# CEN 449

# BROADBAND AND HIGH SPEED NETWORKS

Dr. Ashraf Abdelaziz Taha

# NETWORK PERFORMANCE

- determined by parameters like: bandwidth and latency.
  - **Bandwidth:** the number of bits can be transferred in a unit of time. Broadband means the number is large.
  - **Latency:** the time it takes to transfer a certain size of message from one end to the other end. High-speed means the latency should be short.

# CIRCUIT-SWITCHING AND PACKET-SWITCHING

## Circuit Switching

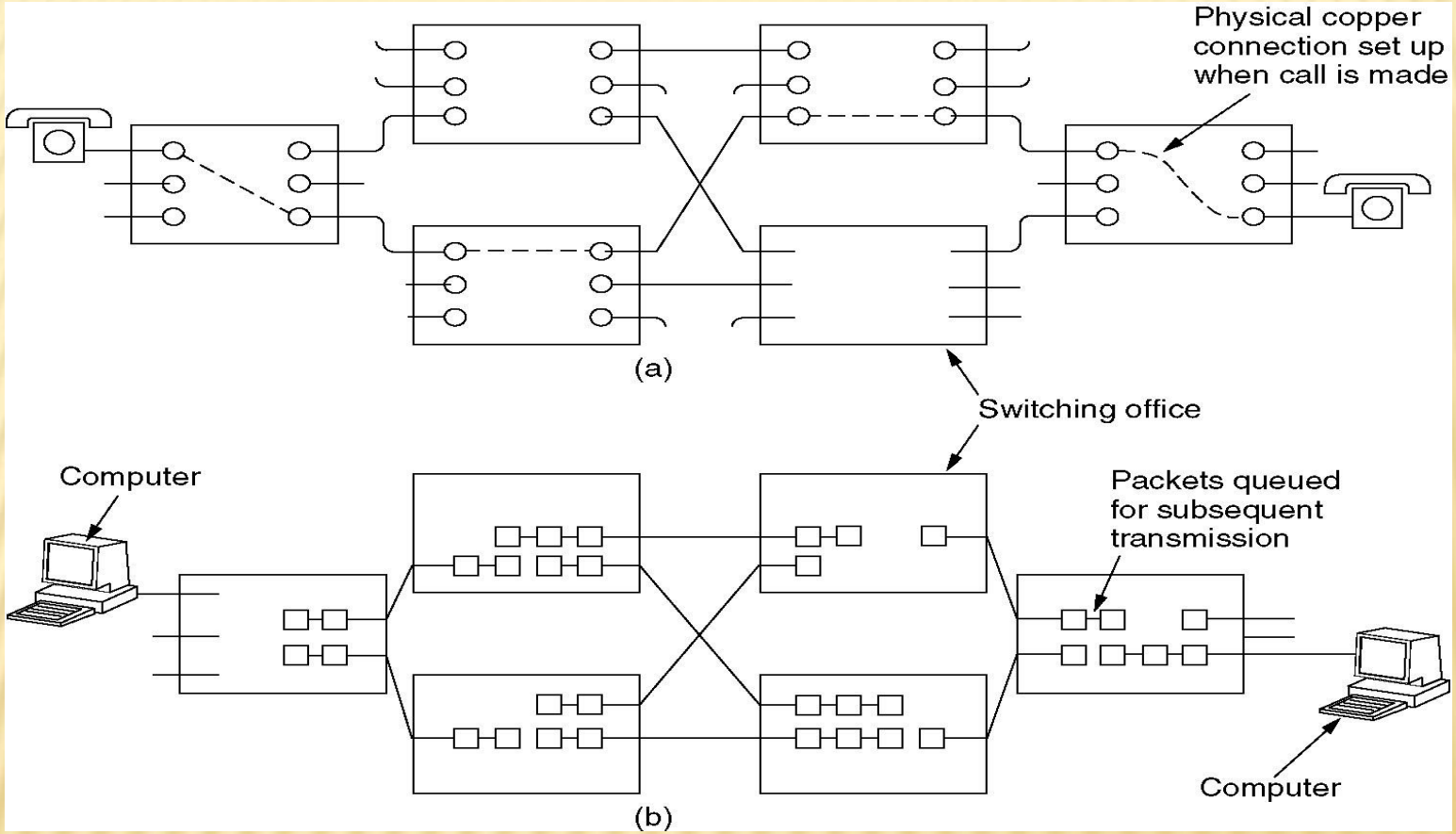
- Long-haul telecom network designed for voice
- Network resources dedicated to one call
- Obstacles when used for data:
  - Inefficient (high idle time)
  - Constant data rate

