

# Microsoft® Official Course



Module4

Connecting Network Components

**Microsoft®**

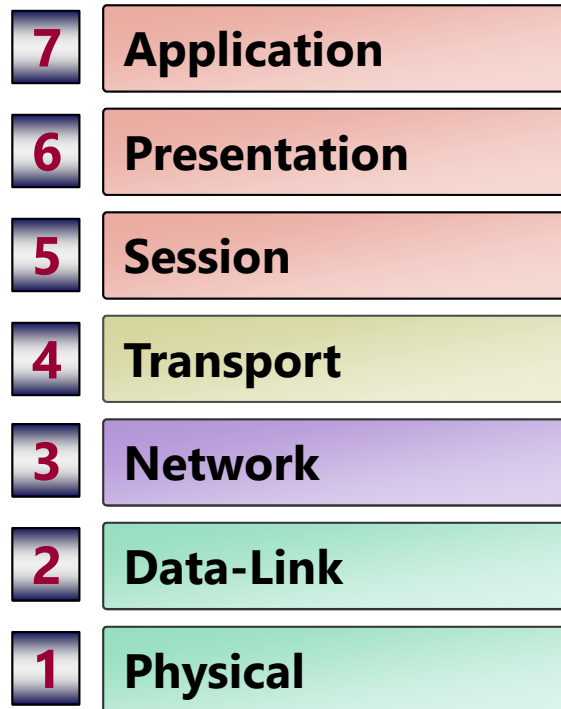
# Module Overview

- Understanding the Open Systems Interconnection Reference Model
- Understanding Media Types
- Understanding Adapters, Hubs, and Switches
- Understanding Routing

# Lesson 1: Understanding the Open Systems Interconnection Reference Model

- The OSI Model
- The Lower Layers of the OSI Model
- The Middle Layers of the OSI Model
- The Upper Layers of the OSI Model

# The OSI Model



- The OSI model defines the generic tasks that are performed for network communication
- Each layer defines networking tasks
- Each layer communicates with the layers above and below it
- Layer 7 provides services for programs to gain access to the network
- Layers 1 and 2 define the network's physical media and related task

# The Lower Layers of the OSI Model

- The lower layers of the OSI model are responsible for encapsulating requests from the upper layers into a meaningful structure

OSI Layer	Functions
Data-link layer	<ul style="list-style-type: none"><li>• Transferring data between devices</li><li>• Managing MAC addressing</li><li>• Encapsulating higher protocols into frames</li><li>• Passing protocol-specific data up the stack</li><li>• Error checking</li></ul>
Physical layer	<ul style="list-style-type: none"><li>• Managing connections to the media</li><li>• Managing shared media access</li><li>• Merging data onto the media</li><li>• Converting signals on the media into frames</li></ul>

# The Middle Layers of the OSI Model

- These layers are often referred to as the network protocol layer

OSI Layer	Functions
Transport layer	<ul style="list-style-type: none"><li>• Transferring data between applications</li><li>• Providing reliable end-to-end transfer</li><li>• Encapsulating application requests</li><li>• Passing incoming datagrams to the appropriate session layer protocol</li></ul>
Network layer	<ul style="list-style-type: none"><li>• Implementing a logical addressing scheme</li><li>• Routing packets to the appropriate logical address</li><li>• Encapsulating transport layer datagrams</li><li>• Passing incoming packets up the protocol stack</li></ul>

# The Upper Layers of the OSI Model

- These upper layers are occupied by network applications, or services

OSI Layer	Functions
Application layer	<ul style="list-style-type: none"><li>• Identifying network hosts</li><li>• Determining available resources</li><li>• Synchronizing communications</li></ul>
Presentation layer	<ul style="list-style-type: none"><li>• Formatting and encrypting data</li><li>• Providing compatibility by selecting appropriate syntax</li></ul>
Session layer	<ul style="list-style-type: none"><li>• Establishing, maintaining, and terminating sessions</li><li>• Selecting the appropriate transport layer protocol</li></ul>

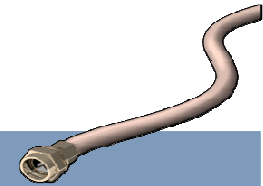
## Lesson 2: Understanding Media Types

- Coaxial Cable
- Twisted-Pair Cable
- Fiber-Optic Cable
- Discussion: What Cabling Strategy Would You Use?



