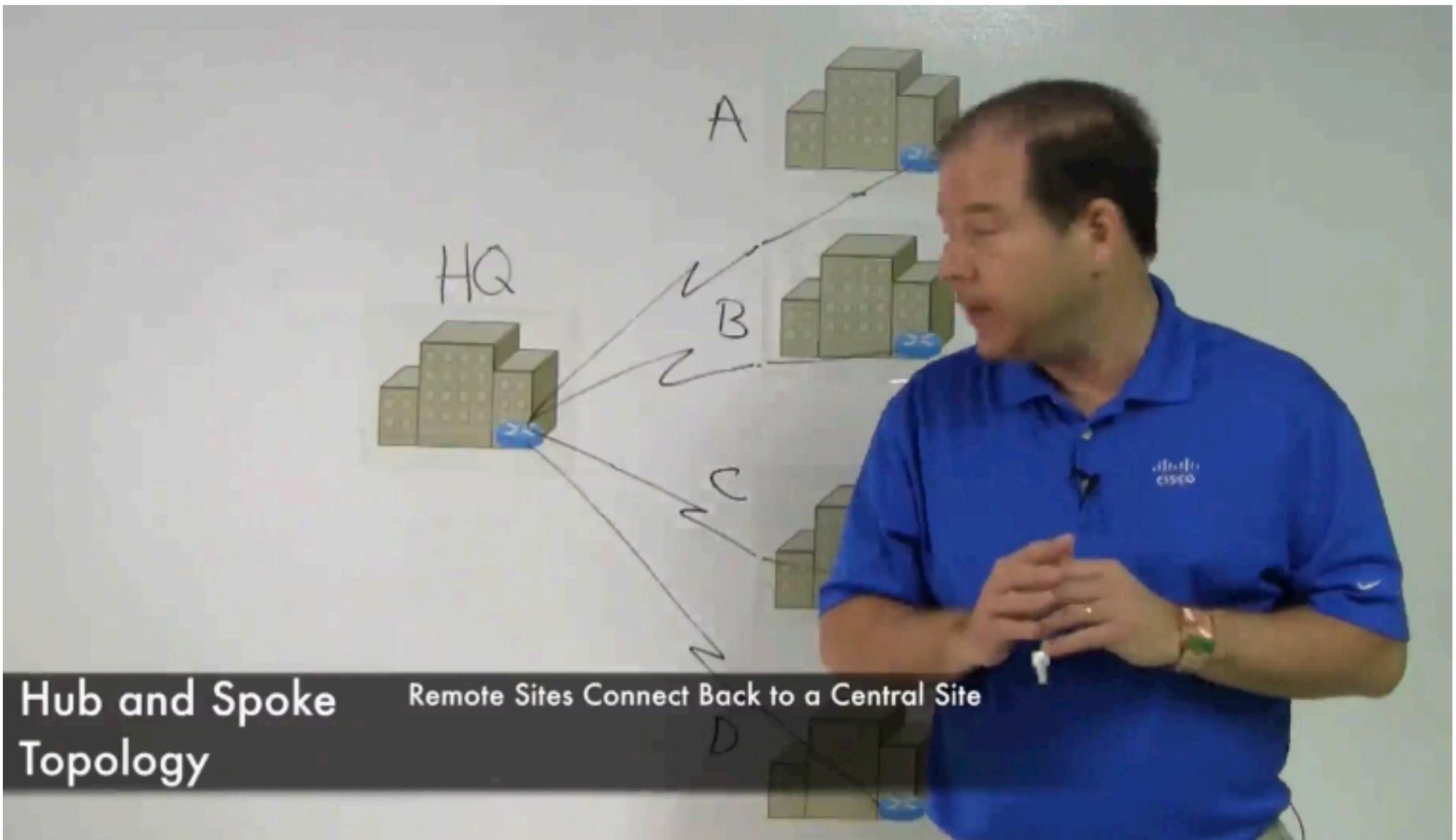
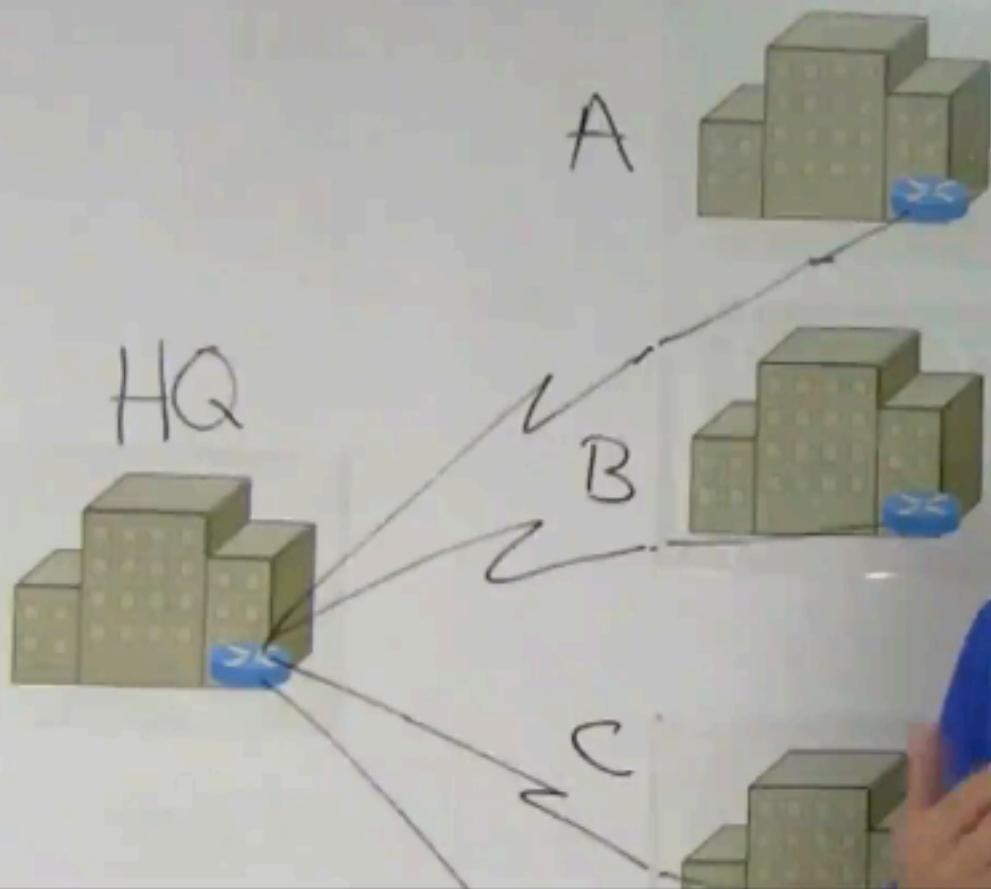


# Module 3: Network Topologies

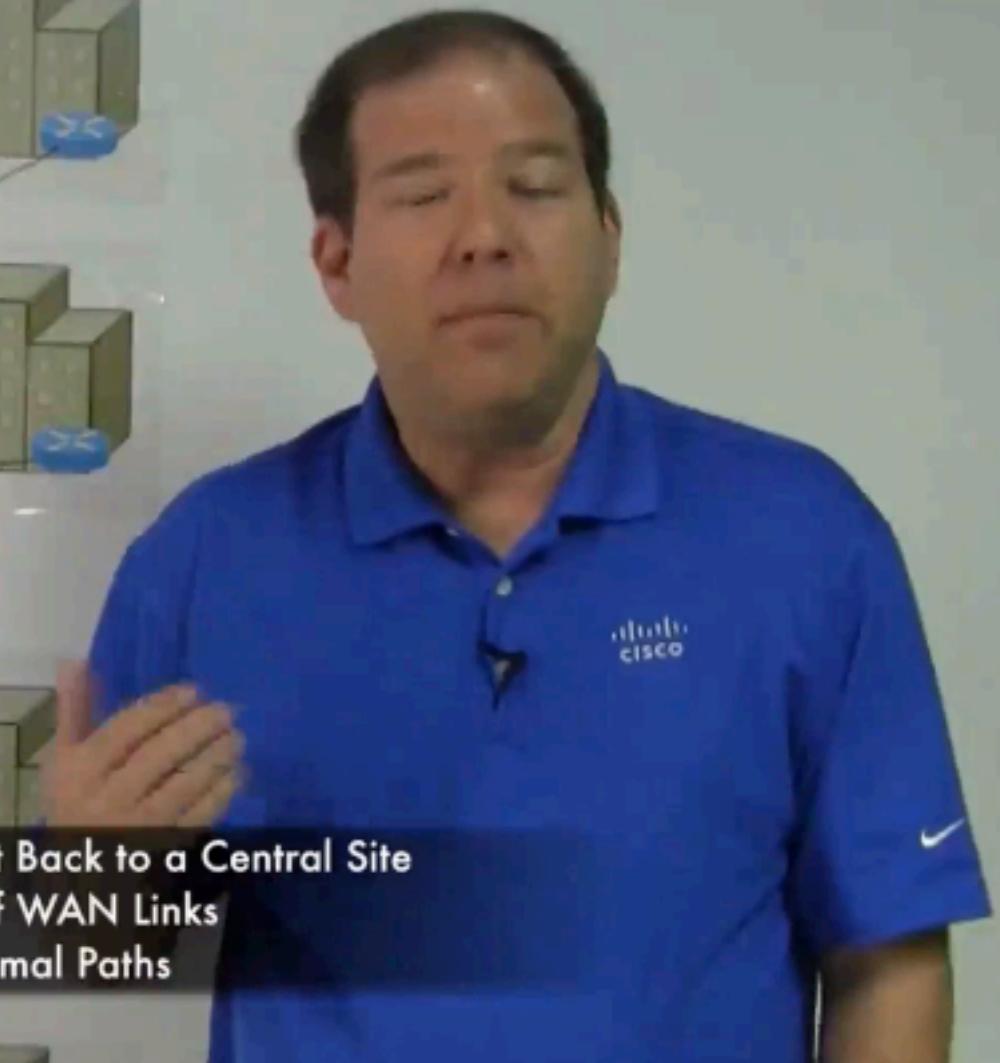
# Hub and Spoke



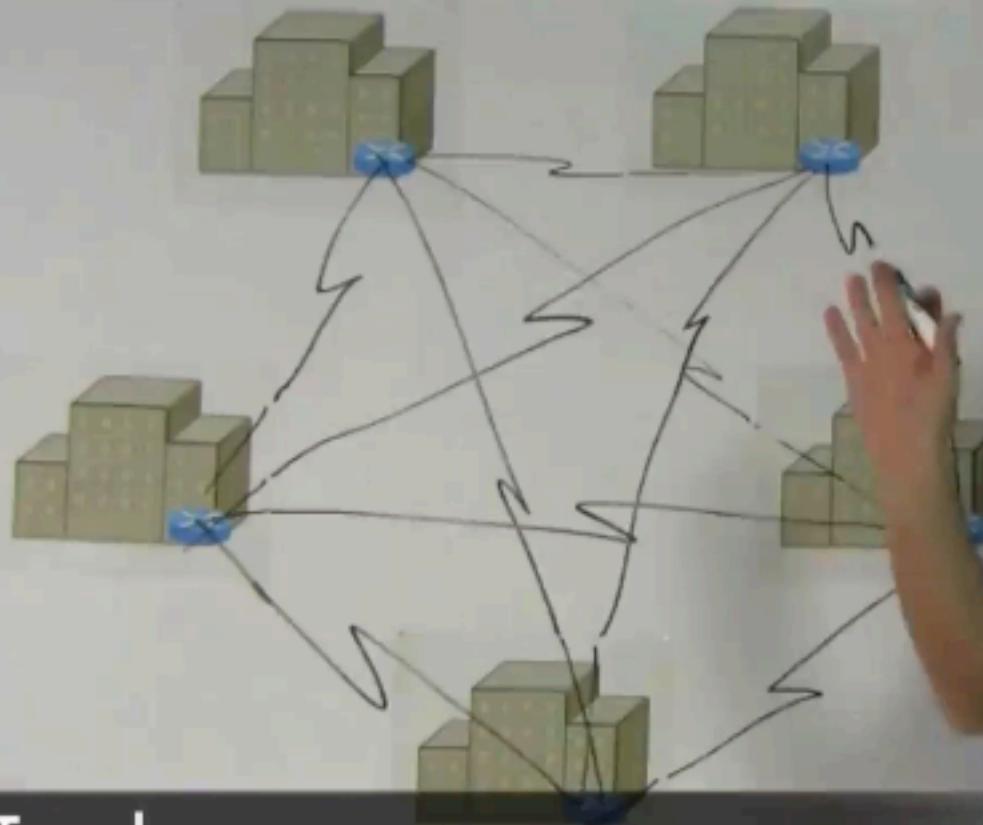


## Hub and Spoke Topology

Remote Sites Connect Back to a Central Site  
Minimizes Number of WAN Links  
Can Result in Suboptimal Paths

