

IP Networking Basics




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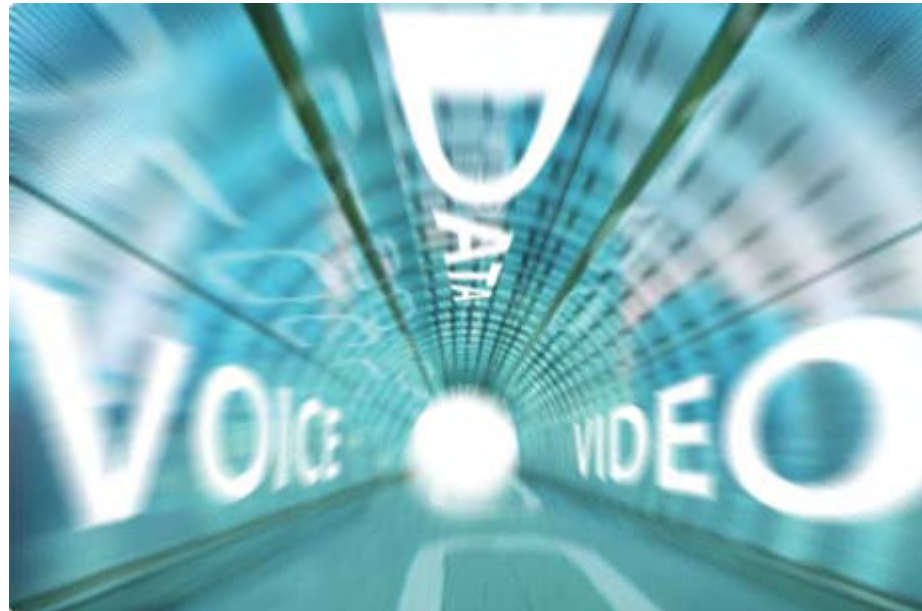
Products That Make Wireless Work

Objectives

- Review IP Networking Applications and Terminology
- Define the “Internet Protocol”
- Review Networking Equipment and Topologies
- Learn Addressing and Subnetting
- Discover Troubleshooting Techniques
- Answer Your Questions

IP Networking Applications

- Everything is becoming connected
- Convergence – It's all becoming “data”
 - Voice
 - Video
 - Data



Where is IP?

- Utility Applications
 - Two-way Radio (Radio-over-IP)
 - Video Surveillance
 - SCADA
 - Smart Grid
 - Worldwide Communications