# Coaxial Cable

- Coaxial cables must be terminated



Coaxial Cable Types	Impedance	Key Points
RG58	50	<ul style="list-style-type: none"><li>• Approx 20 AWG, thin and flexible</li><li>• Loses signal over long distances</li></ul>
RG8	50	<ul style="list-style-type: none"><li>• Approx 16 AWG, thicker than RG58</li><li>• Less signal loss than RG58 over distance</li></ul>
RG59	75	<ul style="list-style-type: none"><li>• Approx 20 AWG, thinner than RG6</li><li>• Can suffer signal loss over distance</li></ul>
RG11	75	<ul style="list-style-type: none"><li>• Approx 14 AWG, thick and not flexible</li><li>• Most expensive in this list</li></ul>
RG6	75	<ul style="list-style-type: none"><li>• Approx 18 AWG, flexible</li><li>• Supports higher frequencies than RG59</li></ul>

# Twisted-Pair Cable

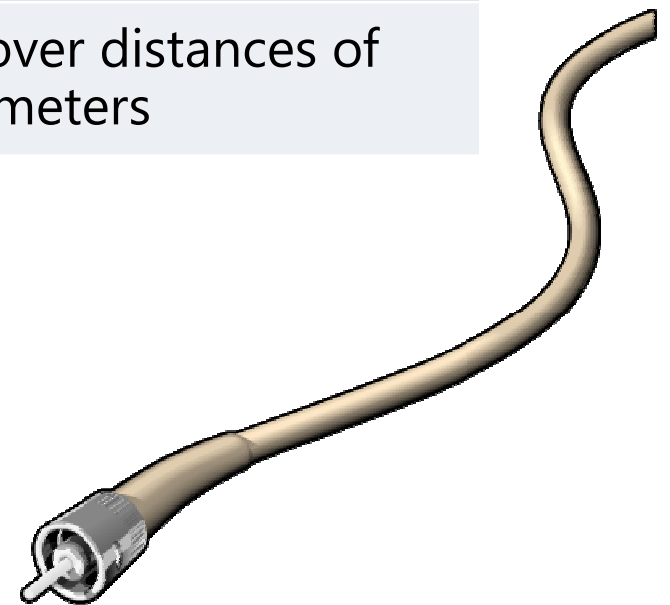
- Installation is comparatively inexpensive
- Fault finding is easier due to the star wired way in which cable is laid
- The cable supports many uses, including data and telephony

Category	Usage
1	Voice or modem
2	IBM cabling
3	Ethernet
4	Token ring
5	High-speed Ethernet
5e	Gigabit Ethernet
6	Gigabit Ethernet and 10G Ethernet
6a	10G Ethernet
7	10G Ethernet

# Fiber-Optic Cable

- Fiber-optic cabling is less prone to electromagnetic interference (EMI) and signal attenuation

Types of Fiber Cable	Description
Multimode fiber	<ul style="list-style-type: none"><li>• Supports bandwidths of around 100 Mbps at distances of up to 2 kilometers and 10 Gbps over 300 meters</li></ul>
Single-mode fiber	<ul style="list-style-type: none"><li>• 40 Gbps is possible over distances of several hundred kilometers</li></ul>



## Discussion: What Cabling Strategy Would You Use?

- Fabrikam, Inc. has purchased a new building for their R & D team. The new building is located across the parking lot from the headquarters. The building has two floors, each floor has around 100 workstations, each with a telephone. The R & D team will use a lot of bandwidth. You want to minimize future disruption and support any emerging standards
- What cabling solutions will you recommend?

## Lesson 3: Understanding Adapters, Hubs, and Switches

- What Is a Network Adapter?
- What Is a Hub?
- What Is a Switch?

# What Is a Network Adapter?

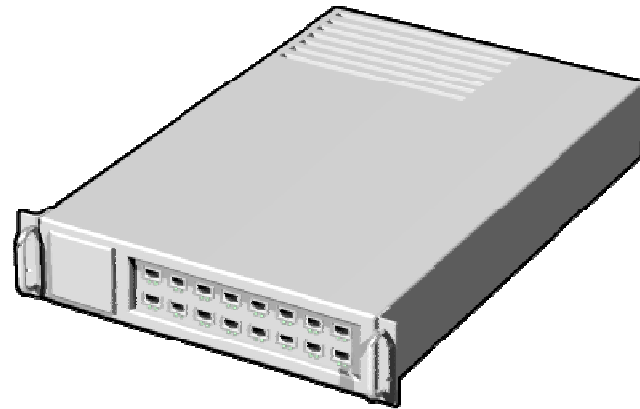
- Converts instructions from the network protocol stack into electrical signals
- Merges these signals onto the wire
- Converts electrical signals received on the wire into meaningful instructions for the network protocol stack

