Lab 2 :- Networking Commands Lab File

- **AIM**

1. To study and execute various Windows networking commands such as arp -a, hostname, ipconfig, ipconfig/all, ipconfig/renew, ipconfig/release, ipconfig/flushdns, nbtstat -a, netdiag, netstat, nslookup, pathping, ping, route, and tracert to understand their functionality in troubleshooting and managing network configurations.

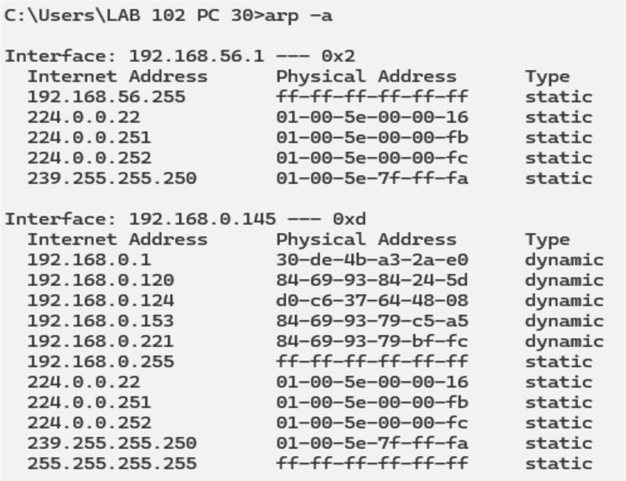
- **SOFTWARE REQUIRED**

1. Operating System: Windows (Windows 7/10/11)
2. Command Prompt (cmd.exe)
3. Internet connectivity (for external commands like ping, tracert, nslookup)

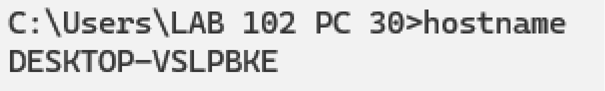
THEORY

1. **arp -a** → Displays the Address Resolution Protocol (ARP) cache, showing the mapping between IP addresses and MAC addresses.
2. **hostname** → Displays the computer's hostname (system name).
3. **ipconfig** → Displays basic network configuration details like IP address, subnet mask, default gateway.
4. **ipconfig /all** → Displays detailed configuration including MAC address, DHCP, DNS, etc.
5. **ipconfig /renew** → Requests a new IP address from the DHCP server.
6. **ipconfig /release** → Releases the current IP address obtained from DHCP.
7. **ipconfig /flushdns** → Clears DNS cache, useful when DNS entries are outdated.
8. **nbtstat -a <hostname>** → Displays NetBIOS over TCP/IP statistics, helps in finding remote system's NetBIOS name table.
9. **netdiag** → (Older Windows tool) Tests network connectivity and configuration issues.
10. **netstat** → Displays active TCP/UDP connections, ports, and network statistics.
11. **nslookup** → Queries DNS servers to resolve domain names into IP addresses.
12. **pathping <destination>** → Combines ping and tracert to show packet loss and latency at each hop.
13. **ping <destination>** → Tests connectivity to another host and measures round-trip time.
14. **route print** → Displays the system's routing table.
15. **tracert <destination>** → Traces the route packets take to a destination host.

