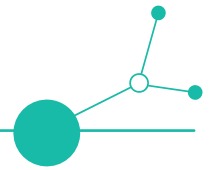


# Testing of a mobile VR lab concept

D.3.3.1



March 2025 | version 1.0





## Introduction

The deliverable **D.3.3.1 - Testing of a mobile VR lab concept** describes the developed methodology for testing the mobile VR lab concept and how to prove that the concept is applicable in everyday use. The document describes the methodology and it contains the results of the tests carried out by the partners JVTP (CZ, LP1), OTH (DE, PP8), and SZE (PP10, HU) who established the three VR Laboratories. Finally the results are summarized. These

The document covers two basic methods of setting up a cooperative and interactive environment for virtual reality (VR). Within the project, these methods will be utilized to connect the VReduMED laboratories, in order to pilot-test the applications used for educational purposes. The tested applications are both third-party software as well as the application prototypes developed within the project framework.

The document freely combines the terms ‘virtual reality’ and ‘VR’, meaning the same thing. Augmented or combined reality (AR, XR) are not considered in this document since they are technically slightly different and, most importantly, work with completely different setups which include interaction (both digital and physical) with outside, real world.

## Connection to pilot actions

The tests shown in this document were carried out in order to check the technical requirements which must be met in order to provide users a good user experience during the the use of VR applications (both other applications and applications developed in the project). This testing is tightly connected to the establishment of the VR laboratories and testing the laboratory equipment among the 3 regions.

The Pilot action #1 was defined as follows: Technical setup of laboratories, its mobility, virtual connectivity and developed VR/AR applications will be tested with regional stakeholders in labs in CZ/HU/DE as well as in our project regions connected to these labs virtually. JVTP will lead this task in cooperation with partners from DE (OTH) and HU (SZE)

Therefore the tests and measurements described in this document are the results of this pilot action to test the mobile lab concept and conduct testing in order to prove the usability of the concept.

## Test methodology and guidelines

The technical prerequisites (like internet connection parameters, headset types or auxiliary steps) have been decribed in D.3.1.1 & D.3.1.2 deliverables. These deliverables set minimal and recommended hardware configuration of VReduMED labs.

The test methodology aims to ensure that these requirements are met in all VR laboratories at all times in order to ensure the usability of the laboratory and to provide a good user experience.

The test methodology consists of the following steps:

1. Ensure that the laboratory has the required amount of equipment (number of VR headsets)



2. Ensure that the laboratory provides the required amount of physical space for VR usage
3. Ensure that the network connection in the laboratory meets the predefined requirements as these are crucial to have a good user experience both in an interconnected laboratory session and when using the mobile lab setup.

The detailed description of these steps are the following:

1. The first test is to enumerate the amount of equipment, present in the laboratory and meant to be used for the pilot actions, demonstrations, TtT workshops (as described in D3.2.1) and for lending out to interested stakeholders.
2. The laboratory should provide adequate physical space for safe and effective VR usage by meeting specific spatial, safety, and design requirements. A VR setup typically should allocate at least 1.5x1.5 meter clear area per user for basic standing or seated VR experiences. For room-scale VR involving free movement, a 3x3 meter space per station should be ensured. In our project, we settled to have at least 2x2m as all applications we use and demonstrate through the project could be used in a standing setup. This can be checked by simply measuring the amount of free space that could be provided in the laboratory. It should be noted that this free space need not be ensured to be available at all times (e.g. furniture is the way) but it should be ensured that this free space could be freed up when necessary for VR sessions.
3. The laboratory network must be verified to ensure it meets the predefined performance and reliability requirements, as these are essential for maintaining a smooth user experience both during interconnected laboratory sessions and when operating the mobile laboratory setup. The verification begins with a physical inspection of cabling, connectors, and switch ports to confirm proper installation and configuration. Afterward, the network configuration is checked by confirming successful communication with a common server (geographically located in a reasonable distance from each VR laboratory) and the laboratory network. Network performance is then evaluated by measuring latency, packet loss, bandwidth, and jitter using appropriate diagnostic tools. These tools were chosen in a way that tests could be carried out both from desktop computers or laptops and also directly from VR equipment in order to mimic real usage conditions. For the mobile laboratory setup, wireless signal strength and connection stability is crucial to ensure a smooth user experience. These tests were carried out on different days dates during the pilot period and in business hours in order to ensure that conditions are within the required limits at all times.

## Summary of tests

During the pilot period, tests were carried out in each of the three VR laboratories. The description of results are the following.



## Results from the VR Lab at JVTP (LP1)

Tests performed at JVTP in České Budějovice, Czech republic, between September and November 2025. All tests have been performed according to the methodology on Pilot #1.

**Physical space:** dedicated room, available space 2x 2x2 metres (2 headsets in use simultaneously, +1 headset available for redundancy and/or for external events)

**Equipment:** 3x MetaQuest 2 + laptop + projector for casting the headset streams  
5G router for external events

Pictures:



**Nominal connection parameters:** 200 Mbit/s max (access point limit)



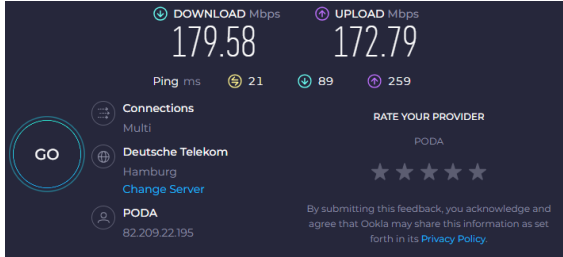
## Connection measurement results

Date: 23<sup>rd</sup> September 2025 @ 9:30 CEST

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	<p>75.82 / 96.99 Mbit Down/Up</p>
Latency	50 ms 30 ms	75/201 ms Down/Up
Jitter	Not set	<pre> Connecting to host iperf3.moji.fr, port 5201 [ 5] local 192.168.180.68 port 57243 connected to 45.147.210.189 port 5201 [ ID] Interval      Transfer      Bitrate      Total Datagrams [ 5] 0.00-1.01 sec  12.4 MBytes  103 Mbits/sec  8895 [ 5] 1.01-2.00 sec  12.2 MBytes  102 Mbits/sec  8753 [ 5] 2.00-3.01 sec  12.2 MBytes  102 Mbits/sec  8788 [ 5] 3.01-4.01 sec  10.9 MBytes  91.9 Mbits/sec  7845 [ 5] 4.01-5.01 sec  10.1 MBytes  84.6 Mbits/sec  7251 [ 5] 5.01-6.01 sec  10.9 MBytes  92.2 Mbits/sec  7832 [ 5] 6.01-7.01 sec  9.60 MBytes  79.8 Mbits/sec  6897 [ 5] 7.01-8.01 sec  9.83 MBytes  82.9 Mbits/sec  7063 [ 5] 8.01-9.01 sec  10.8 MBytes  89.9 Mbits/sec  7724 [ 5] 9.01-10.01 sec 11.6 MBytes  97.6 Mbits/sec  8345 ----- [ ID] Interval      Transfer      Bitrate      Jitter      Lost/Tot. Datagrams [ 5] 0.00-10.01 sec 111 MBytes  92.6 Mbits/sec  0.000 ms  0/79393 (0%) sender [ 5] 0.00-10.06 sec 111 MBytes  92.2 Mbits/sec  0.084 ms  0/79391 (0%) receiver           </pre> <p>0.084 ms</p>
Ping / Round Trip Time	50 ms 30 ms	<pre> Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=21ms TTL=244 Reply from 13.248.68.72: bytes=32 time=22ms TTL=244 Reply from 13.248.68.72: bytes=32 time=18ms TTL=244 Reply from 13.248.68.72: bytes=32 time=25ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 18ms, Maximum = 25ms, Average = 21ms           </pre> <p>RTT avg: 21 ms</p>



