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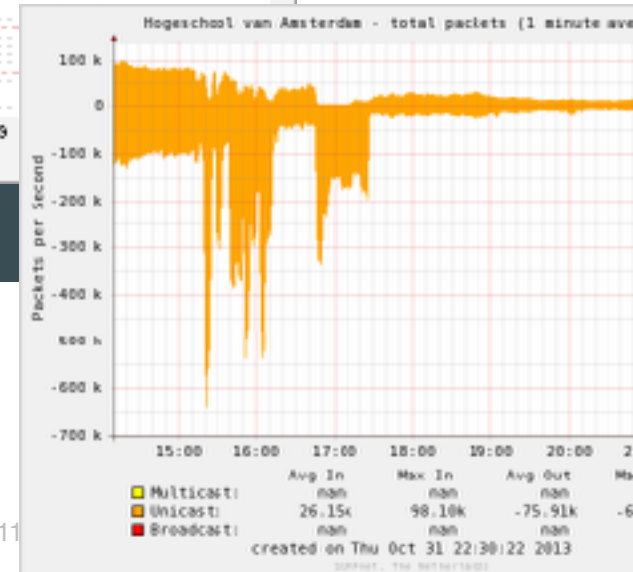
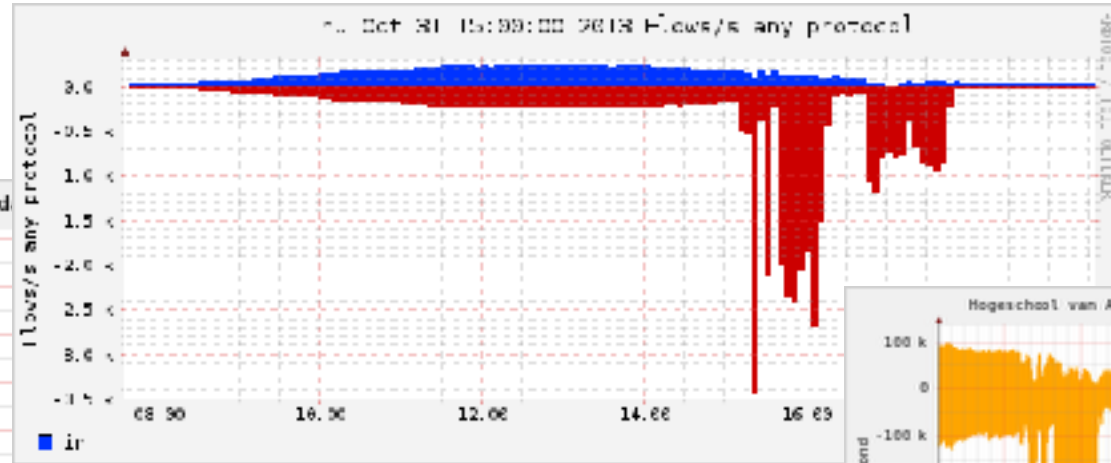
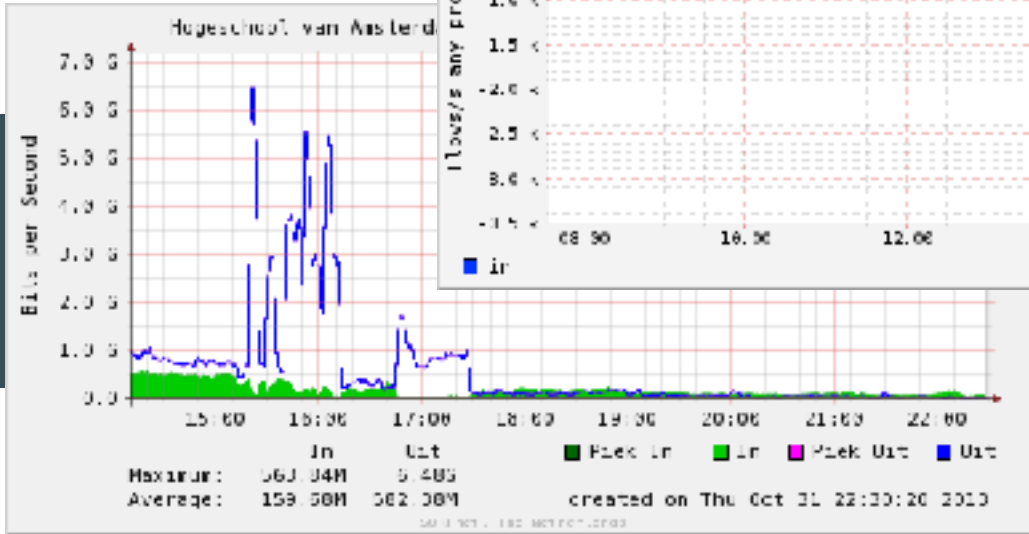
# Session based high bandwidth throughput testing.

