THE UNIVERSITY OF TENNESSEE CHATTANOOGA

Communication in the Network Layer

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GenCyber Workshop

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Agenda

- Networks: How They Operate
- Common Network Security Issues
- Firewalls: A Security Solution
- Additional Resources

Learning Objectives

- Discuss how communication works in the Network Layer
- Describe the role of protocols in communication
- Explore the functions of routers, switches, and firewalls
- Identify common network security issues
- Describe how network security relates to the concept of physical security

Networks: How They Operate

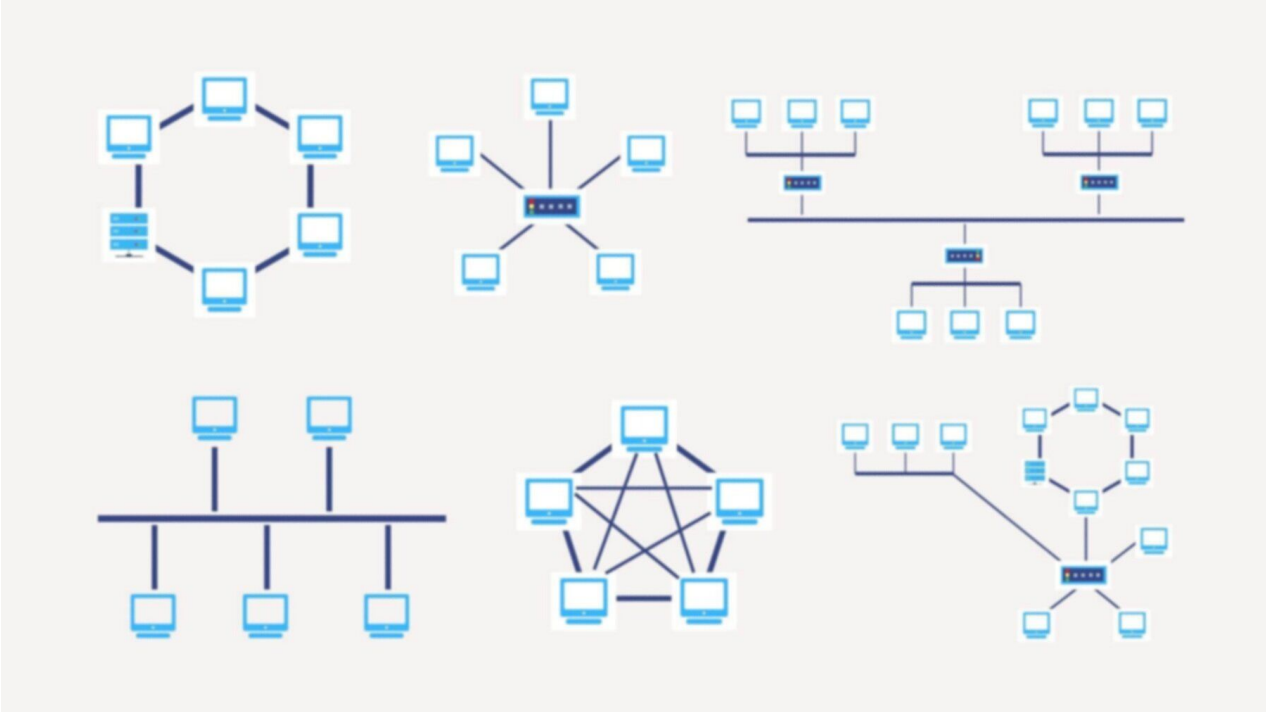
- Most of us access the Internet, send emails, and download files on our devices every day
- Have you ever wondered how we are able to do so?
  - because our devices are connected to a **network**

Networks: How They Operate

- Network: a series of computers and servers connected together for the purpose of communication, file transfer, etc.
- Networks can be arranged in many different ways with a number of different devices

Networks: How They Operate

- Different network structures known as **topologies**
- How do different devices communicate across a network?



