

Network : Wide Area Networks

Jae Hyeon Kim

— Reference

William Stalling, Data and Computer Communications 10/E, Prentice Hall

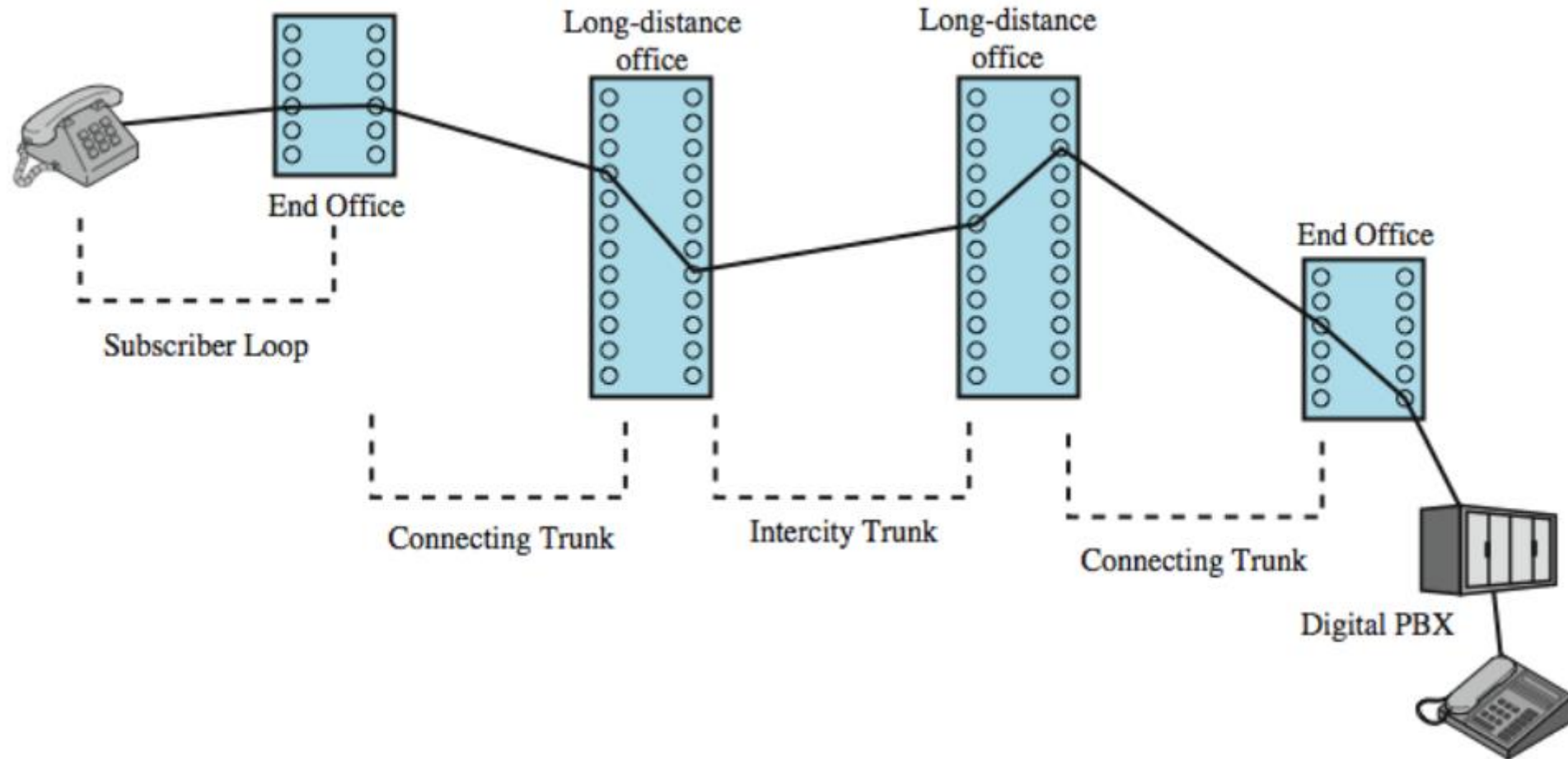
— WAN Technology and Protocols

- Switched communications networks
 - Switching nodes : provide a switching facility that move data between nodes
 - Stations : devices attached to the network
 - Nodes : switching devices that provide communication
 - Communications network : collection of nodes
 - Switched network : data entering the network from a station are routed to the destination by being switched from node to node

