Internetworking and the Internet

One of the world's most rapidly growing and important communications media:

What, How and Why is it happening ?

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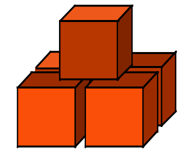
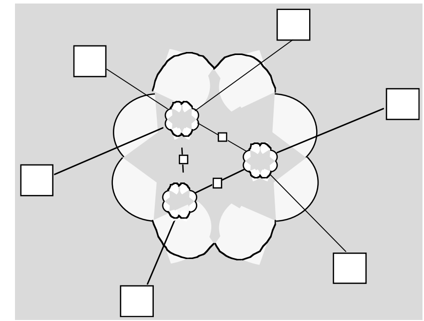
What is internetworking ?



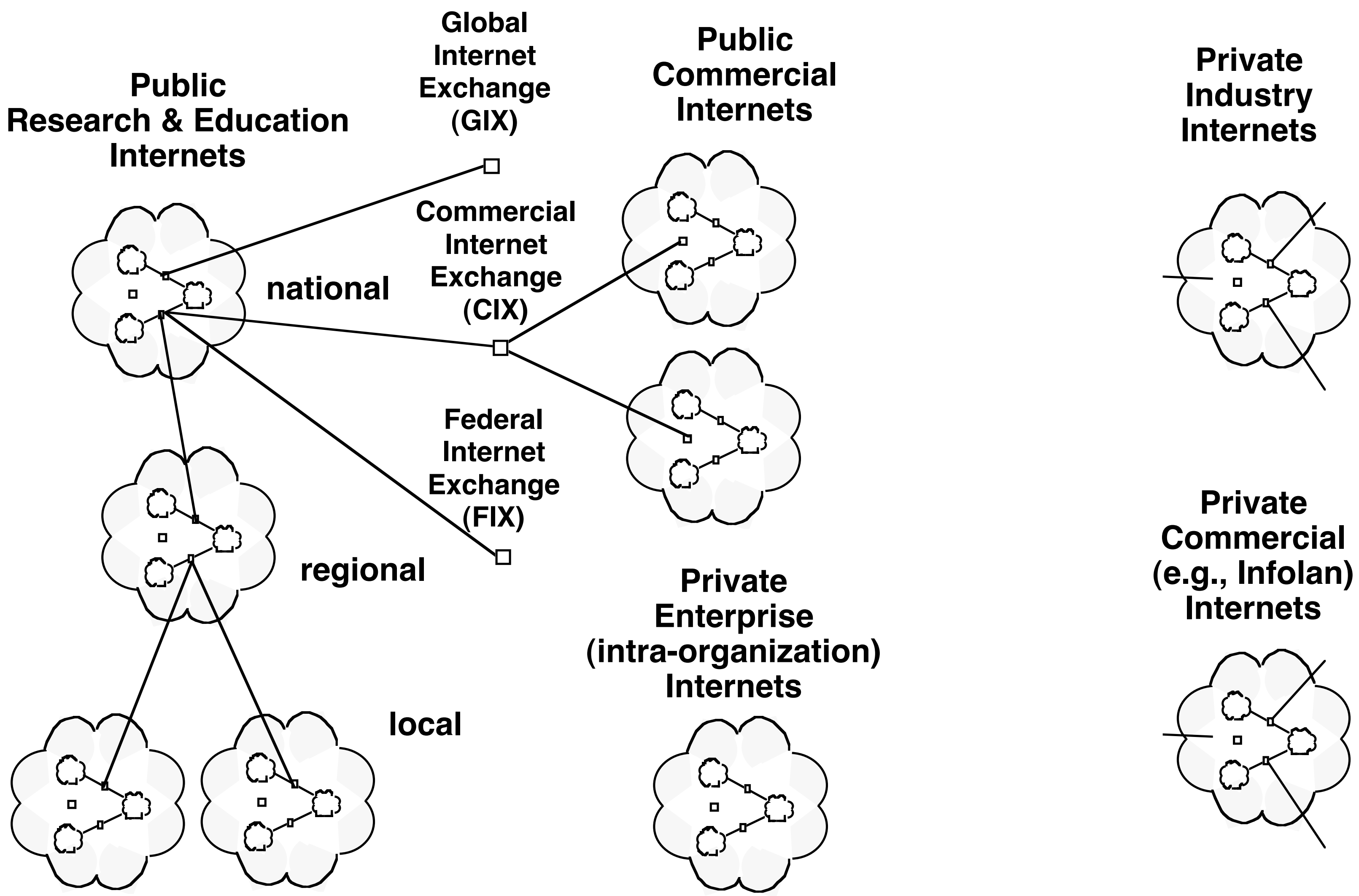
- **VALUE ADDED: protocols that "ride on top" of all other transport and network technologies (e.g., clear channel, dialup, X.25, frame relay, Sonet, SMDS, Appletalk, etc...)**
- **Designed to facilitate a "network of networks" these protocols transparently "glue" diverse networks and end systems together. Provide real open systems interconnection.**
- **Technology & market originally fostered by DOD, now commercial - similar scenario as X.25 network progression**
- **Principal applications are: fast easy file sharing, news broadcast, EMail, remote logon, messaging gateways (e.g., SprintMail), network management, directory services, knowledge discovery**
- **In the works: advanced EMail, security features, multimedia**
- **Internet software (TCP/IP + basic applications) now comes bundled with many computer/ workstation operating system platforms and is available for all systems.**
- **Has spawned explosive growth in network equipment (routers), enterprise networks, universal networking**

