CCNA 200-301, Volume I
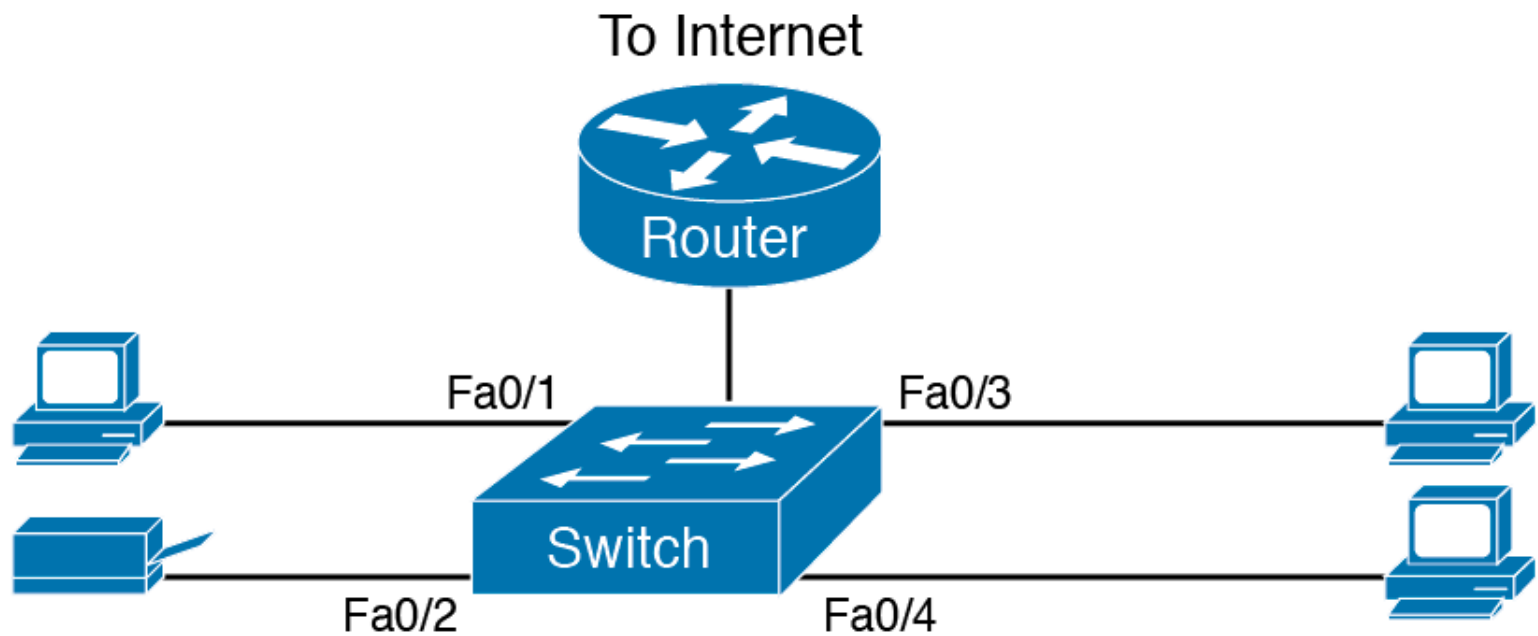
Chapter 2
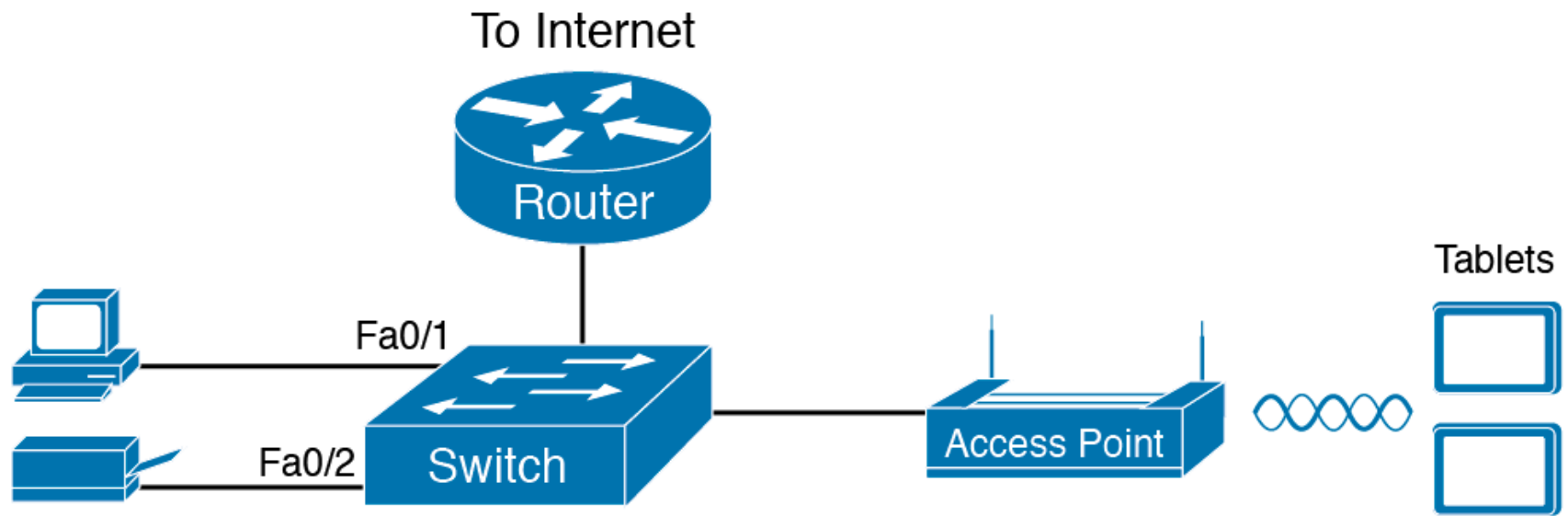
Fundamentals of Ethernet LANs