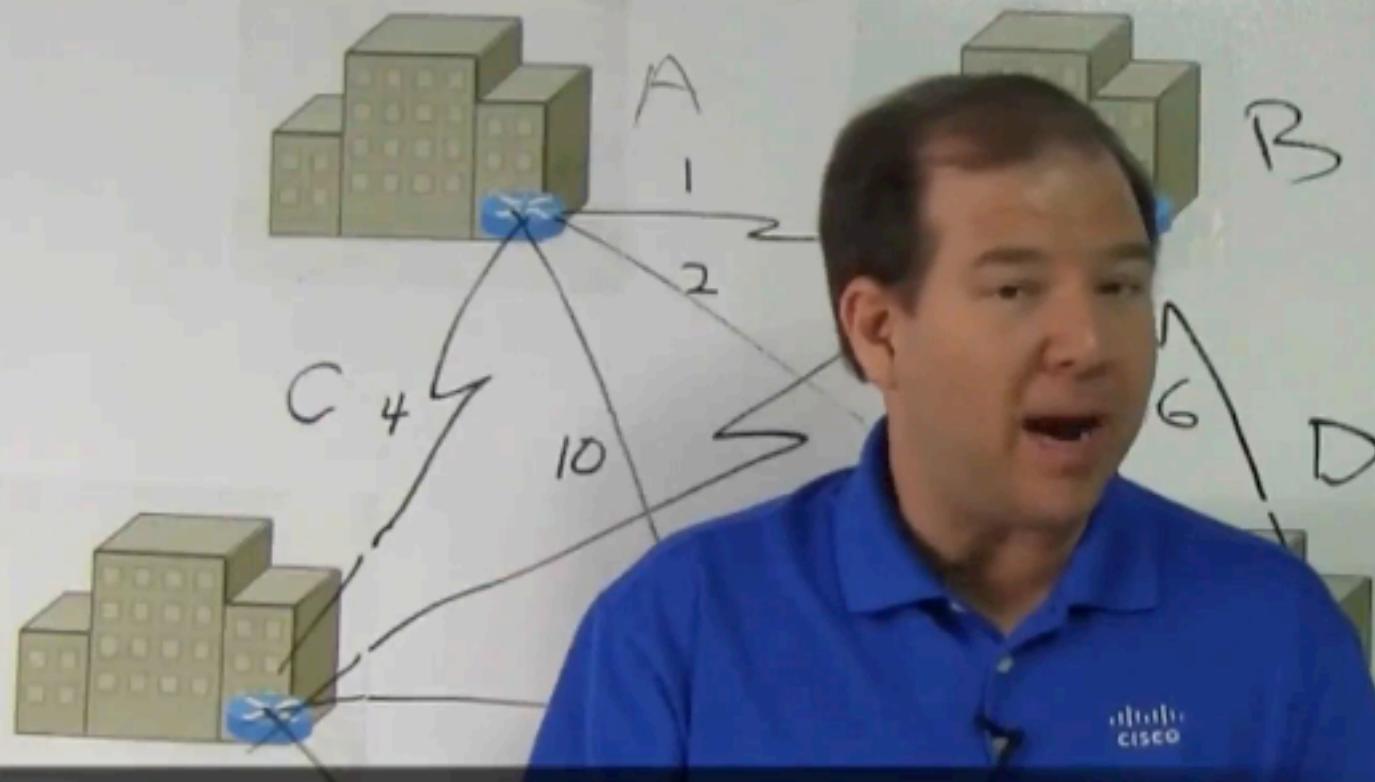


# Full Mesh



## Full Mesh Topology

Every Site Connects to Every Other Site



## Full Mesh Topology

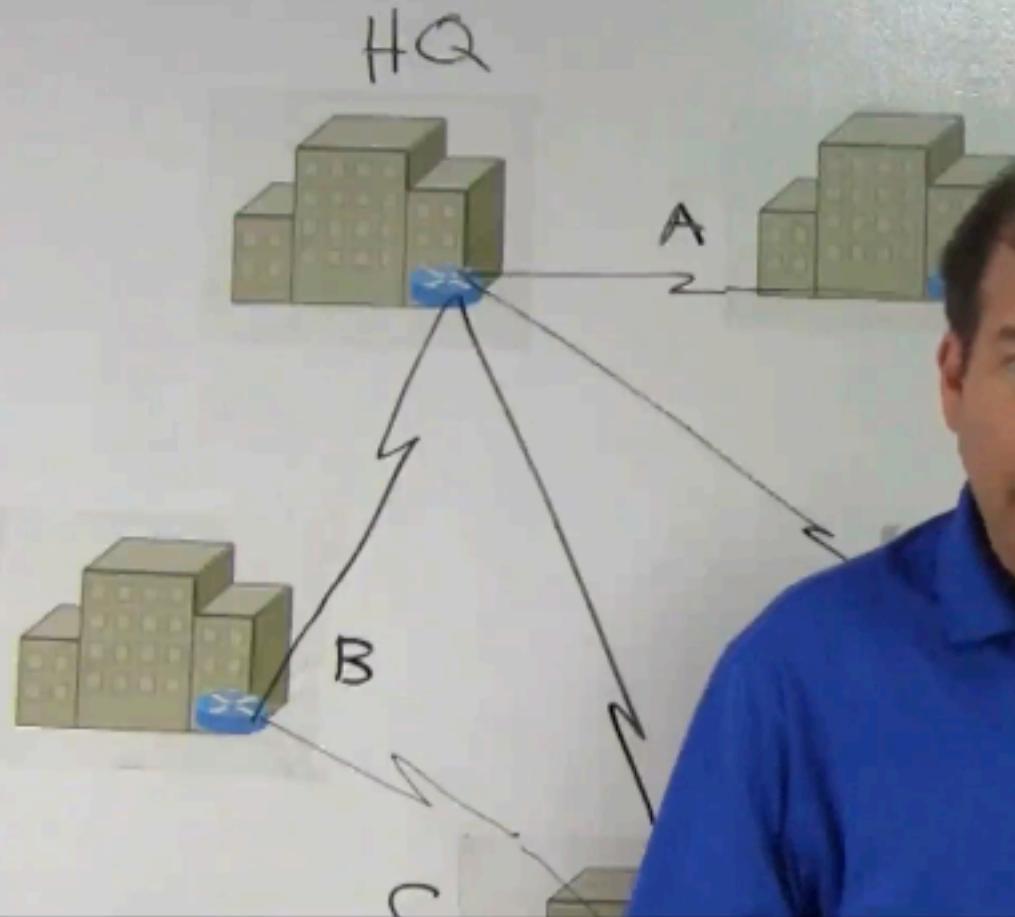
Optimal Paths  
Not Scalable

$$\frac{n(n-1)}{2} = \text{Links}$$

$$\frac{5(5-1)}{2} = 10$$

$$\frac{10(10-1)}{2} = 45$$

# Partial Mesh



## Partial Mesh Topology

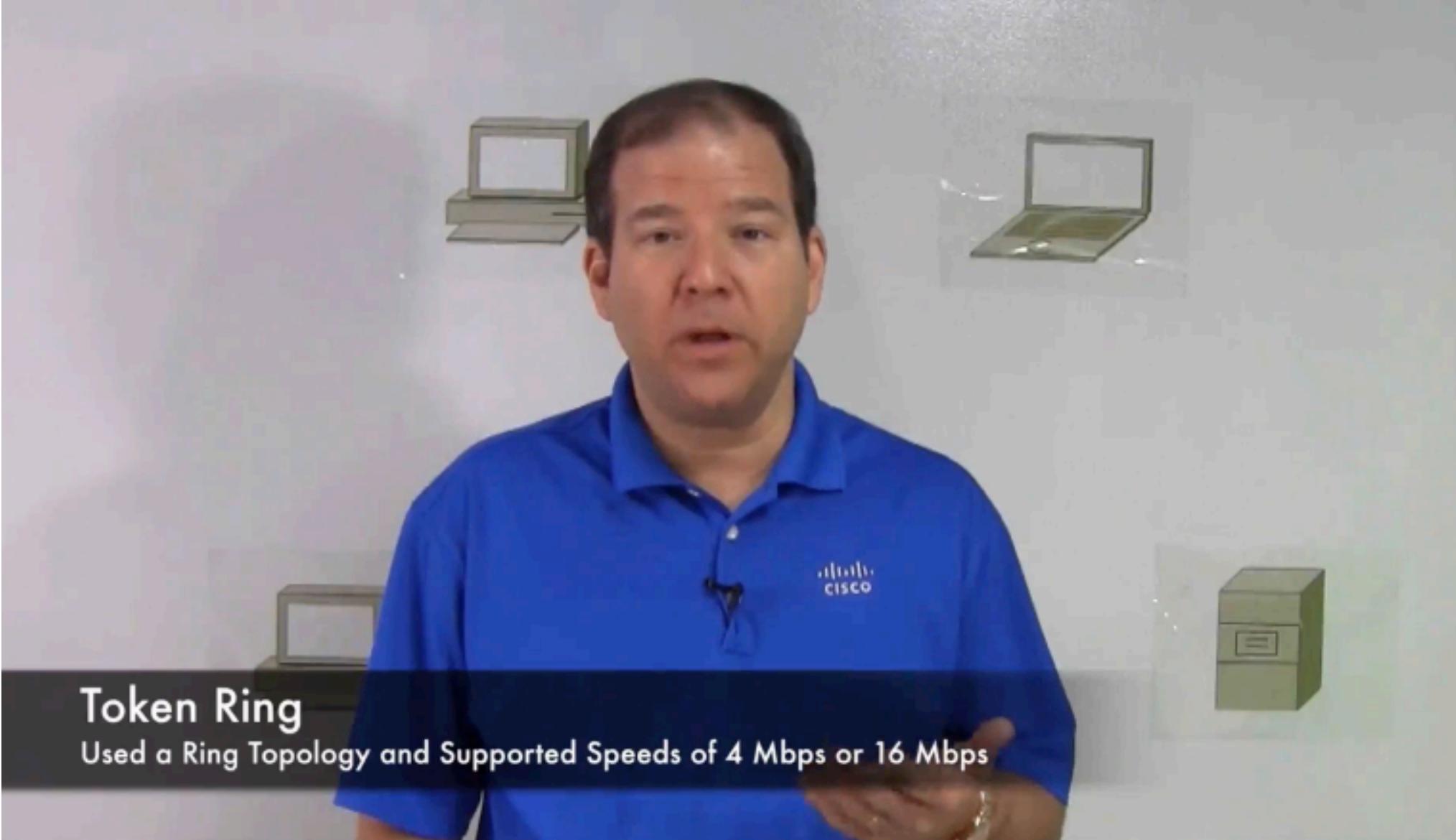
A Subset of a Full Mesh  
Links are Strategically Added Based on Traffic Patterns

