

## 38. DNS (Domain Name System)

### THE PURPOSE OF DNS

- DNS is used to *resolve* human-readable names (google.com) to IP ADDRESSES
- Machines such as PCs don't use names, they use ADDRESSES (ie: IPv4/IPv6)
- Names are much easier for us to use and remember than IP ADDRESSES
  - What is the IP ADDRESS of youtube.com ?
- When you type 'youtube.com' into a web browser, your device will ask a DNS SERVER for the IP ADDRESS of youtube.com
- The DNS SERVER(S) your DEVICE uses can be manually configured or learned via DHCP

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### BASIC FUNCTIONS OF DNS

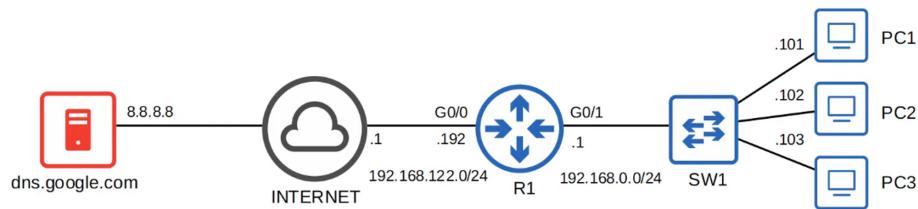


Figure 1: image

Command `ipconfig /all` (Show local IP configuration on current DEVICE)

A screenshot of a terminal window titled "ipconfig /all". The command "ipconfig /all" is entered in the input field. The output shows the configuration for an "Ethernet adapter ローカルエリア接続". The output includes:

```
C:\Users\user>ipconfig /all
[output omitted]
1.10 Verify IP parameters for Client OS (Windows, Mac OS, Linux)

Ethernet adapter ローカルエリア接続 :

  Connection-specific DNS Suffix  . : Intel(R) 82579LM Gigabit Network Connection
  Description . . . . . : Intel(R) 82579LM Gigabit Network Connection
  Physical Address. . . . . : 78-2B-CB-AC-08-67
  DHCP Enabled. . . . . : No
  Autoconfiguration Enabled . . . . . : Yes
  IPv4 Address . . . . . : 192.168.0.101(Preferred)
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 192.168.0.1
  DNS Servers . . . . . : 8.8.8.8
  NetBIOS over Tcpip. . . . . : Enabled
```

Figure 2: image

Command `nslookup` (Shows IP information for a given DNS entry)

WIRESHARK CAPTURE of above COMMANDS

```
C:\Users\user>ipconfig /all
[output omitted]

Ethernet adapter ローカルエリア接続 :

  Connection-specific DNS Suffix  . :
  Description . . . . . : Intel(R) 82579LM Gigabit Network Connection
  Physical Address. . . . . : 78-2B-CB-AC-08-67
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      DNS Servers . . . . . : 8.8.8.8
    NetBIOS over Tcpip. . . . . : Enabled
[output omitted]
```

Figure 3: image

```
C:\Users\user>nslookup youtube.com
Server:  dns.google
Address: 8.8.8.8
Non-authoritative answer:
Name:  youtube.com
Addresses:  2404:6800:4004:819::200e
          172.217.25.110

C:\Users\user>ping youtube.com

Pinging youtube.com [172.217.25.110] with 32 bytes of data:
Reply from 172.217.25.110: bytes=32 time=10ms TTL=117
Reply from 172.217.25.110: bytes=32 time=7ms TTL=117
Reply from 172.217.25.110: bytes=32 time=7ms TTL=117
Reply from 172.217.25.110: bytes=32 time=7ms TTL=117

Ping statistics for 172.217.25.110:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 7ms, Maximum = 10ms, Average = 7ms
```

