layering builds capability incrementally by adding to what exists.
Layering

- Elaboration or specialization
- Services
- Existing layers
## Simplified infrastructure layering

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

Graphical user interface (client only)
Hide details of equipment from the application
Multitasking
Resource management
  - Processing, memory, storage, etc
etc
File system

Hides details of storage equipment from applications

File is:

- Unit of data managed for the benefit of the application
  - Size known, but unspecified structure and interpretation
- Name
- Location in naming hierarchy
Network equipment

Hosts → Swtiches → Backbone links → Access links

Network equipment diagram showing the connections between hosts, switches, and access links.
Messages and packets

Simplest network communication service is the message

- Smallest unit of communicated data meaningful to application
- Size, but unknown structure and interpretation
- Analogous to file in storage

Internally, the network may fragment a message into packets, and reassemble those packets back into a message
Example

Slide adapted from slides for *Understanding Networked Applications*
By David G Messerschmitt. Copyright 2000. See copyright notice
Communication middleware

New application-specific communication services

Location independence
- makes distributed application look similar to centralized

Many possible other functions
Storage middleware

Database

- File with specified structure
- Example: relational table
- Oriented toward business applications

Database management system (DBMS)

- Manage multiple databases
- Basis of online transaction processing (OLTP)
<table>
<thead>
<tr>
<th>Year</th>
<th>City</th>
<th>Accommodation</th>
<th>Tourists</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>Oakley</td>
<td>Bed&amp;Breakfast</td>
<td>14</td>
</tr>
<tr>
<td>2002</td>
<td>Oakley</td>
<td>Resort</td>
<td>190</td>
</tr>
<tr>
<td>2002</td>
<td>Oakland</td>
<td>Bed&amp;Breakfast</td>
<td>340</td>
</tr>
<tr>
<td>2002</td>
<td>Oakland</td>
<td>Resort</td>
<td>230</td>
</tr>
<tr>
<td>2002</td>
<td>Berkeley</td>
<td>Camping</td>
<td>120000</td>
</tr>
<tr>
<td>2002</td>
<td>Berkeley</td>
<td>Bed&amp;Breakfast</td>
<td>3450</td>
</tr>
<tr>
<td>2002</td>
<td>Berkeley</td>
<td>Resort</td>
<td>390800</td>
</tr>
<tr>
<td>2002</td>
<td>Albany</td>
<td>Camping</td>
<td>8790</td>
</tr>
<tr>
<td>2002</td>
<td>Albany</td>
<td>Bed&amp;Breakfast</td>
<td>3240</td>
</tr>
<tr>
<td>2003</td>
<td>Oakley</td>
<td>Bed&amp;Breakfast</td>
<td>55</td>
</tr>
<tr>
<td>2003</td>
<td>Oakley</td>
<td>Resort</td>
<td>320</td>
</tr>
<tr>
<td>2003</td>
<td>Oakland</td>
<td>Bed&amp;Breakfast</td>
<td>280</td>
</tr>
<tr>
<td>2003</td>
<td>Oakland</td>
<td>Resort</td>
<td>210</td>
</tr>
<tr>
<td>2003</td>
<td>Berkeley</td>
<td>Camping</td>
<td>115800</td>
</tr>
<tr>
<td>2003</td>
<td>Berkeley</td>
<td>Bed&amp;Breakfast</td>
<td>4560</td>
</tr>
<tr>
<td>2003</td>
<td>Berkeley</td>
<td>Resort</td>
<td>419000</td>
</tr>
<tr>
<td>2003</td>
<td>Albany</td>
<td>Camping</td>
<td>7650</td>
</tr>
<tr>
<td>2003</td>
<td>Albany</td>
<td>Bed&amp;Breakfast</td>
<td>6750</td>
</tr>
</tbody>
</table>
Some DBMS functions

- Logical structure separated from physical structure
- Platform independence
- Implement standard queries
- Access from multiple users/applications
- Manage data as asset separate from applications
The Internet

by

David G. Messerschmitt
What is the Internet

Internet = the major global internet

An internet is a “network of networks”

- Interconnect standard for LAN’s, MAN’s, and WAN’s

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

Internet

Consumers, field workers, etc.

Intranet
Lock icon indicates this is an extranet
Certificate is the server’s credential
Questions

What business purposes do nomadic workers serve?
Mobile?
What advantage does direct Internet access have over long distance telephony?
Ideas and examples (Chapters 4-5)

by
David G. Messerschmitt
Copyright notice

©Copyright David G. Messerschmitt, 2000. This material may be used, copied, and distributed freely for educational purposes as long as this copyright notice remains attached. It cannot be used for any commercial purpose without the written permission of the author.
Example

Slide adapted from slides for *Understanding Networked Applications* by David G Messerschmitt. Copyright 2000. See copyright notice.
Peer to peer
Email application

Email client sends message to server

Message is stored on POP server

Later, recipient’s email client retrieves message from server

Slide adapted from slides for *Understanding Networked Applications* by David G Messerschmitt. Copyright 2000. See copyright notice
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

Slide adapted from slides for *Understanding Networked Applications*
By David G Messerschmitt. Copyright 2000. See copyright notice.
Three-tier client/server

Presentation

Local-area network

Application logic

Shared data

Note: many clients per application server, several application servers per data server
Host architecture

Client

Web browser

HTTP

Web server

Application logic

Databases and DBMS

Application partition

Slide adapted from slides for *Understanding Networked Applications*  
By David G Messerschmitt. Copyright 2000. See copyright notice
Book distribution centers

Customers

Financial institution

Book distribution centers

Consumer

Enterprise

Inter-enterprise

Slide adapted from slides for *Understanding Networked Applications*
By David G Messerschmitt. Copyright 2000. See copyright notice
Web browser

Web server

Customer logic

Databases

Customers

Merchandise

Orders

Fullfillment logic

Outside links

Acquirer bank

Book distributors

Consumer e-commerce

Inter-enterprise e-commerce

Slide adapted from slides for *Understanding Networked Applications* By David G Messerschmitt. Copyright 2000. See copyright notice