

# COMMUNICATION LATENCY IN THE INTERNET

Communication is the link between the one and the other through phone, internet or any other source....it is nothing but transfer of the messages and data to one other, so network is the major source of communication for the people through internet.

Latency is that which contributes to the network speed. Latency refers to any of several kinds of delays typically incurred in processing of network data. So low latency network connection generally experiences small delay times, while a high latency connection generally suffers from long delays.

***“The Internet is becoming increasingly important for national security and emergency preparedness communications as the circuit-switched telecommunication infrastructure is integrated with emerging Internet Protocol (IP) based networks. It is now more likely that mission-critical communications could be delayed as a result of congested IP networks .”***(copied from the technical notes from one of the sites, site name I forget to copy)

***. “When loading a Web site page, for example, most satellite users can observe a noticeable delay from the time they enter a Web to the time the page begins loading. This high latency is due primarily to propagation delay as the request message travels at the speed of light to the distant satellite station and back to the home network. Once the messages arrive on Earth, however, the page loads quickly like on other high-bandwidth Internet connections (DSL or cable). Besides propagation delays, latency also may also involve transmission delays (properties of the physical medium) and processing delays (such as making network hops on the Internet).”***

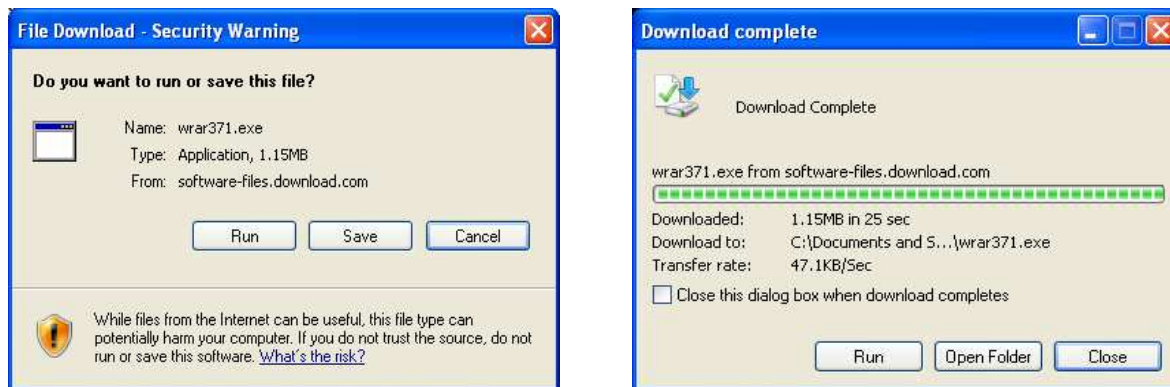
Network tools like ping tests and tracert measure latency by determining the time it takes a given network packet to travel from source to destination and back, the so-called round trip time. Round-trip time is not the only way to specify latency, but it is the most common.

***“Network latency is a measure of how fast a network is running. The term refers to the time elapsed between the sending of a message to a router and the return of that message. Latency problems can signal network-wide slowdowns, and must be treated seriously, as latency issues cause not only slow service but data losses as well.”***(copied from the web)

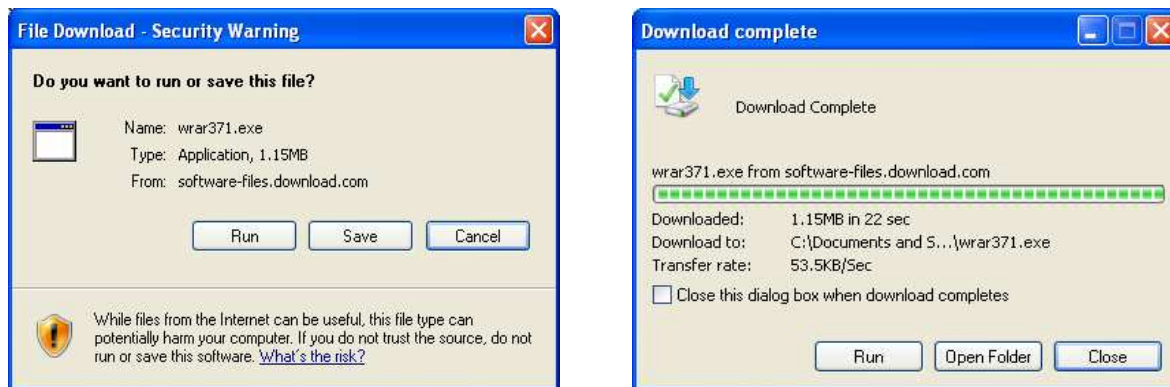
## FILE DOWNLOADED FROM UNITED KINGDOM (LONDON)