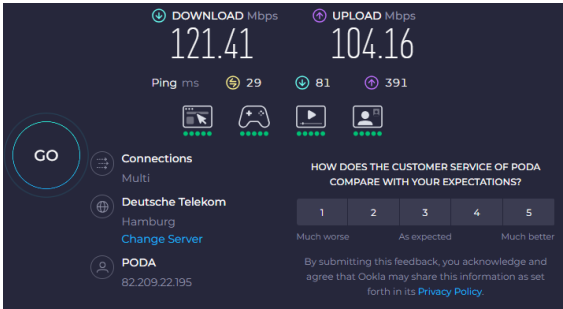
Date: 17<sup>th</sup> October 2025 @ 11:50 CEST

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	 <p>179.58 / 172.79 Mbit Down/Up</p>
Latency	50 ms 30 ms	21/89 ms Down/Up
Jitter	Not set	<pre> Connecting to host iperf3.mojl.fr, port 5200 [ 5] local 192.168.100.78 port 63803 connected to 45.147.210.189 port 5200 [ ID] Interval      Transfer      Bitrate      Total Datagrams [ 5] 0.00-1.01 sec  17.6 MBytes  146 Mbits/sec  12640 [ 5] 1.01-2.00 sec  18.3 MBytes  155 Mbits/sec  13154 [ 5] 2.00-3.02 sec  18.7 MBytes  155 Mbits/sec  13431 [ 5] 3.02-4.00 sec  17.0 MBytes  145 Mbits/sec  12239 [ 5] 4.00-5.01 sec  17.7 MBytes  148 Mbits/sec  12691 [ 5] 5.01-6.01 sec  18.4 MBytes  154 Mbits/sec  13217 [ 5] 6.01-7.01 sec  17.6 MBytes  147 Mbits/sec  12638 [ 5] 7.01-8.01 sec  17.8 MBytes  149 Mbits/sec  12794 [ 5] 8.01-9.01 sec  17.2 MBytes  144 Mbits/sec  12371 [ 5] 9.01-10.01 sec 17.4 MBytes  146 Mbits/sec  12487 ----- [ ID] Interval      Transfer      Bitrate      Jitter      Lost/Total Datagrams [ 5] 0.00-10.01 sec  178 MBytes  149 Mbits/sec  0.080 ms  0/127662 (0%) sender [ 5] 0.00-10.06 sec  178 MBytes  148 Mbits/sec  0.076 ms  0/127661 (0%) receiver           </pre> <p>0.076 ms</p>
Ping / Round Trip Time	50 ms 30 ms	<pre> Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=21ms TTL=244 Reply from 13.248.68.72: bytes=32 time=20ms TTL=244 Reply from 13.248.68.72: bytes=32 time=23ms TTL=244 Reply from 13.248.68.72: bytes=32 time=20ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 20ms, Maximum = 23ms, Average = 21ms           </pre> <p>RTT avg: 21 ms</p>



Date: 20<sup>th</sup> November 2023 @ 11:30 CEST

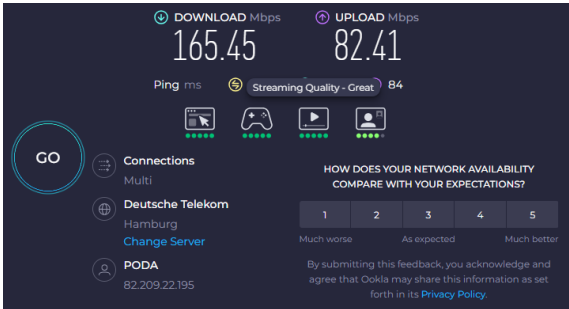
Note: the day after Cloudflare outage

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	 <p>121.41 / 104.16 Mbit Down/Up</p>
Latency	50 ms 30 ms	81/391 ms Down/Up
Jitter	Not set	<pre> Connecting to host iperf3.maji.fr, port 5200 [ 5] local 192.168.180.77 port 59961 connected to 45.147.210.189 port 5200 [ ID] Interval      Transfer      Bitrate      Total Datagrams [ 5] 0.00-1.01 sec  15.3 MBytes  127 Mbits/sec  11020 [ 5] 1.01-2.01 sec  13.1 MBytes  110 Mbits/sec  9435 [ 5] 2.01-3.00 sec   9.65 MBytes  76.7 Mbits/sec  6501 [ 5] 3.00-4.01 sec  12.6 MBytes  105 Mbits/sec  9035 [ 5] 4.01-5.01 sec  13.2 MBytes  110 Mbits/sec  9477 [ 5] 5.01-6.00 sec  12.1 MBytes  102 Mbits/sec  8682 [ 5] 6.00-7.01 sec  13.7 MBytes  114 Mbits/sec  9847 [ 5] 7.01-8.00 sec  12.1 MBytes  103 Mbits/sec  8710 [ 5] 8.00-9.01 sec  13.4 MBytes  112 Mbits/sec  9630 [ 5] 9.01-10.01 sec 14.6 MBytes  122 Mbits/sec  10518 ----- [ ID] Interval      Transfer      Bitrate      Jitter      Lost/Total Datagrams [ 5] 0.00-10.01 sec  129 MBytes  108 Mbits/sec  0.000 ms  0/92855 (0%) sender [ 5] 0.00-10.08 sec  129 MBytes  108 Mbits/sec  0.256 ms  0/92854 (0%) receiver           </pre> <p>0.256 ms</p>
Ping / Round Trip Time	50 ms 30 ms	<pre> Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=28ms TTL=244 Reply from 13.248.68.72: bytes=32 time=20ms TTL=244 Reply from 13.248.68.72: bytes=32 time=24ms TTL=244 Reply from 13.248.68.72: bytes=32 time=21ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 20ms, Maximum = 28ms, Average = 23ms           </pre> <p>RTT avg: 23 ms</p>