Networks: How They Operate

- Components of a network use **network protocols** to communicate
  - network protocols: standards for the format and sequence of messages (referred to as **packets**) being sent between devices across a network
  - Think about mailing a letter to a friend across town:
    - What addresses need to be listed on the envelope?
    - Where do you have to put the letter for it to be sent?

Networks: How They Operate

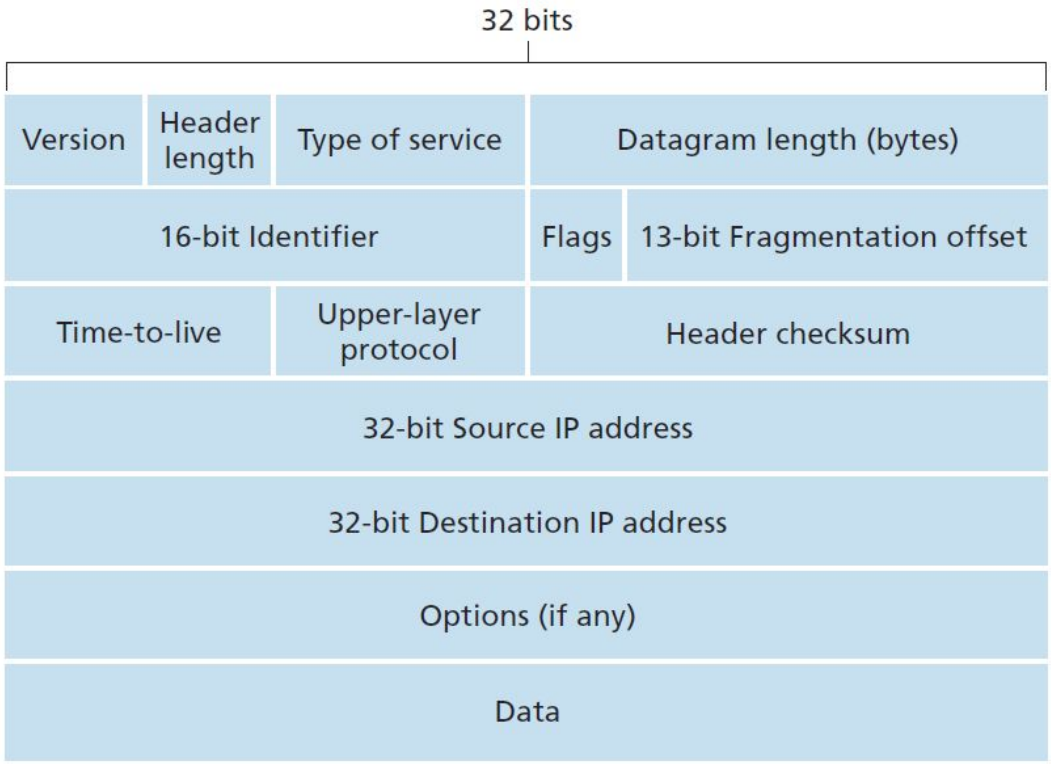
- There are many different protocols that are used within a network for different purposes
  - IP, TCP, UDP, HTTP, ARP, etc.
- Why are protocols important?
  - Without protocols, the devices in a network would have no way of communicating efficiently and in a way that all devices understand
    - regardless of their hardware structure or design