## Packet Switching

- Data transmitted in short blocks, or packets
- Packet length < 1000 octets
- Each packet contains user data plus control info (routing)
- Store and forward

# SWITCHING

A switch is a mechanism that allows us to interconnect links to form a larger network. A switch is a multi-input, multi-output device, which transfers packets from an input to one or more outputs.




**(a) Circuit switching** **(b) Packet switching**

# PACKET-SWITCHING NETWORKS

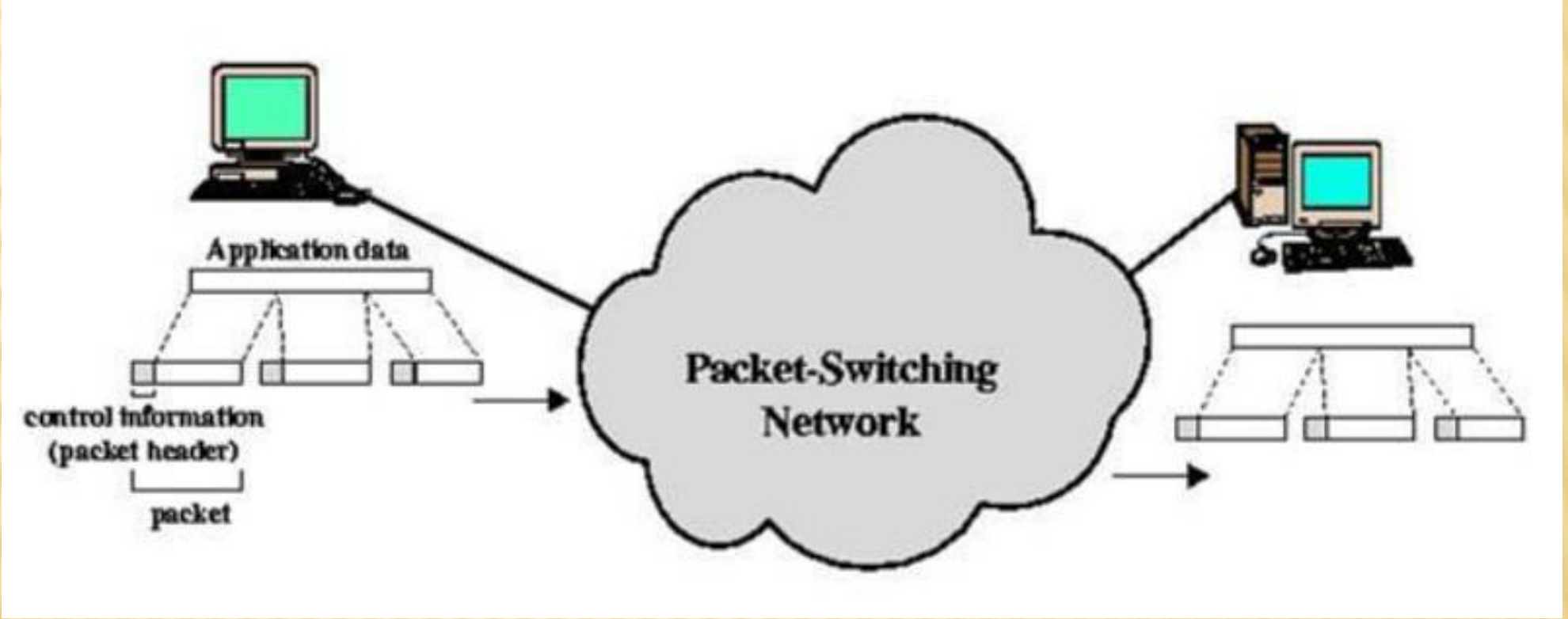
- Basic technology the same as in the 1970s
- One of the few effective technologies for long distance data communications
- Frame relay and ATM are variants of packet-switching

