**SUB: Computer Networks**

**EXPERIMENT NO. 1**

**To study different networking commands.**

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**Theory**

Windows has some very useful networking utilities that are accessed from a command line (cmd console). The networking commands are mainly used for getting system information and troubleshooting networking problems.

The following commands are used most often.

1. **ipconfig Command**

It is used for finding network information about your local machine-like IP addresses, DNS addresses etc.

OUPUT :   
Wireless LAN adapter Local Area Connection\* 4:

Connection-specific DNS Suffix . :

Link-local IPv6 Address . . . . . : fe80::7c74:6c19:ec8d:3cf%24

IPv4 Address. . . . . . . . . . . : 192.168.137.1

Subnet Mask . . . . . . . . . . . : 255.255.255.0

Default Gateway . . . . . . . . . :

Ethernet adapter Ethernet 2:

Media State . . . . . . . . . . . : Media disconnected

Connection-specific DNS Suffix . :

Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . :

Link-local IPv6 Address . . . . . : fe80::49eb:36ea:4eba:d3d%25

IPv4 Address. . . . . . . . . . . : 192.168.0.103

Subnet Mask . . . . . . . . . . . : 255.255.255.0

Default Gateway . . . . . . . . . : 192.168.0.1

Ethernet adapter Ethernet 5:

Media State . . . . . . . . . . . : Media disconnected

Connection-specific DNS Suffix . :

1. **ipconfig/all**

It displays more information about the network setup on your systems including the MAC address.

OUTPUT :

Windows IP Configuration

Host Name . . . . . . . . . . . . : LAPTOP-66KSD5LS

Primary Dns Suffix . . . . . . . :

Node Type . . . . . . . . . . . . : Hybrid

IP Routing Enabled. . . . . . . . : No

WINS Proxy Enabled. . . . . . . . : No

Ethernet adapter Ethernet:

Media State . . . . . . . . . . . : Media disconnected

Connection-specific DNS Suffix . :

Description . . . . . . . . . . . : Realtek PCIe GbE Family Controller

Physical Address. . . . . . . . . : 04-D4-C4-E0-29-F7

DHCP Enabled. . . . . . . . . . . : No

Autoconfiguration Enabled . . . . : Yes

Ethernet adapter Ethernet 3:

Media State . . . . . . . . . . . : Media disconnected

Connection-specific DNS Suffix . :

Description . . . . . . . . . . . : TAP-NordVPN Windows Adapter V9

Physical Address. . . . . . . . . : 00-FF-7D-CF-E3-16

DHCP Enabled. . . . . . . . . . . : Yes

Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection\* 3:

Media State . . . . . . . . . . . : Media disconnected

Connection-specific DNS Suffix . :

Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #5

Physical Address. . . . . . . . . : 40-74-E0-84-BF-A8

DHCP Enabled. . . . . . . . . . . : Yes

Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection\* 4:

Connection-specific DNS Suffix . :

Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #6

Physical Address. . . . . . . . . : 42-74-E0-84-BF-A7

DHCP Enabled. . . . . . . . . . . : No

Autoconfiguration Enabled . . . . : Yes

Link-local IPv6 Address . . . . . : fe80::7c74:6c19:ec8d:3cf%24(Preferred)

IPv4 Address. . . . . . . . . . . : 192.168.137.1(Preferred)

Subnet Mask . . . . . . . . . . . : 255.255.255.0

Default Gateway . . . . . . . . . :

DHCPv6 IAID . . . . . . . . . . . : 356676832

DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-24-EE-04-68-04-D4-C4-E0-29-F7

DNS Servers . . . . . . . . . . . : fec0:0:0:ffff::1%1

fec0:0:0:ffff::2%1

fec0:0:0:ffff::3%1

NetBIOS over Tcpip. . . . . . . . : Enabled

Ethernet adapter Ethernet 2:

Media State . . . . . . . . . . . : Media disconnected

Connection-specific DNS Suffix . :

Description . . . . . . . . . . . : TAP-Windows Adapter V9

Physical Address. . . . . . . . . : 00-FF-50-20-9C-A3

DHCP Enabled. . . . . . . . . . . : Yes

Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . :

Description . . . . . . . . . . . : Intel(R) Wireless-AC 9560 160MHz

Physical Address. . . . . . . . . : 40-74-E0-84-BF-A7

DHCP Enabled. . . . . . . . . . . : Yes

Autoconfiguration Enabled . . . . : Yes

Link-local IPv6 Address . . . . . : fe80::49eb:36ea:4eba:d3d%25(Preferred)

IPv4 Address. . . . . . . . . . . : 192.168.0.103(Preferred)

