Networks in health systems

Networks reading

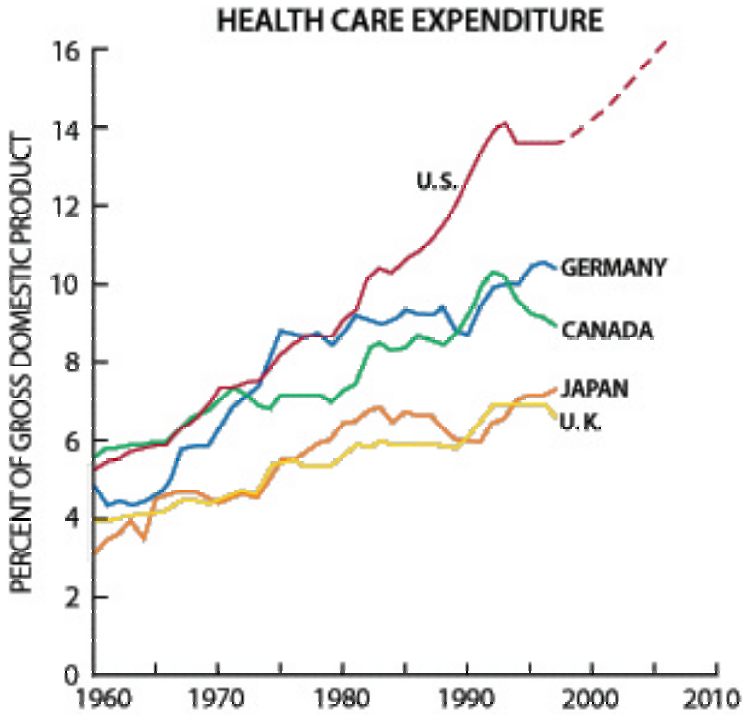
- Shortliffe chapter 10
  - Integrated delivery networks

Context

- References:
  - Healthcare information systems: Davidson

    (Auerbach Best Practices Series)

    "The general perception that the use of information technology in healthcare is ten to fifteen years behind that of other industrial sectors such as banking, manufacturing and the airline industry is rapidly changing"



SOURCE: Organization for Economic Cooperation and Development, Health Data 1997. Dashed line shows projections for U.S. made by Sheila Smith, Mark Freeland, Stephen Heffler et al., "The Next Ten Years of Health Spending," in Health Affairs, *Vol. 17, No. 5, pages 128–140; September–October 1998.*

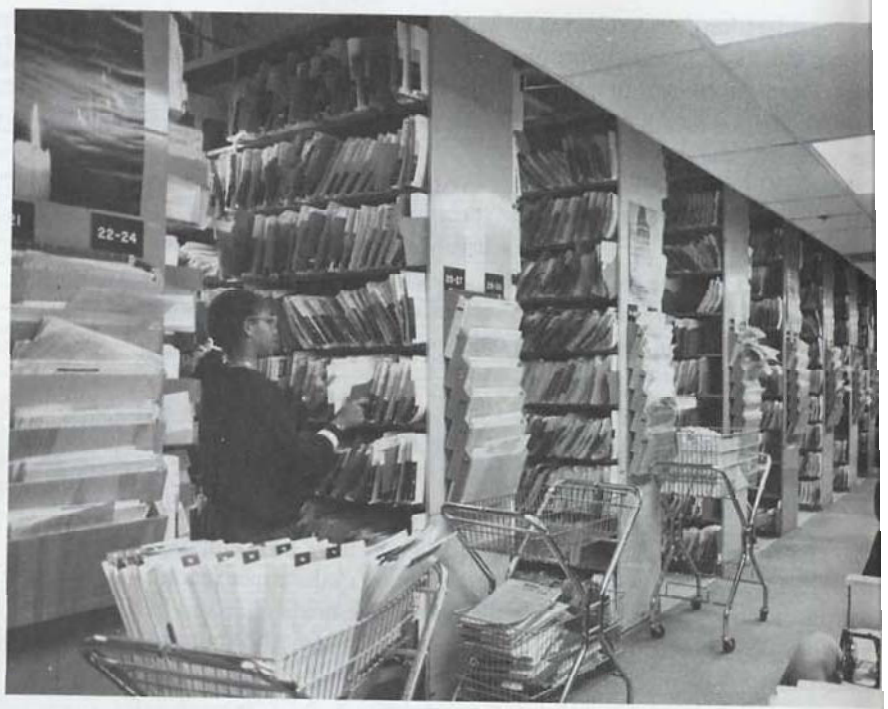


FIGURE 2.7. A typical storage room for medical records. It is not surprising that charts sometimes are mislaid. (*Source:* Photograph by Janice Anne Rohn.)

Banking

- Track money
  - Secure
  - confidentiality
- Loan and mortgage approval
  - Intelligent assistance
  - Automated loan approval
- Credit card fraud management
- Medical counterparts

Airline

- Airline tracking
- Luggage tracking
- Passenger tracking
- Price tracking
- Customer satisfaction
- Medical counterparts

Manufacturing

- Process management
  - Raw materials
  - Assembly line
- Inventory control
  - Just in time
- Sales
  - What's selling where
- Medical counterparts

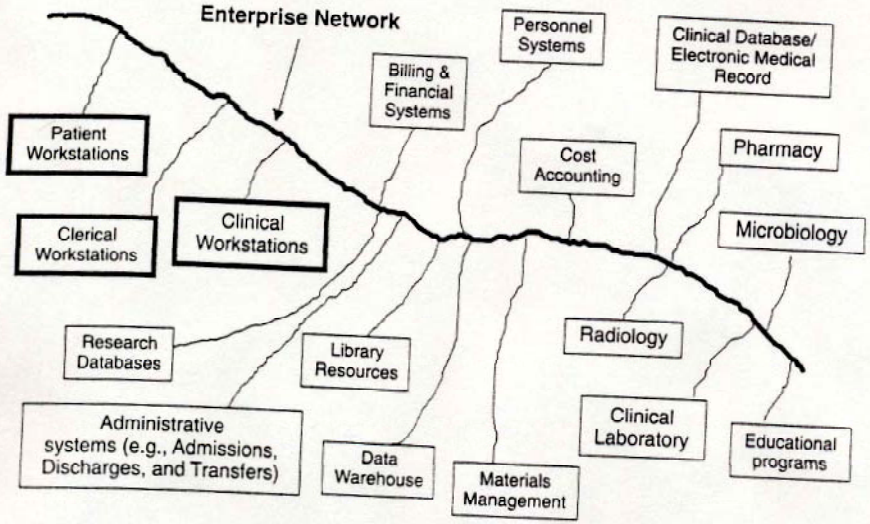


FIGURE 1.6. Networking the organization. The *enterprise intranet* is a locally controlled network that extends throughout a healthcare system. It allows specialized workstations to access a wide variety of information sources: educational, clinical, financial, and administrative. An EMR emerges from such an architecture if a system is implemented that gathers patient-specific data from multiple sources and merges them for ease of access by users such as those illustrated in Figure 1.2. Such systems are often called *clinical data repositories*, particularly if they do not yet contain the full range of information that would normally occur in a medical record.

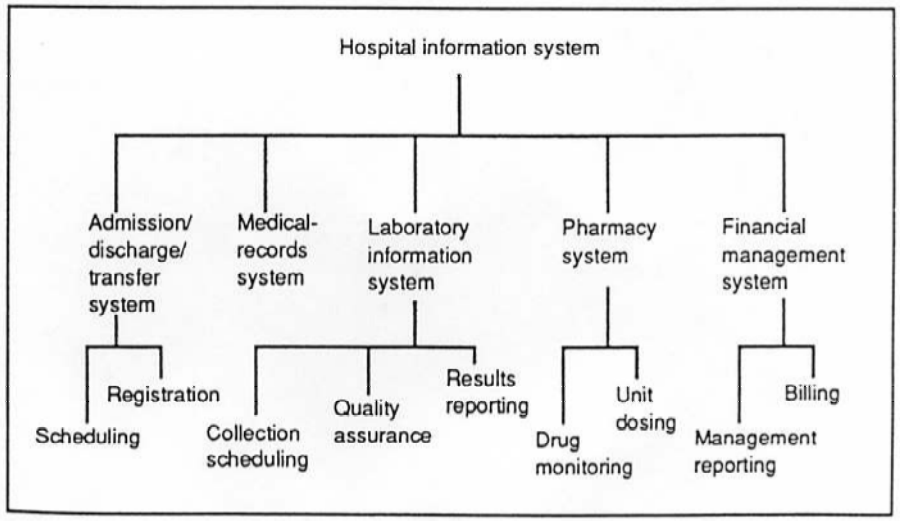


FIGURE 5.4. A hospital information system comprises interrelated subsystems that serve individual departments. In turn, each subsystem comprises multiple functional components.