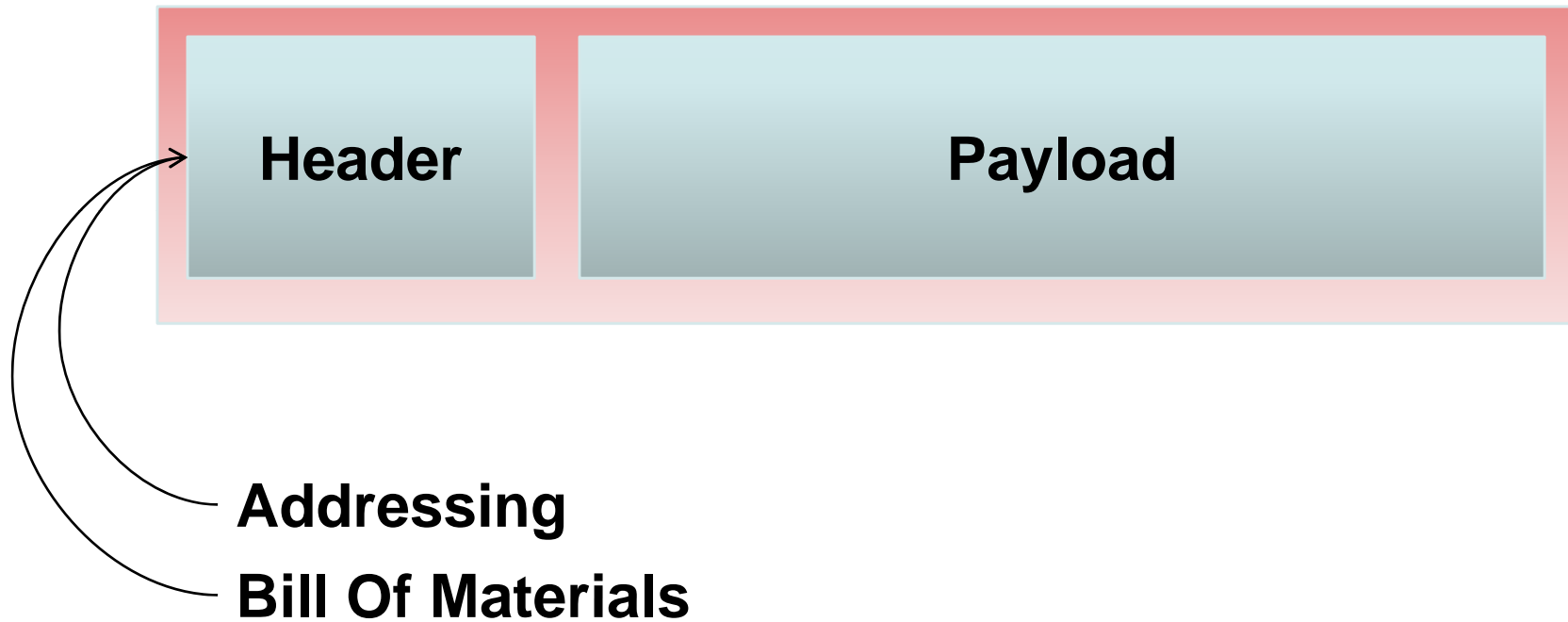


What is IP?

- Internet Protocol is a set of protocols to define how “data” is moved between users and between networks

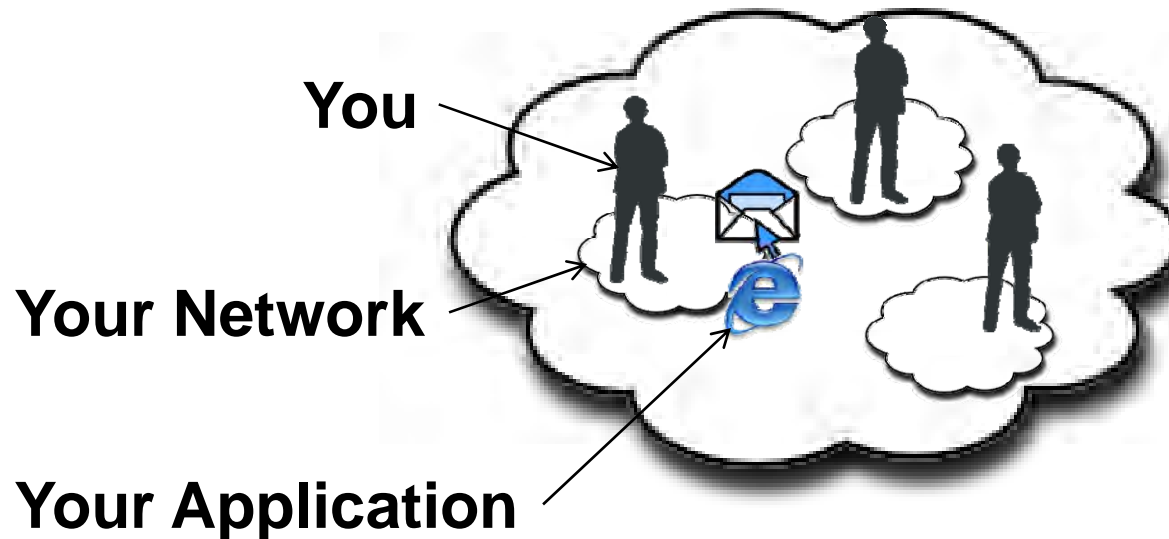


Meet the Packet



The Need for Addressing

- **MAC** - Local / User Identification
- **IP** - Network Identification
- **Port Number** - Application Identification