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# Research Question



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# UDP vs TCP

## UDP

connectionless

8 byte header

no ordering

lightweight

## TCP

connection oriented

20 byte header

ordering

heavyweight

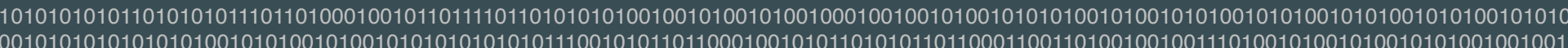
reliable

congestion control

# Research Question



What is needed to perform high bandwidth session based throughput tests and how to go beyond pure network infrastructure testing?

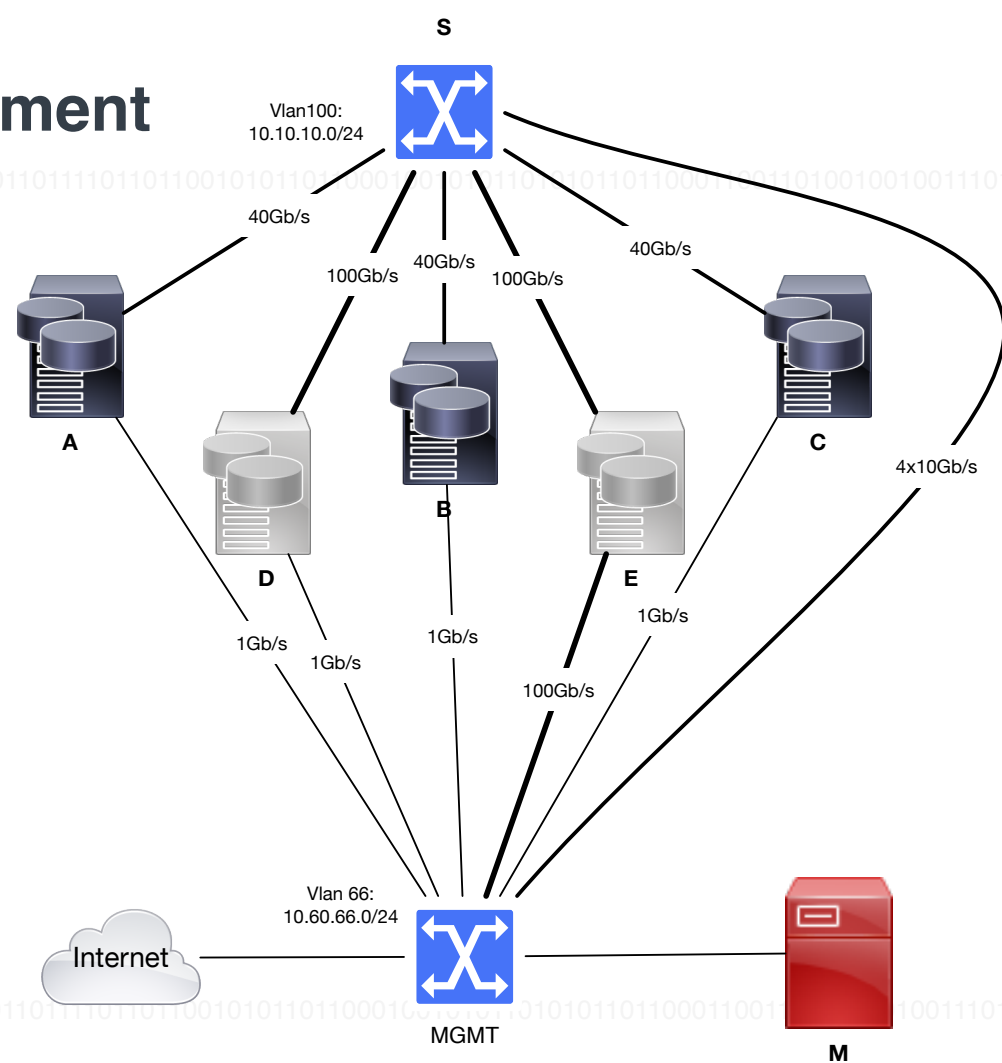


The term "high bandwidth" references to at least 40Gb/s.

The term "session based" references to TCP traffic.



# Test environment





**hping**

pktgen-kernel

BoNeSi



MoonGen

pktgen-DPDK



# First important result



DPDK is the way to go