Objectives

- An Overview of LANs
- Building Physical Ethernet LANSs with UTP
- Building Physical Ethernet LANs with Fiber
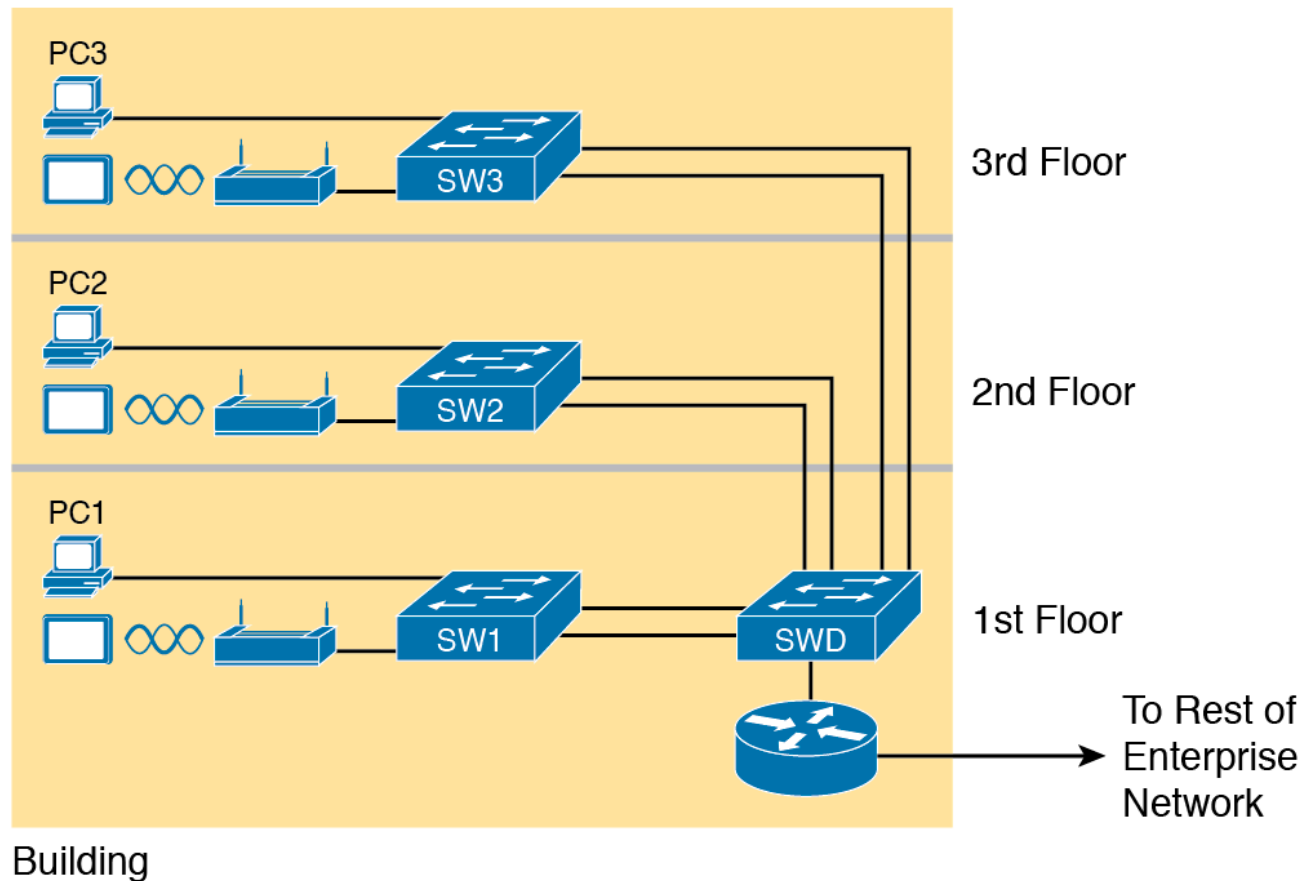- Sending Data in Ethernet Networks

SOHO LAN
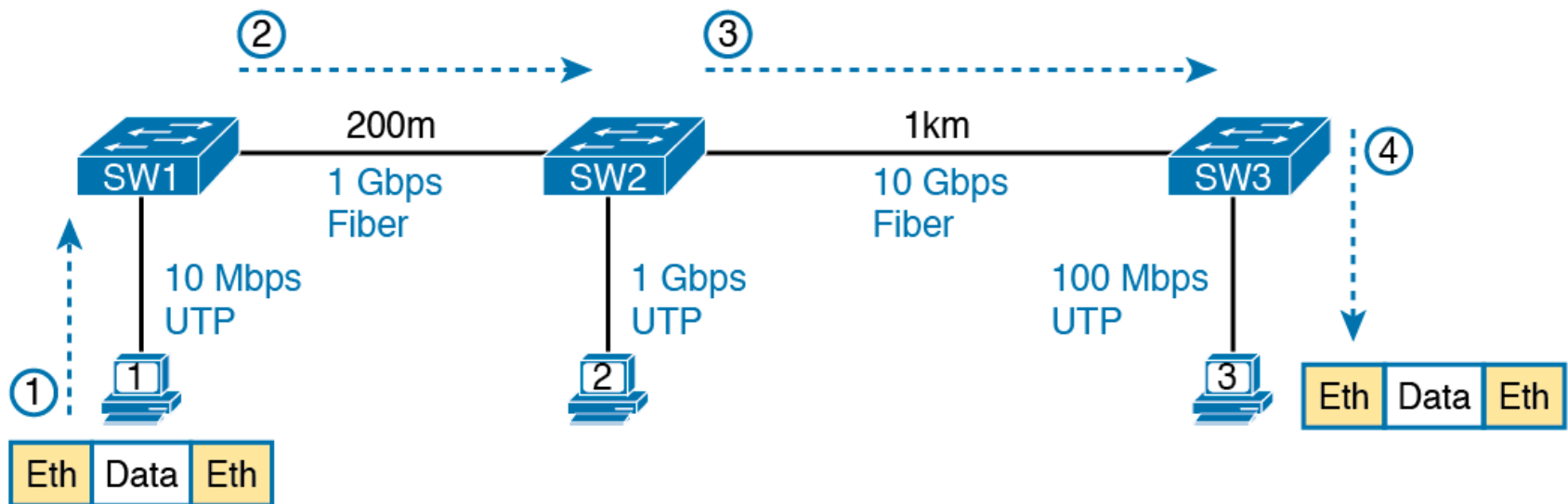
Small Wired and Wireless SOHO LAN

# Single-Building Enterprise Wired and Wireless LAN

Building

Types of Ethernet

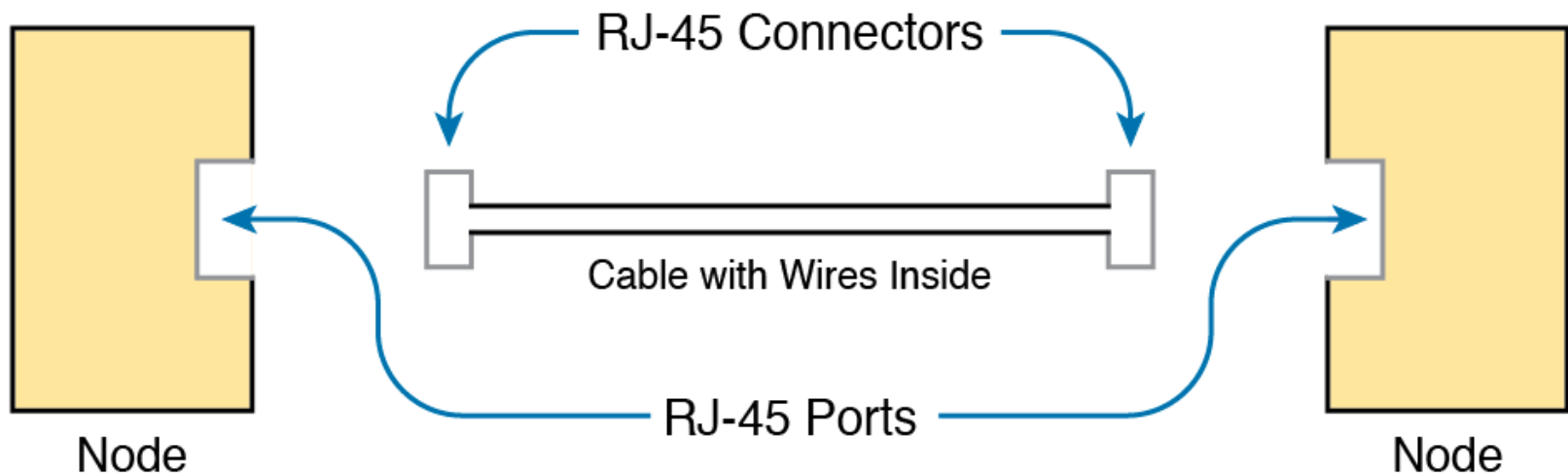| Speed	Common Name	Informal IEEE Standard Name	Formal IEEE Standard Name	Cable Type, Maximum Length
10 Mbps	Ethernet	10BASE-T	802.3	Copper, 100m
100 Mbps	Fast Ethernet	100BASE-T	802.3u	Copper, 100m
1000 Mbps	Gigabit Ethernet	1000BASE-LX	802.3z	Fiber, 5000 m
1000 Mbps	Gigabit Ethernet	1000BASE-T	802.3ab	Copper, 100 m
10 Gbps	10 Gig Ethernet	10GBASE-T	802.3an	Copper, 100 m