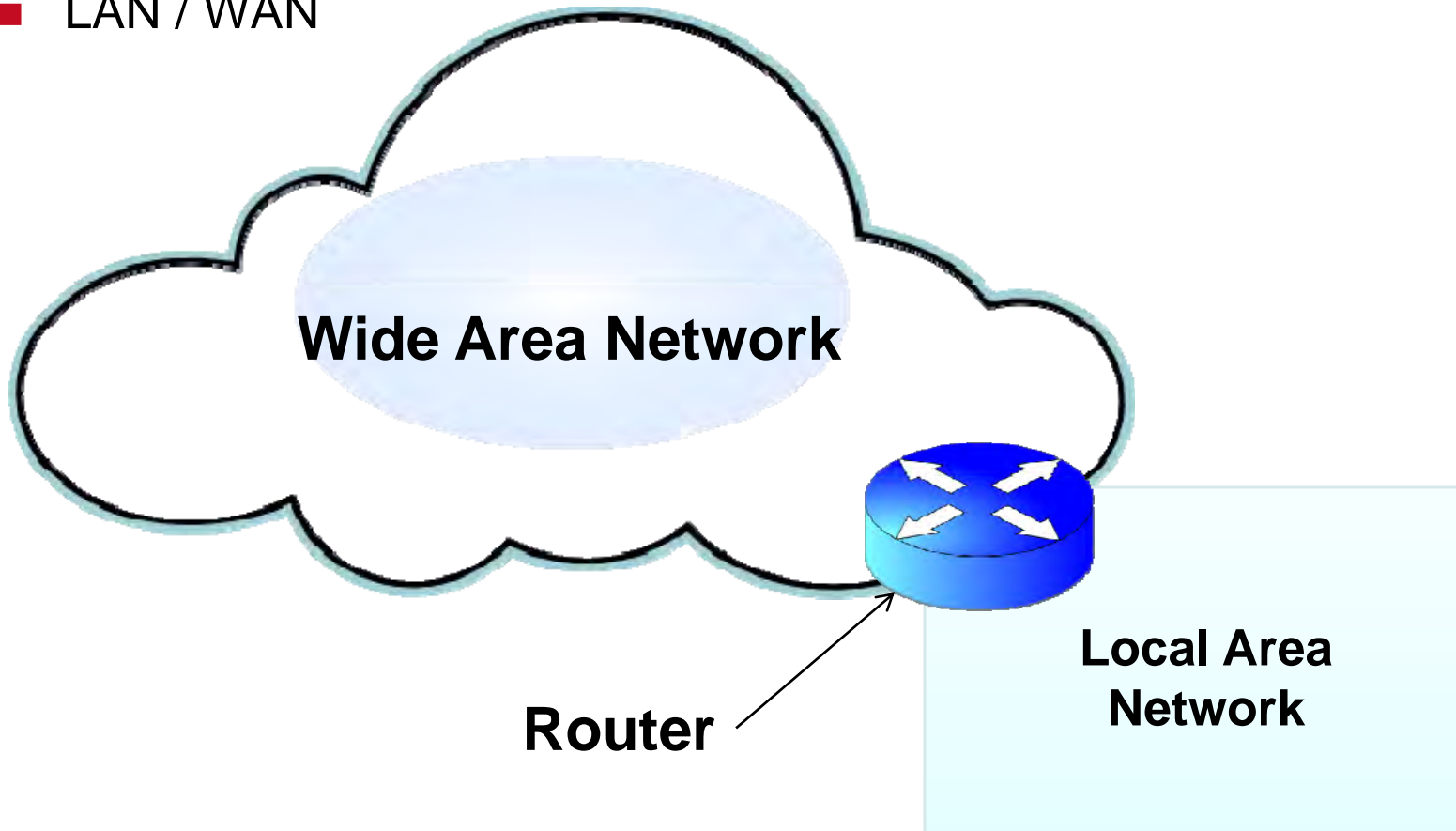
Types of Delivery

- **TCP** - Guaranteed Delivery
 - Acknowledged Delivery
 - Resend as necessary
- **UDP** - Best Effort Delivery

