Telemedicine: Networks in the Service of Healthcare

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National Library of Medicine

Telemedicine

Using telecommunications and computers:

- To exchange information to support medical decision making
- For signal processing and image enhancement

The arrangements for practicing medicine at a distance

Telemedicine

Using telecommunications and computers to exchange information to support medical decision making

- Medical Records – EMR and PHR
- Literature search
- Decision support
- Consultation and Conferencing

So what's new?

1924

1994

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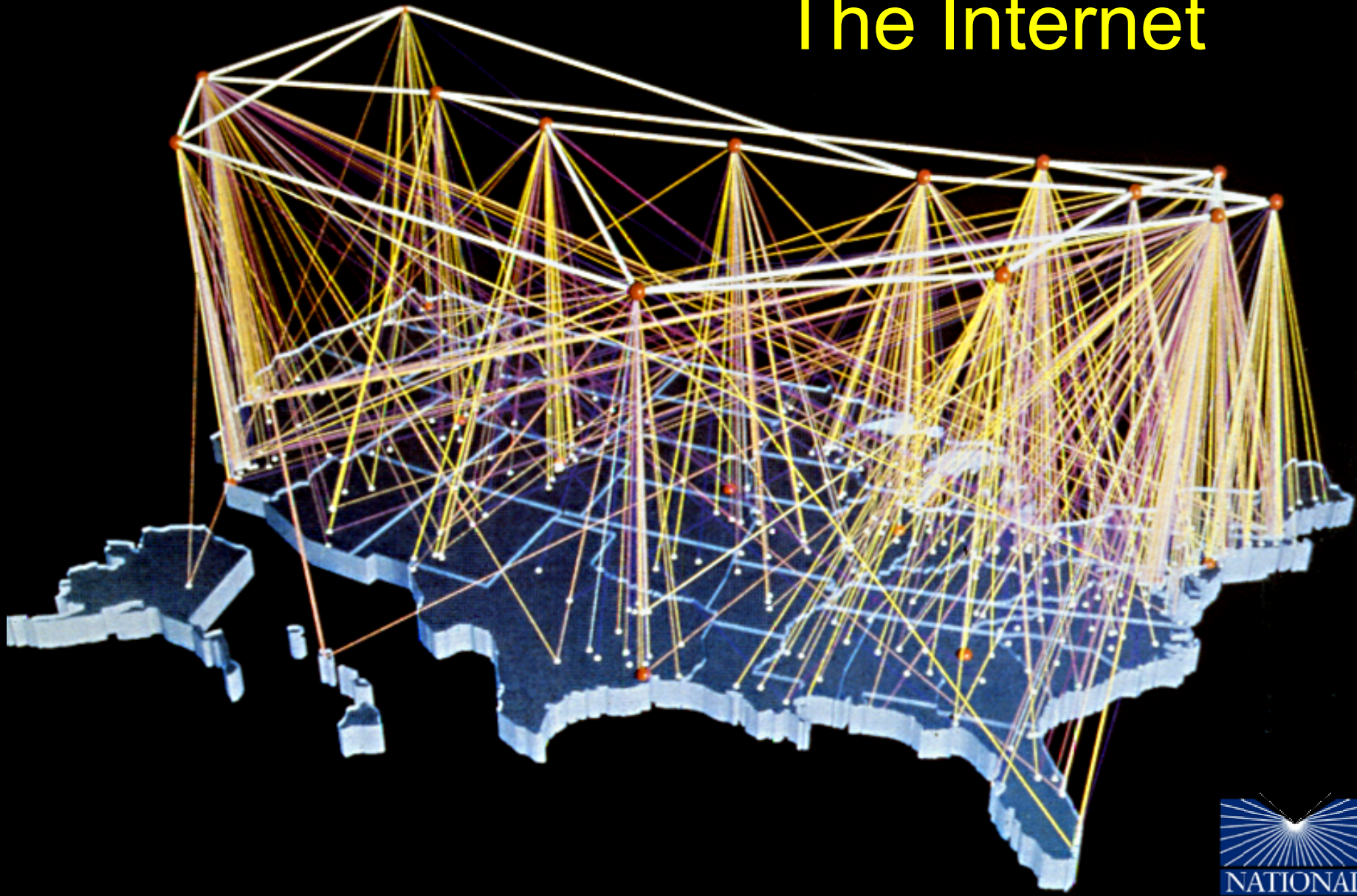
The Internet



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Brief History of the Internet in the U.S.

