

Conceptualization and Development of MATLAB-based Application for Local Area Network

Kartick Upadhyay*¹

¹Advanced Centre for Energetic Materials, DRDO, Nasik, Maharashtra, India

kartick.acem@gov.in¹

ARTICLE INFO

Article History:

Accepted: 01 April 2023

Published: 21 April 2023

Publication Issue

Volume 10, Issue 2

March-April-2023

Page Number

528-540

ABSTRACT

Local Area Network is the epicenter of modern businesses and industries and is a critical requirement for productivity and efficiency. It is the most structured way of connecting different networking devices for communication, database access, and sharing resources among users. As technology, design, and applications continue to evolve, high-speed networks are becoming increasingly important. Devices with high bandwidth requirements, such as cameras, VOIP, and PA over IP, is being added to the network, which tends to increase the amount of data traffic and thus utilize the maximum bandwidth. The increase in bandwidth is a cost-intensive process that requires the installation of additional transmission media and other network equipment. Hence, the network resources need to be monitored for smooth and efficient performance. Network performance monitoring is a complex task and requires proficiency. This paper presents the development of a simple GUI-based network monitoring application.

Keywords: Link speed, MATLAB, Network, Network statistics, Ping, Throughput

I. INTRODUCTION

A Local Area Network (LAN) is a computer network in which two or more computers are connected within a particular area to exchange information, resources, files, and programs. Computers and devices in LAN are connected either using wires or wirelessly (defined under IEEE 802.11 standards). It is limited to a small geographical area spread over a few acres like office buildings, college campuses, commercial establishments, residential apartments, hospitals, factories, etc. LANs are used and maintained privately by an organization using TCP/IP addressing mechanisms. It is designed to allow users high-bandwidth access to data, media, printers, etc. It

involves the use of a computer, Network Interface Card (NIC), cables, Wireless Access Point (WAP), network switch, bridge, etc. Ethernet is the by and large most popular LAN technology, the other two being Token Ring and Fiber Distributed Data Interface. Ethernet's popularity is mostly attributed to its ease of understanding, implementation, maintenance, low cost, scalability, and interoperability.

Ethernet is a set of standards defined under IEEE 802.3 to create a network. It specifies cables, the maximum allowable length of cables, how data is being transmitted using a cable, etc. Wired (or guided media) transmission can be twisted pair cable, coaxial

cable, or Optical Fibre Cable (OFC). It can also be a combination of either two or all three. Selection of cable is guided by factors like the volume of data being transmitted, distance up to which data is being carried, interference from external sources, cost, etc. Data in Ethernet communication is carried as packets. A packet is a logical group of information that contains a header and information.

Despite their high reliability and fault tolerance, Local Area Networks must be regularly monitored to ensure they do not fail. In large enterprises, network administration can be highly complex due to the implementation of network topologies, the number of computers, the volume of data, multiple switches, and servers. Generally, data flow is periodic however in some instants; data flow can abruptly rise leading to network congestion, lag, and slowness. The increase in the data flow is attributed to the functioning of high bandwidth-demanding devices on the network. These devices generate large amounts of data within very short intervals. To overcome this crisis network bandwidth needs to be monitored and if required can be increased.

Bandwidth monitoring and utilization can be done by knowing network statistics, whereas connectivity checks and speed tests can be done using ping. This requires remembering complex commands that demand an adept person; also, the result returned in the command prompt is not presentable. To overcome this an application software has been conceptualized and developed in MATLAB which can be utilized to get insight into networks like connection speed between host and remote or any two devices, bandwidth and instantaneous network usage, and graphical display.

II. LITERATURE SURVEY AND TERMINOLOGIES

Ping stands for Packet Inter Groper; it is an Internet Control Message Protocol (ICMP) that is employed to verify the connection with a networking device. It sends an IP packet to a destination device and requests a reply. The reply for a ping contains packets

sent and received, loss, and round-trip time (RTT). This is also used to test network connectivity, TCP/ IP configuration etc. [1]. Netstat or network statistics is utilized to display devices connected to the network and network interfaces and is being utilized for monitoring and troubleshooting network issues by displaying protocol statistics and current network connections. Netstat displays a list of protocol types, local addresses, port information, remote state, etc. [2].