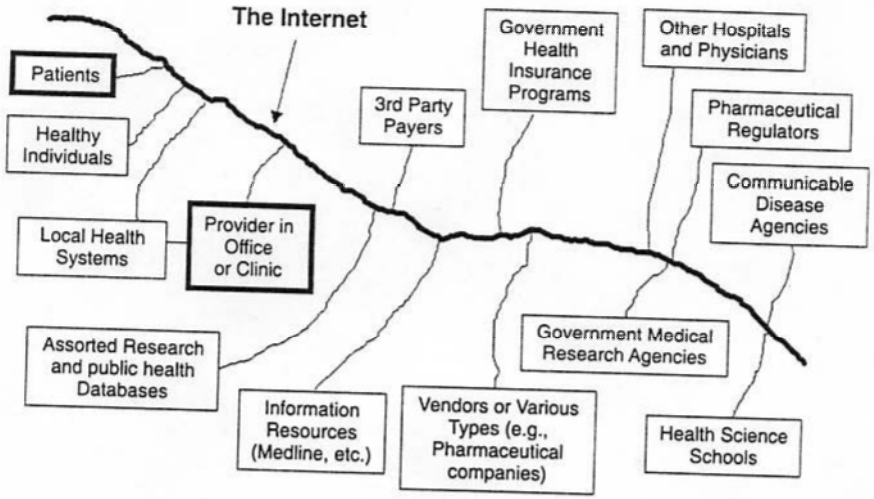
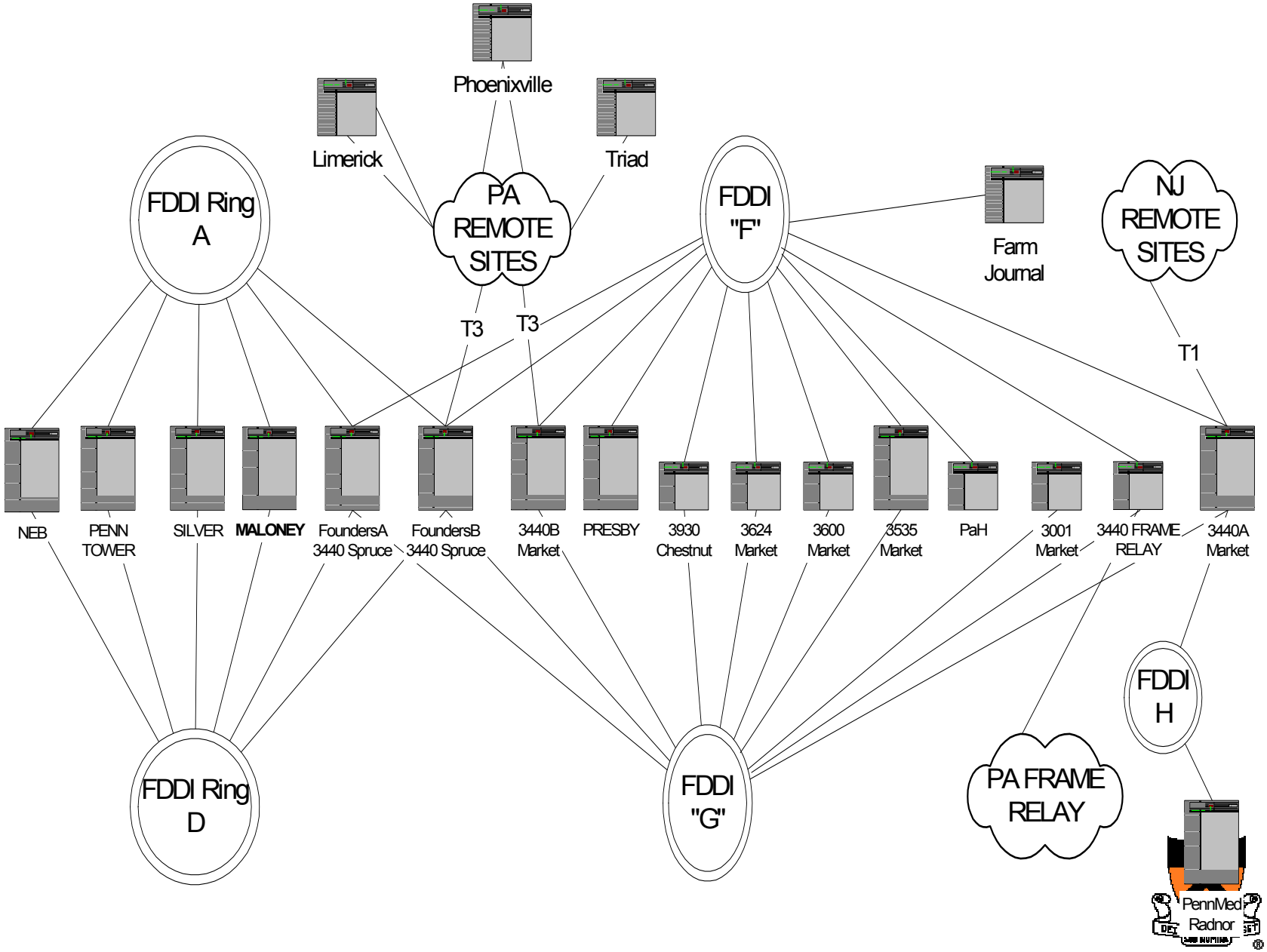


FIGURE 1.7. Moving beyond the organization. The *enterprise Internet* is the integration of an organization's intranet (Fig. 1.6, encapsulated in the box here labeled "Local Health System") with the full potential of the worldwide Internet. Both providers and patients increasingly access the Internet for a wide variety of information sources and functions suggested by this diagram (see text).


Phoenixville
Limerick
Triad
FDDI Ring A
PA REMOTE SITES
FDDI "F"
Farm Journal
NJ REMOTE SITES
T3
T3
T1
NEB
PENN TOWER
SILVER
MALONEY
FoundersA 3440 Spruce
FoundersB 3440 Spruce
3440B Market
PRESBY
3930 Chestnut
3624 Market
3600 Market
3535 Market
PaH
3001 Market
3440 FRAME RELAY
3440A Market
FDDI Ring D
FDDI "G"
PA FRAME RELAY
FDDI H
PennMed Radnor

Functions and components of a HIS

- Financial and resource management
  - Billing (multiple bills from multiple providers)
  - Infrastructure support
    - Materials management
- Managed care support
  - Provider profiling
  - Contract management
  - Patient triage

Functions and components of a HIS

- Patient management
  - MPI – master patient index
  - ADT – census
  - Patient tracking?
- Departmental management
  - Radiology, pharmacy etc

Functions and components of a HIS

- Care delivery and clinical documentation
  - Order entry and results reporting
  - Clinical pathways
- Clinical decision support
  - Remind re: allergies
  - Smart alarms
  - Diagnostic support

1965-73

- Large central computers (IBM/SMS)
- VDT's
- Inhouse data processing, software support
- Example
  - Technicon medical information system
  - TDS
  - Eclipsys

1965-73

- TMIS
- Dual IBM mainframes
  - One machine for user interaction
  - One machine for batch billing
  - Redundancy
  - Could serve multiple hospitals over dedicated phone lines

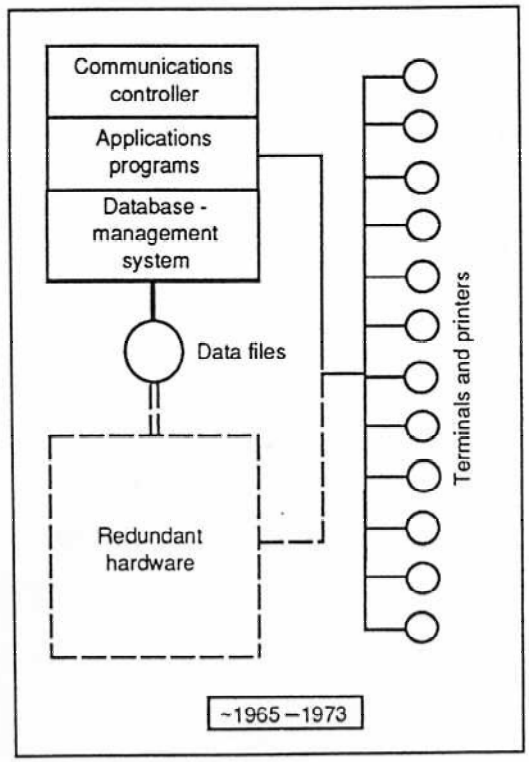


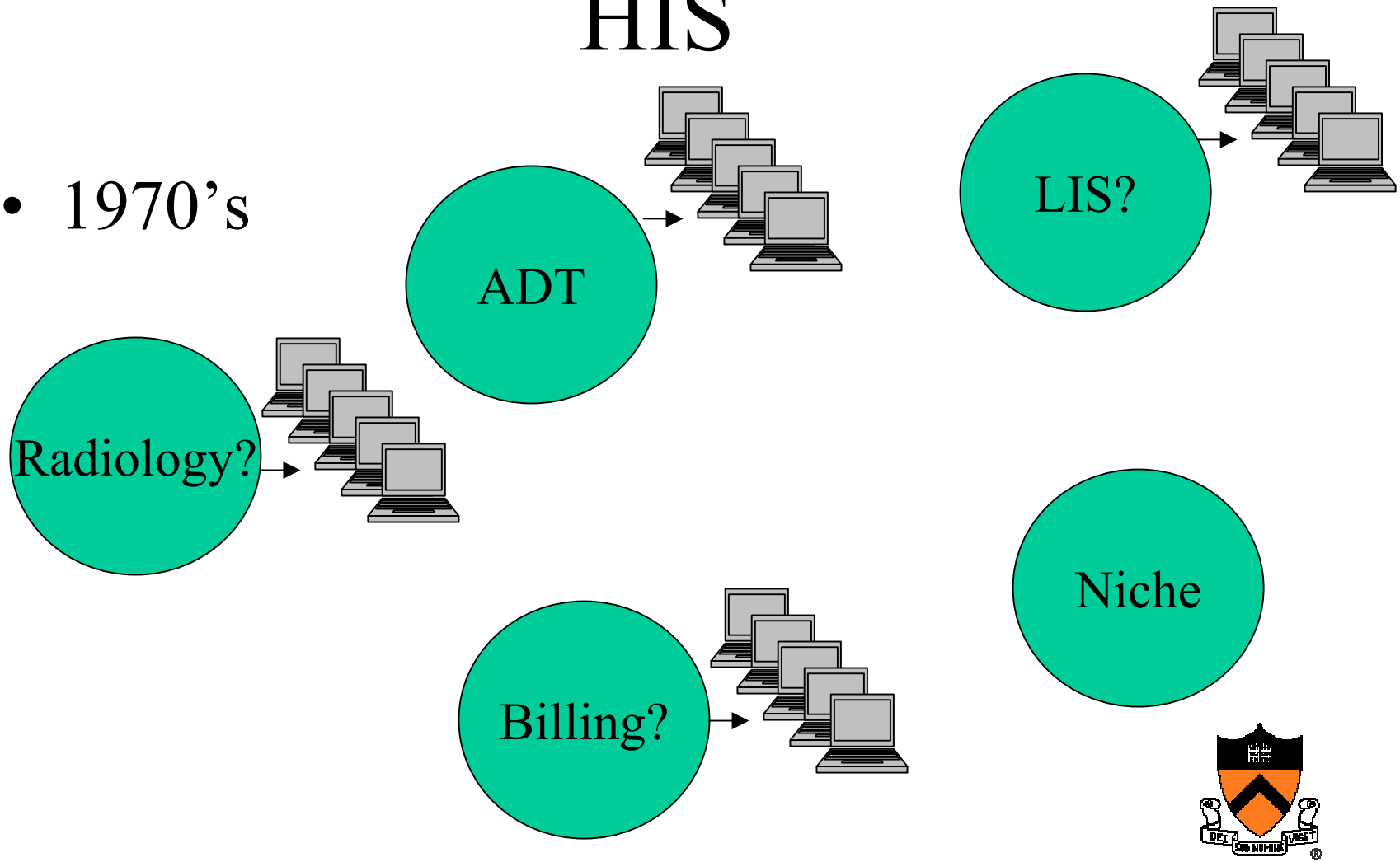
FIGURE 10.5. The earliest HCISs were central systems. In this model a large, central computer serves the information needs of the entire hospital. Users access the computer from video-display terminals via general interface programs.