Ring



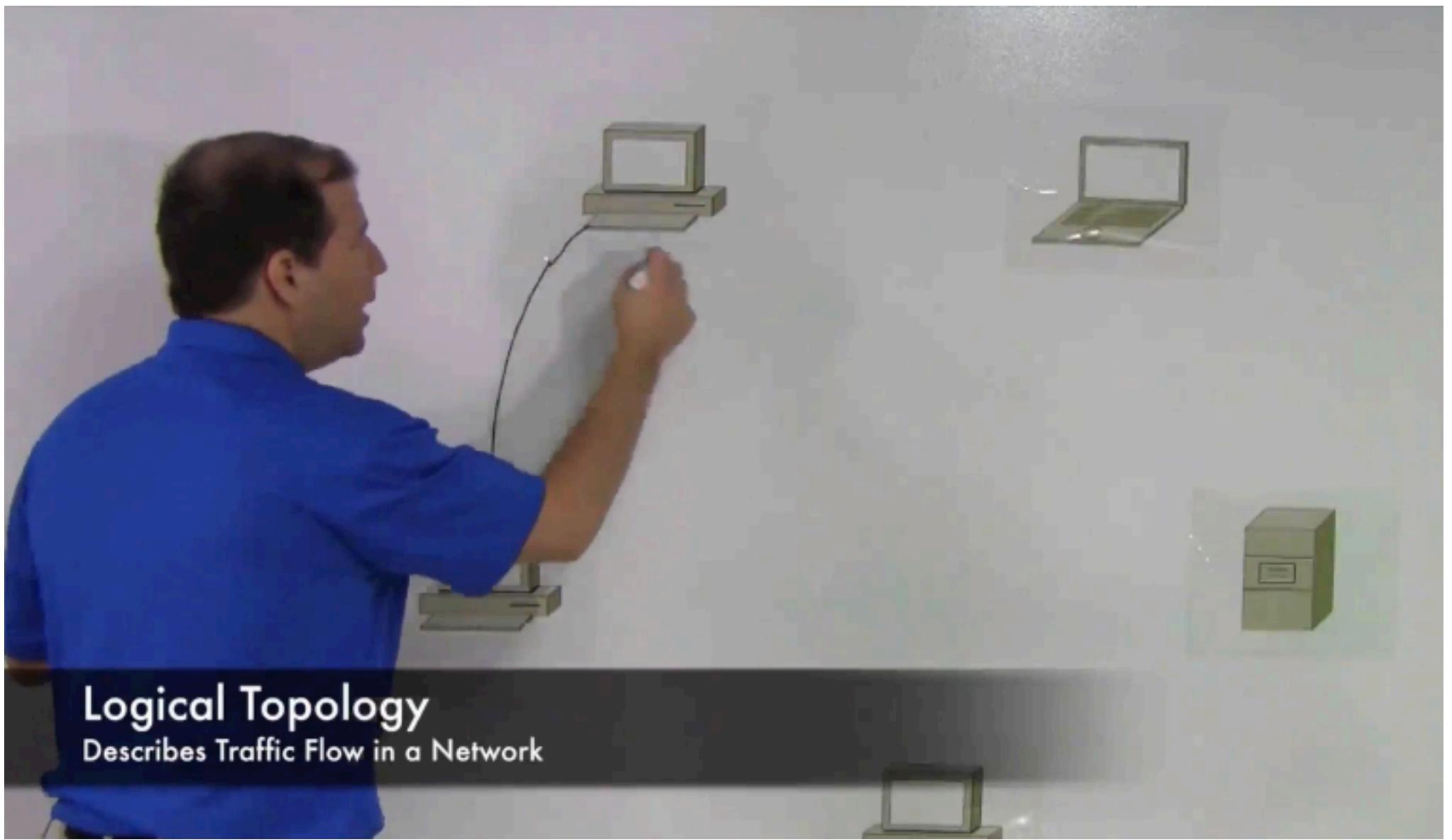
## Ring Topology

Interconnects Devices in a Circular Fashion

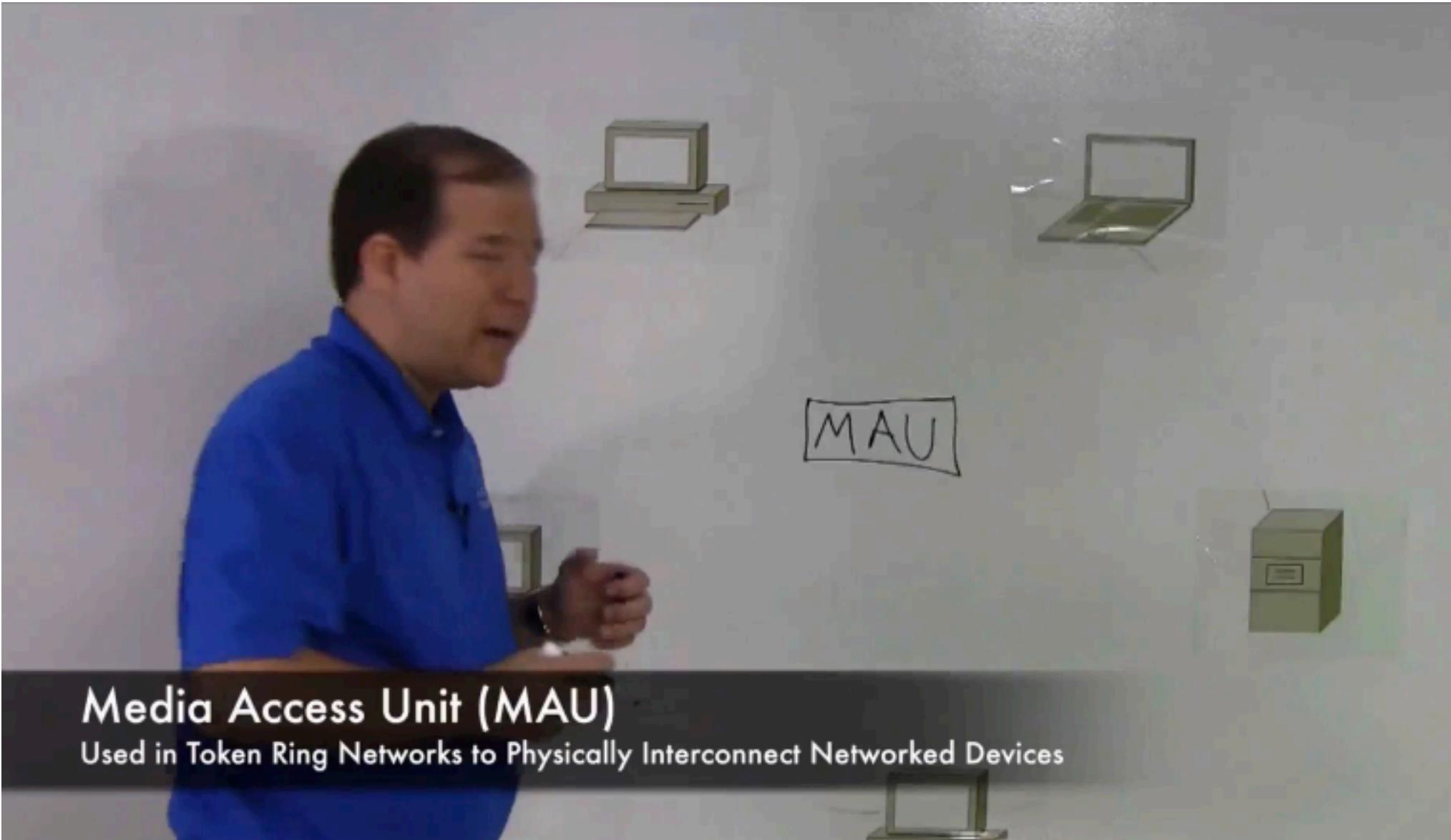


## Token Ring

Used a Ring Topology and Supported Speeds of 4 Mbps or 16 Mbps



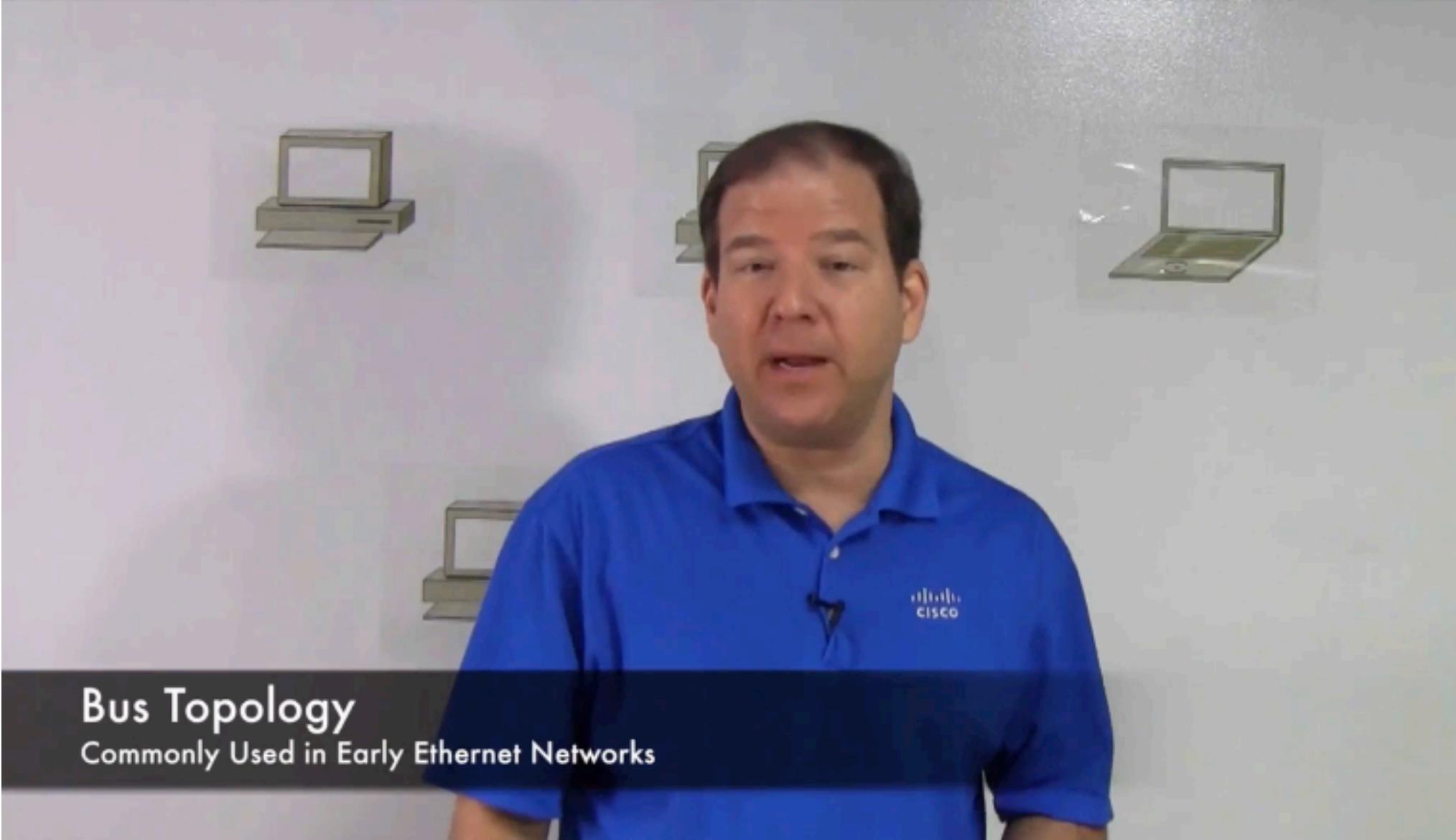
**Logical Topology**  
Describes Traffic Flow in a Network



## Media Access Unit (MAU)

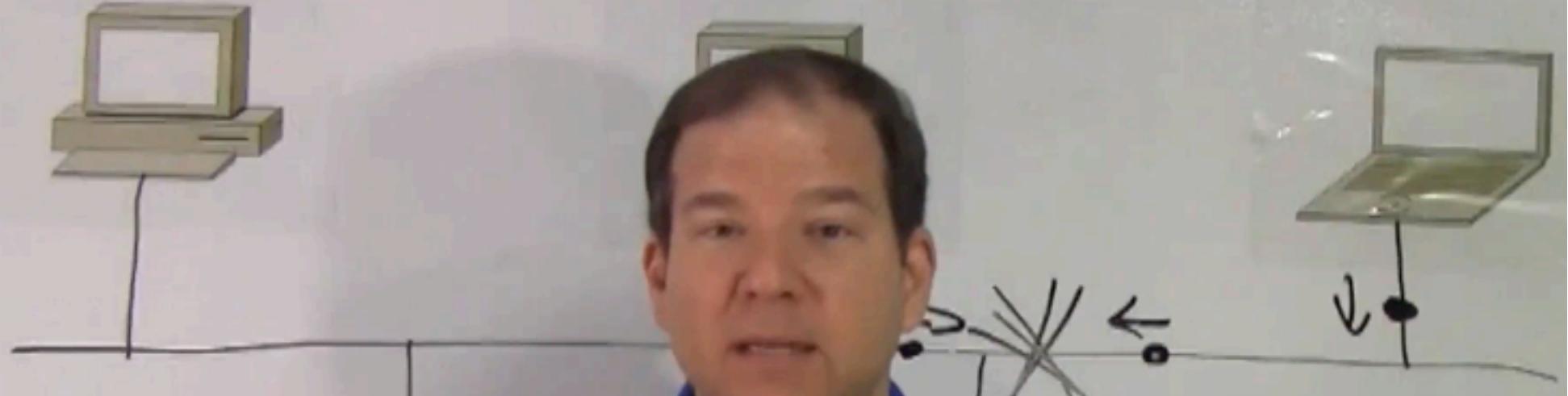
Used in Token Ring Networks to Physically Interconnect Networked Devices

Bus



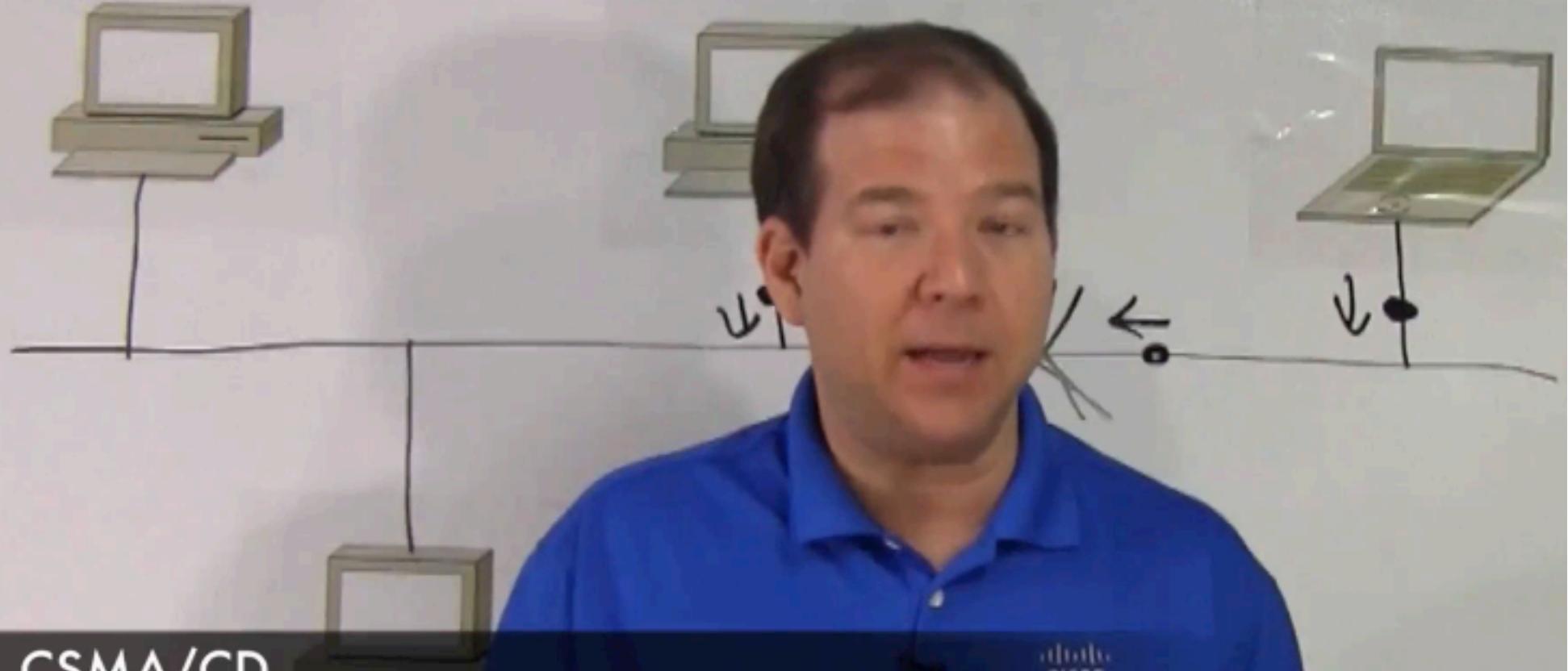
## Bus Topology

Commonly Used in Early Ethernet Networks



## Collision

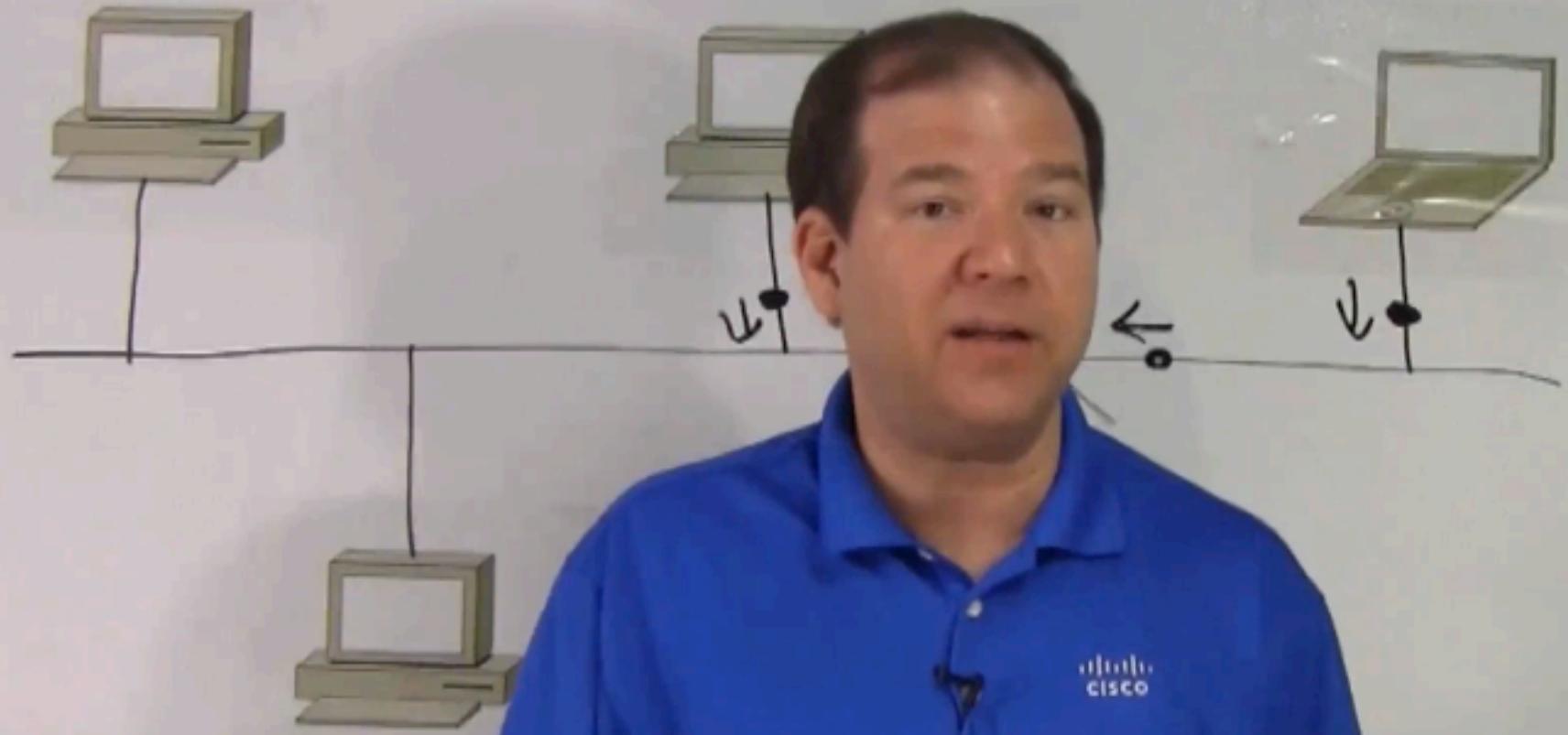
Occurs when Two Stations Simultaneously Transmit Data on a Network  
and Results in Data Corruption



## CSMA/CD

Carrier Sense Multiple Access with Collision Detection





## Bus Topology

Used in Early Ethernet Networks

Typical Speed: 10 Mbps

Distance Limitation: 185 m (10BASE2) or 500 m (10BASE5)