Date: 3<sup>rd</sup> December 2025 @ 9:30 CEST

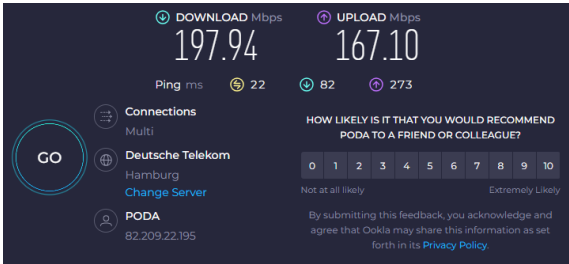
Note: Wi-fi connection under load

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	 <p>165.45 / 82.41 Mbit Down/Up</p>
Latency	50 ms 30 ms	29/81 ms Down/Up
Jitter	Not set	<pre> Connecting to host iperf3.moji.fr, port 5200 [ 5] Local 192.168.100.52 port 57270 connected to 45.147.210.189 port 5200 [ ID] Interval      Transfer      Bitrate      Total Datagrams [ 5] 0.00-1.00 sec  7.64 MBytes  63.9 Mbits/sec  5485 [ 5] 1.00-2.01 sec  7.60 MBytes  63.0 Mbits/sec  5455 [ 5] 2.01-3.01 sec  5.80 MBytes  48.9 Mbits/sec  4165 [ 5] 3.01-4.01 sec  5.06 MBytes  42.4 Mbits/sec  3634 [ 5] 4.01-5.00 sec  5.85 MBytes  49.4 Mbits/sec  4205 [ 5] 5.00-6.01 sec  7.86 MBytes  65.3 Mbits/sec  5642 [ 5] 6.01-7.00 sec  11.9 MBytes  101 Mbits/sec  8582 [ 5] 7.00-8.01 sec  11.7 MBytes  97.7 Mbits/sec  8435 [ 5] 8.01-9.02 sec  11.3 MBytes  94.2 Mbits/sec  8107 [ 5] 9.02-10.01 sec  9.03 MBytes  76.2 Mbits/sec  6483 ----- [ ID] Interval      Transfer      Bitrate      Jitter      Lost/Total Datagrams [ 5] 0.00-10.01 sec  83.8 MBytes  70.2 Mbits/sec  0.000 ms  0/68193 (0%) sender [ 5] 0.00-10.06 sec  83.0 MBytes  69.9 Mbits/sec  0.499 ms  0/68192 (0%) receiver           </pre> <p>0.499 ms</p>
Ping / Round Trip Time	50 ms 30 ms	<pre> Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=25ms TTL=244 Reply from 13.248.68.72: bytes=32 time=25ms TTL=244 Reply from 13.248.68.72: bytes=32 time=33ms TTL=244 Reply from 13.248.68.72: bytes=32 time=22ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 22ms, Maximum = 33ms, Average = 26ms           </pre> <p>RTT avg: 26 ms</p>



Date: 4<sup>th</sup> December 2025 @ 10:20 CEST

Note: Wi-fi connection without load

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	 <p>197.94 / 167.10 Mbit Down/Up</p>
Latency	50 ms 30 ms	82/273 ms Down/Up
Jitter	Not set	<pre>Connecting to host iperf3.moji.fr, port 5200 [ 5] local 192.168.108.52 port 49315 connected to 45.147.210.189 port 5200 [ ID] Interval      Transfer      Bitrate      Total Datagrams [ 5] 0.00-1.00 sec  18.3 MBytes  153 Mbits/sec  13125 [ 5] 1.00-2.00 sec  17.6 MBytes  147 Mbits/sec  12688 [ 5] 2.00-3.01 sec  16.6 MBytes  139 Mbits/sec  11983 [ 5] 3.01-4.01 sec  18.1 MBytes  151 Mbits/sec  13066 [ 5] 4.01-5.01 sec  17.2 MBytes  144 Mbits/sec  12371 [ 5] 5.01-6.00 sec  18.1 MBytes  153 Mbits/sec  12971 [ 5] 6.00-7.01 sec  18.9 MBytes  158 Mbits/sec  13578 [ 5] 7.01-8.02 sec  18.0 MBytes  149 Mbits/sec  12898 [ 5] 8.02-9.00 sec  17.3 MBytes  147 Mbits/sec  12395 [ 5] 9.00-10.00 sec 18.7 MBytes  157 Mbits/sec  13465 ----- [ ID] Interval      Transfer      Bitrate      Jitter      Lost/Total Datagrams [ 5] 0.00-10.00 sec  179 MBytes  150 Mbits/sec  0.000 ms  0/128320 (0%) sender [ 5] 0.00-10.06 sec  179 MBytes  149 Mbits/sec  0.133 ms  1/128319 (0.00078%) receiver</pre> <p>0.133 ms</p>
Ping / Round Trip Time	50 ms 30 ms	<pre>Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=23ms TTL=244 Reply from 13.248.68.72: bytes=32 time=22ms TTL=244 Reply from 13.248.68.72: bytes=32 time=21ms TTL=244 Reply from 13.248.68.72: bytes=32 time=21ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 21ms, Maximum = 23ms, Average = 21ms</pre> <p>RTT avg: 21 ms</p>



Date: 8<sup>th</sup> December 2025 @ 13:10 CEST

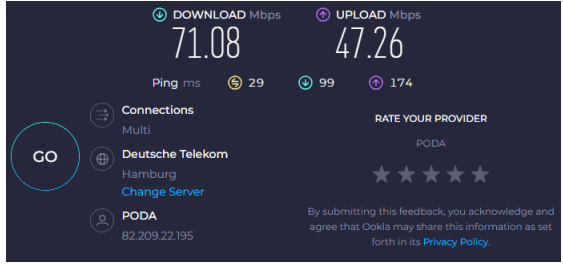
Note:

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	<p>154.67 / 127.44 Mbit Down/Up</p>
Latency	50 ms 30 ms	72/224 ms Down/Up
Jitter	Not set	<pre> Connecting to host iperf3.moj1.fr port 5200 [ S] local 192.168.100.10 port 68552 connected to 45.147.219.189 port 5200 [ ID] Interval      Transfer     Bitrate     Total Datagrams [ S] 0.00-1.02 sec  16.0 MBytes  132 Mbits/sec  11504 [ S] 1.02-2.01 sec  14.3 MBytes  120 Mbits/sec  10271 [ S] 2.01-3.01 sec  11.9 MBytes  101 Mbits/sec   8973 [ S] 3.01-4.01 sec   7.38 MBytes  61.4 Mbits/sec   5298 [ S] 4.01-5.00 sec   12.0 MBytes  102 Mbits/sec   8654 [ S] 5.00-6.00 sec   17.9 MBytes  150 Mbits/sec  12884 [ S] 6.00-7.01 sec   16.7 MBytes  140 Mbits/sec  12806 [ S] 7.01-8.01 sec   16.7 MBytes  140 Mbits/sec  12827 [ S] 8.01-9.01 sec   9.08 MBytes  76.8 Mbits/sec   6523 [ S] 9.01-10.01 sec  8.51 MBytes  70.8 Mbits/sec   6113 ----- [ ID] Interval      Transfer     Bitrate     Jitter    Lost/Totl Datagrams [ S] 0.00-10.01 sec  131 MBytes  109 Mbits/sec  0.000 ms  0/93853 (0%) sender [ S] 0.00-10.06 sec  131 MBytes  109 Mbits/sec  0.263 ms  1/93852 (0.0011%) receiver           </pre> <p>0.263 ms</p>
Ping / Round Trip Time	50 ms 30 ms	<pre> Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=20ms TTL=244 Reply from 13.248.68.72: bytes=32 time=23ms TTL=244 Reply from 13.248.68.72: bytes=32 time=20ms TTL=244 Reply from 13.248.68.72: bytes=32 time=19ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 19ms, Maximum = 23ms, Average = 20ms           </pre> <p>RTT avg: 20 ms</p>



