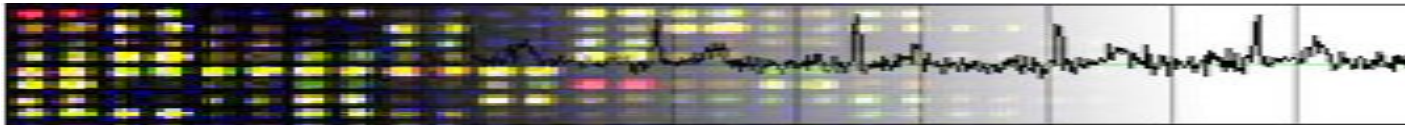


Biomedical Information Technology

2.771J BEH.453J HST.958J Spring 2005

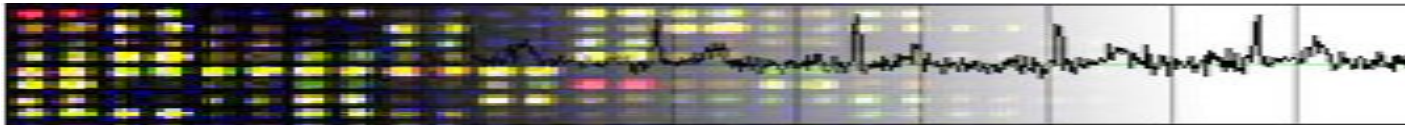
Lecture 8 February 2005

General Principles of Client–Server Architectures



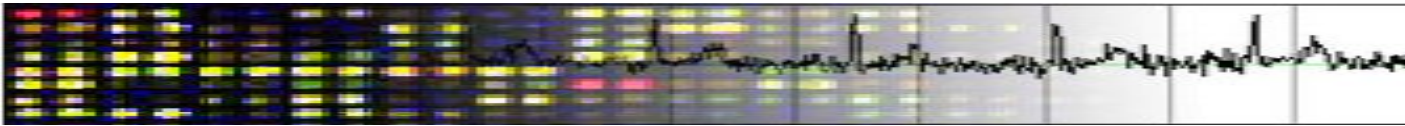
General Principles of Client-Server Architectures

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

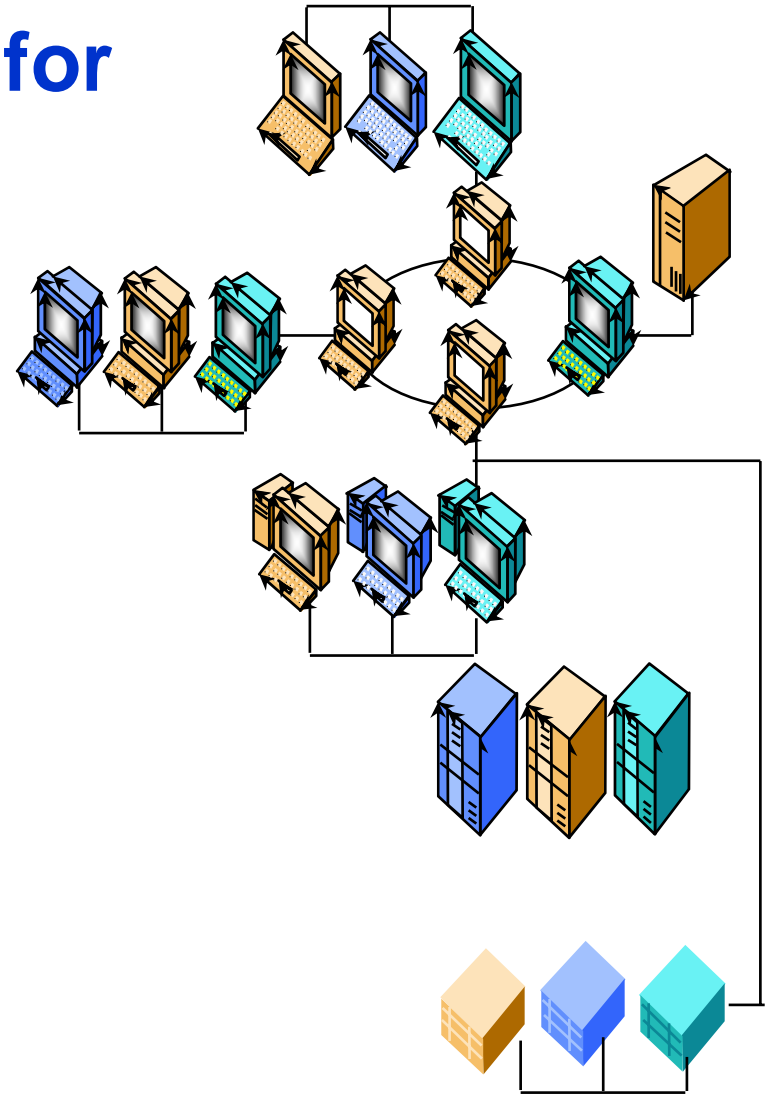
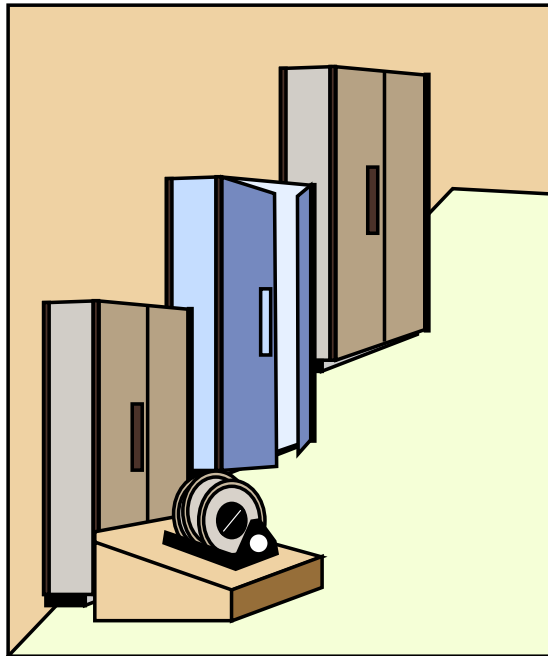


