The Present and the Future of the Internet

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Keynote Address
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Internet Society

An Introductory Odyssey

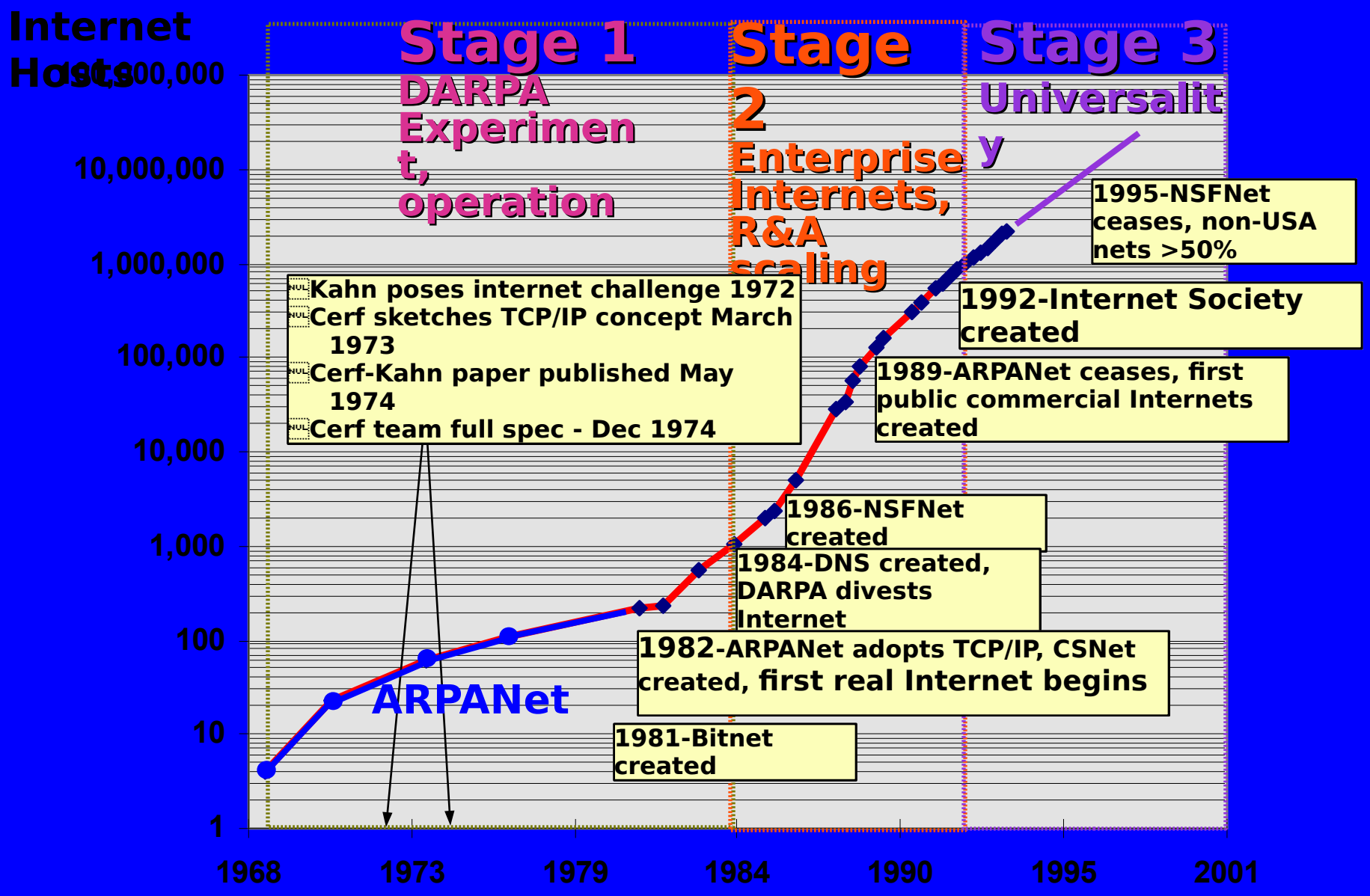
Five Faces of Internet

- Bottom up information infrastructure
- Robust global computer mesh
- Open collaboration and development
- Enables transformations
- Global market sector

