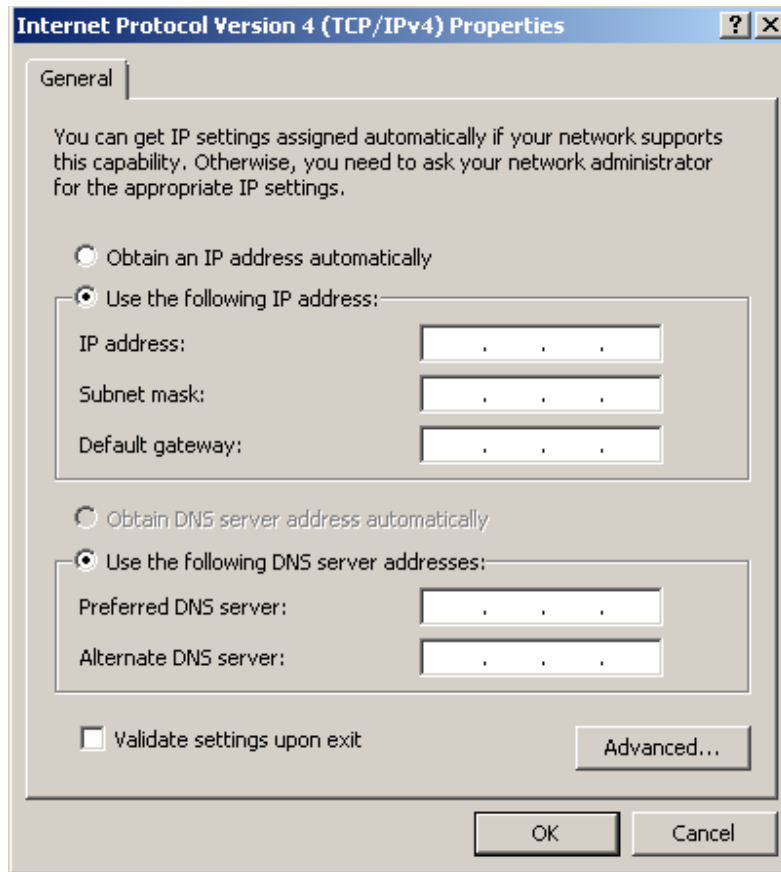


# Automatic configuration of IP address

1



- IPv4:
  - DHCP (and ARP)
  - Windows autoconfiguration
- IPv6:
  - NDP
  - DHCPv6

2

- every computer already has a MAC address, which it could use for communication on the link layer within a LAN segment
- the computer sends a DHCP request from source address 0.0.0.0 to the destination address 255.255.255.255 (**broadcast**)
  - ARP is used to resolve IP address to MAC address
- If the DHCP-server is presented, it answers with an offer for that computer (identified with MAC address). The offer is also sent to 255.255.255.255 (**broadcast**)
- if the computer accepts an offered IP address, it replies with the request of the offered address and waits for the acknowledgement from the server

# What else sends DHCP server?

3

- IP address
- Network mask
- Gateway
- Address of DNS server
- Address of TFTP (Trivial File Transfer Protocol) server
  - Optional
  - Used for booting the Operating System from the Network

# How DHCP selects an IP address? 1/2

4

- From predefined range of addresses (e.g. 192.168.1.100 – 192.168.1.250)

Common Configuration

General Setup

Advanced Settings

Physical Settings

Firewall Settings

Status

br-lan

Uptime: 6d 11h 16m 21s  
MAC-Address: 00:11:22:33:44:55  
RX: 327.03 MB (2650264 Pkts.)  
TX: 7.13 GB (5434759 Pkts.)  
IPv4: 192.168.1.1/24

Protocol

Static address

IPv4 address

192.168.1.1

IPv4 netmask

255.255.255.0

IPv4 gateway

IPv4 broadcast

Use custom DNS servers

DHCP Server

General Setup

Advanced Settings

Ignore interface

☐
Disable DHCP for this interface.

Start

100

Lowest leased address as offset from the network address.

Limit

150

Maximum number of leased addresses.

Leasetime

12h

Expiry time of leased addresses, minimum is 2 Minutes (2m).

# How DHCP selects an IP address? 2/2

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- From the list of addresses predefined for each computer (MAC address) by the administrator

### Active DHCP Leases

| Hostname | IPv4-Address  | MAC-Address | Leasetime remaining |
|----------|---------------|-------------|---------------------|
| T...     | 192.168.1.102 | a...:7c     | 11h 43m 40s         |
| ?        | 192.168.1.135 | b...ed      | 11h 26m 13s         |
| ...      | 192.168.1.109 | 8...ab      | 11h 53m 8s          |
| P...5    | 192.168.1.253 | 00...ae     | 6h 44m 4s           |
| R...     | 192.168.1.101 | b...13      | 10h 8m 21s          |

### Static Leases

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients. They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served. Use the Add Button to add a new lease entry. The MAC-Address identifies the host, the IPv4-Address specifies to the fixed address to use and the Hostname is assigned as symbolic name to the requesting host.

| Hostname | MAC-Address            | IPv4-Address  |        |
|----------|------------------------|---------------|--------|
| T...     | a...7c (192.168.1.102) | 192.168.1.102 | Delete |
| R...     | 0...9b                 | 192.168.1.254 | Delete |
| P...5    | 0...ae (192.168.1.253) | 192.168.1.253 | Delete |
| N...     | 0...0                  | 192.168.1.103 | Delete |
| R...     | b...3                  | 192.168.1.101 | Delete |

Add

# Neighbor Discovery Protocol for IPv6

6

- IPv6 is different from IPv4 – another protocol
  - No ARP by default
  - Uses ICMPv6 for address resolution
  - Uses Neighbor Discovery Protocol to configure IP **addresses**
    - Link-local unicast address for communication within a network segment
    - Global unicast address for communication outside a network segment

# Neighbor Discovery Protocol for IPv6

## Link-local address

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A computer:

- generates a **link-local** IPv6 address from it's MAC address:
  - MAC: 54:31:f3:a1:b7:dd
  - Link-local IPv6: fe80::5631:f3ff:fea1:b7dd
- performs Duplicate Address Detection:
  - Using link-local address, it sends Neighbor Solicitation Message (using ICMPv6) to the same link-local address
  - If other computers are presented, they answer with their link-local addresses in Neighbor Advertisements – duplicate will be found
- waits for Router Advertisement (sends Router Solicitation)

# Neighbor Discovery Protocol for IPv6

## Router advertisement

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- Routers, if presented, constantly send Router Advertisement messages to “all-nodes multicast address”
  - IPv6 **prefix** that the computer could use for automatic configuration of global IPv6 address
  - Gateway
  - ...
- Using the information from router advertisement, the computer configures it's IPv6 address, default gateway and other parameters (DNS, DHCP server, etc.):
  - IPv6 address: **network prefix** + 5631:f3ff:fea1:b7dd