The Bandwidth of a channel is defined by the range of frequencies that it can transmit over a given time interval. The faster the signal changes, the higher its maximum frequency, and the larger its bandwidth. Video content streaming requires large bandwidth when compared to a simple email [3]. Throughput is the actual amount of data that is being transmitted over the communication channel. Practically throughput is always less than the bandwidth of the channel. The throughput of a channel depends upon the signal-to-noise ratio (SNR) and bandwidth of the channel. As a packet travels from source to destination packet has to come across various delays along the path. These delays are processing delay, queuing delay, transmission delay, and propagation delay [4] [11]. Bandwidth, throughput, and latency can be best understood by taking the analogy of a water pipe. Bandwidth can be understood as the total capacity of water that can be carried over by the pipe; throughput can be understood as the actual capacity of water being carried by the pipe during a specific time interval whereas latency is the measure of time taken by water to reach the other end of the pipe. Similarly, in computer networking; bandwidth is the maximum rate at which data can be transmitted. Throughput is the actual rate at which the data is transmitted and latency is the measure of time required to transmit data from the source to the receiver. Latency can increase due to various delays that lead to a decrease in throughput. An increase in bandwidth requires the addition or up-gradation of carrier channels, NIC

adapters, switches, etc. However, increasing throughput is linked with the reduction of network latency by using better protocol conversion devices, replacing faulty media interfaces, increasing computer processing, operating systems, etc. Still implementing all these strategies does not guarantee a complete reduction in latency [5].

III. COMPONENTS OF LAN

Local Area Networks can be highly sophisticated having multiple network switches, various topologies, Virtual LANs, a combination of different transmission media (OFC, twisted pair, coaxial), Wireless Access Points, servers, Network Attached Storages, network shared printers, IP cameras, etc in accordance with the requirements. However, a basic Local Area Network comprises computers, network switches, and cables. Computers are connected to the network using an Unshielded Twisted Pair (UTP) cable, which is initiated from the Network Interface Card of the computer and terminated at the network switch. The members of Ethernet responsible for handling communication are:

3.1 Network Interface Card (NIC)

3.2 Twisted Pair cable

3.3 Network switch

3.1 Network Interface Card: NIC also called as network adapter or LAN adapter is a hardware component for networking connection. It is installed on a computer, printer, server, switch, router, etc for communication and transmission of data. NIC can be internal or external. Internal NICs are either embedded into the motherboard Printed Circuit Board (PCB) or connected to the motherboard using Peripheral Component Interconnect (PCI). External PCIs have a Universal Serial Bus (USB) interface. Both internal and external NICs have their wired and wireless variants. Wired PCI variants can have either a Registered Jack-45 (RJ-45) interface, Optical Fibre connector interface, or coaxial cable interface depending upon the type of cable being used. The

majority of NICs have an RJ-45 interface. It is both layer 1 and layer 2 devices of Open System Interconnect (OSI) architecture. A computer can have more than one NIC. Every NIC has a unique Media Access Control (MAC) address. MAC addresses are unique 12-digit hexadecimal numbers or 48 bits of hardware number embedded into the card. Every NIC has a speed rating (100 Mbps, 1000 Mbps, etc.) which defines its maximum capacity. An RJ-45 (Registered Jack) is a modular 8P8C (8 Point 8 Contact) connector that is used at the terminals of twisted pair cable

3.2 Twisted Pair Cable: These cables are twisted around each other to reduce electrical interference. These cables come under two variants: Shielded Twisted Pair (STP) and Unshielded Twisted Pair (UTP). The majority of Ethernet architectures are made using UTP cable, whereas STP is used in special cases [6]. Twisted Pair cables are categorized on the basis of maximum bandwidth (or maximum data transfer rate) and maximum distance up to which it can successfully transmit data. These categories are defined by ANSI/ EIA* standard 568. Most Twisted Pair cable has 4 pairs out of which 2 pairs are used in general and the maximum allowable length between the computer and the switch should not exceed 328 feet. These cables are terminated using RJ-45 connectors at both ends. Twisted Pair cable terminated as per standards defined by EIA/TIA^ 568 A and EIA/TIA 568 B.