1965-73

- Advantages:
  - well integrated
- Disadvantages:
  - Costly to implement and maintain
  - Not nimble

HIS

- 1970's



1973-83

- Modular HIS
  - Several mainframes
  - Communicate through central machine
  - Limited networking
- Example
  - Distributed hospital computer program (DHCP)
  - Modules
    - Registration, ADT, scheduling, lab etc
    - Written in MUMPS

Modular systems

- Advantages
  - More responsive to local users
  - Smaller central machine
- Disadvantages
  - Difficulties with integration, communication

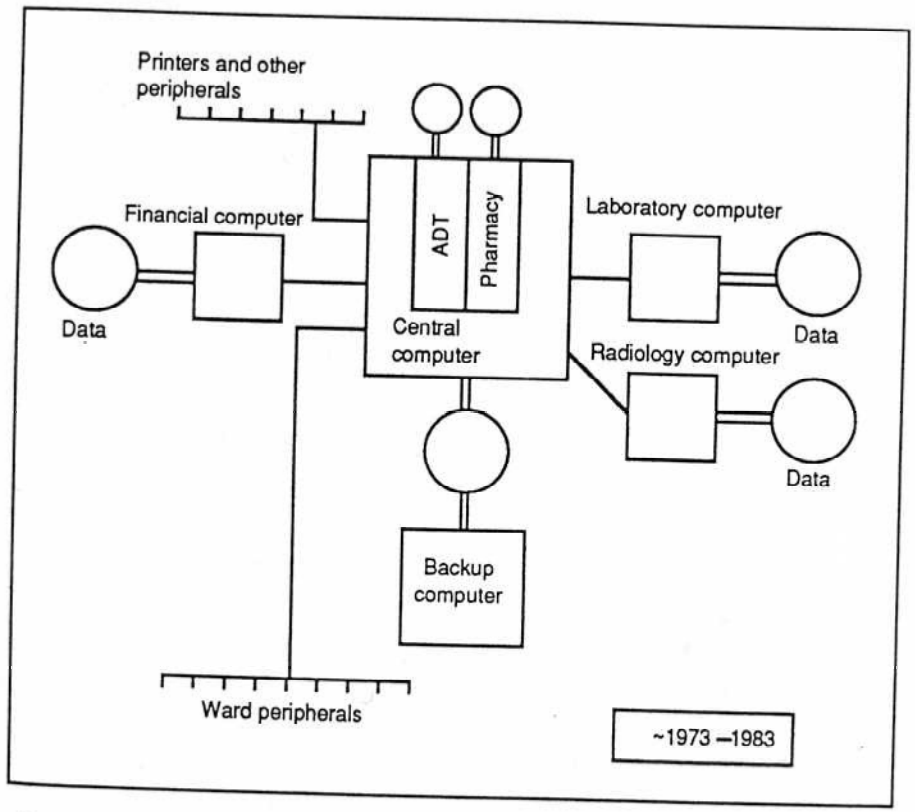


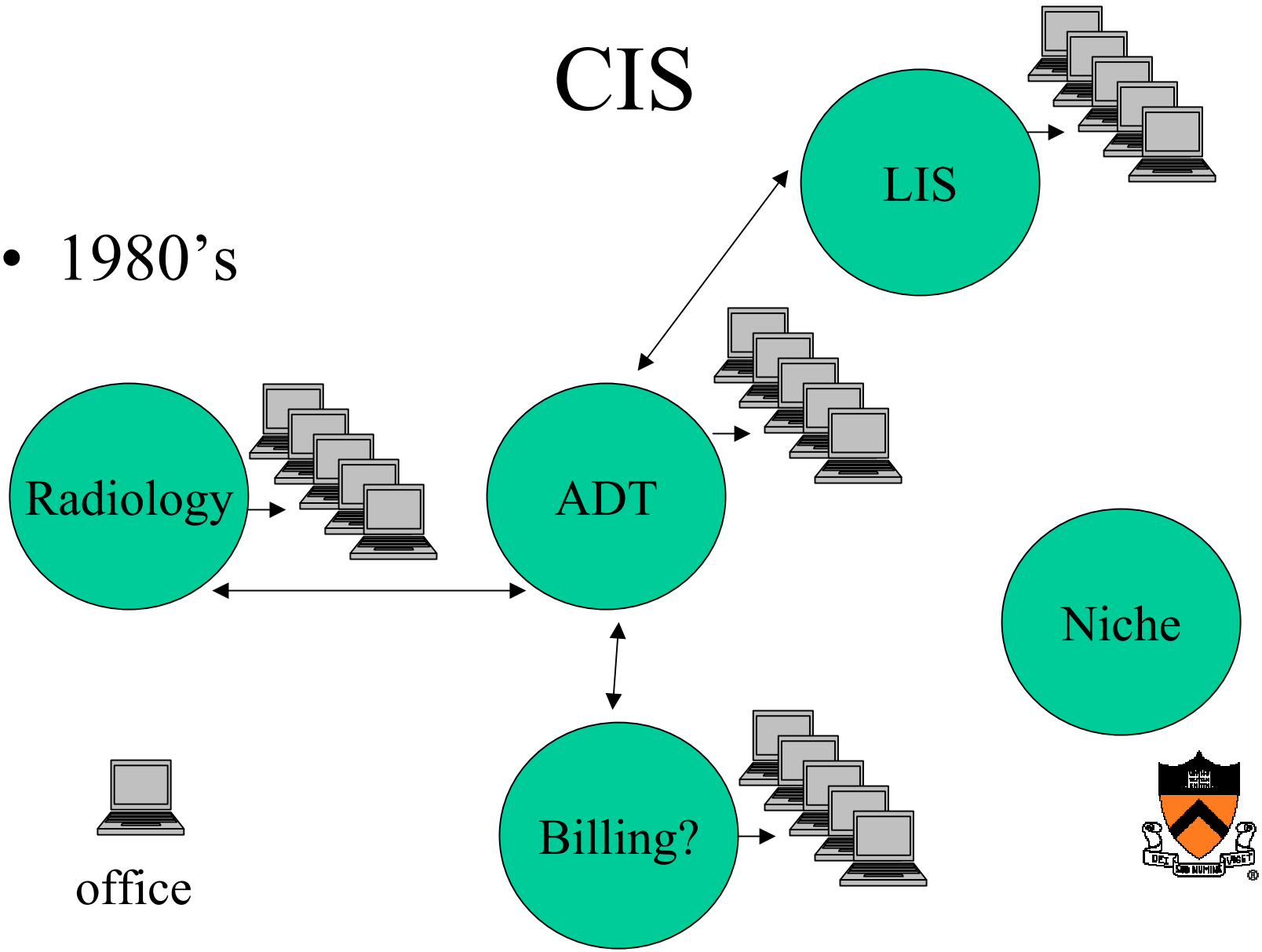
FIGURE 10.6. In modular systems, much information processing is performed locally on dedicated machines that communicate with a central machine via direct interfaces. ADT = admission–discharge–transfer.

Latter 1980's

- Distributed systems
  - Microcomputers
  - Gateways between LAN's
- Development of standards
  - Communication
  - Nomenclature

CIS

- 1980's



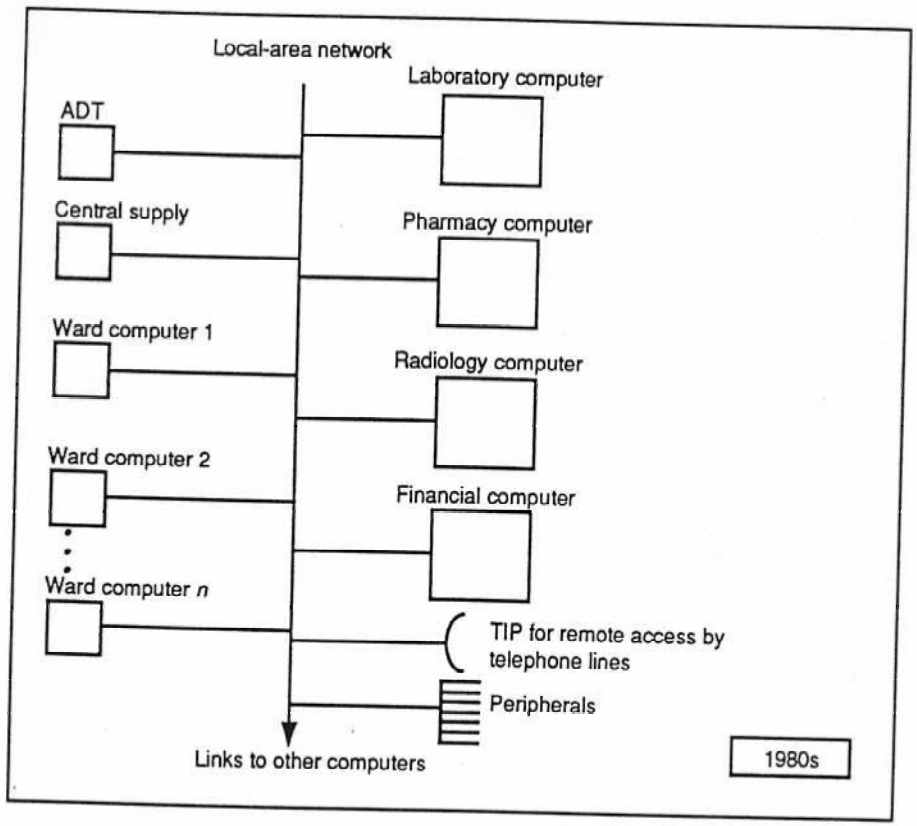
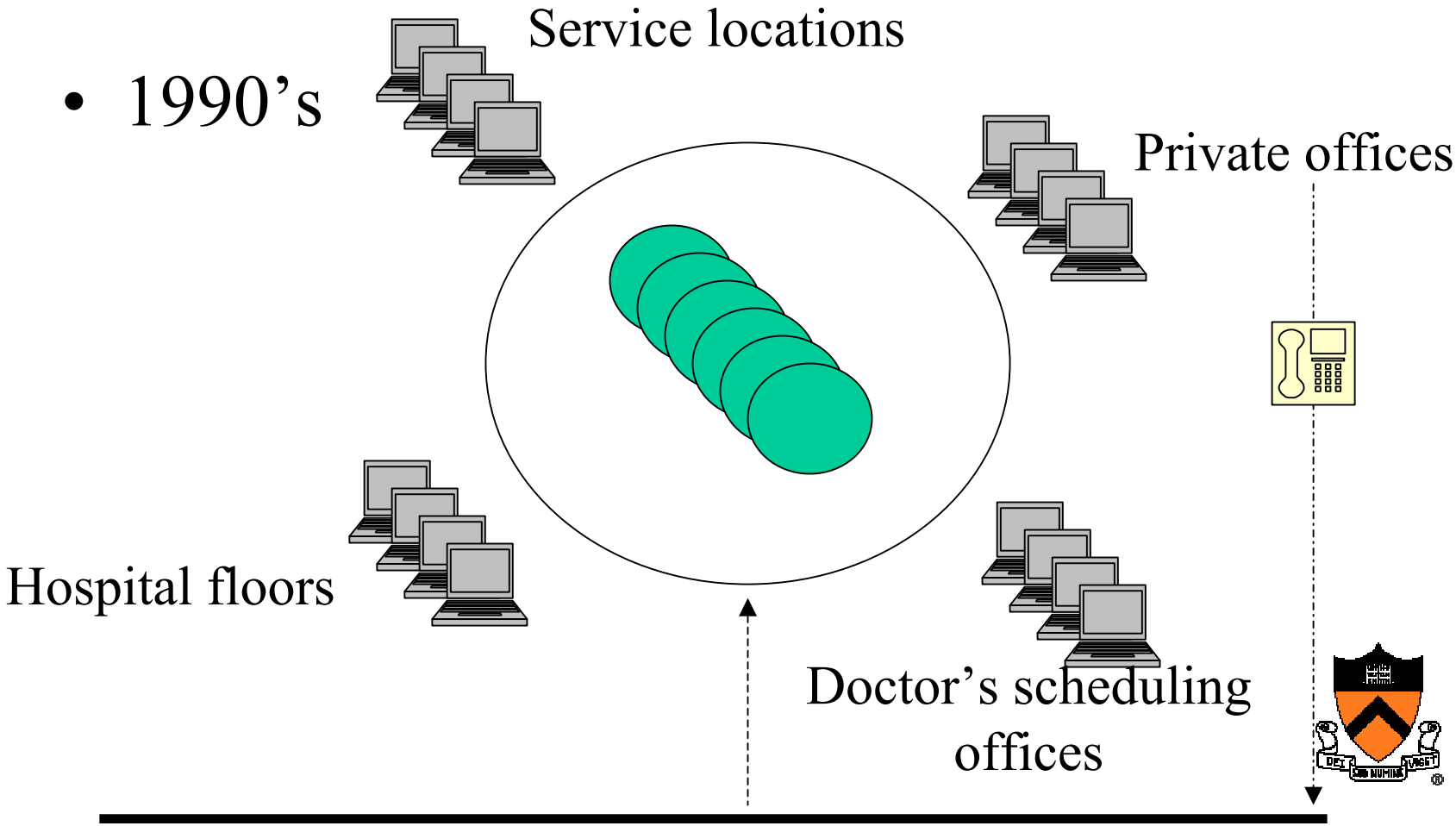