Ethernet LAN Forwards a Data Link Frame Over Many Types of Links

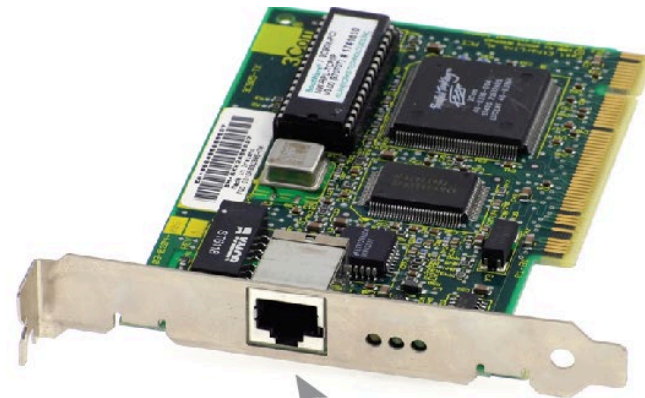# Creating One Electrical Circuit over One Pair to Send in One Direction

One Wire in a Pair

Transmitter — Electrical Current — Receiver

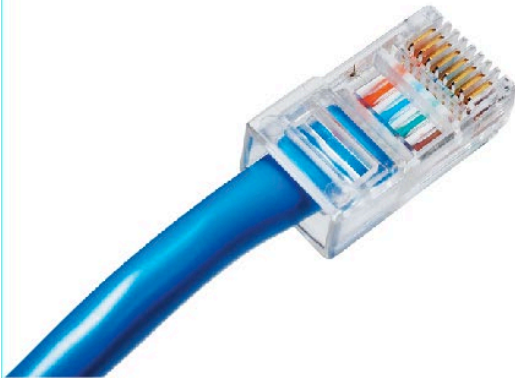Other Wire, Same Pair

Node 1

Node 2
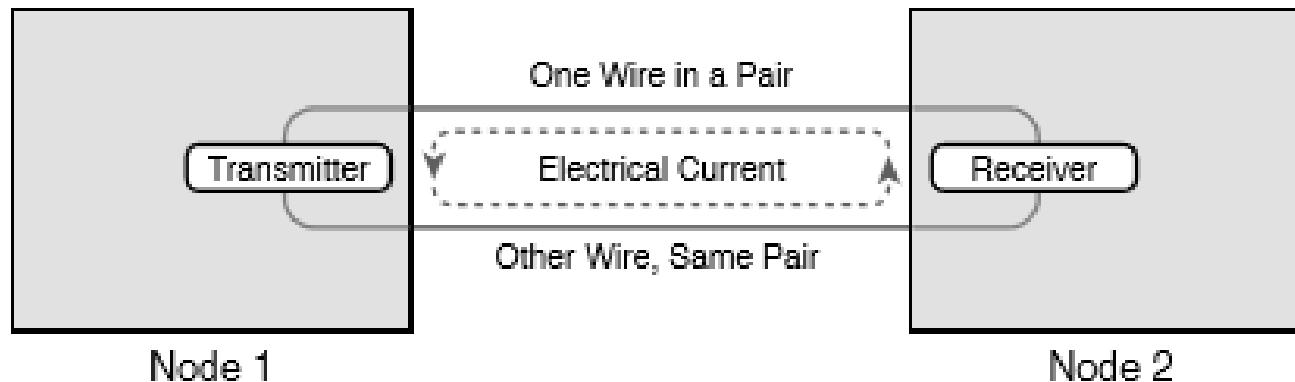
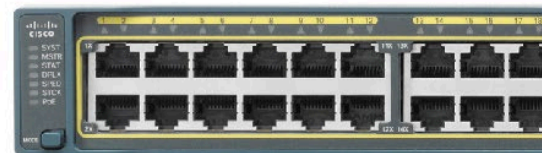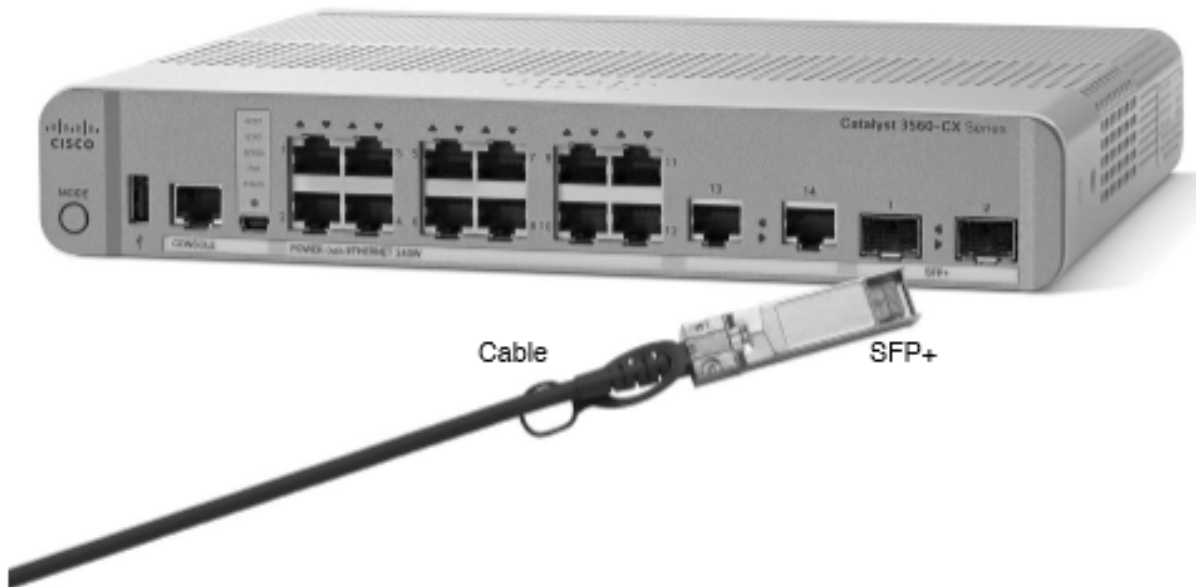# Basic Components of an Ethernet Link

