DIPL.ING.(FH)KLAUS ROCK

HTTP-QuSS

HTTP - QUANTUM SPEED AND SECURITY Ψ

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TCP 1 GBIT/S LATENCY BENCHMARKS

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1.0 Types of Benchmark Tests and Limitations

The following Benchmark Measurement Series, performed with Software and highly accurate Hardware supported Network Simulators, will deliver Figures and Facts how the **Latency** affects the real used **TCP Bandwidth** and an Evidence that the **HTTP-QuSS Technology** solves this Problem.

This is especially important because in the Field of Human–Machine Interaction, **perceptible Latency has a strong effect on User Satisfaction**.

1.1 Physical Latency

Latency is a Time interval between the Stimulation and Response, or, from a more general Point of View, a Time Delay between the Cause and the Effect of some physical change in the system being observed. Latency is physically a consequence of the limited Velocity with which any physical Interaction can propagate. The Magnitude of this Velocity is always less than or equal to the Speed of Light. Therefore, every physical System with any physical Separation (**Distance**) between Cause and Effect will experience some sort of Latency, regardless of the nature of Stimulation that it has been exposed to.

The precise Definition of Latency depends on the System being observed and the Nature of Stimulation. In Communications, the lower Limit of Latency is determined by the Medium being used for Communications. In reliable two-way Communication Systems, Latency limits the maximum Rate that information can be transmitted, as there is often a limit on the amount of Information that is "in-flight" at any one moment.

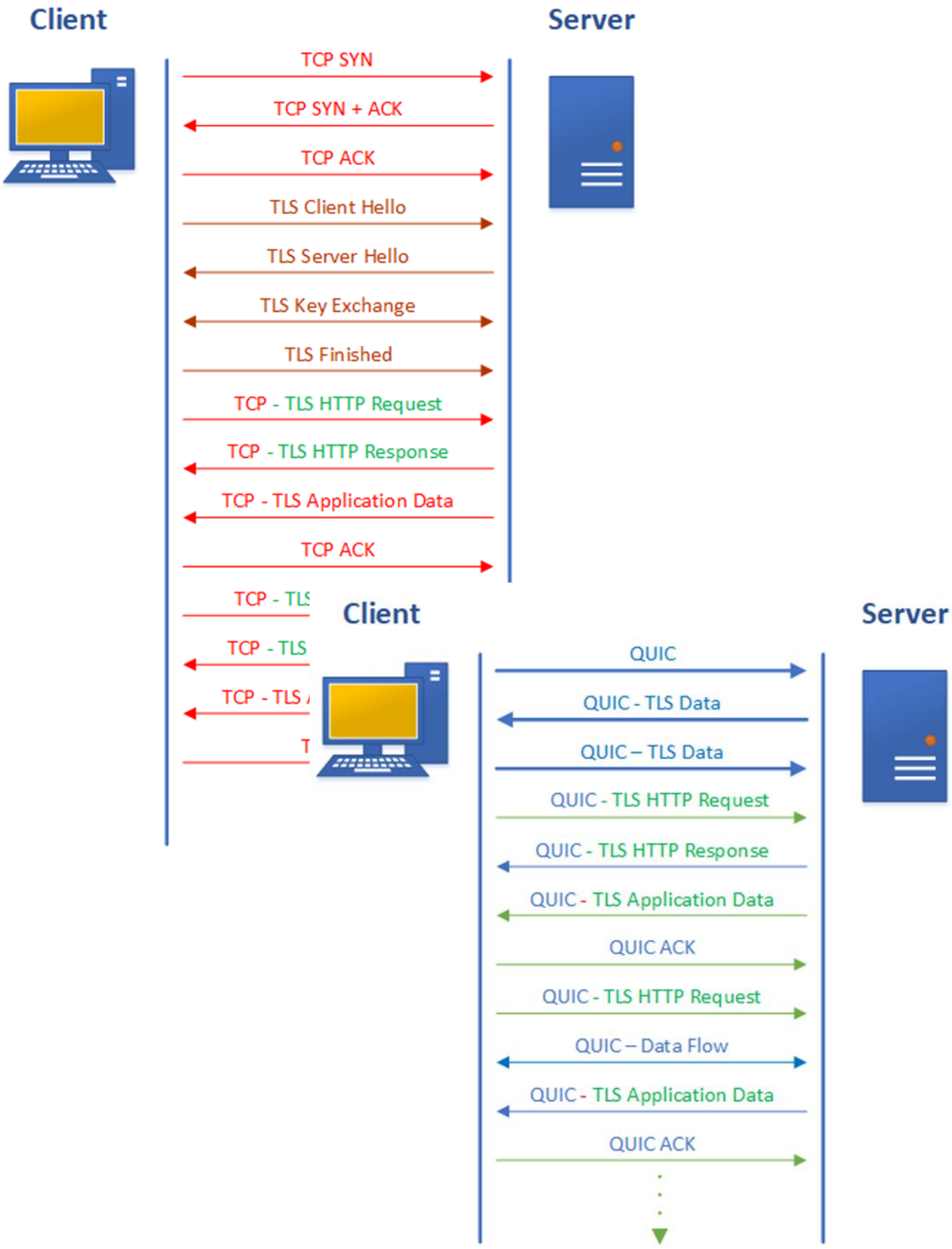
1.2 Hop Latency

In Computer Networking, including the Internet, a Hop occurs when a Packet is passed from one Network Segment to the next. Data Packets pass through Routers and Switches as they travel between Source and Destination. The Hop Count refers to the Number of intermediate Devices through which Data must pass between Source and Destination.

Since store and forward, analyse the Header Information, adding additional Information’s and other Latencies are incurred through each Hop, many Hops between Source and Destination increases the Round-Trip Time and implies therefore to a lower real-time performance caused by Bandwidth Losses.

1.3 Protocol Round Trip Latency

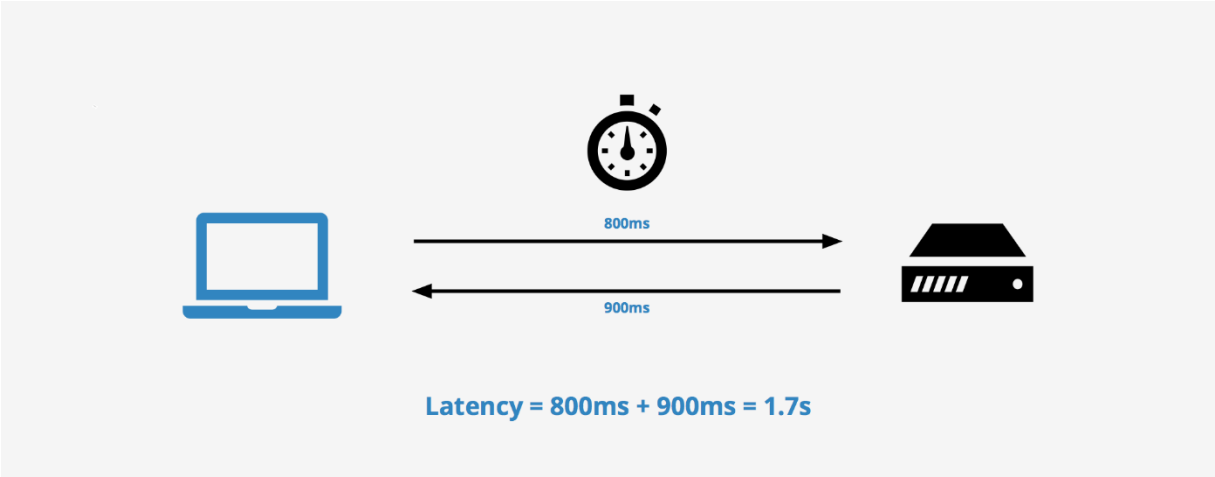
Internet Protocols like http, TLS, TCP, QUICK, RDP, only to mention a few, use heavy Flow Control Handshakes to guarantee a secure Package Delivery, Retransmission Algorithm in Case of Package Losses, Congestion Control and much more which leads into higher Latencies which at last destroys the available Bandwidth significantly.


Client
Server
TCP SYN
TCP SYN + ACK
TCP ACK
TLS Client Hello
TLS Server Hello
TLS Key Exchange
TLS Finished
TCP - TLS HTTP Request
TCP - TLS HTTP Response
TCP - TLS Application Data
TCP ACK
Client
Server
QUIC
QUIC - TLS Data
QUIC – TLS Data
QUIC - TLS HTTP Request
QUIC - TLS HTTP Response
QUIC - TLS Application Data
QUIC ACK
QUIC - TLS HTTP Request
QUIC – Data Flow
QUIC - TLS Application Data
QUIC ACK

1.4 Round Trip Time

In Telecommunications, the Round-Trip Delay Time (**RTD**) or Round-Trip Time (**RTT**) is the Length of Time it takes for a Signal to be sent plus the Length of Time it takes for an Acknowledgment of that Signal to be received. This Time Delay therefore consists of the Propagation Times between the two points of a Signal and are directly dependent on Latency see **Chapter 1.1 – 1.3**.

In the Context of Computer Networks, the Signal is generally a Data Packet, and the RTT is also known as the **Ping Time**. An Internet User can determine the RTT by using the ping command which we will also use within this Benchmark Tests.



1.5 Types of Benchmark Tests

The following Latency Benchmark Test Series are divided into 3 Types.

1. **Available TCP bandwidth** depending on Latency when 1 Gbit/s is available

   See Chapter: **3.3** | **4.3**

2. **HTTP-QuSS - Available Bandwidth** for File Download, VoIP, Media Streaming and all other TCP Applications in Dependency of Latency when 1 Gbit/s is available.

   See Chapter: **3.4** | **4.4**

3. **TCP/HTTP ./. HTTP-QuSS Browser Page Load Time** for a Test WEB Site in Dependency of Latency when 1 Gbit/s is available

   See Chapter: **3.5** | **4.5**

4. **Low Latency High Speed TCP Bandwidth Dependency**

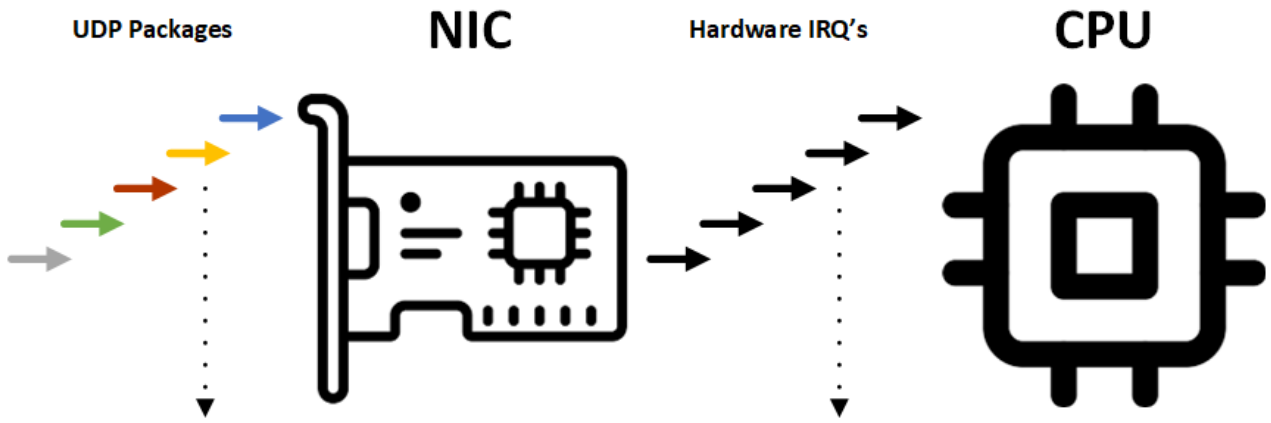
   See Chapter: **4.6**

1.6 Bandwidth Usage

Max. possible Bandwidth was **700 Mbit/s** respectively **800 Mbit/s**

Reasons

- Because the Test Environment was built up on a real local LAN and Internet Environment there was a high **Background Traffic**.
- Client **CPU Speed** was to slow for this 1 Gbit/s Bandwidth and no Hardware Offload support on NIC Card was available.
- **Hardware CPU Interrupts** in the Area above 700 Mbit/s are coming in too fast which causes Latency and Package Loss on the Client Site (CPU Utilization)



X Mbit/s * 1.000.000 bits/Mbit / 8 bits/byte / 1500 bytes/packet = Y Packages/s

1 000 Mbit/s = 1 000 000 000 / 8 / 1500 = 83 333 Packages/s

In a first Phase a Software **WANEm Satellite Simulator** between Server and Client was used and, in some Cases, a special Traffic Control Script with various **netem** parameters for a realistic Jitter with a normal Distribution was used before Packages left the Server.

But **netem** has shown some major Limitation related to Timer granularity and Accuracy because no real-time Linux Kernel was used for these Measurement Series.

Also, there are still Software Bugs within the netem Code which produces large Inaccuracies with unusable Results.

In a second Phase (**Chapter 4**) a Netropy N91 | 1 Gbit/s Network Emulator was used to avoid the above Inaccuracies.

The existing **HTTP-QuSS** Client for the Browser Page Load Time Test Series is still in a Proof of Concept (*POC*) Status and has shown some Software Bugs in the Latency Ranges 1 - 25 ms.

Despite these remaining Inaccuracies, however, it can clearly be proofed that there is only a **minimal Dependency between Latency and Bandwidth Utilization** when the HTTP-QuSS Data Transmission Technology is used compared to state-of-the-art TCP/TLS/HTTP and other Protocol Families.

1.7 Benchmark Summary Pages

Bandwidth - TCP Latency Dependency:

3.3.16 Benchmark Summary
4.3.17 Benchmark Summary

HTTP-QuSS - http Download | FTP | VoIP | Media Streaming etc.:

3.4.17 Benchmark Summary
4.4.16 Benchmark Summary

TCP/HTTP ./. HTTP-QuSS - WEB Page Load Time – Latency Dependency:

3.5.19 Benchmark Summary
4.5.17 Benchmark Summary

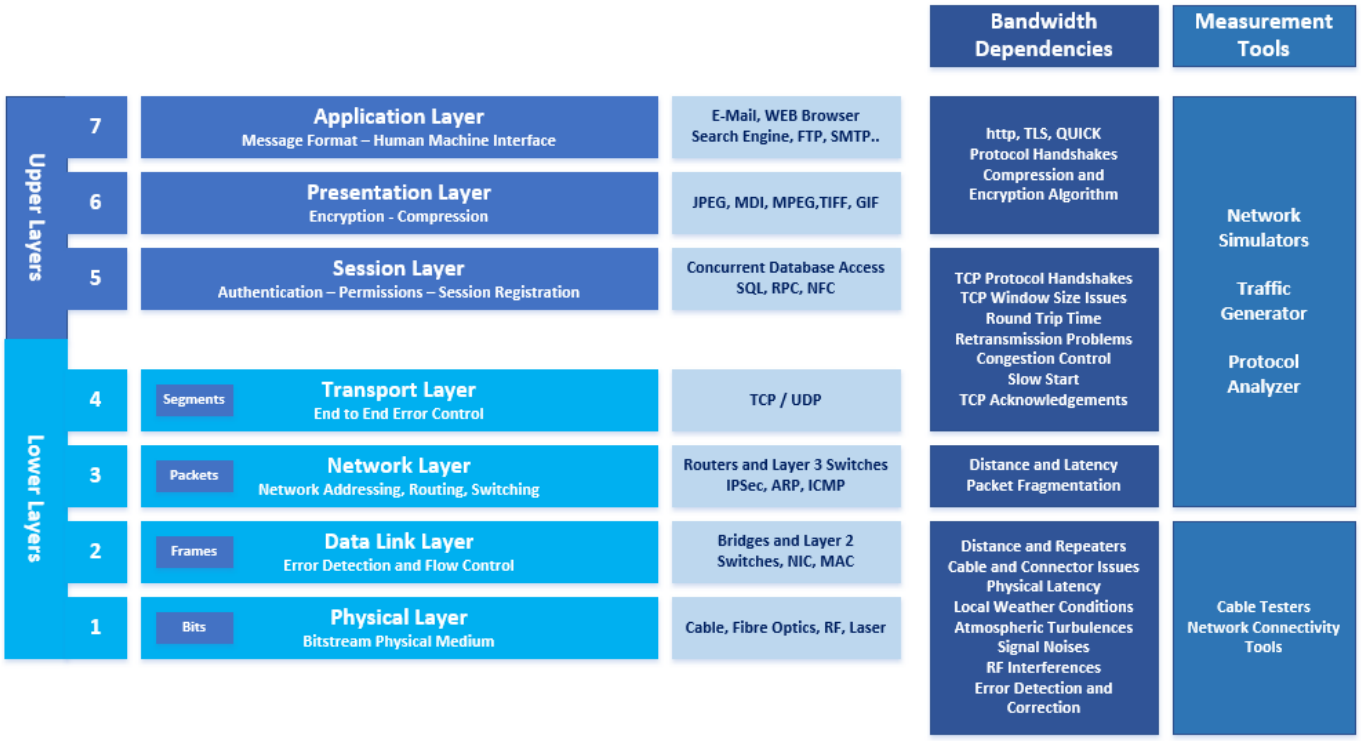
Low Latency High Speed TCP - Bandwidth Dependency

4.6.22 Benchmark Summary

2.0 HTTP-QuSS - TCP Benchmark Environment

2.1 OSI Model and Layer Bandwidth Dependencies

This TCP 1 Gbit/s Bandwidth Benchmark Test affects OSI Layers 3 – 7 and so Network Simulators, Traffic Generators and a Protocol Analyser must be used.



2.1.1 Layer 1: Physical Layer

The physical layer is responsible for the transmission and reception of unstructured raw data between a device and a physical transmission medium. It converts the digital bits into electrical, radio, or optical signals. Layer specifications define characteristics such as voltage levels, the timing of voltage changes, physical data rates, maximum transmission distances, modulation scheme, channel access method and physical connectors. This includes the layout of pins, voltages, line impedance, cable specifications, signal timing and frequency for wireless devices. Bit rate control is done at the physical layer and may define transmission mode as simplex, half duplex, and full duplex. The components of a physical layer can be described in terms of a network topology. Bluetooth, Ethernet, and USB all have specifications for a physical layer.

Please Note:

The possible Bandwidths on this Physical Layer is much higher compared to the real utilized Bandwidths on Layers 3 – 7.

2.1.2 Layer 2: Data Link Layer

The data link layer provides node-to-node data transfer—a link between two directly connected nodes. It detects and possibly corrects errors that may occur in the physical layer. It defines the protocol to establish and terminate a connection between two physically connected devices. It also defines the protocol for flow control between them.

IEEE 802 divides the data link layer into two sublayers:

- Medium access control (MAC) layer – responsible for controlling how devices in a network gain access to a medium and permission to transmit data.
- Logical link control (LLC) layer – responsible for identifying and encapsulating network layer protocols, and controls error checking and frame synchronization.

The MAC and LLC layers of IEEE 802 networks such as 802.3 Ethernet, 802.11 Wi-Fi, and 802.15.4 ZigBee operate at the data link layer.

The Point-to-Point Protocol (PPP) is a data link layer protocol that can operate over several different physical layers, such as synchronous and asynchronous serial lines.

The ITU-T G.hn standard, which provides high-speed local area networking over existing wires (power lines, phone lines and coaxial cables), includes a complete data link layer that provides both error correction and flow control by means of a selective-repeat sliding-window protocol.

2.1.3 Layer 3: Network Layer

The network layer provides the functional and procedural means of transferring variable length data sequences (called packets) from one node to another connected in "different networks". A network is a medium to which many nodes can be connected, on which every node has an address and which permits nodes connected to it to transfer messages to other nodes connected to it by merely providing the content of a message and the address of the destination node and letting the network find the way to deliver the message to the destination node, possibly routing it through intermediate nodes. If the message is too large to be transmitted from one node to another on the data link layer between those nodes, the network may implement message delivery by splitting the message into several fragments at one node, sending the fragments independently, and reassembling the fragments at another node. It may, but does not need to, report delivery errors.

Message delivery at the network layer is not necessarily guaranteed to be reliable; a network layer protocol may provide reliable message delivery, but it need not do so.

A number of layer-management protocols, a function defined in the management annex, ISO 7498/4, belong to the network layer. These include routing protocols, multicast group management, network-layer information and error, and network-layer address assignment. It is the function of the payload that makes these belong to the network layer, not the protocol that carries them.

2.1.4 Layer 4: Transport Layer

The transport layer provides the functional and procedural means of transferring variable-length data sequences from a source to a destination host, while maintaining the quality of service functions.

The transport layer controls the reliability of a given link through flow control, segmentation/desegmentation, and error control. Some protocols are state- and connection-oriented. This means that the transport layer can keep track of the segments and re-transmit those that fail delivery. The transport layer also provides the acknowledgement of the successful data transmission and sends the next data if no errors occurred. The transport layer creates segments out of the message received from the application layer. Segmentation is the process of dividing a long message into smaller messages.

OSI defines five classes of connection-mode transport protocols ranging from class 0 (which is also known as TP0 and provides the fewest features) to class 4 (TP4, designed for less reliable networks, similar to the Internet). Class 0 contains no error recovery, and was designed for use on network layers that provide error-free connections. Class 4 is closest to TCP, although TCP contains functions, such as the graceful close, which OSI assigns to the session layer. Also, all OSI TP connection-mode protocol classes provide expedited data and preservation of record boundaries. Detailed characteristics of TP0-4 classes are shown in the following table

Feature name	TP0	TP1	TP2	TP3	TP4
Connection-oriented network	Yes	Yes	Yes	Yes	Yes
Connectionless network	No	No	No	No	Yes
Concatenation and separation	No	Yes	Yes	Yes	Yes
Segmentation and reassembly	Yes	Yes	Yes	Yes	Yes
Error recovery	No	Yes	Yes	Yes	Yes
Reinitiate connection[a]	No	Yes	No	Yes	No
Multiplexing / demultiplexing over single virtual circuit	No	No	Yes	Yes	Yes
Explicit flow control	No	No	Yes	Yes	Yes
Retransmission on timeout	No	No	No	No	Yes
Reliable transport service	No	Yes	No	Yes	Yes

An easy way to visualize the transport layer is to compare it with a post office, which deals with the dispatch and classification of mail and parcels sent. A post office inspects only the outer envelope of mail to determine its delivery. Higher layers may have the equivalent of double envelopes, such as cryptographic presentation services

that can be read by the addressee only. Roughly speaking, tunneling protocols operate at the transport layer, such as carrying non-IP protocols such as IBM's SNA or Novell's IPX over an IP network, or end-to-end encryption with IPsec. While Generic Routing Encapsulation (GRE) might seem to be a network-layer protocol, if the encapsulation of the payload takes place only at the endpoint, GRE becomes closer to a transport protocol that uses IP headers but contains complete Layer 2 frames or Layer 3 packets to deliver to the endpoint. L2TP carries PPP frames inside transport segments.

Although not developed under the OSI Reference Model and not strictly conforming to the OSI definition of the transport layer, the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP) of the Internet Protocol Suite are commonly categorized as layer-4 protocols within OSI.

2.1.5 Layer 5: Session Layer

The session layer controls the dialogues (connections) between computers. It establishes, manages and terminates the connections between the local and remote application. It provides for full-duplex, half-duplex, or simplex operation, and establishes procedures for checkpointing, suspending, restarting, and terminating a session. In the OSI model, this layer is responsible for gracefully closing a session, which is handled in the Transmission Control Protocol at the transport layer in the Internet Protocol Suite. This layer is also responsible for session checkpointing and recovery, which is not usually used in the Internet Protocol Suite. The session layer is commonly implemented explicitly in application environments that use remote procedure calls.

2.1.6 Layer 6: Presentation Layer

The presentation layer establishes context between application-layer entities, in which the application-layer entities may use different syntax and semantics if the presentation service provides a mapping between them. If a mapping is available, presentation protocol data units are encapsulated into session protocol data units and passed down the protocol stack.

This layer provides independence from data representation by translating between application and network formats. The presentation layer transforms data into the form that the application accepts. This layer formats data to be sent across a network. It is sometimes called the syntax layer. The presentation layer can include compression functions. The Presentation Layer negotiates the Transfer Syntax.

The original presentation structure used the Basic Encoding Rules of Abstract Syntax Notation One (ASN.1), with capabilities such as converting an EBCDIC-coded text file to an ASCII-coded file, or serialization of objects and other data structures from and to XML. ASN.1 effectively makes an application protocol invariant with respect to syntax.

2.1.7 Layer 7: Application Layer

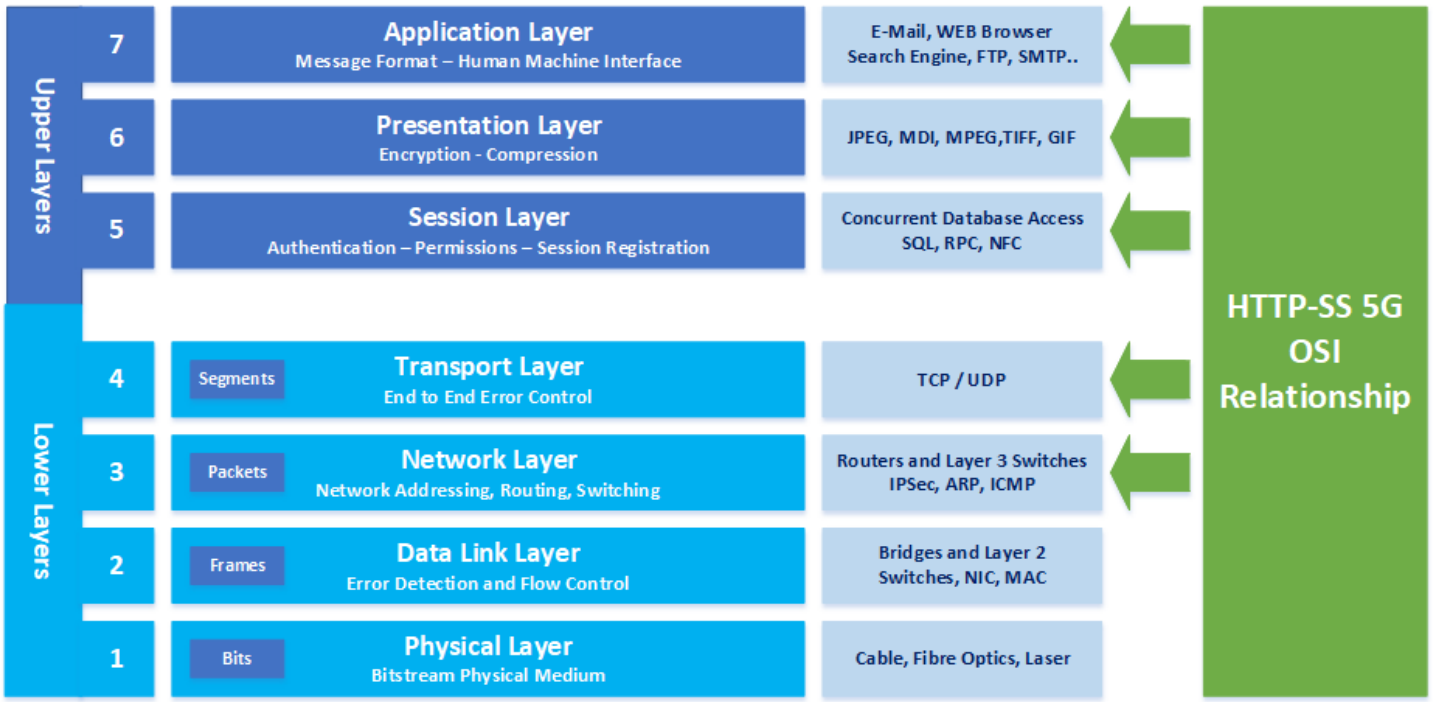
The application layer is the OSI layer closest to the end user, which means both the OSI application layer and the user interact directly with the software application. This layer interacts with software applications that implement a communicating component. Such application programs fall outside the scope of the OSI model. Application-layer functions typically include identifying communication partners, determining resource

availability, and synchronizing communication. When identifying communication partners, the application layer determines the identity and availability of communication partners for an application with data to transmit. The most important distinction in the application layer is the distinction between the application-entity and the application. For example, a reservation website might have two application-entities: one using HTTP to communicate with its users, and one for a remote database protocol to record reservations. Neither of these protocols have anything to do with reservations. That logic is in the application itself. The application layer per se has no means to determine the availability of resources in the network.

2.1.8 HTTP-QuSS Cross-Layer Technology

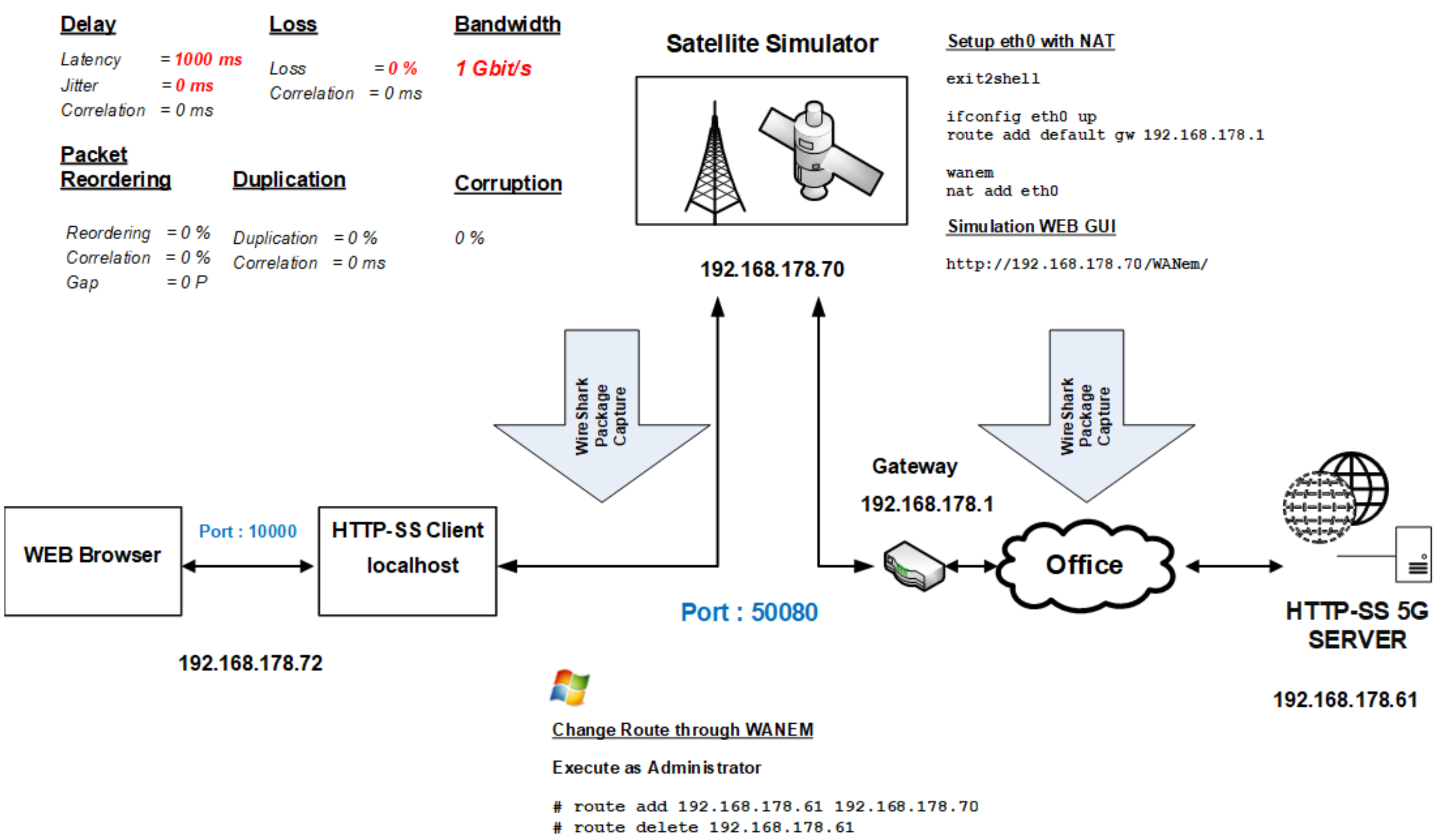
HTTP-QuSS is a Cross-layer Technology which is not tied to a given layer, but affects Layer 3 - 7. Some orthogonal aspects, such as management and security, involve all of the layers (See ITU-T X.800 Recommendation). The HTTP-QuSS Technology is aimed at improving the CIA triad - Confidentiality, Integrity, Availability and addidional high Speed - of the transmitted data. This Cross-layer Technology is very important because the availability of a communication service is determined by the interaction between network design and network management protocols. Appropriate choices for both of these are needed to protect against all Kinds of Cyber Attacks.

HTTP-QuSS affects the following Layers:



2.1 HTTP-QuSS - Test Network

HTTP-SS 5G - Benchmark Measurement Environment with Satellite Simulator



2.2 HTTP-QuSS - Server Hardware

```
# lshw -short

H/W path                        Device      Class       Description
=====================================================================
system      PowerEdge 860
/0                                          bus         0XM089
/0/0                                        memory      64KiB BIOS
/0/400   processor  Intel(R) Xeon(R) CPU    3050         @ 2.13GHz
/0/400/700                                  memory      64KiB L1 cache
/0/400/701                                  memory      2MiB L2 cache
/0/1000                                     memory      4GiB System
/0/1000/0    memory     1GiB DIMM DDR2 Synchronous 667 MHz (1.5 ns)
/0/1000/1    memory     1GiB DIMM DDR2 Synchronous 667 MHz (1.5 ns)
/0/1000/2    memory     1GiB DIMM DDR2 Synchronous 667 MHz (1.5 ns)
/0/1000/3    memory     1GiB DIMM DDR2 Synchronous 667 MHz (1.5 ns)
```

```
/0/100      bridge          E7230/3000/3010 Memory Controller Hub
/0/100/1    bridge          /3000/3010 PCI Express Root Port
/0/100/1c   bridge          NM10/ICH7 Family PCI Express Port 1
/0/100/1c/0 bridge          6702PXH PCI Express-to-PCI Bridge A
/0/100/1c.4 bridge          82801GR/GH/GHM (ICH7 Family)PCI ExpressPort 5
/0/100/1c.4/0 enp4s0        network NetXtreme BCM5721Gigabit Ethernet PCI
/0/100/1c.5 bridge          82801GR/GH/GHM (ICH7 Family)PCIExpress Port 6
/0/100/1d   bus             NM10/ICH7 Family USB UHCI Controller #1
/0/100/1d/1 usb2            bus         UHCI Host Controller
/0/100/1d.1 bus             NM10/ICH7 Family USB UHCI Controller #2
/0/100/1d.1/1 usb3          bus         UHCI Host Controller
/0/100/1d.2  bus            NM10/ICH7 Family USB UHCI Controller #3
/0/100/1d.2/1 usb4          bus         UHCI Host Controller
/0/100/1d.7  bus            NM10/ICH7 Family USB2 EHCI Controller
/0/100/1d.7/1 usb1          bus         EHCI Host Controller
/0/100/1d.7/1/3 bus         CY7C65640 USB-2.0 "TetraHub"
/0/100/1d.7/1/3/1           scsi4       storage     Cruzer Glide
/0/100/1d.7/1/3/1/0.0.0     /dev/sdc    disk        31GB Cruzer Glide
/0/100/1d.7/1/3/1/0.0.0/0   /dev/sdc    disk        31GB
/0/100/1d.7/1/3/1/0.0.0/0/1 /dev/sdc1   volume      29GiB Windows FAT
/0/100/1d.7/1/3/2           scsi5       storage     USB to ATA/ATAPI bridge
/0/100/1d.7/1/3/2/0.0.0     /dev/sdd    disk        160GB SCSI Disk
/0/100/1d.7/1/3/2/0.0.0/1   /dev/sdd1   volume      149GiB Windows FAT
/0/100/1e                   bridge      82801 PCI Bridge
/0/100/1e/5                 display     ES1000
/0/100/1f         bridge    82801GB/GR (ICH7 Family) LPC Interface Bridge
/0/100/1f.1       storage   82801G (ICH7 Family) IDE Controller
/0/100/1f.2       storage   NM10/ICH7 Family SATA Controller [IDE mode]
/0/100/1f.3       bus       NM10/ICH7 Family SMBus Controller
/0/1              scsi2     storage
/0/1/0.0.0        /dev/sda  disk        2TB Hitachi HUA72202
/0/1/0.0.0/1      /dev/sda1 volume      1859GiB EXT4 volume
/0/1/0.0.0/2      /dev/sda2 volume      4095MiB Extended partition
/0/1/0.0.0/2/5    /dev/sda5 volume      4095MiB Linux swap / Solaris
/0/2              scsi3     storage
/0/2/0.0.0        /dev/sdb  disk        160GB Hitachi HDP72501
/0/2/0.0.0/1      /dev/sdb1 volume      145GiB EXT4 volume
/0/2/0.0.0/2      /dev/sdb2 volume      4094MiB Extended partition
/0/2/0.0.0/2/5    /dev/sdb5 volume      4094MiB Linux swap / Solaris
```

2.3 HTTP-QuSS - Server OS

```
# cat /proc/version

Linux version 4.4.140 (root@HTTP-SS) (gcc version 5.4.0 20160609
(Ubuntu 5.4.0-6ubuntu1~16.04.10) ) #1 SMP Sat Jul 14 11:15:14 CEST
2018
```

2.4 HTTP-QuSS - Server IP

```
# Ifconfig

enp4s0    Link encap:Ethernet  HWaddr 00:1c:23:e2:0d:b2
          inet addr:192.168.178.61  Bcast:192.168.178.255
          Mask:255.255.255.0
          inet6 addr: fe80::21c:23ff:fee2:db2/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:7018 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4615 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:7134624 (7.1 MB)  TX bytes:421621 (421.6 KB)
          Interrupt:16
```

2.5 HTTP-QuSS - Server NIC Speed

```
# ethtool enp4s0 | grep Speed

Speed: 1000Mb/s
```

2.6 HTTP-QuSS - Client Hardware

Device name	KLAUS-RAD
Processor	Intel(R) Core(TM) i5-3470 CPU @ 3.20GHz 3.20 GHz
Installed RAM	16.0 GB (15.9 GB usable)

2.7 HTTP-QuSS - Client OS

Windows specifications

Edition	Windows 10 Pro
Version	1809
Installed on	07/03/2019
OS build	17763.805

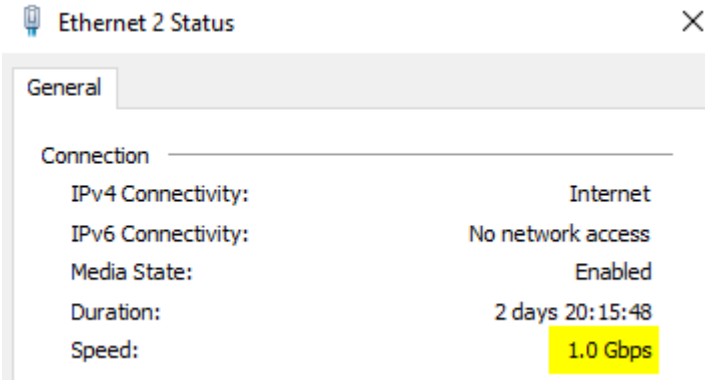
2.8 HTTP-QuSS - Client IP

```
# ipconfig

Ethernet-Adapter Ethernet 2:

   Verbindungsspezifisches DNS-Suffix: fritz.box
   Verbindungslokale IPv6-Adresse  . : fe80::acf7:1412:85aa:ed46%16
   IPv4-Adresse  . . . . . . . . . . : 192.168.178.72
   Subnetzmaske  . . . . . . . . . . : 255.255.255.0
   Standardgateway . . . . . . . . . : 192.168.178.1
```

2.9 HTTP-QuSS - Client NIC Speed



3.0 Real Network Condition with Background Traffic

3.1 WANem - Network Emulation Software

WANem is a Software Tool which brings the Internet into the development/test/lab Environment. It emulates internet like Conditions so that it can be checked how an Application Performance under various real Network Conditions.

3.2 Initial Functional Tests

3.2.1 WANem - Satellite Simulator Latency Test

Latency = **1 000 ms**
Bandwidth = **1 Gbit/s**
Jitter = **0 ms**
Loss = **0 %**
Correlation = 0 ms
Reordering = 0 %
Corruption = **0 %**
Duplication = 0 %

3.2.2 Satellite Simulation Settings

Interface: eth0		Packet Limit 1000 (Default=1000)								Symmetrical Network: Yes	
Bandwidth	Choose BW	Other								Other: Specify BW(Kbps)	0
Delay		Loss		Duplication		Packet reordering		Corruption			
Delay time(ms)	482	Loss(%)	0	Duplication(%)	0	Reordering(%)	0	Corruption(%)	0		
Jitter(ms)	0	Correlation(%)	0	Correlation(%)	0	Correlation(%)	0				
Correlation(%)	0					Gap(packets)	0				
Distribution	-N/A-										
Idle timer Disconnect		Type none				Idle Timer				Disconnect Timer	
Random Disconnect		Type none				MTTF Low		MTTF High		MTTR Low	MTTR High
Random connection Disconnect		Type none				MTTF Low		MTTF High		MTTR Low	MTTR High
IP source address	any	IP source subnet		IP dest address	any	IP dest subnet		Application port if any	any		

3.2.3 Routing through Satellite Simulator

POC-Client ←→ Satellite Simulator ←→ HTTP-QuSS Server

```
# route add 192.168.178.61 192.168.178.70
```

3.2.4 Ping Test for Satellite Simulation

192.168.178.72 ←→ 192.168.178.61

```
# Ping 192.168.178.61
```

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=968ms TTL=63
Antwort von 192.168.178.61: Bytes=32 Zeit=967ms TTL=63
Antwort von 192.168.178.61: Bytes=32 Zeit=967ms TTL=63
Antwort von 192.168.178.61: Bytes=32 Zeit=968ms TTL=63
```

3.3 TCP Bandwidth – Latency Dependency

Available Layer 1 Bitstream Bandwidth : **1000 Mbit/s**

3.3.1 iPerf3 - Network Performance Measurement Tool

iPerf is a widely used tool for network performance measurement and tuning. It is significant as a cross-platform tool that can produce standardized performance measurements for any network. Iperf has client and server functionality and can create data streams to measure the throughput between the two ends in one or both directions. Typical Iperf output contains a time-stamped report of the amount of data transferred and the throughput measured.

The data streams can be either Transmission Control Protocol (TCP) or User Datagram Protocol (UDP):

- **UDP**: When used for testing UDP capacity, Iperf allows the user to specify the datagram size and provides results for the datagram throughput and the packet loss.

- **TCP**: When used for testing TCP capacity, Iperf measures the throughput of the payload. Iperf uses 1024 × 1024 for mebibytes and 1000 × 1000 for megabytes.

The network link is delimited by two hosts running Iperf.

The quality of a link can be tested as follows:

- Latency (response time or RTT): can be measured with the Ping command.
- Jitter (latency variation): can be measured with an Iperf UDP test.
- Datagram loss: can be measured with an Iperf UDP test.

The bandwidth is measured through TCP tests.

To be clear, the difference between TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) is that TCP use processes to check that the packets are correctly sent to the receiver whereas with UDP the packets are sent without any checks but with the advantage of being quicker than TCP.

Iperf uses the different capacities of TCP and UDP to provide statistics about network links.

Finally, Iperf can be installed very easily on any UNIX/Linux or Microsoft Windows system. One host must be set as client, the other one as server.

3.3.2 Starting iperf3 Server

Starting iPerf3 on HTTP-QuSS Server **192.168.178.61** as Domain on Port 5200

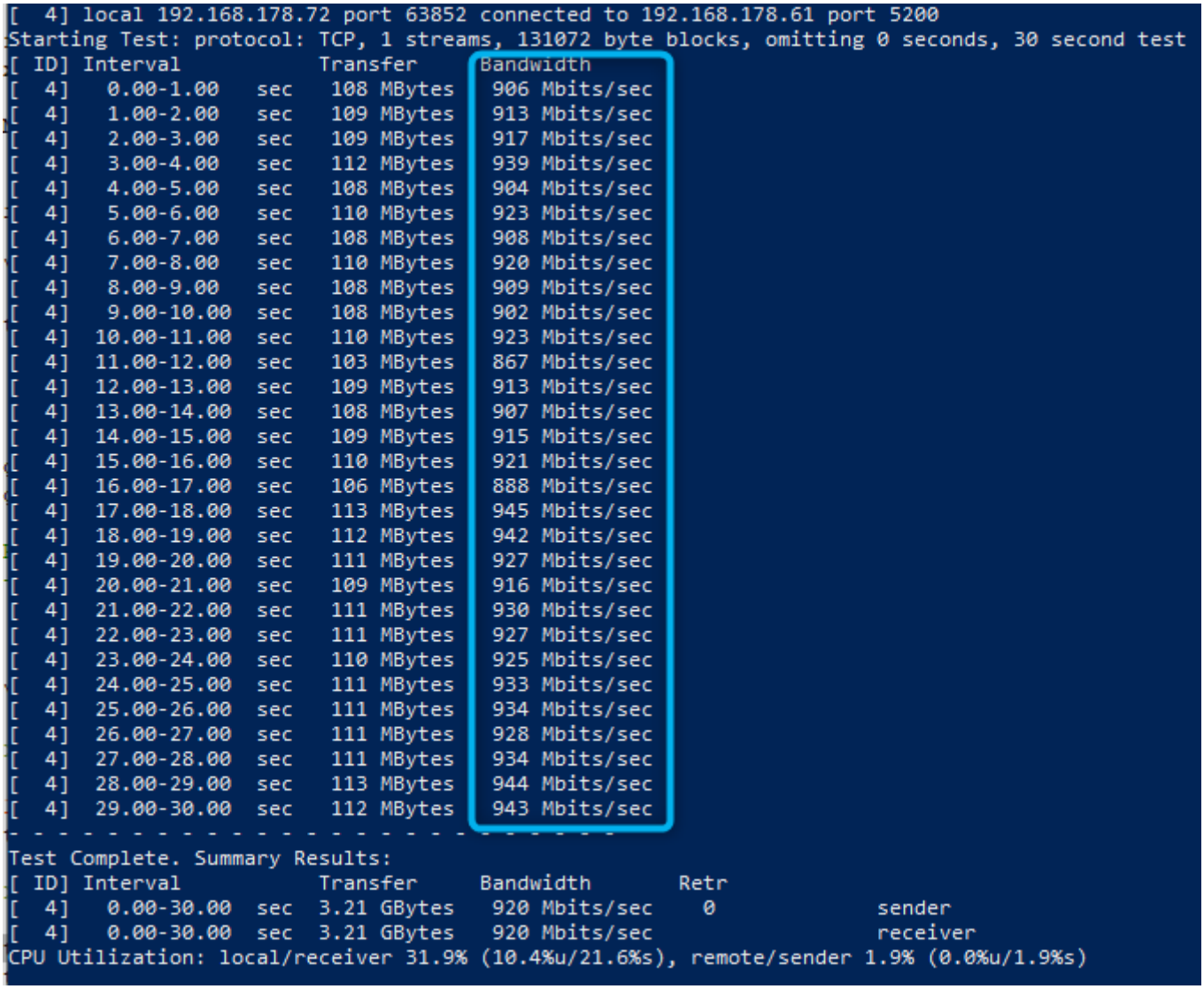
```
./iperf3 -s -D -p 5200
```

3.3.3 TCP - max Bandwidth with RTT = 1 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V

-c        As Client
-p        Port 5200
-R        Run in Reverse Mode (Server sends, Client receives)
-t        Time in seconds to transmit = 30 s
-V        More detailed output
```



```
[  4] local 192.168.178.72 port 63852 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec   108 MBytes   906 Mbits/sec
[  4]   1.00-2.00   sec   109 MBytes   913 Mbits/sec
[  4]   2.00-3.00   sec   109 MBytes   917 Mbits/sec
[  4]   3.00-4.00   sec   112 MBytes   939 Mbits/sec
[  4]   4.00-5.00   sec   108 MBytes   904 Mbits/sec
[  4]   5.00-6.00   sec   110 MBytes   923 Mbits/sec
[  4]   6.00-7.00   sec   108 MBytes   908 Mbits/sec
[  4]   7.00-8.00   sec   110 MBytes   920 Mbits/sec
[  4]   8.00-9.00   sec   108 MBytes   909 Mbits/sec
[  4]   9.00-10.00  sec   108 MBytes   902 Mbits/sec
[  4]  10.00-11.00  sec   110 MBytes   923 Mbits/sec
[  4]  11.00-12.00  sec   103 MBytes   867 Mbits/sec
[  4]  12.00-13.00  sec   109 MBytes   913 Mbits/sec
[  4]  13.00-14.00  sec   108 MBytes   907 Mbits/sec
[  4]  14.00-15.00  sec   109 MBytes   915 Mbits/sec
[  4]  15.00-16.00  sec   110 MBytes   921 Mbits/sec
[  4]  16.00-17.00  sec   106 MBytes   888 Mbits/sec
[  4]  17.00-18.00  sec   113 MBytes   945 Mbits/sec
[  4]  18.00-19.00  sec   112 MBytes   942 Mbits/sec
[  4]  19.00-20.00  sec   111 MBytes   927 Mbits/sec
[  4]  20.00-21.00  sec   109 MBytes   916 Mbits/sec
[  4]  21.00-22.00  sec   111 MBytes   930 Mbits/sec
[  4]  22.00-23.00  sec   111 MBytes   927 Mbits/sec
[  4]  23.00-24.00  sec   110 MBytes   925 Mbits/sec
[  4]  24.00-25.00  sec   111 MBytes   933 Mbits/sec
[  4]  25.00-26.00  sec   111 MBytes   934 Mbits/sec
[  4]  26.00-27.00  sec   111 MBytes   928 Mbits/sec
[  4]  27.00-28.00  sec   111 MBytes   934 Mbits/sec
[  4]  28.00-29.00  sec   113 MBytes   944 Mbits/sec
[  4]  29.00-30.00  sec   112 MBytes   943 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  3.21 GBytes   920 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  3.21 GBytes   920 Mbits/sec                  receiver
CPU Utilization: local/receiver 31.9% (10.4%u/21.6%s), remote/sender 1.9% (0.0%u/1.9%s)
```

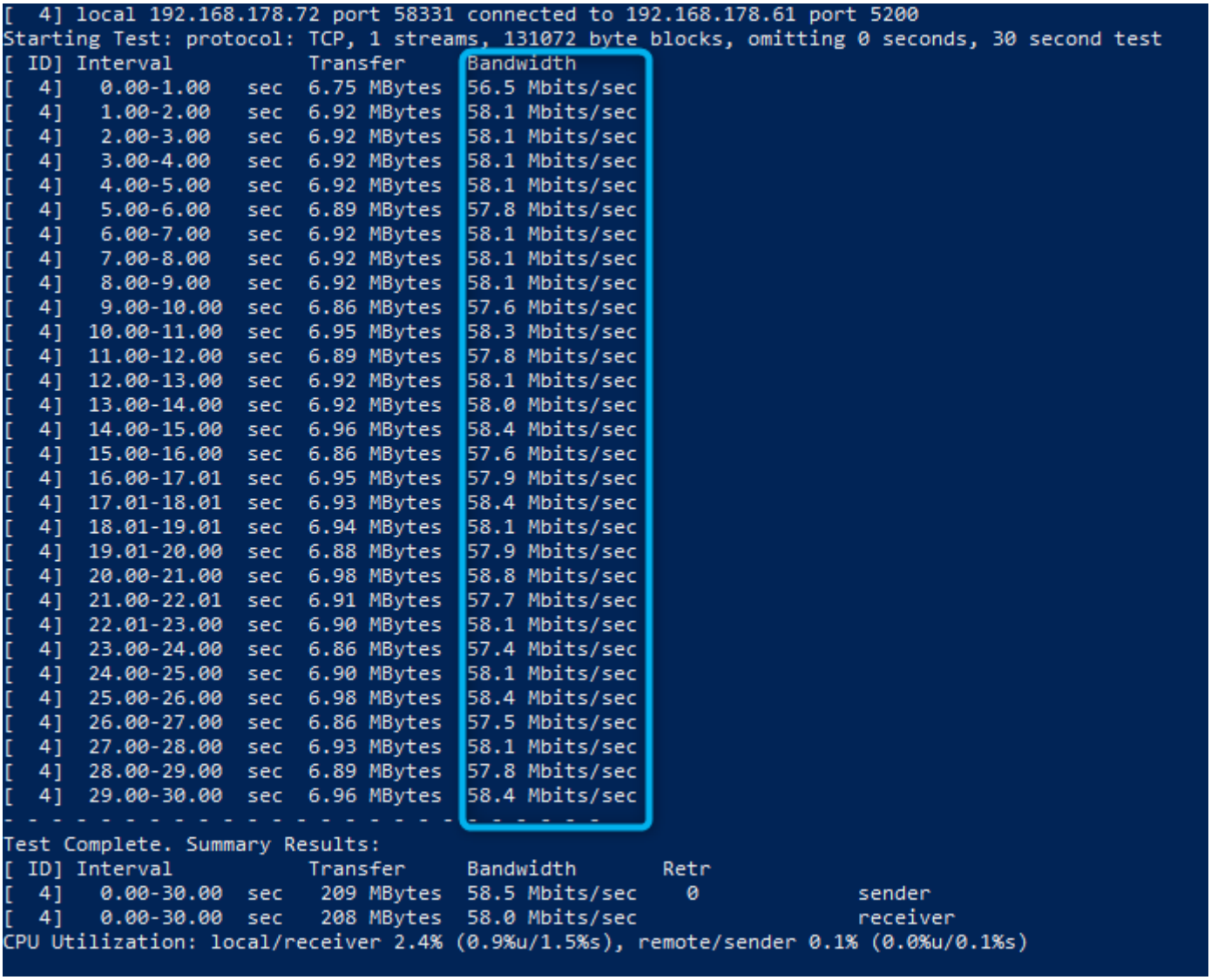
Average used bandwidth : **920 Mbit/s of 1000 Mbit/s**

3.3.2 TCP - max Bandwidth with RTT = 25 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```



```
[  4] local 192.168.178.72 port 58331 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  6.75 MBytes  56.5 Mbits/sec
[  4]   1.00-2.00   sec  6.92 MBytes  58.1 Mbits/sec
[  4]   2.00-3.00   sec  6.92 MBytes  58.1 Mbits/sec
[  4]   3.00-4.00   sec  6.92 MBytes  58.1 Mbits/sec
[  4]   4.00-5.00   sec  6.92 MBytes  58.1 Mbits/sec
[  4]   5.00-6.00   sec  6.89 MBytes  57.8 Mbits/sec
[  4]   6.00-7.00   sec  6.92 MBytes  58.1 Mbits/sec
[  4]   7.00-8.00   sec  6.92 MBytes  58.1 Mbits/sec
[  4]   8.00-9.00   sec  6.92 MBytes  58.1 Mbits/sec
[  4]   9.00-10.00  sec  6.86 MBytes  57.6 Mbits/sec
[  4]  10.00-11.00  sec  6.95 MBytes  58.3 Mbits/sec
[  4]  11.00-12.00  sec  6.89 MBytes  57.8 Mbits/sec
[  4]  12.00-13.00  sec  6.92 MBytes  58.1 Mbits/sec
[  4]  13.00-14.00  sec  6.92 MBytes  58.0 Mbits/sec
[  4]  14.00-15.00  sec  6.96 MBytes  58.4 Mbits/sec
[  4]  15.00-16.00  sec  6.86 MBytes  57.6 Mbits/sec
[  4]  16.00-17.01  sec  6.95 MBytes  57.9 Mbits/sec
[  4]  17.01-18.01  sec  6.93 MBytes  58.4 Mbits/sec
[  4]  18.01-19.01  sec  6.94 MBytes  58.1 Mbits/sec
[  4]  19.01-20.00  sec  6.88 MBytes  57.9 Mbits/sec
[  4]  20.00-21.00  sec  6.98 MBytes  58.8 Mbits/sec
[  4]  21.00-22.01  sec  6.91 MBytes  57.7 Mbits/sec
[  4]  22.01-23.00  sec  6.90 MBytes  58.1 Mbits/sec
[  4]  23.00-24.00  sec  6.86 MBytes  57.4 Mbits/sec
[  4]  24.00-25.00  sec  6.90 MBytes  58.1 Mbits/sec
[  4]  25.00-26.00  sec  6.98 MBytes  58.4 Mbits/sec
[  4]  26.00-27.00  sec  6.86 MBytes  57.5 Mbits/sec
[  4]  27.00-28.00  sec  6.93 MBytes  58.1 Mbits/sec
[  4]  28.00-29.00  sec  6.89 MBytes  57.8 Mbits/sec
[  4]  29.00-30.00  sec  6.96 MBytes  58.4 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   209 MBytes  58.5 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   208 MBytes  58.0 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.4% (0.9%u/1.5%s), remote/sender 0.1% (0.0%u/0.1%s)
```

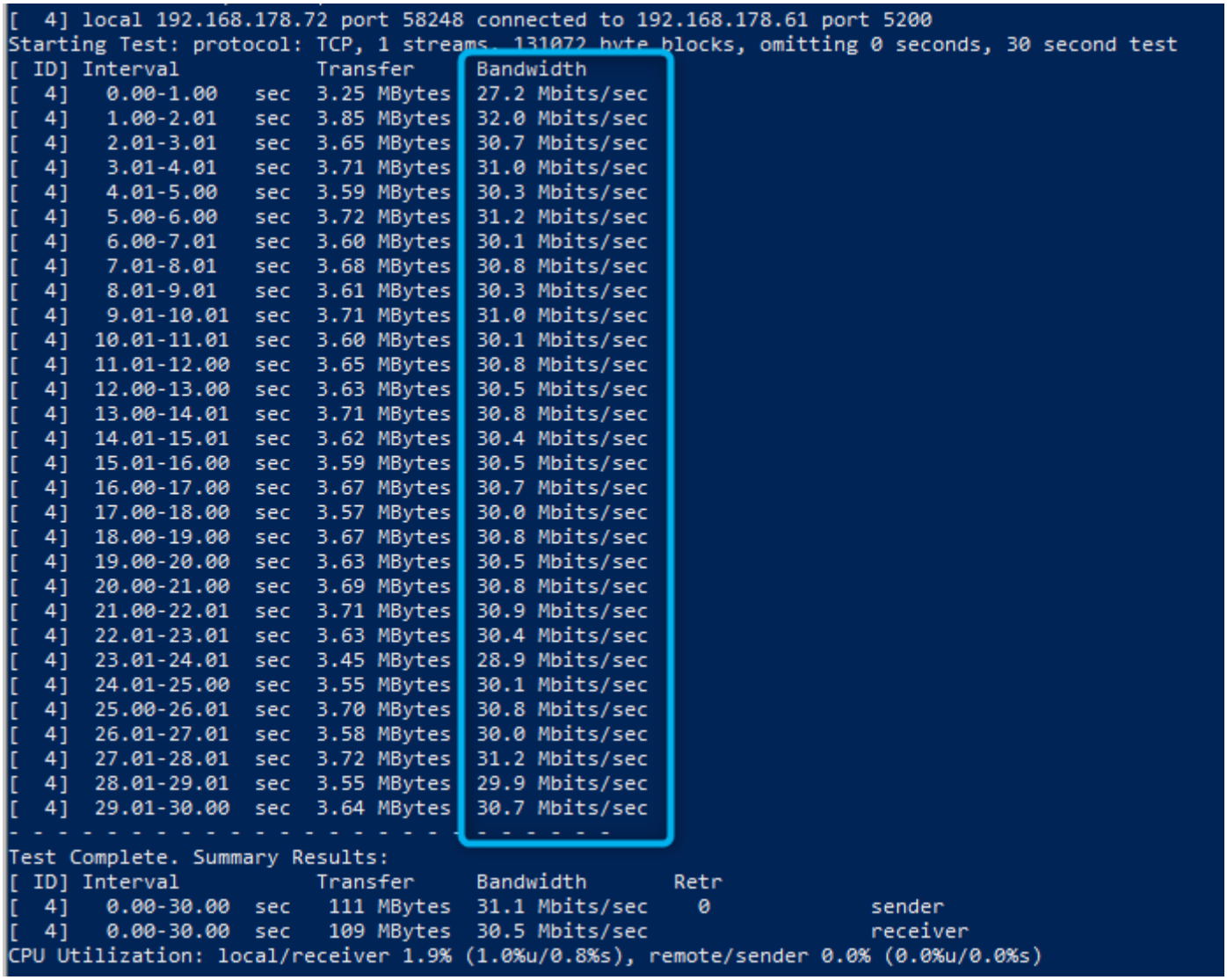
Average used bandwidth : **58.5 Mbit/s of 1000 Mbit/s**

3.3.3 TCP - max Bandwidth with RTT = 50 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V

-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```



```
[  4] local 192.168.178.72 port 58248 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  3.25 MBytes  27.2 Mbits/sec
[  4]   1.00-2.01   sec  3.85 MBytes  32.0 Mbits/sec
[  4]   2.01-3.01   sec  3.65 MBytes  30.7 Mbits/sec
[  4]   3.01-4.01   sec  3.71 MBytes  31.0 Mbits/sec
[  4]   4.01-5.00   sec  3.59 MBytes  30.3 Mbits/sec
[  4]   5.00-6.00   sec  3.72 MBytes  31.2 Mbits/sec
[  4]   6.00-7.01   sec  3.60 MBytes  30.1 Mbits/sec
[  4]   7.01-8.01   sec  3.68 MBytes  30.8 Mbits/sec
[  4]   8.01-9.01   sec  3.61 MBytes  30.3 Mbits/sec
[  4]   9.01-10.01  sec  3.71 MBytes  31.0 Mbits/sec
[  4]  10.01-11.01  sec  3.60 MBytes  30.1 Mbits/sec
[  4]  11.01-12.00  sec  3.65 MBytes  30.8 Mbits/sec
[  4]  12.00-13.00  sec  3.63 MBytes  30.5 Mbits/sec
[  4]  13.00-14.01  sec  3.71 MBytes  30.8 Mbits/sec
[  4]  14.01-15.01  sec  3.62 MBytes  30.4 Mbits/sec
[  4]  15.01-16.00  sec  3.59 MBytes  30.5 Mbits/sec
[  4]  16.00-17.00  sec  3.67 MBytes  30.7 Mbits/sec
[  4]  17.00-18.00  sec  3.57 MBytes  30.0 Mbits/sec
[  4]  18.00-19.00  sec  3.67 MBytes  30.8 Mbits/sec
[  4]  19.00-20.00  sec  3.63 MBytes  30.5 Mbits/sec
[  4]  20.00-21.00  sec  3.69 MBytes  30.8 Mbits/sec
[  4]  21.00-22.01  sec  3.71 MBytes  30.9 Mbits/sec
[  4]  22.01-23.01  sec  3.63 MBytes  30.4 Mbits/sec
[  4]  23.01-24.01  sec  3.45 MBytes  28.9 Mbits/sec
[  4]  24.01-25.00  sec  3.55 MBytes  30.1 Mbits/sec
[  4]  25.00-26.01  sec  3.70 MBytes  30.8 Mbits/sec
[  4]  26.01-27.01  sec  3.58 MBytes  30.0 Mbits/sec
[  4]  27.01-28.01  sec  3.72 MBytes  31.2 Mbits/sec
[  4]  28.01-29.01  sec  3.55 MBytes  29.9 Mbits/sec
[  4]  29.01-30.00  sec  3.64 MBytes  30.7 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   111 MBytes  31.1 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   109 MBytes  30.5 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.9% (1.0%u/0.8%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used bandwidth : **31.1 Mbit/s of 1000 Mbit/s**

3.3.4 TCP - max Bandwidth with RTT = 75 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```

```
[  4] local 192.168.178.72 port 58529 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  2.43 MBytes  20.3 Mbits/sec
[  4]   1.01-2.00   sec  2.62 MBytes  22.1 Mbits/sec
[  4]   2.00-3.01   sec  2.68 MBytes  22.4 Mbits/sec
[  4]   3.01-4.00   sec  2.71 MBytes  22.8 Mbits/sec
[  4]   4.00-5.00   sec  2.70 MBytes  22.7 Mbits/sec
[  4]   5.00-6.00   sec  2.68 MBytes  22.5 Mbits/sec
[  4]   6.00-7.00   sec  2.71 MBytes  22.7 Mbits/sec
[  4]   7.00-8.00   sec  2.68 MBytes  22.5 Mbits/sec
[  4]   8.00-9.01   sec  2.71 MBytes  22.7 Mbits/sec
[  4]   9.01-10.00  sec  2.68 MBytes  22.6 Mbits/sec
[  4]  10.00-11.00  sec  2.69 MBytes  22.6 Mbits/sec
[  4]  11.00-12.00  sec  2.69 MBytes  22.6 Mbits/sec
[  4]  12.00-13.00  sec  2.68 MBytes  22.5 Mbits/sec
[  4]  13.00-14.01  sec  2.71 MBytes  22.6 Mbits/sec
[  4]  14.01-15.00  sec  2.67 MBytes  22.5 Mbits/sec
[  4]  15.00-16.00  sec  2.71 MBytes  22.7 Mbits/sec
[  4]  16.00-17.00  sec  2.69 MBytes  22.6 Mbits/sec
[  4]  17.00-18.00  sec  2.68 MBytes  22.5 Mbits/sec
[  4]  18.00-19.00  sec  2.69 MBytes  22.6 Mbits/sec
[  4]  19.00-20.00  sec  2.69 MBytes  22.6 Mbits/sec
[  4]  20.00-21.00  sec  2.70 MBytes  22.6 Mbits/sec
[  4]  21.00-22.00  sec  2.70 MBytes  22.7 Mbits/sec
[  4]  22.00-23.00  sec  2.67 MBytes  22.4 Mbits/sec
[  4]  23.00-24.00  sec  2.70 MBytes  22.6 Mbits/sec
[  4]  24.00-25.00  sec  2.71 MBytes  22.7 Mbits/sec
[  4]  25.00-26.01  sec  2.66 MBytes  22.2 Mbits/sec
[  4]  26.01-27.01  sec  2.70 MBytes  22.6 Mbits/sec
[  4]  27.01-28.00  sec  2.65 MBytes  22.3 Mbits/sec
[  4]  28.00-29.00  sec  2.70 MBytes  22.6 Mbits/sec
[  4]  29.00-30.00  sec  2.68 MBytes  22.5 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  82.7 MBytes  23.1 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  80.6 MBytes  22.5 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.1% (1.0%u/1.1%s), remote/sender 0.0% (0.0%u/0.0%s)
```

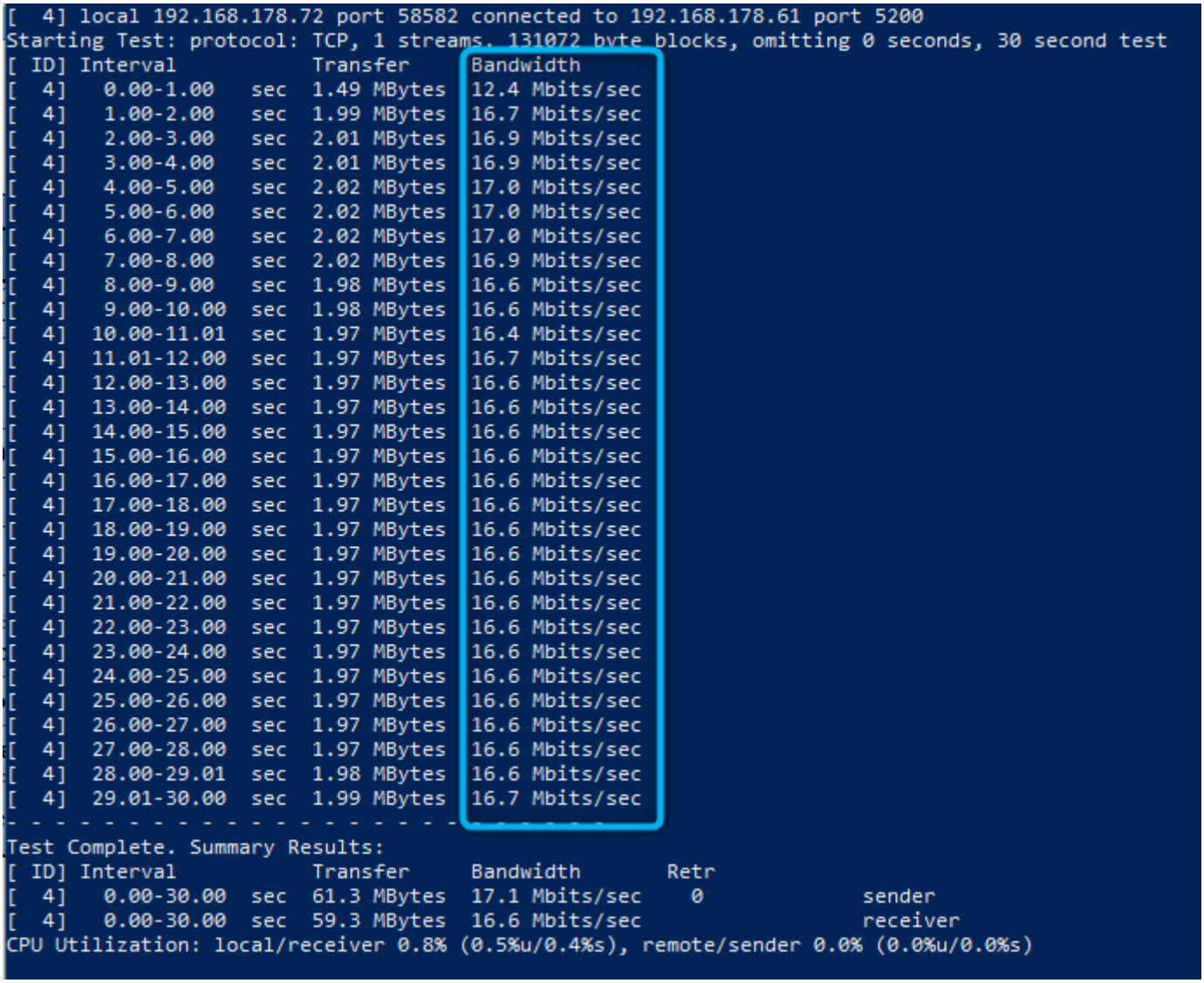
Average used bandwidth : **23.1 Mbit/s of 1000 Mbit/s**

3.3.5 TCP - max Bandwidth with RTT = 100 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V

-c        As Client
-p        Port 5200
-R        Run in Reverse Mode (Server sends, Client receives)
-t        Time in seconds to transmit = 30 s
-V        More detailed output
```



```
[  4] local 192.168.178.72 port 58582 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  1.49 MBytes  12.4 Mbits/sec
[  4]   1.00-2.00   sec  1.99 MBytes  16.7 Mbits/sec
[  4]   2.00-3.00   sec  2.01 MBytes  16.9 Mbits/sec
[  4]   3.00-4.00   sec  2.01 MBytes  16.9 Mbits/sec
[  4]   4.00-5.00   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   5.00-6.00   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   6.00-7.00   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   7.00-8.00   sec  2.02 MBytes  16.9 Mbits/sec
[  4]   8.00-9.00   sec  1.98 MBytes  16.6 Mbits/sec
[  4]   9.00-10.00  sec  1.98 MBytes  16.6 Mbits/sec
[  4]  10.00-11.01  sec  1.97 MBytes  16.4 Mbits/sec
[  4]  11.01-12.00  sec  1.97 MBytes  16.7 Mbits/sec
[  4]  12.00-13.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  13.00-14.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  14.00-15.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  15.00-16.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  16.00-17.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  17.00-18.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  18.00-19.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  19.00-20.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  20.00-21.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  21.00-22.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  22.00-23.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  23.00-24.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  24.00-25.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  25.00-26.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  26.00-27.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  27.00-28.00  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  28.00-29.01  sec  1.98 MBytes  16.6 Mbits/sec
[  4]  29.01-30.00  sec  1.99 MBytes  16.7 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  61.3 MBytes  17.1 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  59.3 MBytes  16.6 Mbits/sec                  receiver
CPU Utilization: local/receiver 0.8% (0.5%u/0.4%s), remote/sender 0.0% (0.0%u/0.0%s)
```

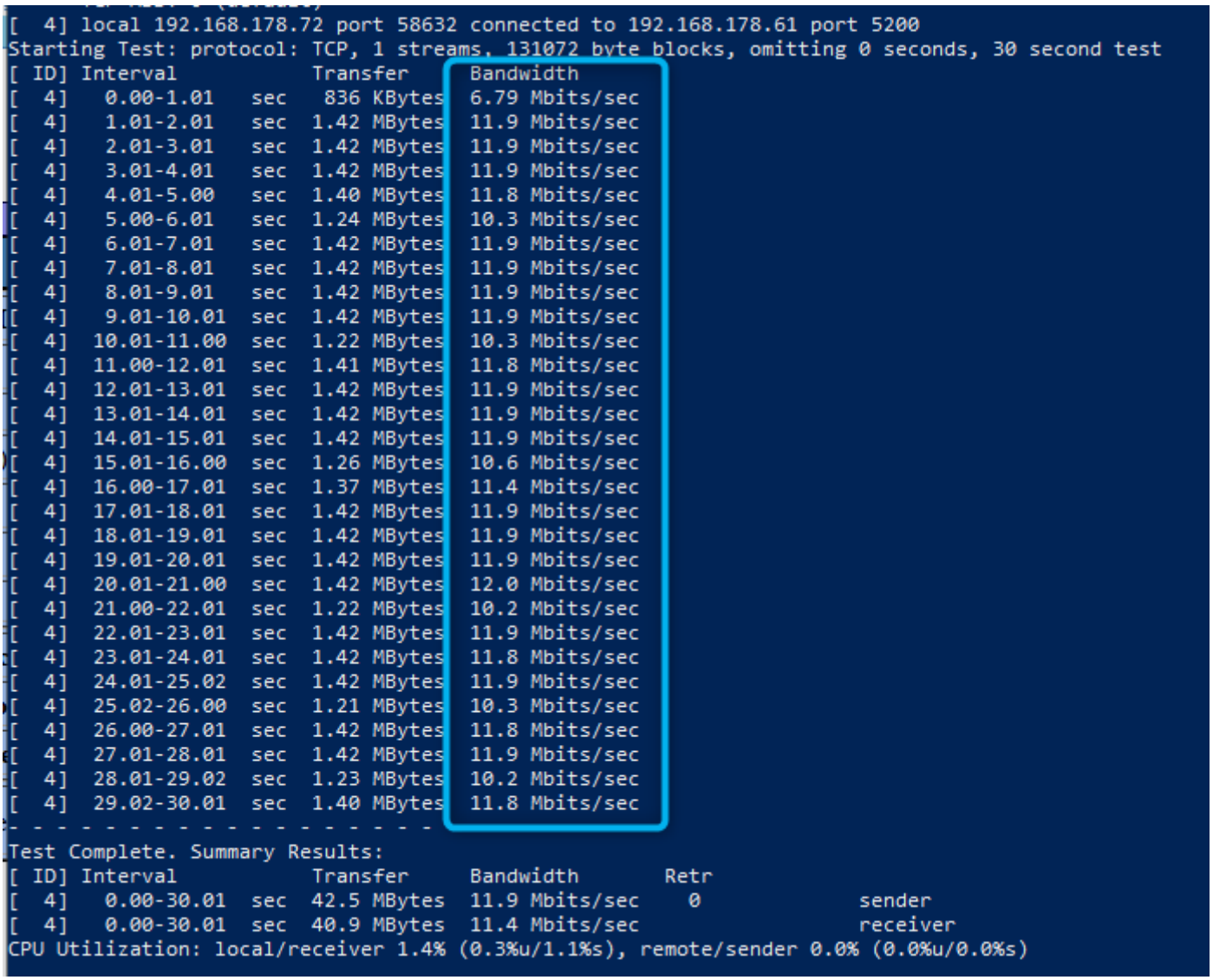
Average used bandwidth : **17.1 Mbit/s of 1000 Mbit/s**

3.3.6 TCP - max Bandwidth with RTT = 150 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V

-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```



```
[  4] local 192.168.178.72 port 58632 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec   836 KBytes  6.79 Mbits/sec
[  4]   1.01-2.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   2.01-3.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   3.01-4.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   4.01-5.00   sec  1.40 MBytes  11.8 Mbits/sec
[  4]   5.00-6.01   sec  1.24 MBytes  10.3 Mbits/sec
[  4]   6.01-7.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   7.01-8.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   8.01-9.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   9.01-10.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  10.01-11.00  sec  1.22 MBytes  10.3 Mbits/sec
[  4]  11.00-12.01  sec  1.41 MBytes  11.8 Mbits/sec
[  4]  12.01-13.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  13.01-14.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  14.01-15.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  15.01-16.00  sec  1.26 MBytes  10.6 Mbits/sec
[  4]  16.00-17.01  sec  1.37 MBytes  11.4 Mbits/sec
[  4]  17.01-18.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  18.01-19.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  19.01-20.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  20.01-21.00  sec  1.42 MBytes  12.0 Mbits/sec
[  4]  21.00-22.01  sec  1.22 MBytes  10.2 Mbits/sec
[  4]  22.01-23.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  23.01-24.01  sec  1.42 MBytes  11.8 Mbits/sec
[  4]  24.01-25.02  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  25.02-26.00  sec  1.21 MBytes  10.3 Mbits/sec
[  4]  26.00-27.01  sec  1.42 MBytes  11.8 Mbits/sec
[  4]  27.01-28.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  28.01-29.02  sec  1.23 MBytes  10.2 Mbits/sec
[  4]  29.02-30.01  sec  1.40 MBytes  11.8 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  42.5 MBytes  11.9 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  40.9 MBytes  11.4 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.4% (0.3%u/1.1%s), remote/sender 0.0% (0.0%u/0.0%s)
```

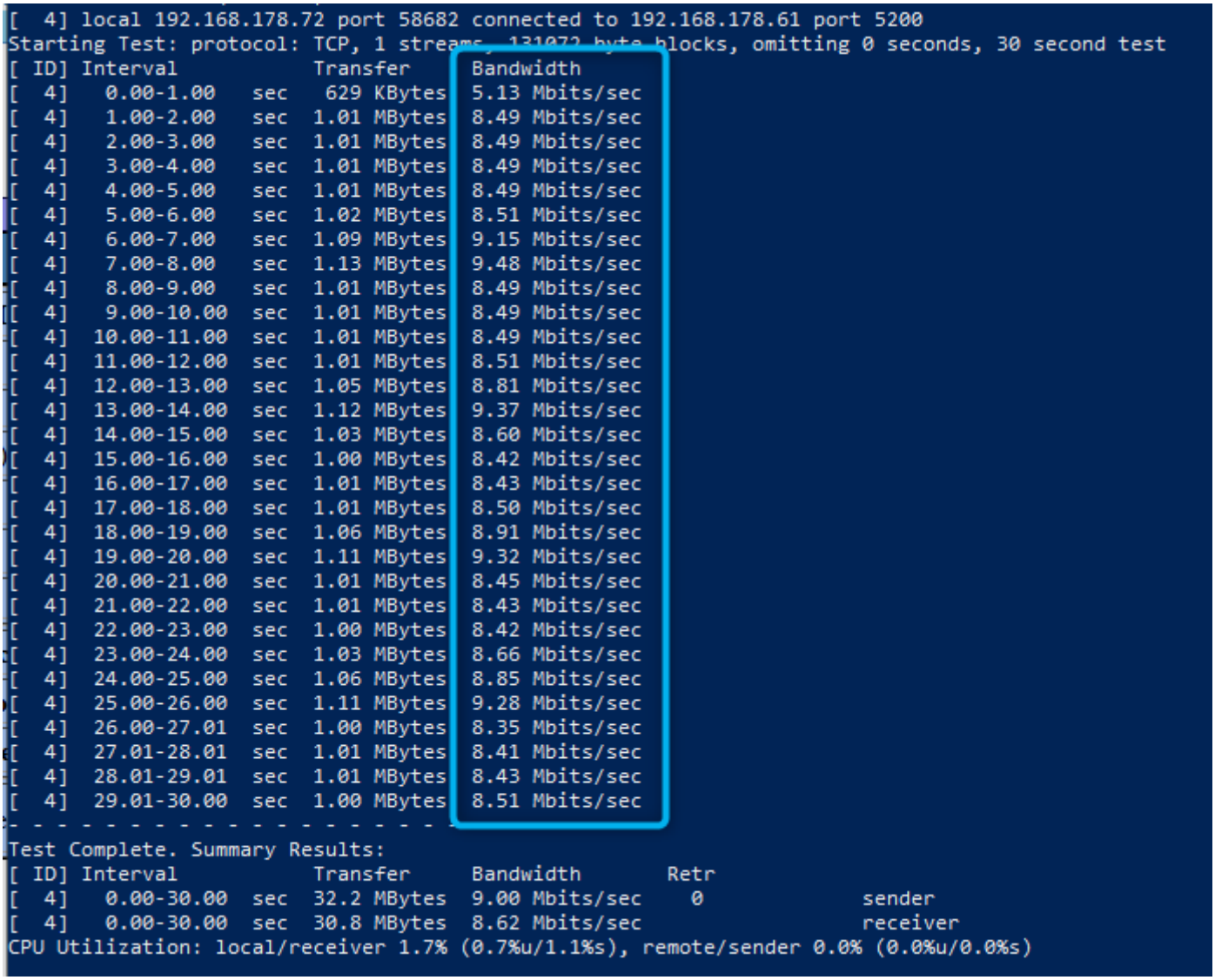
Average used bandwidth : **11.9 Mbit/s of 1000 Mbit/s**