Evolution of client-server systems

- *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 Paulo

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

Ref.: Lincoln Moura, Ph.D.

Open Systems = Lower Cost

Result

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

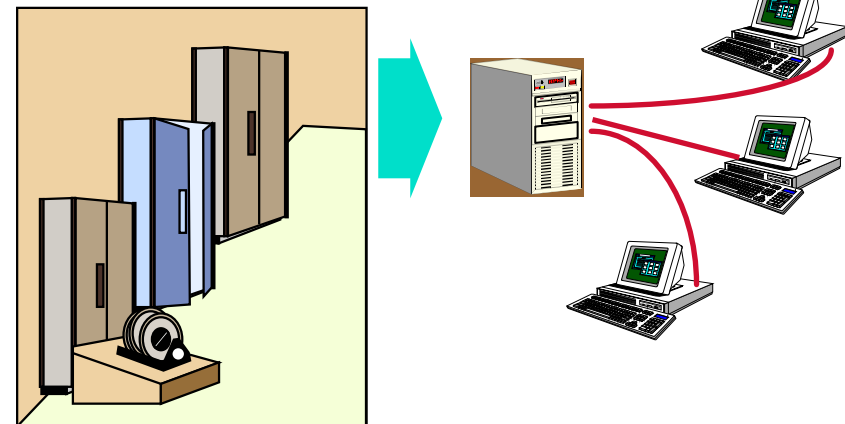
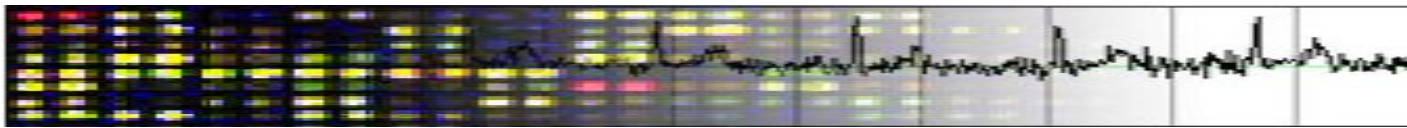
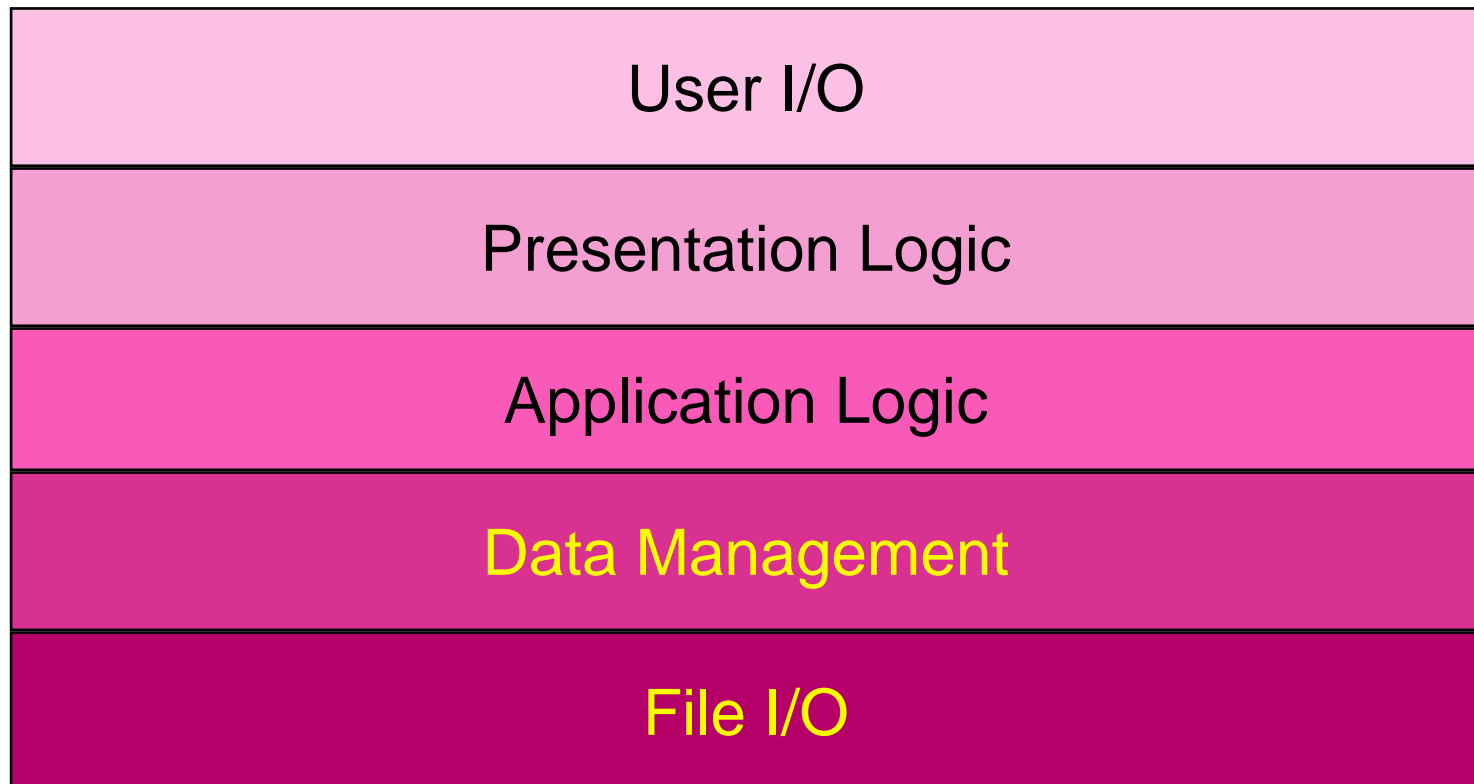
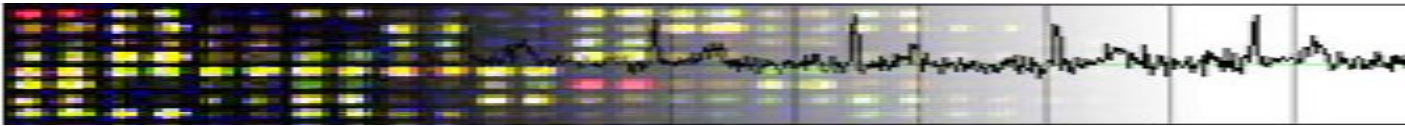


