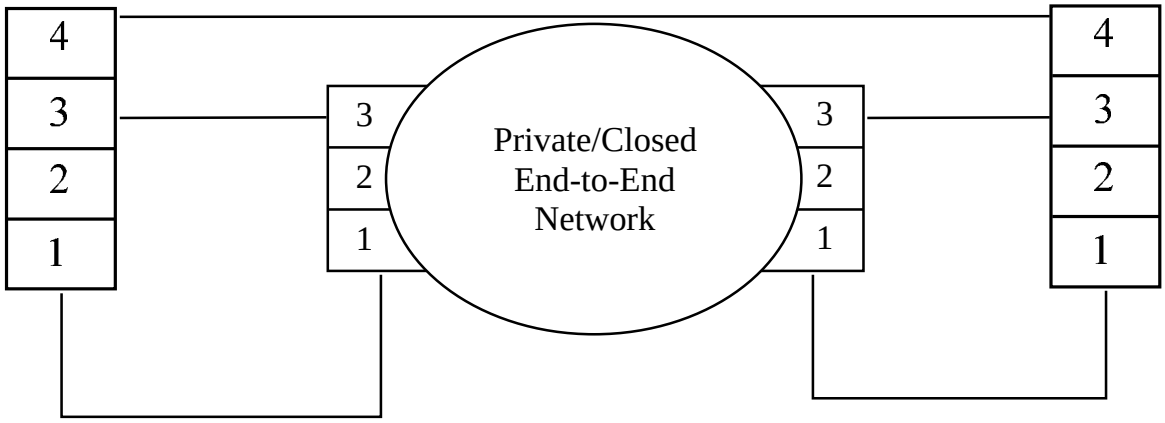
CprE 530

Lecture 9

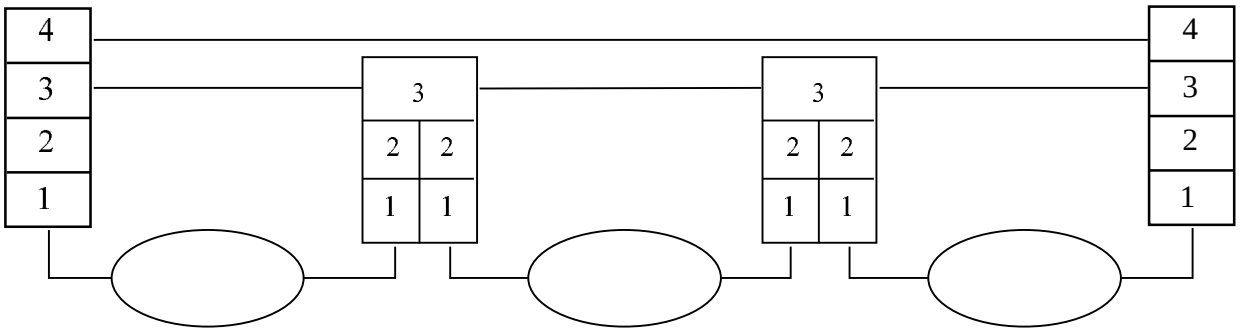
Network Layer

- Two Types:
  - Network access layer
    - Connection to a private end-to-end network
    - Used by ISPs to interconnect
  - Internetwork Layer
    - Distributed set of network layers working together
    - Used throughout the Internet