FIGURE 10.7. Network technology that enables users to perform all information processing locally. Independent machines share data over the network by passing messages according to a communication protocol. A terminal-interface processor (TIP) is a utility communications computer that is used to attach video-display terminals and other communications devices to the local-area network. ADT = admission–discharge–transfer.

CIS

- 1990's

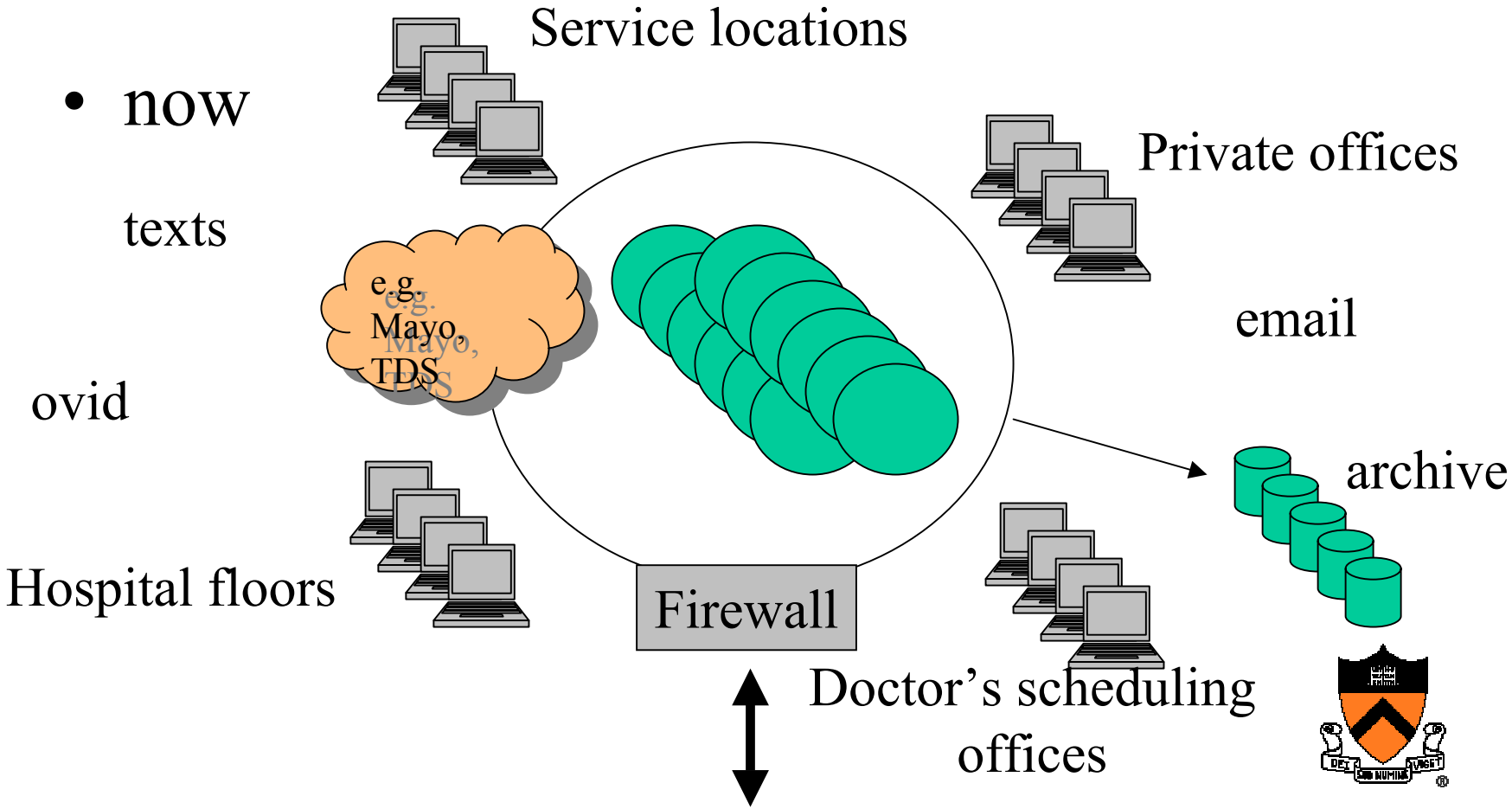

Service locations
Private offices
Hospital floors
Doctor's scheduling offices

IDN

- now

texts

ovid



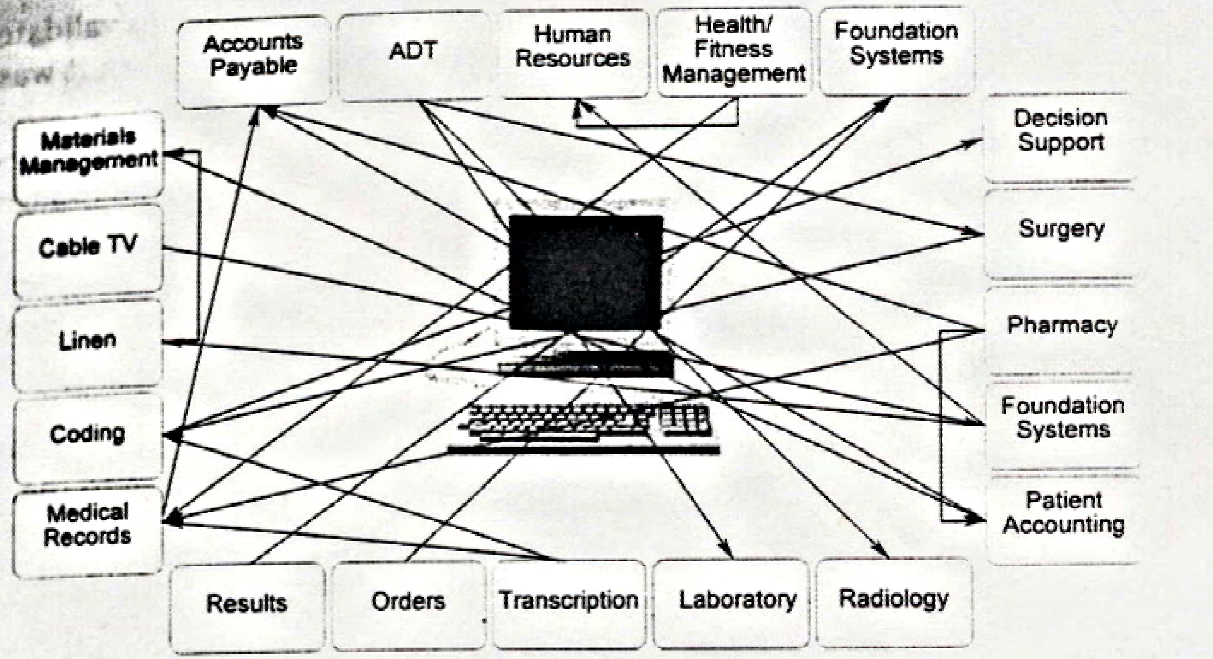
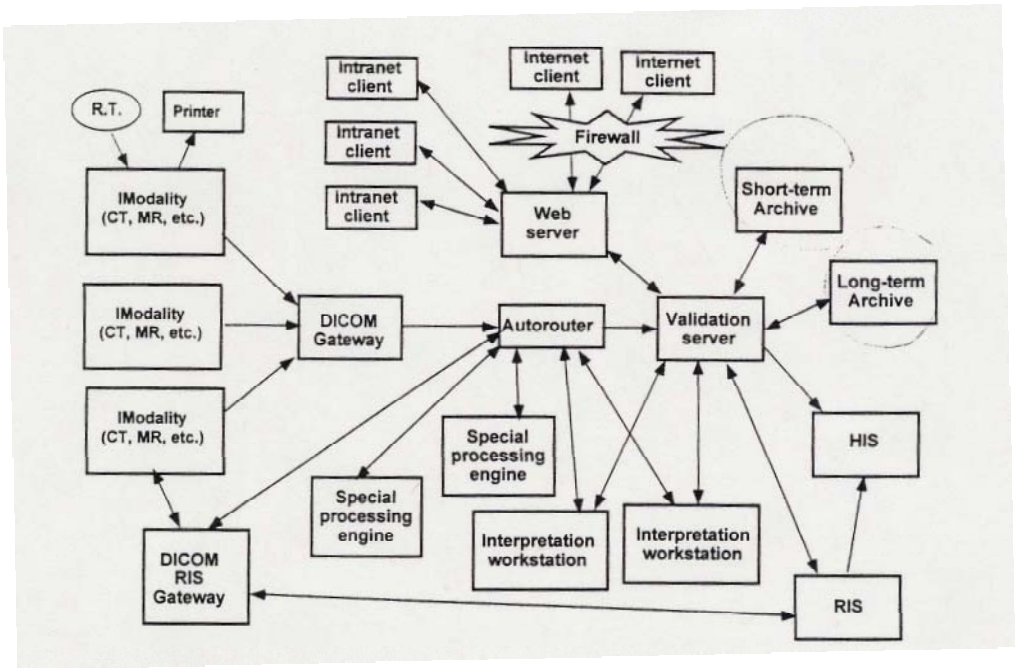


Exhibit 4-2. Complex system with complex interfaces.


