Packet Sniffing and Spoofing

Lecture 01

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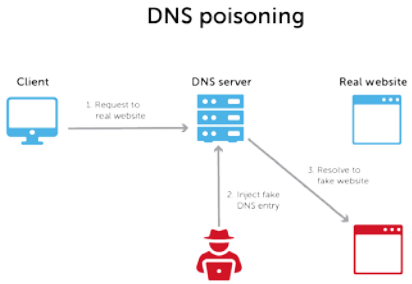
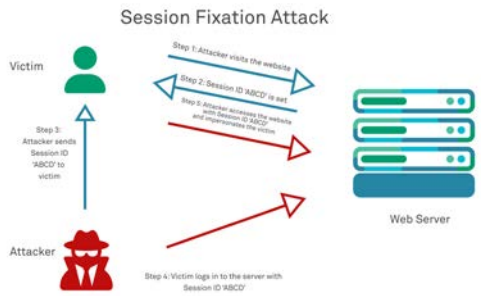
Introduction

- Two *common attacks* on *networks*:
  - ***sniffing attack***
    - eavesdropping on and capturing packets over networks
  - ***spoofing attack***
    - sending out invalid packets with false identification
- *sniffing* and *spoofing* are the *basis* for other network attacks
  - e.g., DNS cache poisoning and TCP session hijacking attacks





- *tools for conducting sniffing* and *spoofing*
  - *Wireshark* *Netwox* *Scapy*

How Packets Are Received?

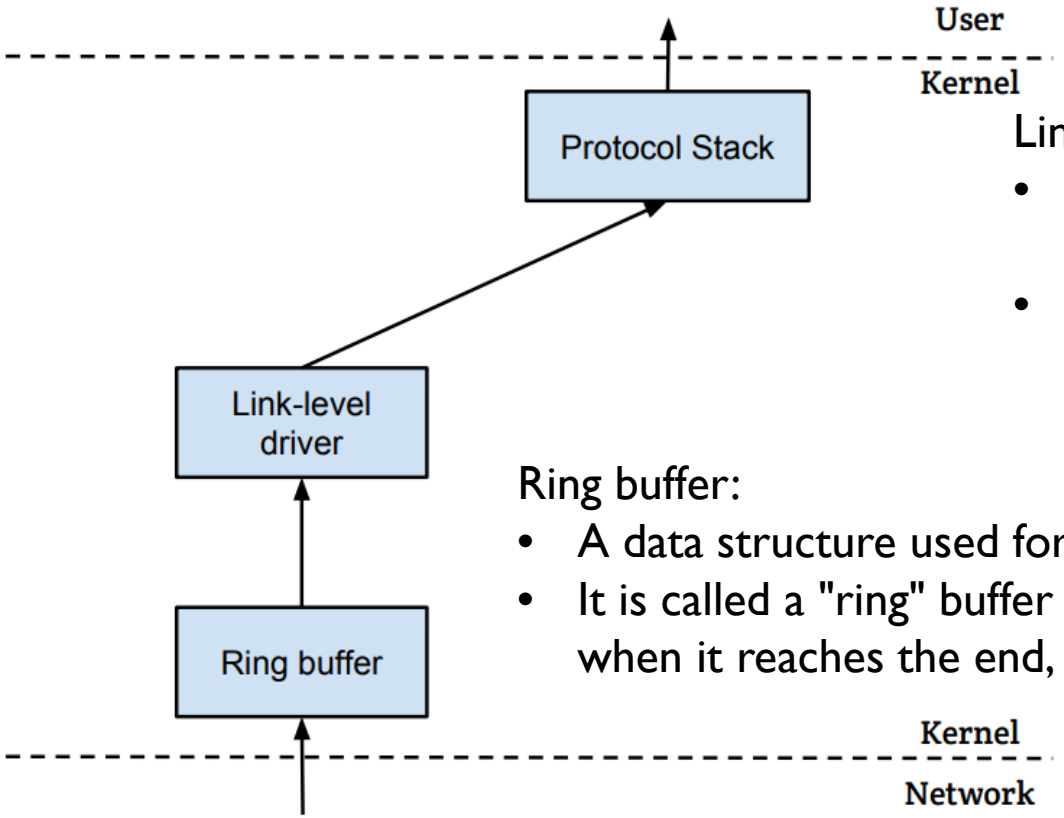


- Network Interface Card (NIC)
  - a *link* (physical or logical) between machine and network
  - NIC has a *hardware address*: ***MAC address***
- Common local comm. techniques: Ethernet and WiFi
  - *broadcast medium* by nature (or *single shared medium*)
  - as data (frame) flow in the medium, **every NIC** "***hears***" data
    - when frame arrives, it is copied into the memory in the NIC
      - checks des. MAC address in the header
        - if ***matching*** with NIC's MAC addr., the frame is copied into kernel buffer
          - interrupts the CPU for new packet
          - CPU copies packet into a queue (making room for other incoming packets)
        - if ***not matching***, the frame is *discarded*

function calls

How Packets Are Received? (cont.)