RJ-45 Connectors and Ports

RJ-45 Connector

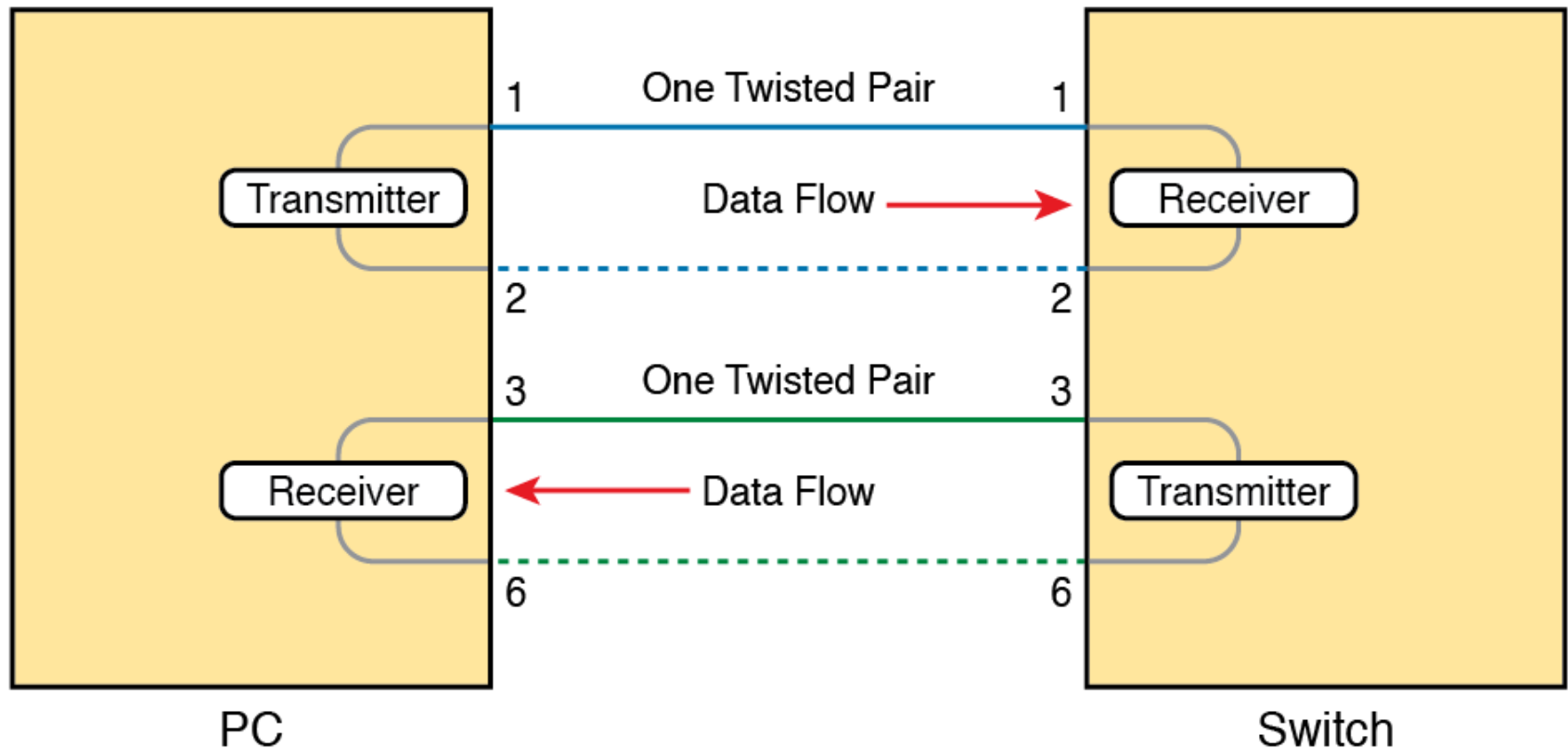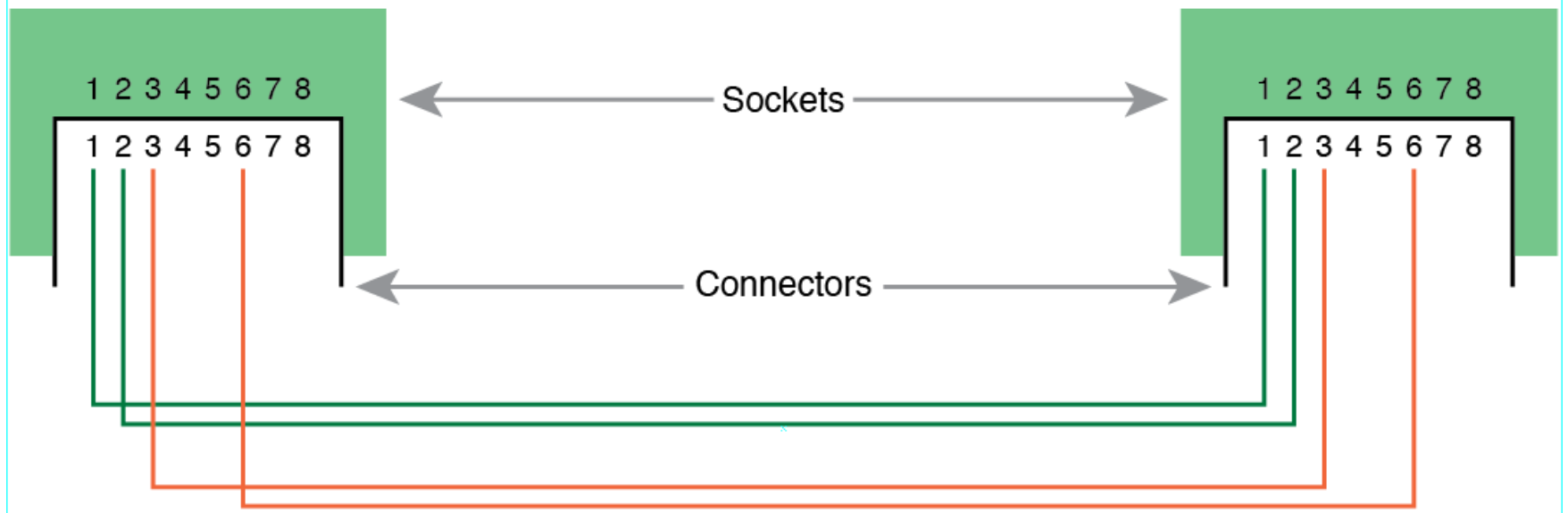RJ-45 Ports