# DPDK

DATA PLANE DEVELOPMENT KIT



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NR	Use case	DUT	Explanation
UC1	Bandwidth generation	Client	The goal is to see if the client is capable of filling up the link and to reach the maximum amount of pps
UC2	Throughput	Switch/Router	Generate the maximum amount of bidirectional data to make sure the intermediate hardware is able to forward at line rate
UC3	Session per second	Client/Server	Get the hardware limitations of the end hosts.
UC4	Application	Server and intermediate devices	The clients will try to overload the server with requests at application level

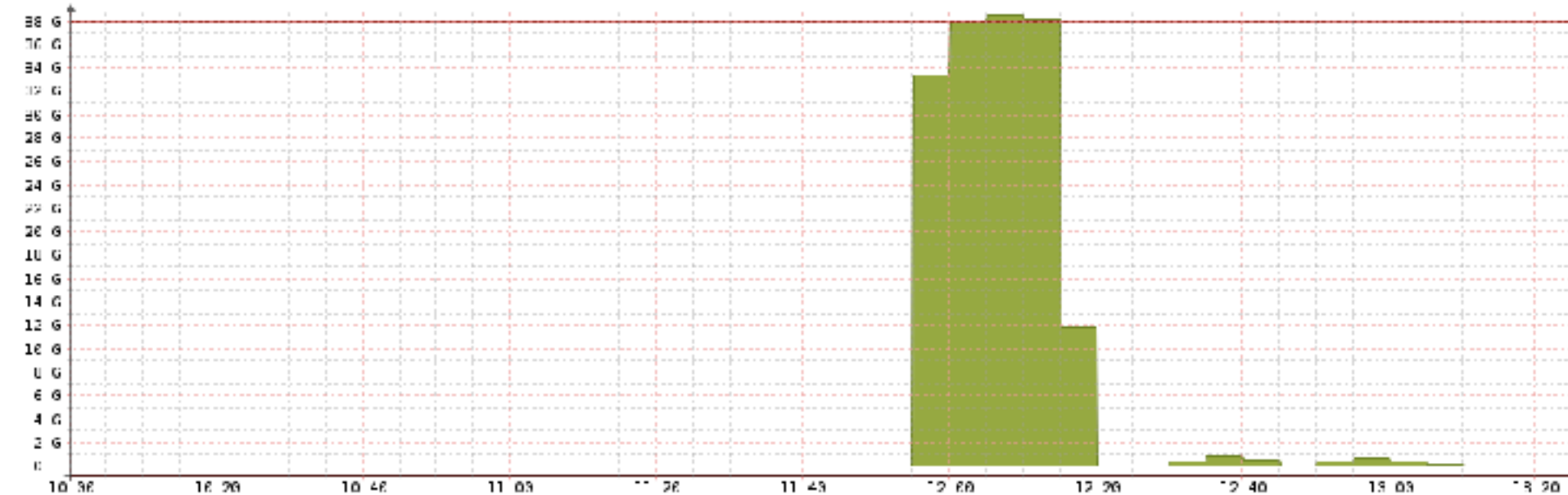
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# Experiment UC1 bandwidth