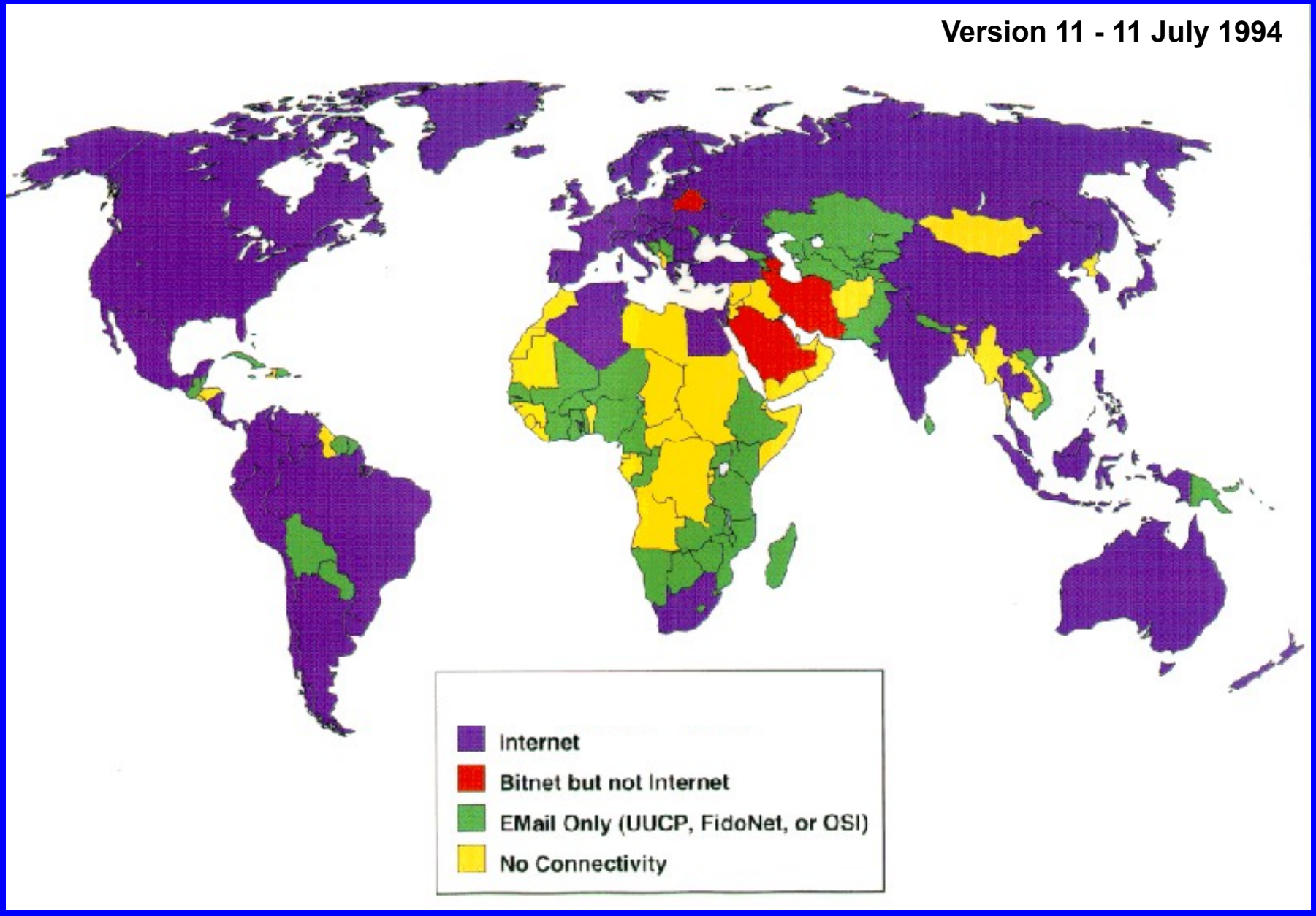
Bottom-up Infrastructure

- Last decade a collective learning experience
- VLSI + PCs + workstations + LANs, routers + software + individual initiative + restructured workplace = bottom up information infrastructure
- Massive markets and new paradigms created
- Internet technologies and applications were “there”

