CPE348: Introduction to Computer Networks

Lecture #8: Chapter 3.1

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Chapter 3 – Internetworking

- How do we build networks of global scale?

- How do we interconnect different types of networks to build a large global network?

Chapter Outline

- Switching and Bridging (L2)

- Basic Internet Protocol (IP) (L3)

- Routing (L3)

Chapter Goal

- Understanding the functions of switches, bridges and routers

- Discussing Internet Protocol (IP) for interconnecting networks
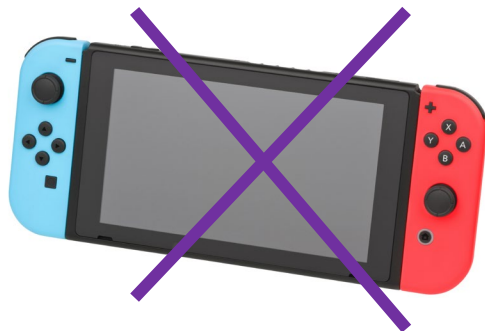
- Understanding the concept of routing

Switching and Forwarding

- Store-and-Forward Switches
- Bridges and Extended LANs
- Cell Switching
- Segmentation and Reassembly
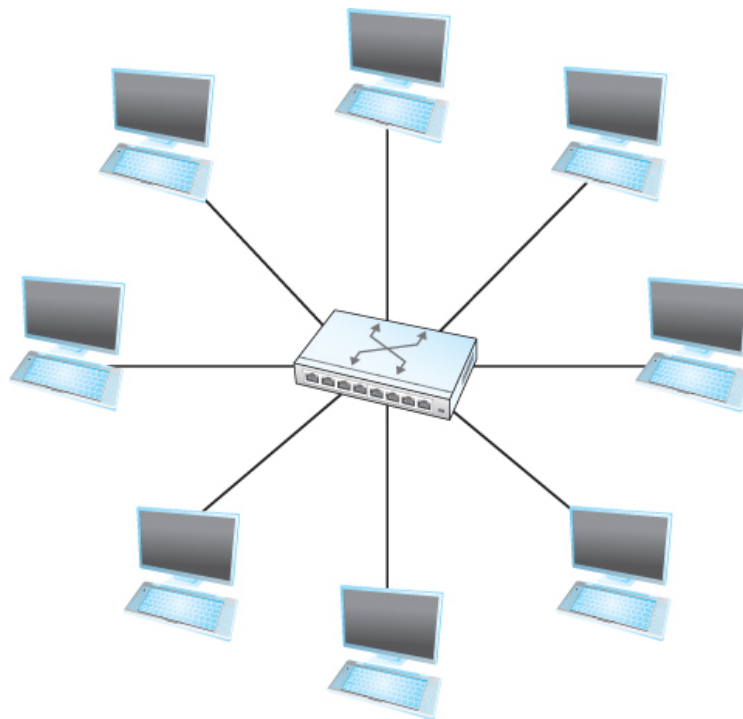
Switching and Forwarding

- Switch

  - A mechanism: that allows us to interconnect links to form a large network

  - A device: which transfers packets from an input to one or more outputs

Switching and Forwarding

Switches add the star topology to the point-to-point link, bus (Ethernet), and ring (802.5) topologies

Switching and Forwarding

Properties of this star topology

- Switch have a fixed number of inputs and outputs – limits the number of hosts supported by a switch

- Large networks have interconnected switches

- Use point-to-point links between switches and hosts

- Additional hosts do not impact performance of current hosts

Switching and Forwarding

- A switch is connected to a set of links

- For each link, the switch runs the link protocol to communicate with that node

- Switches receive incoming packets on one of its links and transmit them on a different link(s)
  - This function is referred as *switching and forwarding*

Switch is a L2 device!

Switching and Forwarding

How does the switch decide which output port to place each packet on?

