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# *Internet*

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# *Internet - Historical Backgrounds(1/11)*

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## *Internet - Historical Backgrounds(2/11)*

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- ▶ 1957 Soviet Union launched Sputnik, caused US Military to jump-start US technology and find safeguards against a space-based missile attack
- ▶ US was mainly concerned about their communications infrastructure
- ▶ US launched the Advanced Research Project Agency (ARPA)
- ▶ 1962: ARPA starts working on a survivable computer network to interconnect the military main computers

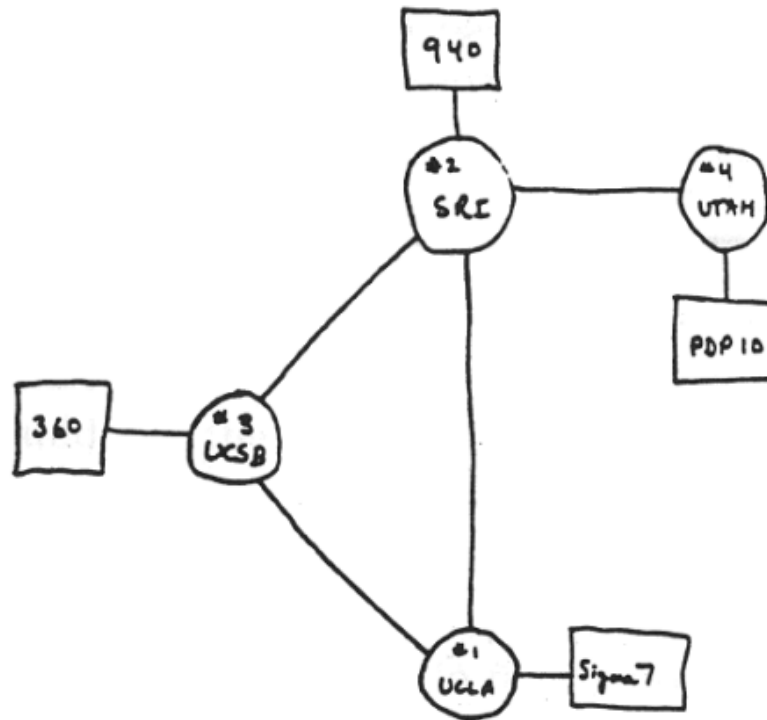
## *Internet - Historical Backgrounds(3/11)*

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- ▶ John Licklider and Leonard Klienrock: 'Galactic Network'
- ▶ Concepts of 'Galactic Network'
  - ▶ Open Architecture
  - ▶ Breaking messages into 'packets'
  - ▶ Sending packets not reliant on a single routing
  - ▶ Network based on dedicated lines (no dial-up lines)
- ▶ 1967-1969: Design and development of ARPANET together with other research institutes

# Internet - Historical Backgrounds(4/11)

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THE ARPA NETWORK

DEC 1969

## *Internet - Historical Backgrounds(5/11)*







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- ▶ 1969-1972: Further development of ARPANET
- ▶ 1972: ARPANET went public
- ▶ 1974: ARPA develops a common language to allow different networks to communicate: Transmission Control Protocol/Internet Protocol (TCP/IP)

## *Internet - Historical Backgrounds(6/11)*

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### TCP/IP Design Ideas:

-  Each network should be able to work on its own → no modification needed to participate in the Internet.
-  Each network has a 'gateway' linking it to the 'outside world'.
-  The gateway retains no information about the traffic passing through → no censorship or control.
-  Packages are routed through the fastest available route. If one computer was blocked or slow, the packages would be rerouted through the new one
-  The gateways between the networks are always open, and they would route the traffic without discrimination.
-  The operating principles would be freely available to all the networks

## *Internet - Historical Backgrounds(7/11)*

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- ▶ 1974-1982: Further development of TCP/IP
- ▶ New networks are developed: Universities, US Government, Phone Companies, Bitnet, etc.
- ▶ In Europe: EUNET, EARN, etc.
- ▶ 1982: ARPANET adopts TCP/IP → the Internet is born
- ▶ The Internet: Connected set of networks using the TCP/IP standard

## *Internet - Historical Backgrounds(8/11)*

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The “New Hacker’s Dictionary” describes the reason for the success of TCP/IP as following:

TCP/IP evolved primarily by actually being used, rather than being handed down from on high by a vendor or a heavily-politicized standards committee. Consequently, it (a) works, (b) actually promotes cheap cross-platform connectivity, and (c) annoys the hell out of corporate and governmental empire-builders everywhere.