Download Site : [www.download.com](http://www.download.com)  
Downloaded File : [www.download.com/WinRAR/3000-2250\\_4-10745708.html](http://www.download.com/WinRAR/3000-2250_4-10745708.html)  
File Size : 1.15 MB  
IP Address : 216.239.122.225  
Site Location : United Kingdom  
Downloaded At : Elephant & Castle U.K (Internet Café)  
My IP Address : 192.168.2.1

This file I downloaded on Tuesday (13/11/2007), it took 25 seconds for 1.15 MB.....



The same file I downloaded on Wednesday(14/11/2007),it took 22 seconds for 1.15MB..



**NSLOOKUP** is the command which displays the information of the system we are using through IP and also the details of the web with IP address and server wherever in the world it may be....

Through **NSLOOKUP** command I found the IP address of the location, **NSLOOKUP** displays the information of the domain from where file is downloading....as shown below..

```

C:\WINDOWS\system32\command.com

C:\>nslookup www.download.com
*** Can't find server name for address 192.168.2.1: Non-existent domain
*** Default servers are not available
Server: UnKnown
Address: 192.168.2.1

Non-authoritative answer:
Name:      c18-gdl-xw-lb.cnet.com
Address:  216.239.122.225
Aliases:   www.download.com

C:\>_

```

**TRACERT** is the command which shows the path taken for the server to download the file from the other server, it shows through hops....

Through **TRACERT** command I found the path taken to the file to get downloaded.....*"The path displayed is the list of near-side router interfaces of the routers in the path between a source host and a destination"*(this point is copied from help and support center of windows). 24 hops are taken to trace the route.....

```

C:\WINDOWS\system32\command.com

C:\>tracert 216.239.122.225
Tracing route to c18-gdl-xw-lb.cnet.com [216.239.122.225]
over a maximum of 30 hops:
  0  <1 ms    <1 ms    <1 ms    192.168.2.1
  1  21 ms     19 ms     19 ms     btdhg564-hg3.ealing.broadband.bt.net [217.47.196.74]
  2  20 ms     18 ms     18 ms     217.47.196.2
  3  19 ms     21 ms     19 ms     217.47.196.106
  4  19 ms     19 ms     19 ms     217.47.219.154
  5  27 ms     32 ms     19 ms     217.41.168.29
  6  28 ms     29 ms     44 ms     217.41.168.118
  7  20 ms     20 ms     20 ms     212.140.233.38
  8  20 ms     22 ms     20 ms     217.47.155.106
  9  26 ms     30 ms     26 ms     core2-pos0-15-0-7.ealing.ukcore.bt.net [62.6.201.94]
 10  26 ms     23 ms     21 ms     core2-pos0-15-0-10.ilford.ukcore.bt.net [194.72.20.145]
 11  19 ms     20 ms     23 ms     transit1-pos5-0.ilford.ukcore.bt.net [194.72.20.146]
 12  22 ms     21 ms     21 ms     t2c1-ge14-0-0.uk-ilm.eu.bt.net [166.49.168.89]
 13  111 ms    112 ms    110 ms    t2c1-p4-0-0.us-nyc.eu.bt.net [166.49.164.78]
 14  116 ms    112 ms    111 ms    12.116.102.17
 15  151 ms    149 ms    150 ms    tbr2-n54ny.ip.att.net [12.122.105.70]
 16  146 ms    149 ms    147 ms    cr2-n54ny.ip.att.net [12.122.16.197]
 17  150 ms    148 ms    154 ms    cr2-wsxdc.ip.att.net [12.122.3.38]
 18  155 ms    158 ms    154 ms    tbr1-wsxdc.ip.att.net [12.122.16.62]
 19  151 ms    150 ms    151 ms    tbr1-sl9mo.ip.att.net [12.122.10.30]
 20  153 ms    150 ms    151 ms    tbr2-dlstx.ip.att.net [12.122.10.90]
 21  149 ms    148 ms    151 ms    12.122.100.109
 22  152 ms    152 ms    152 ms    12.87.121.22
 23  149 ms    147 ms    148 ms    c18-gdl-xw-lb.cnet.com [216.239.122.225]

Trace complete.

C:\>_