Internet Evolution



Global Internet Connectivity

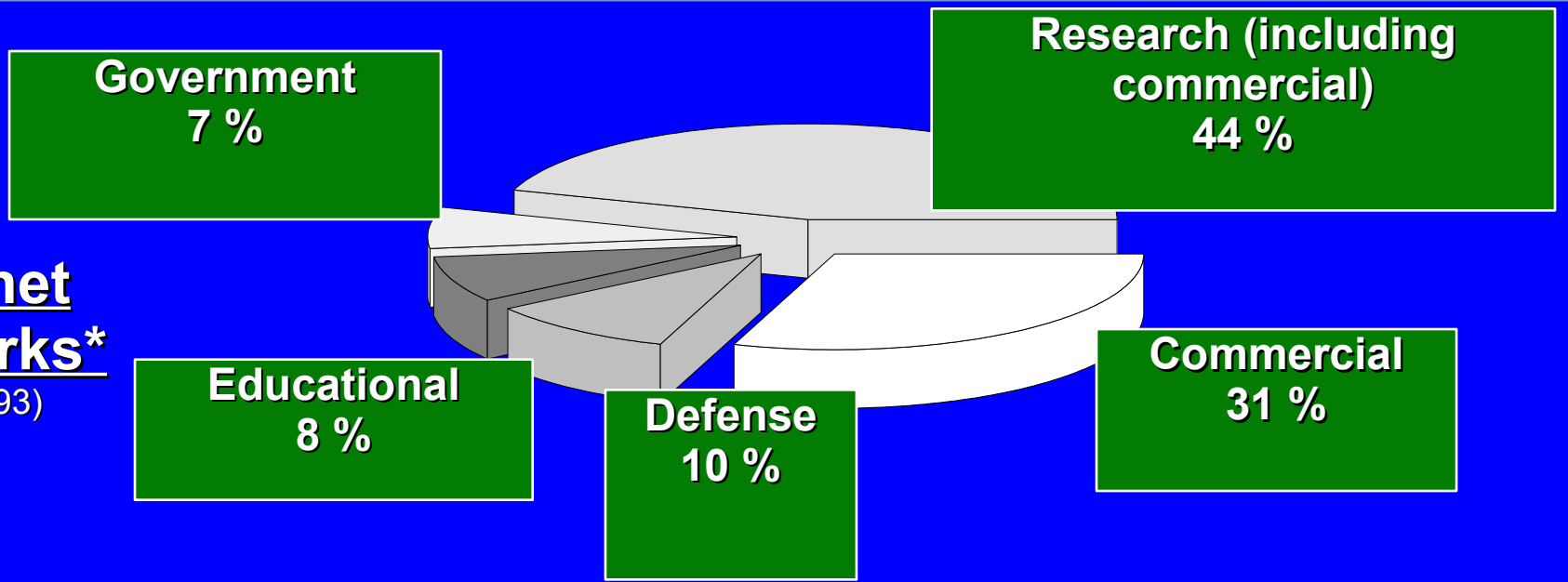


Current Internet Dynamics

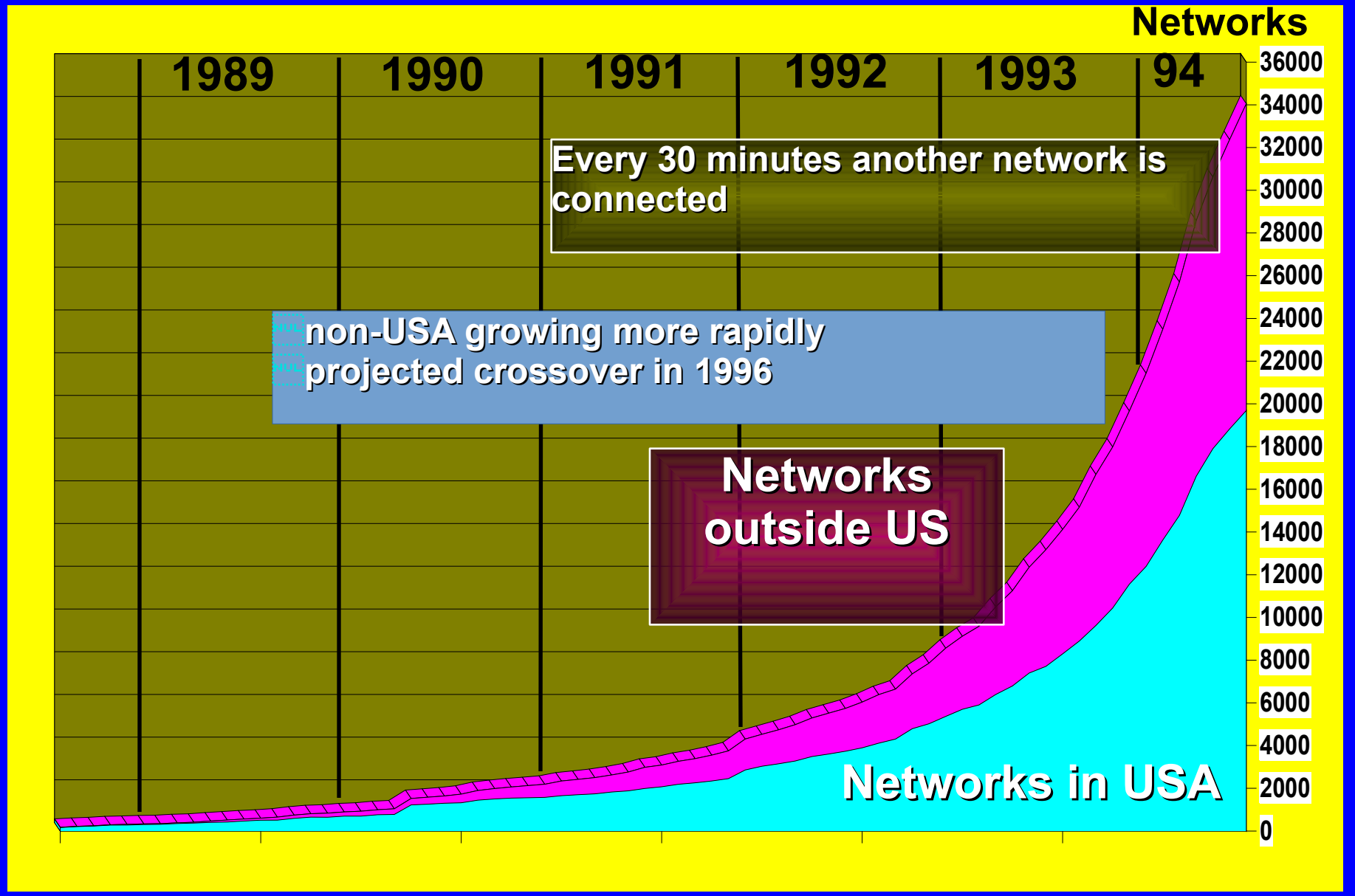
Internet

- 35,326 (NSFNet 19 July 94) plus 10 % ? connected IP internets seen at other backbones
- 83 (74 verified) connected IP countries (1 July 94)
- '93 ave network growth 160 % (183 % non-USA)
- 2.217 million computer hosts; 30,000 domains (Dec 93)
- E-mail and other gateways to 154 countries (Jun 94)

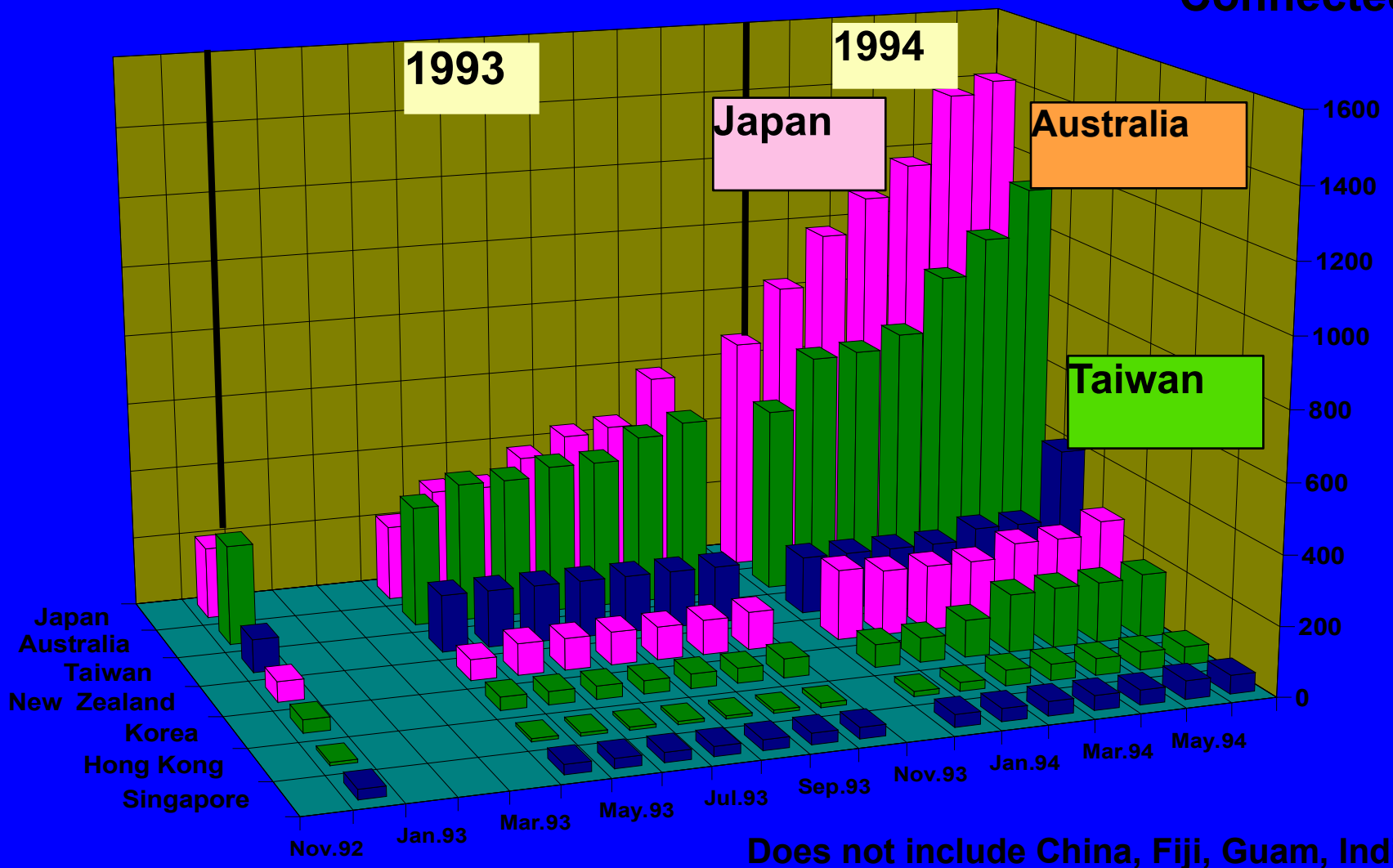
Internet Networks*
(2 July 93)