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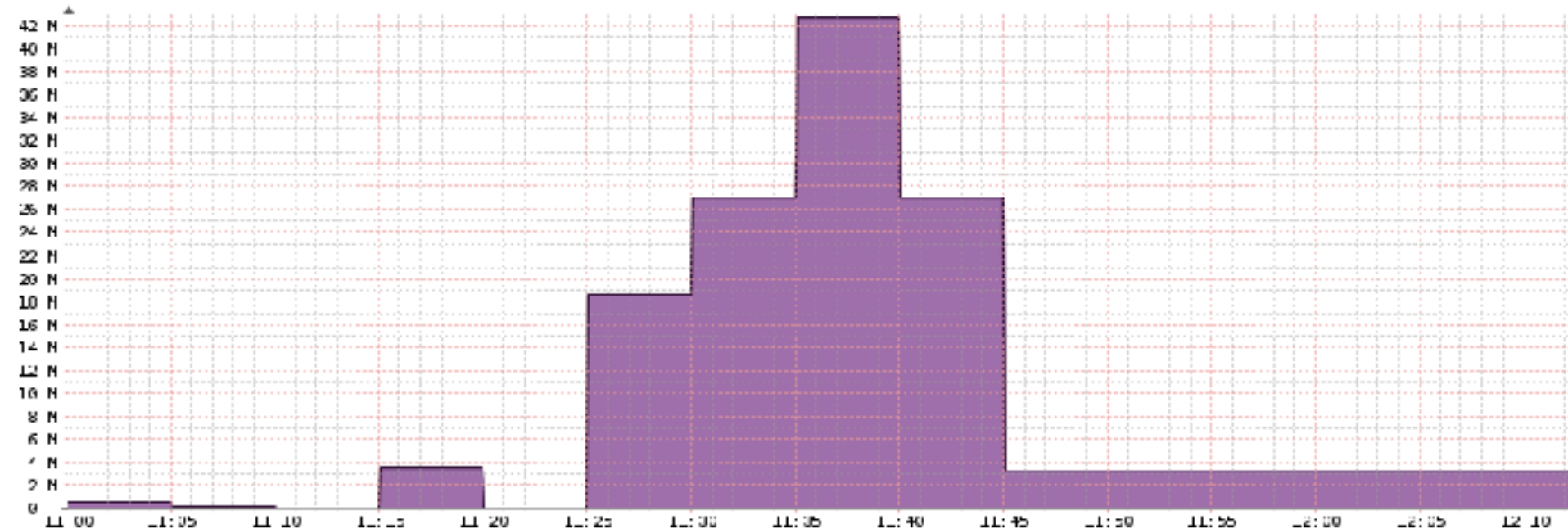
bps	low	Ave	Max	95th %
In	1.58G	8.45G	38.47G	37.97G
Out	752.94M	62.21M	770.13M	752.94M
Total	6.4513	10.6341E	Out	114.390E