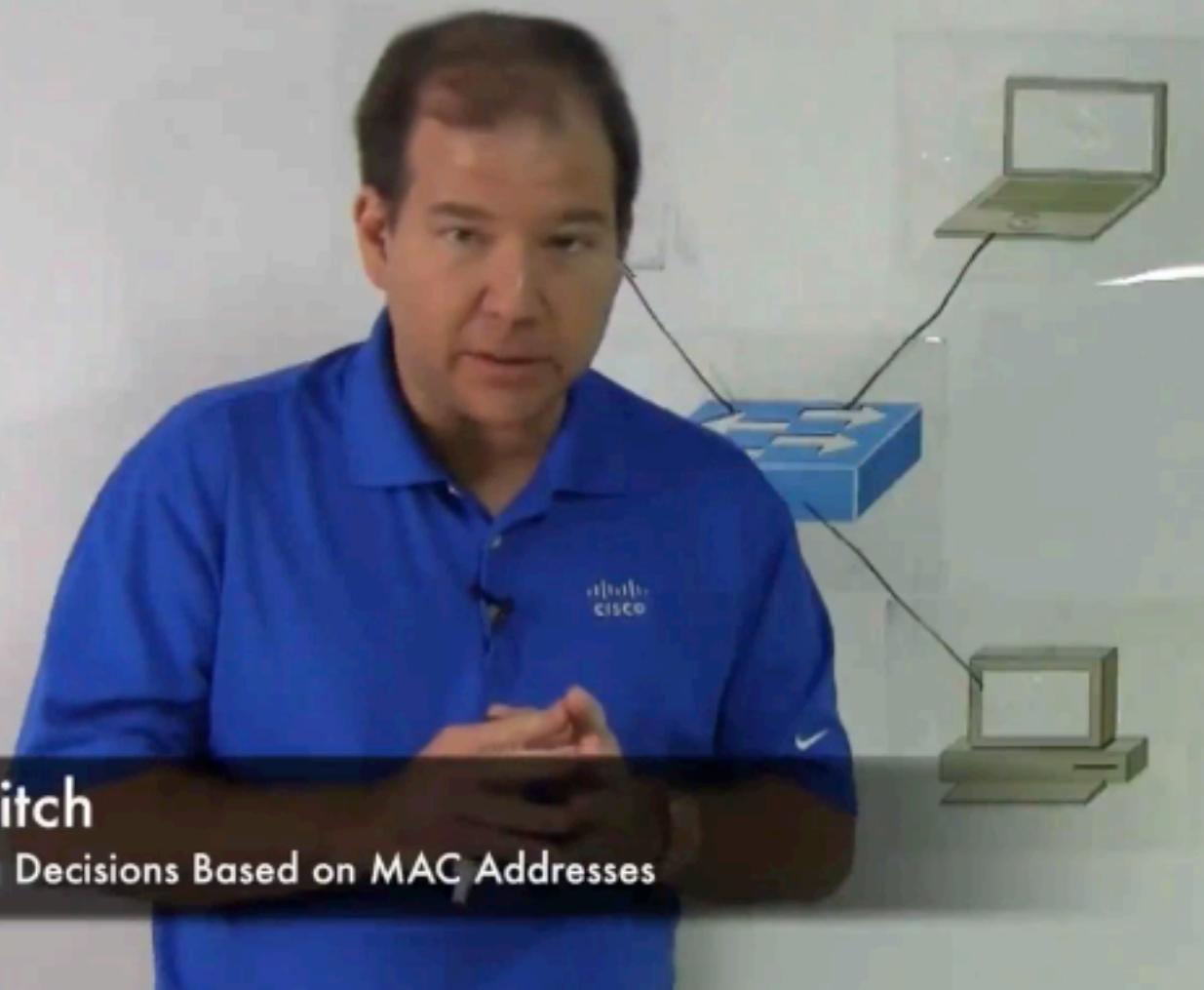
Star

## Star Topology

Devices Connect Back to a Centralized Device



**Ethernet Switch**  
Makes Forwarding Decisions Based on MAC Addresses



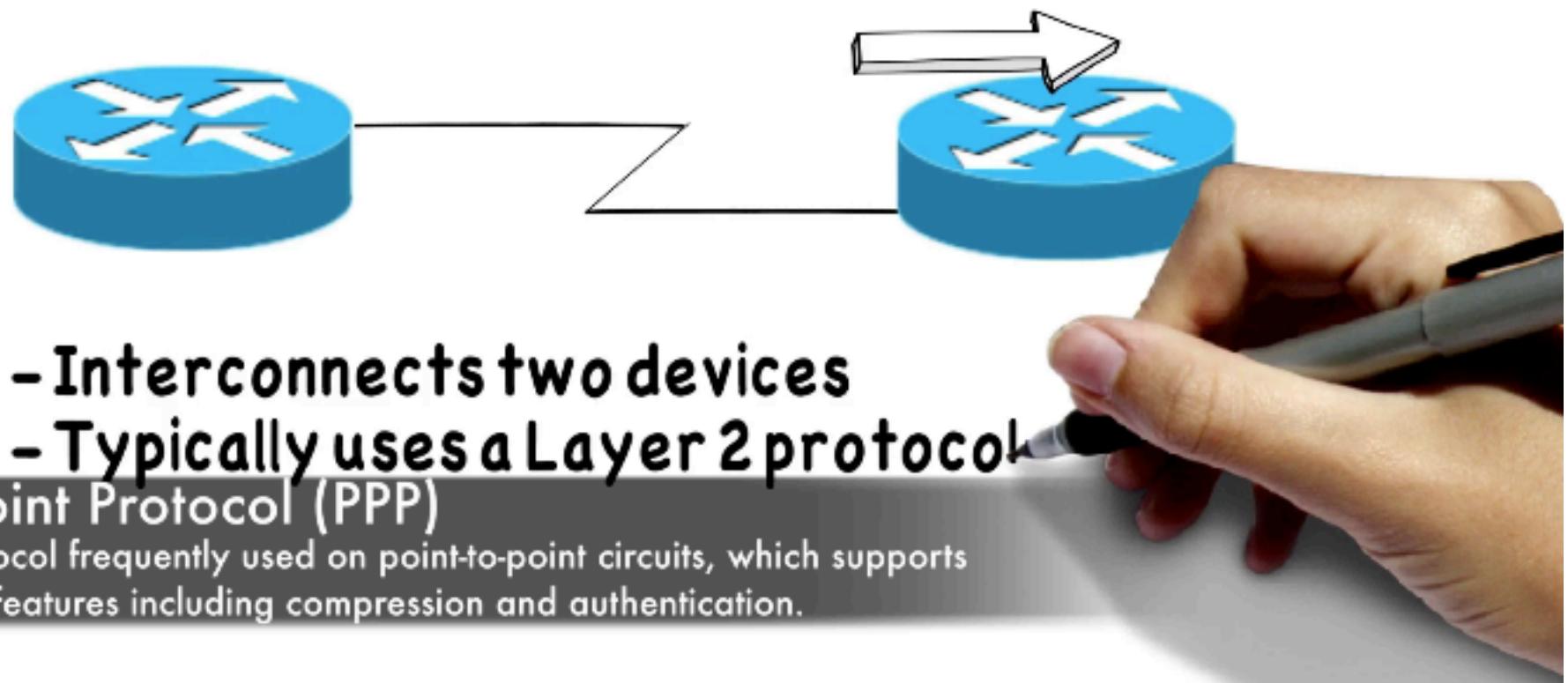


## Star Topology

If One Link Fails, Other Links Continue to Function  
The Centralized Device is a Single Point of Failure

# Point-to-Point

# Point-to-Point Networks

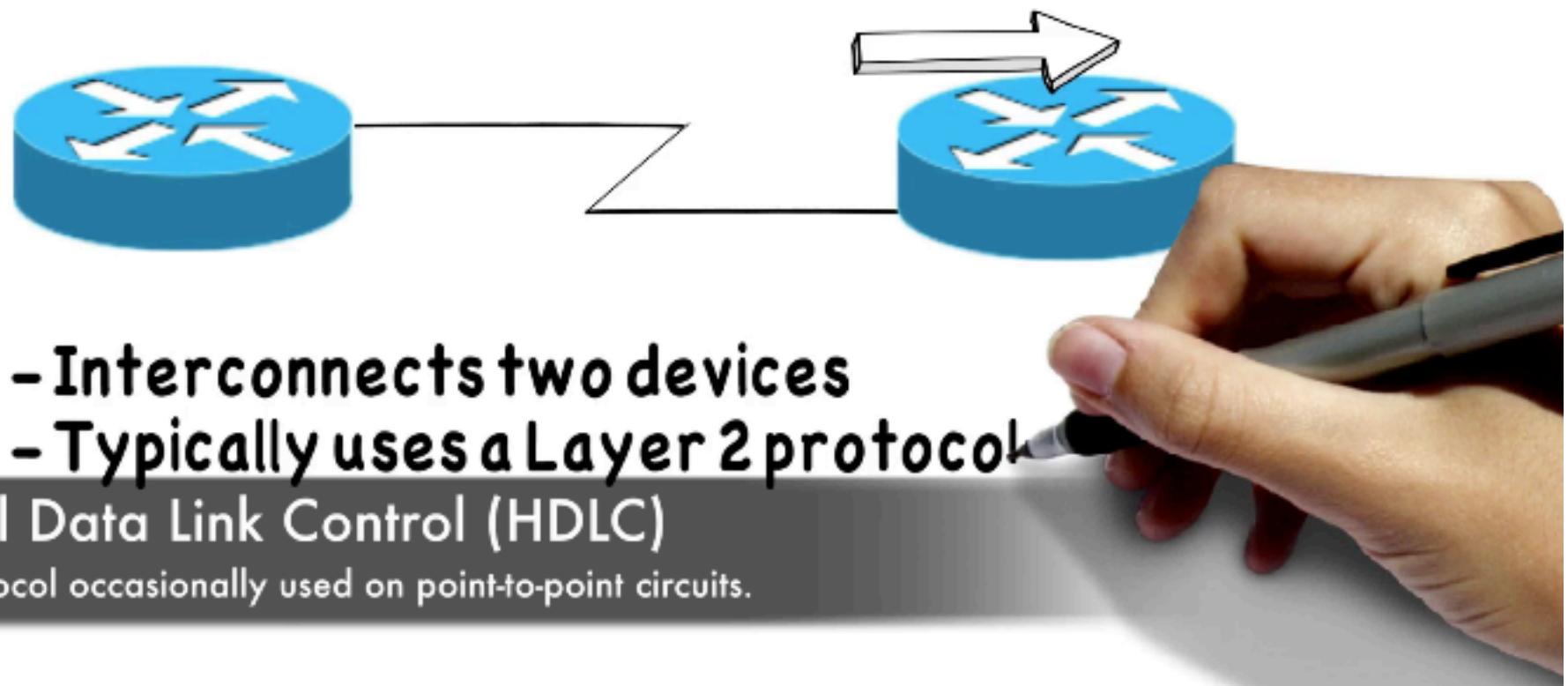


- Interconnects two devices
- Typically uses a Layer 2 protocol

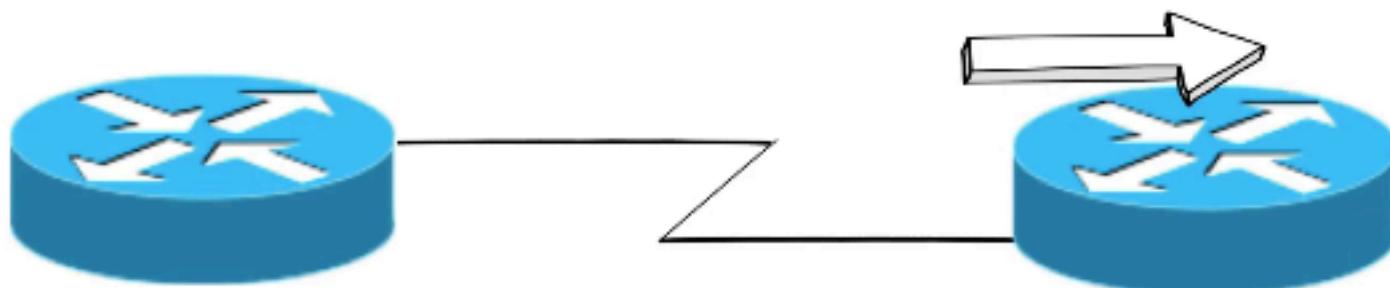
## Point-to-Point Protocol (PPP)

Layer 2 protocol frequently used on point-to-point circuits, which supports a collection of features including compression and authentication.

# Point-to-Point Networks

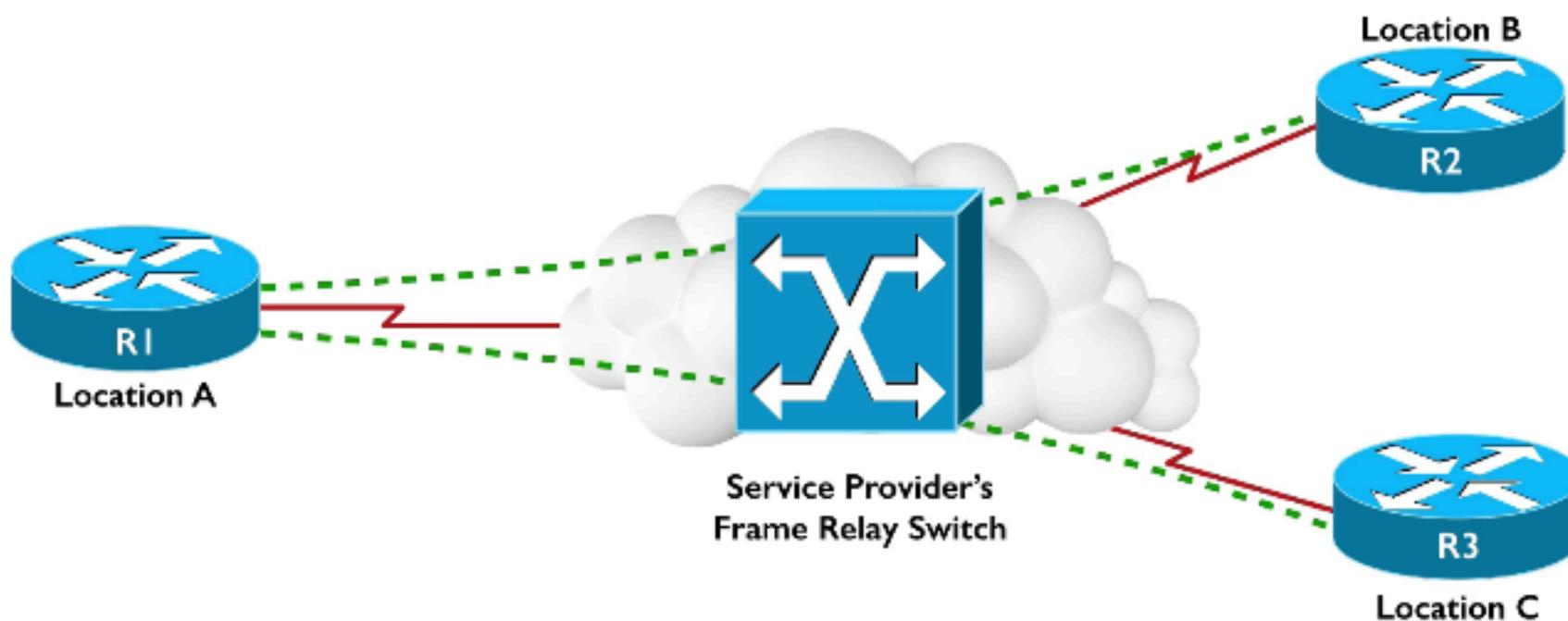


# Point-to-Point Networks

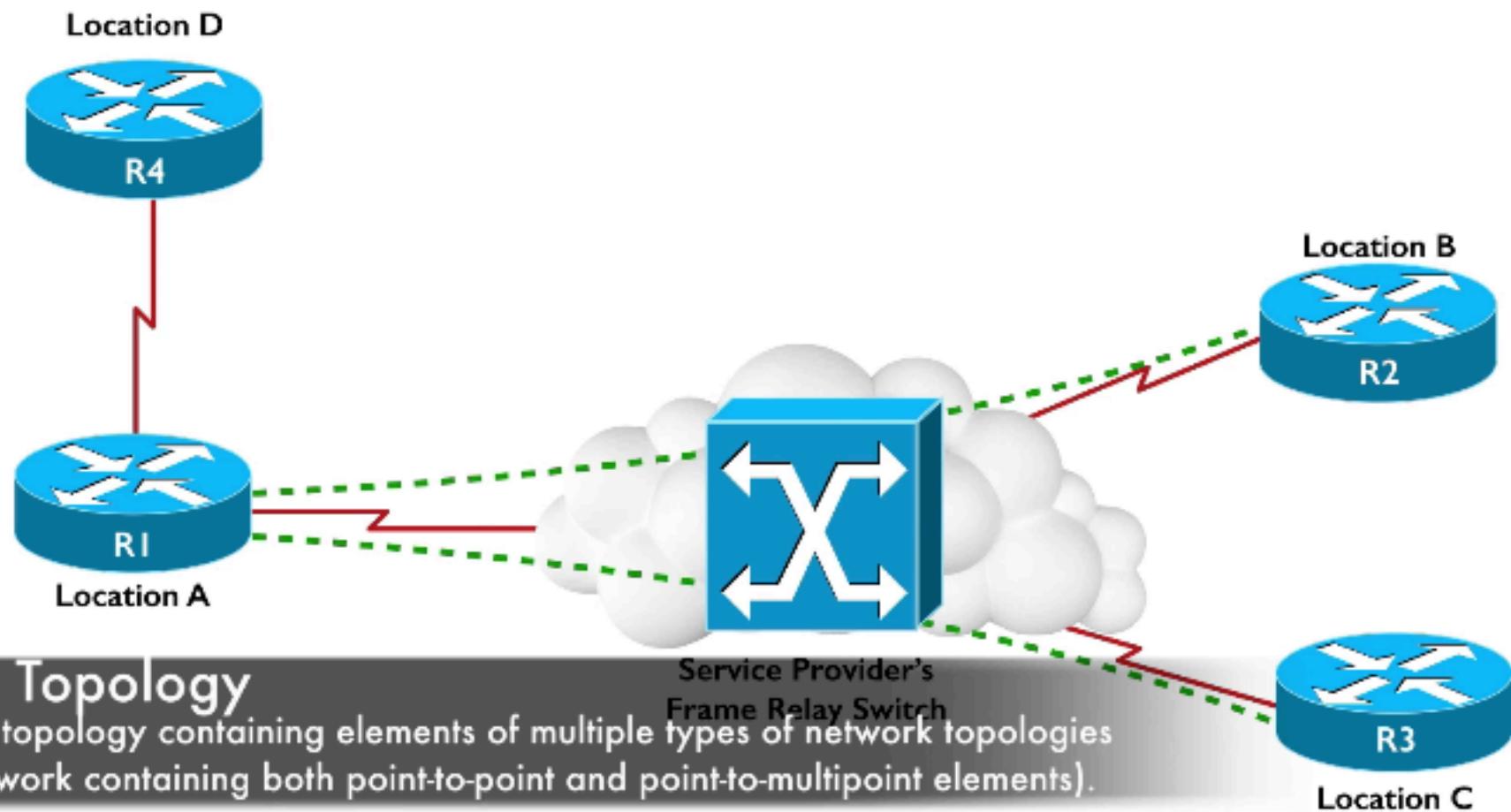


- Interconnects two devices
- Typically uses a Layer 2 protocol
- Could be a physical point-to-point connection
- Could be a logical point-to-point connection