10-Gbps SFP+ with Cable Sitting Just Outside a Catalyst 3560CX Switch

Cable   SFP+

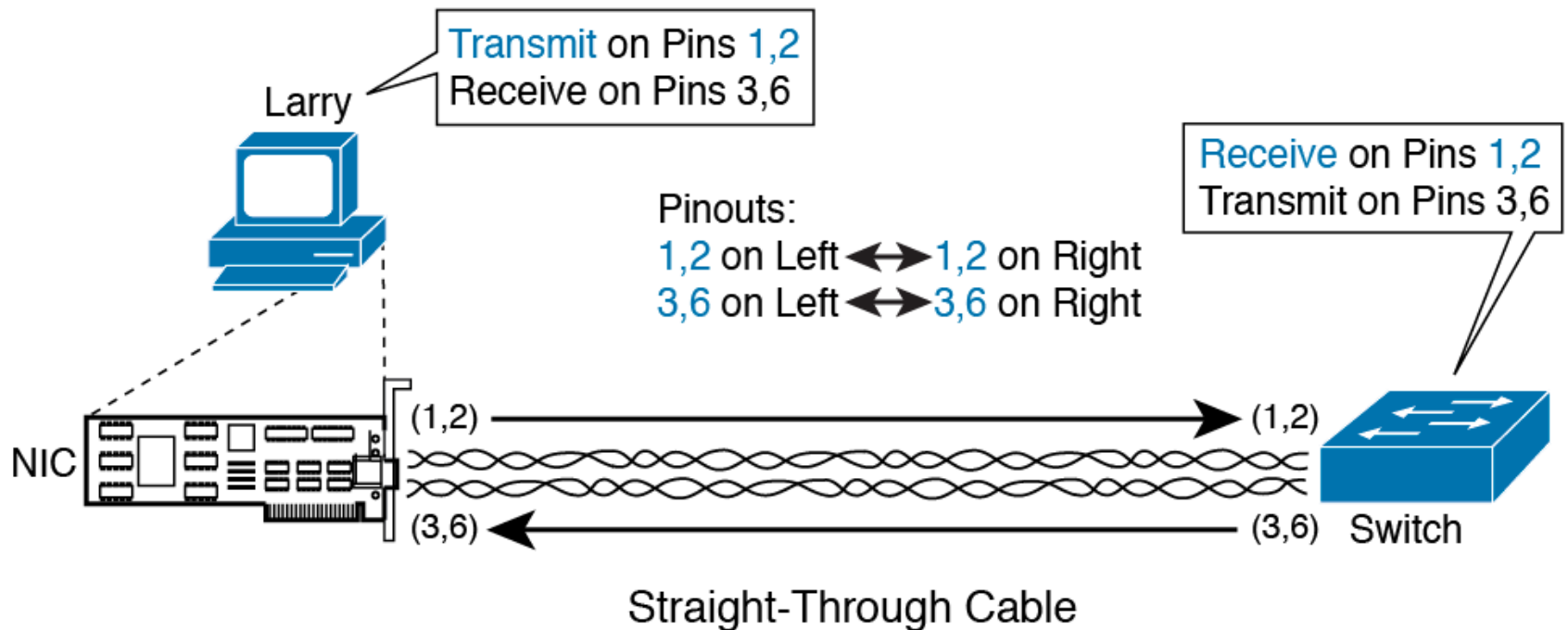# Using one Pair for Each Transmission Direction with 10- and 100-Mbps Ethernet

10Base-T and 100Base-T Straight-Through Cable Pinout

Ethernet Straight-Through Cable Concept

Crossover Ethernet Cable
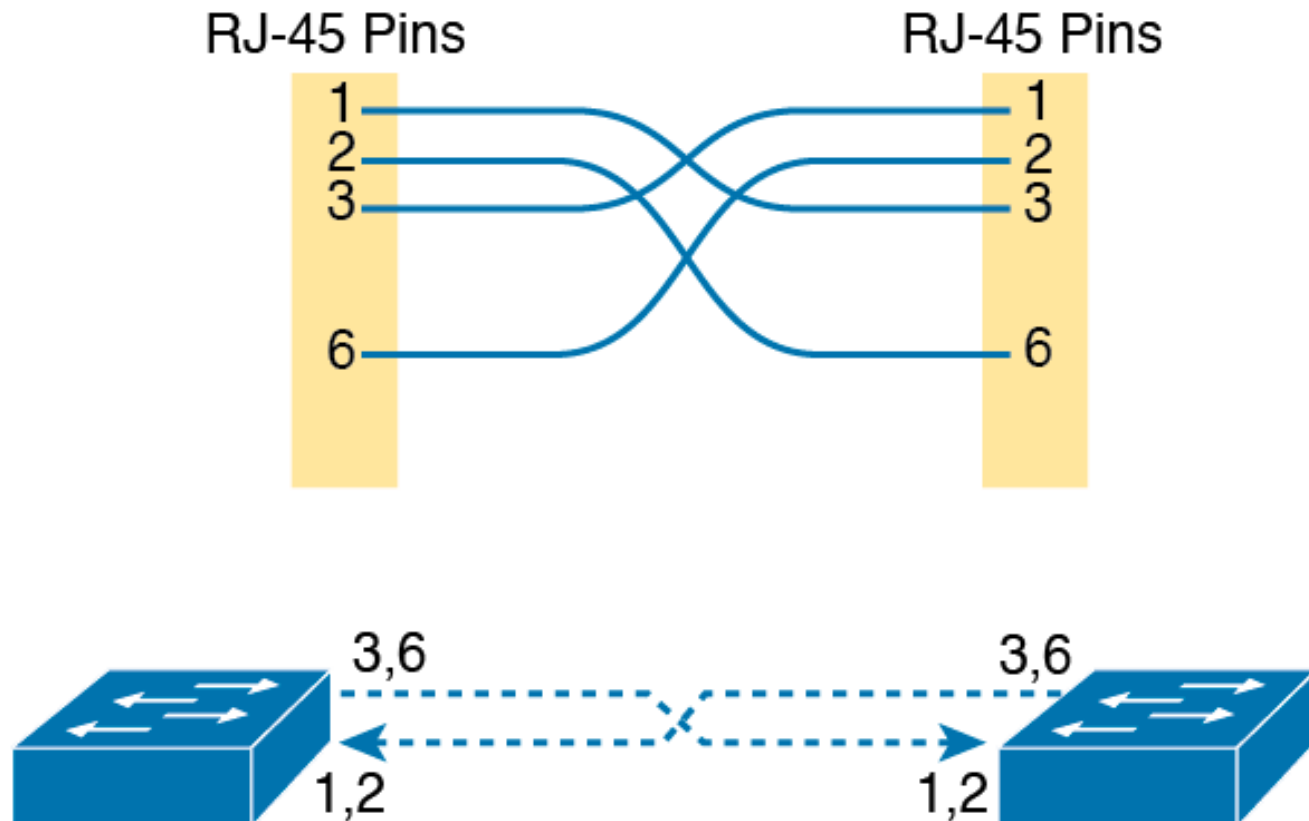
Typical Uses for Straight-Through and Crossover Ethernet Cables
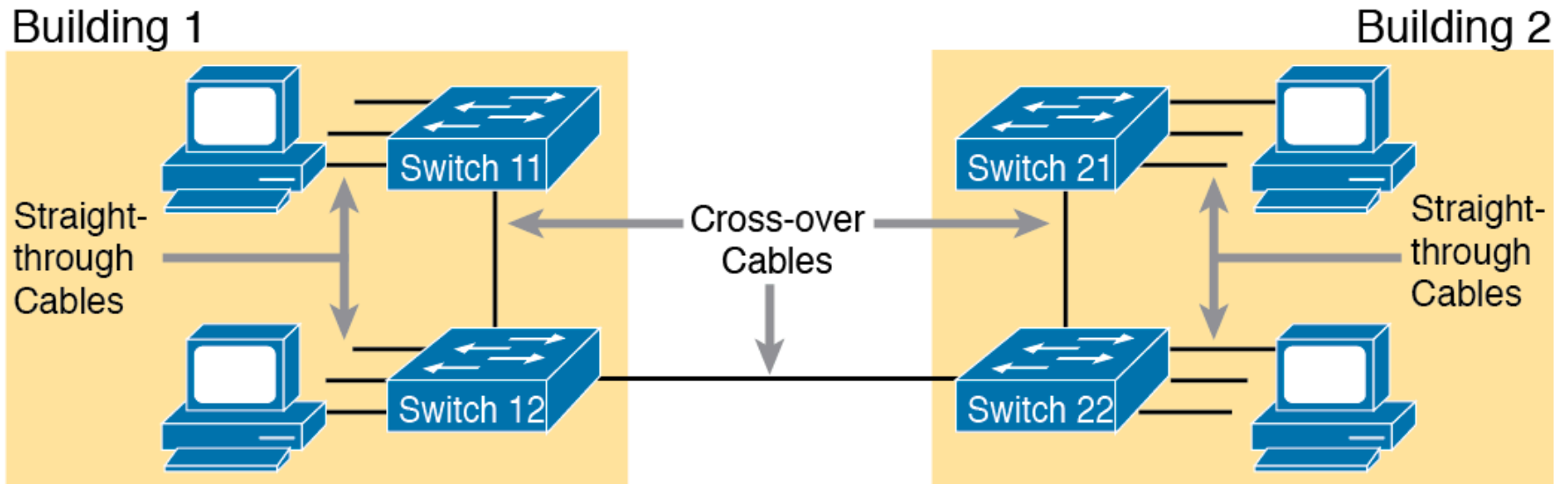
Four-Pair Straight-Through Cable to 1000BASE-T

