Obtaining IP Addresses

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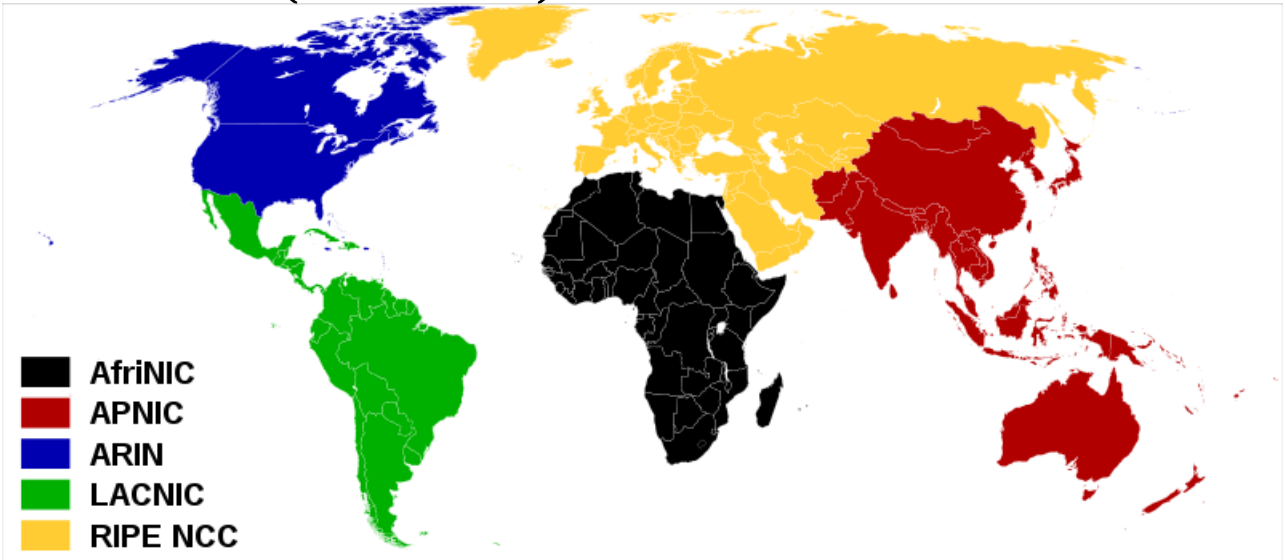
Organization

- 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

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

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

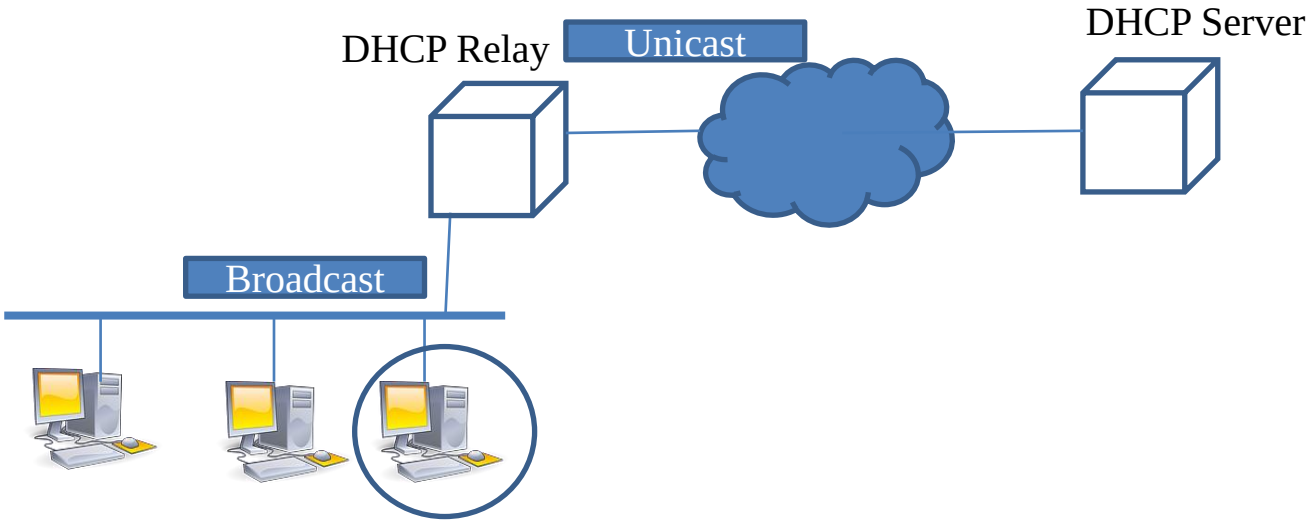
- DHCP server maintains a pool of available addresses
- Addresses handed out on demand (leased for some specific time)
  - Host periodically needs to renew the lease
- Advantages: Ease of configuration (automated), reuse of IP addresses, supports portability
- But how does the host know address of DHCP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