Growth of The Internet



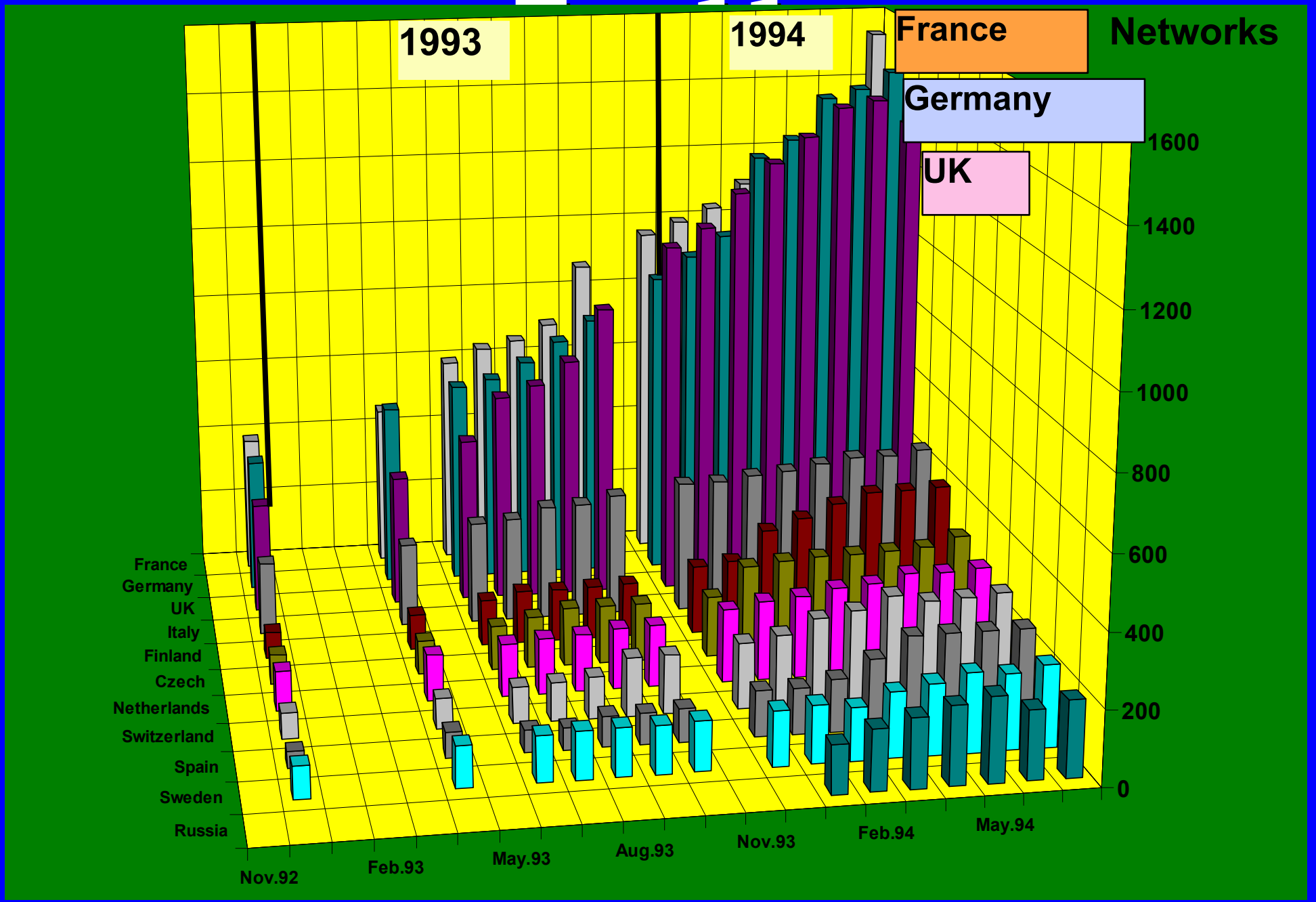
Internet in Asia-Pacific Today



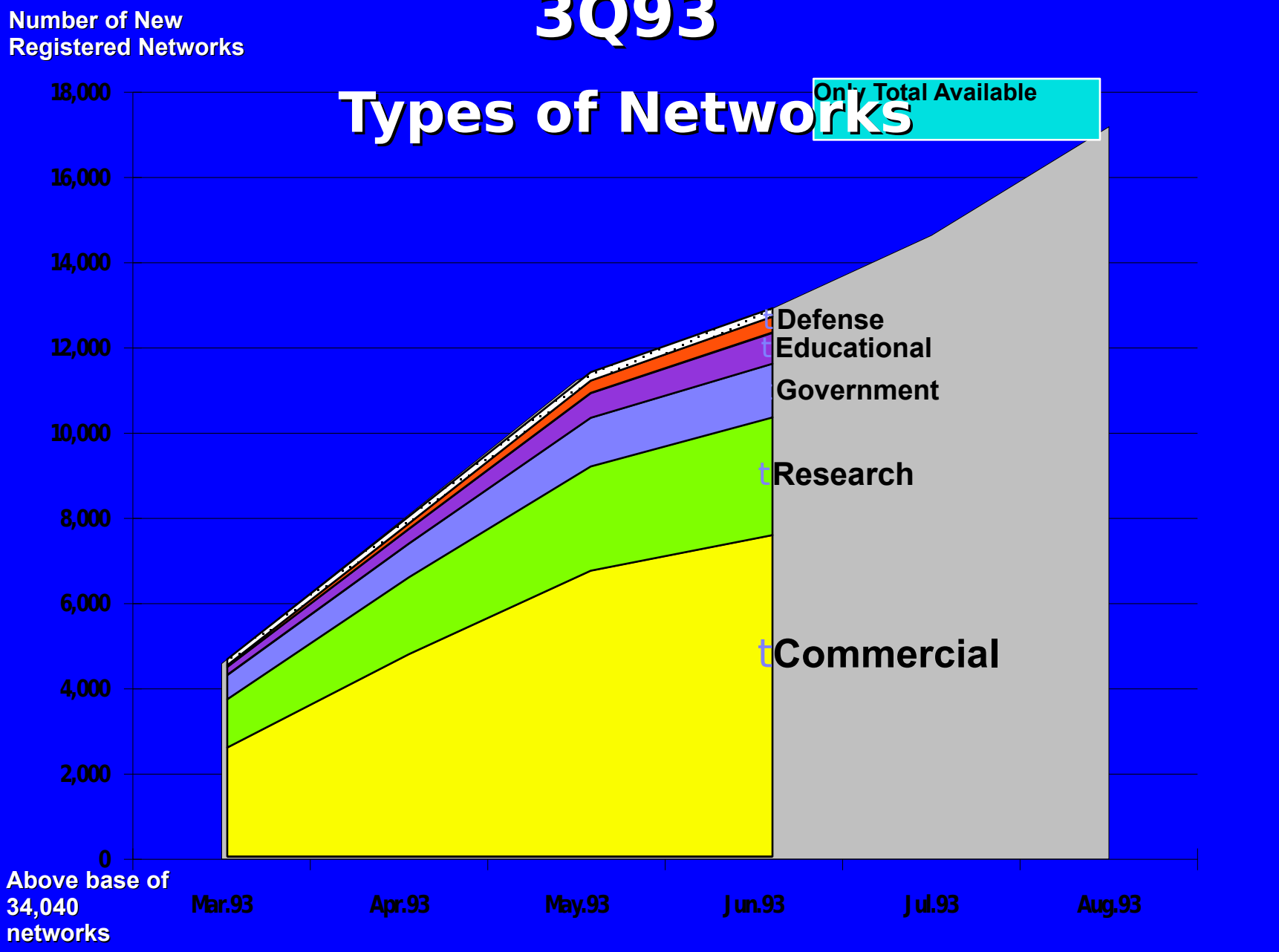
Does not include China, Fiji, Guam, India, Indonesia, Kazakhstan, Macau, Malaysia, Philippines, Sri Lanka, or Thailand