— Circuit Switching

- Uses a dedicated path between two stations
- Has three phases
 - Establish
 - Transfer
 - disconnect
- Inefficient
 - Channel capacity dedicated for duration of connection
 - If no data, capacity wasted
- Set up (connection) takes time
- Once connected, transfer is transparent

Public Circuit Switched Network

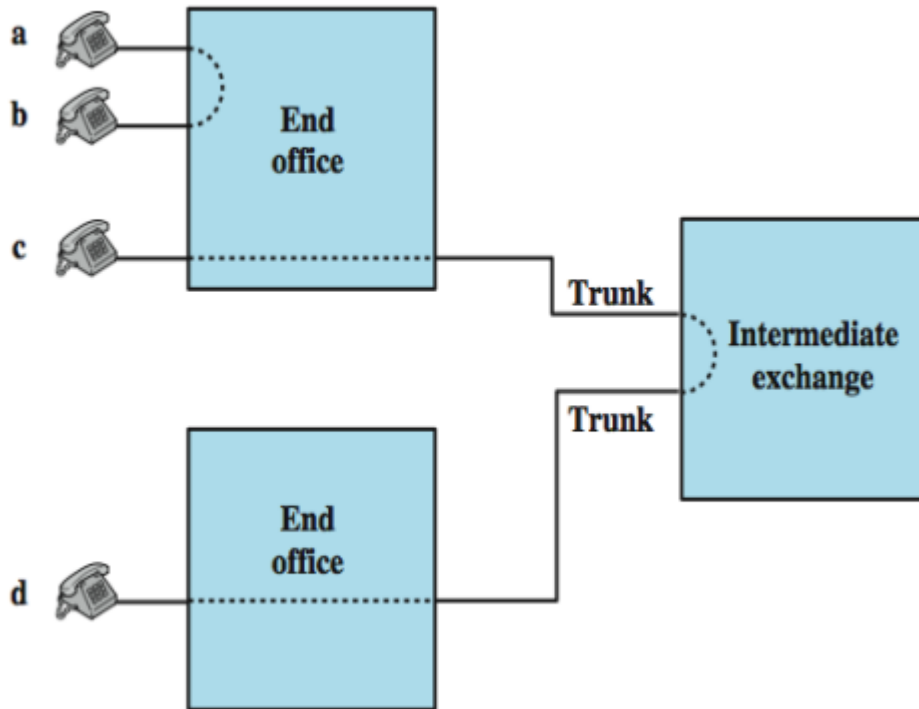


— Circuit-Switching Technology

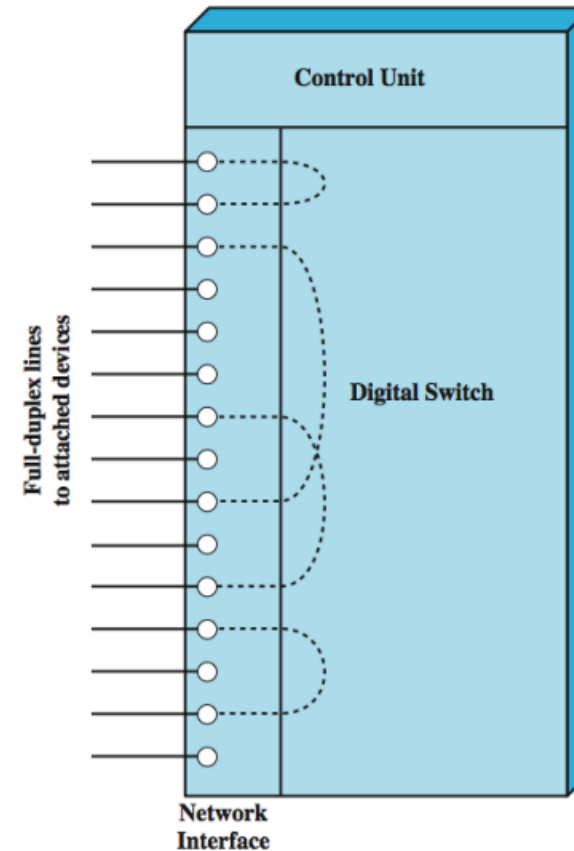
- Driven by application that handle voice traffic
 - Key requirements is no transmission delay and no variation in delay
 - Efficient for analog trans. Of voice signals but, inefficient for digital trans.
- Transparent
 - Once a circuit is established, it appears as a direct connection no special logic is needed
- Telecommunication components
 - Subscriber : devices attached to network
 - Local loop : subscriber loop
 - Exchange : switching centers
 - Trunks : branched between exchanges

