



## Configuring DNS

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The Domain Name System (DNS) is a distributed database in which you can map host names to IP addresses through the DNS protocol from a DNS server. Each unique IP address can have an associated host name. The Cisco IOS XE software maintains a cache of host-name-to-address mappings for use by the **connect**, **telnet**, and **ping** EXEC commands, and related Telnet support operations. This cache speeds the process of converting names to addresses.

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## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

## Prerequisites for Configuring DNS

To use DNS, you must have a DNS name server on your network.

# Information About DNS

## DNS Overview

If your network devices require connectivity with devices in networks for which you do not control name assignment, you can assign device names that uniquely identify your devices within the entire internetwork. The global naming scheme of the Internet, the DNS, accomplishes this task. This service is enabled by default. The following sections summarize DNS concepts and function:

### Host Names for Network Devices

Each unique IP address can have an associated host name. DNS uses a hierarchical scheme for establishing host names for network nodes. This allows local control of the segments of the network through a client-server scheme. The DNS system can locate a network device by translating the host name of the device into its associated IP address.

### Domains Names for Groups of Networks

IP defines a naming scheme that allows a device to be identified by its location in the IP. This is a hierarchical naming scheme that provides for *domains*. On the Internet, a domain is a portion of the naming hierarchy tree that refers to general groupings of networks based on organization type or geography. Domain names are pieced together with periods (.) as the delimiting characters. For example, Cisco is a commercial organization that the IP identifies by a *com* domain name, so its domain name is *cisco.com*. A specific device in this domain, the File Transfer Protocol (FTP) system, for example, is identified as *ftp.cisco.com*.

### Name Servers

To keep track of domain names, IP has defined the concept of a *name server*. Name servers are programs that have complete information about their namespace portion of the domain tree and may also contain pointers to other name servers that can be used to lead to information from any other part of the domain tree. Name servers know the parts of the domain tree for which they have complete information. A name server may also store information about other parts of the domain tree. To map domain names to IP addresses, you must first identify the host names, then specify a name server, and enable the DNS service.

### Cache

To speed the process of converting names to addresses, the name server maintains a database, called a *cache*, of host-name-to-address mappings for use by the **connect**, **telnet**, and **ping EXEC** commands, and related Telnet support operations. The cache stores the results from previous responses. Upon receiving a client-issued DNS query, it will check this local storage to see if the answer is available locally.

### Name Resolvers

Name resolvers are programs that extract information from name servers in response to client requests. Resolvers must be able to access at least one name server. The resolver either uses that name server's information to answer a query directly or pursues the query using referrals to other names servers. A resolver will typically be a system routine that is directly accessible to user programs. Therefore, no protocol is necessary between the resolver and the user program.

## Zones

The domain namespace is divided into areas called zones that are points of delegation in the DNS tree. A zone contains all domains from a certain point downward, except those for which other zones are authoritative.

## Authoritative Name Servers

A name server is said to be an authority for the parts of the domain tree for which it has complete information. A zone usually has an authoritative name server, often more than one. An authoritative name server has been configured with host table information or has acquired host table information through a zone transfer (the action that occurs when a secondary DNS server starts up and updates itself from the primary server).

## DNS Operation

Within an organization, you can have many name servers, but Internet clients can query only those that the root name servers know. The other name servers answer internal queries only.

A name server handles client-issued queries to the DNS server for locally defined hosts within a particular zone as follows:

- An authoritative name server responds to DNS user queries for a domain name that is under its zone of authority by using the permanent and cached entries in its own host table. If the query is for a domain name that is under its zone of authority but for which it does not have any configuration information, the authoritative name server simply replies that no such information exists..
- A name server that is not configured as the authoritative name server responds to DNS user queries by using information that it has cached from previously received query responses. If no device is configured as the authoritative name server for a zone, queries to the DNS server for locally defined hosts will receive nonauthoritative responses.

Name servers answer DNS queries (forward incoming DNS queries or resolve internally generated DNS queries) according to the forwarding and lookup parameters configured for the specific domain.

# How to Configure DNS

## Mapping Host Names to IP Addresses

Perform this task to associate host names with IP addresses.