Subnet Mask . . . . . . . . . . . : 255.255.255.0

Lease Obtained. . . . . . . . . . : 26 February 2021 13:56:10

Lease Expires . . . . . . . . . . : 26 February 2021 15:56:09

Default Gateway . . . . . . . . . : 192.168.0.1

DHCP Server . . . . . . . . . . . : 192.168.0.1

DHCPv6 IAID . . . . . . . . . . . : 390100192

DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-24-EE-04-68-04-D4-C4-E0-29-F7

DNS Servers . . . . . . . . . . . : 192.168.0.1

NetBIOS over Tcpip. . . . . . . . : Enabled

1. **Ping**

The ping command is one of the most often used networking utilities for detecting devices on a network and for troubleshooting network problems. Ping is used to test the ability of one network host to communicate with another. Simply enter the Ping command, followed by the name or the IP address of the destination host. Assuming that there are no network problems or firewalls preventing the ping from completing, the remote host will respond to the ping with four packets. Receiving these packets confirms that a valid and functional network path exists between the two hosts. When you ping a device, you send that device a short message, which it then sends back (the echo). The general format is **ping hostname** or **ping IPaddress**.

OUTPUT :

Pinging 192.168.0.1 with 32 bytes of data:

Reply from 192.168.0.1: bytes=32 time=1ms TTL=64

Reply from 192.168.0.1: bytes=32 time=1ms TTL=64

Reply from 192.168.0.1: bytes=32 time=2ms TTL=64

Reply from 192.168.0.1: bytes=32 time=2ms TTL=64

Ping statistics for 192.168.0.1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 1ms, Maximum = 2ms, Average = 1ms

1. **Nslookup**

Used for checking DNS record entries.

OUTPUT :

Server: UnKnown

Address: 192.168.0.1

Non-authoritative answer:

Name: www.google.com

Addresses: 2404:6800:4009:80e::2004

172.217.166.164

1. **Arp –a**

This is used for showing the address resolution cache.

The ARP command corresponds to the Address Resolution Protocol. Although it is easy to think of network communications in terms of IP addressing, packet delivery is ultimately dependent on the Media Access Control (MAC) address of the device’s network adapter. This is where the Address Resolution Protocol comes into play. Its job is to map IP addresses to MAC addresses. Windows devices maintain an ARP cache, which contains the results of recent ARP queries. You can see the contents of this cache by using the ARP -A command. If you are having problems communicating with one specific host, you can append the remote host’s IP address to the **ARP -A** command.

This command must be used with a command line switch **arp -a** is the most common.

OUTPUT :   
Interface: 192.168.137.1 --- 0x18

Internet Address Physical Address Type

192.168.137.255 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

224.77.77.77 01-00-5e-4d-4d-4d static

239.255.255.250 01-00-5e-7f-ff-fa static

255.255.255.255 ff-ff-ff-ff-ff-ff static

Interface: 192.168.0.103 --- 0x19

Internet Address Physical Address Type

192.168.0.1 98-da-c4-91-4d-52 dynamic

192.168.0.102 08-25-25-57-28-25 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

224.77.77.77 01-00-5e-4d-4d-4d static

239.255.102.18 01-00-5e-7f-66-12 static

239.255.255.250 01-00-5e-7f-ff-fa static

255.255.255.255 ff-ff-ff-ff-ff-ff static

1. **Netstat**

Displays the active TCP connections, ports on which the computer is listening. If you are experiencing problems with network communications, then network statistics can sometimes help point you toward the root cause of the problem. That is where the aptly named NetStat command comes into play. This command has several different functions, but the most useful of these is to display network summary information for the device. The command used is **NetStat -e.**

OUTPUT :

