Network Communications
Chapter 12

Local Area Network Switching

Ethernet Switch

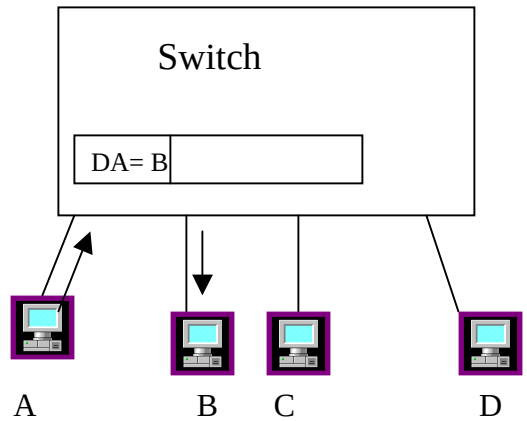


Figure 12.1

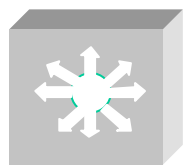


Figure 12.2: Symbol

LAN Segments via a Switch

- Each segment uses one or more hubs

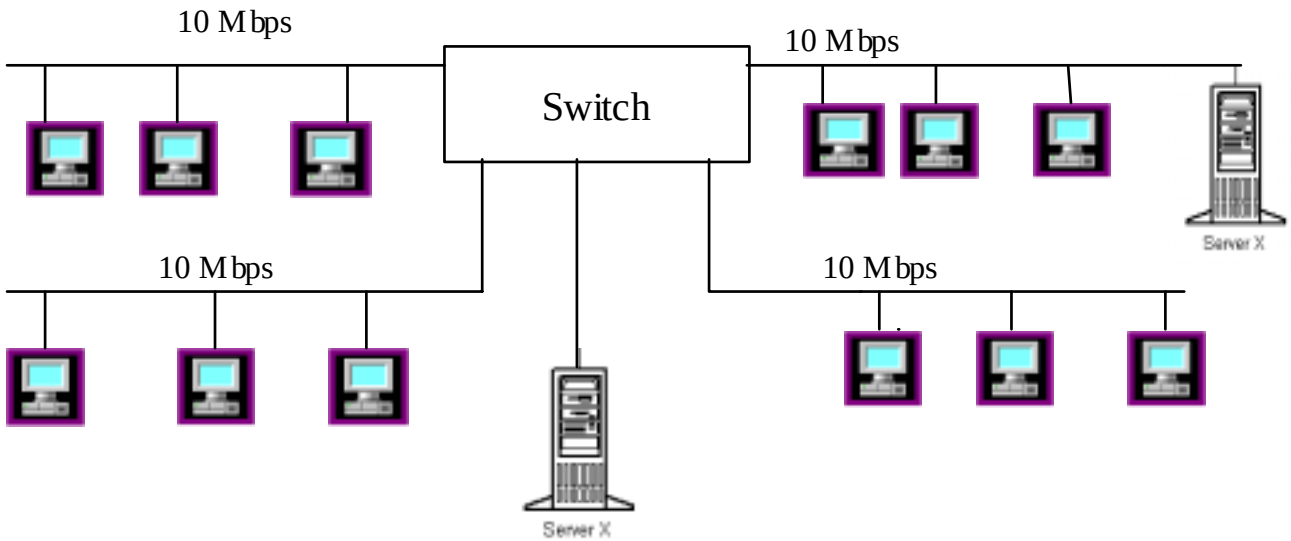


Figure 12.3

Symmetric Switching

- All connected segment are the same
- Benefits
  - Isolate collisions
  - Independent simultaneous transfers
  - Reliability