A name server is used to keep track of information associated with domain names. A name server can maintain a database of host name-to-address mappings. Each name can map to one or more IP addresses. In order to use this service to map domain names to IP addresses, you must specify a name server.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip host name** [*tcp-port-number*] *address1* [*address2 ... address8*]
4. Do one of the following:
  - **ip domain name** *name*
  - **ip domain list** *name*
5. **ip name-server** *server-address1* [*server-address2 ... server-address6*]
6. **ip domain lookup**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>ip host name</b> [ <i>tcp-port-number</i> ] <i>address1</i> [ <i>address2 ... address8</i> ]  <b>Example:</b> Device(config)# ip host cisco-rtp 192.168.0.148	Defines a static host name-to-address mapping in the host name cache. <ul style="list-style-type: none"> <li>• Typically, it is easier to refer to network devices by symbolic names rather than numerical addresses (services such as Telnet can use host names or addresses). Host names and IP addresses can be associated with one another through static or dynamic means.</li> <li>• Manually assigning host names to addresses is useful when dynamic mapping is not available.</li> </ul>
<b>Step 4</b>	Do one of the following: <ul style="list-style-type: none"> <li>• <b>ip domain name</b> <i>name</i></li> <li>• <b>ip domain list</b> <i>name</i></li> </ul> <b>Example:</b> Device(config)# ip domain name cisco.com	(Optional) Defines a default domain name that the Cisco IOS XE software will use to complete unqualified host names.  or (Optional) Defines a list of default domain names to complete unqualified host names. <ul style="list-style-type: none"> <li>• You can specify a default domain name that the Cisco IOS XE software will use to complete domain name requests. You can specify either a single domain name or a list of domain names. Any host name that does not contain a complete domain name will have the default domain name you specify appended to it before the name is looked up.</li> </ul>

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Device(config)# ip domain list cisco1.com</pre>	<p><b>Note</b> If there is no domain list, the domain name that you specified with the <b>ip domain name</b> global configuration command is used. If there is a domain list, the default domain name is not used. The <b>ip domain list</b> command is similar to the <b>ip domain name</b> command, except that with the <b>ip domain list</b> command you can define a list of domains, each to be tried in turn until the system finds a match.</p>
<b>Step 5</b>	<p><b>ip name-server</b> <i>server-address1</i> [<i>server-address2 ... server-address6</i>]</p> <p><b>Example:</b></p> <pre>Device(config)# ip name-server 172.16.1.111 172.16.1.2</pre>	<p>Specifies one or more hosts that supply name information.</p> <ul style="list-style-type: none"> <li>• Specifies one or more hosts (up to six) that can function as a name server to supply name information for DNS.</li> </ul>
<b>Step 6</b>	<p><b>ip domain lookup</b></p> <p><b>Example:</b></p> <pre>Device(config)# ip domain lookup</pre>	<p>(Optional) Enables DNS-based address translation.</p> <ul style="list-style-type: none"> <li>• DNS is enabled by default. Use this command if DNS has been disabled.</li> </ul>

### What to Do Next

The name lookup system can be statically configured using the commands described in this task. Some other functions in Cisco IOS XE, such as DHCP can dynamically modify the state of the name lookup system. Use the **show hosts** command to display the cached host names and the DNS configuration.

## Customizing DNS

Perform this task to customize your DNS configuration.

In a multiple server configuration without the DNS round-robin functionality, many programs will use the first host server/IP address for the whole time to live (TTL) of the cache while using the second and third host servers/IP addresses only in the event of host failure. This behavior presents a problem when a high volume of users all arrive at the first host during the TTL time. For example, the network access server (NAS) sends out a DNS query; the DNS servers reply with a list of the configured IP addresses to the NAS. The NAS then caches these IP addresses for a given time (for example, five minutes). All users that dial in during the five minute TTL time will land on one host, the first IP address in the list.

In a multiple server configuration with the DNS round-robin functionality, the DNS server returns the IP address of all hosts to rotate between the cache of host names. During the TTL of the cache, users are distributed among the hosts. This functionality distributes calls across the configured hosts and reduces the amount of DNS queries.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip domain timeout** *seconds*
4. **ip domain retry** *number*
5. **ip domain round-robin**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>ip domain timeout</b> <i>seconds</i>  <b>Example:</b> Device(config)# ip domain timeout 17	(Optional) Specifies the amount of time to wait for a response to a DNS query. <ul style="list-style-type: none"> <li>• If the <b>ip domain timeout</b> command is not configured, the Cisco IOS XE software will wait 3 seconds for a response to a DNS query.</li> </ul>
<b>Step 4</b>	<b>ip domain retry</b> <i>number</i>  <b>Example:</b> Device(config)# ip domain retry 10	(Optional) Specifies the number of times to retry sending DNS queries. <ul style="list-style-type: none"> <li>• If the <b>ip domain retry</b> command is not configured, the Cisco IOS XE software will retry DNS queries twice.</li> </ul>
<b>Step 5</b>	<b>ip domain round-robin</b>  <b>Example:</b> Device(config)# ip domain round-robin	(Optional) Enables round-robin functionality on DNS servers.