3.3.7 TCP - max Bandwidth with RTT = 200 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```



```
[  4] local 192.168.178.72 port 58682 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec   629 KBytes  5.13 Mbits/sec
[  4]   1.00-2.00   sec  1.01 MBytes  8.49 Mbits/sec
[  4]   2.00-3.00   sec  1.01 MBytes  8.49 Mbits/sec
[  4]   3.00-4.00   sec  1.01 MBytes  8.49 Mbits/sec
[  4]   4.00-5.00   sec  1.01 MBytes  8.49 Mbits/sec
[  4]   5.00-6.00   sec  1.02 MBytes  8.51 Mbits/sec
[  4]   6.00-7.00   sec  1.09 MBytes  9.15 Mbits/sec
[  4]   7.00-8.00   sec  1.13 MBytes  9.48 Mbits/sec
[  4]   8.00-9.00   sec  1.01 MBytes  8.49 Mbits/sec
[  4]   9.00-10.00  sec  1.01 MBytes  8.49 Mbits/sec
[  4]  10.00-11.00  sec  1.01 MBytes  8.49 Mbits/sec
[  4]  11.00-12.00  sec  1.01 MBytes  8.51 Mbits/sec
[  4]  12.00-13.00  sec  1.05 MBytes  8.81 Mbits/sec
[  4]  13.00-14.00  sec  1.12 MBytes  9.37 Mbits/sec
[  4]  14.00-15.00  sec  1.03 MBytes  8.60 Mbits/sec
[  4]  15.00-16.00  sec  1.00 MBytes  8.42 Mbits/sec
[  4]  16.00-17.00  sec  1.01 MBytes  8.43 Mbits/sec
[  4]  17.00-18.00  sec  1.01 MBytes  8.50 Mbits/sec
[  4]  18.00-19.00  sec  1.06 MBytes  8.91 Mbits/sec
[  4]  19.00-20.00  sec  1.11 MBytes  9.32 Mbits/sec
[  4]  20.00-21.00  sec  1.01 MBytes  8.45 Mbits/sec
[  4]  21.00-22.00  sec  1.01 MBytes  8.43 Mbits/sec
[  4]  22.00-23.00  sec  1.00 MBytes  8.42 Mbits/sec
[  4]  23.00-24.00  sec  1.03 MBytes  8.66 Mbits/sec
[  4]  24.00-25.00  sec  1.06 MBytes  8.85 Mbits/sec
[  4]  25.00-26.00  sec  1.11 MBytes  9.28 Mbits/sec
[  4]  26.00-27.01  sec  1.00 MBytes  8.35 Mbits/sec
[  4]  27.01-28.01  sec  1.01 MBytes  8.41 Mbits/sec
[  4]  28.01-29.01  sec  1.01 MBytes  8.43 Mbits/sec
[  4]  29.01-30.00  sec  1.00 MBytes  8.51 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  32.2 MBytes  9.00 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  30.8 MBytes  8.62 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.7% (0.7%u/1.1%s), remote/sender 0.0% (0.0%u/0.0%s)
```

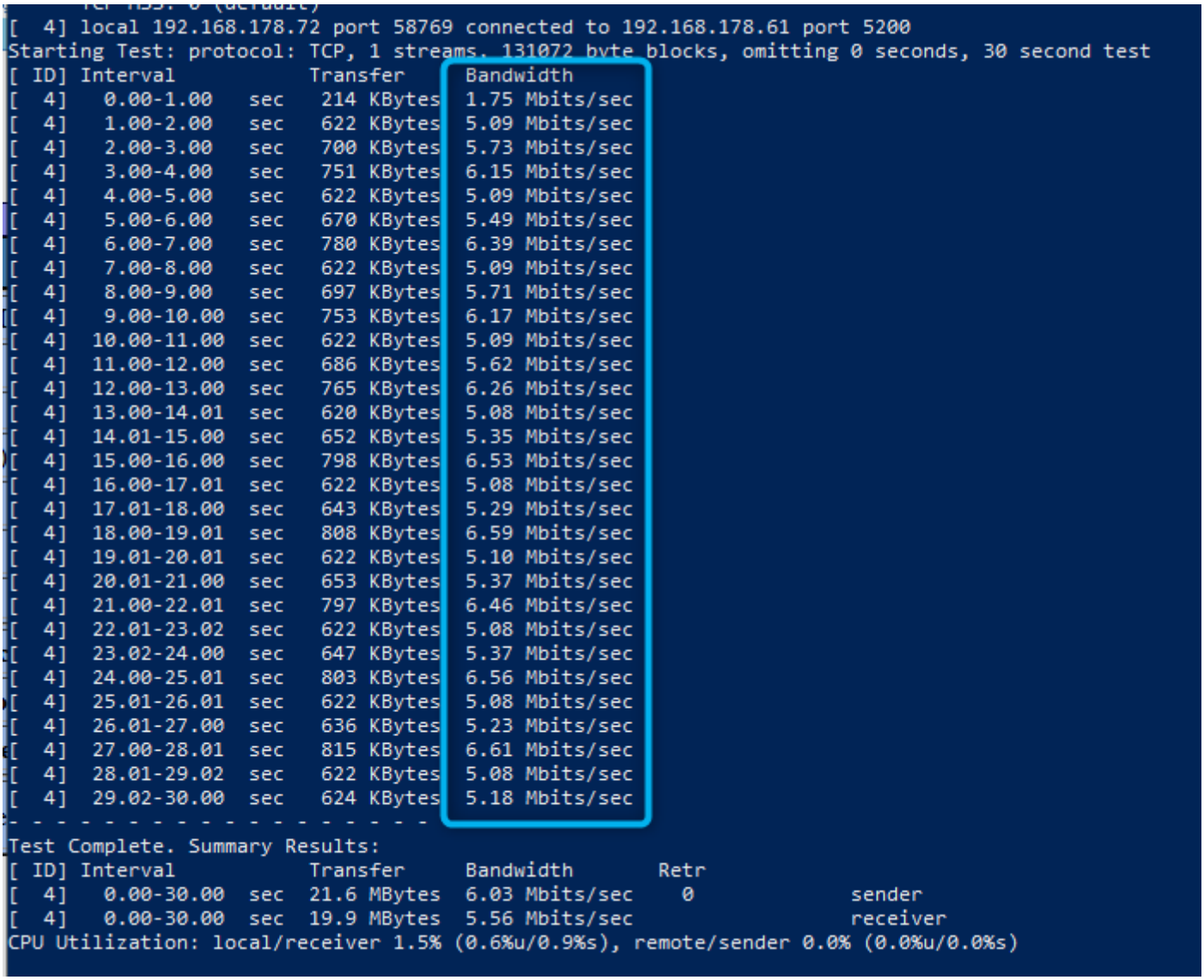
Average used bandwidth : **9 Mbit/s of 1000 Mbit/s**

3.3.8 TCP - max Bandwidth with RTT = 300 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V

-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```



Average used bandwidth : **6.03 Mbit/s of 1000 Mbit/s**

3.3.9 TCP - max Bandwidth with RTT = 400 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```

```
[  4] local 192.168.178.72 port 58808 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  99.8 KBytes   807 Kbits/sec
[  4]   1.01-2.01   sec   322 KBytes  2.64 Mbits/sec
[  4]   2.01-3.01   sec   622 KBytes  5.11 Mbits/sec
[  4]   3.01-4.01   sec   414 KBytes  3.38 Mbits/sec
[  4]   4.01-5.01   sec   622 KBytes  5.09 Mbits/sec
[  4]   5.01-6.01   sec   415 KBytes  3.40 Mbits/sec
[  4]   6.01-7.01   sec   622 KBytes  5.09 Mbits/sec
[  4]   7.01-8.01   sec   415 KBytes  3.40 Mbits/sec
[  4]   8.01-9.01   sec   622 KBytes  5.09 Mbits/sec
[  4]   9.01-10.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  10.01-11.01  sec   622 KBytes  5.09 Mbits/sec
[  4]  11.01-12.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  12.01-13.01  sec   418 KBytes  3.42 Mbits/sec
[  4]  13.01-14.01  sec   619 KBytes  5.06 Mbits/sec
[  4]  14.01-15.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  15.01-16.01  sec   622 KBytes  5.09 Mbits/sec
[  4]  16.01-17.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  17.01-18.01  sec   622 KBytes  5.09 Mbits/sec
[  4]  18.01-19.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  19.01-20.01  sec   622 KBytes  5.09 Mbits/sec
[  4]  20.01-21.02  sec   414 KBytes  3.37 Mbits/sec
[  4]  21.02-22.00  sec   573 KBytes  4.77 Mbits/sec
[  4]  22.00-23.01  sec   462 KBytes  3.78 Mbits/sec
[  4]  23.01-24.00  sec   443 KBytes  3.65 Mbits/sec
[  4]  24.00-25.01  sec   592 KBytes  4.80 Mbits/sec
[  4]  25.01-26.02  sec   413 KBytes  3.38 Mbits/sec
[  4]  26.02-27.00  sec   622 KBytes  5.16 Mbits/sec
[  4]  27.00-28.00  sec   415 KBytes  3.39 Mbits/sec
[  4]  28.00-29.01  sec   622 KBytes  5.06 Mbits/sec
[  4]  29.01-30.01  sec   415 KBytes  3.39 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  16.2 MBytes  4.54 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  14.6 MBytes  4.09 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.3% (0.3%u/0.9%s), remote/sender 0.0% (0.0%u/0.0%s)
```

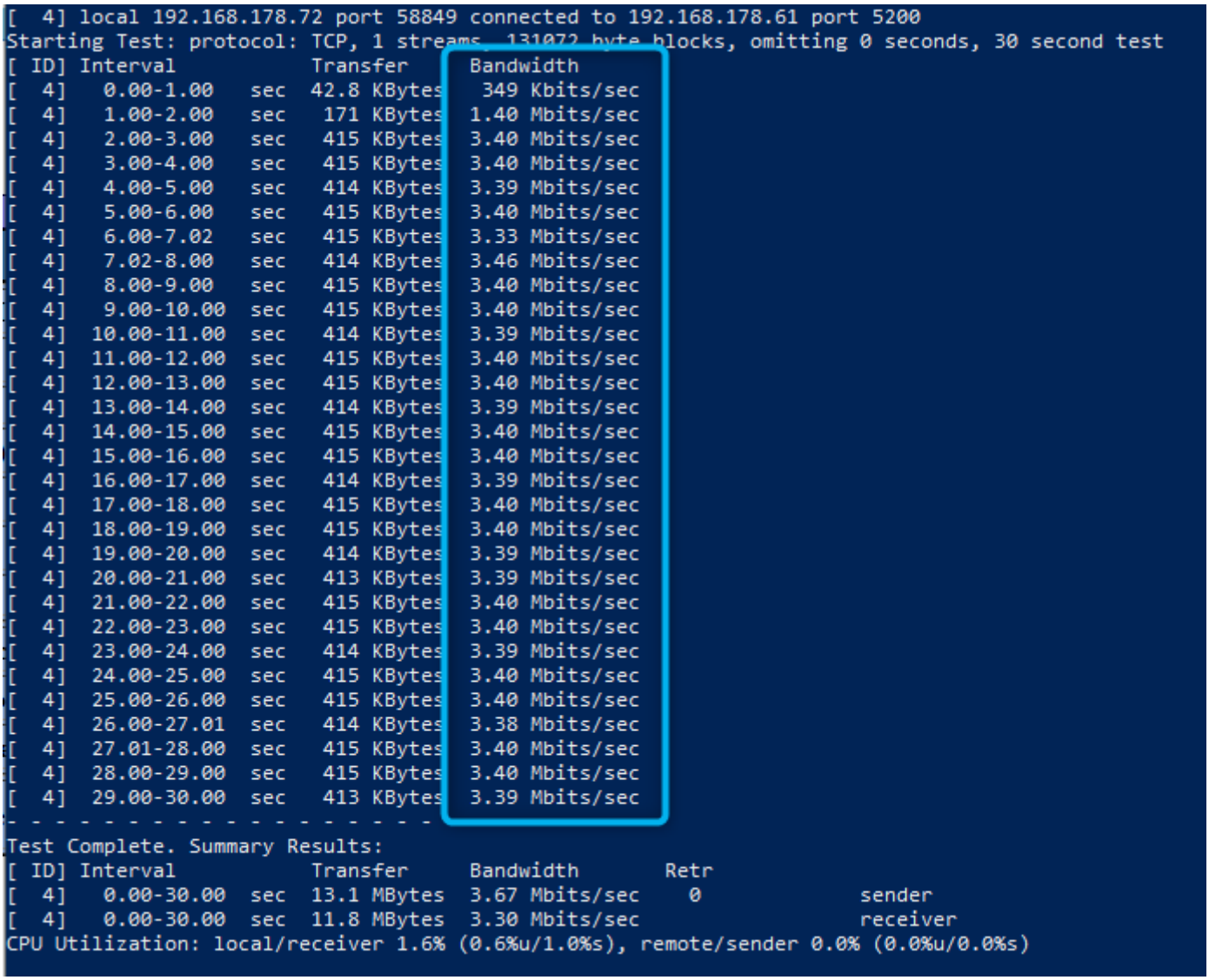
Average used bandwidth : **4.54 Mbit/s of 1000 Mbit/s**

3.3.10 TCP - max Bandwidth with RTT = 500 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```



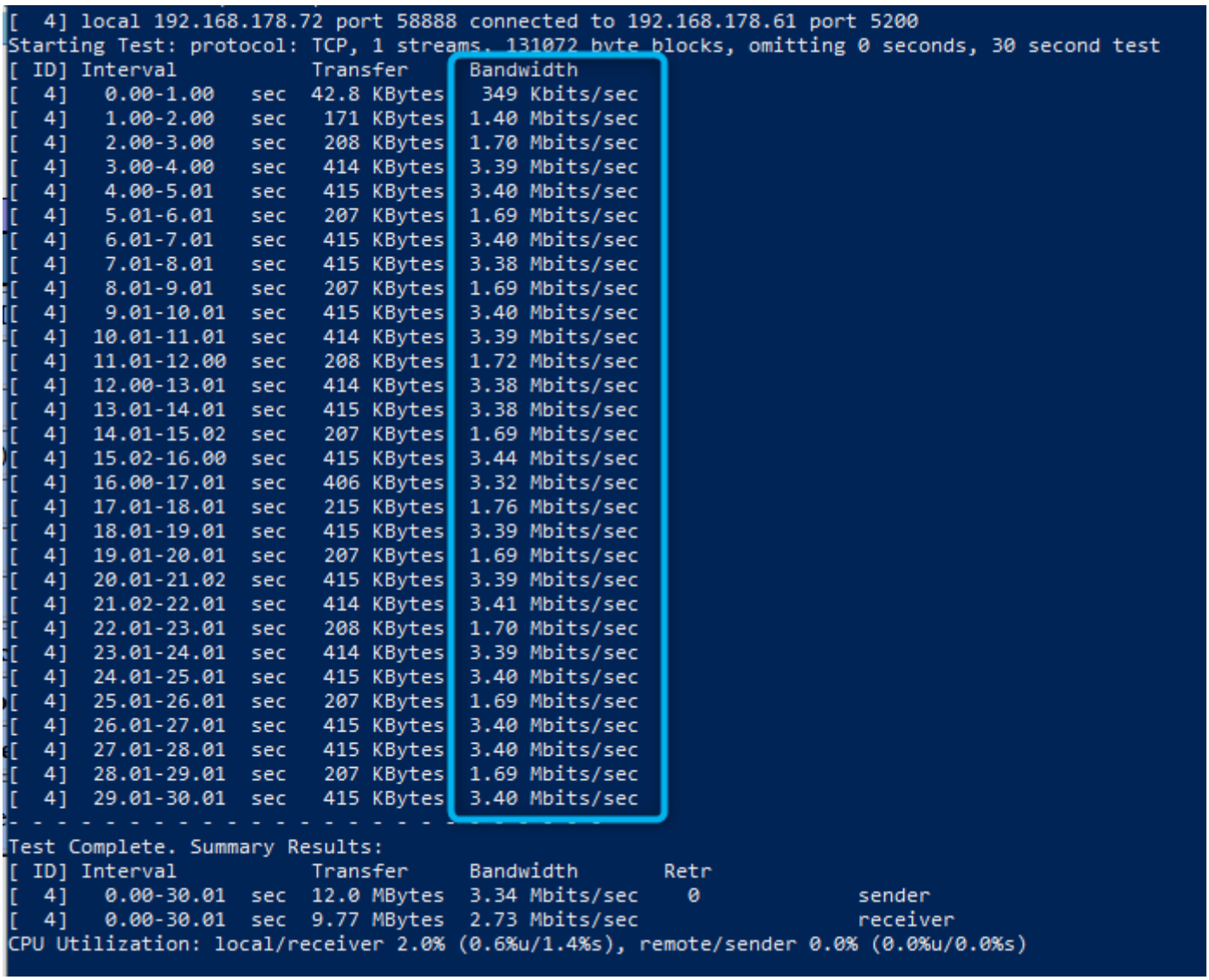
Average used bandwidth : **3.67 Mbit/s of 1000 Mbit/s**

3.3.11 TCP - max Bandwidth with RTT = 600 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```



```
[  4] local 192.168.178.72 port 58888 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  42.8 KBytes   349 Kbits/sec
[  4]   1.00-2.00   sec   171 KBytes  1.40 Mbits/sec
[  4]   2.00-3.00   sec   208 KBytes  1.70 Mbits/sec
[  4]   3.00-4.00   sec   414 KBytes  3.39 Mbits/sec
[  4]   4.00-5.01   sec   415 KBytes  3.40 Mbits/sec
[  4]   5.01-6.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   6.01-7.01   sec   415 KBytes  3.40 Mbits/sec
[  4]   7.01-8.01   sec   415 KBytes  3.38 Mbits/sec
[  4]   8.01-9.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   9.01-10.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  10.01-11.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  11.01-12.00  sec   208 KBytes  1.72 Mbits/sec
[  4]  12.00-13.01  sec   414 KBytes  3.38 Mbits/sec
[  4]  13.01-14.01  sec   415 KBytes  3.38 Mbits/sec
[  4]  14.01-15.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  15.02-16.00  sec   415 KBytes  3.44 Mbits/sec
[  4]  16.00-17.01  sec   406 KBytes  3.32 Mbits/sec
[  4]  17.01-18.01  sec   215 KBytes  1.76 Mbits/sec
[  4]  18.01-19.01  sec   415 KBytes  3.39 Mbits/sec
[  4]  19.01-20.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  20.01-21.02  sec   415 KBytes  3.39 Mbits/sec
[  4]  21.02-22.01  sec   414 KBytes  3.41 Mbits/sec
[  4]  22.01-23.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  23.01-24.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  24.01-25.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  25.01-26.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  26.01-27.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  27.01-28.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  28.01-29.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  29.01-30.01  sec   415 KBytes  3.40 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  12.0 MBytes  3.34 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  9.77 MBytes  2.73 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.0% (0.6%u/1.4%s), remote/sender 0.0% (0.0%u/0.0%s)
```

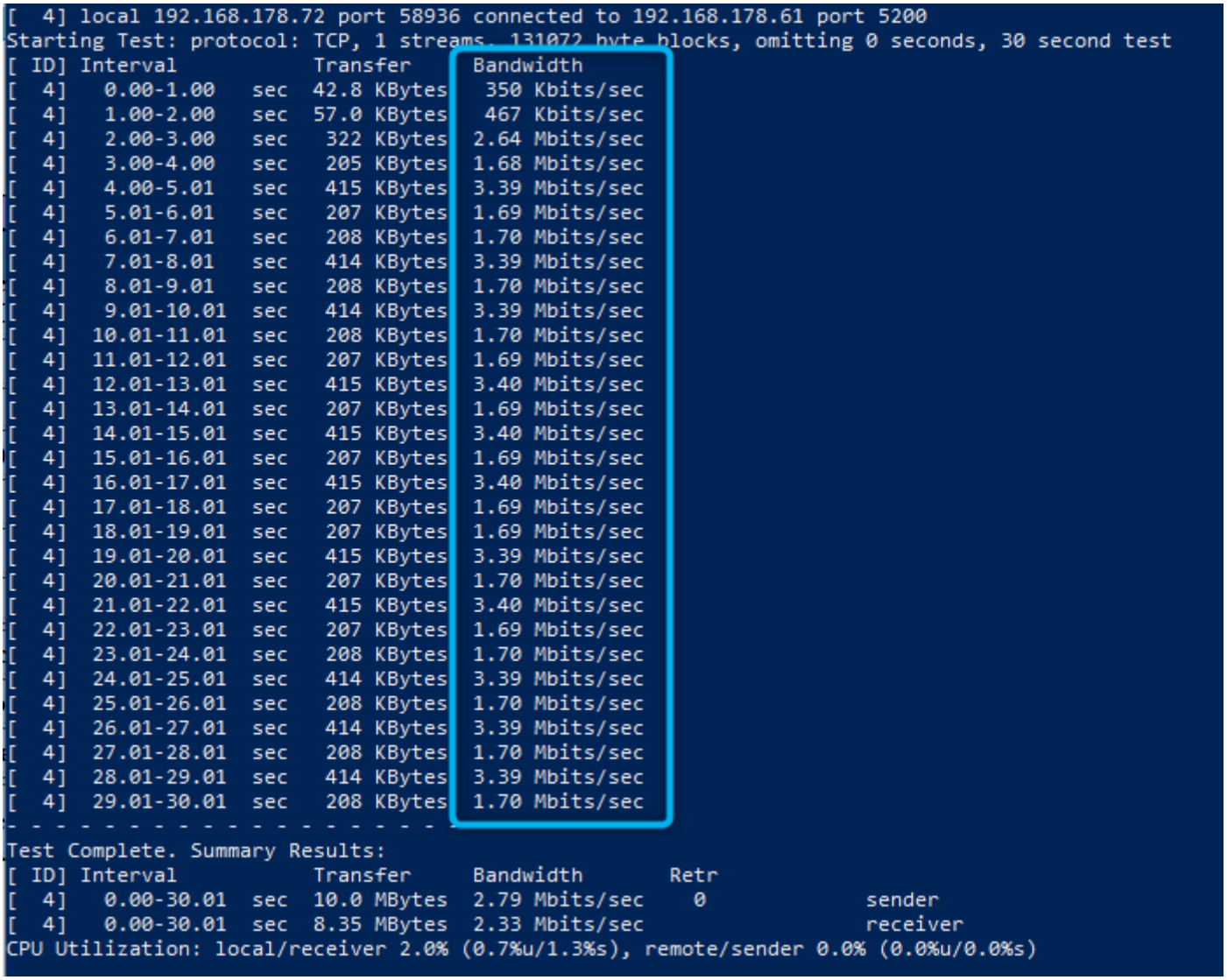
Average used bandwidth : **3.34 Mbit/s of 1000 Mbit/s**

3.3.12 TCP - max Bandwidth with RTT = 700 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```



```
[  4] local 192.168.178.72 port 58936 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  42.8 KBytes   350 Kbits/sec
[  4]   1.00-2.00   sec  57.0 KBytes   467 Kbits/sec
[  4]   2.00-3.00   sec   322 KBytes  2.64 Mbits/sec
[  4]   3.00-4.00   sec   205 KBytes  1.68 Mbits/sec
[  4]   4.00-5.01   sec   415 KBytes  3.39 Mbits/sec
[  4]   5.01-6.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   6.01-7.01   sec   208 KBytes  1.70 Mbits/sec
[  4]   7.01-8.01   sec   414 KBytes  3.39 Mbits/sec
[  4]   8.01-9.01   sec   208 KBytes  1.70 Mbits/sec
[  4]   9.01-10.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  10.01-11.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  11.01-12.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  12.01-13.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  13.01-14.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  14.01-15.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  15.01-16.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  16.01-17.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  17.01-18.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  18.01-19.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  19.01-20.01  sec   415 KBytes  3.39 Mbits/sec
[  4]  20.01-21.01  sec   207 KBytes  1.70 Mbits/sec
[  4]  21.01-22.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  22.01-23.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  23.01-24.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  24.01-25.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  25.01-26.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  26.01-27.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  27.01-28.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  28.01-29.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  29.01-30.01  sec   208 KBytes  1.70 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  10.0 MBytes  2.79 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  8.35 MBytes  2.33 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.0% (0.7%u/1.3%s), remote/sender 0.0% (0.0%u/0.0%s)
```

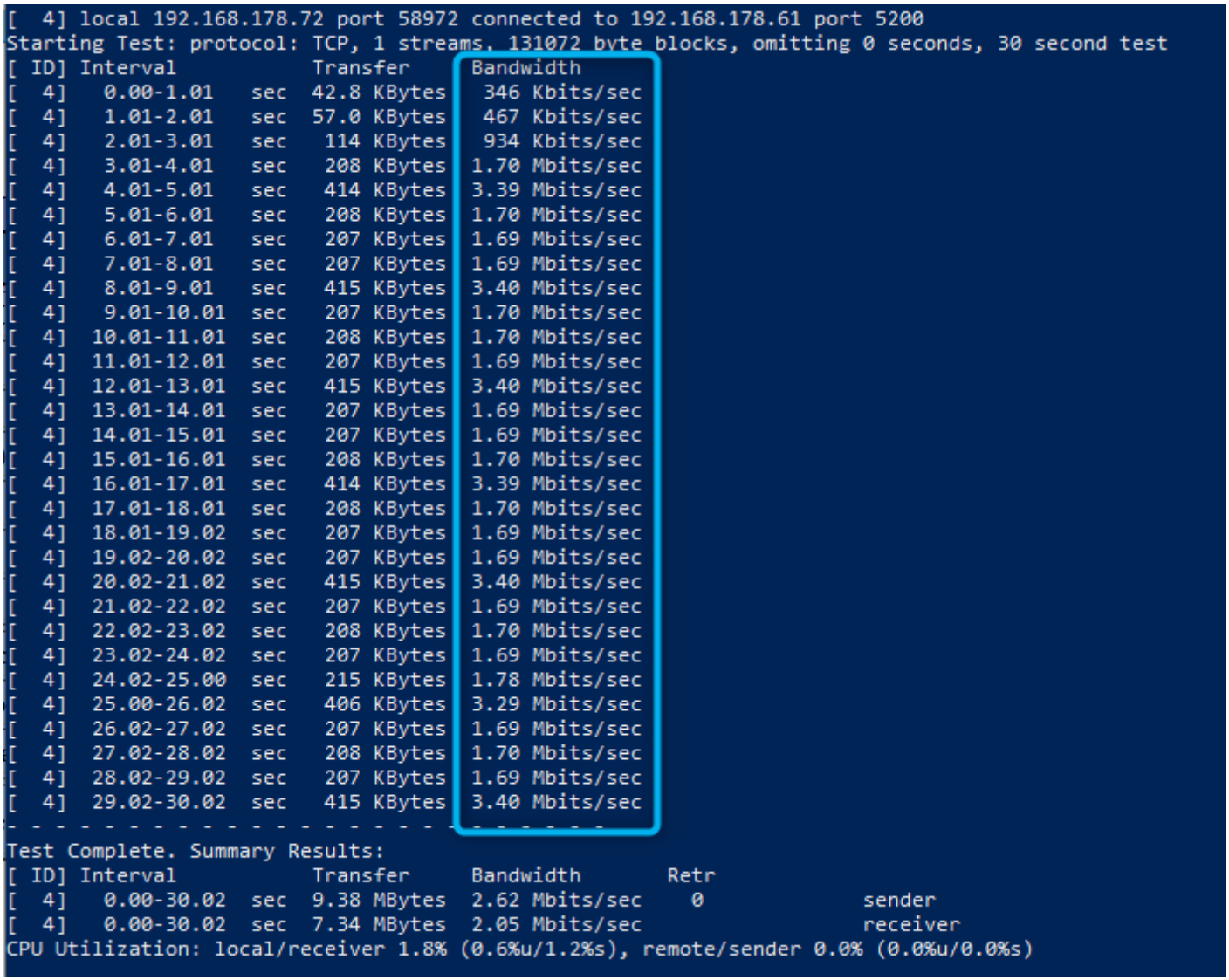
Average used bandwidth : **2.79 Mbit/s of 1000 Mbit/s**

3.3.13 TCP - max Bandwidth with RTT = 800 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```



```
[  4] local 192.168.178.72 port 58972 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  42.8 KBytes   346 Kbits/sec
[  4]   1.01-2.01   sec  57.0 KBytes   467 Kbits/sec
[  4]   2.01-3.01   sec   114 KBytes   934 Kbits/sec
[  4]   3.01-4.01   sec   208 KBytes  1.70 Mbits/sec
[  4]   4.01-5.01   sec   414 KBytes  3.39 Mbits/sec
[  4]   5.01-6.01   sec   208 KBytes  1.70 Mbits/sec
[  4]   6.01-7.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   7.01-8.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   8.01-9.01   sec   415 KBytes  3.40 Mbits/sec
[  4]   9.01-10.01  sec   207 KBytes  1.70 Mbits/sec
[  4]  10.01-11.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  11.01-12.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  12.01-13.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  13.01-14.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  14.01-15.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  15.01-16.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  16.01-17.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  17.01-18.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  18.01-19.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  19.02-20.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  20.02-21.02  sec   415 KBytes  3.40 Mbits/sec
[  4]  21.02-22.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  22.02-23.02  sec   208 KBytes  1.70 Mbits/sec
[  4]  23.02-24.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  24.02-25.00  sec   215 KBytes  1.78 Mbits/sec
[  4]  25.00-26.02  sec   406 KBytes  3.29 Mbits/sec
[  4]  26.02-27.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  27.02-28.02  sec   208 KBytes  1.70 Mbits/sec
[  4]  28.02-29.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  29.02-30.02  sec   415 KBytes  3.40 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.02  sec  9.38 MBytes  2.62 Mbits/sec    0             sender
[  4]   0.00-30.02  sec  7.34 MBytes  2.05 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.8% (0.6%u/1.2%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used bandwidth : **2.62 Mbit/s of 1000 Mbit/s**

3.3.14 TCP - max Bandwidth with RTT = 900 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```

```
[  4] local 192.168.178.72 port 59011 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.02   sec  42.8 KBytes   345 Kbits/sec
[  4]   1.02-2.02   sec  57.0 KBytes   467 Kbits/sec
[  4]   2.02-3.01   sec   114 KBytes   943 Kbits/sec
[  4]   3.01-4.02   sec   208 KBytes  1.69 Mbits/sec
[  4]   4.02-5.02   sec   207 KBytes  1.69 Mbits/sec
[  4]   5.02-6.02   sec   207 KBytes  1.69 Mbits/sec
[  4]   6.02-7.02   sec   208 KBytes  1.70 Mbits/sec
[  4]   7.02-8.02   sec   205 KBytes  1.68 Mbits/sec
[  4]   8.02-9.02   sec   208 KBytes  1.70 Mbits/sec
[  4]   9.02-10.02  sec   414 KBytes  3.39 Mbits/sec
[  4]  10.02-11.02  sec   208 KBytes  1.70 Mbits/sec
[  4]  11.02-12.01  sec   207 KBytes  1.71 Mbits/sec
[  4]  12.01-13.01  sec   207 KBytes  1.68 Mbits/sec
[  4]  13.01-14.02  sec   208 KBytes  1.70 Mbits/sec
[  4]  14.02-15.00  sec   207 KBytes  1.72 Mbits/sec
[  4]  15.00-16.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  16.01-17.01  sec   208 KBytes  1.69 Mbits/sec
[  4]  17.01-18.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  18.01-19.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  19.02-20.00  sec   415 KBytes  3.44 Mbits/sec
[  4]  20.00-21.01  sec   207 KBytes  1.68 Mbits/sec
[  4]  21.01-22.01  sec   208 KBytes  1.71 Mbits/sec
[  4]  22.01-23.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  23.01-24.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  24.01-25.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  25.01-26.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  26.01-27.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  27.01-28.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  28.01-29.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  29.01-30.01  sec   415 KBytes  3.40 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  8.34 MBytes  2.33 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  6.53 MBytes  1.83 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.5% (1.0%u/1.5%s), remote/sender 0.0% (0.0%u/0.0%s)
```

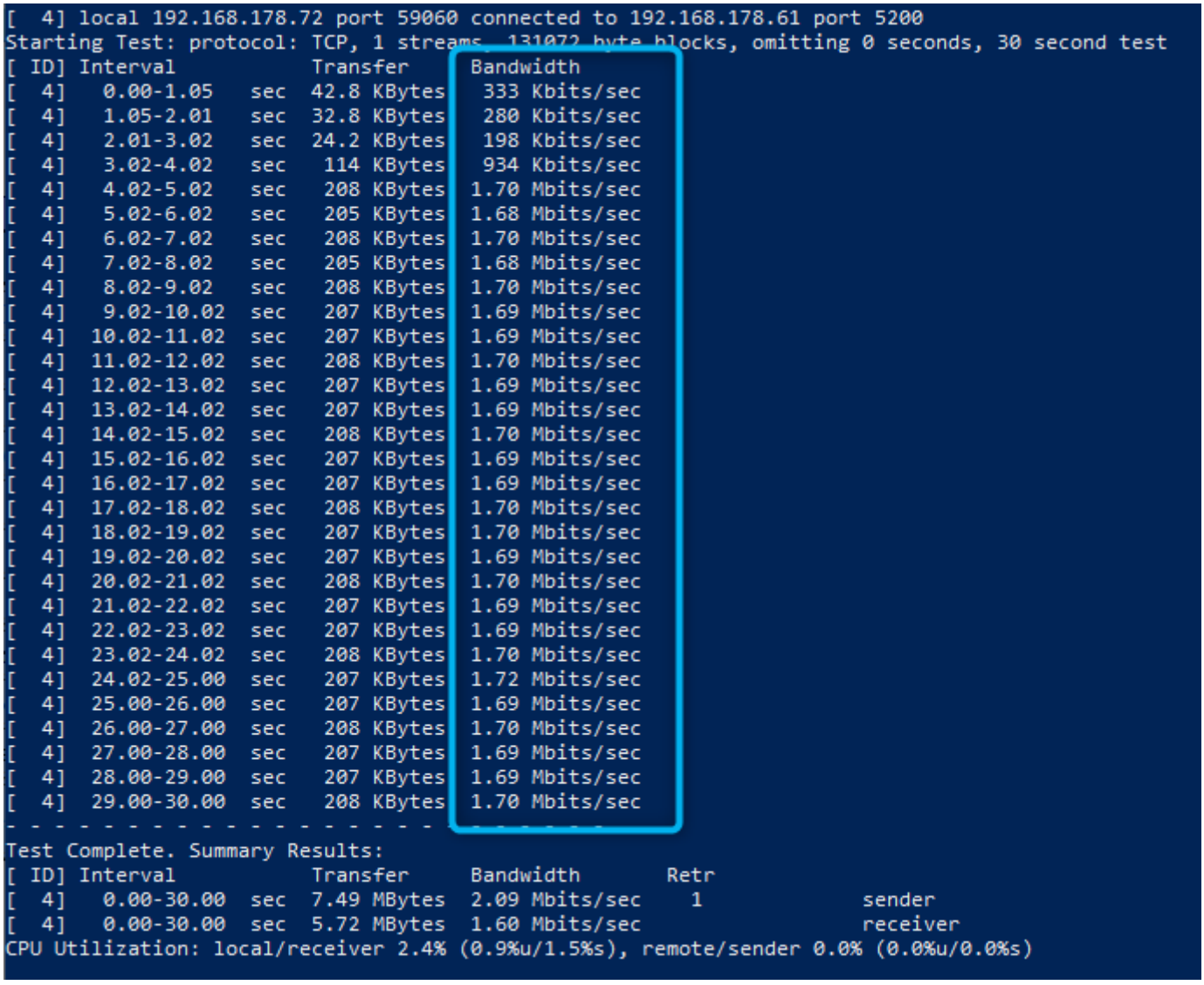
Average used bandwidth : **2.33 Mbit/s of 1000 Mbit/s**

3.3.15 TCP - max Bandwidth with RTT = 1000 ms

Starting iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

```
-c          As Client
-p          Port 5200
-R          Run in Reverse Mode (Server sends, Client receives)
-t          Time in seconds to transmit = 30 s
-V          More detailed output
```

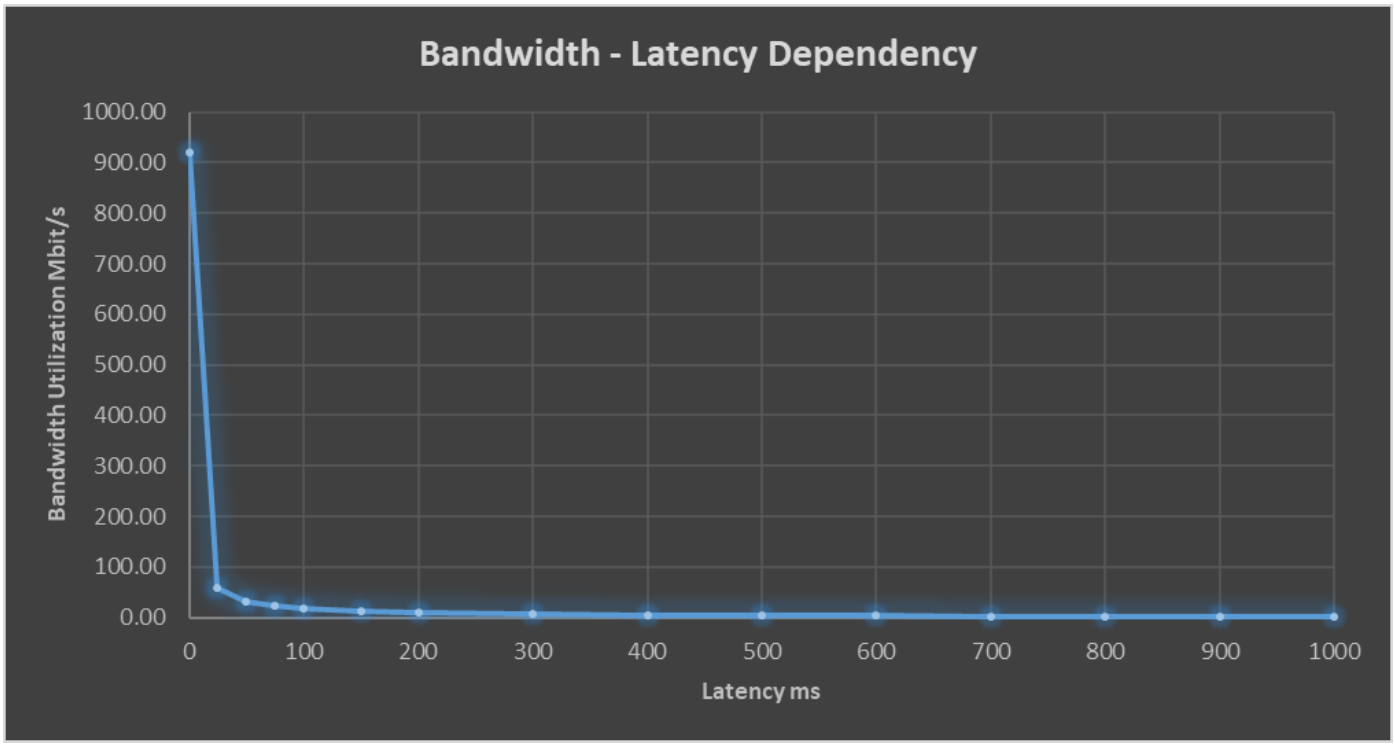


```
[  4] local 192.168.178.72 port 59060 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.05   sec  42.8 KBytes   333 Kbits/sec
[  4]   1.05-2.01   sec  32.8 KBytes   280 Kbits/sec
[  4]   2.01-3.02   sec  24.2 KBytes   198 Kbits/sec
[  4]   3.02-4.02   sec   114 KBytes   934 Kbits/sec
[  4]   4.02-5.02   sec   208 KBytes  1.70 Mbits/sec
[  4]   5.02-6.02   sec   205 KBytes  1.68 Mbits/sec
[  4]   6.02-7.02   sec   208 KBytes  1.70 Mbits/sec
[  4]   7.02-8.02   sec   205 KBytes  1.68 Mbits/sec
[  4]   8.02-9.02   sec   208 KBytes  1.70 Mbits/sec
[  4]   9.02-10.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  10.02-11.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  11.02-12.02  sec   208 KBytes  1.70 Mbits/sec
[  4]  12.02-13.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  13.02-14.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  14.02-15.02  sec   208 KBytes  1.70 Mbits/sec
[  4]  15.02-16.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  16.02-17.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  17.02-18.02  sec   208 KBytes  1.70 Mbits/sec
[  4]  18.02-19.02  sec   207 KBytes  1.70 Mbits/sec
[  4]  19.02-20.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  20.02-21.02  sec   208 KBytes  1.70 Mbits/sec
[  4]  21.02-22.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  22.02-23.02  sec   207 KBytes  1.69 Mbits/sec
[  4]  23.02-24.02  sec   208 KBytes  1.70 Mbits/sec
[  4]  24.02-25.00  sec   207 KBytes  1.72 Mbits/sec
[  4]  25.00-26.00  sec   207 KBytes  1.69 Mbits/sec
[  4]  26.00-27.00  sec   208 KBytes  1.70 Mbits/sec
[  4]  27.00-28.00  sec   207 KBytes  1.69 Mbits/sec
[  4]  28.00-29.00  sec   207 KBytes  1.69 Mbits/sec
[  4]  29.00-30.00  sec   208 KBytes  1.70 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  7.49 MBytes  2.09 Mbits/sec    1             sender
[  4]   0.00-30.00  sec  5.72 MBytes  1.60 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.4% (0.9%u/1.5%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used bandwidth : **2.09 Mbit/s of 1000 Mbit/s**

3.3.16 Benchmark Summary

Latency ms	TCP Bandwidth Utilization of 1 Gbit/s	%
1	920.00	**92.0%**
25	58.50	**5.9%**
50	31.10	**3.1%**
75	24.10	**2.3%**
100	17.10	**1.7%**
150	11.90	**1.2%**
200	9.00	**0.9%**
300	6.03	**0.6%**
400	4.54	**0.5%**
500	3.67	**0.4%**
600	3.34	**0.3%**
700	2.79	**0.3%**
800	2.62	**0.3%**
900	2.33	**0.2%**
1000	2.09	**0.2%**



3.4 HTTP-QuSS - http | FTP | VoIP | Media Streaming | ...

Please Note:

Due to Hardware Restrictions, Network Congestion, Processor and Timer Inaccuracy a lossless Data Transmission for this Test Scenario was only possible upto 700 Mbit/s

Sending 1000 HTTP-QuSS UDP Packages
Available Bandwidth : 700 Mbit/s

Delay

Latency = 1 - 1000 ms
Jitter = 0 ms
Correlation = 0 ms

Loss

Loss = 0 %
Correlation = 0 ms

Bandwidth

700 Mbit/s

Packet Reordering

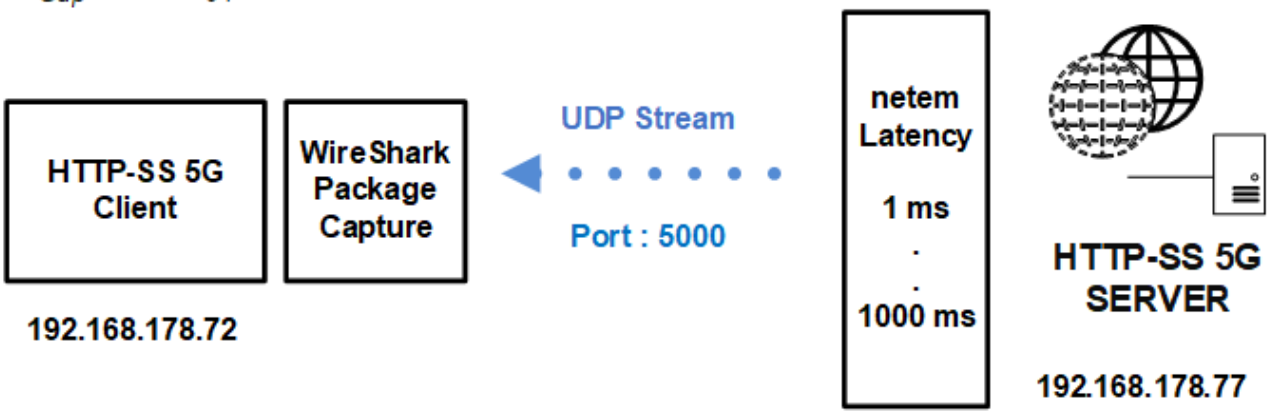
Reordering = 0 %
Correlation = 0 %
Gap = 0 P

Duplication

Duplication = 0 %
Correlation = 0 ms

Corruption

0 %



3.4.1 HTTP-QuSS - Lossless used Bandwidth with RTT = 1 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit<1ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.020	0.020	—
Average pps	51119.5	51119.5	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	77 M	77 M	—
Average bits/s	619 M	619 M	—

Lossless used Bandwidth: **619 Mbit/s of 700 Mbit/s**

3.4.2 HTTP-QuSS - Lossless used Bandwidth with RTT = 25 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=25ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=25ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=25ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=25ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.017	0.017	—
Average pps	57813.4	57813.4	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	87 M	87 M	—
Average bits/s	700 M	700 M	—

Lossless used Bandwidth: **700 Mbit/s of 700 Mbit/s**

3.4.3 HTTP-QuSS - Lossless used Bandwidth with RTT = 50 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=50ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.017	0.017	—
Average pps	57813.4	57813.4	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	87 M	87 M	—
Average bits/s	700 M	700 M	—

Lossless used Bandwidth: **700 Mbit/s of 700 Mbit/s**

3.4.4 HTTP-QuSS - Lossless used Bandwidth with RTT = 75 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=75ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=75ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=75ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=75ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.020	0.020	—
Average pps	50510.0	50510.0	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	76 M	76 M	—
Average bits/s	611 M	611 M	—

Lossless used Bandwidth: **611 Mbit/s of 700 Mbit/s**

3.4.5 HTTP-QuSS - Lossless used Bandwidth with RTT = 100 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=100ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=100ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=100ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=100ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.018	0.018	—
Average pps	56398.6	56398.6	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	85 M	85 M	—
Average bits/s	683 M	683 M	—

Lossless used Bandwidth: **683 Mbit/s of 700 Mbit/s**

3.4.6 HTTP-QuSS - Lossless used Bandwidth with RTT = 150 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=150ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=150ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=150ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=150ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.018	0.018	—
Average pps	56660.6	56660.6	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	85 M	85 M	—
Average bits/s	686 M	686 M	—

Lossless used Bandwidth: **686 Mbit/s of 700 Mbit/s**

3.4.7 HTTP-QuSS - Lossless used Bandwidth with RTT = 200 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=200ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=200ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=200ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=200ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.020	0.020	—
Average pps	49714.4	49714.4	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	75 M	75 M	—
Average bits/s	602 M	602 M	—

Lossless used Bandwidth: **602 Mbit/s of 700 Mbit/s**

3.4.8 HTTP-QuSS - Lossless used Bandwidth with RTT = 300 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=300ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=300ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=300ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=300ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.018	0.018	—
Average pps	54942.4	54942.4	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	83 M	83 M	—
Average bits/s	665 M	665 M	—

Lossless used Bandwidth: **665 Mbit/s of 700 Mbit/s**

3.4.9 HTTP-QuSS - Lossless used Bandwidth with RTT = 400 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=400ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=400ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=400ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=400ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.019	0.019	—
Average pps	54009.9	54009.9	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	81 M	81 M	—
Average bits/s	654 M	654 M	—

Lossless used Bandwidth: **654 Mbit/s of 700 Mbit/s**

3.4.10 HTTP-QuSS - Lossless used Bandwidth with RTT = 500 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=500ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=500ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=500ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=500ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.019	0.019	—
Average pps	53731.8	53731.8	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	81 M	81 M	—
Average bits/s	650 M	650 M	—

Lossless used Bandwidth: **650 Mbit/s of 700 Mbit/s**

3.4.11 HTTP-QuSS - Lossless used Bandwidth with RTT = 600 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=600ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.021	0.021	—
Average pps	47739.6	47739.6	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	72 M	72 M	—
Average bits/s	578 M	578 M	—

Lossless used Bandwidth: **578 Mbit/s of 700 Mbit/s**

3.4.12 HTTP-QuSS - Lossless used Bandwidth with RTT = 700 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=700ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=700ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=700ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=700ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.020	0.020	—
Average pps	51080.3	51080.3	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	77 M	77 M	—
Average bits/s	618 M	618 M	—

Lossless used Bandwidth: **618 Mbit/s of 700 Mbit/s**

3.4.13 HTTP-QuSS - Lossless used Bandwidth with RTT = 800 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=800ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=800ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=800ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=800ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.018	0.018	—
Average pps	55282.0	55282.0	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	83 M	83 M	—
Average bits/s	669 M	669 M	—

Lossless used Bandwidth: **669 Mbit/s of 700 Mbit/s**

3.4.14 HTTP-QuSS - Lossless used Bandwidth with RTT = 900 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=900ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=900ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=900ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=900ms TTL=64
```

Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.018	0.018	—
Average pps	55008.0	55008.0	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	83 M	83 M	—
Average bits/s	666 M	666 M	—

Lossless used Bandwidth: **666 Mbit/s of 700 Mbit/s**

3.4.15 HTTP-QuSS - Lossless used Bandwidth with RTT = 1000 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit=1000ms TTL=64
```

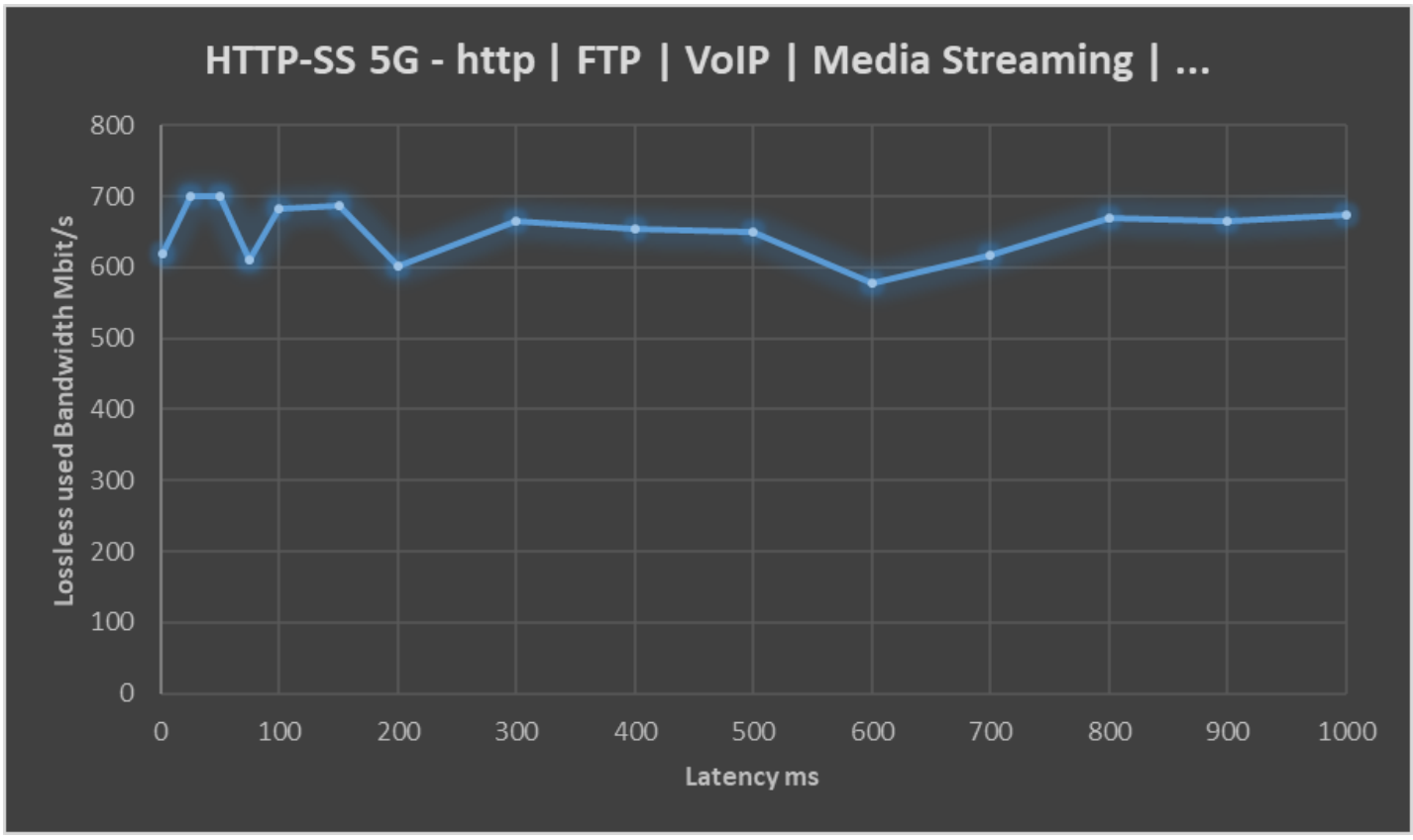
Statistics

Measurement	Captured	Displayed	Marked
Packets	1000	1000 (100.0%)	—
Time span, s	0.018	0.018	—
Average pps	55564.7	55564.7	—
Average packet size, B	1514	1514	—
Bytes	1514000	1514000 (100.0%)	0
Average bytes/s	84 M	84 M	—
Average bits/s	673 M	673 M	—

Lossless used Bandwidth: **673 Mbit/s of 700 Mbit/s**

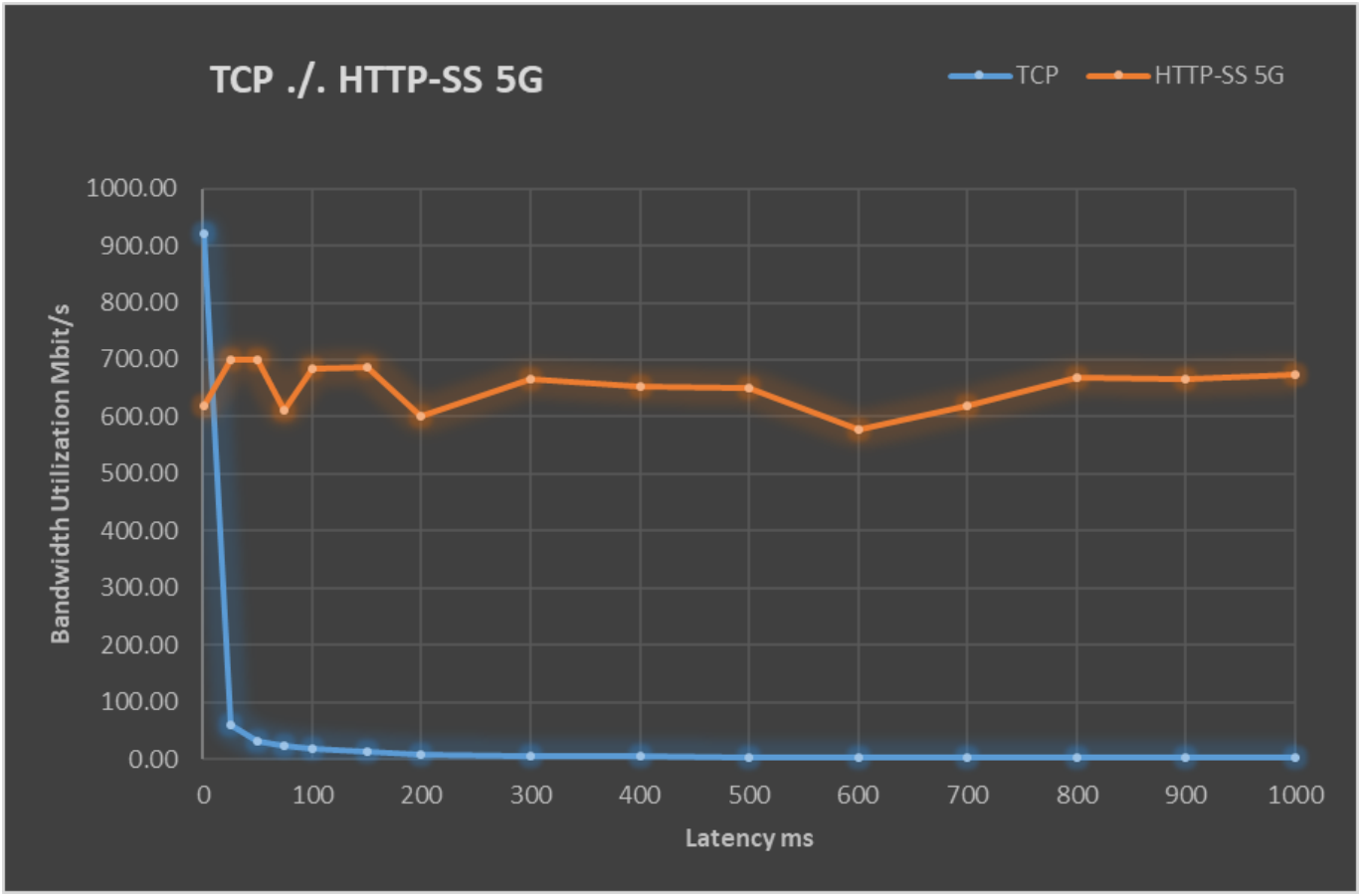
3.4.17 Benchmark Summary

	HTTP-QuSS http | ftp | VoIP | | Media Streaming |	
Latency ms	Lossless used Bandwidth of 700 Mbit/s	%
1	619.00	**88.4%**
25	700.00	**100.0%**
50	700.00	**100.0%**
75	611.00	**87.3%**
100	683.00	**97.6%**
150	686.00	**98.0%**
200	602.00	**86.0%**
300	665.00	**95.0%**
400	654.00	**93.4%**
500	650.00	**92.9%**
600	578.00	**82.6%**
700	618.00	**88.3%**
800	669.00	**95.6%**
900	666.00	**95.1%**
1000	673.00	**96.1%**



3.4.18 Bandwidth Utilization TCP ./. HTTP-QuSS

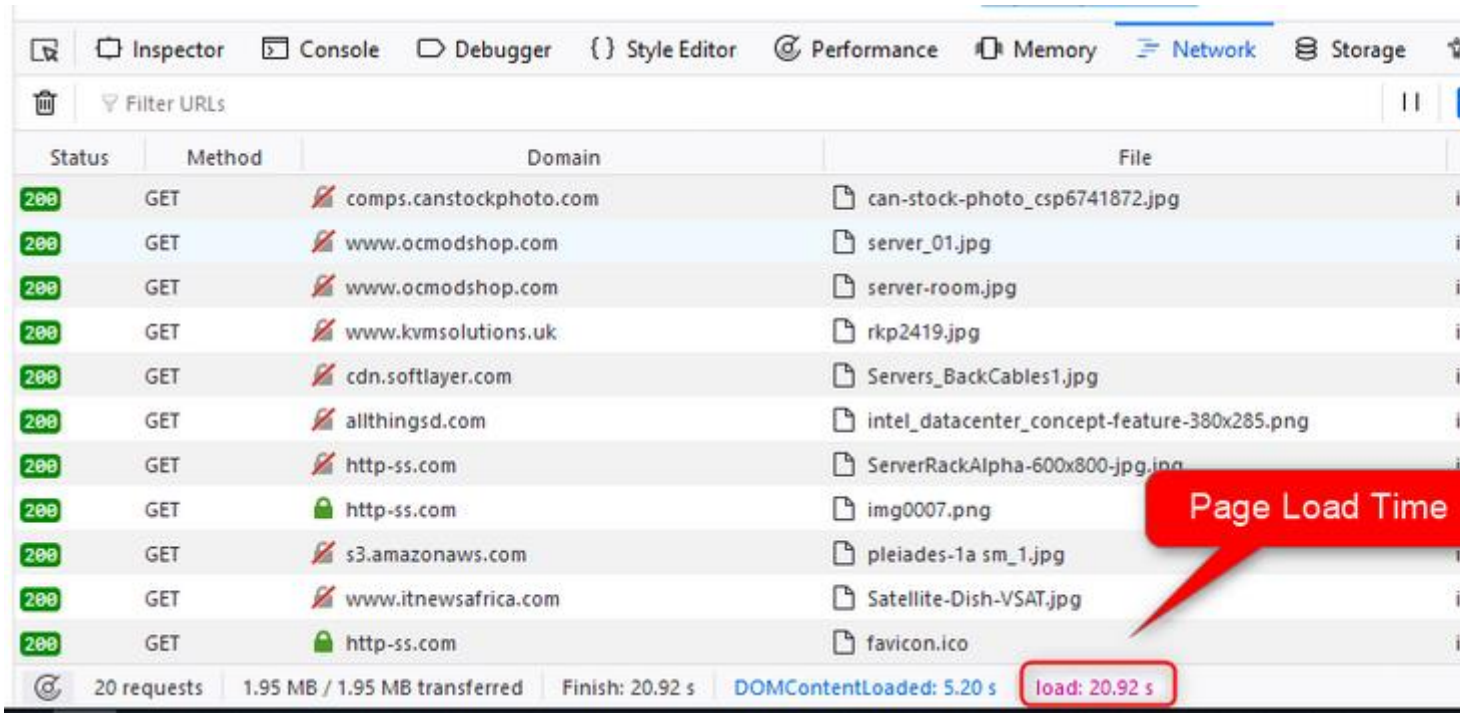
Latency ms	TCP Bandwidth Utilization of 1 Gbit/s	HTTP-QuSS http | ftp | VoIP | Media Streaming … Lossless used Bandwidth of 700 Mbit/s
1	**920.00**	**619.00**
25	**58.50**	**700.00**
50	**31.10**	**700.00**
75	**23.10**	**611.00**
100	**17.10**	**683.00**
150	**11.90**	**686.00**
200	**9.00**	**602.00**
300	**6.03**	**665.00**
400	**4.54**	**654.00**
500	**3.67**	**650.00**
600	**3.34**	**578.00**
700	**2.79**	**618.00**
800	**2.62**	**669.00**
900	**2.33**	**666.00**
1000	**2.09**	**673.00**



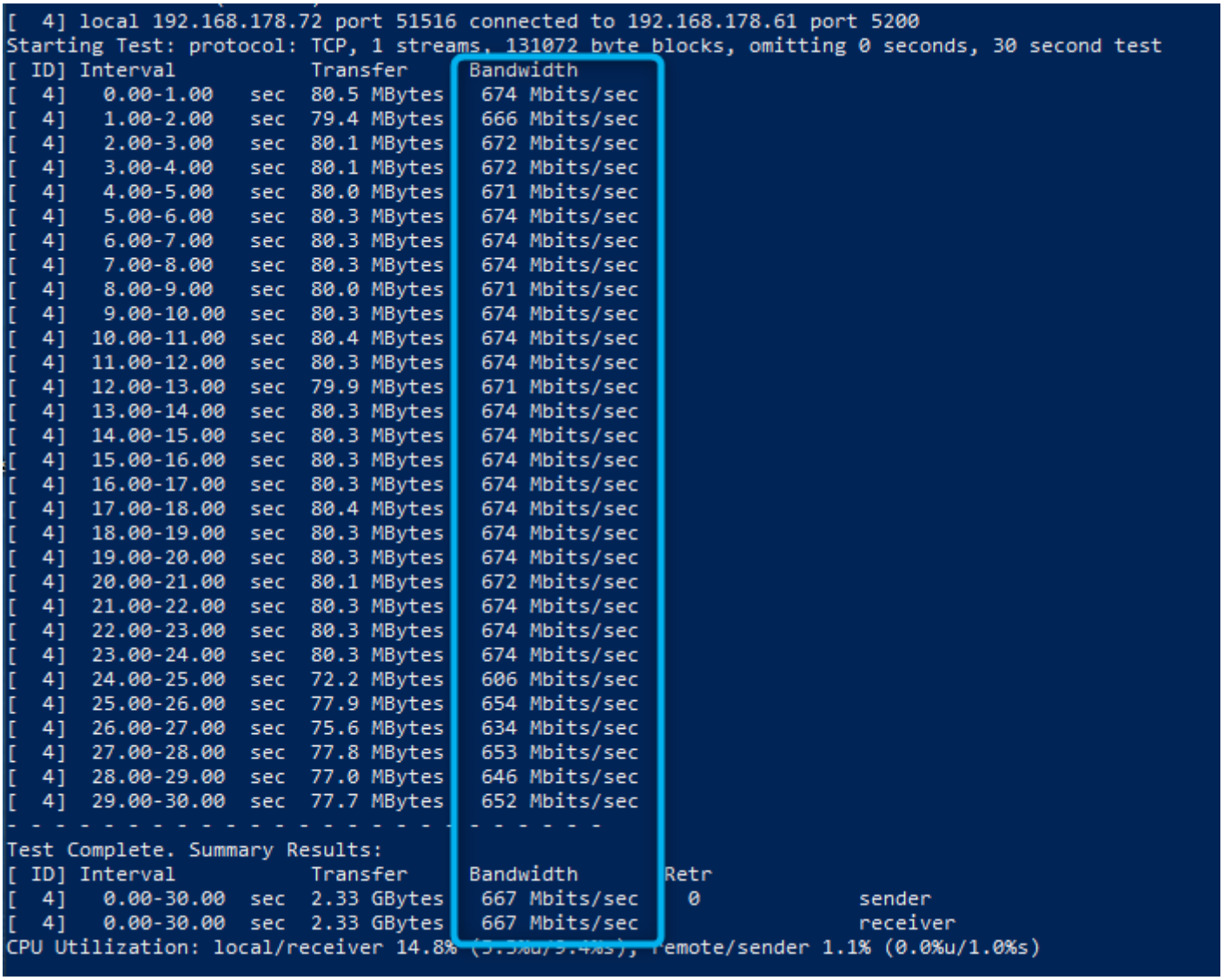
3.5 Browser WEB Page Load Time - Latency Dependency

3.5.1 What is Page Load Time

In its simplest terms, page load time is the average amount of time it takes for a page to show up on your screen. It's calculated from initiation (when you click on a page link or type in a Web address) to completion (when the page is fully loaded in the browser).



3.5.2 Available TCP Bandwidth - 700 Mbit/s



Available TCP Bandwidth: 700 Mbit/s

3.5.3 TCP/http/TLS Protocol

TCP = **T**ransport **C**ontrol **P**rotocol
HTTP = **H**yper**t**ext **T**ransfer **P**rotocol
TLS = **T**ransport **L**ayer **S**ecurity

The TLS Protocol is not used for this Measurement Series because it would even worsen the Results because of his additional Handshakes.

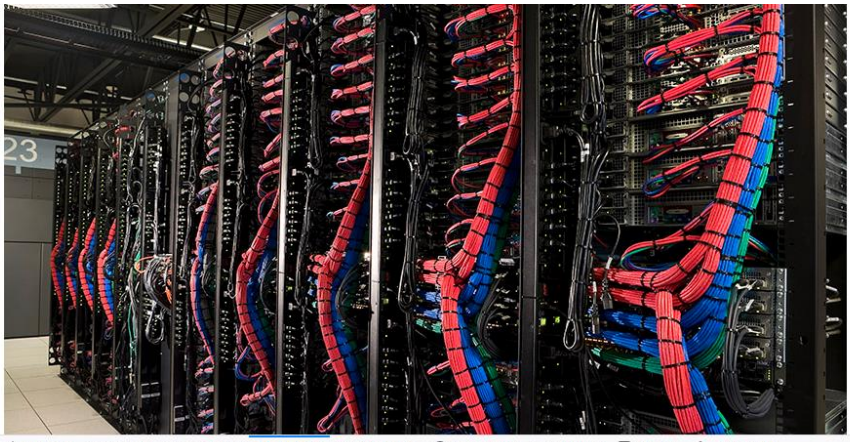
3.5.4 RTT = 1 ms

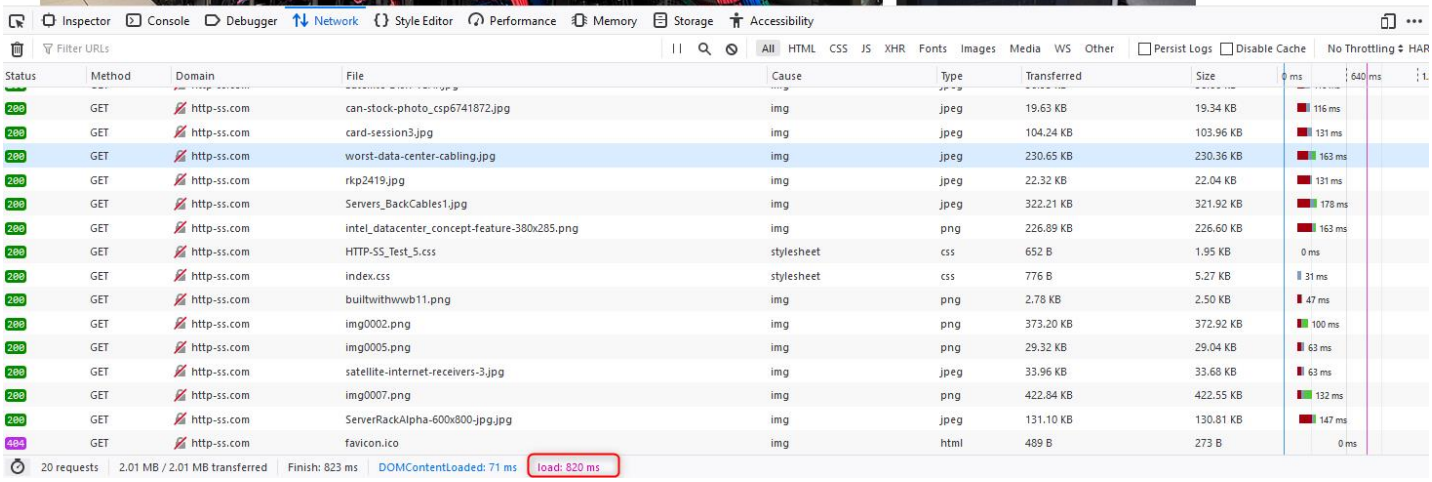
Bandwidth 700 Mbit/s
Latency 1 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit<1ms TTL=64
```

3.5.5.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

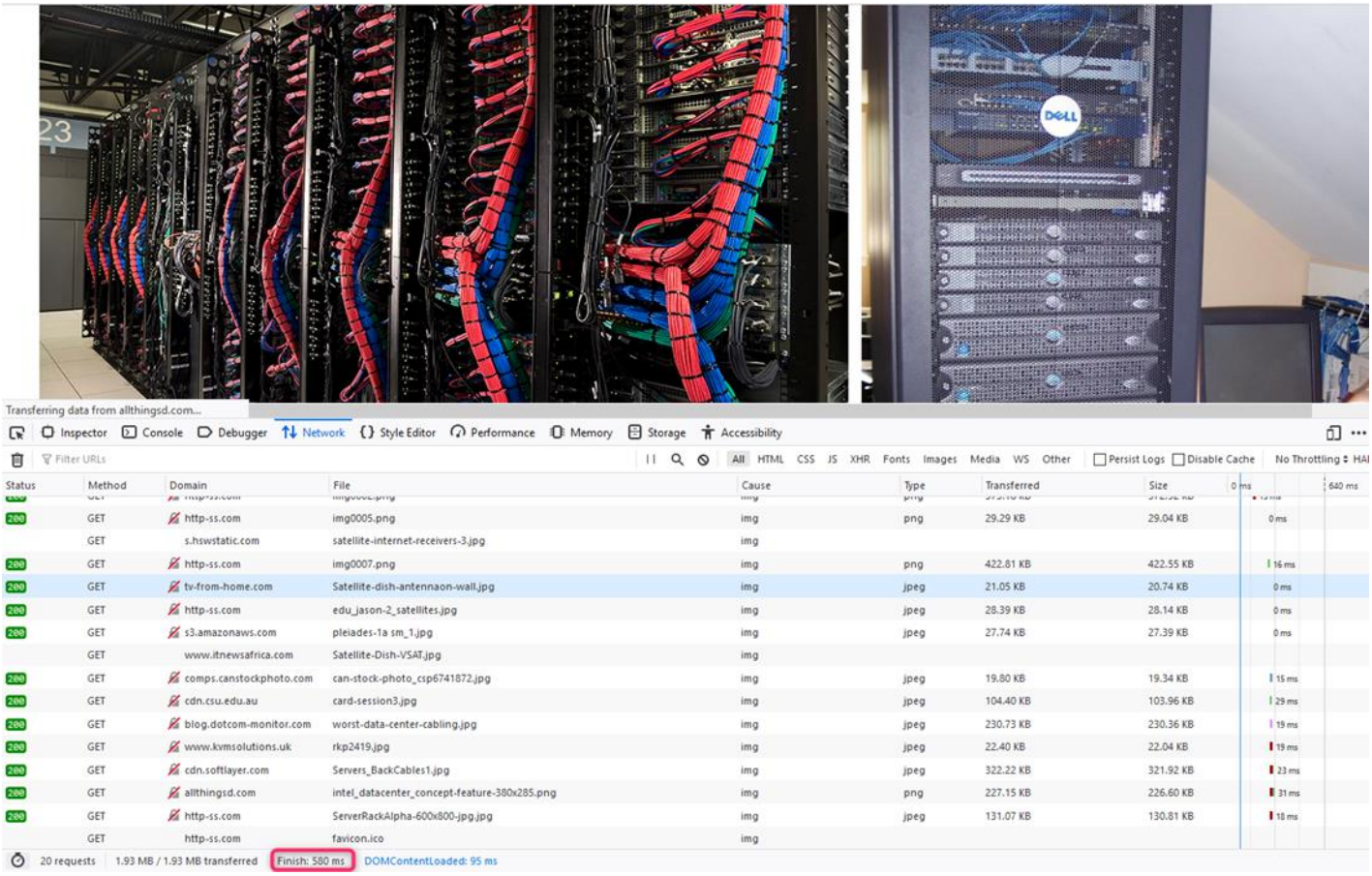




Page Load Time: **820 ms**

3.5.5.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **580 ms**

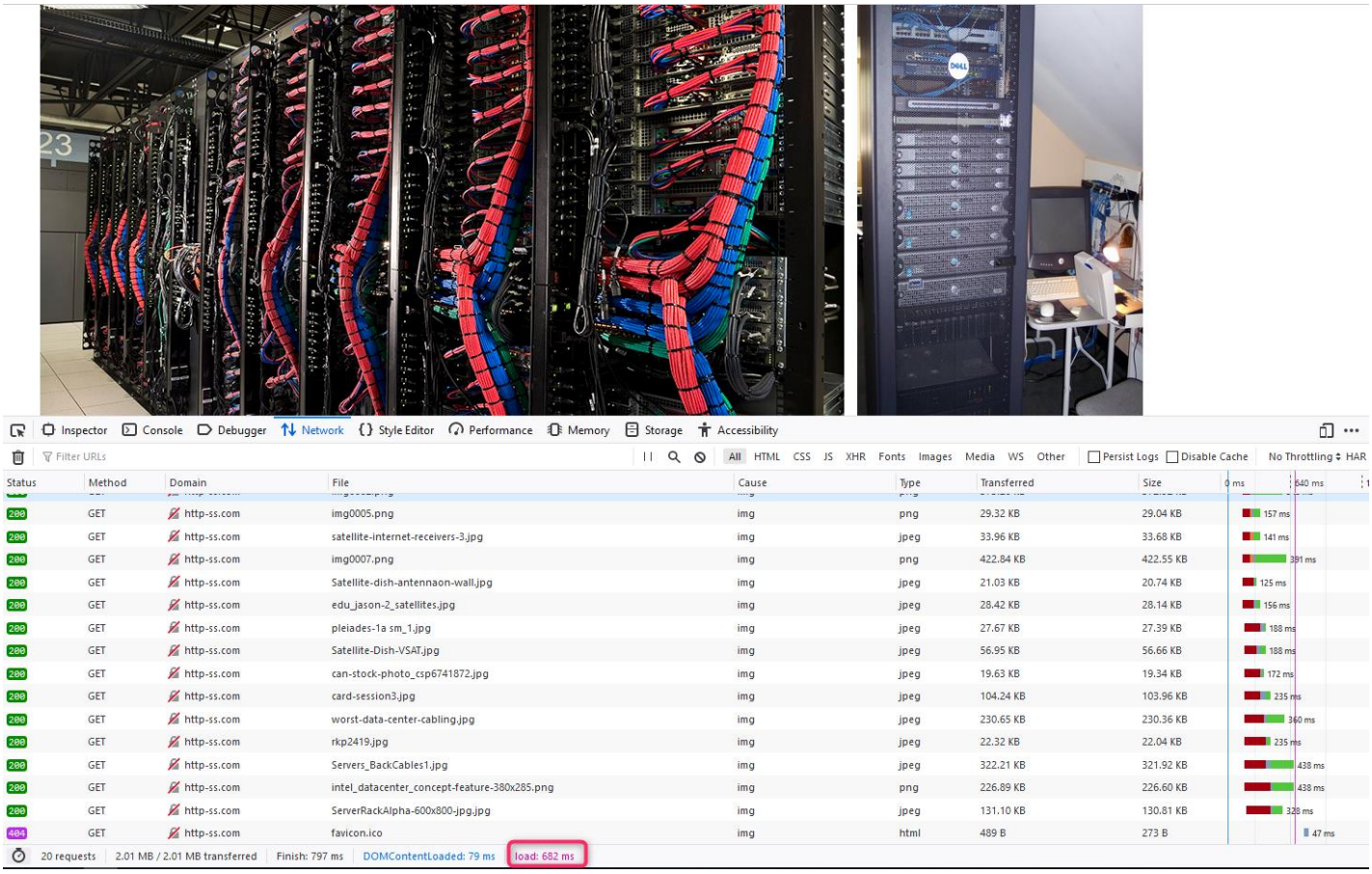
3.5.5 RTT = 25 ms

Bandwidth 700 Mbit/s
Latency 25 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=24ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=30ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=33ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=9ms  TTL=64
```

3.5.5.1 Page Load Time - TCP/HTTP

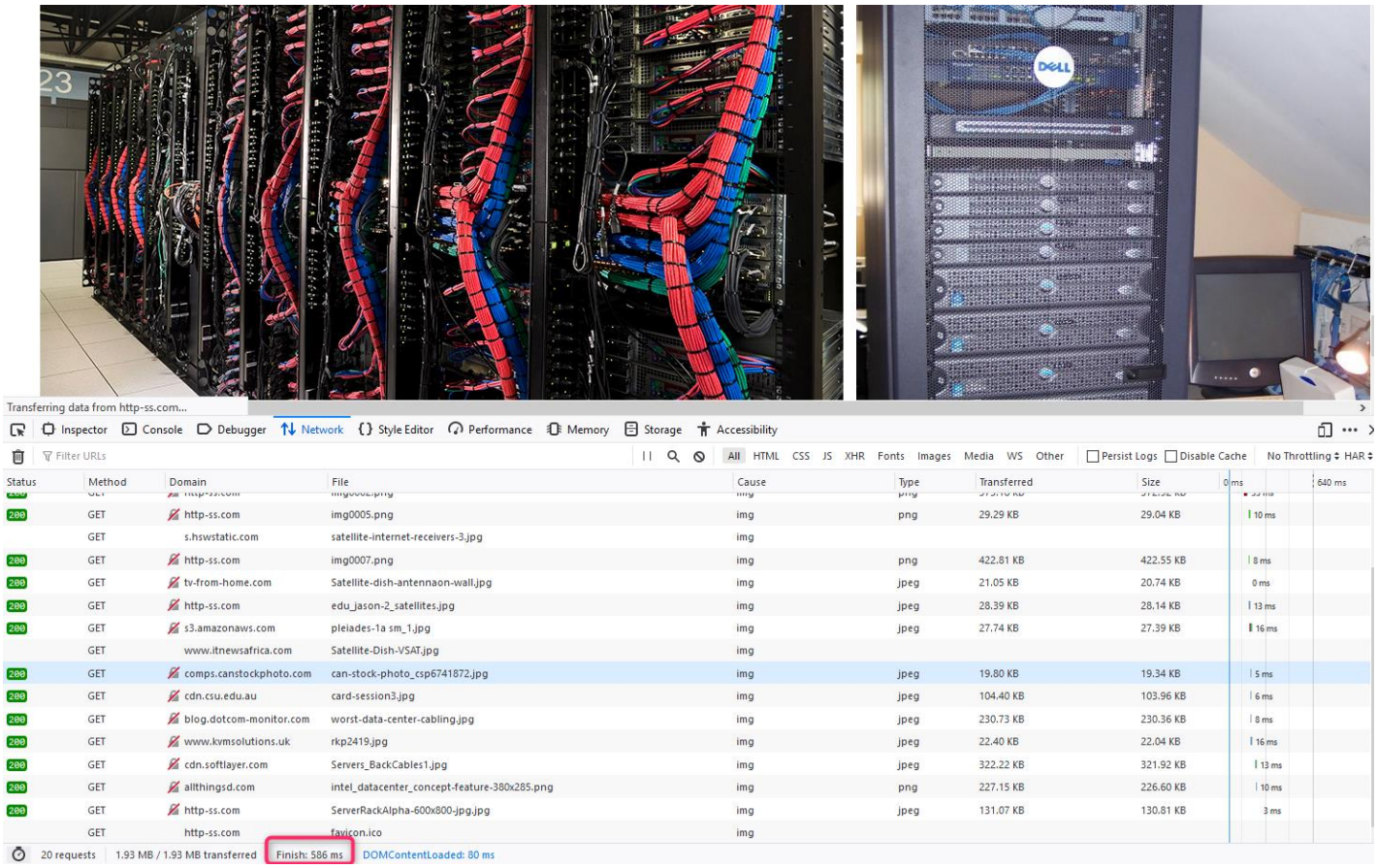
Browser Cache deleted!