What are internets ?



- Networks of networks built using internet protocols
  - TCP/IP suite is the most common, but many other protocols also exist.
- General physical architecture
  - wide area transport subnetworks, transmission links, routers, LANs, and hosts (mainframes, minis, workstations, PCs)
- End-to-end transport techniques are connectionless (a/k/a datagram).
  - Ability to globally address individual machines and processes - even on LANs - is very valuable
- Technology widely used for internal company networks known as Enterprise Networks.
  - Sets the stage for widespread connectivity and the market for interoperation with other internets.

internets: many flavours



Internet: what is it?

- ☞ A global open internet metanetwork (a network of networks)
- ☞ Began in late 70s as DARPA testbed to meet DOD research needs and for developing internetworking technology. (Many of same people and scenarios as packet switching evolution.)
- ☞ Divested in 1986 to other agencies in USA (NSF, DOE, NASA) and around the world for educational & research purposes with intent to commercialize
- ☞ Initial three-tier national architectures: regionals, mid-levels, and national backbones
- ☞ First commercial carriers appear in 1990 in U.S. and Europe
- ☞ Connected hosts became predominantly industrial in mid-1991 as commercial demand for Internet connectivity increases

Internet: what is happening ?

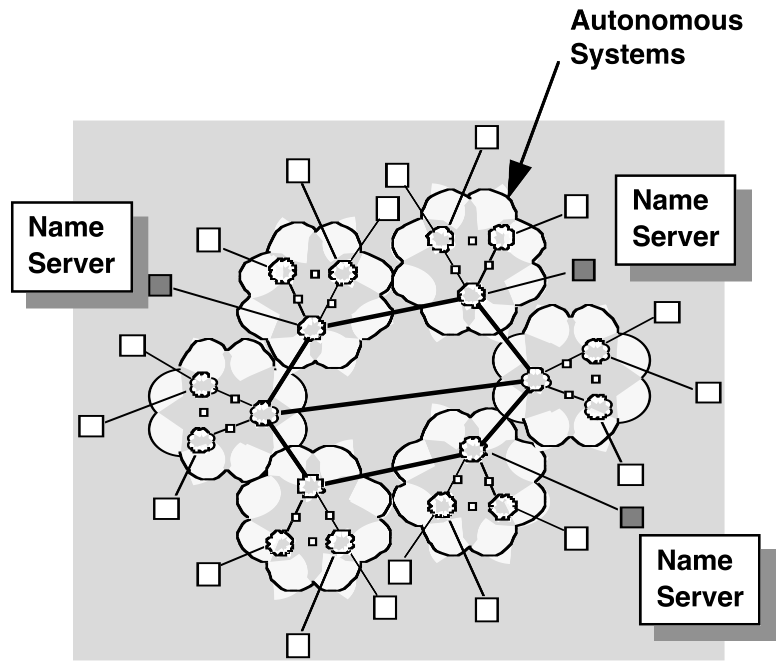
- **Massive, Unprecedented, Consistent Growth**
  - networks
  - hosts
  - users - using and reachable
  - traffic
  - information
- **Commercialization**
- **Creating Flat Information Space**
- **Institutionalization - the Internet Society**
- **Profound Effects**
  - Infrastructure
  - Organizations
  - Professions
  - People

Internetworking: why is it happening?