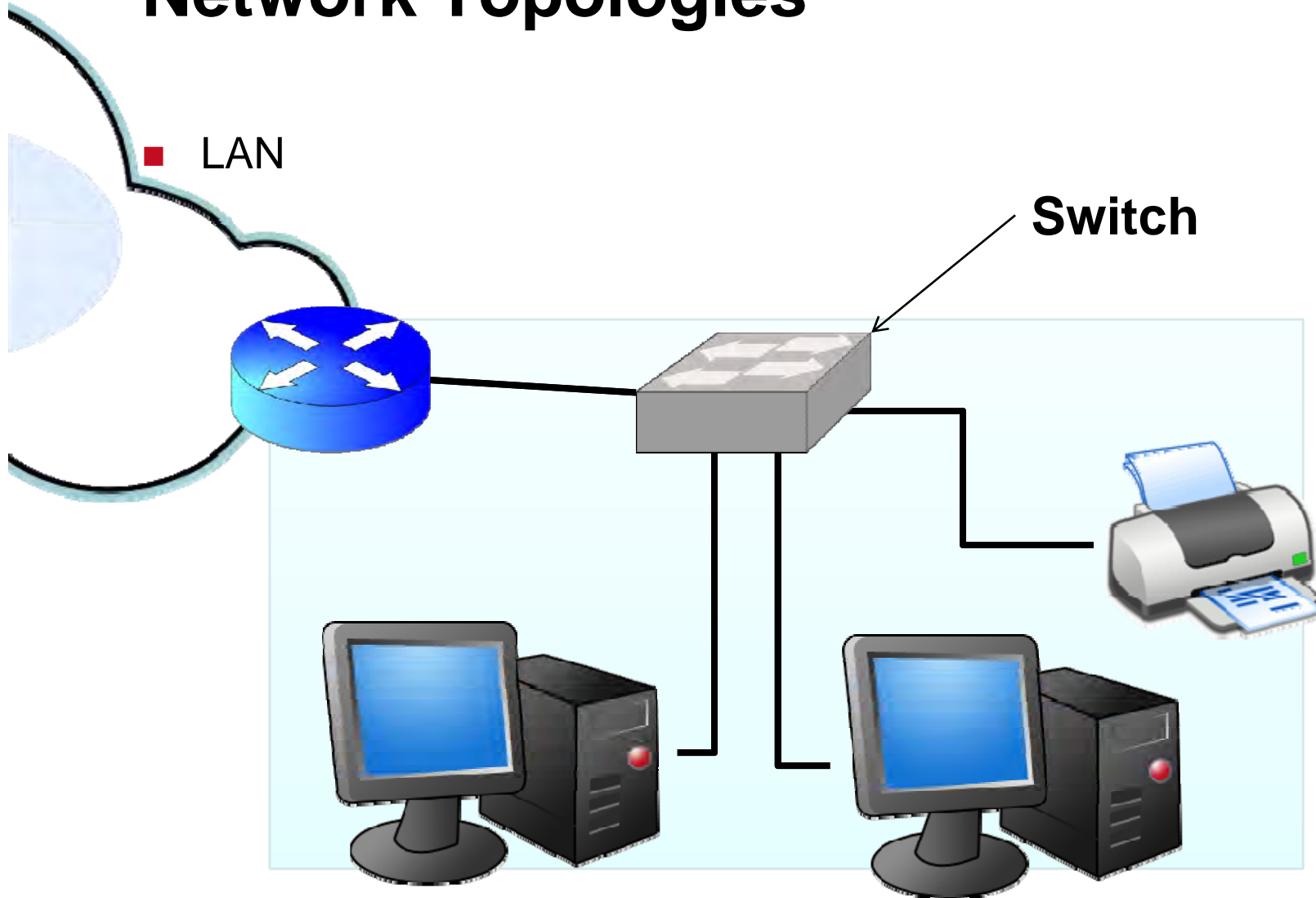


Network Topologies

- LAN / WAN



Network Topologies



Network Equipment

- **Interfaces** – Connect to the network
 - Wireless or hard-wired



Network Equipment

- **Switches** – Connect multiple interfaces together
 - Can provide power to devices (Power-over-Ethernet)
 - Can be extended with wireless access points



Network Equipment

- **Routers** – Connect networks together



Network Equipment

- **Cabling**
 - Ethernet CAT5 or better
 - RJ-45 Connectors
 - Supports 10/100/1000 Mbps
 - Limited to 328ft



IP Addressing

- Current version is IPv4
- Addressing allows for 4.3 billion combinations (32 bits)
- Format is four numbers separated by a dot
- There are three main classes of IP addresses

[1-254]

[0-255]

[0-255]

[1-254]