R.T.
Printer
IModality (CT, MR, etc.)
IModality (CT, MR, etc.)
IModality (CT, MR, etc.)
DICOM Gateway
DICOM RIS Gateway
Intranet client
Intranet client
Intranet client
Internet client
Internet client
Firewall
Web server
Autorouter
Special processing engine
Special processing engine
Interpretation workstation
Interpretation workstation
Short-term Archive
Long-term Archive
Validation server
HIS
RIS

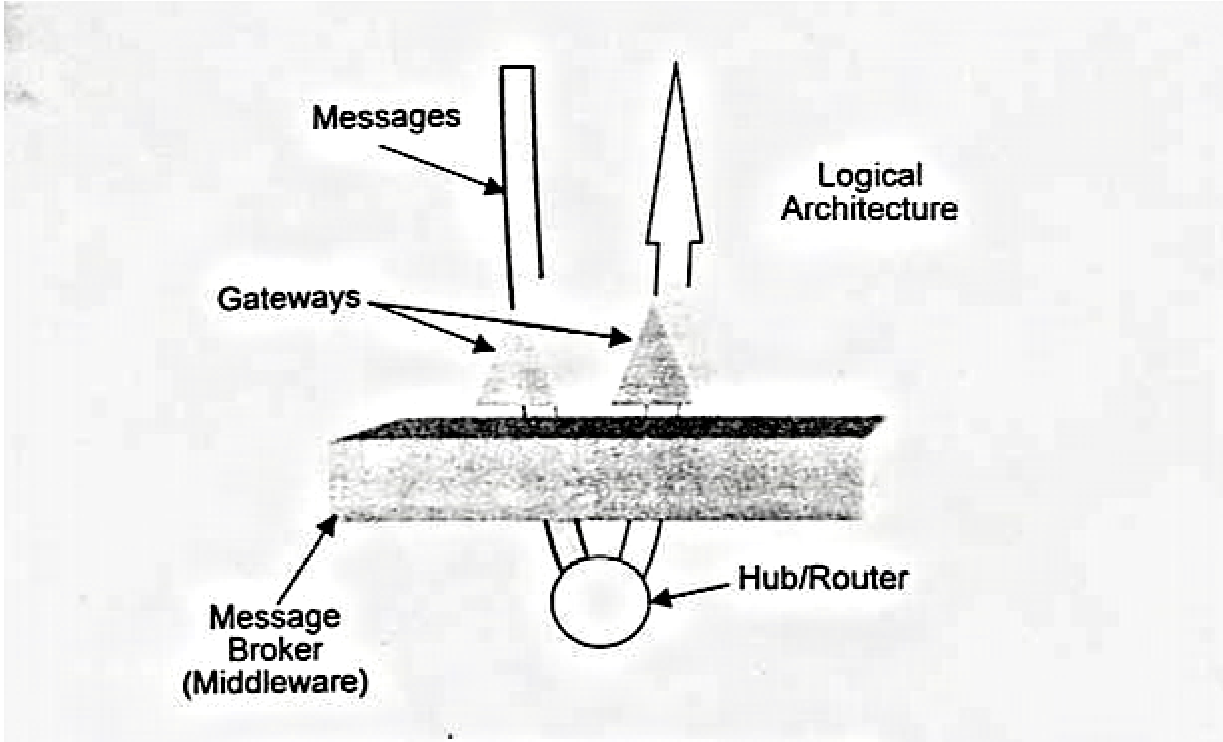


Exhibit 4-3. A simple interface model.

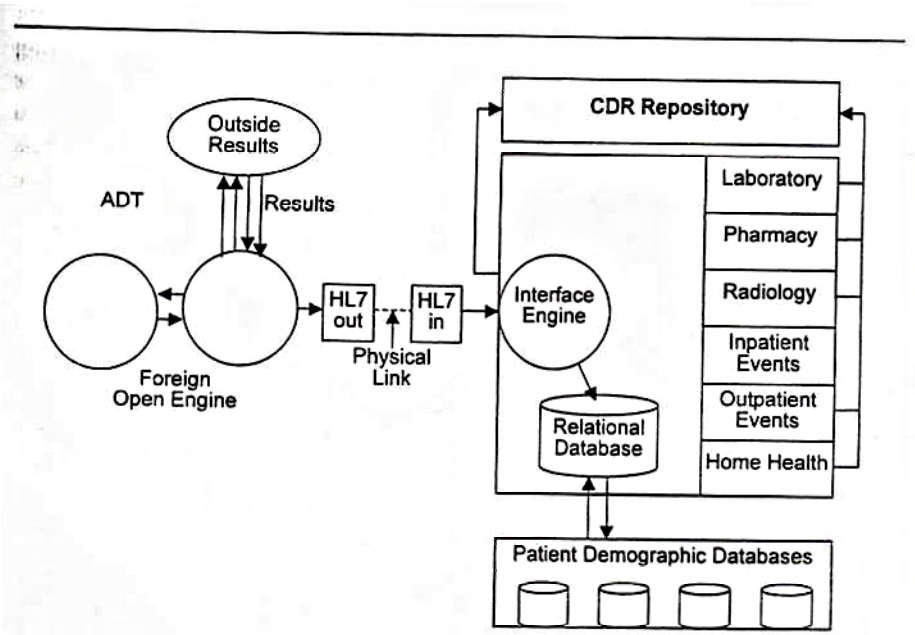


Exhibit 7-3. Connectivity to a foreign system.

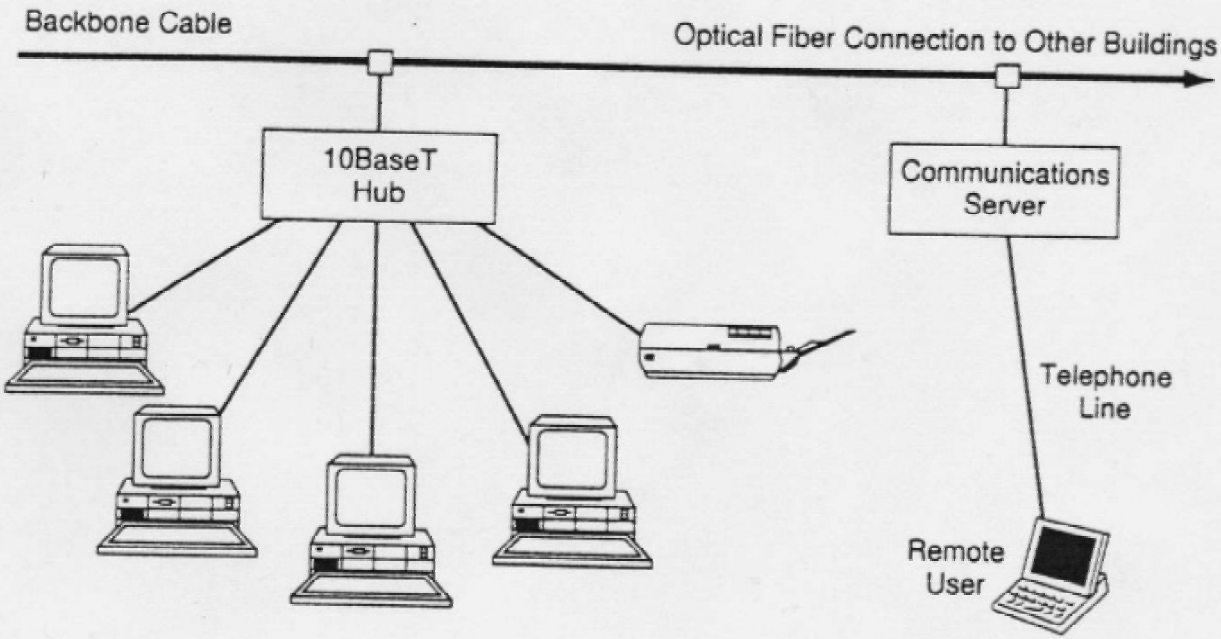
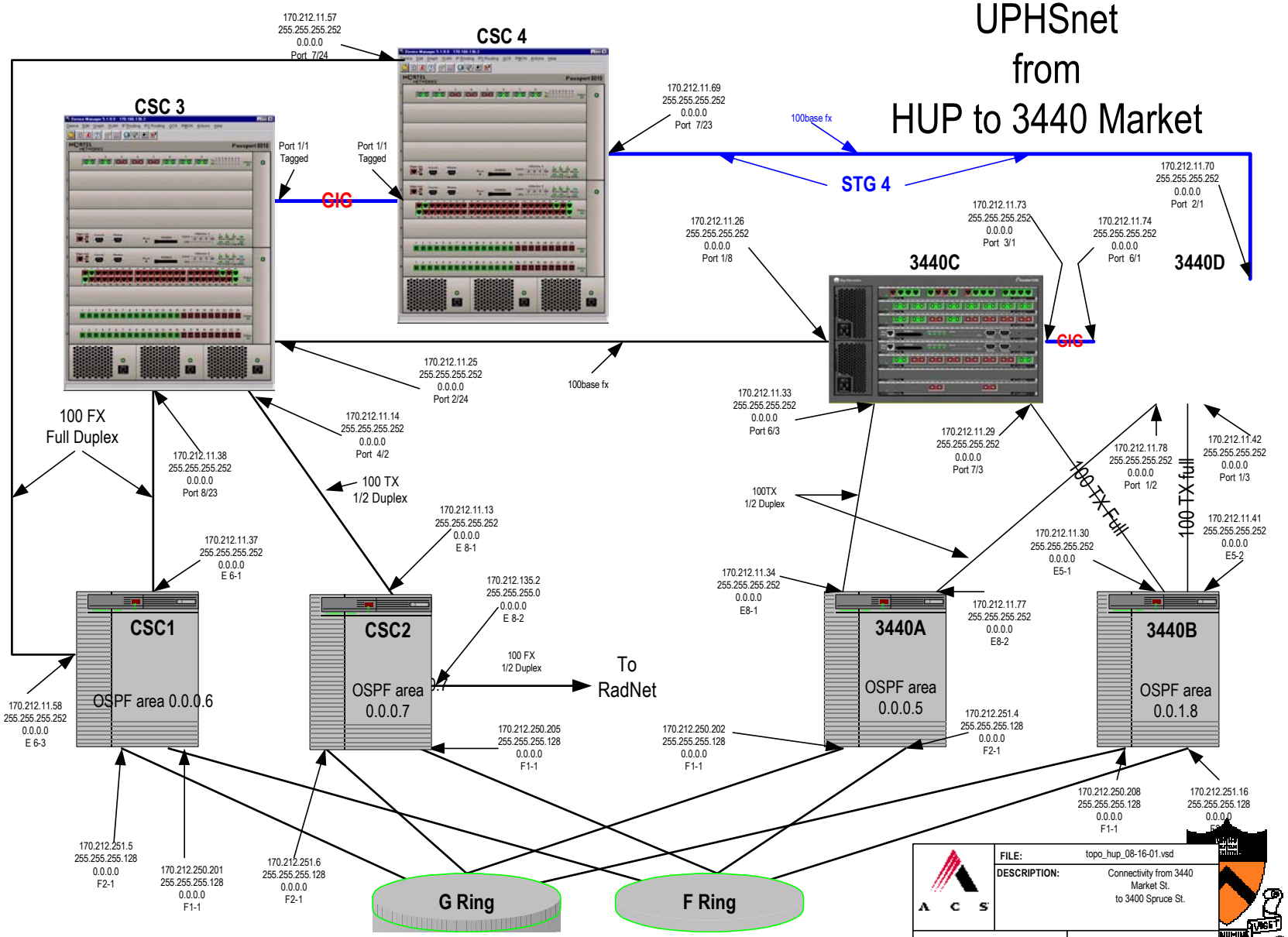