- Two common approaches
  - *Datagram or Connectionless approach*
  - *Virtual circuit or Connection-oriented approach*

- A third approach *source routing* is less common

- Specified at the header of the packet

Switching and Forwarding

Let's first clear some terminologies!

connectionless

connection-oriented

packet-switching

circuit-switching

Switching and Forwarding

Overview

- Applications at endpoints send data without warning in <u>CL networks</u>;

- <u>CO networks</u> need a connection setup phase;

Networking modes

Switching modes

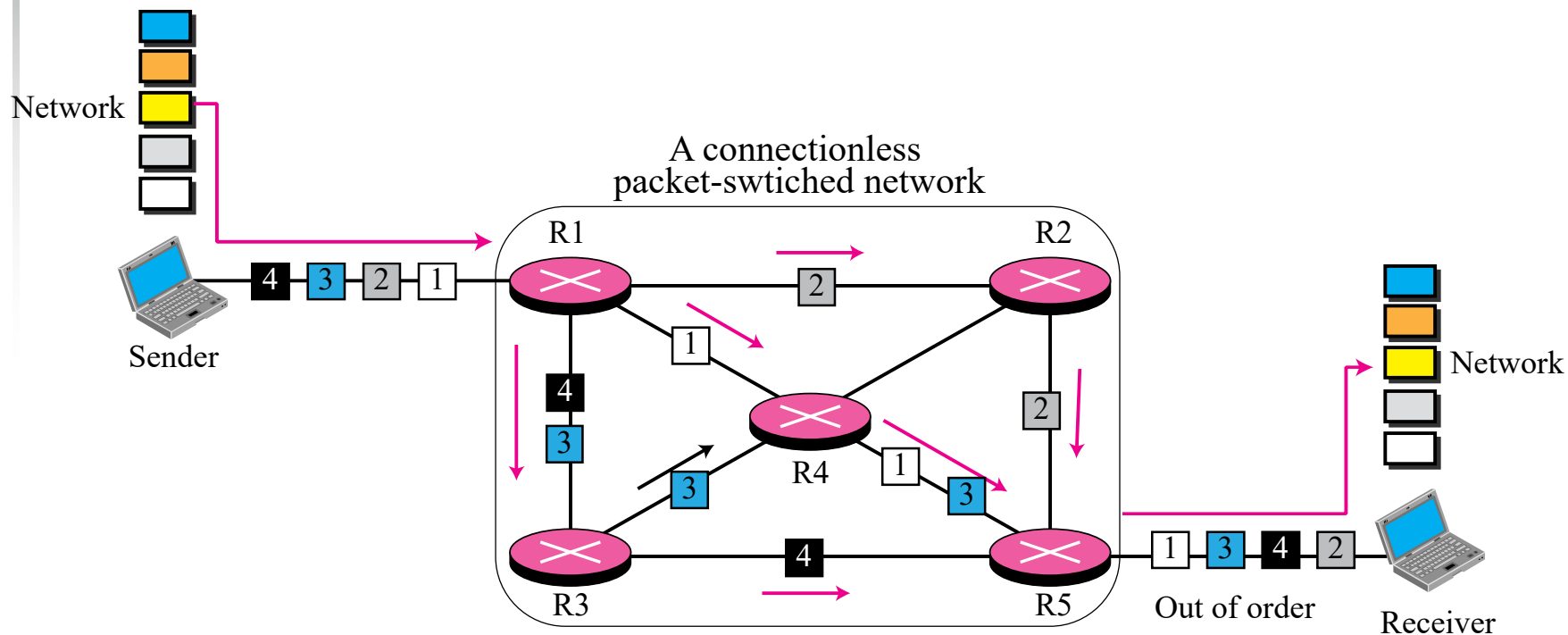|	Connectionless	Connection-oriented
Packet-switching	IP	ATM
Circuit-switching		Telephony network

Switching and Forwarding

Overview

- In circuit switching, the whole message is sent from the source to the destination without being divided into packets.