Networks: How They Operate

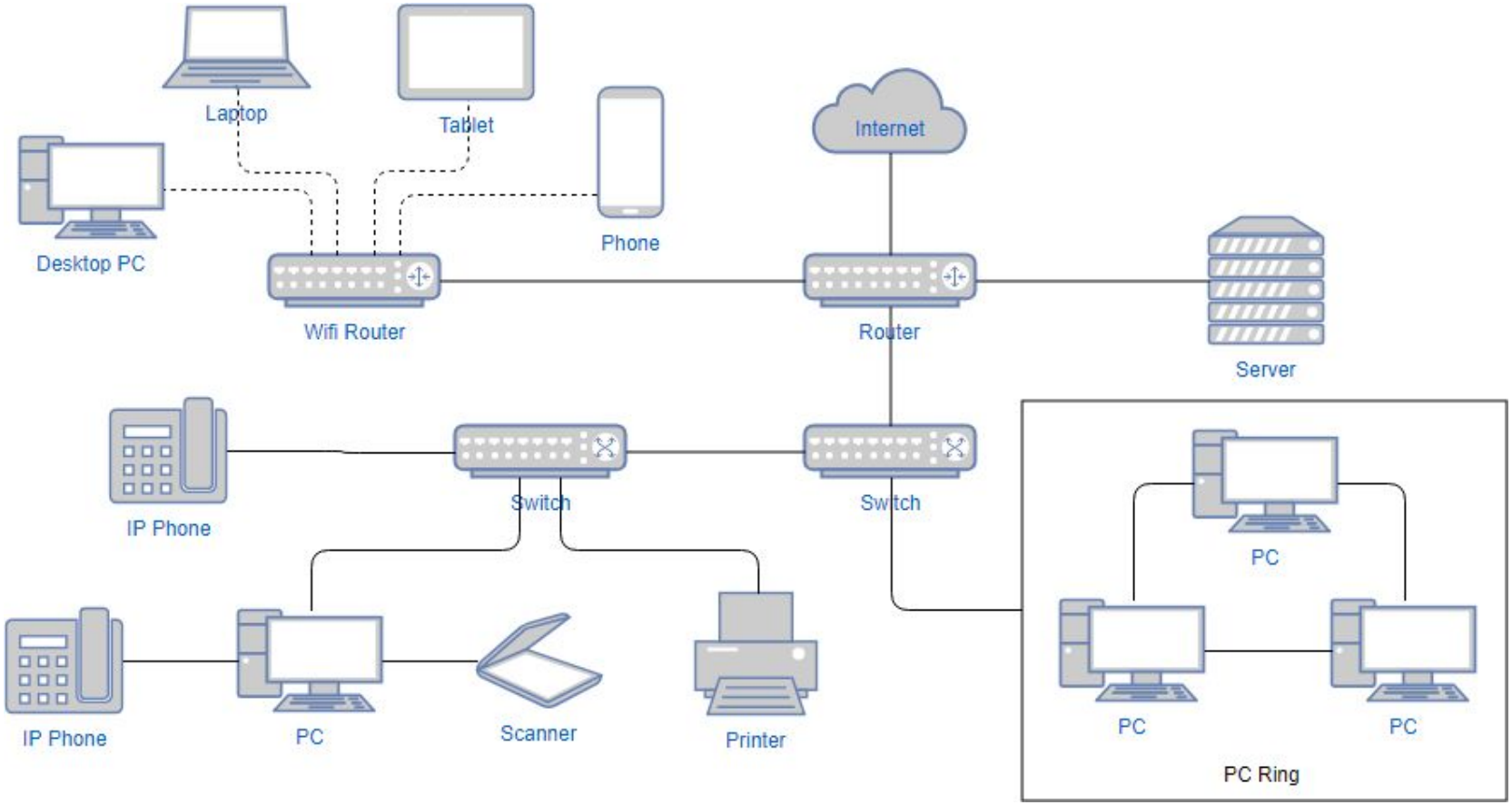
- When a packet leaves its source address, it flows through the network until it reaches a **router** or **packet switch**
  - Routers and packet switches retrieve the destination address from the **packet header** (structured by protocols)
    - forward the packet along the shortest path to its destination

Networks: How They Operate

Example of a packet header:



Networks: How They Operate



Common Network Security Issues

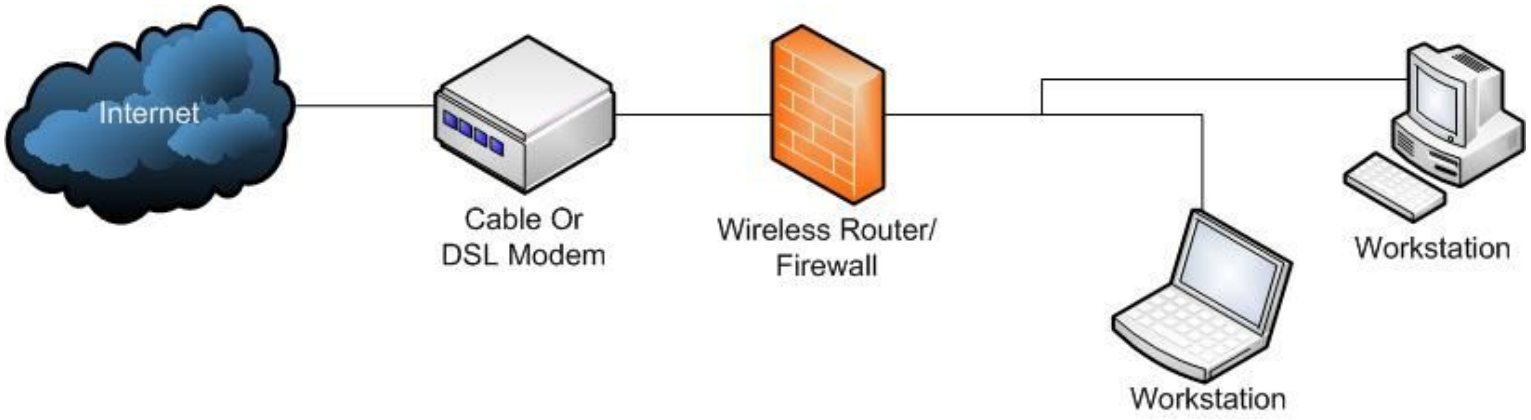
- Now that you know more about how a network functions, what security issues could you identify in a typical network?

Common Network Security Issues

- An attacker could spread a virus or other forms of malware to several computers through a network
- A packet sniffer could be used to gain access to confidential information found in the network
- Denial-of-Service (DOS) attack: hundreds or thousands of devices flood a network server with traffic, forcing it to crash

Firewalls: A Security Solution

- How do we protect a network against these security concerns?
  - One way to do so is by using a **firewall**
    - **firewall**: a security device that controls the inbound/outbound traffic between an internal network and outside networks
    - can also be used to monitor and control traffic between devices within an internal network



Firewalls: A Security Solution

- Firewalls protect the network the same way security guards, key cards, and other security measures protect a physical space
  - all control what comes in/goes out of a space based on a set of predetermined rules

Firewalls: A Security Solution

Access Control Lists > Edit

< Back

General

Access List Name WLC-ACL

Deny Counters 0

Seq	Action	Source IP/Mask	Destination IP/Mask	Protocol	Source Port	Dest Port	DSCP	Direction	Number of Hits
1	Deny	10.10.14.0 / 255.255.255.0	10.10.205.20 / 255.255.255.255	ICMP	Any	Any	Any	Inbound	0
2	Permit	10.10.14.0 / 255.255.255.0	0.0.0.0 / 0.0.0.0	ICMP	Any	Any	Any	Inbound	0
3	Permit	0.0.0.0 / 0.0.0.0	10.10.14.0 / 255.255.255.0	ICMP	Any	Any	Any	Outbound	0
4	Permit	0.0.0.0 / 0.0.0.0	0.0.0.0 / 0.0.0.0	Any	Any	Any	Any	Any	0

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Additional Resources

- An overview of computer networking: https://www.geeksforgeeks.org/basics-computer-networking/
- Popular network protocols: https://www.baeldung.com/cs/popular-network-protocols
- More on firewalls: https://www.youtube.com/watch?v=kDEX1HXybrU
- Common cyber attacks: https://www.cisco.com/c/en/us/products/security/common-cyberattacks.html

LAB

- Complete the questions for Lab - Paper Airplanes Message Routing