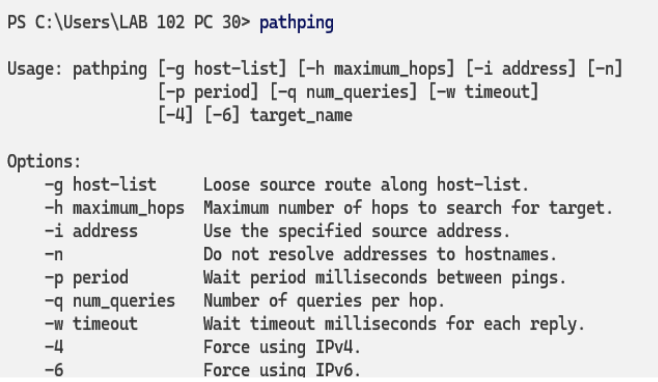
COMMANDS EXCUTED ON CMD



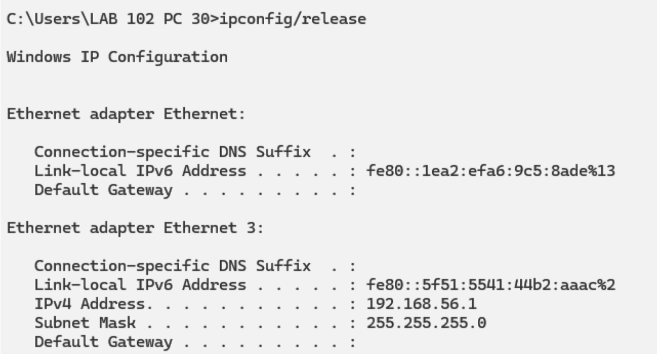
```
C:\Users\LAB 102 PC 30>arp -a

Interface: 192.168.56.1 --- 0x2
  Internet Address      Physical Address      Type
  192.168.56.255        ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static

Interface: 192.168.0.145 --- 0xd
  Internet Address      Physical Address      Type
  192.168.0.1           30-de-4b-a3-2a-e0     dynamic
  192.168.0.120         84-69-93-84-24-5d     dynamic
  192.168.0.124         d0-c6-37-64-48-08     dynamic
  192.168.0.153         84-69-93-79-c5-a5     dynamic
  192.168.0.221         84-69-93-79-bf-fc     dynamic
  192.168.0.255         ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```



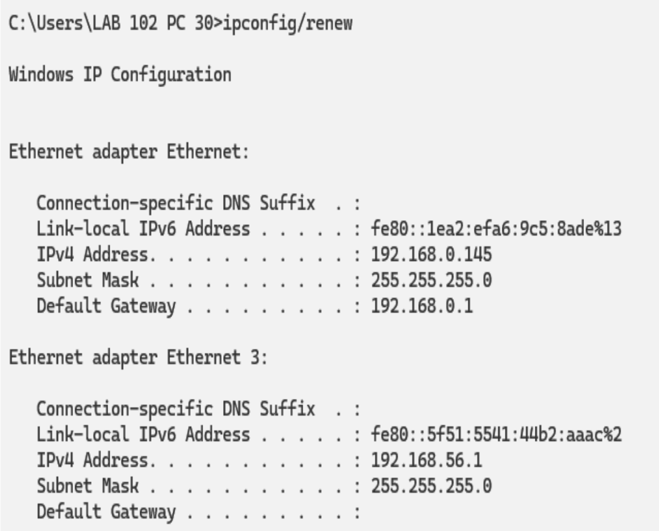
```
C:\Users\LAB 102 PC 30>hostname
DESKTOP-VSLPBKE
```



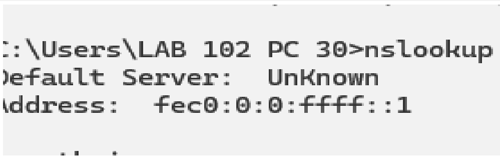
```
PS C:\Users\LAB 102 PC 30> pathping

Usage: pathping [-g host-list] [-h maximum_hops] [-i address] [-n]
                [-p period] [-q num_queries] [-w timeout]
                [-4] [-6] target_name

