Protocol Principles

Summary Protocol Principles Day 1

- Two important principles of data communication
  - Layering
    - Structuring the complex task of data communication into smaller pieces by usage of "layers"
    - A layer is built by the resources of the corresponding protocol peer entities and by the protocol procedures performed between them
      - protocol standards define fields of the control field of a frame (bits seen on the wire) and the communication behavior of the peers receiving and sending frames
      - A layer is using the services of the lower layers to provide a enhanced service to the upper layer
        - The application layer can access the lower layer (the protocol stack) via API (application programming interface)
        - The communication layer can access the lower layer via network-card driver
  - Connectionless versus connection-oriented service

Connectionless Service (Com-SW)

- Like packet or telegram service of a PTT
- No error recovery of corrupted frames
Connection-Oriented Service (Com-SW)

Connection Request
Connection Acknowledgement
Data
Disconnected Acknowledgement

Station A
like telephone call of Telecom

Station B

Connection establishment
time
time
clearing of connection
error recovery of corrupted frames is possible by usage of ARQ techniques

Connection Request
Connection Acknowledgement
Data
Disconnected Acknowledgement

Station A
like telephone call of Telecom

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Connection establishment
time
time
clearing of connection
error recovery of corrupted frames is possible by usage of ARQ techniques

Summary Protocol Principles Day 2

- Connection-oriented service
  - allows error recovery by feedback error control
  - ARQ techniques
    - Receiver acknowledges correct receipt of data frame
    - Idle-RQ
      - Easy to implement (few resources necessary) but inefficient concerning usage of bandwidth in case of full-duplex line
    - Continuous-RQ
      - Several methods
        » Selective ACK (e.g. TCP optional SACK procedure)
        » GoBackN (e.g. HDLC basic REJ procedure)
        » Positive Acknowledgement (e.g. TCP basic procedure)
        » Selective Reject (HDLC optional SREJ procedure)
      - More complex to implement (much more resources necessary) , more efficient concerning usage of bandwidth in case of full-duplex line

Idle-RQ versus Continuous-RQ

Data and Acks
are sent continuously!!

Data
Ack
Data
Data
Ack
Data
Ack

Idle-RQ
Wait for Ack before next Data can be sent

Continuous-RQ
Data and Acks are sent continuously!!

Necessary Resources for Com-SW Layer 1

Computer A
Protocol State Machine
Retransmission List
Receive List
Timers
Control Variables
Queues / Mailboxes for operating API

Computer B
Protocol State Machine
Retransmission List
Receive List
Timers
Control Variables
Queues / Mailboxes for operating API

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Necessary Resources for Com-SW Layer 2

Generic Frame Format

Frame Types:
Connect request, ack
Disconnect request, ack
I, ACK, NACK, SREJ
Identifiers

Frame Type Field: Connect Request, I, ACK, NACK, ...
Identifier Field: N, N+1, ...

control information = line protocol header
checksum

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