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
MacOS

Ufficio Poli

TCP/IP  DNS  WINS  802.1X  Proxies  Hardware

DNS Servers:
130.192.3.24
130.192.3.21

Search Domains:

Status: Cable Unplugged
Either the cable for Ufficio Poli is not plugged in or the device at the other end is not responding.

Manually
130.192.5.33
255.255.255.0
130.192.5.17
130.192.3.24, 130.192.3.21

IPv4 or IPv6 addresses

Click the lock to prevent further changes.
Issues

→ Non-technical users
→ Mobile terminals
Dynamic Configuration

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:

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
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

Here it is: address, netmask, ...

DHCP Server

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

- **op**: op code/ message type
  - 1 = BOOTREQUEST
  - 2 = BOOTREPLY
- **htype**: HW type
- **hlen**: HW address len
- **chaddr**: client HW address
- **yiaddr**: server assigned IP address
- **file**: message options
  - (128)
  - (variable)

<table>
<thead>
<tr>
<th>op</th>
<th>htype</th>
<th>hlen</th>
<th>hops</th>
<th>xid</th>
</tr>
</thead>
<tbody>
<tr>
<td>secs</td>
<td>flags</td>
<td>ciaddr</td>
<td>yiaddr</td>
<td>siaddr</td>
</tr>
</tbody>
</table>
### Options

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

- Message type (53)
- Subnet mask (1)
- Router (3)
- Domain name (15)
- DNS server (5)
## Message Type

<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>

<table>
<thead>
<tr>
<th>53</th>
<th>1</th>
<th>Value</th>
</tr>
</thead>
</table>

Message Exchange

00D0B7-4D9EB3

192.168.10.105

000102-0CF9AA
195.31.235.220

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

DHCP Server

DNS Server

DHCP Client Windows 2000

Update DNS PTR record (4)

Update DNS A record (3)

DHCPRequest (1)

DHCPAck (2)

DHCPClient Windows 2000
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.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