Date: 10<sup>th</sup> December 2025 @ 12:20 CEST

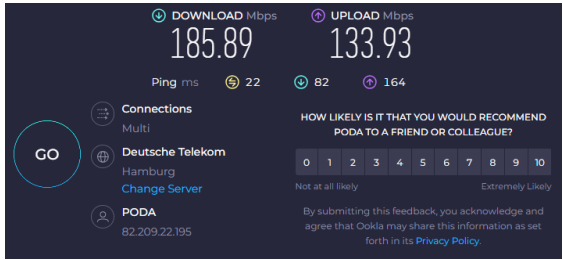
Note: Wi-fi connection under load

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	 <p>71.08 / 47.26 Mbit Down/Up</p>
Latency	50 ms 30 ms	29/99 ms Down/Up
Jitter	Not set	<pre> Connecting to host iperf3.moji.fr, port 5262 [ S] Local 192.168.100.24 port 65378 connected to 45.147.218.189 port 5262 [ ID] Interval      Transfer      Bitrate      Total Datagrams [ S] 0.00-1.02 sec  3.69 MBytes  38.5 Mbits/sec  2652 [ S] 1.02-2.02 sec  4.55 MBytes  38.1 Mbits/sec  3267 [ S] 2.02-3.01 sec  4.08 MBytes  34.4 Mbits/sec  2931 [ S] 3.01-4.01 sec  4.78 MBytes  48.2 Mbits/sec  3433 [ S] 4.01-5.00 sec  5.28 MBytes  44.5 Mbits/sec  3792 [ S] 5.00-6.00 sec  3.57 MBytes  38.0 Mbits/sec  2563 [ S] 6.00-7.01 sec  4.61 MBytes  38.2 Mbits/sec  3318 [ S] 7.01-8.01 sec  4.77 MBytes  48.2 Mbits/sec  3428 [ S] 8.01-9.01 sec  3.88 MBytes  32.6 Mbits/sec  2788 [ S] 9.01-10.01 sec  5.15 MBytes  45.3 Mbits/sec  3701 ----- [ ID] Interval      Transfer      Bitrate      Jitter      Lost/Total Datagrams [ S] 0.00-10.01 sec  44.4 MBytes  37.2 Mbits/sec  0.000 ms  0/31865 (0%) sender [ S] 0.00-10.06 sec  44.4 MBytes  37.0 Mbits/sec  0.539 ms  1/31857 (0.0031%) receiver           </pre> <p>0.539 ms</p>
Ping / Round Trip Time	50 ms 30 ms	<pre> Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=22ms TTL=244 Reply from 13.248.68.72: bytes=32 time=22ms TTL=244 Reply from 13.248.68.72: bytes=32 time=22ms TTL=244 Reply from 13.248.68.72: bytes=32 time=24ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 22ms, Maximum = 24ms, Average = 22ms           </pre> <p>RTT avg: 22 ms</p>



Date: 15<sup>th</sup> December 2025 @ 12:20 CEST

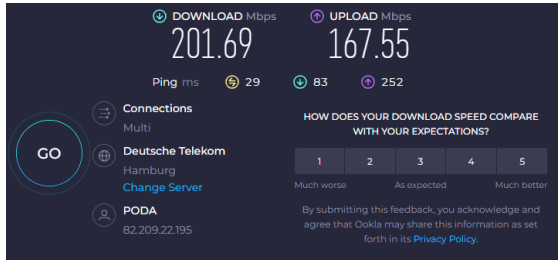
Note:

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	 <p>185.89 / 133.93 Mbit Down/Up</p>
Latency	50 ms 30 ms	82/164 ms Down/Up
Jitter	Not set	<pre> Connecting to host iperf3.moj1.fr, port 5202 [ 5] local 192.168.180.92 port 64889 connected to 45.147.210.189 port 5202 [ ID] Interval      Transfer      Bitrate      Total Datagrams [ 5] 0.00-1.01 sec  6.82 MBytes  56.6 Mbits/sec  4896 [ 5] 1.01-2.01 sec  6.67 MBytes  56.1 Mbits/sec  4791 [ 5] 2.01-3.00 sec  12.3 MBytes  104 Mbits/sec  8838 [ 5] 3.00-4.01 sec  6.82 MBytes  57.2 Mbits/sec  4980 [ 5] 4.01-5.02 sec  7.38 MBytes  61.2 Mbits/sec  5298 [ 5] 5.02-6.01 sec  7.41 MBytes  62.6 Mbits/sec  5321 [ 5] 6.01-7.00 sec  6.14 MBytes  51.7 Mbits/sec  4410 [ 5] 7.00-8.02 sec  9.77 MBytes  81.1 Mbits/sec  7017 [ 5] 8.02-9.01 sec  8.13 MBytes  68.6 Mbits/sec  5836 [ 5] 9.01-10.04 sec  6.29 MBytes  51.2 Mbits/sec  4518 ----- [ ID] Interval      Transfer      Bitrate      Jitter      Lost/Total Datagrams [ 5] 0.00-10.04 sec  77.7 MBytes  64.9 Mbits/sec  0.000 ms  0/55825 (0%) sender [ 5] 0.00-10.11 sec  77.7 MBytes  64.5 Mbits/sec  0.329 ms  0/55824 (0%) receiver           </pre> <p>0.329 ms</p>
Ping / Round Trip Time	50 ms 30 ms	<pre> Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=22ms TTL=244 Reply from 13.248.68.72: bytes=32 time=20ms TTL=244 Reply from 13.248.68.72: bytes=32 time=21ms TTL=244 Reply from 13.248.68.72: bytes=32 time=21ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 20ms, Maximum = 22ms, Average = 21ms           </pre> <p>RTT avg: 21 ms</p>



Date: 13<sup>th</sup> January 2026 @ 8:40 CEST

Note:

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	 <p>201.69 / 167.55 Mbit Down/Up</p>
Latency	50 ms 30 ms	29/83 ms Down/Up
Jitter	Not set	<pre> Connecting to host iperf3.mejil.fr, port 5200 [ 5] local 192.168.100.45 port 50146 connected to 45.147.210.189 port 5200 [ ID] Interval      Transfer     Bitrate     Total Datagrams [ 5] 0.00-1.02 sec  17.3 MBytes  143 Mbits/sec  12485 [ 5] 1.02-2.01 sec  17.6 MBytes  149 Mbits/sec  12674 [ 5] 2.01-3.00 sec  18.6 MBytes  157 Mbits/sec  13364 [ 5] 3.00-4.01 sec  19.6 MBytes  163 Mbits/sec  14046 [ 5] 4.01-5.00 sec  15.9 MBytes  134 Mbits/sec  11391 [ 5] 5.00-6.01 sec  18.0 MBytes  150 Mbits/sec  12983 [ 5] 6.01-7.00 sec  19.2 MBytes  162 Mbits/sec  13759 [ 5] 7.00-8.01 sec  18.5 MBytes  153 Mbits/sec  13253 [ 5] 8.01-9.02 sec  19.0 MBytes  158 Mbits/sec  13639 [ 5] 9.02-10.00 sec 18.4 MBytes  156 Mbits/sec  13216 ----- [ ID] Interval      Transfer     Bitrate     Jitter    Lost/Totals  Datagrams [ 5] 0.00-10.00 sec  182 MBytes  153 Mbits/sec  0.000 ms  0/130650 (0% sender) [ 5] 0.00-10.00 sec  182 MBytes  152 Mbits/sec  0.001 ms  12/130650 (0.0092% receiver)           </pre> <p>0.061 ms</p>
Ping / Round Trip Time	50 ms 30 ms	<pre> Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=20ms TTL=244 Reply from 13.248.68.72: bytes=32 time=18ms TTL=244 Reply from 13.248.68.72: bytes=32 time=18ms TTL=244 Reply from 13.248.68.72: bytes=32 time=19ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 18ms, Maximum = 20ms, Average = 18ms           </pre> <p>RTT avg: 18 ms</p>



## Summary of results of VR Lab at JVTP



- the amount of VR equipment is sufficient
- the physical space is sufficient
- Network parameters were within the recommended ranges, except latency, which when measured with speedtest was higher than the recommended, especially in upload direction. However the measurements by the ping command shows that to a server in the same geographical region produced better values, which were within the recommended range. In some cases this could impact the user experience when using collaborative applications, however it depends on the servers used by the application in question.