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# Experiment UC1 PPS



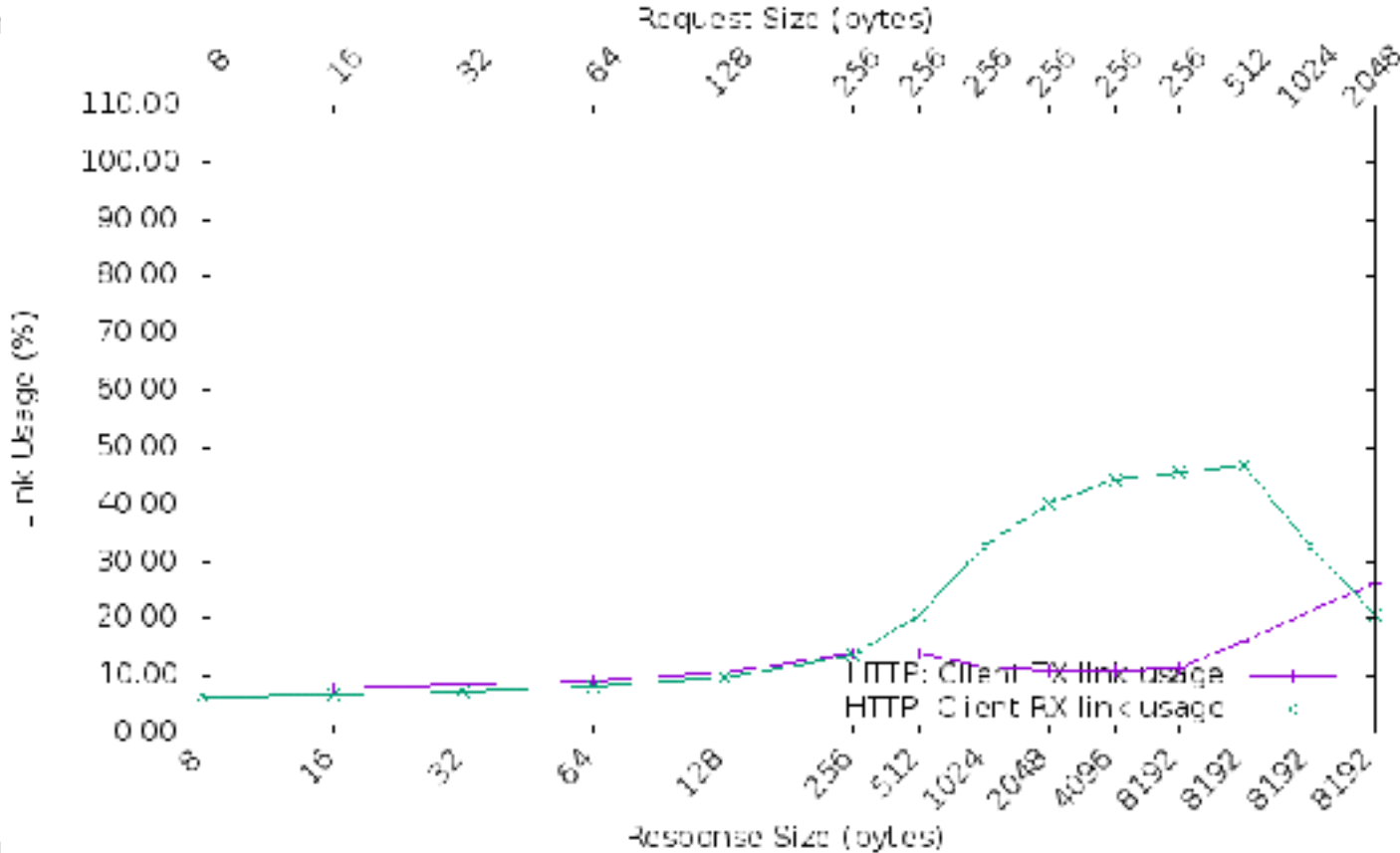
