Dynamic Host Configuration Protocol (DHCP)

Part - I

Outline

- What is DHCP, and when & where is it used?
- Components of DHCP
- BOOTP and DHCP relation
- DHCP procedures
- Benefits of DHCP

What is DHCP?

- Dynamic Host Configuration Protocol
  - Used for dynamic allocation of IP addresses
    - used for hosts that run only client applications
  - Allows for host-specific configuration parameters to be delivered from a DHCP server to a host
- DHCP can also be used to convey permanent IP address assignments to hosts
  - Server interfaces need permanent addresses because clients need to be able to reach them
  - Also, router interfaces should have permanent addresses for stability of routing data

Where is DHCP used?

- Since class B and class C address spaces have been exhausted, service providers and enterprises use dynamically allocated IP addresses
  - e.g., a cable modem service provider who has many customers
    - since not all customers are simultaneously on the Internet, a client host dynamically obtains an address for a short period of time and releases it for use by some other client
  - e.g., used on the Poly campus on our 802.11 wireless network, where many students, faculty and staff members use their wireless cards for access to the Poly campus network

Relevance of DHCP to wireless and mobile networking

- If an end host only runs the "client" ends of applications
    - e.g. a web browser, but not a web server
    - e.g. Outlook to download email messages delivered to a PC user's incoming mail server, but not the mail server itself
    - e.g. Windows PCs have ftp clients but not ftp servers
        - you ftp into utopia, but do you typically ftp into your PC?
    - Then, the end host can simply connect to the network at any "point of attachment," obtain a network address and start receiving information

Why is a dynamically obtained address sufficient for such hosts?

- Because, such end hosts only make "outgoing calls"
  - When such an end host initiates a call (TCP connection), the called server receives an IP packet from the calling host with the host's new temporary address and hence can, in turn, send the caller back requested data
- These hosts do not receive "incoming calls," i.e., no one calls them
  - Therefore, such end hosts do not need a permanent address that potentially "callees" will need to know
- Question: can we categorize a cellular telephone as such an "end point"

Answer to question in previous slide

- No, because a cell phone can be called.
- Therefore callees (calling parties) will need to know the network address of the cellular phone.

Is DHCP needed only for wireless users or also wired?

- DHCP can be used whether link to endpoint is "wired" or "wireless"
  - Even with an Ethernet NIC, a host can use DHCP to dynamically obtain an IP address
  - e.g. cable modem user; Ethernet from host to cable modem; cable from modem to Internet

DHCP for mobile users?

- DHCP is not designed to handle mobility by itself
  - location management problem is to enable the delivery of calls to mobiles; but this means the callee needs the permanent address of the called mobile; so location management problem does not arise for DHCP hosts
  - handoff management requires a rerouting of packets when end host is in a connection; "costly" to update far end of connection with a new temporary address if DHCP is used to change addresses when a user moves

Components

- DHCP client: a host using DHCP to obtain an IP address and other configuration information
- DHCP server: a host that returns IP addresses and other configuration information
- BOOTP relay agents: host or router that passes DHCP messages between DHCP clients and DHCP servers

DHCP uses BOOTP

- Based on BOOTP
  - Uses BOOTP format for messages
  - Uses BOOTP relay agents to avoid having one DHCP server per network segment
- BOOTP used to bootstrap hosts
  - First operation, get Ethernet and IP address for itself and the address of a server and bootfile name (diskless client)
  - Second operation, uses TFTP to download bootfile
- BOOTP uses UDP
  - 67 for the server port
  - 68 for the client port

