HOST CONFIGURATION
Outline

→ Manual configuration
→ Dynamic configuration: DHCP
→ Automatic configuration
Host Configuration

→ Required
  → IP address
  → Netmask
→ Practically required
  → Default gateway(s)
  → DNS server(s)
Host Configuration

→ Optional
→ Name
→ Default domain
→ WINS server

Traditionally manual
Issues

→ Non-technical users
→ Mobile terminals
Dynamic Configuration

**Internet Protocol (TCP/IP) Properties**

**General**

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

- **Obtain an IP address automatically**
- **Use the following IP address:**
  - IP address:
  - Subnet mask:
  - Default gateway:

- **Obtain DNS server address automatically**
- **Use the following DNS server addresses:**
  - Preferred DNS server:
  - Alternate DNS server:

**Alternate Configuration**

**Status:** Connected
DHCP is currently active and has the IP address 192.168.1.175.

- **Configure IPv4:** Using DHCP
- **IP Address:** 192.168.1.175
- **Subnet Mask:** 255.255.255.0
- **Router:** 192.168.1.1
- **DNS Server:** 192.168.1.74, 192.168.1.12
- **Search Domains:** nettunoroma

**Advanced...**

**OK**  **Cancel**

- **Click the lock to prevent further changes.**
DYNAMIC ADDRESS CONFIGURATION

DHCP: Dynamic Host Configuration Protocol
Legacy: Multiple Request Approach

→ RARP request to get IP address
→ ICMP Address Mask Request Message
→ ICMP Gateway Discovery Message
→ Possibly multiple replies
DHCP: Dynamic Host Configuration Protocol

DHCP Client

I need a configuration

DHCP Server

Here it is: address, netmask, ...

IP address database
DHCP: Dynamic Host Configuration Protocol

- Encapsulated in UDP
- Port 67
- Broadcasted messages
- Both MAC and IP
- Client uses 0.0.0.0
- Server uses 255.255.255.255
Negotiation

- Server proposes IP configuration
- There might be multiple servers
- Multiple proposals
- Client picks and requests
Address Allocation

- Dynamic allocation
- An IP address is assigned to different hosts over time
- A host might be assigned different addresses over time
Address Allocation

- Automatic allocation
- A client always gets the same IP address
- Not known/determined in advance
Address Allocation

- Manual allocation
- A client always gets the same IP address
- Manually assigned by the network administrator
Address Allocation

- Manual allocation

- DHCP is used for automatic configuration of the client
## Main Message Fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>op</td>
<td>op code/message type</td>
</tr>
<tr>
<td>htype</td>
<td>HW type</td>
</tr>
<tr>
<td>hlen</td>
<td>HW address length</td>
</tr>
<tr>
<td>hops</td>
<td>Hops</td>
</tr>
<tr>
<td>xid</td>
<td>Transaction ID</td>
</tr>
<tr>
<td>secs</td>
<td>Secs</td>
</tr>
<tr>
<td>flags</td>
<td>Flags</td>
</tr>
<tr>
<td>ciaddr</td>
<td>Client HW address</td>
</tr>
<tr>
<td>yiaddr</td>
<td>Server assigned IP address</td>
</tr>
<tr>
<td>siaddr</td>
<td></td>
</tr>
<tr>
<td>giaddr</td>
<td></td>
</tr>
<tr>
<td>chaddr</td>
<td>Client HW address</td>
</tr>
<tr>
<td>sname</td>
<td></td>
</tr>
<tr>
<td>file</td>
<td>File size of 128 bytes</td>
</tr>
<tr>
<td>option</td>
<td>Option (variable)</td>
</tr>
</tbody>
</table>

- **op**: op code/message type
  - 1 = BOOTREQUEST
  - 2 = BOOTREPLY
- **htype**: HW type
- **hlen**: HW address length
- **chaddr**: client HW address
- **xid**: Transaction ID
- **yiaddr**: server assigned IP address
Options

<table>
<thead>
<tr>
<th>Code</th>
<th>Length</th>
<th>Value</th>
<th>Extensible</th>
</tr>
</thead>
</table>

- Message type (53)
- Subnet mask (1)
- Router (3)
- Domain name (15)
- DNS server (5)
<table>
<thead>
<tr>
<th>Value</th>
<th>Message Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DHCPDISCOVER</td>
</tr>
<tr>
<td>2</td>
<td>DHCPOFFER</td>
</tr>
<tr>
<td>3</td>
<td>DHCPREQUEST</td>
</tr>
<tr>
<td>4</td>
<td>DHCPDECLINE</td>
</tr>
<tr>
<td>5</td>
<td>DHCPACK</td>
</tr>
<tr>
<td>6</td>
<td>DHCPNAK</td>
</tr>
<tr>
<td>7</td>
<td>DHCPRELEASE</td>
</tr>
<tr>
<td>8</td>
<td>DHCPINFORM</td>
</tr>
</tbody>
</table>

53 | 1 | Value
Message Exchange

1. DHCPdiscover
2. DHCPoffer
3. DHCPrequest
4. DHCPack

00D0B7-4D9EB3
192.168.10.105

000102-0CF9AA
195.31.235.220
Lease

- IP address allocation has limited duration
- Client can request a renewal before exp.
- DHCP Request–DHCP Ack
- A new configuration might be offered
- DHCP Request–DHCP Offer
Lease Renewal

→ If renewal fails, full assignment procedure

→ E.g., server does not respond to DHCP Request

→ From DHCP Discover on
Lease Renewal

- Rebooting host
- Lease renewal (DHCP Request)
- New configuration (DHCP Discover)
DHCP Shortcoming

- Client and server on one physical network
- Impractical on large networks with many subnets
DHCP Relay

- Usually implemented in routers
- Forwards DHCP Request messages to a DHCP server
- Server address manually configured
DHCP Relay

- Usually implemented in routers
- Forwards DHCP Request message to DHCP server
- DHCP Relay address on client network included in giaddr field
DHCP Relay

- Address assigned based on client network
- giaddr field
- Server sends DHCP Reply message to DHCP Relay
- DHCP Relay forwards DHCP Reply message on client subnet
DHCP and DDNS
Windows 2000 DHCP Client

Update DNS PTR record (4)

Update DNS A record (3)

DHCP Request (1)

DHCP Ack (2)

DHCP Client
Windows 2000

DNS Server

DHCP Server
DHCP and DDNS

Other DHCP Clients (Win9x e NT)
AUTOMATIC CONFIGURATION
Motivation

- There might be no server
- Dentist office
Automatic Configuration

→ Reserved addresses: 169.254.0.0/16
→ Automatic Addresses
→ Link-local addresses
→ Only communication on physical network
→ No default gateway
Operating Principle

⇒ Host generates host part
⇒ Random
⇒ MAC address or time as seed
⇒ ARP to check uniqueness