

TR-471: Automated speed test via TR-069 / TR-369

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**Complete
Home Networking**

Fritz!

FRITZ!

Everything for the home network



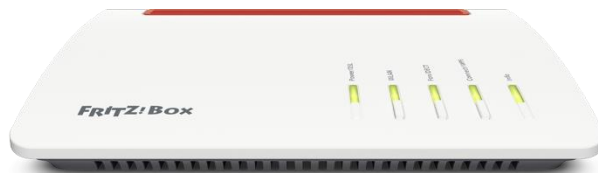
Founded in Berlin in 1986



Development in Berlin
Production in Europe:
Poland, Germany, Hungary



Outstanding security (0 CVSS
incidents since 2019)



Abstract

More and more countries regulators require ISP`s to show what speeds they actually deliver to their customers. But how to proof?

Within the BBF, the standard TR-471 is used for this purpose.

This presentation shows how this can be applied in practice

Why should we use TR-471?

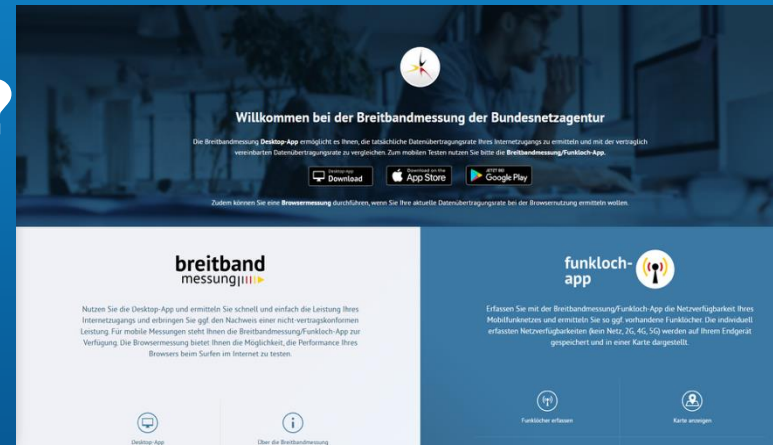
Disabling inhome network when measuring speed

- Bad Wi-Fi
- Poor in-house cabling
- Inappropriate hardware (NIC)

Just “proof” the Linkspeed!



Why should we use TR-471?