```

***“PING is a program that sends a series of packets over a network or the internet to a specific computer in order to generate a response from that computer. The other computer responds with an acknowledgment that it received the packets.”***

**PING** is used to test both IP address and computer name. **PING** verifies IP level connectivity to another TCP/IP computer by sending Internet Control Message Protocol (ICMP) Echo Request messages. The receipt of corresponding Echo Reply messages are displayed, along with round-trip times. **PING** is the primary TCP/IP command used to troubleshoot connectivity, reach ability, and name resolution. **PING** is used to test both IP address and computer name. **PING -t** specifies sending echo request message to the destination until interrupted.....(copied from help and support centre)

```

C:\Windows\system32\command.com
C:\>ping 216.239.122.225
Pinging 216.239.122.225 with 32 bytes of data:
Reply from 216.239.122.225: bytes=32 time=147ms TTL=232
Reply from 216.239.122.225: bytes=32 time=149ms TTL=232
Reply from 216.239.122.225: bytes=32 time=147ms TTL=232
Reply from 216.239.122.225: bytes=32 time=148ms TTL=232
Ping statistics for 216.239.122.225:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 147ms, Maximum = 149ms, Average = 147ms
C:\>ping 216.239.122.225 -t
Pinging 216.239.122.225 with 32 bytes of data:
Reply from 216.239.122.225: bytes=32 time=148ms TTL=232
Reply from 216.239.122.225: bytes=32 time=153ms TTL=232
Reply from 216.239.122.225: bytes=32 time=163ms TTL=232
Reply from 216.239.122.225: bytes=32 time=146ms TTL=232
Reply from 216.239.122.225: bytes=32 time=151ms TTL=232
Reply from 216.239.122.225: bytes=32 time=160ms TTL=232
Reply from 216.239.122.225: bytes=32 time=147ms TTL=232
Reply from 216.239.122.225: bytes=32 time=148ms TTL=232
Reply from 216.239.122.225: bytes=32 time=148ms TTL=232
Reply from 216.239.122.225: bytes=32 time=146ms TTL=232
Reply from 216.239.122.225: bytes=32 time=149ms TTL=232
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Reply from 216.239.122.225: bytes=32 time=149ms TTL=232
Reply from 216.239.122.225: bytes=32 time=151ms TTL=232
Reply from 216.239.122.225: bytes=32 time=148ms TTL=232
Reply from 216.239.122.225: bytes=32 time=148ms TTL=232
Reply from 216.239.122.225: bytes=32 time=148ms TTL=232
Reply from 216.239.122.225: bytes=32 time=152ms TTL=232
Reply from 216.239.122.225: bytes=32 time=147ms TTL=232
Reply from 216.239.122.225: bytes=32 time=147ms TTL=232
Reply from 216.239.122.225: bytes=32 time=148ms TTL=232
Ping statistics for 216.239.122.225:
    Packets: Sent = 27, Received = 27, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 146ms, Maximum = 163ms, Average = 149ms
Control-C
C:\>_
  
```

TIME	LOCATION	SIZE	TIME	AVERAGE TRANSFER RATE	BEFORE (ms)	AFTER (ms)	RTT (ms)
Tue 3:00pm	UK	1.15MB	25 sec	18387828.7	55	43	49
Tue 4:00pm	UK	1.15MB	22 sec	20895259.9	40	57	48.5
Wed 3:00pm	UK	1.15MB	24 sec	19153988.2	70	27	48.5
Wed 4:00pm	UK	1.15MB	20 sec	22984785.9	67	77	72

