Introduction to Security

Computer Networks
Term B14

Intro to Security Outline

- Network Security
- Malware
  - Spyware, viruses, worms and trojan horses, botnets
- Denial of Service and Distributed DOS Attacks
- Packet Sniffing
- Masquerading Attacks
- Man-in-the-Middle Attacks

Networks under Attack

- The "original" Internet (i,e., ARPANET) was not designed with security in mind.
  - The early vision was "a group of mutually trusting users attached to a transparent network".
    - ARPANET started out as academics and DoD users!!
  - Protocol and application designers are playing "catch-up".
- The Internet changed:
  - Added industrial management partners → ISP's
  - WWW made the Internet accessible to the masses.
- Bad guys can attack networks and attempt to wreak havoc on our daily lives.

Network Security

- Network security is about:
  - How bad guys can attack computer networks.
  - How we can defend networks against attacks.
  - How to design architectures that are immune to attacks.
- Network security is becoming more important as more individuals become dependent on the Internet and as the destructive nature of new attacks increases.
- Security issues exist at all layers!

Malware

- Malware:: malicious “stuff” that enters our hosts from the Internet and infects our devices.
- Spyware collects private information (e.g., keystrokes and web sites visited) and uploads info to bad guy collection sites.
- An infected host can be enrolled in a botnet, used for spam and distributed denial-of-service (DDoS) attacks.
- Malware is often self-replicating (i.e., from an infected host, it seeks entry into other hosts).

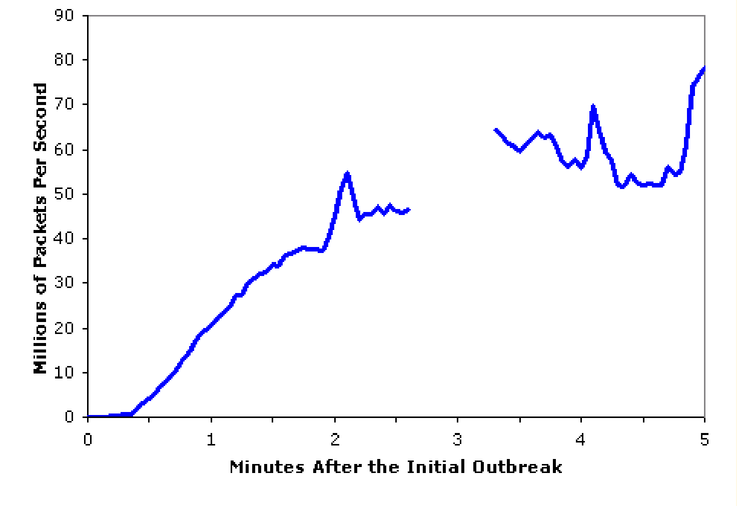
Malware from the Internet

- Malware can get into a host and spread in the form of a virus, worm, or trojan horse.
- Virus::
  - Requires some form of user active execution.
  - Classic example: an email attachment containing malicious executable code that is triggered when the attachment is opened.
  - Self-replicating (e.g., via address book)

Worms and Trojan Horses

- Worm
  - Infects by passively receiving object via a vulnerable network application that runs the malware to create worm.
  - Self-replicates by searching for hosts running the same application.

Sapphire Worm: aggregate scans/sec in first 5 minutes of outbreak (CAIDA, UWisc data)