Circuit Switch Elements

- Circuit establishment



- Circuit switch elements



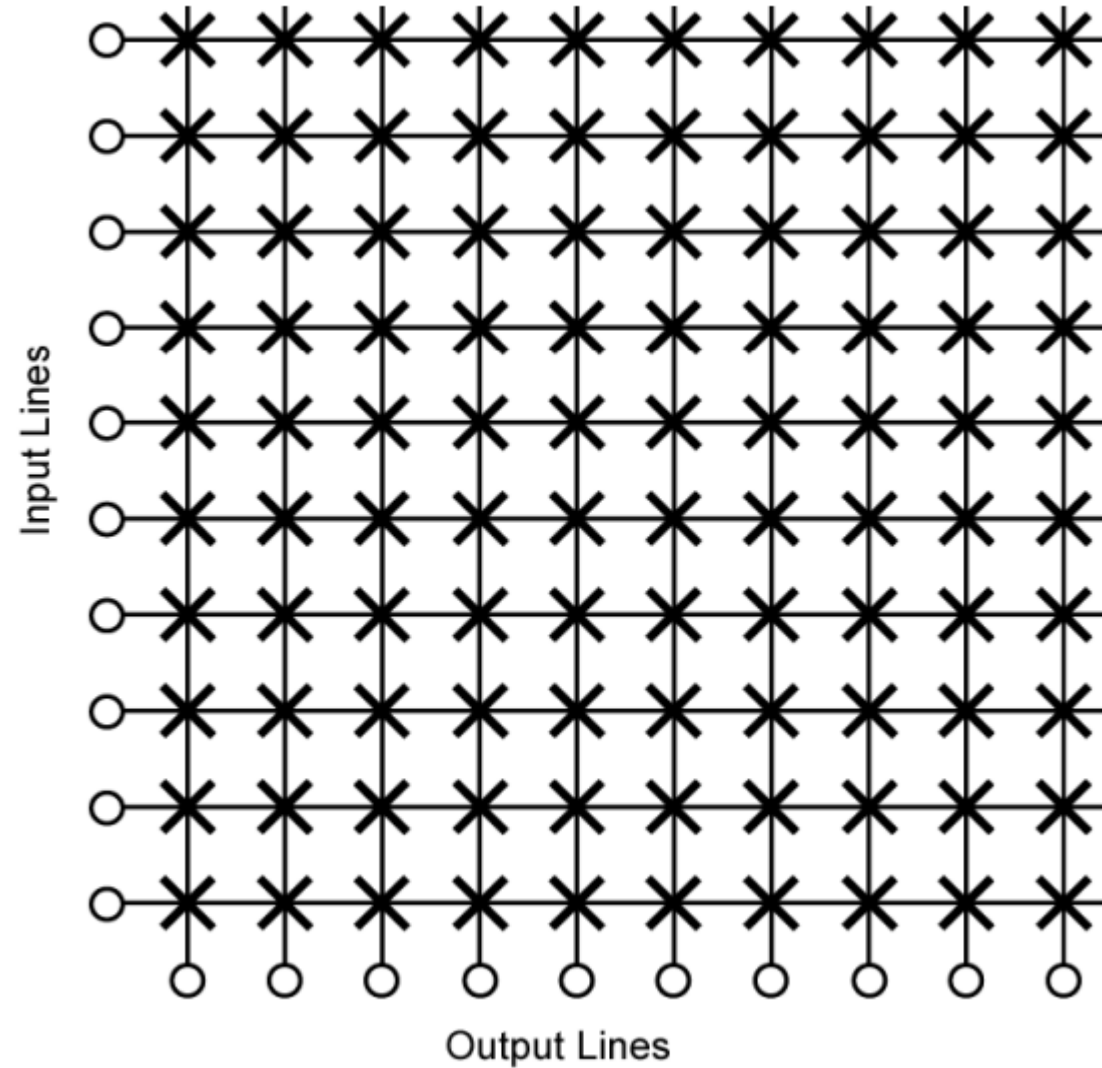
— Blocking or Non-blocking

- Blocking network
 - May be unable to connect stations because all paths are in use
 - Used on voice systems because it is expected to be of short duration and that a fraction of the phoned will be engaged at any one time
- Non-blocking network
 - Permits all stations to connect at once
 - Grants all possible connection requests as long as the called party is free
 - On using data connections, terminals can be continuously connected for long periods of time so nonblocking configurations are required