- Late 1960s & 1970s: *ARPA-Net*
- 1980s: *NSF-Net* or *NREN*

  Research Network

  Public Network
- Early 1990s: *Internet*
- Current: "*The Web*"

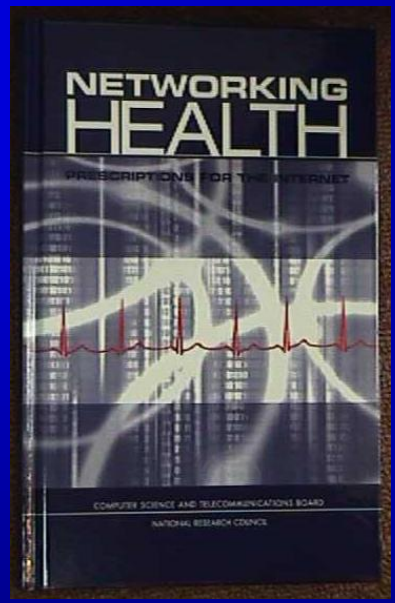
University Corporation for Advanced Internet Development (UCAID) sponsored

Internet2 Program

1996

Networking Health: Prescriptions for the Internet

2000



A study by the:

U.S. National Research Council

Computer Science Technology Board

http://www.nap.edu/catalog/9750.html

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The notion of End-to-End "Quality of Service" - QoS

- Highly subjective
  - application-dependent
  - user-dependent
- Difficult to determine
  - often obscured by smart applications programming
  - often obscured by network architecture like caching

End-to-End QoS Features for Healthcare

- Bandwidth reservation
- Low latency
- Low jitter
- Variable priority
- Data Integrity
- Selectable Loss Rate
- Security

A Comprehensive Tele-dermatology Program

Oregon Health Sciences University,
Portland, OR

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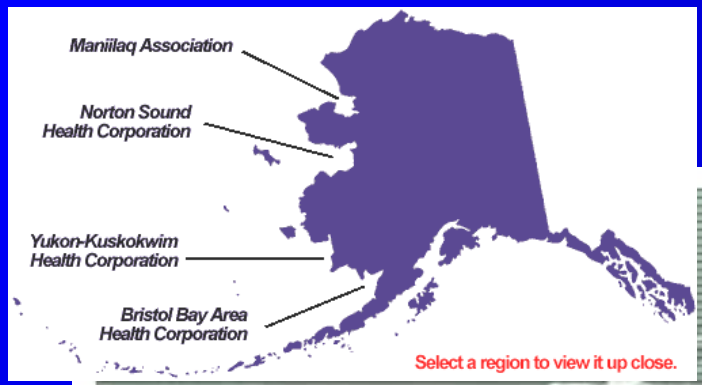

Alaska Telemedicine Testbed Project | *NLM Contract N01-LM-6-3540*

OVERVIEW | WORKSTATION | NEWS | VILLAGES

nlminfo@telemedicine.alaska.edu

University of Alaska at Anchorage,
Anchorage, AK

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Baby CareLink

Beth Israel Deaconess Medical Center,
Boston, MA

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Video house calls for patients with special needs

National Laboratory for the Study of Rural Telemedicine, University of Iowa, Iowa City, IA

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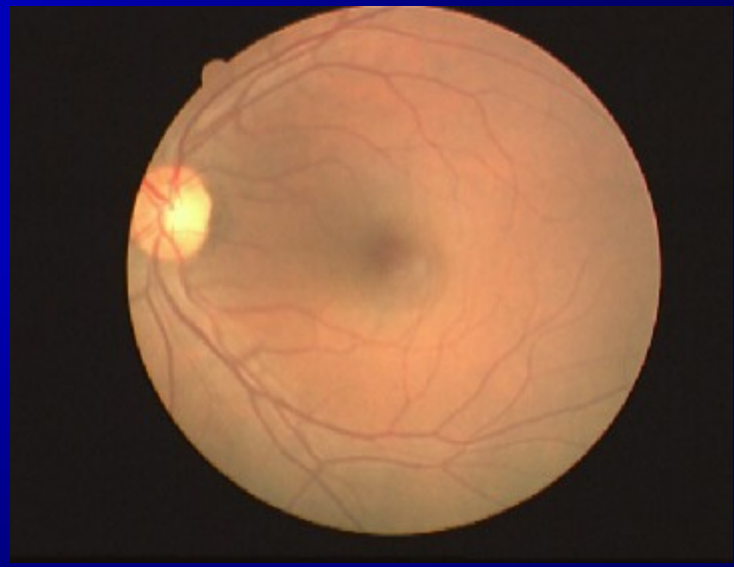
Providing Healthcare to the Underserved Center-City



University of Southern California
Advanced Biotechnical Consortium

Drew University School of Medicine

Los Angeles, CA

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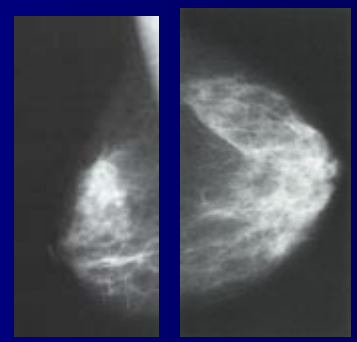
Telemammography for the Next Generation Internet, Phase II: The National Digital Mammography Archive

