



Request for Proposal

Mobile & Web Application for Speed/Bitrate Test

Appendix A

Delay, Jitter & Packet Loss Calculation

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Document Control

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1 INTRODUCTION

As part of the application there is Delay, Jitter & Packet Loss measurements shall be conducted. Company is requesting to use Linux “ping” tool to be used for this purpose as it is supported both Android & IOS platforms. On Table-1 below, Bidder can find brief information about Ping tool and required options as part of application.

SYNOPSIS

ping <Test-Server-Address> -f [-c count] [-s packetsize]

DESCRIPTION

ping uses the ICMP protocol's mandatory ECHO_REQUEST datagram to elicit an ICMP ECHO_RESPONSE from a host or gateway. ECHO_REQUEST datagrams (“pings”) have an IP and ICMP header, followed by a struct timeval and then an arbitrary number of “pad” bytes used to fill out the packet.

OPTIONS

Tag	Description	Value
-f	Flood ping. For every ECHO_REQUEST sent a period “.” is printed, while for ever ECHO_REPLY received a backspace is printed. This provides a rapid display of how many packets are being dropped. If interval is not given, it sets interval to zero and outputs packets as fast as they come back or one hundred times per second, whichever is more. Only the super-user may use this option with zero interval.	-
-c count	Stop after sending <i>count</i> ECHO_REQUEST packets. With <i>deadline</i> option, ping waits for <i>count</i> ECHO_REPLY packets, until the timeout expires.	100
-s packetsize	Specifies the number of data bytes to be sent. The default is 56, which translates into 64 ICMP data bytes when combined with the 8 bytes of ICMP header data.	72

Table – 1: Linux Ping Tool & Required Options

TEST #1

```
[root@OPRVS-SRV01 ~]# ping www.google.com -f -c 100 -s 72
--- www.google.com ping statistics ---
100 packets transmitted, 98 received, 2% packet loss, time 1654ms
rtt min/avg/max/mdev = 77.352/77.402/77.516/0.190 ms, pipe 6, ipg/ewma 16.710/77.403 ms
```

TEST #2

```
[root@OPRVS-SRV01 ~]# ping www.google.com -f -c 100 -s 72
--- www.google.com ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 1397ms
rtt min/avg/max/mdev = 75.275/75.331/75.496/0.106 ms, pipe 7, ipg/ewma 14.118/75.329 ms
```

TEST #3

```
[root@OPRVS-SRV01 ~]# ping www.google.com -f -c 100 -s 72
--- www.google.com ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 1475ms
rtt min/avg/max/mdev = 75.279/75.343/75.660/0.126 ms, pipe 6, ipg/ewma 14.903/75.332 ms
```

TEST #4

```
[root@OPRVS-SRV01 ~]# ping www.google.com -f -c 100 -s 72
--- www.google.com ping statistics ---
100 packets transmitted, 99 received, 1% packet loss, time 1418ms
rtt min/avg/max/mdev = 76.802/76.876/77.004/0.035 ms, pipe 7, ipg/ewma 14.329/76.871 ms
```

TEST #5

```
[root@OPRVS-SRV01 ~]# ping www.google.com -f -c 100 -s 72
--- www.google.com ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 1449ms
rtt min/avg/max/mdev = 76.814/76.875/77.156/0.179 ms, pipe 7, ipg/ewma 14.642/76.866 ms
```

Table – 2: Example Test Result of 5 consecutive ping command run

2 CALCULATION METHODS FOR THE TEST

2.1 Delay

- Application should run the ping command (with defined parameters) 5 (five) consecutive times.
- Rtt Average should be taken as delay for each test. See example in Table – 2.
- Average of 5 Tests' "Rtt Avg" values will be the final delay of the measurement. See example in Table – 3.

$$\text{Delay}_{(final)} = \text{Average} [\text{Delay}_{(Test \#1)}, \text{Delay}_{(Test \#2)}, \text{Delay}_{(Test \#3)}, \text{Delay}_{(Test \#4)}, \text{Delay}_{(Test \#5)}]$$

2.2 Packet Loss

- Application should run the ping command (with defined parameters) 5 (five) consecutive times.
- Packet Loss should be taken as Loss for each test. See example in Table – 2.
- Average of 5 Tests' "Packet Loss" values will be the final Packet Loss of the measurement. See example in Table – 3.

$$\text{Packet-Loss}_{(final)} = \text{Average} [\text{Packet-Loss}_{(Test \#1)}, \text{Packet-Loss}_{(Test \#2)}, \text{Packet-Loss}_{(Test \#3)}, \text{Packet-Loss}_{(Test \#4)}, \text{Packet-Loss}_{(Test \#5)}]$$

2.3 Jitter

- Application should run the ping command (with defined parameters) 5 (five) consecutive times.
- Jitter should be taken as absolute variance of Delay Test(n) and Delay Test(n+1) for each test. See example in Table – 2.
- Average of 4 "Jitter" values will be the final Jitter of the measurement. See example in Table – 3.

$$\text{Jitter}_{(1)} = \text{Abs} [\text{Delay}_{(1)} - \text{Delay}_{(2)}]$$

$$\text{Jitter}_{(2)} = \text{Abs} [\text{Delay}_{(2)} - \text{Delay}_{(3)}]$$

$$\text{Jitter}_{(3)} = \text{Abs} [\text{Delay}_{(3)} - \text{Delay}_{(4)}]$$

$$\text{Jitter}_{(4)} = \text{Abs} [\text{Delay}_{(4)} - \text{Delay}_{(5)}]$$

$$\text{Jitter}_{(final)} = \text{Average} [\text{Jitter}_{(1)}, \text{Jitter}_{(2)}, \text{Jitter}_{(3)}, \text{Jitter}_{(4)}]$$

TEST #	Packet Loss (%)	Delay (rtt avg)(ms)	Jitter (ms)
Test #1	2%	77.402	=Abs(77.402 - 75.331) = 2.071
Test #2	0%	75.331	=Abs(75.331 - 75.343) = 0.012
Test #3	0%	75.343	=Abs(75.343 - 76.876) = 1.533
Test #4	1%	76.876	=Abs(76.876 - 76.875) = 0.001
Test #5	0%	76.875	
Results	0.06%	76.3654	0.904

Table – 3: Calculation Example

3 PARAMETER EXCHANGE WITH CENTRAL SERVER

Application will exchange the test parameters as part of Initialization of application on mobile handset. Aim is to provide flexibility of changing test parameters without updating the application on the client handset. The server will send the “count”, “packet-size” & number of times that test should be run consecutively as integer during the negotiation.

Parameter	Value Type	Description
Server FQDN	String	The address of test server to be used during test. Example: tests1.speedtest.ileritech.com
Count	Integer	Number of packet should sent in each test. Example: 100
Packet-Size	Integer	Size of each packet that will be sent. Example: 72
Test Run	Integer	Number of Test should run. Example : 3

Bidder shall propose a mechanism for exchanging these parameters.