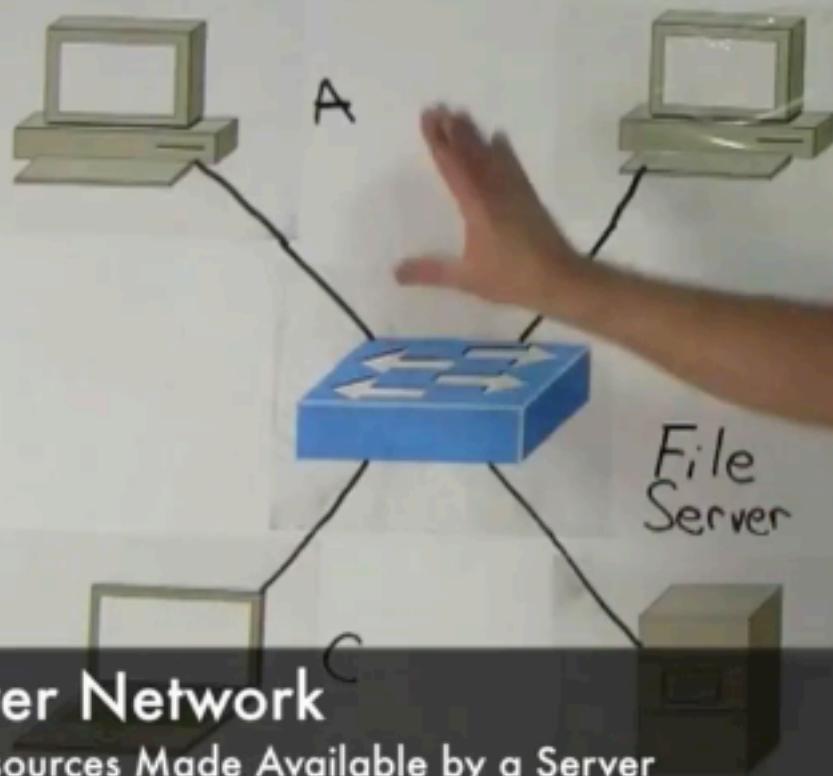
# Point-to-Multipoint



# Hybrid

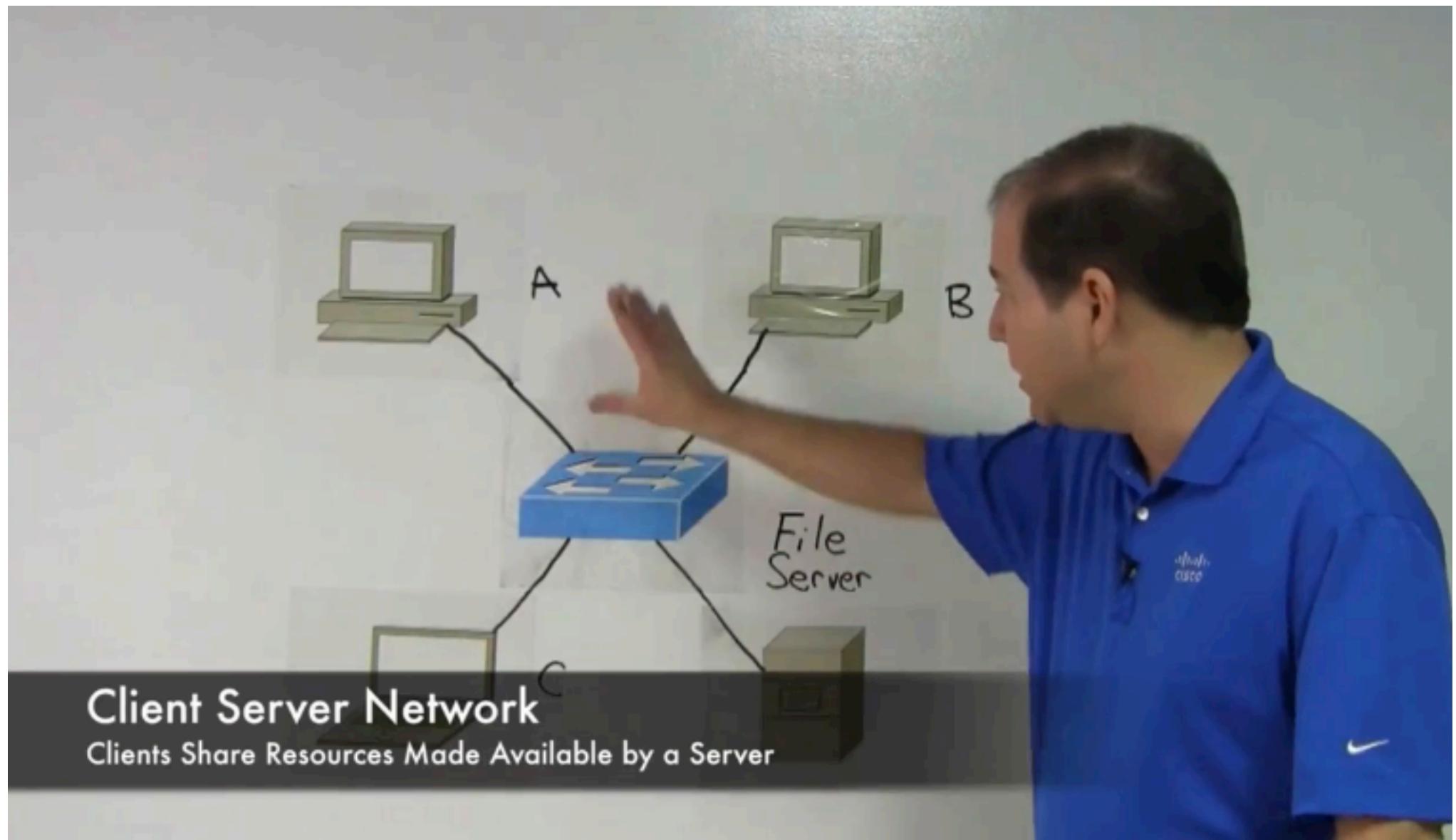


# Client-Server



## Client Server Network

Clients Share Resources Made Available by a Server





A



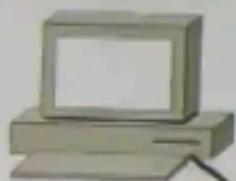
B

## Network Operating System (NOS)

Software that Enables a Computer to Act as a Server

## Client Server Network

Also Known as a Client Server Architecture  
Clients Access a Common Server  
The Server Shares Resources with Clients



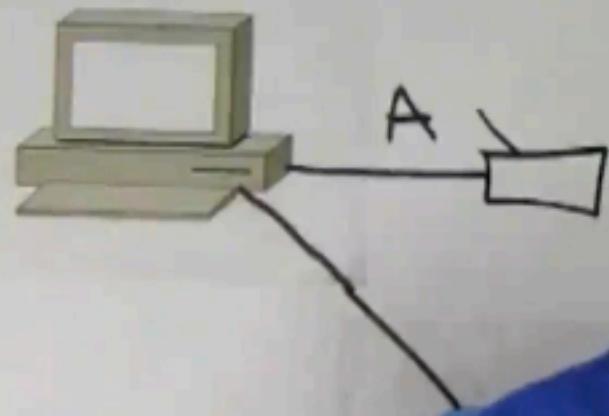
A



B

apple  
CISCO

# Peer-to-Peer



## Peer to Peer Network

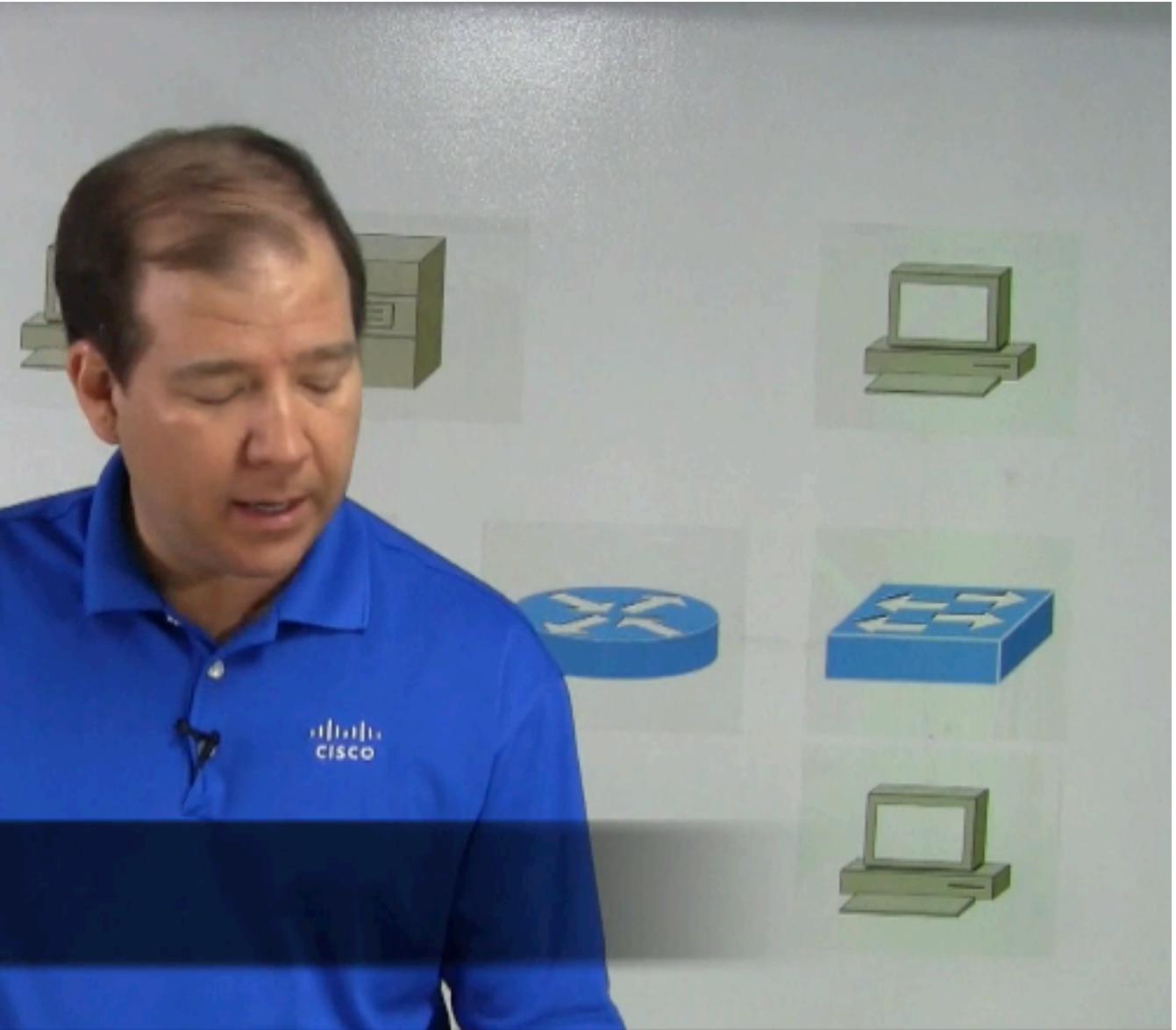
Also Known as a Peer to Peer Architecture  
Clients Share Resources (Printers and Files)  
Not as Robust as Using a Network Operating System

**LAN**

**LAN**  
Local Area Network



**Client**  
The End-User Device





**Ethernet Switch**  
Connects to Clients

CISCO



## File Server

A Computer with a Repository of Files Accessible by Clients



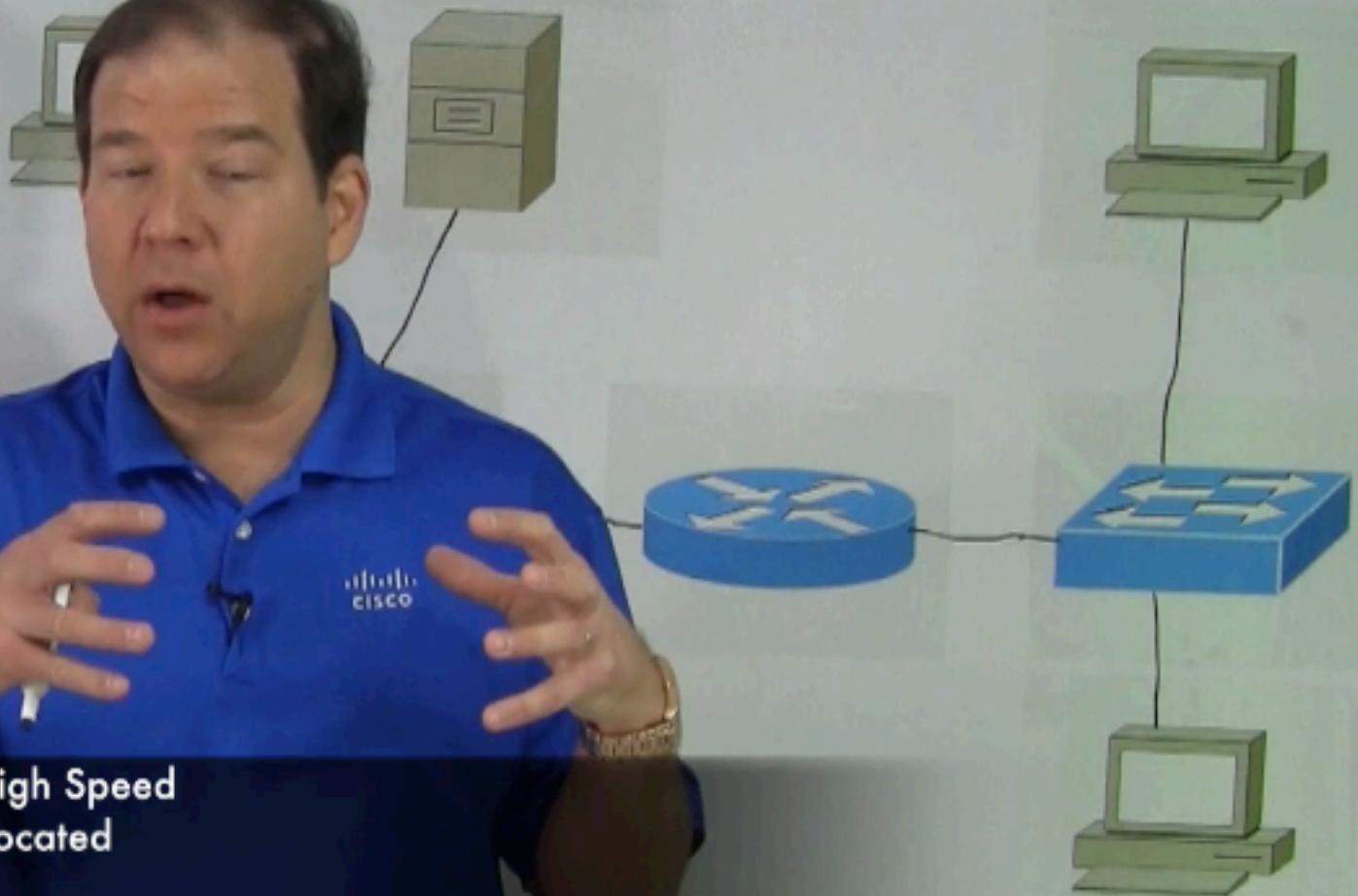
## Router

Interconnects Network Address Spaces

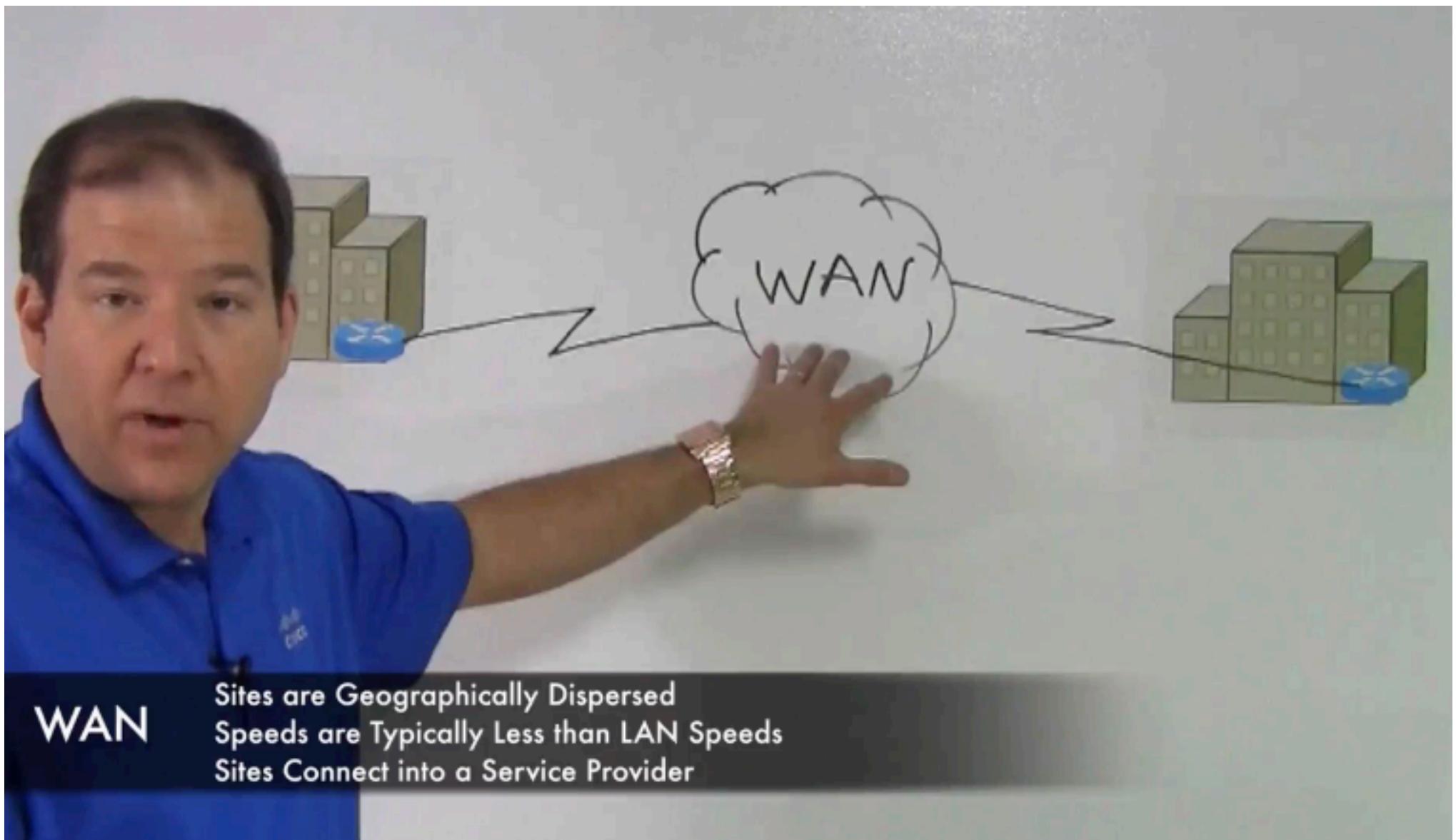


LAN

Typically High Speed  
Centrally Located



WAN



**WAN**

Sites are Geographically Dispersed  
Speeds are Typically Less than LAN Speeds  
Sites Connect into a Service Provider