Options:
    -g host-list     Loose source route along host-list.
    -h maximum_hops  Maximum number of hops to search for target.
    -i address       Use the specified source address.
    -n               Do not resolve addresses to hostnames.
    -p period        Wait period milliseconds between pings.
    -q num_queries   Number of queries per hop.
    -w timeout       Wait timeout milliseconds for each reply.
    -4               Force using IPv4.
    -6               Force using IPv6.
```



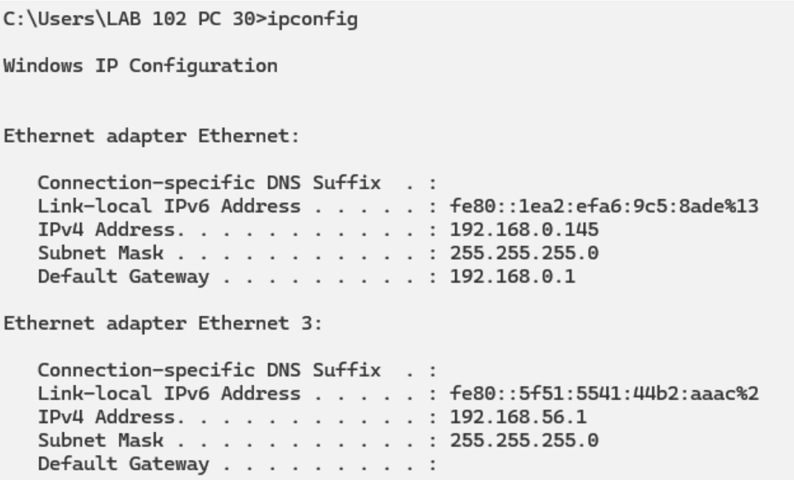
```
C:\Users\LAB 102 PC 30>ipconfig/release

Windows IP Configuration


Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::1ea2:efa6:9c5:8ade%13
   Default Gateway . . . . . . . . . :

Ethernet adapter Ethernet 3:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::5f51:5541:44b2:aaac%2
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :
```



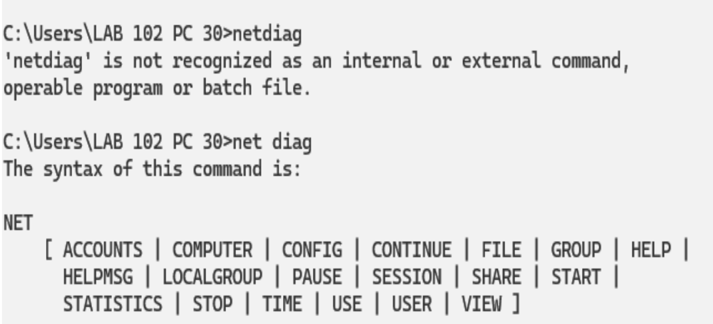
```
C:\Users\LAB 102 PC 30>ipconfig/renew

Windows IP Configuration


Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::1ea2:efa6:9c5:8ade%13
   IPv4 Address. . . . . . . . . . . : 192.168.0.145
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.0.1

Ethernet adapter Ethernet 3:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::5f51:5541:44b2:aaac%2
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :
```



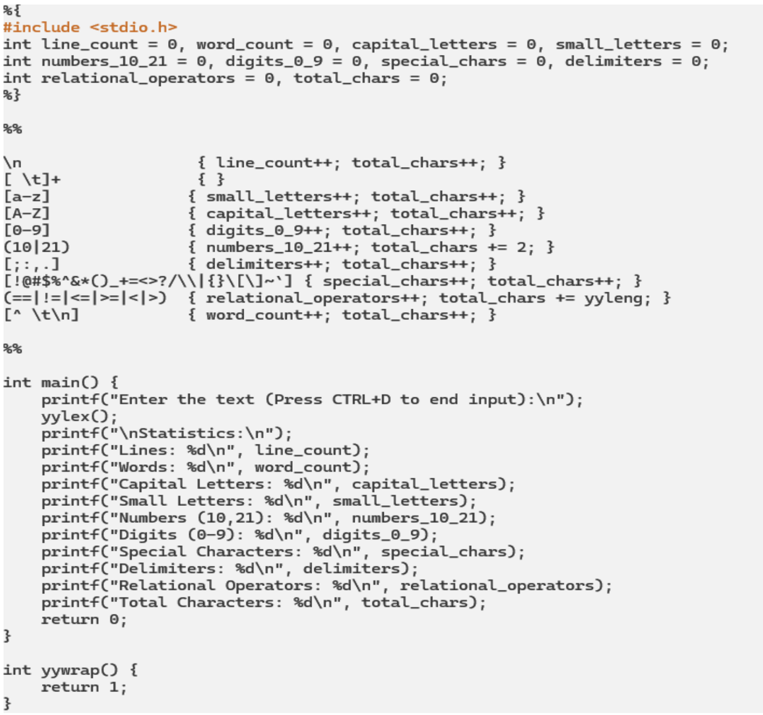
```
:\Users\LAB 102 PC 30>nslookup
efault Server:  UnKnown
ddress:  fec0:0:0:ffff::1
```



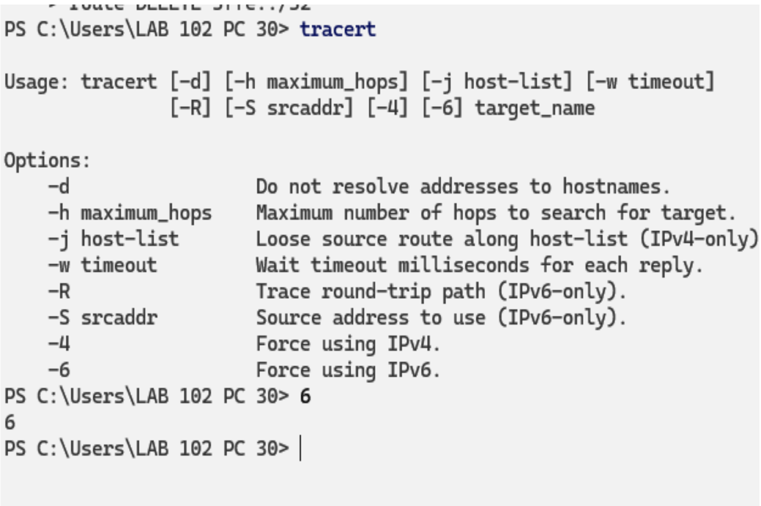
```
C:\Users\LAB 102 PC 30>ipconfig

