Rechnernetze

(Computer Networks)

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Contents

History

- Mainframes+Terminals, proprietary (for example SNA of IBM), local
- ARPAnet vendor–neutral local net
- local: Ethernet, IPX (Novell), Token Ring (IBM), ...
- 1973 design of IP (internet protocol) by Cerf and Kahn
- 1977 transition from ARPAnet to IP

$\rightsquigarrow$ link local networks

- internet protocol definitions in RFCs

Jon Postel

http://www.postel.org/postel.html

Jon Postel, Internet Pioneer
August 6, 1943 - October 16, 1998

"Be liberal in what you accept,
 and conservative in what you send."
-- jon

RFC 1122 (originates in RFC 760)

Jon Postel

- In its infancy, Jon worked on its development, from its early protocols, to the creation of TCP/IP.
- Documenter and co-developer many of the key Internet standards, including TCP/IP (basic Internet protocols), SMTP (email transfer), and DNS (name servers).
- Editor of the RFC series from April 7, 1969 (its inception) until his untimely departure in Oct. 1998, covering over 2400 RFCs, and advocate of clean, conservative protocol design and specification. See RFC 2555 for more information.
- Co-author of over 204 Internet RFCs
- The Internet Assigned Numbers Authority (IANA), and advocate of conservation of protocol and port numbers.

Request for Comments

RFC 2026

In general, an Internet Standard is a specification that is _____ and _____, is technically _____, has multiple, independent, and _____ implementations with substantial _____, enjoys significant _____, and is recognizably _____ in some or all parts of the Internet.

Request for Comments

RFC 2026

In general, an Internet Standard is a specification that is stable and well-understood, is technically competent, has multiple, independent, and interoperable implementations with substantial operational experience, enjoys significant public support, and is recognizably useful in some or all parts of the Internet.

Request for Comments

RFC 2026

1. Proposed Standard

   is generally stable, has resolved known design choices, is believed to be well-understood, has received significant community review

2. Draft Standard

   at least two independent and interoperable implementations from different code bases have been developed, and for which sufficient successful operational experience has been obtained

3. Internet Standard

   significant implementation and successful operational experience, high degree of technical maturity

RFC 791 (IP protocol)

The Internet Protocol is designed for use in interconnected systems of packet-switched computer communication networks.

The internet protocol provides for transmitting blocks of data called datagrams from sources to destinations, where sources and destinations are hosts identified by fixed length addresses.

The internet protocol also provides for fragmentation and reassembly of long datagrams, if necessary, for transmission through "small packet" networks.

Complexity of Network Communications

- Physical Devices (Network adapters, Routers, Bridges, Switches,. . .)
- local network technologies
- inter network technologies
- reliable services HTTP, FTP, Mail,. . .
- Web Services

