

Newer Procedures In Radiology

6/1/91

**Electronic Image Management:
Picture Archiving and Communication Systems
(PACS)**

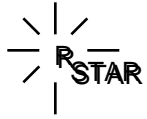
The Department of Radiology
Massachusetts General Hospital

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Director, PACS Project



PACS is ...

- **PACS** - Picture Archiving and Communications System
- **FDD** - Fully Digital Department
- **DIN** - Digital Information Network
- **MIMS** - Medical Image Management System
- **IMAC** - Image Management and Communication



PACS Components - 1

The Workstation

That component of the system where radiologists, referring physicians, and researchers can search for, view, and manipulate radiological images.

The user interface to the system.



PACS Components - 2

The Archive

That component of the system that stores images and their associated demographics for future recall.

The electronic file room.

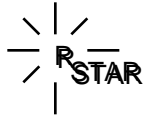


PACS Components - 3

The LAN

That component of the system that transports images, demographics, and other related information to the workstations.

A digital communications network.



PACS Components - 4

The Image Processor

That component of the system that manipulates and transforms images digitally.

- **Edge enhancement**
- **Reconstruction**
- **3-D imaging**
- **Etc.**

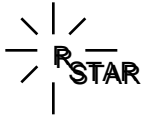


PACS Components - 5

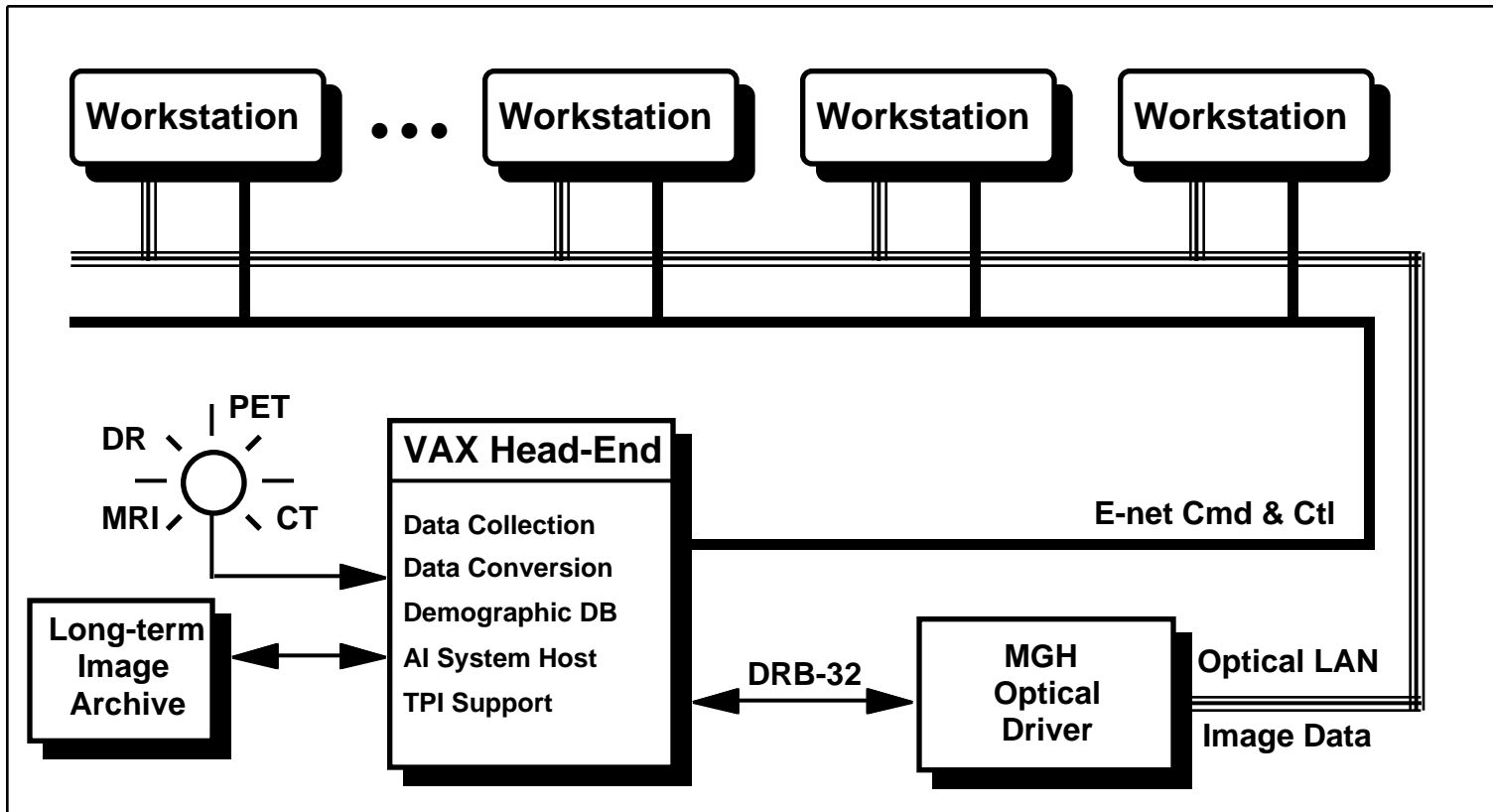
System Control

That component of the system that:

- **Collects the studies**
- **Tracks the studies**
- **Manages the work-flow**
- **Aids the user**



PACS Overall Block Diagram





What is PACS? - A Solution

**An answer to
the problems of
increasing...**

- **Volume of images**
 - **Retention of images**
 - **Demand for viewing**



What is PACS? - 1

**Better
Medicine**

- **Easy access to clinical data**
- **Images available anywhere**
- **Images available anytime**
- **Multimodality viewing**
- **Multimedia viewing**
- **Image processing**
- **Conferencing**
- **Teaching**



What is PACS? - 2

Better Management

For the Hospital

- Increased revenue capture
- New source of revenue

For the Department

- Increased film availability
- Enhanced case tracking

For the User

- Electronic "Librarian"
- Electronic "Secretary"
- Increased throughput



What is PACS? - 3

**A work-flow management system
for radiological studies**

Consisting of

- **Data/image collection**
- **Data/image archiving**
- **Data/image transmission**
- **Data/image display**
- **Management algorithms**



RSTAR is...