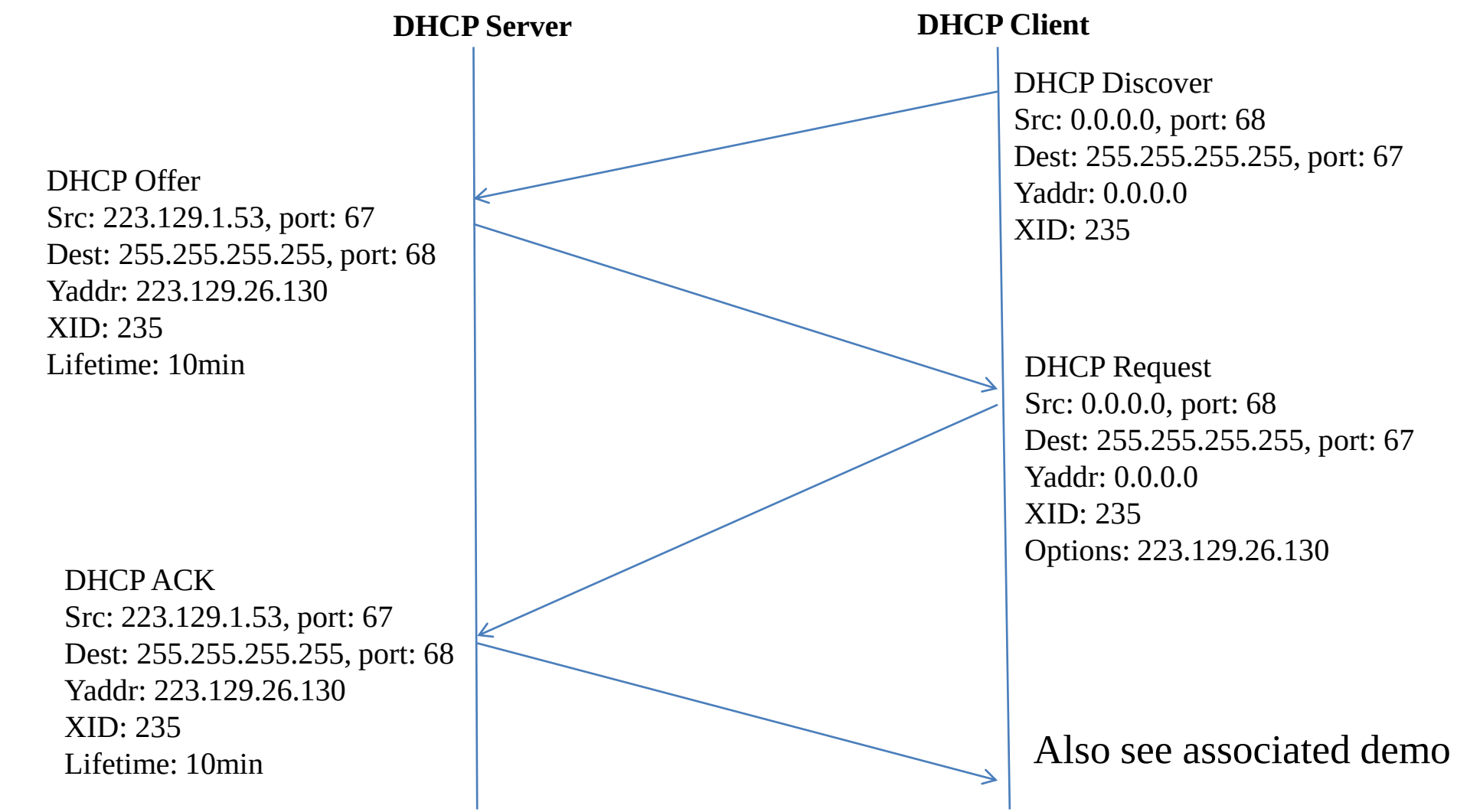


Message Exchange

- 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

Operation (1)	Htype (1)	Hlen (1)	Hops (1)
Xid (4)			
Secs (2)		Flags (2)	
Ciaadr (4)			
Yiaddr (4)			
Siaddr (4)			
Giaddr (4)			
Chaddr (4)			
Sname (64)			
File (128)			
Options (312)			


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
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