Overall, the VR Laboratory located at JVTP fulfills the defined criteria set.




## Results from the VR Lab at OTH (PP8)

### Checklist

Item	Minimum Recommended	Results measured
Headsets	1x Meta Quest 2 3x Meta Quest 2/3	15x Meta Quest 3 2 x HTC VIVE PRO 2 8 Router One setup with one class. A setup normally includes three VR headsets. See Appendix 1 for more information. 
Available space	1x: 2x2 metres 3x: 2x2 metres	1x: 4x4metres The following images refer to the VR lab, which was adapted in period 6. For reasons of sustainability, an additional room was set up within the university that could also be used after the end of the project. 



		
<b>Mobile?</b>	<b>Yes/No</b>	Yes, in addition to internal testing in the project countries, we also tested it in 35 nursing schools and at external conferences and meetings. Mobile lending was made possible in 21 institutions over a trial period of six weeks.




## Connection measurement results

Date: 17.09.2025 | 11:10

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	<p><b>181.99 / 34,44 Mbit Down/Up</b></p>
Latency	50 ms 30 ms	<p><b>26.4 ms Ping</b> <b>5.33 ms Jitter</b> <b>102 Mbit/s Download</b> <b>101 Mbit/s Upload</b></p>
Jitter	Not set	<pre> Connecting to host iperf3.moji.fr, port 5202 [ 5] local 172.19.32.158 port 53565 connected to 45.147.210.189 port 5202 [ ID] Interval      Transfer  Bitrate  Total Datagrams [ 5] 0.00-1.01 sec  92.6 MBytes  770 Mbits/sec  77038 [ 5] 1.01-2.00 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 2.00-3.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 3.01-4.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 4.01-5.00 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 5.00-6.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 6.01-7.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 7.01-8.00 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 8.00-9.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 9.01-10.01 sec 0.00 Bytes  0.00 bits/sec  0 ----- [ ID] Interval      Transfer  Bitrate  Jitter  Lost/Total Datagrams [ 5] 0.00-10.01 sec  92.6 MBytes  77.6 Mbits/sec  0.000 ms  0/77038 (0%) sender [ 5] 0.00-19.56 sec  92.6 MBytes  39.7 Mbits/sec  0.242 ms  0/77038 (0%) receiver           </pre> <p><b>0.242ms</b></p>
Ping / Round Trip Time	50 ms 30 ms	<b>RTT avg: 18 ms</b>



Date: 29.09.2025 | 09:25

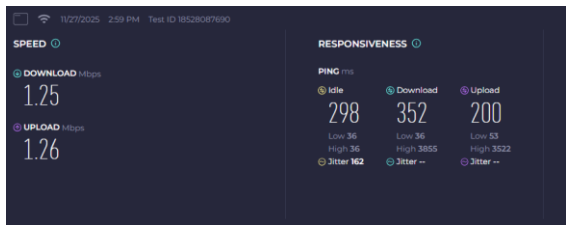
Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	 <p>810.90 / 744,18 Mbit Down/Up</p>
Latency	50 ms 30 ms	43/38 ms Down/Up
Jitter	Not set	<pre>(base) l@rcbe-mob-135 ~ % iperf3 -u -b 0 -c iperf3.moji.fr -p 5202 Connecting to host iperf3.moji.fr, port 5202 [ 7 ] local 10.121.1.47 port 59362 connected to 45.147.210.189 port 5202 [ ID ] Interval      Transfer  Bitrate   Total Datagrams [ 7 ] 0.00-1.00 sec  118 MBytes  986 Mbits/sec  85118 [ 7 ] 1.00-2.00 sec  113 MBytes  945 Mbits/sec  81884 [ 7 ] 2.00-3.00 sec  113 MBytes  948 Mbits/sec  81542 [ 7 ] 3.00-4.00 sec  114 MBytes  954 Mbits/sec  82655 [ 7 ] 4.00-5.01 sec  113 MBytes  948 Mbits/sec  81904 [ 7 ] 5.01-6.00 sec  113 MBytes  952 Mbits/sec  81836 [ 7 ] 6.00-7.01 sec  114 MBytes  952 Mbits/sec  82578 [ 7 ] 7.01-8.00 sec  113 MBytes  951 Mbits/sec  82879 [ 7 ] 8.00-9.01 sec  114 MBytes  954 Mbits/sec  82428 [ 7 ] 9.01-10.01 sec 113 MBytes  952 Mbits/sec  82158 ----- [ ID ] Interval      Transfer  Bitrate   Jitter  Lost/Total Datagrams [ 7 ] 0.00-10.01 sec  1.11 GBytes  954 Mbits/sec  0.000 ms  0/824166 (0%) sender [ 7 ] 0.00-10.03 sec  1.10 GBytes  945 Mbits/sec  0.009 ms  3068/828928 (0.37%) receiver</pre> <p>0.009ms</p>
Ping / Round Trip Time	50 ms 30 ms	RTT avg: 12 ms



Date: 08.10.2025 | 12:00

Note: mobile lab setup

Remark: Results too low, therefore termination and use of existing network structure in the educational institution

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	
Latency	50 ms 30 ms	
Jitter	Not set	
Ping / Round Trip Time	50 ms 30 ms	



Date: 09.10.2025 | 10:00

Note: mobile lab setup

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	
Latency	50 ms 30 ms	109/79 ms Down/Up
Jitter	Not set	<pre> Connecting to host iperf3.moj1.fr, port 5202 [ 5] Local 172.19.32.188 port 53505 connected to 45.107.210.189 port 5202 [ ID] Interval      Transfer      Bitrate      Total Datagrams [ 5] 0.00-1.01 sec  92.6 MBytes  77.0 Mbits/sec  77938 [ 5] 1.01-2.00 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 2.00-3.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 3.01-4.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 4.01-5.00 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 5.00-6.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 6.01-7.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 7.01-8.00 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 8.00-9.01 sec  0.00 Bytes  0.00 bits/sec  0 [ 5] 9.01-10.01 sec 0.00 Bytes  0.00 bits/sec  0 ----- [ ID] Interval      Transfer      Bitrate      Jitter  Lost/Total Datagrams [ 5] 0.00-10.01 sec  92.6 MBytes  77.6 Mbits/sec  0.000 ms  0/77938 (0%) sender [ 5] 0.00-19.56 sec  92.6 MBytes  39.7 Mbits/sec  0.242 ms  0/77938 (0%) receiver iperf Done PS C:\Users\Uca40638\Downloads&gt;iperf -s -i -min60v -l iperf3.exe -n -b 0 -c iperf3.moj1.fr -p 5202 Connecting to host iperf3.moj1.fr, port 5202 </pre>
Ping / Round Trip Time	50 ms 30 ms	RTT avg: 14 ms