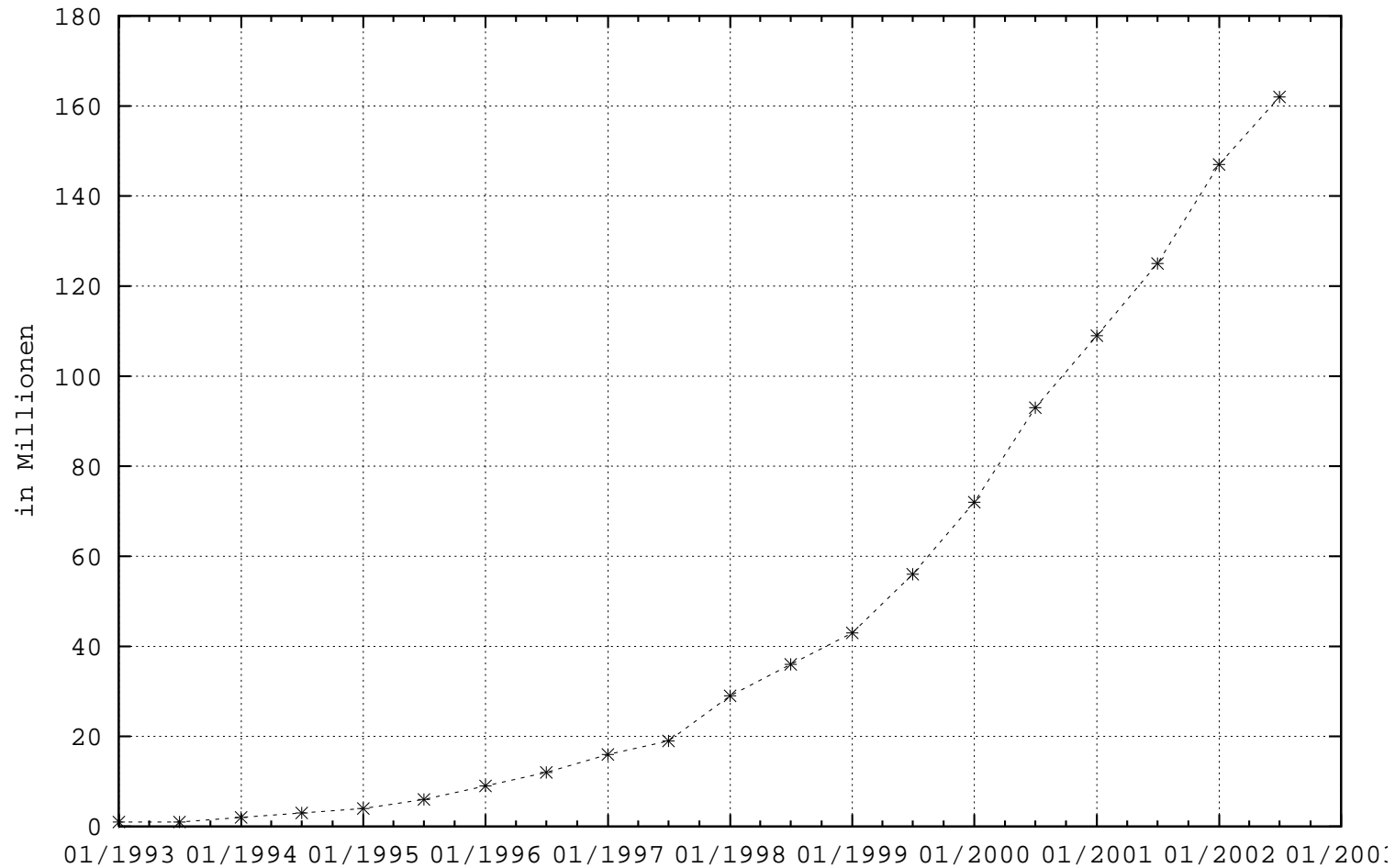
## *Internet - Historical Backgrounds(9/11)*

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- ▶ Implementation of TCP/IP given away
- ▶ in computer-science institutes: 90% BSD-Unix → 90% connectivity
- ▶ no alternatives
- ▶ enormous grow rates