Page Load Time: **682 ms**

3.5.5.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **586 ms**

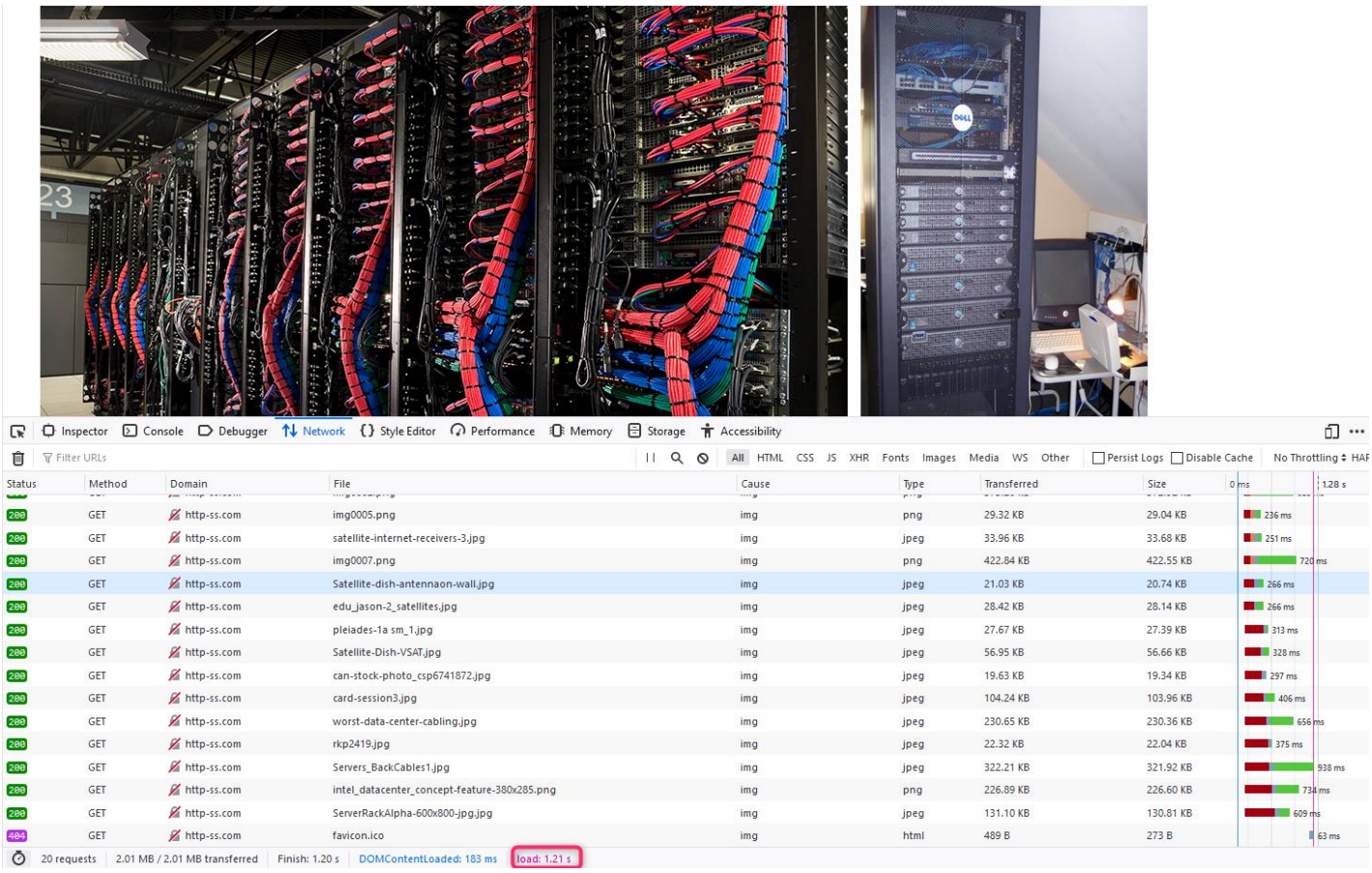
3.5.6 RTT = 50 ms

Bandwidth 700 Mbit/s
Latency 50 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=47ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=43ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=56ms TTL=64
```

3.5.6.1 Page Load Time - TCP/HTTP

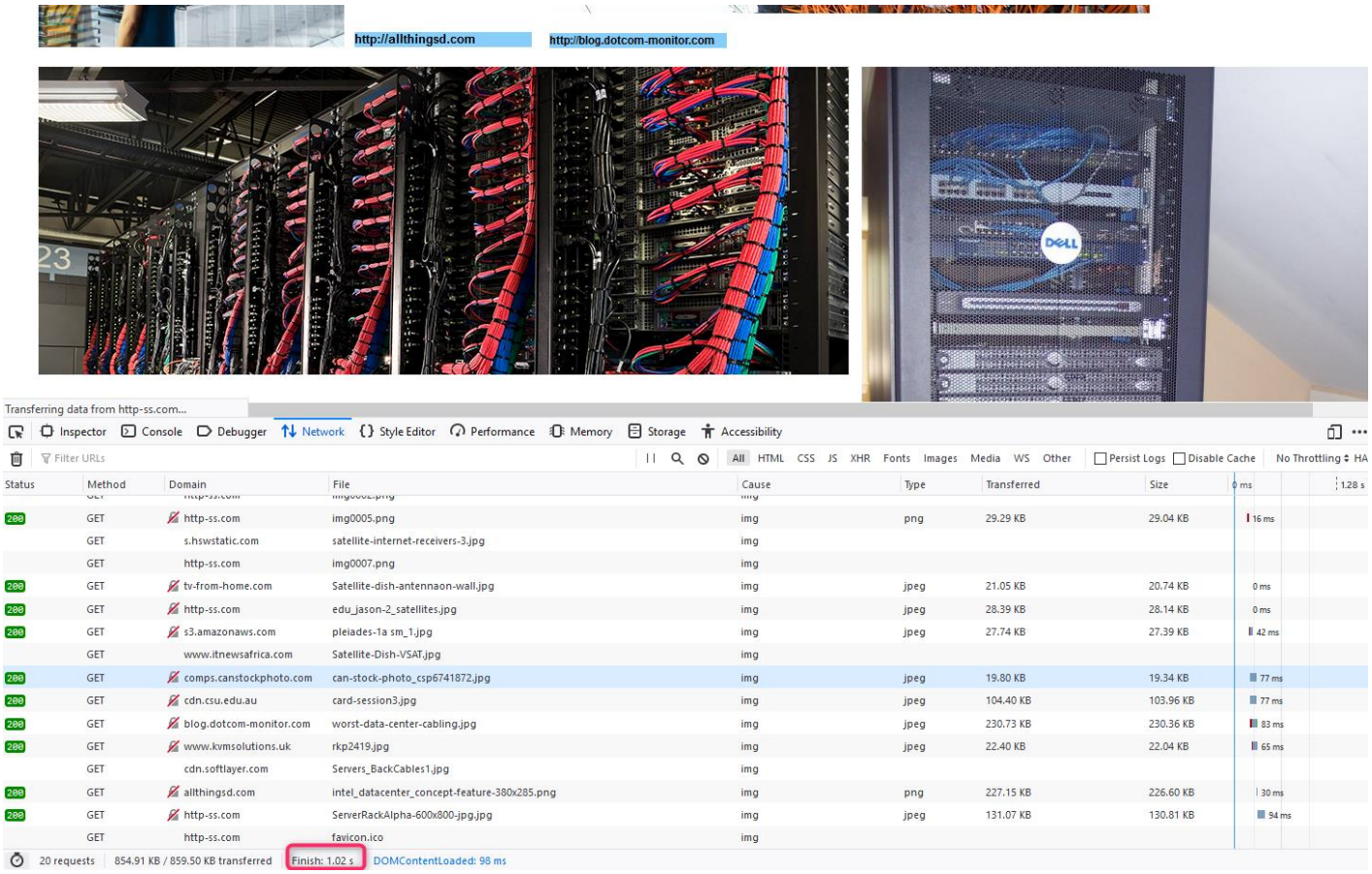
Browser Cache deleted!



Page Load Time: **1,21 s**

3.5.6.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,02 ms**

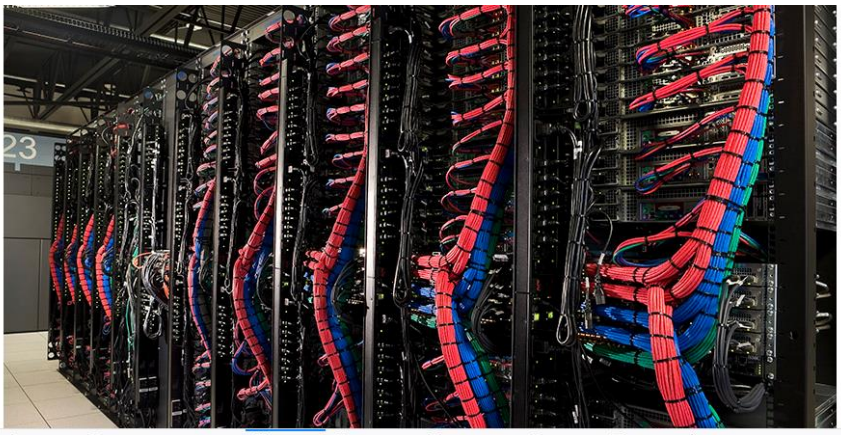
3.5.7 RTT = 75 ms

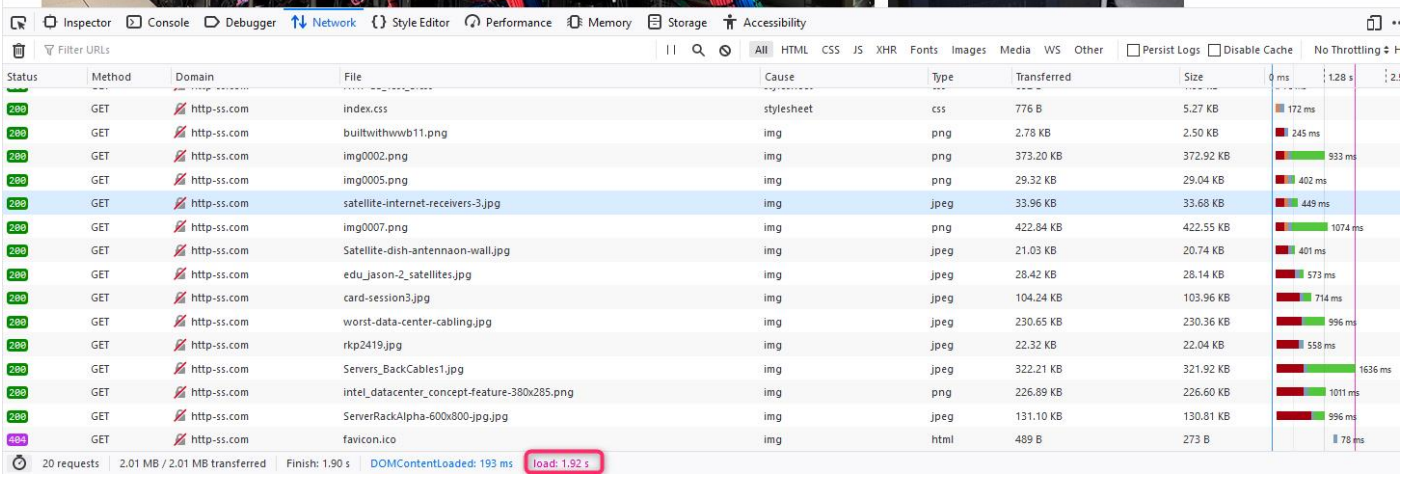
Bandwidth 700 Mbit/s
Latency 75 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=72ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=74ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=80ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=93ms TTL=64
```

3.5.7.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

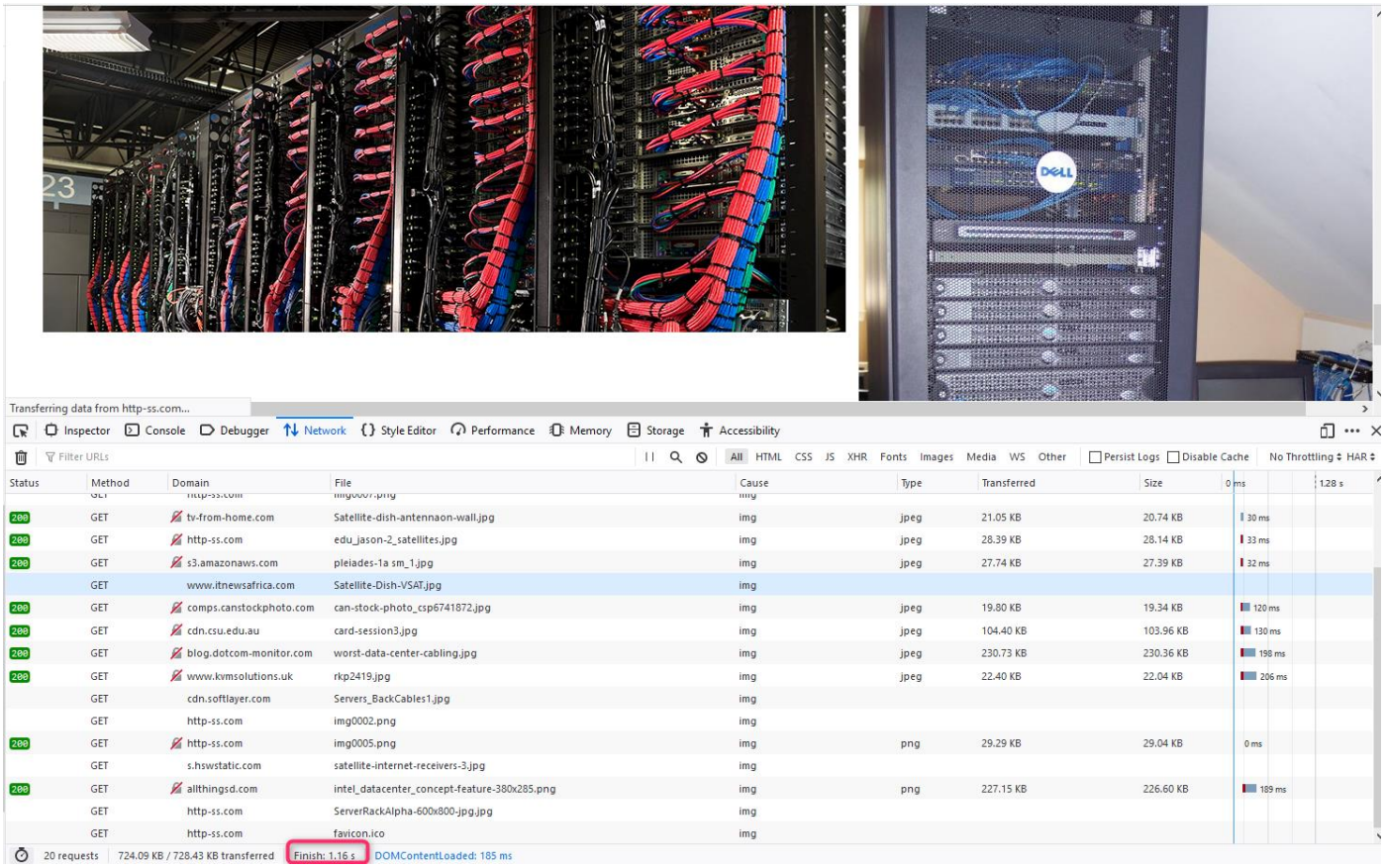




Page Load Time: **1,92 s**

3.5.7.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,16 ms**

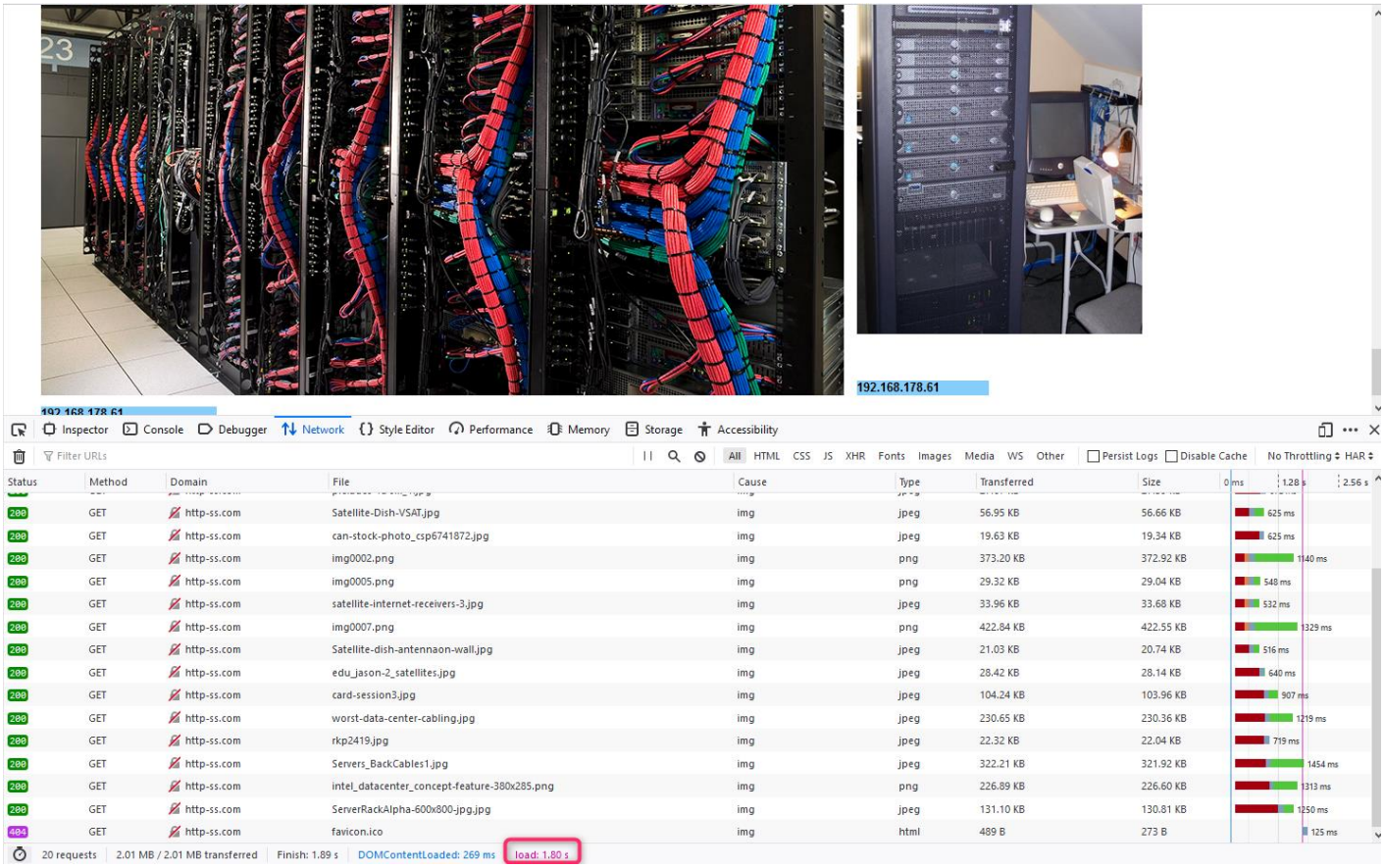
3.5.8 RTT = 100 ms

Bandwidth 700 Mbit/s
Latency 100 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=105ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=94ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=95ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=106ms TTL=64
```

3.5.8.1 Page Load Time - TCP/HTTP

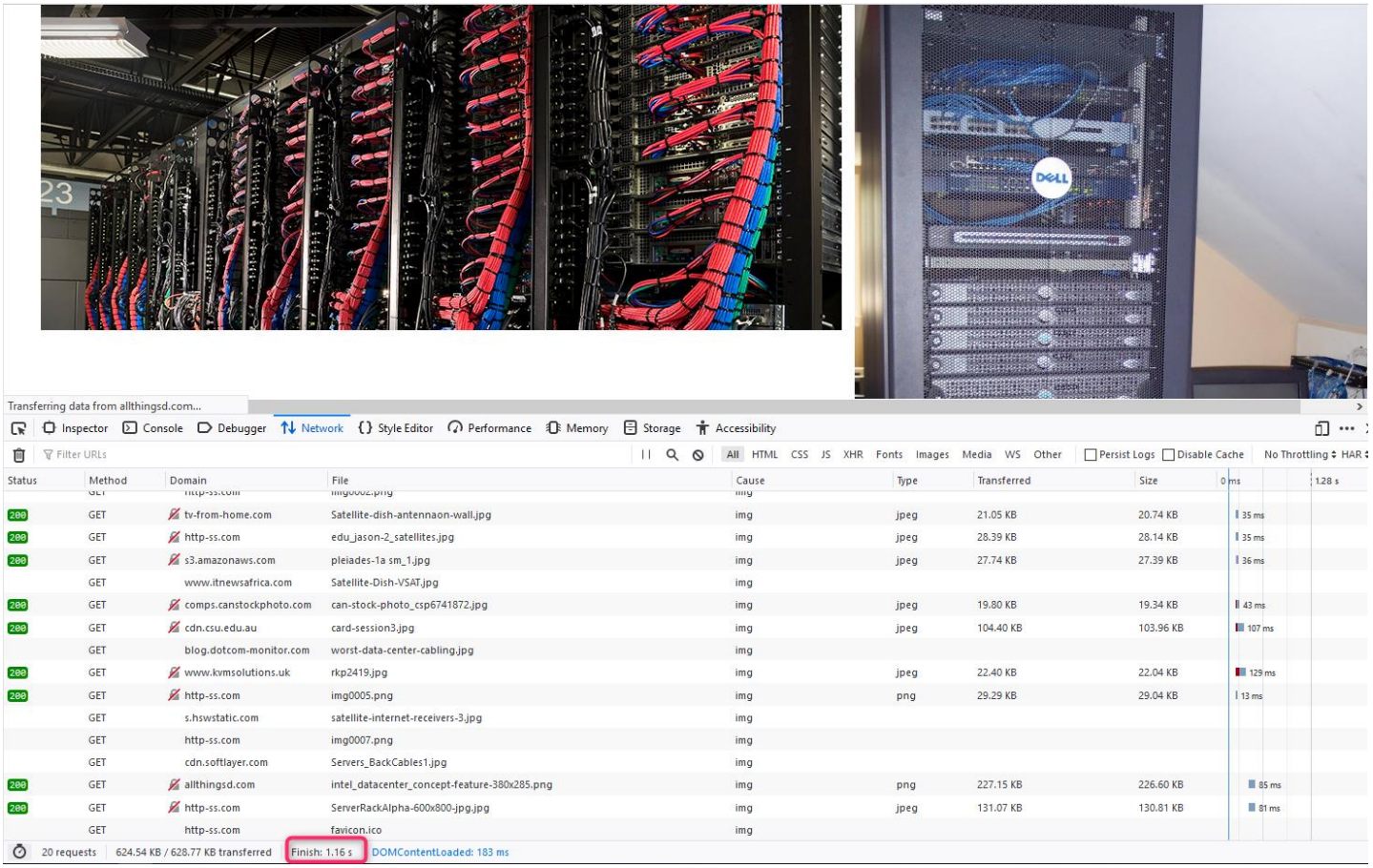
Browser Cache deleted!



Page Load Time: **1,80 s**

3.5.8.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,16 s**

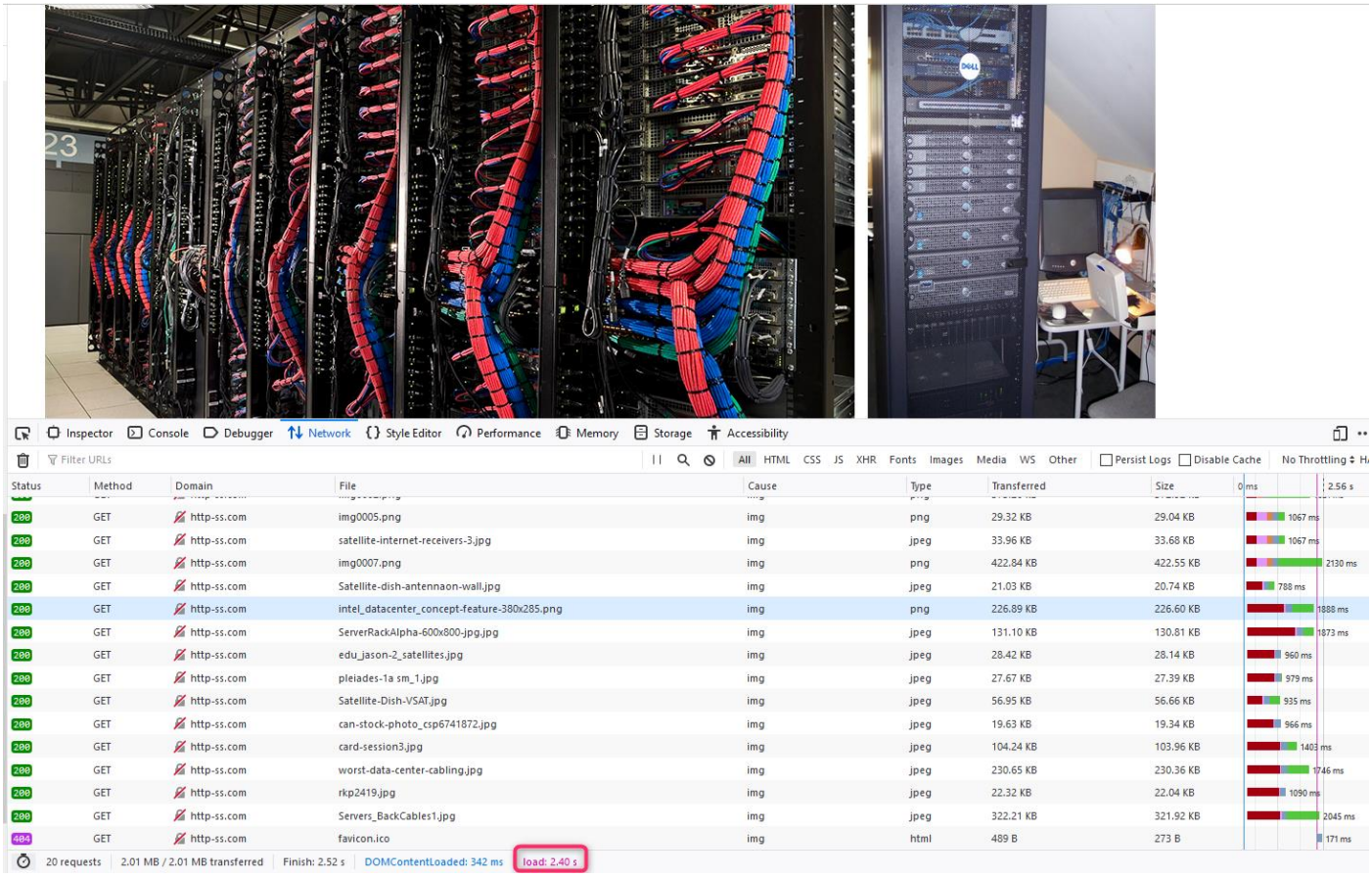
3.5.9 RTT = 150 ms

Bandwidth 700 Mbit/s
Latency 150 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=159ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=141ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=147ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=149ms TTL=64
```

3.5.9.1 Page Load Time - TCP/HTTP

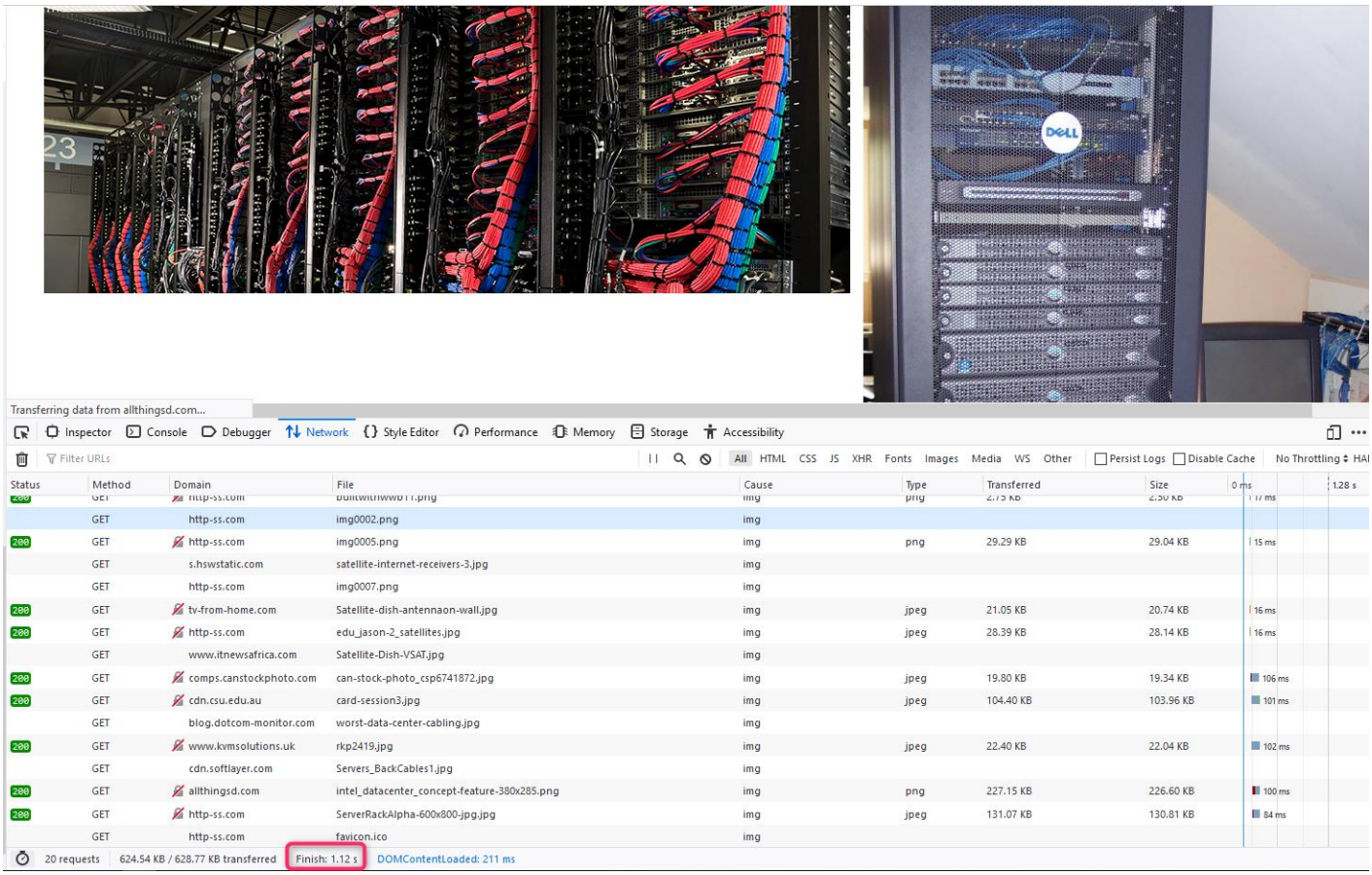
Browser Cache deleted!



Page Load Time: **2,40 s**

3.5.9.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,12 s**

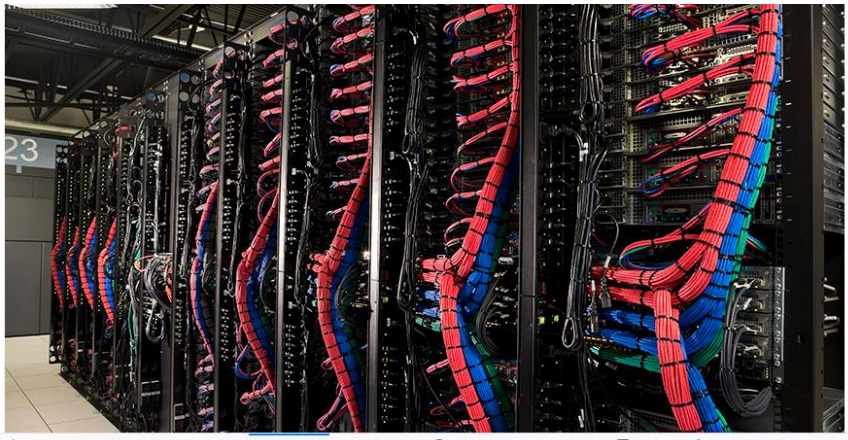
3.5.10 RTT = 200 ms

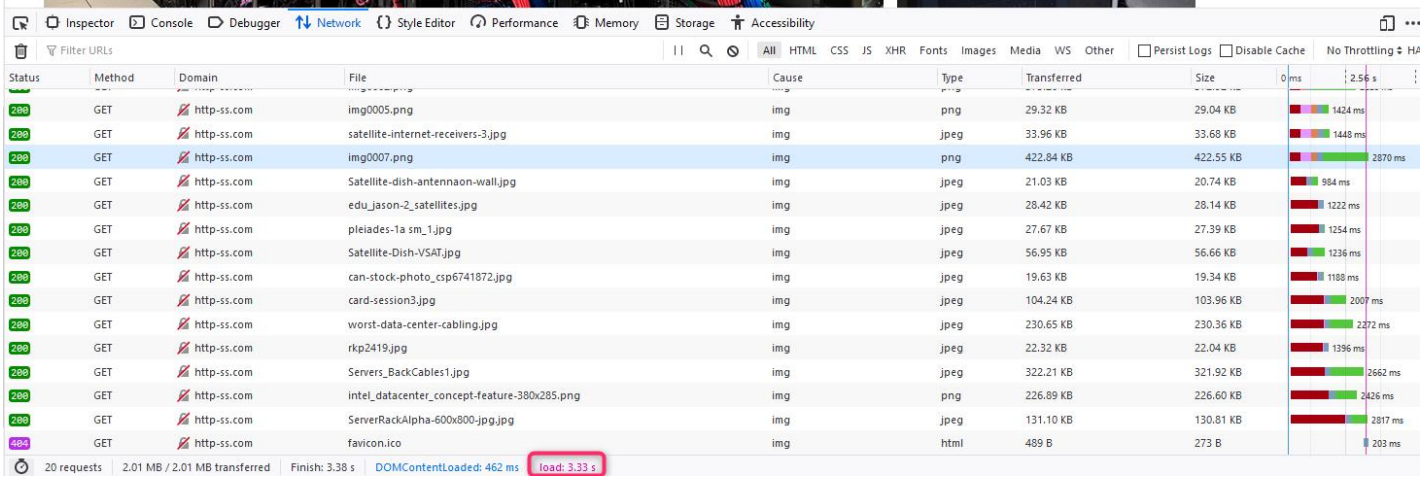
Bandwidth 700 Mbit/s
Latency 200 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=205ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=196ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=191ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=188ms TTL=64
```

3.5.10.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

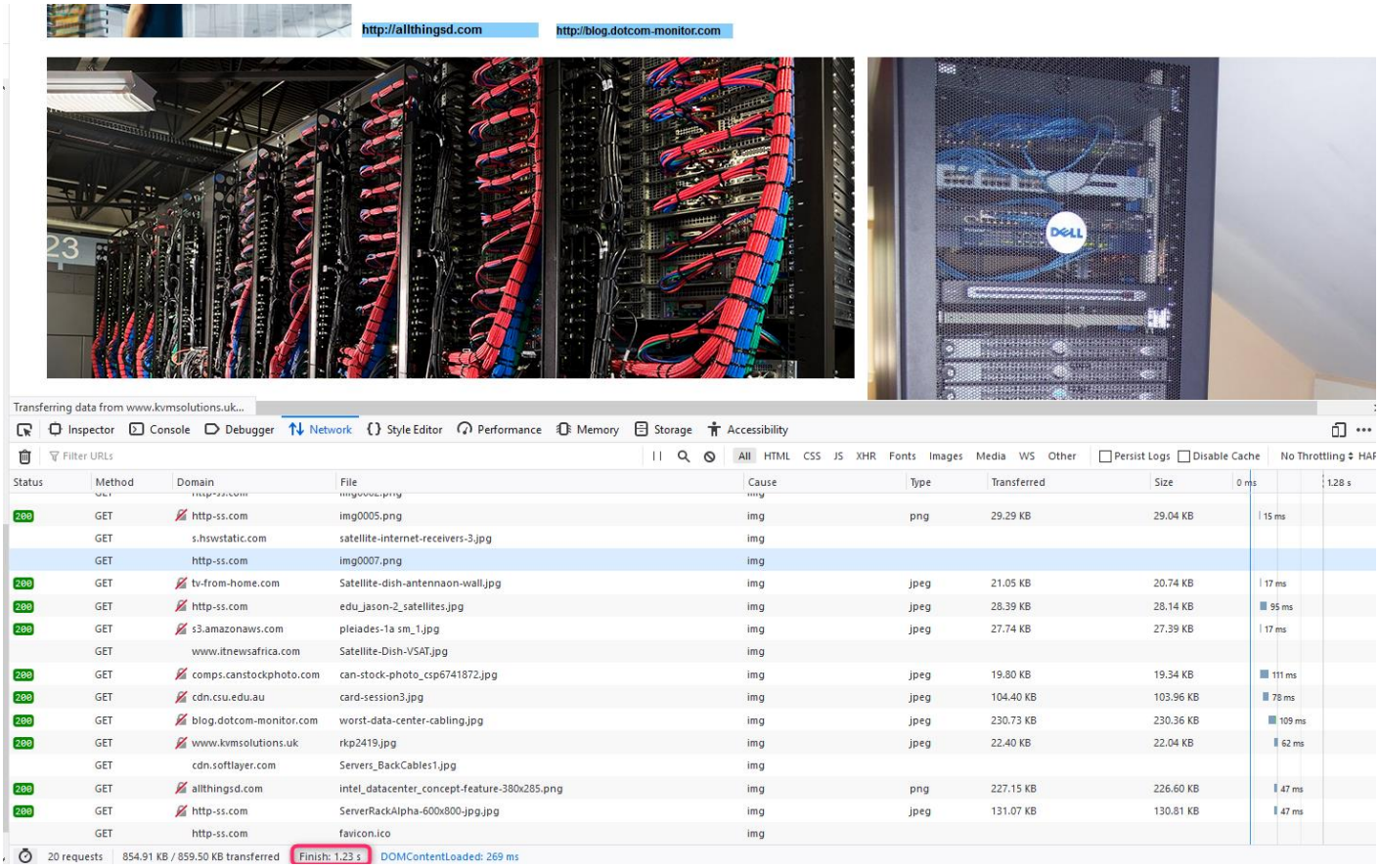




Page Load Time: **3,33 s**

3.5.10.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,23 s**

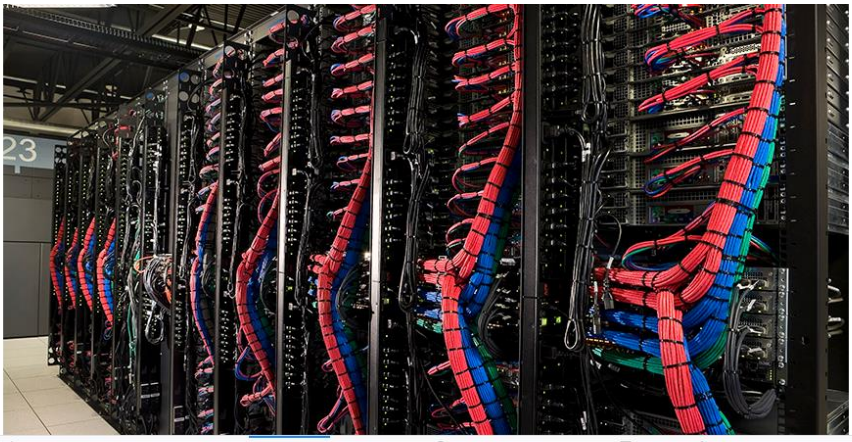
3.5.11 RTT = 300 ms

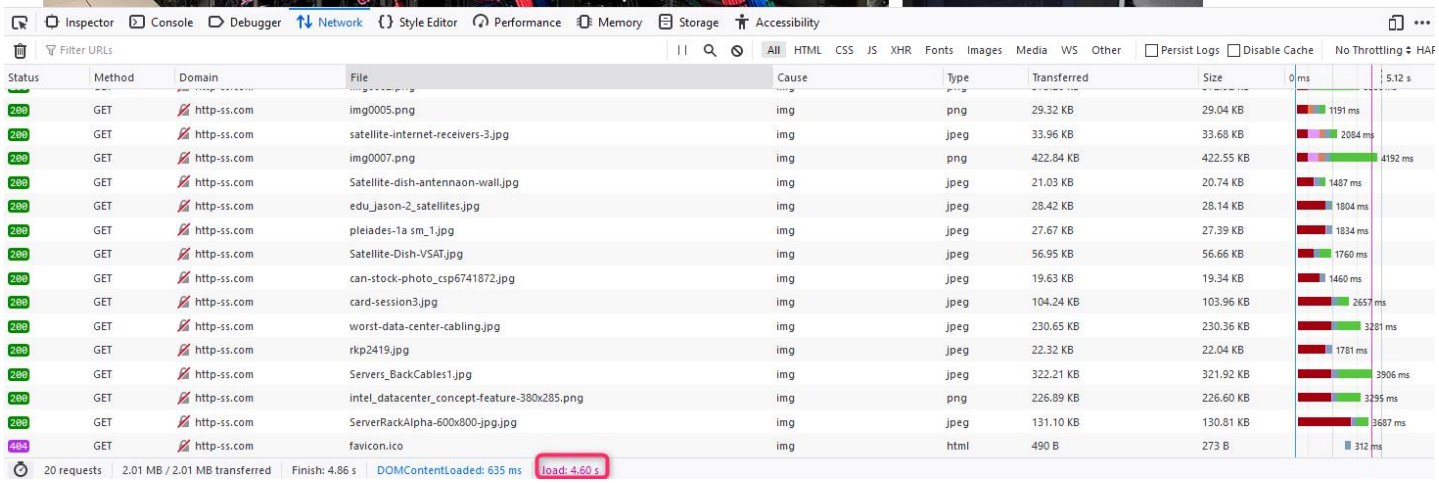
Bandwidth 700 Mbit/s
Latency 300 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=292ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=305ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=270ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=306ms TTL=64
```

3.5.11.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

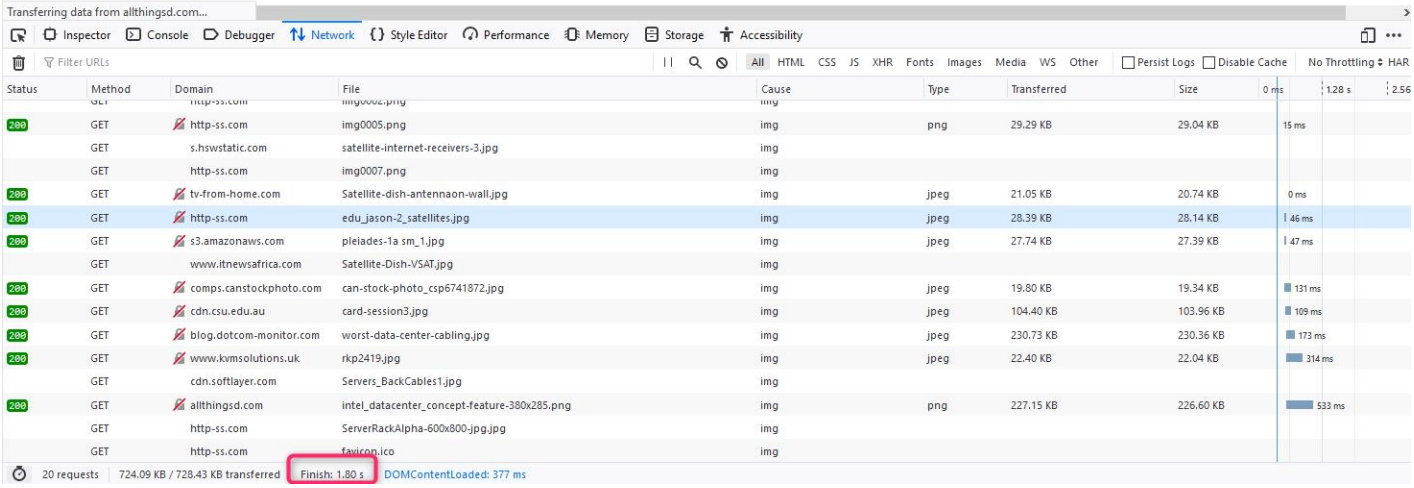




Page Load Time: **4,6 s**

3.5.11.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,80 s**

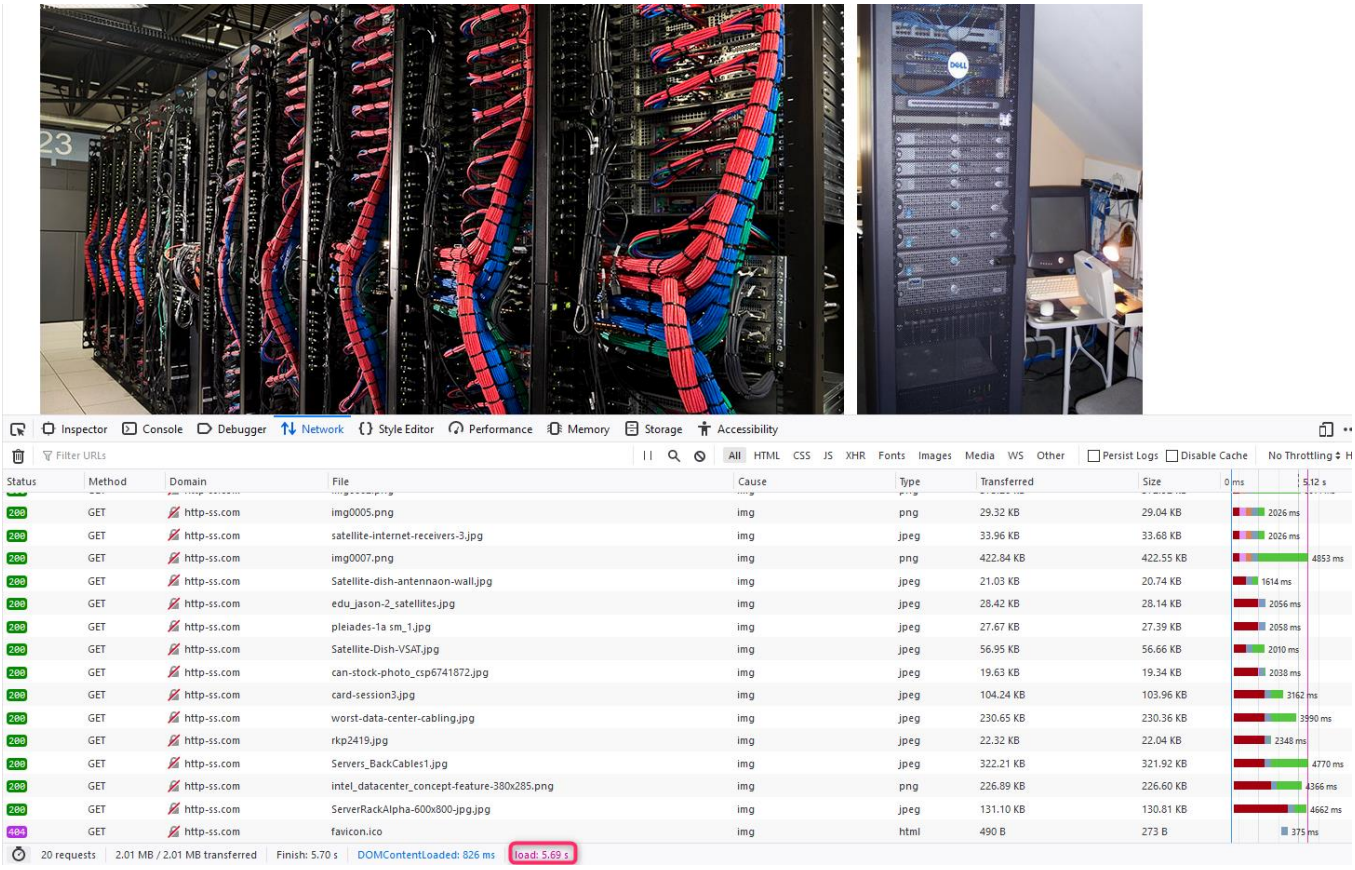
3.5.12 RTT = 400 ms

Bandwidth 700 Mbit/s
Latency 400 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=409ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=422ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=388ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=401ms TTL=64
```

3.5.12.1 Page Load Time - TCP/HTTP

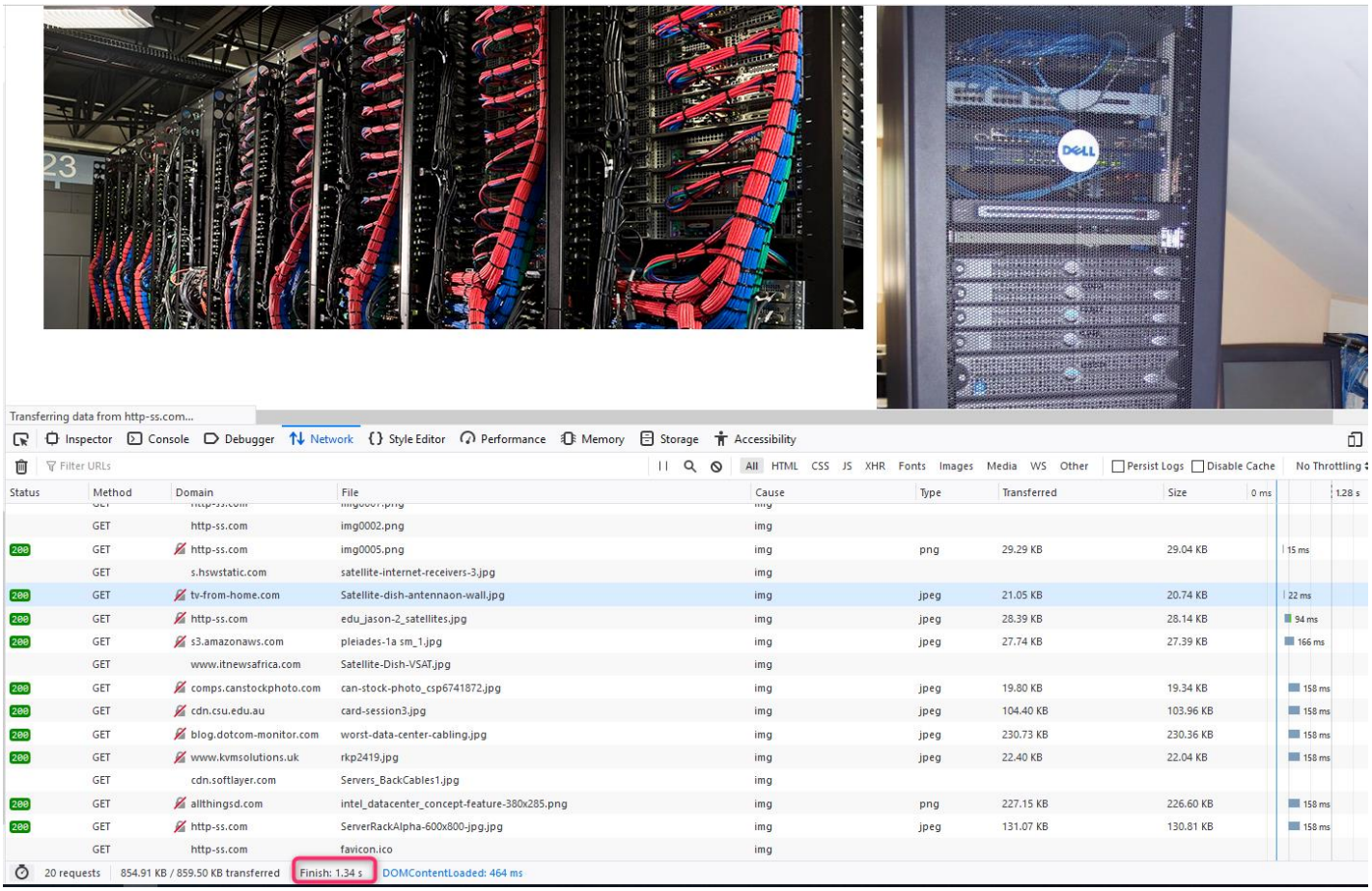
Browser Cache deleted!



Page Load Time: **5,69 s**

3.5.12.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,34 s**

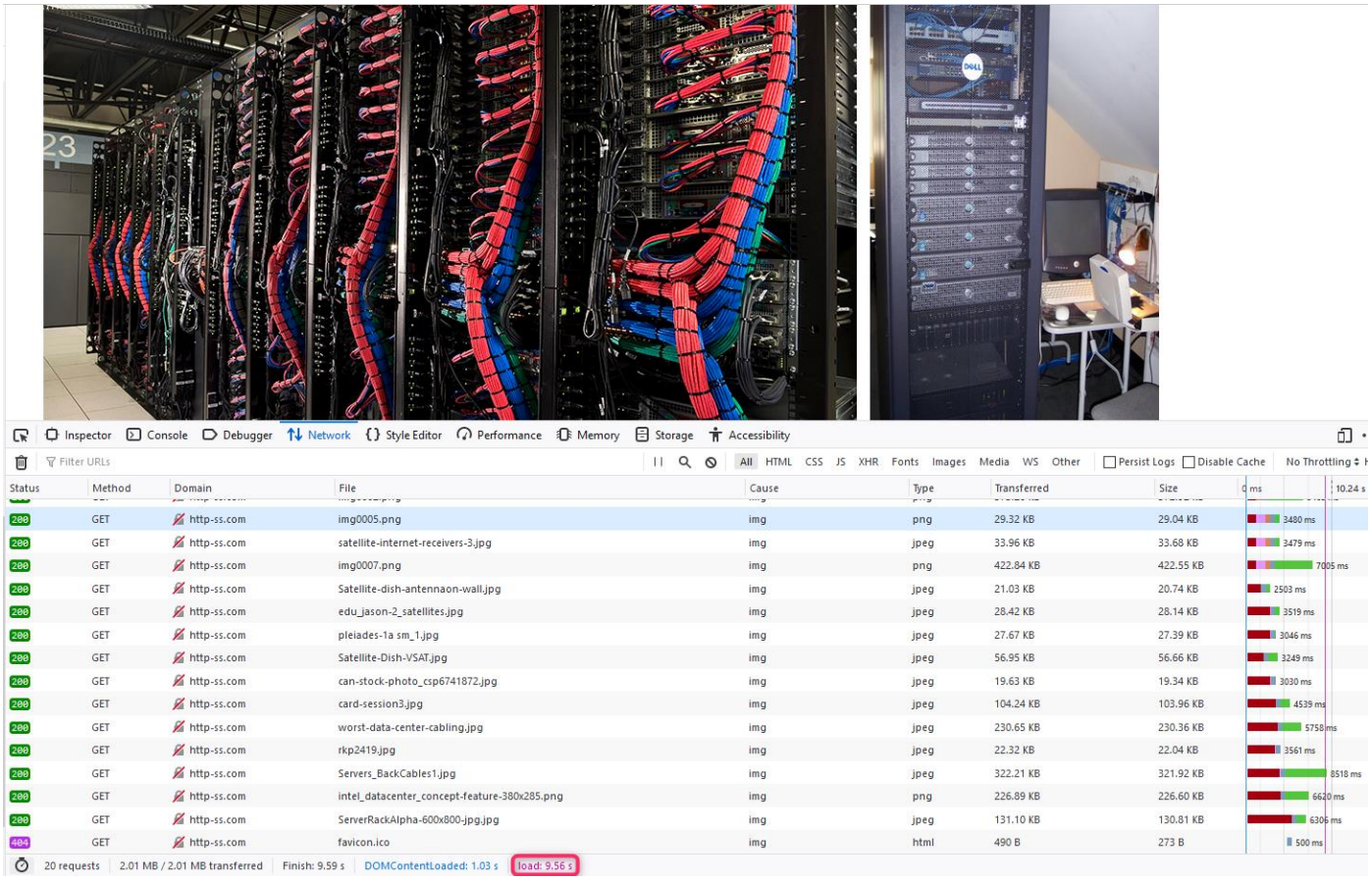
3.5.13 RTT = 500 ms

Bandwidth 700 Mbit/s
Latency 500 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=508ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=511ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=511ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=507ms TTL=64
```

3.5.13.1 Page Load Time - TCP/HTTP

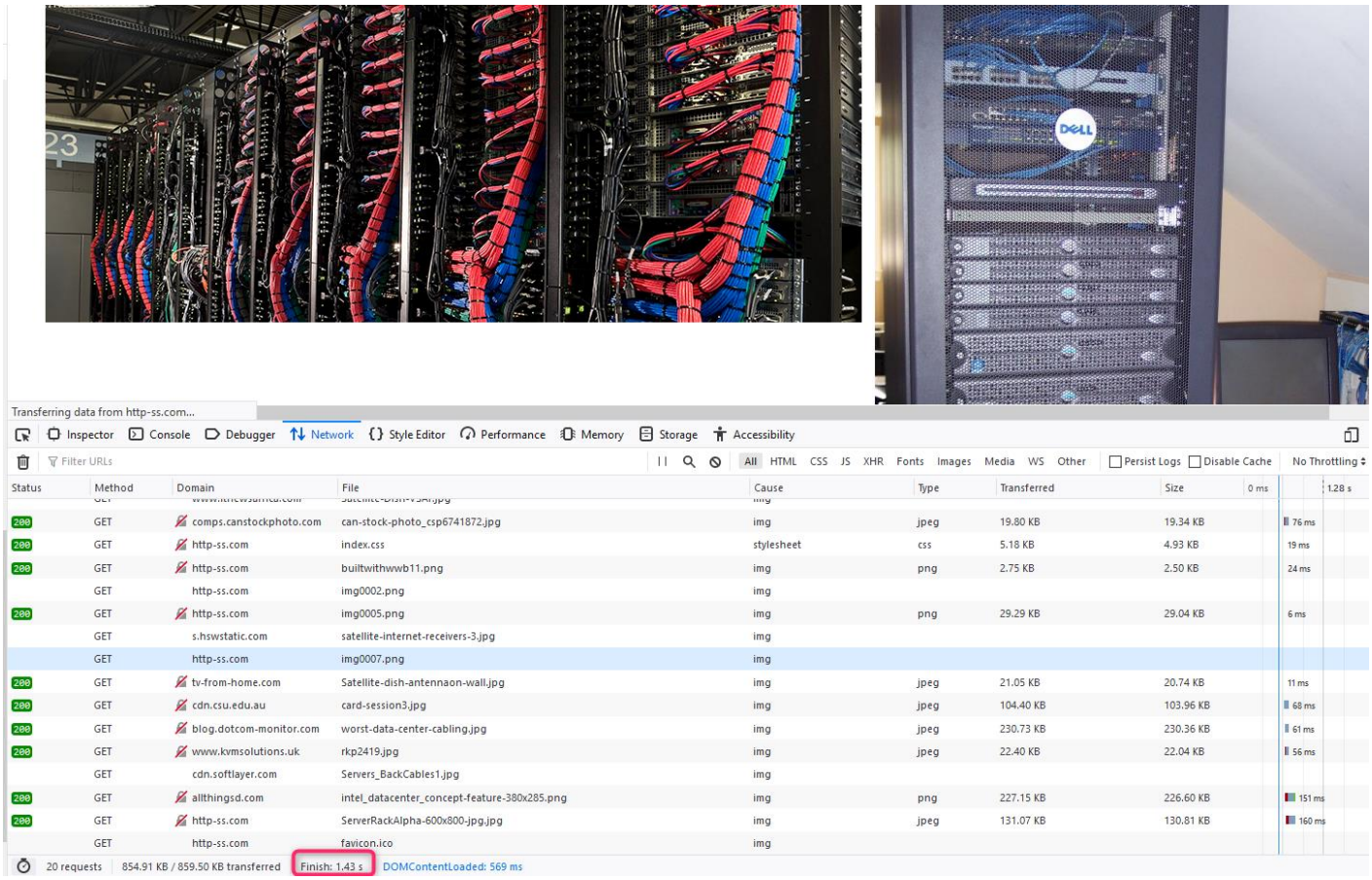
Browser Cache deleted!



Page Load Time: **9,56 s**

3.5.13.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,43 s**

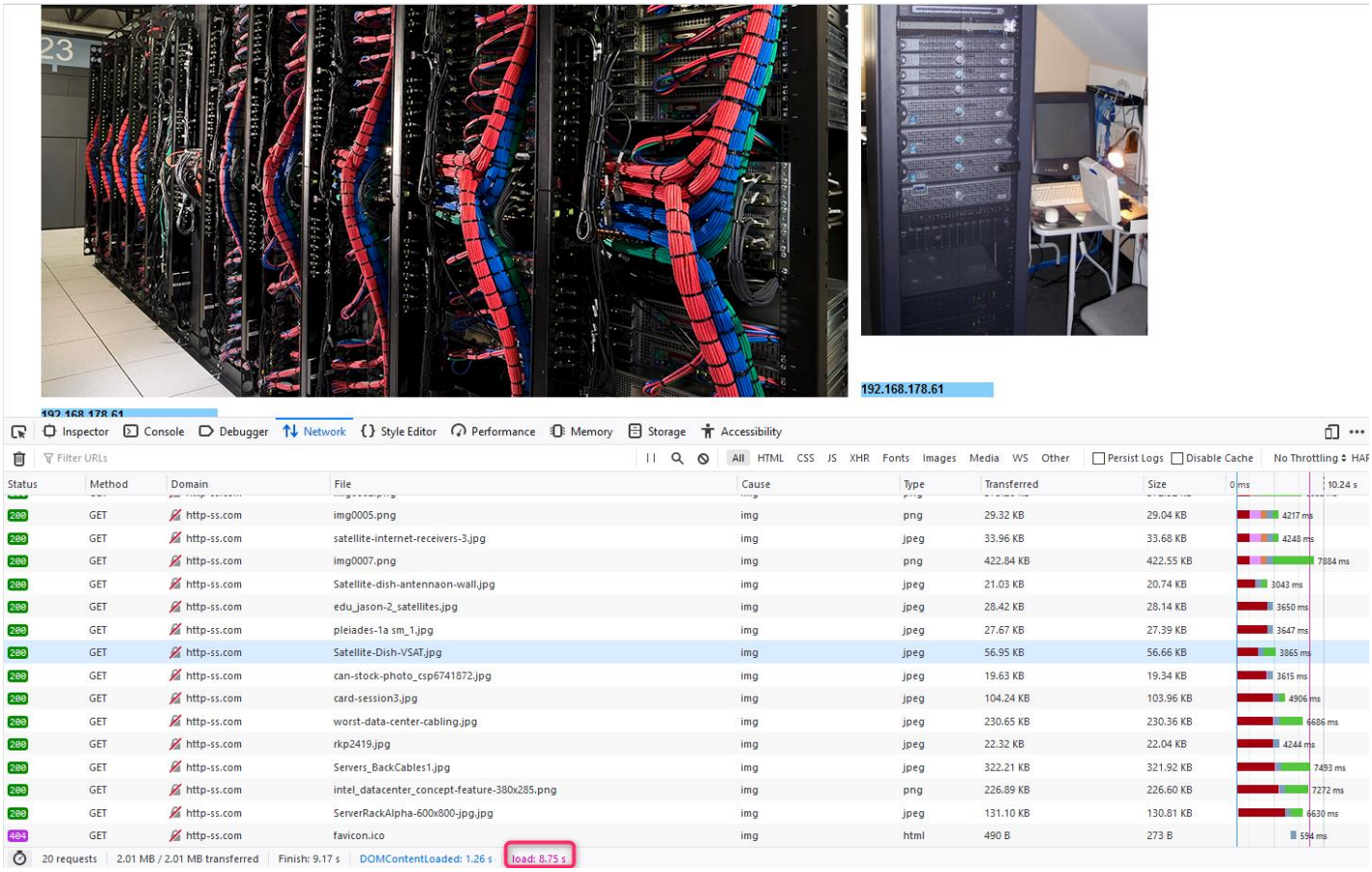
3.5.14 RTT = 600 ms

Bandwidth 700 Mbit/s
Latency 600 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=592ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=607ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=602ms TTL=64
```

3.5.15.1 Page Load Time - TCP/HTTP

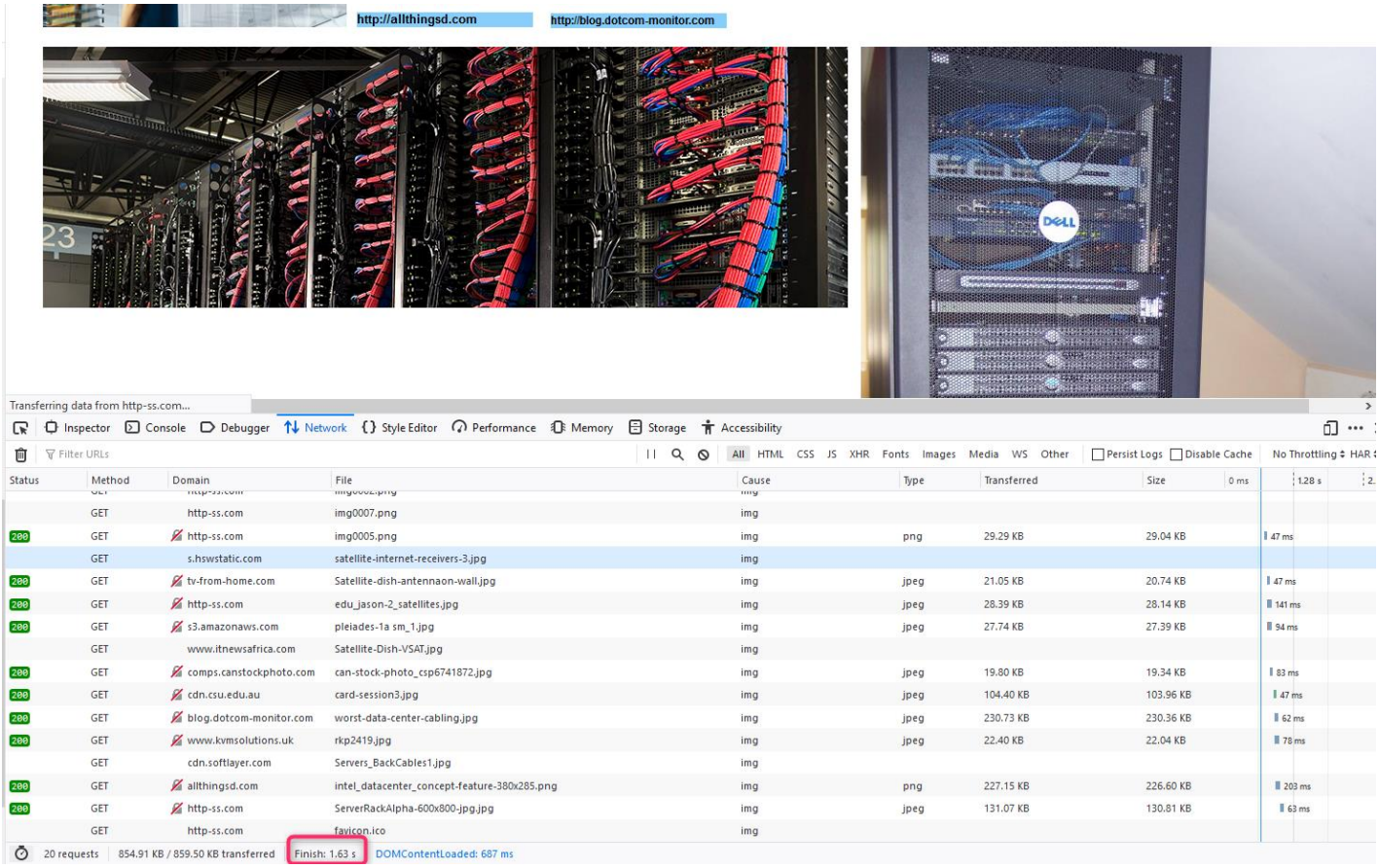
Browser Cache deleted!



Page Load Time: **8,75 s**

3.5.15.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,63 s**

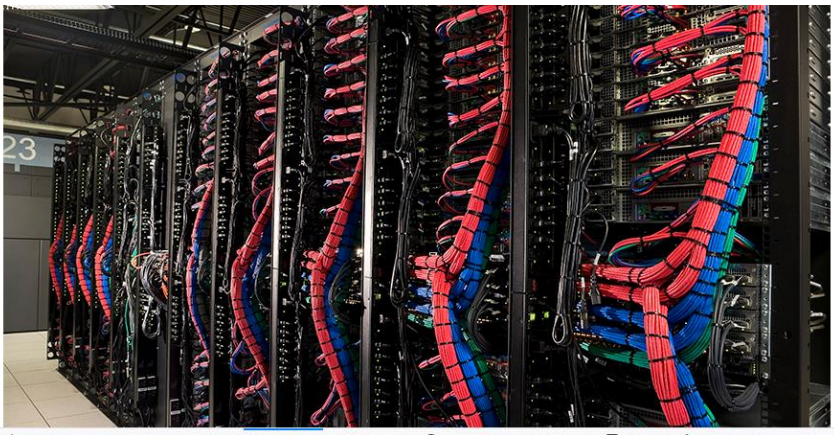
3.5.15 RTT = 700 ms

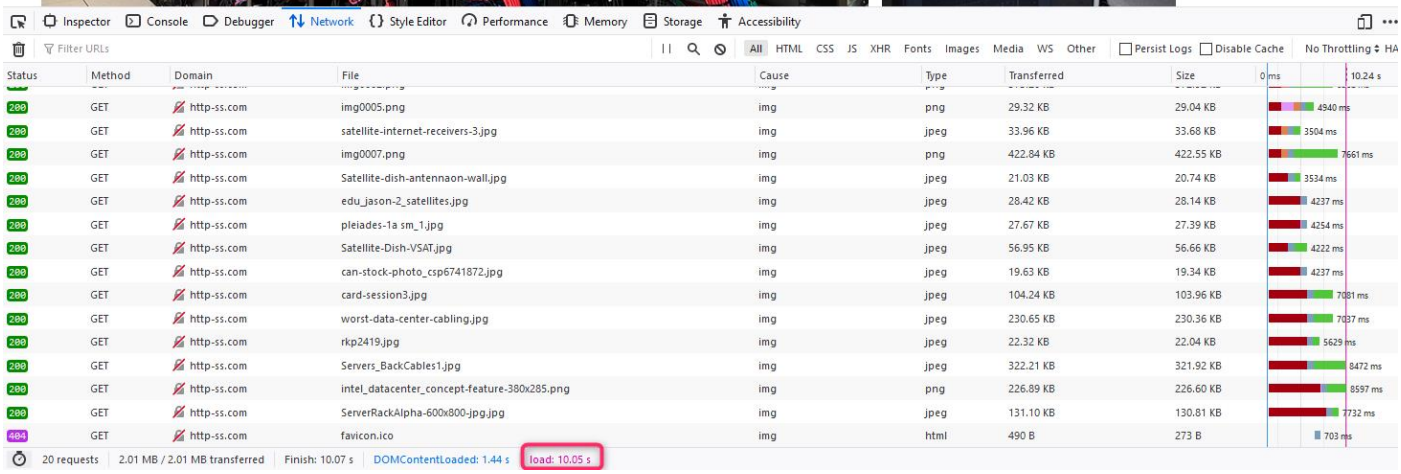
Bandwidth 700 Mbit/s
Latency 700 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=697ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=717ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=687ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=699ms TTL=64
```