*ANSI: American National Standards Institute

EIA: Electronic Industries Association

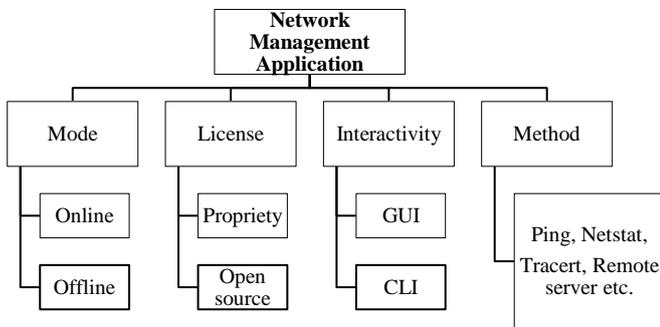
^TIA: Telecommunications Industries Association

3.3 Network switch: A network switch is a layer 2 device, however, some switches are capable of routing data to the network level and hence stated as both layer 2 and layer 3 devices. It accepts incoming packets from the access point of the physical port and forwards these packets using the MAC address table to the designated port connected to the designated device. It is a multiport bridge with a buffer and is designed to boost efficiency. Switches are capable of

data traffic management and also perform error checking.

IV. NETWORK MANAGEMENT APPLICATIONS

There are various applications and techniques used worldwide to measure network speed, bandwidth, current network utilization, etc. Software applications and utilities can be simple or complex in design. Some of these applications are effective for small LANs only and some are designed to cater to large LANs of enterprises. These applications can be broadly classified into the following types:



4.1 Mode:

4.1.1 Online: This tool requires an internet connection. The test provider finds the nearest server based on location and then downloads data of known size from the server to the user's computer and thereby calculates the download speed by dividing the amount of data by the time taken to download and returns the result to the user. Similarly, the reverse process is done to calculate the upload speed.

4.1.2 Offline: This method uses similar technique as online; however, this known amount of data is either sent to or downloaded from the server or a remote device in the Local Area Network.

4.2 License:

4.2.1 Propriety: These software applications are excellent in their performance and provide wide functionalities to users. It utilizes complex algorithms in order to gain insight into the network and provides

a rich Graphical User Interface (GUI) in order to provide the user with a comprehensive analysis of the network. However, they are premium and preferred by enterprises to manage their large and complex networks. Some of these applications were provided as trial versions for a limited period with limited features.

4.2.2 Open source/Free version: These applications were available under free license; some of these were available as open source. The major problems for these applications or tools are poor GUI and lack of features. A large number of them offer Command Line Interface (CLI), which is not user-friendly and requires expertise to operate. These are suitable for small, simple networks or home networks.

4.3 Interactivity:

4.3.1 Graphic User Interface: GUIs are always user-friendly for both nonprofessionals and experts. It does not require memorizing and recollecting commands. GUIs are rich in both features and functionality. It provides options like tabulated data, graphs, etc.

4.3.2 Command Line Interface: CLIs are used by experts and professionals. These are generally light applications and can be easily installed on devices without requiring some pre-installed application and utilize less space and memory.

4.4 Methods:

Software application or utility uses techniques like ping, tracert, netstat, etc. to calculate speed, bandwidth, lag, latency, current networking utilization, etc. Some may use a particular technique or combination of techniques to estimate latency, throughput, etc. Some offline applications use NIC adapter data i.e., bytes sent and received to calculate upload and download speed respectively.

The above classification is mutually inclusive which means that an application can also be online, CLI, and open source or can be offline, premium, and GUI.

V. CONCEPTUALIZATION OF SOFTWARE AND METHODOLOGY

Delays lead to an increase in network latency, which in turn results in a decrease in network speed. Network latency can be estimated using the round trip time (RTT). RTT is the time elapsed in sending an Internet Control Messaging Protocol (ICMP) echo packet and getting a response. A high RTT indicates high network latency and slow network speed and vice-versa.

Ping is the simplest command in the command prompt used to test connectivity between the source and destination computer. Connectivity check can also be done on any device connected to the network like Internet Protocol (IP) camera, printer, server, etc. Ping sends an echo request message to a device in the network and waits for the response. Every device connected to the network is assigned an IP address. An IP address is a 32 bits field having a dot-decimal unique address that identifies a device in the network. No two devices in a network can have the same IP address.