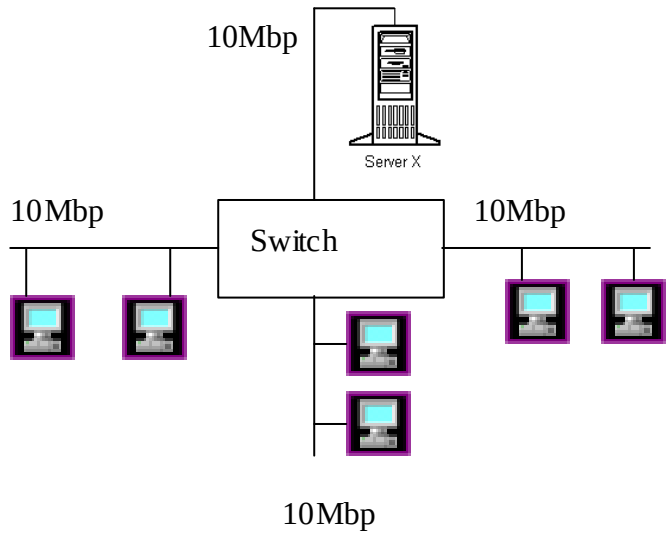


Figure 12.4

Asymmetric Switching

- Allows different speed segments
- Use old hardware/cables along with new equipment
- Don’t mix speeds on the same segment

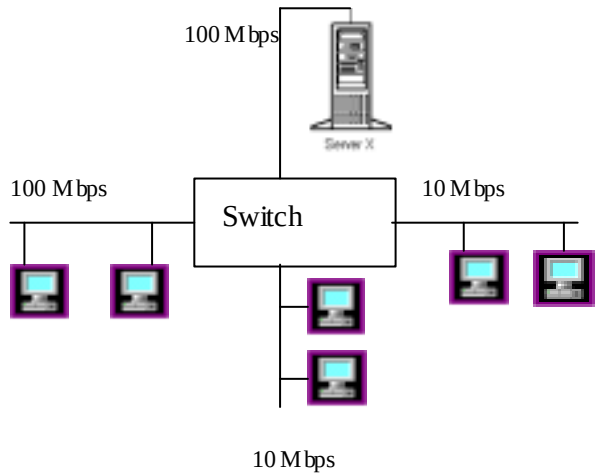
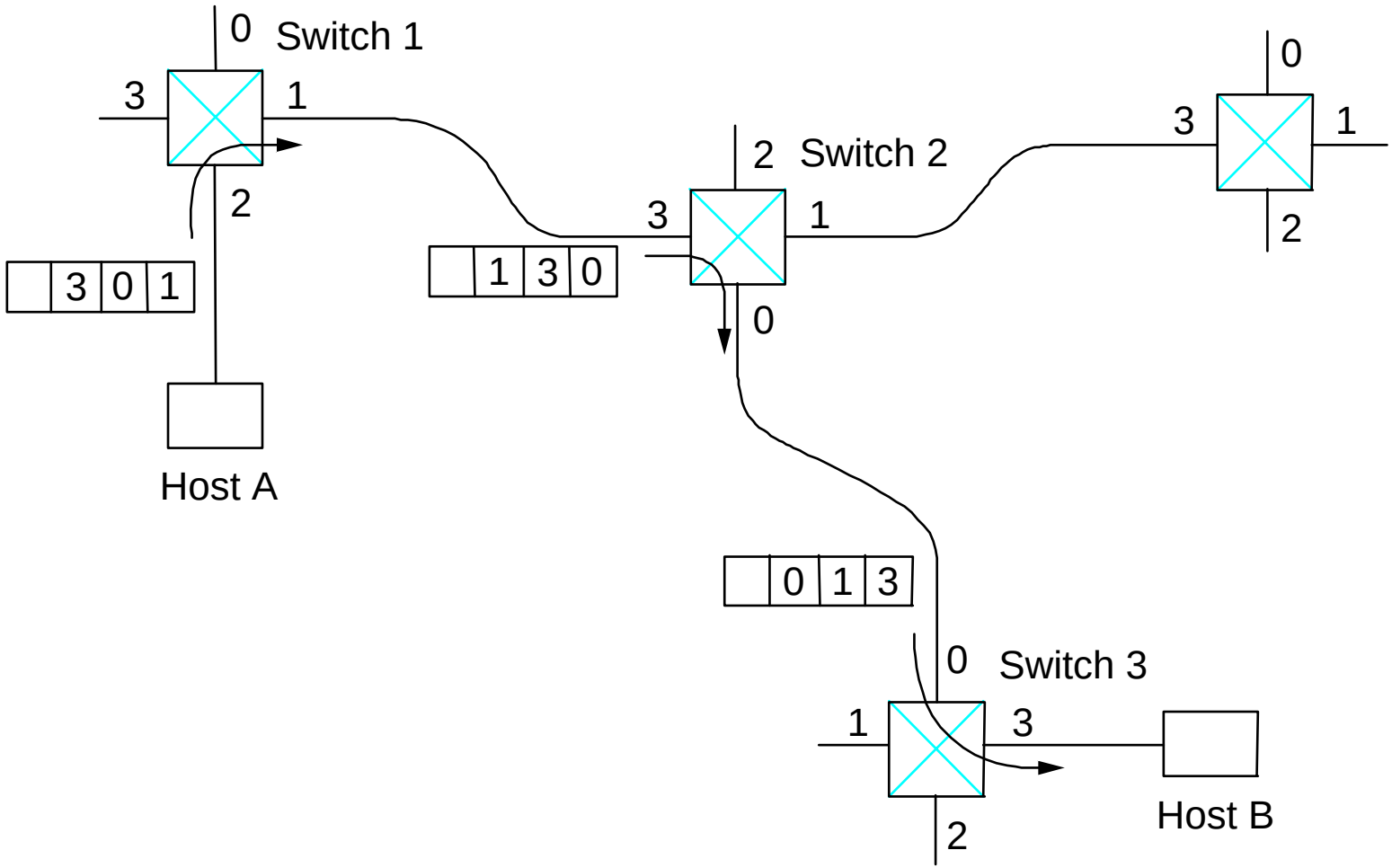