3.5.15.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

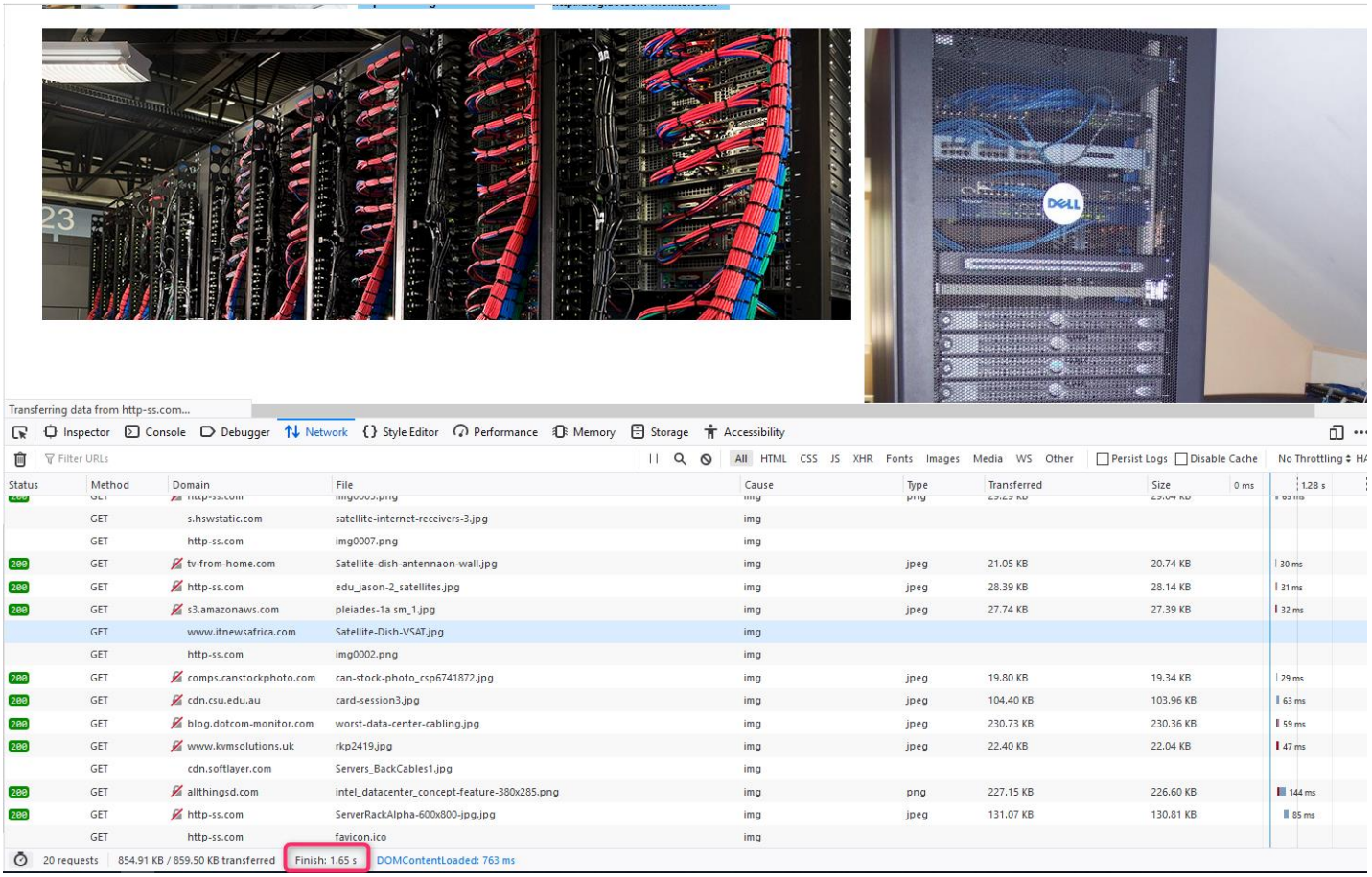




Page Load Time: **10,05 s**

3.5.15.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,65 s**

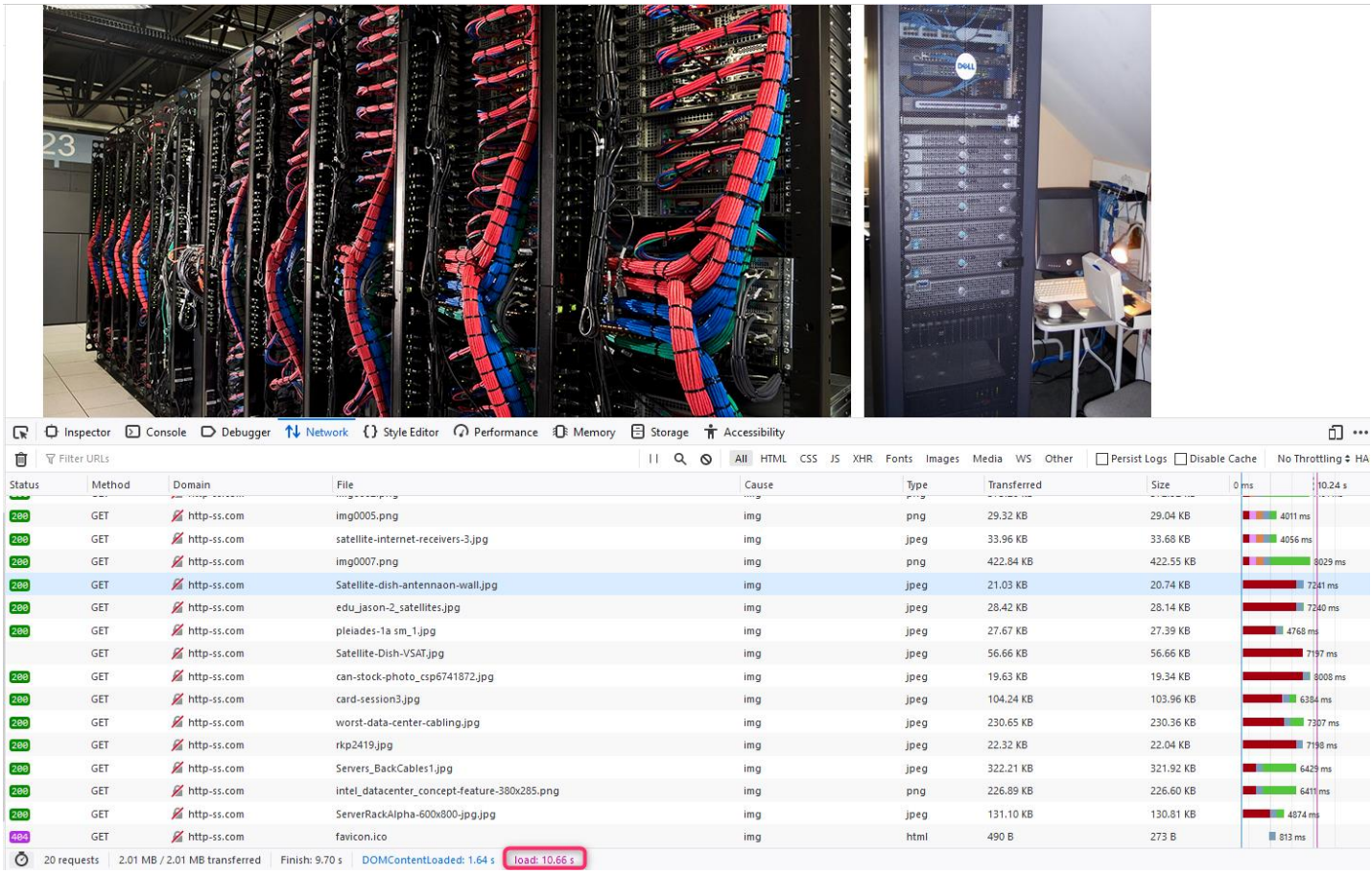
3.5.16 RTT = 800 ms

Bandwidth 700 Mbit/s
Latency 800 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=792ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=795ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=797ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=799ms TTL=64
```

3.5.16.1 Page Load Time - TCP/HTTP

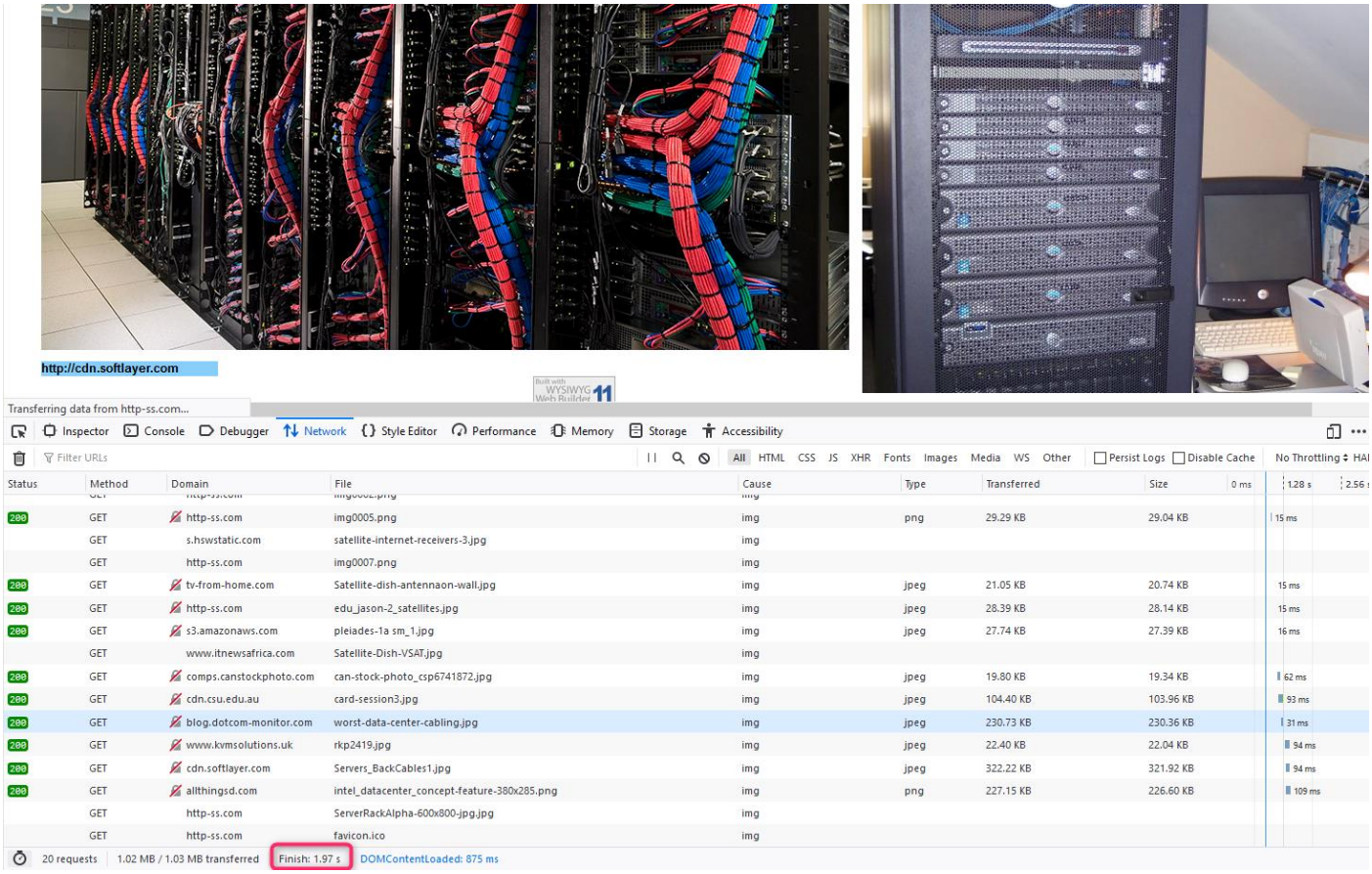
Browser Cache deleted!



Page Load Time: **10,66 s**

3.5.16.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,97 s**

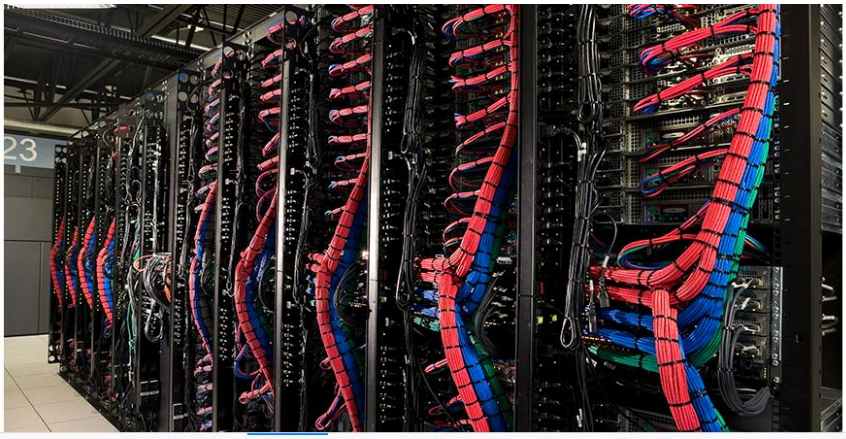
3.5.17 RTT = 900 ms

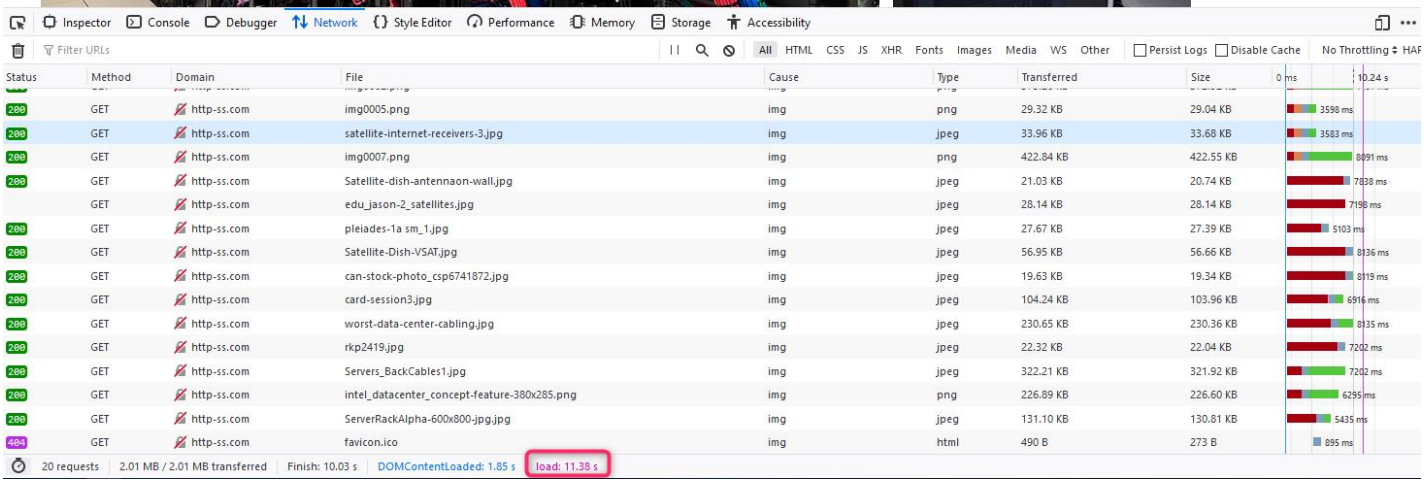
Bandwidth 700 Mbit/s
Latency 900 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=919ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=905ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=926ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=876ms TTL=64
```

3.5.17.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

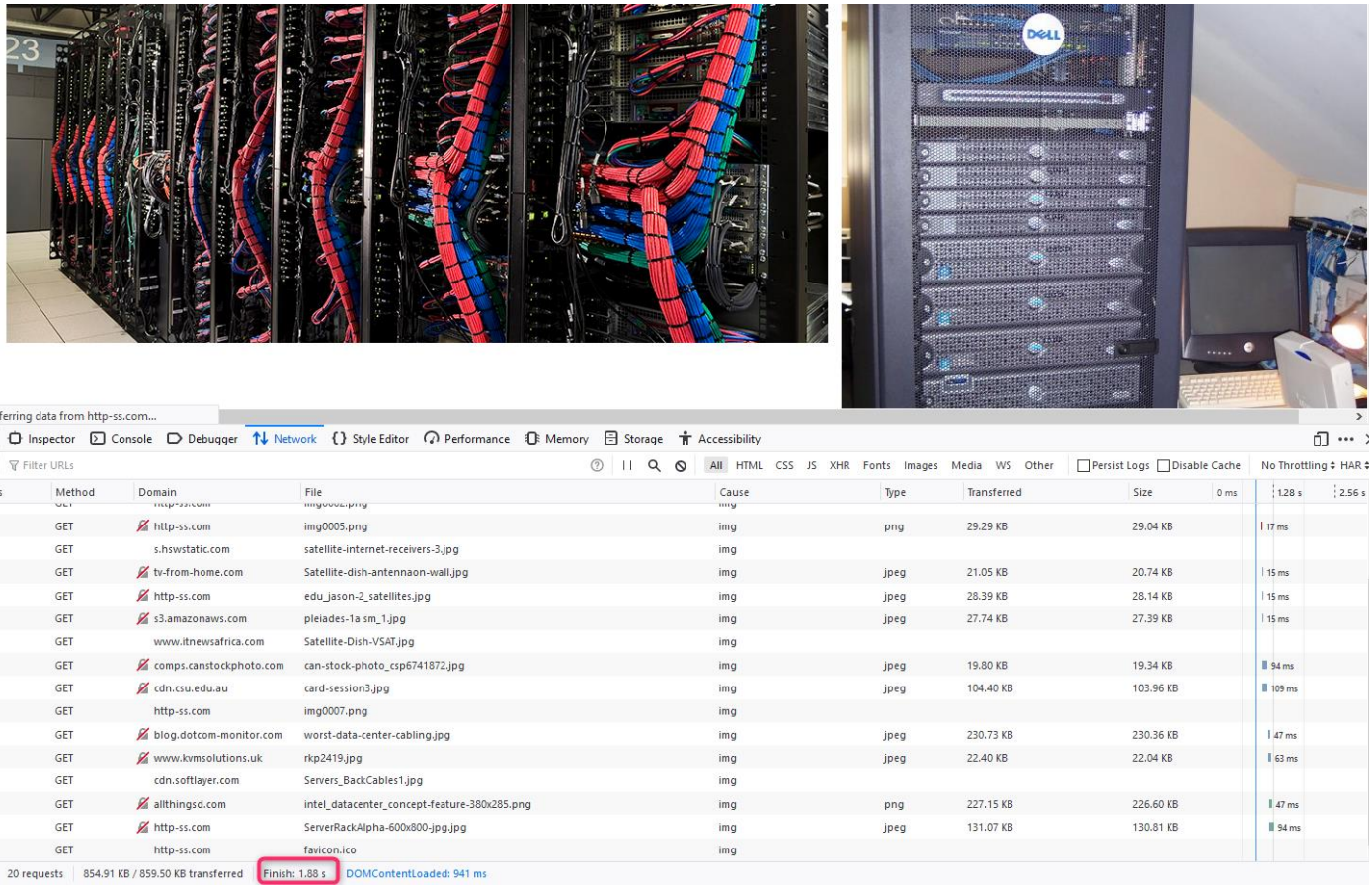




Page Load Time: **11,38 s**

3.5.17.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1,88 s**

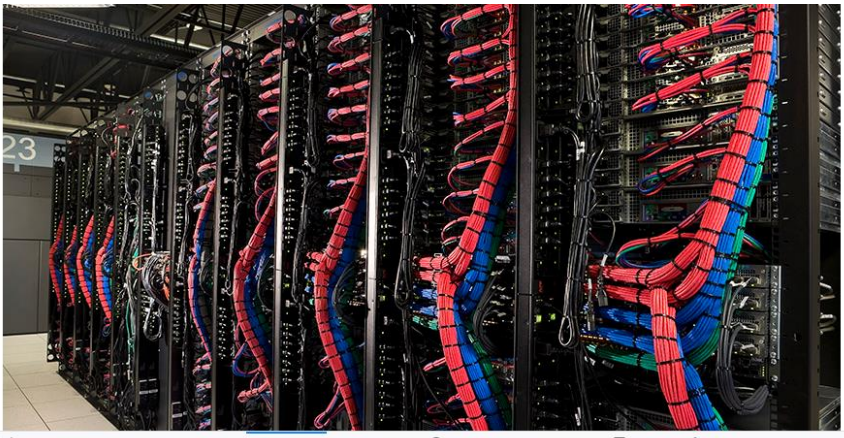
3.5.18 RTT = 1 000 ms

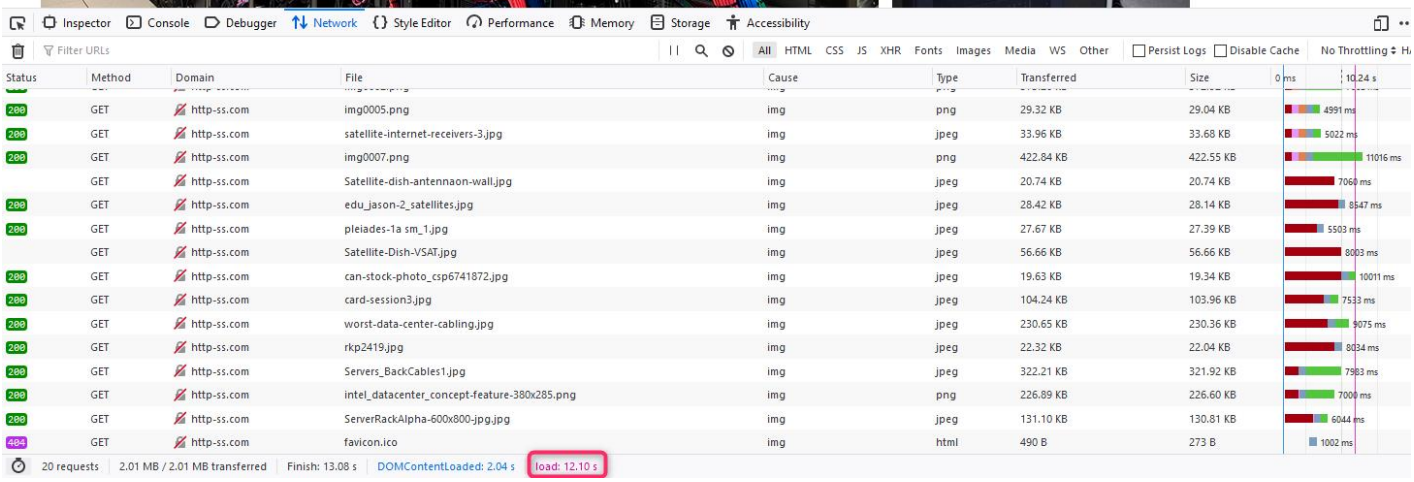
Bandwidth 700 Mbit/s
Latency 1000 ms
Jitter 25 %
Distribution Normal

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=997ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1003ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=991ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
```

3.5.18.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

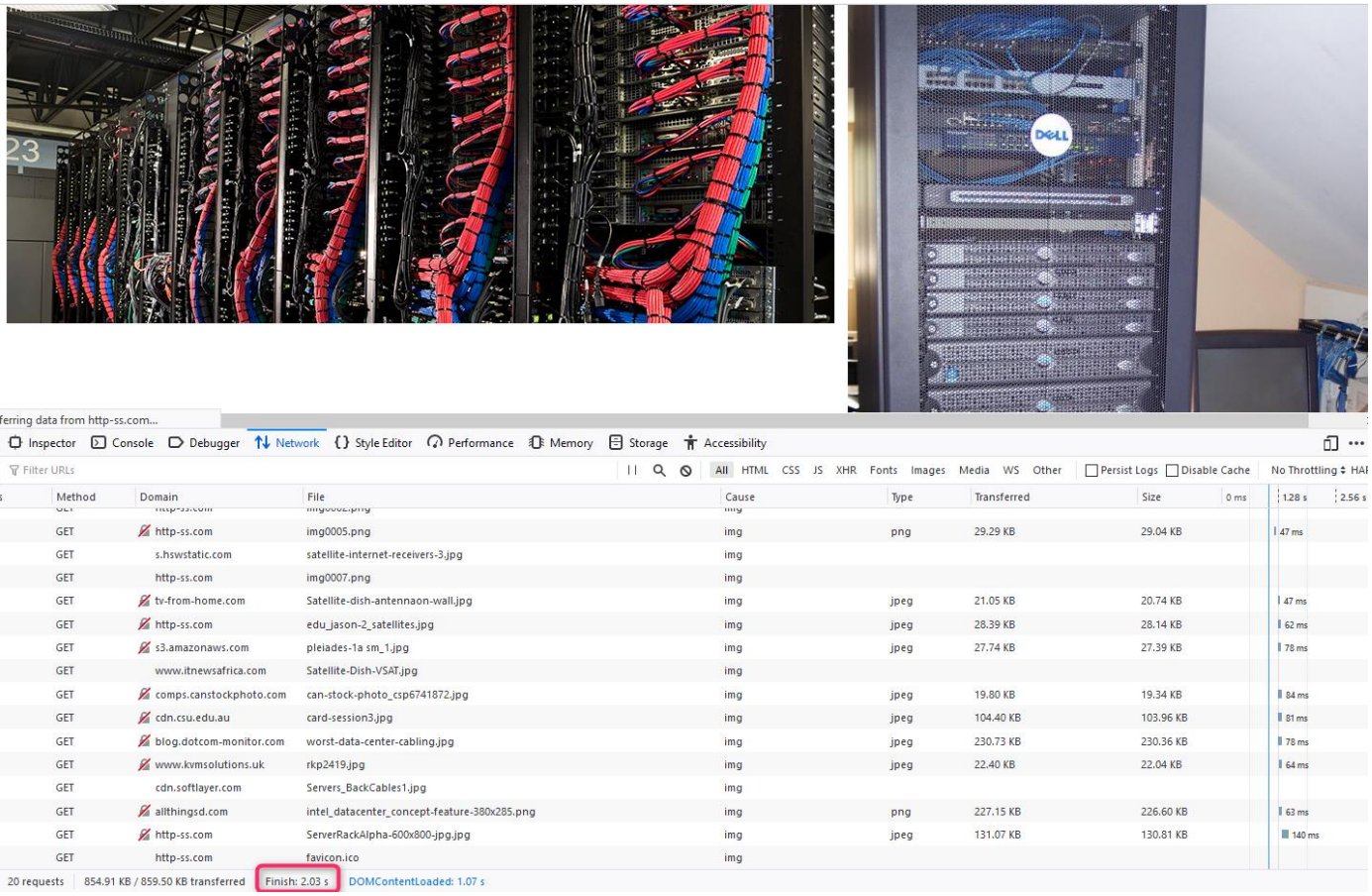




Page Load Time: **12,10 s**

3.5.18.2 Page Load Time - HTTP-QuSS

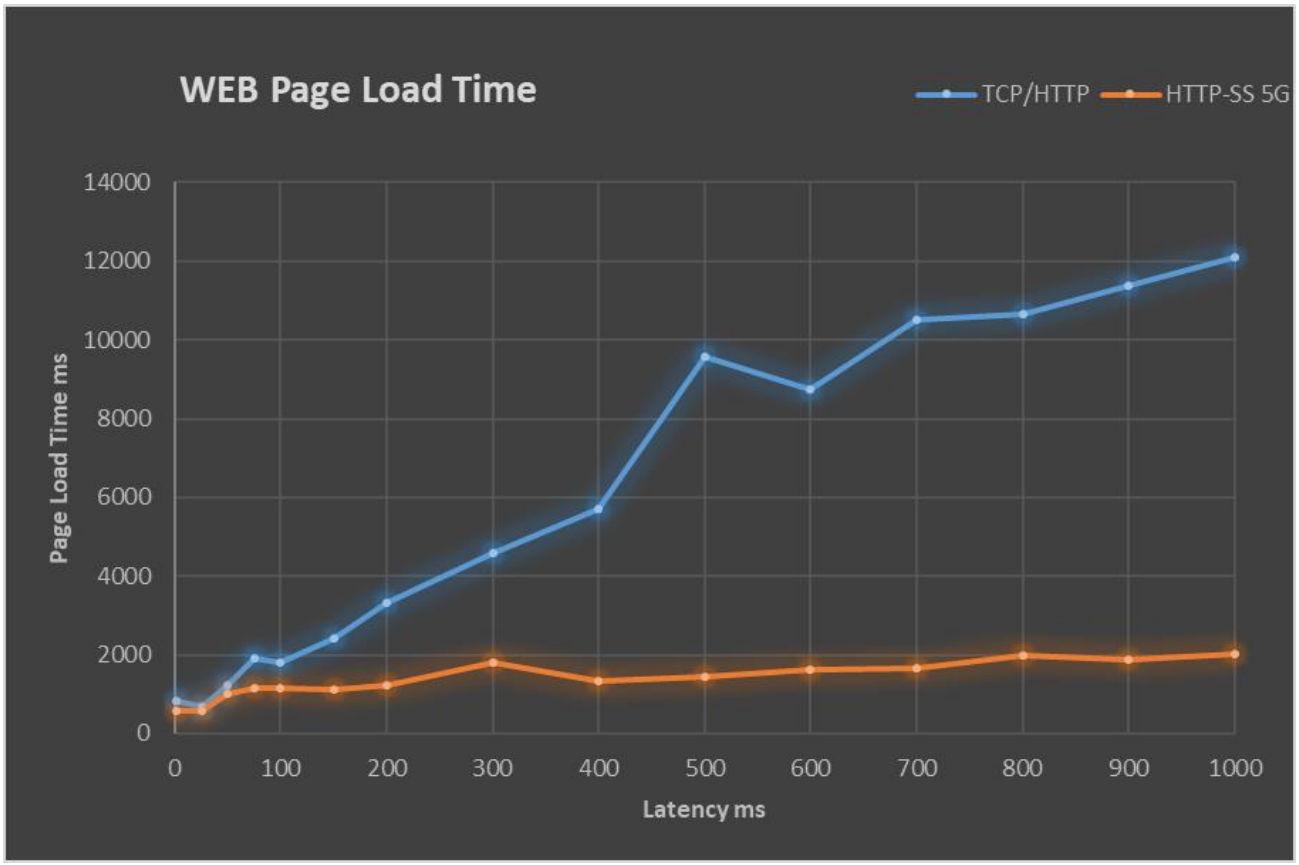
Browser Cache deleted!



Page Load Time: **2,03 s**

3.5.19 Benchmark Summary

	WEB Page Load Time / ms	700 Mbit/s
Latency ms	TCP/HTTP	HTTP-QuSS
1	820	580
25	682	586
50	1210	1020
75	1920	1160
100	1800	1160
150	2400	1120
200	3330	1230
300	4600	1800
400	5690	1320
500	9560	1430
600	8750	1630
700	10500	1650
800	10660	1970
900	11380	1880
1000	12100	2030



4.0 LAB Network Condition

An isolated test bed in a clear lab environment with fully available 1 Gbit/s bandwidth and a realistic simulated up- and downlink satellite connection with a Hardware supported Network Emulator.

4.1 Netropy – N91 Network Emulator

Apposite's Netropy network emulators offer advanced capabilities to benchmark, troubleshoot, and optimize the performance of critical applications. Netropy's unique, high-performance Emulation Engine enables high-precision emulation of up to 15 separate WAN links to model complex network topologies or run multiple concurrent tests. Each link is configured with its own bandwidth, latency, loss and other properties. Packets can be assigned to the appropriate link by IP address range, VLAN, application port number, or any other packet identifier.

Netropy models are available with up to 4 separate Emulation Engines per unit, and capacities up to 100 Gbps. Netropy is also available in a software version, NetropyVE, that runs as a virtual machine in virtual test environments.

Netropy network emulators are configured and managed through an intuitive, browser-based interface for easy operation, or through a comprehensive command line interface for integration with test automation tools.

4.1.1 Features

Multiple Links

Simulate up to 15 separate WAN links through each Emulation Engine.

Multiple Engines

Take advantage of multiple Emulation Engines in the N91, 10G2 and 10G4 models for concurrent testing or multi-user environments.

Packet filtering

Assign packets to different links by IP address, VLAN, or any other packet identifier.

Bandwidths up to 100 Gbps

Accurately simulate links from 100 bits per second up to 100 Gbps.

Latency up to 20 sec.

Emulate delay and jitter of 10 seconds or more in each direction, in increments of 0.01 ms.

Flexible interfaces

The N61 and N91 are available with copper or SFP ports. The 10G1 and 10G2 offer 1/10 Gbps dual rate SFP+ ports for easy integration into 1 or 10 Gbps networks.

Loss & Corruption

Set random, burst, or periodic packet loss. Test the effect of corruption on voice and video applications.

Capture & Replay

Record the delay and loss characteristics of the production network as they vary second-by-second and replay them through the Netropy emulator.

Background Utilization

Test how applications run over a congested network without costly traffic generators or a rack full of client machines using Netropy's unique background utilization and PCAP replay features.

Traffic Monitor

View and download up to 24 hours of throughput graphs and link statistics.

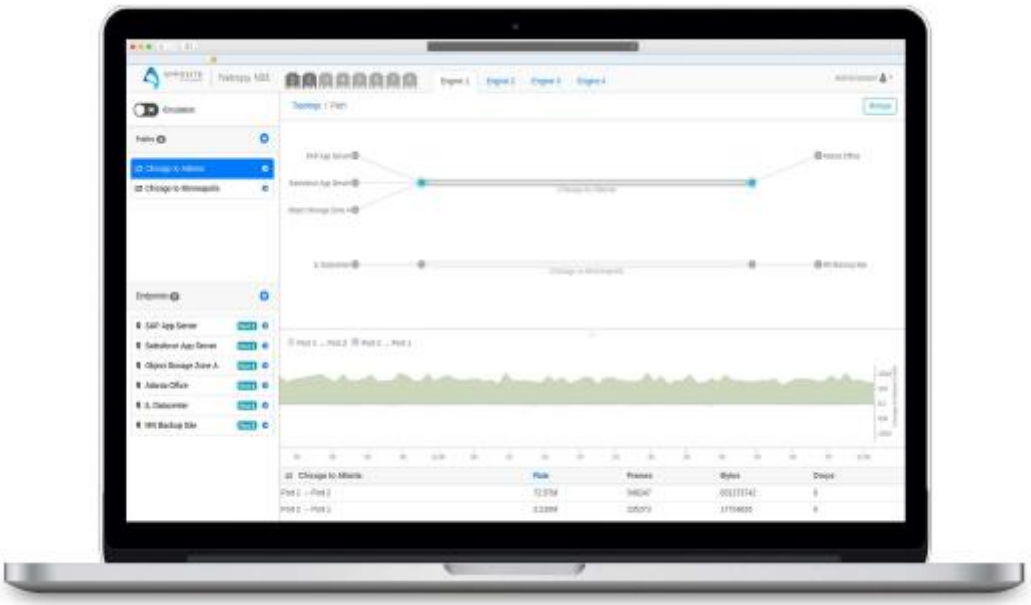
Automated Testing

Automate testing using the comprehensive command line interface.

Unsurpassed Precision

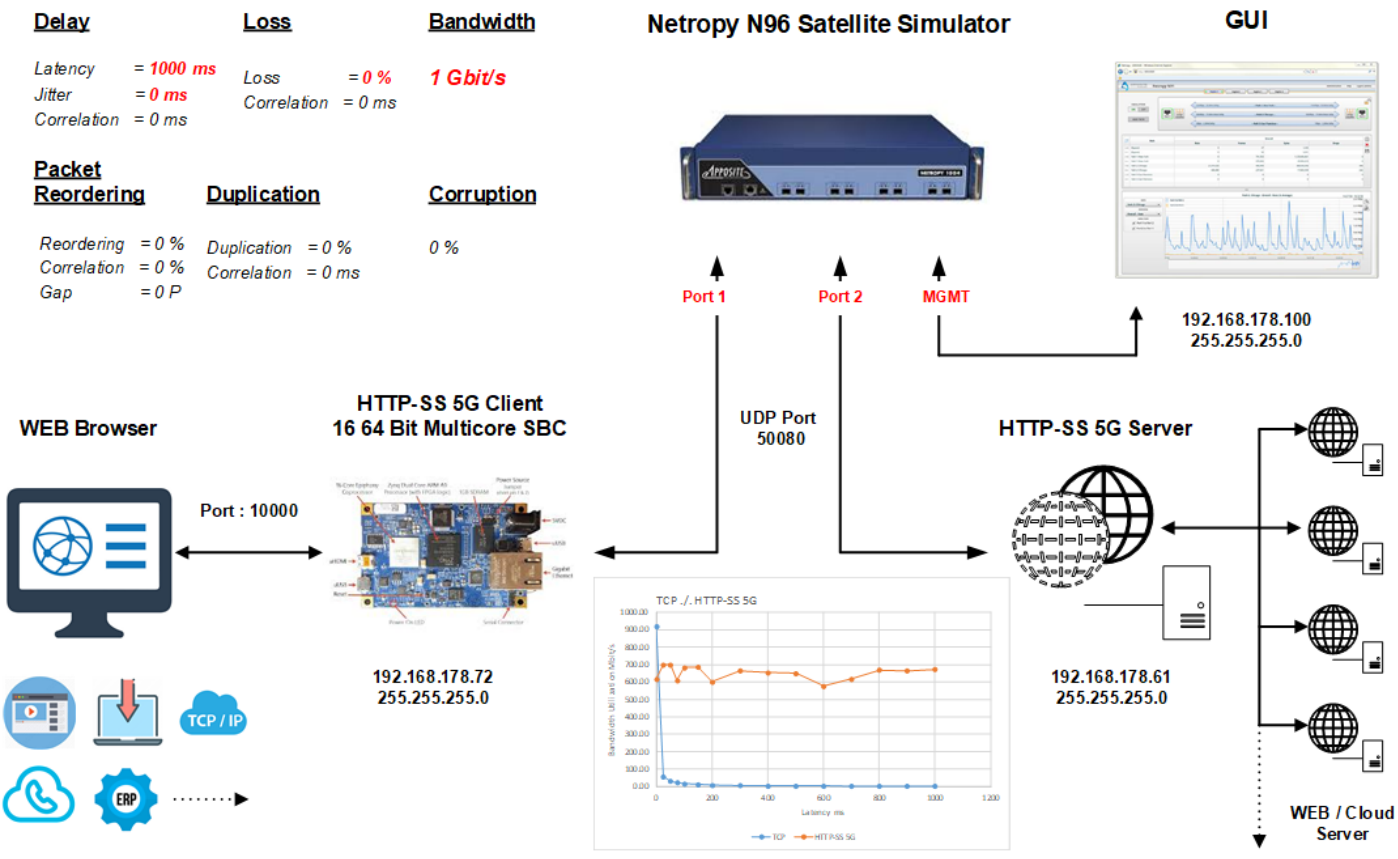
Test with confidence — the high-precision Netropy Emulation Engine e sures accurate and reproducible results.

4.1.2 WEB User Interface

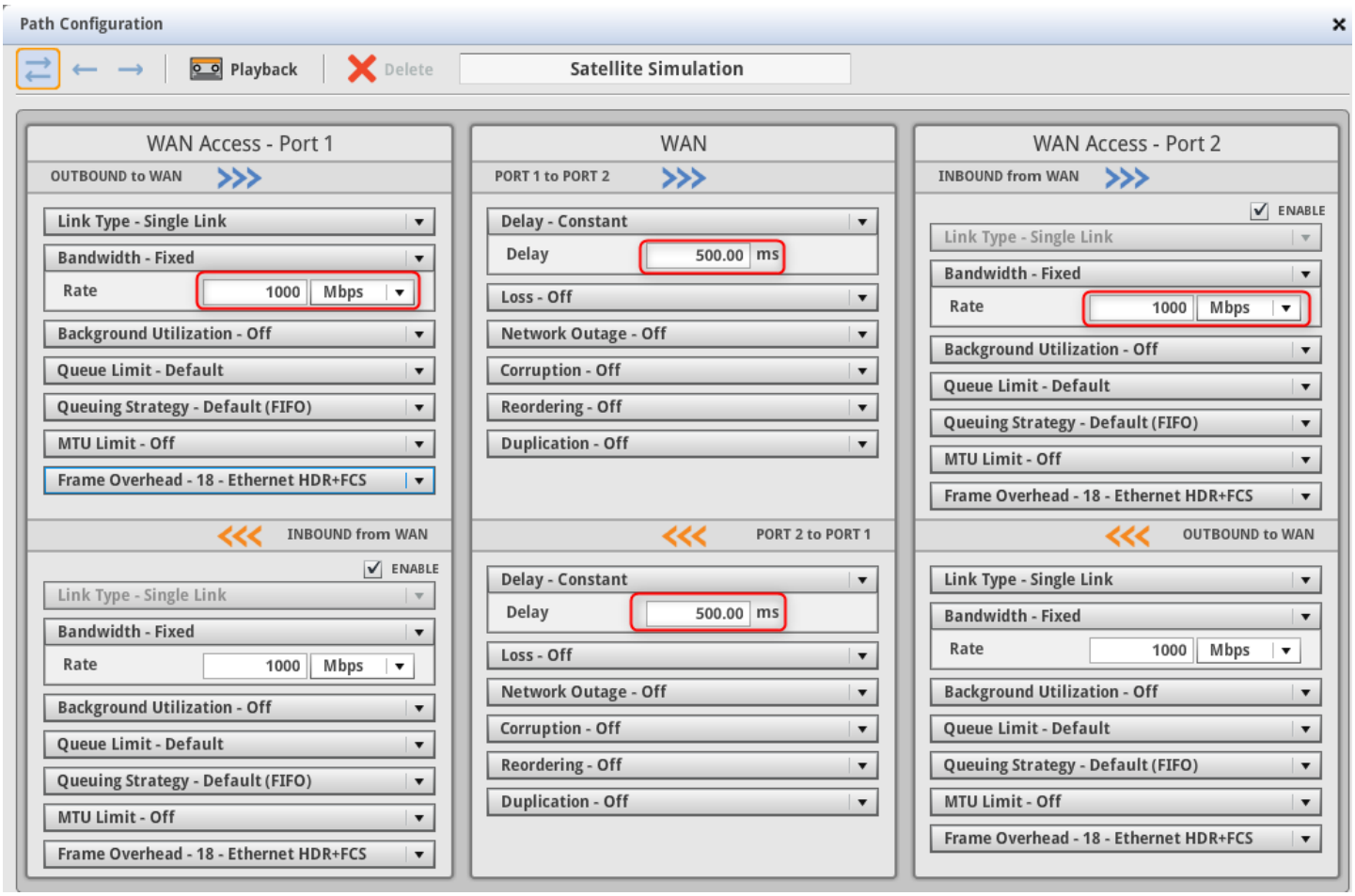


4.2 Initial Functional Tests

4.2.1 Test Environment



4.2.2 Satellite Simulation Settings



4.2.3 Ping Test for Satellite Simulation

192.168.178.72 ←→ 192.168.178.61

```
# Ping 192.168.178.61
```

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
```

4.3 TCP Bandwidth – Latency Dependency

Available Layer 1 Bitstream Bandwidth : **1000 Mbit/s**

4.3.1 iPerf3 - Network Performance Measurement Tool

4.3.1.1 Starting iperf3 Server

Starting iPerf3 on HTTP-QuSS Server **192.168.178.61** as Domain on Port 5200

```
./iperf3 -s -D -p 5200
```

4.3.1.2 Using iperf3 Client

```
./iperf3 -c 192.168.178.61 -p 5200 -R -t 30 -V
```

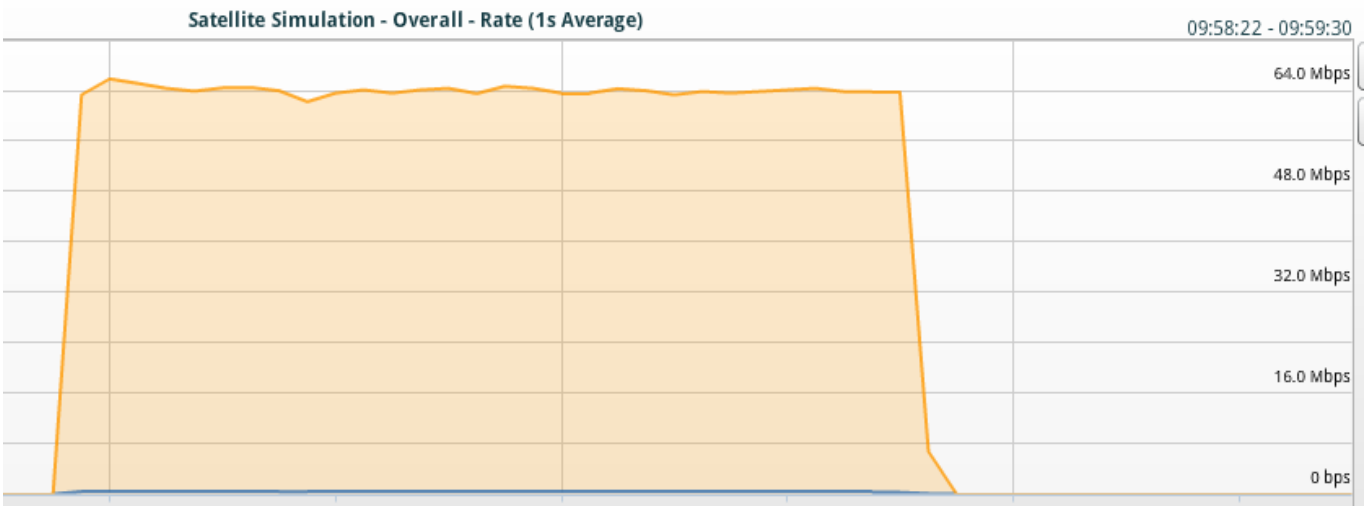
```
-c        As Client
-p        Port 5200
-R        Run in Reverse Mode (Server sends, Client receives)
-t        Time in seconds to transmit = 30 s
-V        More detailed output
```

4.3.2 TCP - max Bandwidth with RTT = 1 ms

```
[  4] local 192.168.178.72 port 61814 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec   113 MBytes   951 Mbits/sec
[  4]   1.00-2.00   sec   112 MBytes   937 Mbits/sec
[  4]   2.00-3.00   sec   112 MBytes   940 Mbits/sec
[  4]   3.00-4.00   sec   112 MBytes   939 Mbits/sec
[  4]   4.00-5.00   sec   112 MBytes   939 Mbits/sec
[  4]   5.00-6.00   sec   111 MBytes   934 Mbits/sec
[  4]   6.00-7.00   sec   112 MBytes   939 Mbits/sec
[  4]   7.00-8.00   sec   112 MBytes   943 Mbits/sec
[  4]   8.00-9.00   sec   113 MBytes   946 Mbits/sec
[  4]   9.00-10.00  sec   112 MBytes   939 Mbits/sec
[  4]  10.00-11.00  sec   112 MBytes   939 Mbits/sec
[  4]  11.00-12.00  sec   113 MBytes   949 Mbits/sec
[  4]  12.00-13.00  sec   113 MBytes   944 Mbits/sec
[  4]  13.00-14.00  sec   113 MBytes   949 Mbits/sec
[  4]  14.00-15.00  sec   113 MBytes   949 Mbits/sec
[  4]  15.00-16.00  sec   113 MBytes   949 Mbits/sec
[  4]  16.00-17.00  sec   113 MBytes   949 Mbits/sec
[  4]  17.00-18.00  sec   111 MBytes   929 Mbits/sec
[  4]  18.00-19.00  sec   113 MBytes   949 Mbits/sec
[  4]  19.00-20.00  sec   109 MBytes   915 Mbits/sec
[  4]  20.00-21.00  sec   109 MBytes   914 Mbits/sec
[  4]  21.00-22.00  sec   104 MBytes   872 Mbits/sec
[  4]  22.00-23.00  sec   101 MBytes   848 Mbits/sec
[  4]  23.00-24.00  sec   104 MBytes   876 Mbits/sec
[  4]  24.00-25.00  sec   111 MBytes   931 Mbits/sec
[  4]  25.00-26.00  sec   107 MBytes   895 Mbits/sec
[  4]  26.00-27.00  sec   109 MBytes   913 Mbits/sec
[  4]  27.00-28.00  sec   107 MBytes   898 Mbits/sec
[  4]  28.00-29.00  sec   111 MBytes   934 Mbits/sec
[  4]  29.00-30.00  sec   111 MBytes   935 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  3.24 GBytes   928 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  3.24 GBytes   928 Mbits/sec                  receiver
CPU Utilization: local/receiver 17.0% (5.9%u/11.1%s), remote/sender 2.9% (0.1%u/2.8%s)
```

Average used Bandwidth : **928 Mbit/s of 1000 Mbit/s**

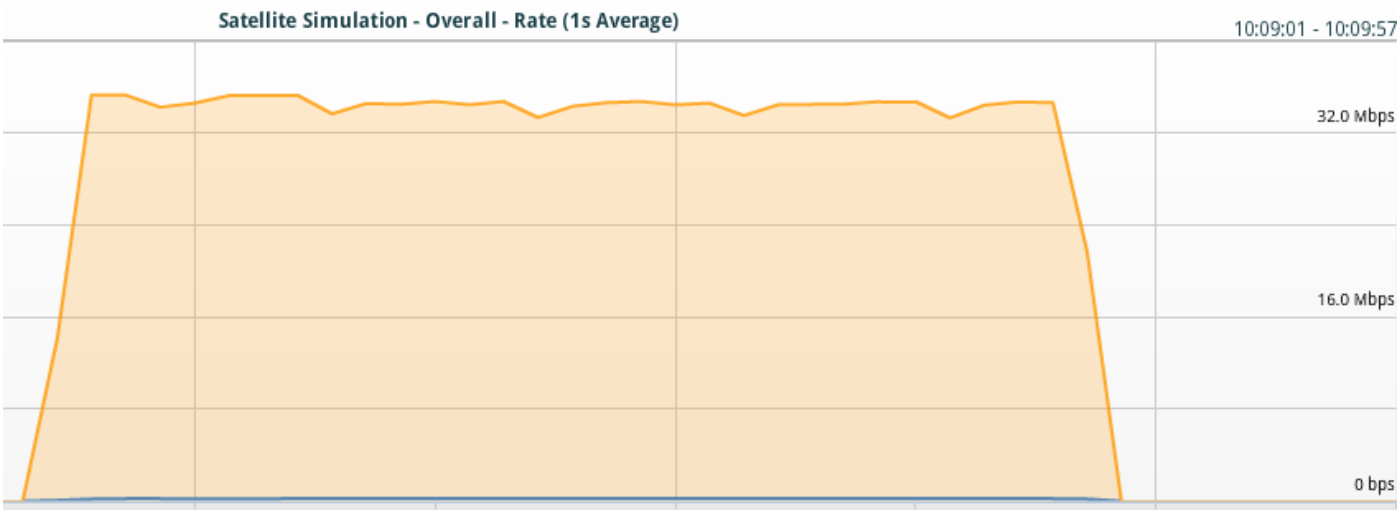
4.3.3 TCP - max Bandwidth with RTT = 25 ms




```
[  4] local 192.168.178.72 port 61953 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  7.29 MBytes  61.1 Mbits/sec
[  4]   1.00-2.00   sec  7.61 MBytes  63.7 Mbits/sec
[  4]   2.00-3.01   sec  7.57 MBytes  63.4 Mbits/sec
[  4]   3.01-4.00   sec  7.20 MBytes  60.7 Mbits/sec
[  4]   4.00-5.02   sec  7.31 MBytes  60.4 Mbits/sec
[  4]   5.02-6.00   sec  7.49 MBytes  63.7 Mbits/sec
[  4]   6.00-7.00   sec  7.47 MBytes  62.8 Mbits/sec
[  4]   7.00-8.00   sec  7.30 MBytes  61.1 Mbits/sec
[  4]   8.00-9.01   sec  7.16 MBytes  59.9 Mbits/sec
[  4]   9.01-10.01  sec  7.29 MBytes  61.2 Mbits/sec
[  4]  10.01-11.00  sec  7.30 MBytes  61.4 Mbits/sec
[  4]  11.00-12.01  sec  7.34 MBytes  61.5 Mbits/sec
[  4]  12.01-13.00  sec  7.31 MBytes  61.5 Mbits/sec
[  4]  13.00-14.01  sec  7.42 MBytes  61.9 Mbits/sec
[  4]  14.01-15.01  sec  7.32 MBytes  61.4 Mbits/sec
[  4]  15.01-16.01  sec  7.41 MBytes  62.2 Mbits/sec
[  4]  16.01-17.00  sec  7.31 MBytes  61.5 Mbits/sec
[  4]  17.00-18.01  sec  7.34 MBytes  61.4 Mbits/sec
[  4]  18.01-19.01  sec  7.29 MBytes  61.2 Mbits/sec
[  4]  19.01-20.01  sec  7.36 MBytes  61.9 Mbits/sec
[  4]  20.01-21.00  sec  7.33 MBytes  61.5 Mbits/sec
[  4]  21.00-22.00  sec  7.26 MBytes  61.0 Mbits/sec
[  4]  22.00-23.00  sec  7.30 MBytes  61.4 Mbits/sec
[  4]  23.00-24.01  sec  7.33 MBytes  61.2 Mbits/sec
[  4]  24.01-25.00  sec  7.29 MBytes  61.4 Mbits/sec
[  4]  25.00-26.00  sec  7.31 MBytes  61.4 Mbits/sec
[  4]  26.00-27.00  sec  7.40 MBytes  62.1 Mbits/sec
[  4]  27.00-28.00  sec  7.33 MBytes  61.5 Mbits/sec
[  4]  28.00-29.01  sec  7.35 MBytes  61.4 Mbits/sec
[  4]  29.01-30.00  sec  7.21 MBytes  60.8 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   222 MBytes  62.1 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   220 MBytes  61.6 Mbits/sec                  receiver
CPU Utilization: local/receiver 3.9% (1.4%u/2.5%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **62 Mbit/s of 1000 Mbit/s**

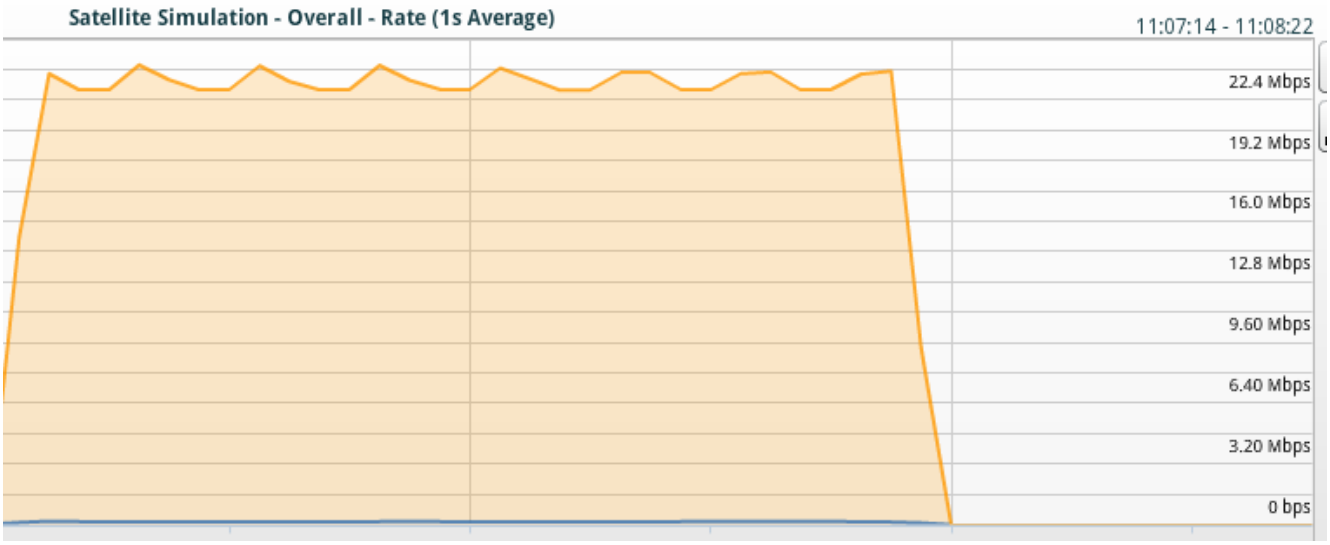
4.3.4 TCP - max Bandwidth with RTT = 50 ms




```
[  4] local 192.168.178.72 port 62134 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  3.45 MBytes  28.8 Mbits/sec
[  4]   1.01-2.01   sec  4.05 MBytes  33.9 Mbits/sec
[  4]   2.01-3.01   sec  4.04 MBytes  33.9 Mbits/sec
[  4]   3.01-4.01   sec  4.05 MBytes  34.0 Mbits/sec
[  4]   4.01-5.00   sec  3.86 MBytes  32.6 Mbits/sec
[  4]   5.00-6.01   sec  4.04 MBytes  33.7 Mbits/sec
[  4]   6.01-7.00   sec  4.04 MBytes  34.0 Mbits/sec
[  4]   7.00-8.01   sec  4.03 MBytes  33.6 Mbits/sec
[  4]   8.01-9.01   sec  3.98 MBytes  33.4 Mbits/sec
[  4]   9.01-10.00  sec  3.87 MBytes  32.8 Mbits/sec
[  4]  10.00-11.01  sec  3.93 MBytes  32.9 Mbits/sec
[  4]  11.01-12.00  sec  3.95 MBytes  33.3 Mbits/sec
[  4]  12.00-13.01  sec  3.97 MBytes  33.1 Mbits/sec
[  4]  13.01-14.00  sec  3.97 MBytes  33.5 Mbits/sec
[  4]  14.00-15.01  sec  3.95 MBytes  32.9 Mbits/sec
[  4]  15.01-16.00  sec  3.86 MBytes  32.6 Mbits/sec
[  4]  16.00-17.00  sec  3.94 MBytes  33.1 Mbits/sec
[  4]  17.00-18.00  sec  3.96 MBytes  33.2 Mbits/sec
[  4]  18.00-19.00  sec  3.96 MBytes  33.3 Mbits/sec
[  4]  19.00-20.01  sec  3.98 MBytes  33.2 Mbits/sec
[  4]  20.01-21.00  sec  3.97 MBytes  33.4 Mbits/sec
[  4]  21.00-22.00  sec  3.85 MBytes  32.4 Mbits/sec
[  4]  22.00-23.01  sec  3.92 MBytes  32.8 Mbits/sec
[  4]  23.01-24.01  sec  3.98 MBytes  33.3 Mbits/sec
[  4]  24.01-25.00  sec  3.96 MBytes  33.4 Mbits/sec
[  4]  25.00-26.01  sec  3.97 MBytes  33.2 Mbits/sec
[  4]  26.01-27.01  sec  3.98 MBytes  33.4 Mbits/sec
[  4]  27.01-28.00  sec  3.85 MBytes  32.5 Mbits/sec
[  4]  28.00-29.00  sec  3.94 MBytes  33.1 Mbits/sec
[  4]  29.00-30.01  sec  3.97 MBytes  33.2 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec   121 MBytes  33.7 Mbits/sec    0             sender
[  4]   0.00-30.01  sec   119 MBytes  33.1 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.9% (1.1%u/1.8%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Average used Bandwidth : **34 Mbit/s of 1000 Mbit/s**

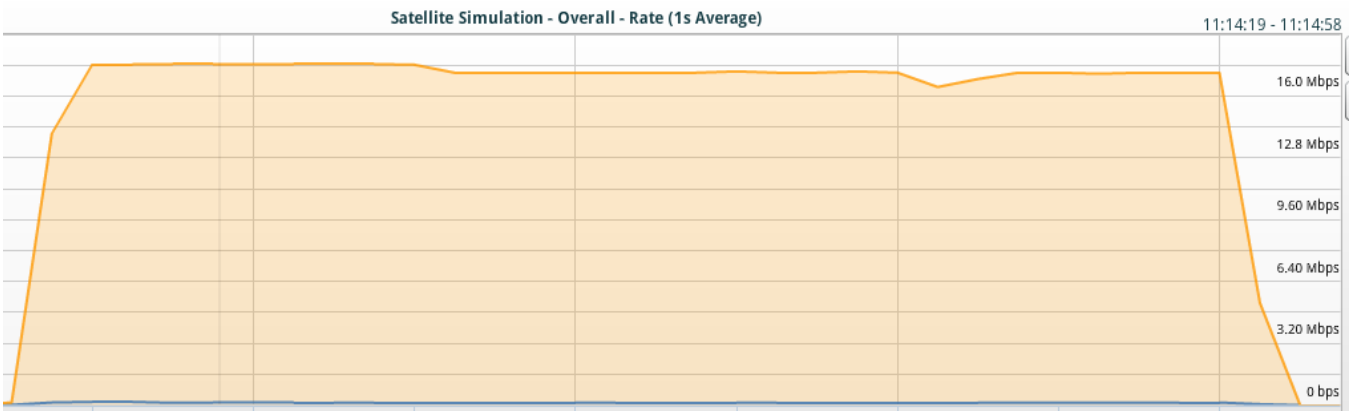
4.3.5 TCP - max Bandwidth with RTT = 75 ms




```
[  4] local 192.168.178.72 port 60547 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.02   sec  2.23 MBytes  18.3 Mbits/sec
[  4]   1.02-2.02   sec  2.63 MBytes  22.1 Mbits/sec
[  4]   2.02-3.02   sec  2.63 MBytes  22.2 Mbits/sec
[  4]   3.02-4.02   sec  2.83 MBytes  23.6 Mbits/sec
[  4]   4.02-5.02   sec  2.63 MBytes  22.1 Mbits/sec
[  4]   5.02-6.02   sec  2.63 MBytes  22.1 Mbits/sec
[  4]   6.02-7.02   sec  2.63 MBytes  22.2 Mbits/sec
[  4]   7.02-8.02   sec  2.82 MBytes  23.5 Mbits/sec
[  4]   8.02-9.02   sec  2.63 MBytes  22.1 Mbits/sec
[  4]   9.02-10.02  sec  2.63 MBytes  22.1 Mbits/sec
[  4]  10.02-11.01  sec  2.64 MBytes  22.3 Mbits/sec
[  4]  11.01-12.02  sec  2.82 MBytes  23.5 Mbits/sec
[  4]  12.02-13.02  sec  2.63 MBytes  22.1 Mbits/sec
[  4]  13.02-14.02  sec  2.63 MBytes  22.1 Mbits/sec
[  4]  14.02-15.01  sec  2.64 MBytes  22.3 Mbits/sec
[  4]  15.01-16.02  sec  2.83 MBytes  23.6 Mbits/sec
[  4]  16.02-17.02  sec  2.62 MBytes  22.0 Mbits/sec
[  4]  17.02-18.02  sec  2.63 MBytes  22.1 Mbits/sec
[  4]  18.02-19.03  sec  2.75 MBytes  23.0 Mbits/sec
[  4]  19.03-20.02  sec  2.71 MBytes  22.9 Mbits/sec
[  4]  20.02-21.02  sec  2.63 MBytes  22.1 Mbits/sec
[  4]  21.02-22.02  sec  2.63 MBytes  22.1 Mbits/sec
[  4]  22.02-23.02  sec  2.64 MBytes  22.2 Mbits/sec
[  4]  23.02-24.02  sec  2.83 MBytes  23.6 Mbits/sec
[  4]  24.02-25.02  sec  2.63 MBytes  22.1 Mbits/sec
[  4]  25.02-26.02  sec  2.63 MBytes  22.1 Mbits/sec
[  4]  26.02-27.02  sec  2.64 MBytes  22.2 Mbits/sec
[  4]  27.02-28.02  sec  2.82 MBytes  23.6 Mbits/sec
[  4]  28.02-29.02  sec  2.63 MBytes  22.1 Mbits/sec
[  4]  29.02-30.02  sec  2.63 MBytes  22.1 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.02  sec  82.1 MBytes  22.9 Mbits/sec    0             sender
[  4]   0.00-30.02  sec  80.2 MBytes  22.4 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.1% (0.6%u/1.5%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **23 Mbit/s of 1000 Mbit/s**

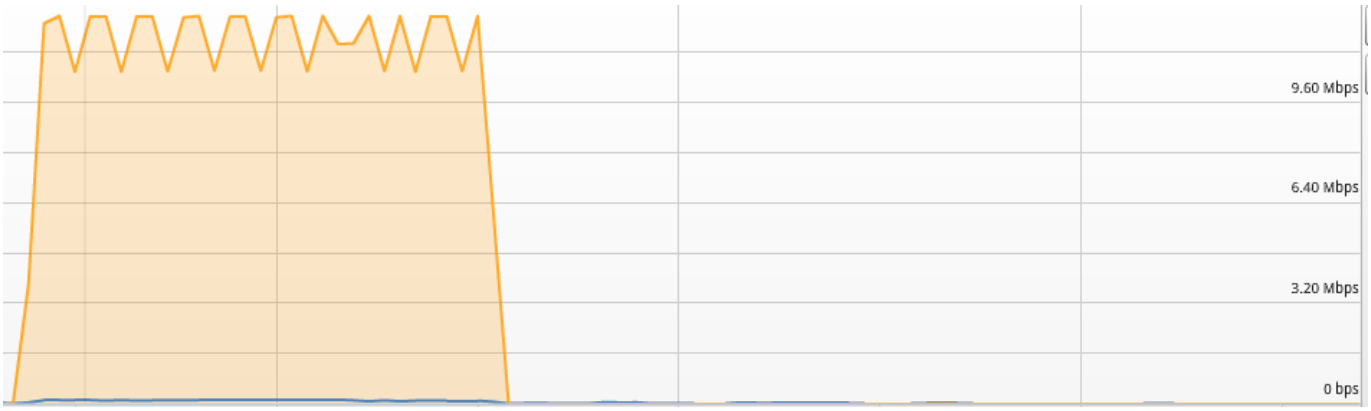
4.3.6 TCP - max Bandwidth with RTT = 100 ms




```
[  4] local 192.168.178.72 port 60667 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.05   sec  1.63 MBytes  13.0 Mbits/sec
[  4]   1.05-2.05   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   2.05-3.05   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   3.05-4.05   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   4.05-5.05   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   5.05-6.05   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   6.05-7.05   sec  2.03 MBytes  17.0 Mbits/sec
[  4]   7.05-8.05   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   8.05-9.05   sec  2.02 MBytes  17.0 Mbits/sec
[  4]   9.05-10.05  sec  2.02 MBytes  17.0 Mbits/sec
[  4]  10.05-11.04  sec  1.86 MBytes  15.8 Mbits/sec
[  4]  11.04-12.04  sec  1.96 MBytes  16.4 Mbits/sec
[  4]  12.04-13.04  sec  1.97 MBytes  16.5 Mbits/sec
[  4]  13.04-14.04  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  14.04-15.04  sec  1.97 MBytes  16.5 Mbits/sec
[  4]  15.04-16.04  sec  1.97 MBytes  16.5 Mbits/sec
[  4]  16.04-17.05  sec  1.98 MBytes  16.6 Mbits/sec
[  4]  17.05-18.05  sec  1.97 MBytes  16.5 Mbits/sec
[  4]  18.05-19.05  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  19.05-20.05  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  20.05-21.05  sec  1.97 MBytes  16.5 Mbits/sec
[  4]  21.05-22.05  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  22.05-23.05  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  23.05-24.05  sec  1.98 MBytes  16.6 Mbits/sec
[  4]  24.05-25.05  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  25.05-26.05  sec  1.97 MBytes  16.6 Mbits/sec
[  4]  26.05-27.04  sec  1.97 MBytes  16.7 Mbits/sec
[  4]  27.04-28.04  sec  1.93 MBytes  16.2 Mbits/sec
[  4]  28.04-29.04  sec  1.97 MBytes  16.5 Mbits/sec
[  4]  29.04-30.04  sec  1.97 MBytes  16.6 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.04  sec  60.8 MBytes  17.0 Mbits/sec    0             sender
[  4]   0.00-30.04  sec  59.4 MBytes  16.6 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.9% (0.9%u/1.1%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **17 Mbit/s of 1000 Mbit/s**

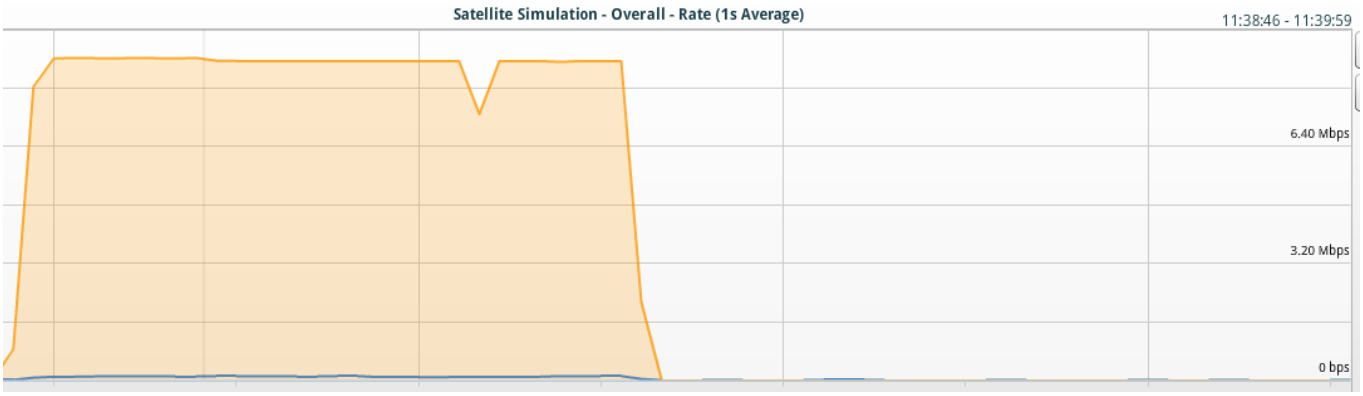
4.3.7 TCP - max Bandwidth with RTT = 150 ms




```
[  4] local 192.168.178.72 port 61264 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  1.02 MBytes  8.49 Mbits/sec
[  4]   1.01-2.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   2.01-3.01   sec  1.21 MBytes  10.2 Mbits/sec
[  4]   3.01-4.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   4.01-5.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   5.01-6.01   sec  1.22 MBytes  10.2 Mbits/sec
[  4]   6.01-7.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   7.01-8.01   sec  1.42 MBytes  11.9 Mbits/sec
[  4]   8.01-9.01   sec  1.21 MBytes  10.2 Mbits/sec
[  4]   9.01-10.01  sec  1.41 MBytes  11.8 Mbits/sec
[  4]  10.01-11.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  11.01-12.01  sec  1.22 MBytes  10.2 Mbits/sec
[  4]  12.01-13.01  sec  1.41 MBytes  11.8 Mbits/sec
[  4]  13.01-14.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  14.01-15.01  sec  1.22 MBytes  10.2 Mbits/sec
[  4]  15.01-16.01  sec  1.41 MBytes  11.8 Mbits/sec
[  4]  16.01-17.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  17.01-18.01  sec  1.22 MBytes  10.2 Mbits/sec
[  4]  18.01-19.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  19.01-20.00  sec  1.27 MBytes  10.7 Mbits/sec
[  4]  20.00-21.01  sec  1.37 MBytes  11.4 Mbits/sec
[  4]  21.01-22.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  22.01-23.01  sec  1.21 MBytes  10.2 Mbits/sec
[  4]  23.01-24.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  24.01-25.01  sec  1.23 MBytes  10.3 Mbits/sec
[  4]  25.01-26.00  sec  1.40 MBytes  11.9 Mbits/sec
[  4]  26.00-27.00  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  27.00-28.01  sec  1.21 MBytes  10.2 Mbits/sec
[  4]  28.01-29.01  sec  1.42 MBytes  11.9 Mbits/sec
[  4]  29.01-30.00  sec  1.27 MBytes  10.7 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  41.7 MBytes  11.7 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  40.2 MBytes  11.2 Mbits/sec                  receiver
CPU Utilization: local/receiver 0.9% (0.5%u/0.5%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **12 Mbit/s of 1000 Mbit/s**

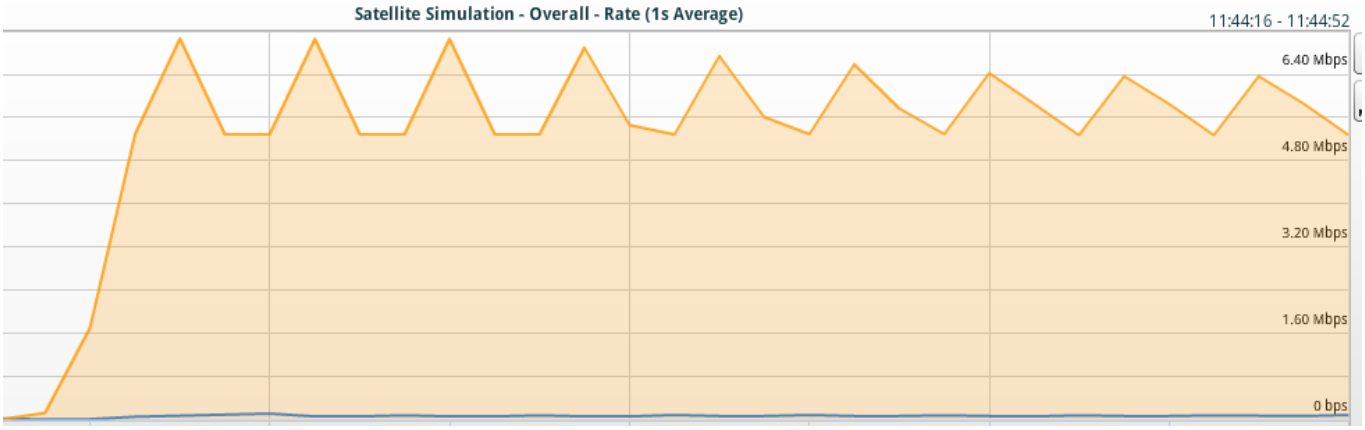
4.3.8 TCP - max Bandwidth with RTT = 200 ms




```
[  4] local 192.168.178.72 port 61362 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec   436 KBytes  3.57 Mbits/sec
[  4]   1.00-2.00   sec  1.00 MBytes  8.39 Mbits/sec
[  4]   2.00-3.00   sec  1.01 MBytes  8.47 Mbits/sec
[  4]   3.00-4.01   sec  1.01 MBytes  8.50 Mbits/sec
[  4]   4.01-5.01   sec  1.01 MBytes  8.44 Mbits/sec
[  4]   5.01-6.01   sec  1.01 MBytes  8.48 Mbits/sec
[  4]   6.01-7.01   sec  1.01 MBytes  8.48 Mbits/sec
[  4]   7.01-8.01   sec  1.01 MBytes  8.45 Mbits/sec
[  4]   8.01-9.01   sec  1.01 MBytes  8.49 Mbits/sec
[  4]   9.01-10.01  sec  1.01 MBytes  8.49 Mbits/sec
[  4]  10.01-11.01  sec  1.01 MBytes  8.48 Mbits/sec
[  4]  11.01-12.01  sec  1.01 MBytes  8.46 Mbits/sec
[  4]  12.01-13.01  sec  1.00 MBytes  8.41 Mbits/sec
[  4]  13.01-14.01  sec  1.00 MBytes  8.41 Mbits/sec
[  4]  14.01-15.01  sec  1.00 MBytes  8.41 Mbits/sec
[  4]  15.01-16.01  sec  1.00 MBytes  8.41 Mbits/sec
[  4]  16.01-17.01  sec  1.00 MBytes  8.47 Mbits/sec
[  4]  17.01-18.01  sec  1.00 MBytes  8.39 Mbits/sec
[  4]  18.01-19.01  sec  1.00 MBytes  8.39 Mbits/sec
[  4]  19.01-20.01  sec  1.00 MBytes  8.39 Mbits/sec
[  4]  20.01-21.02  sec  1.00 MBytes  8.39 Mbits/sec
[  4]  21.02-22.00  sec  1.00 MBytes  8.52 Mbits/sec
[  4]  22.00-23.01  sec  1.00 MBytes  8.38 Mbits/sec
[  4]  23.01-24.01  sec  1.00 MBytes  8.39 Mbits/sec
[  4]  24.01-25.01  sec  1.00 MBytes  8.39 Mbits/sec
[  4]  25.01-26.01  sec  1.00 MBytes  8.39 Mbits/sec
[  4]  26.01-27.01  sec  1024 KBytes  8.40 Mbits/sec
[  4]  27.01-28.01  sec  1.00 MBytes  8.41 Mbits/sec
[  4]  28.01-29.01  sec  1.00 MBytes  8.41 Mbits/sec
[  4]  29.01-30.01  sec  1.00 MBytes  8.41 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  31.6 MBytes  8.84 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  29.8 MBytes  8.34 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.0% (0.8%u/1.2%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **9 Mbit/s of 1000 Mbit/s**

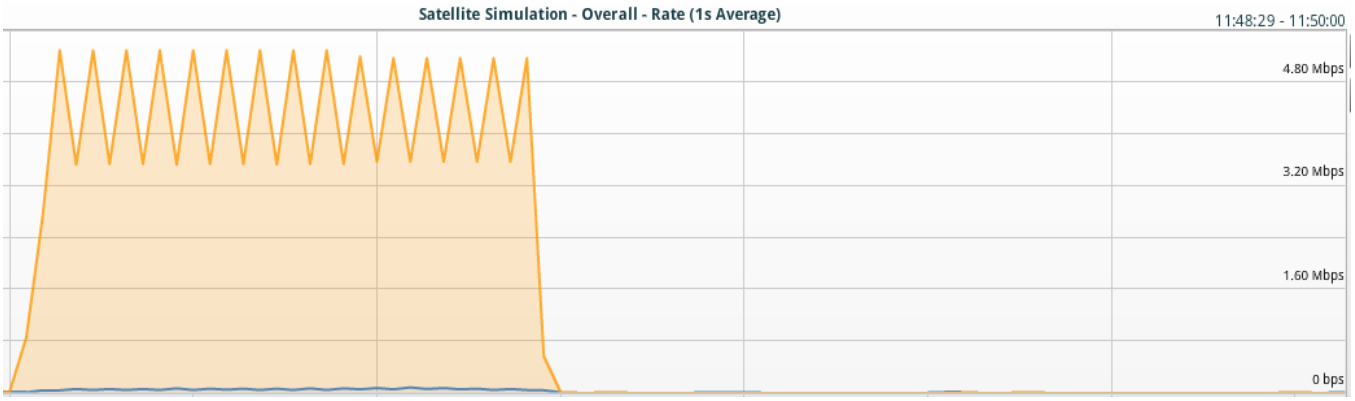
4.3.9 TCP - max Bandwidth with RTT = 300 ms




```
[  4] local 192.168.178.72 port 61448 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec   214 KBytes  1.73 Mbits/sec
[  4]   1.01-2.01   sec   622 KBytes  5.09 Mbits/sec
[  4]   2.01-3.00   sec   629 KBytes  5.21 Mbits/sec
[  4]   3.00-4.01   sec   823 KBytes  6.66 Mbits/sec
[  4]   4.01-5.01   sec   622 KBytes  5.09 Mbits/sec
[  4]   5.01-6.01   sec   624 KBytes  5.16 Mbits/sec
[  4]   6.01-7.02   sec   826 KBytes  6.71 Mbits/sec
[  4]   7.02-8.02   sec   622 KBytes  5.09 Mbits/sec
[  4]   8.02-9.01   sec   624 KBytes  5.14 Mbits/sec
[  4]   9.01-10.02  sec   826 KBytes  6.73 Mbits/sec
[  4]  10.02-11.02  sec   622 KBytes  5.09 Mbits/sec
[  4]  11.02-12.01  sec   627 KBytes  5.15 Mbits/sec
[  4]  12.01-13.02  sec   824 KBytes  6.74 Mbits/sec
[  4]  13.02-14.02  sec   620 KBytes  5.08 Mbits/sec
[  4]  14.02-15.02  sec   622 KBytes  5.09 Mbits/sec
[  4]  15.02-16.02  sec   817 KBytes  6.69 Mbits/sec
[  4]  16.02-17.02  sec   633 KBytes  5.18 Mbits/sec
[  4]  17.02-18.02  sec   622 KBytes  5.09 Mbits/sec
[  4]  18.02-19.02  sec   799 KBytes  6.54 Mbits/sec
[  4]  19.02-20.02  sec   652 KBytes  5.34 Mbits/sec
[  4]  20.02-21.02  sec   622 KBytes  5.09 Mbits/sec
[  4]  21.02-22.02  sec   780 KBytes  6.39 Mbits/sec
[  4]  22.02-23.02  sec   659 KBytes  5.40 Mbits/sec
[  4]  23.02-24.02  sec   616 KBytes  5.05 Mbits/sec
[  4]  24.02-25.02  sec   778 KBytes  6.38 Mbits/sec
[  4]  25.02-26.02  sec   659 KBytes  5.40 Mbits/sec
[  4]  26.02-27.02  sec   616 KBytes  5.05 Mbits/sec
[  4]  27.02-28.02  sec   778 KBytes  6.38 Mbits/sec
[  4]  28.02-29.02  sec   659 KBytes  5.39 Mbits/sec
[  4]  29.02-30.02  sec   616 KBytes  5.05 Mbits/sec
- - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.02  sec  21.3 MBytes  5.94 Mbits/sec    0             sender
[  4]   0.00-30.02  sec  19.8 MBytes  5.54 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.6% (0.6%u/0.9%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **6 Mbit/s of 1000 Mbit/s**

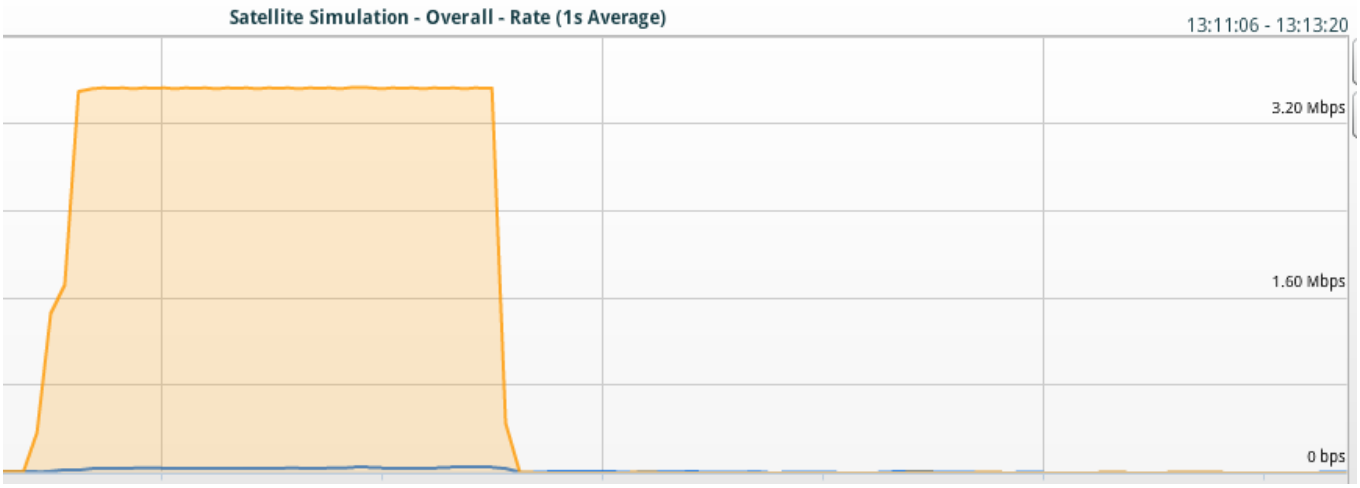
4.3.10 TCP - max Bandwidth with RTT = 400 ms




```
[  4] local 192.168.178.72 port 61538 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.02   sec  99.8 KBytes   805 Kbits/sec
[  4]   1.02-2.00   sec   345 KBytes  2.87 Mbits/sec
[  4]   2.00-3.02   sec   599 KBytes  4.84 Mbits/sec
[  4]   3.02-4.00   sec   416 KBytes  3.46 Mbits/sec
[  4]   4.00-5.02   sec   619 KBytes  5.01 Mbits/sec
[  4]   5.02-6.00   sec   423 KBytes  3.51 Mbits/sec
[  4]   6.00-7.02   sec   613 KBytes  4.97 Mbits/sec
[  4]   7.02-8.02   sec   415 KBytes  3.39 Mbits/sec
[  4]   8.02-9.00   sec   622 KBytes  5.17 Mbits/sec
[  4]   9.00-10.00  sec   414 KBytes  3.39 Mbits/sec
[  4]  10.00-11.00  sec   622 KBytes  5.09 Mbits/sec
[  4]  11.00-12.00  sec   415 KBytes  3.40 Mbits/sec
[  4]  12.00-13.00  sec   622 KBytes  5.09 Mbits/sec
[  4]  13.00-14.00  sec   415 KBytes  3.40 Mbits/sec
[  4]  14.00-15.00  sec   622 KBytes  5.09 Mbits/sec
[  4]  15.00-16.00  sec   414 KBytes  3.39 Mbits/sec
[  4]  16.00-17.00  sec   622 KBytes  5.09 Mbits/sec
[  4]  17.00-18.00  sec   415 KBytes  3.40 Mbits/sec
[  4]  18.00-19.00  sec   622 KBytes  5.09 Mbits/sec
[  4]  19.00-20.00  sec   415 KBytes  3.40 Mbits/sec
[  4]  20.00-21.00  sec   616 KBytes  5.05 Mbits/sec
[  4]  21.00-22.00  sec   413 KBytes  3.39 Mbits/sec
[  4]  22.00-23.01  sec   613 KBytes  5.01 Mbits/sec
[  4]  23.01-24.01  sec   413 KBytes  3.39 Mbits/sec
[  4]  24.01-25.01  sec   613 KBytes  5.02 Mbits/sec
[  4]  25.01-26.01  sec   413 KBytes  3.39 Mbits/sec
[  4]  26.01-27.01  sec   613 KBytes  5.01 Mbits/sec
[  4]  27.01-28.01  sec   413 KBytes  3.39 Mbits/sec
[  4]  28.01-29.01  sec   613 KBytes  5.02 Mbits/sec
[  4]  29.01-30.00  sec   413 KBytes  3.41 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  16.1 MBytes  4.51 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  14.8 MBytes  4.13 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.9% (0.7%u/1.2%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **4.5 Mbit/s of 1000 Mbit/s**