<b>Preamble</b>	<b>Start Frame Delimiter</b>	<b>Dest. MAC Address</b>	<b>Source MAC Address</b>	<b>Length</b>	<b>Data</b>	<b>Pad</b>	<b>Frame Check Sequence (CRC)</b>
-----------------	--------------------------------------	----------------------------------	-----------------------------------	---------------	-------------	------------	---

- The network adapter encapsulates the instructions it receives from the protocol stack into a logical sequence known as a frame

# What Is a Hub?

- Enables star wiring to provide a central wiring point
- Supports multiple ports
- Provides for a degree of fault isolation
- Extends your network



# What Is a Switch?

- A switch is an intelligent hub
- Provides wiring concentrator functionality like a hub
- Enables network traffic management
- Performs firewall functions
- Makes routing decisions based upon traffic priority

Type	Description
Layer 2	MAC-level bridging
Layer 3	Routing functionality added
Layer 4	Firewall and QoS support available

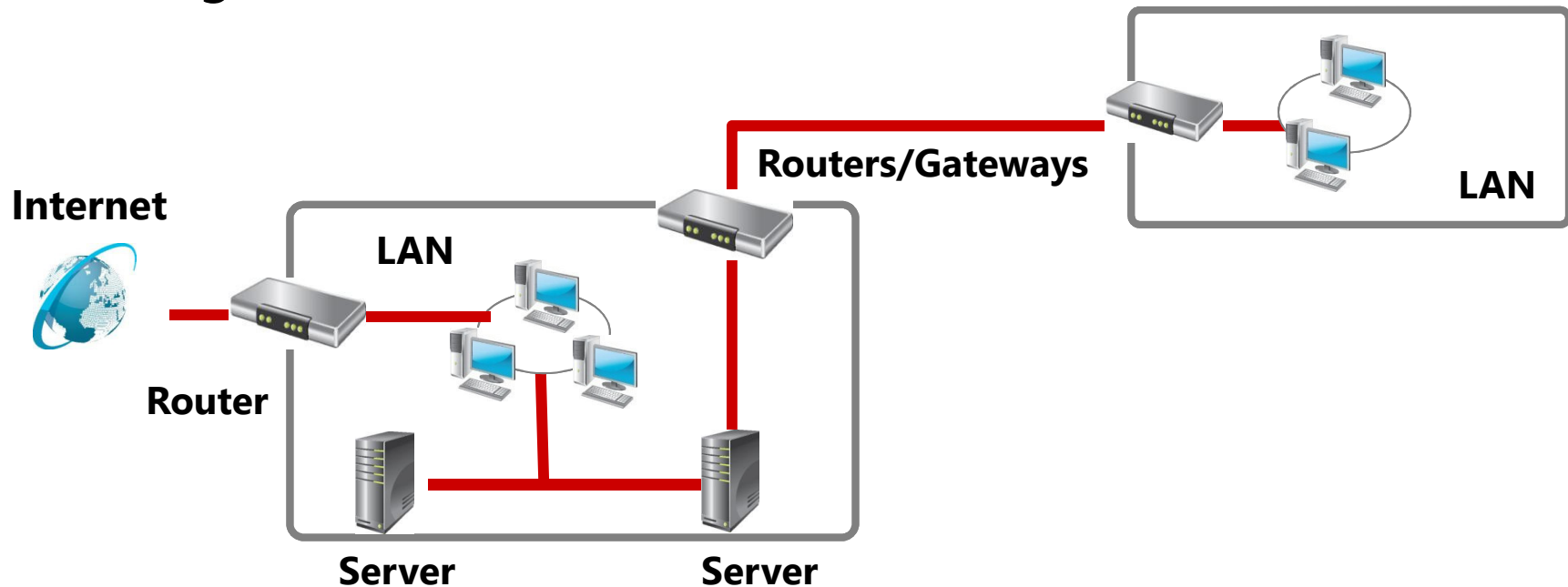


## Lesson 4: Understanding Routing

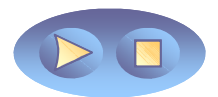
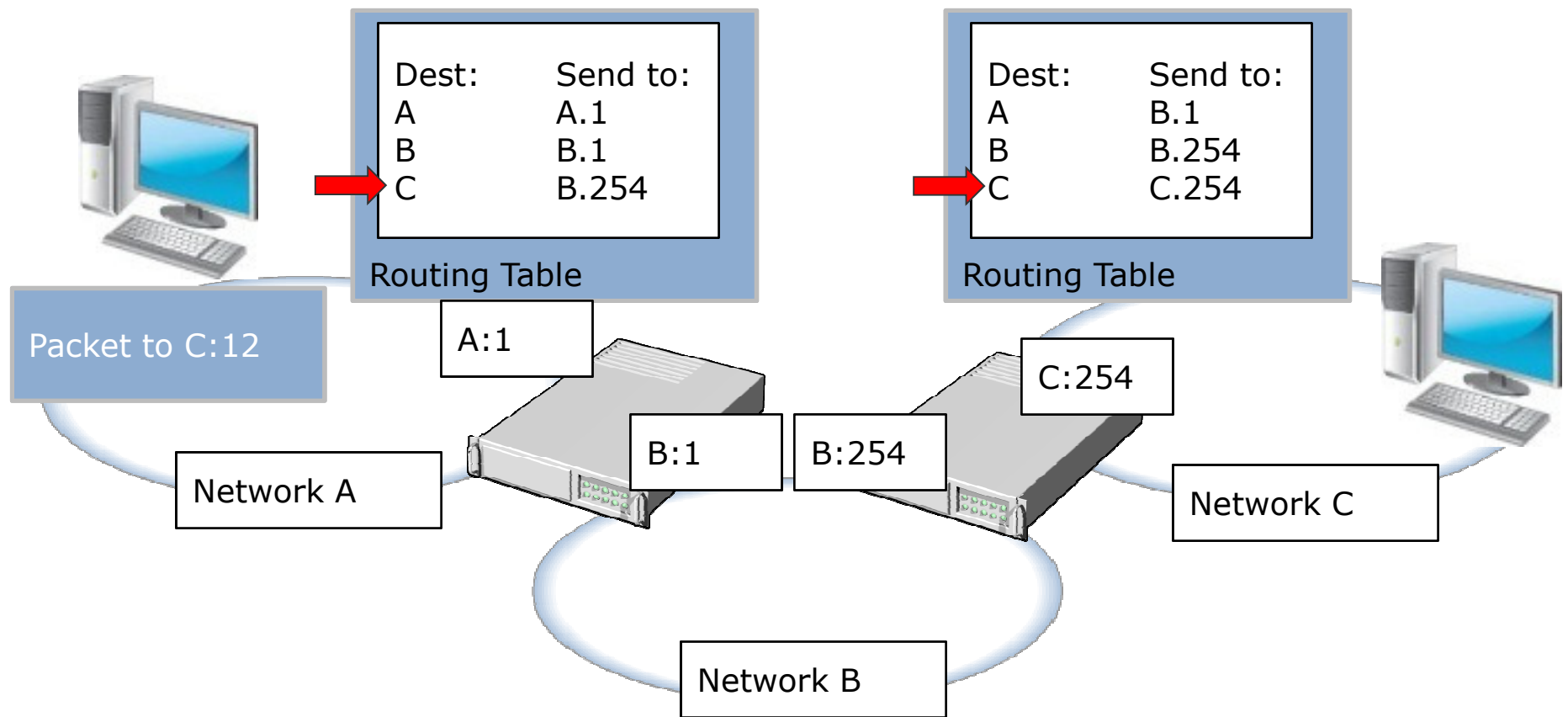
- What Is a Router?
- How a Router Determines a Destination
- Common Routing Standards
- Discussion: Which Routing Protocol Would You Use?

