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Evaluation of available bandwidth and network delay

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The Model

One year ago, at RIPE 56 meeting in Berlin, we presented a method of measurement of an available bandwidth between two points in a global network. Today it would be important to show possibility of application of this method at RIPE Test Traffic Measurement system.

Our method supposes the variation of packet size on the same path for measurement of the available bandwidth. If the testing process between two fixed points is organized by packets with different sizes W_1 and W_2 then the delay times D_i get two different values. Experiments should give the identical value for available bandwidth B_{av} independently from packet size W_i that gives:

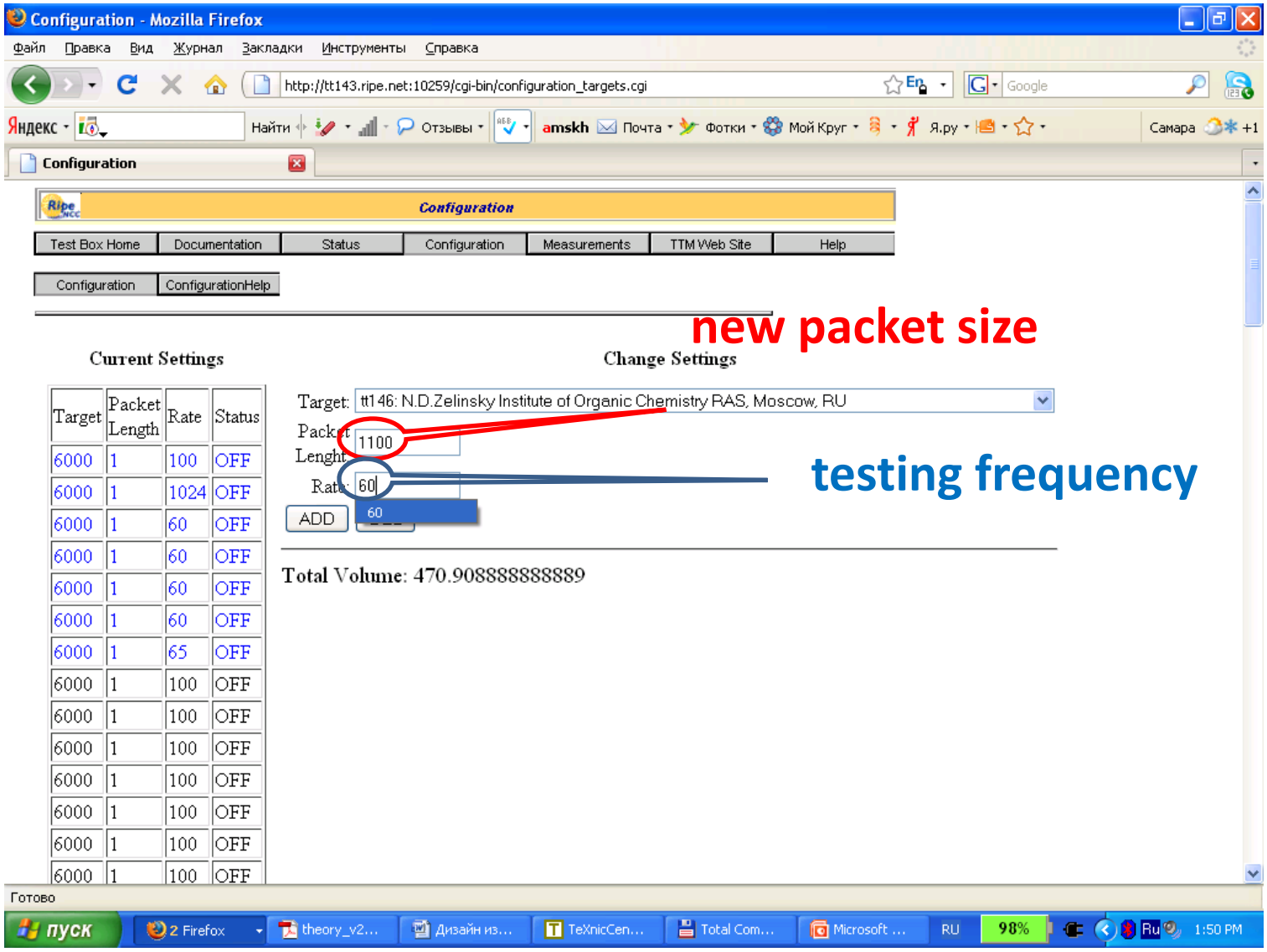
$$B_{av} = \frac{W_2 - W_1}{D_2 - D_1}$$

Changing packet size

The design of the RIPE TTM system meets all requirements shown by our method, namely it allows to change the size of a testing package and to find network delay with a split-hair accuracy.

