CSCI 297: ~~Ethical~~ Hacking

Network Protocols

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Overview of Network Models

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- Network models provide a conceptual framework for understanding how communication occurs in computer networks.
- Two widely used models are the OSI (Open Systems Interconnection) model and the TCP/IP (Transmission Control Protocol/Internet Protocol) model.

Packet Visualization

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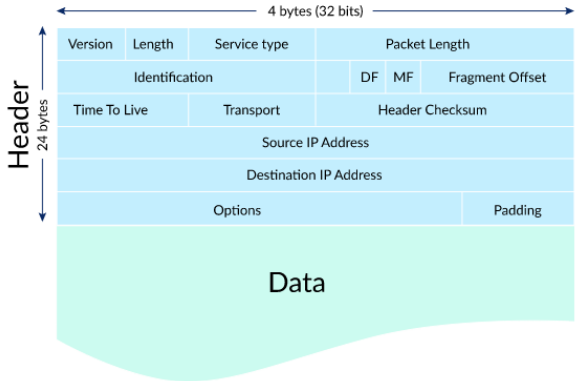

The OSI Model: Introduction

- The OSI model is a conceptual framework that standardizes the functions of a telecommunication or computing system into seven abstraction layers.
- Each layer serves a specific purpose and interacts with adjacent layers to facilitate data transmission.

Layer 1: Physical Layer

- The Physical Layer is the lowest layer of the OSI model.
- It deals with the physical connection between devices and transmission of raw data.
- Examples include cables, hubs, and network interface cards (NICs).

Layer 2: Data Link Layer

- The Data Link Layer is responsible for node-to-node communication.
- It handles errors in the physical layer and ensures reliable transmission of data.
- Examples include switches, Ethernet frames, and MAC addresses.

Layer 3: Network Layer

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- The Network Layer provides routing and forwarding of data packets.
- It determines the best path for data to travel from source to destination.
- Examples include routers, IP addresses, and ICMP (Internet Control Message Protocol).

Layer 4: Transport Layer

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- The Transport Layer ensures end-to-end communication between hosts.
- It manages data flow, error checking, and packet sequencing.
- Examples include TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).

Layer 5: Session Layer

- The Session Layer establishes, manages, and terminates connections between applications.
- It facilitates dialogue control and synchronization between devices.
- Examples include API (Application Programming Interface) and RPC (Remote Procedure Call).

Layer 6: Presentation Layer

- The Presentation Layer is responsible for data translation and encryption.
- It formats data for presentation and ensures compatibility between different systems.
- Examples include encryption protocols (SSL/TLS) and data compression algorithms.

Layer 7: Application Layer

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- The Application Layer provides services directly to end-users.
- It enables communication between applications and network services.
- Examples include HTTP (Hypertext Transfer Protocol), FTP (File Transfer Protocol), and SMTP (Simple Mail Transfer Protocol).

Comparing OSI and TCP/IP Models

- While the OSI model has seven layers, the TCP/IP model has four layers.
- Despite the difference in the number of layers, both models serve as guidelines for designing and understanding network protocols.

The TCP/IP Model: Introduction

- The TCP/IP model is a concise version of the OSI model and is widely used in practice, especially in the context of the Internet.
- It consists of four layers: Link Layer, Internet Layer, Transport Layer, and Application Layer.

Link Layer (Equivalents to OSI Layers 1 and 2)

- The Link Layer is responsible for the physical connection between devices and data transmission.
- It includes protocols such as Ethernet, Wi-Fi, and PPP (Point-to-Point Protocol).

Internet Layer (Equivalent to OSI Layer 3)

- The Internet Layer handles addressing, routing, and packet forwarding.
- It includes the Internet Protocol (IP) and its variants, such as IPv4 and IPv6.
- IP addresses are used to identify devices on a network and facilitate communication between them.

Transport Layer (Equivalent to OSI Layer 4)

- The Transport Layer provides end-to-end communication between devices.
- It includes protocols such as TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).
- TCP ensures reliable data transmission with error checking and retransmission mechanisms, while UDP offers a connectionless, unreliable service.

Application Layer (Equivalent to OSI Layers 5, 6, and 7)

- The Application Layer enables communication between networked applications.
- It includes various protocols and services for specific applications, such as HTTP, FTP, SMTP, and DNS (Domain Name System).
- These protocols define how data is formatted, transmitted, and received by applications running on different devices.

Routing in TCP/IP Networks

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- Routing is the process of selecting the best path for data packets to travel from a source to a destination.
- Routers are devices that forward data packets between networks based on routing tables and algorithms.
- Routing protocols, such as RIP (Routing Information Protocol) and OSPF (Open Shortest Path First), are used to exchange routing information and update routing tables dynamically.