

TCP/IP illustrated Vol. 1 The Protocols

Chapter 1 - Introduction

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Introduction

- Late 1960's research project
- Today's most widely used network protocol
- Open system
 - Definitions and free implementations available
- Base of worldwide Internet

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Summary of Chapter

- Layered structure
- Internet addresses
- Domain Name System
- Encapsulation
- Demultiplexing
- Client server model
- Port numbers

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Layered structure

- TCP/IP is combination of different protocols at various layers.
- TCP is 4-layer system

Application (Sovellus)	Telnet, FTP, e-mail, etc.
Transport (Kuljetus)	TCP, UDP
Network (Verkko)	IP, ICMP, IGMP
Link (Linkki)	device driver and interface card

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Link layer

- Device driver and network interface card handle hardware details of physically interfacing with the media

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Network layer

- Handles movement of packet around in the network
- Routing of packets
- IP (Internet Protocol)
- ICMP (Internet Control Message Protocol)
- IGMP (Internet Group Management Protocol)

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Transport layer

- Provides flow of data between two hosts, for application layer above (TCP and UDP)
- TCP (Transmission Control Protocol) provides reliable data flow between two hosts. Dividing data to packets, acknowledging of packets, timeouts...
- UDP (User Datagram Protocol) sends datagrams from a host to another. No guarantees!

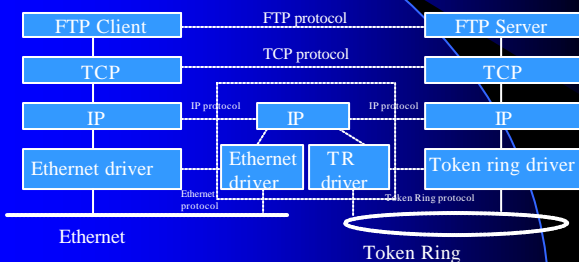
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Application layer

- Handles details of the particular application
- Telnet, FTP (File Transfer Protocol), SMTP (Simple Mail Transfer Protocol), SNMP (Simple Network Management Protocol) ...

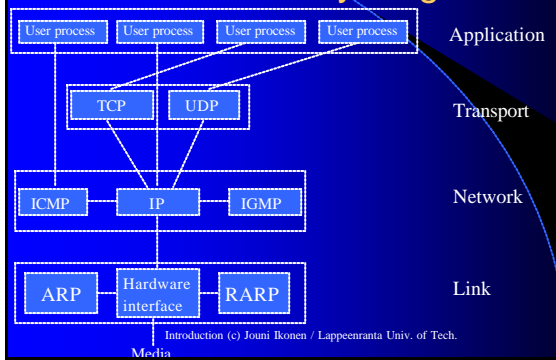
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Two networks connected with a router



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TCP/IP layering



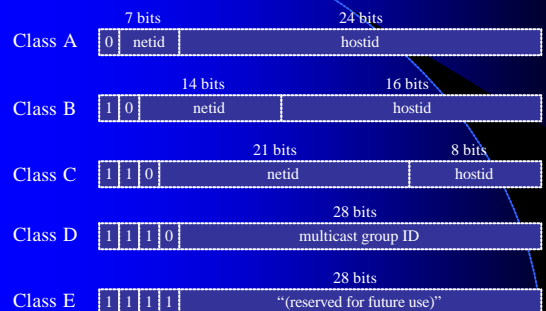
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Internet addresses

- Every interface must have a unique Internet Address (IP address)
- 32-bit address, e.g, 157.24.10.16
- 3 types of addresses
 - Unicast
 - Broadcast
 - Multicast

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Internet addresses



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Internet addresses

Class	Range
A	0.0.0.0 – 127.255.255.255
B	128.0.0.0 – 191.255.255.255
C	192.0.0.0 – 223.255.255.255
D	224.0.0.0 – 239.255.255.255
E	240.0.0.0 – 255.255.255.255

- Multihomed host has multiple IP addresses (1/interface)

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Private IP addresses

- The Internet Assigned Numbers Authority (IANA) has reserved the three blocks of the IP address space for private internets (local networks)
 - 10.0.0.0 - 10.255.255.255
 - 172.16.0.0 - 172.31.255.255
 - 192.168.0.0 - 192.168.255.255
- The **Internet Assigned Numbers Authority (IANA)** has reserved private IP addresses in the range of **169.254.0.0 - 169.254.255.255** for Automatic Private IP Addressing.

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Domain name system

- A distributed database system that provides mapping between IP addresses and hostnames.
- Any application can call a standard library function to look up an IP address corresponding given hostname.

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Encapsulation

- Each layer adds its own header (and maybe a trailer) to user data which is send through network.
- User data + application header => TCP segment => IP datagram => Ethernet frame

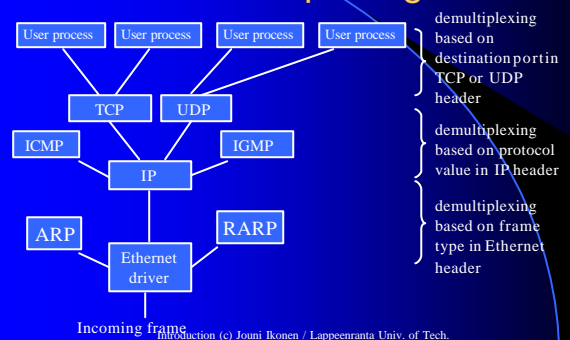
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Demultiplexing

- When an Ethernet frame is received all the headers are removed in appropriate places.
- Each protocol looks at certain identifiers in its header to determine which protocol on next upper layer receives data. E.g. IP detect if packet should be given to UDP or TCP.

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Demultiplexing



Client-server model

- Server provides some services for clients.
- Most applications follow this model.
- Two flavors:
 - Iterative, wait for request, serve it, wait for a next ...
 - Concurrent, serve multiple request at a time, may fork an own process for all requests

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Port numbers

- TCP and UDP identifies applications using 16-bit port numbers.
- Reserved ports 1-1023
- Well known port numbers
- /etc/services

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Programming interfaces

- sockets (Berkeley sockets)
- TLI (Transport Layer Interface, also known as XTI)

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Internet standards

- Standards published as *Request for Comments* (RFCs). (All of them are NOT standards).
- <http://ftp.funet.fi/rfc>
- rfc-index.txt – shows status of the standards:
 - Standard, proposed standard, obsolete, experimental, informational, ...
- Internet Official Protocol Standards. J. Reynolds, Ed., S. Ginoza, Ed.. July 2004. RFC3700 (Check that it is still valid!).
<http://ftp.funet.fi/rfc/rfc3700.txt>

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Summary

- Link, Network, Transport and application layers
- Network layer provides hop-by-hop service (IP)
- Transport layer provides end-to-end service (UDP and TCP)
- Internet is a collection of networks
- DNS mapping between names and addresses

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