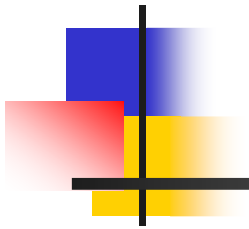

EC 553
Communication Networks

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Syllabus

- Tentatively

Week 1	Overview
Week 2	**Packet Switching**
Week 3	IP addressing and subnetting
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Week 5	Routing algorithms
Week 6	Routing protocols
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Week 8	Multiple access II
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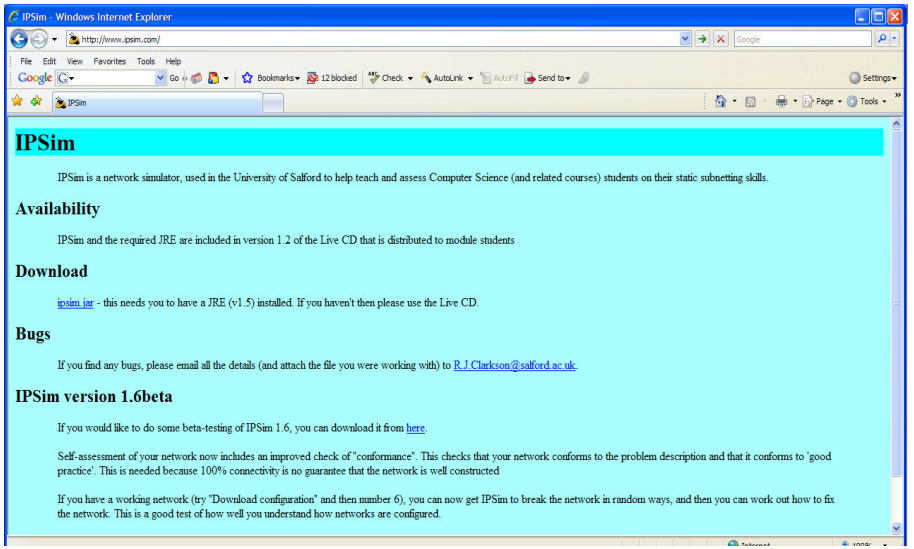
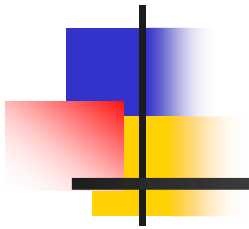
Week 10	Token ring networks
Week 11	VOIP
Week 12	WLAN
Week 13	TCP
Week 14	Congestion control
Week 15	QOS