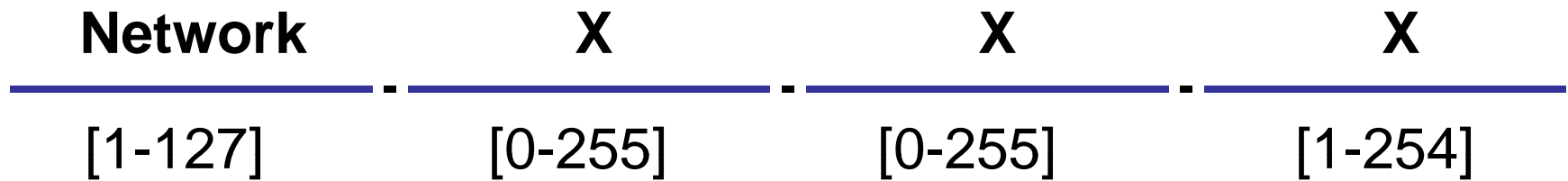
192.168.1.1

10.0.0.1

216.239.51.99

IP Addressing

- Class A



- Example

10.0.0.1
10.0.1.2

IP Addressing

- Class B

Network	Network	X	X
[128-191]	[0-255]	[0-255]	[1-254]

- Example

172.16.0.1
172.16.1.2

IP Addressing

- Class C

Network	Network	Network	X
[192-223]	[0-255]	[0-255]	[1-254]