Source: <nis.nsf.net> country tables

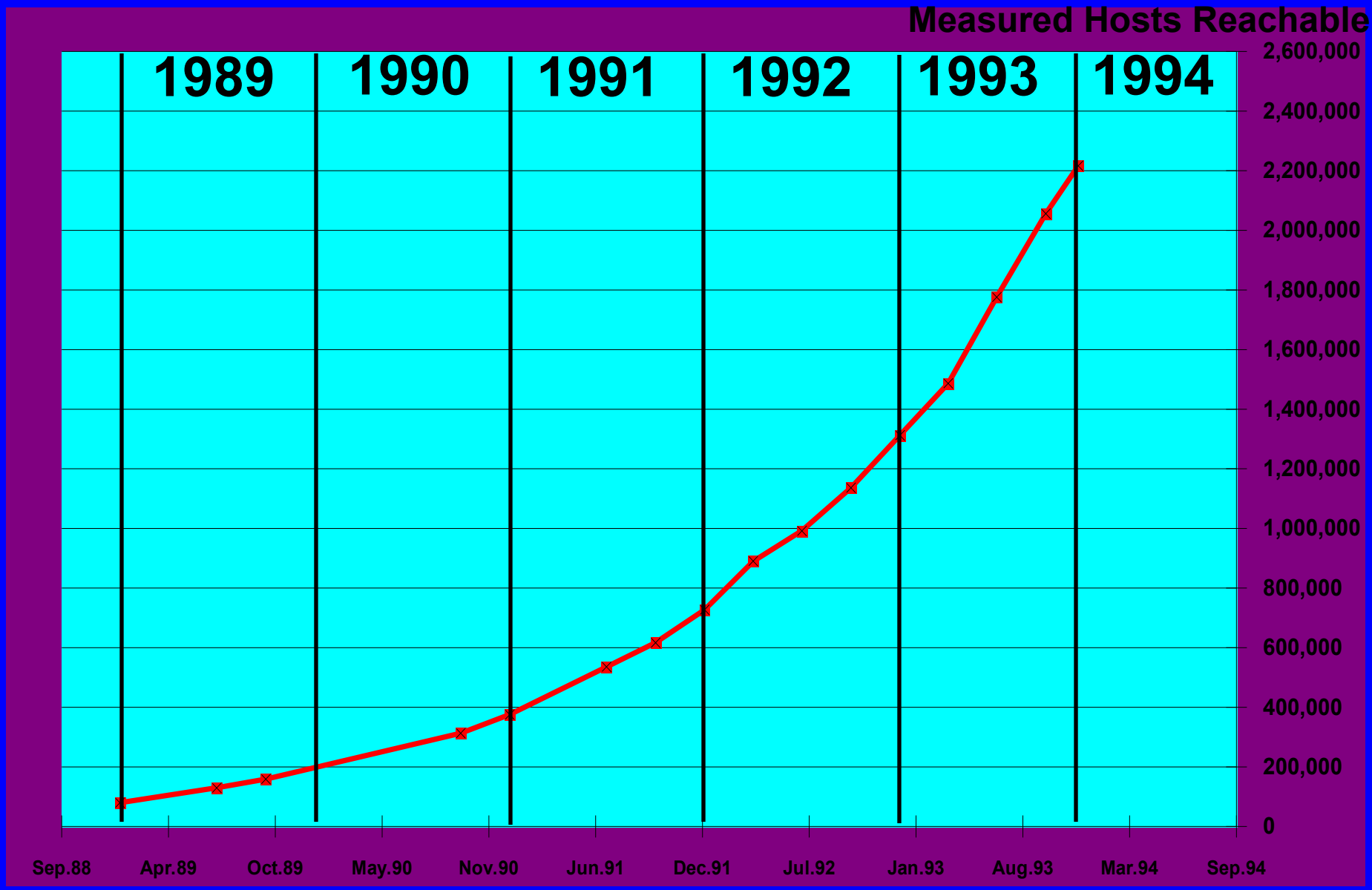
Internet in Europe Today -



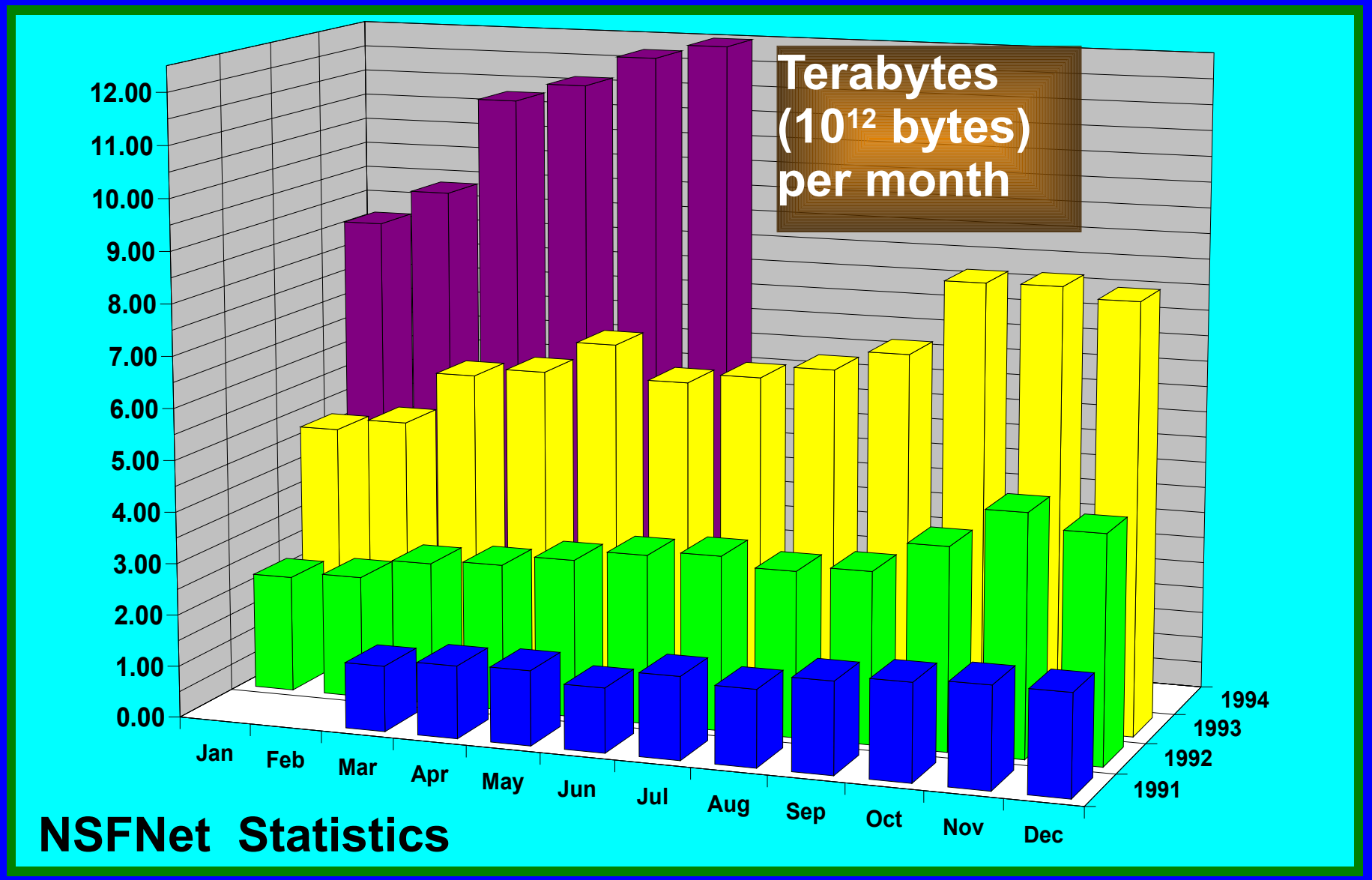
Growth in New IP Networks 2Q93-3Q93



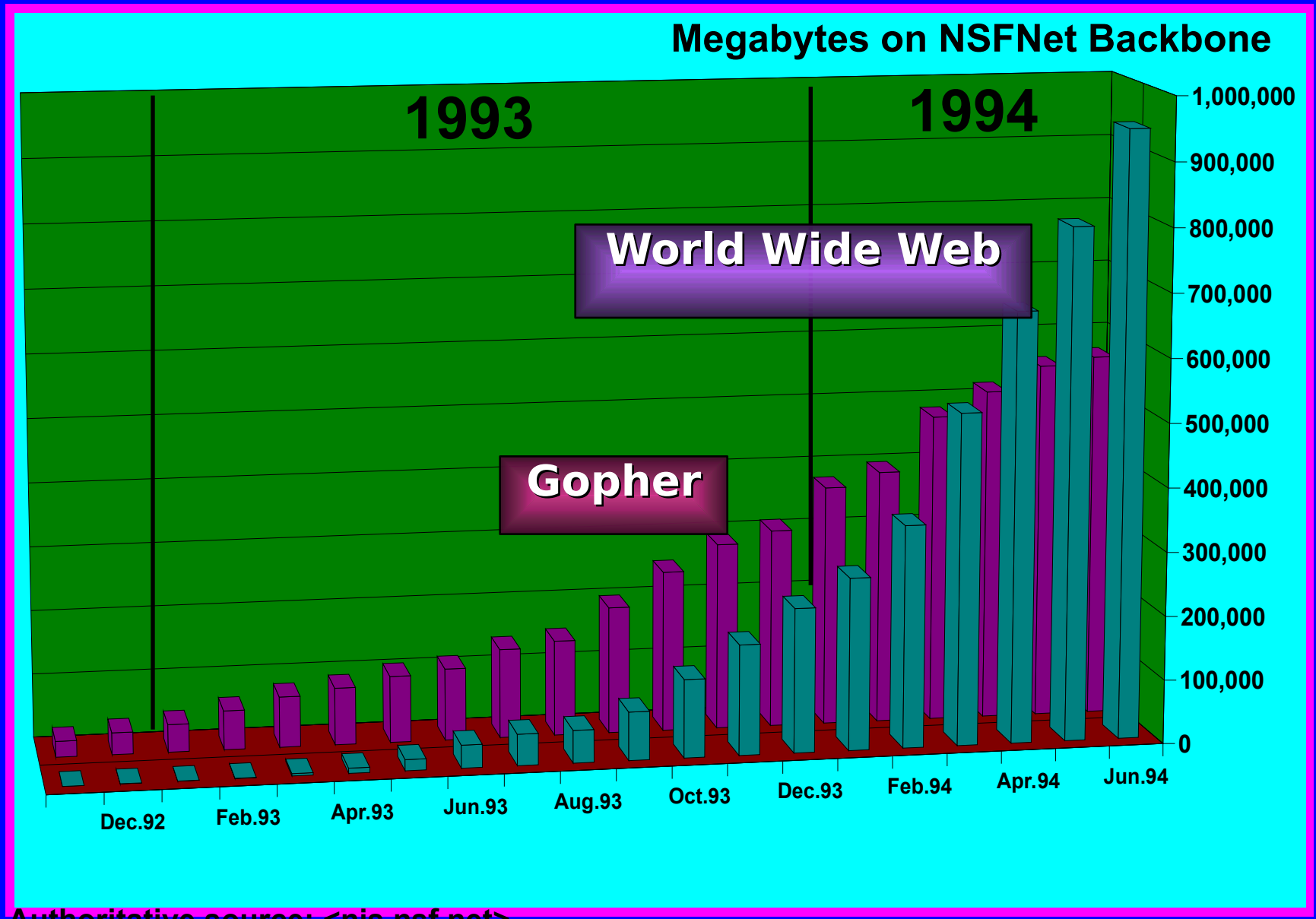
Internet Hosts Reachable 1989-1993



Traffic on the NSFNet Backbone

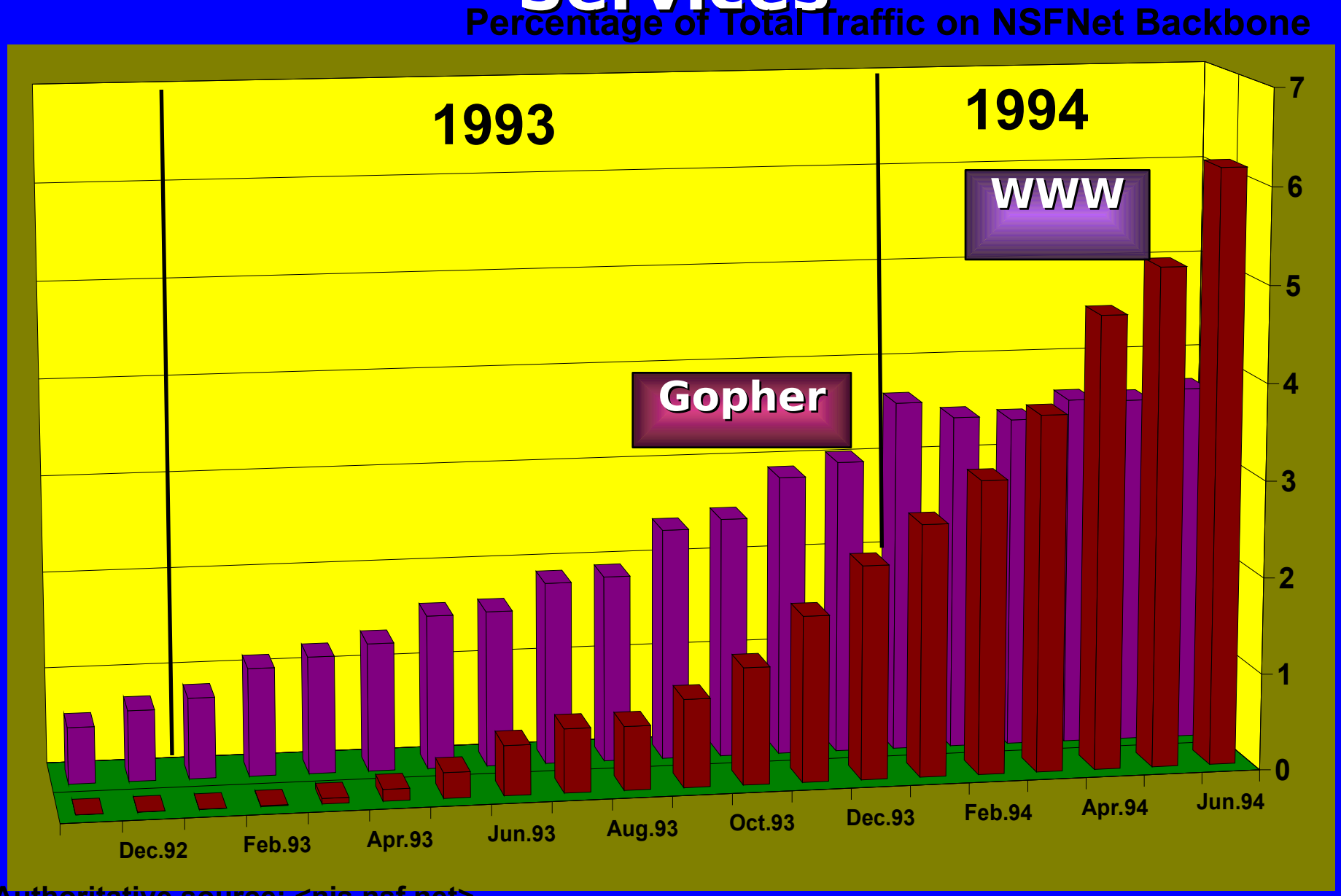


Growth of Internet Browsing Services



Authoritative source: <nis.nsf.net>

Growth of Internet Browsing Services



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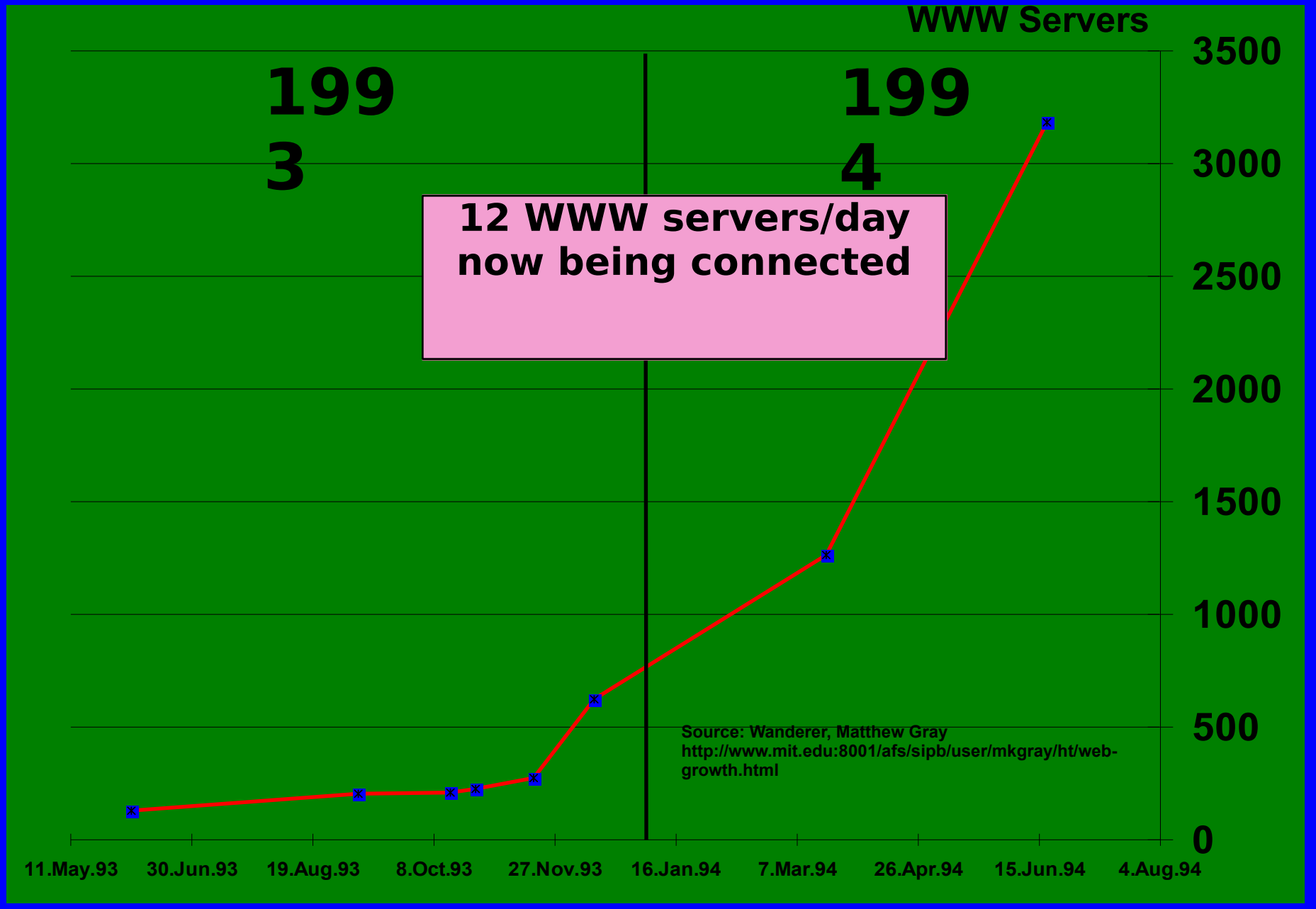
WWW Server Growth



Open Collaboration & Development

- Internet supports mesh among
  - Up to 4 billion computers
  - 64,000 process ports
  - tens of millions of people
- Technology transfer mechanism
  - Network techniques and applications
  - user populations
- Promotes rapid development of user applications through Internet standards process and network distribution

Internet Standards and Research Infrastructure

as of 16 Jul 94

Internet Architecture Board (IAB)

IAB Secretariat

Internet Engineering Task Force (IETF)

IETF Engineering Steering Group (IESG)

IETF Secretariat