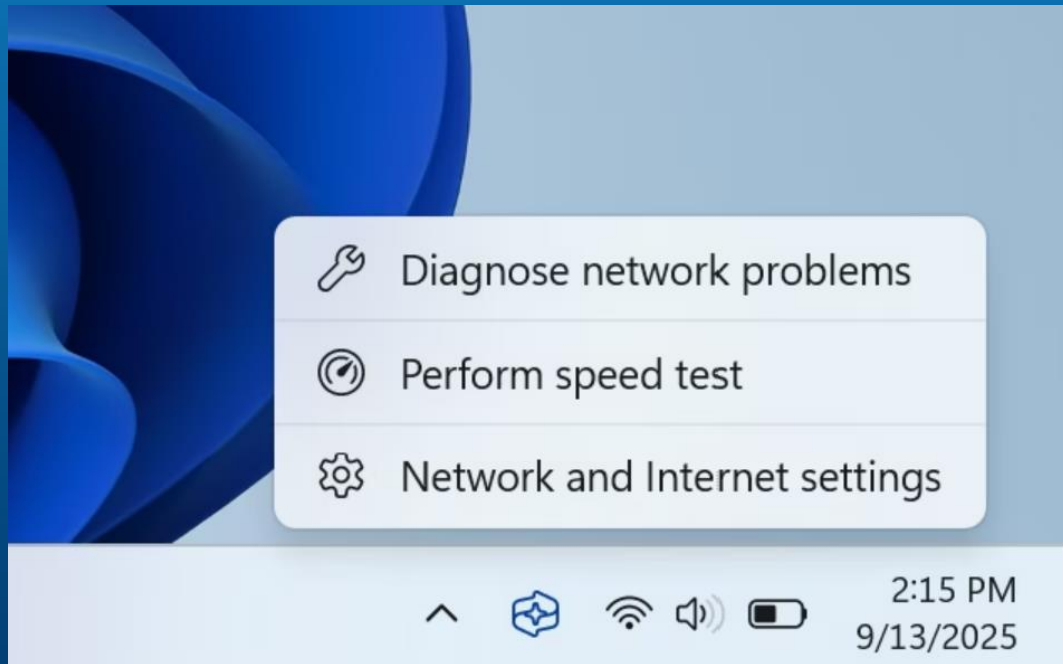


- “Use the desktop app to quickly and easily determine the performance of your Internet access and, if necessary, provide proof of non-compliant performance. The broadband measurement/radio gap app is available for mobile measurements. The browser measurement allows you to test the performance of your browser when surfing the Internet.”

<https://www.breitbandmessung.de/>

- With TR-471 you can debug in the event of line problems, proof to the customer if they report speed problems

Microsoft Windows 11



Source: <https://x.com/phantomofearth/status/1966975772033511751>

Fritz!

OBUDPST -> TR-471

OBUDPST (Open Broadband – User Datagram Protocol Speed Test):

- The **open-source implementation** of the Broadband Forum's TR-471 specification.
- Represents the practical toolset and project for executing **UDP-based IP capacity measurements**.
- Aims to provide a more accurate assessment of network performance, especially for **ultra-fast broadband** and **latency-sensitive applications**.

TR-471 (Broadband Forum Technical Report 471):

- Titled "Maximum IP-Layer Capacity Metric, Related Metrics, and Measurements."
- A **defined standard** by the Broadband Forum for quantifying and verifying broadband networks.
- Specifically designed to address the limitations of older **TCP-based speed tests** (like **TR-143**) in modern **Gigabit networks** and for increasing **UDP traffic** (e.g., QUIC).

Speedtest Croatia

← Croatia Median Country Speeds Updated July 2026

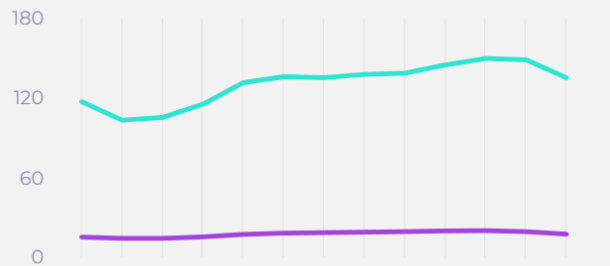
Mobile

Rank ⁻⁸
33

Download
135.33
Mbps

Upload
17.54
Mbps

Latency
21
ms



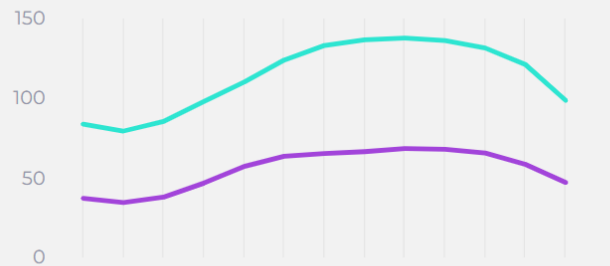
Fixed Broadband

Rank ⁻¹³
71

Download
98.56
Mbps

Upload
47.05
Mbps

Latency
9
ms



Transition & Impact: TR-471 vs. TR-143

Rationale for Transition:

- **Inaccuracy of TCP-based tests (TR-143):** TCP's slow start, congestion control, and sensitivity to packet loss often **underreport** actual network capacity, especially above 500 Mbps. (XGS-Pon Networks)
- **Rise of UDP Traffic:** Growing prevalence of latency-sensitive applications (gaming, UHD streaming, AR/VR) and protocols like **QUIC** necessitate **native UDP measurement**.
- **True Capacity Measurement:** Need to reveal the **true IP-layer capacity** of high-speed networks.