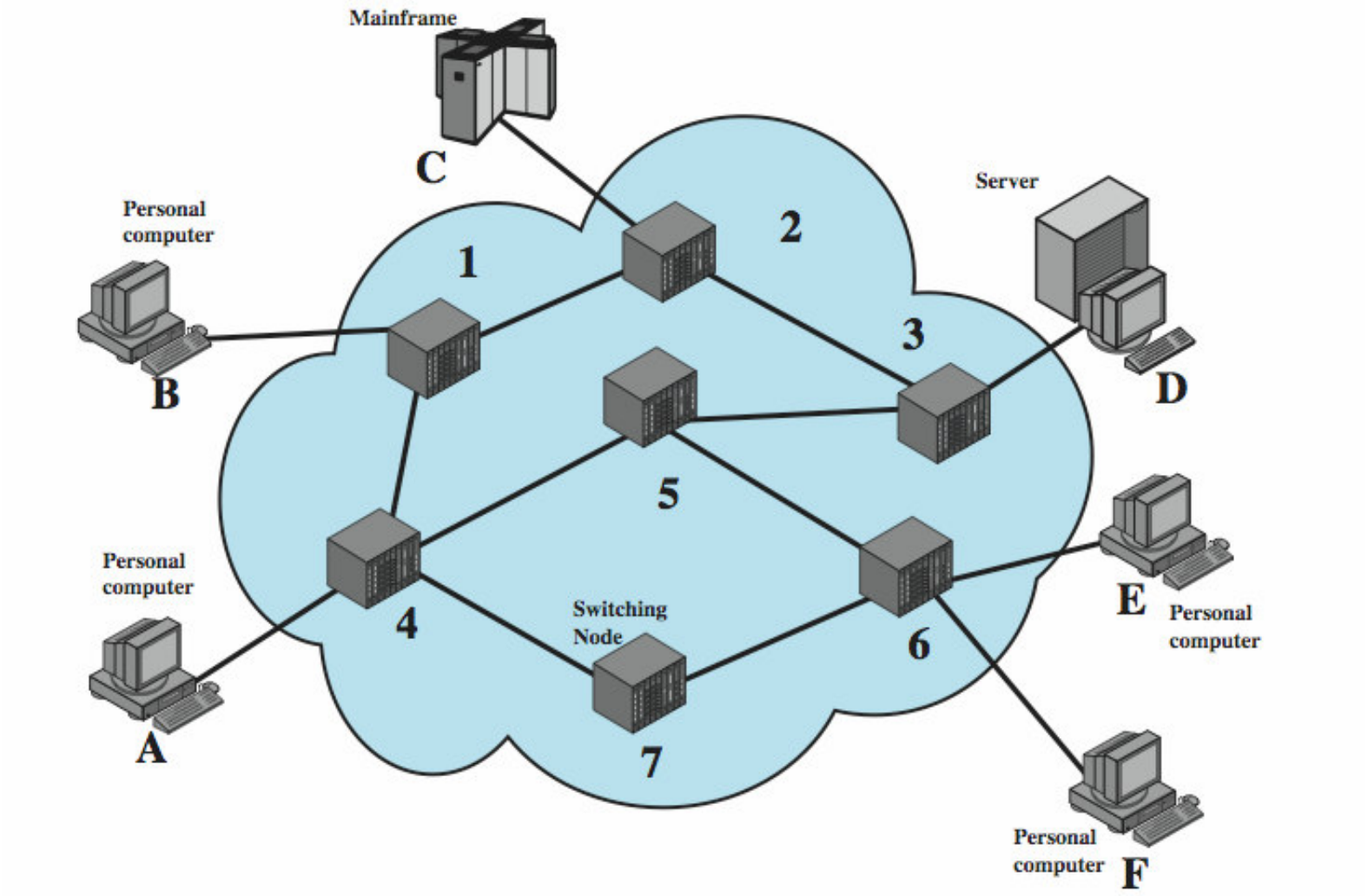
- Please download the following
  - www.ipsim.com
  - http://www.opnet.com/university_program/itguru_academic_edition/





Circuit Switching and Packet Switching

Switched Network



Nodes

- a collection of nodes and connections is a communications network
- nodes may connect to other nodes only, or to stations and other nodes
- network is usually partially connected
  - some redundant connections are desirable
- have two different switching technologies
  - circuit switching
  - packet switching