MAN

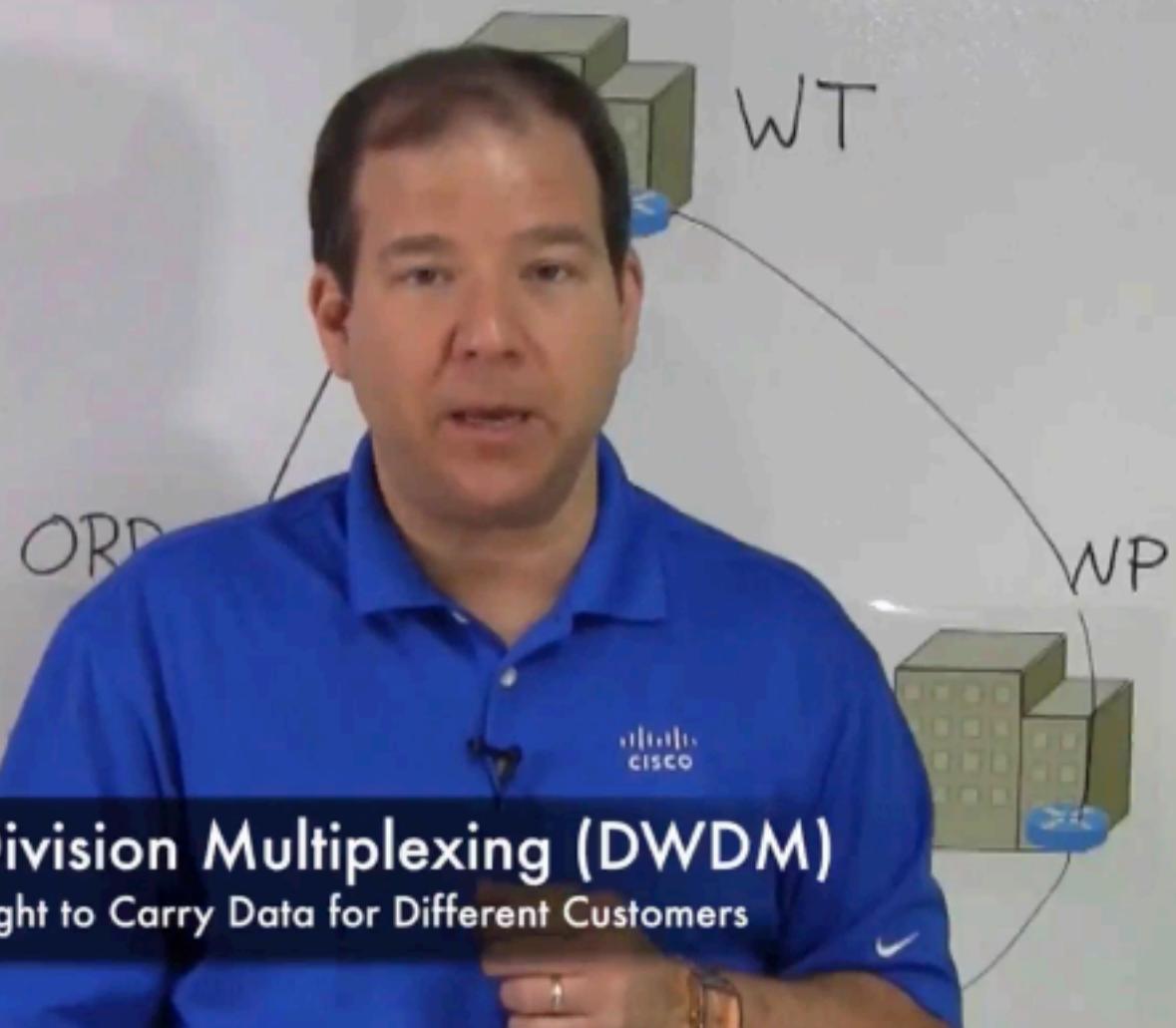


## Metropolitan Area Network (MAN)

Interconnects Office Locations in a Metropolitan Area

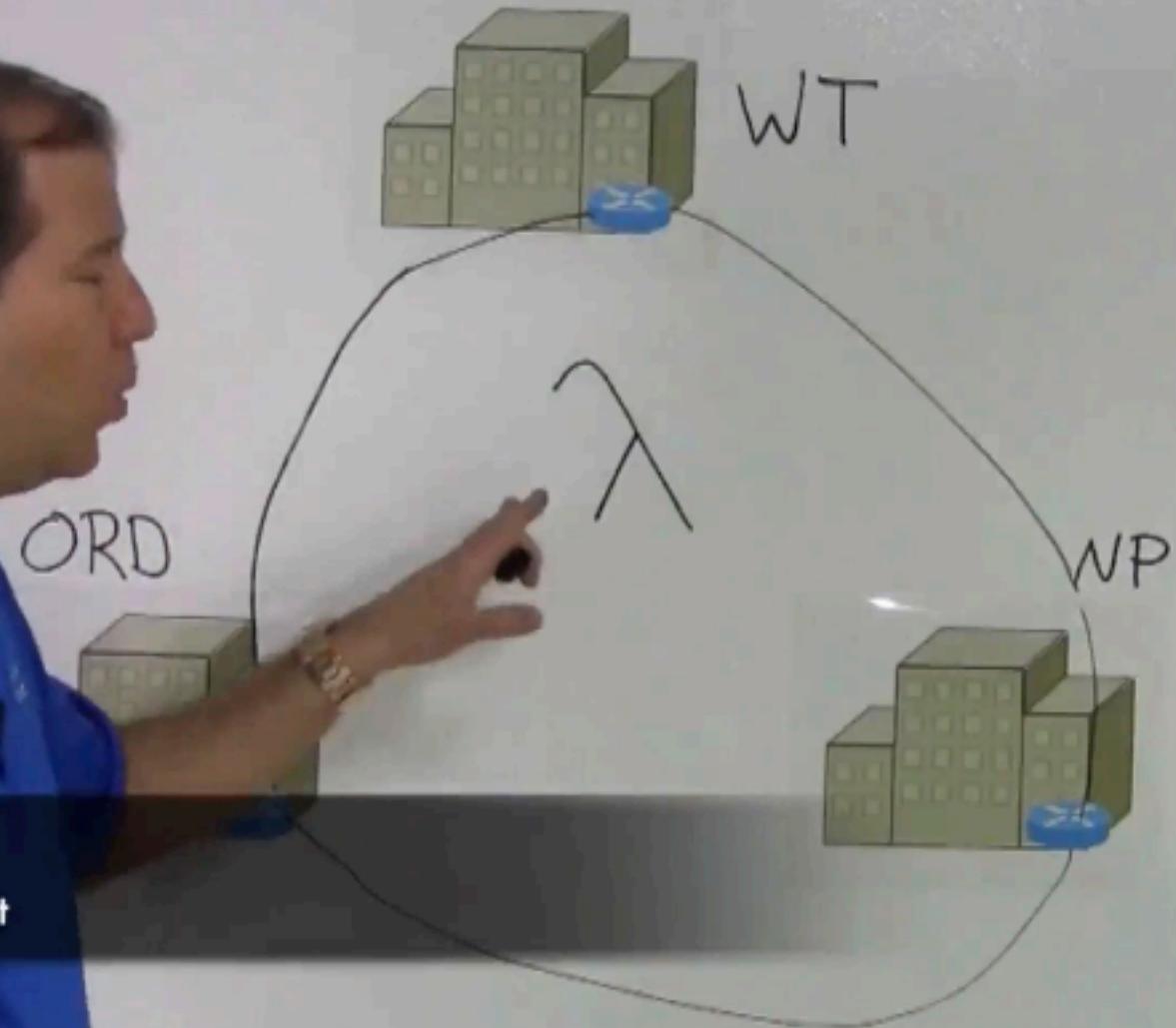
## Dense Wavelength Division Multiplexing (DWDM)

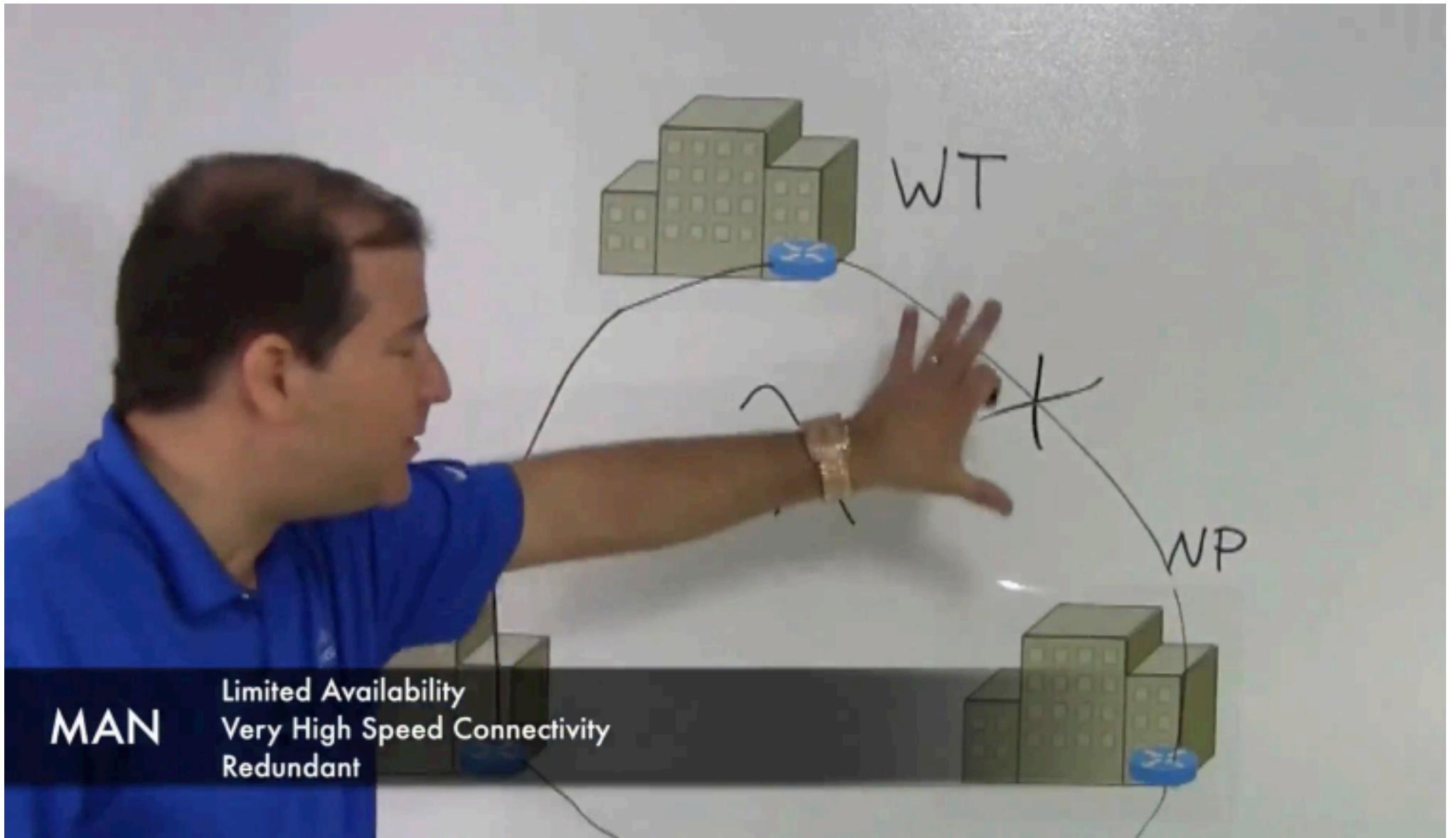
Uses Different Wavelengths of Light to Carry Data for Different Customers