# What Is a Router?

- Manages network traffic by only forwarding packets when required
- Supports one or more routable protocols, such as IP
- Receives explicitly addressed frames from network nodes
- Makes routing decisions based on the information in the routing table



# How a Router Determines a Destination



# Common Routing Standards

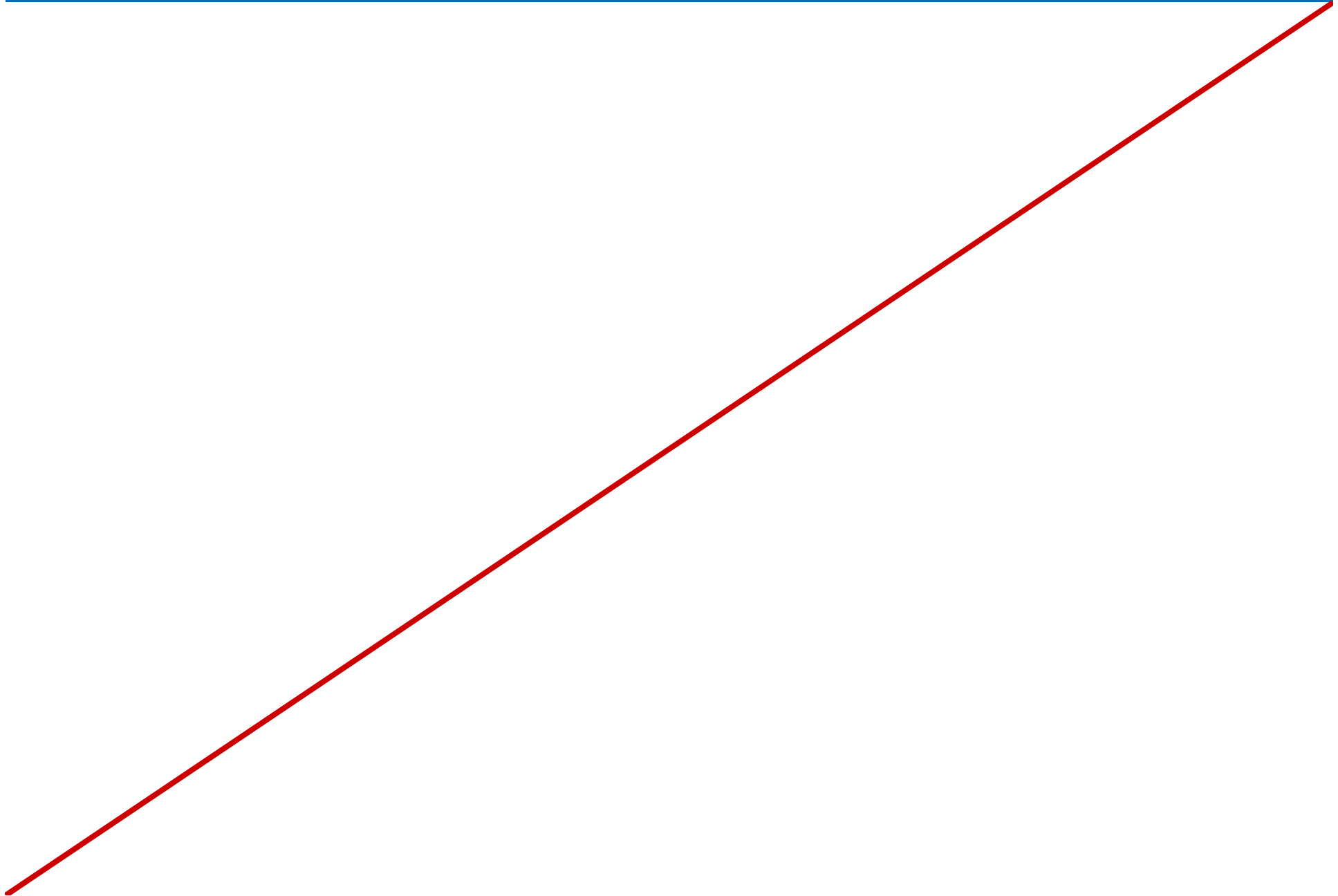
- Routing protocols help routers to learn about the network

Protocol	Description
RIP	<ul style="list-style-type: none"><li>• IGP distance-vector-based algorithm</li><li>• Supports small networks</li><li>• Hop count &gt; 16 unreachable</li><li>• Uses User Datagram Protocol (UDP)</li></ul>
OSPF	<ul style="list-style-type: none"><li>• IGP routing protocol</li><li>• Link-state based</li><li>• Scales better than RIP</li><li>• Doesn't use TCP/IP</li><li>• Widely used</li></ul>
BGP	<ul style="list-style-type: none"><li>• EGP specifically designed to support the Internet</li><li>• Widely used</li></ul>

## Discussion: Which Routing Protocol Would You Use?

- **Scenario 1:** A subsidiary of Fabrikam has a medium-sized network consisting of around 500 nodes. These nodes are distributed across several floors in their headquarters building. Additionally, there are about a dozen branch offices each with around 10 nodes. Routers have been deployed within the network to interconnect the networks.
- **Scenario 2:** Tailspin Toys has a small network consisting of around 100 nodes. Recently, network throughput has been affected by network traffic. You decide to install routers to help manage the network traffic. Initially, there will be three networks connected by two routers.

