

Manually Configured IP Addresses

This option requires technicians or support staff to manually configure IP addresses and related settings, such as subnet masks, default gateways, and DNS suffixes on computers and network devices. In the case of Windows operating systems, this requires editing properties of the network connection. In other operating systems, configuration can involve the creation or modification of configuration files. Depending on the type of device, it might be possible to automate this process. For example, when deploying Windows-based computers, IP address information can be included in unattended information files used during automatic software builds.

In addition to the address configuration task, it is essential to have a clear plan and documentation system in place to ensure that the correct addresses are used and the same addresses are not allocated more than once. Many devices, including Windows-based computers, report a failure and refuse to bind an IP address if an Address Resolution Protocol discovery shows that it is already bound to another device.

Advantages

The advantages of manually configured IP addresses include:

- **Simple approach:** This option is the simplest approach to understand and is not dependent on any other technology or service. If the correct IP address configuration information is used, the device will have a functional IP stack and will be able to communicate on the network.
- **Fixed and predictable:** Manually configured addresses are fixed and therefore predictable. Allocating addresses from central servers can result in changes to the address or to its associated IP information; if these changes are not anticipated, there can be network problems.

Disadvantages

The disadvantages of manually configured IP addresses include:

- **High overhead:** Using manual configuration to maintain all IP addresses across an enterprise network would generate excessive overhead expense. There would also be a great risk of errors and incorrect configurations due to the numbers of addresses that need to be managed. However, this approach is feasible if the network is small or if manual configuration is used only in parts of a larger network.
- **Risk of wasting addresses:** Manually configured addressing can lead to the waste of IP addresses. Devices with an assigned address might be decommissioned but the IP address cannot be reused without some means of reclaiming those no longer in use.

- **Mobile device reconfiguration:** Devices moved from one part of the network to another must be reconfigured for proper network operation. For mobile computing devices, such as laptop computers or PDAs, such reconfiguration becomes time-consuming; it is an impediment to efficient business operations.

DHCP

DHCP uses a single-phase boot configuration process. The DHCP client negotiates with a DHCP server to determine its IP address and obtain any other initial configuration details it needs for network operation. The network administrator establishes one or more DHCP servers that maintain TCP/IP configuration information and provide it to clients. The server database includes the following:

- Valid configuration parameters for all clients on the network.
- Valid IP addresses maintained in a pool for assignment to clients and reserved addresses for manual assignment.
- Duration of a lease offered by the server, which defines the length of time for which the assigned IP address can be used.

Windows-based computers become DHCP clients if the **Obtain an IP address automatically** option is selected in its TCP/IP properties. When a client computer is set to use DHCP, it accepts a lease offer and can receive the following information from the server:

- A temporary IP address known to be valid for the network it is joining.
- Additional TCP/IP configuration parameters in the form of options data for the client to use.

Advantages

The advantages of DHCP include:

- **Safe and reliable configuration:** DHCP prevents configuration errors caused when manually typing values at each computer. DHCP also helps prevent address conflicts caused by previously assigned IP addresses being reused to configure new computers on the network.
- **Reduced configuration management:** Use of DHCP servers can greatly reduce the time spent configuring and reconfiguring computers on the network. Servers can be configured to supply a full range of additional configuration values when assigning address leases,

which are assigned using DHCP options. The DHCP options can be global or subnet-specific TCP/IP parameters that are managed centrally for use throughout the network.

- **Support for mobile devices:** The DHCP lease renewal process helps ensure that client configurations that must be updated often (such as for laptop computers whose locations change frequently), changes can be made efficiently and automatically by clients communicating directly with DHCP servers.
- **Address reuse:** When a client computer moves between subnets, its old IP address is freed for reuse. The client reconfigures its TCP/IP settings automatically when the computer is restarted in its new location, which also means that DHCP can support more clients than it has addresses in its pool if all clients are not online at the same time. This feature is widely used by ISPs to support dial-up customers.

DHCP has a default 8-day expiration on IP address leases, which is considerably shorter than the BOOTP default; even if the default lease duration is not changed, addresses can be reused much more quickly than with BOOTP.

- **DHCP options:** DHCP supports a large and extensible set of client configuration parameters called options. Examples of options include a preferred list of IP addresses for routers on the same subnet as DHCP clients, IP addresses of DNS name servers that DHCP clients can contact to resolve a domain host name query, the DNS domain name that DHCP clients should use when resolving unqualified names during DNS domain name resolution, and WINS server information.
- **Automatic rebinding:** DHCP clients do not require a system restart to rebind or renew configuration with the DHCP server. Instead, clients automatically enter a rebinding state at established timed intervals to renew their leased address allocation with the DHCP server. This process occurs in the background and is transparent to the user.
- **Multicast support:** Recent developments in DHCP have added support for multicast addressing using the MADCAP protocol (RFC 2730), which means DHCP servers can assign multicast addresses in addition to unicast addresses. The primary benefit of the MADCAP standard is that you can use it to leverage your existing network infrastructure for assigning multicast addresses in the same way other IP addresses are currently assigned using DHCP.

Typical applications for multicast are conferencing and audio, which usually require users to configure multicast addresses specifically. Unlike IP broadcasts, which are received by all computers or other hosts on the network, a multicast address is a group of computers using the concept of a group membership to identify the computers to which the message is to be sent.

Disadvantages

The disadvantages of DHCP include:

- **Security requirements:** DHCP requires careful attention to security; it is easy to introduce rogue DHCP servers into a network unless authorizations are used. For more information, see [DHCP Security](#).
- **Point of network failure:** Once in place, DHCP becomes a critical core service; there are risks associated with its failure. DHCP clients without a current IP address will either fail to bind any address to their IP stack and hence have no network communication or, if they are Windows-based clients, they might bind an auto configuration address. For more information, see [DHCP Interoperability](#). DHCP clients that have previously obtained an IP address from a DHCP server attempt to renew this address with the original DHCP server after 50 percent of the lease period. If this DHCP server is unavailable, the client tries to contact any DHCP server after 87.5 percent of the lease period. If no DHCP server is available at that time, the client loses its IP address when the lease expires. Therefore, one way to manage the potential problem of DHCP server unavailability is to set long lease periods. You will need to balance that design decision against other DHCP design issues outlined in this guide.