Contents

1 Configuring DNS

1.1 Overview

Domain Name System (DNS) is important and commonly used in a Transmission Control Protocol/Internet Protocol (TCP/IP) network environment. The main function of DNS is to convert a domain name that is easy to remember into an IP address that is hard to remember. The process of obtaining an IP address mapped to a host name is called domain name resolution (or host name resolution).

A domain name can be resolved firstly through static domain name resolution. If this fails, dynamic domain name resolution can be used instead. You can put the commonly used domain names into the static domain name resolution table, which can greatly improve the efficiency of domain name resolution.

Both the TCP and User Datagram Protocol (UDP) port IDs of DNS are 53, and generally a UDP port is used.

1.2 Principles

1.2.1 Static Domain Name Resolution

Static domain name resolution means that a user presets the mappings between domain names and IP addresses on a device. When you perform domain name operations by using application programs (such as ping and telnet), the system can find the required IP address with no need to connect to the DNS server on the network.

When the application programs access a small number of relatively fixed hosts, the domain name-IP mappings can be configured in advance in the form of static domain name entries. Then, no search request needs to be sent to the DNS server, improving the resolution efficiency.

1.2.2 Dynamic Domain Name Resolution

1.   System Structure

Dynamic domain name resolution means that when a user performs domain name operations by using some application programs, the DNS resolver of the system queries an external DNS server for the IP addresses mapped to the domain names.

Figure 1-1   Structure of Dynamic Domain Name Resolution
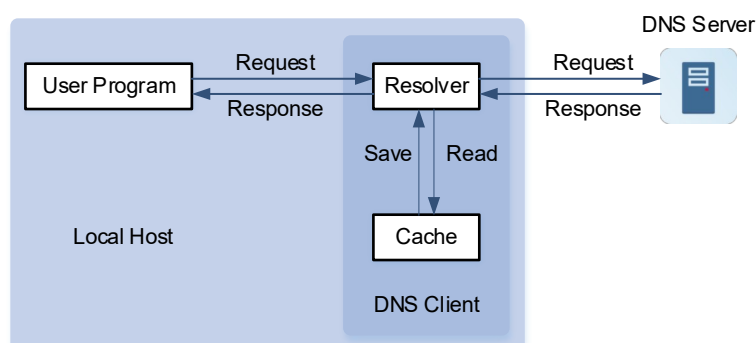
As shown in [Figure 1-1](#), a resolver is integrated with a cache to form a DNS client, which accepts DNS requests from user programs and makes responses accordingly. In general, user programs (such as ping and traceroute), a cache, and a resolver are on the same host, but a DNS server is on a different host.

2.   **Resolution Process**

The process of dynamic domain name resolution is as follows:

(1) A user application program requests the IP address mapped to a domain name from the DNS resolver of the system.

(2) The DNS resolver queries the dynamic cache at first. If the domain name in the dynamic cache does not expire, the DNS resolver returns the domain name to the application program.

(3) If all domain names expire, the DNS resolver initiates a request for domain name-IP address conversion to the external DNS server.

(4) After receiving a response from the DNS server, the DNS resolver caches and transfers the response to the application program.

3.   **Cache Function**

The dynamic domain name resolution supports the cache function. The cache stores the domain name-IP mappings successfully and dynamically resolved each time. When the same domain name is queried next time, the mapping can be read from the cache, with no need to send a request to the DNS server every time, thereby improving the resolution efficiency.

1.2.3 DNS Proxy

DNS proxy is generally deployed on the front-end egress gateway between a DNS server and a PC, and acts as a proxy of the DNS server to process users' DNS domain name resolution requests. When processing a request packet from the DNS client, the DNS proxy searches for the domain name-IP mapping locally first. If the required domain name-IP mapping is found, the DNS proxy directly returns it to the client. If the required domain name-IP mapping is not found, the DNS resolver searches an external DNS server for the IP address mapped to the domain name and returns a reply packet to the client.

1.2.4 Protocols and Standards

● RFC1034: DOMAIN NAMES - CONCEPTS AND FACILITIES

● RFC1035: DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION

1.3 Configuration Task Summary

All the following configuration tasks are optional and may be selected as needed.

● [Configuring Static Domain Name Resolution](#)

● [Configuring Dynamic Domain Name Resolution](#)

● [Configuring the Source Interface for Dynamic Domain Name Resolution](#)

● [Configuring DNS Proxy](#)

1.4   Configuring Static Domain Name Resolution

(1) Enter the privileged EXEC mode.

   enable

(2) Enter the global configuration mode.

   configure terminal

(3) Configure the IP address mapped to a domain name.

