Lecture 8 February 2005

General Principles of Client–Server Architectures
General Principles of Client-Server Architectures

• The parts: client, server, and “glue”
• Dividing the tasks
• Re-usable code
• Return to client-server architecture with web-based computing
Evolution of client-server systems

- **Batch cards** – the client walked to the machine
- **ASCII Terminals** connected by RS-232 lines
- **Shift to PC-Based systems**: Client = Server
- **Return to client-server architecture with web-based computing**
Client-server paradigm for distributed computing

Open Systems = Lower Cost

Figure by MIT OCW
Case Study at Hospital das Clinicas, Sao Paolo

**Before . . . . .**

- Prodesp System with Mainframes
  - $5M/yr Maintenance
- IBM 3090 Mainframe
  - $250K/yr SW License

**Implementation . . . .**

- $4 M Total Investment
  (Unix, Alphas, Client-Server, Fiber)
- $1M/yr Maintenance

**Result . . . .**

- Personnel from 75 to 30
- Backup 6 hrs $\Rightarrow$ 45 minutes
- Dramatic Increase in Procedures

Ref.: Lincoln Moura, Ph.D.

Open Systems = Lower Cost

Figure by MIT OCW
## Basic Application Structure

<table>
<thead>
<tr>
<th>User I/O</th>
<th>Presentation Logic</th>
<th>Application Logic</th>
<th>Data Management</th>
<th>File I/O</th>
</tr>
</thead>
</table>

2.771J  BEH.453J  HST.958J  Spring 2005
Client-Server Model

Client

User I/O

Presentation Logic

Application Logic

Network

Server

Application Logic

Data Management

File I/O
Advantages of client-server architecture

• Central storage and backup of critical data
• Single copy of application programs
• Scalable computing to supercomputer levels
• Negligible latency above 10 Mb/s network speeds for most non-graphics applications (100+ Mb/s networking for graphics)
Duke University Medical Center

- 1996 Implementation: Louis Humphrey and Minh Do Van
- ATM Image Server Network
- Switched Ethernet to Image Sources
- RAID Image Storage
- 2Kx2K Display
- DICOM Format for Images
- Sybase System 10 Database
- Switched Connection to Ethernet
- Supports US, CT, MR

Hospital Integrated Delivery Network

Electronic Medical Record
From Buddy Gillespie, York Medical

YHS NETWORK

Affiliated Physician Offices (PHO, MSO, HMO)

Physician 1
Physician 2
Physician 3

*Indemnity  *Medicare
*HMO/PPO  *Medicaid

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Conceptual connections between information entities
Using a Request Interpreter
Accessing multiple information entities
Client-server implementation

- **Network strategies**
  - Direct connect
  - Web browser
  - Downloadable application
  - Caching

- **Interface requirements**
  - Graphics
  - Client-side calculations

- **Data exchange formats**
  - CORBA and XML
Reusable code

- **Down-loadable applications**
  - Always current
  - Perfect for Java
  - Networks are now capable (>1 Gb/s)

- **Use databases and stored procedures**
  - Very robust engines
  - Will support many downloadable clients

- **Reusable data exchange formats**
  - CORBA and XML
Projecting the future

- **Wireless and the WWW**
  - Contracted compute services
  - Example: airline reservation systems
  - Can submit data for analysis

- **Medical computing**
  - “Portable” medical records
  - 4-D image-based diagnosis
  - Rules-based expert systems

- **Biological computing**
  - Semantics is a key technology
  - Progression to predictive models
The whole nine yards ... caBIO