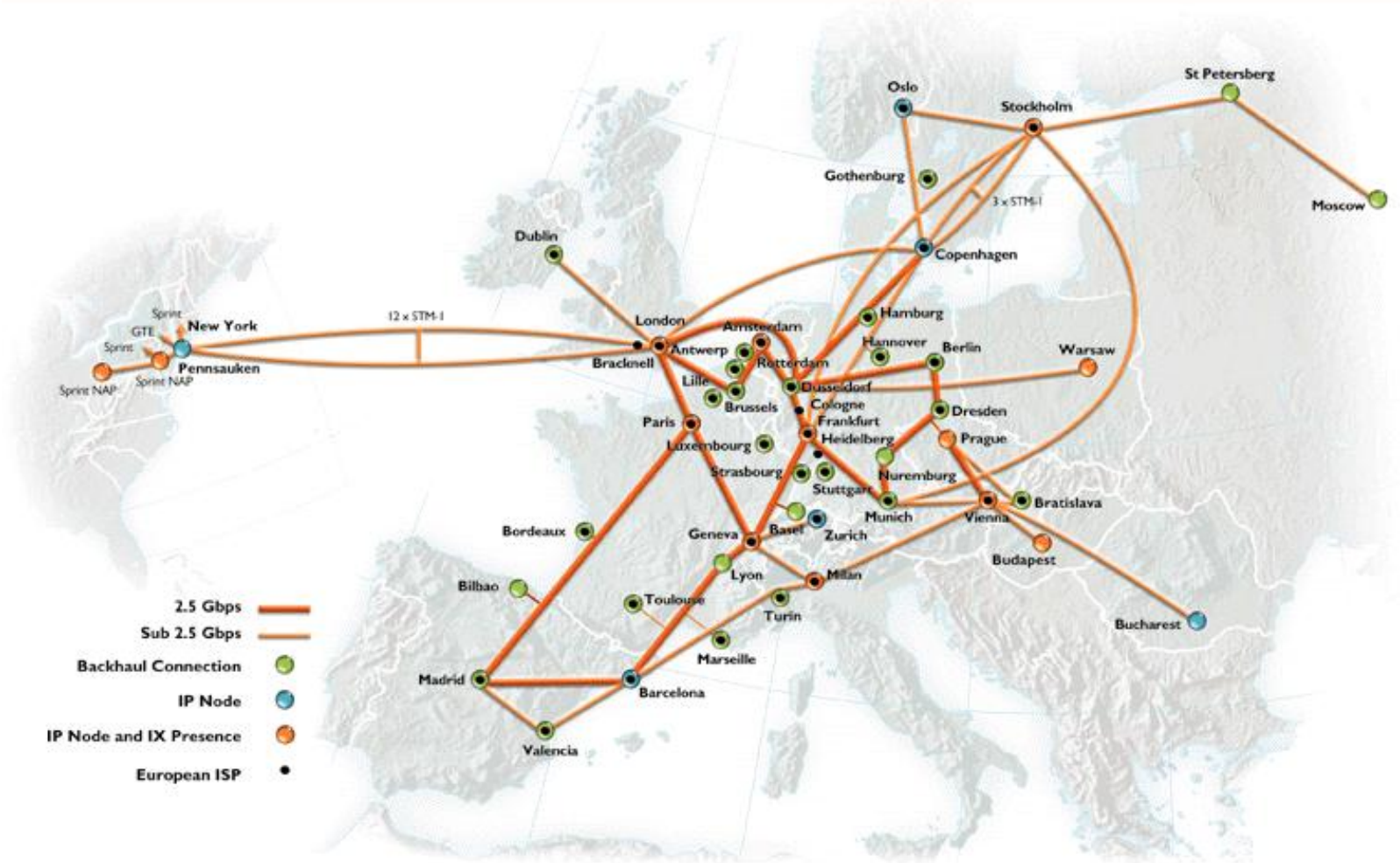
# Internet - Historical Backgrounds(10/11)

Anzahl der Computer im Internet  
(Source: Internet Software Consortium (<http://www.isc.org/>))



- ▶ different nets connected
  - ▶ public (org, net, gov)
  - ▶ commercial (com, e.g. EUnet)
  - ▶ military (mil, e.g. MILnet)
  - ▶ university (e.g. NFSnet, ACOnet, ...)