Network Access



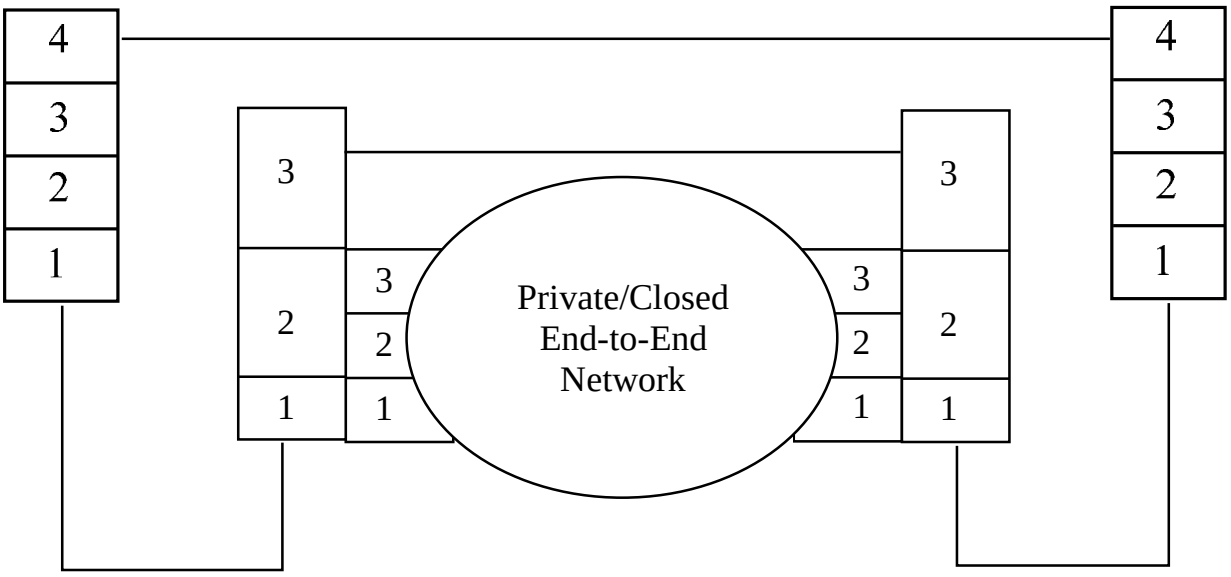
Internetwork



Differences between networks

Differences	Remediation
Physical network layer addressing schemes	The network will need to adapt to the different address types which is more complex in devices like routers
Maximum and minimum packet sizes	The network layer will need to implement segmentation and reassembly
Network access methods	The network layer will need to provide buffering which handle different access methods, especially in a router
Error and flow control	The network layer will need to handle lost and delayed packets
Machine and user authentication	The network layer will need to provide authentication to the physical network if required