**Average transfer rate** is transfer of packets or bits in a sec.....

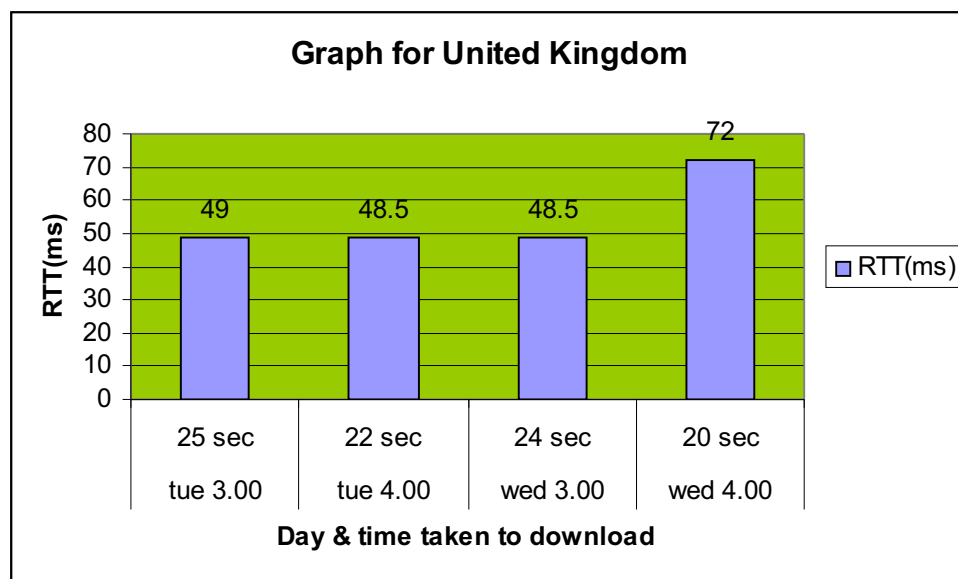
It is calculated by dividing file size in bits and the time taken to download file...

$$\text{Average Transfer Rate (bits/sec)} = \frac{\text{File Size (bits)}}{\text{Time taken to transfer}}$$

**Round Trip Time (RTT)** is the delay for transfer of files.....

It is calculated by adding the start ping and the end ping and dividing by 2.....

$$\text{Round Trip Time (ms)} = \frac{\text{Start Ping} + \text{End Ping}}{2}$$



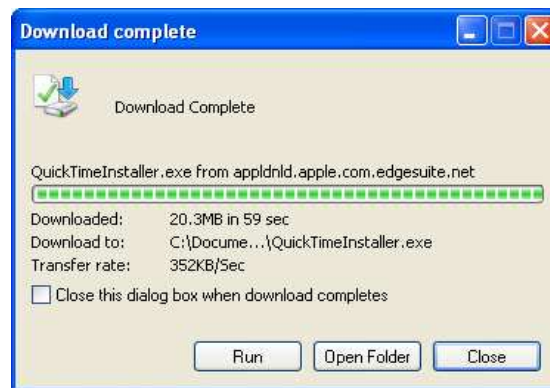
The graph above shows the RTT for different times the file downloaded

### **FILE DOWNLOADED FROM USA**

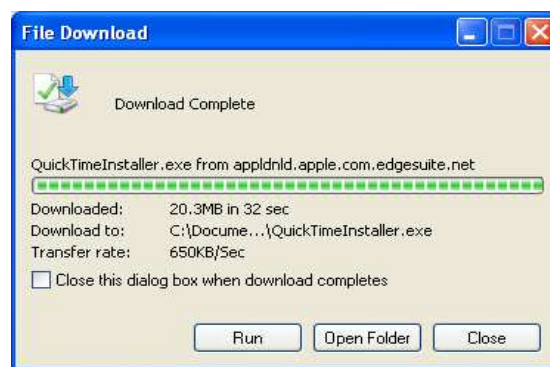
Download Site : [www.apple.com](http://www.apple.com)  
Downloaded File : [www.apple.com/quicktime/download.html](http://www.apple.com/quicktime/download.html)  
File Size : 20.3 MB  
IP Address : 17.112.152.32  
Site Location : United States of America  
Downloaded At : Elephant & Castle U.K (Internet Café)  
My IP Address : 192.168.2.1



This file I downloaded on Tuesday (13/11/2007), it took 59 sec for 20.3MB.....