Date: 15.10.2025 | 14:00

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	
Latency	50 ms 30 ms	62/28 ms Down/Up
Jitter	Not set	<pre>(base) lk@rbe-mob-135 ~ % iperf3 -u -b 0 -c iperf3.moji.fr -p 5203 Connecting to host iperf3.moji.fr, port 5203 [ 7] local 19.121.1.47 port 56493 connected to 45.147.210.189 port 5203 [ ID] Interval      Transfer  Bitrate  Total Datagrams [ 7] 0.00-1.00 sec  116 Mbytes  974 Mbits/sec  84899 [ 7] 1.00-2.01 sec  113 Mbytes  945 Mbits/sec  82893 [ 7] 2.01-3.00 sec  112 Mbytes  948 Mbits/sec  81456 [ 7] 3.00-4.00 sec  113 Mbytes  947 Mbits/sec  81828 [ 7] 4.00-5.00 sec  112 Mbytes  948 Mbits/sec  81854 [ 7] 5.00-6.01 sec  113 Mbytes  944 Mbits/sec  81974 [ 7] 6.01-7.00 sec  113 Mbytes  952 Mbits/sec  81865 [ 7] 7.00-8.00 sec  114 Mbytes  958 Mbits/sec  82689 [ 7] 8.00-9.00 sec  114 Mbytes  955 Mbits/sec  82450 [ 7] 9.00-10.00 sec 114 Mbytes  955 Mbits/sec  82361 ----- [ ID] Interval      Transfer  Bitrate  Jitter  Lost/TOTAL Datagrams [ 7] 0.00-10.00 sec  1.11 Gbytes  952 Mbits/sec  0.000 ms  0/821679 (0%) sender [ 7] 0.00-10.02 sec  1.10 Gbytes  942 Mbits/sec  0.009 ms  3145/818286 (0.38%) receiver iperf Done.</pre>
Ping / Round Trip Time	50 ms 30 ms	RTT avg: 15 ms



Date: 17.10.2025 | 08:00

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	<p>SPEEDTEST by OOKLA 11/24/2025 10:34 AM GMT @Speedtest DOWNLOAD Mbps: 725.97 UPLOAD Mbps: 644.35 Ping ms: 28, 83, 46 Deutsches Forschungs... Deutsche Telekom Speedtest.net Berlin</p>
Latency	50 ms 30 ms	<p>LibreSpeed Start Ping: 27.9 ms Jitter: 6.68 ms Download: 94.5 Mbit/s Upload: 100 Mbit/s 212.201.131.47 - Verein zur Förderung eines Deutschen Forschungsnetzes e.V., Germany</p>
Jitter	Not set	<pre>(base) lk@rcbe-mob-135 ~ % iperf3 -u -b 0 -c iperf3.moji.fr -p 5203 Connecting to host iperf3.moji.fr, port 5203 [ 7] local 10.121.1.47 port 50493 connected to 45.147.210.189 port 5203 [ ID] Interval      Transfer  Bitrate  Total Datagrams [ 7] 0.00-1.00 sec  116 MBytes  974 Mbits/sec  84099 [ 7] 1.00-2.01 sec  113 MBytes  945 Mbits/sec  82803 [ 7] 2.02-3.00 sec  112 MBytes  948 Mbits/sec  81456 [ 7] 3.00-4.00 sec  113 MBytes  947 Mbits/sec  81928 [ 7] 4.00-5.00 sec  112 MBytes  940 Mbits/sec  81054 [ 7] 5.00-6.01 sec  113 MBytes  944 Mbits/sec  81874 [ 7] 6.02-7.00 sec  113 MBytes  952 Mbits/sec  81865 [ 7] 7.00-8.00 sec  114 MBytes  958 Mbits/sec  82589 [ 7] 8.00-9.00 sec  114 MBytes  955 Mbits/sec  82450 [ 7] 9.00-10.00 sec 114 MBytes  955 Mbits/sec  82361 ----- [ ID] Interval      Transfer  Bitrate  Jitter  Lost/Total Datagrams [ 7] 0.00-10.00 sec  1.11 GBytes  952 Mbits/sec  0.000 ms  0/821679 (0%) sender [ 7] 0.00-10.02 sec  1.10 GBytes  942 Mbits/sec  0.009 ms  3145/818286 (0.38%) receiver iperf Done.</pre>
Ping / Round Trip Time	50 ms 30 ms	RTT avg: 18 ms



Date: 07.11.2025 | 17:00

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	
Latency	50 ms 30 ms	
Jitter	Not set	<pre>(base) lk@rcbe-mob-135 ~ % iperf3 -u -b 0 -c iperf3.moji.fr -p 5284 Connecting to host iperf3.moji.fr, port 5284 [ 7] local 172.20.36.218 port 63814 connected to 45.147.210.189 port 5284 [ ID] Interval      Transfer  Bitrate  Total Datagrams [ 7] 0.00-1.00 sec  116 MBytes  971 Mbits/sec  83933 [ 7] 1.00-2.00 sec  116 MBytes  955 Mbits/sec  82667 [ 7] 2.00-3.01 sec  115 MBytes  968 Mbits/sec  83886 [ 7] 3.01-4.01 sec  114 MBytes  957 Mbits/sec  82592 [ 7] 4.01-5.00 sec  114 MBytes  962 Mbits/sec  82719 [ 7] 5.00-6.00 sec  115 MBytes  968 Mbits/sec  82987 [ 7] 6.00-7.00 sec  115 MBytes  959 Mbits/sec  83844 [ 7] 7.00-8.00 sec  114 MBytes  968 Mbits/sec  82647 [ 7] 8.00-9.01 sec  115 MBytes  962 Mbits/sec  83288 [ 7] 9.01-10.00 sec  114 MBytes  963 Mbits/sec  82798 ----- [ ID] Interval      Transfer  Bitrate  Jitter  Lost/Total Datagrams [ 7] 0.00-10.00 sec  1.12 GBytes  961 Mbits/sec  0.800 ms  0/829560 (0%) sender [ 7] 0.00-10.02 sec  1.11 GBytes  952 Mbits/sec  0.812 ms  2532/826178 (0.31%) receiver iperf Done.</pre>
Ping / Round Trip Time	50 ms 30 ms	RTT avg: 18 ms




Date: 14.11.2025 | 15:00

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	
Latency	50 ms 30 ms	
Jitter	Not set	<pre>(base) lk@rbc-mob-135 ~ % iperf3 -u -b 0 -c iperf3.moji.fr -p 5203 Connecting to host iperf3.moji.fr, port 5203 [ 7 ] local 19.121.1.47 port 56493 connected to 45.147.219.189 port 5203 [ ID] Interval      Transfer  Bitrate  Total Datagrams [ 7 ] 0.00-1.00 sec  116 MBytes  974 Mbits/sec  84099 [ 7 ] 1.00-2.01 sec  113 MBytes  945 Mbits/sec  82003 [ 7 ] 2.01-3.00 sec  112 MBytes  948 Mbits/sec  81456 [ 7 ] 3.00-4.00 sec  113 MBytes  947 Mbits/sec  81928 [ 7 ] 4.00-5.00 sec  112 MBytes  940 Mbits/sec  81954 [ 7 ] 5.00-6.01 sec  113 MBytes  944 Mbits/sec  81874 [ 7 ] 6.01-7.00 sec  113 MBytes  952 Mbits/sec  81865 [ 7 ] 7.00-8.00 sec  114 MBytes  958 Mbits/sec  82689 [ 7 ] 8.00-9.00 sec  114 MBytes  955 Mbits/sec  82450 [ 7 ] 9.00-10.00 sec  114 MBytes  955 Mbits/sec  82361 -- -- -- -- -- [ ID] Interval      Transfer  Bitrate  Jitter  Lost/Total Datagrams [ 7 ] 0.00-10.00 sec  1.11 GBytes  952 Mbits/sec  0.000 ms  0/821679 (0%) sender [ 7 ] 0.00-10.02 sec  1.10 GBytes  942 Mbits/sec  0.009 ms  3145/818286 (0.38%) receiver iperf Done.</pre>
Ping / Round Trip Time	50 ms 30 ms	