By default, testing is conducted by packages in the size of 100 byte, but there is a page http://tt143.ripe.net:10259/cgi-in/configuration_targets.cgi corresponding to point of the menu «Configuration» of local Test Box. On which it is possible to add testing packages to RIPE Box up to 1500 byte in size with demanded frequency.

In our case it is reasonable to add testing **1100 byte** packages with frequency of 60 times in a minute. It is necessary to notice that the results of tests will be available on next day.


Configuration - Mozilla Firefox
http://tt143.ripe.net:10259/cgi-bin/configuration_targets.cgi
Configuration
Test Box Home
Documentation
Status
Configuration
Measurements
TTM Web Site
Help
Configuration
ConfigurationHelp
new packet size
Current Settings
Change Settings
Target
Packet Length
Rate
Status
Target: tt146: N.D.Zelinsky Institute of Organic Chemistry RAS, Moscow, RU
Packet Lenght: 1100
Rate: 60
ADD
testing frequency
Total Volume: 470.908888888889
Готово

Testing results

Testing results are available in telnet to RIPE Test Box on port 9142. It is important to come and write down simultaneously the data on both ends of the investigated channel, in the case presented here it is tt01.ripe.net and tt143.ripe.net.

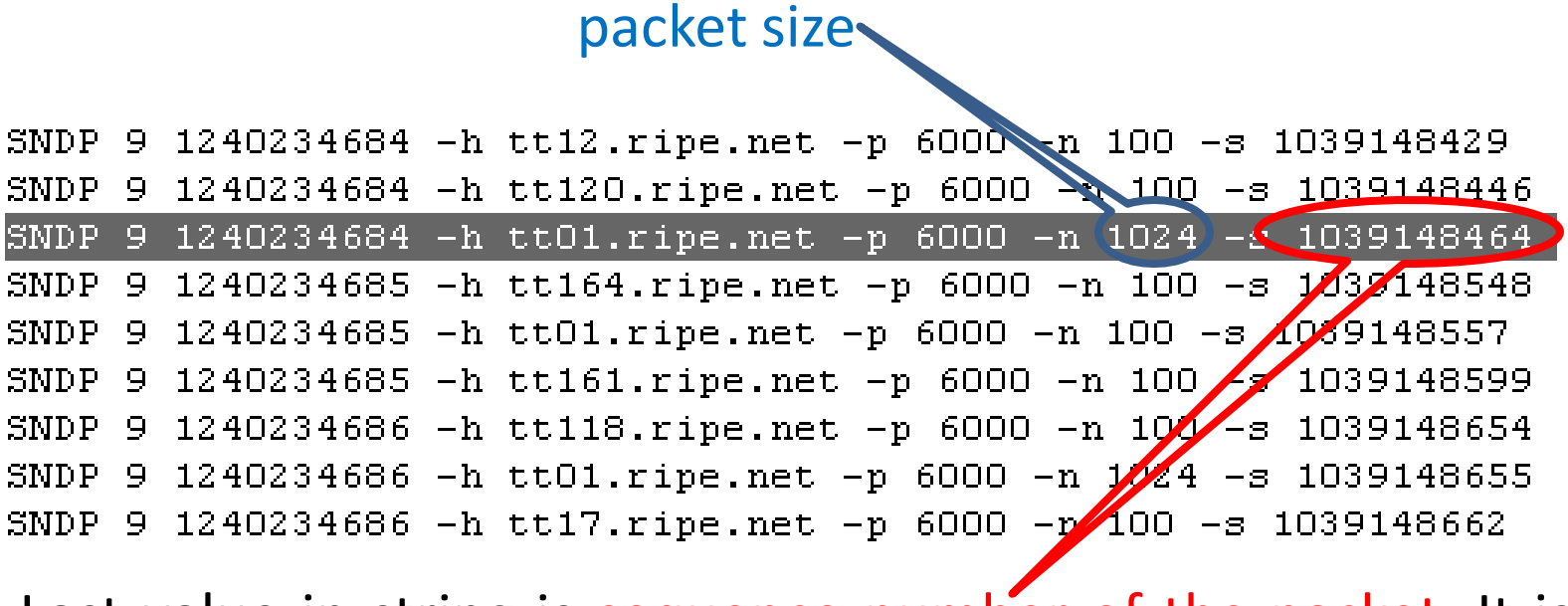
$ telnet tt143.ripe.net 9142

$ telnet tt01.ripe.net 9142

Obtained data will contain required delay of packages of the different sizes. Also, we need to distinguish packages.