Windows IP Configuration


Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::1ea2:efa6:9c5:8ade%13
   IPv4 Address. . . . . . . . . . . : 192.168.0.145
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.0.1

Ethernet adapter Ethernet 3:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::5f51:5541:44b2:aaac%2
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :
```



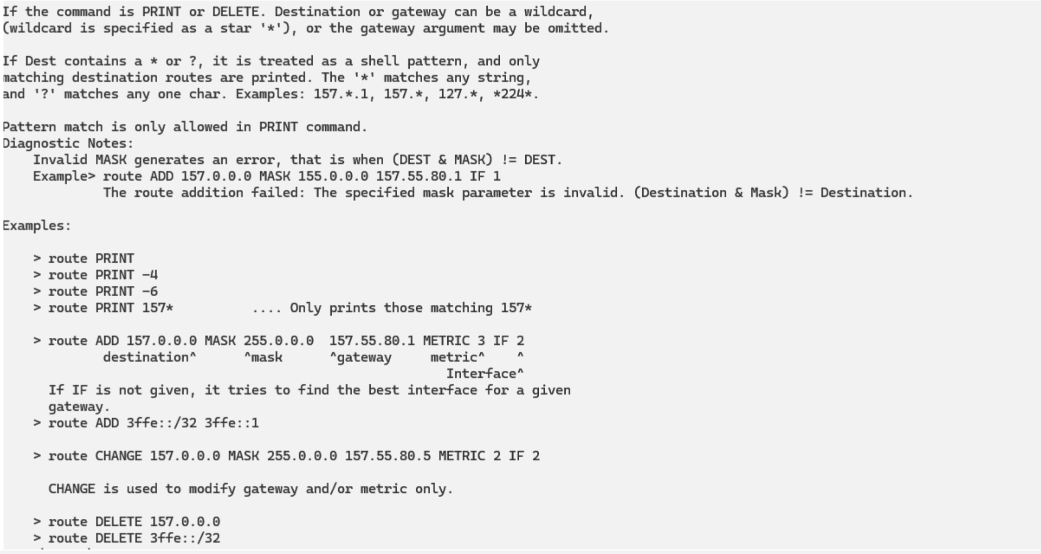
```
C:\Users\LAB 102 PC 30>netdiag
'netdiag' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\LAB 102 PC 30>net diag
The syntax of this command is:

NET
    [ ACCOUNTS | COMPUTER | CONFIG | CONTINUE | FILE | GROUP | HELP |
      HELPMSG | LOCALGROUP | PAUSE | SESSION | SHARE | START |
      STATISTICS | STOP | TIME | USE | USER | VIEW ]
```



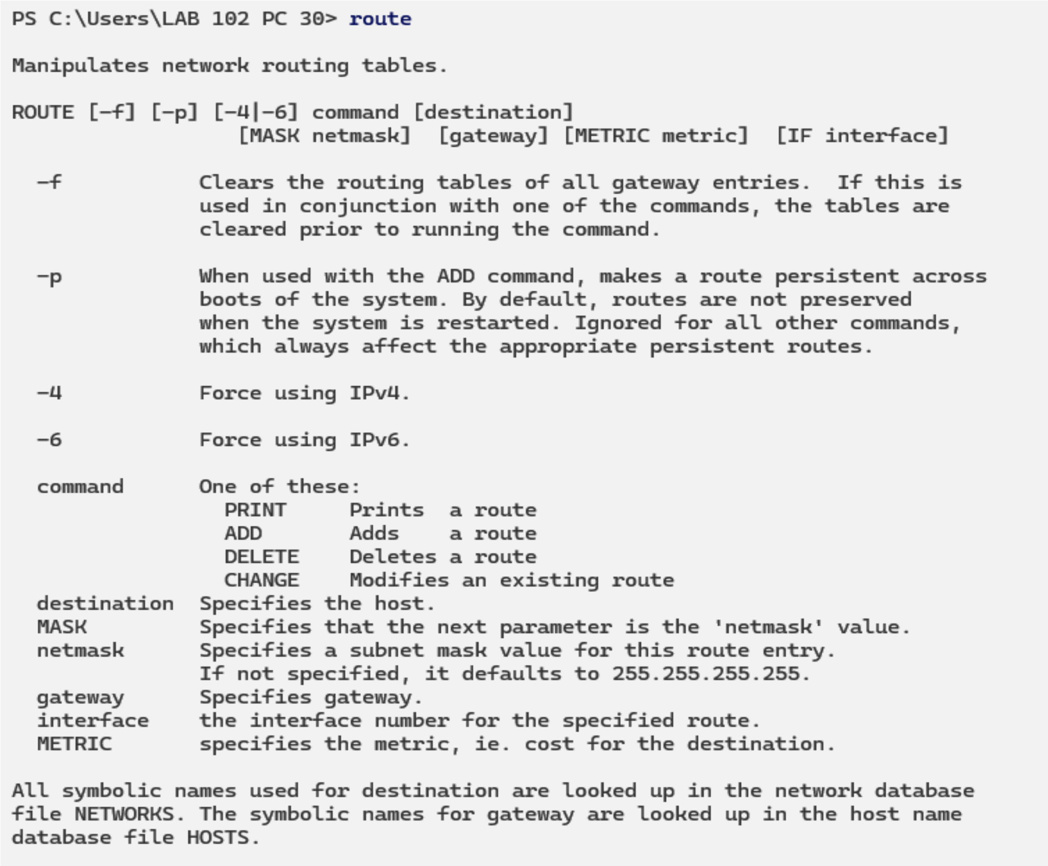
```
%{
#include <stdio.h>
int line_count = 0, word_count = 0, capital_letters = 0, small_letters = 0;
int numbers_10_21 = 0, digits_0_9 = 0, special_chars = 0, delimiters = 0;
int relational_operators = 0, total_chars = 0;
%}

%%

\n                    { line_count++; total_chars++; }
[ \t]+                { }
[a-z]                { small_letters++; total_chars++; }
[A-Z]                { capital_letters++; total_chars++; }
[0-9]                { digits_0_9++; total_chars++; }
(10|21)              { numbers_10_21++; total_chars += 2; }
[;:,.]               { delimiters++; total_chars++; }
[!@#$%^&*()_+=<>?/\\|{}\[\]~`] { special_chars++; total_chars++; }
(==|!=|<=|>=|<|>)  { relational_operators++; total_chars += yyleng; }
[^ \t\n]             { word_count++; total_chars++; }