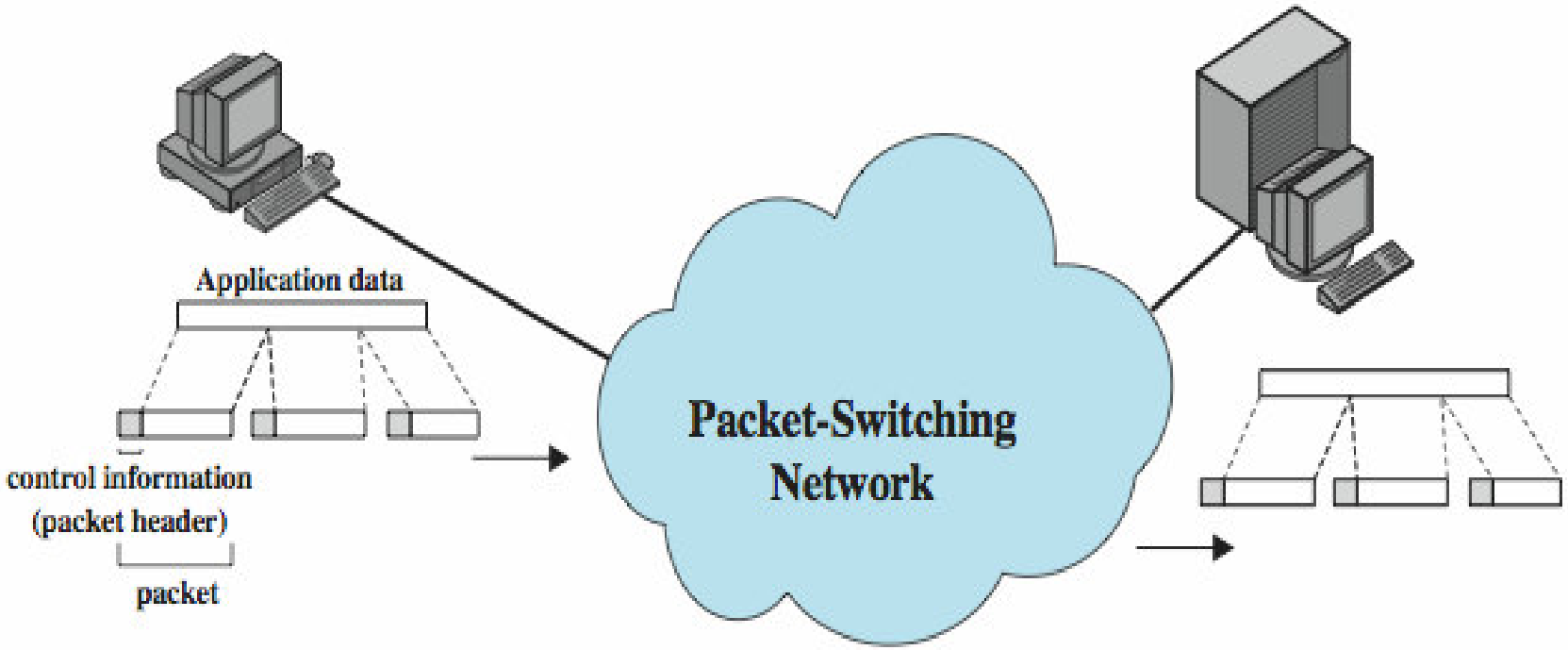
Circuit Switching

- 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

Packet Switching

- circuit switching was designed for voice
- packet switching was designed for data
- transmitted in small packets
- packets contains user data and control info
  - user data may be part of a larger message
  - control info includes routing (addressing) info
- packets are received, stored briefly (buffered) and past on to the next node

Packet Switching



Advantages

- line efficiency
  - single link shared by many packets over time
  - packets queued and transmitted as fast as possible
- data rate conversion
  - stations connects to local node at own speed
  - nodes buffer data if required to equalize rates
- packets accepted even when network is busy
- priorities can be used

Switching Techniques

- station breaks long message into packets
- packets sent one at a time to the network
- packets can be handled in two ways
  - datagram
  - virtual circuit