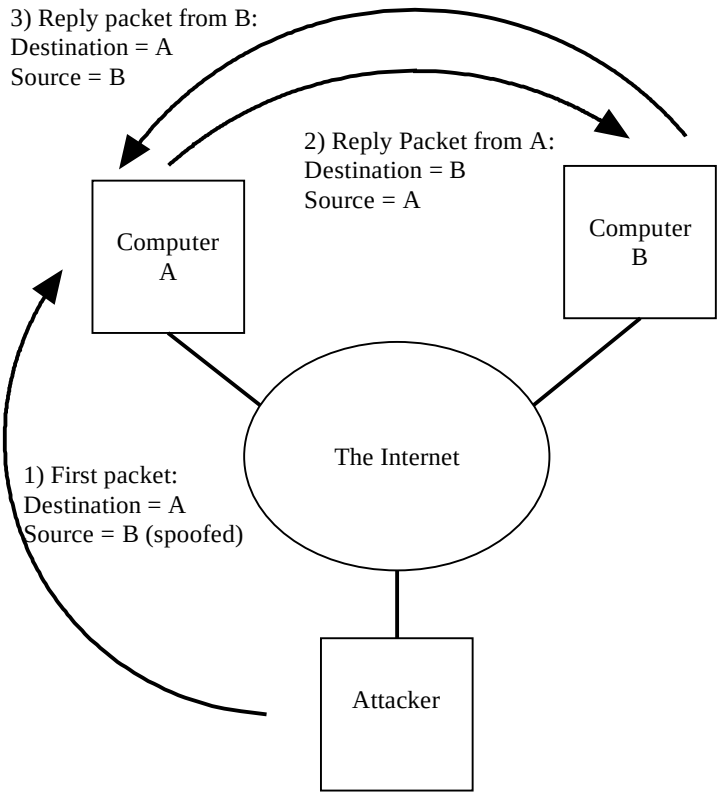
Using network access



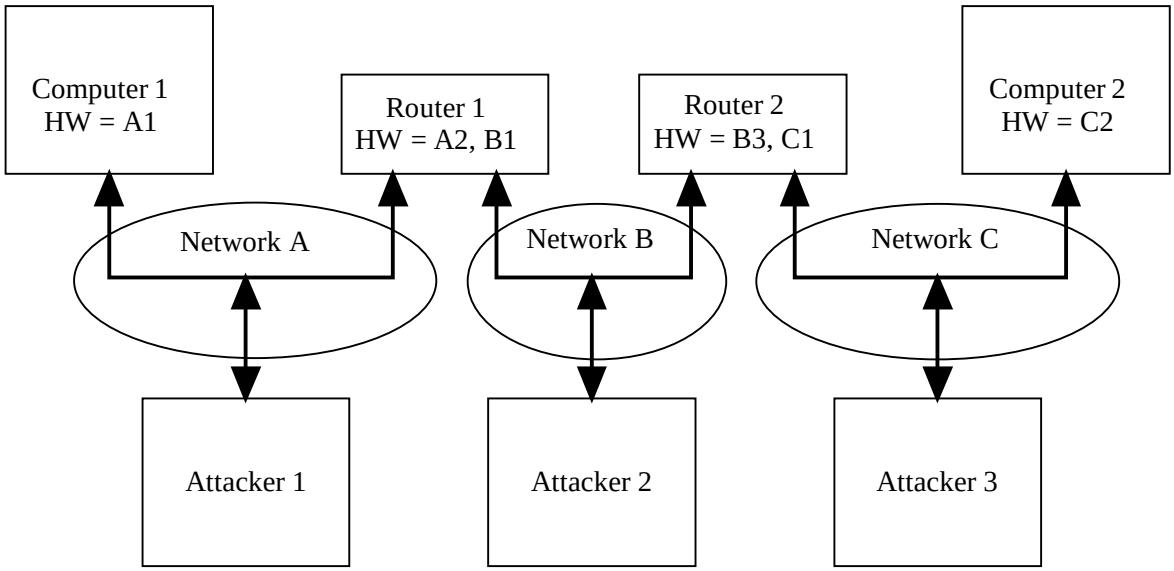
Common Attack Methods

- Address Spoofing
- Network Sniffing
- Network Scanning

Address Spoofing



Network Sniffing



Network Scanning

- Network layer is a global address space
- You can use the network layer protocols to locate targets
- Catch-22, you need to be able to locate a device to send packets to it, but that also allows someone to see if a device exists.

IP Layer Topics

- 1. Addressing
- 2. Routing
- 3. Packet Formats
- 4. ICMP Internet Control Message Protocol

Addressing

- We will look at three different parts of addressing.

- 1. IP addresses
- 2. Name to IP addresses translation
- 3. IP address to station datalink address