The same file I downloaded on Wednesday (14/11/2007), it took 32 sec for 20.3 MB.....



Through **NSLOOKUP** command I found the IP address of the location, **NSLOOKUP** displays the information of the domain from where file is downloading....as shown below..

```
C:\WINDOWS\system32\command.com

C:\>nslookup www.apple.com
*** Can't find server name for address 192.168.2.1: Non-existent domain
*** Default servers are not available
Server: Unknown
Address: 192.168.2.1

Non-authoritative answer:
Name:    www.apple.com.akadns.net
Address: 17.112.152.32
Aliases: www.apple.com

C:\>_
```

Through **TRACERT** command I found the path taken to the file to get downloaded.....The path displayed is the list of near-side router interfaces of the routers in the path between a source host and a destination(this point is copied from help and support center of windows). 24 hops are taken to trace the route.....

```

C:\WINDOWS\system32\command.com

C:\>tracert 17.112.152.32

Tracing route to eg-www.apple.com [17.112.152.32]
over a maximum of 30 hops:
  0  <1 ms    <1 ms    <1 ms    192.168.2.1
  1  78 ms     79 ms     77 ms     btdhg564-hg3.ealing.broadband.bt.net [217.47.196.74]
  2  89 ms     54 ms     69 ms     217.47.196.33
  3  19 ms     18 ms     19 ms     217.47.196.106
  4  22 ms     24 ms     18 ms     217.47.219.154
  5  19 ms     20 ms     19 ms     217.41.168.29
  6  22 ms     22 ms     22 ms     217.41.168.118
  7  20 ms     19 ms     23 ms     217.41.168.46
  8  19 ms     19 ms     18 ms     217.47.70.114
  9  37 ms     47 ms     49 ms     core1-pos0-0-0-13.ealing.ukcore.bt.net [62.6.200.117]
 10  19 ms     18 ms     21 ms     62.6.200.118
 11  20 ms     19 ms     20 ms     t2c2-ge14-0-0.uk-eal.eu.bt.net [166.49.168.57]
 12  22 ms     129 ms    19 ms     195.50.91.153
 13  *         29 ms     24 ms     ae-31-51.ebr1.London2.Level3.net [4.68.117.30]
 14  21 ms     20 ms     21 ms     ae-1-100.ebr2.London2.Level3.net [4.69.132.122]
 15  26 ms     21 ms     21 ms     ae-2.ebr1.London1.Level3.net [4.69.132.146]
 16  103 ms    29 ms     96 ms     ae-4.ebr1.NewYork1.Level3.net [4.69.132.109]
 17  93 ms     103 ms    91 ms     ae-4.ebr1.NewYork1.Level3.net [4.69.132.109]
 18  99 ms     91 ms     112 ms    ae-81-81.csw3.NewYork1.Level3.net [4.69.134.74]
 19  164 ms    98 ms     91 ms     ae-84-84.ebr4.NewYork1.Level3.net [4.69.134.121]
 20  172 ms    169 ms    175 ms    ae-64-64.csw1.SanJose1.Level3.net [4.69.134.242]
 21  171 ms    160 ms    164 ms    ae-61-61.ebr1.SanJose1.Level3.net [4.69.134.193]
 22  171 ms    161 ms    163 ms    ae-4-4.car2.Sacramento1.Level3.net [4.69.132.157]
 23  164 ms    164 ms    163 ms    ae-4-4.car2.Sacramento1.Level3.net [4.69.132.157]
 24  165 ms    162 ms    165 ms    APPLE-COMPU.car1.Sacramento1.Level3.net [64.158.148.6]
 25  163 ms    164 ms    164 ms    17.112.254.36
 26  271 ms    204 ms    164 ms    17.112.254.41
 27  165 ms    163 ms    164 ms    eg-www.apple.com [17.112.152.32]

Trace complete.

C:\>_