Datagram Diagram

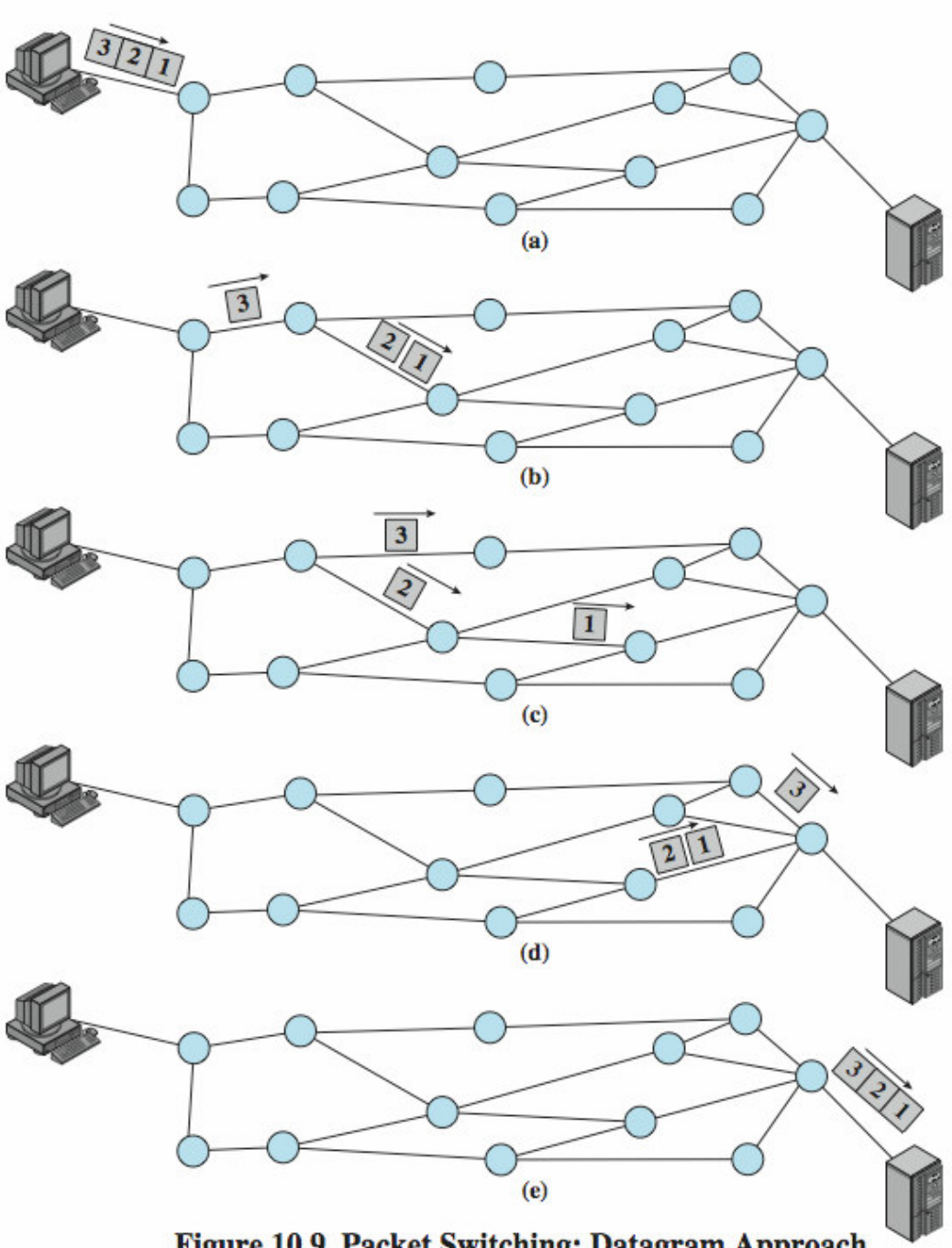


Figure 10.9 