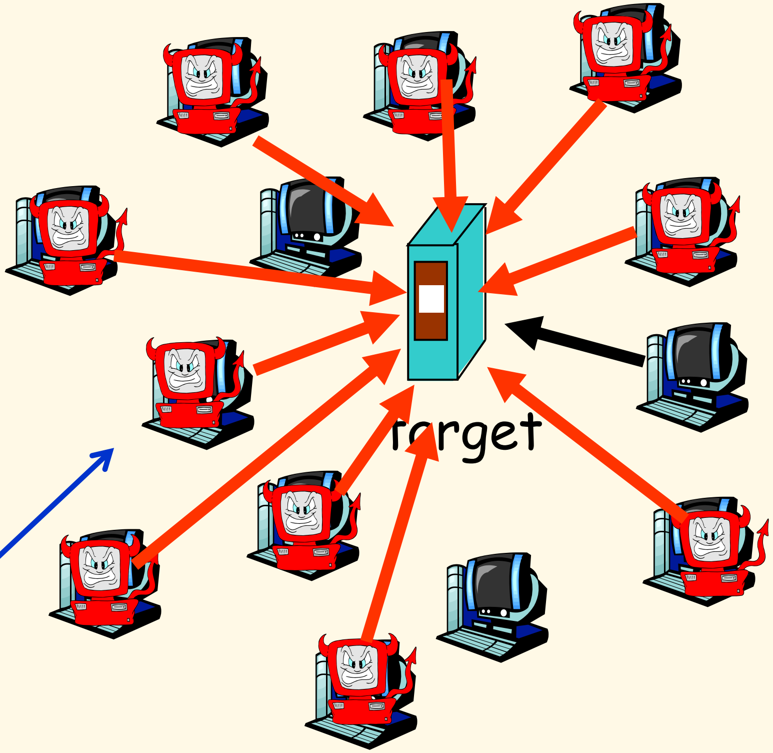


- Trojan horse
  - Hidden in some otherwise useful software.
  - Often found today on a Web page (Active-X, plugin).

Denial-of-Service Attack

- **Denial-of-service (DoS) renders resources (server, link) unusable by legitimate users by overwhelming the resource with bogus traffic.**

1. select target
2. break into hosts around the network (see botnet)
3. send packets toward target from compromised hosts



Distributed DoS (DDoS)

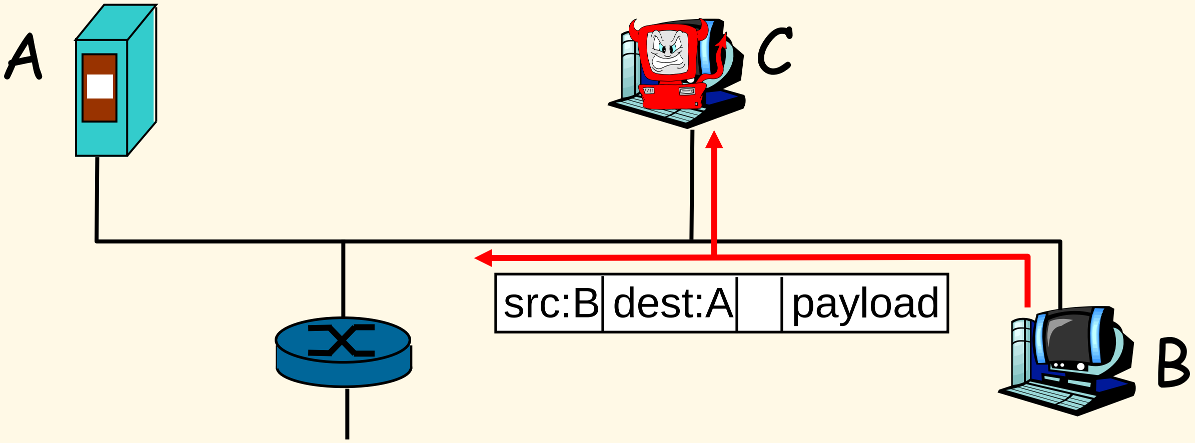
Denial-of-Service Attack

- Three categories:
  - Vulnerability attack:: attack application with well-crafted messages (result – service stops or host crashes).
  - Bandwidth flooding:: deluge victim with so many messages such that target's access link gets clogged.
  - Connection flooding:: initiate so many half-open or open TCP connections that target stops accepting legitimate connections.