Exhibit 5-1. Traditional wireline network.

UPHSnet from HUP to 3440 Market



A C S	FILE:	topo_hup_08-16-01.vsd	
	DESCRIPTION:	Connectivity from 3440 Market St. to 3400 Spruce St.	
DRAWN BY:	Kevin Stead	DATE:	04/10/00
REVISED:	02/11/02	CUSTOMER:	UPHS

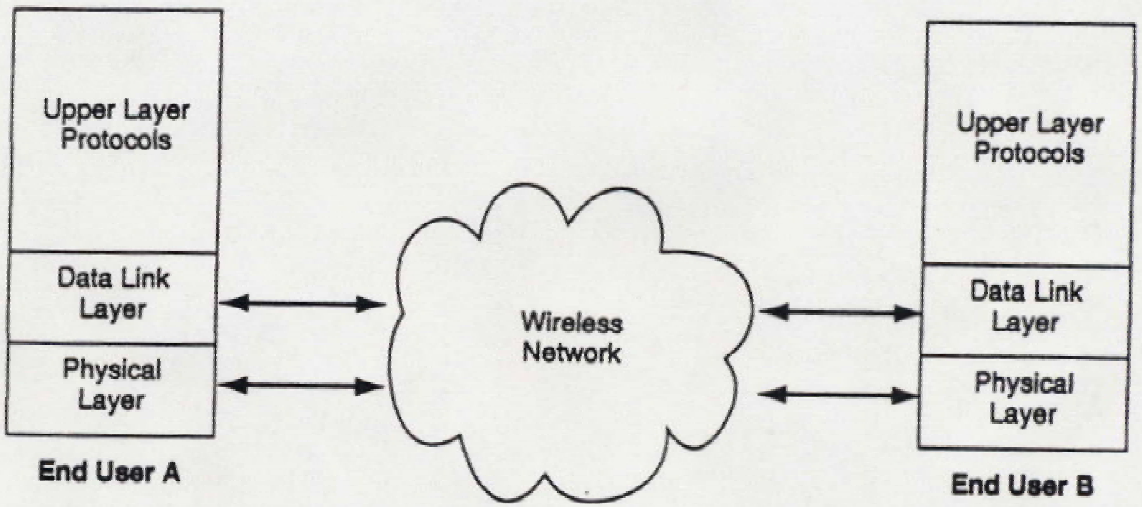


Exhibit 5-2. Wireless network logical architecture.

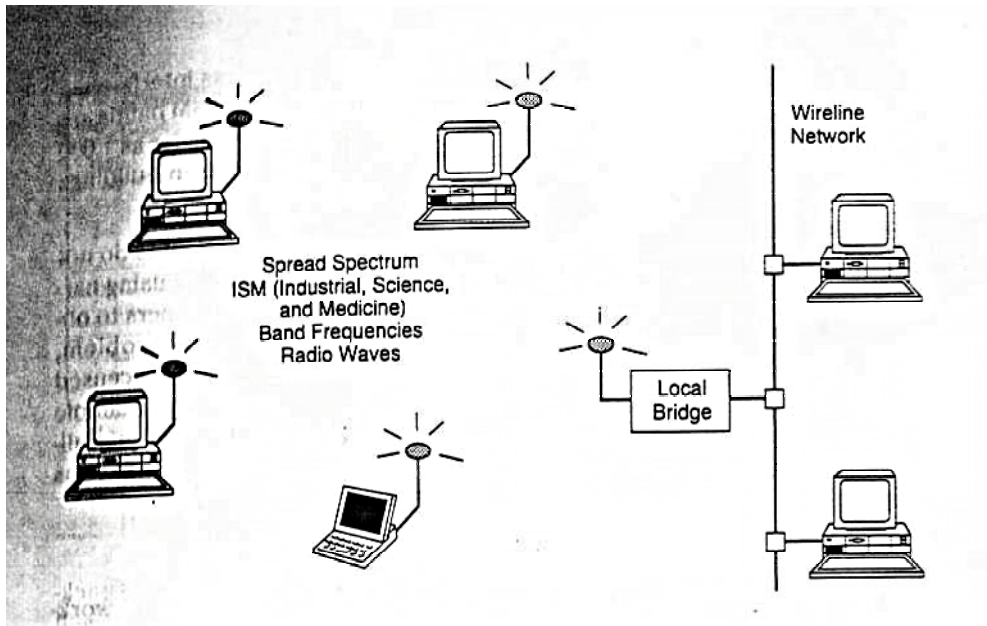


Exhibit 5-3. Radio-based wireless LAN.

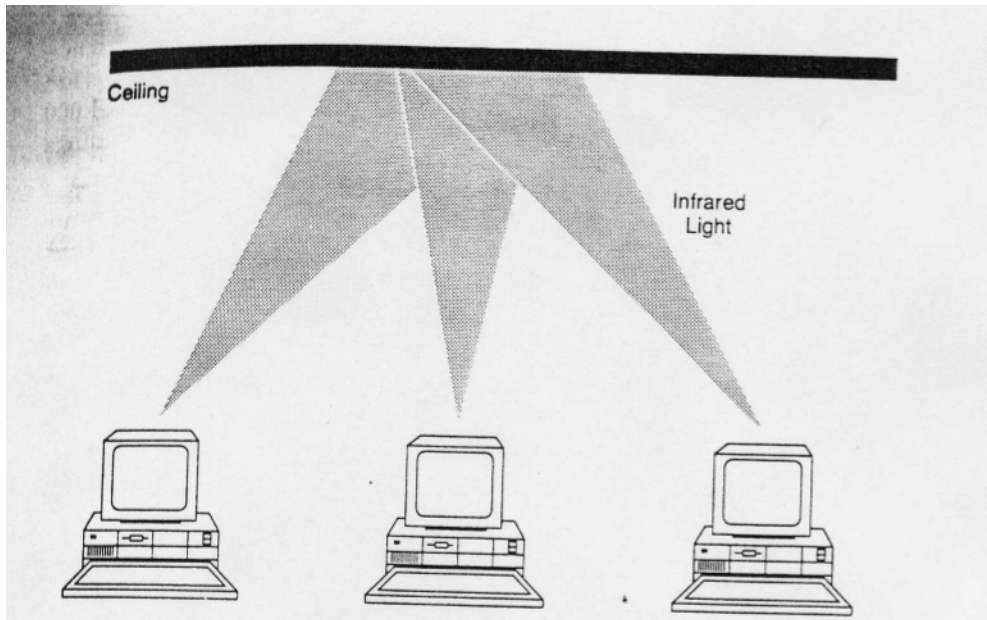


Exhibit 5-4. Diffused infrared-based wireless LAN technique.

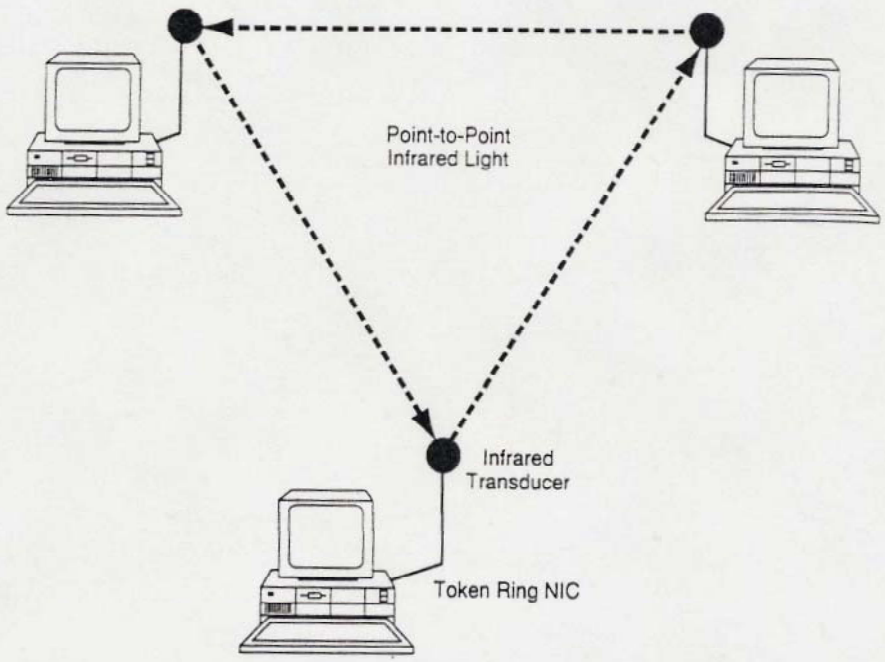


Exhibit 5-5. Point-to-point infrared-based LAN technique.