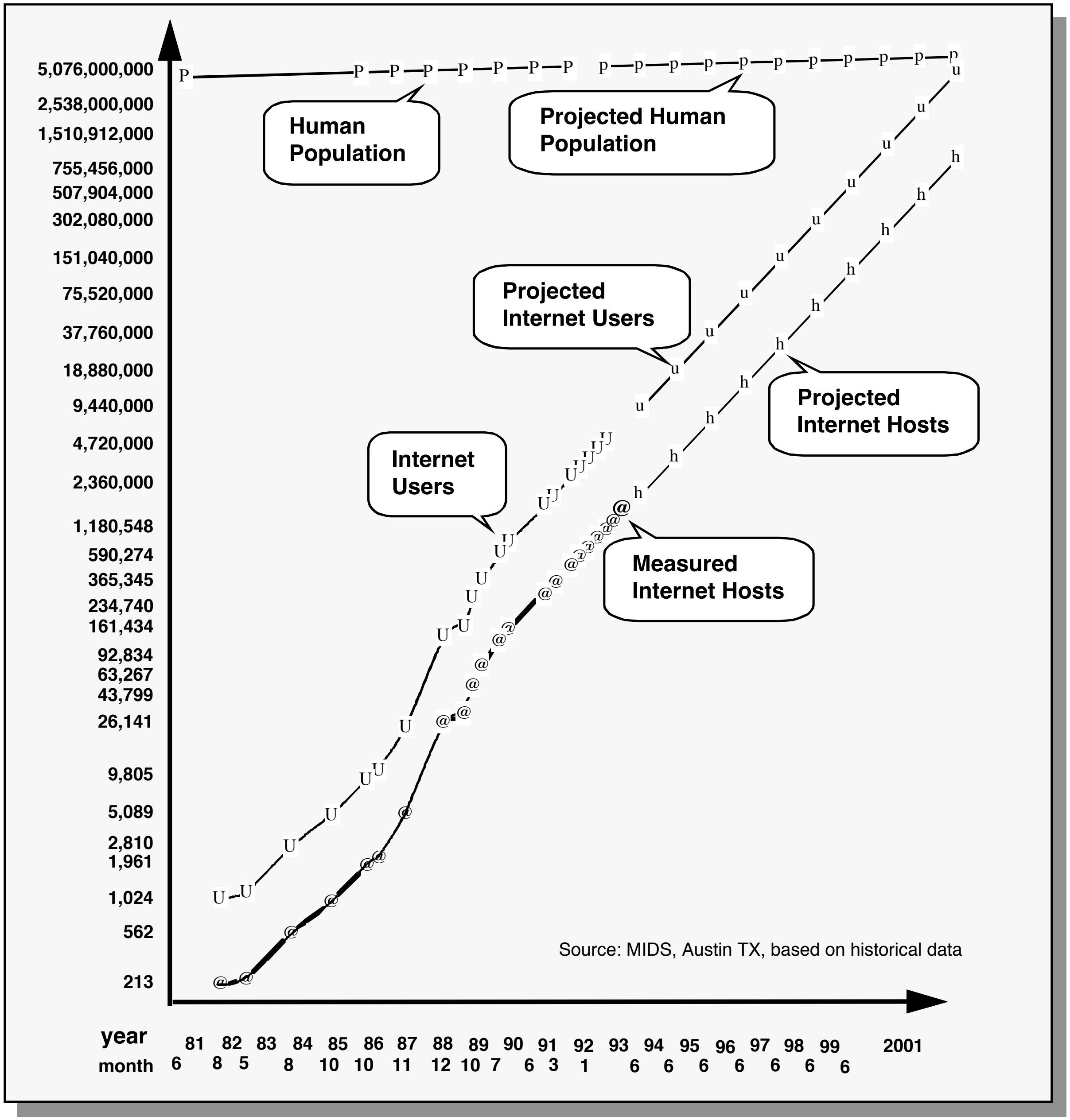
- **Bundling.** The TCP/IP osi suite was bundled into every workstation and mini sold; and is now invading every PC
- **Development.** It is developed by a highly unique applications development and standards process that promises continued rapid innovation and development
- **Bottom-up activity.** It is just the kind of osi that users want
- **New paradigms.** The network architecture is an ideal match to today's heterogeneous, non-hierarchal technology, provisioning and organizational environment
- **Corporate synergy.** Nearly every enterprise internet uses the TCP/IP osi suite and they now want to plug into the Matrix for <u>inter</u>-organization communication
- **Education/youth synergy.** Every recent college student has been given an Internet address with their student ID
- **Technological/economic synergy.** Connectionless internetworking offers a good cost-performance match for the PC workstation-LAN environment now dominant
- **Government synergy.** Government has encouraged it as critically important infrastructure