**Radiology Storage Transfer Analysis
and
Reporting**



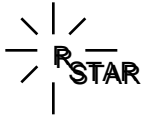
Goals: Clinical Focus

**Primary Interpretation
Workstation for
Radiology**

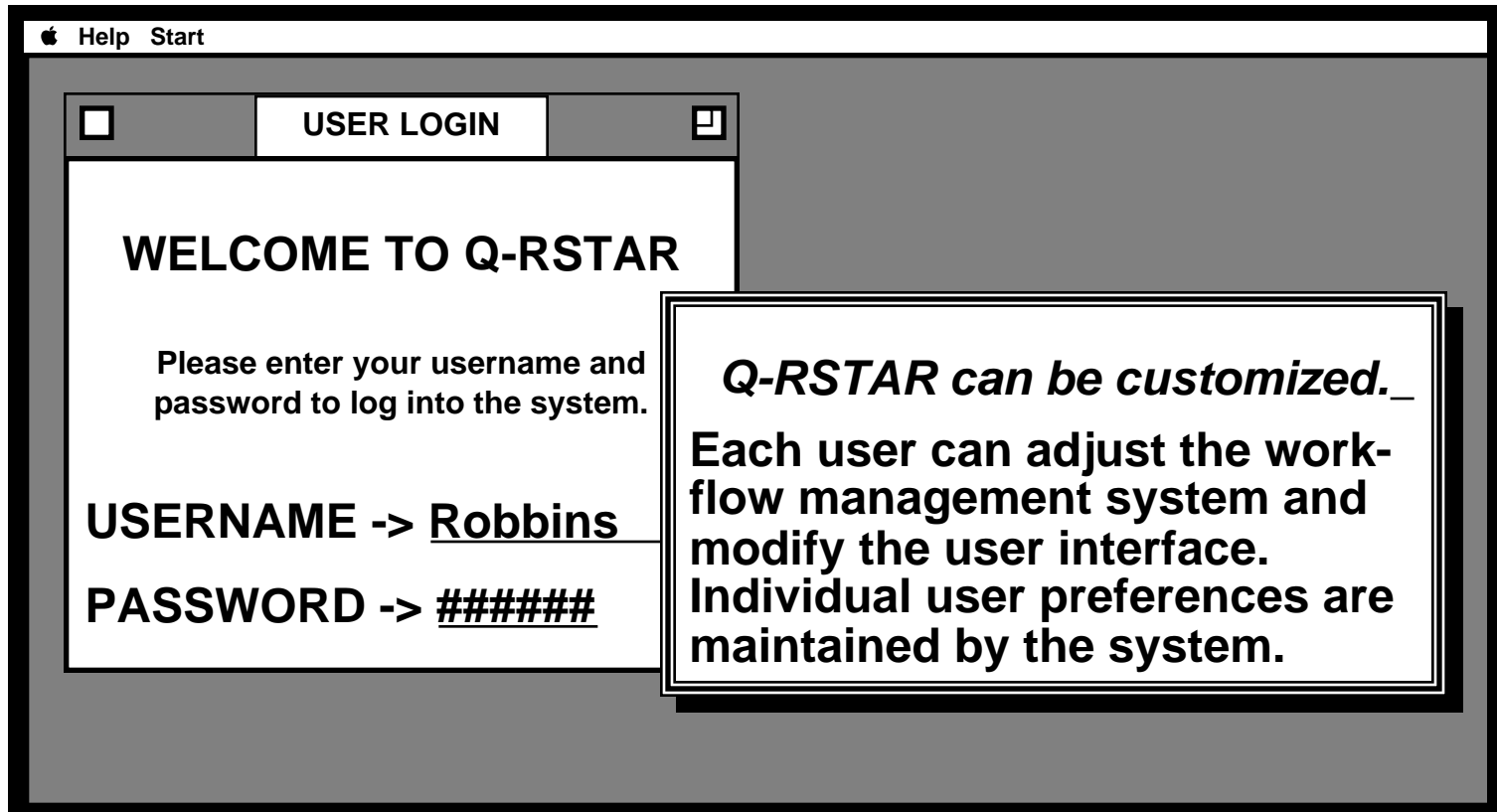


User Interface: Goals

- **Minimum User Interaction**
- **Speed**
- **Completeness**
- **Flexibility**
- **Tailorability**