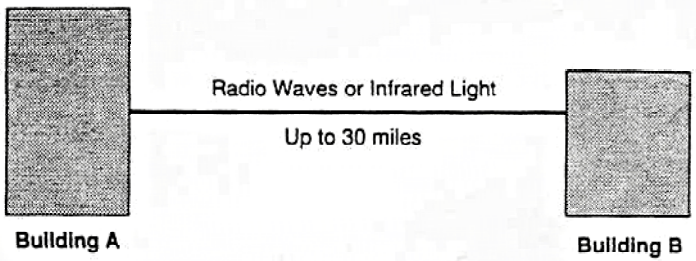


Exhibit 5-8. Point-to-point wireless technique.

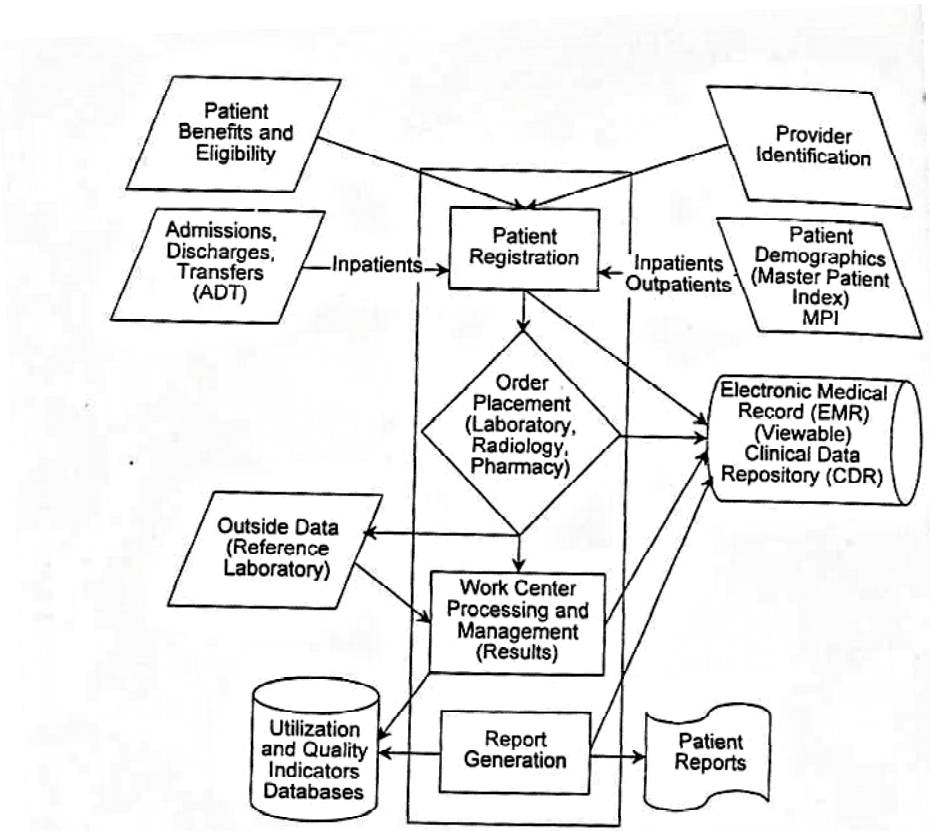


Exhibit 7-1. Generic inter-enterprise healthcare solution.

TABLE 12.3. Societal forces that have influenced the design and implementation of patient care systems.

	1970s	1980s	1990s
Delivery-system structure	Single institution	Single organization	Integrated delivery systems
Professional-practice model	Team nursing Single or small group physician practice	Primary nursing Group models for physicians	Patient-focused care Multidisciplinary care Case management Variety of constellations of physician group practice models
Payer model	Fee for service	Fee for service Prospective payment, diagnosis-related groups (DRGs)	Capitation Managed Care
Quality focus	Professional Standards Review Organizations (PSROs) Retrospective chart review Joint Commission on Accreditation of Hospitals' Peer Evaluation Program Quality of Patient Care System (QUALPACS)	Continuous quality improvement Joint Commission on Accreditation of Health Care Organization (JCAHO)'s Agenda for Change	Risk-adjusted outcomes Benchmarking Practice guidelines Critical paths/care maps Health Employer Data and Information set (HEDIS)

Current network issues

- Consolidation of health systems
  - Columbia
  - UPHS
- Niche products vs. integrated products

Exhibit 4-1. Healthcare IT business trends.

Leading to the need for specialized tools for connecting systems:

• Stand-alone departmental systems	→	• The need for integrated solutions
• Systems focused on financial process	→	• Systems focused on clinical process
• The age of the community hospital, cost-based reimbursement and stand-alone systems — slow pace of consolidation	→	• The rise of the "integrated delivery network" — capitation and falling government reimbursement causes rapid consolidation of hospitals with existing legacy systems

Key enablers, making the new tools possible:

• Most interfacing done in custom, mutually agreed upon formats	→	• Standards for message format become more complete and ubiquitous
• No universally accepted communication protocol	→	• TCP/IP becomes the standard for network communication

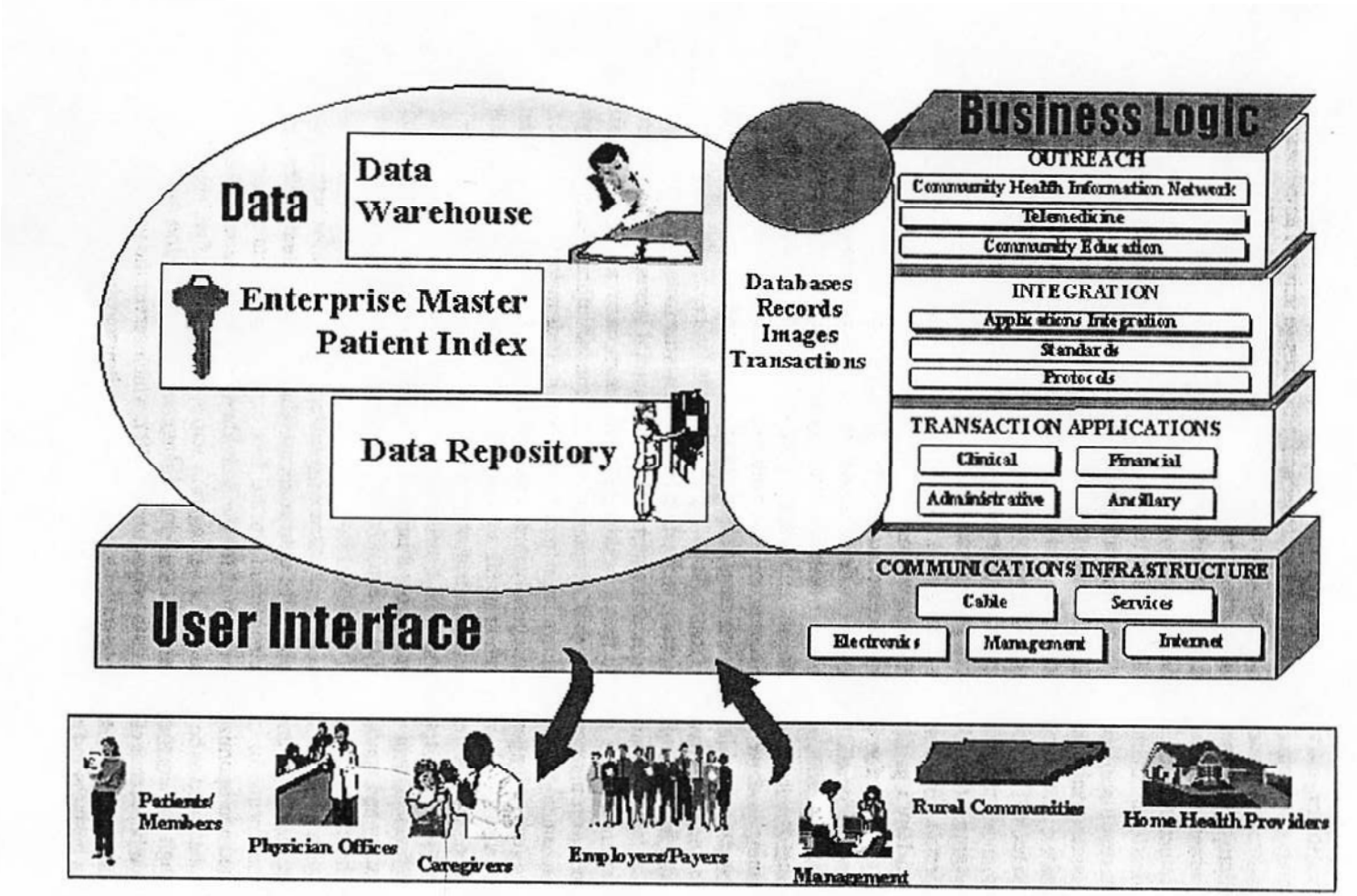


FIGURE 10.8. Three conceptual layers of an IDN's architectural model. Separation of data, business logic, and user interface allows system developers to modify applications and interfaces over time to meet changing needs while preserving the IDN's long-term data asset.

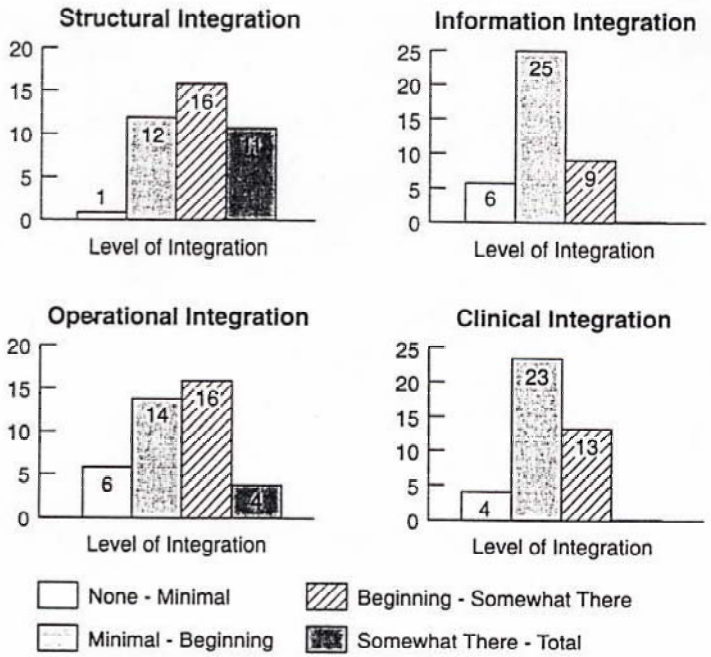


FIGURE 10.2. Relative progress in structural, operational, clinical, and information integration among 40 IDNs from a 1996 survey of organizational members of the Center for Clinical Integration. Clinical integration and information systems typically lag behind structural and operational integration in emerging IDNs. (*Source:* Copyright First Consulting Group. Reprinted with permission.)