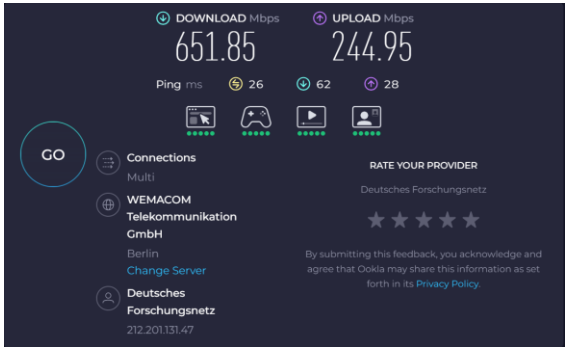
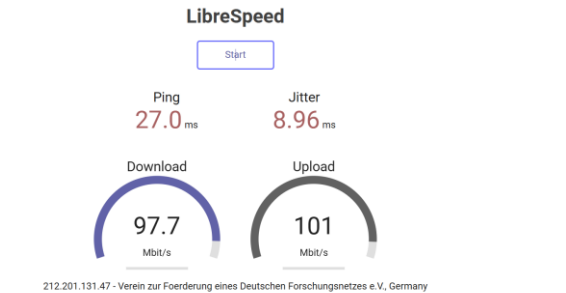
Date: 17.11.2025 | 11:00

Note: mobile lab setup

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	
Latency	50 ms 30 ms	
Jitter	Not set	
Ping / Round Trip Time	50 ms 30 ms	



Date: 24.11.2025 | 08:00

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	
Latency	50 ms 30 ms	
Jitter	Not set	<pre data-bbox="839 1391 1406 1429">[ ID] Interval      Transfer  Bitrate    Jitter    Lost/Total Datagrams [ 5] 0.00-10.01 sec  423 BBytes 354 Mbits/sec 0.000 ms 0/354716 (0%) sender</pre>
Ping / Round Trip Time	50 ms 30 ms	



## Summary of results of VR Lab at OTH



- the amount of VR equipment is sufficient
- the physical space is sufficient
- Network parameters were within the recommended ranges, except in some cases where the mobile lab setup were used. In one occasion, the testing was not finished because the network was unusable. This aligns with the preliminary assumption that the mobile lab setup could be used in the same way as the fixed IT infrastructure in the laboratory.

Overall, the VR Laboratory located at OTH fulfills the defined criteria set.



## Results from the VR Lab at SZE (PP10)

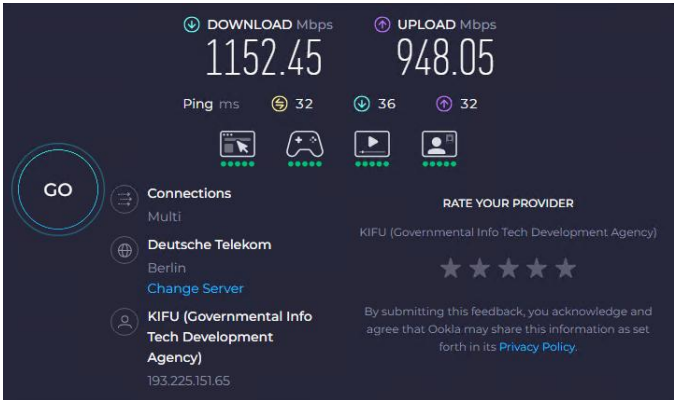
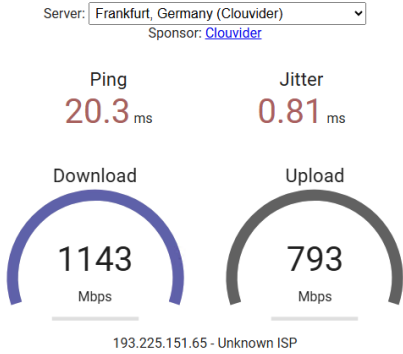
### Checklist

Item	Minimum Recommended	Results measured
Headsets	1x Meta Quest 2 3x Meta Quest 2/3	2x Meta Quest 2 3 x Meta Quest 3 
Available space	1x: 2x2 metres 3x: 2x2 metres	1x: 3x3metres In the VR laboratory one or two participant can use the available space with headsets. 
Mobile?	Yes/No	Yes, we can lend portable mobile routers for network coverage. These, together with the headsets and optional equipment (dummy for VR-CPR) can be relocated to elsewhere.



## Connection measurement results

Date: 23.09.2025, Time: 09:00 CET

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	 <p>speedtest: down: 1152.45 Mbit/s, up: 948,05 Mbit/s</p>  <p>librspeed: down: 1143 Mbit/s, up: 793 Mbit/s</p>
Latency	50 ms 30 ms	<p>speedtest: 32ms</p> <p>librspeed: 20.3ms</p>
Jitter	Not set	librspeed: 0.81ms
Ping / Round Trip Time	50 ms 30 ms	<pre>Pinging 13.248.68.72 with 32 bytes of data: Reply from 13.248.68.72: bytes=32 time=22ms TTL=244 Reply from 13.248.68.72: bytes=32 time=22ms TTL=244 Reply from 13.248.68.72: bytes=32 time=22ms TTL=244  Ping statistics for 13.248.68.72:     Packets: Sent = 3, Received = 3, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 22ms, Maximum = 22ms, Average = 22ms</pre> <p>Round Trip time average: 22 ms</p>



Date: 14.10.2025, Time: 09:00 CET

Item	Minimum Recommended	Results measured
<b>Connection speed/bitrate</b>	<b>25/5 Mbit</b> <b>200/50 Mbit</b>	<p>speedtest: down: 1206.51 Mbit/s, up: 1027,96 Mbit/s</p> <p>Server: <input type="text" value="Frankfurt, Germany (Clouvider)"/> Sponsor: <a href="#">Clouvider</a></p> <p>Ping <b>20.6</b> ms      Jitter <b>0.90</b> ms</p> <p>Download <b>1189</b> Mbps      Upload <b>539</b> Mbps</p> <p>193.225.151.65 - Unknown ISP</p> <p>librespeed: down: 1189 Mbit/s, up: 539 Mbit/s</p>
<b>Latency</b>	<b>50 ms</b> <b>30 ms</b>	speedtest: 31ms librespeed: 20.6ms
<b>Jitter</b>	<b>Not set</b>	librespeed: 0.90ms
<b>Ping / Round Trip Time</b>	<b>50 ms</b> <b>30 ms</b>	Round Trip time average: 20 ms