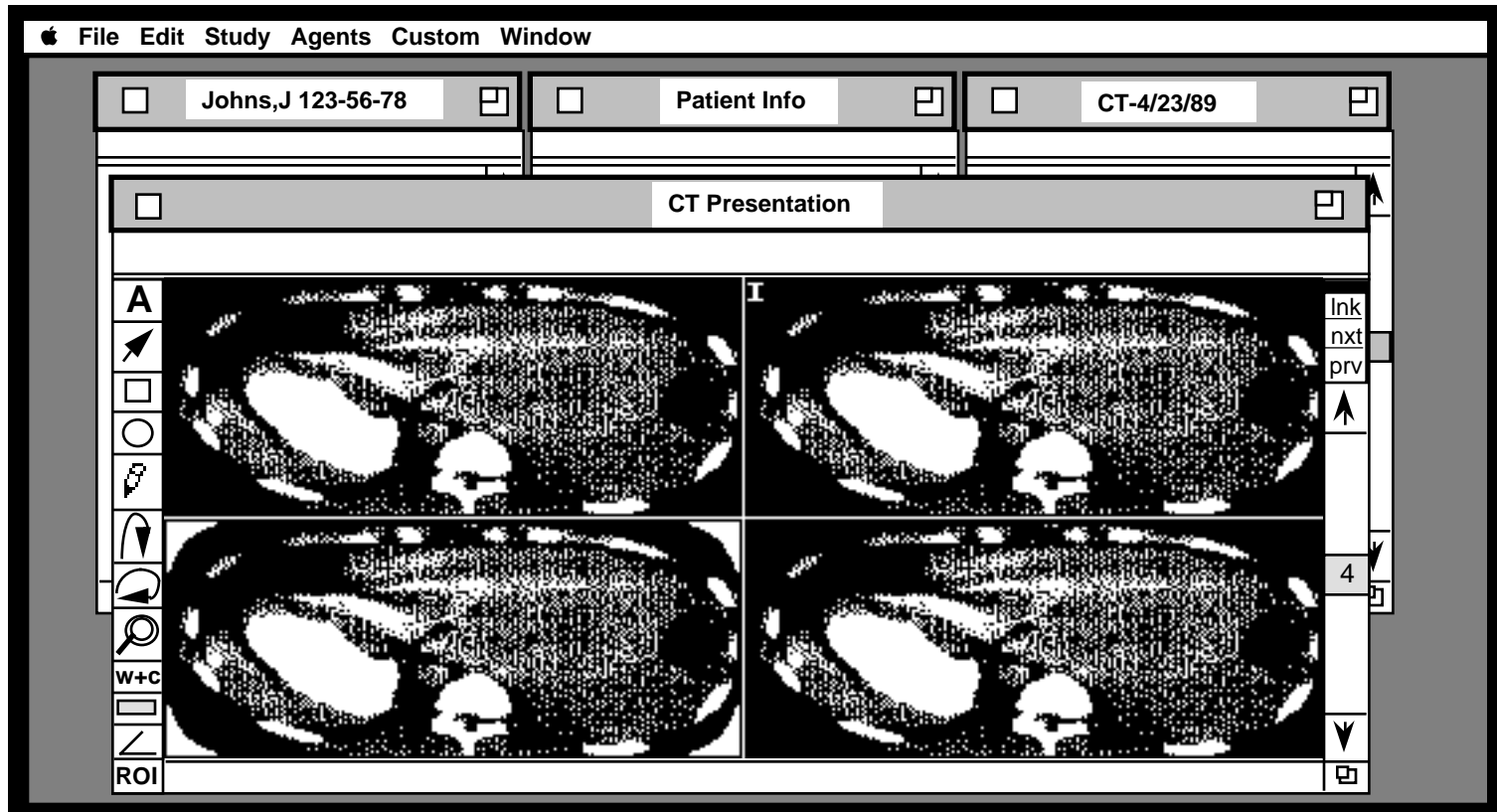


User Interface: Login



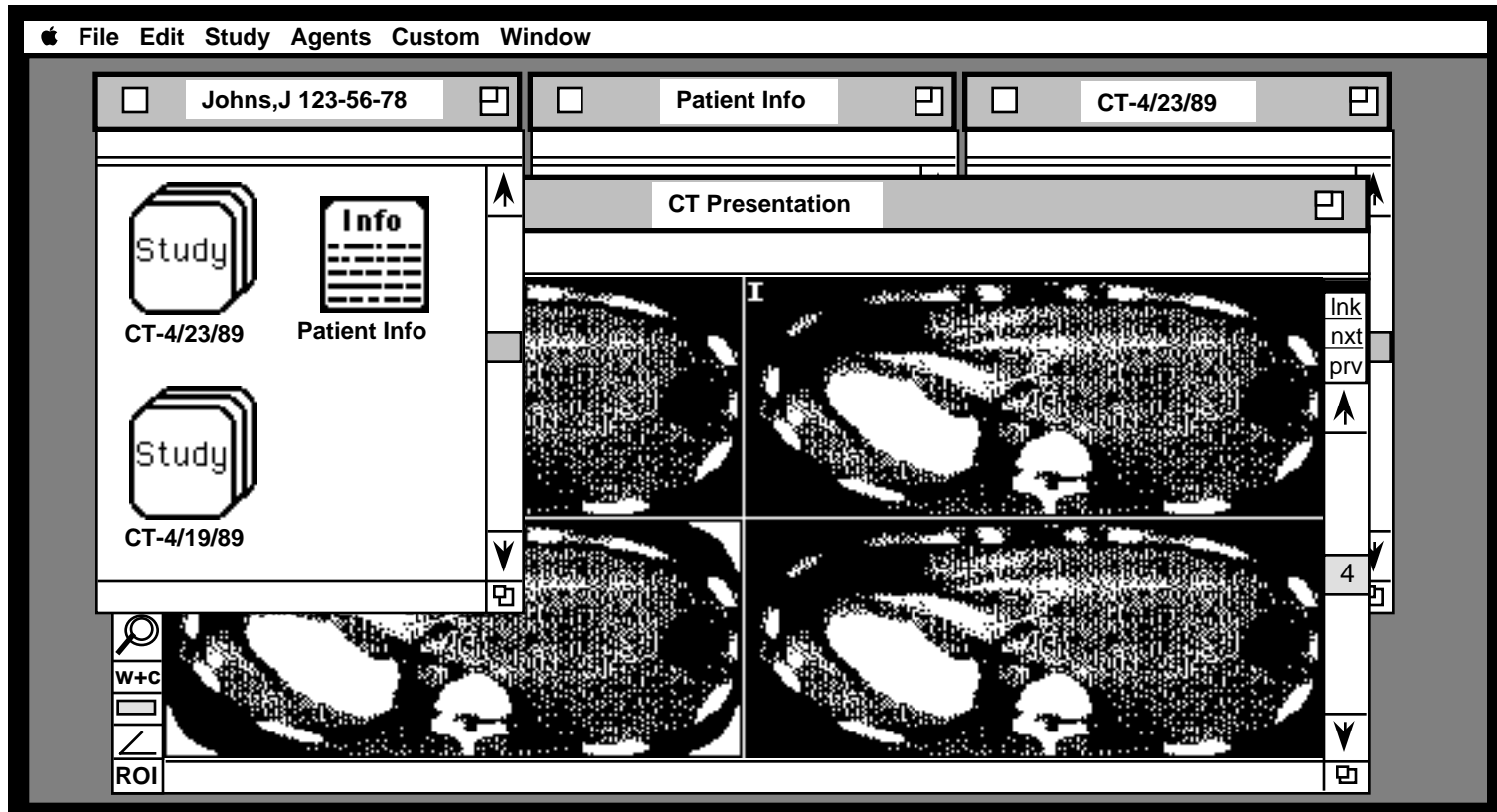


User Interface: Study Presentation





User Interface: Master Folder





User Interface: Clinical Review

File Edit Study Agents Custom Window

Catalog of Images

DECRAD: Patient Report

Patient Report

Patient Loc: EW9 123-44-55
Status: 0 Mary Smith
DOB: 2-DEC-44 SEX: F
Physician: Jones, Harry
AN: 123123 8-MAY-88 10:25am