Notes Page Over-flow Slide. Do Not Print Slide.



# Lab: Connecting Network Components

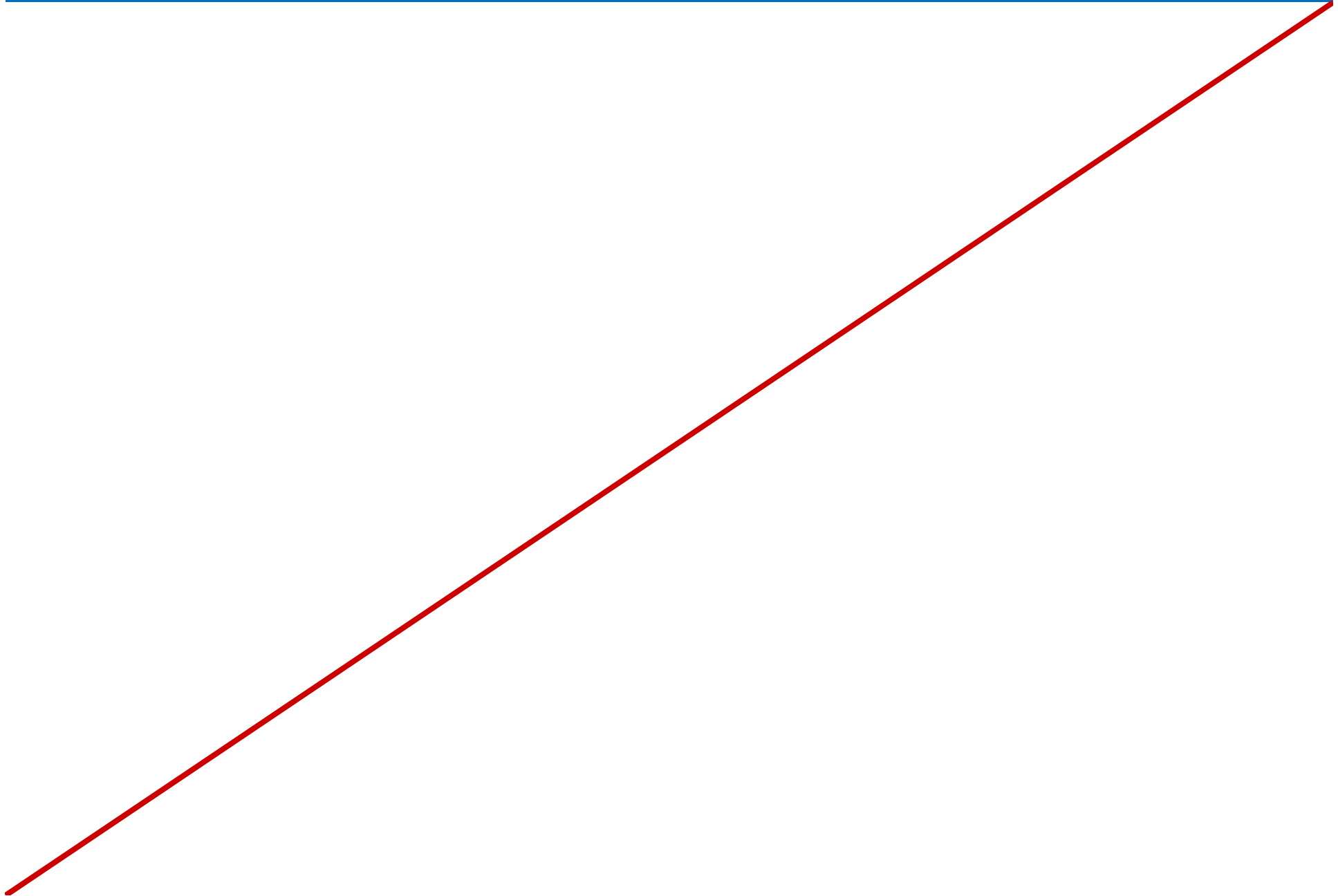
- Exercise 1: Connecting Network Components
- Exercise 2: Selecting a Suitable Wiring Infrastructure

## Logon Information

No virtual machines are required for this exercise.