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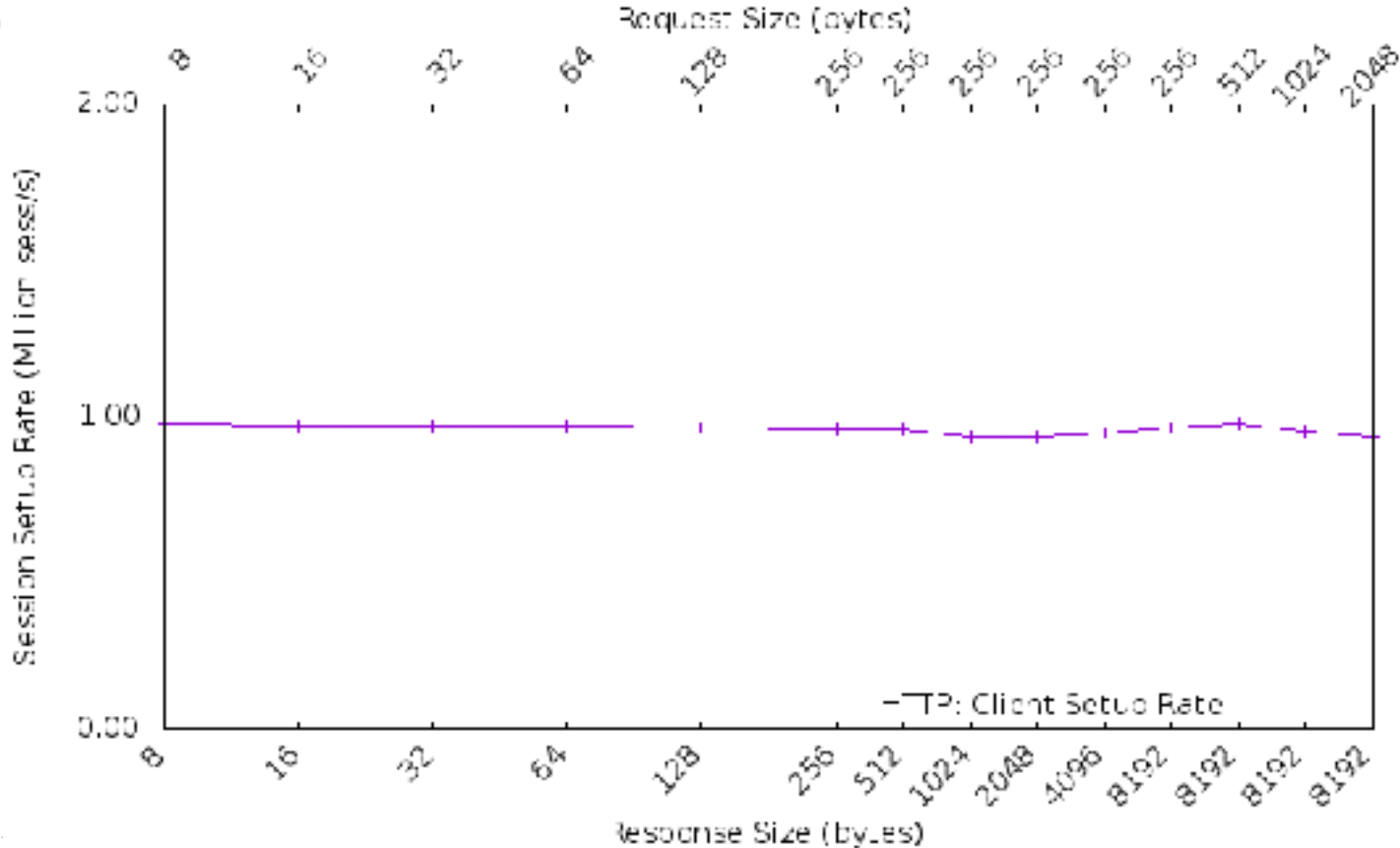
Packets	Now	Ave	Max
1*	38.52r	7.74M	42 /5P
0..	79.71r	1.86k	90 09k