A simple ping command followed by the IP address of the remote device in the command window

```
ping 192.168.1.1
```

would return results as shown in the Fig. 1 below

```
C:\Users\Comanche>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:
Reply from 192.168.1.1: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Fig. 1

Now if the command is modified to

```
ping 192.168.1.1 -l 65500 -n
```

The return result (Fig. 2) would be:

```
C:\Users\Comanche>ping 192.168.1.1 -l 65500 -n 1

Pinging 192.168.1.1 with 65500 bytes of data:
Reply from 192.168.1.1: bytes=65500 time=4ms TTL=64

Ping statistics for 192.168.1.1:
    Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 4ms, Average = 4ms
```

Fig. 2

Here **-l** after the IP address sets the size of the echo request in bytes. The maximum size is 65500 bytes. The echo request size ranges from 32 to 65527 bytes. **-n** used after packet size (65500 in this case) sets the echo request number. The default echo packet size and echo request number is 32 bytes and four times respectively as seen in Figure.

The size of the packet (65500 Bytes) for ping is selected on the basis on four ping tests carried from a source computer to four different remote hosts on a network.

The methodology of the test is as follows:

a. **Test 1:** The first ping test was carried out on the server separated by a distance of 1 km from the source. The server is connected to a network switch and the source is connected to another network switch. Both switches are connected to an optical fiber backbone as shown in Fig. 3.

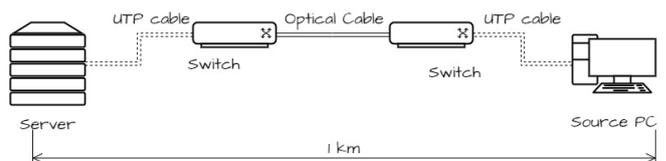


Fig. 3

b. **Test 2:** The second test was carried out from a PC and server connected to the same network switch separated by a distance not exceeding 10 m (Fig. 4).

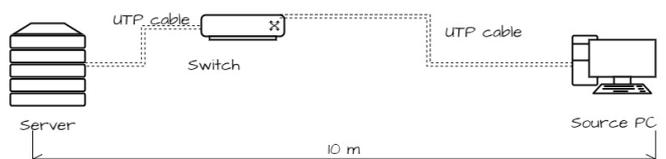
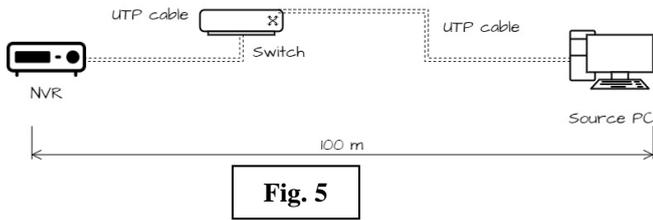
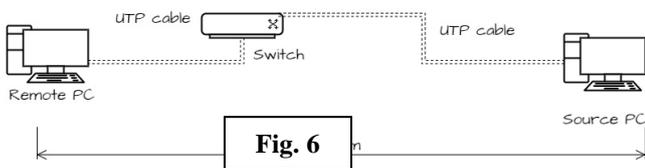


Fig. 4

c. **Test 3:** The third test was conducted on a Network Video Recorder (NVR) connected to the same switch separated by a distance of approx 100 m (Fig. 5).



c. **Test 4:** The fourth test was done on a remote PC on the same switch separated by a distance of 60 m (Fig.6).

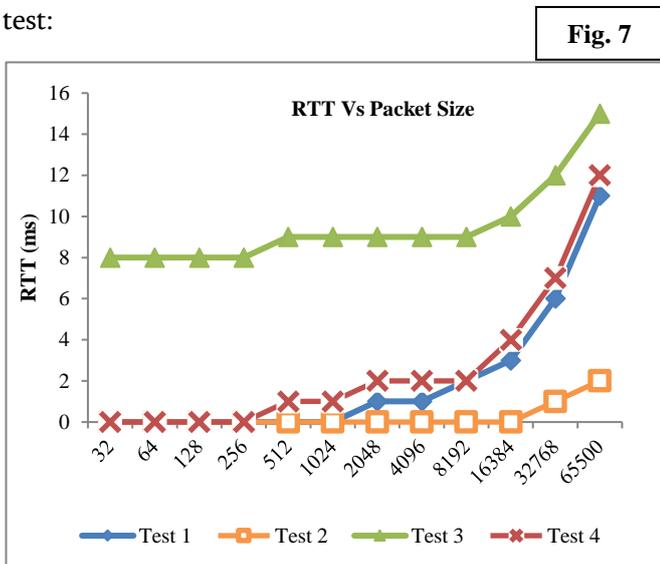


e. Packet size started from 32 Bytes and stepped up in multiples of two up to 32768 Bytes. The maximum packet size used in the test is 65500 Bytes. A packet size of 65500 is the maximum size permitted by the operating system.

f. The number of echo requests sent is set to one as against the default number i.e. four. This has resulted in the same values of max, min, and average RTT.

g. The RTT of a particular packet size is noted after three repetitive results.

Following are the observations and conclusions of the test:



a. In Test 1, the Round Trip Time (RTT) of packet size up to 1024 Bytes is 0 (zero) milliseconds. Whereas RTT is, zero up to 16384 Bytes in Test 2 and up to 256 Bytes in Test 4. It can be concluded that a higher packet size is better for the measurement of latency and hence speed. It also implies that the lesser the distance, the lower will be latency and the higher will be the speed.

b. From Test 1 and 2, where the remote host is the same i.e. server. The RTT is less in Test 2 which can be attributed to less distance and fewer carrier media interfaces as against Fig a. where the interface is UTP-optical fibre-UTP.

c. From Test 3, it can be said that high RTT is due to the large distance in which the carrier media is UTP between the source and the remote host. The delay can also be due to the slow processing capability of NVR.

On similar lines, the `netstat -e` command in the command prompt displays the activity of the Network Interface Card along with the number of packets sent and received. In addition, it also displays the number of unicast, and non-unicast packets sent and received along with the number of packets discarded due to damage, errors encountered in sending and receiving, and the unknown protocol i.e. number of packets not known to the system as shown in Fig. 8.