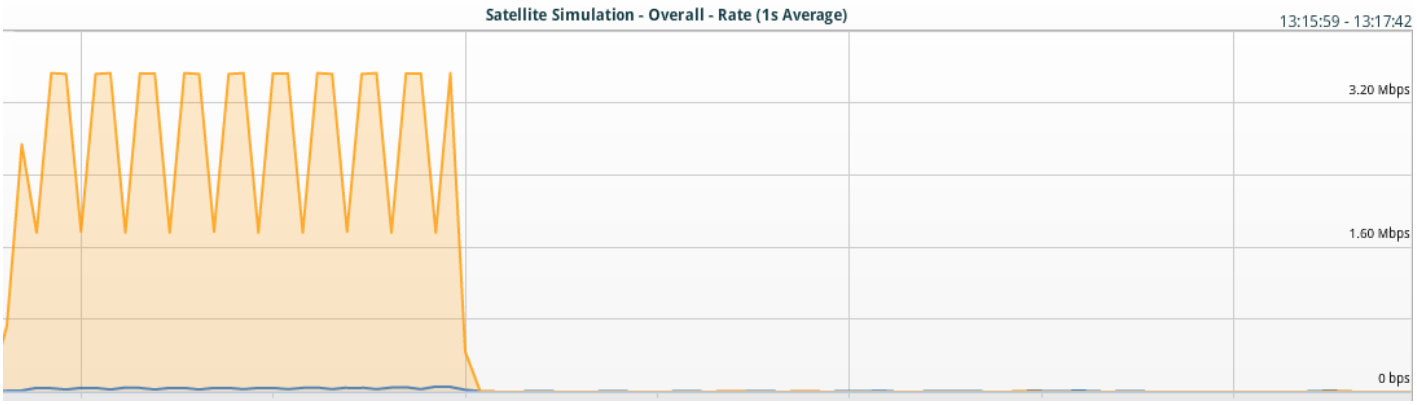
4.3.11 TCP - max Bandwidth with RTT = 500 ms




```
[  4] local 192.168.178.72 port 63048 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec   624 KBytes  5.10 Mbits/sec
[  4]   1.00-2.00   sec   412 KBytes  3.37 Mbits/sec
[  4]   2.00-3.00   sec   415 KBytes  3.40 Mbits/sec
[  4]   3.00-4.00   sec   414 KBytes  3.39 Mbits/sec
[  4]   4.00-5.01   sec   415 KBytes  3.40 Mbits/sec
[  4]   5.01-6.01   sec   416 KBytes  3.41 Mbits/sec
[  4]   6.01-7.01   sec   418 KBytes  3.42 Mbits/sec
[  4]   7.01-8.01   sec   411 KBytes  3.36 Mbits/sec
[  4]   8.01-9.01   sec   416 KBytes  3.41 Mbits/sec
[  4]   9.01-10.01  sec   419 KBytes  3.43 Mbits/sec
[  4]  10.01-11.01  sec   412 KBytes  3.37 Mbits/sec
[  4]  11.01-12.01  sec   406 KBytes  3.33 Mbits/sec
[  4]  12.01-13.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  13.01-14.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  14.01-15.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  15.01-16.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  16.01-17.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  17.01-18.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  18.01-19.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  19.01-20.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  20.01-21.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  21.01-22.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  22.01-23.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  23.01-24.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  24.01-25.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  25.01-26.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  26.01-27.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  27.01-28.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  28.01-29.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  29.01-30.01  sec   415 KBytes  3.40 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  14.2 MBytes  3.98 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  12.6 MBytes  3.52 Mbits/sec                  receiver
CPU Utilization: local/receiver 0.4% (0.1%u/0.3%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **4.0 Mbit/s of 1000 Mbit/s**

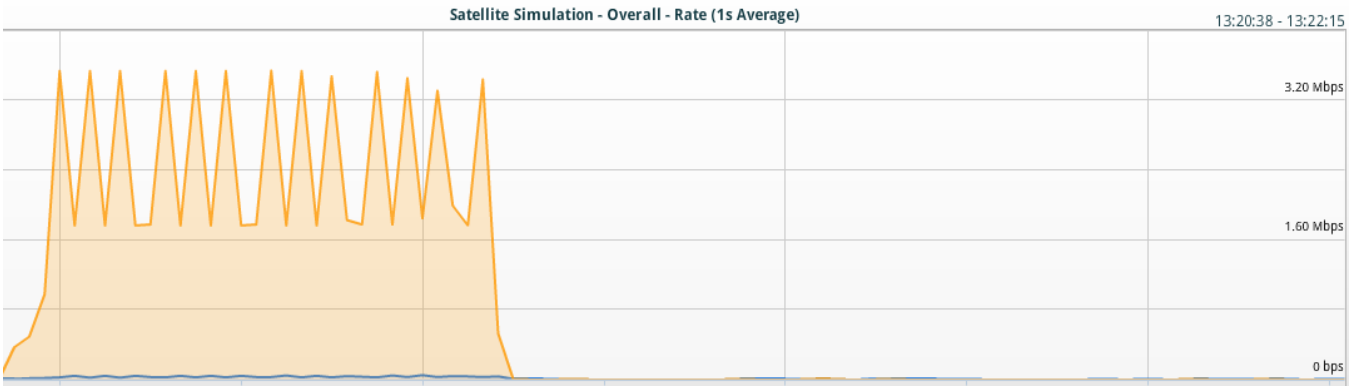
4.3.12 TCP - max Bandwidth with RTT = 600 ms




```
[  4] local 192.168.178.72 port 63141 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  42.8 KBytes   346 Kbits/sec
[  4]   1.01-2.01   sec   171 KBytes  1.40 Mbits/sec
[  4]   2.01-3.00   sec   214 KBytes  1.77 Mbits/sec
[  4]   3.00-4.01   sec   408 KBytes  3.30 Mbits/sec
[  4]   4.01-5.01   sec   415 KBytes  3.40 Mbits/sec
[  4]   5.01-6.00   sec   210 KBytes  1.73 Mbits/sec
[  4]   6.00-7.01   sec   412 KBytes  3.34 Mbits/sec
[  4]   7.01-8.01   sec   415 KBytes  3.40 Mbits/sec
[  4]   8.01-9.01   sec   210 KBytes  1.73 Mbits/sec
[  4]   9.01-10.01  sec   412 KBytes  3.35 Mbits/sec
[  4]  10.01-11.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  11.01-12.01  sec   211 KBytes  1.74 Mbits/sec
[  4]  12.01-13.01  sec   411 KBytes  3.35 Mbits/sec
[  4]  13.01-14.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  14.01-15.01  sec   218 KBytes  1.79 Mbits/sec
[  4]  15.01-16.01  sec   403 KBytes  3.29 Mbits/sec
[  4]  16.01-17.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  17.01-18.01  sec   280 KBytes  2.29 Mbits/sec
[  4]  18.01-19.01  sec   342 KBytes  2.80 Mbits/sec
[  4]  19.01-20.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  20.01-21.01  sec   211 KBytes  1.73 Mbits/sec
[  4]  21.01-22.01  sec   411 KBytes  3.36 Mbits/sec
[  4]  22.01-23.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  23.01-24.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  24.01-25.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  25.01-26.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  26.01-27.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  27.01-28.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  28.01-29.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  29.01-30.01  sec   208 KBytes  1.70 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  11.8 MBytes  3.31 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  9.77 MBytes  2.73 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.7% (0.6%u/1.1%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **3.0 Mbit/s of 1000 Mbit/s**

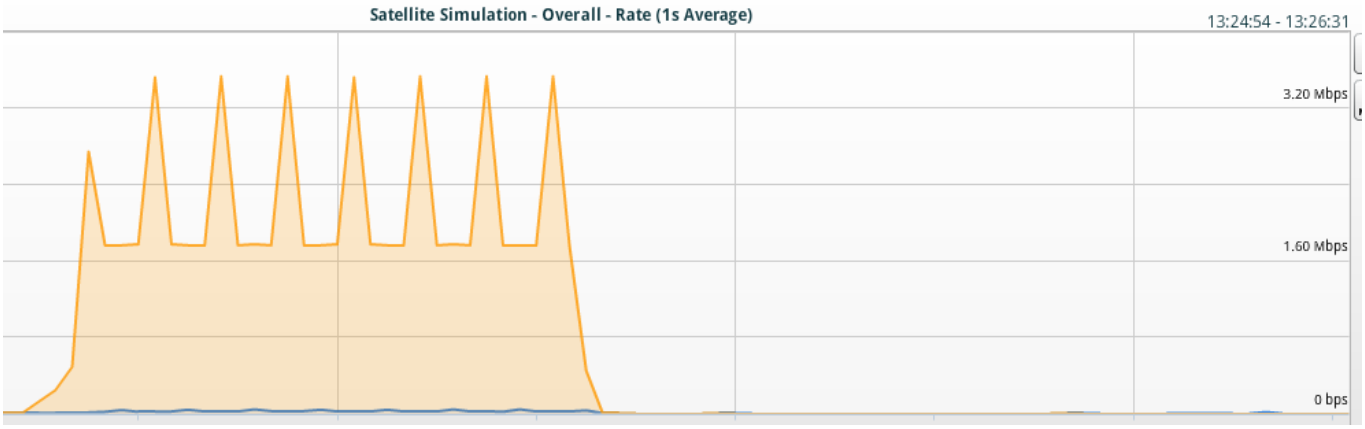
4.3.13 TCP - max Bandwidth with RTT = 700 ms




```
[  4] local 192.168.178.72 port 63233 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  42.8 KBytes   348 Kbits/sec
[  4]   1.01-2.01   sec  57.0 KBytes   467 Kbits/sec
[  4]   2.01-3.01   sec   322 KBytes  2.64 Mbits/sec
[  4]   3.01-4.02   sec   207 KBytes  1.67 Mbits/sec
[  4]   4.02-5.00   sec   415 KBytes  3.46 Mbits/sec
[  4]   5.00-6.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   6.01-7.00   sec   210 KBytes  1.72 Mbits/sec
[  4]   7.00-8.01   sec   412 KBytes  3.35 Mbits/sec
[  4]   8.01-9.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   9.01-10.02  sec   415 KBytes  3.39 Mbits/sec
[  4]  10.02-11.00  sec   208 KBytes  1.73 Mbits/sec
[  4]  11.00-12.01  sec   415 KBytes  3.39 Mbits/sec
[  4]  12.01-13.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  13.01-14.01  sec   207 KBytes  1.70 Mbits/sec
[  4]  14.01-15.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  15.01-16.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  16.01-17.01  sec   416 KBytes  3.41 Mbits/sec
[  4]  17.01-18.01  sec   207 KBytes  1.70 Mbits/sec
[  4]  18.01-19.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  19.01-20.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  20.01-21.01  sec   207 KBytes  1.70 Mbits/sec
[  4]  21.01-22.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  22.01-23.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  23.01-24.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  24.01-25.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  25.01-26.01  sec   396 KBytes  3.25 Mbits/sec
[  4]  26.01-27.01  sec   225 KBytes  1.85 Mbits/sec
[  4]  27.01-28.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  28.01-29.01  sec   411 KBytes  3.37 Mbits/sec
[  4]  29.01-30.01  sec   211 KBytes  1.73 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  10.1 MBytes  2.81 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  8.35 MBytes  2.34 Mbits/sec                  receiver
CPU Utilization: local/receiver 1.7% (0.7%u/1.0%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **2.5 Mbit/s of 1000 Mbit/s**

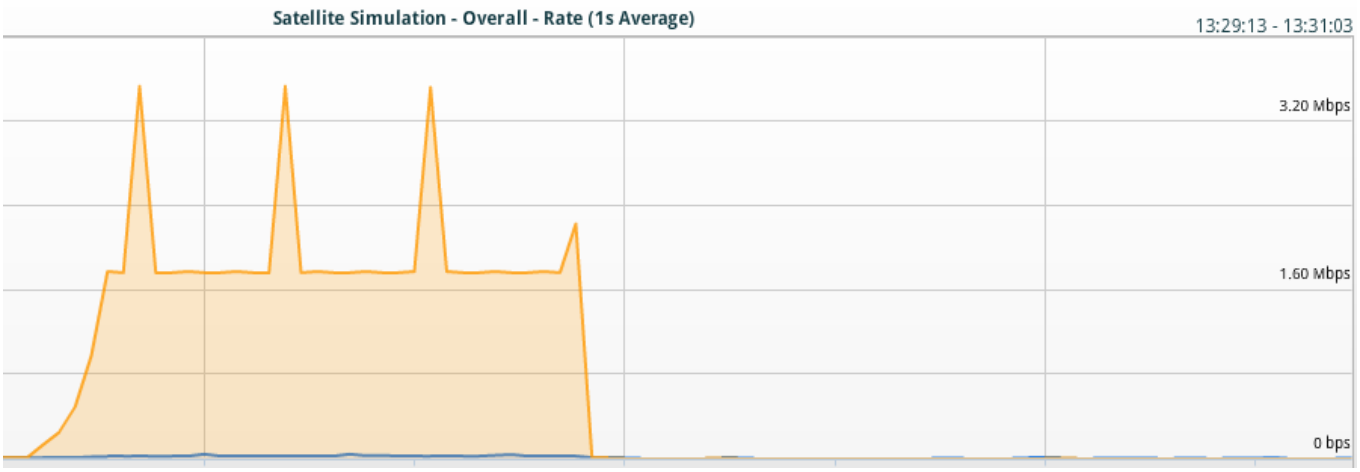
4.3.14 TCP - max Bandwidth with RTT = 800 ms




```
[  4] local 192.168.178.72 port 63308 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  42.8 KBytes   347 Kbits/sec
[  4]   1.01-2.01   sec  57.0 KBytes   467 Kbits/sec
[  4]   2.01-3.01   sec   114 KBytes   934 Kbits/sec
[  4]   3.01-4.00   sec   214 KBytes  1.77 Mbits/sec
[  4]   4.00-5.01   sec   408 KBytes  3.31 Mbits/sec
[  4]   5.01-6.01   sec   208 KBytes  1.71 Mbits/sec
[  4]   6.01-7.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   7.01-8.00   sec   210 KBytes  1.72 Mbits/sec
[  4]   8.00-9.01   sec   412 KBytes  3.36 Mbits/sec
[  4]   9.01-10.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  10.01-11.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  11.01-12.01  sec   210 KBytes  1.73 Mbits/sec
[  4]  12.01-13.01  sec   412 KBytes  3.36 Mbits/sec
[  4]  13.01-14.01  sec   207 KBytes  1.70 Mbits/sec
[  4]  14.01-15.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  15.01-16.01  sec   212 KBytes  1.74 Mbits/sec
[  4]  16.01-17.01  sec   409 KBytes  3.35 Mbits/sec
[  4]  17.01-18.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  18.01-19.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  19.01-20.01  sec   212 KBytes  1.74 Mbits/sec
[  4]  20.01-21.01  sec   409 KBytes  3.35 Mbits/sec
[  4]  21.01-22.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  22.01-23.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  23.01-24.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  24.01-25.01  sec   415 KBytes  3.40 Mbits/sec
[  4]  25.01-26.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  26.01-27.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  27.01-28.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  28.01-29.01  sec   414 KBytes  3.39 Mbits/sec
[  4]  29.01-30.01  sec   207 KBytes  1.69 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  9.20 MBytes  2.57 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  7.34 MBytes  2.05 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.5% (1.1%u/1.4%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **2.25 Mbit/s of 1000 Mbit/s**

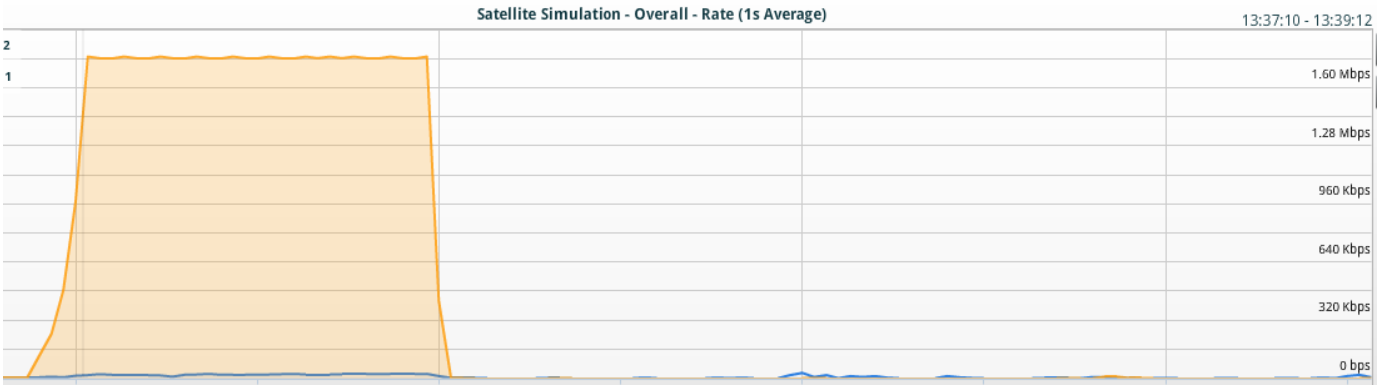
4.3.15 TCP - max Bandwidth with RTT = 900 ms




```
[  4] local 192.168.178.72 port 63414 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  42.8 KBytes   347 Kbits/sec
[  4]   1.01-2.01   sec  57.0 KBytes   467 Kbits/sec
[  4]   2.01-3.01   sec   114 KBytes   934 Kbits/sec
[  4]   3.01-4.01   sec   208 KBytes  1.70 Mbits/sec
[  4]   4.01-5.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   5.01-6.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   6.01-7.01   sec   208 KBytes  1.71 Mbits/sec
[  4]   7.01-8.01   sec   207 KBytes  1.69 Mbits/sec
[  4]   8.01-9.00   sec   210 KBytes  1.73 Mbits/sec
[  4]   9.00-10.01  sec   412 KBytes  3.36 Mbits/sec
[  4]  10.01-11.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  11.01-12.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  12.01-13.01  sec   207 KBytes  1.70 Mbits/sec
[  4]  13.01-14.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  14.01-15.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  15.01-16.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  16.01-17.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  17.01-18.01  sec   212 KBytes  1.74 Mbits/sec
[  4]  18.01-19.01  sec   409 KBytes  3.35 Mbits/sec
[  4]  19.01-20.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  20.01-21.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  21.01-22.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  22.01-23.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  23.01-24.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  24.01-25.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  25.01-26.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  26.01-27.01  sec   207 KBytes  1.70 Mbits/sec
[  4]  27.01-28.02  sec   415 KBytes  3.36 Mbits/sec
[  4]  28.02-29.01  sec   207 KBytes  1.71 Mbits/sec
[  4]  29.01-30.01  sec   207 KBytes  1.69 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  8.47 MBytes  2.37 Mbits/sec    0             sender
[  4]   0.00-30.01  sec  6.53 MBytes  1.83 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.4% (0.9%u/1.5%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **2 Mbit/s of 1000 Mbit/s**

4.3.16 TCP - max Bandwidth with RTT = 1000 ms

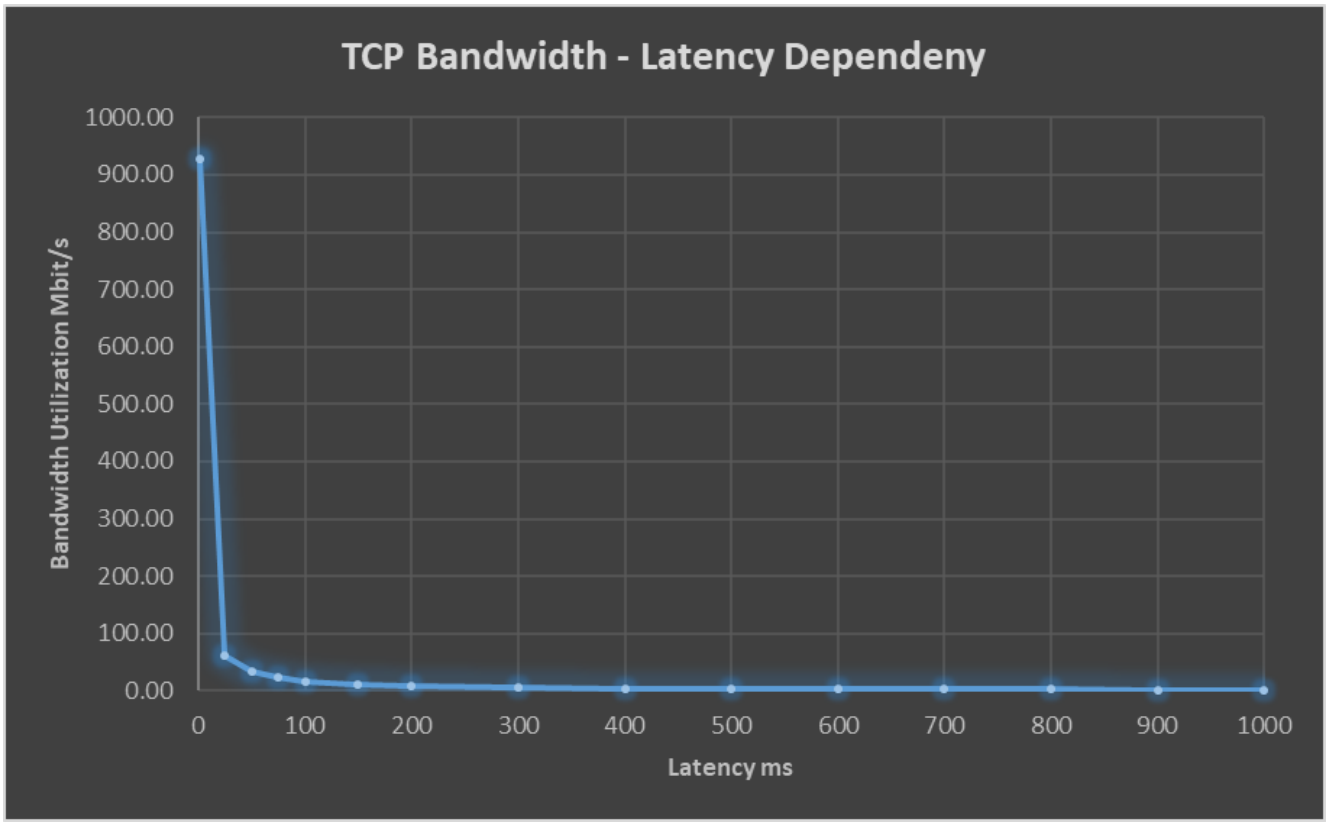



```
[  4] local 192.168.178.72 port 63540 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  42.8 KBytes   350 Kbits/sec
[  4]   1.00-2.00   sec  20.0 KBytes   164 Kbits/sec
[  4]   2.00-3.00   sec  54.2 KBytes   444 Kbits/sec
[  4]   3.00-4.00   sec   103 KBytes   841 Kbits/sec
[  4]   4.00-5.00   sec   205 KBytes  1.68 Mbits/sec
[  4]   5.00-6.00   sec   215 KBytes  1.76 Mbits/sec
[  4]   6.00-7.00   sec   210 KBytes  1.72 Mbits/sec
[  4]   7.00-8.00   sec   208 KBytes  1.70 Mbits/sec
[  4]   8.00-9.00   sec   195 KBytes  1.60 Mbits/sec
[  4]   9.00-10.00  sec   207 KBytes  1.69 Mbits/sec
[  4]  10.00-11.00  sec   219 KBytes  1.80 Mbits/sec
[  4]  11.00-12.01  sec   198 KBytes  1.62 Mbits/sec
[  4]  12.01-13.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  13.01-14.00  sec   202 KBytes  1.66 Mbits/sec
[  4]  14.00-15.00  sec   207 KBytes  1.69 Mbits/sec
[  4]  15.00-16.01  sec   215 KBytes  1.76 Mbits/sec
[  4]  16.01-17.01  sec   205 KBytes  1.68 Mbits/sec
[  4]  17.01-18.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  18.01-19.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  19.01-20.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  20.01-21.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  21.01-22.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  22.01-23.01  sec   210 KBytes  1.72 Mbits/sec
[  4]  23.01-24.01  sec   211 KBytes  1.73 Mbits/sec
[  4]  24.01-25.01  sec   199 KBytes  1.63 Mbits/sec
[  4]  25.01-26.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  26.01-27.01  sec   208 KBytes  1.70 Mbits/sec
[  4]  27.01-28.01  sec   207 KBytes  1.69 Mbits/sec
[  4]  28.01-29.01  sec   215 KBytes  1.76 Mbits/sec
[  4]  29.01-30.01  sec   197 KBytes  1.61 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec  7.49 MBytes  2.09 Mbits/sec    1             sender
[  4]   0.00-30.01  sec  5.72 MBytes  1.60 Mbits/sec                  receiver
CPU Utilization: local/receiver 2.6% (1.0%u/1.6%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Average used Bandwidth : **1.5 Mbit/s of 1000 Mbit/s**

4.3.17 Benchmark Summary

	Netropy N91 Satellite Simulator	
Latency ms	TCP Bandwidth Utilization of 1 Gbit/s	Utilization %
1	928.00	92.80%
25	62.00	6.20%
50	34.00	3.40%
75	23.00	2.30%
100	17.00	1.70%
150	12.00	1.20%
200	9.00	0.90%
300	6.00	0.60%
400	4.50	0.45%
500	4.00	0.40%
600	3.00	0.30%
700	2.50	0.25%
800	2.25	0.23%
900	2.00	0.20%
1000	1.50	0.15%

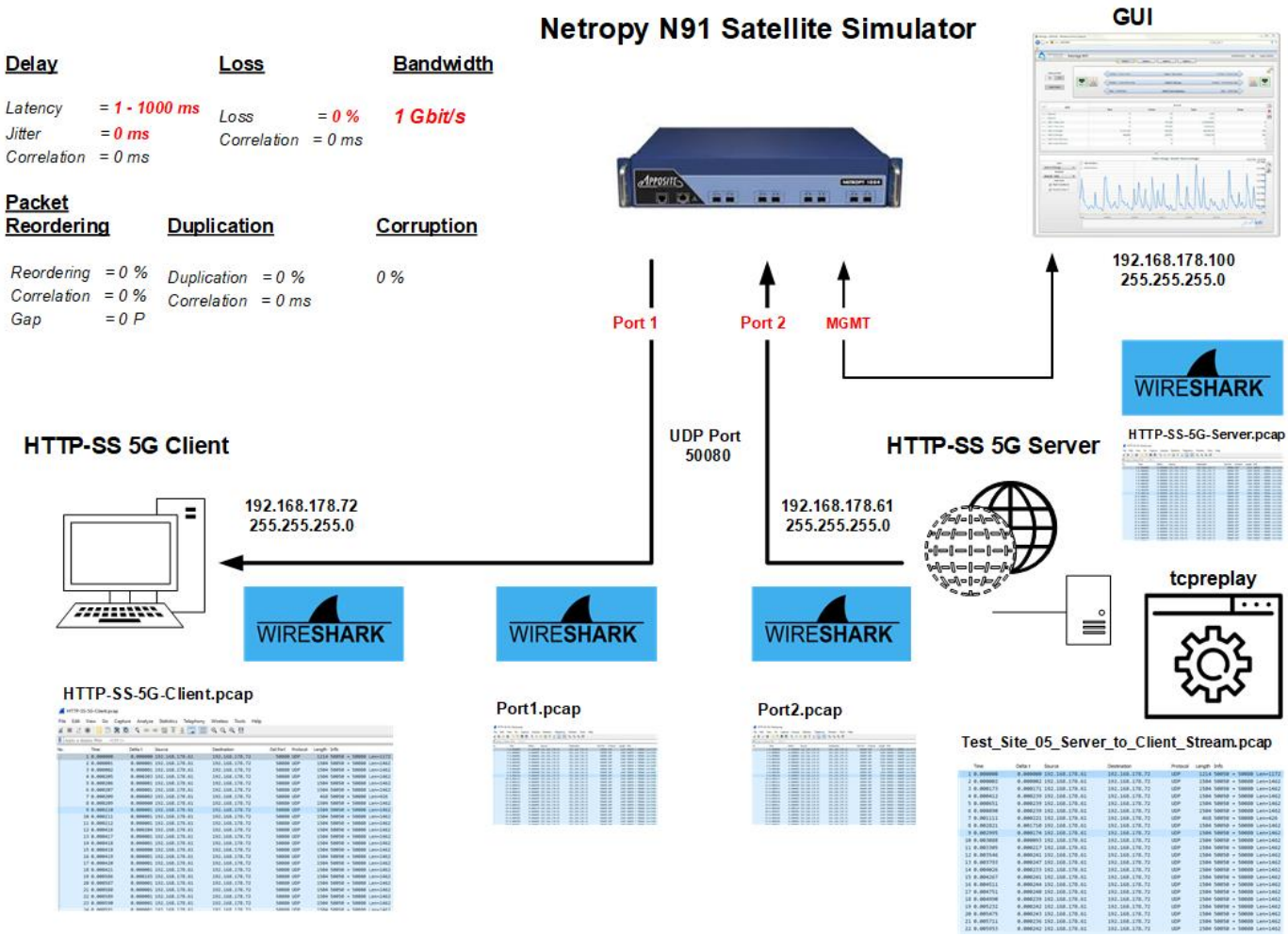


4.4 HTTP-QuSS - http | FTP | VoIP | Media Streaming | ...

Please Note:

Due to Hardware Restrictions, Processor Timer Inaccuracy and most of all huge NIC Hardware Interrupts and related CPU Usage a lossless Data Transmission for this Test Scenario was only possible upto 800 Mbit/s

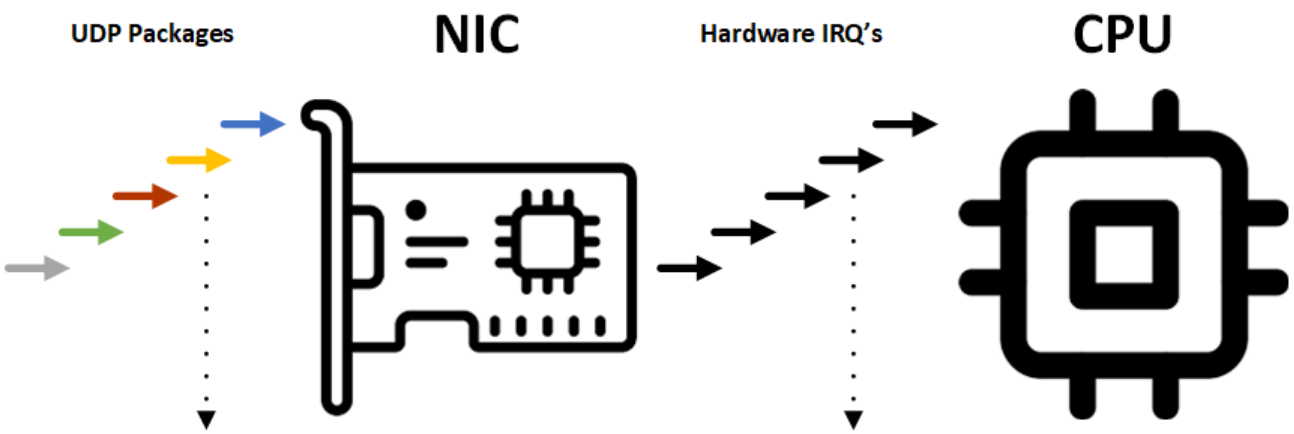
Sending 1495 HTTP-QuSS UDP Packages
Available Bandwidth : 800 Mbit/s



- Measured were the UDP Data Packets transmitted from the server (Number and Bandwidth) and the UDP Data Packets arriving at the Desktop Client (Number and Bandwidth)

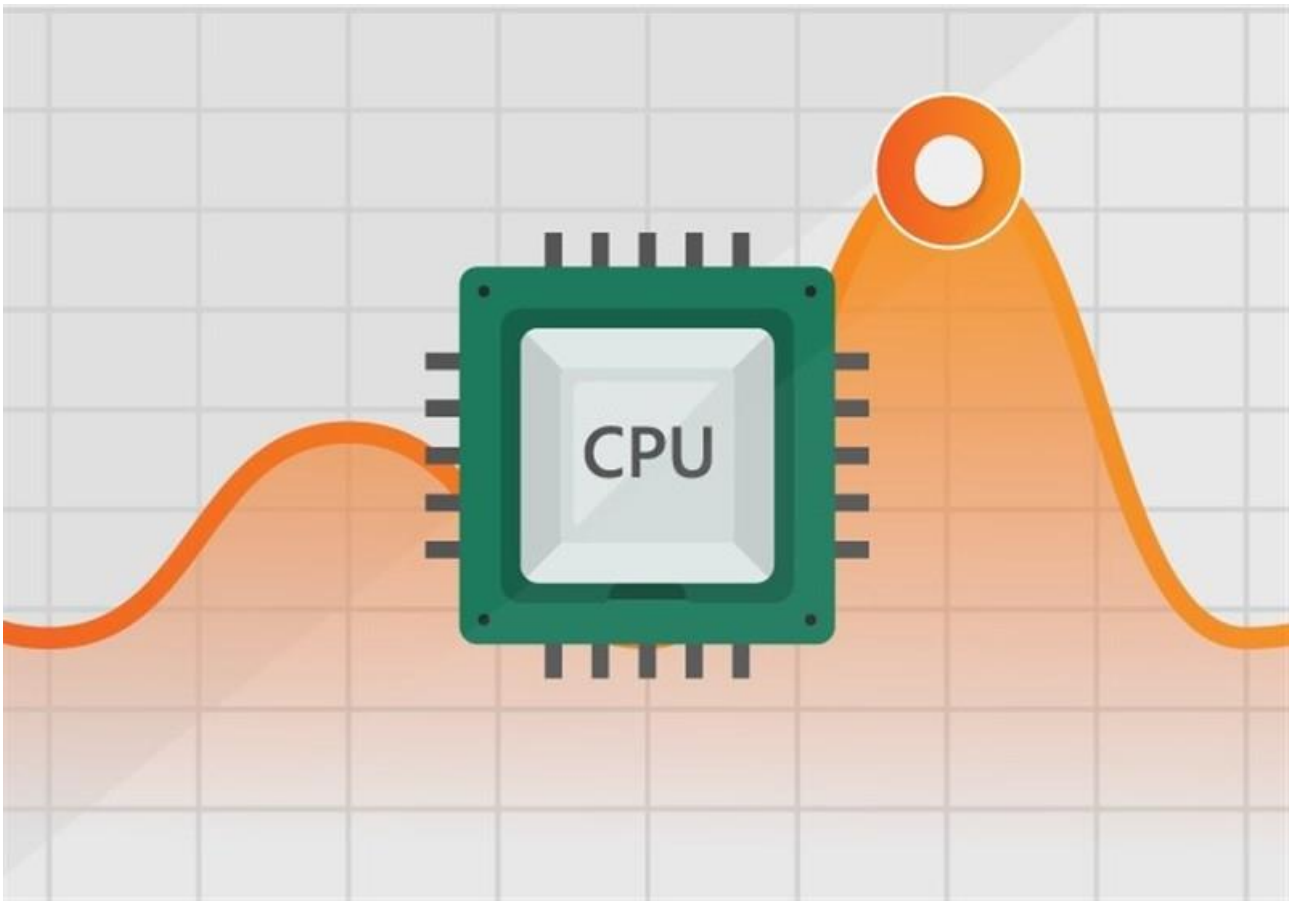
- Used measured Results for Arrived Packages only **without any Package Losses**.

- As earlier mentioned, the additional Latencies at Receiving Site result in a lower Bandwidth which is caused due to the high CPU Utilization which must process huge NIC Hardware Interrupts.



X Mbit/s * 1.000.000 bits/Mbit / 8 bits/byte / 1500 bytes/packet = Y Packages/s

1 000 Mbit/s = 1 000 000 000 / 8 / 1500 = 83 333 Packages/s



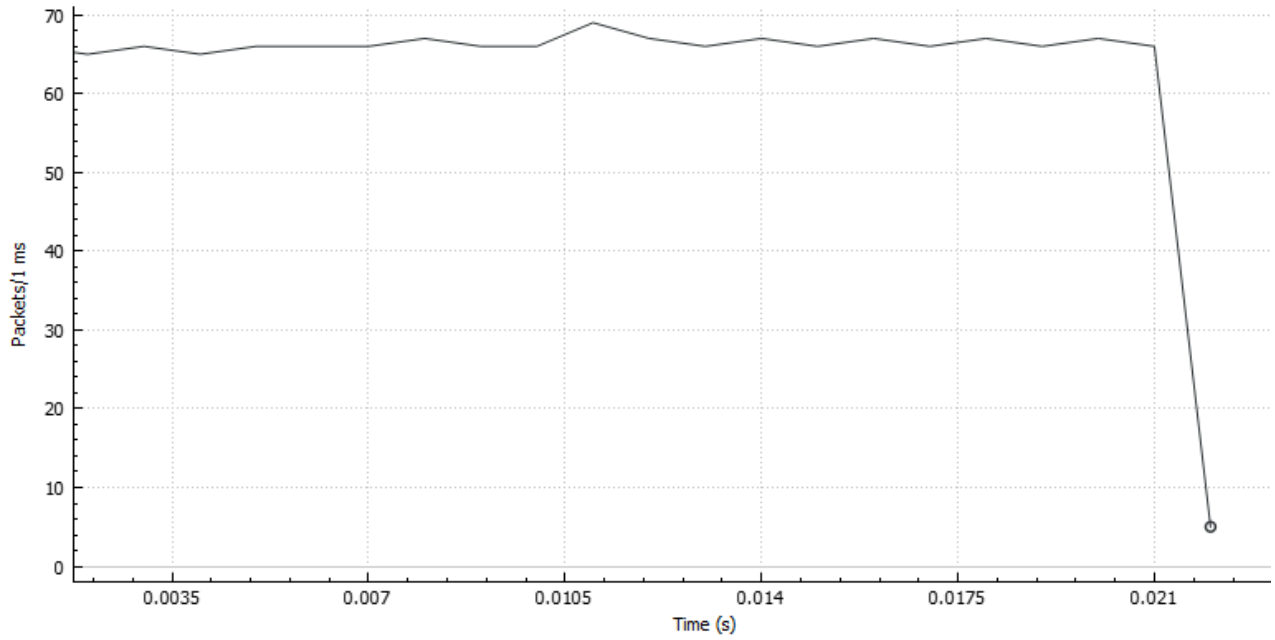
4.4.1 HTTP-QuSS - Lossless used Bandwidth with RTT = 1 ms

```
Ping wird ausgeführt für 192.168.178.77 mit 32 Bytes Daten:
Antwort von 192.168.178.77: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.77: Bytes=32 Zeit<1ms TTL=64
```

4.4.1.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66382.8	66382.8	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	99 M	99 M	—
Average bits/s	794 M	794 M	—

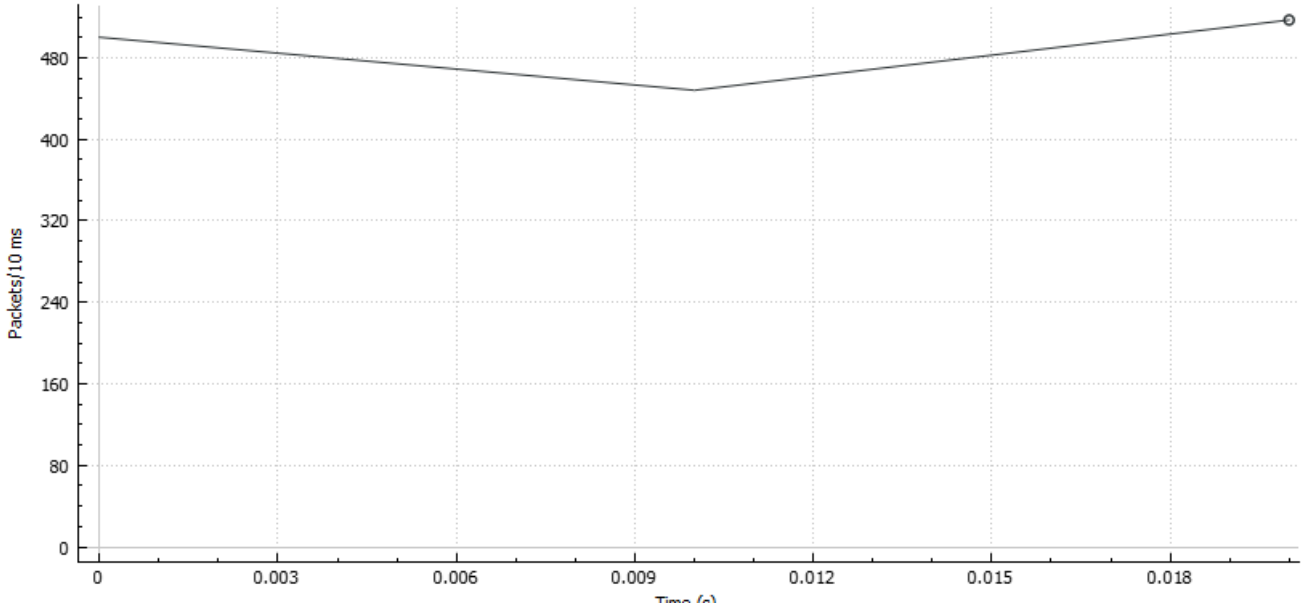


Lossless used Bandwidth: **794 Mbit/s of 800 Mbit/s**

4.1.1.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.028	0.028	—
Average pps	52951.1	52951.1	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	79 M	79 M	—
Average bits/s	633 M	633 M	—



Lossless used Bandwidth: **633 Mbit/s of 800 Mbit/s**

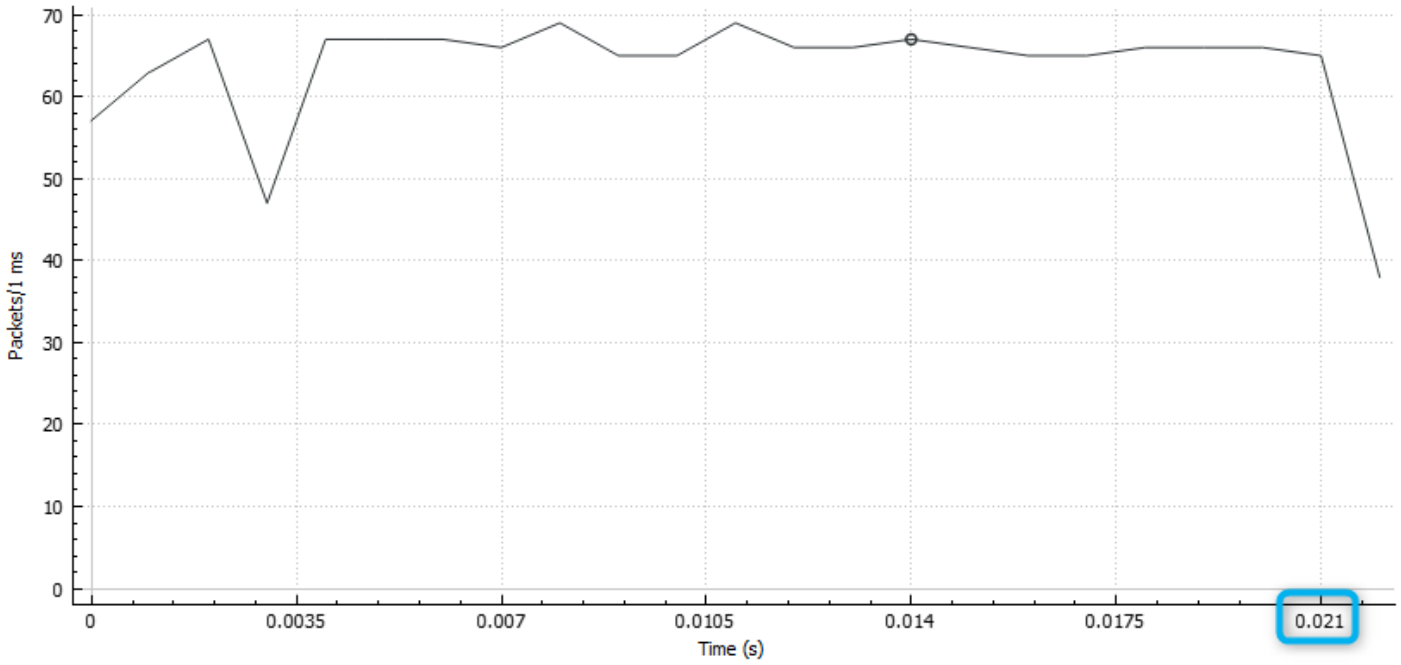
4.4.2 HTTP-QuSS - Lossless used Bandwidth with RTT = 25 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=25ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=25ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=27ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=25ms TTL=64
```

4.4.2.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.023	0.023	—
Average pps	64935.5	64935.5	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	97 M	97 M	—
Average bits/s	776 M	776 M	—

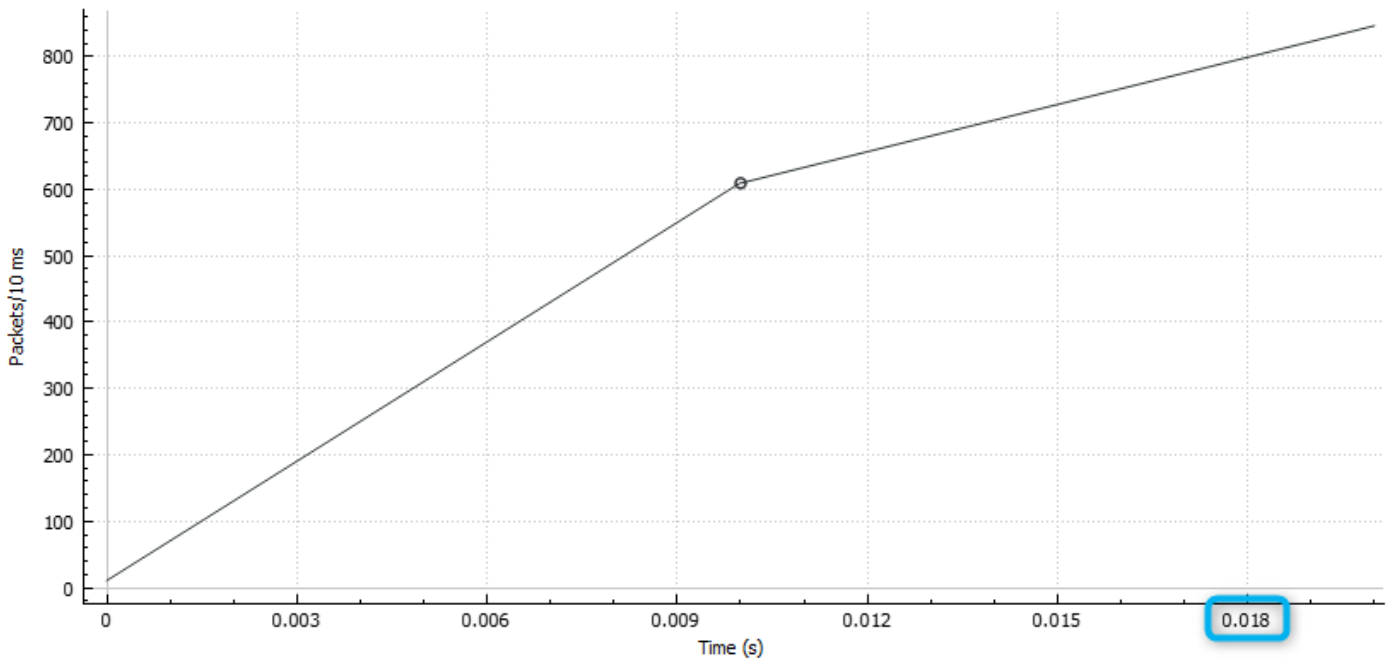


Lossless used Bandwidth: **776 Mbit/s of 800 Mbit/s**

4.4.2.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.029	0.029	—
Average pps	50894.6	50894.6	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	76 M	76 M	—
Average bits/s	608 M	608 M	—



Lossless used Bandwidth: **608 Mbit/s of 800 Mbit/s**

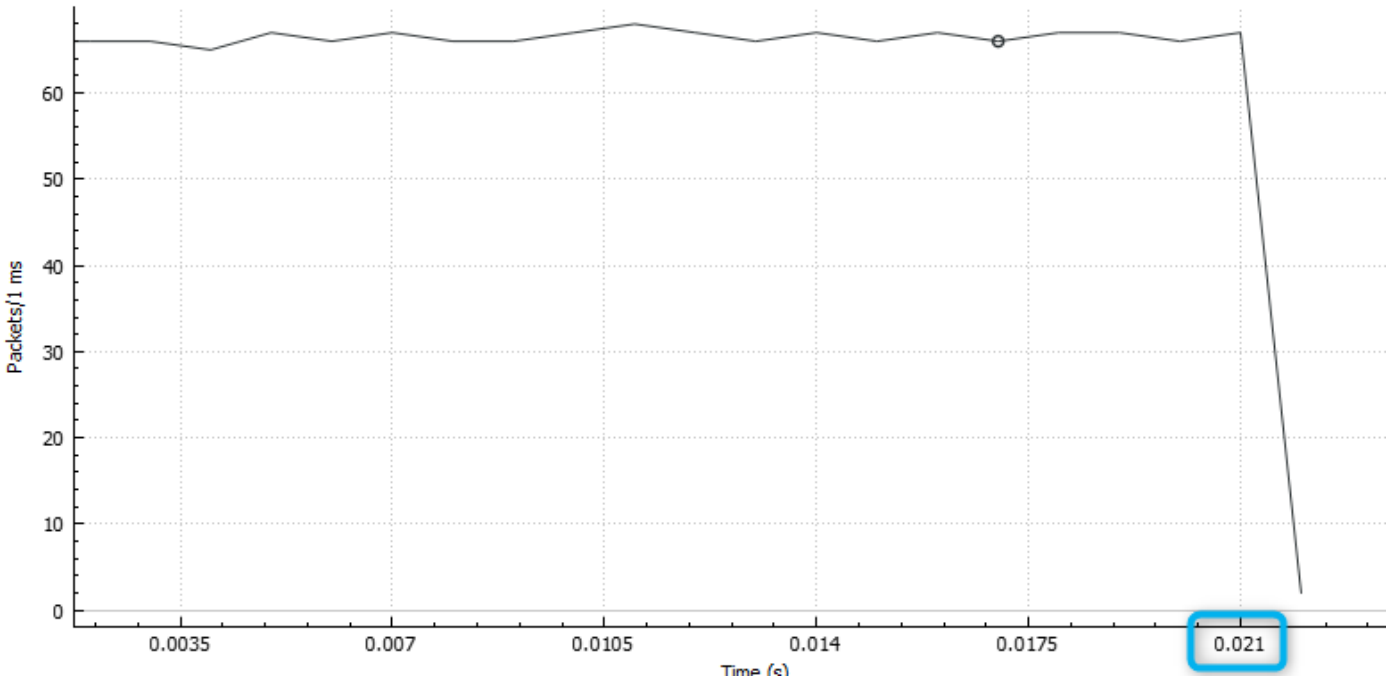
4.4.3 HTTP-QuSS - Lossless used Bandwidth with RTT = 50 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=50ms TTL=64
```

4.4.3.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66530.1	66530.1	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	99 M	99 M	—
Average bits/s	795 M	795 M	—

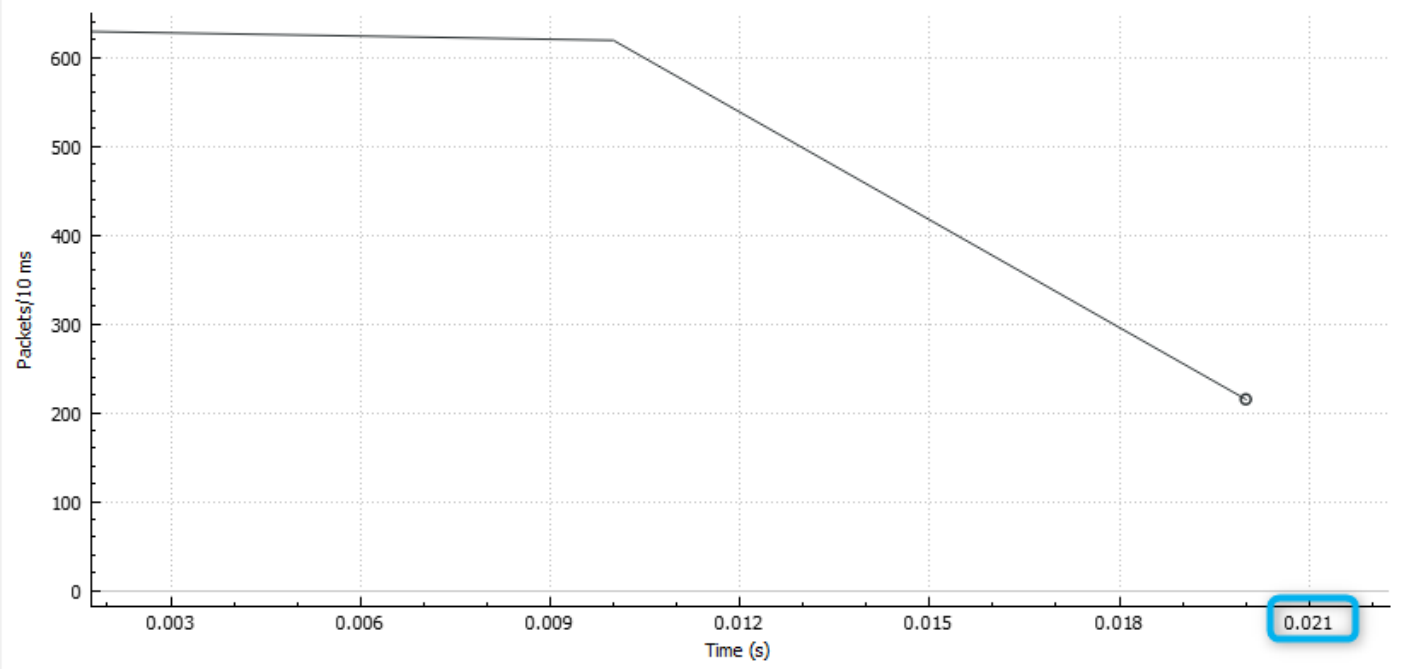


Lossless used Bandwidth: **795 Mbit/s of 800 Mbit/s**

4.4.3.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.023	0.023	—
Average pps	64341.9	64341.9	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	96 M	96 M	—
Average bits/s	769 M	769 M	—



Lossless used Bandwidth: **769 Mbit/s of 800 Mbit/s**

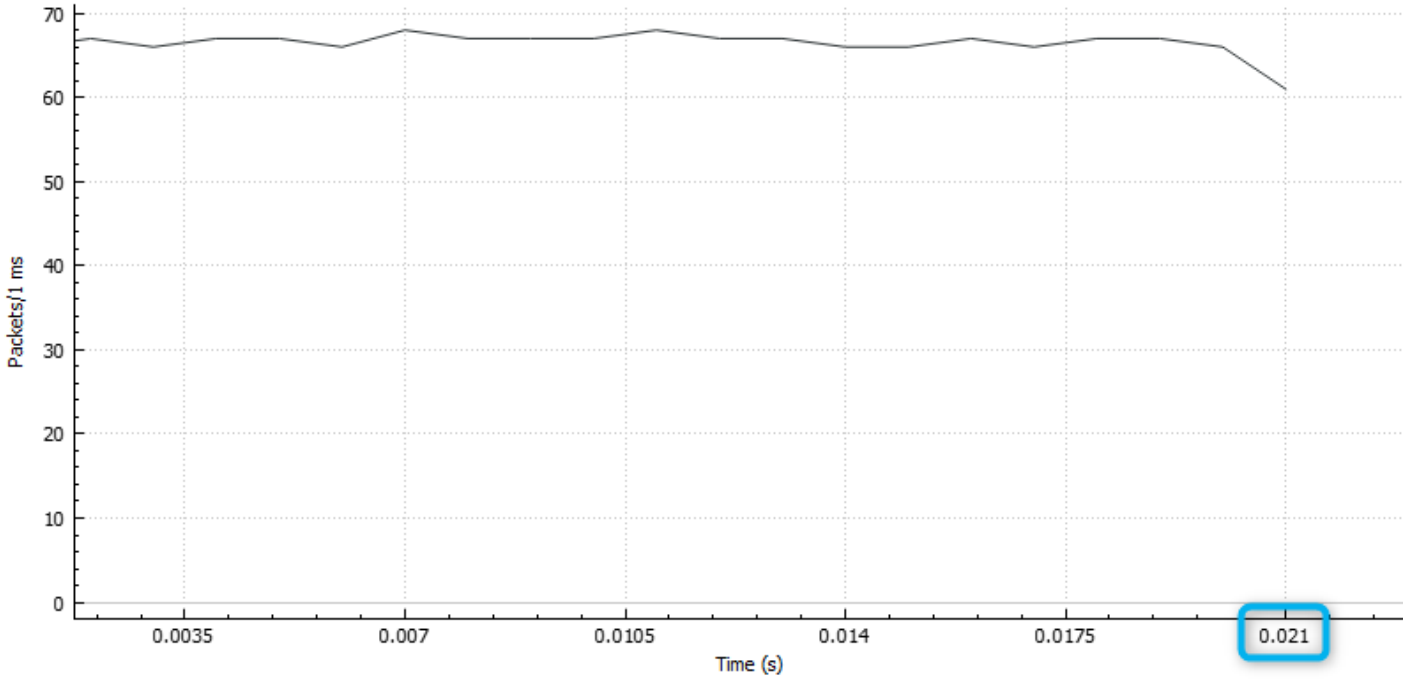
4.4.4 HTTP-QuSS - Lossless used Bandwidth with RTT = 75 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=75ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=75ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=75ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=75ms TTL=64
```

4.4.4.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66861.0	66861.0	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	99 M	99 M	—
Average bits/s	799 M	799 M	—

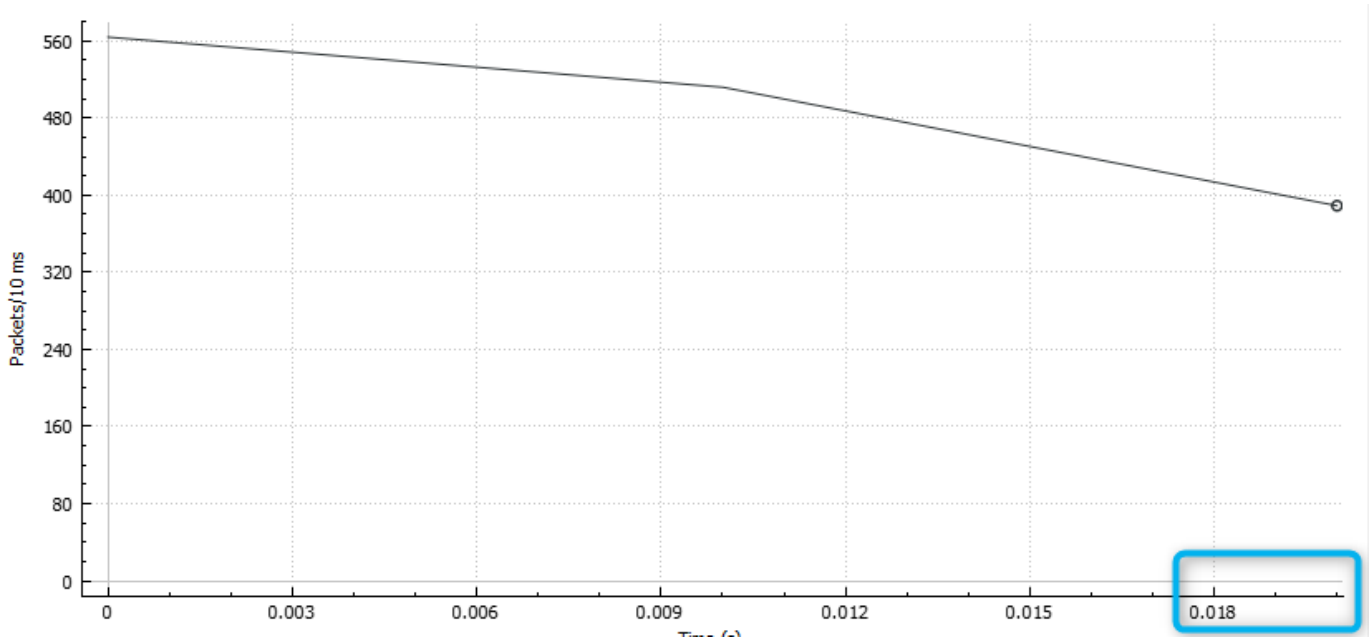


Lossless used Bandwidth: **799 Mbit/s of 800 Mbit/s**

4.4.4.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.028	0.028	—
Average pps	52121.9	52121.9	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	77 M	77 M	—
Average bits/s	623 M	623 M	—



Lossless used Bandwidth: **623 Mbit/s of 800 Mbit/s**

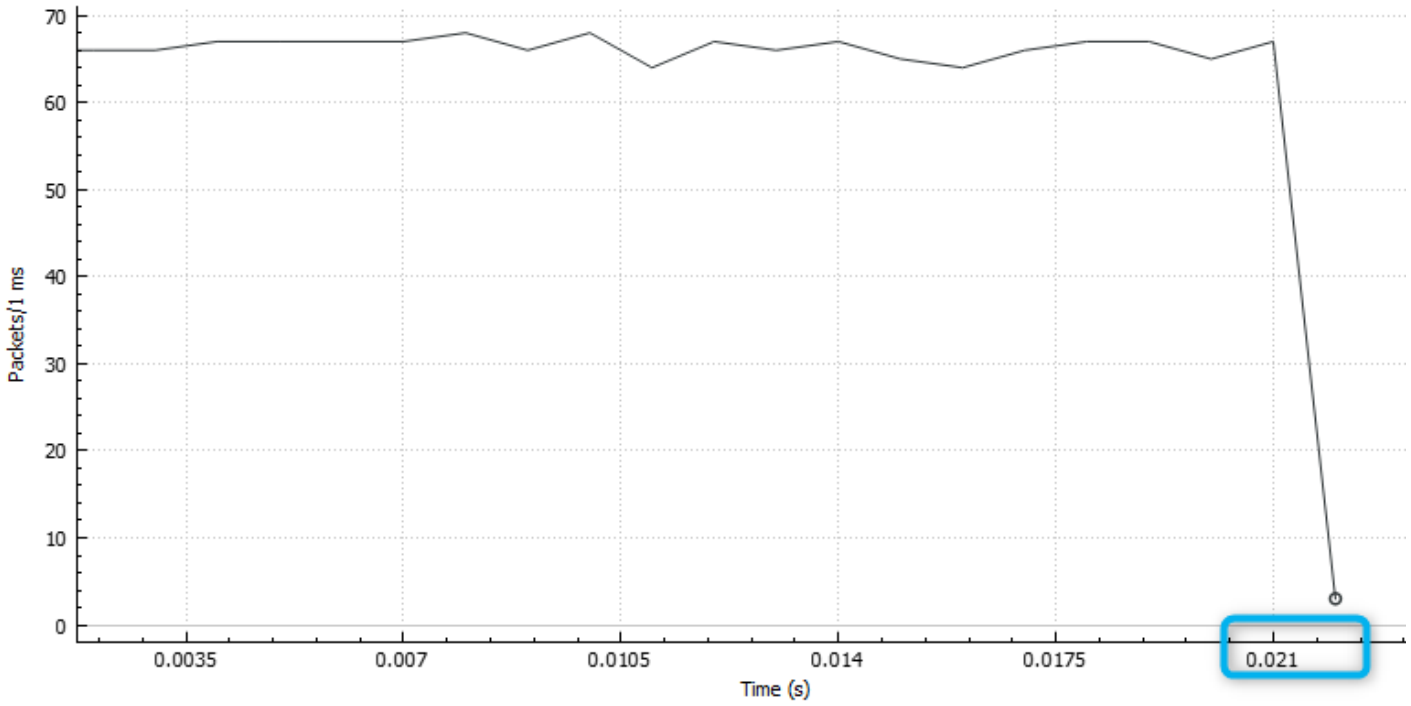
4.4.5 HTTP-QuSS - Lossless used Bandwidth with RTT = 100 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=100ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=100ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=100ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=100ms TTL=64
```

4.4.5.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66481.9	66481.9	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	99 M	99 M	—
Average bits/s	795 M	795 M	—

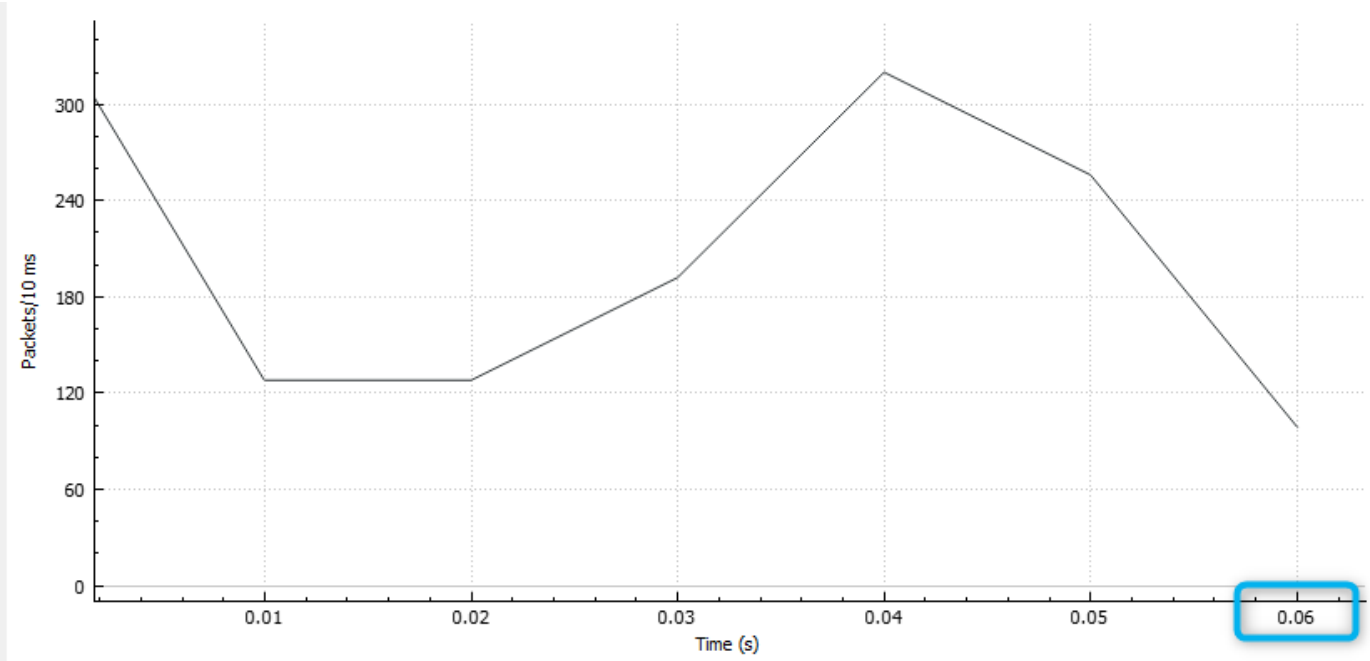


Lossless used Bandwidth: **795 Mbit/s of 800 Mbit/s**

4.4.5.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.063	0.063	—
Average pps	23403.7	23403.7	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	34 M	34 M	—
Average bits/s	279 M	279 M	—



Lossless used Bandwidth: **297 Mbit/s of 800 Mbit/s**

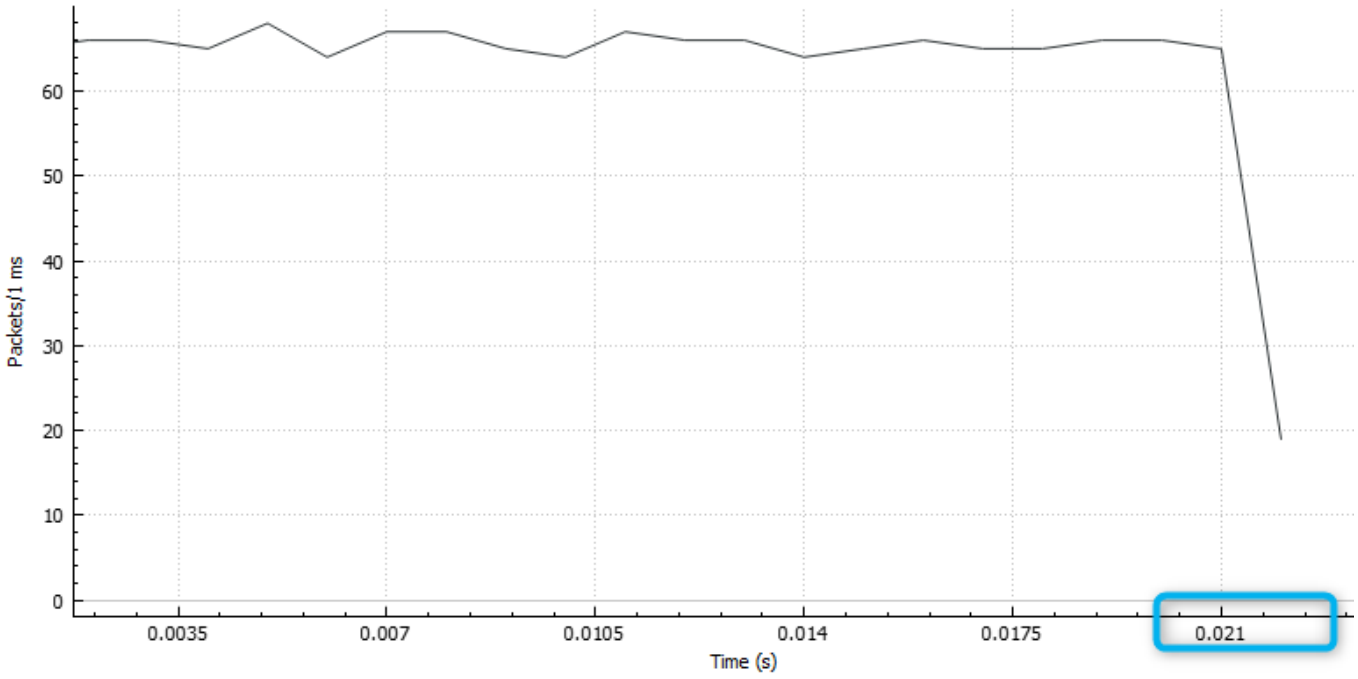
4.4.6 HTTP-QuSS - Lossless used Bandwidth with RTT = 150 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=150ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=150ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=150ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=150ms TTL=64
```

4.4.6.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	65804.1	65804.1	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	98 M	98 M	—
Average bits/s	787 M	787 M	—

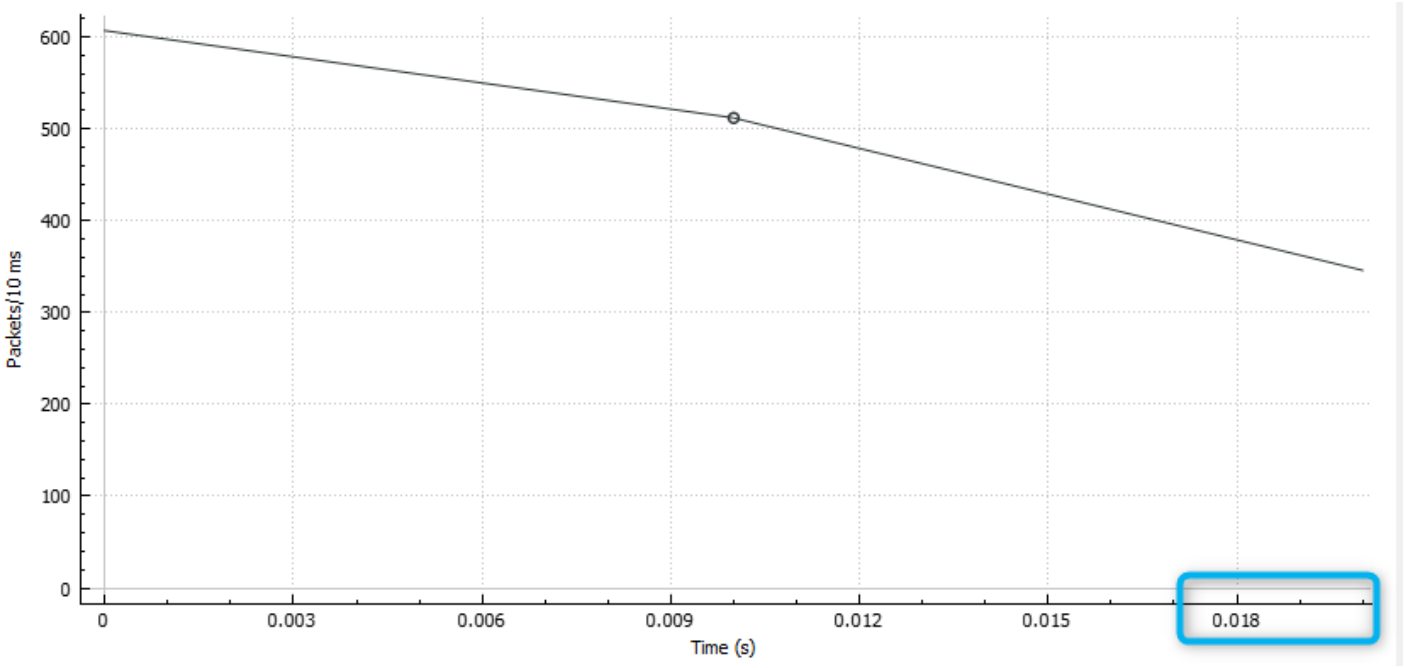


Lossless used Bandwidth: **787 Mbit/s of 800 Mbit/s**

4.4.6.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.025	0.025	—
Average pps	57627.6	57627.6	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	86 M	86 M	—
Average bits/s	689 M	689 M	—



Lossless used Bandwidth: **689 Mbit/s of 800 Mbit/s**

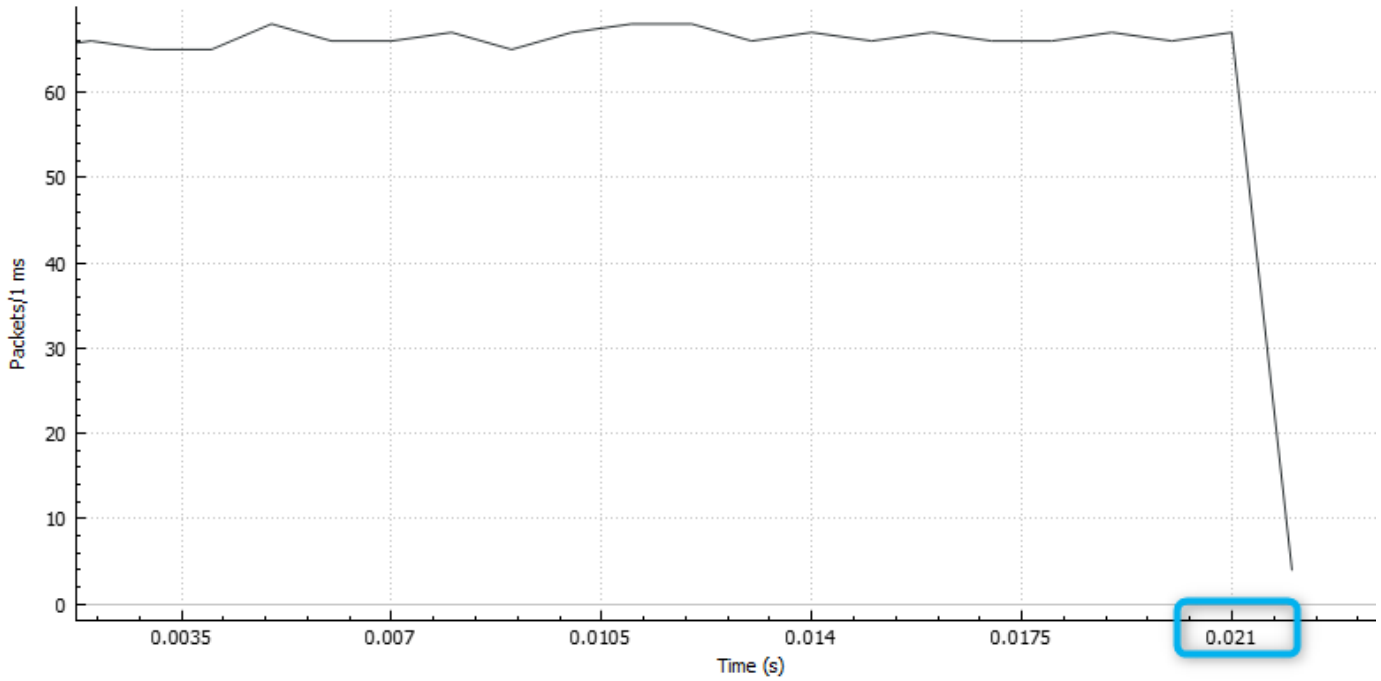
4.4.7 HTTP-QuSS - Lossless used Bandwidth with RTT = 200 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=200ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=200ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=200ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=200ms TTL=64
```

4.4.7.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66415.8	66415.8	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	99 M	99 M	—
Average bits/s	794 M	794 M	—

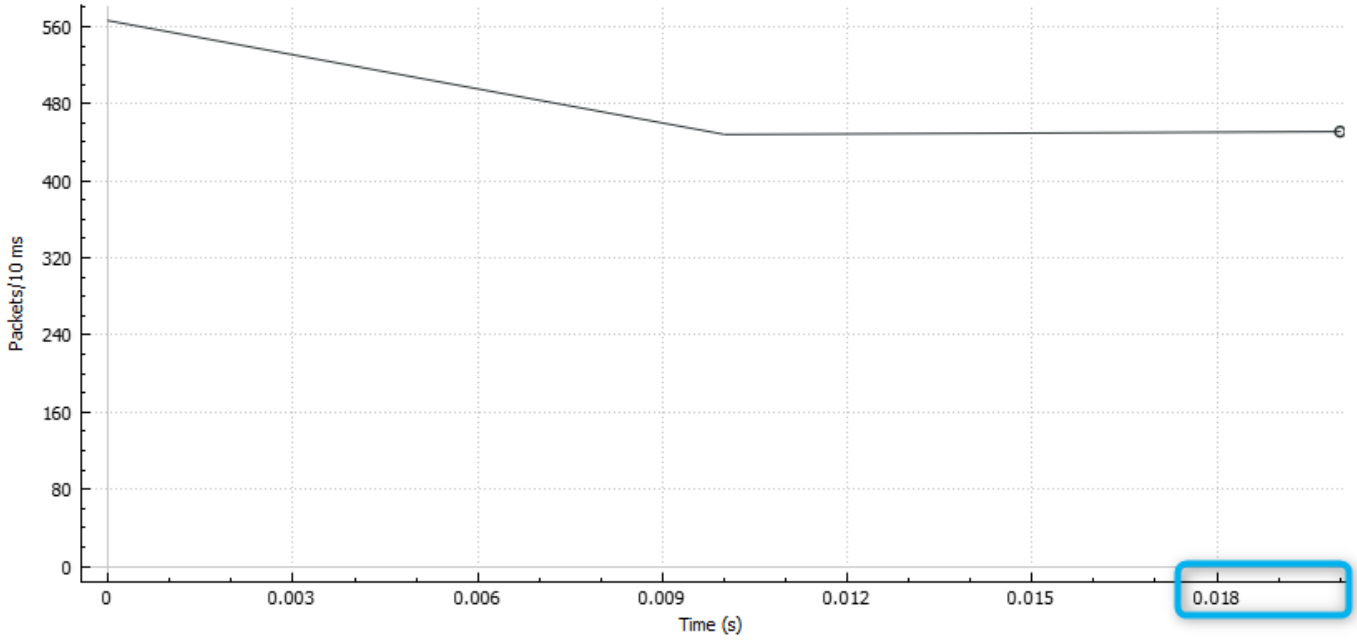


Lossless used Bandwidth: **794 Mbit/s of 800 Mbit/s**

4.4.7.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.029	0.029	—
Average pps	50210.9	50210.9	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	75 M	75 M	—
Average bits/s	600 M	600 M	—