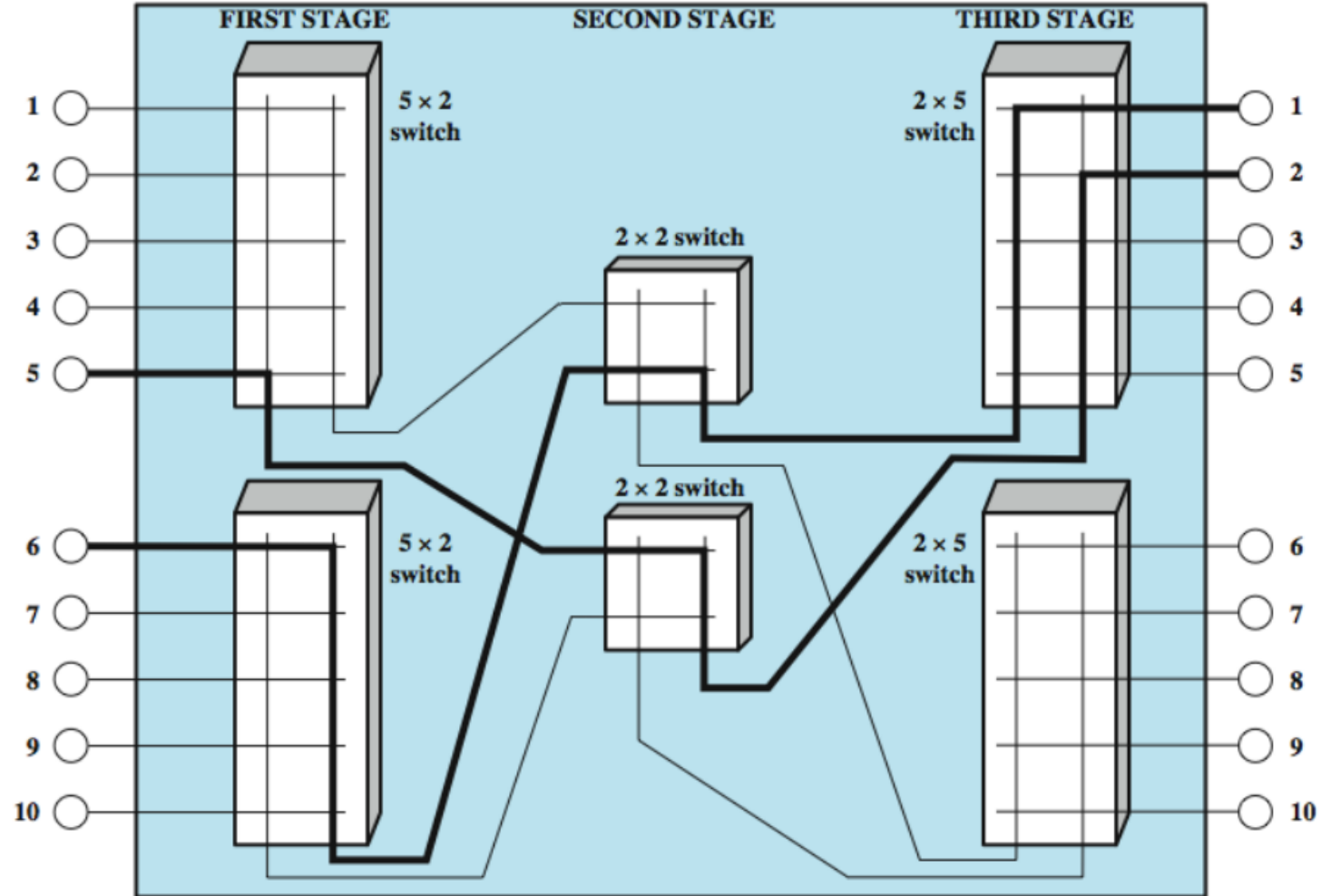
— Space Division Switching

- Originally developed for analog environment
 - Signal paths are physically separate from one another
- Crossbar switch
 - Number of crosspoints grows as square of number of stations
 - Loss of crosspoint prevents connection
 - Inefficient : all stations connected, only a few crosspoints in use
- Multistage switch
 - Reduced number of crosspoints