Bad Guy Packet Sniffing

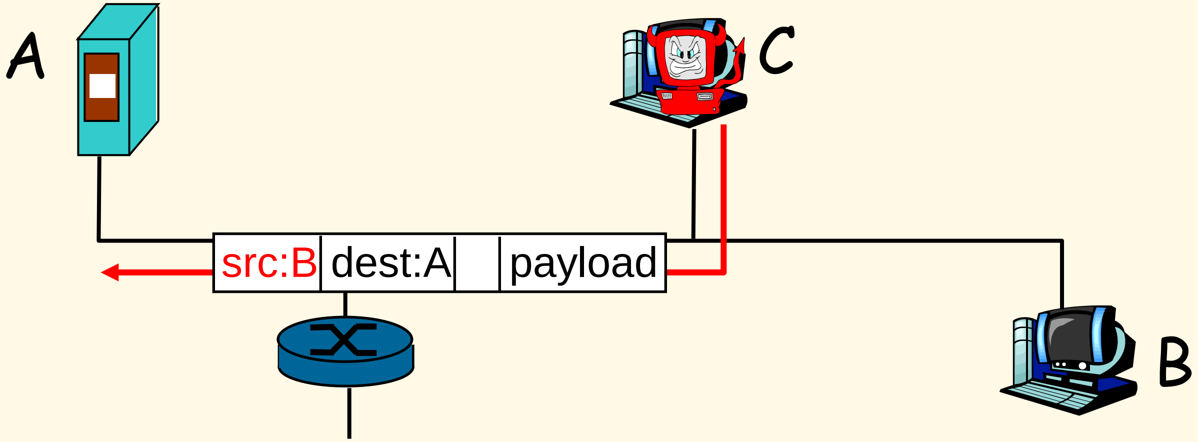
Packet sniffing:: passive receiver that records a copy of every packet that goes by (e.g., Wireshark)

- broadcast media (shared Ethernet, wireless)
- promiscuous network interface reads/records all packets (e.g., including passwords!) passing by



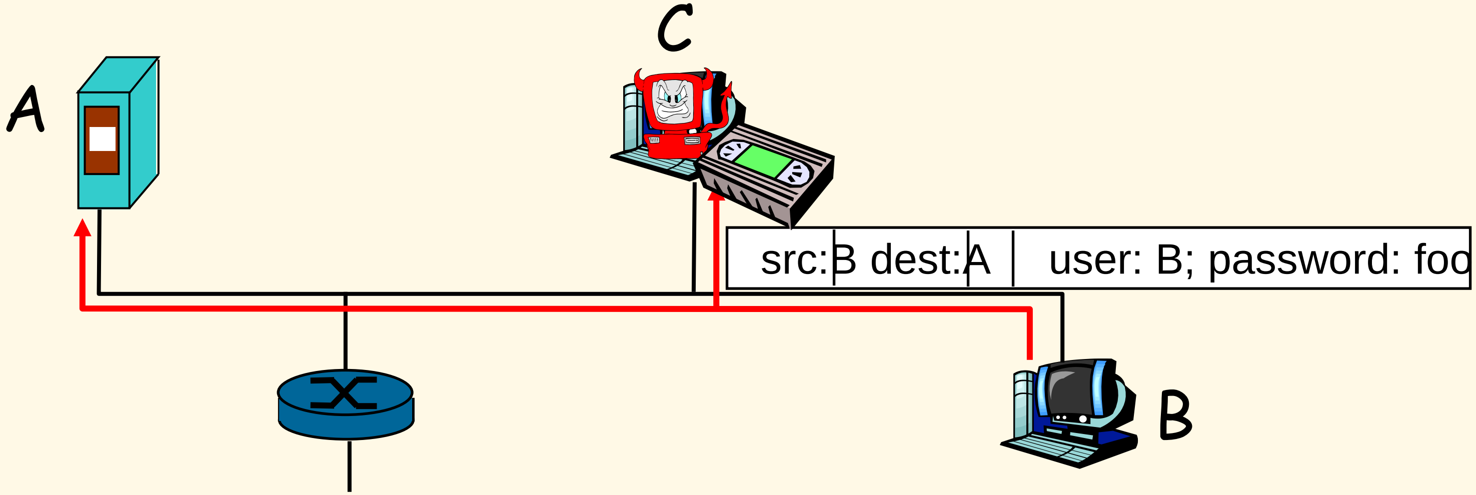
Masquerade Attack

- IP spoofing:: send a packet with false source address



Man-in-the-Middle Attack

- **record-and-playback::** sniff sensitive info (e.g., password), and use later
  - Bad guy password holder *is* that user from system point of view



Intro to Security Summary

- Network Security
- Malware
  - Spyware, viruses, worms and trojan horses, botnets
- DoS and DDOS Attacks
- Packet Sniffing (promiscuous mode)
- Masquerading Attacks (IP spoofing)
- Man-in-the-Middle Attacks
  - Record and playback