- Example

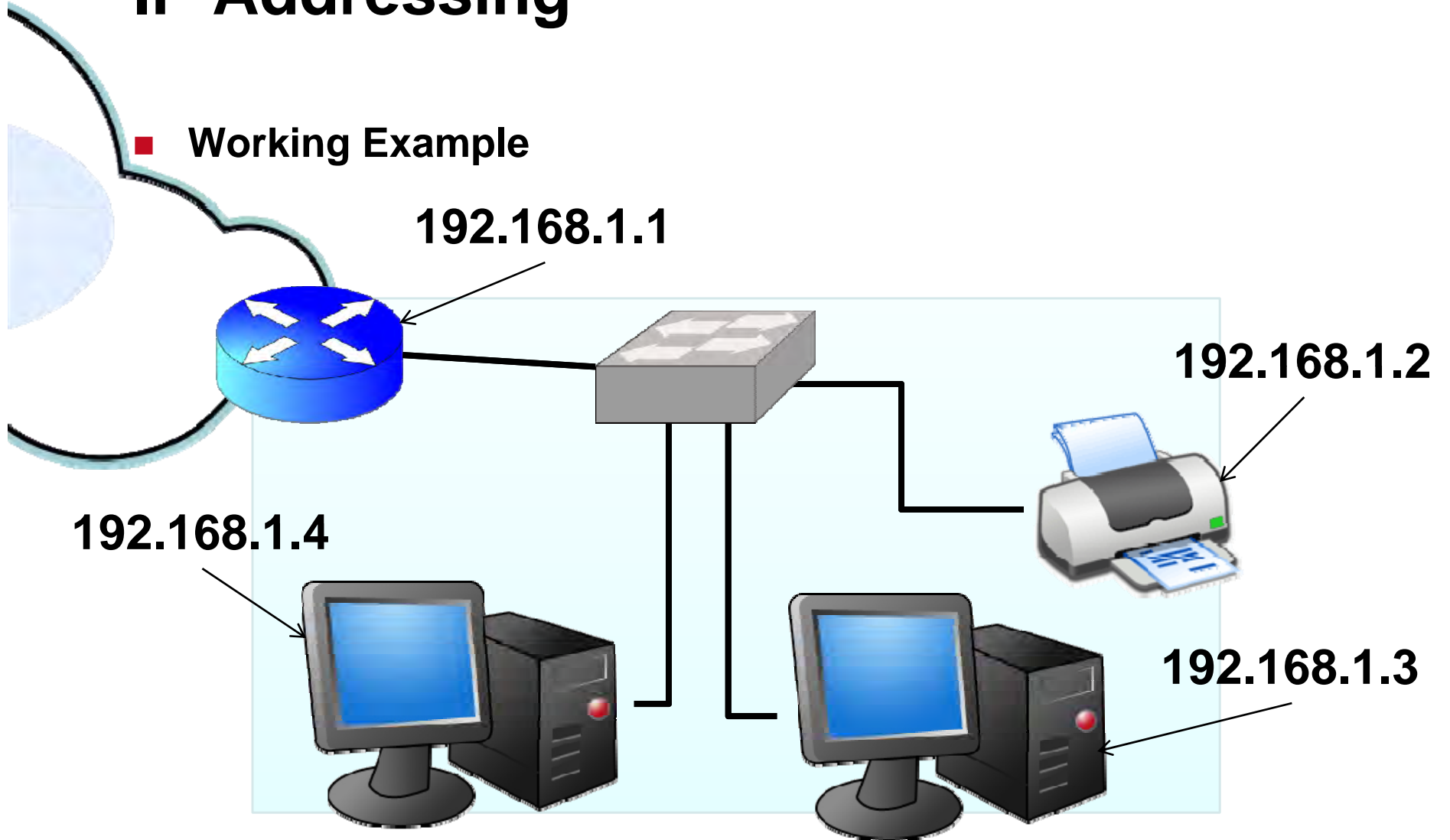
192.168.0.1
192.168.0.2

IP Addressing

- Rules
- Users must have unique addresses
- Users must share network part of address