 - More than one path through network, so increased reliability
 - More complex control
 - May be blocking

— Crossbar Matrix

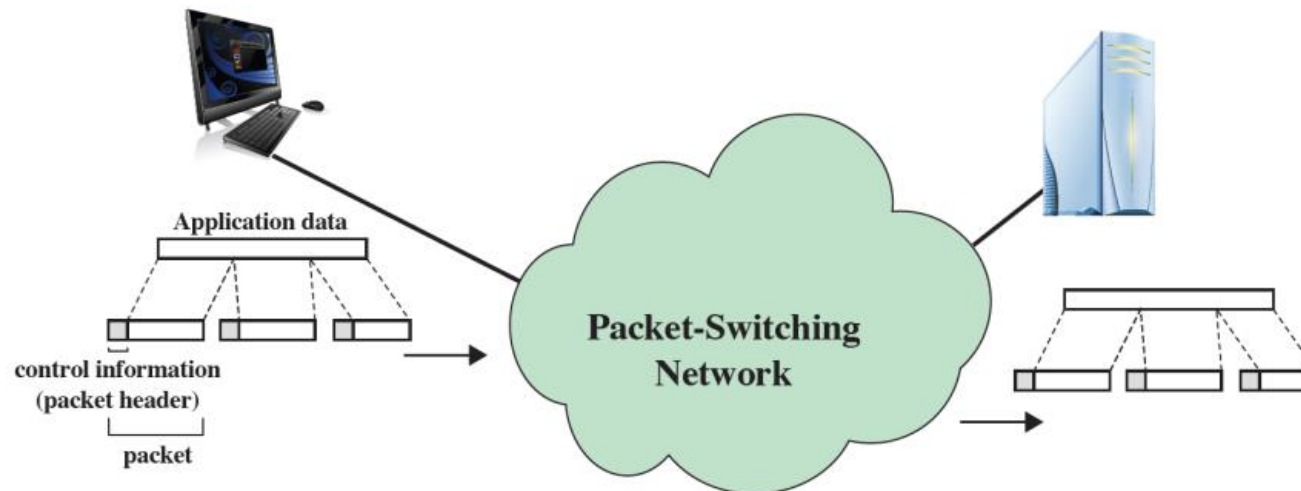


— Three Stage Space-Division Switch



— Packet Switching

- While circuit switching was designed for voice, packet switching was designed for data
- Transmitted in small packets
 - Packets contains user data and control information
 - Packets are received, stored and past on to the next node