**Advantages:**

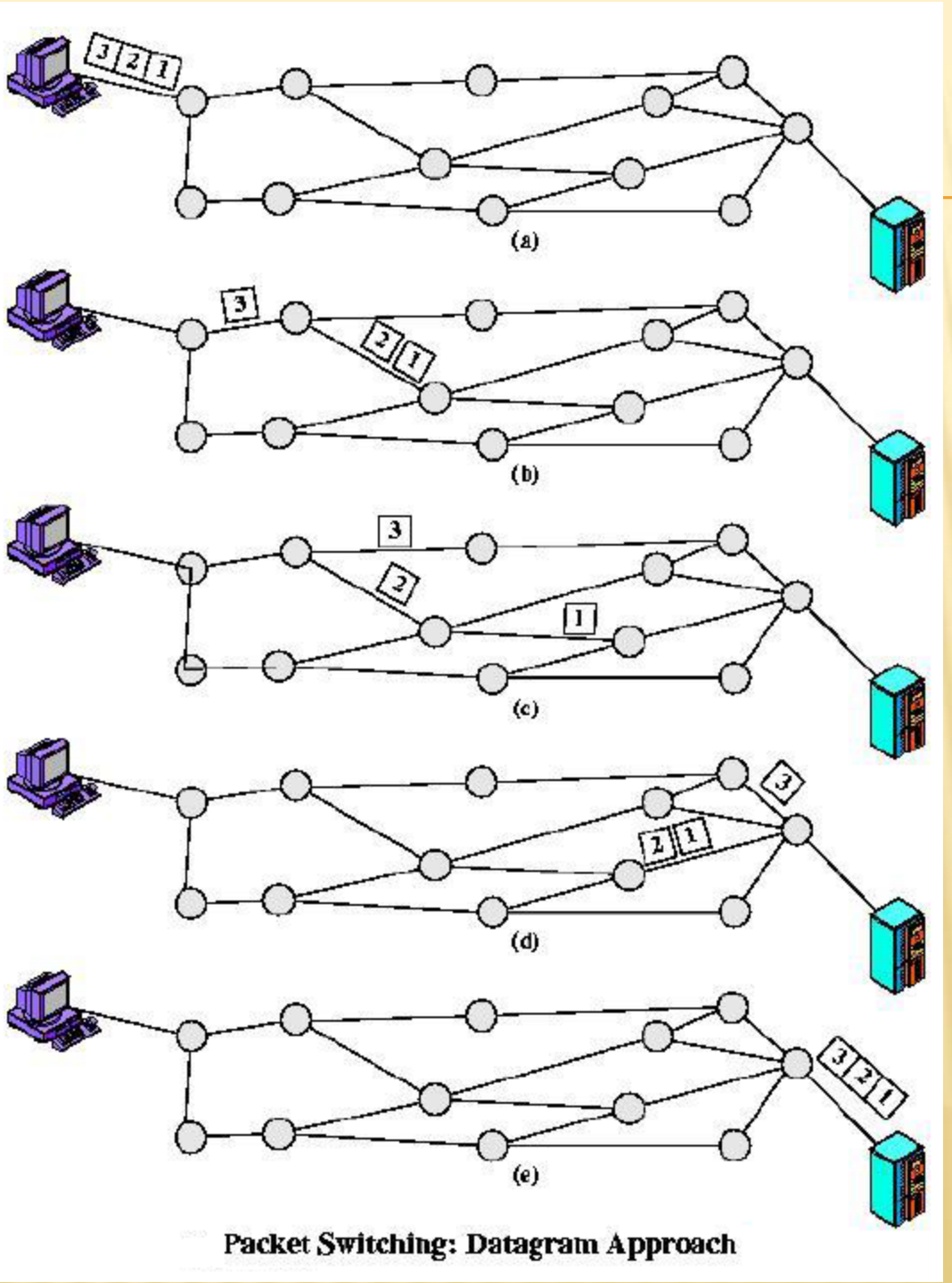
- flexibility, resource sharing, robust, responsive

**Disadvantages:**

- Time delays in distributed network, overhead penalties
- Need for routing and congestion control