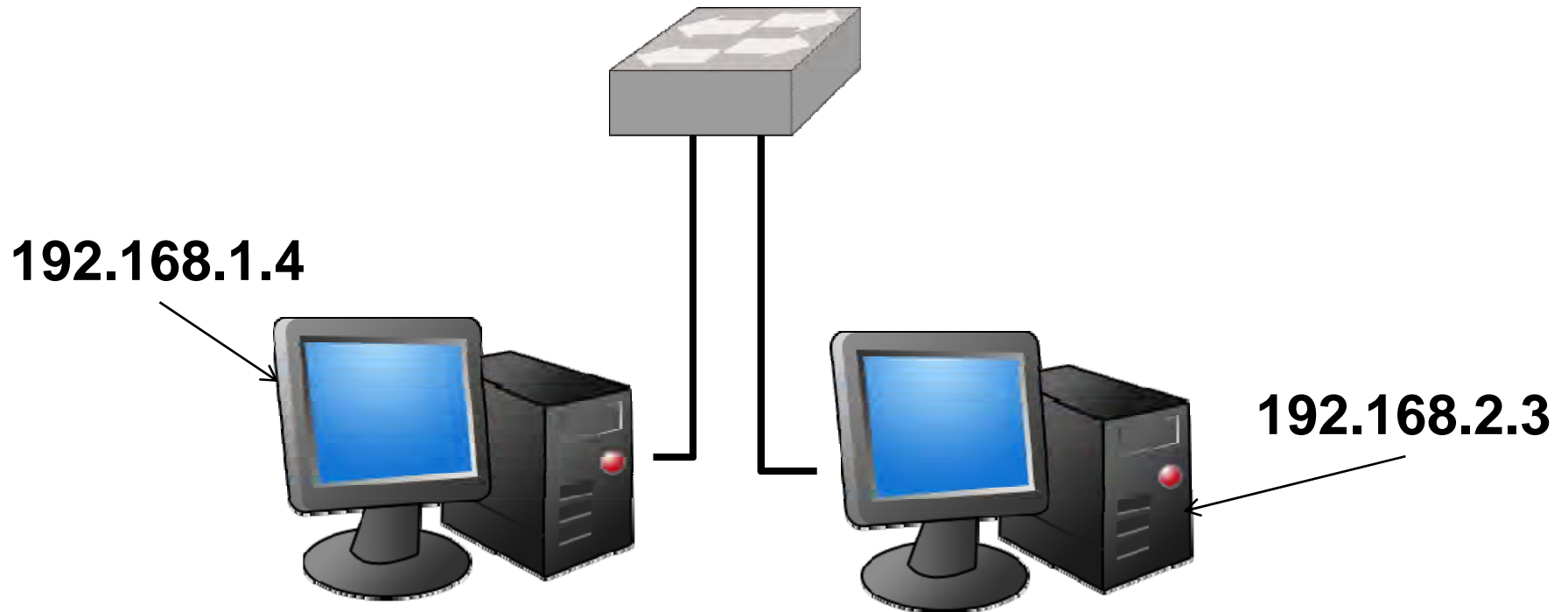
IP Addressing

■ Working Example



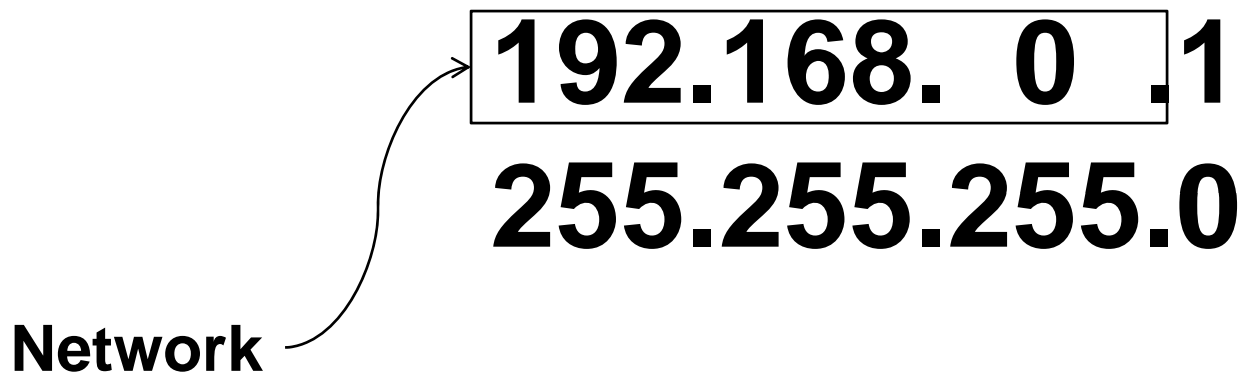
IP Addressing

- Addressing Issue



Introduction to Subnetting

- Break address ranges into smaller groups
- Defines which part of the address is the network portion
- Makes life harder



Introduction to Subnetting

- Default Subnet Masks
 - **Class A** – 255.0.0.0
 - **Class B** – 255.255.0.0
 - **Class C** – 255.255.255.0