History: Angina

There is a marked hypolinesis at the apex of the anterior view with apical akinesis on the LAO projection.

CINE LOOPS • Ejection Fraction

LAO LPO ANT

E.F= 54

VOLUME

100
46

0.1 0.7 1.6

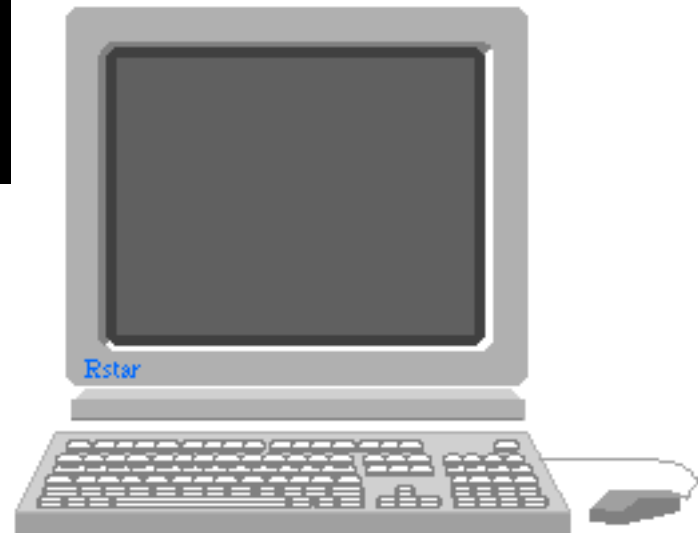
TIME (SEC)

© 1991 The General Hospital Corp. 20



Goals: Any Image Any Time

At any workstation throughout the department (later the hospital) be able to display any patient's radiographic exams.