Components of a Fiber-Optic Cable

Core

Cladding

Buffer

Strengthener

Outer Jacket
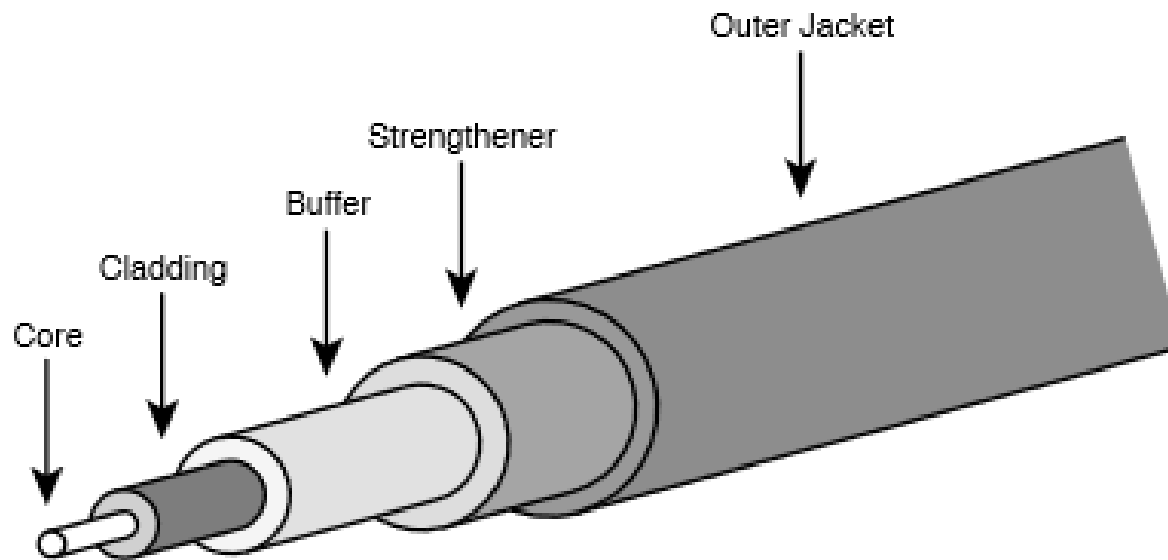
Transmission on Multimode Fiber with Internal Reflection
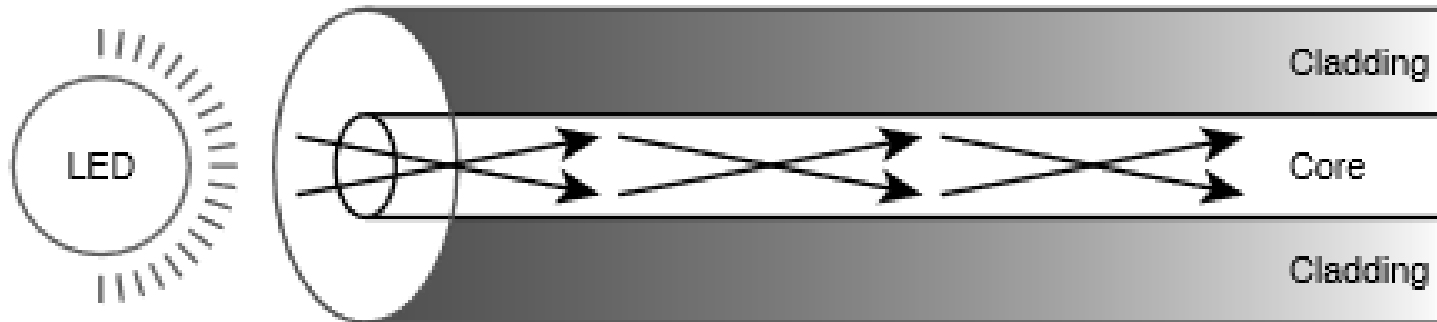
Transmission on Single-Mode Fiber with Laser Transmitter

Two Fiber Cables with Tx Connected to Rx on Each Cable

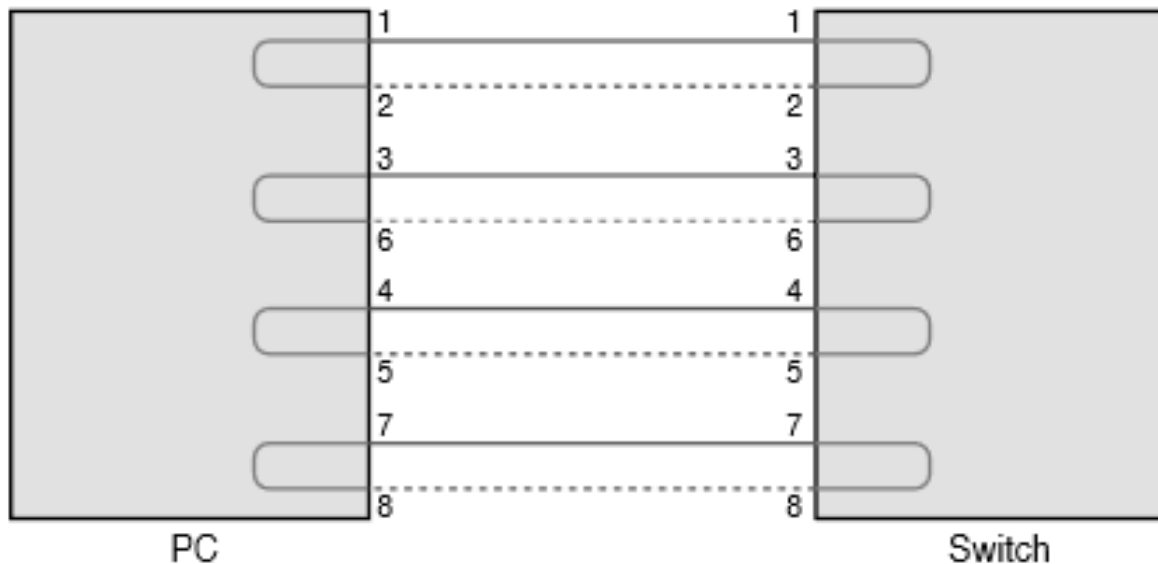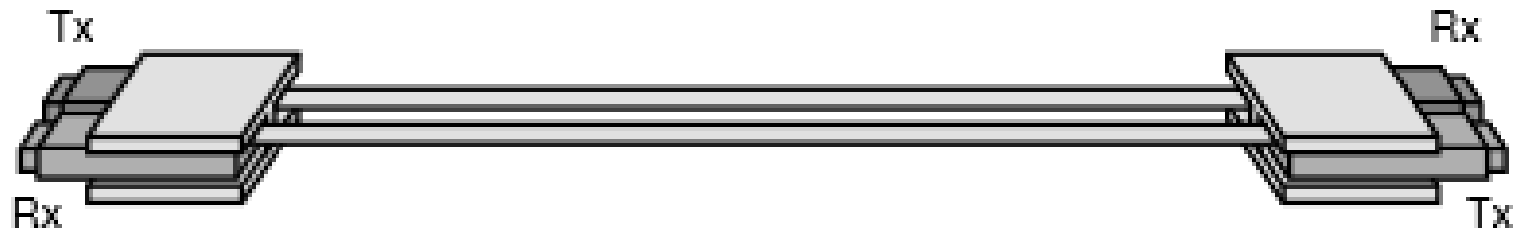# A Sampling of IEEE 802.3 10-Gbps Fiber Standards