Figure 4: image

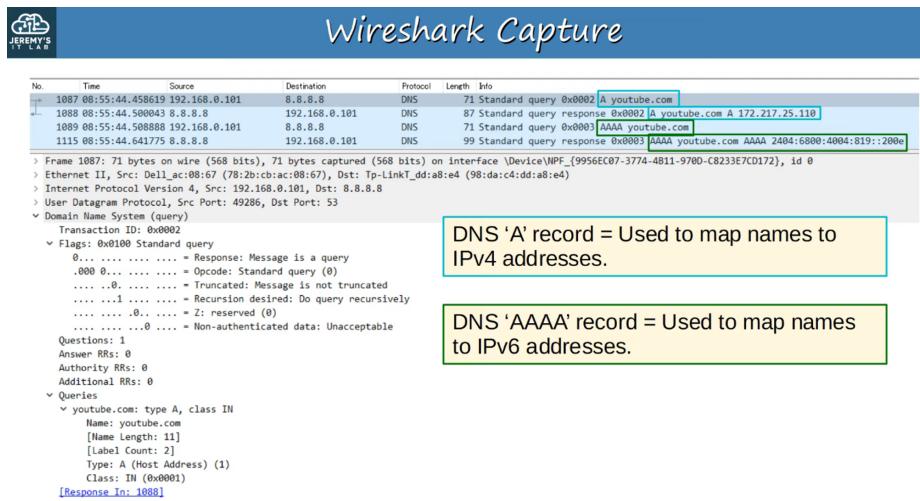


Figure 5: image

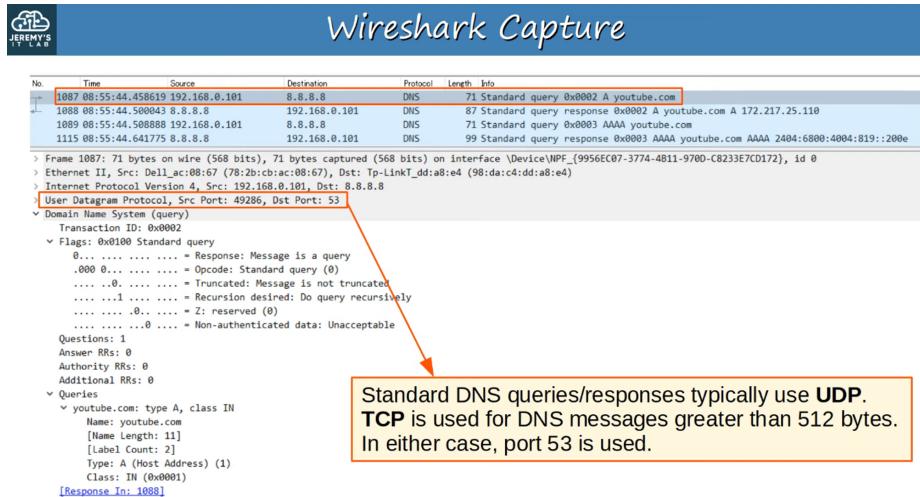


Figure 6: image

```
C:\Users\user>ipconfig /displaydns
[output omitted]
www.youtube.com
-----
Record Name . . . . . : www.youtube.com
Record Type . . . . . : 5
Time To Live . . . . . : 98
Data Length . . . . . : 8
Section . . . . . : Answer
CNAME Record . . . . . : youtube-ui.1.google.com

[output omitted]
Record Name . . . . . : youtube-ui.1.google.com
Record Type . . . . . : 98
Time To Live . . . . . : 98
Data Length . . . . . : 4
Section . . . . . : Answer
A (Host) Record . . . . . : 172.217.25.110
```

Devices will save the DNS server's responses to a local DNS cache. This means they don't have to query the server every single time they want to access a particular destination.

Figure 7: image

Command `ipconfig /displaydns` (Displays DNS cache)

Command `ipconfig /flushdns` (Clears DNS cache)

```
C:\Users\user>ipconfig /flushdns
Windows IP Configuration

Successfully flushed the DNS Resolver Cache.

C:\Users\user>ipconfig /displaydns
Windows IP Configuration

C:\Users\user>
```

Figure 8: image

HOSTS Files

WINDOWS HOSTS location

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#### CONFIGURING DNS IN CISCO IOS

- For HOSTS in a NETWORK to use DNS, you don't need to configure DNS on the ROUTERS.
  - They will simply FORWARD the DNS messages like any other packets
- However, a CISCO ROUTER can be configured as a DNS SERVER, although it's rare
  - If an INTERNAL DNS SERVER is used, usually it's a WINDOWS or LINUX SERVER
- A CISCO ROUTER can also be configured as a DNS CLIENT

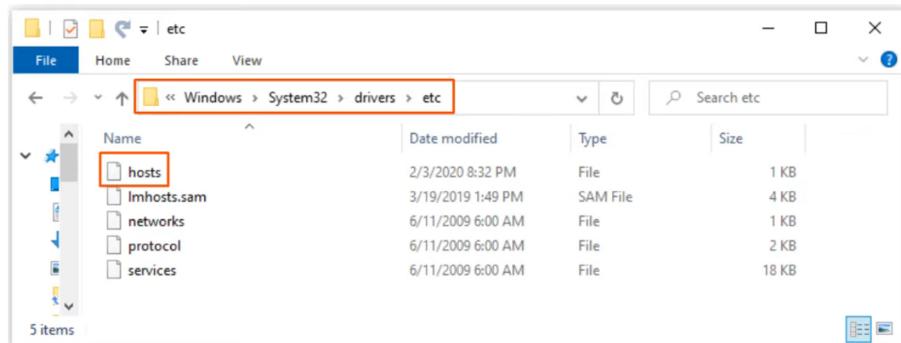


Figure 9: image

```
hosts - Notepad
File Edit Format View Help
# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#      102.54.94.97    rhino.acme.com        # source server
#      38.25.63.10    x.acme.com            # x client host
192.168.0.1 R1
#
# localhost name resolution is handled within DNS itself.
#      127.0.0.1    localhost
#      ::1         localhost
```

