Tools Set-3: Digging deeper into Network Layer
(Computer Networks Lab)

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Network Layer

- **IPv4, IPv6 packet format**
- **Addressing/Forwarding**
- **DHCP**
- **ARP**
- **ICMP**
- **NAT**
- Routing

Version	Traffic Class	Flow Label	
Payload Length		Next Header	Hop Limit
Source Address (16)			
Destination Address (16)			
Next Header / Data			

IPv6 Packet Format

Packet Format/NAT: "wireshark"

- Run Wireshark and explore IPv4 and IPv6 headers
  - "ping ipv6-address"
- Fragmentation: Send a large packet
- Wireshark trace that captures NATing

32 Bits

0	4	8	16	19	31
Ver	HL	Type of Service	Total Length		
Identification			Flags	Fragment Offset	
Time to Live		Protocol	Header Checksum		
Source IP Address					
Destination IP Address					
Options					
Data (Variable Length)					

"code"

server

client

Addressing/Forwarding: "ip"

- Which subnet do I belong to?
  - "ip addr" or "ifconfig"
    - IP prefix, Subnet mask
    - Broadcast address
- Forwarding at a host?
  - "ip route" or "route"
    - Default route
    - IP prefix based forwarding

IP addr
IP address →
MAC

ip route
default

DHCP: "dhclient", "wireshark"

- Run wireshark and then run
  - "dhclient –v eno1" (may or may not see discover) *= verbose*
  - "dhclient –v –r eno1" (DHCP release message)
  - "dhclient –v eno1" (After release, you should see discover)

Needs root permission to run

ARP: "ip", "arping", "wireshark"

some-ip → MAC

machine
10.129.5.64
MAC

- "ip neigh" (arp cache)
- Sending gratuitous ARPs
  - arping –I wlp1s0 –A own-ip-address (Request)
  - arping –I wlp1s0 –U –P own-ip-address (Reply)

"arping" may not be installed by default (then do
"sudo apt-get install arping"). Normally needs root permissions to run

ICMP: "ping", "traceroute/mtr", "wireshark"

ICMP

- Ping : covered before
- traceroute: determines the route to a destination
  - "traceroute www.iitb.ac.in" *IP addr*
- mtr: combines ping with traceroute
  - Does traceroute continuously
  - "mtr www.iitb.ac.in"
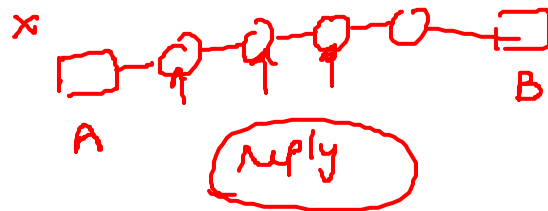
"traceroute" may not be installed by default, then do "sudo apt-get install traceroute".

Summary

- Concepts: Packet formats, Addressing/forwarding, DHCP, ARP and ICMP
  - ip, dhclient, arping, mtr/traceroute and our usual friend wireshark