Figure by MIT OCW

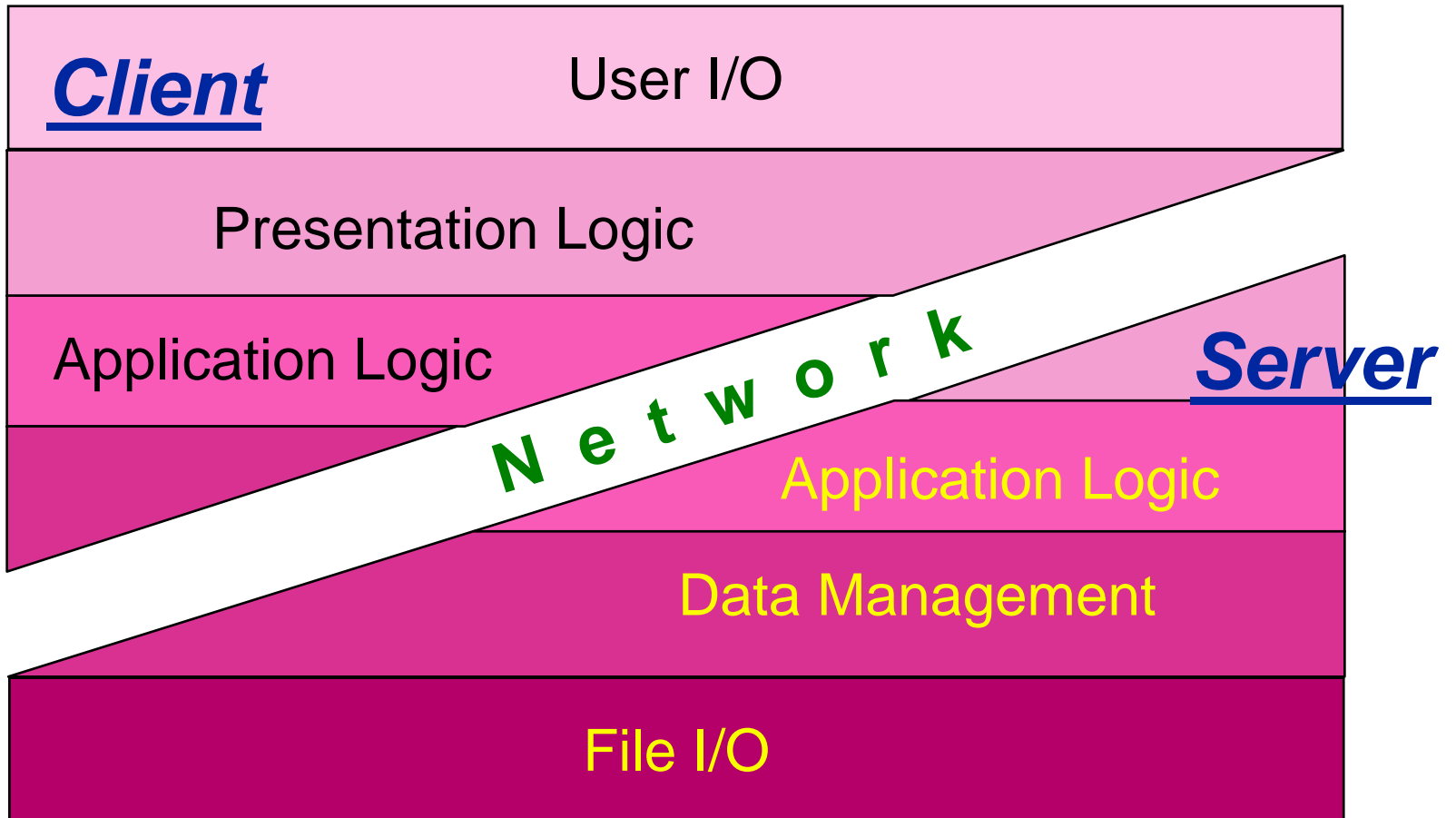


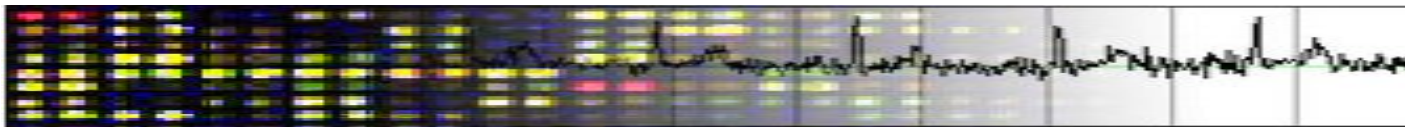
Basic Application Structure