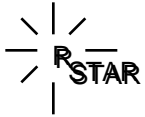


Goals: Multimedia Mail

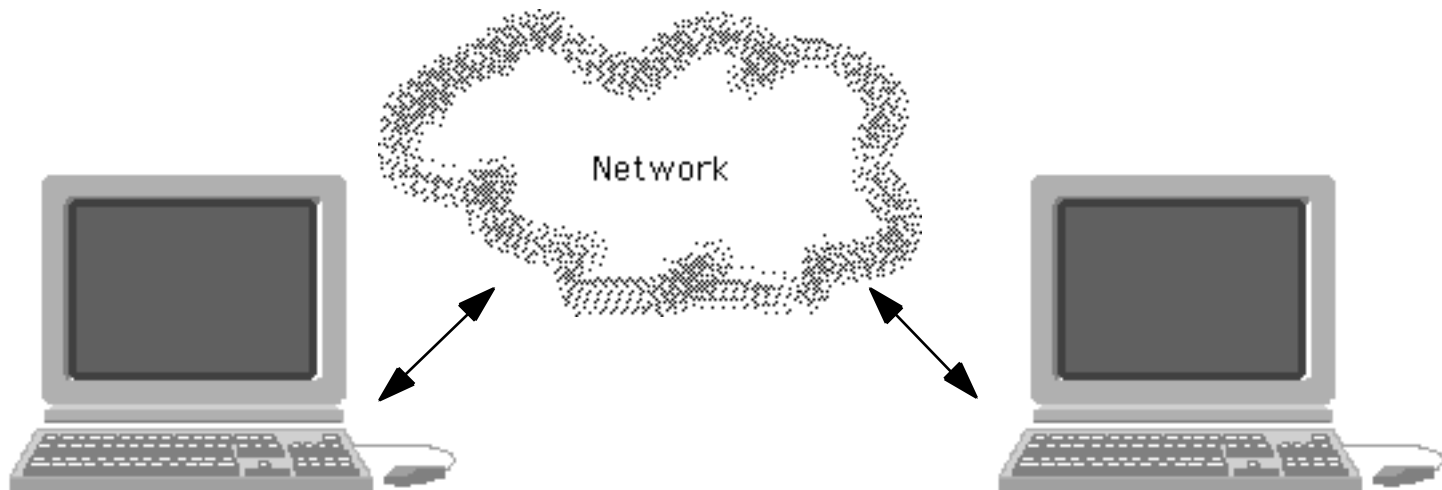
Mail consisting of:
Image
Text
Voice
Pointer movement



Any user can create and send electronic mail to be played back by another user later.



Goals: Multimedia Consultation



By using a real-time network physicians both viewing the same radiographic exam can point out areas of interest on each other's workstation as well as conversing by voice.



Goals: User Perspective

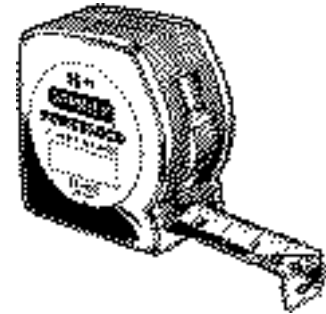
What does Q-RSTAR do?

- **Manages the user's work-flow**
- **Makes studies available quickly**
- **Provides an easy to use system**



What have we been doing? Toolkit

We have been making a PACS toolkit with sufficient flexibility, performance, and image quality to meet the challenging demands.



Hardware

Software

and

Supporting infrastructure

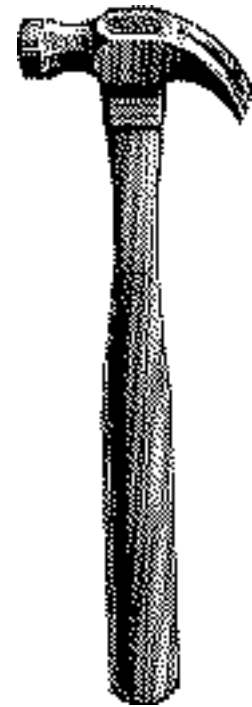


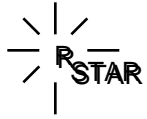


What have ...? Software

TOOLS:

- **Graphic user interface builder**
- **Demographic database**
- **Image database**
- **Image cache**
- **Interface to DecRad**
- **Expert-system substrate for next exam, ...**
- **Study loaders**
- **Software interface-bus**
- **Plus much more...**