**Lambda**

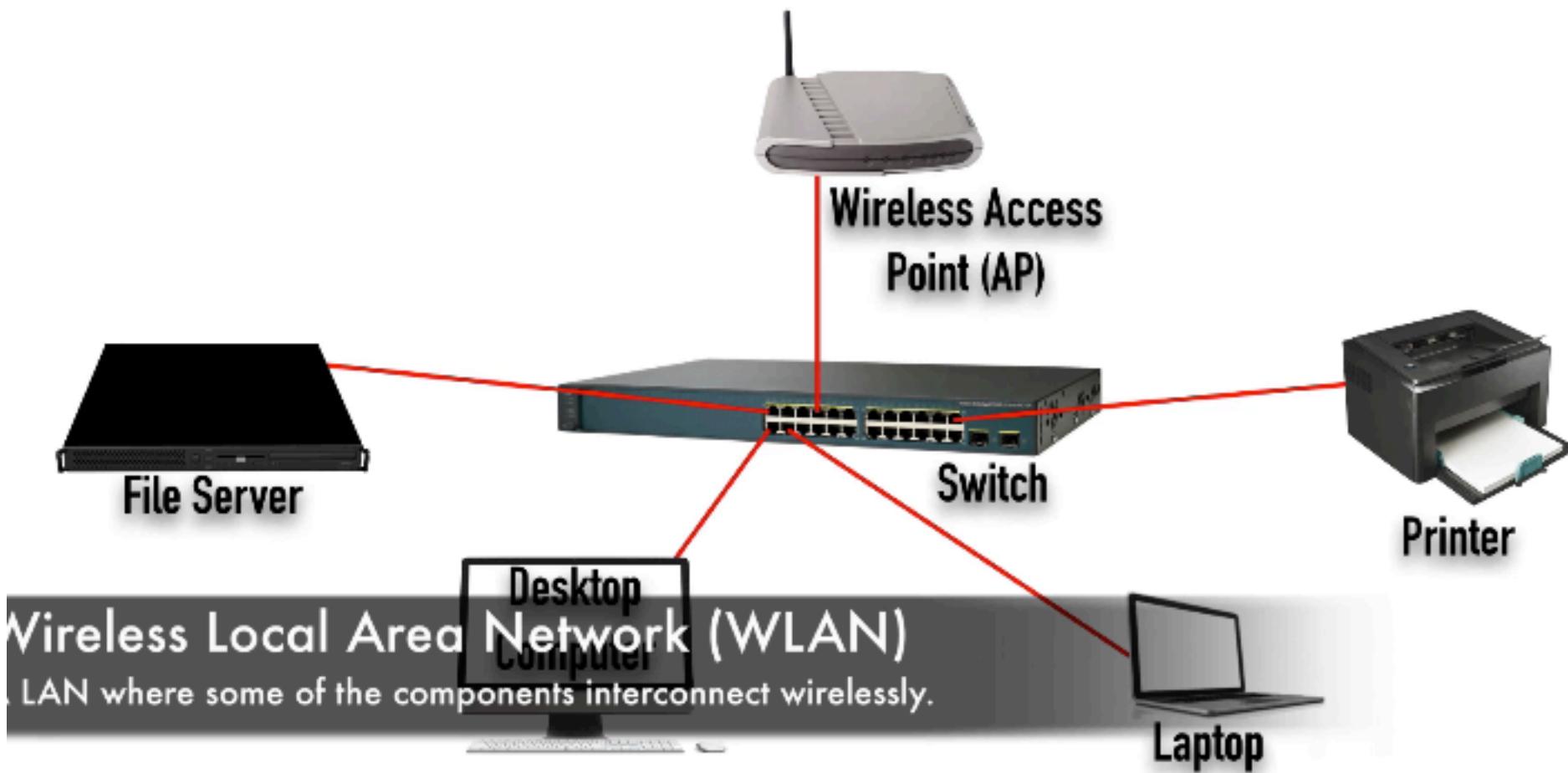
Represents a Wavelength of Light



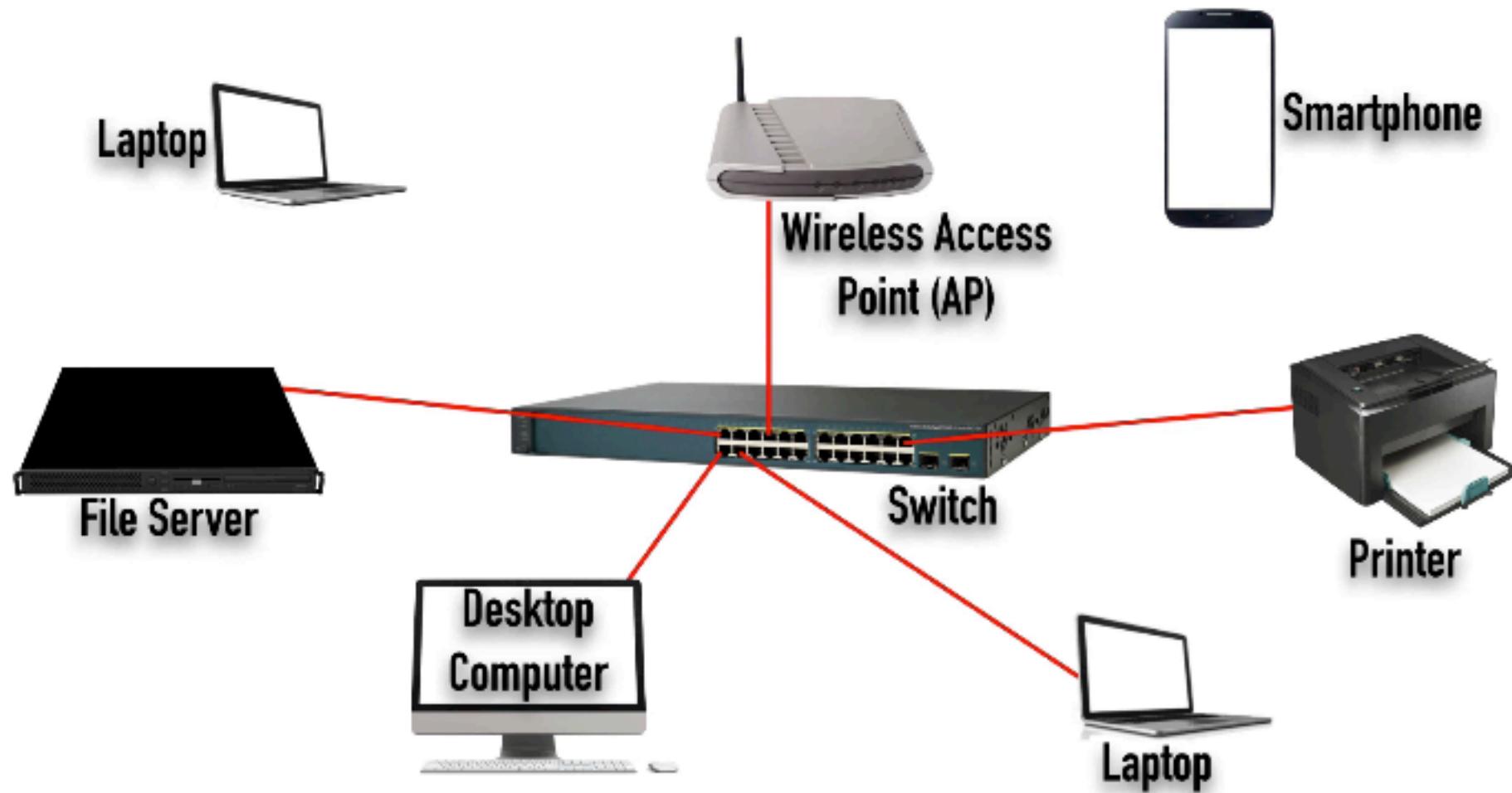


**WLAN**

# Wireless LAN (WLAN) with Wireless AP



# Wireless LAN (WLAN) with Wireless AP



# Wireless LAN (WLAN) with Wireless Router



# Wireless LAN (WLAN) with Wireless Router



PAN



A man with short brown hair, wearing a blue polo shirt with the Cisco logo on the chest, is speaking. He is positioned in front of a light-colored wall.

## Personal Area Network (PAN)

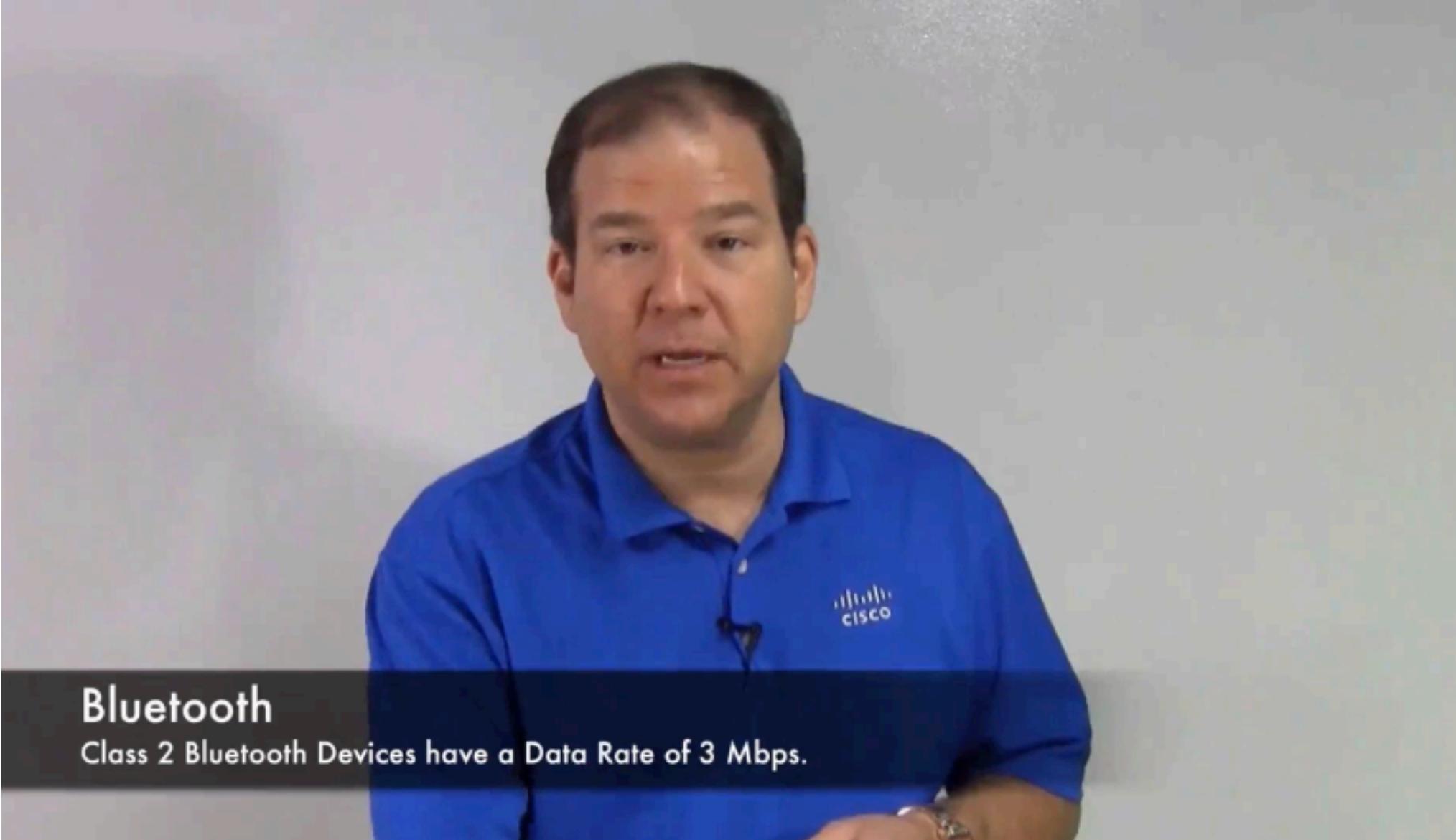
Interconnects Two Devices



A man with short brown hair, wearing a blue polo shirt with the Cisco logo on the chest, is looking down at a white, rectangular Bluetooth device he is holding in his hands. He appears to be speaking or explaining something about the device.

## Bluetooth

Class 2 Bluetooth Devices have a Distance Limitation of 10 meters.



A man with short brown hair, wearing a blue polo shirt with the Cisco logo on the chest, is speaking directly to the camera. He is positioned in front of a plain, light-colored wall.

## Bluetooth

Class 2 Bluetooth Devices have a Data Rate of 3 Mbps.

PAN

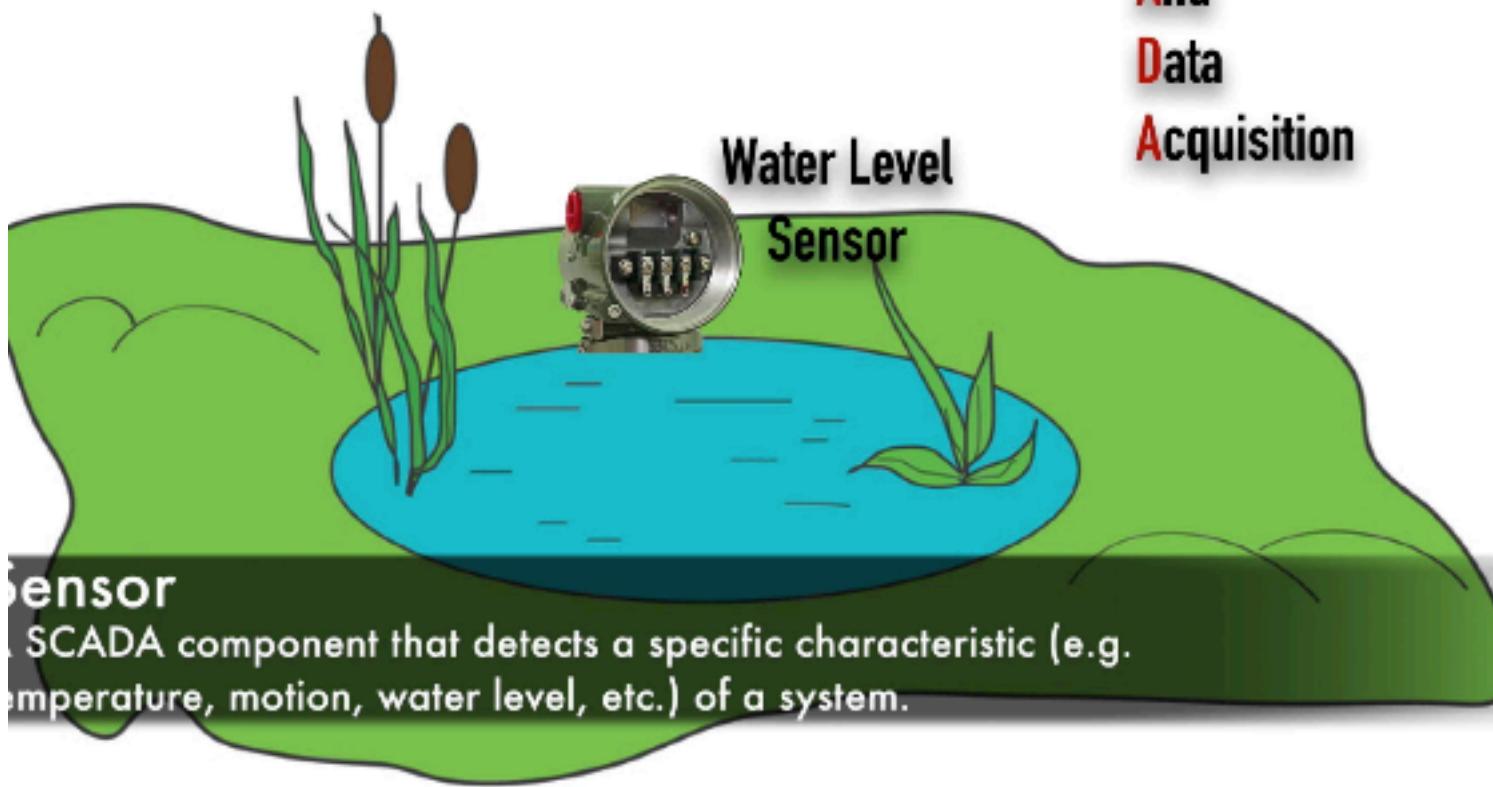
Interconnects Two Devices  
Limited Distance  
Limited Throughput



**SCADA**

# SCADA Fundamentals

**S**upervisory  
**C**ontrol  
**A**nd  
**D**ata  
**A**cquisition

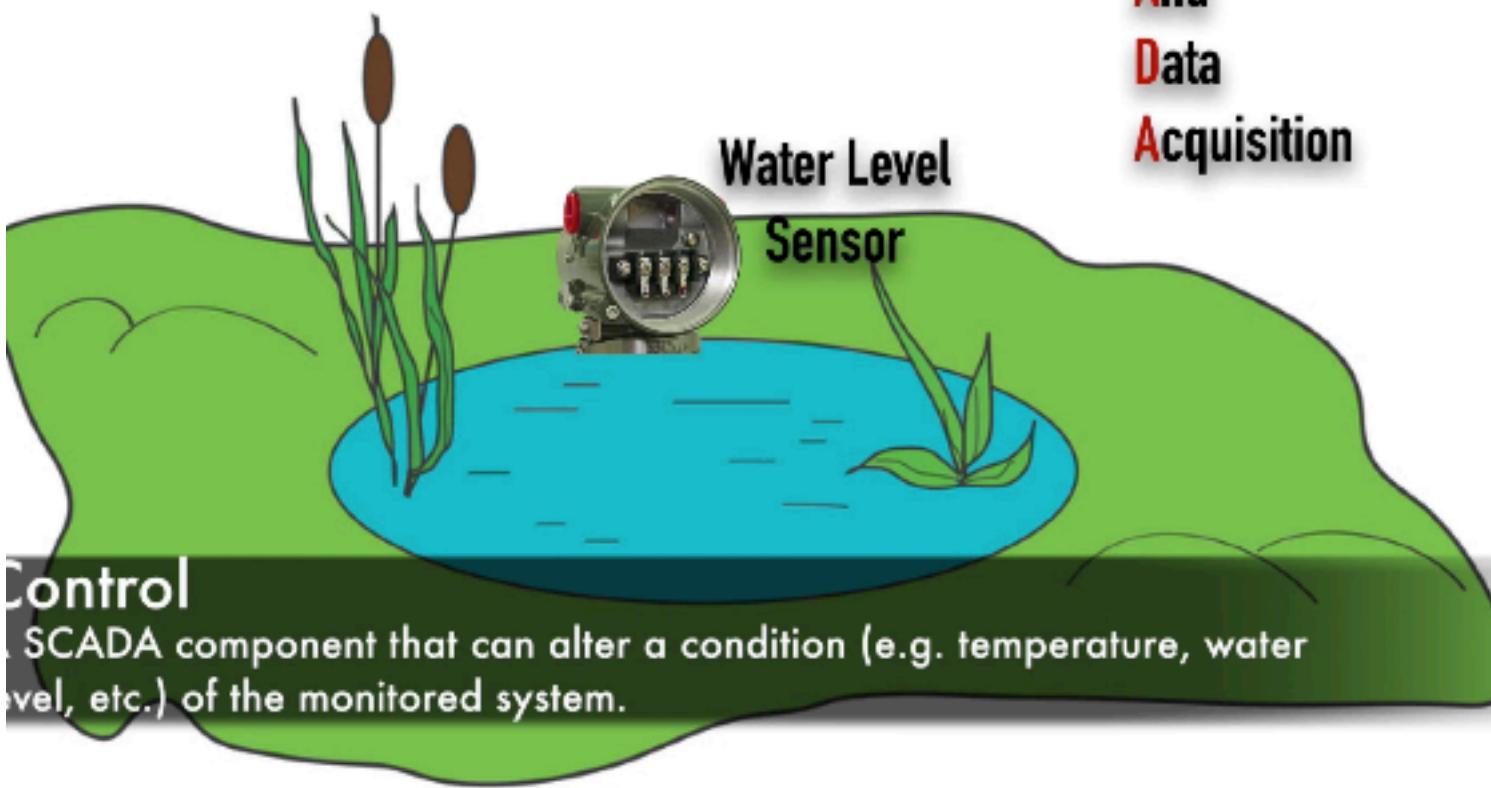


## Sensor

SCADA component that detects a specific characteristic (e.g. temperature, motion, water level, etc.) of a system.