Internet: under the hood

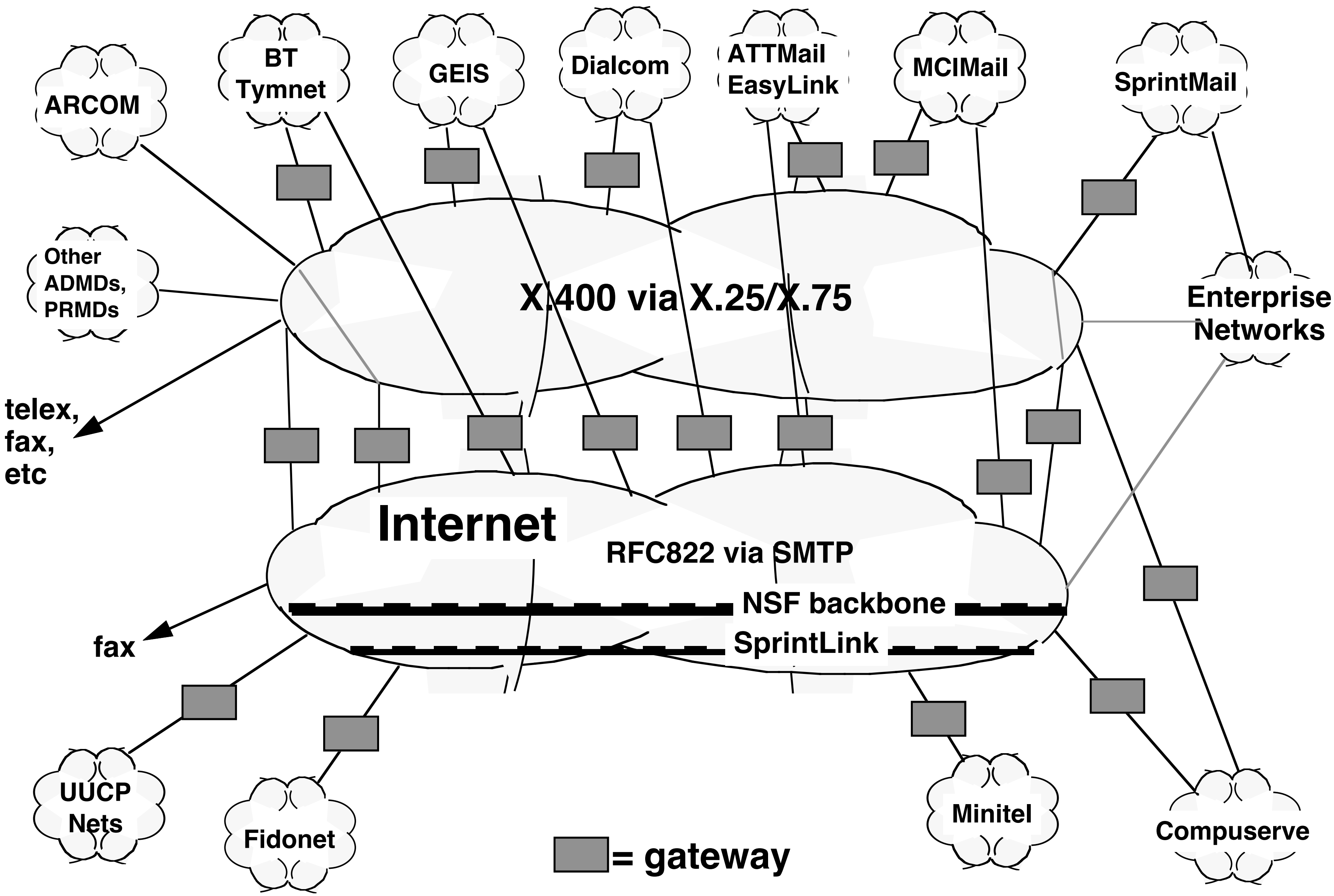
- Managed through cooperation among autonomous systems (i.e., internet administrative domains)
- Everyone follows certain addressing and naming practices
- Portability and user-friendliness achieved through use of domain name servers
- "Sender keeps all" flat rate accounting is universal norm
- Multiprotocol environment



2001: Users = Human Population ?

