Obtaining IP Addresses

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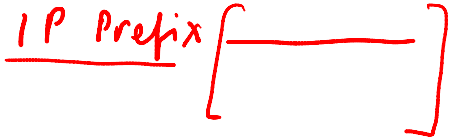
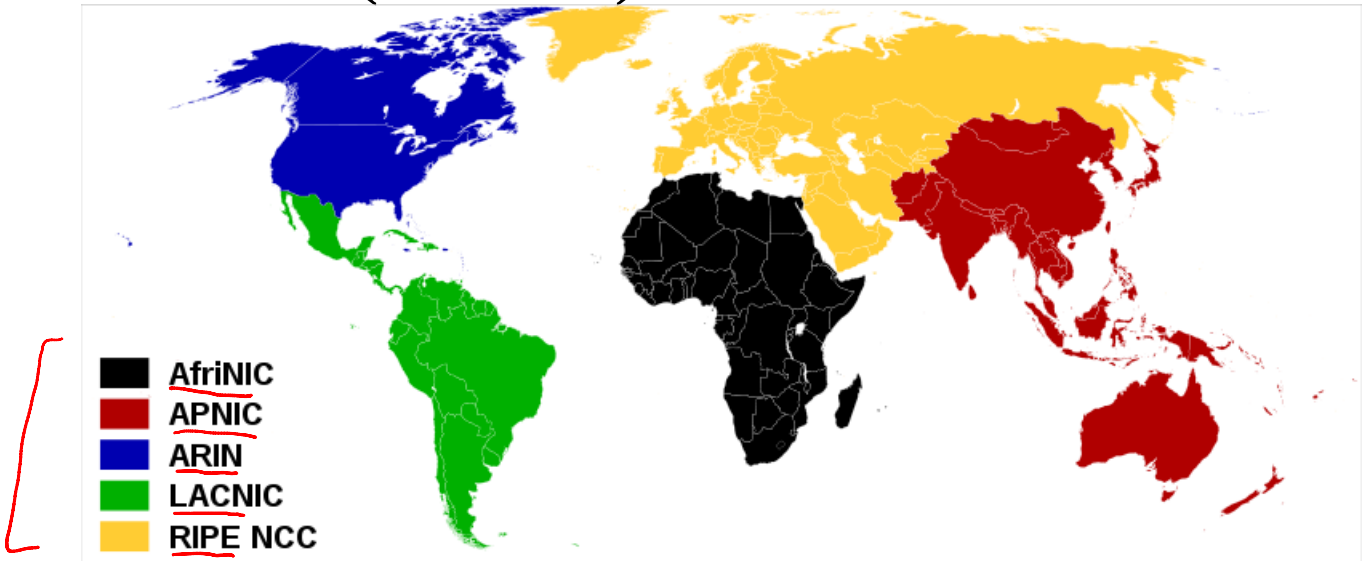
Organization



- How does an organization get an address block?
- Ans: From provider Internet Service Provider (ISP)
- Indian: Reliance, Tata
- International: Sprint, AT&T

Internet Service Provider (ISP)

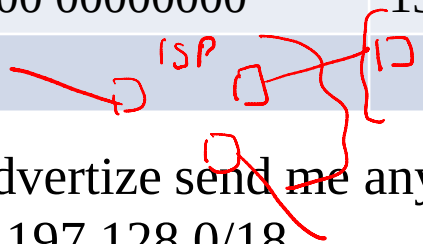
- How does an ISP get address blocks?
- Ans: From Regional Internet Registries (RIR) which are controlled by Internet Corporation for Assigned Names and Numbers (ICANN)



Organization

- How does an organization get an address block?
- Ans: From provider Internet Service Provider (ISP)

ISP's Block	10000101 11000101 10000000 00000000	133.197.128.0/18
Organization 0	10000101 11000101 10000000 00000000	133.197.128.0/19
Organization 1	10000101 11000101 10100000 00000000	133.197.160.0/21
Organization 2	10000101 11000101 10101000 00000000	133.197.168.0/21
Organization 3	10000101 11000101 10110000 00000000	133.197.176.0/21
……	……	



During routing process: ISP Routers will advertize send me anything with addresses beginning 133.197.128.0/18

Host

Physical networks
subnetting

- Organization has an IP prefix
  - How does a host get a specific IP address?
- Address needs to be unique and location-dependent → Re-configurable address

[IP address
Mask
default route
DNS server

- Before any communication, the host needs an IP address and default router's IP address

"Remote"

Configuration

- Manual Configuration
  - Windows: control-panel-> Network and Internet -> Network Connections -> Local Area Connection -> TCP/IPv4 -> properties
  - Unix: ifconfig
  - Remote configuration difficult, error prone
- Automatic Configuration: Dynamic Host Configuration Protocol (DHCP)
  - Dynamically get address from a server
  - “plug-and-play”