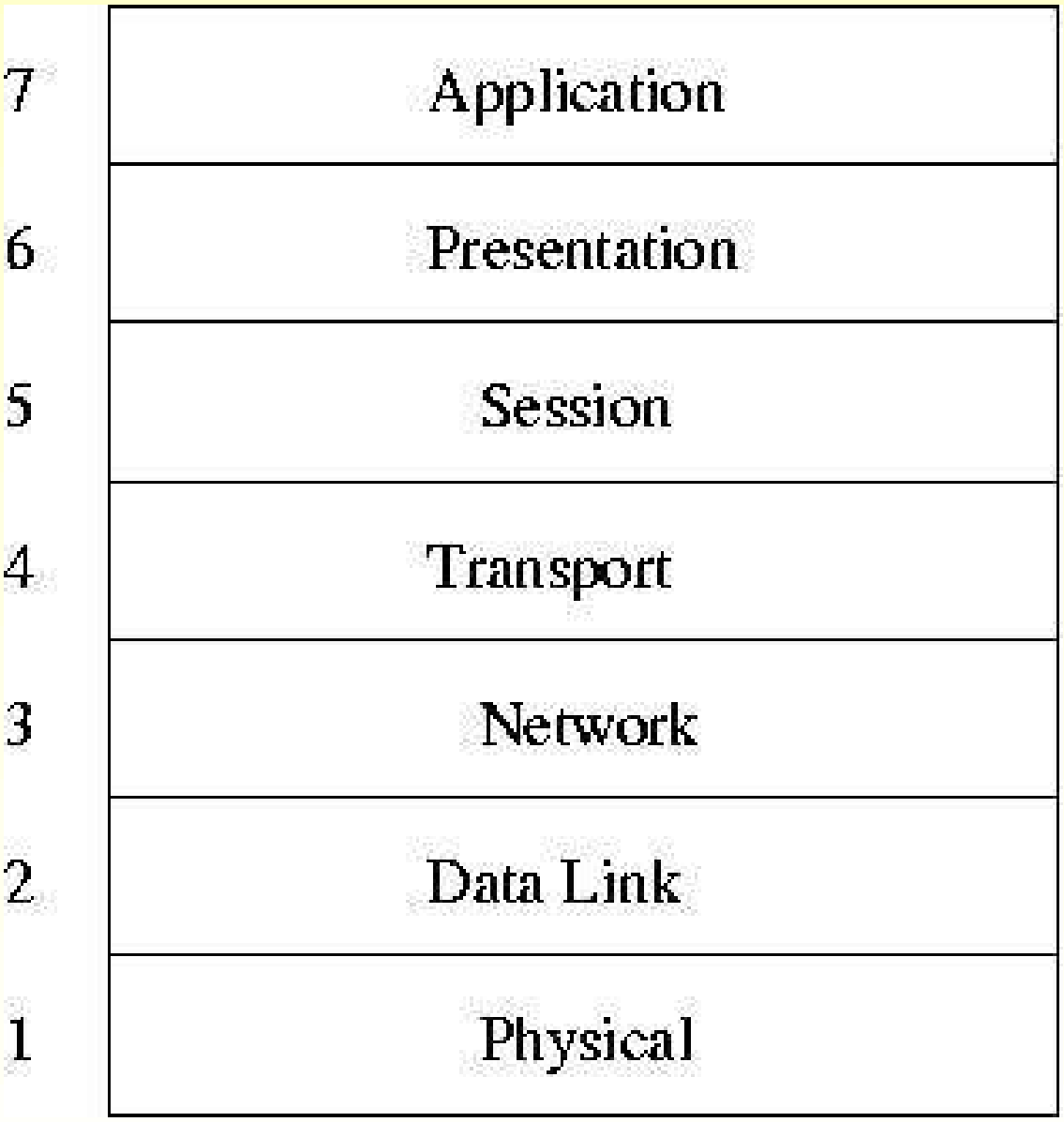
$\rightsquigarrow$splitting into modules

$\rightsquigarrow$software development analogy: procedures $\Longleftrightarrow$ layers

$\rightsquigarrow$each layer can be thought of as a set of functions

$\rightsquigarrow$layer n may only call functions of layer $n-1$

OSI Reference Model



OSI = open systems interconnect $\rightsquigarrow$compatibility

Layer 1: Physical Layer

specifies wiring (serial, parallel, Ethernet, Token Ring cables)