The Use of Packets



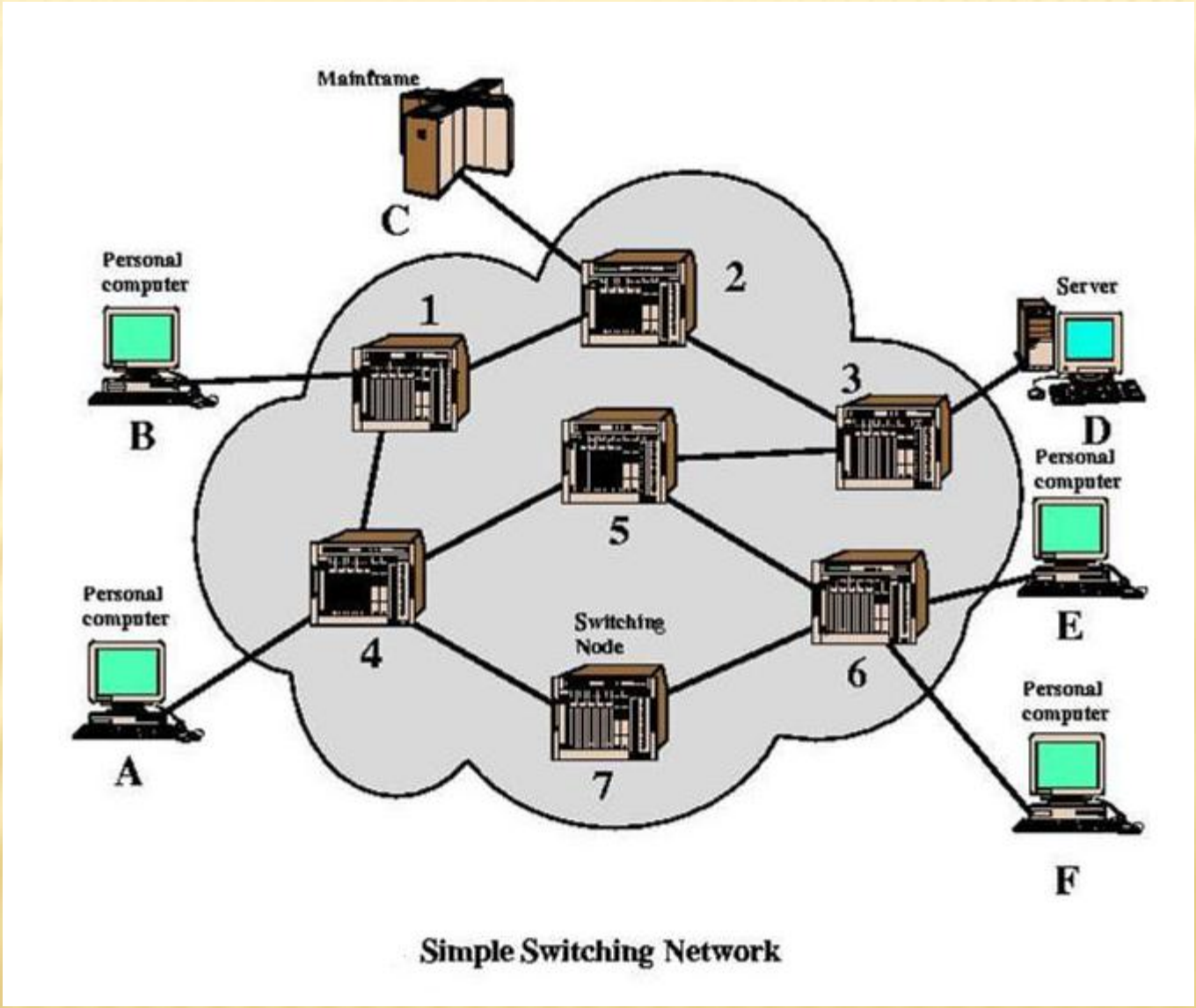

Packet Switching: Datagram Approach

# ADVANTAGES OVER CIRCUIT-SWITCHING

- Greater line efficiency (many packets can go over shared link)
- Data rate conversions
- Non-blocking under heavy traffic (but increased delays)