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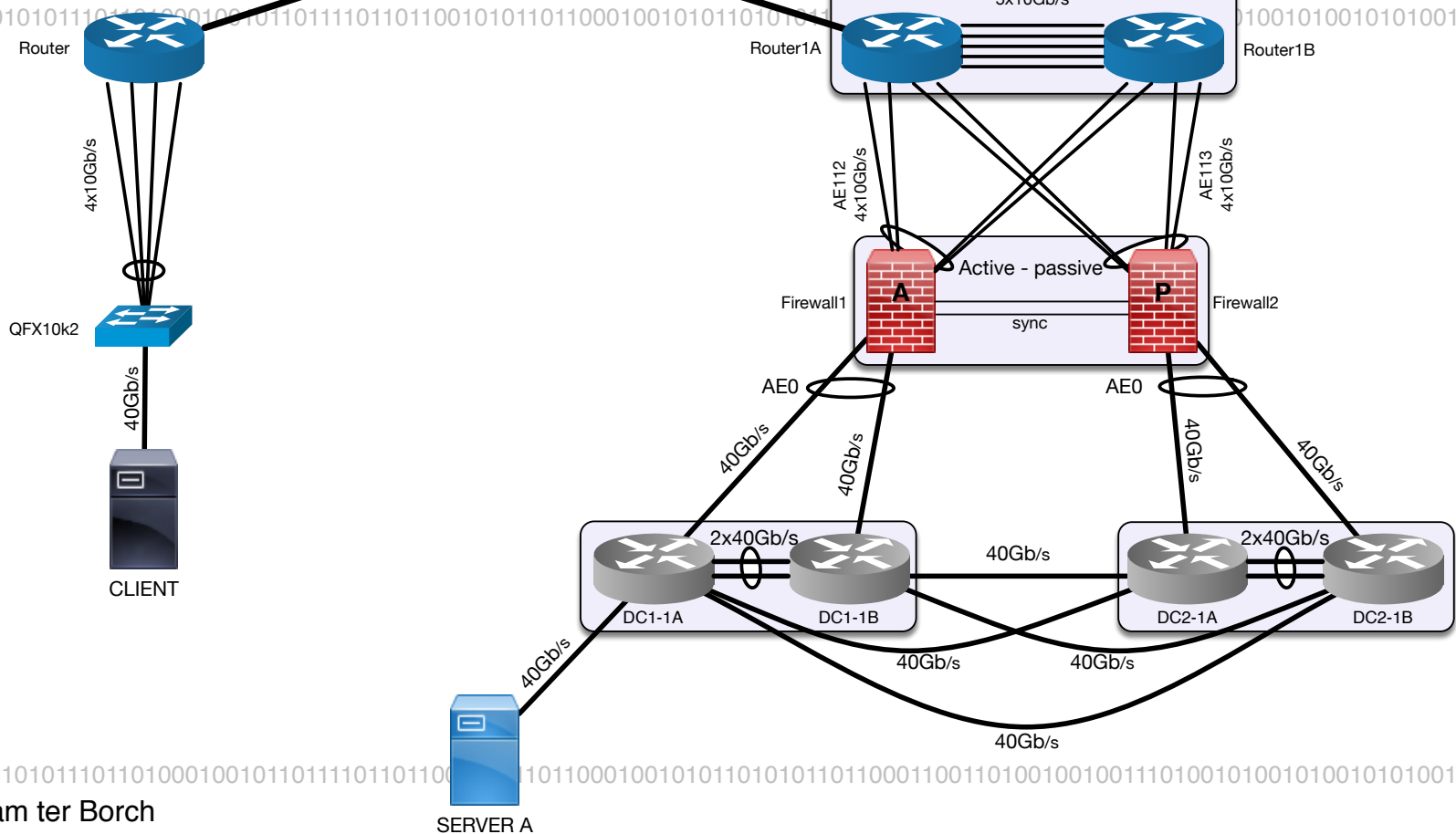
# Experiment UC3 HTTP link usage