Idea

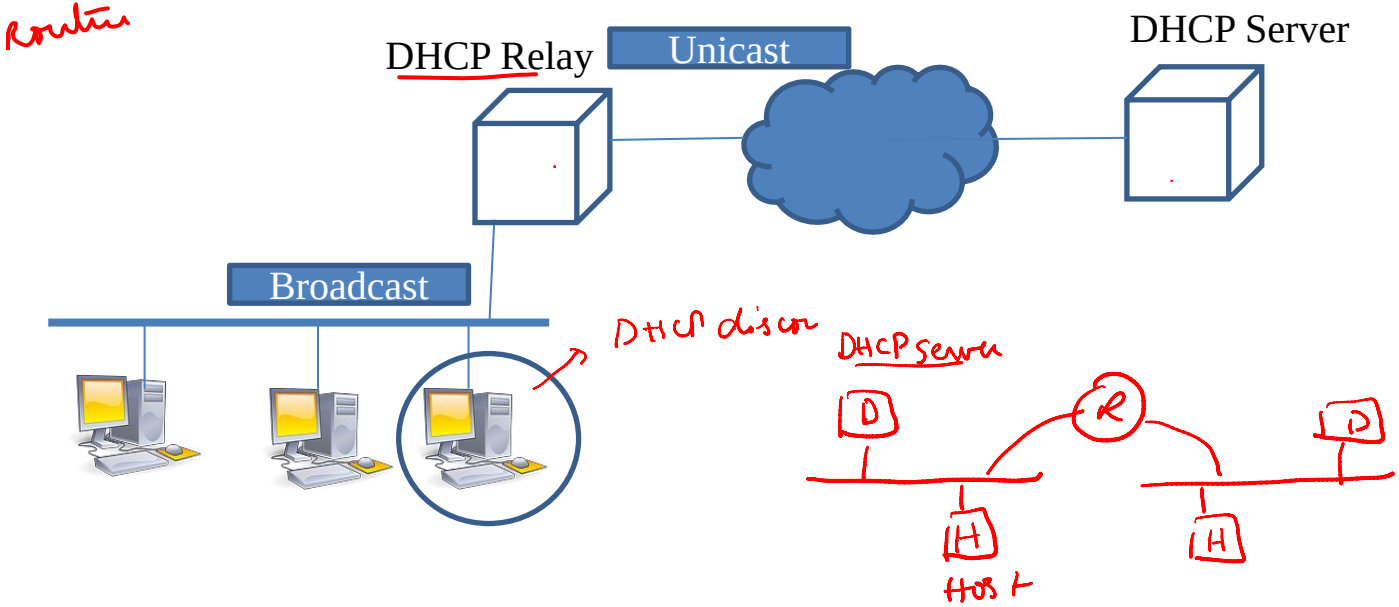
- DHCP server maintains a pool of available addresses
- Addresses handed out on demand (leased for some specific time)
  - Host periodically needs to renew the lease
- Advantages: Ease of configuration (automated), reuse of IP addresses, supports portability
- But how does the host know address of DHCP server?

DHCP Operation

- Operates at application layer using UDP protocol
- A newly booted/attached host 'broadcasts' DHCP discover message
  - IP address: 255.255.255.255 goes as link-layer broadcast (broadcast restricted to physical network)
  - Received by all hosts/routers in the physical network
- DHCP Server replies to host (others ignore message)

