IIT KHARAGPUR

NPTEL ONLINE
CERTIFICATION COURSES

COMPUTER NETWORKS AND INTERNET PROTOCOLS

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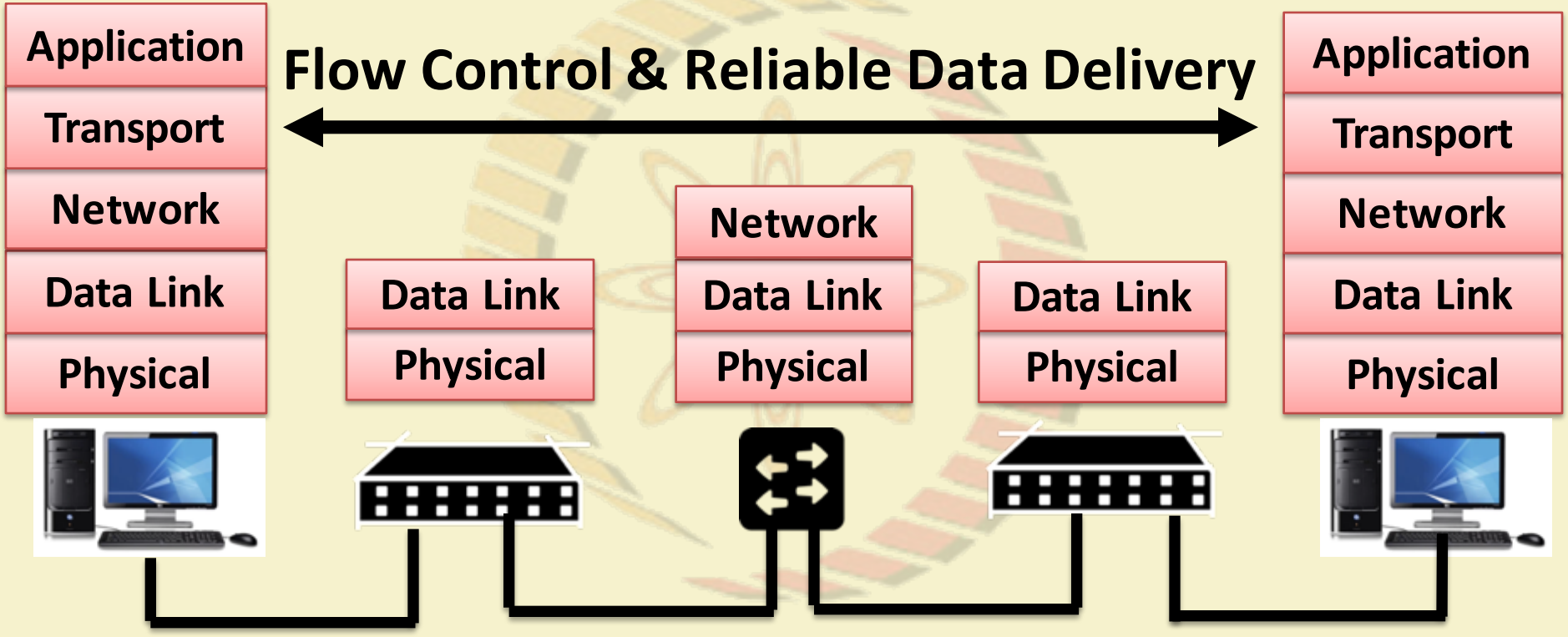
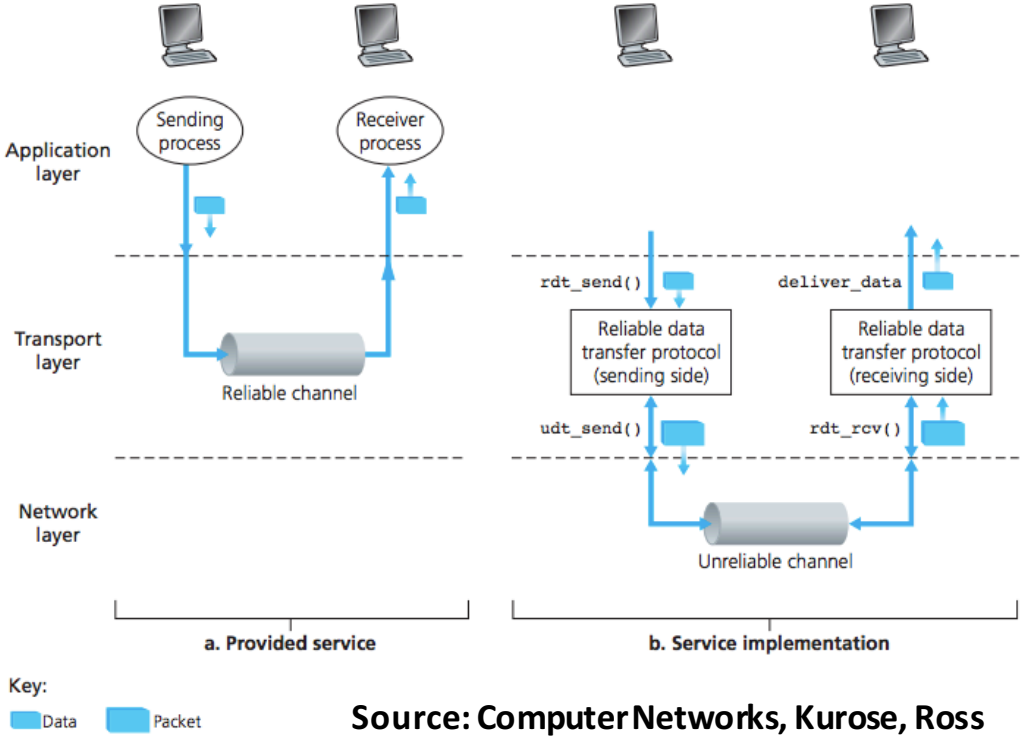
Transport Layer - IV (Reliability & Flow Control)