- In packet switching, the message is first divided into manageable packets at the source before being transmitted. The packets are assembled at the destination.
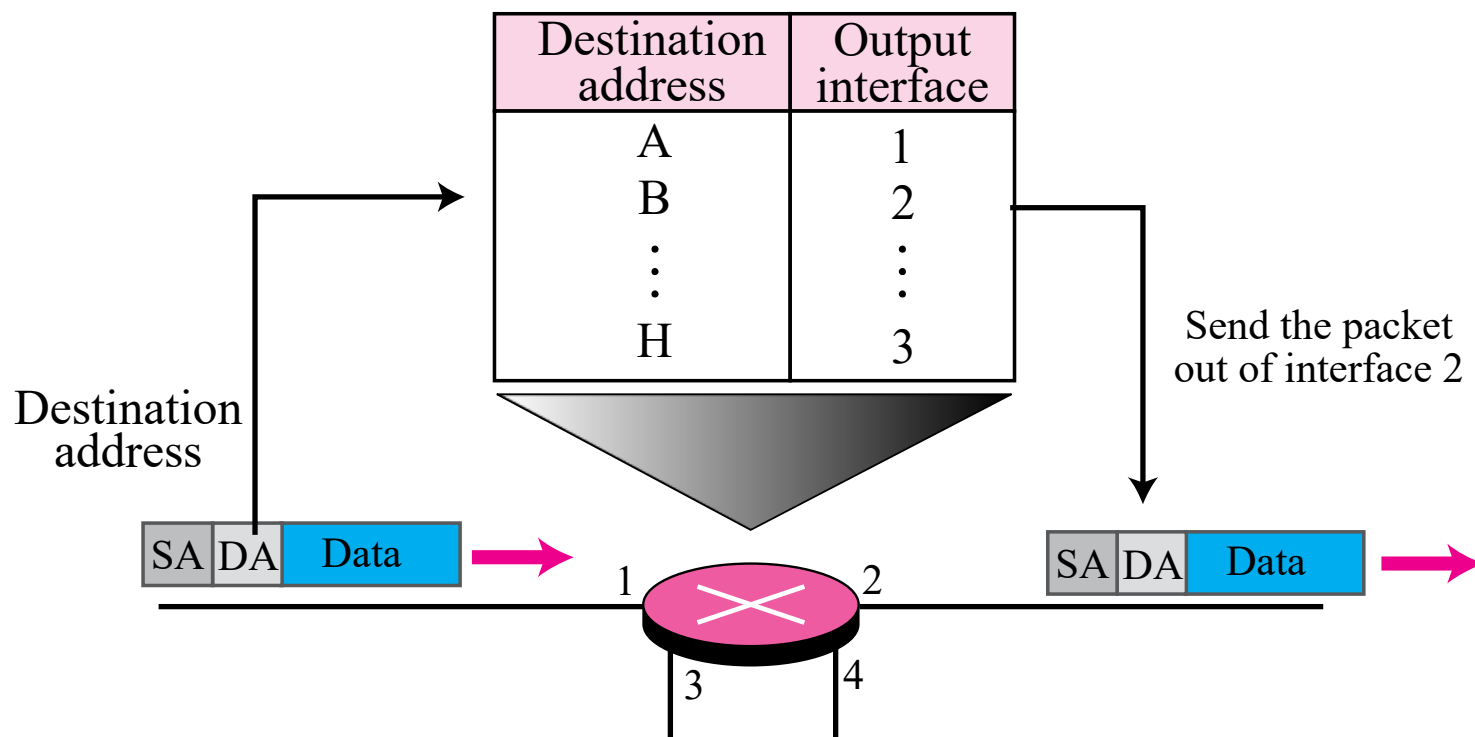
Switching and Forwarding