Internet PCA Registration Authority (IPRA)

Internet Assigned Number Authority (IANA)

- Network Information Centers (NICs)
- Domain Name Administrators

Internet Research Task Force (IRTF)

Internet Research Steering Group (IRSG)

- End-to-End Research Group
- Autonomous Networks Research Group
- Privacy and Security Research Group
- Electronic Libraries Research Group
- Internet Architecture Workshops
- Electronic Communities Research Group
- Resource Discovery Research Group

Applications Area (APP)

- Access/Synchronization of the Internet Directories (asid)
- Electronic Data Interchange (edi)
- Internet Message Access Protocol (imap)
- Internet White Pages Requirements (whip)
- MHS-DS (mhsds)
- Notifications & Acknowledgments Requirements (notary)
- OSI Directory Services (osids)
- TELNET (telnet)

Internet Area (INT)

- DNS IXFR, Notification, and Dynamic Update (dnsind)
- Dynamic Host Configuration (dhc)
- IP over AppleTalk (appleip)
- IP over Asynchronous Transfer Mode (atm)
- Internet Stream Protocol V2 (st2)
- Point-to-Point Protocol Extensions (pppext)
- Router Requirements (rreq)
- Service Location Protocol (svrloc)

Network Management Area (MGT)

- ATM MIB (atommib)
- Character MIB (charmib)
- Interfaces MIB (ifmib)
- Modem Management (modemmgt)
- Printer MIB (printmib)
- Relational Database Management Systems MIB (rdbmsmib)
- Remote LAN Monitoring (rmonmib)
- SNA DLC Services MIB (snadlc)
- SNA NAU Services MIB (snanau)

IP: Next Generation Area (ipng)

- Address Lifetime Expectations (ale)
- Common Architecture for Next-Generation IP (catnip)
- Simple Internet Protocol Plus (sipp)
- TCP/UDP Over CLNP-Addressed Networks (tuba)

Operational Requirements area (OPS)

- Benchmarking Methodology (bmwg)
- CIDR Deployment (cidrd)
- Generic Internet Service Description (gisd)
- Network Status Reports (netstat)
- Operational Statistics (opstat)

Routing Area (RTG)

- Border Gateway Protocol (bgp)
- IP Routing for Wireless/Mobile Hosts (mobileip)
- IS-IS for IP Internets (isis)
- Inter-Domain Multicast Routing (idmr)
- Inter-Domain Policy Routing (idpr)
- Multicast Extensions to OSPF (mospf)
- OSI IDRP for IP over IP (ipidrp)
- Open Shortest Path First IGP (ospf)
- RIP Version II (ripv2)
- Routing over Large Clouds (rolc)
- Source Demand Routing (sdr)