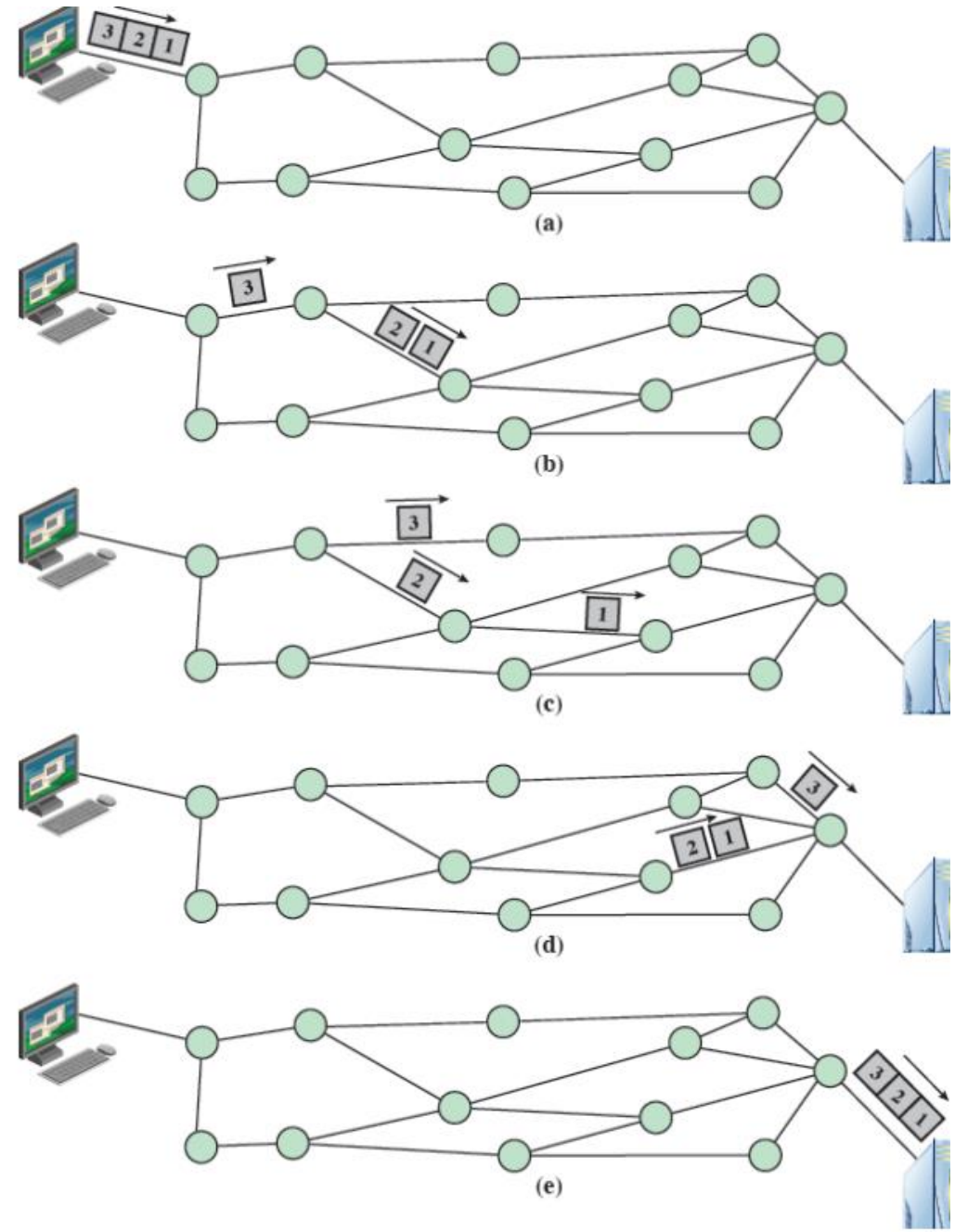
— Advantages

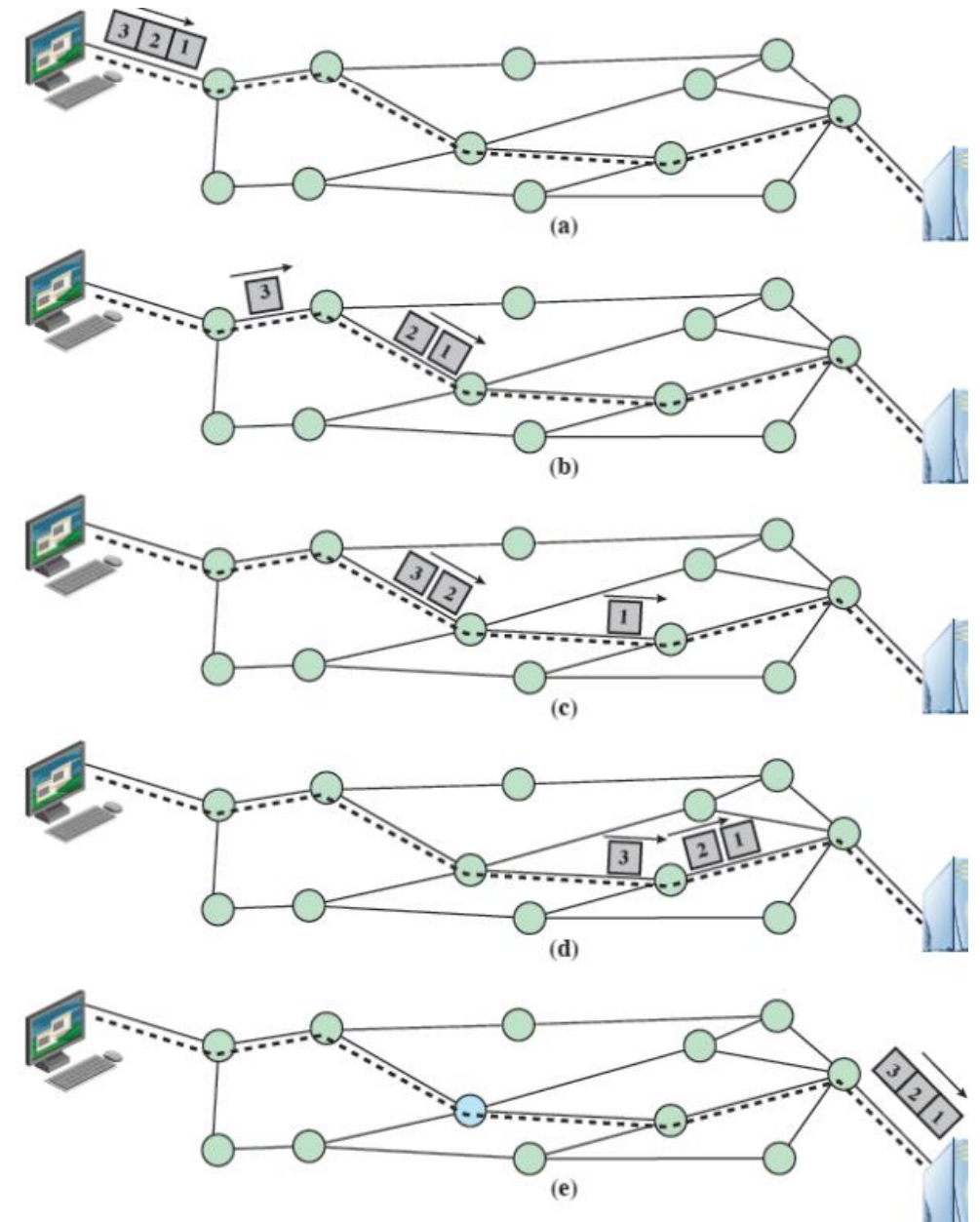
- Line efficiency
 - Single link is shared by many packets over time
 - Packets queue and transmitted as fast as possible
- Data rate conversion
 - Each station connects to the local node at proper speed
 - Nodes buffer data if required to equalize rates
- No blocking of calls
 - Packets are accepted even when network is busy
 - Delivery may slow down – delivery delay increases
- Priorities can be used

— Switching Technique

- Station breaks long message into packets
- Packets sent one at a time to the network
- Packets handled in two ways
 - Datagram : each packet is treated independently with no reference to previous packets
 - Virtual circuit : a preplanned route is established before any packets are sent