%%

int main() {
    printf("Enter the text (Press CTRL+D to end input):\n");
    yylex();
    printf("\nStatistics:\n");
    printf("Lines: %d\n", line_count);
    printf("Words: %d\n", word_count);
    printf("Capital Letters: %d\n", capital_letters);
    printf("Small Letters: %d\n", small_letters);
    printf("Numbers (10,21): %d\n", numbers_10_21);
    printf("Digits (0-9): %d\n", digits_0_9);
    printf("Special Characters: %d\n", special_chars);
    printf("Delimiters: %d\n", delimiters);
    printf("Relational Operators: %d\n", relational_operators);
    printf("Total Characters: %d\n", total_chars);
    return 0;
}

int yywrap() {
    return 1;
}
```



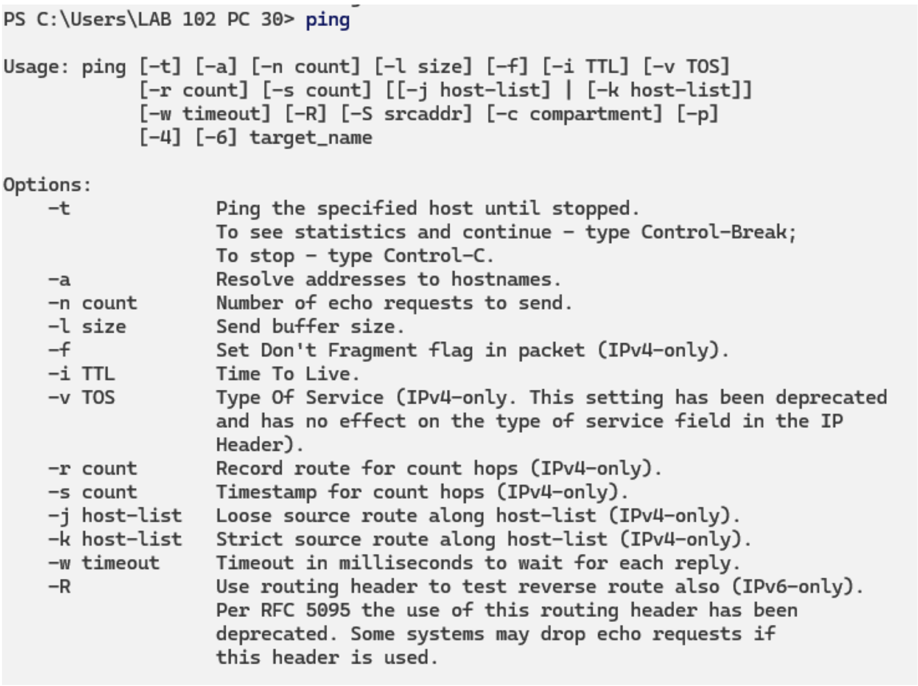
```
PS C:\Users\LAB 102 PC 30> tracert

Usage: tracert [-d] [-h maximum_hops] [-j host-list] [-w timeout]
               [-R] [-S srcaddr] [-4] [-6] target_name

Options:
    -d                 Do not resolve addresses to hostnames.
    -h maximum_hops    Maximum number of hops to search for target.
    -j host-list       Loose source route along host-list (IPv4-only).
    -w timeout         Wait timeout milliseconds for each reply.
    -R                 Trace round-trip path (IPv6-only).
    -S srcaddr         Source address to use (IPv6-only).
    -4                 Force using IPv4.
    -6                 Force using IPv6.
PS C:\Users\LAB 102 PC 30> 6
6
PS C:\Users\LAB 102 PC 30> |
```



```
If the command is PRINT or DELETE. Destination or gateway can be a wildcard,
(wildcard is specified as a star '*'), or the gateway argument may be omitted.

If Dest contains a * or ?, it is treated as a shell pattern, and only
matching destination routes are printed. The '*' matches any string,
and '?' matches any one char. Examples: 157.*.1, 157.*, 127.*, *224*.