   (IPv4 network)

   ip host [**oob**] *host-name* [*telnet-port*] *ip-address* [**via** *mgmt-name*]

   ip host [**vrf** *vrf-name*] *host-name* [*telnet-port*] *ip-address*(IPv6 network)

   Configure the IP**v**6 address mapped to a domain name.

   ipv6 host [**oob**] *host-name* [*telnet-port*] *ipv6-address* [**via** *mgmt-name*]

   ipv6 host [**vrf** *vrf-name*] *host-name* [*telnet-port*] *ipv6-address*

1.5   Configuring Dynamic Domain Name Resolution

1.5.1 Prerequisites

The IP address of a DNS server has been obtained.

1.5.2 Procedure

(1) Enter the privileged EXEC mode.

   enable

(2) Enter the global configuration mode.

   configure terminal

(3) Configure a DNS server.

   (IPv4 network)

   ip name-server [**oob**] { *ipv4-address&<1-6>* } [**via** *mgmt-name*]

   No IPv4 address is configured for a DNS server by default.

   (IPv6 network)

   ip name-server [**oob**] { *ipv6-address&<1-6>* } [**via** *mgmt-name*]

   No IPv6 address is configured for a DNS server by default.

   (IPv4 network)

   ip name-server [**vrf** *vrf-name*] { *ipv4-address*&<1-6> }

   No IPv4 address is configured for a DNS server by default.

   (IPv6 network)

   ip name-server [**vrf** *vrf-name*] { *ipv6-address*&<1-6> }

   No IPv6 address is configured for a DNS server by default.

1.6 Configuring the Source Interface for Dynamic Domain Name Resolution

1.6.1 Overview

If a source interface is specified in the command, when an IPv4 DNS query packet is sent, the primary IPv4 address of the source interface is used as the source address of the DNS query packet. When an IPv6 DNS query packet is sent, the first effective IPv6 address of the source interface is used as the source address of the DNS query packet.

1.6.2 Restrictions and Guidelines

If no address is configured for a source interface, a DNS query packet fails to be sent. If an IPv4 source address is specified in the command, when an IPv4 DNS query packet is sent, the configured IPv4 address serves as the source address of the IPv4 DNS query packet, and the sending of an IPv6 DNS query packet will fail. If an IPv6 source address is specified in the command, when an IPv6 DNS query packet is sent, the configured IPv6 address serves as the source address of the IPv6 DNS query packet, and the sending of an IPv4 DNS query packet will fail.

⚠ **Caution**

An effective IPv6 address is a unicast address, but it cannot be a local link address or a loopback address.

1.6.3 Procedure

(1) Enter the privileged EXEC mode.

   enable

(2) Enter the global configuration mode.

   configure terminal

(3) Configure the domain name resolution using a specified source interface or address. The configuration steps below are mutually exclusive. Please configure only one task.

   ○ Configure the domain name resolution using a specified source interface.

   ip domain-lookup [**oob** [**via** *mgmt-name*] | [**vrf** *vrf-name*] [**source** *interface-type interface-number*]]

   ○ Configure the domain name resolution using a specified source IP address.

   (IPv4 network)

   ip domain-lookup [**oob** [**via** *mgmt-name*] | [**vrf** *vrf-name*] [**source ip** *ipv4-address*]]

   (IPv6 network)

   ip domain-lookup [**oob** [**via** *mgmt-name*] | [**vrf** *vrf-name*] [**source ipv6** *ipv6-address*]]

   By default, no source interface is specified, and the source IP address of a DNS query packet is decided through the routing process.

1.7 Configuring DNS Proxy

1.7.1 Prerequisites

The IP address of a DNS server has been obtained.

1.7.2 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enable the DNS proxy function.

ip dns proxy enable

DNS proxy is disabled by default.

(4) (Optional) Configure the IP address mapped to a domain name.

(IPv4 network)

ip dns proxy host *host-name ipv4-address*

No static mapping between a host name and an IPv4 address is configured by default.

(IPv6 network)

ip dns proxy host *host-name ipv6-address*

No static mapping between a host name and an IPv6 address is configured by default.

(5) Configure a DNS server.

(IPv4 network)

ip dns proxy nameserver *ipv4-address*

No IPv4 address is configured for a DNS server by default.