## Disabling DNS Queries for ISO CLNS Addresses

Perform this task to disable DNS queries for ISO CLNS addresses.

If your device has both IP and ISO Connectionless Network Service (ISO CLNS) enabled and you want to use ISO CLNS network service access point (NSAP) addresses, you can use the DNS to query these addresses, as documented in RFC 1348. This feature is enabled by default.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no ip domain lookup nsap**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>no ip domain lookup nsap</b>  <b>Example:</b> Device(config)# no ip domain lookup nsap	Disables DNS queries for ISO CLNS addresses.

## Verifying DNS

Perform this task to verify your DNS configuration.

## SUMMARY STEPS

1. **enable**
2. **ping *host***
3. **show hosts**
4. **debug ip domain**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>ping <i>host</i></b>  <b>Example:</b> Device# ping cisco-rtp	Diagnoses basic network connectivity. <ul style="list-style-type: none"> <li>• After the DNS configuration is set, you can verify the DNS server by using a hostname to ping or telnet to a device.</li> </ul>
<b>Step 3</b>	<b>show hosts</b>  <b>Example:</b> Device# show hosts	Displays the default domain name, the style of name lookup service, a list of name server hosts, and the cached list of host names and addresses. <ul style="list-style-type: none"> <li>• After a name is resolved using DNS, use the <b>show hosts</b> command to view the cached hostnames and the DNS configuration.</li> </ul>
<b>Step 4</b>	<b>debug ip domain</b>  <b>Example:</b> Device# debug ip domain	Enables DNS debugging and displays DNS debugging information. <ul style="list-style-type: none"> <li>• To view more DNS debugging options such as DNS server response debugging and so on, use the question mark (?) online help function.</li> </ul>

## Configuration Examples for DNS

### Example: Creating a Domain List with Alternate Domain Names

The following example establishes a domain list with several alternate domain names:

```
ip domain list csi.com
ip domain list telecomprog.edu
ip domain list merit.edu
```

### Example: Mapping Host Names to IP Addresses

The following example configures the host-name-to-address mapping process. IP DNS-based translation is specified, the addresses of the name servers are specified, and the default domain name is given.

```
! IP DNS-based host name-to-address translation is enabled
ip domain lookup
! Specifies hosts 192.168.1.111 and 192.168.1.2 as name servers
ip name-server 192.168.1.111 192.168.1.2
```



```
! Defines cisco.com as the default domain name the device uses to complete
! Set the name for unqualified host names
ip domain name cisco.com
```

## Example: Customizing DNS

The following example allows a Telnet to company.example.com to connect to each of the three IP addresses specified in the following order: the first time the hostname is referenced, it would connect to 10.0.0.1; the second time the hostname is referenced, it would connect to 10.1.0.1; and the third time the hostname is referenced, it would connect to 10.2.0.1. In each case, the other two addresses would also be tried if the first one failed; this is the normal operation of the Telnet command.

```
Device(config)# ip host company.example.com 10.0.0.1 10.1.0.1 10.2.0.1
Device(config)# ip domain round-robin
```

## Example: Debugging DNS

The **debug ip domain** command form enables DNS debugging and displays basic DNS debugging information.

```
Device> enable
Device# debug ip domain

Domain Name System debugging is on
Device#
*Jul 18 09:16:19.546: DNS: Incoming UDP query (id#8168)
*Jul 18 09:16:19.547: DNS: Type 1 DNS query (id#8168) for host 'abc.google.com' from
209.165.200.230(27106)
*Jul 18 09:16:19.547: DNS: Servicing request using view default
*Jul 18 09:16:19.547: search_nametype_index: abc.google.com
*Jul 18 09:16:19.547: search_nametype_index: found abc.google.com for abc.google.com
*Jul 18 09:16:19.547: search_nametype_index: abc.google.com
*Jul 18 09:16:19.547: search_nametype_index: found abc.google.com for abc.google.com
*Jul 18 09:16:19.547: search_nametype_index: google.com
*Jul 18 09:16:19.547: search_nametype_index: com
*Jul 18 09:16:19.547: search_nametype_index: abc.google.com
*Jul 18 09:16:19.547: search_nametype_index: found abc.google.com for abc.google.com
*Jul 18 09:16:19.547: DNS: Reply to cIient 209.165.200.230/27106 query A
*Jul 18 09:16:19.547: DNS: Finished processing query (id#8168) in 0.001 secs
*Jul 18 09:16:19.547: DNS: Sending response to 209.165.200.230/27106, len 48
```