Lossless used Bandwidth: **600 Mbit/s of 800 Mbit/s**

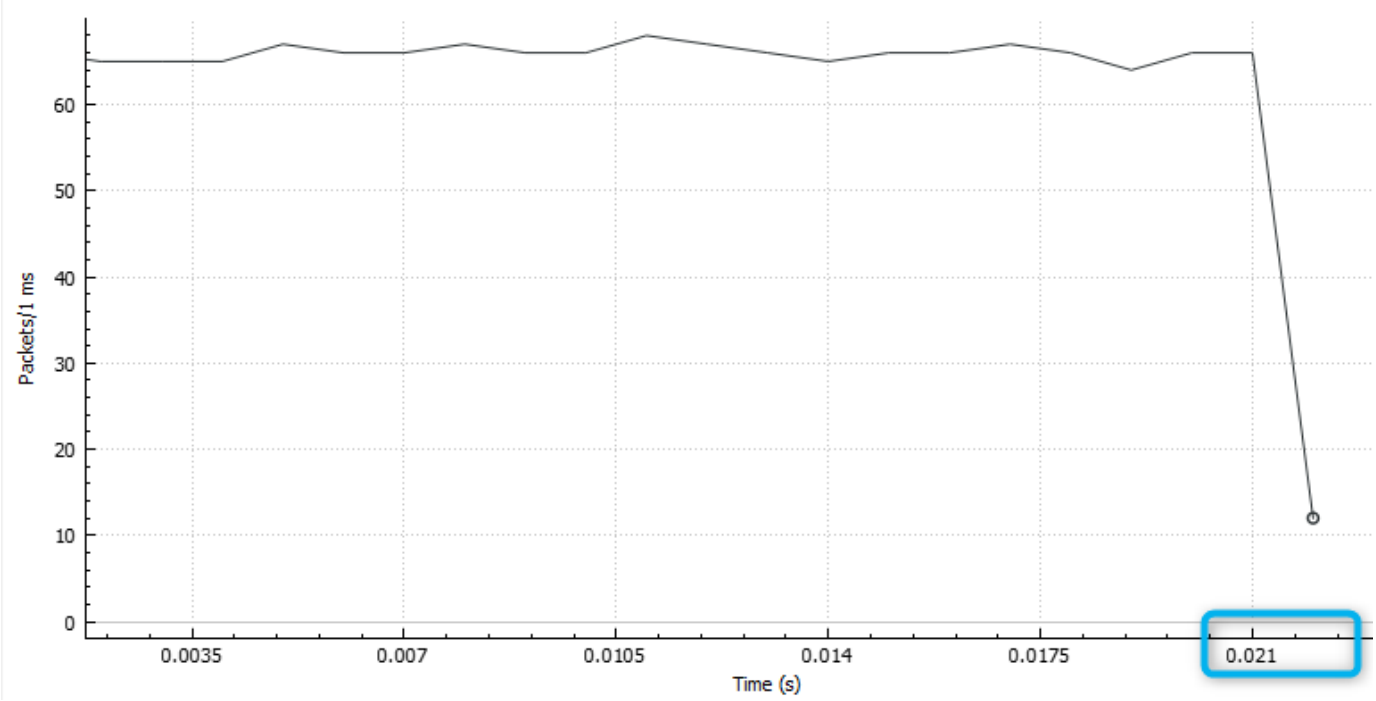
4.4.8 HTTP-QuSS - Lossless used Bandwidth with RTT = 300 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=300ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=300ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=300ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=300ms TTL=64
```

4.4.8.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66083.6	66083.6	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	98 M	98 M	—
Average bits/s	790 M	790 M	—

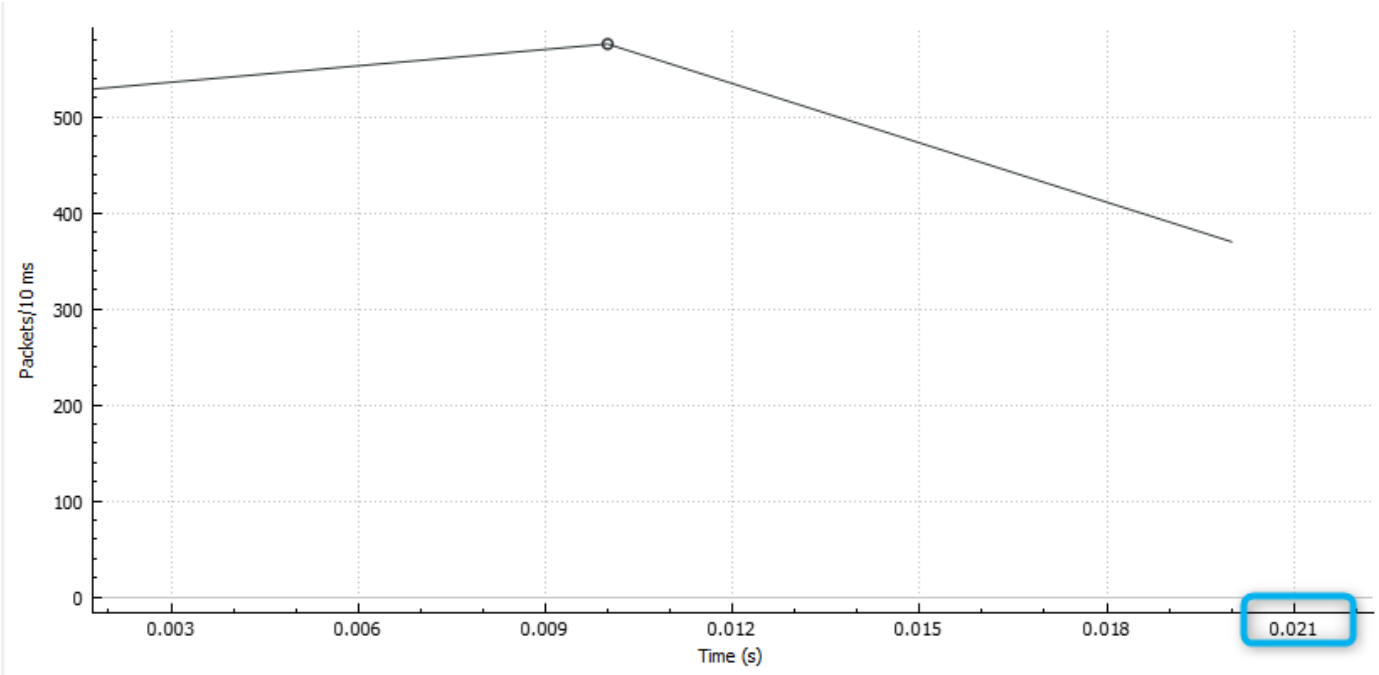


Lossless used Bandwidth: **790 Mbit/s of 800 Mbit/s**

4.4.8.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.025	0.025	—
Average pps	59509.5	59509.5	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	88 M	88 M	—
Average bits/s	711 M	711 M	—



Lossless used Bandwidth: **711 Mbit/s of 800 Mbit/s**

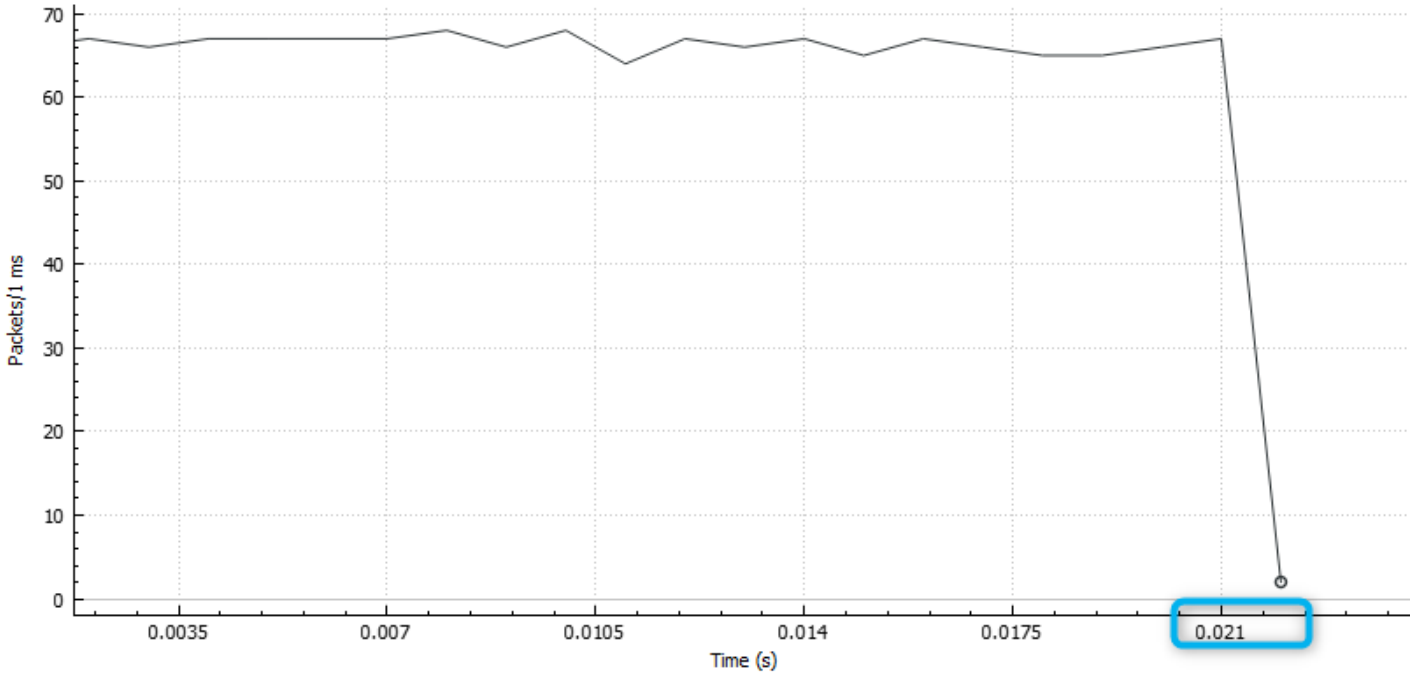
4.4.9 HTTP-QuSS - Lossless used Bandwidth with RTT = 400 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=408ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=400ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=400ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=401ms TTL=64
```

4.4.9.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66517.9	66517.9	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	99 M	99 M	—
Average bits/s	795 M	795 M	—

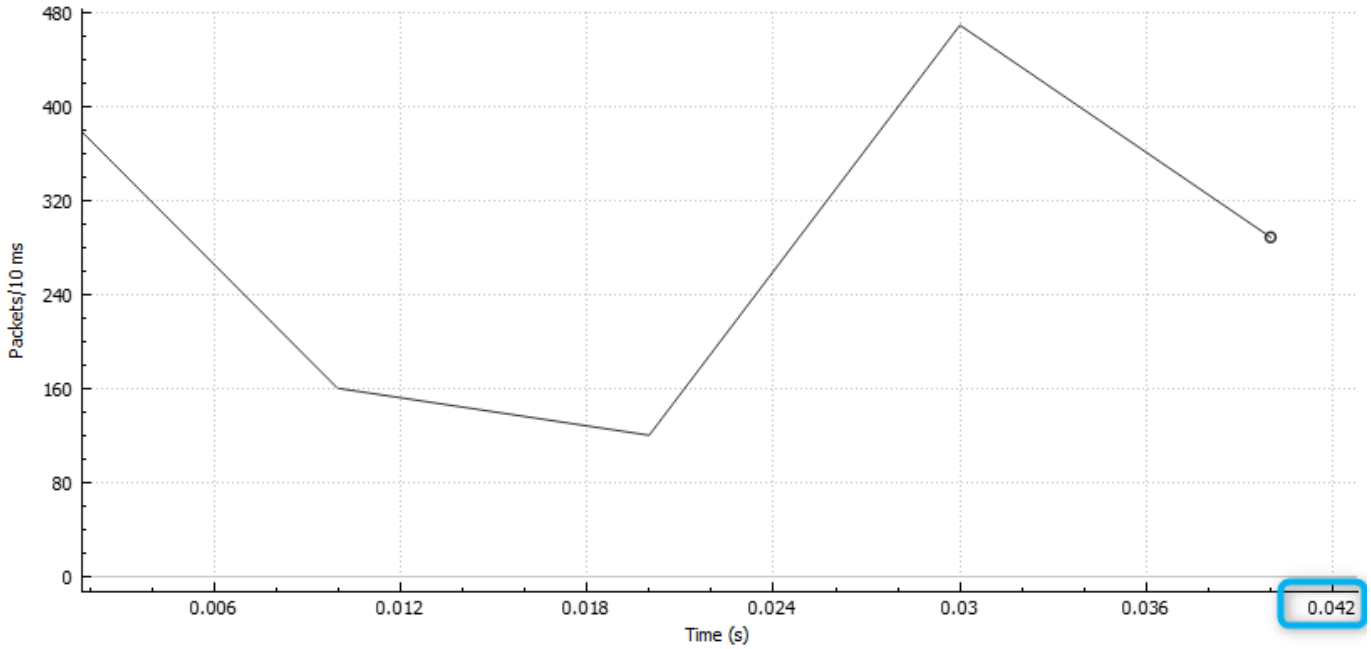


Lossless used Bandwidth: **795 Mbit/s of 800 Mbit/s**

4.4.9.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.045	0.045	—
Average pps	32749.1	32749.1	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	48 M	48 M	—
Average bits/s	391 M	391 M	—



Lossless used Bandwidth: **391 Mbit/s of 800 Mbit/s**

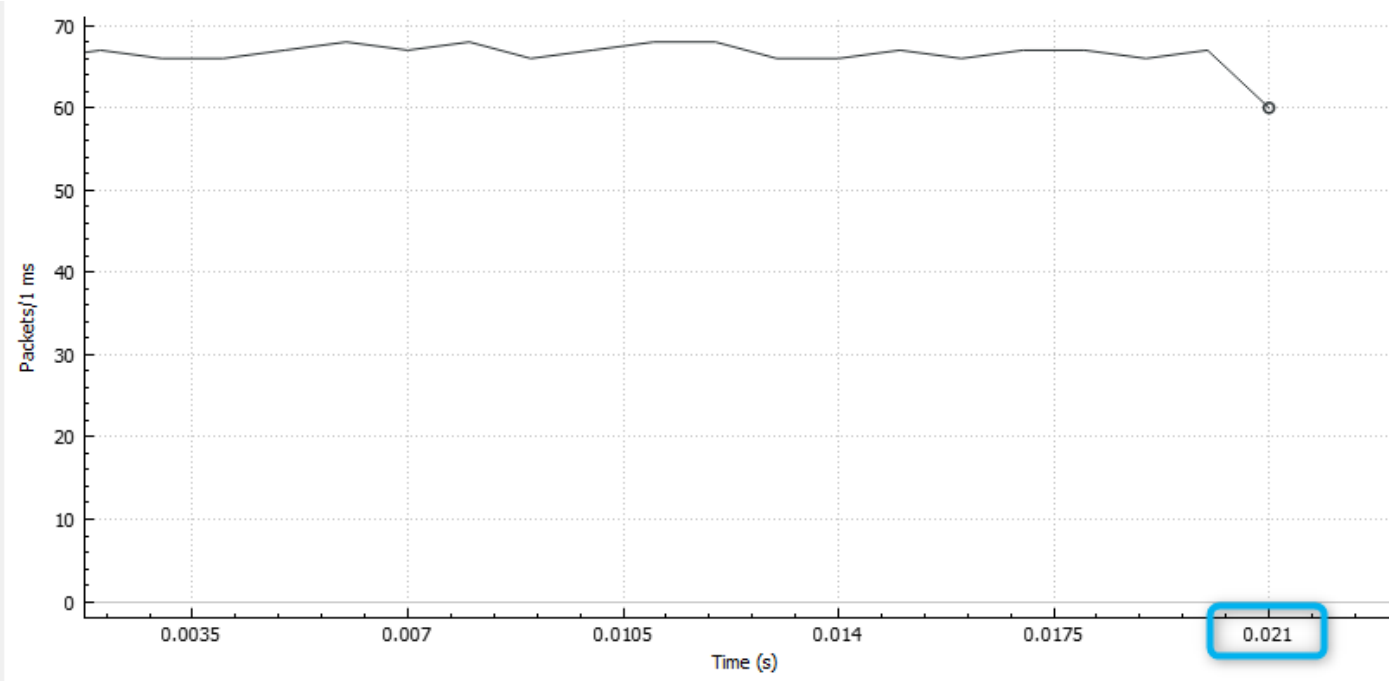
4.4.10 HTTP-QuSS - Lossless used Bandwidth with RTT = 500 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=500ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=500ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=500ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=500ms TTL=64
```

4.4.10.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66892.3	66892.3	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	100 M	100 M	—
Average bits/s	800 M	800 M	—

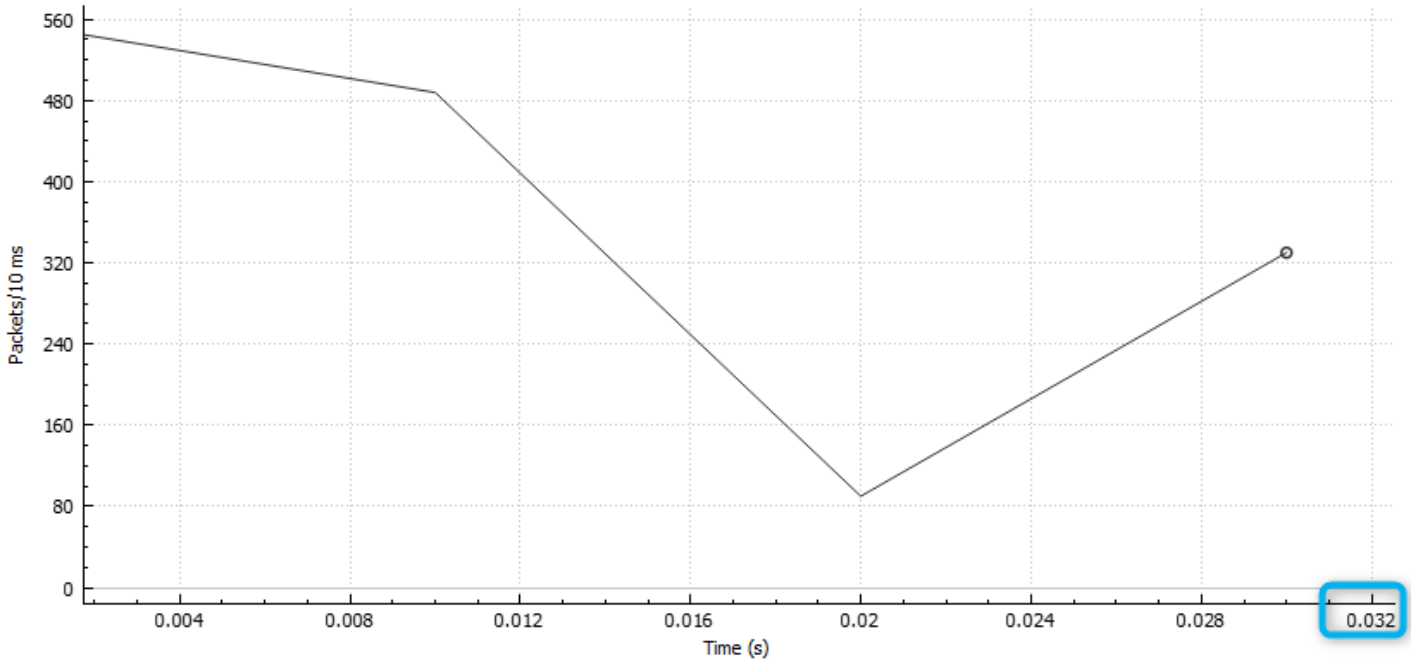


Lossless used Bandwidth: **800 Mbit/s of 800 Mbit/s**

4.4.10.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.039	0.039	—
Average pps	37109.2	37109.2	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	55 M	55 M	—
Average bits/s	443 M	443 M	—



Lossless used Bandwidth: **443 Mbit/s of 800 Mbit/s**

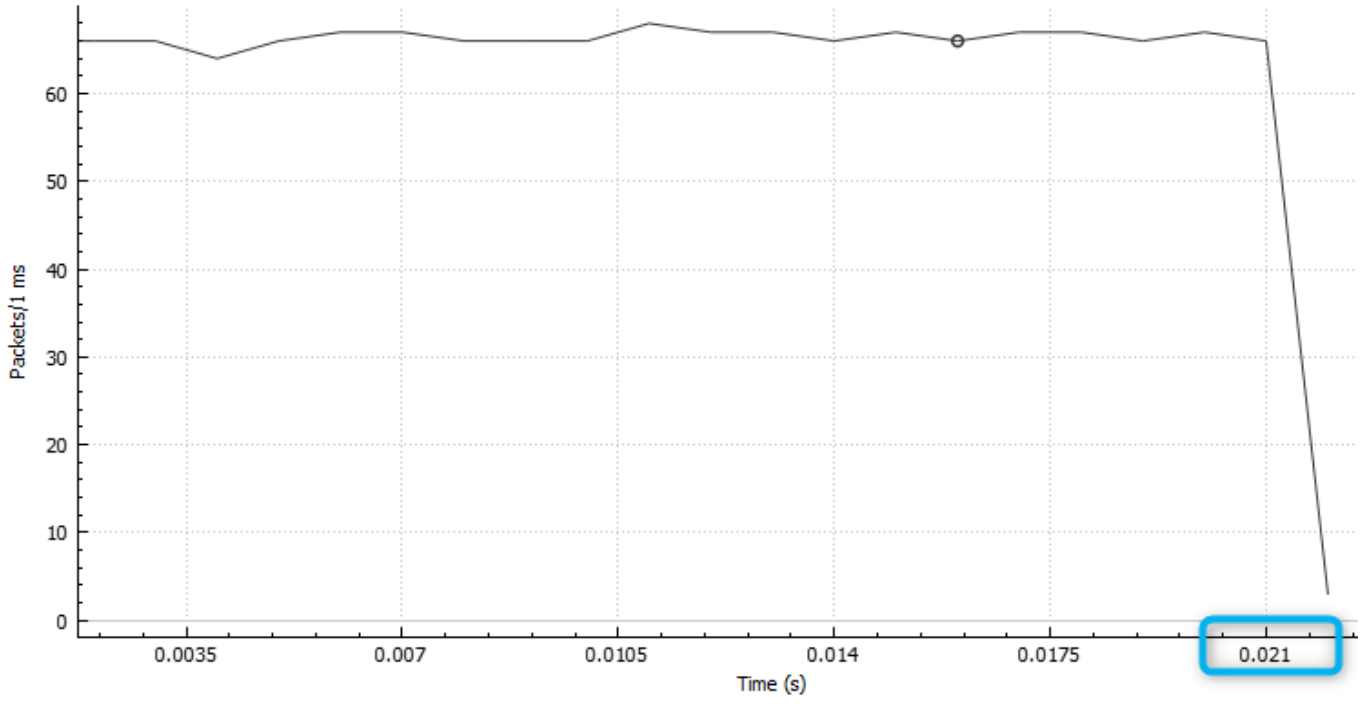
4.4.11 HTTP-QuSS - Lossless used Bandwidth with RTT = 600 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=600ms TTL=64
```

4.4.11.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66469.7	66469.7	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	99 M	99 M	—
Average bits/s	795 M	795 M	—

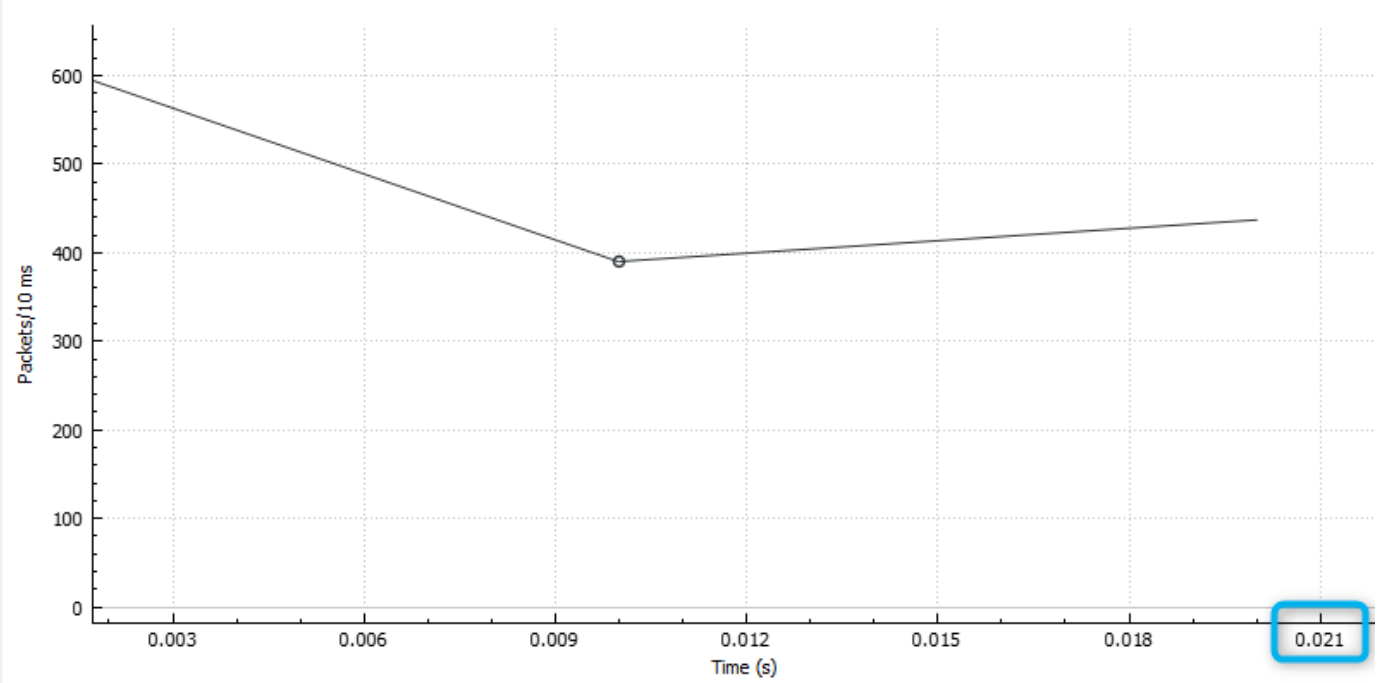


Lossless used Bandwidth: **795 Mbit/s of 800 Mbit/s**

4.4.11.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.026	0.026	—
Average pps	57195.8	57195.8	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	85 M	85 M	—
Average bits/s	684 M	684 M	—



Lossless used Bandwidth: **684 Mbit/s of 800 Mbit/s**

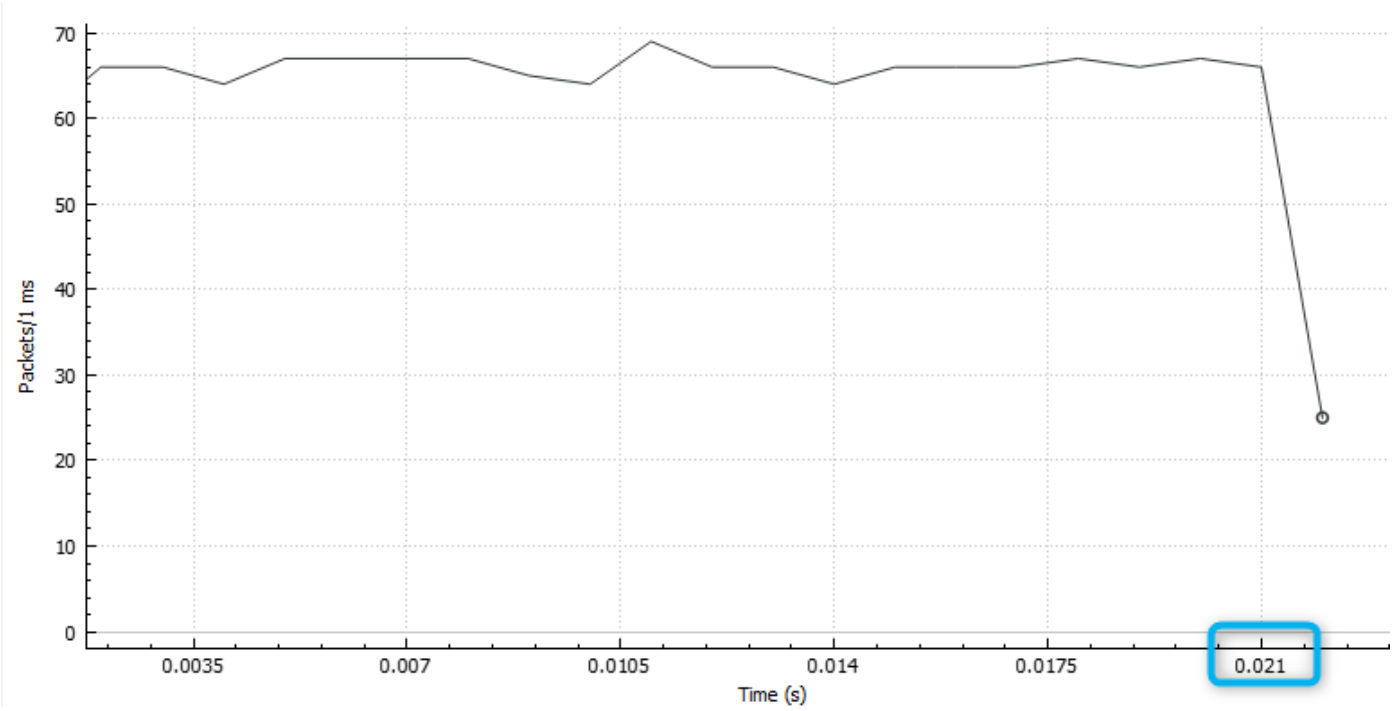
4.4.12 HTTP-QuSS - Lossless used Bandwidth with RTT = 700 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=700ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=700ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=700ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=700ms TTL=64
```

4.4.12.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	65463.4	65463.4	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	97 M	97 M	—
Average bits/s	783 M	783 M	—

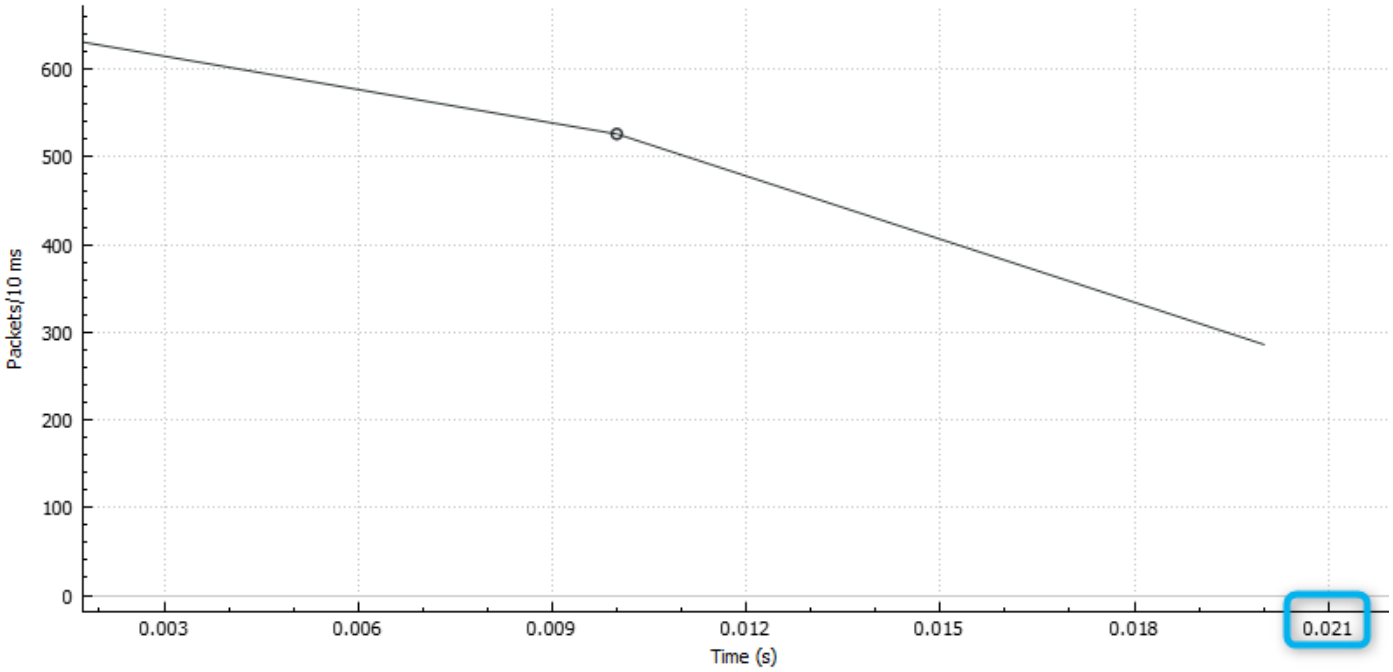


Lossless used Bandwidth: **783 Mbit/s of 800 Mbit/s**

4.4.12.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.024	0.024	—
Average pps	60695.1	60695.1	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	90 M	90 M	—
Average bits/s	726 M	726 M	—



Lossless used Bandwidth: **726 Mbit/s of 800 Mbit/s**

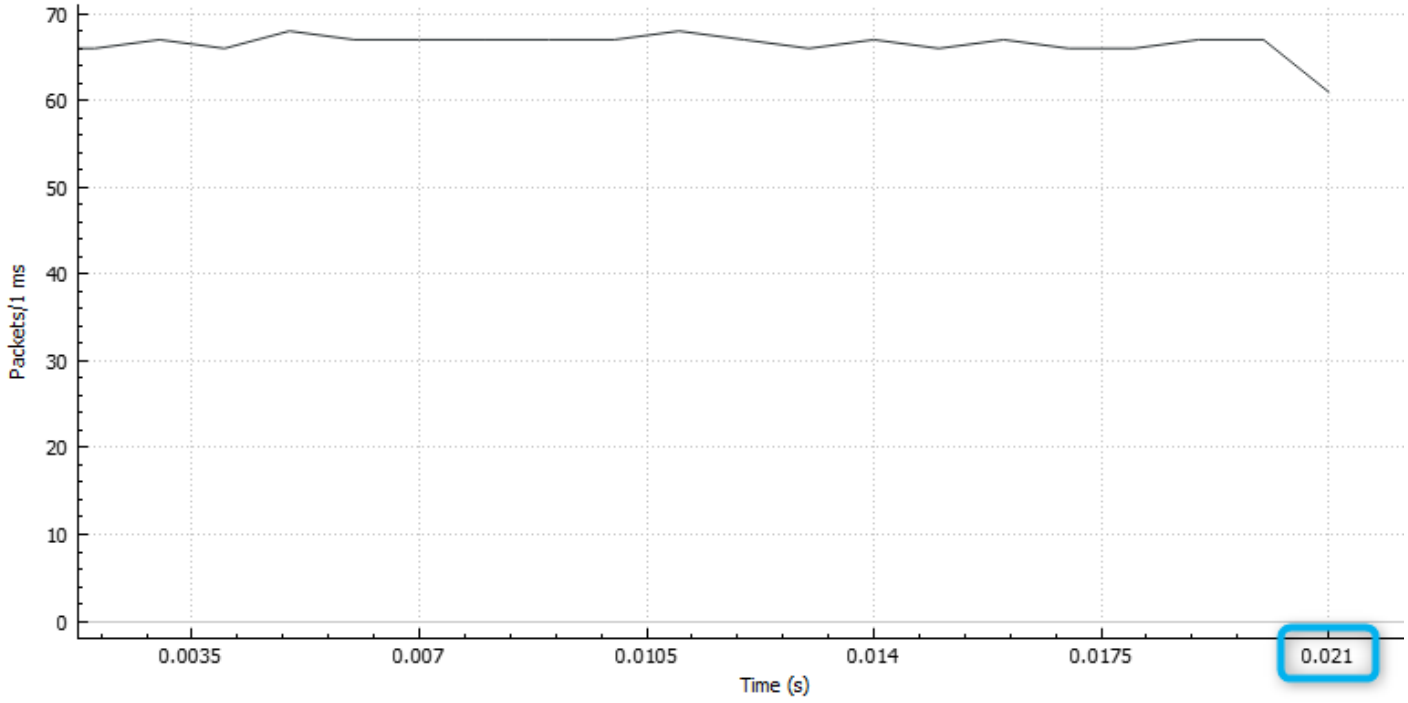
4.4.13 HTTP-QuSS - Lossless used Bandwidth with RTT = 800 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=801ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=800ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=802ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=802ms TTL=64
```

4.4.13.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66889.3	66889.3	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	100 M	100 M	—
Average bits/s	800 M	800 M	—

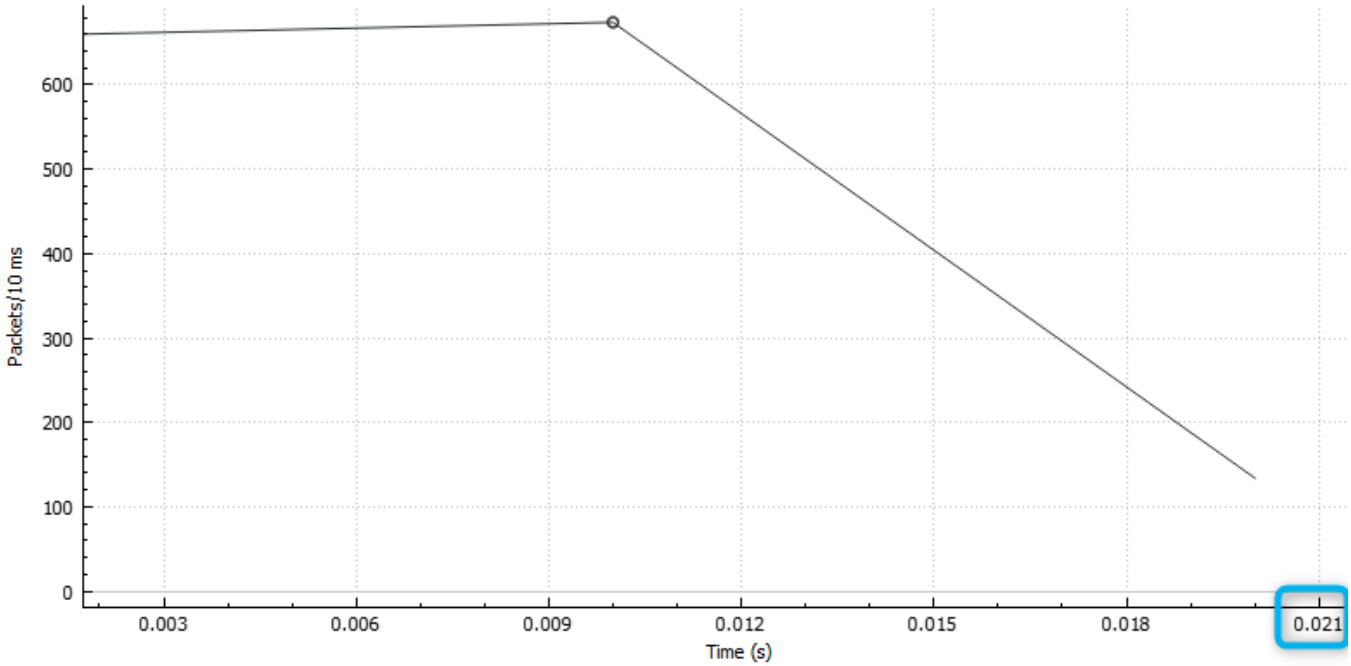


Lossless used Bandwidth: **800 Mbit/s of 800 Mbit/s**

4.4.13.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66548.1	66548.1	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	99 M	99 M	—
Average bits/s	796 M	796 M	—



Lossless used Bandwidth: **796 Mbit/s of 800 Mbit/s**

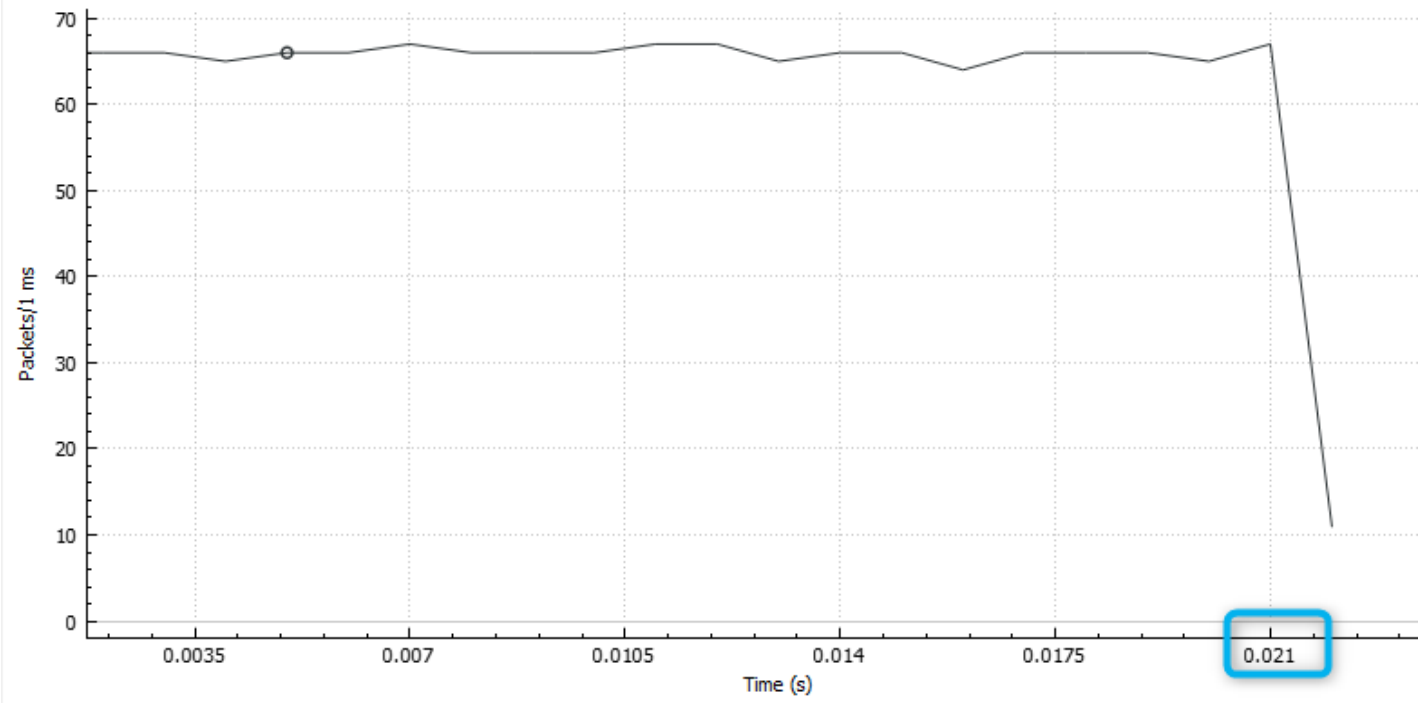
4.4.14 HTTP-QuSS - Lossless used Bandwidth with RTT = 900 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=900ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=900ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=900ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=900ms TTL=64
```

4.4.14.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66101.4	66101.4	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	98 M	98 M	—
Average bits/s	790 M	790 M	—

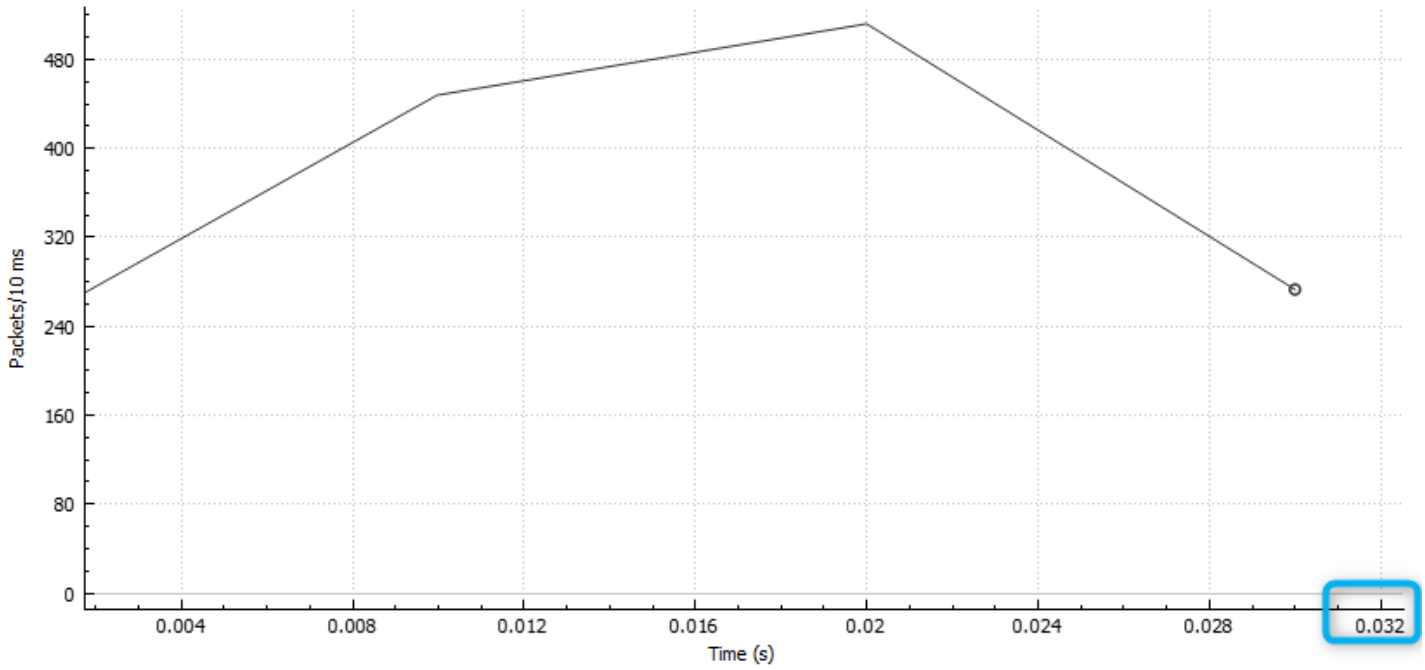


Lossless used Bandwidth: **790 Mbit/s of 800 Mbit/s**

4.4.14.2 Received HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.035	0.035	—
Average pps	41739.0	41739.0	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	62 M	62 M	—
Average bits/s	499 M	499 M	—



Lossless used Bandwidth: **499 Mbit/s of 800 Mbit/s**

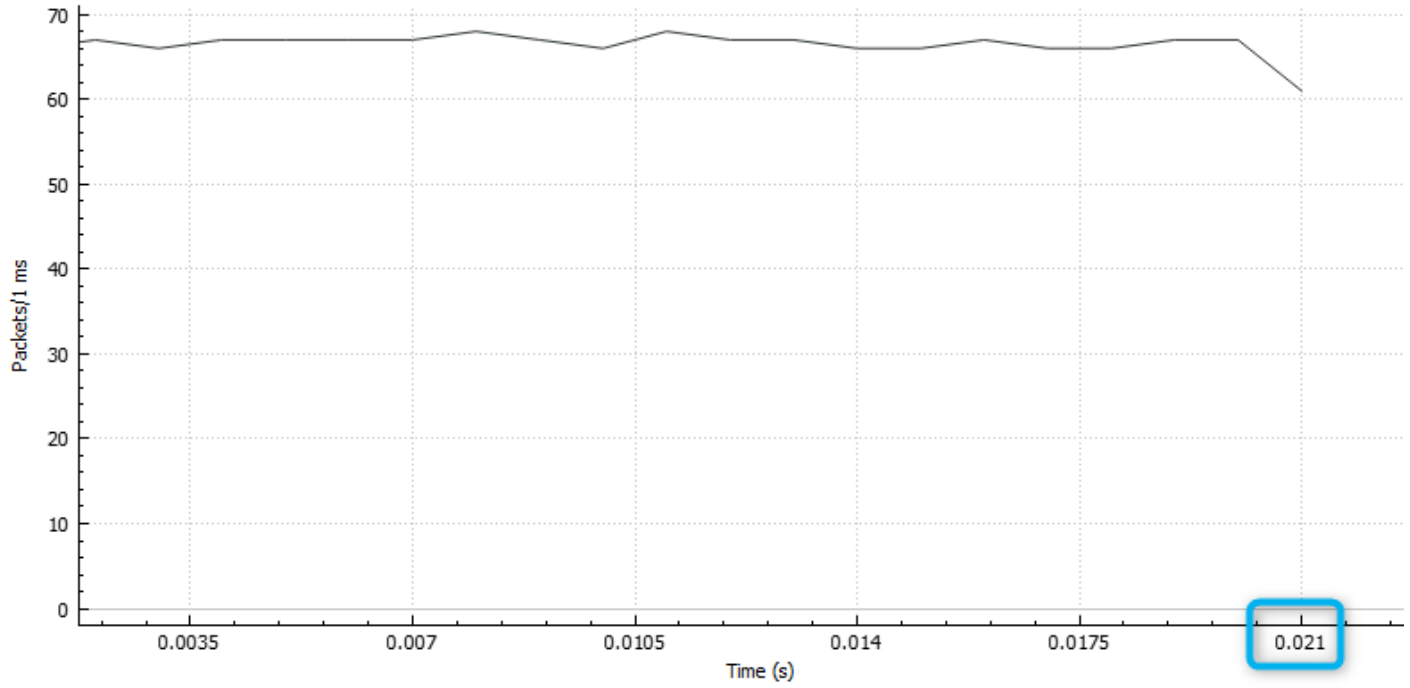
4.4.15 HTTP-QuSS - Lossless used Bandwidth with RTT = 1000 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
```

4.4.15.1 Send HTTP-QuSS UDP Stream

Statistics

Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.022	0.022	—
Average pps	66861.7	66861.7	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	99 M	99 M	—
Average bits/s	799 M	799 M	—

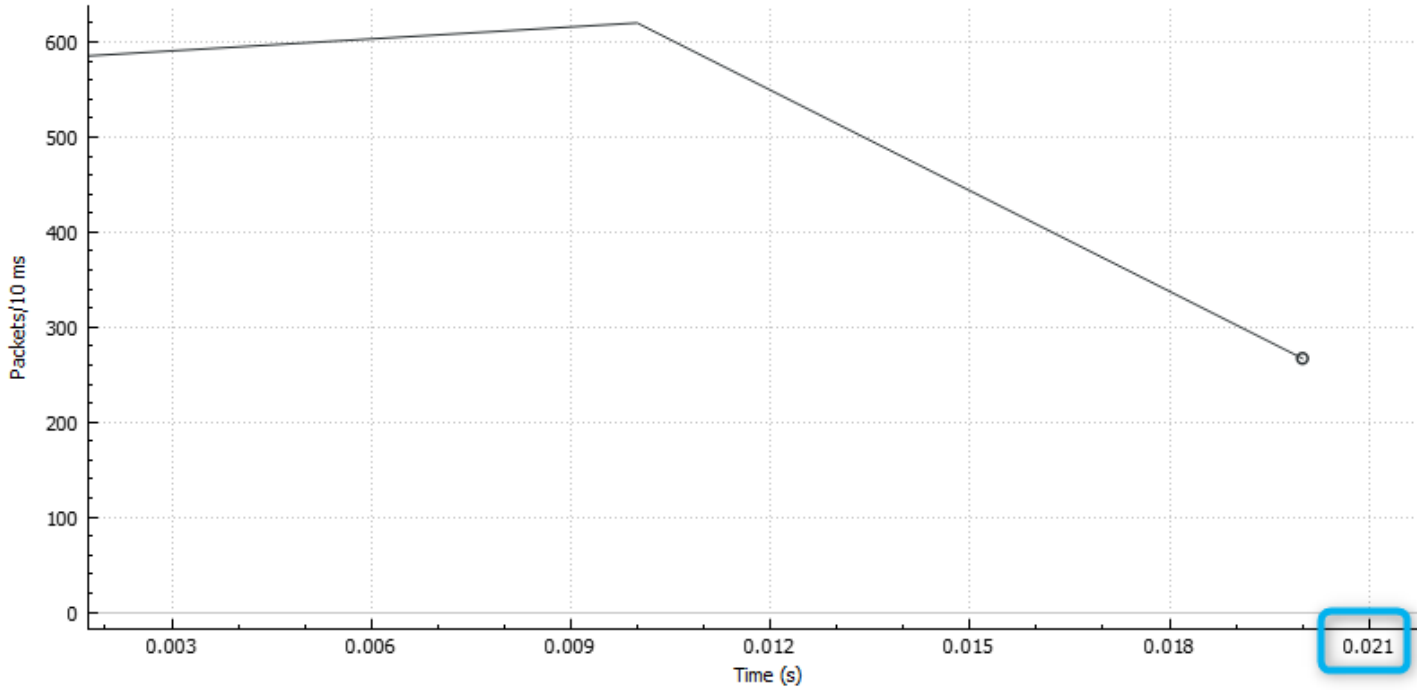


Lossless used Bandwidth: **799 Mbit/s of 800 Mbit/s**

4.4.15.2 Received HTTP-QuSS UDP Stream

Statistics

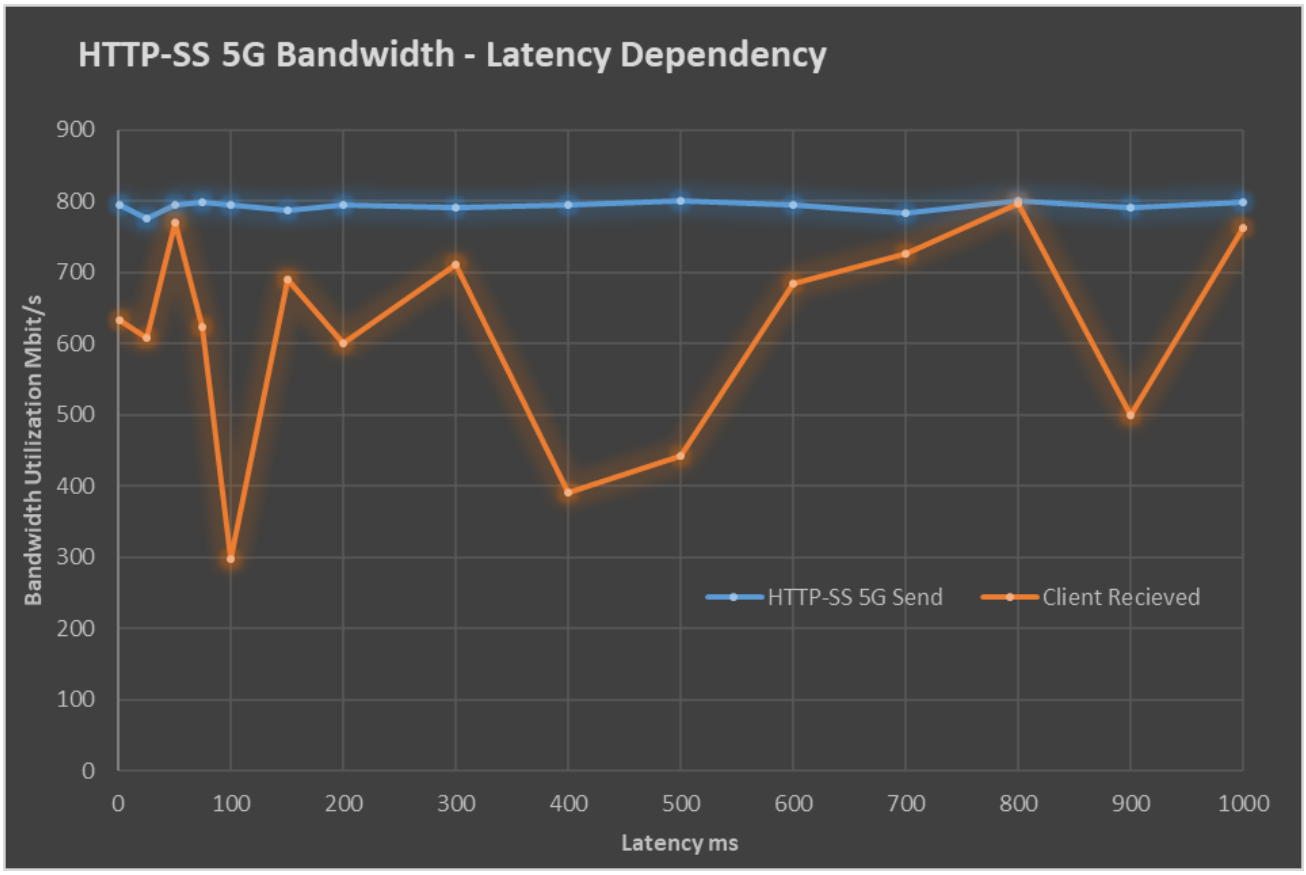
Measurement	Captured	Displayed	Marked
Packets	1465	1465 (100.0%)	—
Time span, s	0.023	0.023	—
Average pps	63759.8	63759.8	—
Average packet size, B	1495	1495	—
Bytes	2190457	2190457 (100.0%)	0
Average bytes/s	95 M	95 M	—
Average bits/s	762 M	762 M	—



Lossless used Bandwidth: **762 Mbit/s of 800 Mbit/s**

4.4.16 Benchmark Summary

	Netropy N91 Satellite Simulator	
Latency ms	Lossless HTTP-QuSS Transmission	Lossless HTTP-QuSS Data Reception
1	**794**	**633**
25	**776**	**608**
50	**795**	**769**
75	**799**	**623**
100	**795**	**297**
150	**787**	**689**
200	**794**	**600**
300	**790**	**711**
400	**795**	**391**
500	**800**	**443**
600	**795**	**684**
700	**783**	**726**
800	**800**	**796**
900	**790**	**499**
1000	**799**	**762**



4.5 Browser WEB Page Load Time - Latency Dependency

4.5.1 Available TCP Bandwidth - 800 Mbit/s

```
[  4] local 192.168.178.72 port 59505 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  91.2 MBytes   764 Mbits/sec
[  4]   1.00-2.00   sec  90.6 MBytes   760 Mbits/sec
[  4]   2.00-3.00   sec  90.4 MBytes   758 Mbits/sec
[  4]   3.00-4.00   sec  91.7 MBytes   769 Mbits/sec
[  4]   4.00-5.00   sec  91.7 MBytes   769 Mbits/sec
[  4]   5.00-6.00   sec  91.7 MBytes   769 Mbits/sec
[  4]   6.00-7.00   sec  91.7 MBytes   769 Mbits/sec
[  4]   7.00-8.00   sec  91.7 MBytes   769 Mbits/sec
[  4]   8.00-9.00   sec  91.7 MBytes   769 Mbits/sec
[  4]   9.00-10.00  sec  91.7 MBytes   769 Mbits/sec
[  4]  10.00-11.00  sec  91.3 MBytes   766 Mbits/sec
[  4]  11.00-12.00  sec  91.7 MBytes   769 Mbits/sec
[  4]  12.00-13.00  sec  90.7 MBytes   761 Mbits/sec
[  4]  13.00-14.00  sec  91.7 MBytes   769 Mbits/sec
[  4]  14.00-15.00  sec  91.3 MBytes   766 Mbits/sec
[  4]  15.00-16.00  sec  91.6 MBytes   768 Mbits/sec
[  4]  16.00-17.00  sec  90.5 MBytes   759 Mbits/sec
[  4]  17.00-18.00  sec  90.3 MBytes   756 Mbits/sec
[  4]  18.00-19.00  sec  90.7 MBytes   763 Mbits/sec
[  4]  19.00-20.00  sec  90.5 MBytes   759 Mbits/sec
[  4]  20.00-21.00  sec  90.8 MBytes   762 Mbits/sec
[  4]  21.00-22.00  sec  90.9 MBytes   763 Mbits/sec
[  4]  22.00-23.00  sec  91.3 MBytes   766 Mbits/sec
[  4]  23.00-24.00  sec  91.7 MBytes   769 Mbits/sec
[  4]  24.00-25.00  sec  91.7 MBytes   769 Mbits/sec
[  4]  25.00-26.00  sec  91.7 MBytes   769 Mbits/sec
[  4]  26.00-27.00  sec  91.3 MBytes   766 Mbits/sec
[  4]  27.00-28.00  sec  90.6 MBytes   759 Mbits/sec
[  4]  28.00-29.00  sec  91.0 MBytes   763 Mbits/sec
[  4]  29.00-30.00  sec  90.5 MBytes   759 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  2.67 GBytes   765 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  2.67 GBytes   765 Mbits/sec                  receiver
CPU Utilization: local/receiver 12.2% (4.4%u/7.8%s), remote/sender 0.7% (0.0%u/0.7%s)
```

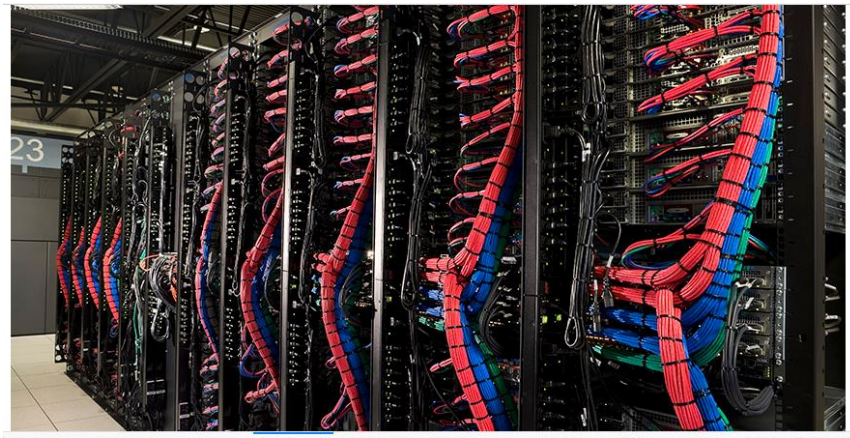
4.5.2 RTT = 1 ms

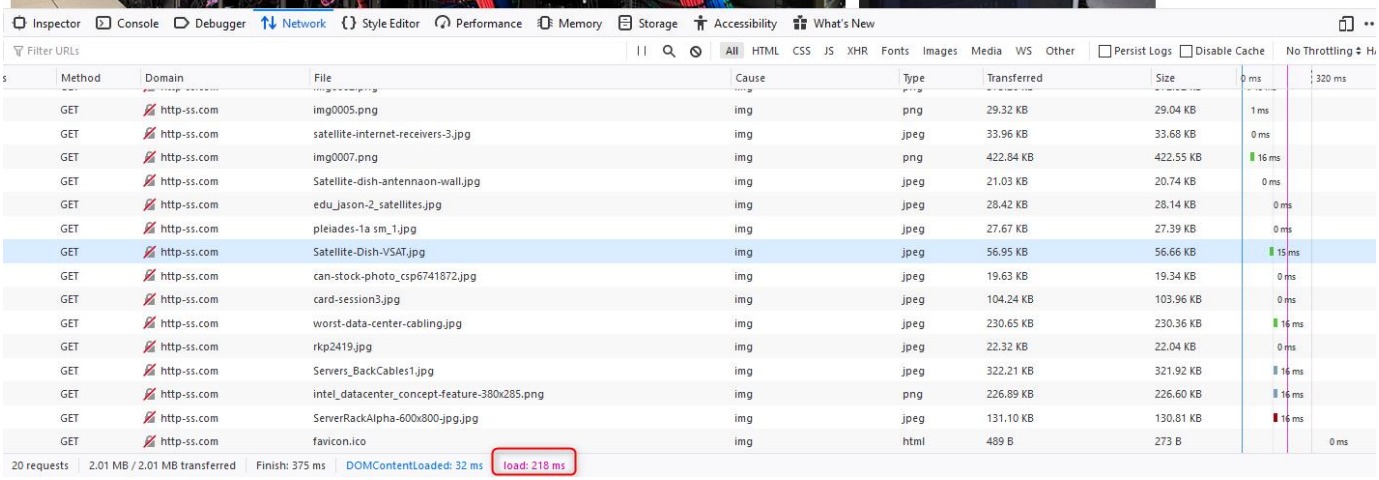
Bandwidth 800 Mbit/s
Latency 1 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1ms TTL=64
```

4.5.2.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

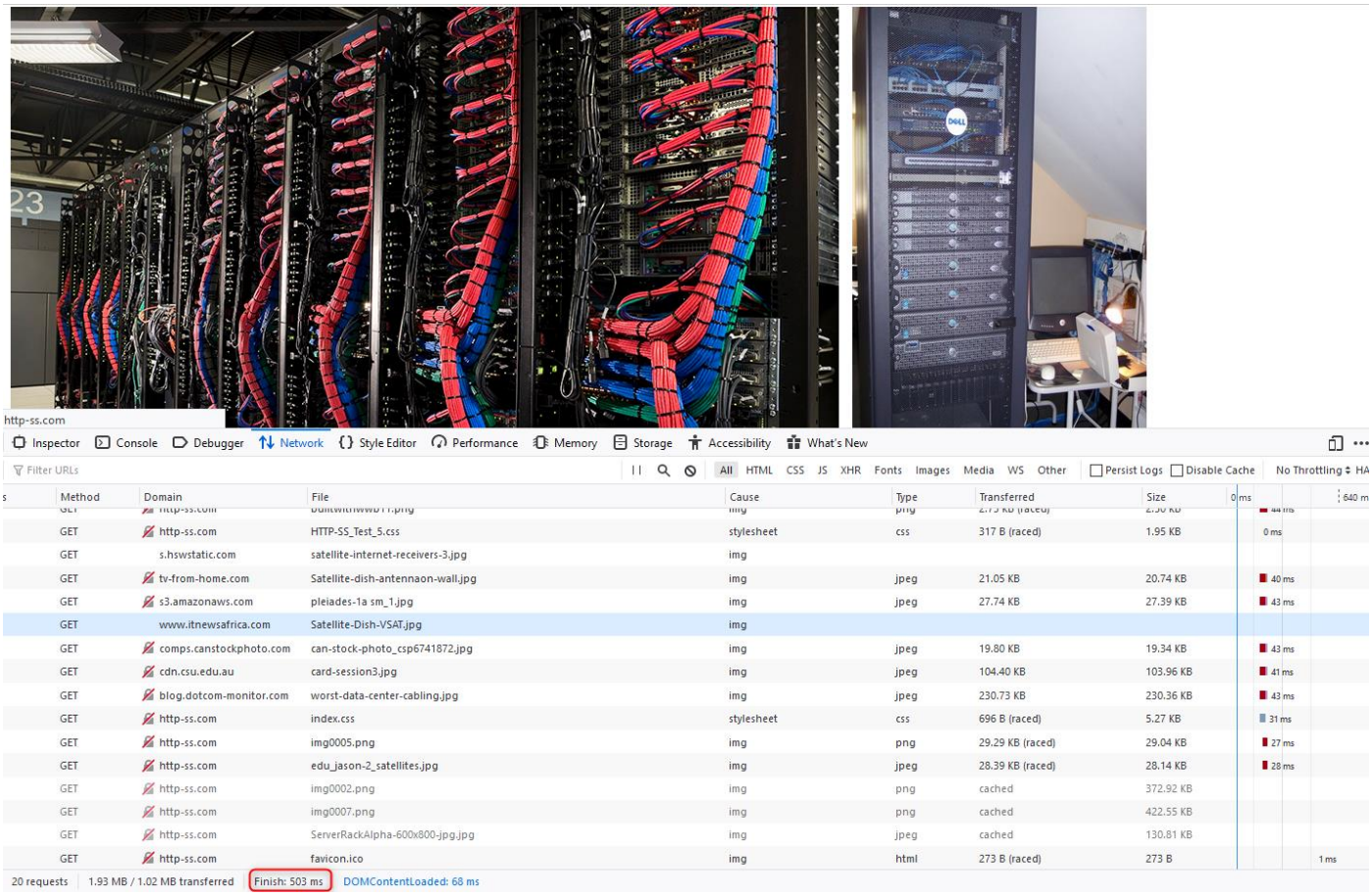




Page Load Time: **218 ms**

4.5.2.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **503 ms**

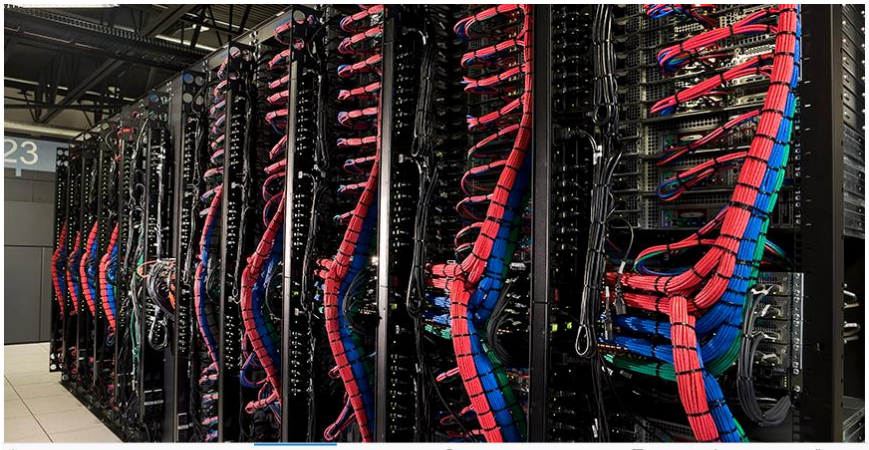
4.5.3 RTT = 25 ms

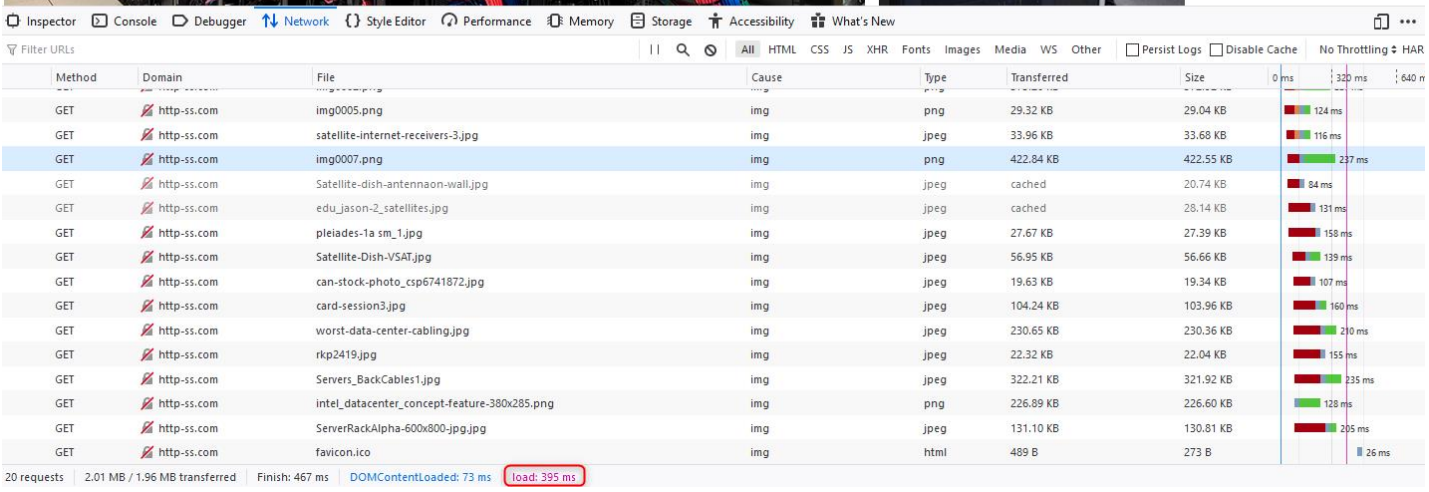
Bandwidth 800 Mbit/s
Latency 25 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=25ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=25ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=25ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=25ms TTL=64
```

4.5.3.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

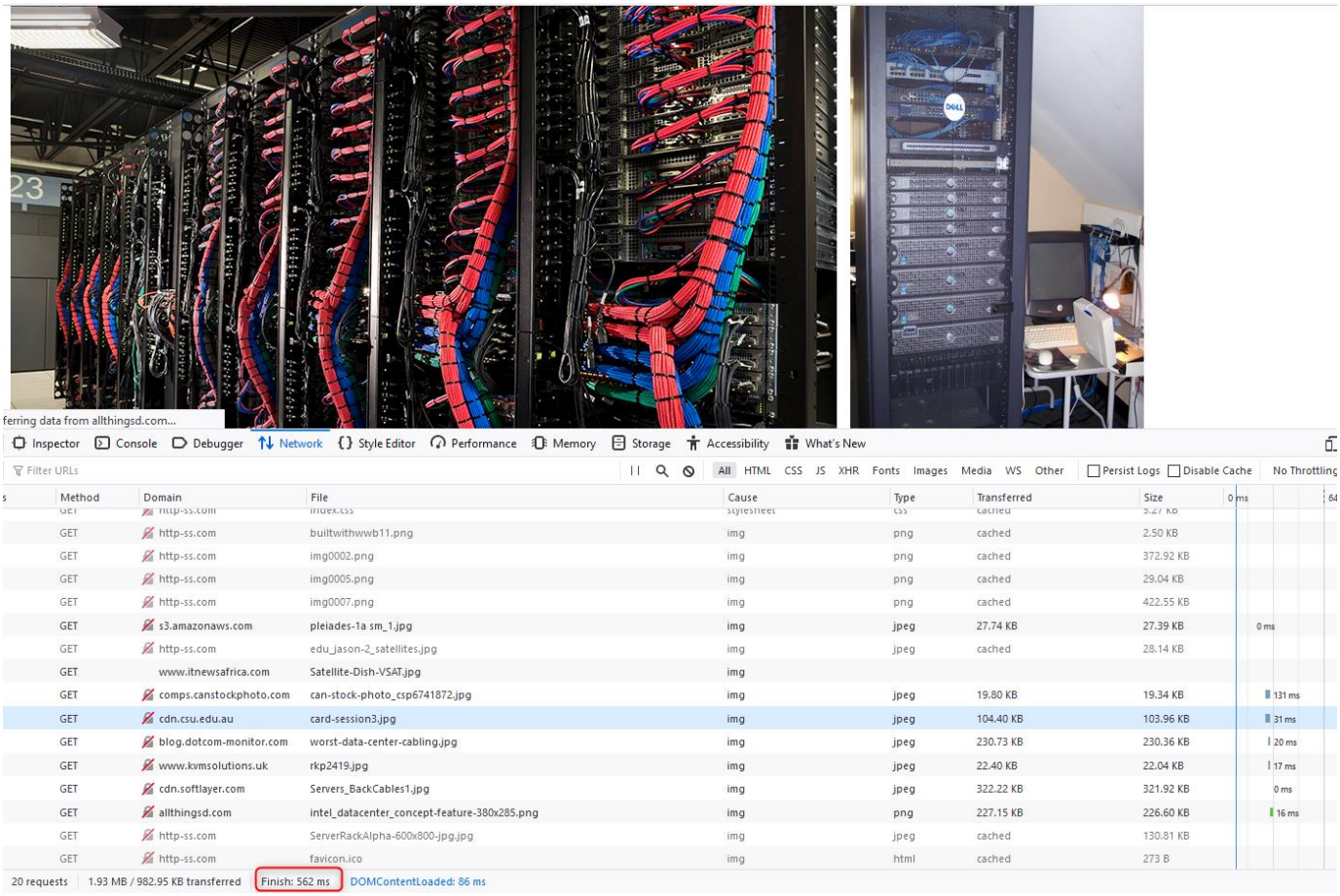




Page Load Time: **395 ms**

4.5.3.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **562 ms**

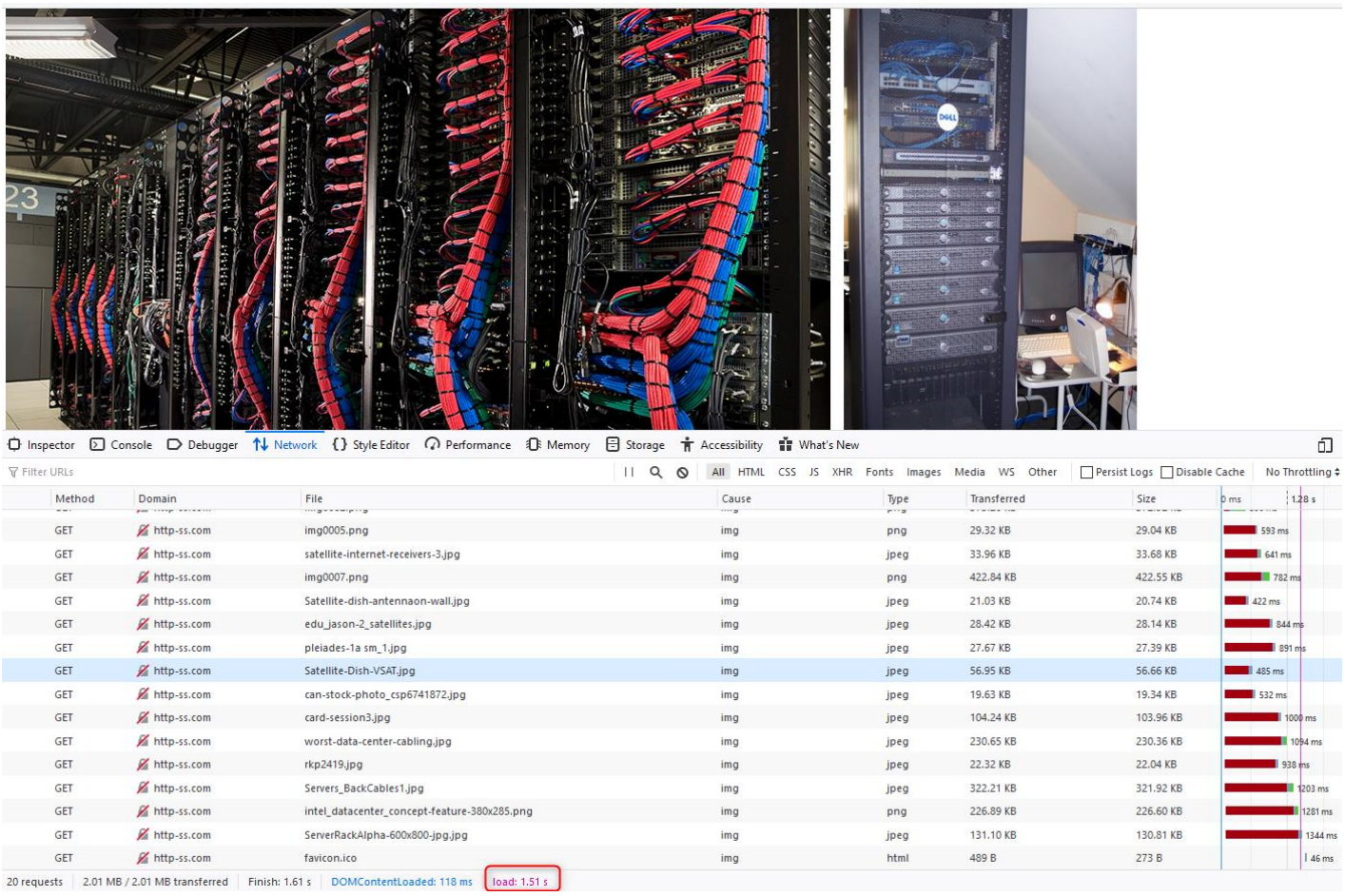
4.5.4 RTT = 50 ms

Bandwidth 800 Mbit/s
Latency 50 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=50ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=50ms TTL=64
```

4.5.4.1 Page Load Time - TCP/HTTP

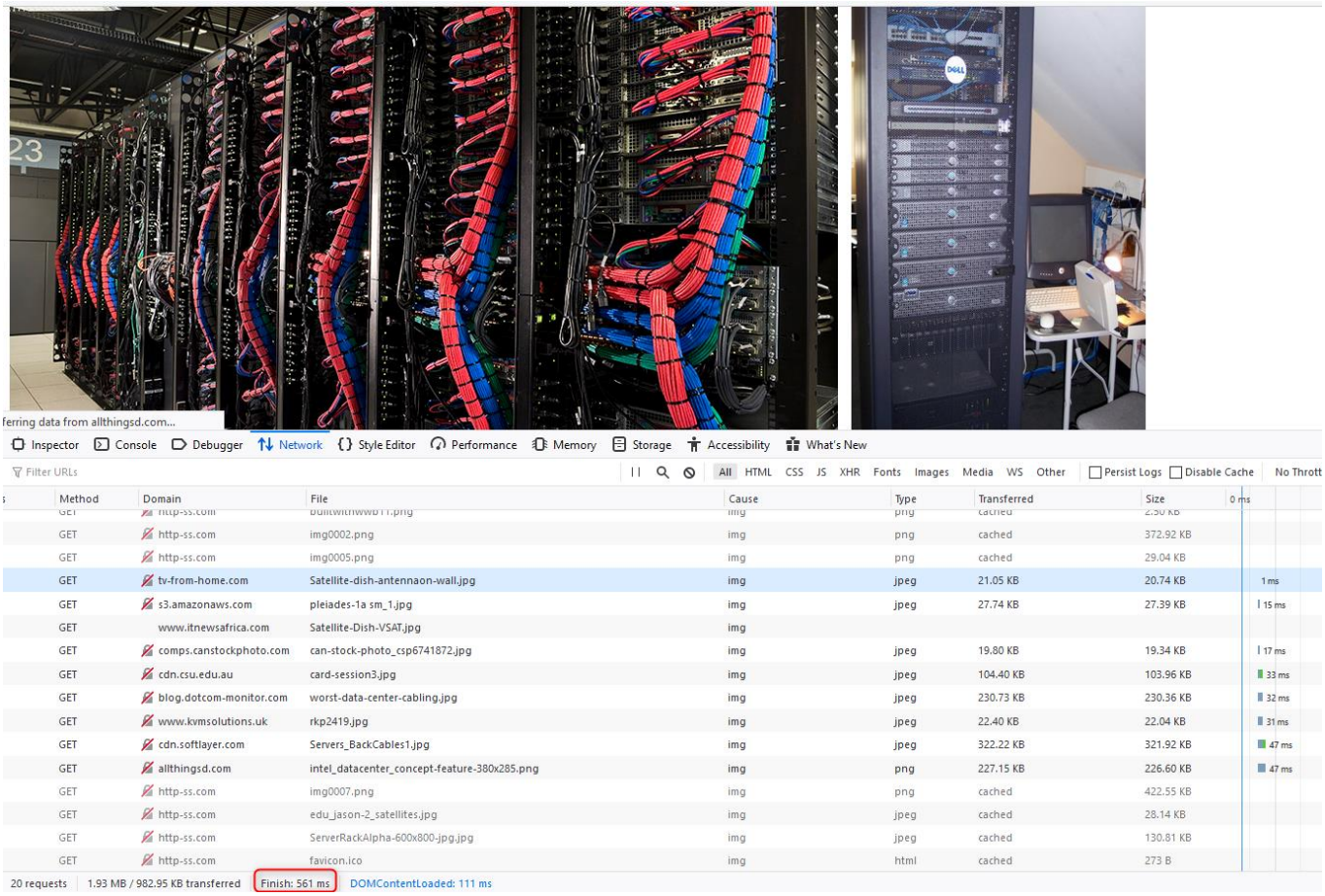
Browser Cache deleted!



Page Load Time: **1.51 s**

4.5.4.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **561 ms**

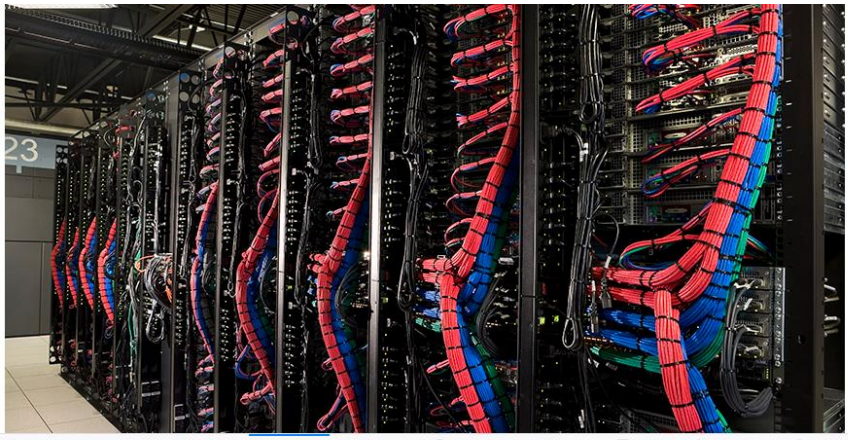
4.5.5 RTT = 75 ms

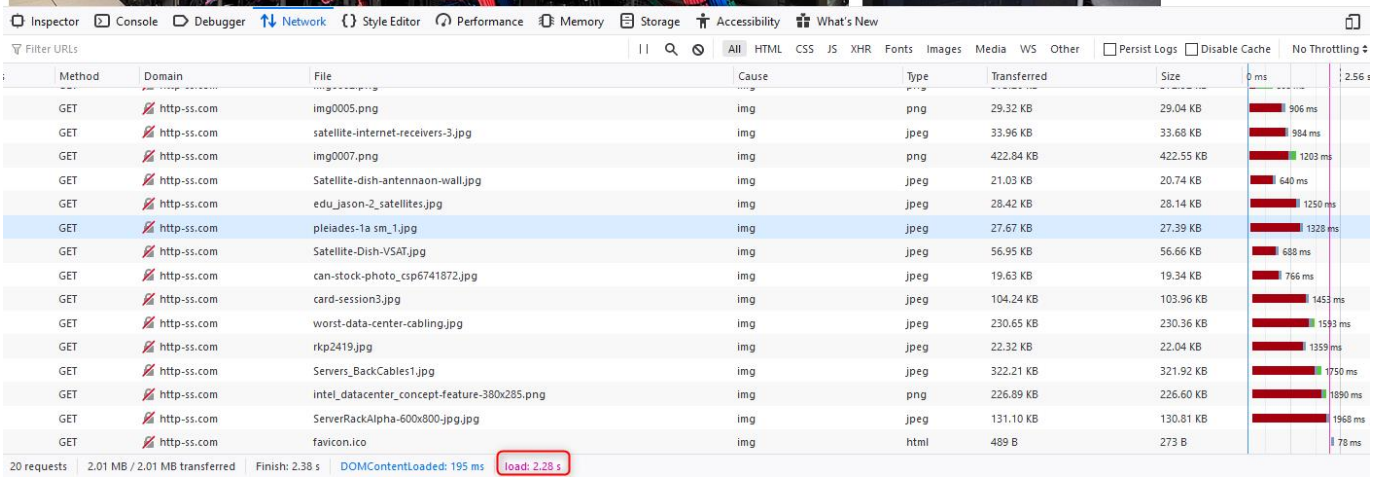
Bandwidth 800 Mbit/s
Latency 75 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=75ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=75ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=75ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=75ms TTL=64
```