- Provide a means to store and retrieve a complete clinical record, consisting of digital, mammographic images as well as radiology and pathology reports and related patient information in standard formats and using standard protocols
- Multi-layered security
- Input and retrieval from multiple locations



University of Pennsylvania, Philadelphia, PA
Y12 National Security Complex in Oak Ridge, Oak Ridge, TN
University of Chicago, Chicago, IL
University of North Carolina at Chapel Hill, Chapel Hill, NC
University of Toronto, Toronto, Canada

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Radiation Oncology Treatment Planning/Care Delivery Application

- Develop, implement, and evaluate NGI capabilities for radiation oncology treatment planning and care delivery.
- Application will provide diagnostic support, treatment planning, and remote verification of equipment from Cancer Center to a remote treatment facility.
- Focus on quality of service, security, privacy, and data integrity.

Johns Hopkins University Applied Physics Laboratory, Laurel, MD
Peninsula Regional Medical Center, Salisbury, MD

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A Multicenter Clinical Trial Using NGI Technology

- Test the network infrastructure capable of high speed transmission of high quality MRI images for a multicenter clinical trial of new therapies for adrenoleukodystrophy (ALD), a fatal neurologic genetic disorder
- Ensure medical data privacy and security.

Kennedy Krieger Research Institute,
Baltimore, MD

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Remote, Real-time Simulation for Teaching Human Anatomy and Surgery

- Demonstrate remote, real-time teaching of human anatomy and surgery
- Deliver real-time simulation and visualization technologies
- Network-based architecture will allow for multiple high-resolution stereo-graphic displays and haptic devices

Stanford University
School of Medicine
Stanford, CA

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A Tele-Immersive System for Surgical Consultation and Implant Modeling

- Employ augmented VR systems for surgical consultation and cranial implant modeling using C-Wall and Physician's Personal VR Displays where medical modelers create virtual implants that precisely fit defects generated from patient CT data.
- Use haptic devices to provide a sense of touch while designing the implants.

University of Illinois at Chicago
Chicago, IL

A Program Lesson: It's not just QoS!

- QoS " . . . can completely and correctly be implemented only with the knowledge and help of the application standing at the endpoints of the communications systems. Therefore, providing that questioned function as a feature of the communications systems itself is not possible."

Marjory Blumenthal and David Clark,

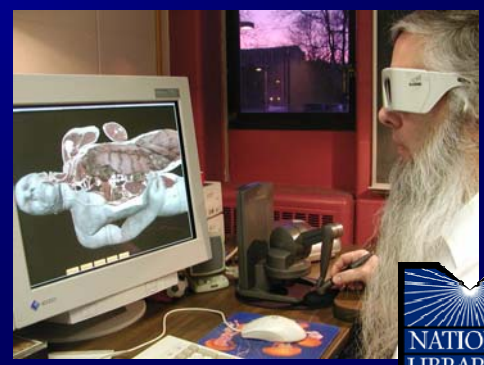
ACM Transactions on Internet Technology

Collaborative Research

- Distance Learning
  - Outcomes
  - Technology

- Videoconferencing
  - The value of video
  - Group interactions

- Telepresence
  - Application sharing
  - 3D video, haptics



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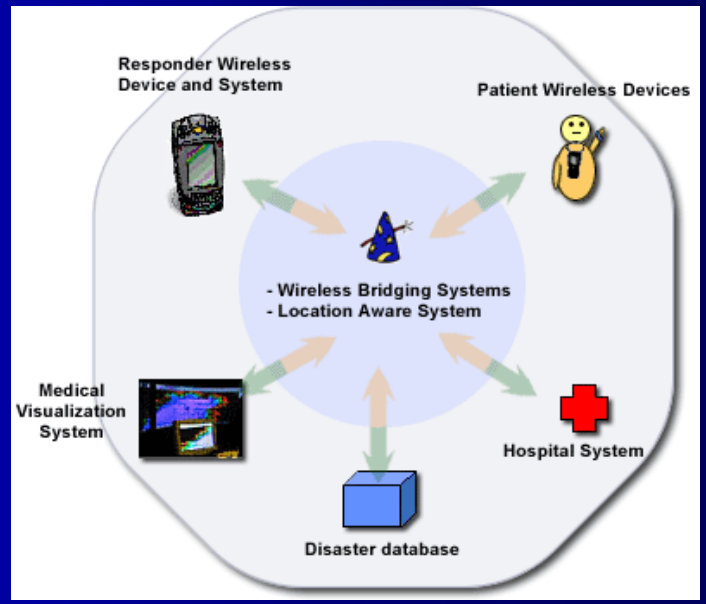
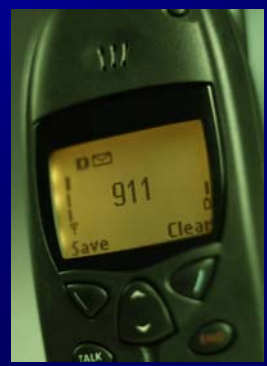
Advanced Network Infrastructure for Health and Disaster Management