Sample output for detailed DNS response debugging is given below:

```
Device> enable
Device# debug ip domain replies detail

Domain Name System Reply debugging is on (detailed)

*Jul 18 09:17:58.635: DNS: Send reply from internal information:
*Jul 18 09:17:58.635: DOM: id=47025, response, opcode=0, aa=0, tc=0, rd=1, ra=1
*Jul 18 09:17:58.635: rcode=0, qdcount=1, ancourt=1, nscount=0, arcount=0
*Jul 18 09:17:58.635: query name is abc.google.com, qtype=1, class=1
*Jul 18 09:17:58.635: Answer section:
*Jul 18 09:17:58.635: Name='abc.google.com'
*Jul 18 09:17:58.635: RR type=1, class=1, ttl=10, data length=4
*Jul 18 09:17:58.635: IP=12.12.12.12
*Jul 18 09:17:58.635: Authority section:
*Jul 18 09:17:58.635: Additional record section:
*Jul 18 09:17:58.635: DNS: Finished processing query (id#47025) in 0.001 secs
```

```

*Jul 18 09:17:58.637: DNS: Send reply from internal information:
*Jul 18 09:17:58.637: DOM: id=25881, response, opcode=0, aa=0, tc=0, rd=1, ra=1
*Jul 18 09:17:58.637:      rcode=0, qdcount=1, ancount=1, nscount=0, arcount=0
*Jul 18 09:17:58.637:      query name is abc.google.com, qtype=1, class=1
*Jul 18 09:17:58.637: Answer section:
*Jul 18 09:17:58.637:      Name='abc.google.com'
*Jul 18 09:17:58.637:      RR type=1, class=1, ttl=10, data length=4
*Jul 18 09:17:58.637:      IP=12.12.12.12
*Jul 18 09:17:58.637: Authority section:
*Jul 18 09:17:58.637: Additional record section:
*Jul 18 09:17:58.637: DNS: Finished processing query (id#25881) in 0.001 secs

*Jul 18 09:17:58.638: DNS: Send reply from internal information:
*Jul 18 09:17:58.638: DOM: id=41387, response, opcode=0, aa=0, tc=0, rd=1, ra=1
*Jul 18 09:17:58.638:      rcode=0, qdcount=1, ancount=1, nscount=0, arcount=0
*Jul 18 09:17:58.638:      query name is abc.google.com, qtype=1, class=1
*Jul 18 09:17:58.638: Answer section:
*Jul 18 09:17:58.638:      Name='abc.google.com'
*Jul 18 09:17:58.638:      RR type=1, class=1, ttl=10, data length=4
*Jul 18 09:17:58.638:      IP=12.12.12.12
*Jul 18 09:17:58.638: Authority section:
*Jul 18 09:17:58.638: Additional record section:
*Jul 18 09:17:58.638: DNS: Finished processing query (id#41387) in 0.000 secs

```

## Additional References for Configuring DNS

### Related Documents

Related Topic	Document Title
Master Command List	<a href="#">Cisco IOS Master Command List</a>
IP Addressing Services Command Reference	<a href="#">Cisco IOS IP Addressing Services Command Reference</a>

### Standards and RFCs

Standard/RFC	Title
RFC 1348	DNS NSAP Resource Records

### MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:  <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

**Technical Assistance**

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p><a href="http://www.cisco.com/support">http://www.cisco.com/support</a></p>

## Feature Information for Configuring DNS

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 1: Feature Information for Configuring DNS**

Feature Name	Releases	Feature Configuration Information
Configuring DNS	Cisco IOS XE Release 2.1	The Domain Name System (DNS) is a distributed database in which you can map host names to IP addresses through the DNS protocol from a DNS server. Each unique IP address can have an associated host name. The Cisco IOS XE software maintains a cache of host name-to-address mappings. This cache speeds the process of converting names to addresses.
	Cisco IOS XE Release 3.13S	In Cisco IOS XE Release 3.13S, support was added for the Cisco ASR 1000 Series Routers.  The following commands were introduced or modified: <b>debug ip domain</b> , <b>debug ip domain replies</b> .