The data from sending Box

Therefore at first it is reversible to sending Box and we will find lines:



Last value in string is sequence number of the packet. It is necessary to us to find this number on the receiving side at the channel.

The data from receiving Box

sequence number of the packet

```
RCDP 12 2 192.36.143.194 3685 193.0.0.228 6000 1240234684.397023 0.011001 0X2107 0X2107 1039148474    0.000015   0.000008
RCDP 12 2 194.25.0.198 2248 193.0.0.228 6000 1240234684.437001 0.008700 0X2107 0X2107 1039148400    0.000005   0.000008
RCDP 12 2 89.186.245.200 60322 193.0.0.228 6000 1240234684.785799 0.044084 0X2107 0X2107 1039148462    0.000002   0.000008
RCDP 12 2 89.186.245.200 53571 193.0.0.228 6000 1240234685.788367 0.043591 0X2107 0X2107 1039148557    0.000002   0.000008
RCDP 12 2 89.186.245.200 55418 193.0.0.228 6000 1240234686.794059 0.044168 0X2107 0X2107 1039148655    0.000002   0.000008
```

For set number of a package it is easy to find network delay, in our case - 0.044084 seconds. The following number of package 1039148557 has the size of 100 bytes and the delay is 0.043591 seconds. Thus, the difference - 0.000493 seconds

Average values

Our model assumes operations with average values; therefore we should note average values, not less than five pairs for the delay, going consistently. In our case, this difference is 0.000571 seconds. (tt143 -> tt01)

N	Sequence number	Packet size, *W (Kbytes)*	Network Delay, *D, sec*	$D_2 - D_1$ *second*	Average ΔD
1	1039148464	1024	0.044084	0.000493	
	1039148557	100	0.043591		
2	1039148857	1024	0.044126	0.000613	
	1039148947	100	0.043507		
3	1039149056	1024	0.044106	0.000592	**0.000571**
	1039149142	100	0.043514		
4	1039149455	1024	0.044080	0.000460	
	1039149538	100	0.043620		
5	1039149645	1024	0.044205	0.000696	
	1039149730	100	0.043509		

tt01 -> tt143

N	Sequence number	Packet size, *W (Kbytes)*	Network Delay, *D, sec*	$D_2 - D_1$ *second*	Average *ΔD*
1	1039149017	1024	0.033720	0.000639	0.000473
	1039149071	100	0.033081		
2	1039149414	1024	0.033638	0.000449	
	1039149469	100	0.033189		
3	1039149603	1024	0.033709	0.000469	
	1039149673	100	0.033240		
4	1039149807	1024	0.033895	0.000491	
	1039149872	100	0.033404		
5	1039150010	1024	0.033777	0.000316	
	1039150067	100	0.033461		

Calculation of bandwidth

Then the required bandwidth of the link (tt143 -> tt01) can be calculated as

$$B_{av} = \frac{W_2 - W_1}{D_2 - D_1} = \frac{924 * 8}{0.000571} = 12.9[Mbps]$$

The bandwidth of the return link (tt01 -> tt143) can be calculated as

$$B_{av} = \frac{W_2 - W_1}{D_2 - D_1} = \frac{924 * 8}{0.000473} = 15.6[Mbps]$$

Additional measurements

The main problem of the offered method is in understanding, what values are measured. Actually, it can be bulk transport capacity or available bandwidth. Alternative measurements of the given values are necessary for specification.

It is ideal to compare the width received by our method to the values measured by alternative methods, first of all by means of the utility iperf. Unfortunately, such tests are not spent yet, we allocate only in the speed of FTP downloading. It makes 3.04 – 3.20 Mbps in a direction from tt143.ripe.net to tt01.ripe.net and

3.2-3.3 Mbps in the opposite direction. That is additional researches for which carrying out partners are required are necessary.