Pattern match is only allowed in PRINT command.
Diagnostic Notes:
    Invalid MASK generates an error, that is when (DEST & MASK) != DEST.
    Example> route ADD 157.0.0.0 MASK 155.0.0.0 157.55.80.1 IF 1
             The route addition failed: The specified mask parameter is invalid. (Destination & Mask) != Destination.

Examples:

    > route PRINT
    > route PRINT -4
    > route PRINT -6
    > route PRINT 157*          .... Only prints those matching 157*

    > route ADD 157.0.0.0 MASK 255.0.0.0  157.55.80.1 METRIC 3 IF 2
             destination^      ^mask      ^gateway     metric^    ^
                                                         Interface^
      If IF is not given, it tries to find the best interface for a given
      gateway.
    > route ADD 3ffe::/32 3ffe::1

    > route CHANGE 157.0.0.0 MASK 255.0.0.0 157.55.80.5 METRIC 2 IF 2

      CHANGE is used to modify gateway and/or metric only.

    > route DELETE 157.0.0.0
    > route DELETE 3ffe::/32
```



```
PS C:\Users\LAB 102 PC 30> route

Manipulates network routing tables.

ROUTE [-f] [-p] [-4|-6] command [destination]
                  [MASK netmask]  [gateway] [METRIC metric]  [IF interface]

  -f           Clears the routing tables of all gateway entries.  If this is
               used in conjunction with one of the commands, the tables are
               cleared prior to running the command.

  -p           When used with the ADD command, makes a route persistent across
               boots of the system. By default, routes are not preserved
               when the system is restarted. Ignored for all other commands,
               which always affect the appropriate persistent routes.

  -4           Force using IPv4.

  -6           Force using IPv6.

  command      One of these:
                 PRINT     Prints  a route
                 ADD       Adds    a route
                 DELETE    Deletes a route
                 CHANGE    Modifies an existing route
  destination  Specifies the host.
  MASK         Specifies that the next parameter is the 'netmask' value.
  netmask      Specifies a subnet mask value for this route entry.
               If not specified, it defaults to 255.255.255.255.
  gateway      Specifies gateway.
  interface    the interface number for the specified route.
  METRIC       specifies the metric, ie. cost for the destination.

All symbolic names used for destination are looked up in the network database
file NETWORKS. The symbolic names for gateway are looked up in the host name
database file HOSTS.
```



```
PS C:\Users\LAB 102 PC 30> ping

Usage: ping [-t] [-a] [-n count] [-l size] [-f] [-i TTL] [-v TOS]
            [-r count] [-s count] [[-j host-list] | [-k host-list]]
            [-w timeout] [-R] [-S srcaddr] [-c compartment] [-p]
            [-4] [-6] target_name

Options:
    -t             Ping the specified host until stopped.
                   To see statistics and continue - type Control-Break;
                   To stop - type Control-C.
    -a             Resolve addresses to hostnames.
    -n count       Number of echo requests to send.
    -l size        Send buffer size.
    -f             Set Don't Fragment flag in packet (IPv4-only).
    -i TTL         Time To Live.
    -v TOS         Type Of Service (IPv4-only. This setting has been deprecated
                   and has no effect on the type of service field in the IP
                   Header).
    -r count       Record route for count hops (IPv4-only).
    -s count       Timestamp for count hops (IPv4-only).
    -j host-list   Loose source route along host-list (IPv4-only).
    -k host-list   Strict source route along host-list (IPv4-only).
    -w timeout     Timeout in milliseconds to wait for each reply.
    -R             Use routing header to test reverse route also (IPv6-only).
                   Per RFC 5095 the use of this routing header has been
                   deprecated. Some systems may drop echo requests if
                   this header is used.
```

RESULT

- Successfully executed and observed outputs of all the above networking commands.
- Understood the usage of each command for **network diagnosis, troubleshooting, and configuration.**

CONCLUSION

- This lab demonstrated practical knowledge of fundamental networking commands available in Windows. These commands are essential for diagnosing network problems, verifying configurations, and ensuring connectivity between systems. Regular practice of these commands improves troubleshooting skills and strengthens understanding of computer networks.