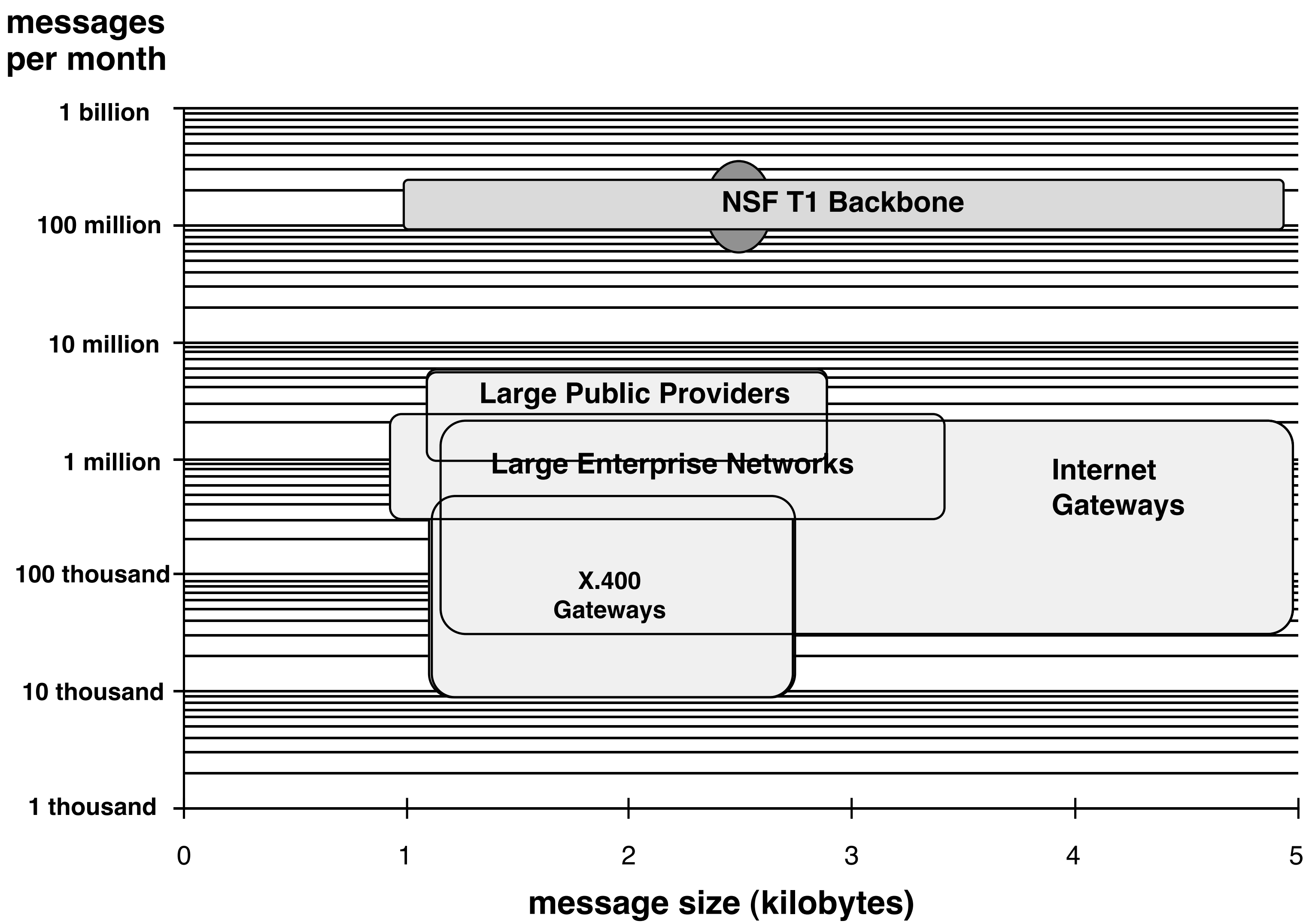


Today's global messaging internet architecture



 Internet Society

Messaging metrics



Where to Learn More

Periodicals

- Internet Society News
- ConneXions
- Matrix News
- Internet Monthly Report

- Electronic Networking, Journal of
- Computer Communication Review (Journal)
- Computer Networks and ISDN Systems (Journal)

Books and Monographs

- Albitz & Liu, DNS and Bind
- Comer, Internetworking with TCP/IP
- Frey & Adams, !%@:: A Directory of Electronic Mail Addressing & Networks
- Hood, User Services Internet Resource Guide
- Hunt, TCP/IP Network Administration
- Kehoe, Zen and the Art of the Internet
- Kroll, The Whole Earth Internet
- Lynch & Rose, The Internet Systems Handbook
- Malamud, Exploring the Internet
- Malamud, Stacks
- Marine, Internet: Getting Started
- Parker, The Internet Companion
- Rose, The Internet Message
- Rose, The Simple Book
- NNSC, Internet Resource Guide

Conferences, Meetings & Proceedings

- International Internetworking Conference
- Internet Engineering Task Force
- Sigcomm Conferences
- Interop
- Joint European Networking Conference