Example: A connectionless packet-switched network
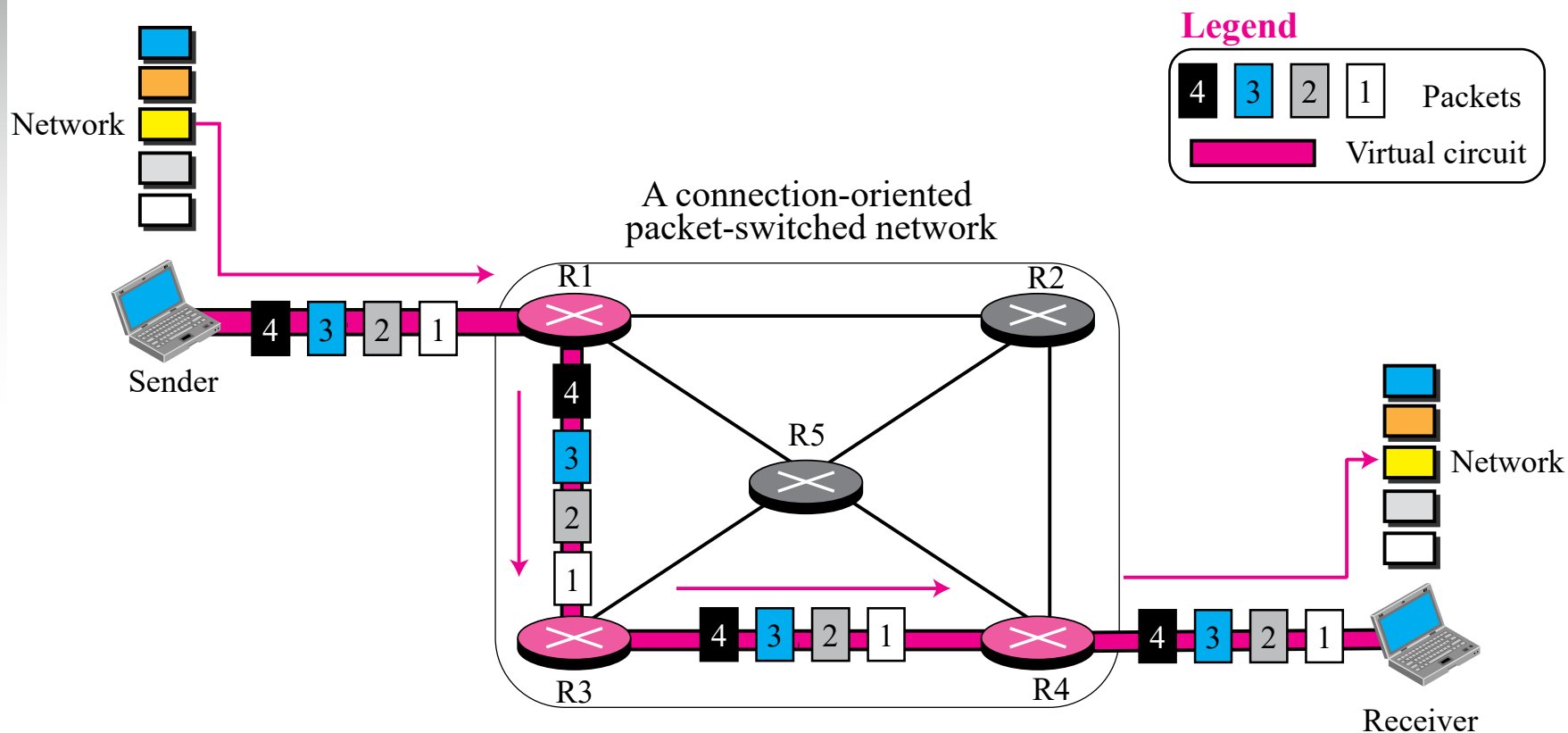
Switching and Forwarding

Example: A connectionless packet-switched network

Forwarding decision is based on destination address.
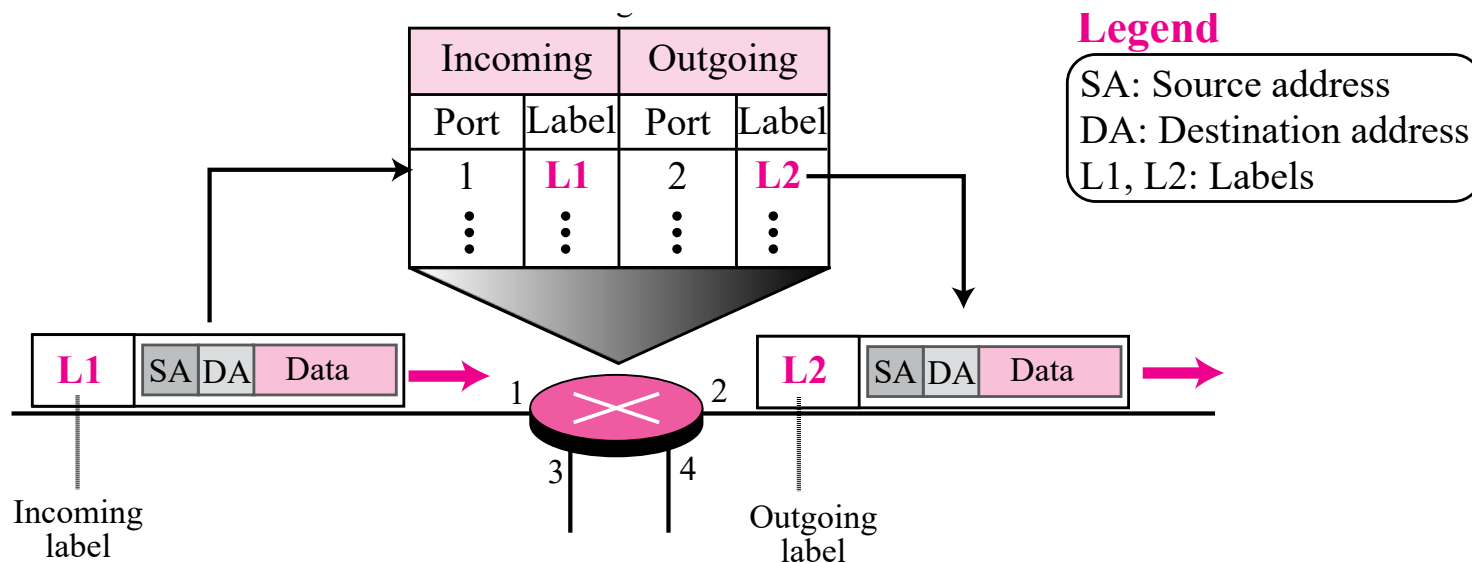
Switching and Forwarding