```

**PING** is used to test both IP address and computer name. **PING** verifies IP level connectivity to another TCP/IP computer by sending Internet Control Message Protocol (ICMP) Echo Request messages. The receipt of corresponding Echo Reply messages are displayed, along with round-trip times. **PING** is the primary TCP/IP command used to troubleshoot connectivity, reach ability, and name resolution. **PING** is used to test both IP address and computer name. **PING -t** specifies sending echo request message to the destination until interrupted.....(copied from help and support centre)

```
C:\WINDOWS\system32\command.com
C:\>ping 17.112.152.32

Pinging 17.112.152.32 with 32 bytes of data:

Reply from 17.112.152.32: bytes=32 time=162ms TTL=228
Reply from 17.112.152.32: bytes=32 time=164ms TTL=228
Reply from 17.112.152.32: bytes=32 time=172ms TTL=228
Reply from 17.112.152.32: bytes=32 time=191ms TTL=228

Ping statistics for 17.112.152.32:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 162ms, Maximum = 191ms, Average = 172ms

C:\>ping 17.112.152.32 -t

Pinging 17.112.152.32 with 32 bytes of data:

Reply from 17.112.152.32: bytes=32 time=201ms TTL=228
Reply from 17.112.152.32: bytes=32 time=206ms TTL=228
Reply from 17.112.152.32: bytes=32 time=232ms TTL=228
Reply from 17.112.152.32: bytes=32 time=229ms TTL=228
Reply from 17.112.152.32: bytes=32 time=239ms TTL=228
Reply from 17.112.152.32: bytes=32 time=218ms TTL=228
Reply from 17.112.152.32: bytes=32 time=165ms TTL=228
Reply from 17.112.152.32: bytes=32 time=169ms TTL=228
Reply from 17.112.152.32: bytes=32 time=165ms TTL=228
Reply from 17.112.152.32: bytes=32 time=162ms TTL=228
Reply from 17.112.152.32: bytes=32 time=164ms TTL=228
Reply from 17.112.152.32: bytes=32 time=162ms TTL=228
Reply from 17.112.152.32: bytes=32 time=164ms TTL=228
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Reply from 17.112.152.32: bytes=32 time=164ms TTL=228
Reply from 17.112.152.32: bytes=32 time=163ms TTL=228
Reply from 17.112.152.32: bytes=32 time=164ms TTL=228

Ping statistics for 17.112.152.32:
    Packets: Sent = 28, Received = 28, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 162ms, Maximum = 239ms, Average = 175ms

Control-C
^C
C:\>
```

TIME	LOCATION	SIZE	TIME	AVERAGE TRANSFER RATE	BEFORE (ms)	AFTER (ms)	RTT (ms)
Tue 3:05pm	USA	20.3MB	59 sec	2886249.86	98	101	99.5
Tue 4:00pm	USA	20.3MB	45 sec	3784194.27	92	80	86
Wed 3:10pm	USA	20.3MB	32 sec	5321523.19	117	123	120
Wed 4:00pm	USA	20.3MB	36 sec	4730242.83	124	143	133.5



**Average transfer rate** is transfer of packets or bits in a sec.....

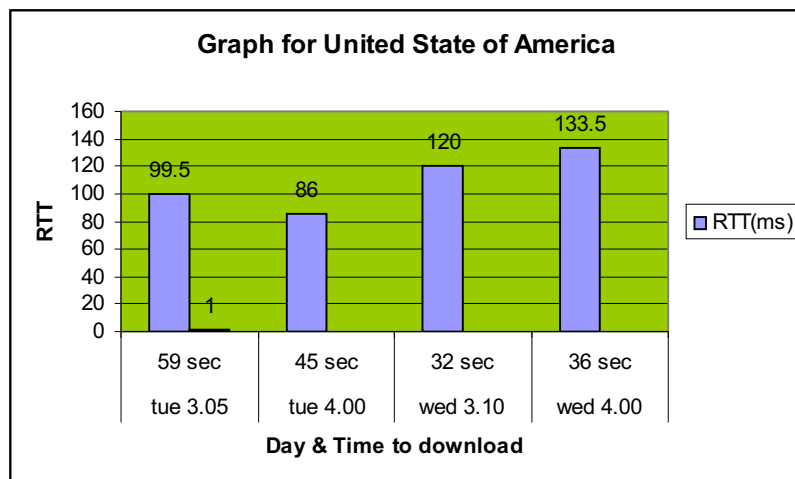
It is calculated by dividing file size in bits and the time taken to download file...