Active Connections

Proto Local Address Foreign Address State

TCP 127.0.0.1:1043 LAPTOP-66KSD5LS:49699 ESTABLISHED

TCP 127.0.0.1:9012 LAPTOP-66KSD5LS:49700 ESTABLISHED

TCP 127.0.0.1:9487 LAPTOP-66KSD5LS:49698 ESTABLISHED

TCP 127.0.0.1:49671 LAPTOP-66KSD5LS:49672 ESTABLISHED

TCP 127.0.0.1:49672 LAPTOP-66KSD5LS:49671 ESTABLISHED

TCP 127.0.0.1:49698 LAPTOP-66KSD5LS:9487 ESTABLISHED

TCP 127.0.0.1:49699 LAPTOP-66KSD5LS:1043 ESTABLISHED

TCP 127.0.0.1:49700 LAPTOP-66KSD5LS:9012 ESTABLISHED

TCP 127.0.0.1:49703 LAPTOP-66KSD5LS:57310 ESTABLISHED

TCP 127.0.0.1:51870 LAPTOP-66KSD5LS:51871 ESTABLISHED

TCP 127.0.0.1:51871 LAPTOP-66KSD5LS:51870 ESTABLISHED

TCP 127.0.0.1:57301 LAPTOP-66KSD5LS:65001 ESTABLISHED

TCP 127.0.0.1:57310 LAPTOP-66KSD5LS:49703 ESTABLISHED

TCP 127.0.0.1:65001 LAPTOP-66KSD5LS:57301 ESTABLISHED

TCP 192.168.0.103:59548 40.90.189.152:https ESTABLISHED

TCP 192.168.0.103:62215 40.90.189.152:https ESTABLISHED

TCP 192.168.0.103:62226 relay-2944465e:http ESTABLISHED

TCP 192.168.0.103:62236 sa-in-f188:https ESTABLISHED

TCP 192.168.0.103:62268 52.114.6.173:https ESTABLISHED

TCP 192.168.0.103:62330 52.111.244.0:https ESTABLISHED

TCP 192.168.0.103:62335 52.114.6.216:https ESTABLISHED

TCP 192.168.0.103:62340 52.109.124.53:https ESTABLISHED

TCP 192.168.0.103:62583 75:4070 ESTABLISHED

1. **Nbtstat**

Computers that are running a Windows operating system are assigned a computer name. Often, there is a domain name or a workgroup name that is also assigned to the computer. The computer name is sometimes referred to as the NetBIOS name. Windows uses several different methods to map NetBIOS names to IP addresses, such as broadcast, LMHost lookup, or even using the nearly extinct method of querying a WINS server. Of course, NetBIOS over TCP/IP can occasionally break down. The NbtStat command can help you to diagnose and correct such problems. The NbtStat -n command for example, shows the NetBIOS names that are in use by a device. The **NbtStat -r** command shows how many NetBIOS names the device has been able to resolve recently. It is a MS-DOS utility that displays protocol statistics and current TCP/IP connections. The command used is **nbtstat –c**.

OUTPUT : Nbtstat -c

Node IpAddress: [0.0.0.0] Scope Id: []

No names in cache

Ethernet:

Node IpAddress: [0.0.0.0] Scope Id: []

No names in cache

Wi-Fi:

Node IpAddress: [192.168.0.103] Scope Id: []

No names in cache

Local Area Connection\* 3:

Node IpAddress: [0.0.0.0] Scope Id: []

No names in cache

OUTPUT : nbtstat -n

Ethernet 3:

Node IpAddress: [0.0.0.0] Scope Id: []

No names in cache

Ethernet 2:

Node IpAddress: [0.0.0.0] Scope Id: []

No names in cache

Ethernet:

Node IpAddress: [0.0.0.0] Scope Id: []

No names in cache

Wi-Fi:

Node IpAddress: [192.168.0.103] Scope Id: []

NetBIOS Local Name Table

Name Type Status

---------------------------------------------

LAPTOP-66KSD5LS<00> UNIQUE Registered

WORKGROUP <00> GROUP Registered

LAPTOP-66KSD5LS<20> UNIQUE Registered

Local Area Connection\* 3:

Node IpAddress: [0.0.0.0] Scope Id: []

No names in cache

Local Area Connection\* 4:

Node IpAddress: [192.168.137.1] Scope Id: []

NetBIOS Local Name Table

Name Type Status

---------------------------------------------

LAPTOP-66KSD5LS<00> UNIQUE Registered

WORKGROUP <00> GROUP Registered

LAPTOP-66KSD5LS<20> UNIQUE Registered

1. **Hostname**

The previously discussed NbtStat command can provide you with the host name that has been assigned to a Windows device, if you know which switch to use with the command. However, if you are just looking for a fast and easy way of verifying a computer’s name, then try using the Hostname command. Typing **Hostname** at the command prompt returns the local computer name.

OUTPUT :   
LAPTOP-66KSD5LS

1. **Tracert**

Traceroute is a computer network diagnostic tool for displaying the route (path) and measuring the transit delays of packets across an Internet Protocol network. It gives you the number of hops required to reach the destination.

OUTPUT :   
Tracing route to www.google.com [172.217.166.164]

over a maximum of 30 hops:

1 <1 ms 1 ms 3 ms 192.168.0.1

2 4 ms 4 ms 4 ms 45.248.138.38

3 12 ms 12 ms 13 ms 103.102.145.65

4 11 ms 12 ms 11 ms 103.80.117.165

5 12 ms 14 ms 14 ms 108.170.248.193

6 13 ms 13 ms \* 74.125.253.107

7 14 ms 13 ms 12 ms bom07s20-in-f4.1e100.net [172.217.166.164]

Trace complete.

1. **Route**

IP networks use routing tables to direct packets from one subnet to another. The Windows Route utility allows you to view the device’s routing tables. To do so, simply type **Route Print**.