Figure 12.5

Switch Operation

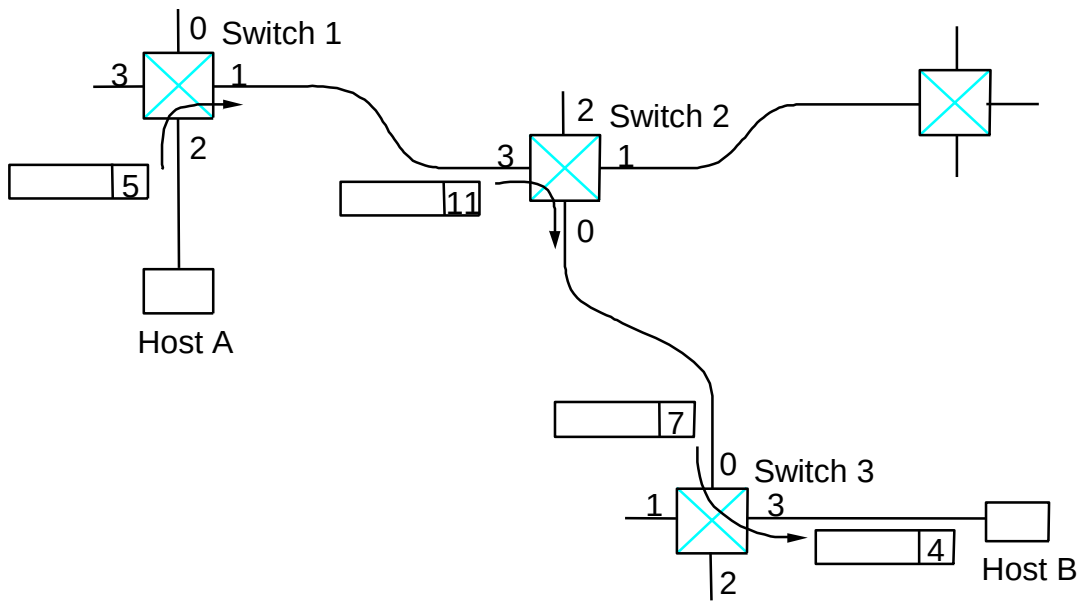
- Cut Through Switch
  - No per link frame checking (done end-to-end)
  - Reads only the header
  - Short frame processing delay
- Store-and-Forward
  - Full error checking per link
  - More reliable
  - Longer frame processing delay