Example: A connection-oriented packet-switched network
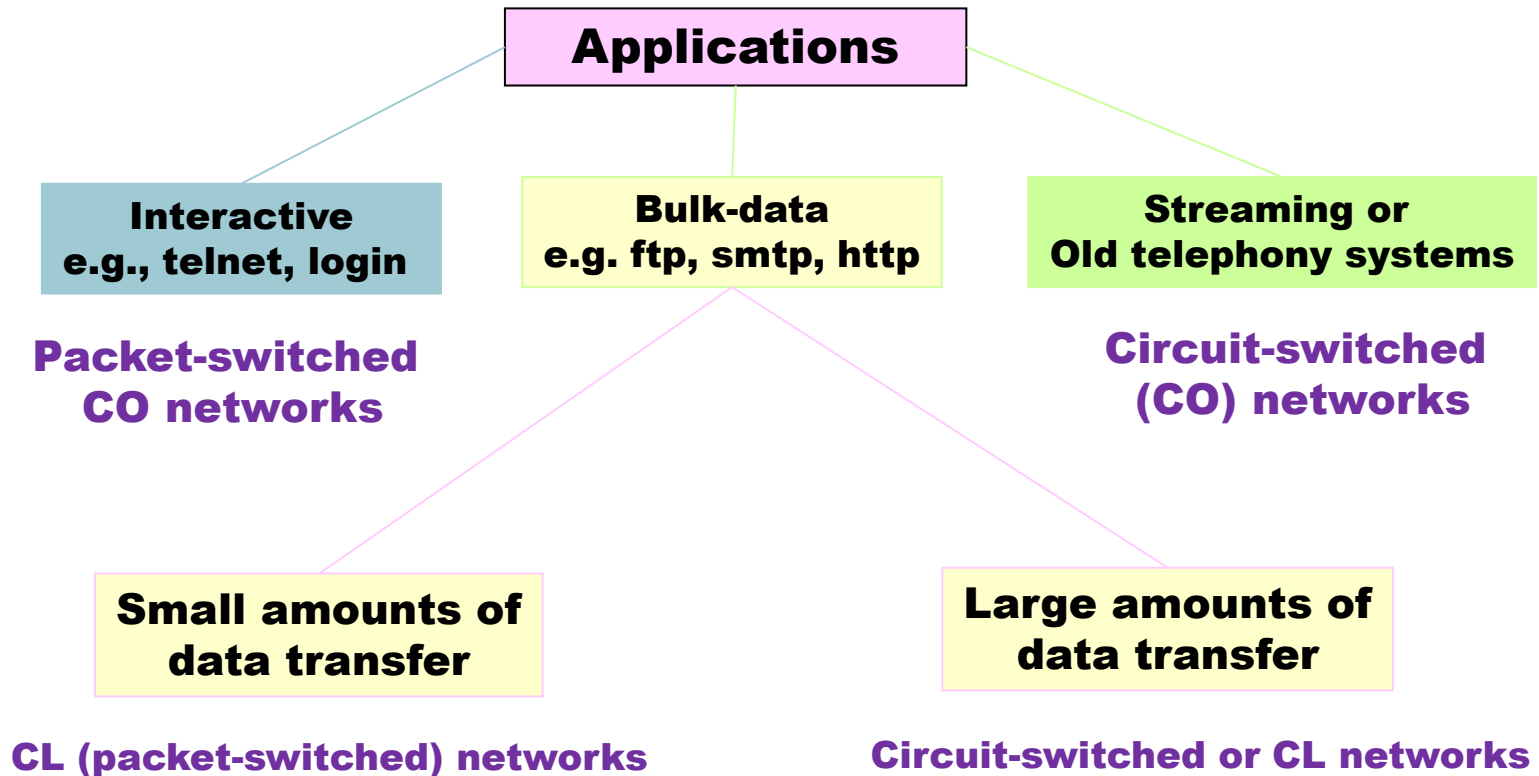
Switching and Forwarding

Example: A connection-oriented packet-switched network

Incoming		Outgoing	
Port	Label	Port	Label
1	**L1**	2	**L2**
⋮	⋮	⋮	⋮

Legend

SA: Source address
DA: Destination address
L1, L2: Labels

L1 | SA | DA | Data

1 ⨉ 2

3 4

L2 | SA | DA | Data

Incoming label

Outgoing label

Forwarding decision is based on the label.