Each time this command is run, the device will add one DNS server. The system supports up to six servers. When a domain name cannot be obtained from the first server, the device tries to send a DNS request to subsequent servers until it receives a correct reply.

(IPv6 network)

ip dns proxy nameserver *ipv6-address*

No IPv6 address is configured for a DNS server by default.

Each time this command is run, the device will add one DNS server. The system supports up to six servers. When a domain name cannot be obtained from the first server, the device tries to send a DNS request to subsequent servers until it receives a correct reply.

(6) (Optional) Enable the function of caching dynamic entries on the DNS proxy.

ip dns proxy cache

The function of caching dynamic entries is enabled on the DNS proxy by default.

(7) (Optional) Configure the time to live (TTL) of a reply packet.

ip dns proxy ttl *ttl*

The default TTL of the reply packet in response to a static entry is 3,600 seconds.

(8) (Optional) Configure the range of a source port used for query in upper-level DNS servers.

ip dns proxy port-range *port-min port-max*

The default port range is from 55000 to 58000.

This command can be used to adjust the range of a port used for query in the upper-level DNS servers. If the port range is too small, the concurrent processing performance of the device is affected. On the contrary, if the port range is too large, excessive flow table entry resources will be occupied and the egress device needs to adjust the flow table restriction synchronously.

1.8 Monitoring

Run the **show** command to check the running status of a configured function to verify the configuration effect.

Run the **debug** command to output debugging information.

⚠   **Caution**

The output debugging information occupies system resources. Therefore, disable the debugging function immediately after use.

Run the **clear** command to clear information.

⚠   **Caution**

Running the **clear** command may lose vital information and thus interrupt services.

Table 1-1   DNS Monitoring

Command	Purpose
clear host [*host-name*]	Clears the dynamic host name cache table.
show hosts [**vrf** *vrf-name*	**oob** [**via** *mgmt-name*]] [*host-name*]	Displays DNS parameters.
debug ip dns	Debugs the DNS function.
clear dns proxy host [*host-name*]	Clears the dynamic host name cache table on the DNS proxy.
show dns proxy hosts	Displays DNS parameters on the DNS proxy.
show dns proxy statistics	Displays DNS proxy packet statistics.
debug dns-proxy	Debugs the DNS proxy.

1.9 Configuration Examples

1.9.1 Configuring Static Domain Name Resolution

1. Requirements

As shown in Figure 1-1, device A needs to access the server through the domain name www.test.com. In this case, static domain name resolution can be used to implement the access to the server whose IP address is 192.168.10.2 through the host name "www.test.com".

2. Topology

Figure 1-1　Topology of Static Domain Name Resolution

3. Notes

Manually create the mapping between www.test.com and IP address 192.168.10.2 in the static resolution table of device A.

4. Procedure

(1) Configure device A.

Configure an IP address for port GigabitEthernet 0/1.

```
DeviceA> enable
DeviceA# configure terminal
DeviceA(config)# interface gigabitethernet 0/1
DeviceA(config-GigabitEthernet 0/1)# ip address 192.168.10.1 24
DeviceA(config)# exit
```

Configure the mapping between www.test.com and IP address 192.168.10.2.

```
DeviceA(config)# ip host www.test.com 192.168.10.2
```

(2) Configure the server.

Set the IP address of the server to 192.168.10.2.

5. Verification

Run the **show hosts** command to check whether the static domain name entry is configured.

```
DeviceA# show hosts
Name servers are:


Host                    type    Address         TTL(sec)
www.test.com            static  192.168.10.1       ---
```

Run the **ping** www.test.com command on device A. The IP address mapped to www.test.com is resolved as 192.168.10.2.

```
DeviceA# ping www.test.com

Translating "www.test.com"...[OK]
Sending 5, 100-byte ICMP Echoes to 192.168.10.2, timeout is 2 seconds:
  < press Ctrl+C to break >
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms.
```

6.   Configuration Files

Device A configuration file

```
hostname DeviceA
!
 interface gigabitethernet 0/1
 ip address 192.168.10.1 24
!
 ip host www.test.com 192.168.10.2
!
```

1.9.2 Configuring Dynamic Domain Name Resolution

1.   Requirements

As shown in Figure 1-1, device A is a DNS client, which can resolve domain names through the DNS server on the network.

2.   Topology

Figure 1-1   Topology of Dynamic Domain Name Resolution

3.   Notes

On device A, set the IP address of a DNS server to 192.168.10.2.

4.   Procedure

(1) Configure device A.