Packet Switching: Datagram Approach

Virtual Circuit Diagram

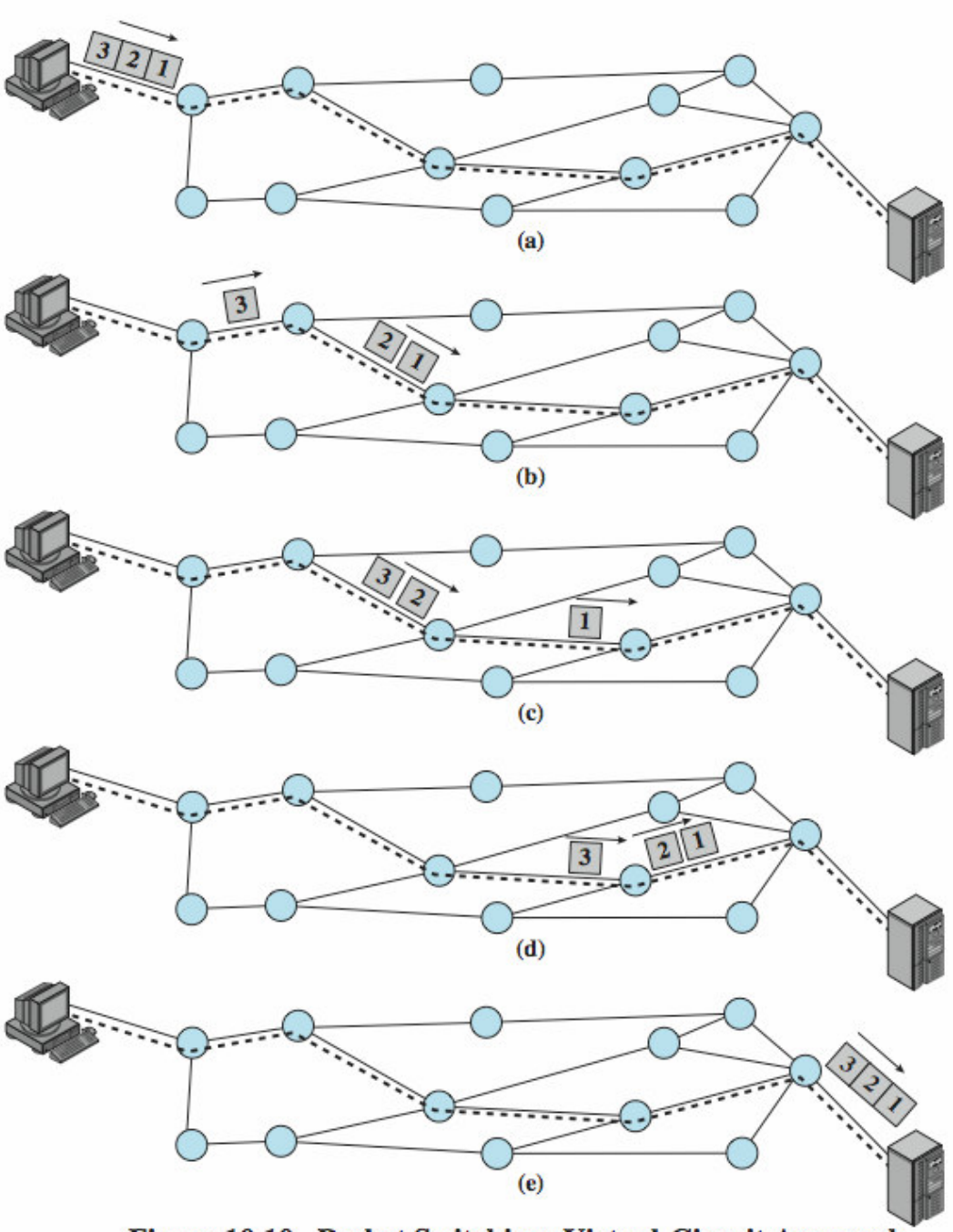
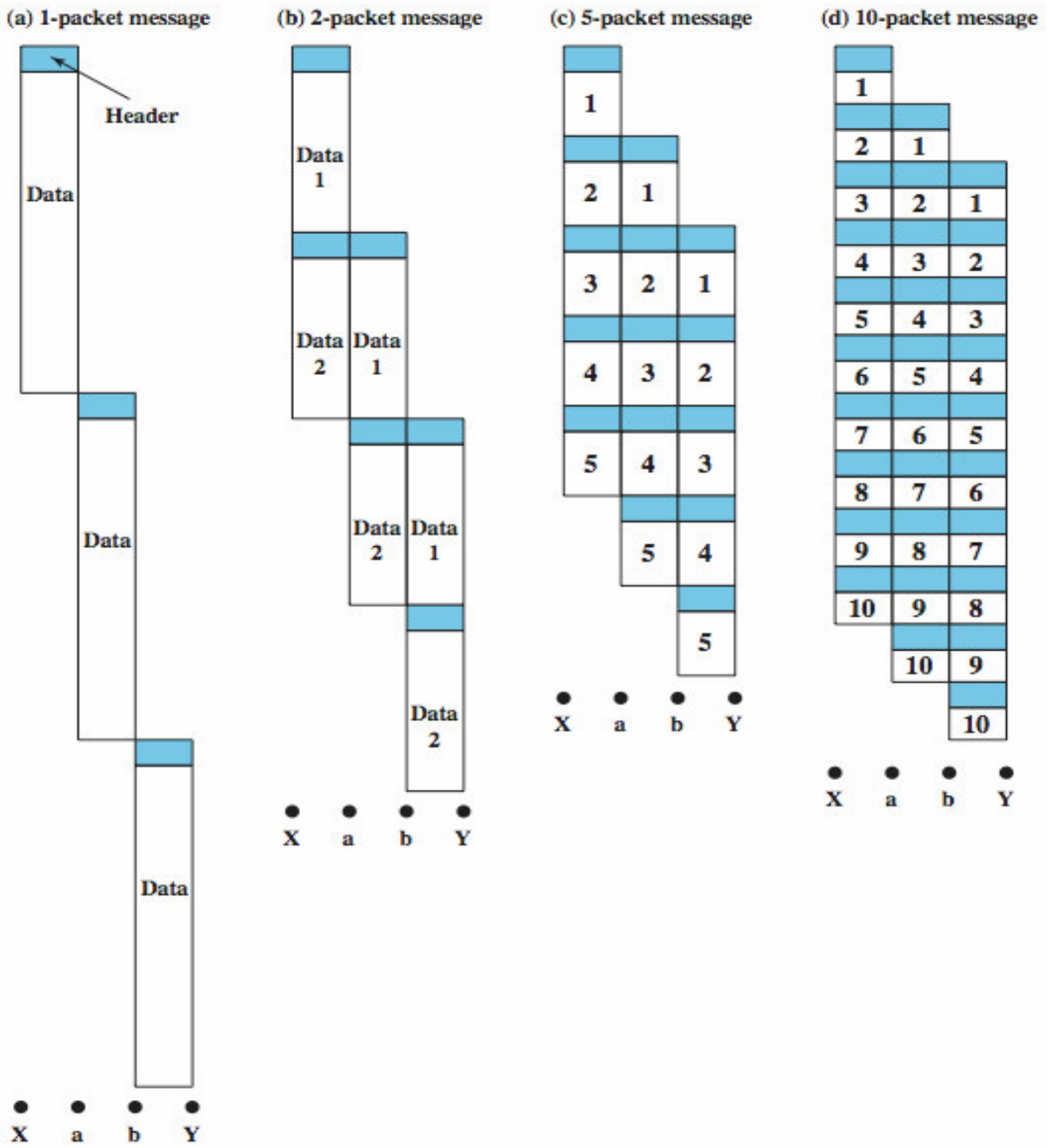