Standard	Cable Type	Max Distance*
10GBASE-S	MM	400m
10GBASE-LX4	MM	300m
10GBASE-LR	SM	10km
10GBASE-E	SM	30km

* The maximum distances are based on the IEEE standards with no repeaters.

Comparisons Between UTP, MM, and SM Ethernet Cabling

Criteria	UTP	Multimode	Single-mode
Relative Cost of Cabling	Low	Medium	Medium
Relative Cost of a Switch Port	Low	Medium	High
Approximate Max Distance	100m	500m	40km
Relative Susceptibility to Interference	Some	None	None
Relative Risk of Copying from Cable Emissions	Some	None	None

Commonly Used Ethernet Frame Format

|	Header						Trailer
Bytes	Preamble 7	SFD 1	Destination 6	Source 6	Type 2	Data and Pad 46 – 1500	FCS 4
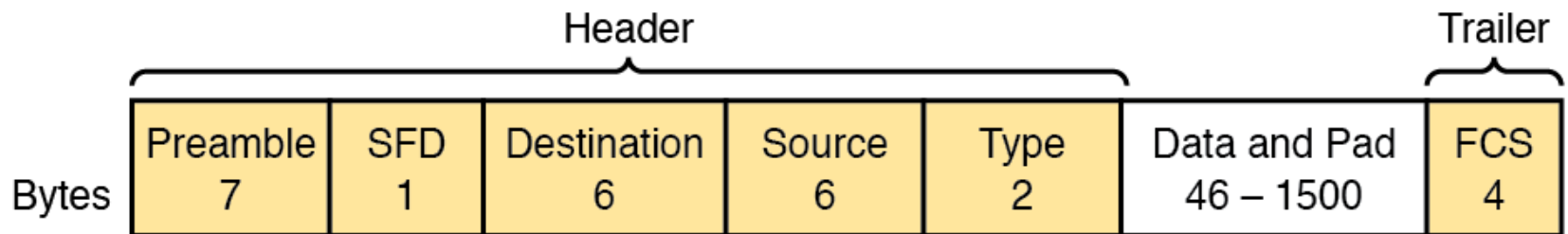
IEEE 802.3 Ethernet Header and Trailer Fields

Field	Field Length in Bytes	Description
Preamble	7	Synchronization
Start Frame Delimiter (SFD)	1	Signifies that the next byte begins the Destination MAC Address field.
Destination MAC address	6	Identifies the intended recipient of this frame.
Source MAC address	6	Identifies the sender of this frame.
Type	2	Defines the type of protocol listed inside the frame; today, most likely identifies IP Version 4 (IPv4) or IP Version 6 (IPv6).
Data and Pad	46-1500	Holds data from a higher layer, typically an L3PDU (usually an IPv4 or IPv6 packet). The sender adds padding to meet the minimum length requirement for this field (46 bytes).
Frame Check Sequence (FCS)	4	Provides a method for the receiving NIC to determine if the frame experienced transmission errors

# Structure of Unicast Ethernet Addresses
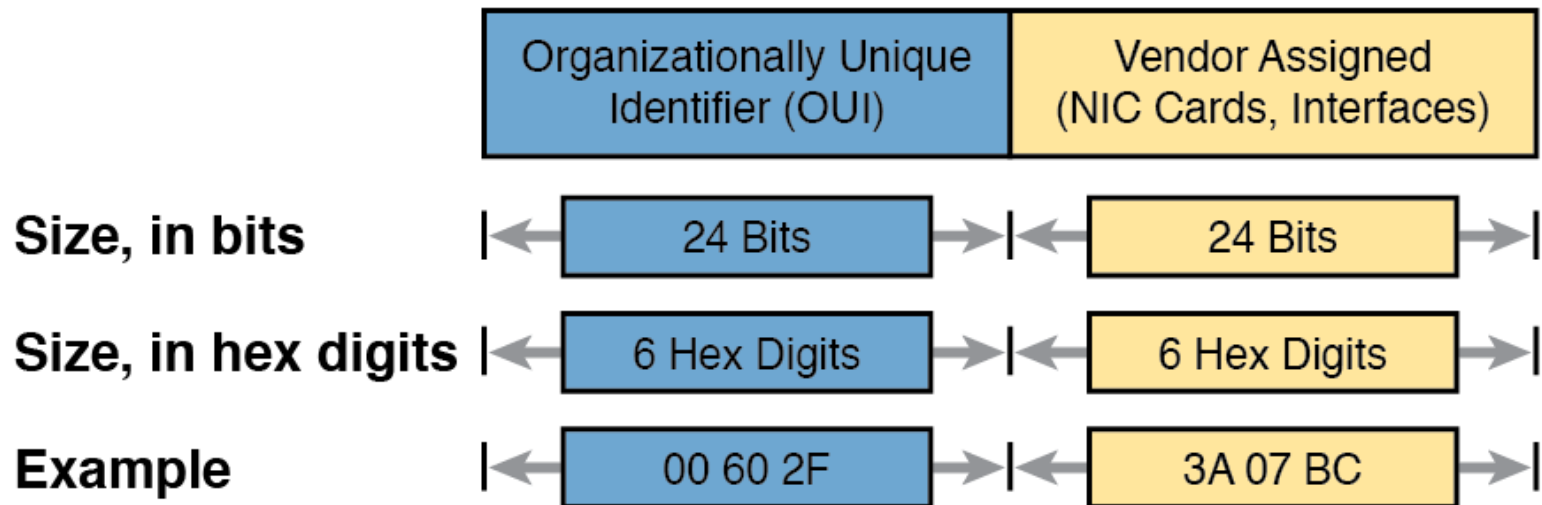
| LAN Addressing Term or Feature	Description
MAC	Media Access Control. 802.3 (Ethernet) defines the MAC sublayer of IEEE Ethernet.
Ethernet address, NIC address, LAN address	Other names often used instead of MAC address. These terms describe the 6-byte address of the LAN interface card.
Burned-in address	The 6-byte address assigned by the vendor making the card.
Unicast address	A term for a MAC that represents a single LAN interface.
Broadcast address	An address that means "all devices that reside on this LAN right now."
Multicast address	On Ethernet, a multicast address implies some subset of all devices currently on the Ethernet LAN.