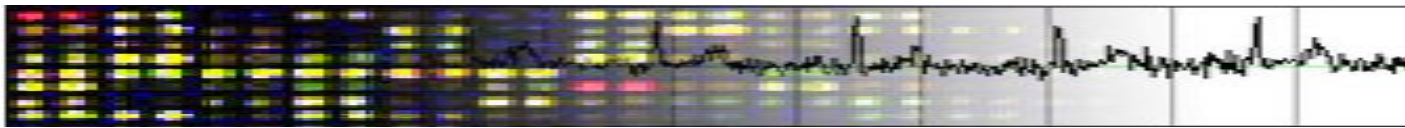
Client-Server Model





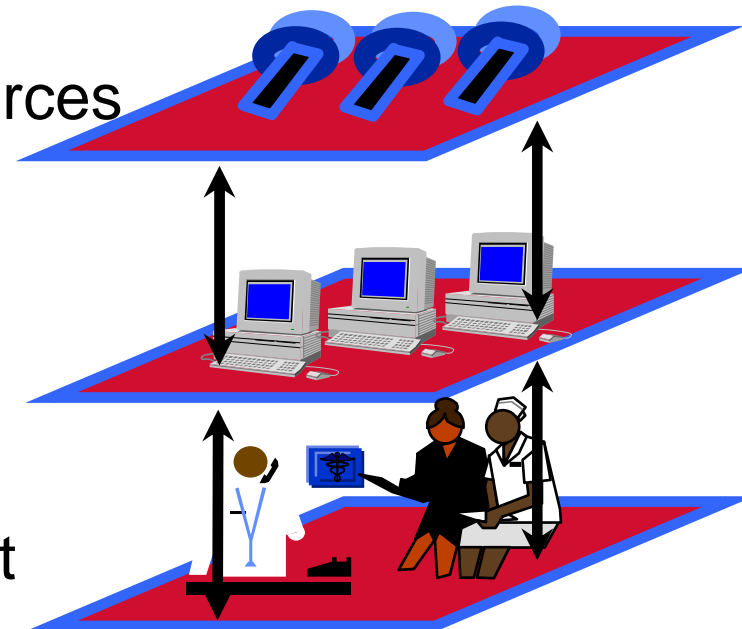
Advantages of client-server architecture