Source Routing



Virtual Circuit Switching

- Explicit connection setup (and tear-down) phase
- Subsequence packets follow same circuit
- Sometimes called *connection-oriented* model
- Analogy: phone call
- Each switch maintains a VC table

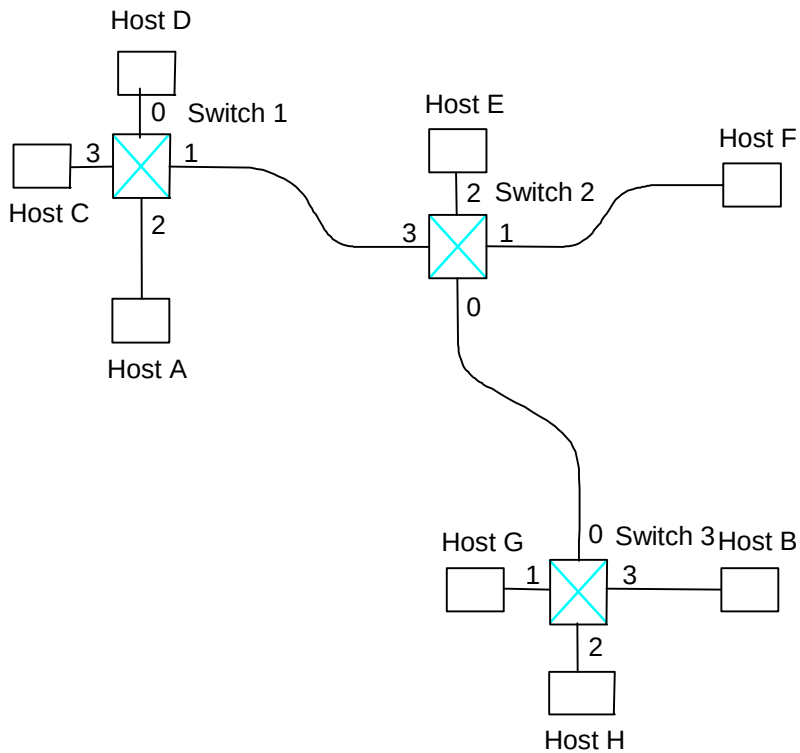


Datagram Switching

- No connection setup phase
- Each packet forwarded independently
- Sometimes called *connectionless* model