## EBONE IP BACKBONE

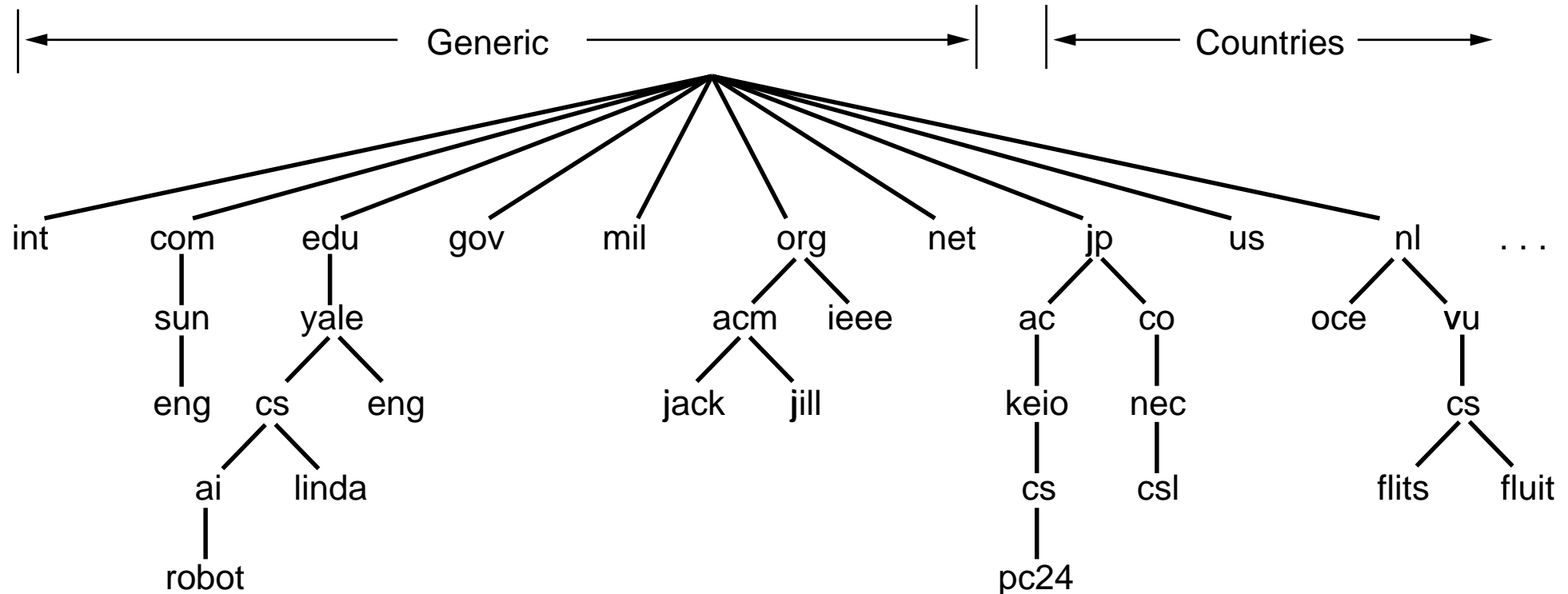


- ▶ Administration of the Internet is decentralized
- ▶ Internet Comitee (Standards): Internet Society <http://www.isoc.org/>
  - ▶ Internet Architecture Board (Requirements) <http://www.iab.org/>
  - ▶ Internet Engineering Task Force (RFC → Standards) <http://www.ietf.org/>

- ▶ IP addressing:
  - ▶ IPv4: 32 bit long (4 bytes) / dot notation
  - ▶ e.g. 2166031126 = 10000001000110110000001100010110  
→ 10000001.00011011.00000011.00010110  
→ 129.27.3.22
  - ▶ IPv6: 128 bit ( $2^{128}$  verschiedene Adressen,  $7 * 10^{23}$  pro  $m^2$ )

# Internet - Technical Background(2/3)

► hierarchical naming service (e.g. `news.tu-graz.ac.at` → 129.27.3.22)



**Figure 1:** hierarchical organisation of domain names

## *Internet - Technical Background(3/3)*

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- ▶ TCP/IP
  - ▶ IP (Internet Protocol): virtual point-to-point connection, routing, no reliable connection
  - ▶ TCP (Transmission Control Protocol): based on IP, reliable connection, handles lost/double/broken/wrong-order packets
- ▶ UDP (User Datagram Protocol): based on IP, not reliable, connectionless protocol, smaller packets, no checking → e.g. good for streaming
- ▶ Ports: different services

- ▶ telnet
- ▶ later email
- ▶ usenet (news)
- ▶ Gopher
  - ▶ search engine Veronica
- ▶ ftp
- ▶ informationsystems

- ▶ specific for service
- ▶ based on TCP or UDP
- ▶ RFCs (<http://www.ietf.org/rfc.html>)
  - ▶ HTTP1.0: RFC 1945
  - ▶ FTP: RFC 959
  - ▶ TCP/IP Tutorial: RFC 1180
- ▶ simple (textbased)