- 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)



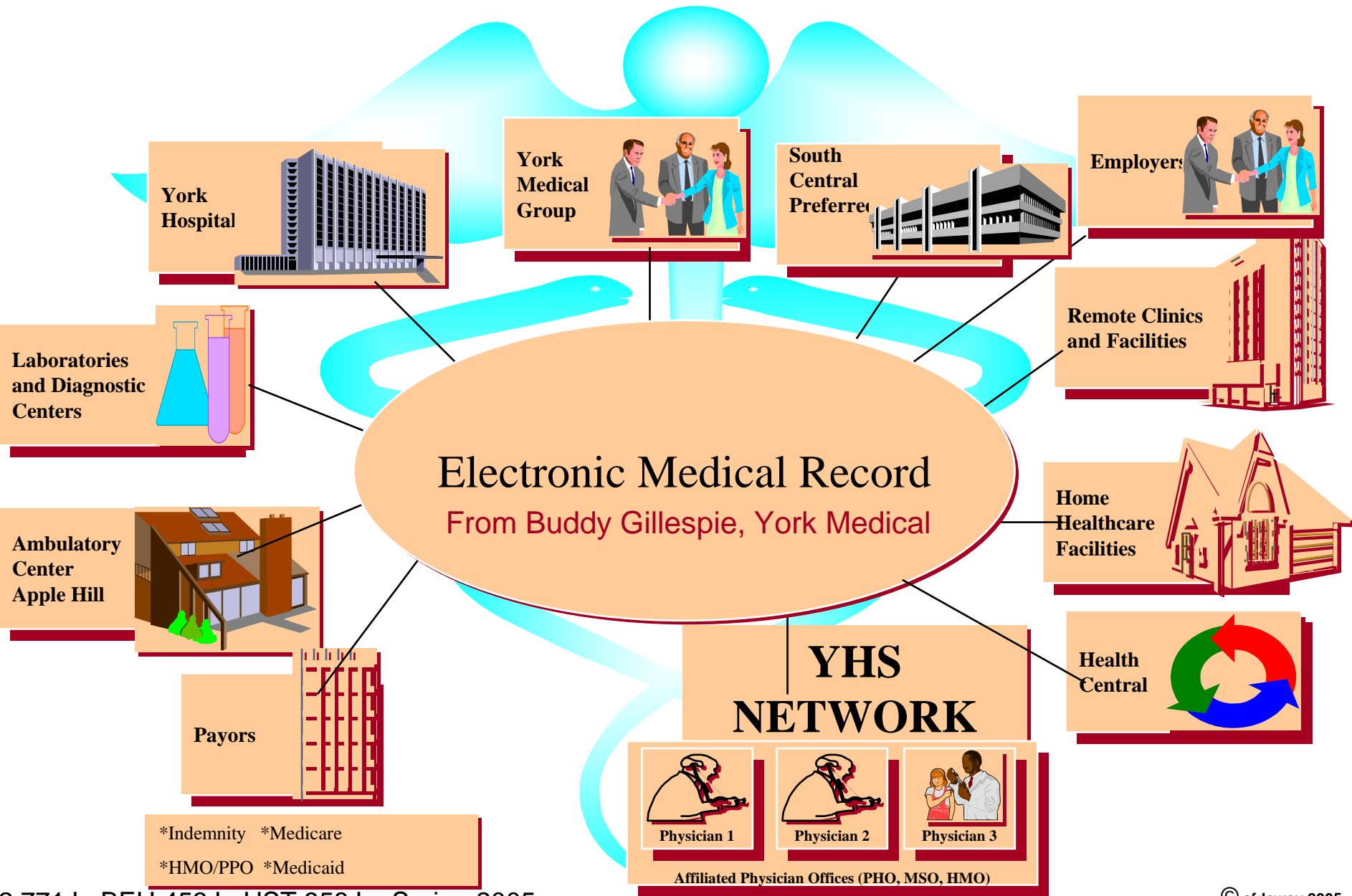
Duke University Medical Center

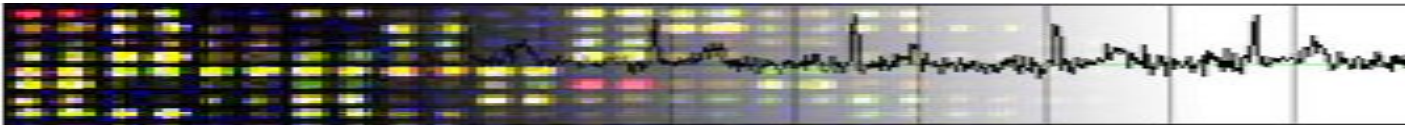
- ❖ 1996 Implementation: Louis Humphrey and Minh Do Van
- ❖ ATM Image Server Network