```
C:\Users\Comanche>netstat -e
Interface Statistics
```

	Received	Sent
Bytes	240285024	65160572
Unicast packets	52144	180972
Non-unicast packets	12052	11092
Discards	0	0
Errors	0	0
Unknown protocols	0	0

Fig. 8

MATLAB (MATrix LABoratory) is a proprietary software package developed by MathWorks for high-performance numerical computation and visualization. It provides an interactive environment with hundreds of built-in functions for technical computation, graphics, and animation [7]. Simply put, MATLAB has a command window, an editor window

for typing commands, and a workspace pane for the display of variables of commands executed using the command prompt or editor window [8]. There is a figure window that displays the graphs. Codes are written in the script or live script window available under the editor window. Codes written in script windows are saved as a .m file whereas codes written in the live script are saved as a .mlx file. Unlike the script window, the live script window has a panel for the display of the execution of codes. App Designer is an Interactive Development Environment (IDE) for the design of Graphical User Interface (GUI) applications [9] [10]. The features mentioned above have been used for the development of this application; however, MATLAB has many additional features, which are not mentioned here for the sake of brevity.

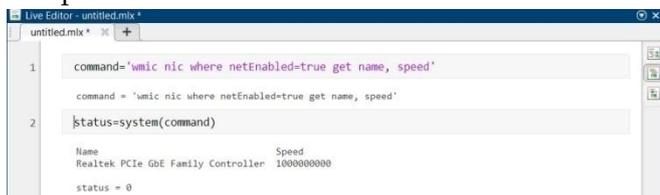
The system command of MATLAB executes the operating system command and returns the output. The syntax of the system command is:

```
status=system(command)
```

This can be used for the speed rating of the network adapter, using the command below

```
command='wmic nic where netEnabled=true get name, speed'
status=system(command)
```

The result returned shown in Fig. 9 can be used to get the speed of NIC.