4.5.5.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

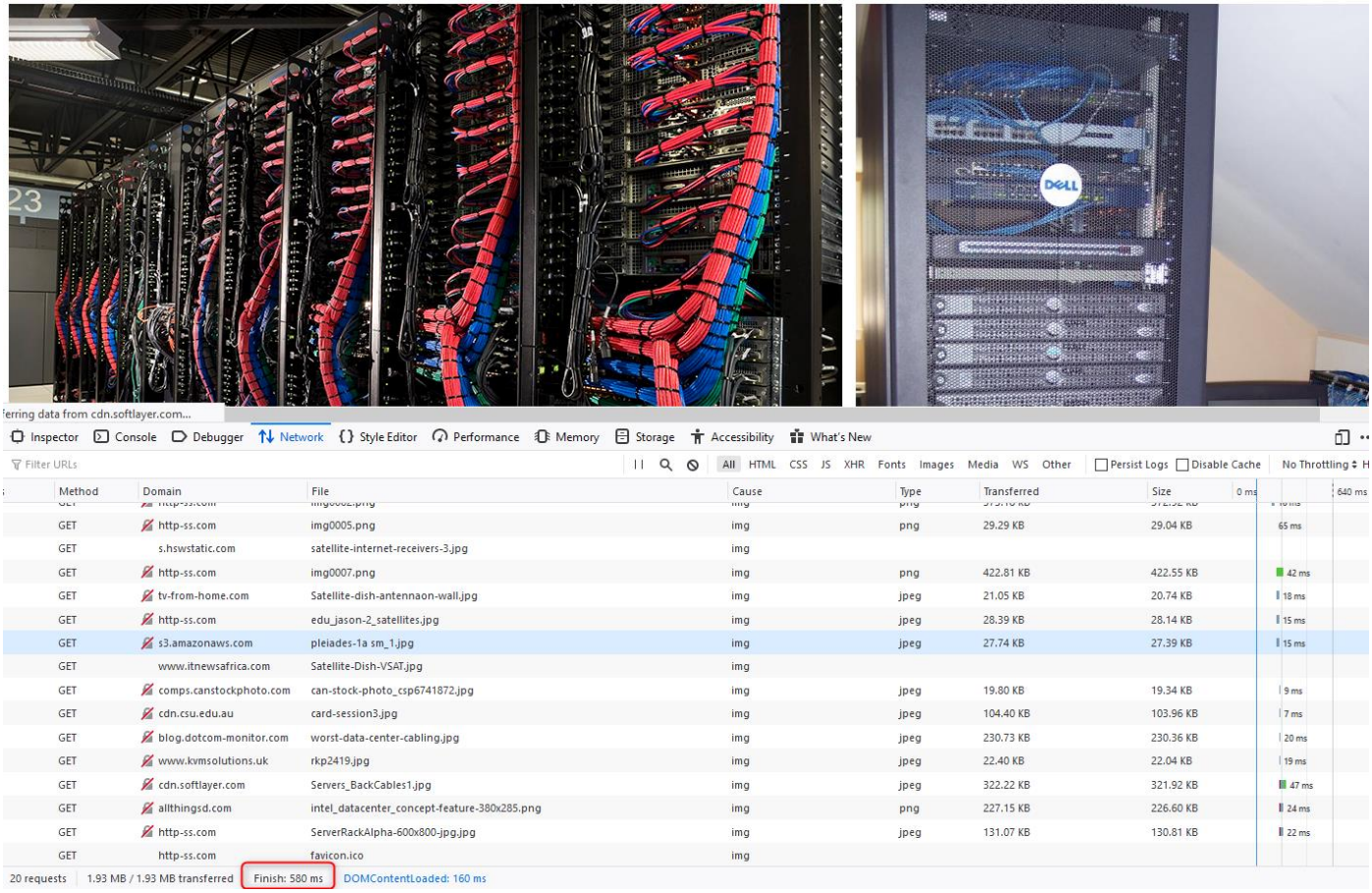




Page Load Time: **2.28 s**

4.5.5.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **580 ms**

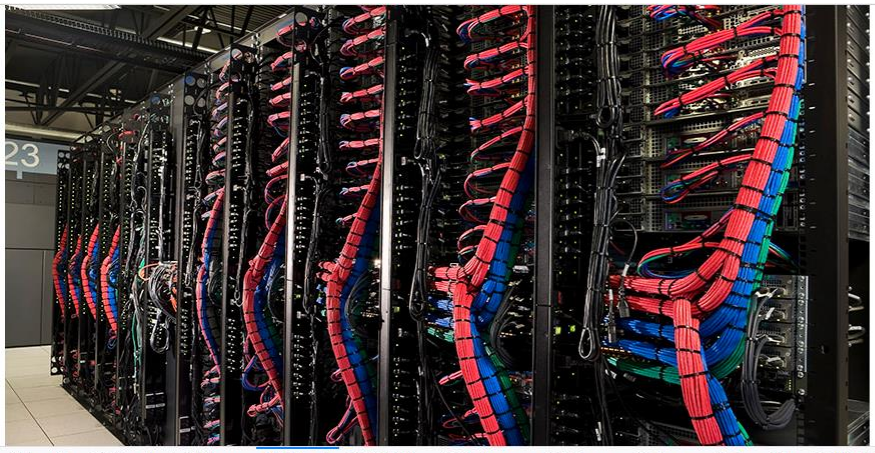
4.5.6 RTT = 100 ms

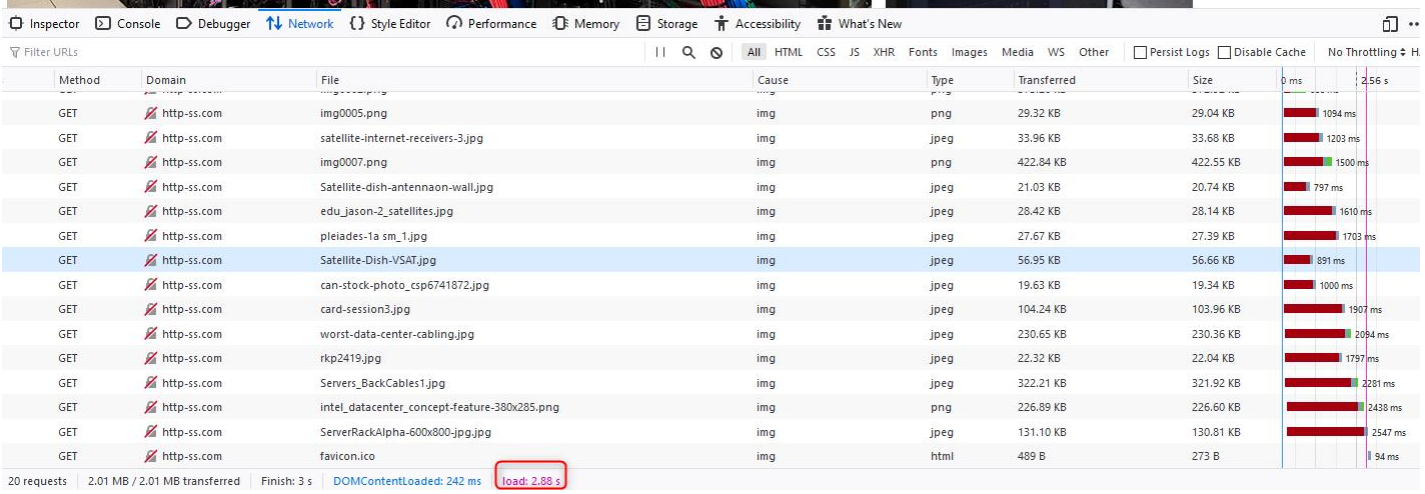
Bandwidth 800 Mbit/s
Latency 100 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=100ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=100ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=100ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=100ms TTL=64
```

4.5.6.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

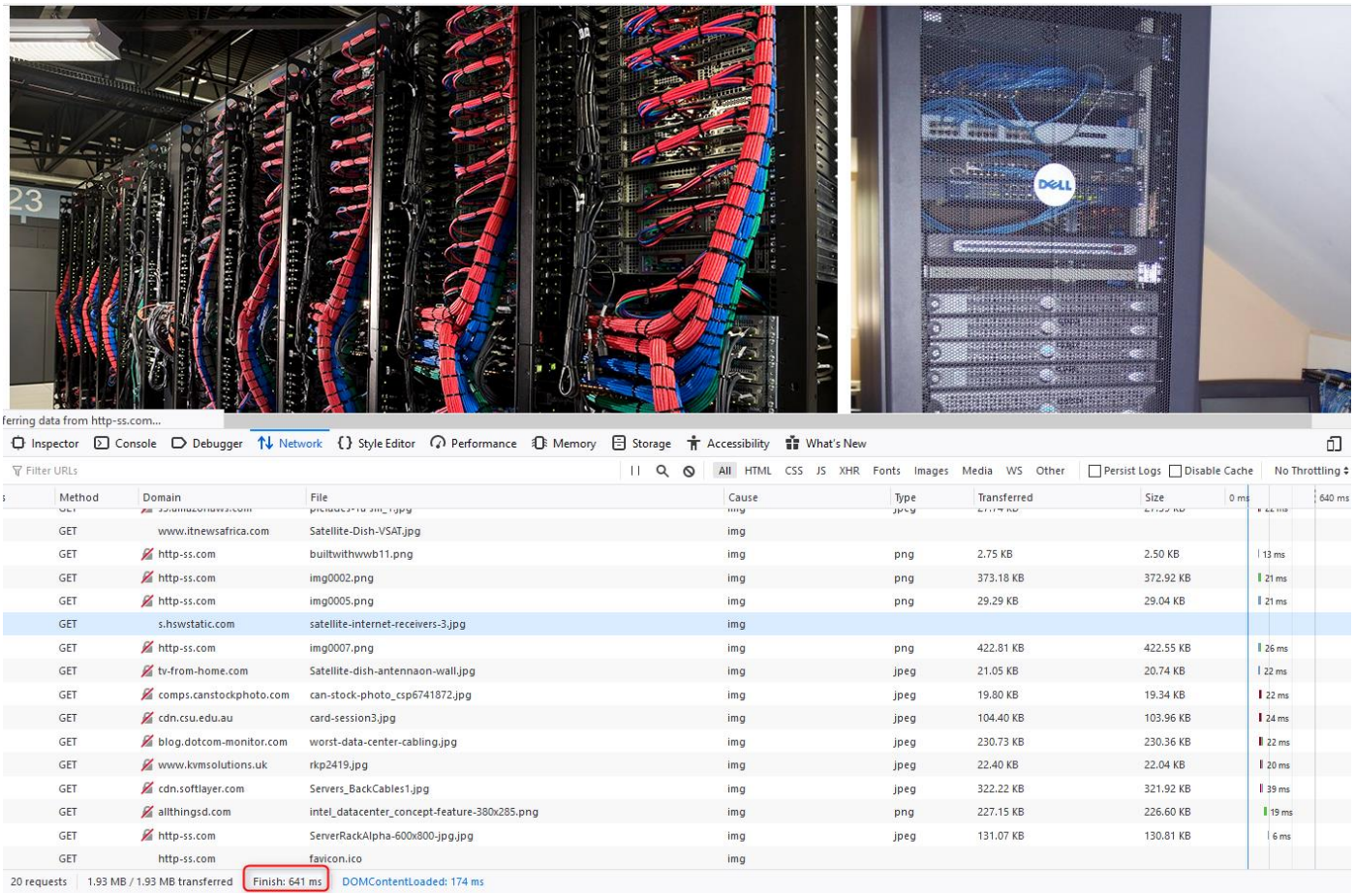




Page Load Time: **2.88 s**

4.5.6.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **641 ms**

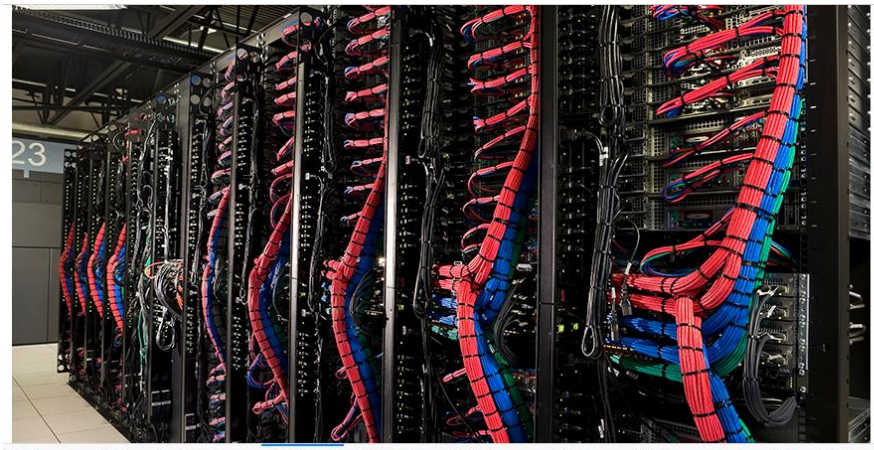
4.5.7 RTT = 150 ms

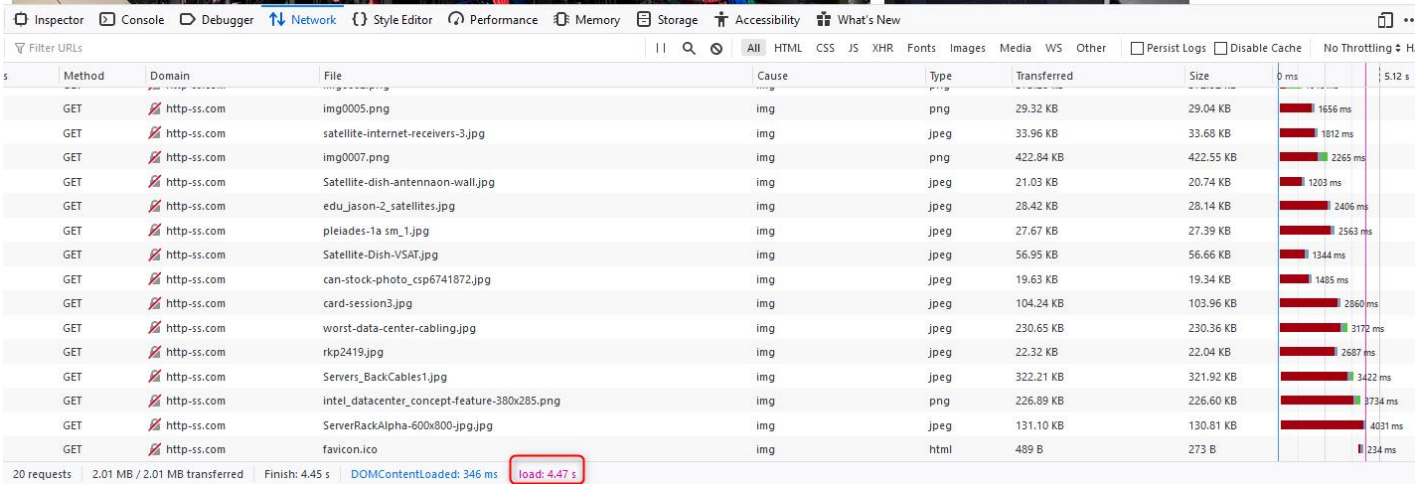
Bandwidth 800 Mbit/s
Latency 150 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=151ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=151ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=151ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=151ms TTL=64
```

4.5.7.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

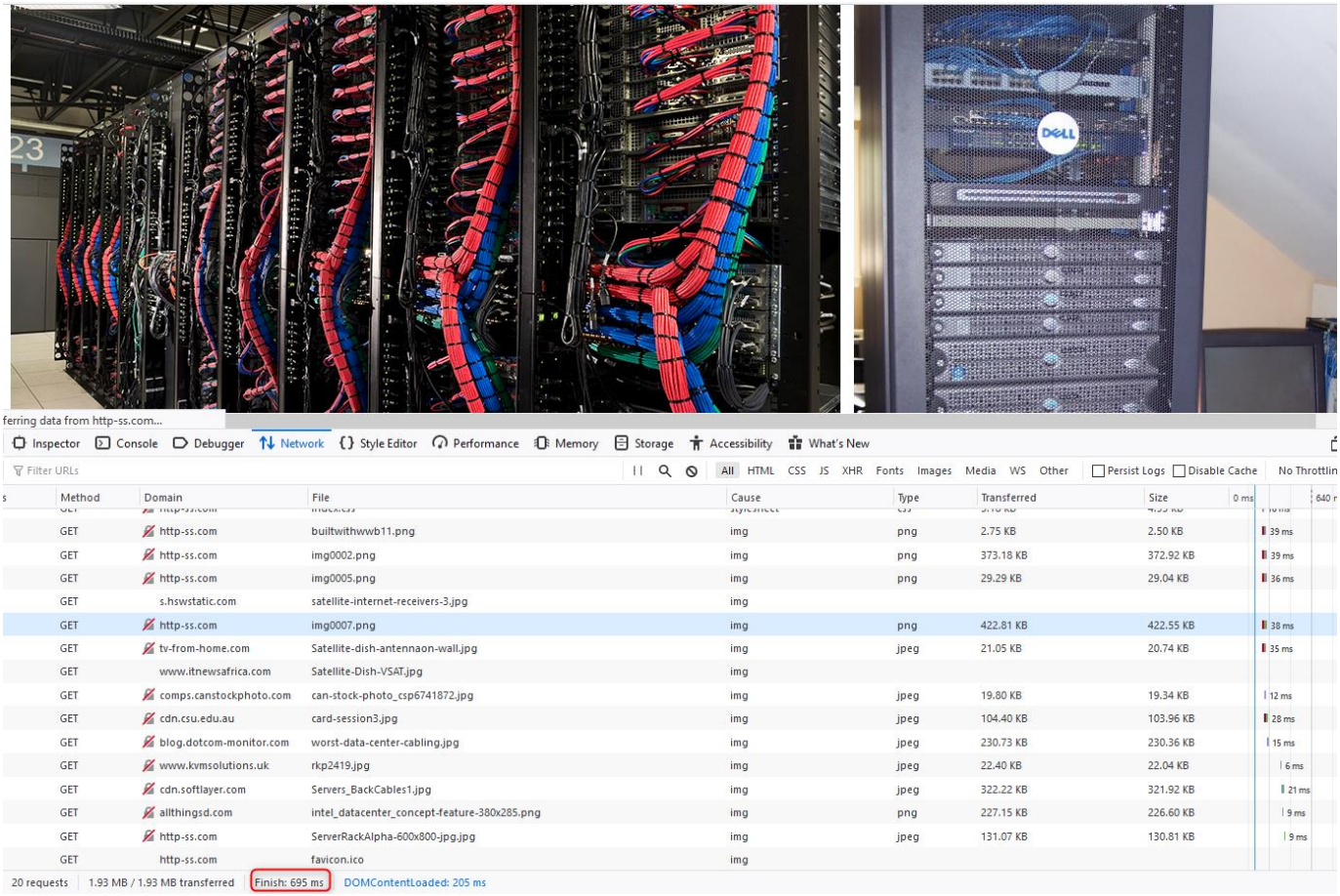




Page Load Time: **4.47 s**

4.5.7.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **695 ms**

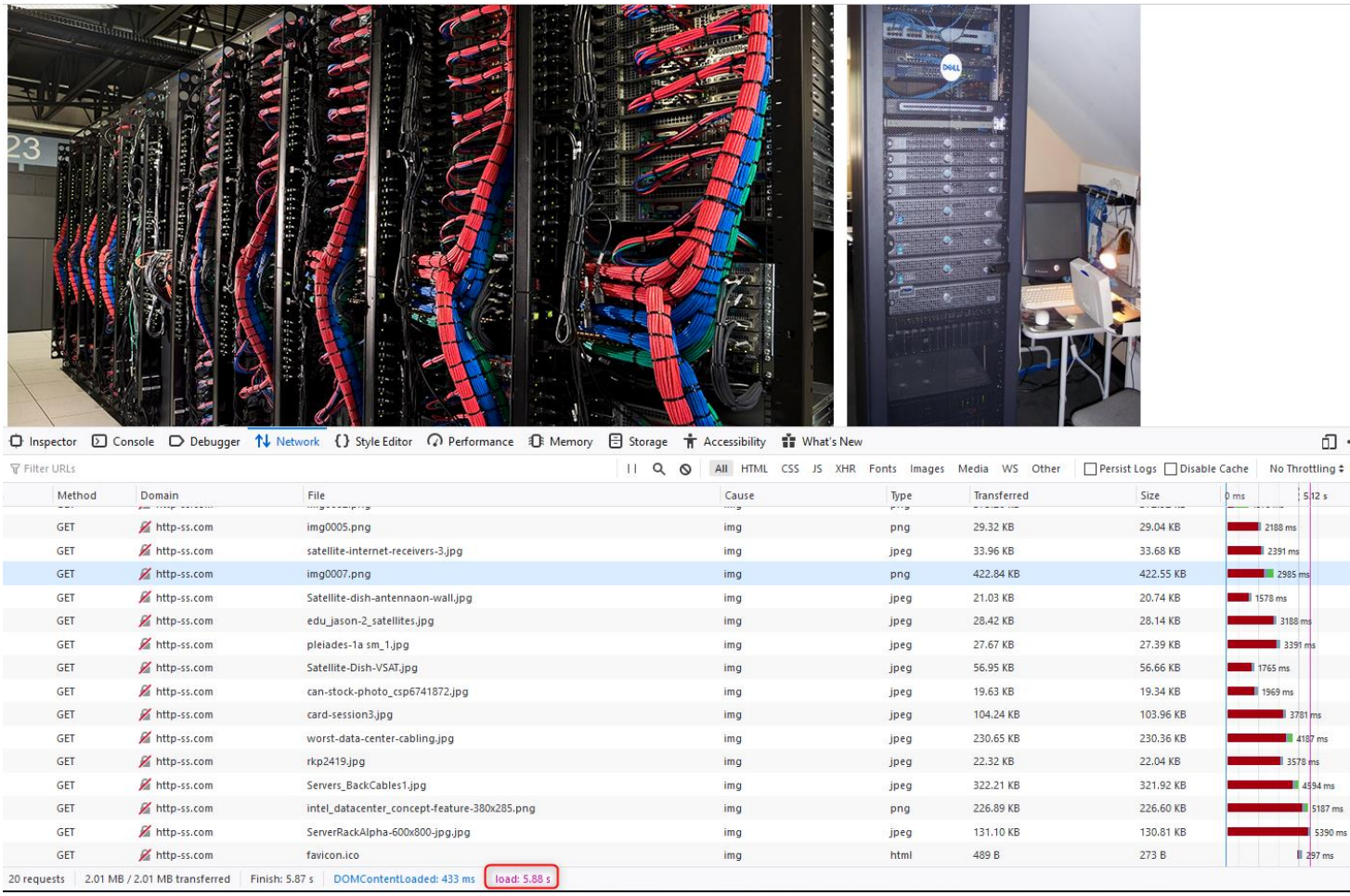
4.5.8 RTT = 200 ms

Bandwidth 800 Mbit/s
Latency 200 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=200ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=200ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=200ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=200ms TTL=64
```

4.5.8.1 Page Load Time - TCP/HTTP

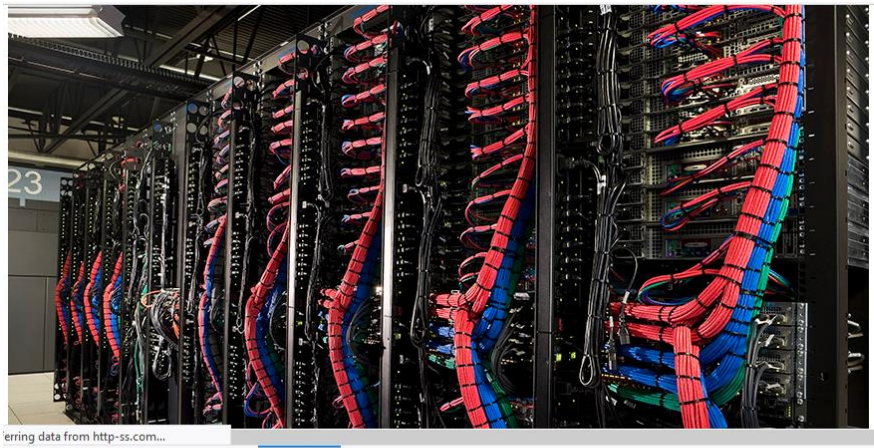
Browser Cache deleted!

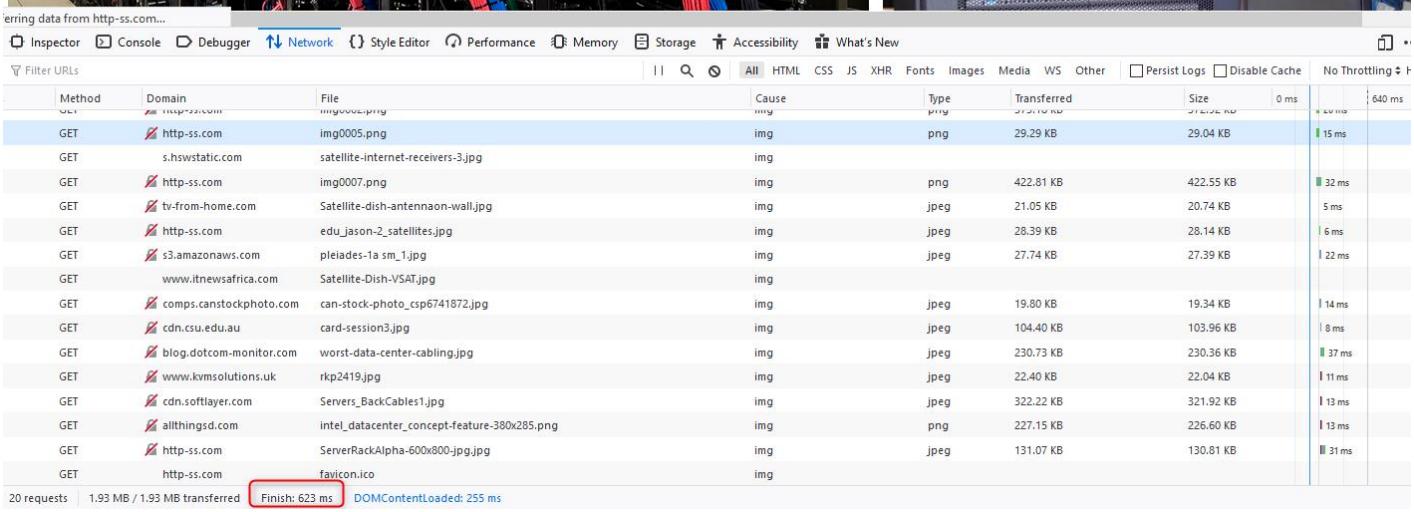


Page Load Time: **5.88 s**

4.5.8.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!





Page Load Time: **623 ms**

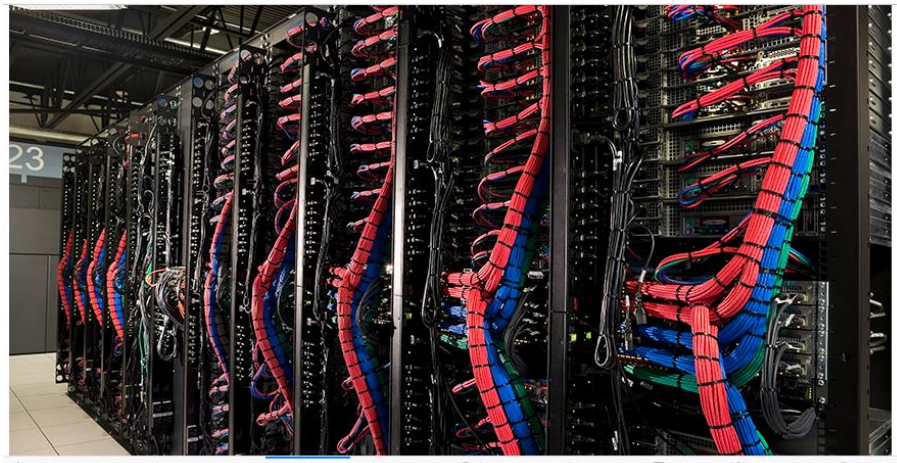
4.5.9 RTT = 300 ms

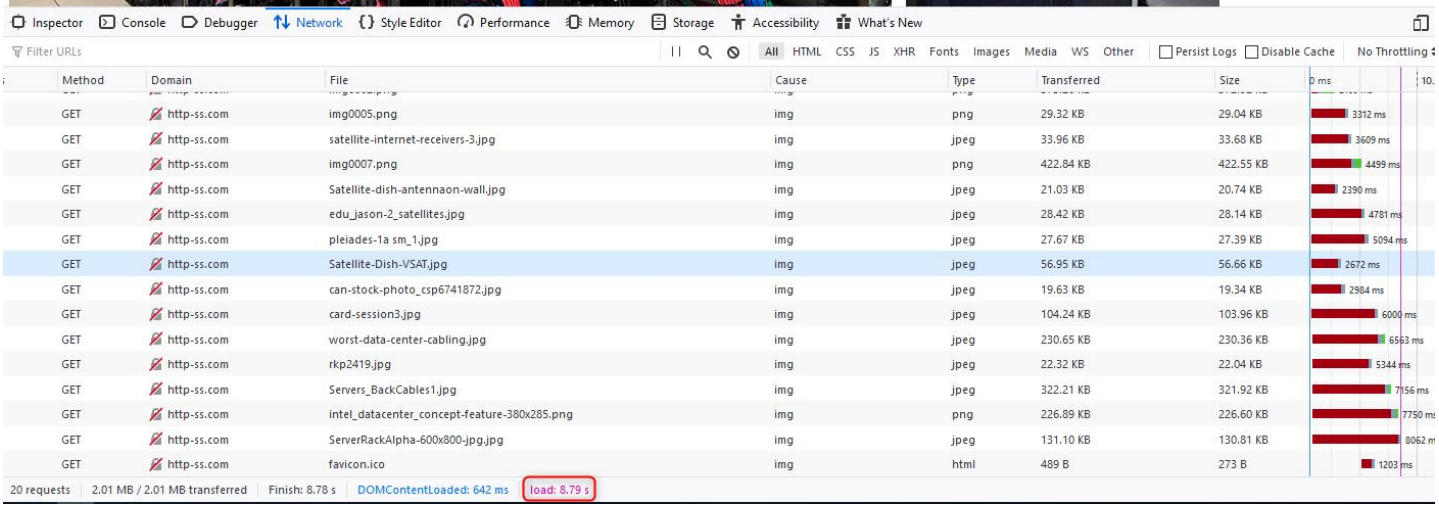
Bandwidth 800 Mbit/s
Latency 300 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=300ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=300ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=300ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=300ms TTL=64
```

4.5.9.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

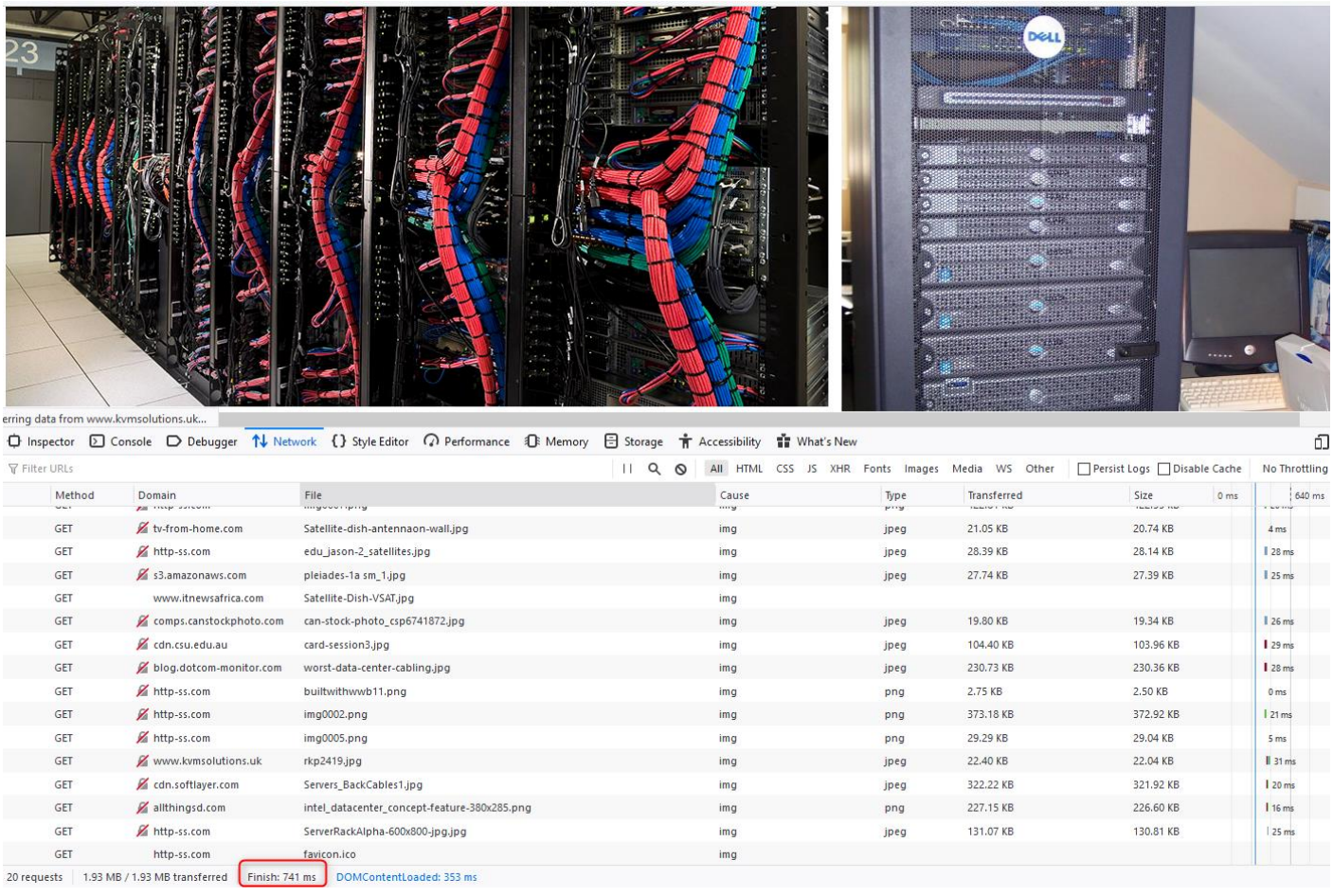




Page Load Time: **8.79 s**

4.5.9.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **741 ms**

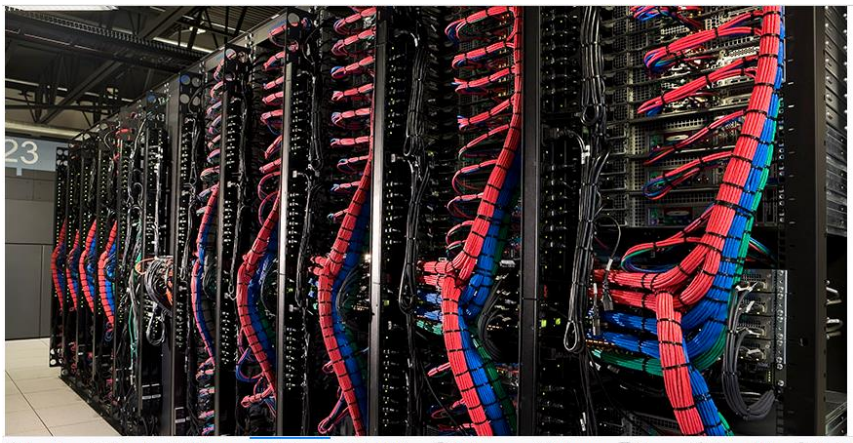
4.5.10 RTT = 400 ms

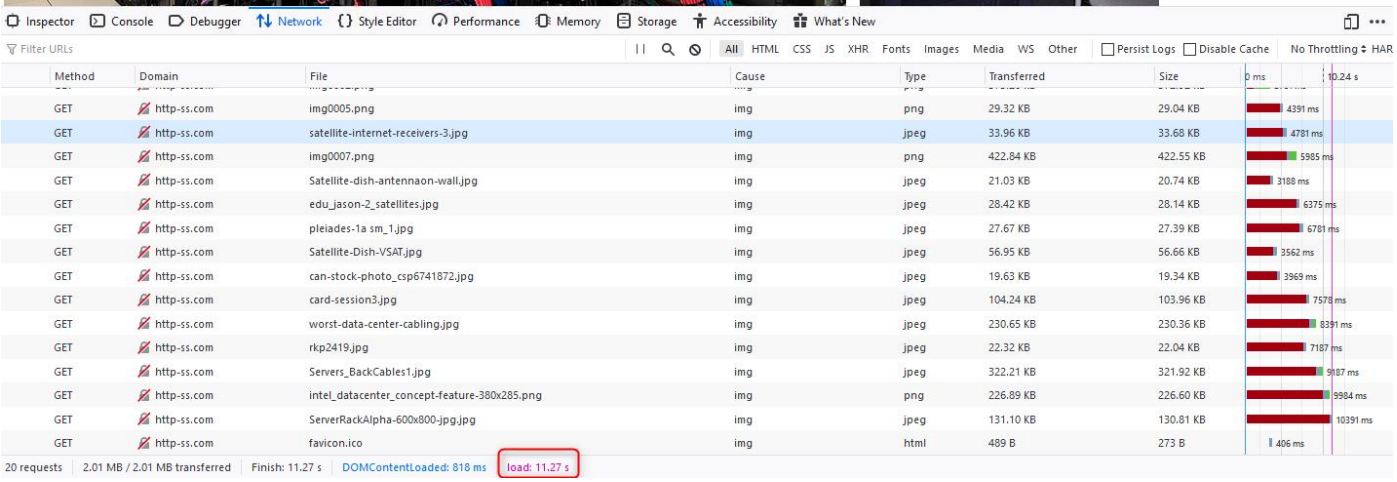
Bandwidth 800 Mbit/s
Latency 400 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=400ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=400ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=400ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=400ms TTL=64
```

4.5.10.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

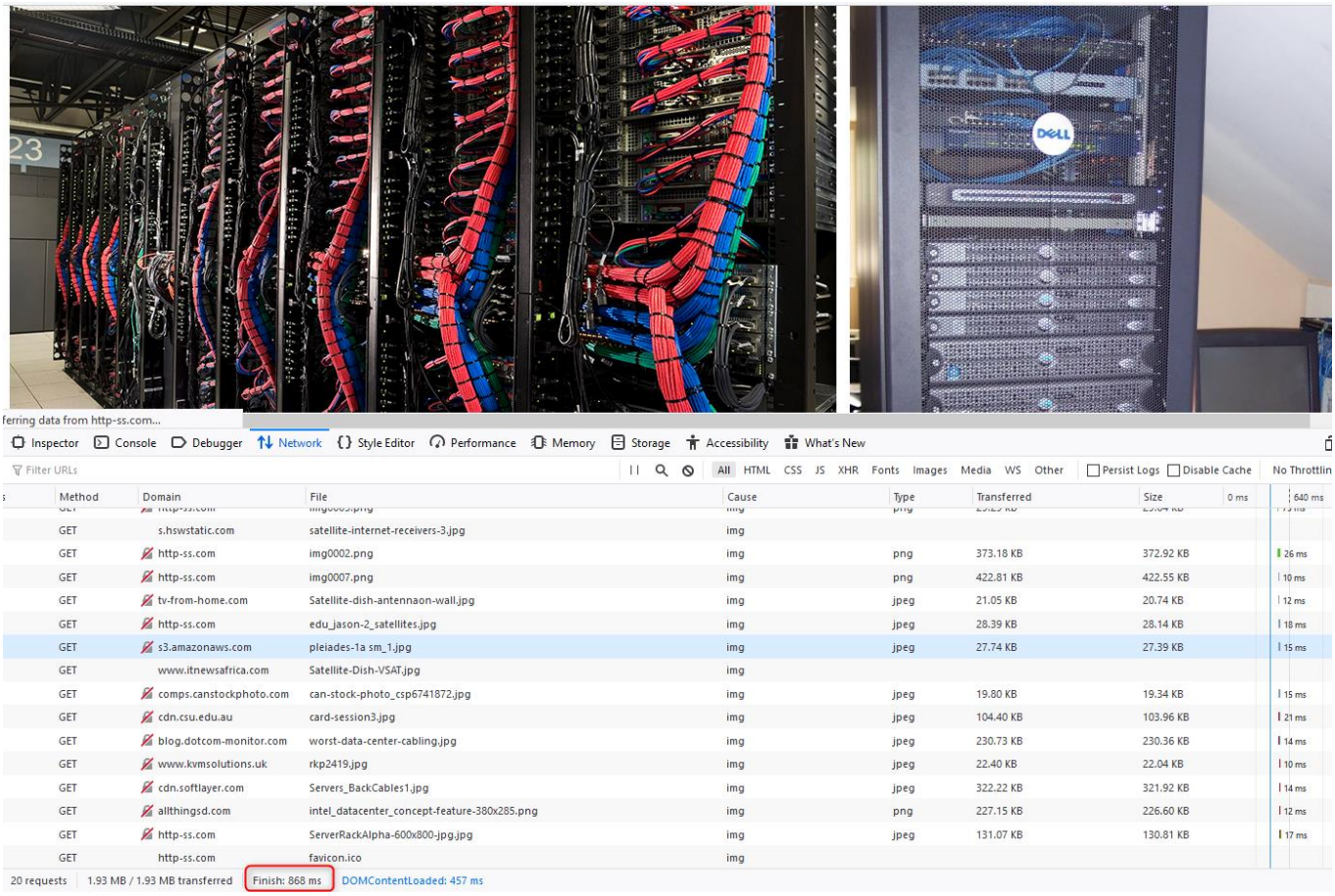




Page Load Time: **11.27 s**

4.5.10.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **868 ms**

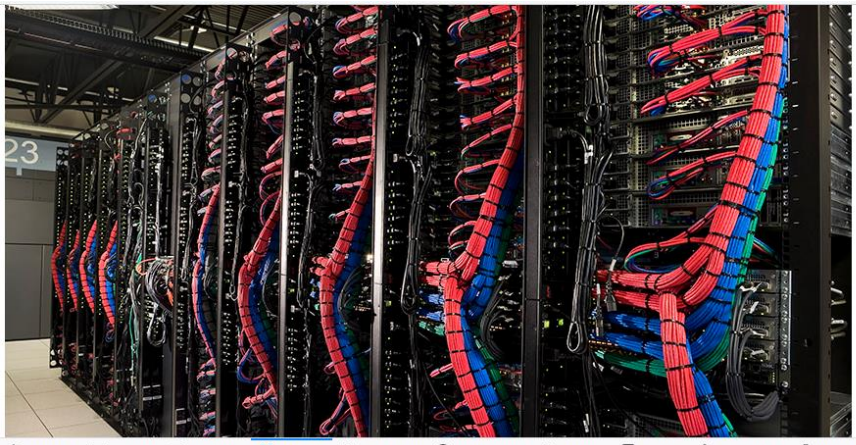
4.5.11 RTT = 500 ms

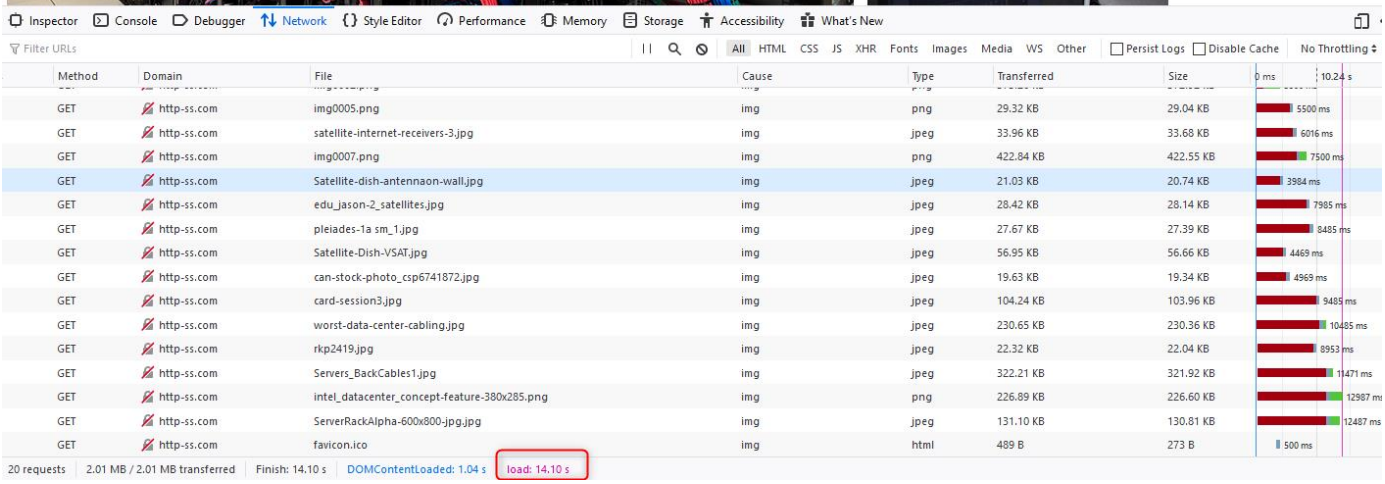
Bandwidth 800 Mbit/s
Latency 500 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=500ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=500ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=500ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=500ms TTL=64
```

4.5.11.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

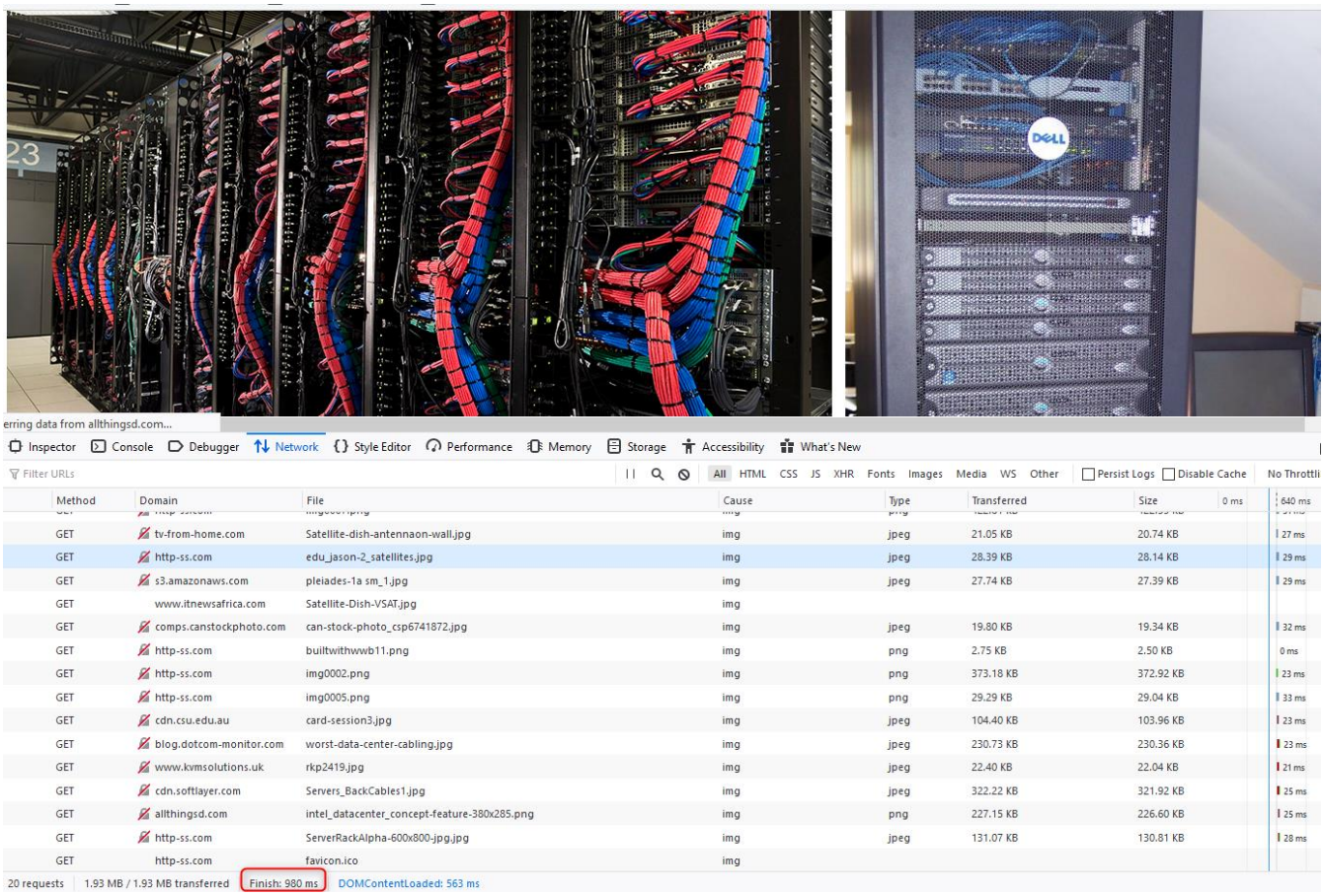




Page Load Time: **14.10 s**

4.5.11.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **980 ms**

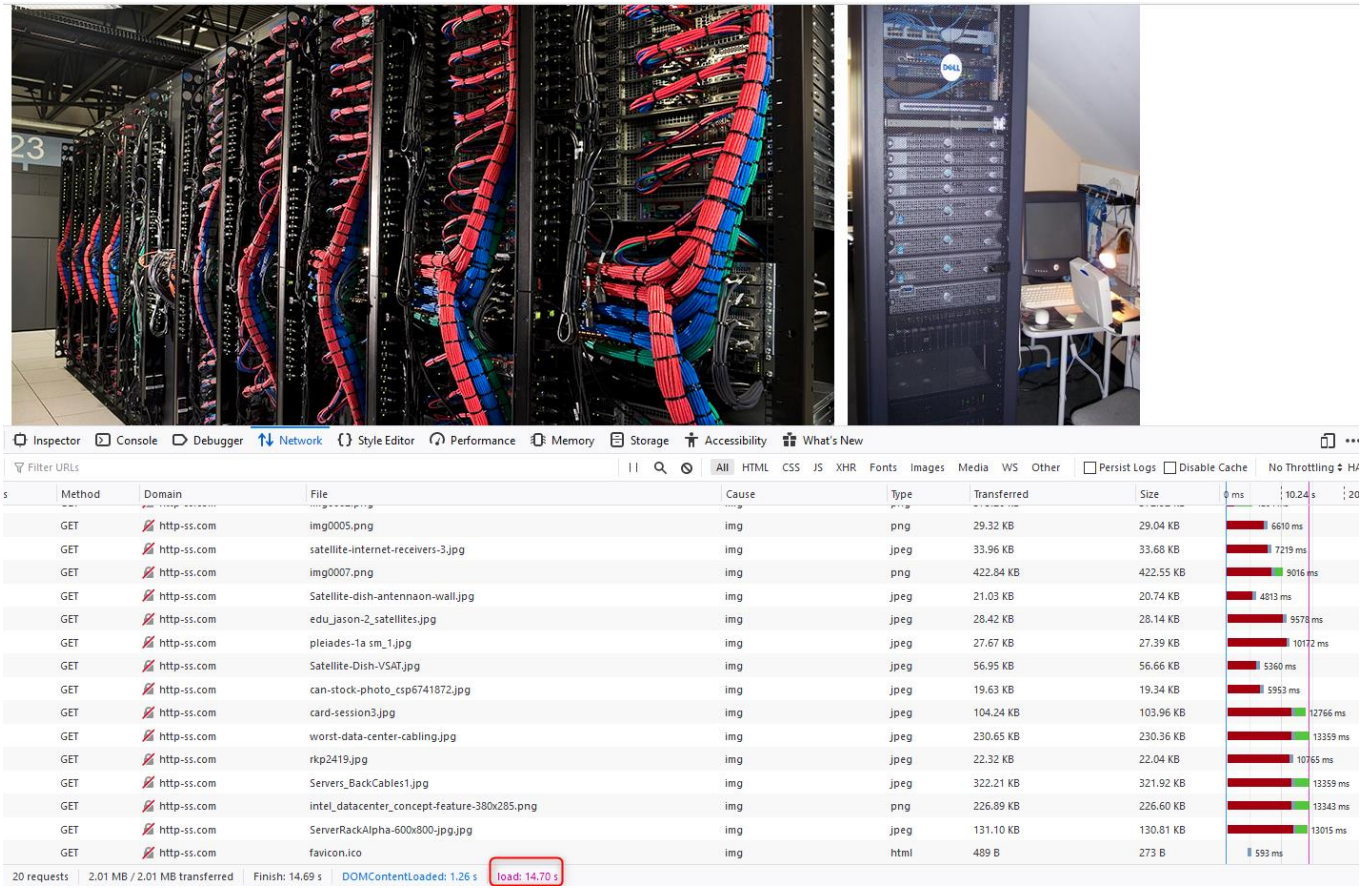
4.5.12 RTT = 600 ms

Bandwidth 800 Mbit/s
Latency 600 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=600ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=600ms TTL=64
```

4.5.12.1 Page Load Time - TCP/HTTP

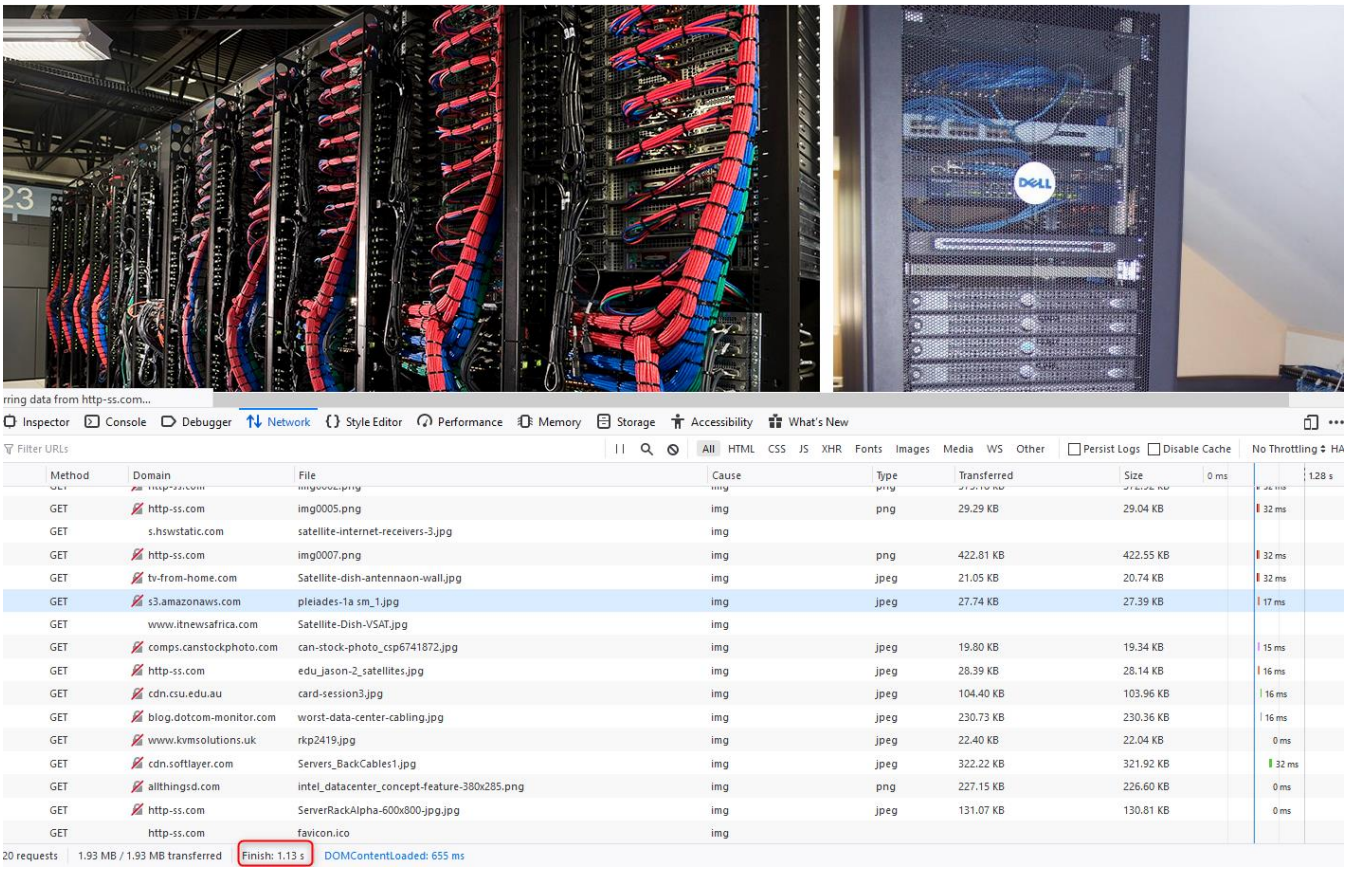
Browser Cache deleted!



Page Load Time: **14.70 s**

4.5.12.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1.13 s**

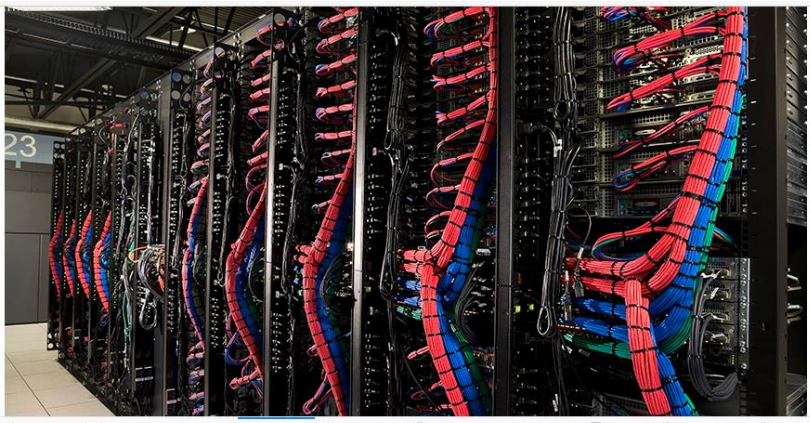
4.5.13 RTT = 700 ms

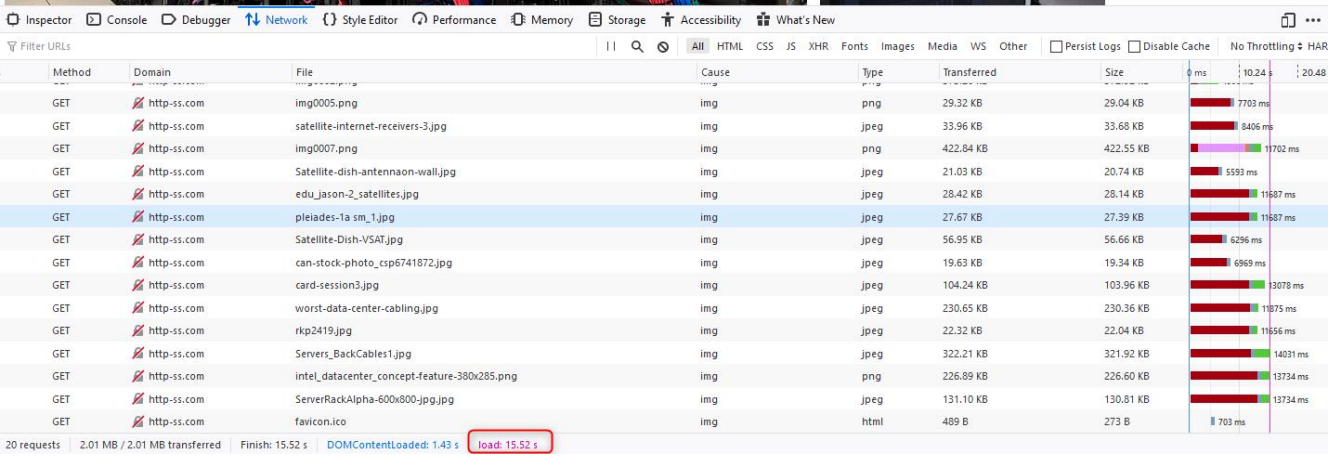
Bandwidth 800 Mbit/s
Latency 700 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=700ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=700ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=700ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=700ms TTL=64
```

4.5.13.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

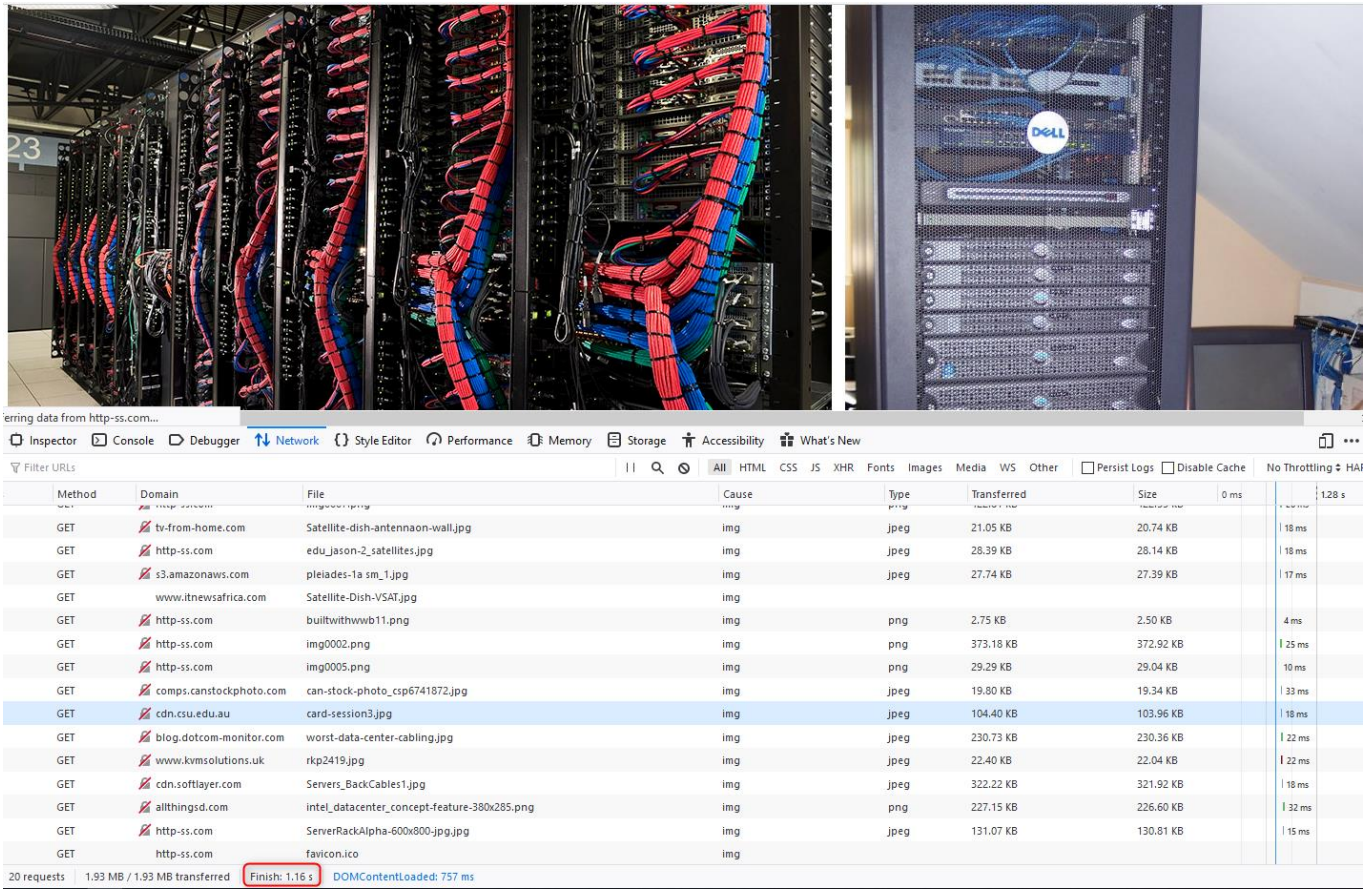




Page Load Time: **15.52 s**

4.5.13.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1.16 s**

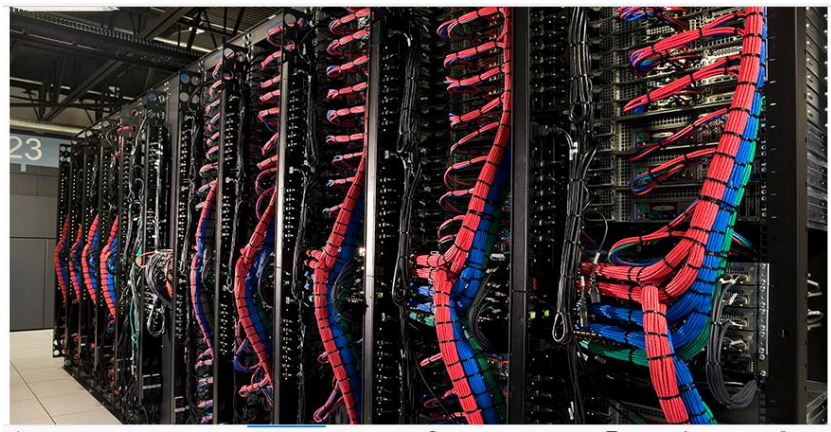
4.5.14 RTT = 800 ms

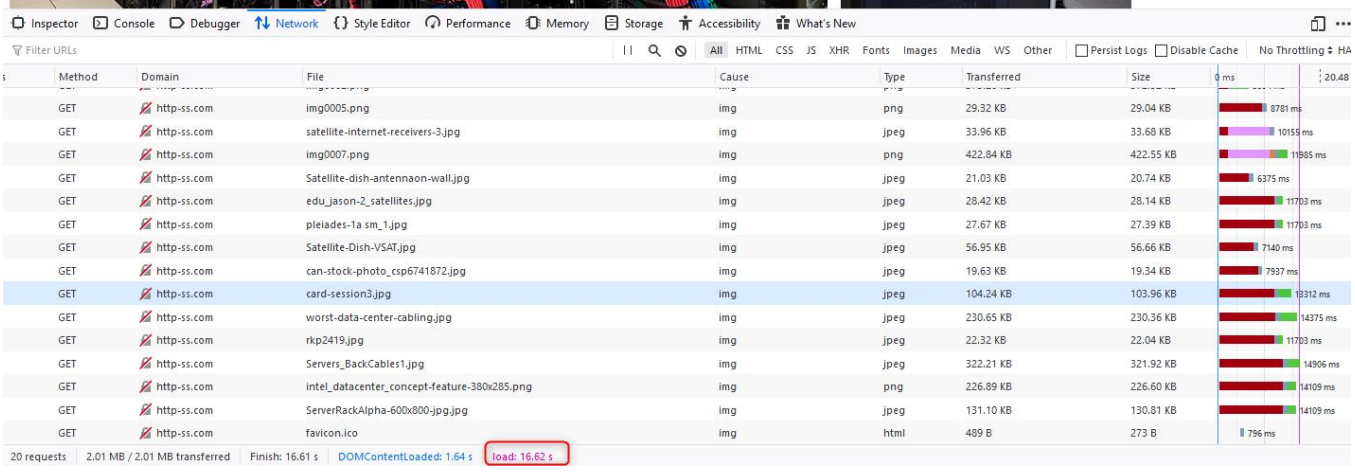
Bandwidth 800 Mbit/s
Latency 800 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=800ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=800ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=800ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=800ms TTL=64
```

4.5.14.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

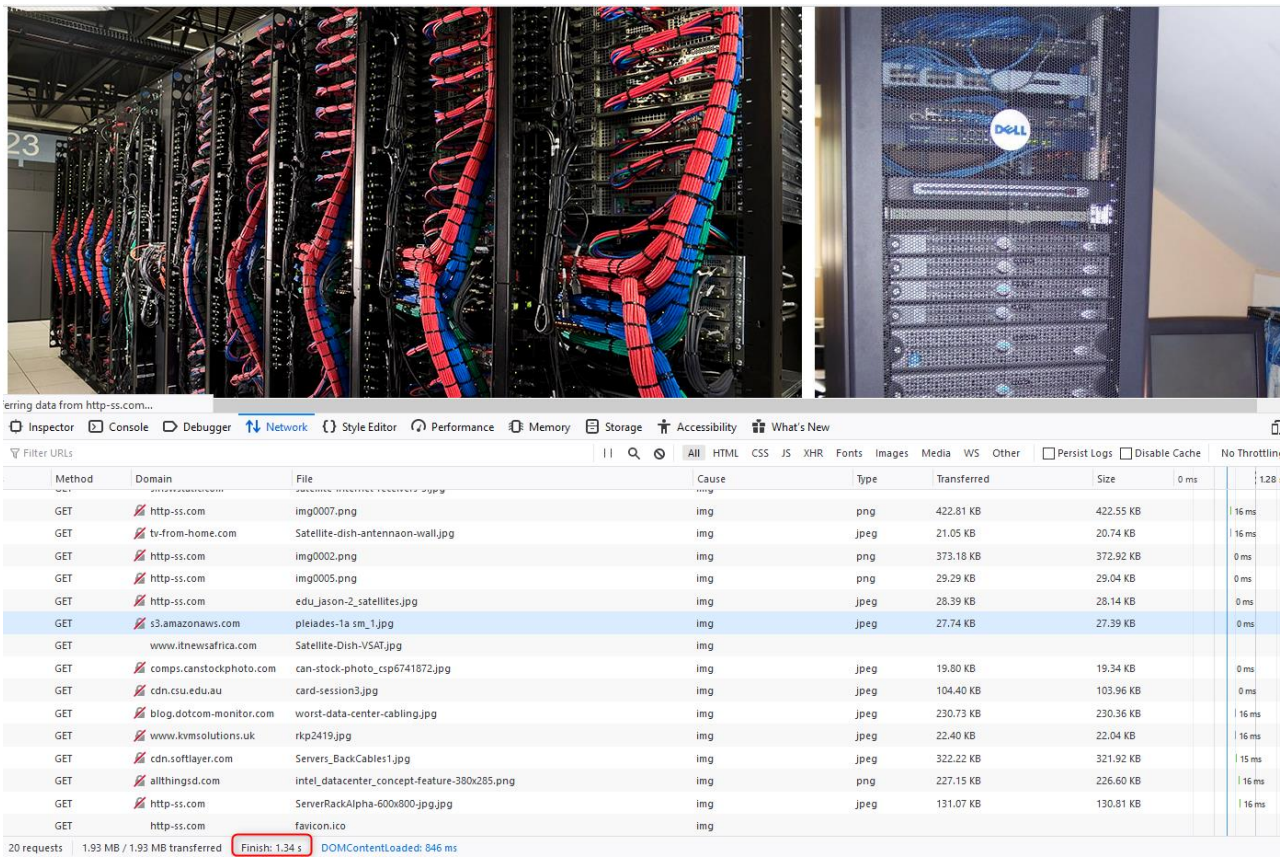




Page Load Time: **16.62 s**

4.5.14.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1.34 s**

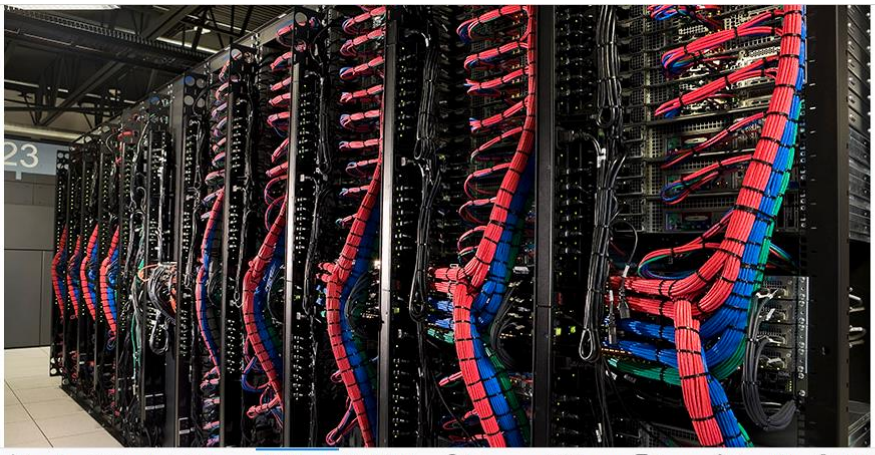
4.5.15 RTT = 900 ms

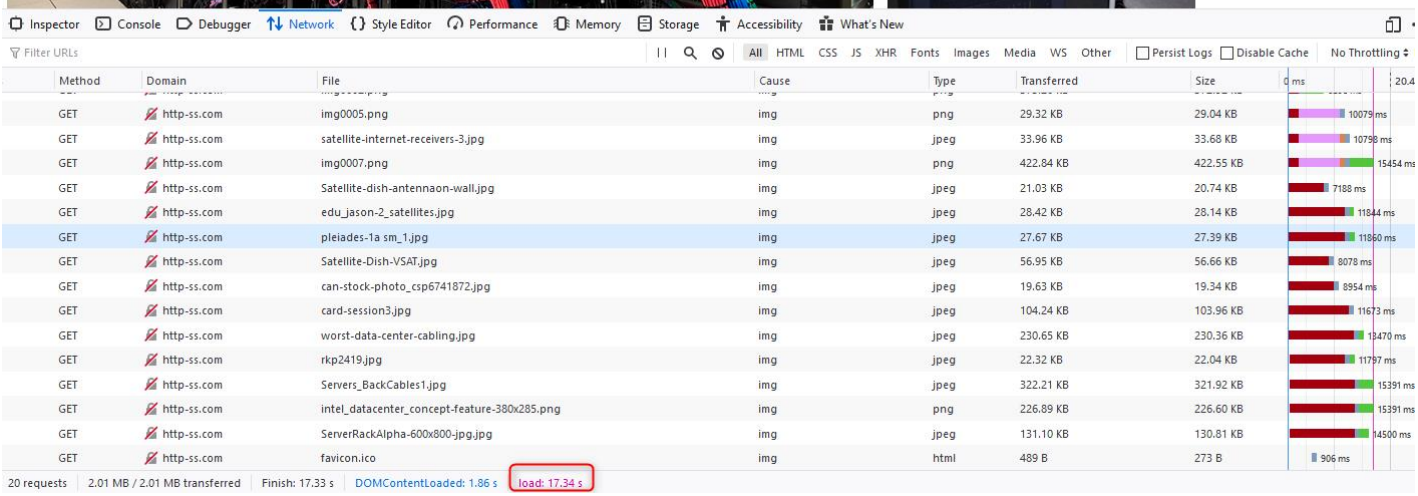
Bandwidth 800 Mbit/s
Latency 900 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=900ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=900ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=900ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=900ms TTL=64
```

4.5.15.1 Page Load Time - TCP/HTTP

Browser Cache deleted!