— Datagram Approach

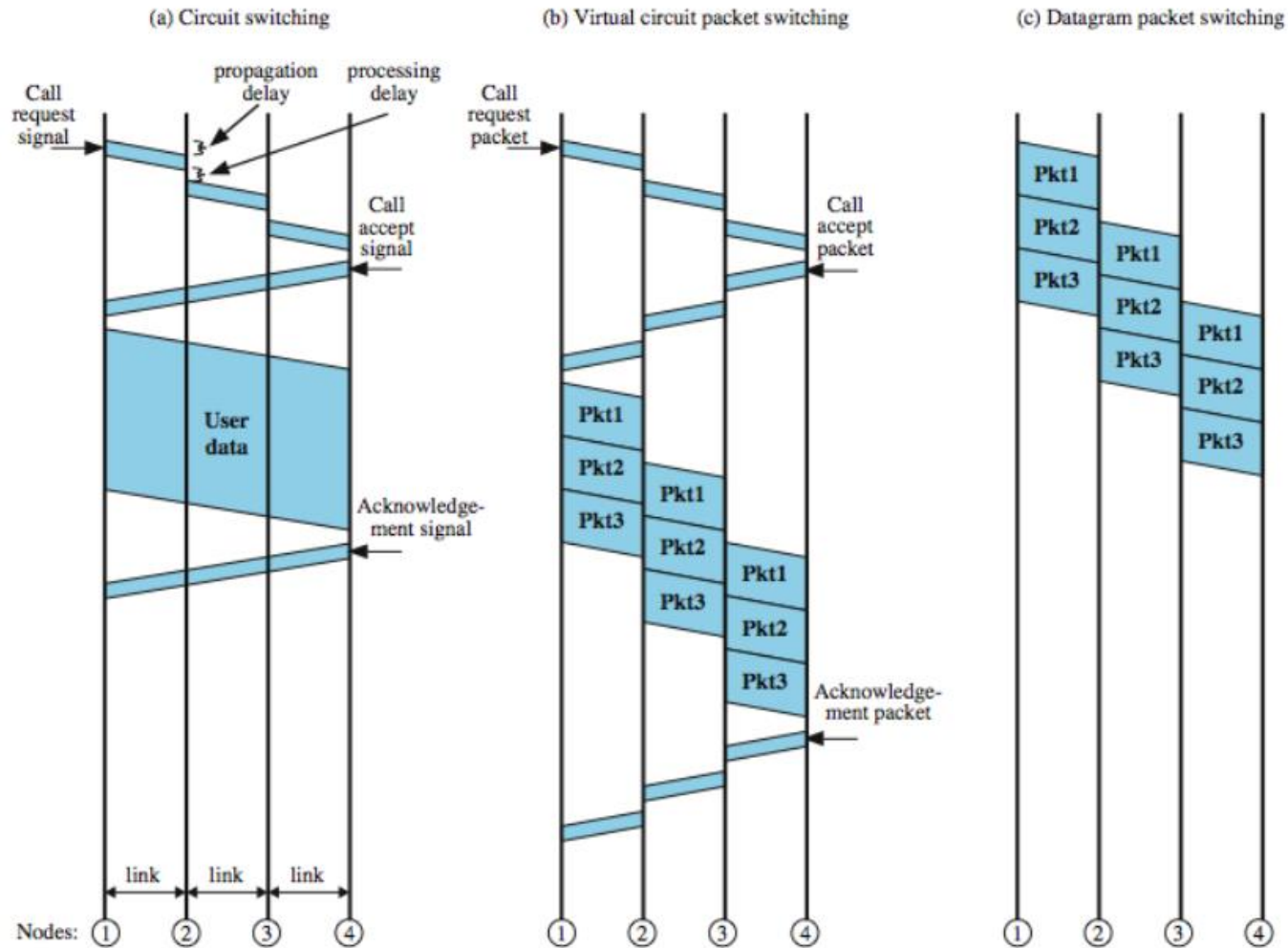




— Virtual Circuits vs. Datagram

- Virtual circuits
 - Network can provide sequencing and error control
 - Packets are forwarded more quickly (no routing decisions to make)
 - Less reliable (failure of a node lose all circuits through that node)
- Datagram
 - No call setup phase (better if few packets)
 - More flexible (routing can be used to avoid congested parts of the network)
 - More reliable (if a node fails, find an alternate route)

Event Timing



Effect of Packet Size

- There is a significant relationship between packet size and transmission time
 - data pass through X to Y,
 - packet size 43 octets (40 data, 3 control)