- Analogy: postal system

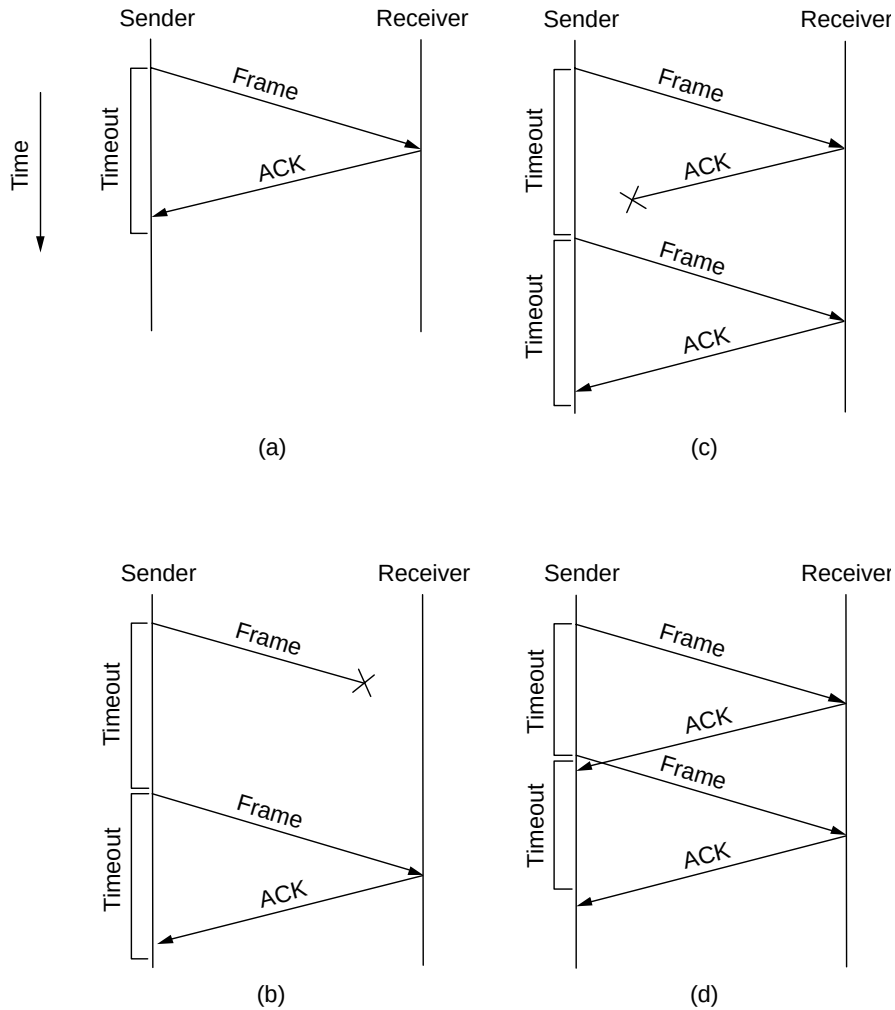
- Each switch maintains a forwarding (routing) table