IP Addresses

- Globally unique
- Two parts
  - Network address
  - Host address

Example IP addresses

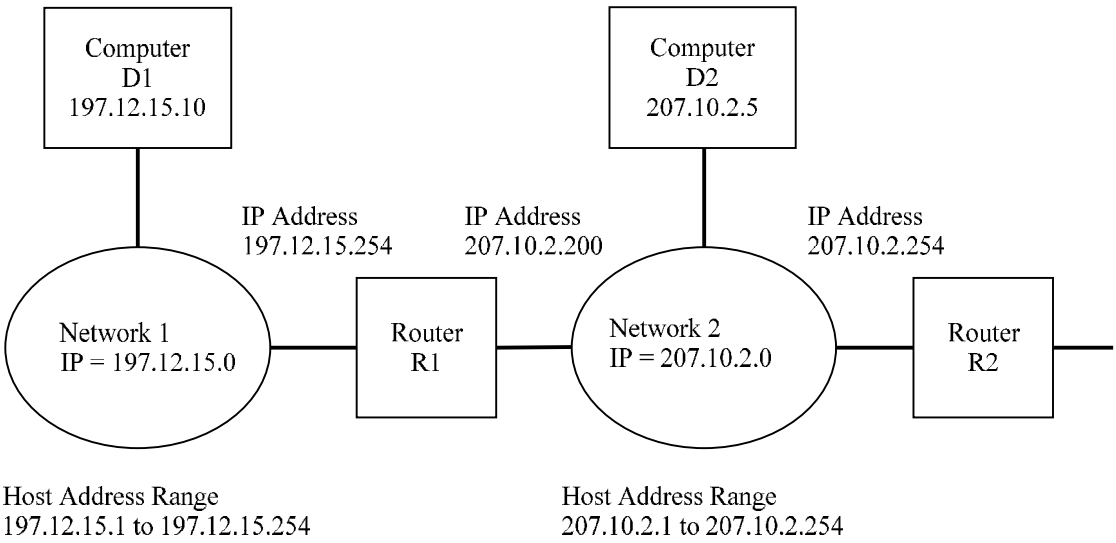


Figure 6.3 Example IP Addresses

IP Address Space

- In Version 4 the IP address is 32 Bits
- Total IP address space is 4,294,967,296

IP addresses

- The IP address is written as a four-tuple where each tuple is in decimal and are separated by a "." (called a dot). When talking about an address you pronounce the word dot. So 129.186.5.102 is pronounced 129 dot 186 dot 5 dot 102

IP Addresses

A	0 + Netid (7 bits)	Host ID (24 bits)	
B	10 + NetID (14 bits)	Host ID (16 bits)	
C	110 + Net ID (21 Bits)		Host ID (8 bits)
D	1110 + Multicast address		
E	11110 Reserved		

IP Address Allocation

Class	# of Addresses	%
A	2^31 = 2,147,483,648	50%
B	2^30 = 1,073,741,824	25%
C	2^29 = 536,870,912	12.5%
D	2^28 = 268,435,456	6.25%
E	2^28 = 268,435,456	6.25%

IP Address Distribution

Class	First network	Last network	# of Networks	# of hosts per network
A	1.0.0.0	126.0.0.0	126	16,777,214
B	128.0.0.0	191.255.0.0	16,384	65,534
C	192.0.0.0	223.255.255.0	2,097,152	254