Figure 10: image

Command ip dns server and ip host <hostname> <ip address>

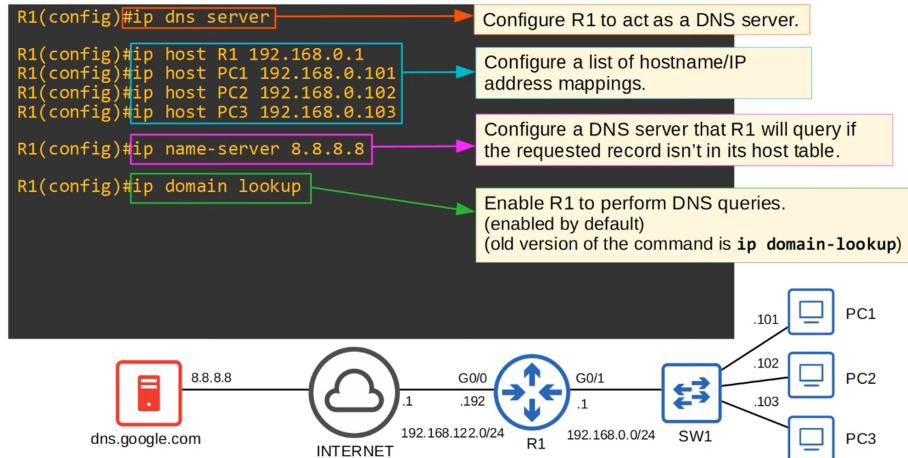


Figure 11: image

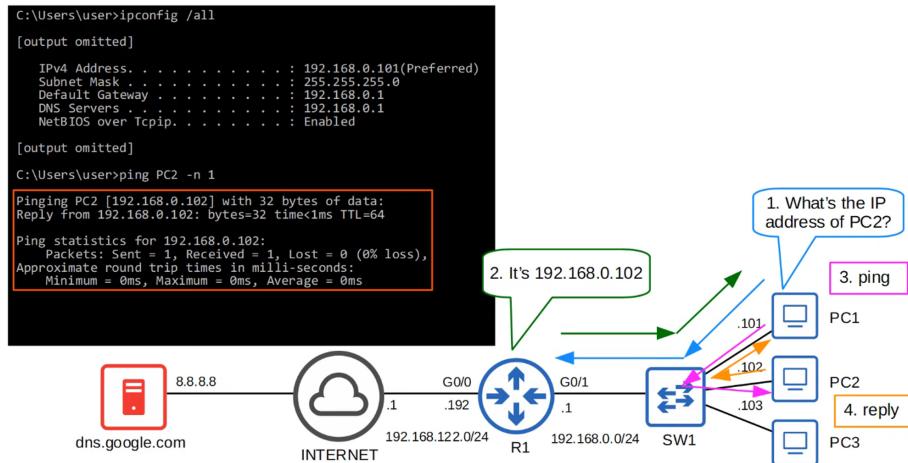


Figure 12: image

Command show hosts

Command ip name-server and ip domain lookup

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COMMAND REVIEW:

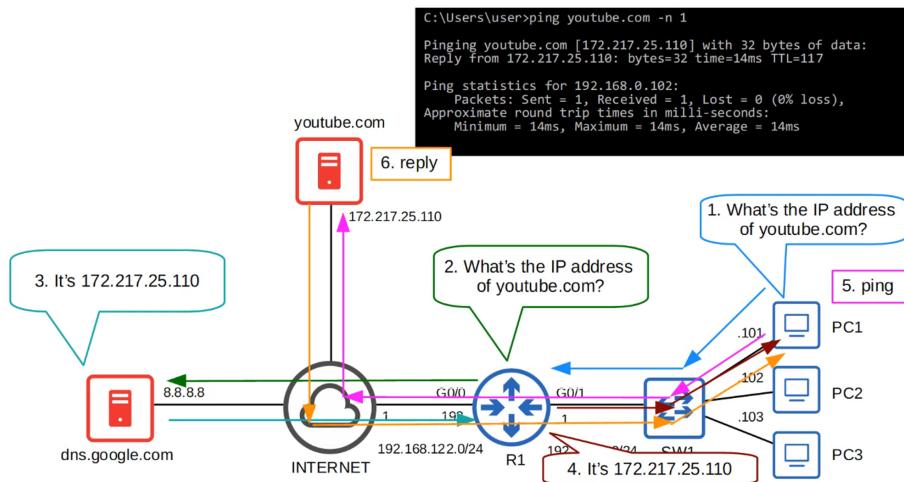


Figure 13: image

```
R1#show hosts
Default domain is not set
Name/address lookup uses domain service
Name servers are 8.8.8.8

Codes: UN - unknown, EX - expired, OK - OK, ?? - revalidate
      temp - temporary, perm - permanent
      NA - Not Applicable None - Not defined



| Host        | Port | Flags           | Age | Type | Address(es)    |
|-------------|------|-----------------|-----|------|----------------|
| youtube.com |      | None (temp, OK) | 0   | IP   | 172.217.25.110 |
| R1          |      | None (perm, OK) | 4   | IP   | 192.168.0.1    |
| PC1         |      | None (perm, OK) | 1   | IP   | 192.168.0.101  |
| PC2         |      | None (perm, OK) | 4   | IP   | 192.168.0.102  |
| PC3         |      | None (perm, OK) | 4   | IP   | 192.168.0.103  |


```

Figure 14: image

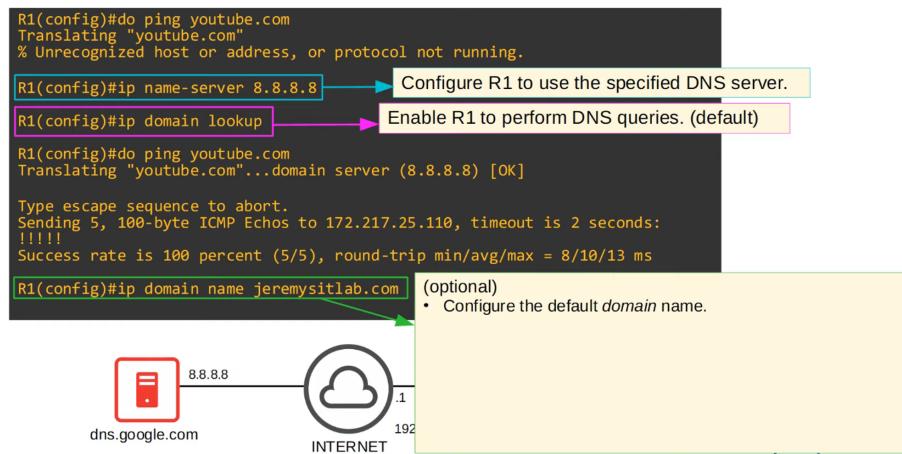


Figure 15: image

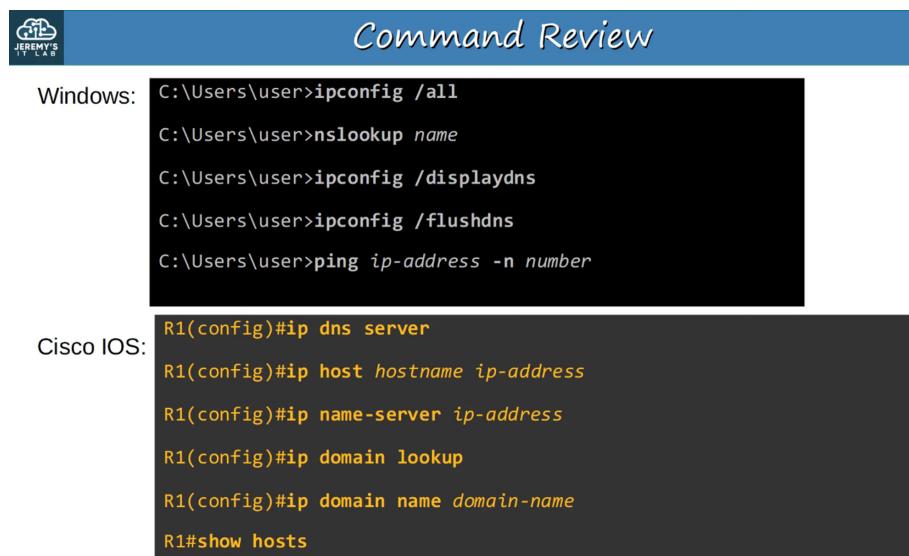


Figure 16: image