Transport Services Area (tsv)

- Audio/Video Transport (avt)
- Integrated Services (intserv)
- Minimal OSI Upper-Layers (thinosi)
- Multiparty Multimedia Session Control (mmusic)
- ONC Remote Procedure Call (oncrpc)
- RSVP - Resource Reservation Setup Protocol (rsvp)
- TCP Large Windows (tcplw)

- Process for Organization of Internet Standards (poised)

Security Area (SEC)

- Authorization and Access Control (aac)
- Commercial Internet Protocol Security Option (cipso)
- Common Authentication Technology (cat)
- DNS Security (dnssec)
- Internet Protocol Security Protocol (ipsec)
- Network Access Server Requirements (nasreq)
- Privacy-Enhanced Electronic Mail (pem)
- Trusted Network File Systems (tnfs)

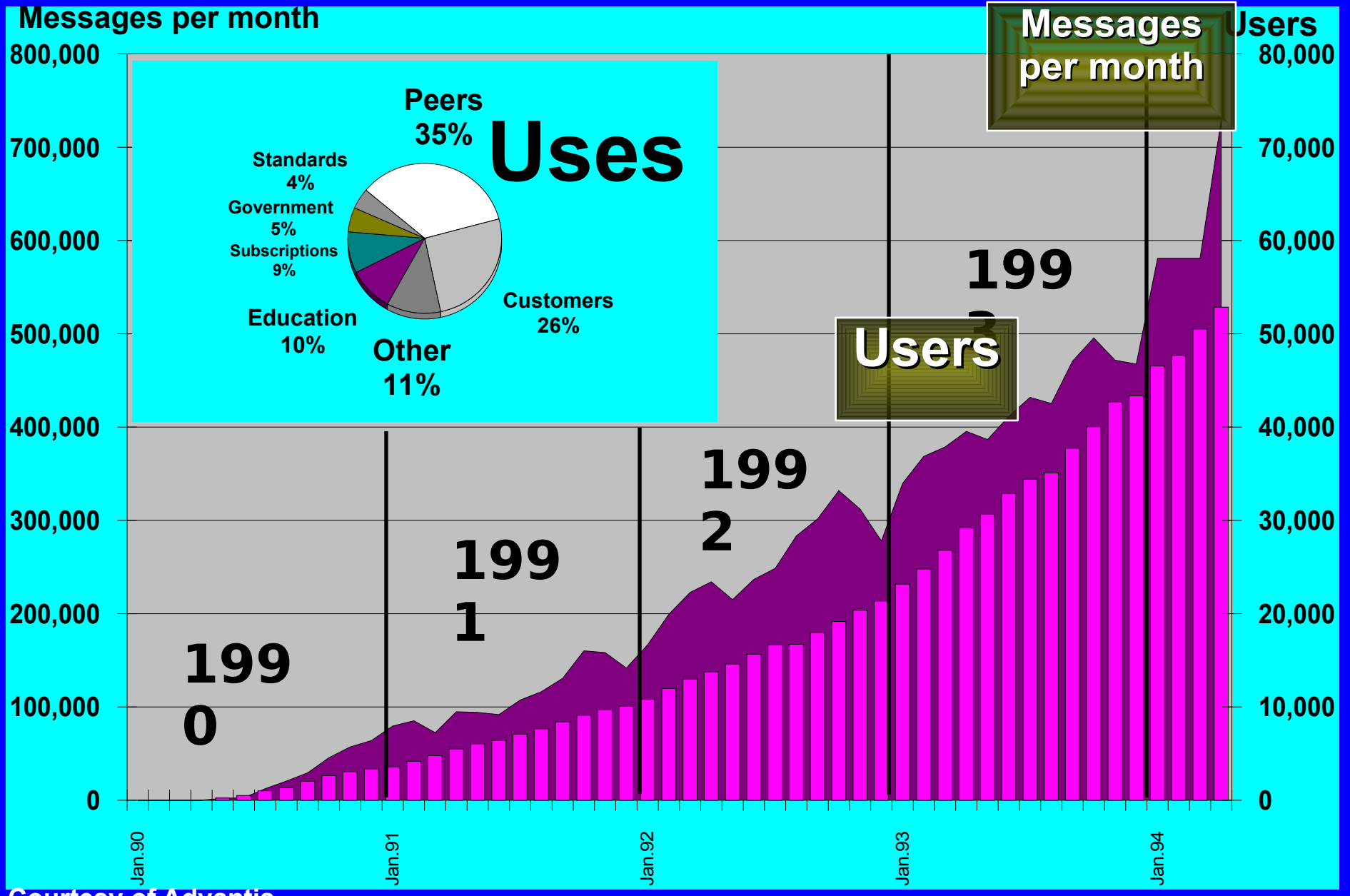
User Services Area (USV)

- Integrated Directory Services (ids)
- Integration of Internet Information Resources (iiir)
- Internet School Networking (isn)
- Network Information Services Infrastructure (nisi)
- Network Training Materials (trainmat)
- Networked Information Retrieval (nir)
- Uniform Resource Identifiers (uri)
- User Documents Revisions (userdoc2)
- User Services (uswg)
- Whois and Network Information Lookup Service (wnils)

Transforming

- Needed change in old enterprises
- Bundled with new enterprises
- Reinventing government
- Creating new distributed networking field
- Being introduced at K12 level

IBM Corporate-Internet Gateway Profile



Courtesy of Advantis

Huge Market Sector

- Ideal market population
- Low-cost access
- Opportunities include sales, sampling, product development, and follow-ons
- Caveat: market is very sensitive to misconduct

The Future

- Computer internetworking will continue scaling and developing indefinitely
- Major human historical landmark
- Near-term indicators include:
  - Business on the network
    - Monetary transactions
    - EDI forms
  - Massive connectivity by major business, government and professionals
  - Stunning growth in WWW-Mosaic multimedia browsing
  - Ubiquity
    - People
    - Geography
    - Media

What Promotes Internet Diffusion ?

- Available investment capital
- Minimal government impediments to service provisioning
- Freedom from government restrictions on operational agreements
- Motivated internet and computer experts
- Commitment to GATS provisions to allow competition in public Internet services and access to underlying transport services
- Cost-oriented leased lines
- No restrictions on or taxation of modems or computer equipment

Challenges and Promises

- Massive growth over the next 2 orders of magnitude is a challenge
- Addressing, security problems, and operations appear manageable
- Ultimate limits determined by computers, access methods, and bandwidth in remote areas
- Human and institutional aspects pose biggest unknowns

- A world of shared minds transcends accidental boundaries, geography, institutions, and time
- ...potentially filled with discovery, fulfillment and fascination for everyone

What is the Internet Society?

- The global international organization for open systems internetworking and the *Internet*
- A common mechanism for:
  - standards making
  - operational administration and coordination
  - research coordination and education
  - global cooperation among national, regional, and other international bodies
- An international means for sharing information and encouraging development of internet-related infrastructure and use around the world
- Members consists of individuals and organizations - commercial, governmental and non-profit
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