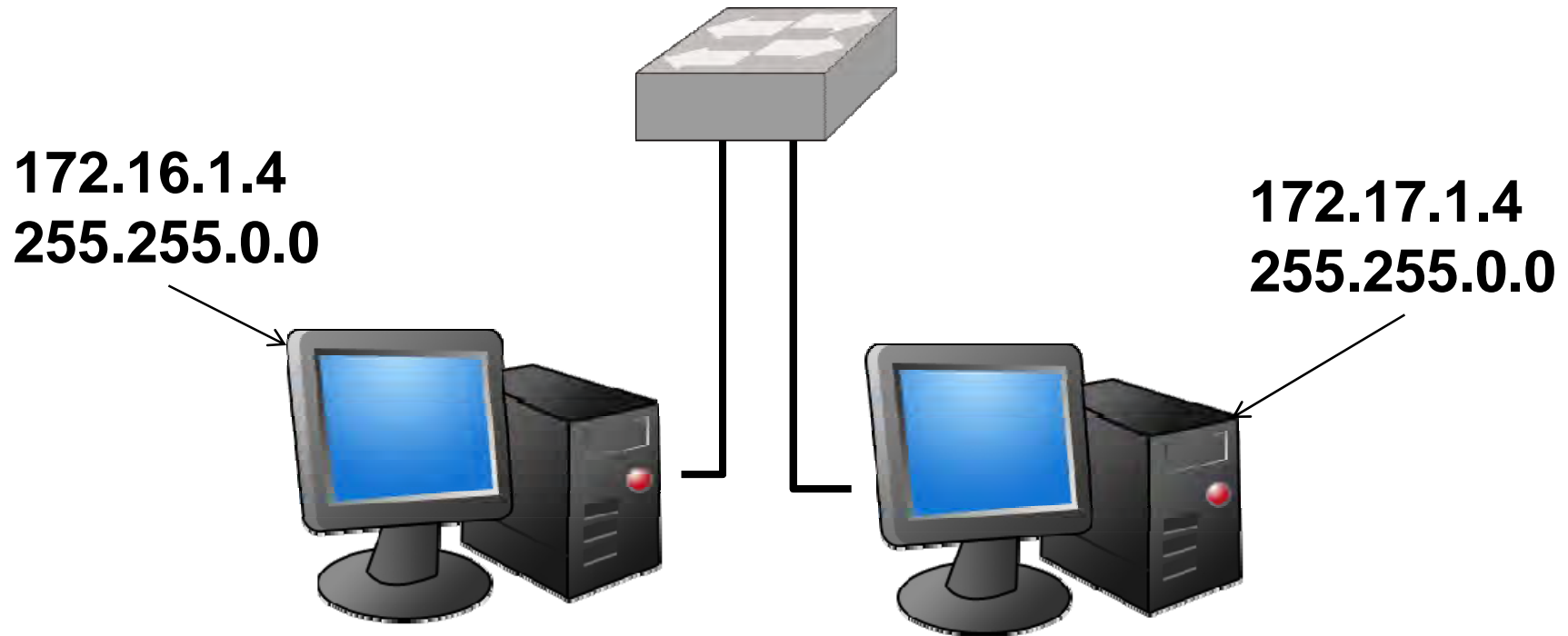
Introduction to Subnetting

- What is the default subnet mask for this user?

136.168.0.1

Introduction to Subnetting

- Why does this not work?



Introduction to Subnetting



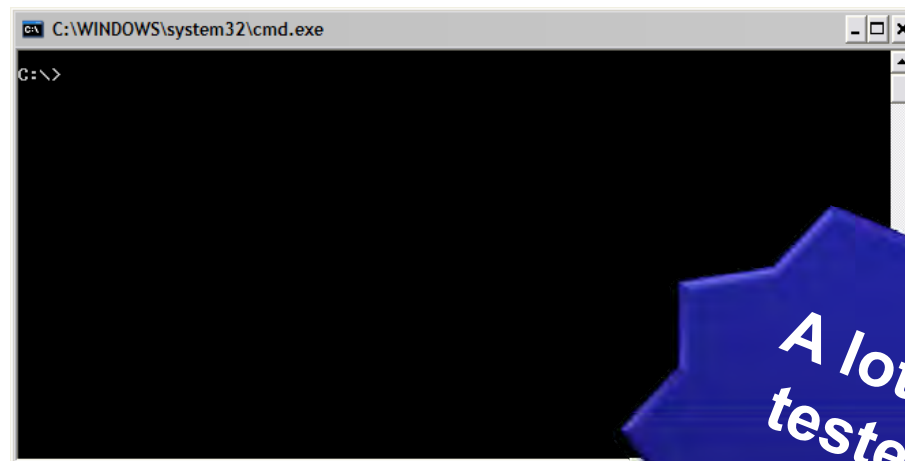
Troubleshooting

- Packet Loss (<1%)
- Packet Delay (<150ms one-way)
- Routing
- Addressing
- Throughput

Connection	Actual Bandwidth	Practical Throughput
Ethernet	10 Mbps	7 Mbps
Fast Ethernet	100 Mbps	60 Mbps
Gigabit Ethernet	1000 Mbps	500 Mbps
802.11b	11 Mbps	5 Mbps
802.11g	54 Mbps	24 Mbps
Mesh Backbone	Varies	70 Mbps

Troubleshooting

- Commands



A lot can be tested with your laptop

- >> Click the *Start Button*
- >> Select *Run* from the *Start Menu*
- >> Type “**cmd**” into the *Run Window*
- >> Click *OK*

Troubleshooting

■ Commands You Have to Know

ipconfig

Displays IP address, subnet mask, and default gateway address

ping [address]

Sends a 32B request to a domain name address or IP address and measures round trip delay of response

tracert [address]

Tests connectivity and delay through each hop to get to a destination domain name or IP address. Pathping additionally tests packet loss between hops

pathping [address]

Troubleshooting

- Test and Certify Cabling
 - 1000 Mbps / Gigabit Ethernet



Fluke Networks LinkRunner Pro Network Tool

Where to go from here...

- Find Online Resources
 - <http://www.tessco.com/go/utilities>
 - <http://www.tessco.com/go/training>
- Contact Dale Martin
 - martind@tessco.com
 - 410-229-1248



Review Objectives

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