```
Live Editor - untitled.mlx
untitled.mlx *
1  command='wmic nic where netEnabled=true get name, speed'
   command = 'wmic nic where netEnabled=true get name, speed'
2  [status=system(command)]
   Name          Speed
   Realtek PCIe GbE Family Controller 1000000000
   status = 0
```

The result returned needs to be processed to get the information in a presentable form. The result returned is available as a character file (char file). The char file needs to be arranged in a regular expression, followed by tabulation and conversion into double or

num format. The number obtained is in bytes which need to be converted into Megabits or Gigabits as per requirement.

App Designer of MATLAB can be accessed by typing “appdesigner” in the command window of MATLAB followed by pressing the enter key. This App Designer has a component library to drag and drop components for designing GUI applications. Design View is the place where the components are dropped and Code View is for defining the behavior of the application. The components dragged and dropped are programmed using callbacks. The App Designer is used for creating MATLAB applications, web applications, and standalone desktop applications.

VI.DISCUSSION

A heterogeneous Local Area Network can have multiple transmission media interfaces (optical-UTP etc.), various devices like IP cameras, encoder-decoder for streaming, wired-wireless interfaces, etc. Protocol conversion at each media interface, media packetization by the camera, encoders at the sender’s end, and de-packetization by the decoder at the receiver’s end are adding delay to the network. The network speed depends upon transmission media bandwidth, NICs, network switches, computers, and other devices connected to the network. Even if data is being transmitted via UTP at 1Gbps but the NIC has a bandwidth of 300 Mbps, the NIC will limit the overall throughput, resulting in queuing delays. Similarly, limitations of network switches, transmission media interface, and processing capacity of networking devices contribute to increasing processing delay.

Measurement of latency using the round trip time (RTT) or ping command method gives an estimation of the latency of the network. RTT depends upon the distance between the source and destination, traffic in the network, transmission media, total delays, etc. Time taken from source to destination and back may be of different intervals, which means that the one

trip time is not exactly equal to half of RTT. However, when two computers (local and remote host) are connected to each other RTT imitates the best of what will happen when real transmissions occur. Its estimations are based on taking consideration of all network interfaces, switches, and computer processing capabilities. As the packets in TCP/IP are based on sending a packet followed by acknowledgement and then again sending the next packet, hence averaging RTT gives a good estimation of latency and can be used to calculate throughput.

Online speed testing tools are neither used nor recommended for measuring the speed of LAN as exposing LAN to the internet makes it vulnerable to threats. Premium software offers great features and in-depth analysis of networks but they have high graphic and memory usage. Open-source CLI-based applications are not for common users due to the use of long commands, even professionals are likely to forget commands if they do not use them for a long period. Some of these applications need to be installed in both source and destination computers for measuring link speed.

VII. CONCLUSION AND FUTURE SCOPE

Although Command Line Interface-based applications like Command Prompt are intuitive tools for almost all network and system-related needs of a user, it lacks appeal and user-friendliness. On the other hand, Graphic User Interface (GUI) based applications are attractive and are easy to learn due to the presence of icons, menus, comprehensible texts, etc. GUI-based applications are not as fast in response as CLI-based applications but the main advantage of the former is that users do not remember long commands. A GUI application is suitable for repetitive use and helpful in multitasking thereby increasing efficiency.

The application developed for monitoring LAN can be tailored for different purposes and deep network analysis as per user requirements. Further development includes customization of ping packet size using a drop-down list and/or a user-based packet size value entry in a numeric box. Also, features like the customizable entry of the number of times the ping request to the remote host, and the discovery of devices connected to the network will be incorporated in upcoming versions.

VIII. ACKNOWLEDGEMENT

The author is thankful to Mr. TV Jagadeeswar Rao, Sc 'G' and General Manager, ACEM; Mr. Ravi Shankar, Sc 'E', ACEM, Training Division, CEPTAM, New Delhi; Mr. Mananjaya Nayak, Engineer (Training Department), CTTC, Bhubaneswar, Mr. Mruduraj, Learning Vibes, Mr. Benito Sebastian, Sr. Flight Control Engineer, BAE Systems Air, Mr. Walter Roberson and others of MATLAB community.

IX. REFERENCES

- [1]. Cisco Networking Academy Program, "CCNA 1 and 2 Companion Guide", Third Edition, 2003, Cisco Press 201 West 103rd Street Indianapolis, Indiana 46290 USA
- [2]. Cisco Networking Academy Program, "Second-Year Companion Guide" Second Edition, 2001, Cisco Press 201 West 103rd Street Indianapolis, Indiana 46290 USA
- [3]. B.P. Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems" (Fourth Edition), 2021, Oxford University Press, New York, Oxford. ISBN-13: 978-0-19-806534-0, ISBN-10: 0-19-806534-5
- [4]. Kurose, J. F., Ross, K. W. (2014). Computer Networking: A Top-Down Approach (5th

- Edition). Addison Wesley. ISBN: 978-81-317-9054-0.
- [5]. Tanenbaum, A. S. (2008). Computer Networks. (Fourth Edition), Dorling Kindersley. ISBN: 978-81-7758-165-2
- [6]. Lowe, D. (2004). Networking For Dummies (7th ed.), Wiley Publishing, Inc., 111 River Street, Hoboken, NJ 07030-5774, ISBN: 0-7645-7583-X.
- [7]. Pratap, R. (2009). Getting started with MATLAB 7.8: A quick introduction for scientists and engineers. Oxford University Press.
- [8]. Mathworks.com.RetrievedApril19,2023fromhttps://www.mathworks.com/help/pdf_doc/matlab/rn.pdf
- [9]. Documentation - MATLAB & Simulink - MathWorks India. (n.d.). Mathworks.com. Retrieved April 16, 2023, from https://in.mathworks.com/help/?s_tid=gn_supp
- [10]. MATLABAppDesigner(n.d.)Mathworks.com.RetrievedApril16,2023,fromhttps://in.mathworks.com/products/matlab/app-designer.html
- [11]. Datta, S.(N.d.-b). Baeldung.com. Retrieved April 18, 2023, from https://www.baeldung.com/cs/packet-time-latency-bandwidth

APPENDIX

A.1 LINK SPEED ESTIMATION BETWEEN REMOTE AND LOCAL HOST USING PING

A.1.1 MATLAB COMMAND FOR LINK SPEED ESTIMATION

MATLAB command to interpret the result in simpler terms is:

```
command=('ping 192.168.1.1 -l 65500 -n 1');
[status,cmdout]=system(command);
hdr = regexp(cmdout,'^s*(\S+\s\S+)\s+(\S+)\s+(\S+)\s+(.*)','tokens','once');
tkn = regexp(hdr{end},'\S+(\s\S+)*\s+(\d+(\s+\d+)*)','tokens');
tmp = vertcat(tkn{:});
mat = sscanf(sprintf('%s',tmp{:,:}),'%lu',[2,Inf]).';
% tbl = array2table(mat, 'RowNames',tmp(:,1), 'VariableNames',hdr(2:end-1));
time=double(mat(2,2))
load=0.524 %Megabits
speed=(load)/(0.001*time) %Mbps
```

The above command can be modified for user-based entry of IP address

A.1.2 MATLAB BASED APPLICATION FOR LINK SPEED ESTIMATION



Fig. 10

In Figure 10 above, user input of remote machine IP address is requested. Upon entry of IP address and pressing Get Speed, link speed is returned by the application.

The code for the above application is

```
ip=app.EnterRemoteMachineIPAddressEditField.Value;
ld=app.EditField2.Value;
cat=[ip,ld];
[~,cmdout]=system(['ping ' cat]);
app.TextArea.Value=cmdout;
str = 'Average = ';
% Extract average value.
index = strfind(cmdout, str);
startingIndex = index + length(str);
for k = 1 : length(startingIndex)
    s = cmdout(startingIndex(k):startingIndex(k)+3);
    % Get rid of any trailing non-numeric characters
    while isnan(str2double(s(end))) && length(s) > 1
        s = s(1 : end-1);
    end
    averagetime{k} = s;
end

kar=convertCharsToStrings(cmdout);
k=strfind(kar,'Average = ');

if k>0

actualtime=str2double(convertCharsToStrings(s));
nettime=actualtime/2;
speed=((65500*8)/(1000*1000*nettime*0.001));
app.SpeedEditField.Value=speed;
else
    errordlg('No Connection with Remote Machine/Check your connection', 'Error');