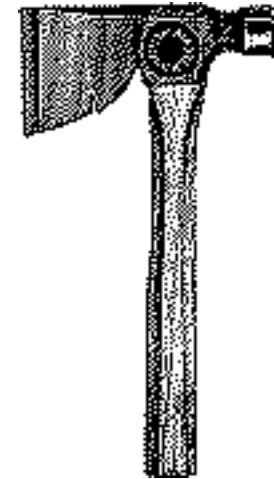




What have ...? Hardware

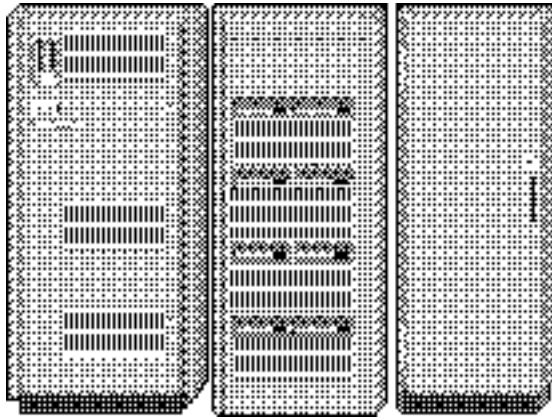
TOOLS:

- Optical Local-Area-Network
- 2K squared display controller
- DuPont digitizer interface
- 3M laser printer interface
- Generic high-speed interface
- Integrated 90 megaflop image processor
- High speed telephone interface
- High Res workstation 2K
- Medium Res workstation 1K
- Plus much more...





What have ...? Infrastructure -1



VAX 6430 Computer

- 15 Gigabytes disk storage
- Optical storage units
- Vector processor -90 megaflop
- Text-to-speech