Relay Operation

- One DHCP server over multiple subnets



Message Exchange

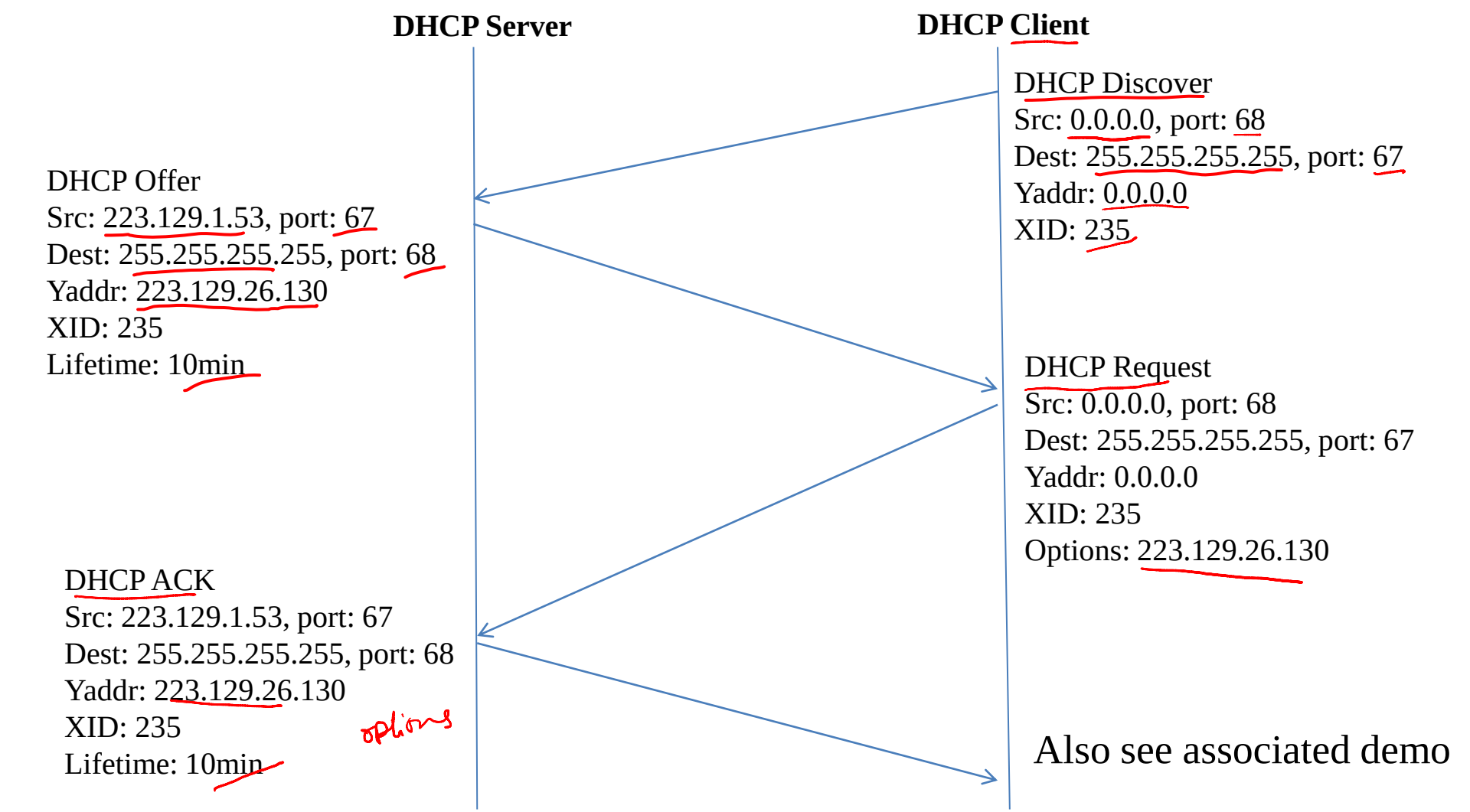
- Host broadcasts “DHCP discover” msg
- DHCP server responds with “DHCP offer” msg
- Host requests IP address: “DHCP request” msg
- DHCP server confirms address: “DHCP ack” msg
- DHCP server also passes subnet mask, default router, domain name, DNS server info etc if host asks for it

DHCP Packet Format

request / reply

Operation (1)	Htype (1) (Hardware)	Hlen (1) 6	Hops (1) =0
Xid (4) transaction id			
Secs (2)		Flags (2) 16 bit – 1 bit – Broadcast flag	
Ciaadr (4) ✓			
Yiaddr (4) Your IP			
Siaddr (4) Server IP			
Giaddr (4) Relay agent			
Chaddr (16) → Hardware			
Sname (64) hostname			
File (128)			
Options (312) Server			

BOOTP


DHCP Server
DHCP Client
DHCP Discover
Src: 0.0.0.0, port: 68
Dest: 255.255.255.255, port: 67
Yaddr: 0.0.0.0
XID: 235
DHCP Offer
Src: 223.129.1.53, port: 67
Dest: 255.255.255.255, port: 68
Yaddr: 223.129.26.130
XID: 235
Lifetime: 10min
DHCP Request
Src: 0.0.0.0, port: 68
Dest: 255.255.255.255, port: 67
Yaddr: 0.0.0.0
XID: 235
Options: 223.129.26.130
DHCP ACK
Src: 223.129.1.53, port: 67
Dest: 255.255.255.255, port: 68
Yaddr: 223.129.26.130
XID: 235
Lifetime: 10min
options
Also see associated demo

Router Configuration

- How are router interface addresses configured?
- By a system administrator manually via a network management tool

Summary

- IP addresses crucial for communication
- Organizations get IP prefixes from ISPs
- ISPs get from RIRs
- Hosts gets from DHCP server
- Ahead: Supporting Protocols – ARP, ICMP

Demo in Linux

- Run a packet capture tool like wireshark or tcpdump
- Run “dhclient eth0” (replace eth0 with whatever is the correct interface).
- Stop packet capture and analyze captured packets