

Distributed Applications

Computer communications and networks

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Networking concepts

- Physics
- Medium

Connection

- Electrical - twisted pair, coaxial cable
- Optical - direct line of sight, optic fibre
- Wireless - radio

Networking implementation

- connection-oriented
- connectionless

Deterministic and non-deterministic transmission

- Connectionless networks allow more flexibility but are more complex in their operation
- Aloha
- Ethernet
- Token methods

Topology

- Star
- Spine
- Ring

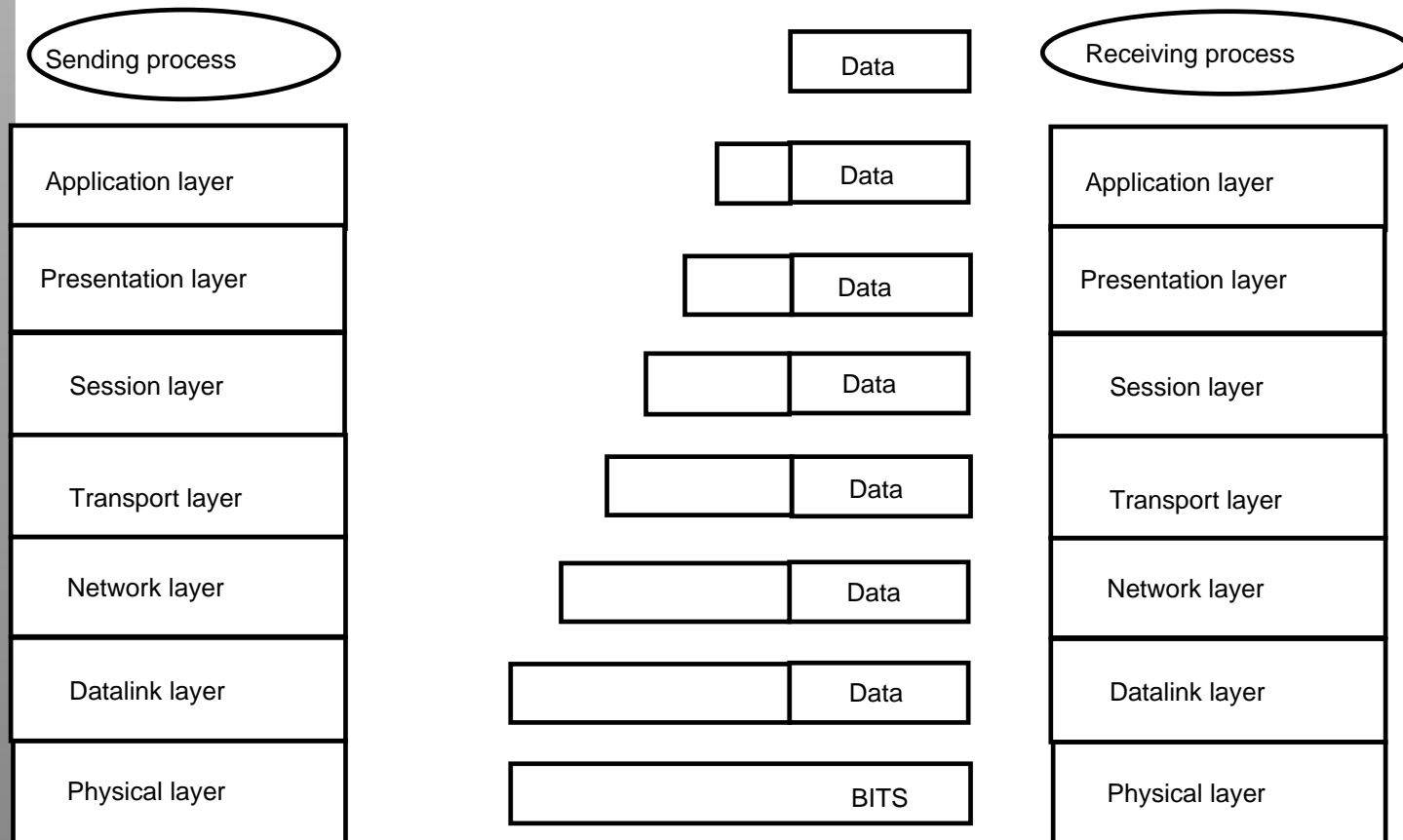
Encoding

- Agreed interpretations, agreed ways of 'doing things'
- Each communication has a sender and a receiver.
- Send bits
- 8 bit groups, representing the ASCII character set plus a parity bit.
- This process is called 'encoding'.
- NOTE: Encoding is different to encryption.

Errors

- Any physical signal is subject to errors
- It is usual to send a message in small packets and to error check each packet.
- A clear design aim: reliable transmission between sender and receiver.

Layered architectures



LAN, MAN, WAN, VPN

Part measured by degree of local control vs open sharing

- LAN
- MAN
- WAN
- VPN

Connecting networks

- Repeater
- Bridge
- Router

Wireless LANs

- Bluetooth
- IEEE 802.11
- Blackberry - wireless connection to handhelds

The Internet and TCP/IP

- The Internet is a collection of end-systems that communicate using the TCP/IP protocol suite.
- TCP/IP stands for "Transmission Control Protocol/Internet Protocol".
- The TCP/IP protocol suite includes services at the network and transport layers.
- The network layer needs a data link.
- TCP/IP does not include a data link layer (or a physical layer).

TCP/IP network layer

The network layer of TCP/IP is called IP (Internet Protocol).

IP networks have the following properties:

- Each end-system has a unique address (and IP address)
- The IP layer in each end-system uses a data link layer to transmit and receive IP packets
- Addressing is needed to determine where each packet should go.

TCP/IP Transport Layers

The TCP/IP protocol suite includes 2 transport layers, called

- UDP (user datagram protocol)
- TCP (transmission control protocol).

UDP

- Unreliable - there is no guarantee that the network will deliver a message, and the network does not inform the sender if the message is lost.
- Connectionless - there is no initial "connection" made between the sender and receiver before data is sent.
- Datagram-oriented - data is sent and received in chunks without any order imposed or implied.

TCP

- connection-oriented
- bi-directional
- byte stream transmission of data.

Most applications on The Internet are based on TCP

- Both TCP and UDP must provide communication between processes identified by protocol "ports".
- Many network services operate on a prescribed port number, for example HTTP (WWW) servers use port 80 and mail servers (SMTP) use port 25.

Internet Applications and Application Protocols

Documentation for some Internet Application Protocols is listed below:

- HTTP - Hypertext Transfer Protocol: RFC 2068
- FTP - File Transfer Protocol: RFC 959
- SMTP - Simple Mail Transfer Protocol: RFC 821

Applications

- Application Protocols
- HTTP