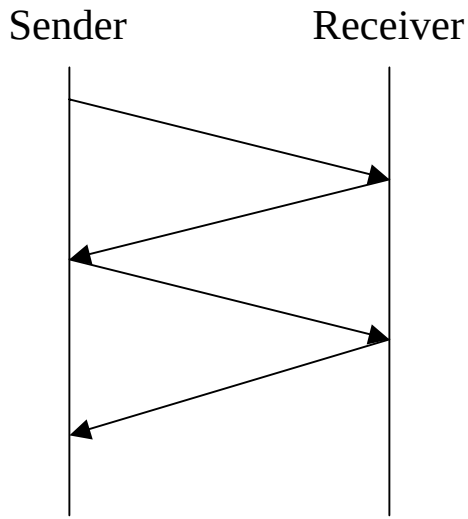
Delay calculation

- Timelines
- Acknowledgements & Timeouts
- Stop-and-Wait
- Sliding Window

Acknowledgements & Timeouts



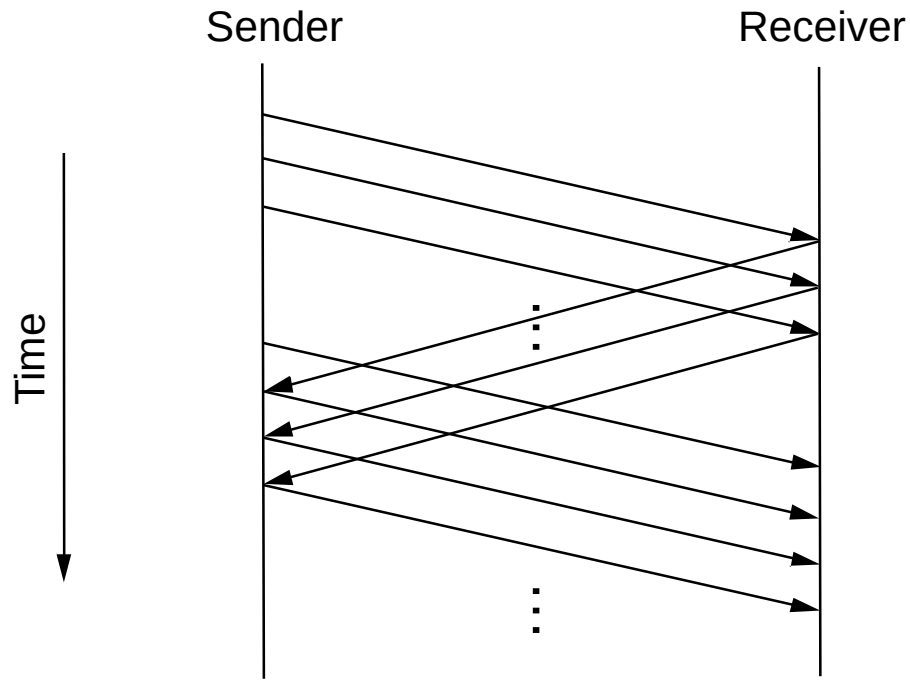
Stop-and-Wait



- Problem: keeping the pipe full
- Example
  - 1.5Mbps link x 45ms RTT = 67.5Kb (8KB)
  - 1KB frames imples 1/8th link utilization

Sliding Window

- Allow multiple outstanding (un-ACKed) frames
- Upper bound on un-ACKed frames, called *window*



Switch Architecture

- Layer 2 Switch
  - Data Link Level
  - MAC Addresses Based
- Layer 3 Switch
  - IP Address Based
- Layer 4
  - Transport Layer (UDP, TCP)
  - NAT & Packet Filtering

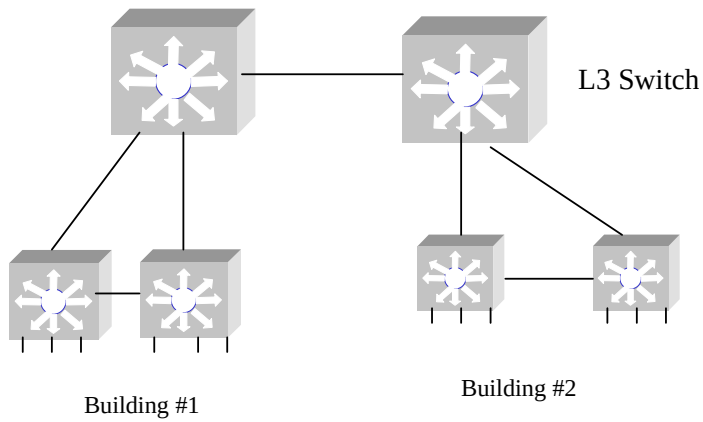


Figure 12.6:
Connecting buildings

Firewall

- NAT (Network Address Translation)
- Packet Filtering
  - Accept/reject/modify
  - Rule-based
- Port/Protocol/Application
- Proxy Server
  - Application Surrogate
  - Allows Controlled Access

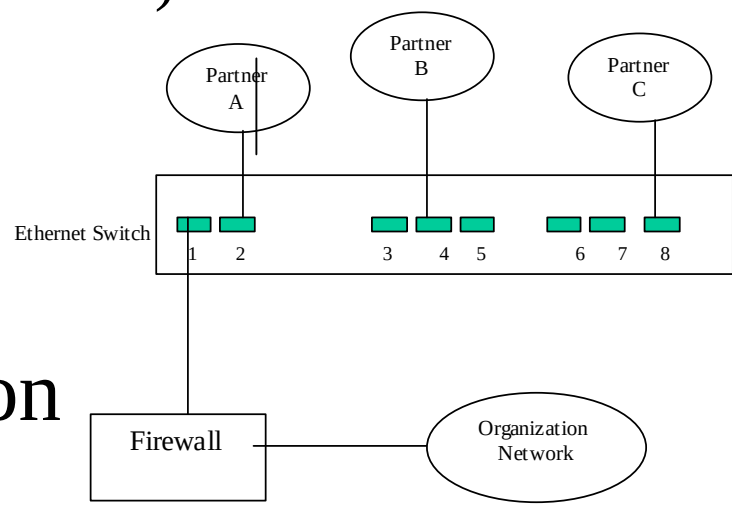


Figure 12.7

VLAN

- Quasi-static switch configuration
  - Connect specific LAN segments to form a VLAN
  - Isolate all VLANs from each other
- Maintained by administrator
  - Subject to hacking (lock equipment cabinets)
  - Complex to maintain in a large multi-switch environment