Use of Ethernet Type Field
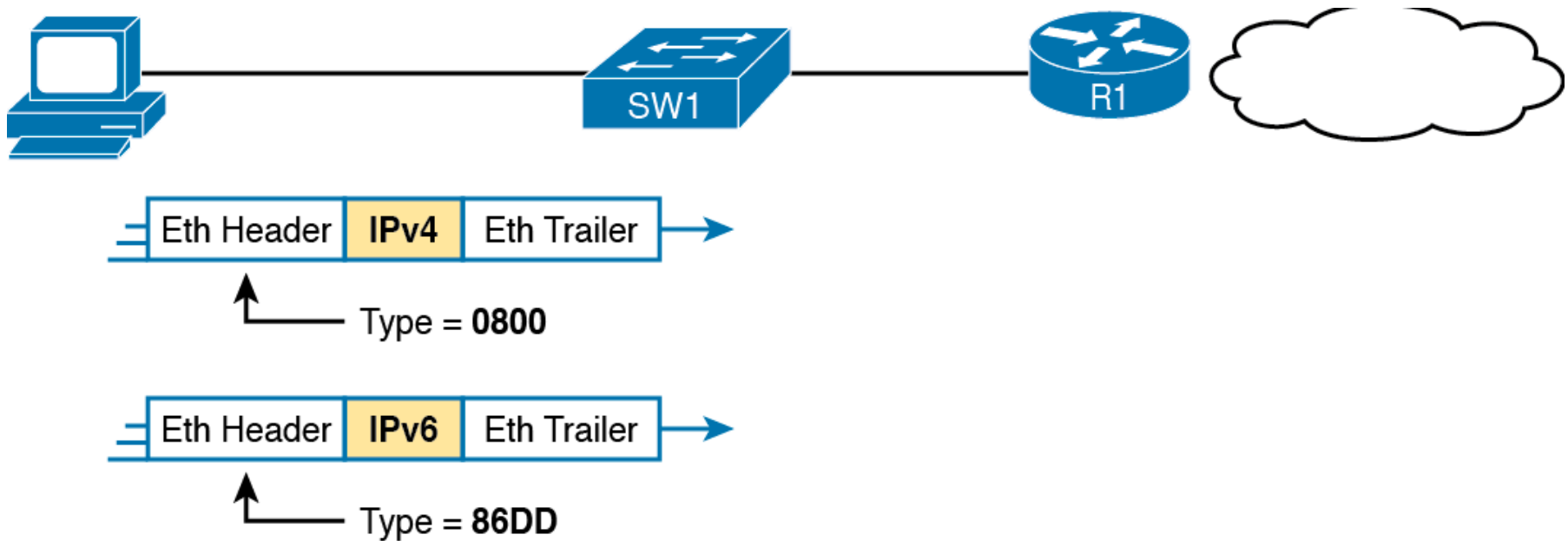
Example of Sending Data in a Modern Ethernet LAN
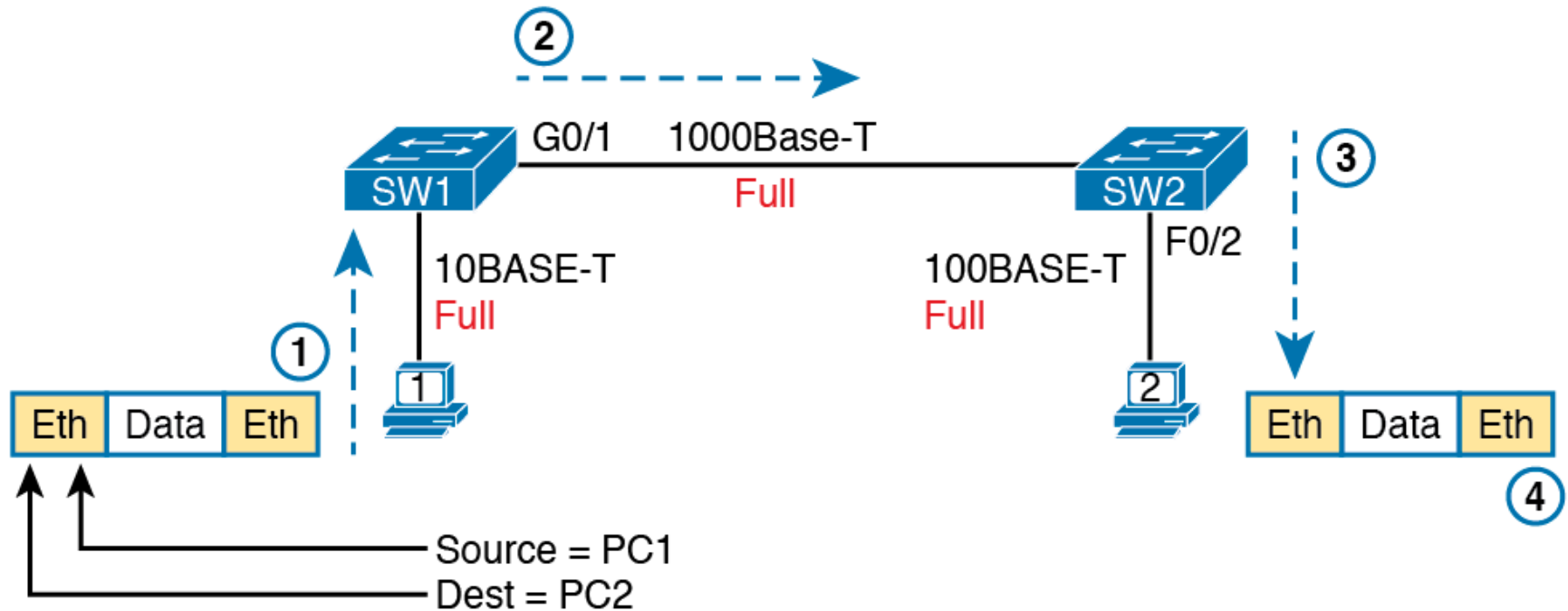
A Collision Occurring Because of LAN Hub Behavior
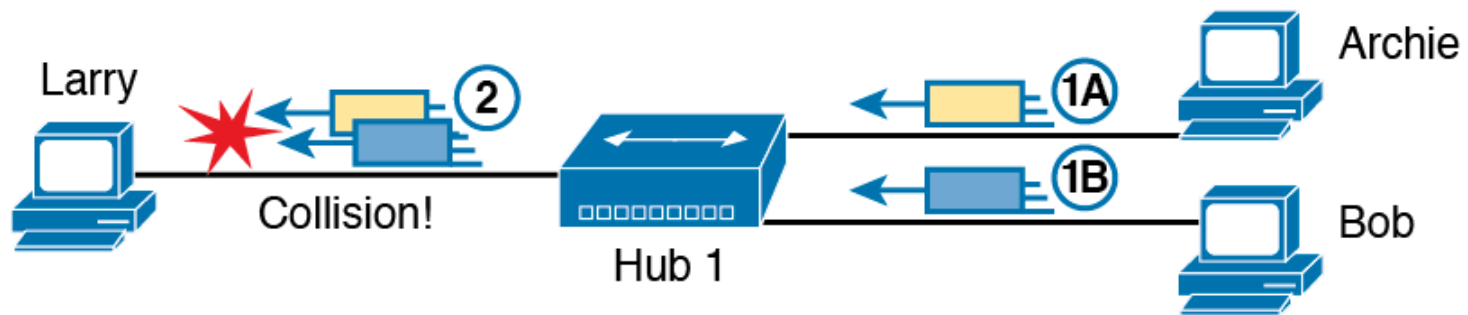
Full and Half Duplex in an Ethernet LAN