- Next generation emergency medical dispatch
- Supporting emergency medical teams away from the hospital
- Mobile video conferencing
- Delivery of medical care at the sites of terrorist attacks and other disasters
- Evaluating effects on clinical care





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Hurricane Katrina:
Ultra Low Bandwidth Communications

- Only text messaging worked consistently
  - Situation awareness and disaster relief information in 160 characters or less

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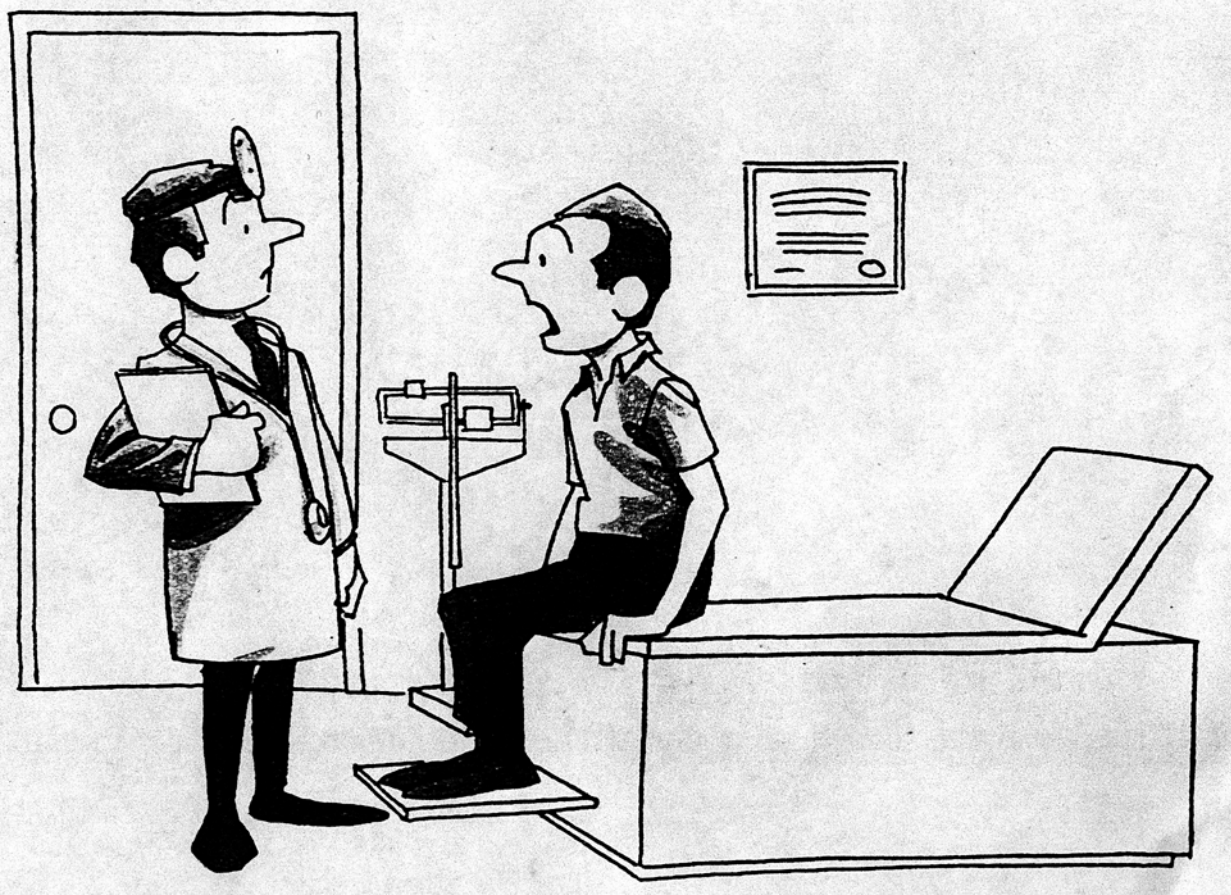

"Well, *www.what'swrongwithme?.com* says it's just a virus, but I came to you for a second opinion."

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The only way to predict the future is to invent it.

Lister Hill Center National Center for Biomedical Communications

http://www.nlm.nih.gov

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