HOST CONFIGURATION
Outline

→ Manual configuration
→ Dynamic configuration: DHCP
→ Automatic configuration
MANUAL 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
Windows XP

Network Connections

Local Area Connection Properties

Internet Protocol (TCP/IP) Properties

- Obtain an IP address automatically
- Use the following IP address:
  - IP address: 130.132.16.21
  - Subnet mask: 255.255.255.0
  - Default gateway: 130.132.16.17

- Obtain DNS server address automatically
- Use the following DNS server addresses:
  - Preferred DNS server: 130.132.3.21
  - Alternate DNS server: 130.132.3.24

Configure...
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

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

<table>
<thead>
<tr>
<th>op</th>
<th>htype</th>
<th>hlen</th>
<th>hops</th>
<th>xid</th>
<th>secs</th>
<th>flags</th>
<th>ciaddr</th>
<th>yiaddr</th>
<th>siaddr</th>
<th>giaddr</th>
<th>chaddr</th>
<th>sname</th>
<th>file (128)</th>
<th>option (variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>op: op code/ message type</td>
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<tr>
<td>1 = BOOTREQUEST</td>
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<td>2 = BOOTREPLY</td>
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<td>htype: HW type</td>
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<td>hlen: HW address len</td>
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<td>chaddr: client HW address</td>
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<td>xid: Transaction ID</td>
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<td>yiaddr: server assigned IP address</td>
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</tbody>
</table>

- **op**: Op code/message type
- **htype**: HW type
- **hlen**: HW address len
- **chaddr**: Client HW address
- **yiaddr**: Server assigned IP address
- **xid**: Transaction ID
Options

- 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>
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<tr>
<td>4</td>
<td>DHCPDECLINE</td>
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<tr>
<td>5</td>
<td>DHCPACK</td>
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<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>

The value 53 is associated with the Message Type 1.
Message Exchange

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

192.168.10.105
00D0B7-4D9EB3

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
Other DHCP Clients (Win9x e NT)

Update DNS A record (3)
Update DNS PTR record (4)

DHCP Request (1)
DHCP Ack (2)

DNS Server
DHCP Server
DHCP Client Windows NT
AUTOMATIC CONFIGURATION
Motivation

- There might be no server
- Dentist office
Automatic Configuration

- Reserved addresses: 169.254.O.O/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