- ❖ Switched Ethernet to Image Sources
- ❖ RAID Image Storage
- ❖ 2Kx2K Display
- ❖ DICOM Format for Images
- ❖ Sybase System 10 Database
- ❖ Switched Connection to Ethernet
- ❖ Supports US, CT, MR



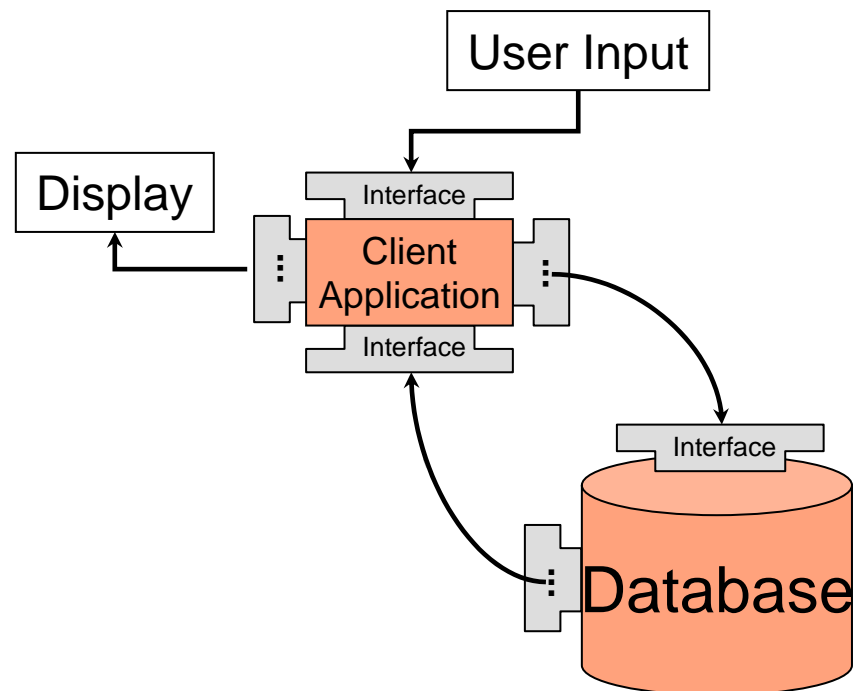
Refs: J. Digital Imaging 8:43 (1995)