Examples of Networking

- Orlando Regional Healthcare System
  - One stop shopping for all kinds of healthcare
- Ohio
  - Community Health Information Network
    - 20 hospitals
    - 2400 doctors
    - 1.4 million people

Examples

- Shands Hospital
  - Patient movement
  - Information about referring MD's
  - Coordinated clinic scheduling
  - Online EPR

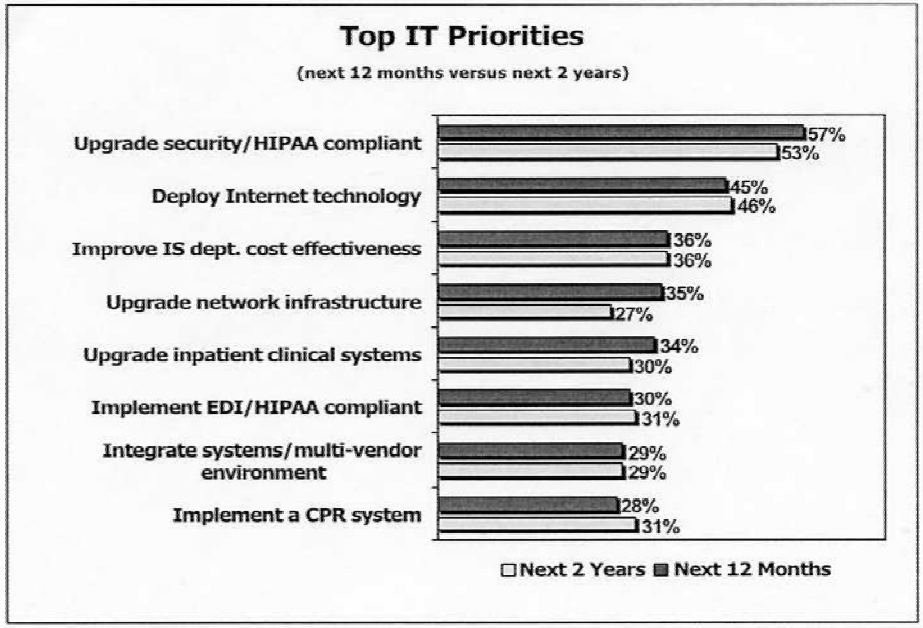
Examples

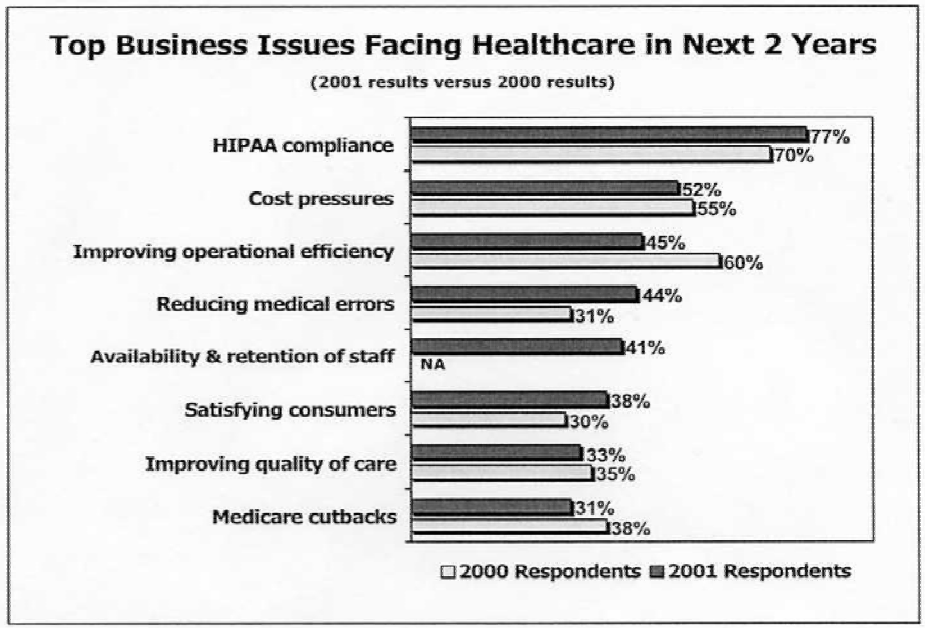
- Asynchronous Transfer Mode (ATM) nets
  - Unlimited bandwidth on demand
  - Integration of voice, data and video
  - Seamless integration of systems
  - Well-defined quality of service
- Perfect for consultation
  - Radiology, lab

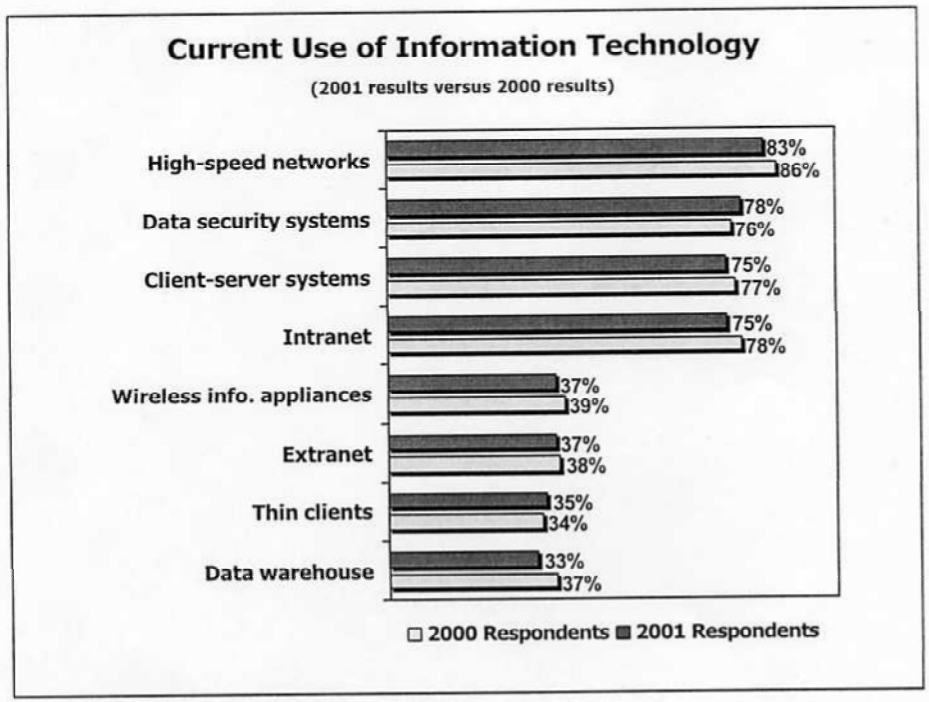
Examples

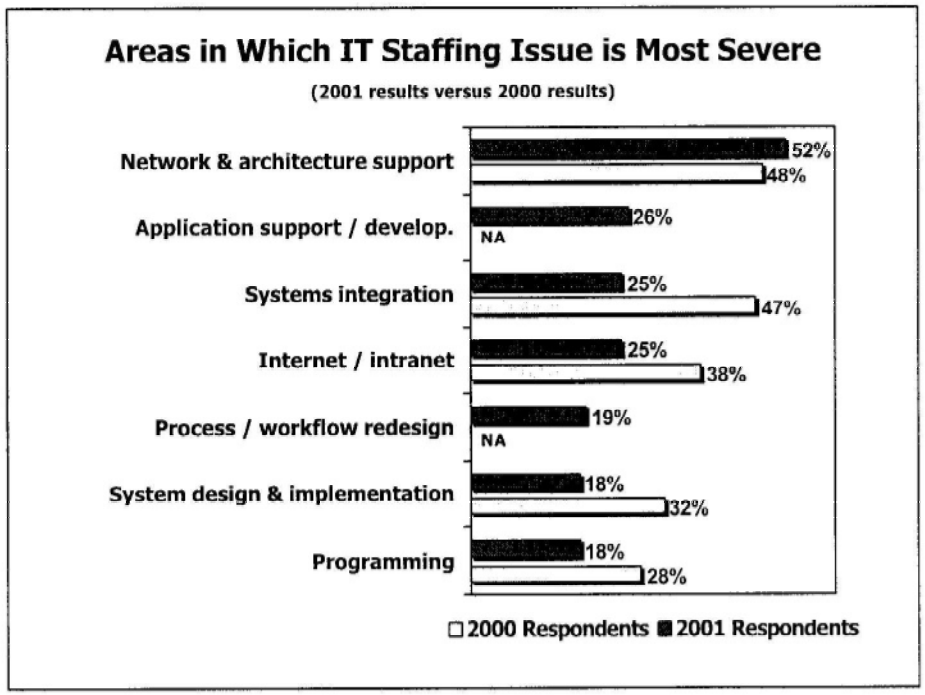
- Gigabit ethernet
  - Interactive cardiac testing
  - Surgery Cam (QOS issues)


DEI
NUMINE
VIGET


Top IT Priorities
(next 12 months versus next 2 years)
Upgrade security/HIPAA compliant
57%
53%
Deploy Internet technology
45%
46%
Improve IS dept. cost effectiveness
36%
36%
Upgrade network infrastructure
35%
27%
Upgrade inpatient clinical systems
34%
30%
Implement EDI/HIPAA compliant
30%
31%
Integrate systems/multi-vendor environment
29%
29%
Implement a CPR system
28%
31%
Next 2 Years
Next 12 Months


Top Business Issues Facing Healthcare in Next 2 Years
(2001 results versus 2000 results)
HIPAA compliance
77%
70%
Cost pressures
52%
55%
Improving operational efficiency
45%
60%
Reducing medical errors
44%
31%
Availability & retention of staff
41%
NA
Satisfying consumers
38%
30%
Improving quality of care
33%
35%
Medicare cutbacks
31%
38%
2000 Respondents
2001 Respondents


Current Use of Information Technology
(2001 results versus 2000 results)
High-speed networks
83%
86%
Data security systems
78%
76%
Client-server systems
75%
77%
Intranet
75%
78%
Wireless info. appliances
37%
39%
Extranet
37%
38%
Thin clients
35%
34%
Data warehouse
33%
37%
2000 Respondents
2001 Respondents


Areas in Which IT Staffing Issue is Most Severe
(2001 results versus 2000 results)
Network & architecture support
52%
48%
Application support / develop.
26%
NA
Systems integration
25%
47%
Internet / intranet
25%
38%
Process / workflow redesign
19%
NA
System design & implementation
18%
32%
Programming
18%
28%
2000 Respondents
2001 Respondents