Ensure Reliability at the Transport Layer



Source: Computer Networks, Kurose, Ross

Error Control and Flow Control

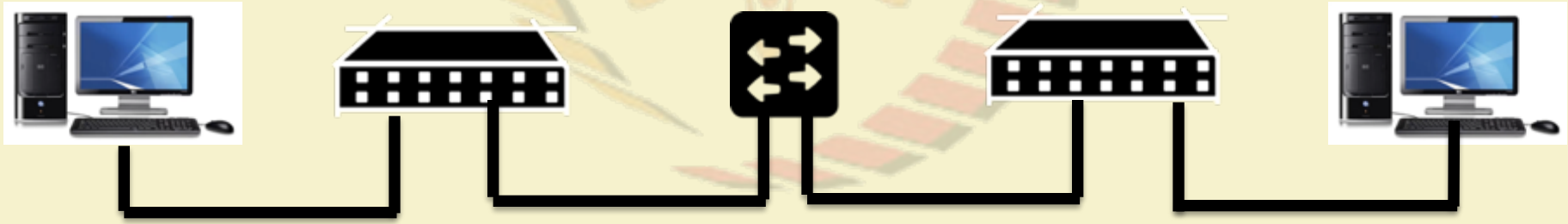
- These features are used in both Data Link Layer and Transport Layer – Why?
- Flow control and error control at the transport layer is essential
- Flow control and error control at the data link layer improves performance