Figure 10.10 Packet Switching: Virtual-Circuit Approach

Virtual Circuits v Datagram

- virtual circuits
  - network can provide sequencing and error control
  - packets are forwarded more quickly
  - less reliable
- datagram
  - no call setup phase
  - more flexible
  - more reliable

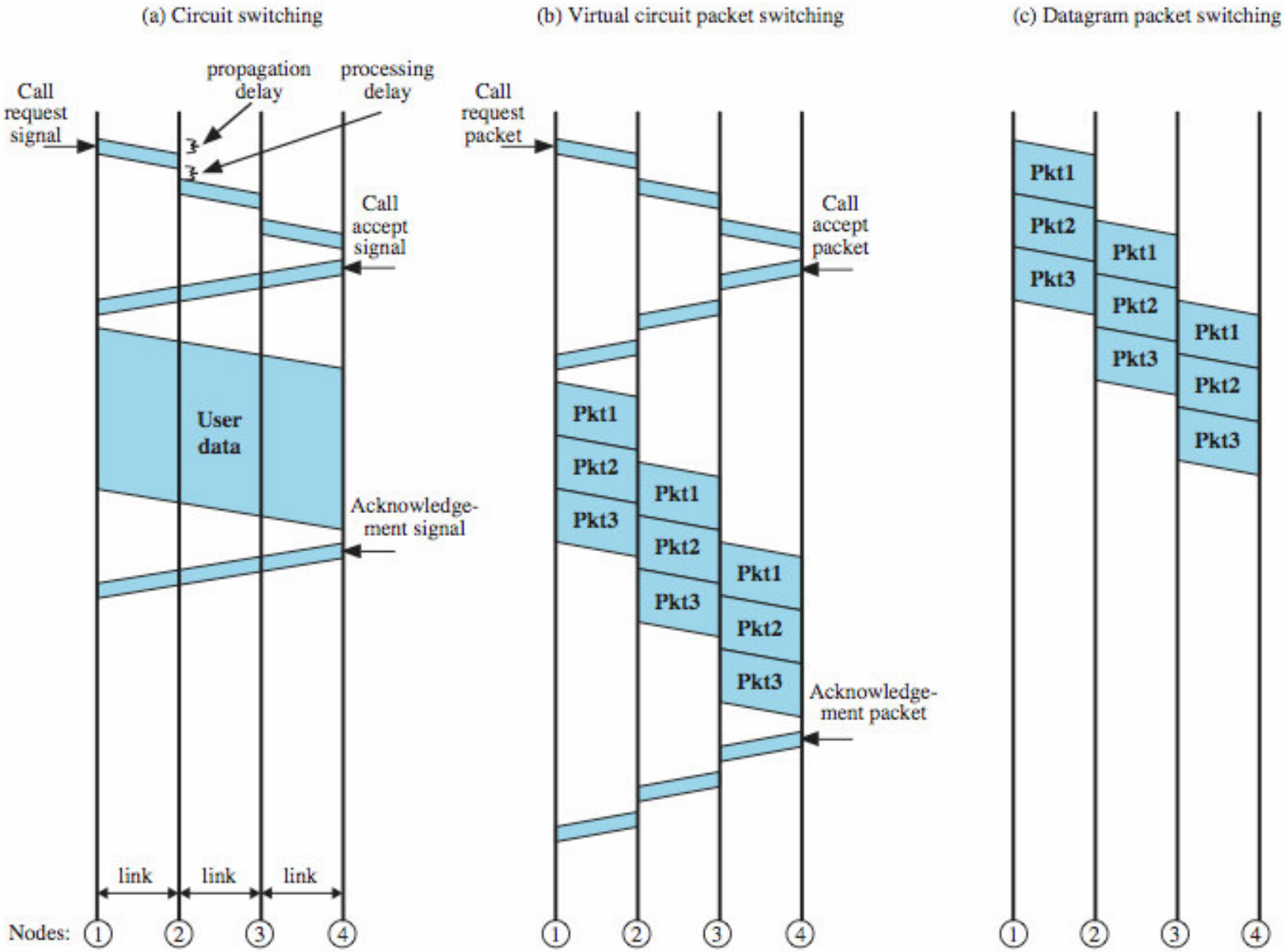
Packet Size


(a) 1-packet message
Header
Data
Data
Data
X
a
b
Y
(b) 2-packet message
Data 1
Data 2
Data 1
Data 2
Data 1
Data 2
X
a
b
Y
(c) 5-packet message
1
2 1
3 2 1
4 3 2
5 4 3
5 4
5
X
a
b
Y
(d) 10-packet message
1
2 1
3 2 1
4 3 2
5 4 3
6 5 4
7 6 5
8 7 6
9 8 7
10 9 8
10 9
10
X
a
b
Y

Circuit v Packet Switching

- performance depends on various delays
  - propagation delay
  - transmission time
  - node delay
- range of other characteristics, including:
  - transparency
  - amount of overhead

Event Timing



- Thank you