# DISADVANTAGES RELATIVE TO CIRCUIT-SWITCHING

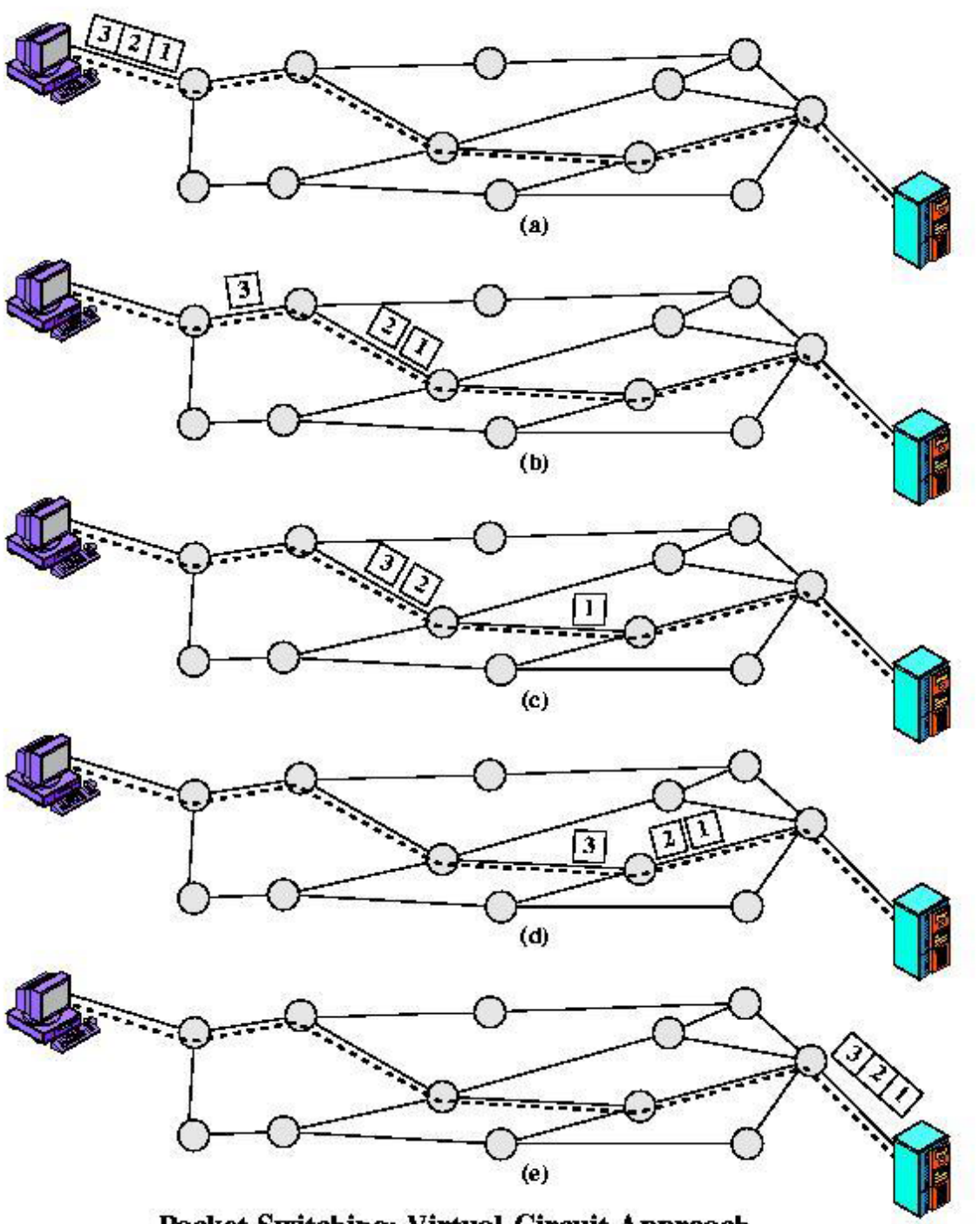
- Packets incur additional delay with every node they pass through
  - Jitter: variation in packet delay
- Data overhead in every packet for routing information, etc
- Processing overhead for every packet at every node traversed




Simple Switching Network

# SWITCHING TECHNIQUE

- Large messages broken up into smaller packets
- Datagram
  - Each packet sent independently of the others
  - No call setup
  - More reliable (can route around failed nodes or congestion)
- Virtual circuit
  - Fixed route established before any packets sent
  - No need for routing decision for each packet at each node




Packet Switching: Virtual-Circuit Approach