Configure an IP address for port GigabitEthernet 0/1.

```
DeviceA> enable
DeviceA# configure terminal
DeviceA(config)# interface gigabitEthernet 0/1
DeviceA(config-GigabitEthernet 0/1)# ip address 192.168.10.1 24
DeviceA(config)# exit
```
Configure the IP address of the DNS server.

```
DeviceA(config)# ip name-server 192.168.10.2
DeviceA(config)# exit
```

(2) Configure the DNS server.

The way to configure a DNS server varies with the operating system. For details, see the configuration instructions from system vendors.

5.   Verification

Run the **show hosts** command to display the configured DNS server.

```
DeviceA(config)# show hosts
Name servers are:
192.168.10.2 static


Host          type    Address                              TTL(sec)
```

6.   Configuration Files

Device A configuration file

```
hostname DeviceA
!
 interface gigabitEthernet 0/1
 ip address 192.168.10.1 24
!
 ip name-server 192.168.10.2
!
```

1.9.3 Configuring DNS Proxy

1.   Requirements

As shown in <u>Figure 1-1</u>, a DNS server is deployed on the network to provide the domain name service for external devices. test.com is deployed on the network to provide services for external devices over test.com.

There are several hosts A-Z in the local area network (LAN). If the IP address of the DNS server is specified on each host, the network administrator needs to change the configuration of all the hosts one by one when the IP address of the DNS server changes. The workload is very heavy. Device A in the LAN needs to configured as a DNS proxy, the IP address of the DNS server specified on the DNS proxy is the real address of the DNS server. In this way, when the IP address of the DNS server changes, only the configuration on the DNS proxy needs to be changed, which can greatly reduce the workload.

2. Topology

Figure 1-1 Topology of DNS Proxy
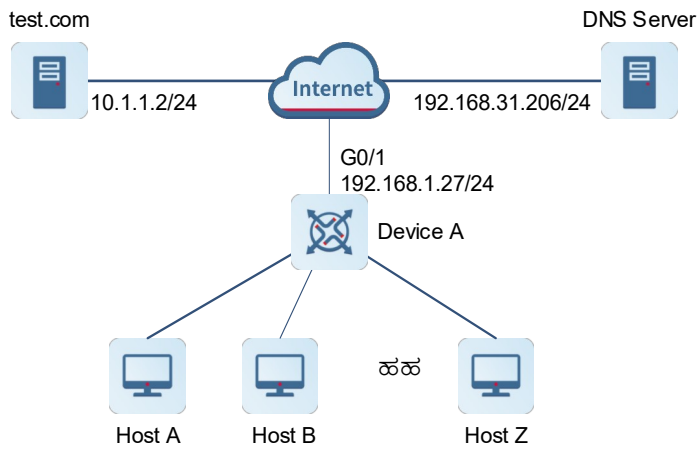
3. Notes

- On device A, enable the DNS proxy function.
- On device A, set the IP address mapped to test.com to 10.1.1.2/24.
- On device A, set the IP address of the DNS server to 192.168.31.206/24.

4. Procedure

(1) Configure device A.

Configure an IP address for port GigabitEthernet 0/1.

```
DeviceA> enable
DeviceA# configure terminal
DeviceA(config)# interface gigabitethernet 0/1
DeviceA(config-GigabitEthernet 0/1)# ip address 192.168.1.27 24
DeviceA(config-GigabitEthernet 0/1)# exit
```

Configure the DNS proxy function.

```
DeviceA(config)# ip dns proxy enable
DeviceA(config)# ip dns proxy host test.com 10.1.1.2
DeviceA(config)# ip dns proxy nameserver 192.168.31.206
DeviceA(config)# exit
```

(2) Configure the DNS server.

The way to configure a DNS server varies with the operating system. For details, see the configuration instructions from system vendors.

5. Verification

Run the **show dns proxy hosts** command to check whether the DNS proxy is configured.

```
DeviceA(config)# show dns proxy hosts
proxy state: enable
Name servers are:
```

```
192.168.31.206

                                              11

static host     max: 1024
static host   count: 1
cache domain    max: 5120
cache domain  count: 0
Host                          type          TTL(sec)        Address
host.com                      static        ---             192.168.31.206
```

6.   Configuration Files

Device A configuration file

```
hostname DeviceA
!
interface gigabitethernet 0/1
ip address 192.168.1.27 24
!
ip dns proxy enable
ip dns proxy host test.com 10.1.1.2
ip dns proxy nameserver 192.168.31.206
!
```