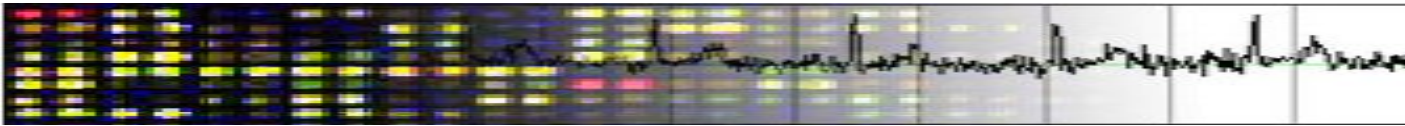
Hospital Integrated Delivery Network



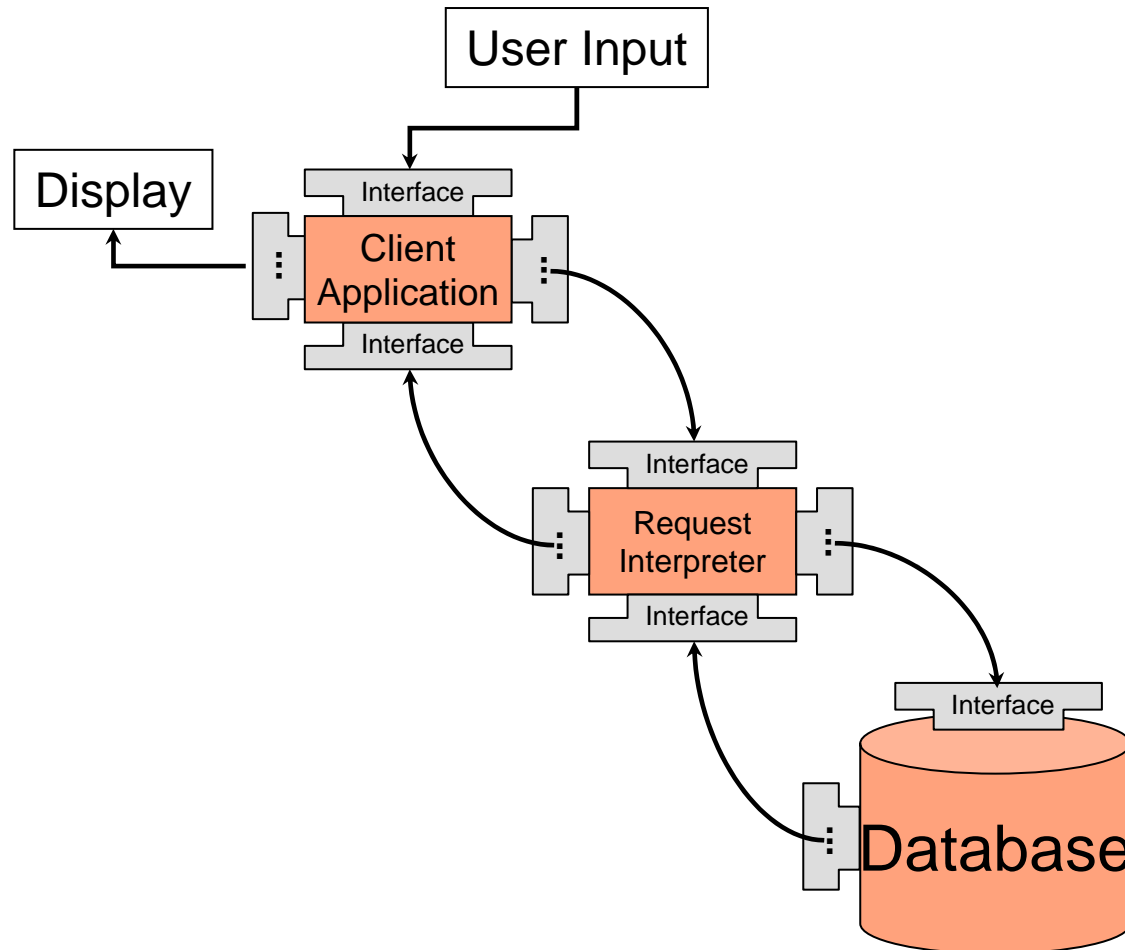


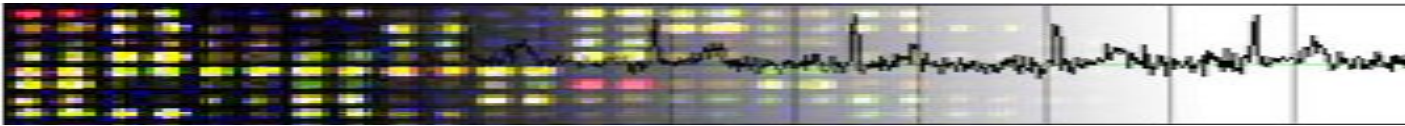
Conceptual connections between information entities