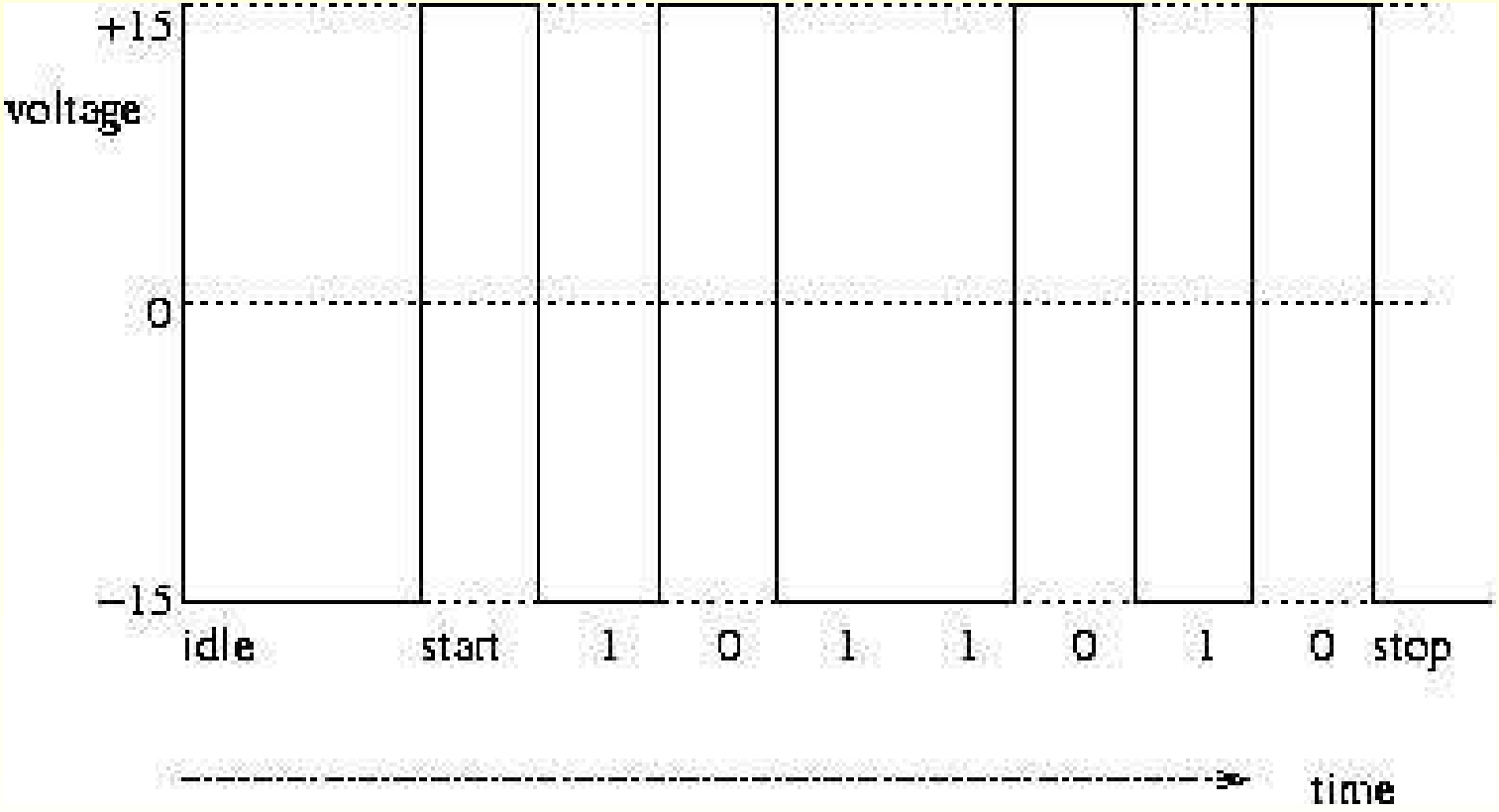
specifies connectors

specifies electronic data (voltage, impedance, timing,. . .)

Layer 2: Data Link Layer

specifies information transmitted across physical layer

error handling for physical layer (retransmit or report to upper layer)



local networks

addressing stations within local network

Layer 3: Network Layer

address handling across network boundaries

packaging data

no integrity checking required $\rightsquigarrow$higher level protocols

layer 3 hardware: router

common failures:

- data loss,
- data duplication,
- data modification,
- out-of-order arrival

Layer 4: Transport Layer

reliable network services

recover from

- data loss,
- data duplication,
- data modification,
- out-of-order arrival

caution: there are unreliable transport services

Layer 5: Session Layer

establishing connections

terminating connections

Layer 6: Presentation Layer

data representation (high endian vs. little endian)

data handling (for example a compression service)

Layer 7: Application Layer

application protocols used by end–user network programs

examples: HTTP, SMTP, FTP, ...