- Common local comm. techniques: Ethernet and WiFi
  - as data (frame) flow in the medium, **every NIC** "***hears***" data



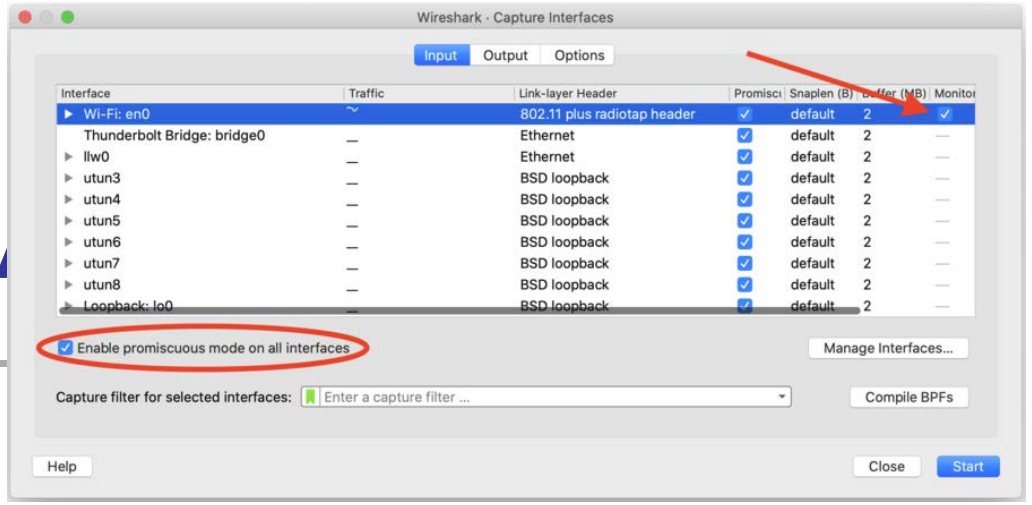
Linux kernel

- The core component of the Linux operating system.
- Acts as a bridge between the hardware of a computer and the software applications running on it.

Ring buffer:

- A data structure used for efficient data storage and retrieval.
- It is called a "ring" buffer because it is circular, meaning that when it reaches the end, it wraps around to the beginning

How Packets A



- *promiscuous mode*
  - most NIC have this special mode: pass every frame from network to the kernel, regardless of destination MAC add.
  - if registered, the kernel forwards all frames to sniffer program
    - usually require *elevated privilege*, e.g., root, to use promiscuous mode
- *monitor mode* (wireless network card)
  - unlike Ethernet, wireless devices suffer interference from other nearby wireless devices
  - to solve this, wireless devices transmit data on *different channels*
  - when NIC is placed in *monitor mode*, it captures 802.11 frames transmitting on the channel that it is listening to

BSD (Berkeley Software Distribution) Packet Filter (BPF)

- When sniffing, we're interested in certain types of packet
  - e.g., TCP packets or DNS query packets
- OS can deliver all captured packets to sniffer program, who can discard unwanted packets
  - ***inefficient*** and ***taking time***
    - processing and delivering unwanted packets (if large volume)
- Filtering unwanted packets ASAP
  - *BSD Packet Filter* (BPF): filtering at the ***lower level***
  - allow user-space program attaches a filter to a socket
    - discarding unwanted packets
  - filter: written in human readable format, and interpreted by BSD Pseudo-Machine (packet filtering)
  - *ref.*: https://www.tcpdump.org/papers/bpf-usenix93.pdf

BPF Filter Examples

- Capture traffic *to* and *from* IP host 192.168.1.1

  ip host 192.168.1.1

- Capture traffic *from* IP host 192.168.1.1

  ip *src* host 192.168.1.1

- Capture Ethernet packets *to* and *from* a host with a *MAC address* of 00:40:D0:13:35:36

  ether host 00:40:D0:13:35:36

- Capture Ethernet packets *to* host 00:40:D0:13:35:36

  ether *dst* 00:40:D0:13:35:36

ref.: https://www.ibm.com/docs/en/qsip/7.4?topic=queries-berkeley-packet-filters