$$\text{Average Transfer Rate (bits/sec)} = \frac{\text{File Size (bits)}}{\text{Time taken to transfer}}$$

**Round Trip Time (RTT)** is the delay for transfer of files.....

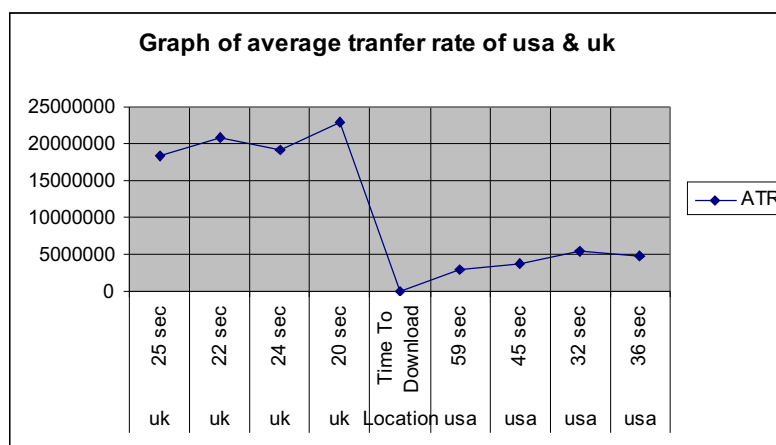
It is calculated by adding the start ping and the end ping and dividing by 2.....

$$\text{Round Trip Time (ms)} = \frac{\text{Start Ping} + \text{End Ping}}{2}$$



Graph shows the RTT for different times the file got downloaded with the time taken to download.

## ANALYSIS



The graph shows the analysis between the transfer rates for the two countries from where I downloaded the files. The transfer rate is more for UK compared to USA, so I think that due to the distance the packets loss will be more, so the transfer rate is less for USA. Above shown are two more graphs which shows the RTT for different downloads, for different time I downloaded the download time was different. It is due to the working

hours of the people, it means that in the day time the analysis is different and during time when I downloaded some files the transfer rate was different and RTT was less. The start ping and the end ping is different, and the average for the different time is different.

## **CONCLUSION**

I used the most common method to find out the latency in the network, I downloaded the two files for the two days, and through ping I found the delays occurred..... The method is easy , first I selected the web offering free files, then selected file to download, before downloading I found the details through nslookup and traced the route, after that I have recorded the ping and then started downloading. After downloading I recorded the ping and the time taken to download. This method I learned in my graduation, and also took some help of my internet while doing these experiments.

While downloading the files I have noticed that if the file size is short it takes small time and for big size obviously it takes long time....and the distance from where it is getting downloaded doesn't matter the speed of the download, if the network congestion occurs then it effects the download speed. I've noticed here that while the file is getting downloaded, when packets are transferred if any packet misses the download then it sends an acknowledgment and receives the packet, so missing the packets and sending the acknowledgment and again receiving it is nothing but delay.

I have also noticed and learned that for different times the download time will be different, this is because of number of users for the network will be differing at regular intervals, and the traffic congestion in the network will be decreasing. ***“And at users latency issues may be caused by PC software. Some software designed for networking might slows down user traffic; one should use only necessary networking tools and applications. Traffic can also be slowed by tray icons and spy ware that take up network time without any input from the user (and most certainly without his or her consent). Unnecessary icons should be disabled, and spy ware checks run frequently.”***

If I would have got more time on this experiment I would have downloaded more files at different time periods and analyze the delays in detailed, but the pages needed are also only 10 in which I could not go in detail. So I have done it very briefly.

MOHAMMED ABDUL BASEER

000482043

MSc COMPUTER SYSTEMS AND NETWORKING