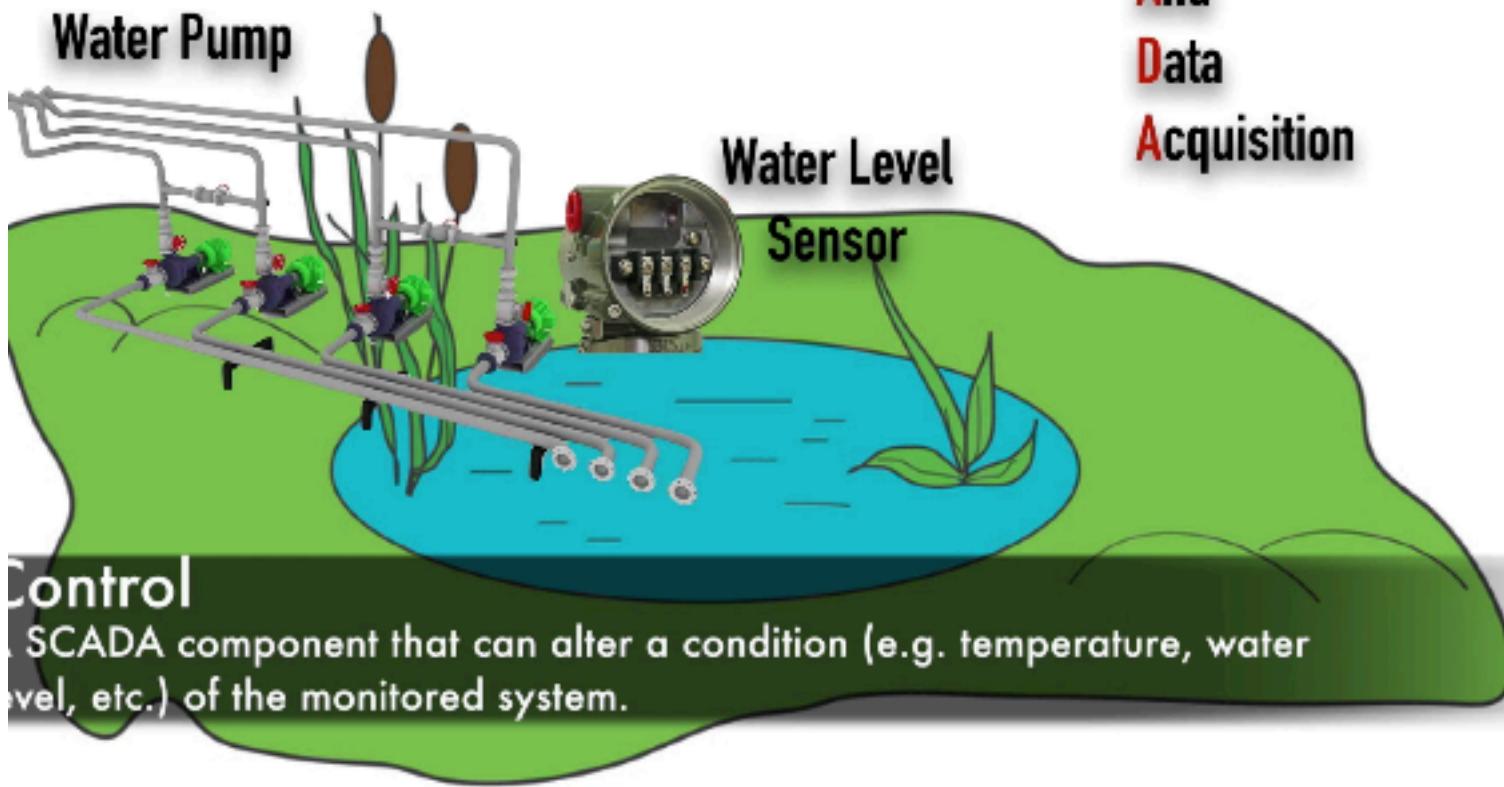
# SCADA Fundamentals

Supervisory  
Control  
And  
Data  
Acquisition



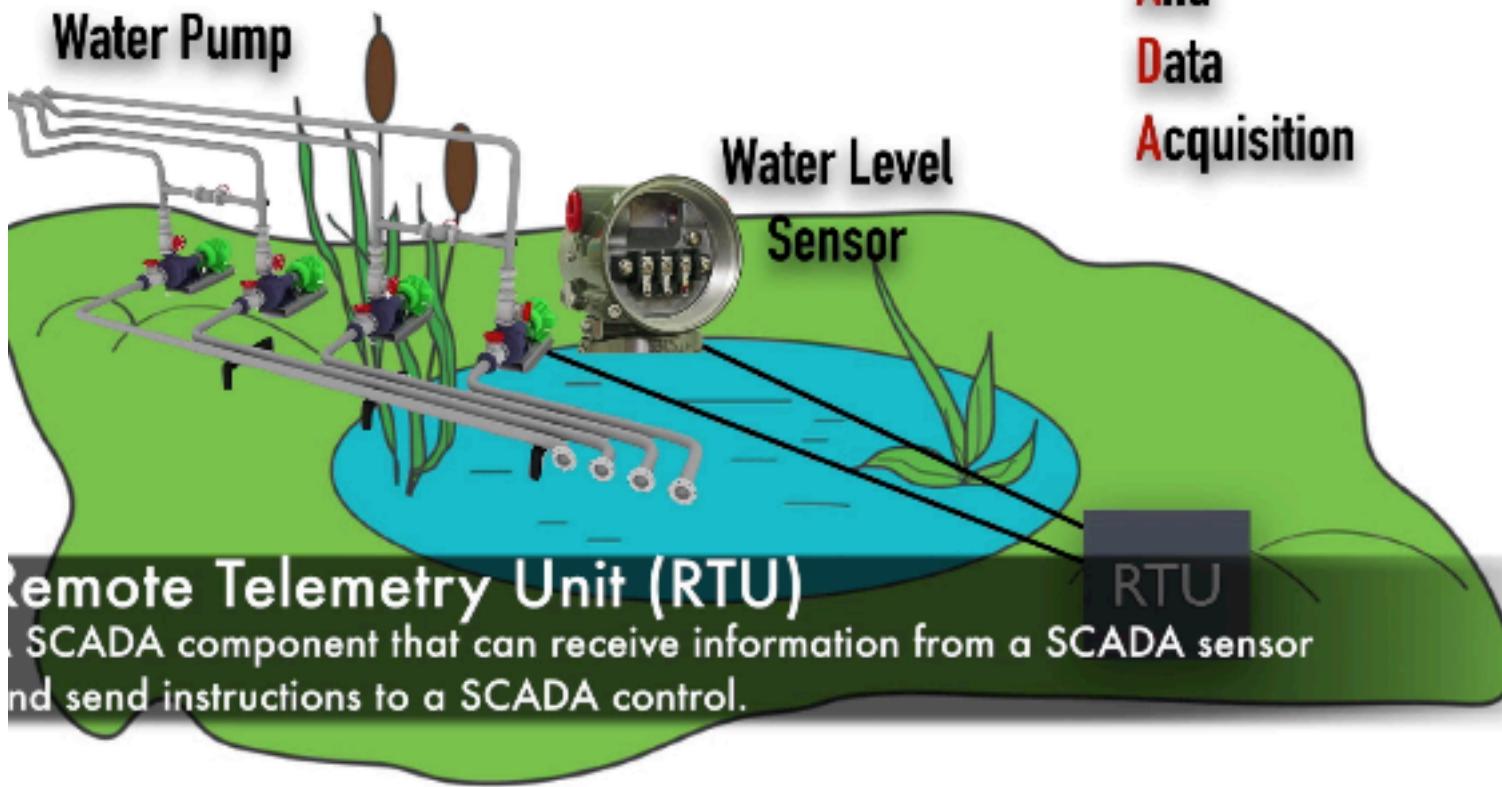
# SCADA Fundamentals

Supervisory  
Control  
And  
Data  
Acquisition



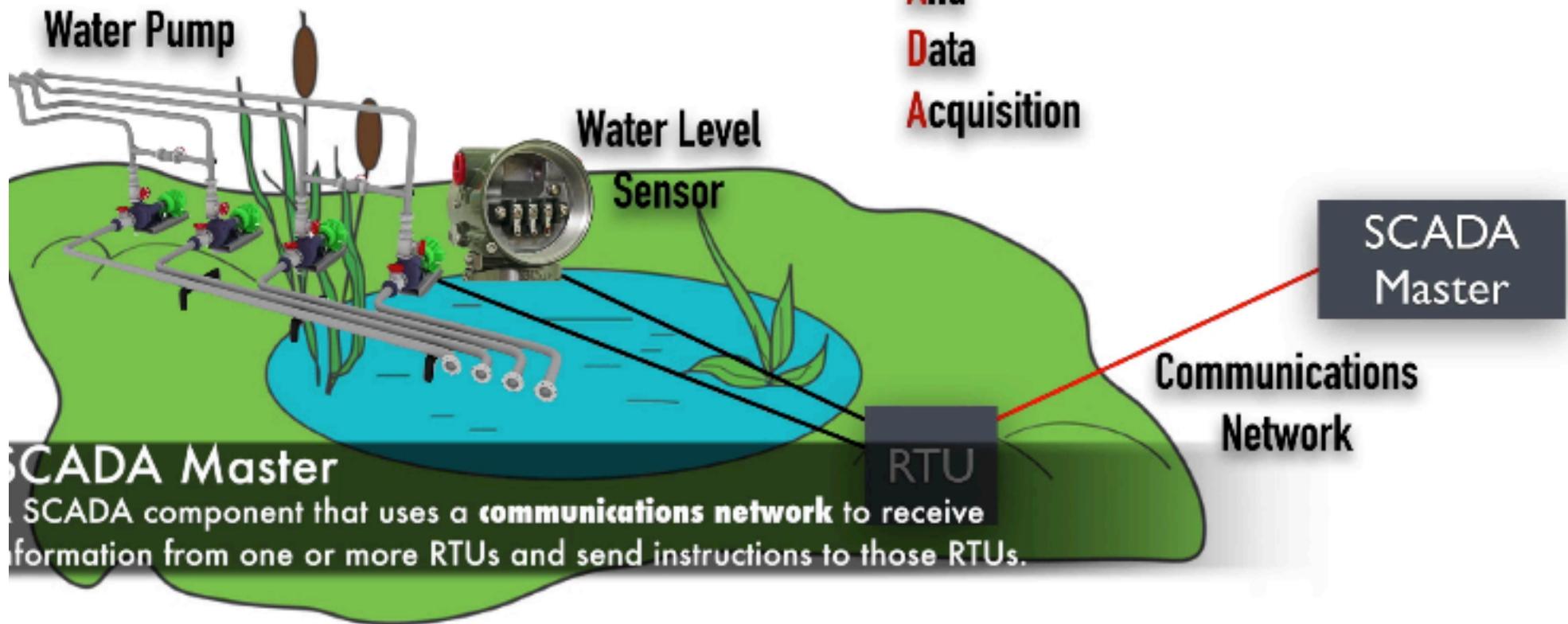
# SCADA Fundamentals

Supervisory  
Control  
And  
Data  
Acquisition

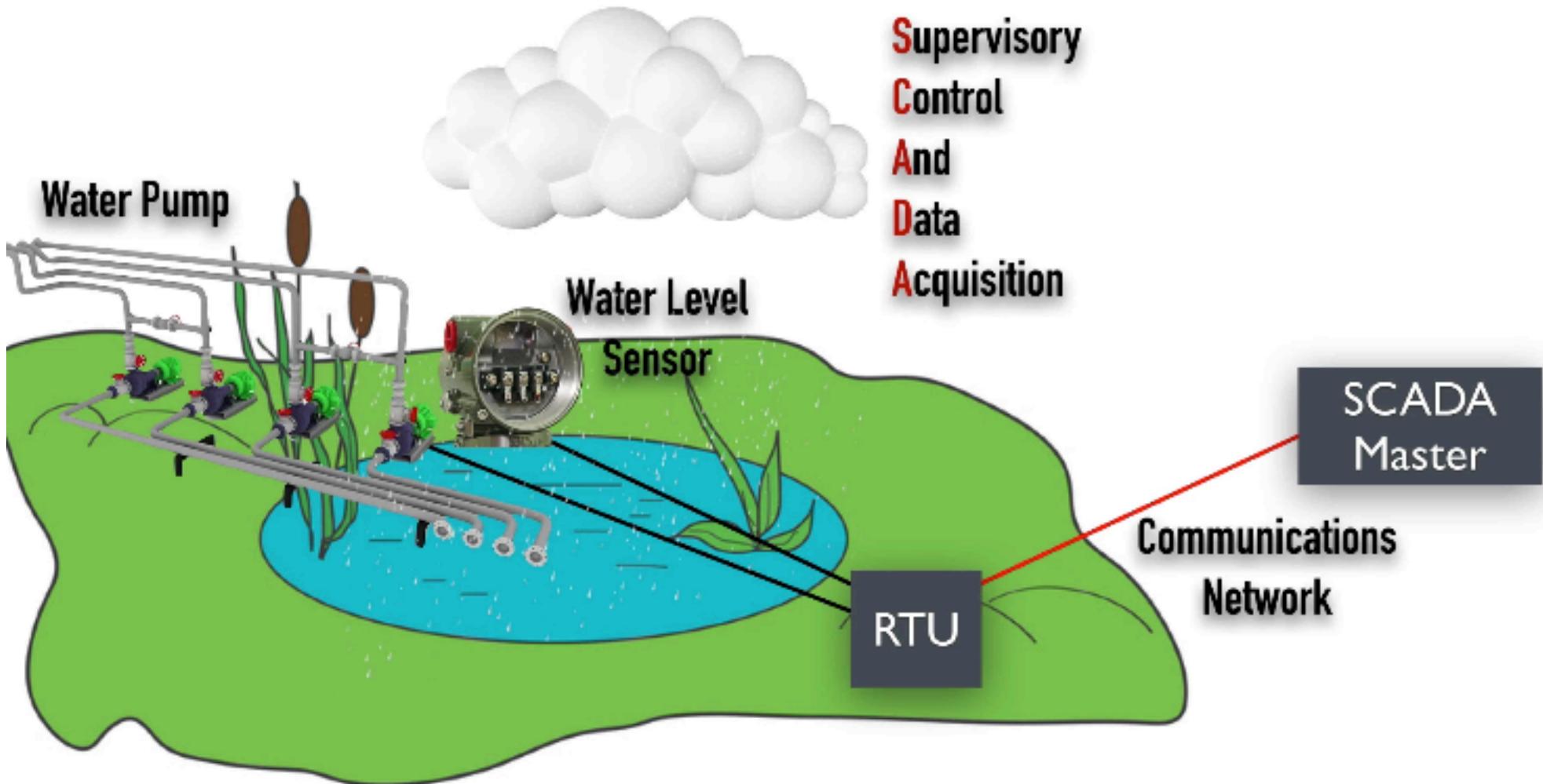


# SCADA Fundamentals

Supervisory  
Control  
And  
Data  
Acquisition



# SCADA Fundamentals



# **Module 3: Review**