Differences between BOOTP and DHCP

- Two differences
  - DHCP specifies a "lease time" for IP address usage allowing for allocation of the same address to another client upon lease expiry
  - DHCP can acquire all IP-related configuration information, more than in BOOTP
- BOOTP clients can talk to DHCP servers (backward compatibility)
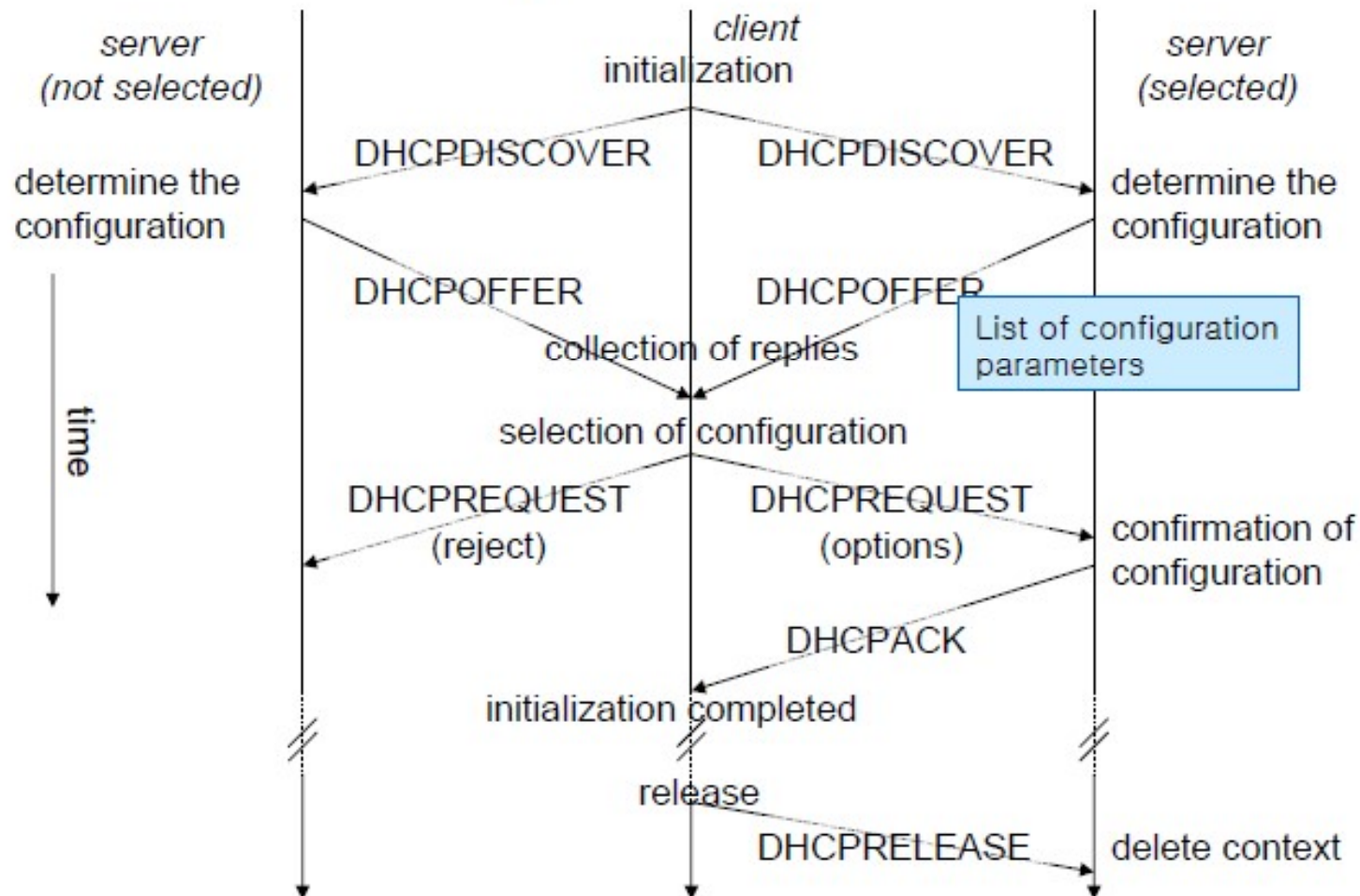 - DHCP is an extension of BOOTP
  - Message format similar

Types of DHCP messages

- DHCPDISCOVER
- DHCPOFFER
- DHCPREQUEST
- DHCPACK
- DHCPNAK
- DHCPDECLINE
- DHCPRELEASE
- DHCPINFORM

DHCP procedures/ DHCP - protocol mechanisms

- Obtaining a new address
- Reusing a previously allocated address

Allocating new address

DHCP characteristics (1/2)

- Server
  - several servers can be configured for DHCP, coordination not yet standardized (i.e., manual configuration)
- Renewal of configurations
  - IP addresses have to be requested periodically, simplified protocol
- Options
  - available for routers, subnet mask, NTP (network time protocol) timeserver, SLP (service location protocol) directory,
- DNS (domain name system)
  - Big security problems!
  - no authentication of DHCP information specified

DHCP characteristics (2/2)

❑ Application
  ◆ If a new computer is connected to a network, DHCP provide it with all necessary information for full system integration into the network.
  ◆ supplies systems with all necessary information, such as IP address, DNS server address, domain name, subnet mask, default router etc.
  ◆ enables automatic integration of systems into an Intranet or the Internet, can be used to acquire a COA for Mobile IP

❑ Client/Server-Model
  ◆ the client sends via a MAC broadcast a request to the DHCP server: DHCP Discover.