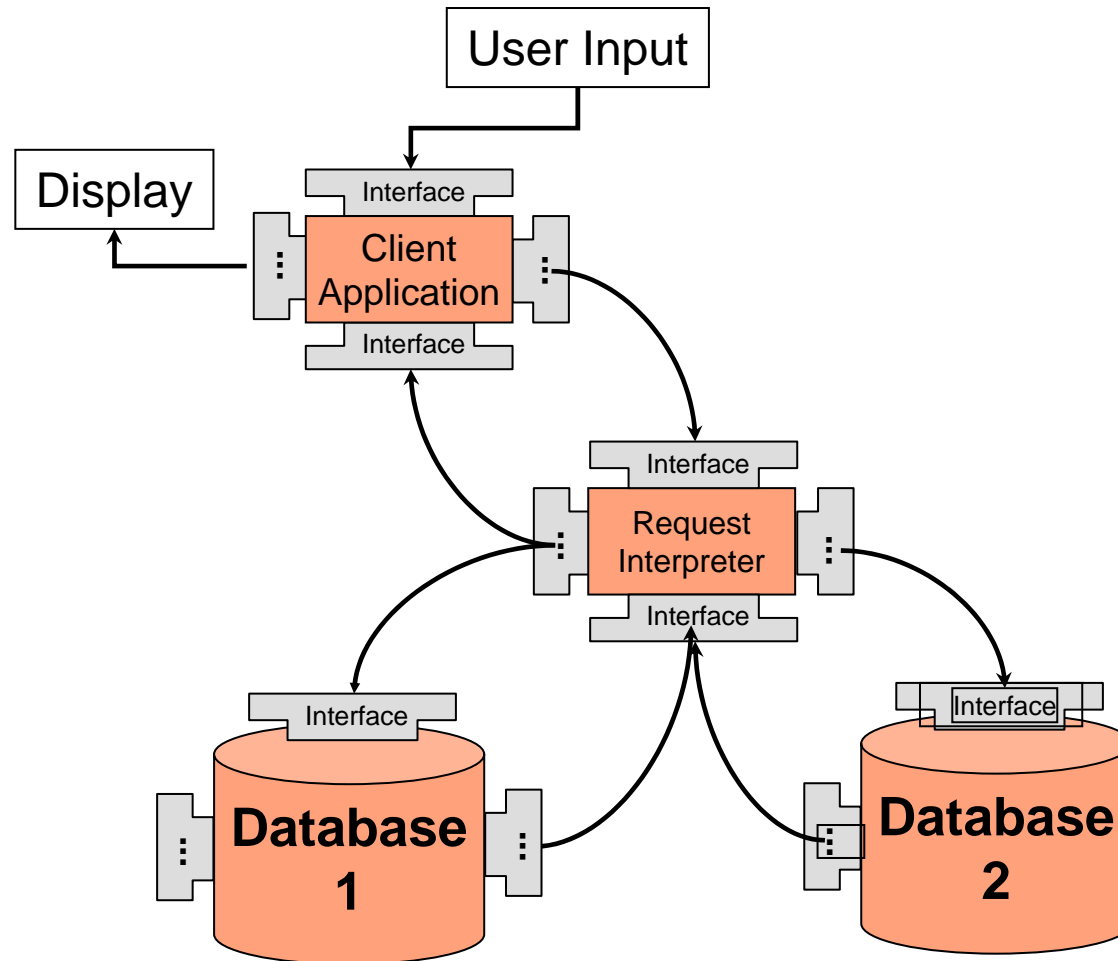


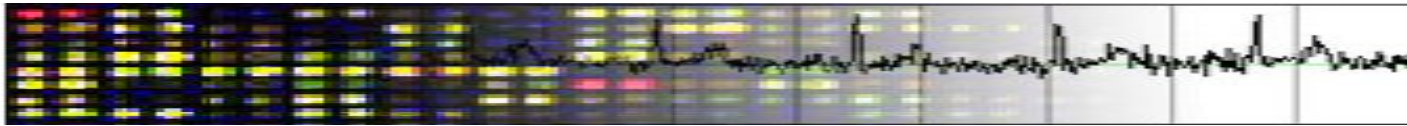
Using a Request Interpreter





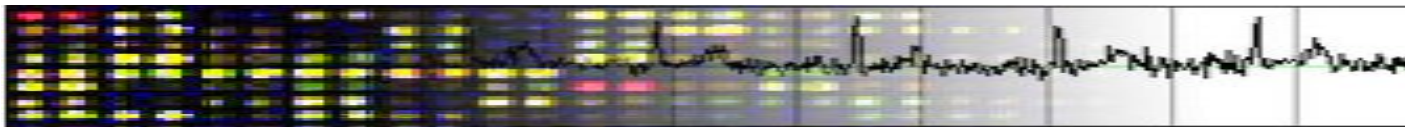
Accessing multiple information entities





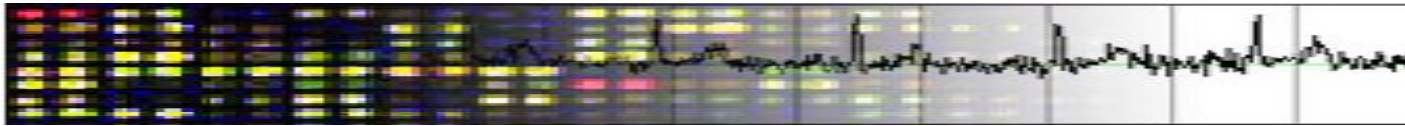
Client-server implementation

- ❖ *Network strategies*
 - *Direct connect*
 - *Web browser*
 - *Down-loadable application*
 - *Caching*
- ❖ *Interface requirements*
 - *Graphics*
 - *Client-side calculations*
- ❖ *Data exchange formats*
 - *CORBA and XML*



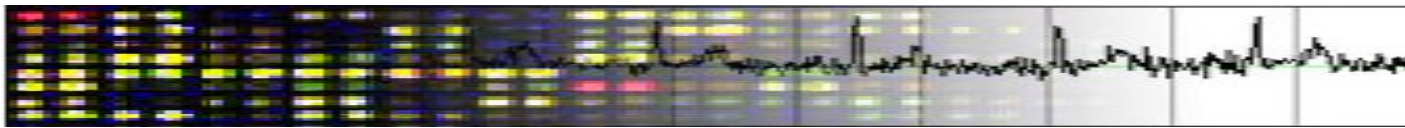
Reusable code

- ❖ *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