OUTPUT :   
Interface List

4...04 d4 c4 e0 29 f7 ......Realtek PCIe GbE Family Controller

62...........................NordLynx Tunnel

19...........................WireGuard Tunnel

21...00 ff 7d cf e3 16 ......TAP-NordVPN Windows Adapter V9

15...40 74 e0 84 bf a8 ......Microsoft Wi-Fi Direct Virtual Adapter #5

24...42 74 e0 84 bf a7 ......Microsoft Wi-Fi Direct Virtual Adapter #6

13...00 ff 50 20 9c a3 ......TAP-Windows Adapter V9

25...40 74 e0 84 bf a7 ......Intel(R) Wireless-AC 9560 160MHz

20...00 ff 7c b5 d3 49 ......TunnelBear Adapter V9

1...........................Software Loopback Interface 1

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IPv4 Route Table

===========================================================================

Active Routes:

Network Destination Netmask Gateway Interface Metric

0.0.0.0 0.0.0.0 192.168.0.1 192.168.0.103 40

127.0.0.0 255.0.0.0 On-link 127.0.0.1 331

127.0.0.1 255.255.255.255 On-link 127.0.0.1 331

127.255.255.255 255.255.255.255 On-link 127.0.0.1 331

192.168.0.0 255.255.255.0 On-link 192.168.0.103 296

192.168.0.103 255.255.255.255 On-link 192.168.0.103 296

192.168.0.255 255.255.255.255 On-link 192.168.0.103 296

192.168.137.0 255.255.255.0 On-link 192.168.137.1 281

192.168.137.1 255.255.255.255 On-link 192.168.137.1 281

192.168.137.255 255.255.255.255 On-link 192.168.137.1 281

224.0.0.0 240.0.0.0 On-link 127.0.0.1 331

224.0.0.0 240.0.0.0 On-link 192.168.0.103 296

224.0.0.0 240.0.0.0 On-link 192.168.137.1 281

255.255.255.255 255.255.255.255 On-link 127.0.0.1 331

255.255.255.255 255.255.255.255 On-link 192.168.0.103 296

255.255.255.255 255.255.255.255 On-link 192.168.137.1 281

===========================================================================

Persistent Routes:

Network Address Netmask Gateway Address Metric

0.0.0.0 0.0.0.0 192.168.1.2 Default

===========================================================================

IPv6 Route Table

===========================================================================

Active Routes:

If Metric Network Destination Gateway

1 331 ::1/128 On-link

25 296 fe80::/64 On-link

24 281 fe80::/64 On-link

25 296 fe80::49eb:36ea:4eba:d3d/128

On-link

24 281 fe80::7c74:6c19:ec8d:3cf/128

On-link

1 331 ff00::/8 On-link

25 296 ff00::/8 On-link

24 281 ff00::/8 On-link

===========================================================================

Persistent Routes:

None

**11. PathPing**

Entering the PathPing command followed by a host name initiates what looks like a somewhat standard Tracert process. Once this process completes however, the tool takes 300 seconds (five minutes) to gather statistics, and then reports latency and packet loss statistics that are more detailed than those provided by Ping or Tracert.

OUTPUT :   
Tracing route to www.google.com [142.250.67.228]

over a maximum of 30 hops:

0 LAPTOP-66KSD5LS [192.168.0.103]

1 192.168.0.1

2 45.248.138.38

3 103.102.145.65

4 103.80.117.165

5 108.170.248.209

6 216.239.58.19

7 bom07s24-in-f4.1e100.net [142.250.67.228]

Computing statistics for 175 seconds...

Source to Here This Node/Link

Hop RTT Lost/Sent = Pct Lost/Sent = Pct Address

0 LAPTOP-66KSD5LS [192.168.0.103]

0/ 100 = 0% |

1 2ms 0/ 100 = 0% 0/ 100 = 0% 192.168.0.1

0/ 100 = 0% |

2 5ms 0/ 100 = 0% 0/ 100 = 0% 45.248.138.38

2/ 100 = 2% |

3 14ms 3/ 100 = 3% 1/ 100 = 1% 103.102.145.65

0/ 100 = 0% |

4 14ms 7/ 100 = 7% 5/ 100 = 5% 103.80.117.165

0/ 100 = 0% |

5 15ms 3/ 100 = 3% 1/ 100 = 1% 108.170.248.209

0/ 100 = 0% |

6 --- 100/ 100 =100% 98/ 100 = 98% 216.239.58.19

0/ 100 = 0% |

7 14ms 2/ 100 = 2% 0/ 100 = 0% bom07s24-in-f4.1e100.net [142.250.67.228]

Trace complete.