end
```

A.2 NETWORK ACTIVITY MONITORING

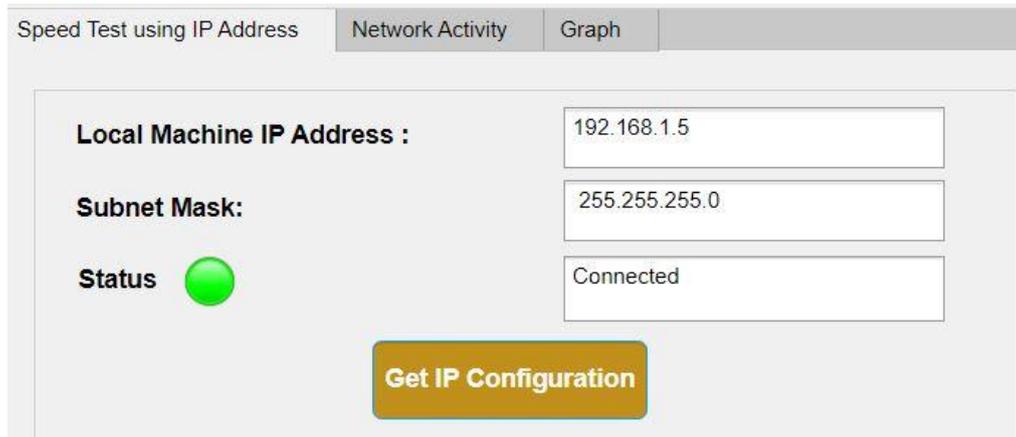
A.2.1 MATLAB CODE FOR NETWORK ACTIVITY

```
command='netstat -e';
[~,cmdout]=system(command);
hdr = regexp(cmdout, '^s*(\S+\s\S+)\s+(\S+)\s+(\S+)\s+(\S+)(.*)', 'tokens', 'once');
tkn = regexp(hdr{end}, '(\S+(\s\S+)*)\s+(\d+(\s+\d+)*)', 'tokens');
tmp = regexpprep(vertcat(tkn{:}), '^d+$', '$& NaN');
tbl = array2table(str2double(split(tmp(:,2))), 'RowNames', tmp(:,1), 'VariableNames', hdr(2:end-1));
download=tbl(1,1)
upload=tbl(1,2)
dw=table2array(download)
up=table2array(upload)
uploadspeed=((up*8)/(1000000))%mb
downloadspeak=((dw*8)/(1000000)) %mb
```


can be accessed by hovering the mouse over the graph window. The marker generated during the test can be clicked to get exact values of the x and y-axis.

A.4 IP ADDRESS OF LOCAL MACHINE

The application also incorporates features of getting the IP address and subnet of the local machine. Although a simple **ipconfig** command in the command prompt window can get the information, still it may be difficult for laymen. The application also displays the status connected or disconnected in the information bar and LED indication. A green LED indicates connected while a red one will indicate disconnected. An error dialog will also pop up in case of disconnection.



The MATLAB code for the application is:

```
[~, commandOutput] = system('ipconfig');
str = 'IPv4 Address. . . . . : ';
% Extract ip addresses. There will be one for each network adapter, e.g. wired, wireless, etc.
index = strfind(commandOutput, str);
startingIndex = index + length(str);
for k = 1 : length(startingIndex)
    s = commandOutput(startingIndex(k):startingIndex(k)+15);
    % Get rid of any trailing non-numeric characters
    while isnan(str2double(s(end))) && length(s) > 1
        s = s(1 : end-1);
    end
    ipAddress{k} = s;
end

cmdout=convertCharsToStrings(commandOutput);
t=strfind(cmdout,'IPv4 Address. . . . . : ');

if t>0 % connected
    app.LocalMachineIPAddressTextArea.Value=s;
else
    errordlg('Not Connected','Error');
end
```

```
[~, commandOutput] = system('ipconfig');
subnet= 'Subnet Mask . . . . . :';

index1= strfind(commandOutput,subnet);
startingIndex1= index1 + length(subnet);
for l = 1:length(startingIndex1)
    s1= commandOutput(startingIndex1(l):startingIndex1(l)+15);
    while isnan(str2double(s1(end))) && length(s1) > 1
        s1=s1(1:end-1);
    end
    Subnet{l} = s1;

end

if t>0
app.SubnetMaskTextArea_2.Value=s1;
else
end

if t > 0 % not connected
    app.StatusLamp_2.Color='Green';
    app.TextArea_3.Value='Connected';
else
    app.StatusLamp_2.Color='Red';
    app.TextArea_3.Value='Not Connected/Check Status';
end
```

Note: The MATLAB version used development is R2021a.

Cite this article as :

Kartick Upadhyay, "Conceptualization and Development of MATLAB-based Application for Local Area Network", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 9, Issue 2, pp.528-540, March-April-2023. Available at doi : <https://doi.org/10.32628/CSEIT2390270>
Journal URL : <https://ijsrcseit.com/CSEIT2390270>