Workstations

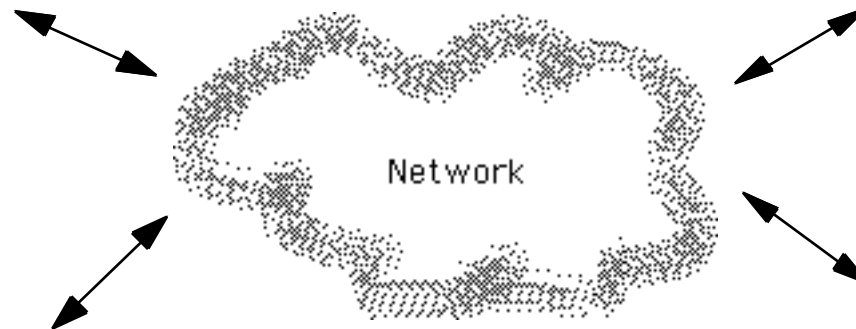
Local area network

Wide area network

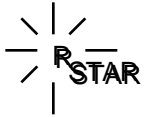


What have ...? Infrastructure-2

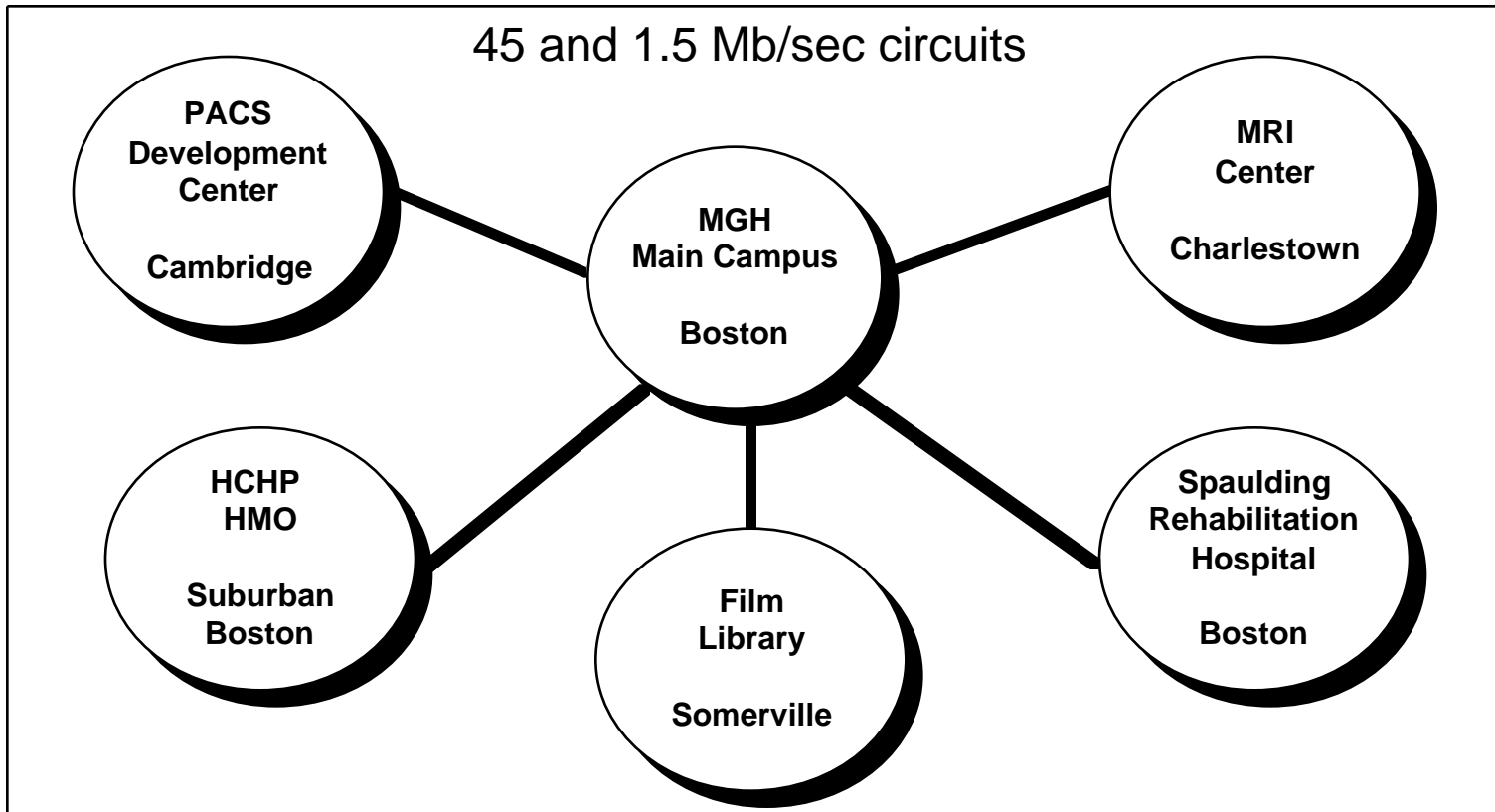
Local Area Network
10 & 100 megabit/second

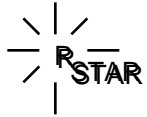


White 1...2, Ellison 2...9, ACC 2...5, Phillips 2, Gray 2, POB 1...4
(Bulfinch, Wellman)



What have ...? Infrastructure-3





In Process: ICU: 2

Specialized workstations for the Intensive Care Unit.

**Choosing
the patient.**

TOP
MORE
BACK

ICU Patients -- 29 FEB 1989
Press MORE to see next page

	PATIENT NAME	MRN
1.	Armstrong, Walt	302-54-67
2.	Bernstein, Leo	505-52-89
3.	Charles, Ray	408-41-85
4.	Donovan, Shirley	201-52-98
5.	Edwards, Jon	333-55-23
6.	Franklin, Aretha	567-32-12
7.	Gerber, Joyce	432-67-00
8.	Howard, Joseph	112-42-83
9.	Isaacs, James	809-76-27
10.	Johnson, Jack	933-43-11

SPEC



In Process: ICU: 3

Specialized workstations for the Intensive Care Unit.

Choosing
the study.

TOP
MORE
BACK

Armstrong, Walt 302-54-67
Press BACK to select another patient.

	Exam Date	Time	Type
1.	11-JAN-89	10:00	Chest
2.	10-JAN-89	21:30	Chest
3.	10-JAN-89	15:30	Chest
4.	09-JAN-89	08:45	KUB
5.	08-JAN-89	17:35	Chest
6.	08-JAN-89	20:30	Chest

SPEC



In Process: ICU: 4

Specialized workstations for the Intensive Care Unit.

Viewing
the images.