Switching and Forwarding

The operation mode is determined by specific applications!

Applications

Interactive
e.g., telnet, login

Bulk-data
e.g. ftp, smtp, http

Streaming or
Old telephony systems

Packet-switched
CO networks

Circuit-switched
(CO) networks

Small amounts of
data transfer

Large amounts of
data transfer

CL (packet-switched) networks

Circuit-switched or CL networks

Switching and Forwarding

An overview of the Internet
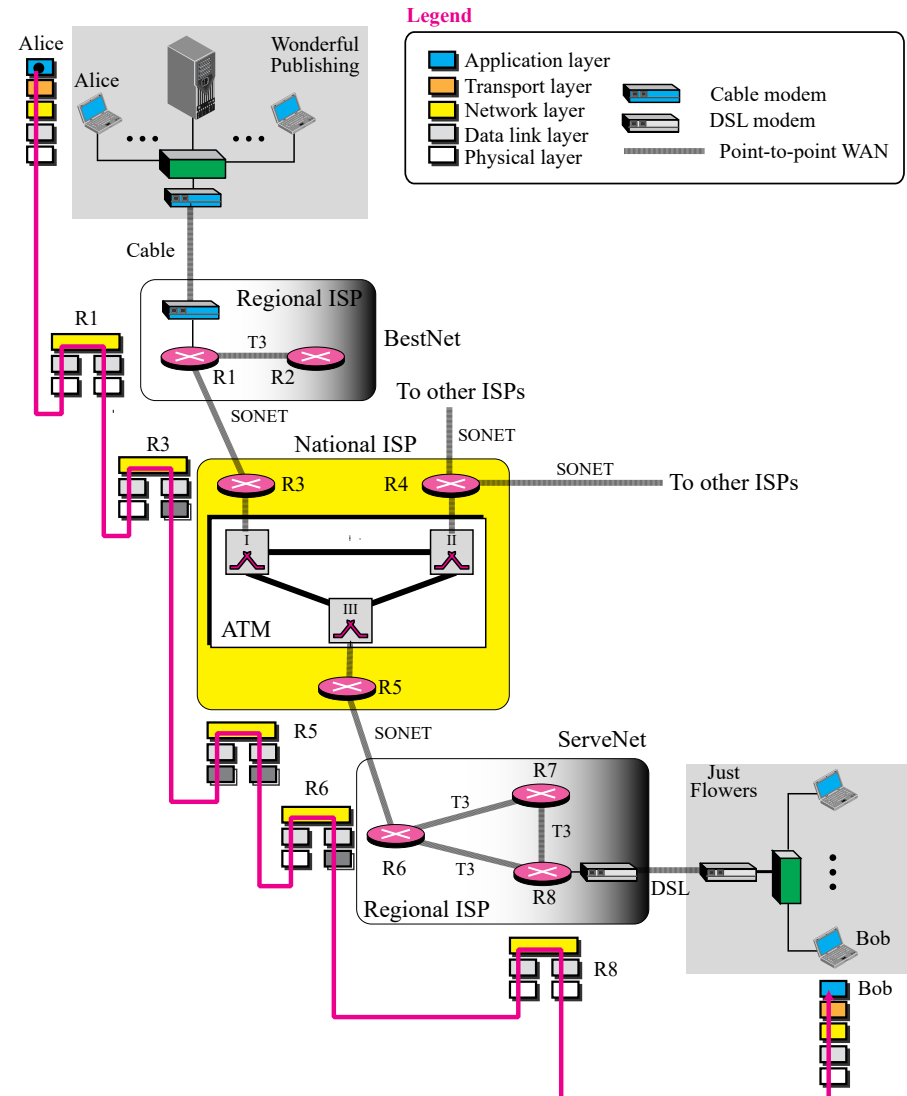
Switching and Forwarding

An overview of the Internet using the OSI model