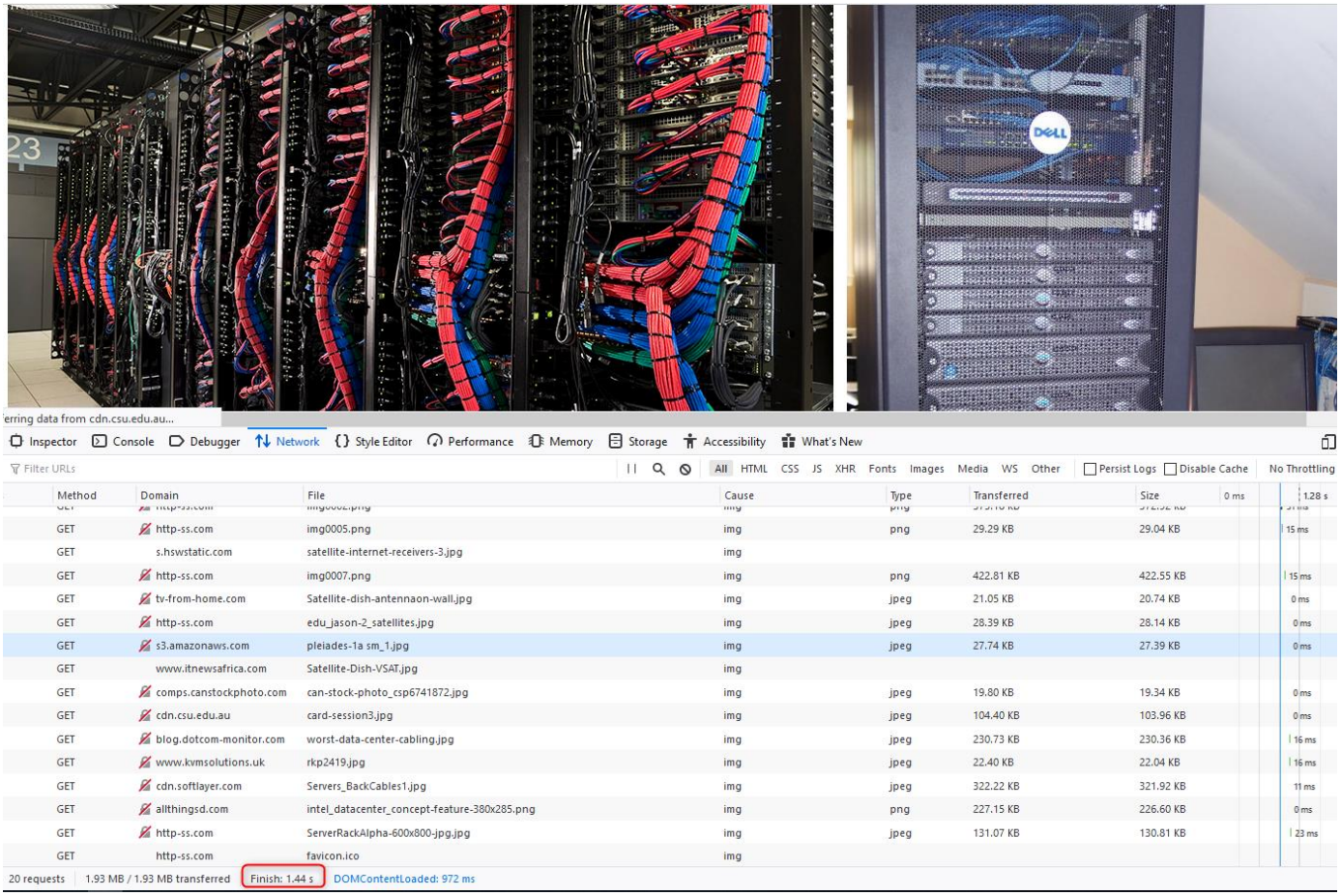




Page Load Time: **17.34 s**

4.5.15.2 Page Load Time - HTTP-QuSS

Browser Cache deleted!



Page Load Time: **1.44 s**

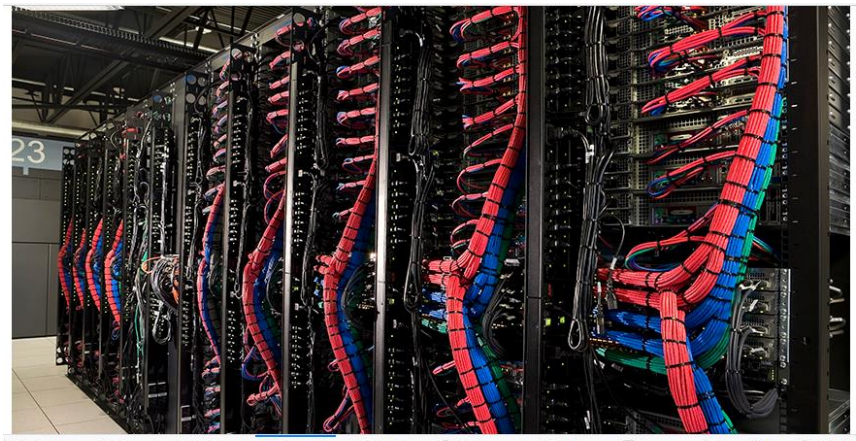
4.5.16 RTT = 1000 ms

Bandwidth 800 Mbit/s
Latency 1000 ms

```
Ping wird ausgeführt für http-ss.com [192.168.178.61] mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1000ms TTL=64
```

4.5.16.1 Page Load Time - TCP/HTTP

Browser Cache deleted!



Inspector | Console | Debugger | Network | Style Editor | Performance | Memory | Storage | Accessibility | What's New

Filter URLs | All | HTML | CSS | JS | XHR | Fonts | Images | Media | WS | Other | Persist Logs | Disable Cache | No Throttling

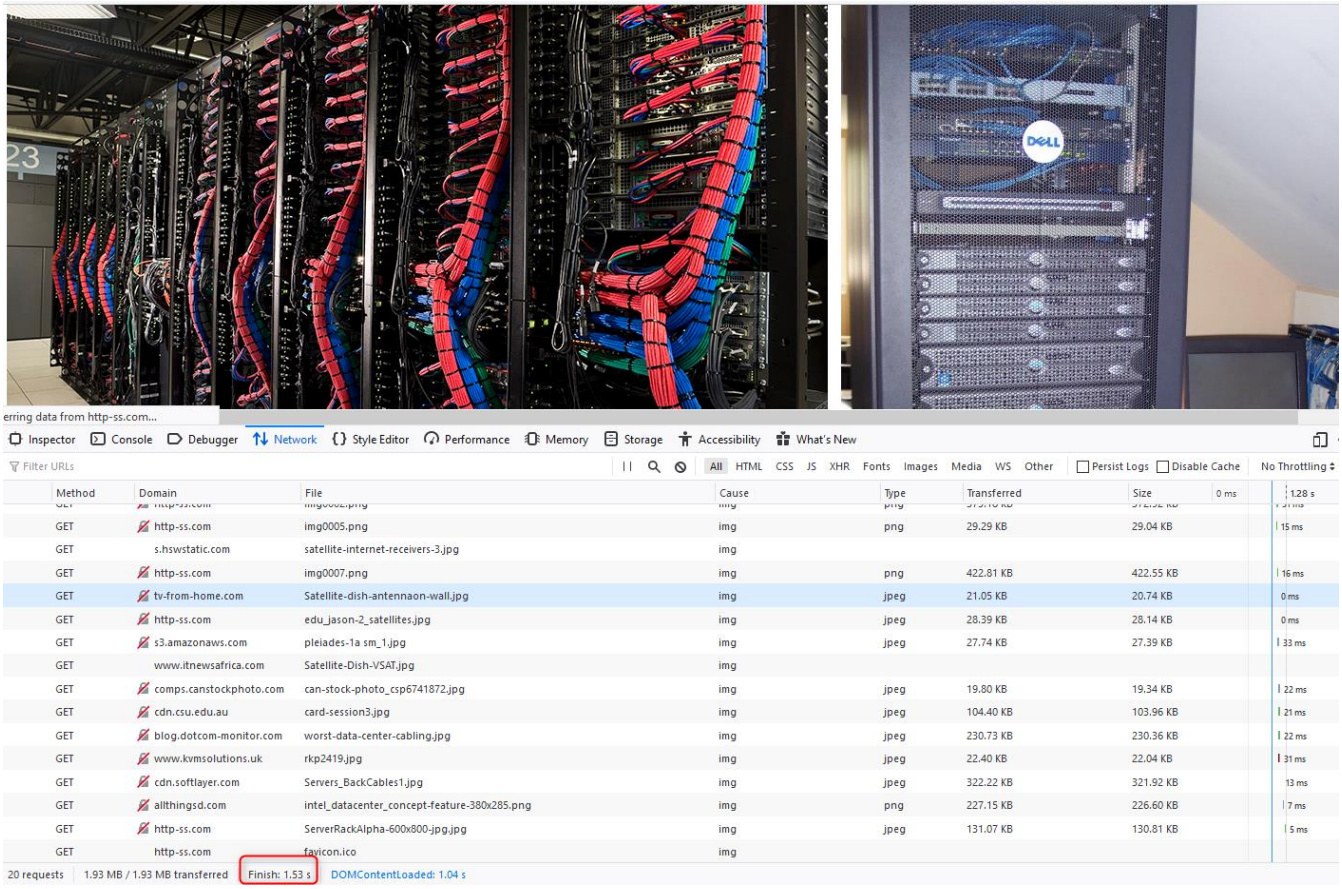
Method	Domain	File	Cause	Type	Transferred	Size
GET	http-ss.com	img0005.png	img	png	29.32 KB	29.04 KB
GET	http-ss.com	satellite-internet-receivers-3.jpg	img	jpeg	33.96 KB	33.68 KB
GET	http-ss.com	img0007.png	img	png	422.84 KB	422.55 KB
GET	http-ss.com	Satellite-dish-antennaon-wall.jpg	img	jpeg	21.03 KB	20.74 KB
GET	http-ss.com	edu_jason-2_satellites.jpg	img	jpeg	28.42 KB	28.14 KB
GET	http-ss.com	pleiades-1a sm_1.jpg	img	jpeg	27.67 KB	27.39 KB
GET	http-ss.com	Satellite-Dish-VSAT.jpg	img	jpeg	56.95 KB	56.66 KB
GET	http-ss.com	can-stock-photo_csp6741872.jpg	img	jpeg	19.63 KB	19.34 KB
GET	http-ss.com	card-session3.jpg	img	jpeg	104.24 KB	103.96 KB
GET	http-ss.com	worst-data-center-cabling.jpg	img	jpeg	230.65 KB	230.36 KB
GET	http-ss.com	rkp2419.jpg	img	jpeg	22.32 KB	22.04 KB
GET	http-ss.com	Servers_BackCables1.jpg	img	jpeg	322.21 KB	321.92 KB
GET	http-ss.com	intel_datacenter_concept-feature-380x285.png	img	png	226.89 KB	226.60 KB
GET	http-ss.com	ServerRackAlpha-600x800-jpg.jpg	img	jpeg	131.10 KB	130.81 KB
GET	http-ss.com	favicon.ico	img	html	489 B	273 B

20 requests | 2.01 MB / 2.01 MB transferred | Finish: 18.02 s | DOMContentLoaded: 2.04 s | load: 18.01 s

Page Load Time: **18.01 s**

4.5.16.2 Page Load Time - HTTP-QuSS

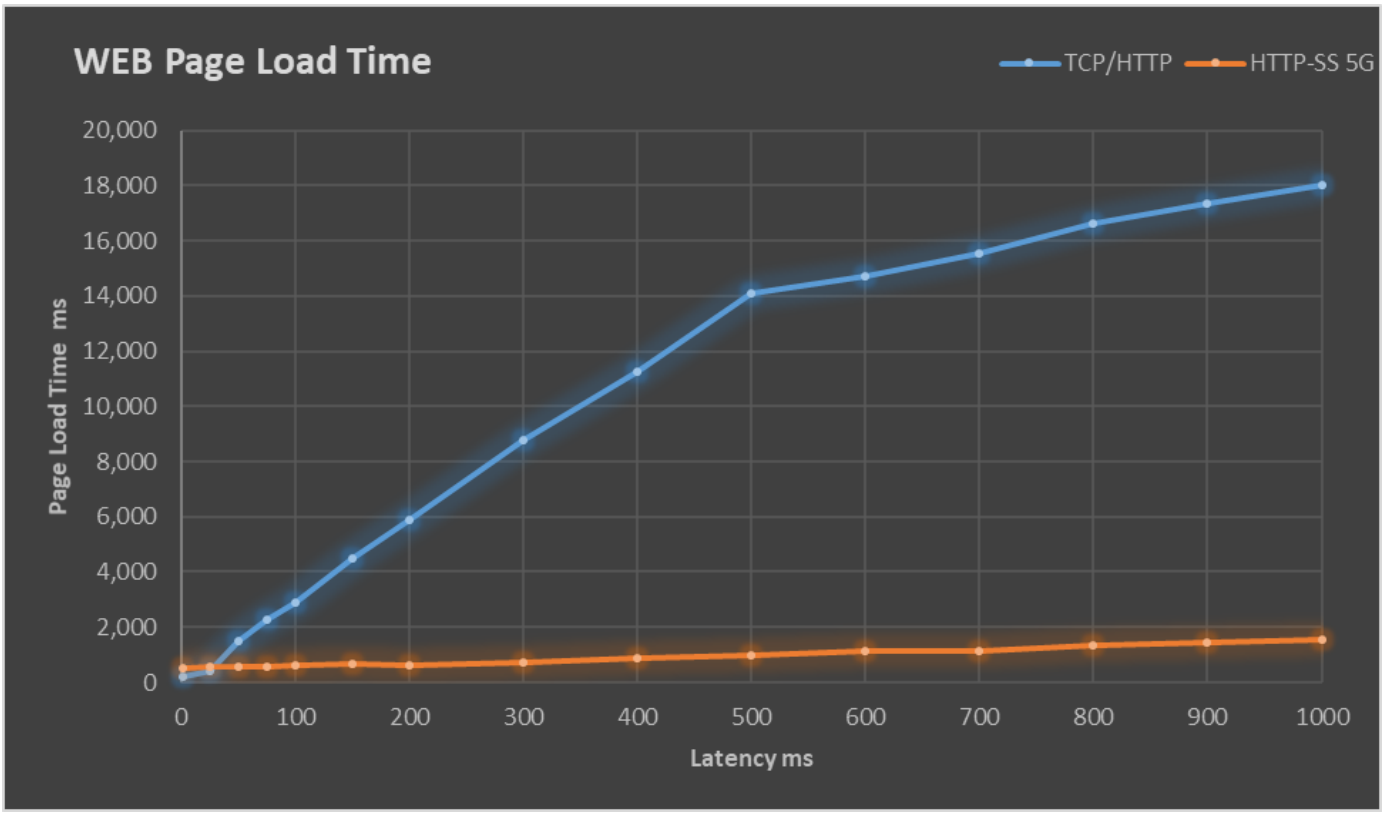
Browser Cache deleted!



Page Load Time: **1.53 ms**

4.5.17 Benchmark Summary

	WEB Page Load Time / ms	800 Mbit/s
Latency ms	TCP/HTTP	HTTP-QuSS
1	**218**	**503**
25	**395**	**562**
50	**1,510**	**561**
75	**2,280**	**580**
100	**2,880**	**641**
150	**4,470**	**695**
200	**5,880**	**623**
300	**8,790**	**741**
400	**11,270**	**868**
500	**14,100**	**980**
600	**14,700**	**1,130**
700	**15,520**	**1,160**
800	**16,620**	**1,340**
900	**17,340**	**1,440**
1000	**18,010**	**1,530**



4.6 Low Latency High Speed TCP Bandwidth Dependency

Tested Latency Bandwidth Dependencies in the Range of <= 1 ms – 20 ms in 2 ms Steps.

4.6.1 RTT < 1 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit<1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit<1ms TTL=64
```

```
[  4] local 192.168.178.72 port 49879 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec   112 MBytes   937 Mbits/sec
[  4]   1.00-2.00   sec   113 MBytes   949 Mbits/sec
[  4]   2.00-3.00   sec   112 MBytes   938 Mbits/sec
[  4]   3.00-4.00   sec   113 MBytes   947 Mbits/sec
[  4]   4.00-5.00   sec   113 MBytes   949 Mbits/sec
[  4]   5.00-6.00   sec   112 MBytes   936 Mbits/sec
[  4]   6.00-7.00   sec   113 MBytes   949 Mbits/sec
[  4]   7.00-8.00   sec   113 MBytes   944 Mbits/sec
[  4]   8.00-9.00   sec   113 MBytes   949 Mbits/sec
[  4]   9.00-10.00  sec   113 MBytes   949 Mbits/sec
[  4]  10.00-11.00  sec   113 MBytes   949 Mbits/sec
[  4]  11.00-12.00  sec   113 MBytes   945 Mbits/sec
[  4]  12.00-13.00  sec   113 MBytes   949 Mbits/sec
[  4]  13.00-14.00  sec   113 MBytes   948 Mbits/sec
[  4]  14.00-15.00  sec   113 MBytes   949 Mbits/sec
[  4]  15.00-16.00  sec   113 MBytes   947 Mbits/sec
[  4]  16.00-17.00  sec   112 MBytes   936 Mbits/sec
[  4]  17.00-18.00  sec   113 MBytes   949 Mbits/sec
[  4]  18.00-19.00  sec   113 MBytes   949 Mbits/sec
[  4]  19.00-20.00  sec   113 MBytes   944 Mbits/sec
[  4]  20.00-21.00  sec   113 MBytes   949 Mbits/sec
[  4]  21.00-22.00  sec   113 MBytes   949 Mbits/sec
[  4]  22.00-23.00  sec   111 MBytes   934 Mbits/sec
[  4]  23.00-24.00  sec   113 MBytes   944 Mbits/sec
[  4]  24.00-25.00  sec   113 MBytes   949 Mbits/sec
[  4]  25.00-26.00  sec   113 MBytes   949 Mbits/sec
[  4]  26.00-27.00  sec   113 MBytes   949 Mbits/sec
[  4]  27.00-28.00  sec   113 MBytes   945 Mbits/sec
[  4]  28.00-29.00  sec   113 MBytes   946 Mbits/sec
[  4]  29.00-30.00  sec   112 MBytes   940 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  3.30 GBytes   946 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  3.30 GBytes   946 Mbits/sec                  receiver
CPU Utilization: local/receiver 7.5% (2.4%u/5.1%s), remote/sender 1.9% (0.1%u/1.8%s)
```

Utilized TCP Bandwidth: **946 Mbit/s of 1000 Mbit/s**

4.6.2 RTT = 1 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=1ms TTL=64
```

```
[  4] local 192.168.178.72 port 50321 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec   103 MBytes   863 Mbits/sec
[  4]   1.00-2.00   sec   102 MBytes   852 Mbits/sec
[  4]   2.00-3.00   sec   103 MBytes   864 Mbits/sec
[  4]   3.00-4.00   sec  99.6 MBytes   835 Mbits/sec
[  4]   4.00-5.00   sec   101 MBytes   843 Mbits/sec
[  4]   5.00-6.00   sec  98.6 MBytes   827 Mbits/sec
[  4]   6.00-7.00   sec  98.5 MBytes   826 Mbits/sec
[  4]   7.00-8.00   sec  99.1 MBytes   831 Mbits/sec
[  4]   8.00-9.00   sec  99.5 MBytes   835 Mbits/sec
[  4]   9.00-10.00  sec   100 MBytes   838 Mbits/sec
[  4]  10.00-11.00  sec  99.9 MBytes   838 Mbits/sec
[  4]  11.00-12.00  sec   100 MBytes   842 Mbits/sec
[  4]  12.00-13.00  sec  99.8 MBytes   838 Mbits/sec
[  4]  13.00-14.00  sec  99.9 MBytes   838 Mbits/sec
[  4]  14.00-15.00  sec  99.9 MBytes   838 Mbits/sec
[  4]  15.00-16.00  sec  99.9 MBytes   838 Mbits/sec
[  4]  16.00-17.00  sec  99.1 MBytes   831 Mbits/sec
[  4]  17.00-18.00  sec  99.8 MBytes   837 Mbits/sec
[  4]  18.00-19.00  sec  98.1 MBytes   823 Mbits/sec
[  4]  19.00-20.00  sec   101 MBytes   845 Mbits/sec
[  4]  20.00-21.00  sec   100 MBytes   841 Mbits/sec
[  4]  21.00-22.00  sec  98.6 MBytes   827 Mbits/sec
[  4]  22.00-23.00  sec  99.9 MBytes   838 Mbits/sec
[  4]  23.00-24.00  sec  99.9 MBytes   838 Mbits/sec
[  4]  24.00-25.00  sec  99.9 MBytes   838 Mbits/sec
[  4]  25.00-26.00  sec  99.4 MBytes   834 Mbits/sec
[  4]  26.00-27.00  sec  99.8 MBytes   837 Mbits/sec
[  4]  27.00-28.00  sec  99.6 MBytes   835 Mbits/sec
[  4]  28.00-29.00  sec   100 MBytes   839 Mbits/sec
[  4]  29.00-30.00  sec  98.3 MBytes   824 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  2.93 GBytes   838 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  2.93 GBytes   838 Mbits/sec                  receiver
CPU Utilization: local/receiver 15.3% (4.5%u/10.4%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **838 Mbit/s of 1000 Mbit/s**

4.6.3 RTT = 2 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=2ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=2ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=2ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=3ms TTL=64
```

```
[  4] local 192.168.178.72 port 50417 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  65.3 MBytes   547 Mbits/sec
[  4]   1.00-2.00   sec  66.3 MBytes   556 Mbits/sec
[  4]   2.00-3.00   sec  66.3 MBytes   556 Mbits/sec
[  4]   3.00-4.00   sec  66.8 MBytes   560 Mbits/sec
[  4]   4.00-5.00   sec  66.7 MBytes   559 Mbits/sec
[  4]   5.00-6.00   sec  67.1 MBytes   563 Mbits/sec
[  4]   6.00-7.00   sec  67.0 MBytes   562 Mbits/sec
[  4]   7.00-8.00   sec  66.9 MBytes   561 Mbits/sec
[  4]   8.00-9.00   sec  66.7 MBytes   560 Mbits/sec
[  4]   9.00-10.00  sec  66.6 MBytes   559 Mbits/sec
[  4]  10.00-11.00  sec  66.4 MBytes   557 Mbits/sec
[  4]  11.00-12.00  sec  66.8 MBytes   560 Mbits/sec
[  4]  12.00-13.00  sec  67.0 MBytes   562 Mbits/sec
[  4]  13.00-14.00  sec  66.6 MBytes   558 Mbits/sec
[  4]  14.00-15.00  sec  66.9 MBytes   561 Mbits/sec
[  4]  15.00-16.00  sec  67.1 MBytes   563 Mbits/sec
[  4]  16.00-17.00  sec  66.3 MBytes   556 Mbits/sec
[  4]  17.00-18.00  sec  66.4 MBytes   557 Mbits/sec
[  4]  18.00-19.00  sec  67.2 MBytes   563 Mbits/sec
[  4]  19.00-20.00  sec  66.3 MBytes   556 Mbits/sec
[  4]  20.00-21.00  sec  66.7 MBytes   559 Mbits/sec
[  4]  21.00-22.00  sec  67.2 MBytes   563 Mbits/sec
[  4]  22.00-23.00  sec  67.0 MBytes   562 Mbits/sec
[  4]  23.00-24.00  sec  66.4 MBytes   557 Mbits/sec
[  4]  24.00-25.00  sec  67.1 MBytes   563 Mbits/sec
[  4]  25.00-26.00  sec  67.1 MBytes   563 Mbits/sec
[  4]  26.00-27.00  sec  66.9 MBytes   562 Mbits/sec
[  4]  27.00-28.00  sec  67.1 MBytes   563 Mbits/sec
[  4]  28.00-29.00  sec  67.1 MBytes   563 Mbits/sec
[  4]  29.00-30.00  sec  67.1 MBytes   563 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  1.96 GBytes   560 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  1.96 GBytes   560 Mbits/sec                  receiver
CPU Utilization: local/receiver 13.0% (5.7%u/7.3%s), remote/sender 0.2% (0.0%u/0.2%s)
```

Utilized TCP Bandwidth: **560 Mbit/s of 1000 Mbit/s**

4.6.4 RTT = 3 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=3ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=3ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=3ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=3ms TTL=64
```

```
[  4] local 192.168.178.72 port 50488 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  50.0 MBytes   419 Mbits/sec
[  4]   1.00-2.00   sec  49.7 MBytes   417 Mbits/sec
[  4]   2.00-3.00   sec  49.7 MBytes   417 Mbits/sec
[  4]   3.00-4.00   sec  49.7 MBytes   417 Mbits/sec
[  4]   4.00-5.00   sec  49.7 MBytes   417 Mbits/sec
[  4]   5.00-6.00   sec  49.8 MBytes   417 Mbits/sec
[  4]   6.00-7.00   sec  49.7 MBytes   417 Mbits/sec
[  4]   7.00-8.00   sec  49.7 MBytes   417 Mbits/sec
[  4]   8.00-9.00   sec  49.8 MBytes   417 Mbits/sec
[  4]   9.00-10.00  sec  49.8 MBytes   418 Mbits/sec
[  4]  10.00-11.00  sec  49.6 MBytes   416 Mbits/sec
[  4]  11.00-12.00  sec  49.6 MBytes   416 Mbits/sec
[  4]  12.00-13.00  sec  49.3 MBytes   413 Mbits/sec
[  4]  13.00-14.00  sec  49.4 MBytes   414 Mbits/sec
[  4]  14.00-15.00  sec  49.5 MBytes   415 Mbits/sec
[  4]  15.00-16.00  sec  49.5 MBytes   415 Mbits/sec
[  4]  16.00-17.00  sec  49.2 MBytes   412 Mbits/sec
[  4]  17.00-18.00  sec  49.3 MBytes   413 Mbits/sec
[  4]  18.00-19.00  sec  49.3 MBytes   414 Mbits/sec
[  4]  19.00-20.00  sec  49.5 MBytes   415 Mbits/sec
[  4]  20.00-21.00  sec  48.6 MBytes   408 Mbits/sec
[  4]  21.00-22.00  sec  49.1 MBytes   412 Mbits/sec
[  4]  22.00-23.00  sec  49.5 MBytes   415 Mbits/sec
[  4]  23.00-24.00  sec  49.4 MBytes   414 Mbits/sec
[  4]  24.00-25.00  sec  49.9 MBytes   418 Mbits/sec
[  4]  25.00-26.00  sec  50.0 MBytes   420 Mbits/sec
[  4]  26.00-27.00  sec  50.0 MBytes   419 Mbits/sec
[  4]  27.00-28.00  sec  50.1 MBytes   420 Mbits/sec
[  4]  28.00-29.00  sec  50.0 MBytes   419 Mbits/sec
[  4]  29.00-30.00  sec  49.4 MBytes   415 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  1.45 GBytes   416 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  1.45 GBytes   416 Mbits/sec                  receiver
CPU Utilization: local/receiver 11.5% (5.7%u/5.8%s), remote/sender 0.2% (0.0%u/0.2%s)
```

Utilized TCP Bandwidth: **416 Mbit/s of 1000 Mbit/s**

4.6.5 RTT = 4 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=4ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=4ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=4ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=4ms TTL=64
```

```
[  4] local 192.168.178.72 port 50547 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  39.3 MBytes   329 Mbits/sec
[  4]   1.00-2.00   sec  39.3 MBytes   329 Mbits/sec
[  4]   2.00-3.00   sec  39.3 MBytes   330 Mbits/sec
[  4]   3.00-4.00   sec  39.3 MBytes   330 Mbits/sec
[  4]   4.00-5.00   sec  39.1 MBytes   328 Mbits/sec
[  4]   5.00-6.00   sec  39.3 MBytes   329 Mbits/sec
[  4]   6.00-7.00   sec  39.5 MBytes   331 Mbits/sec
[  4]   7.00-8.00   sec  39.5 MBytes   332 Mbits/sec
[  4]   8.00-9.00   sec  39.5 MBytes   331 Mbits/sec
[  4]   9.00-10.00  sec  39.4 MBytes   331 Mbits/sec
[  4]  10.00-11.00  sec  39.4 MBytes   331 Mbits/sec
[  4]  11.00-12.00  sec  39.5 MBytes   331 Mbits/sec
[  4]  12.00-13.00  sec  39.5 MBytes   332 Mbits/sec
[  4]  13.00-14.00  sec  39.5 MBytes   331 Mbits/sec
[  4]  14.00-15.00  sec  39.5 MBytes   331 Mbits/sec
[  4]  15.00-16.00  sec  39.4 MBytes   330 Mbits/sec
[  4]  16.00-17.00  sec  39.6 MBytes   332 Mbits/sec
[  4]  17.00-18.00  sec  39.4 MBytes   330 Mbits/sec
[  4]  18.00-19.00  sec  39.5 MBytes   332 Mbits/sec
[  4]  19.00-20.00  sec  39.5 MBytes   331 Mbits/sec
[  4]  20.00-21.00  sec  39.4 MBytes   331 Mbits/sec
[  4]  21.00-22.00  sec  39.5 MBytes   331 Mbits/sec
[  4]  22.00-23.00  sec  39.6 MBytes   332 Mbits/sec
[  4]  23.00-24.00  sec  39.5 MBytes   331 Mbits/sec
[  4]  24.00-25.00  sec  39.5 MBytes   331 Mbits/sec
[  4]  25.00-26.00  sec  39.4 MBytes   330 Mbits/sec
[  4]  26.00-27.00  sec  39.4 MBytes   331 Mbits/sec
[  4]  27.00-28.00  sec  39.5 MBytes   331 Mbits/sec
[  4]  28.00-29.00  sec  39.6 MBytes   332 Mbits/sec
[  4]  29.00-30.00  sec  39.5 MBytes   331 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec  1.16 GBytes   331 Mbits/sec    0             sender
[  4]   0.00-30.00  sec  1.16 GBytes   331 Mbits/sec                  receiver
CPU Utilization: local/receiver 12.5% (7.4%u/5.1%s), remote/sender 0.3% (0.0%u/0.3%s)
```

Utilized TCP Bandwidth: **331 Mbit/s of 1000 Mbit/s**

4.6.6 RTT = 5 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=5ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=5ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=5ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=5ms TTL=64
```

```
[  4] local 192.168.178.72 port 50609 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  32.4 MBytes   272 Mbits/sec
[  4]   1.00-2.00   sec  32.4 MBytes   271 Mbits/sec
[  4]   2.00-3.00   sec  32.2 MBytes   270 Mbits/sec
[  4]   3.00-4.00   sec  32.6 MBytes   273 Mbits/sec
[  4]   4.00-5.00   sec  32.3 MBytes   271 Mbits/sec
[  4]   5.00-6.00   sec  32.4 MBytes   272 Mbits/sec
[  4]   6.00-7.00   sec  32.3 MBytes   271 Mbits/sec
[  4]   7.00-8.00   sec  32.3 MBytes   271 Mbits/sec
[  4]   8.00-9.00   sec  32.4 MBytes   272 Mbits/sec
[  4]   9.00-10.00  sec  32.4 MBytes   272 Mbits/sec
[  4]  10.00-11.00  sec  32.3 MBytes   271 Mbits/sec
[  4]  11.00-12.00  sec  32.4 MBytes   272 Mbits/sec
[  4]  12.00-13.00  sec  32.2 MBytes   271 Mbits/sec
[  4]  13.00-14.00  sec  32.5 MBytes   272 Mbits/sec
[  4]  14.00-15.00  sec  32.6 MBytes   273 Mbits/sec
[  4]  15.00-16.00  sec  32.5 MBytes   273 Mbits/sec
[  4]  16.00-17.00  sec  32.6 MBytes   273 Mbits/sec
[  4]  17.00-18.00  sec  32.6 MBytes   273 Mbits/sec
[  4]  18.00-19.00  sec  32.4 MBytes   272 Mbits/sec
[  4]  19.00-20.00  sec  32.6 MBytes   273 Mbits/sec
[  4]  20.00-21.00  sec  32.5 MBytes   273 Mbits/sec
[  4]  21.00-22.00  sec  32.6 MBytes   273 Mbits/sec
[  4]  22.00-23.00  sec  32.4 MBytes   272 Mbits/sec
[  4]  23.00-24.00  sec  32.5 MBytes   273 Mbits/sec
[  4]  24.00-25.00  sec  32.6 MBytes   273 Mbits/sec
[  4]  25.00-26.00  sec  32.5 MBytes   273 Mbits/sec
[  4]  26.00-27.00  sec  32.5 MBytes   273 Mbits/sec
[  4]  27.00-28.00  sec  32.6 MBytes   273 Mbits/sec
[  4]  28.00-29.00  sec  32.6 MBytes   273 Mbits/sec
[  4]  29.00-30.00  sec  32.5 MBytes   273 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   976 MBytes   273 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   974 MBytes   272 Mbits/sec                  receiver
CPU Utilization: local/receiver 7.7% (2.6%u/5.1%s), remote/sender 0.2% (0.0%u/0.2%s)
```

Utilized TCP Bandwidth: **273 Mbit/s of 1000 Mbit/s**

4.6.7 RTT = 6 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=6ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=6ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=6ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=6ms TTL=64
```

```
[  4] local 192.168.178.72 port 50676 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  28.0 MBytes   235 Mbits/sec
[  4]   1.00-2.00   sec  27.7 MBytes   232 Mbits/sec
[  4]   2.00-3.00   sec  27.5 MBytes   231 Mbits/sec
[  4]   3.00-4.00   sec  27.6 MBytes   231 Mbits/sec
[  4]   4.00-5.00   sec  27.6 MBytes   231 Mbits/sec
[  4]   5.00-6.00   sec  27.4 MBytes   230 Mbits/sec
[  4]   6.00-7.00   sec  27.6 MBytes   231 Mbits/sec
[  4]   7.00-8.00   sec  27.5 MBytes   231 Mbits/sec
[  4]   8.00-9.00   sec  27.5 MBytes   231 Mbits/sec
[  4]   9.00-10.00  sec  27.6 MBytes   232 Mbits/sec
[  4]  10.00-11.00  sec  27.6 MBytes   232 Mbits/sec
[  4]  11.00-12.00  sec  27.6 MBytes   231 Mbits/sec
[  4]  12.00-13.00  sec  27.6 MBytes   232 Mbits/sec
[  4]  13.00-14.00  sec  27.5 MBytes   231 Mbits/sec
[  4]  14.00-15.00  sec  27.6 MBytes   231 Mbits/sec
[  4]  15.00-16.00  sec  27.6 MBytes   232 Mbits/sec
[  4]  16.00-17.00  sec  27.5 MBytes   231 Mbits/sec
[  4]  17.00-18.00  sec  27.7 MBytes   232 Mbits/sec
[  4]  18.00-19.00  sec  27.6 MBytes   231 Mbits/sec
[  4]  19.00-20.00  sec  27.4 MBytes   230 Mbits/sec
[  4]  20.00-21.00  sec  27.3 MBytes   230 Mbits/sec
[  4]  21.00-22.00  sec  27.5 MBytes   230 Mbits/sec
[  4]  22.00-23.00  sec  27.7 MBytes   232 Mbits/sec
[  4]  23.00-24.00  sec  27.4 MBytes   230 Mbits/sec
[  4]  24.00-25.00  sec  27.4 MBytes   230 Mbits/sec
[  4]  25.00-26.00  sec  27.6 MBytes   232 Mbits/sec
[  4]  26.00-27.00  sec  27.6 MBytes   231 Mbits/sec
[  4]  27.00-28.00  sec  27.4 MBytes   230 Mbits/sec
[  4]  28.00-29.00  sec  27.7 MBytes   233 Mbits/sec
[  4]  29.00-30.00  sec  27.7 MBytes   233 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   829 MBytes   232 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   827 MBytes   231 Mbits/sec                  receiver
CPU Utilization: local/receiver 7.4% (2.9%u/4.5%s), remote/sender 0.2% (0.0%u/0.2%s)
```

Utilized TCP Bandwidth: **232 Mbit/s of 1000 Mbit/s**

4.6.8 RTT = 7 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=7ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=7ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=7ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=7ms TTL=64
```

```
[  4] local 192.168.178.72 port 50750 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  24.9 MBytes   209 Mbits/sec
[  4]   1.00-2.00   sec  24.1 MBytes   202 Mbits/sec
[  4]   2.00-3.00   sec  24.3 MBytes   204 Mbits/sec
[  4]   3.00-4.00   sec  24.2 MBytes   203 Mbits/sec
[  4]   4.00-5.00   sec  24.2 MBytes   203 Mbits/sec
[  4]   5.00-6.00   sec  24.3 MBytes   203 Mbits/sec
[  4]   6.00-7.00   sec  24.2 MBytes   203 Mbits/sec
[  4]   7.00-8.00   sec  24.2 MBytes   203 Mbits/sec
[  4]   8.00-9.00   sec  24.4 MBytes   204 Mbits/sec
[  4]   9.00-10.00  sec  24.1 MBytes   202 Mbits/sec
[  4]  10.00-11.00  sec  24.2 MBytes   203 Mbits/sec
[  4]  11.00-12.00  sec  24.5 MBytes   205 Mbits/sec
[  4]  12.00-13.00  sec  24.1 MBytes   202 Mbits/sec
[  4]  13.00-14.00  sec  24.2 MBytes   203 Mbits/sec
[  4]  14.00-15.00  sec  24.2 MBytes   203 Mbits/sec
[  4]  15.00-16.00  sec  24.1 MBytes   202 Mbits/sec
[  4]  16.00-17.00  sec  24.3 MBytes   204 Mbits/sec
[  4]  17.00-18.00  sec  23.9 MBytes   201 Mbits/sec
[  4]  18.00-19.00  sec  24.3 MBytes   204 Mbits/sec
[  4]  19.00-20.00  sec  24.2 MBytes   203 Mbits/sec
[  4]  20.00-21.00  sec  24.1 MBytes   202 Mbits/sec
[  4]  21.00-22.00  sec  24.1 MBytes   203 Mbits/sec
[  4]  22.00-23.00  sec  24.1 MBytes   202 Mbits/sec
[  4]  23.00-24.00  sec  24.1 MBytes   203 Mbits/sec
[  4]  24.00-25.00  sec  24.3 MBytes   203 Mbits/sec
[  4]  25.00-26.00  sec  24.2 MBytes   203 Mbits/sec
[  4]  26.00-27.00  sec  24.1 MBytes   202 Mbits/sec
[  4]  27.00-28.00  sec  24.1 MBytes   203 Mbits/sec
[  4]  28.00-29.00  sec  24.4 MBytes   204 Mbits/sec
[  4]  29.00-30.00  sec  24.4 MBytes   205 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   729 MBytes   204 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   727 MBytes   203 Mbits/sec                  receiver
CPU Utilization: local/receiver 7.0% (2.7%u/4.3%s), remote/sender 0.2% (0.0%u/0.2%s)
```

Utilized TCP Bandwidth: **204 Mbit/s of 1000 Mbit/s**

4.6.9 RTT = 8 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=8ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=8ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=8ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=8ms TTL=64
```

```
[  4] local 192.168.178.72 port 50818 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  21.7 MBytes   182 Mbits/sec
[  4]   1.00-2.00   sec  21.5 MBytes   180 Mbits/sec
[  4]   2.00-3.00   sec  21.5 MBytes   181 Mbits/sec
[  4]   3.00-4.00   sec  21.5 MBytes   180 Mbits/sec
[  4]   4.00-5.00   sec  21.5 MBytes   180 Mbits/sec
[  4]   5.00-6.00   sec  21.5 MBytes   180 Mbits/sec
[  4]   6.00-7.00   sec  21.5 MBytes   181 Mbits/sec
[  4]   7.00-8.00   sec  21.6 MBytes   181 Mbits/sec
[  4]   8.00-9.00   sec  21.4 MBytes   180 Mbits/sec
[  4]   9.00-10.00  sec  21.4 MBytes   180 Mbits/sec
[  4]  10.00-11.00  sec  21.5 MBytes   180 Mbits/sec
[  4]  11.00-12.00  sec  21.5 MBytes   180 Mbits/sec
[  4]  12.00-13.00  sec  21.4 MBytes   179 Mbits/sec
[  4]  13.00-14.00  sec  21.3 MBytes   179 Mbits/sec
[  4]  14.00-15.00  sec  21.4 MBytes   180 Mbits/sec
[  4]  15.00-16.00  sec  21.4 MBytes   180 Mbits/sec
[  4]  16.00-17.00  sec  21.4 MBytes   180 Mbits/sec
[  4]  17.00-18.00  sec  21.4 MBytes   179 Mbits/sec
[  4]  18.00-19.00  sec  21.5 MBytes   180 Mbits/sec
[  4]  19.00-20.00  sec  21.5 MBytes   181 Mbits/sec
[  4]  20.00-21.00  sec  21.5 MBytes   180 Mbits/sec
[  4]  21.00-22.00  sec  21.5 MBytes   180 Mbits/sec
[  4]  22.00-23.00  sec  21.4 MBytes   180 Mbits/sec
[  4]  23.00-24.00  sec  21.4 MBytes   180 Mbits/sec
[  4]  24.00-25.00  sec  21.4 MBytes   179 Mbits/sec
[  4]  25.00-26.00  sec  21.6 MBytes   181 Mbits/sec
[  4]  26.00-27.00  sec  21.4 MBytes   180 Mbits/sec
[  4]  27.00-28.00  sec  21.5 MBytes   180 Mbits/sec
[  4]  28.00-29.00  sec  21.5 MBytes   180 Mbits/sec
[  4]  29.00-30.00  sec  21.5 MBytes   180 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   647 MBytes   181 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   645 MBytes   180 Mbits/sec                  receiver
CPU Utilization: local/receiver 6.3% (2.6%u/3.6%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **182 Mbit/s of 1000 Mbit/s**

4.6.10 RTT = 9 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=9ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=9ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=9ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=9ms TTL=64
```

```
[  4] local 192.168.178.72 port 50887 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  19.4 MBytes   163 Mbits/sec
[  4]   1.00-2.00   sec  19.2 MBytes   161 Mbits/sec
[  4]   2.00-3.00   sec  19.2 MBytes   161 Mbits/sec
[  4]   3.00-4.00   sec  19.2 MBytes   161 Mbits/sec
[  4]   4.00-5.00   sec  19.2 MBytes   161 Mbits/sec
[  4]   5.00-6.00   sec  19.2 MBytes   161 Mbits/sec
[  4]   6.00-7.00   sec  19.2 MBytes   161 Mbits/sec
[  4]   7.00-8.00   sec  19.2 MBytes   161 Mbits/sec
[  4]   8.00-9.00   sec  19.2 MBytes   161 Mbits/sec
[  4]   9.00-10.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  10.00-11.00  sec  19.2 MBytes   162 Mbits/sec
[  4]  11.00-12.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  12.00-13.00  sec  19.3 MBytes   162 Mbits/sec
[  4]  13.00-14.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  14.00-15.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  15.00-16.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  16.00-17.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  17.00-18.00  sec  19.3 MBytes   161 Mbits/sec
[  4]  18.00-19.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  19.00-20.00  sec  19.3 MBytes   162 Mbits/sec
[  4]  20.00-21.00  sec  19.3 MBytes   162 Mbits/sec
[  4]  21.00-22.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  22.00-23.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  23.00-24.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  24.00-25.00  sec  19.3 MBytes   162 Mbits/sec
[  4]  25.00-26.00  sec  19.3 MBytes   161 Mbits/sec
[  4]  26.00-27.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  27.00-28.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  28.00-29.00  sec  19.2 MBytes   161 Mbits/sec
[  4]  29.00-30.00  sec  19.3 MBytes   162 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   579 MBytes   162 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   577 MBytes   161 Mbits/sec                  receiver
CPU Utilization: local/receiver 7.3% (3.3%u/4.0%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **162 Mbit/s of 1000 Mbit/s**

4.6.11 RTT = 10 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=10ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=10ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=10ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=10ms TTL=64
```

```
[  4] local 192.168.178.72 port 51169 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  17.7 MBytes   148 Mbits/sec
[  4]   1.00-2.00   sec  17.2 MBytes   145 Mbits/sec
[  4]   2.00-3.00   sec  17.5 MBytes   147 Mbits/sec
[  4]   3.00-4.00   sec  17.4 MBytes   146 Mbits/sec
[  4]   4.00-5.00   sec  17.4 MBytes   146 Mbits/sec
[  4]   5.00-6.00   sec  17.3 MBytes   145 Mbits/sec
[  4]   6.00-7.00   sec  17.4 MBytes   146 Mbits/sec
[  4]   7.00-8.00   sec  17.3 MBytes   146 Mbits/sec
[  4]   8.00-9.00   sec  17.4 MBytes   146 Mbits/sec
[  4]   9.00-10.00  sec  17.4 MBytes   146 Mbits/sec
[  4]  10.00-11.00  sec  17.5 MBytes   147 Mbits/sec
[  4]  11.00-12.00  sec  17.4 MBytes   146 Mbits/sec
[  4]  12.00-13.00  sec  17.4 MBytes   146 Mbits/sec
[  4]  13.00-14.00  sec  17.4 MBytes   146 Mbits/sec
[  4]  14.00-15.00  sec  17.3 MBytes   146 Mbits/sec
[  4]  15.00-16.00  sec  17.5 MBytes   147 Mbits/sec
[  4]  16.00-17.00  sec  16.8 MBytes   141 Mbits/sec
[  4]  17.00-18.00  sec  17.4 MBytes   145 Mbits/sec
[  4]  18.00-19.00  sec  17.3 MBytes   145 Mbits/sec
[  4]  19.00-20.00  sec  16.8 MBytes   141 Mbits/sec
[  4]  20.00-21.00  sec  17.1 MBytes   143 Mbits/sec
[  4]  21.00-22.00  sec  17.0 MBytes   142 Mbits/sec
[  4]  22.00-23.01  sec  17.5 MBytes   146 Mbits/sec
[  4]  23.01-24.00  sec  17.2 MBytes   145 Mbits/sec
[  4]  24.00-25.00  sec  17.2 MBytes   144 Mbits/sec
[  4]  25.00-26.00  sec  17.5 MBytes   147 Mbits/sec
[  4]  26.00-27.00  sec  17.4 MBytes   146 Mbits/sec
[  4]  27.00-28.00  sec  17.4 MBytes   146 Mbits/sec
[  4]  28.00-29.00  sec  17.3 MBytes   146 Mbits/sec
[  4]  29.00-30.00  sec  17.5 MBytes   146 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   522 MBytes   146 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   520 MBytes   145 Mbits/sec                  receiver
CPU Utilization: local/receiver 8.5% (3.5%u/5.0%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **146 Mbit/s of 1000 Mbit/s**

4.6.12 RTT = 11 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=11ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=11ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=11ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=11ms TTL=64
```

```
[  4] local 192.168.178.72 port 51243 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  16.4 MBytes   137 Mbits/sec
[  4]   1.00-2.00   sec  16.0 MBytes   134 Mbits/sec
[  4]   2.00-3.00   sec  16.0 MBytes   134 Mbits/sec
[  4]   3.00-4.00   sec  16.1 MBytes   135 Mbits/sec
[  4]   4.00-5.00   sec  16.1 MBytes   135 Mbits/sec
[  4]   5.00-6.00   sec  16.1 MBytes   135 Mbits/sec
[  4]   6.00-7.00   sec  16.1 MBytes   135 Mbits/sec
[  4]   7.00-8.00   sec  16.1 MBytes   134 Mbits/sec
[  4]   8.00-9.00   sec  16.0 MBytes   134 Mbits/sec
[  4]   9.00-10.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  10.00-11.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  11.00-12.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  12.00-13.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  13.00-14.02  sec  16.2 MBytes   134 Mbits/sec
[  4]  14.02-15.00  sec  15.9 MBytes   135 Mbits/sec
[  4]  15.00-16.00  sec  15.9 MBytes   134 Mbits/sec
[  4]  16.00-17.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  17.00-18.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  18.00-19.00  sec  16.1 MBytes   135 Mbits/sec
[  4]  19.00-20.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  20.00-21.00  sec  16.1 MBytes   135 Mbits/sec
[  4]  21.00-22.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  22.00-23.00  sec  15.9 MBytes   134 Mbits/sec
[  4]  23.00-24.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  24.00-25.00  sec  15.9 MBytes   134 Mbits/sec
[  4]  25.00-26.00  sec  16.1 MBytes   135 Mbits/sec
[  4]  26.00-27.00  sec  15.8 MBytes   133 Mbits/sec
[  4]  27.00-28.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  28.00-29.00  sec  16.0 MBytes   134 Mbits/sec
[  4]  29.00-30.00  sec  16.0 MBytes   134 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   483 MBytes   135 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   481 MBytes   134 Mbits/sec                  receiver
CPU Utilization: local/receiver 7.2% (3.2%u/4.1%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **134 Mbit/s of 1000 Mbit/s**

4.6.13 RTT = 12 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=12ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=12ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=12ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=12ms TTL=64
```

```
[  4] local 192.168.178.72 port 51299 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  15.0 MBytes   125 Mbits/sec
[  4]   1.00-2.00   sec  14.7 MBytes   123 Mbits/sec
[  4]   2.00-3.00   sec  14.8 MBytes   124 Mbits/sec
[  4]   3.00-4.00   sec  14.7 MBytes   124 Mbits/sec
[  4]   4.00-5.00   sec  14.7 MBytes   124 Mbits/sec
[  4]   5.00-6.00   sec  14.8 MBytes   124 Mbits/sec
[  4]   6.00-7.00   sec  14.7 MBytes   124 Mbits/sec
[  4]   7.00-8.00   sec  14.7 MBytes   124 Mbits/sec
[  4]   8.00-9.00   sec  14.7 MBytes   124 Mbits/sec
[  4]   9.00-10.00  sec  14.7 MBytes   124 Mbits/sec
[  4]  10.00-11.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  11.00-12.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  12.00-13.00  sec  14.8 MBytes   124 Mbits/sec
[  4]  13.00-14.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  14.00-15.00  sec  14.8 MBytes   124 Mbits/sec
[  4]  15.00-16.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  16.00-17.00  sec  14.7 MBytes   124 Mbits/sec
[  4]  17.00-18.00  sec  14.8 MBytes   124 Mbits/sec
[  4]  18.00-19.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  19.00-20.00  sec  14.7 MBytes   124 Mbits/sec
[  4]  20.00-21.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  21.00-22.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  22.00-23.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  23.00-24.00  sec  14.8 MBytes   124 Mbits/sec
[  4]  24.00-25.00  sec  14.8 MBytes   124 Mbits/sec
[  4]  25.00-26.00  sec  14.7 MBytes   124 Mbits/sec
[  4]  26.00-27.00  sec  14.7 MBytes   124 Mbits/sec
[  4]  27.00-28.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  28.00-29.00  sec  14.7 MBytes   123 Mbits/sec
[  4]  29.00-30.00  sec  14.7 MBytes   124 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   444 MBytes   124 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   443 MBytes   124 Mbits/sec                  receiver
CPU Utilization: local/receiver 6.2% (2.1%u/4.0%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **124 Mbit/s of 1000 Mbit/s**

4.6.14 RTT = 13 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=13ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=13ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=13ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=13ms TTL=64
```

```
[  4] local 192.168.178.72 port 51372 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  13.6 MBytes   114 Mbits/sec
[  4]   1.00-2.00   sec  13.7 MBytes   114 Mbits/sec
[  4]   2.00-3.00   sec  13.6 MBytes   114 Mbits/sec
[  4]   3.00-4.00   sec  13.6 MBytes   114 Mbits/sec
[  4]   4.00-5.00   sec  13.6 MBytes   114 Mbits/sec
[  4]   5.00-6.00   sec  13.6 MBytes   114 Mbits/sec
[  4]   6.00-7.00   sec  13.6 MBytes   114 Mbits/sec
[  4]   7.00-8.00   sec  13.6 MBytes   114 Mbits/sec
[  4]   8.00-9.00   sec  13.7 MBytes   115 Mbits/sec
[  4]   9.00-10.00  sec  13.7 MBytes   114 Mbits/sec
[  4]  10.00-11.00  sec  13.7 MBytes   115 Mbits/sec
[  4]  11.00-12.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  12.00-13.00  sec  13.7 MBytes   115 Mbits/sec
[  4]  13.00-14.00  sec  13.7 MBytes   115 Mbits/sec
[  4]  14.00-15.00  sec  13.7 MBytes   115 Mbits/sec
[  4]  15.00-16.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  16.00-17.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  17.00-18.00  sec  13.6 MBytes   115 Mbits/sec
[  4]  18.00-19.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  19.00-20.00  sec  13.7 MBytes   114 Mbits/sec
[  4]  20.00-21.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  21.00-22.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  22.00-23.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  23.00-24.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  24.00-25.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  25.00-26.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  26.00-27.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  27.00-28.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  28.00-29.00  sec  13.6 MBytes   114 Mbits/sec
[  4]  29.00-30.00  sec  13.7 MBytes   114 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   411 MBytes   115 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   409 MBytes   114 Mbits/sec                  receiver
CPU Utilization: local/receiver 5.8% (2.5%u/3.3%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **115 Mbit/s of 1000 Mbit/s**

4.6.15 RTT = 14 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=14ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=14ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=14ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=14ms TTL=64
```

```
[  4] local 192.168.178.72 port 51445 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  12.9 MBytes   108 Mbits/sec
[  4]   1.00-2.00   sec  12.7 MBytes   106 Mbits/sec
[  4]   2.00-3.00   sec  12.7 MBytes   107 Mbits/sec
[  4]   3.00-4.00   sec  12.8 MBytes   108 Mbits/sec
[  4]   4.00-5.00   sec  12.7 MBytes   107 Mbits/sec
[  4]   5.00-6.00   sec  12.7 MBytes   107 Mbits/sec
[  4]   6.00-7.00   sec  12.7 MBytes   106 Mbits/sec
[  4]   7.00-8.00   sec  12.7 MBytes   107 Mbits/sec
[  4]   8.00-9.00   sec  12.7 MBytes   107 Mbits/sec
[  4]   9.00-10.00  sec  12.7 MBytes   107 Mbits/sec
[  4]  10.00-11.00  sec  12.7 MBytes   107 Mbits/sec
[  4]  11.00-12.00  sec  12.7 MBytes   106 Mbits/sec
[  4]  12.00-13.00  sec  12.7 MBytes   107 Mbits/sec
[  4]  13.00-14.00  sec  12.7 MBytes   106 Mbits/sec
[  4]  14.00-15.00  sec  12.7 MBytes   107 Mbits/sec
[  4]  15.00-16.00  sec  12.7 MBytes   106 Mbits/sec
[  4]  16.00-17.00  sec  12.7 MBytes   107 Mbits/sec
[  4]  17.00-18.00  sec  12.7 MBytes   106 Mbits/sec
[  4]  18.00-19.00  sec  12.7 MBytes   107 Mbits/sec
[  4]  19.00-20.00  sec  12.7 MBytes   106 Mbits/sec
[  4]  20.00-21.00  sec  12.7 MBytes   106 Mbits/sec
[  4]  21.00-22.00  sec  12.7 MBytes   107 Mbits/sec
[  4]  22.00-23.00  sec  12.7 MBytes   106 Mbits/sec
[  4]  23.00-24.00  sec  12.7 MBytes   106 Mbits/sec
[  4]  24.00-25.00  sec  12.7 MBytes   107 Mbits/sec
[  4]  25.00-26.00  sec  12.6 MBytes   106 Mbits/sec
[  4]  26.00-27.00  sec  12.7 MBytes   107 Mbits/sec
[  4]  27.00-28.01  sec  12.7 MBytes   106 Mbits/sec
[  4]  28.01-29.00  sec  12.7 MBytes   106 Mbits/sec
[  4]  29.00-30.00  sec  12.7 MBytes   106 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   383 MBytes   107 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   382 MBytes   107 Mbits/sec                  receiver
CPU Utilization: local/receiver 4.5% (1.7%u/2.7%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **107 Mbit/s of 1000 Mbit/s**

4.6.16 RTT = 15 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=15ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=15ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=15ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=15ms TTL=64
```

```
[  4] local 192.168.178.72 port 52542 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  11.7 MBytes  98.2 Mbits/sec
[  4]   1.00-2.00   sec  11.9 MBytes   100 Mbits/sec
[  4]   2.00-3.00   sec  11.8 MBytes  98.8 Mbits/sec
[  4]   3.00-4.01   sec  11.7 MBytes  97.4 Mbits/sec
[  4]   4.01-5.00   sec  11.6 MBytes  97.4 Mbits/sec
[  4]   5.00-6.00   sec  11.6 MBytes  97.4 Mbits/sec
[  4]   6.00-7.01   sec  11.8 MBytes  98.8 Mbits/sec
[  4]   7.01-8.00   sec  11.6 MBytes  97.6 Mbits/sec
[  4]   8.00-9.00   sec  12.0 MBytes   100 Mbits/sec
[  4]   9.00-10.00  sec  11.7 MBytes  98.2 Mbits/sec
[  4]  10.00-11.00  sec  11.8 MBytes  98.8 Mbits/sec
[  4]  11.00-12.00  sec  11.6 MBytes  96.9 Mbits/sec
[  4]  12.00-13.00  sec  11.9 MBytes  99.8 Mbits/sec
[  4]  13.00-14.00  sec  11.6 MBytes  97.4 Mbits/sec
[  4]  14.00-15.00  sec  11.8 MBytes  98.9 Mbits/sec
[  4]  15.00-16.00  sec  11.6 MBytes  97.3 Mbits/sec
[  4]  16.00-17.00  sec  11.8 MBytes  99.3 Mbits/sec
[  4]  17.00-18.00  sec  11.7 MBytes  97.9 Mbits/sec
[  4]  18.00-19.00  sec  11.8 MBytes  99.0 Mbits/sec
[  4]  19.00-20.00  sec  11.4 MBytes  95.6 Mbits/sec
[  4]  20.00-21.00  sec  11.9 MBytes  99.5 Mbits/sec
[  4]  21.00-22.00  sec  11.9 MBytes  99.7 Mbits/sec
[  4]  22.00-23.00  sec  11.9 MBytes   100 Mbits/sec
[  4]  23.00-24.00  sec  11.8 MBytes  98.5 Mbits/sec
[  4]  24.00-25.00  sec  12.0 MBytes   101 Mbits/sec
[  4]  25.00-26.00  sec  11.9 MBytes  99.6 Mbits/sec
[  4]  26.00-27.00  sec  11.6 MBytes  96.9 Mbits/sec
[  4]  27.00-28.00  sec  11.7 MBytes  98.4 Mbits/sec
[  4]  28.00-29.01  sec  11.8 MBytes  98.5 Mbits/sec
[  4]  29.01-30.02  sec  12.1 MBytes   100 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.02  sec   355 MBytes  99.2 Mbits/sec    0             sender
[  4]   0.00-30.02  sec   353 MBytes  98.6 Mbits/sec                  receiver
CPU Utilization: local/receiver 4.3% (2.1%u/2.3%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **100 Mbit/s of 1000 Mbit/s**

4.6.17 RTT = 16 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=16ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=16ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=16ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=16ms TTL=64
```

```
[  4] local 192.168.178.72 port 52624 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.01   sec  11.1 MBytes  92.0 Mbits/sec
[  4]   1.01-2.00   sec  11.2 MBytes  95.2 Mbits/sec
[  4]   2.00-3.00   sec  11.2 MBytes  94.5 Mbits/sec
[  4]   3.00-4.00   sec  11.2 MBytes  93.8 Mbits/sec
[  4]   4.00-5.00   sec  11.2 MBytes  93.4 Mbits/sec
[  4]   5.00-6.00   sec  11.1 MBytes  93.2 Mbits/sec
[  4]   6.00-7.00   sec  11.3 MBytes  94.8 Mbits/sec
[  4]   7.00-8.00   sec  11.1 MBytes  93.1 Mbits/sec
[  4]   8.00-9.01   sec  10.9 MBytes  90.6 Mbits/sec
[  4]   9.01-10.00  sec  11.2 MBytes  94.9 Mbits/sec
[  4]  10.00-11.00  sec  11.5 MBytes  96.2 Mbits/sec
[  4]  11.00-12.00  sec  10.8 MBytes  91.3 Mbits/sec
[  4]  12.00-13.00  sec  11.1 MBytes  92.9 Mbits/sec
[  4]  13.00-14.00  sec  11.1 MBytes  93.1 Mbits/sec
[  4]  14.00-15.01  sec  11.1 MBytes  93.0 Mbits/sec
[  4]  15.01-16.00  sec  11.0 MBytes  92.5 Mbits/sec
[  4]  16.00-17.01  sec  11.1 MBytes  92.5 Mbits/sec
[  4]  17.01-18.00  sec  11.2 MBytes  94.8 Mbits/sec
[  4]  18.00-19.00  sec  11.2 MBytes  94.2 Mbits/sec
[  4]  19.00-20.01  sec  11.3 MBytes  93.9 Mbits/sec
[  4]  20.01-21.00  sec  10.8 MBytes  90.7 Mbits/sec
[  4]  21.00-22.01  sec  11.2 MBytes  93.2 Mbits/sec
[  4]  22.01-23.00  sec  11.2 MBytes  94.7 Mbits/sec
[  4]  23.00-24.00  sec  11.0 MBytes  92.7 Mbits/sec
[  4]  24.00-25.00  sec  11.4 MBytes  95.4 Mbits/sec
[  4]  25.00-26.00  sec  11.4 MBytes  95.4 Mbits/sec
[  4]  26.00-27.00  sec  11.3 MBytes  94.7 Mbits/sec
[  4]  27.00-28.00  sec  11.4 MBytes  95.4 Mbits/sec
[  4]  28.00-29.00  sec  11.0 MBytes  92.4 Mbits/sec
[  4]  29.00-30.00  sec  11.2 MBytes  93.4 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   337 MBytes  94.2 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   335 MBytes  93.7 Mbits/sec                  receiver
CPU Utilization: local/receiver 6.0% (2.4%u/3.6%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **94 Mbit/s of 1000 Mbit/s**

4.6.18 RTT = 17 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=17ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=17ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=17ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=17ms TTL=64
```

```
[  4] local 192.168.178.72 port 52705 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  10.5 MBytes  88.2 Mbits/sec
[  4]   1.00-2.00   sec  11.1 MBytes  92.5 Mbits/sec
[  4]   2.00-3.00   sec  10.7 MBytes  89.9 Mbits/sec
[  4]   3.00-4.01   sec  10.5 MBytes  87.5 Mbits/sec
[  4]   4.01-5.01   sec  10.6 MBytes  88.7 Mbits/sec
[  4]   5.01-6.00   sec  10.4 MBytes  87.9 Mbits/sec
[  4]   6.00-7.01   sec  10.7 MBytes  89.4 Mbits/sec
[  4]   7.01-8.00   sec  10.3 MBytes  87.2 Mbits/sec
[  4]   8.00-9.00   sec  10.6 MBytes  88.9 Mbits/sec
[  4]   9.00-10.00  sec  10.5 MBytes  87.8 Mbits/sec
[  4]  10.00-11.00  sec  10.9 MBytes  91.0 Mbits/sec
[  4]  11.00-12.00  sec  10.8 MBytes  90.5 Mbits/sec
[  4]  12.00-13.00  sec  10.4 MBytes  86.8 Mbits/sec
[  4]  13.00-14.00  sec  10.3 MBytes  86.1 Mbits/sec
[  4]  14.00-15.01  sec  10.5 MBytes  87.7 Mbits/sec
[  4]  15.01-16.00  sec  10.2 MBytes  86.3 Mbits/sec
[  4]  16.00-17.01  sec  10.4 MBytes  87.2 Mbits/sec
[  4]  17.01-18.01  sec  10.4 MBytes  87.1 Mbits/sec
[  4]  18.01-19.00  sec  10.6 MBytes  89.7 Mbits/sec
[  4]  19.00-20.00  sec  10.4 MBytes  87.1 Mbits/sec
[  4]  20.00-21.00  sec  10.6 MBytes  88.5 Mbits/sec
[  4]  21.00-22.01  sec  10.6 MBytes  88.5 Mbits/sec
[  4]  22.01-23.01  sec  10.5 MBytes  88.0 Mbits/sec
[  4]  23.01-24.01  sec  10.4 MBytes  87.7 Mbits/sec
[  4]  24.01-25.00  sec  10.2 MBytes  85.6 Mbits/sec
[  4]  25.00-26.02  sec  10.6 MBytes  87.5 Mbits/sec
[  4]  26.02-27.00  sec  10.6 MBytes  90.2 Mbits/sec
[  4]  27.00-28.00  sec  10.6 MBytes  88.6 Mbits/sec
[  4]  28.00-29.00  sec  10.2 MBytes  85.4 Mbits/sec
[  4]  29.00-30.00  sec  10.6 MBytes  89.3 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   317 MBytes  88.7 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   316 MBytes  88.3 Mbits/sec                  receiver
CPU Utilization: local/receiver 4.5% (1.7%u/2.7%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **89 Mbit/s of 1000 Mbit/s**

4.6.19 RTT = 18 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=18ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=18ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=18ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=18ms TTL=64
```

```
[  4] local 192.168.178.72 port 53237 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  10.3 MBytes  85.8 Mbits/sec
[  4]   1.00-2.01   sec  9.99 MBytes  83.6 Mbits/sec
[  4]   2.01-3.00   sec  9.92 MBytes  83.6 Mbits/sec
[  4]   3.00-4.00   sec  9.99 MBytes  83.6 Mbits/sec
[  4]   4.00-5.01   sec  9.99 MBytes  83.6 Mbits/sec
[  4]   5.01-6.00   sec  9.92 MBytes  83.6 Mbits/sec
[  4]   6.00-7.00   sec  10.0 MBytes  83.9 Mbits/sec
[  4]   7.00-8.00   sec  9.91 MBytes  83.2 Mbits/sec
[  4]   8.00-9.00   sec  9.97 MBytes  83.6 Mbits/sec
[  4]   9.00-10.00  sec  9.99 MBytes  83.6 Mbits/sec
[  4]  10.00-11.00  sec  9.97 MBytes  83.9 Mbits/sec
[  4]  11.00-12.00  sec  9.95 MBytes  83.5 Mbits/sec
[  4]  12.00-13.00  sec  9.97 MBytes  83.4 Mbits/sec
[  4]  13.00-14.01  sec  9.98 MBytes  83.6 Mbits/sec
[  4]  14.01-15.00  sec  9.97 MBytes  84.0 Mbits/sec
[  4]  15.00-16.00  sec  9.97 MBytes  83.4 Mbits/sec
[  4]  16.00-17.00  sec  9.95 MBytes  83.6 Mbits/sec
[  4]  17.00-18.00  sec  9.99 MBytes  83.8 Mbits/sec
[  4]  18.00-19.00  sec  9.96 MBytes  83.5 Mbits/sec
[  4]  19.00-20.00  sec  9.95 MBytes  83.3 Mbits/sec
[  4]  20.00-21.00  sec  9.94 MBytes  83.6 Mbits/sec
[  4]  21.00-22.00  sec  10.1 MBytes  84.3 Mbits/sec
[  4]  22.00-23.00  sec  9.96 MBytes  83.7 Mbits/sec
[  4]  23.00-24.00  sec  10.1 MBytes  84.6 Mbits/sec
[  4]  24.00-25.00  sec  9.97 MBytes  83.6 Mbits/sec
[  4]  25.00-26.01  sec  10.1 MBytes  83.9 Mbits/sec
[  4]  26.01-27.00  sec  9.93 MBytes  83.7 Mbits/sec
[  4]  27.00-28.00  sec  9.97 MBytes  83.5 Mbits/sec
[  4]  28.00-29.00  sec  10.0 MBytes  83.7 Mbits/sec
[  4]  29.00-30.00  sec  9.96 MBytes  83.8 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   301 MBytes  84.2 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   300 MBytes  83.8 Mbits/sec                  receiver
CPU Utilization: local/receiver 4.3% (1.5%u/2.8%s), remote/sender 0.0% (0.0%u/0.0%s)
```

Utilized TCP Bandwidth: **84 Mbit/s of 1000 Mbit/s**

4.6.20 RTT = 19 ms

```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=19ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=19ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=19ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=19ms TTL=64
```

```
[  4] local 192.168.178.72 port 53306 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  9.67 MBytes  81.0 Mbits/sec
[  4]   1.00-2.00   sec  9.52 MBytes  79.7 Mbits/sec
[  4]   2.00-3.00   sec  9.45 MBytes  79.4 Mbits/sec
[  4]   3.00-4.01   sec  9.52 MBytes  79.5 Mbits/sec
[  4]   4.01-5.00   sec  9.43 MBytes  79.5 Mbits/sec
[  4]   5.00-6.00   sec  9.62 MBytes  80.5 Mbits/sec
[  4]   6.00-7.00   sec  9.41 MBytes  79.0 Mbits/sec
[  4]   7.00-8.00   sec  9.52 MBytes  79.8 Mbits/sec
[  4]   8.00-9.00   sec  9.48 MBytes  79.5 Mbits/sec
[  4]   9.00-10.00  sec  9.49 MBytes  79.8 Mbits/sec
[  4]  10.00-11.01  sec  9.51 MBytes  79.5 Mbits/sec
[  4]  11.01-12.01  sec  9.47 MBytes  79.3 Mbits/sec
[  4]  12.01-13.00  sec  9.45 MBytes  79.7 Mbits/sec
[  4]  13.00-14.01  sec  9.56 MBytes  79.9 Mbits/sec
[  4]  14.01-15.00  sec  9.49 MBytes  79.9 Mbits/sec
[  4]  15.00-16.00  sec  9.51 MBytes  79.8 Mbits/sec
[  4]  16.00-17.00  sec  9.47 MBytes  79.4 Mbits/sec
[  4]  17.00-18.01  sec  9.45 MBytes  79.0 Mbits/sec
[  4]  18.01-19.00  sec  9.54 MBytes  80.4 Mbits/sec
[  4]  19.00-20.00  sec  9.40 MBytes  78.8 Mbits/sec
[  4]  20.00-21.01  sec  9.59 MBytes  80.2 Mbits/sec
[  4]  21.01-22.00  sec  9.41 MBytes  79.4 Mbits/sec
[  4]  22.00-23.00  sec  9.43 MBytes  79.2 Mbits/sec
[  4]  23.00-24.01  sec  9.48 MBytes  79.2 Mbits/sec
[  4]  24.01-25.01  sec  9.49 MBytes  79.6 Mbits/sec
[  4]  25.01-26.00  sec  9.49 MBytes  80.1 Mbits/sec
[  4]  26.00-27.00  sec  9.43 MBytes  79.1 Mbits/sec
[  4]  27.00-28.01  sec  9.54 MBytes  79.6 Mbits/sec
[  4]  28.01-29.01  sec  9.51 MBytes  79.9 Mbits/sec
[  4]  29.01-30.01  sec  9.50 MBytes  79.7 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.01  sec   287 MBytes  80.2 Mbits/sec    0             sender
[  4]   0.00-30.01  sec   285 MBytes  79.7 Mbits/sec                  receiver
CPU Utilization: local/receiver 4.2% (1.6%u/2.6%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **80 Mbit/s of 1000 Mbit/s**

4.6.21 RTT = 20 ms

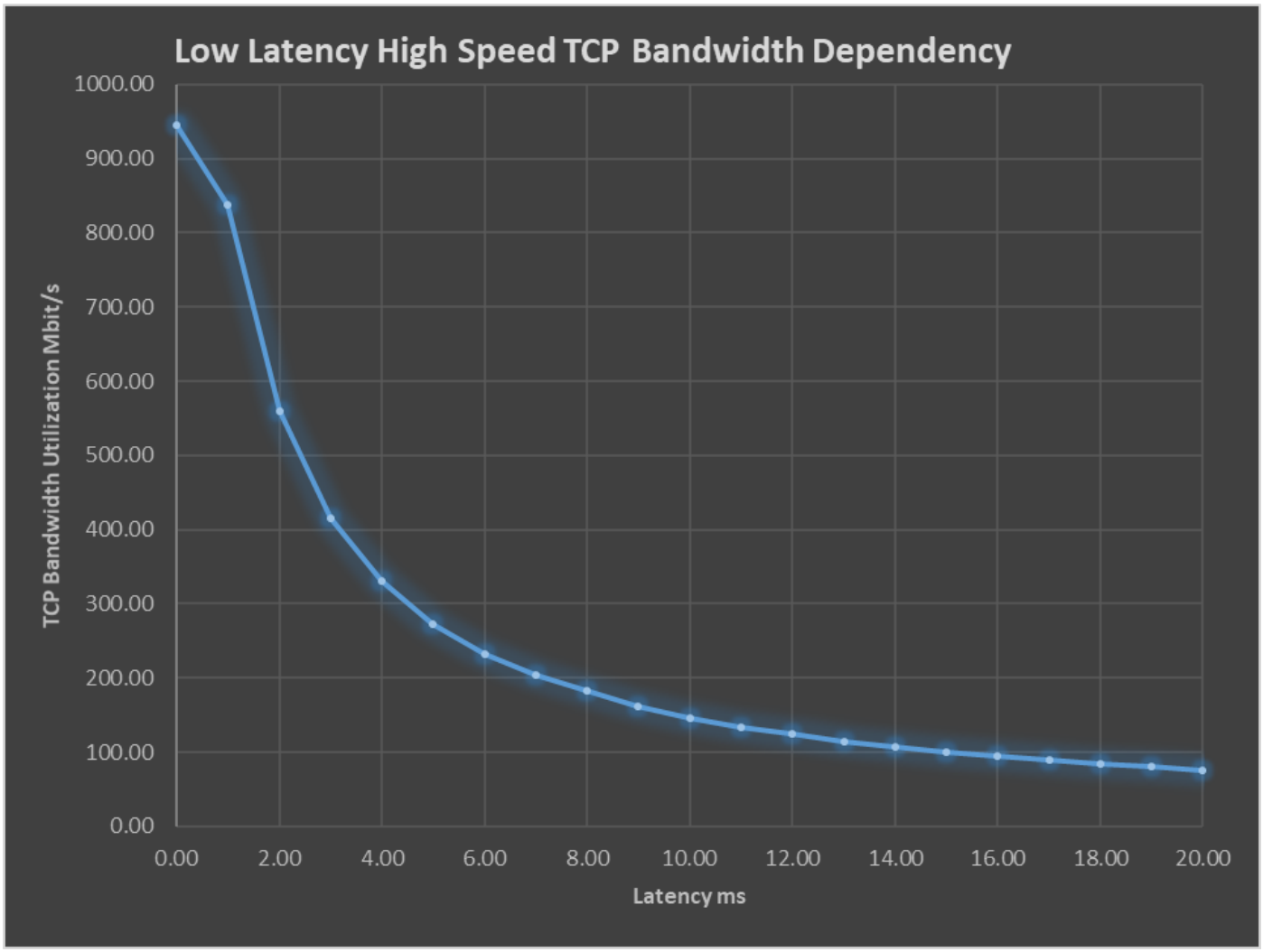
```
Ping wird ausgeführt für 192.168.178.61 mit 32 Bytes Daten:
Antwort von 192.168.178.61: Bytes=32 Zeit=20ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=20ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=20ms TTL=64
Antwort von 192.168.178.61: Bytes=32 Zeit=20ms TTL=64
```

```
[  4] local 192.168.178.72 port 53366 connected to 192.168.178.61 port 5200
Starting Test: protocol: TCP, 1 streams, 131072 byte blocks, omitting 0 seconds, 30 second test
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec  9.11 MBytes  76.3 Mbits/sec
[  4]   1.00-2.00   sec  8.99 MBytes  75.3 Mbits/sec
[  4]   2.00-3.00   sec  9.00 MBytes  75.5 Mbits/sec
[  4]   3.00-4.00   sec  9.00 MBytes  75.7 Mbits/sec
[  4]   4.00-5.01   sec  9.02 MBytes  75.3 Mbits/sec
[  4]   5.01-6.00   sec  8.97 MBytes  75.5 Mbits/sec
[  4]   6.00-7.00   sec  8.98 MBytes  75.4 Mbits/sec
[  4]   7.00-8.00   sec  9.00 MBytes  75.4 Mbits/sec
[  4]   8.00-9.00   sec  9.01 MBytes  75.5 Mbits/sec
[  4]   9.00-10.01  sec  9.01 MBytes  75.5 Mbits/sec
[  4]  10.01-11.00  sec  8.98 MBytes  75.5 Mbits/sec
[  4]  11.00-12.01  sec  9.00 MBytes  75.3 Mbits/sec
[  4]  12.01-13.00  sec  9.01 MBytes  75.8 Mbits/sec
[  4]  13.00-14.00  sec  8.98 MBytes  75.5 Mbits/sec
[  4]  14.00-15.00  sec  8.97 MBytes  75.3 Mbits/sec
[  4]  15.00-16.00  sec  9.05 MBytes  75.9 Mbits/sec
[  4]  16.00-17.00  sec  8.99 MBytes  75.4 Mbits/sec
[  4]  17.00-18.00  sec  8.98 MBytes  75.4 Mbits/sec
[  4]  18.00-19.00  sec  9.00 MBytes  75.3 Mbits/sec
[  4]  19.00-20.00  sec  9.01 MBytes  75.6 Mbits/sec
[  4]  20.00-21.00  sec  9.03 MBytes  75.7 Mbits/sec
[  4]  21.00-22.00  sec  9.03 MBytes  76.0 Mbits/sec
[  4]  22.00-23.00  sec  9.04 MBytes  75.7 Mbits/sec
[  4]  23.00-24.00  sec  8.99 MBytes  75.4 Mbits/sec
[  4]  24.00-25.00  sec  8.99 MBytes  75.3 Mbits/sec
[  4]  25.00-26.01  sec  9.02 MBytes  75.4 Mbits/sec
[  4]  26.01-27.00  sec  8.96 MBytes  75.6 Mbits/sec
[  4]  27.00-28.00  sec  8.97 MBytes  75.4 Mbits/sec
[  4]  28.00-29.00  sec  9.00 MBytes  75.4 Mbits/sec
[  4]  29.00-30.00  sec  8.97 MBytes  75.3 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
Test Complete. Summary Results:
[ ID] Interval           Transfer     Bandwidth       Retr
[  4]   0.00-30.00  sec   272 MBytes  76.1 Mbits/sec    0             sender
[  4]   0.00-30.00  sec   270 MBytes  75.6 Mbits/sec                  receiver
CPU Utilization: local/receiver 4.9% (1.8%u/3.1%s), remote/sender 0.1% (0.0%u/0.1%s)
```

Utilized TCP Bandwidth: **76 Mbit/s of 1000 Mbit/s**

4.6.22 Benchmark Summary

Latency ms	TCP Bandwidth Utilization of 1 Gbit/s	Utilization %	Loss %
0.01	946.00	**94.60%**	**-5.40%**
1.00	838.00	**83.80%**	**-16.20%**
2.00	560.00	**56.00%**	**-44.00%**
3.00	416.00	**41.60%**	**-58.40%**
4.00	331.00	**33.10%**	**-66.90%**
5.00	273.00	**27.30%**	**-72.70%**
6.00	232.00	**23.20%**	**-76.80%**
7.00	204.00	**20.40%**	**-79.60%**
8.00	182.00	**18.20%**	**-81.80%**
9.00	162.00	**16.20%**	**-83.80%**
10.00	146.00	**14.60%**	**-85.40%**
11.00	134.00	**13.40%**	**-86.60%**
12.00	124.00	**12.40%**	**-87.60%**
13.00	115.00	**11.50%**	**-88.50%**
14.00	107.00	**10.70%**	**-89.30%**
15.00	100.00	**10.00%**	**-90.00%**
16.00	94.00	**9.40%**	**-90.60%**
17.00	89.00	**8.90%**	**-91.10%**
18.00	84.00	**8.40%**	**-91.60%**
19.00	80.00	**8.00%**	**-92.00%**
20.00	76.00	**7.60%**	**-92.40%**


Low Latency High Speed TCP Bandwidth Dependency
TCP Bandwidth Utilization Mbit/s
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Latency ms