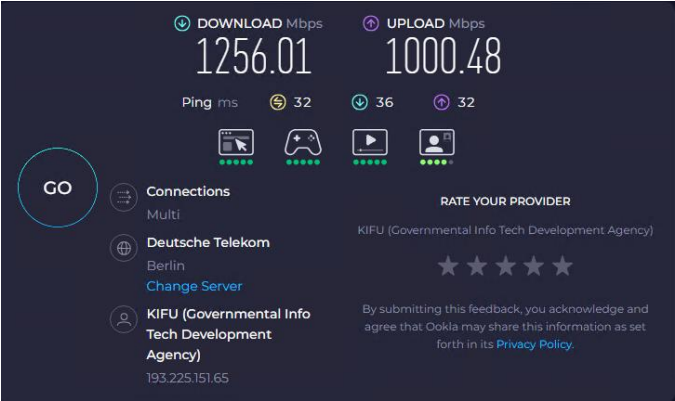


Date: 15.10.2025, Time: 09:00 CET

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	<p>speedtest: down: 1216.75 Mbit/s, up: 1021,79 Mbit/s</p> <p>Server: <input type="text" value="Prague, Czech Republic (CESNET)"/> Sponsor: <a href="#">CESNET</a></p> <p>Ping 12.0 ms Jitter 0.25 ms</p> <p>Download 1190 Mbps Upload 1886 Mbps</p> <p>193.225.151.65</p> <p>librespeed: down: 1190 Mbit/s, up: 1886 Mbit/s</p>
Latency	50 ms 30 ms	speedtest: 31ms librespeed: 12.0ms
Jitter	Not set	librespeed: 0.25ms
Ping / Round Trip Time	50 ms 30 ms	Round Trip time average: 23 ms




Date: 21.10.2025, Time: 09:00 CET

Item	Minimum Recommended	Results measured
<b>Connection speed/bitrate</b>	<b>25/5 Mbit</b> <b>200/50 Mbit</b>	 <p>speedtest: down: 1256.01 Mbit/s, up: 1000,48 Mbit/s</p> <p>Server: <input type="text" value="Frankfurt, Germany (Clouvider)"/> Sponsor: <a href="#">Clouvider</a></p> <p>Ping 20.0 ms Jitter 0.31 ms</p> <p>Download 995 Mbps Upload 611 Mbps</p> <p>193.225.151.65 - Unknown ISP</p> <p>librespeed: down: 995 Mbit/s, up: 611 Mbit/s</p>
<b>Latency</b>	<b>50 ms</b> <b>30 ms</b>	speedtest: 32ms librespeed: 20.0ms
<b>Jitter</b>	<b>Not set</b>	librespeed: 0.31ms
<b>Ping / Round Trip Time</b>	<b>50 ms</b> <b>30 ms</b>	Round Trip time average: 22 ms



Date: 29.10.2025, Time: 09:00 CET

Item	Minimum Recommended	Results measured
<p><b>Connection speed/bitrate</b></p>	<p>25/5 Mbit 200/50 Mbit</p>	 <p>speedtest: down: 1281.14 Mbit/s, up: 1038,78 Mbit/s</p> <p>Server: Frankfurt, Germany (Clouvider) Sponsor: Clouvider</p> <p>Ping 18.4 ms      Jitter 0.68 ms</p> <p>Download 1074 Mbps      Upload 587 Mbps</p> <p>193.225.151.65 - Unknown ISP</p> <p>librespeed: down: 1074 Mbit/s, up: 587 Mbit/s</p>
<p><b>Latency</b></p>	<p>50 ms 30 ms</p>	<p>speedtest: 31ms librespeed: 18.4ms</p>
<p><b>Jitter</b></p>	<p>Not set</p>	<p>librespeed: 0.68ms</p>
<p><b>Ping / Round Trip Time</b></p>	<p>50 ms 30 ms</p>	<p>Round Trip time average: 20 ms</p>



Date: 11.11.2025, Time: 09:00 CET

Item	Minimum Recommended	Results measured
Connection speed/bitrate	25/5 Mbit 200/50 Mbit	<p>speedtest: down: 1152.45 Mbit/s, up: 948,05 Mbit/s</p> <p>Server: <input type="text" value="Frankfurt, Germany (Clouvider)"/> Sponsor: <a href="#">Clouvider</a></p> <p>Ping 20.3 ms Jitter 0.30 ms</p> <p>Download 1191 Mbps Upload 592 Mbps</p> <p>193.225.151.65 - Unknown ISP</p> <p>librespeed: down: 1191 Mbit/s, up: 592 Mbit/s</p>
Latency	50 ms 30 ms	speedtest: 32ms librespeed: 20.3ms
Jitter	Not set	librespeed: 0.30ms
Ping / Round Trip Time	50 ms 30 ms	Round Trip time average: 21 ms



## Summary of results of VR Lab at SZE

- the amount of VR equipment is sufficient
- the physical space is sufficient
- Network parameters were within the recommended ranges at all times, with the fixed IT infrastructure provided in the laboratory.

Overall, the VR Laboratory located at SZE fulfills the defined criteria set.



## Recommendations

For institutions planning to deploy a professional and scalable VR solution, we recommend selecting the **Meta Quest 3** or **Meta Quest 3S** as the primary hardware platform. These headsets provide an optimal balance between performance, usability, and cost-efficiency, making them well suited for educational, medical, research, and development environments.

### Recommended Accessories

To ensure uninterrupted operation during extended sessions, additional **external battery packs** or **battery-equipped head straps** are strongly recommended. This enables continuous usage without downtime caused by charging cycles, which is particularly important in classroom or laboratory environments.

For hygiene and durability in multi-user settings, **antibacterial** or **medical-grade face covers** should be used. These improve user comfort, simplify cleaning procedures, and extend the lifespan of the device.

For users requiring vision correction, prescription lens inserts are recommended as an optional accessory. These provide a safer and more comfortable alternative to wearing glasses inside the headset and reduce the risk of damaging the headset lenses.

### PC Hardware Requirements (for Link, Air Link, and Live Workflows)

Although the Quest headsets function as standalone devices, PC connectivity significantly expands their capabilities for development, high-fidelity rendering, and Live Link workflows (e.g., Unreal Engine or other real-time engines).

For stable PC-VR usage, the following minimum hardware configuration is recommended:

- **Operating System:** Windows 11 (latest stable version recommended)
- **CPU:** Modern multi-core processor (Intel Core i5 / AMD Ryzen 5 or higher)
- **GPU:** Dedicated graphics card such as NVIDIA GeForce RTX 20-series or newer (RTX 3060 or higher recommended for demanding workflows) or equivalent AMD Radeon RX 6000-series or newer
- **Memory:** Minimum 16 GB RAM (32 GB recommended for development environments)
- **Storage:** SSD (NVMe preferred) for fast asset loading
- **Connectivity:** USB 3.2 port (for wired Link) or high-quality network interface for wireless workflows

This configuration ensures smooth rendering performance, low latency, and stable development workflows when using PC-tethered VR.

### Network Requirements for Casting and Air Link

For wireless casting and Air Link applications, network quality is critical. The following setup is strongly recommended:

- **Wi-Fi Standard:** 5 GHz Wi-Fi (802.11ac minimum; Wi-Fi 6 or Wi-Fi 6E preferred)
- **Dedicated Router:** A dedicated mobile or standalone router exclusively used for the VR setup
- **Network Topology:**



- PC connected to the router via wired Gigabit Ethernet
- Headset connected via 5 GHz Wi-Fi
- Both devices on the same local network and subnet
- **Channel Width:** 80 MHz or higher (where supported) for stable high-bandwidth streaming
- **Low Interference Environment:** Avoid congested networks or shared institutional Wi-Fi

Under these conditions, casting to external displays and Live Link streaming to real-time engines can operate with minimal latency and stable frame rates.