An Interesting Read

END-TO-END ARGUMENTS IN SYSTEM DESIGN

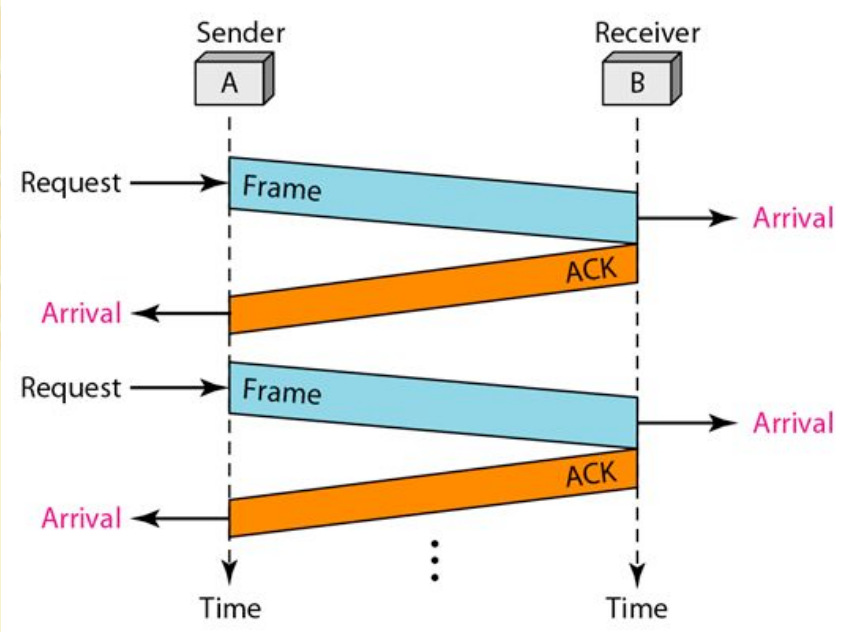
J.H. Saltzer, D.P. Reed and D.D. Clark*

M.I.T. Laboratory for Computer Science



Flow Control Algorithms

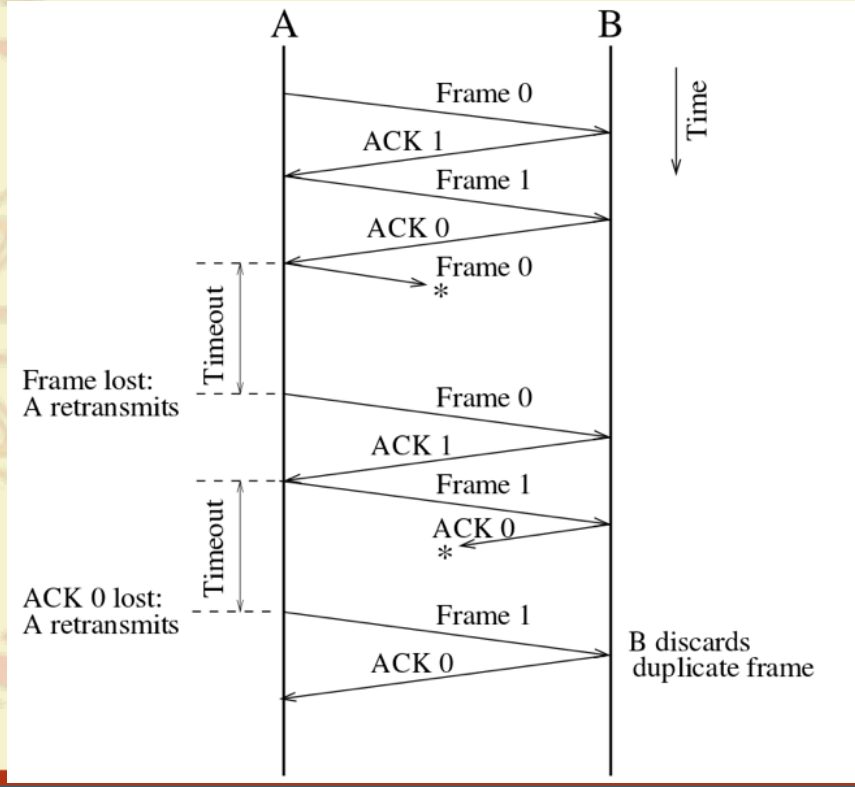
- **Stop and Wait Flow Control (Error Free Channel):**