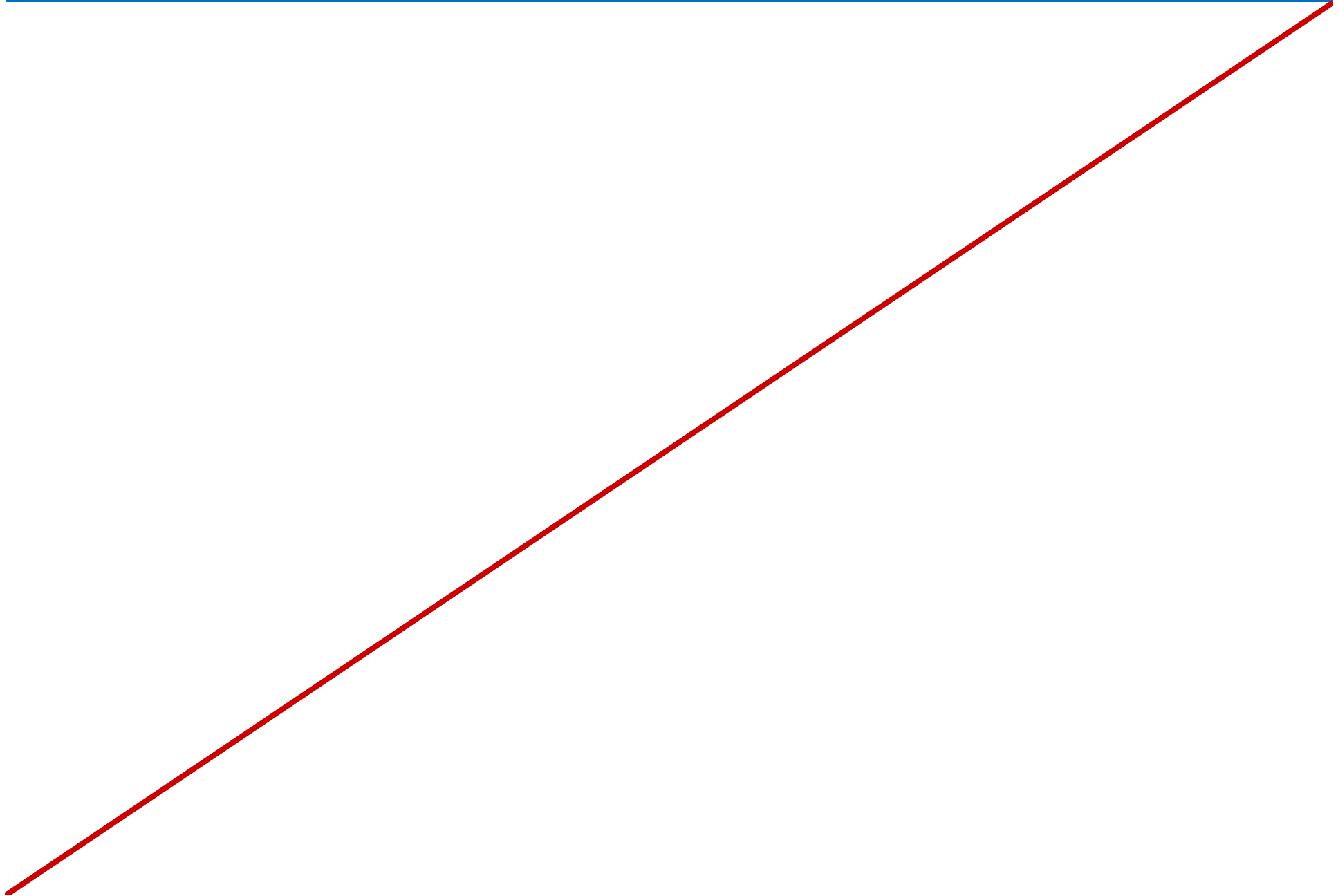
Estimated Time: 30 minutes

Notes Page Over-flow Slide. Do Not Print Slide.





Notes Page Over-flow Slide. Do Not Print Slide.



## Lab Scenario

A. Datum Corporation has created a new Research and Development team. As a result, several remote R & D branch offices are being created.

## Lab Review

- In the lab, you were asked to consider a wiring scheme for branch offices. You were constrained by budget. Had you not been, how would that have changed your plans, if at all?

# Module Review and Takeaways

- Review Questions