IP Address Space

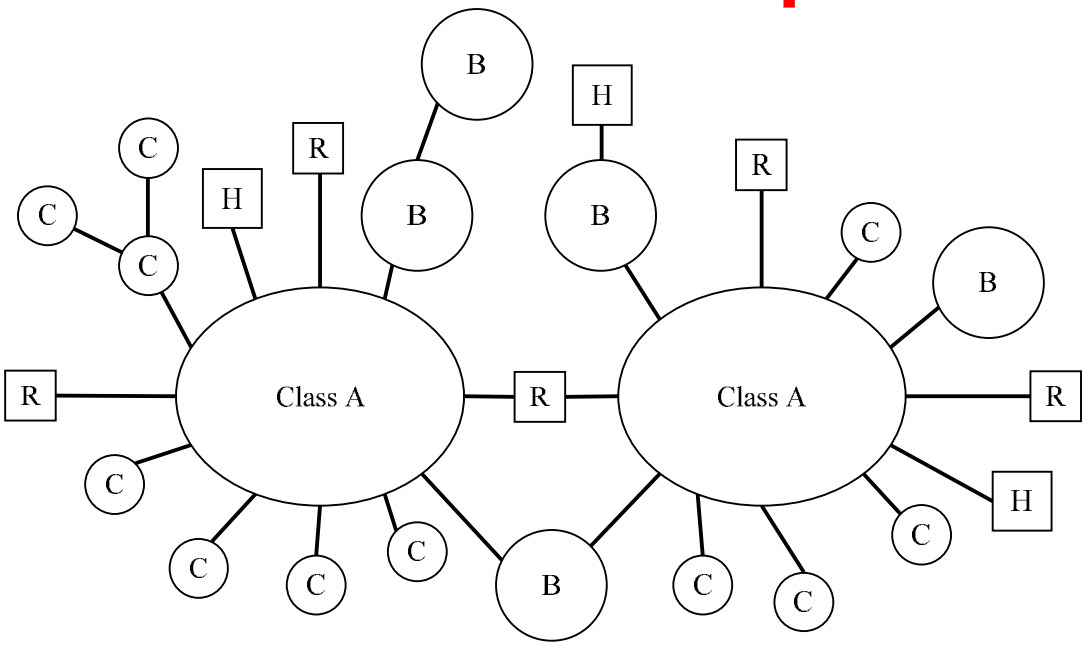


Figure 6.4 IP Address Space

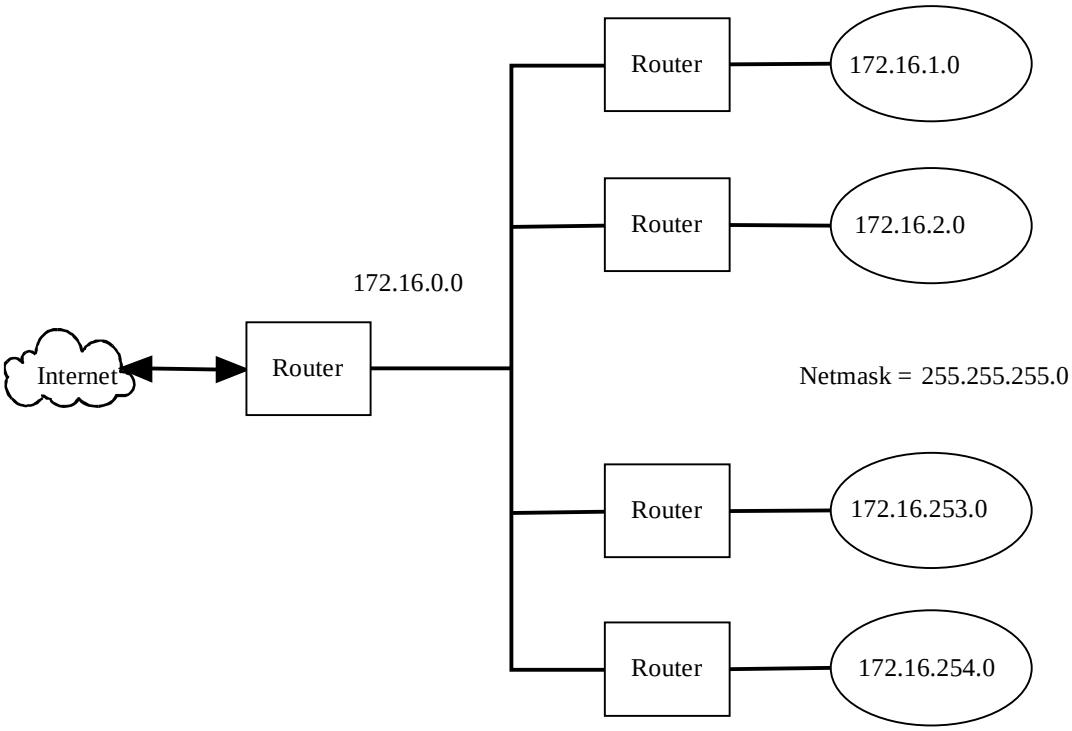
Special Addresses

0.0.0.0	This host, only at system startup, never a dest address
0.0.host	Host on this net, only at system startup, never a dest address
255.255.255.255	Limited Broadcast (local net only) Never a source address
Net.255.255	Directed broadcast address for net. Never a source address
127.0.0.1	Loopback

Loopback address

- The Class A address 127.0.0.0 is reserved for loopback and is designed for testing and interprocess communications on the local machine. When a program uses the loopback address the local host returns the data without sending across the network. The address 127.0.0.0 should never be seen on the network and a host or gateway should never propagate routing information on network 127.

Subnets



Classless Addresses CIDR

Class	Netmask	Example CIDR address
A	255.0.0.0	15.35.26.234/8
B	255.255.0.0	129.186.34.54/16
C	255.255.255.0	192.168.1.30/24