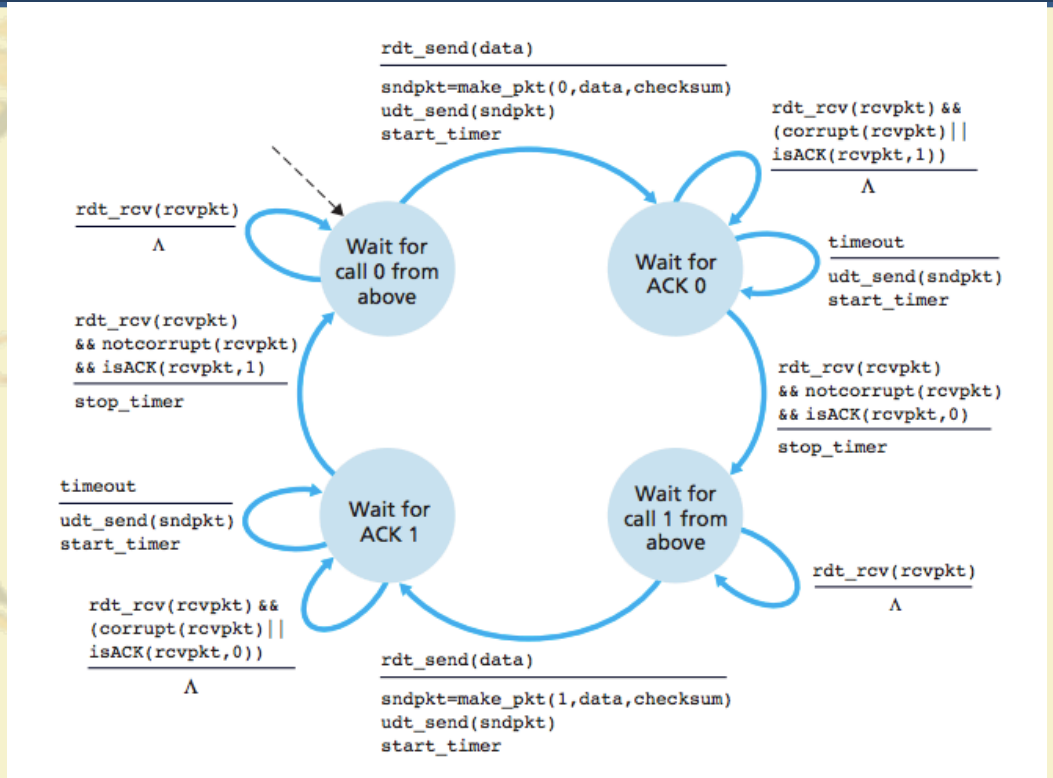
Flow Control Algorithms

- **Stop and Wait (Noisy Channel):**
- Use sequence numbers to individually identify each frame and the corresponding acknowledgement
- **What can be a maximum size of the sequence number in Stop and Wait?**

- **Automatic Repeat Request (ARQ)**



Stop and Wait ARQ – Sender Implementation

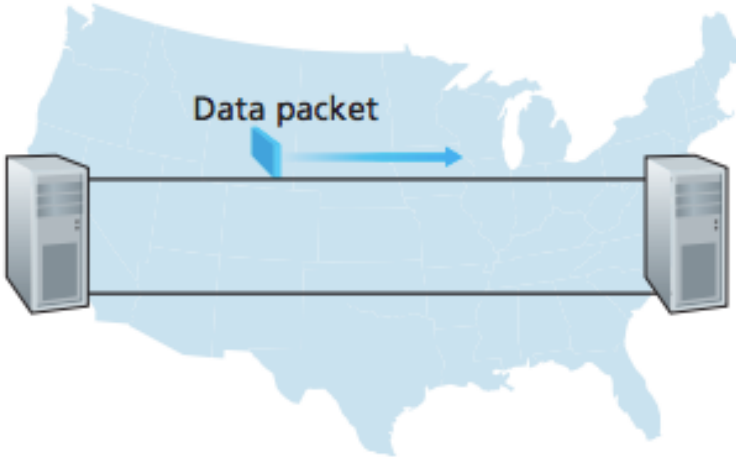


Source: Computer Networks, Kurose, Ross

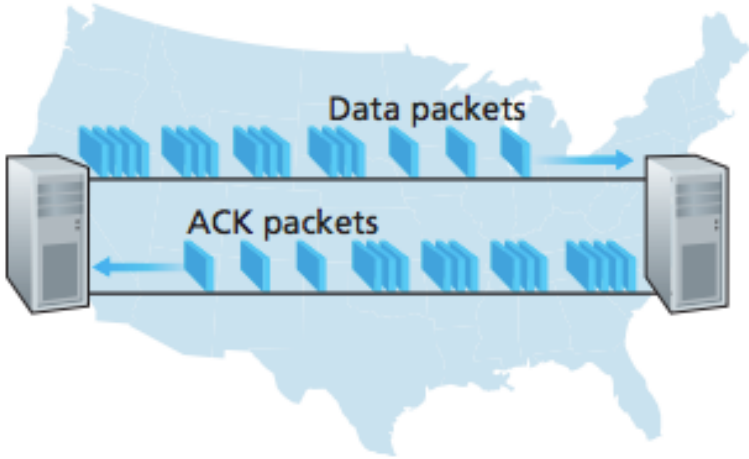
Problem with Stop and Wait

- Every packet needs to wait for the acknowledgement of the previous packet.
- For bidirectional connections – use two instances of the stop and wait protocol at both directions – further waste of resources
- A possible solution: Piggyback data and acknowledgement from both the directions
- Reduce resource waste based on **sliding window protocols (a pipelined protocol)**

Stop and Wait versus Sliding Window (Pipelined)



a. A stop-and-wait protocol in operation



b. A pipelined protocol in operation

Source: Computer Networks, Kurose, Ross


thank you!