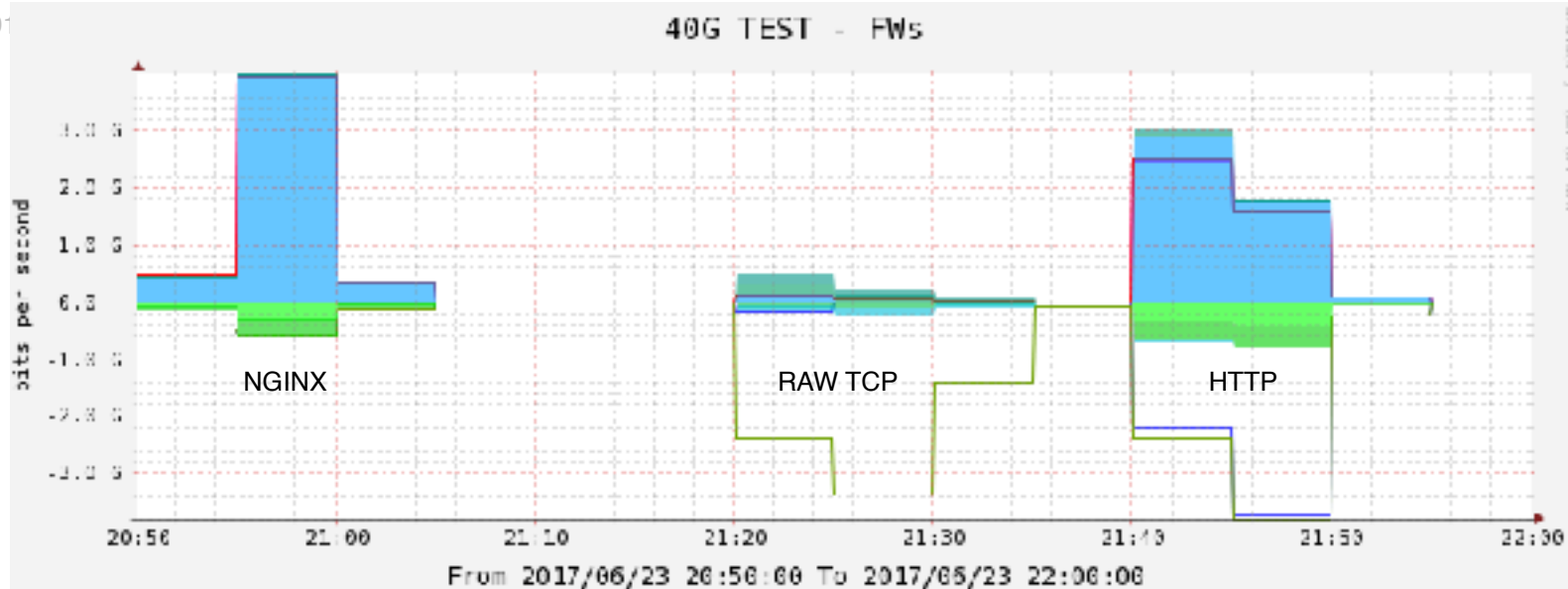
# Experiment UC3 sessions



# Real world test



# Real world result - bandwidth



From DC through FWs to R1:

R1:AE112 IN	Avg: 594.21 M	Max: 3.95 G
R1:AE113 IN	Avg: 19.48 M	Max: 107.48 M
DC1-1A OUT	Avg: 648.26 M	Max: 3.98 G
DC1-1B OUT	Avg: 44.56 k	Max: 94.94 k
DC2-1A OUT	Avg: 27.51 M	Max: 196.08 M
DC2-1B OUT	Avg: 27.48 M	Max: 194.09 M

From R1 through FWs to DC:

R1:AE112 OUT	Avg: 592.26 M	Max: 3.73 G
R1:AE113 OUT	Avg: 485.57 M	Max: 3.38 G
DC1-1A IN	Avg: 80.58 M	Max: 412.47 M
DC1-1B IN	Avg: 73.89 M	Max: 350.84 M
DC2-1A IN	Avg: 15.45 M	Max: 98.34 M
DC2-1B IN	Avg: 15.51 M	Max: 98.91 M

# Conclusion



DPDK is the way to go for high bandwidth session based throughput testing

The use cases are valid

The weakest link in a path can be found

Monitoring is very important

# Future work



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DPDK tests have to be run using 100Gb/s interfaces

IPv6 support has to be added to WARP

Other layer 7 protocols have to be added to WARP

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# Questions

Thank you

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**Student:** Bram ter Borch