Key Changes Introduced by TR-471:

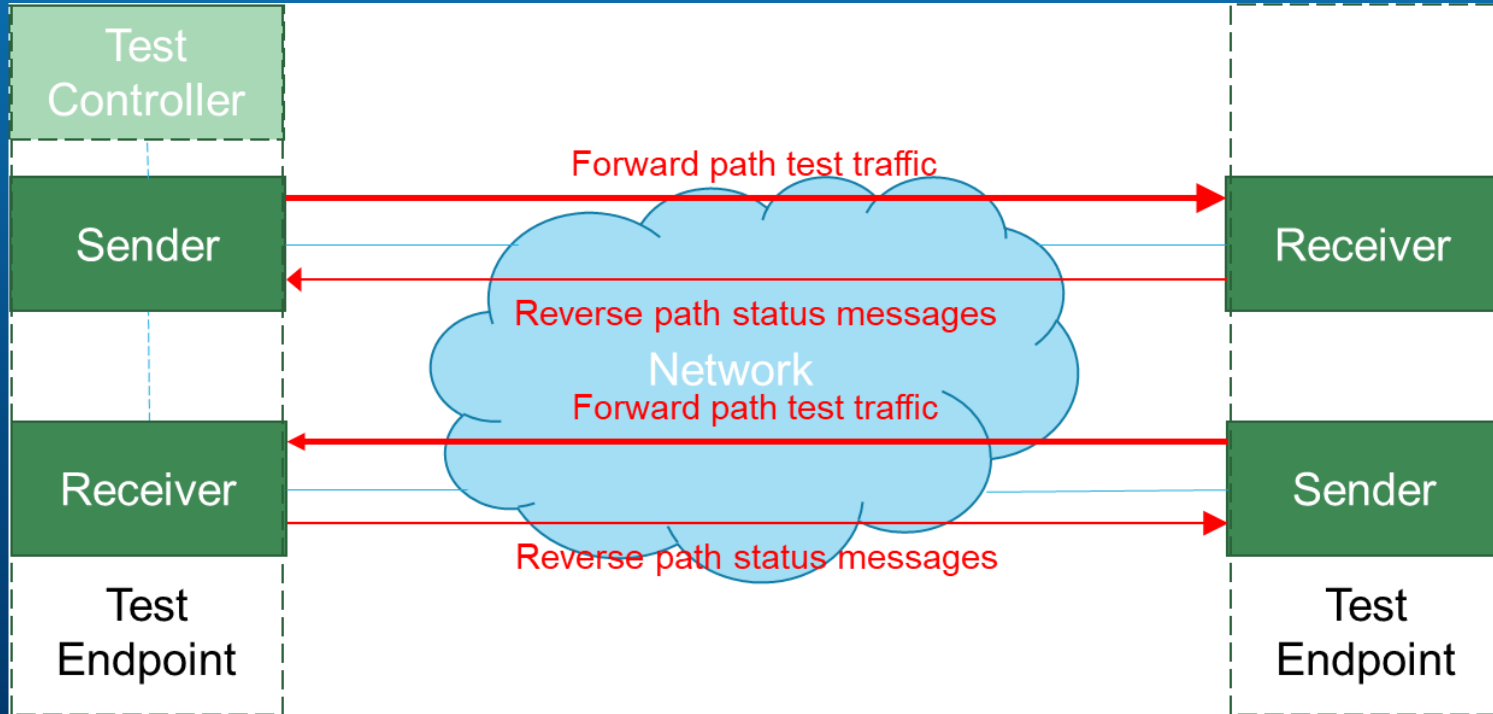
- **Protocol Shift:** Moves from primarily TCP-based testing (TR-143) to **native UDP-based IP-layer testing**.
- **Dynamic Measurement:** Employs a **dynamic Sending Rate Search Algorithm** for rapid determination of maximum capacity.
- **Enhanced Metrics:** Directly measures crucial performance indicators such as **one-way loss, packet reordering, and delay variation**, which TR-143 estimated via TCP retransmissions.



TR-471
**Maximum IP-Layer Capacity Metric, Related Metrics,
and Measurements**

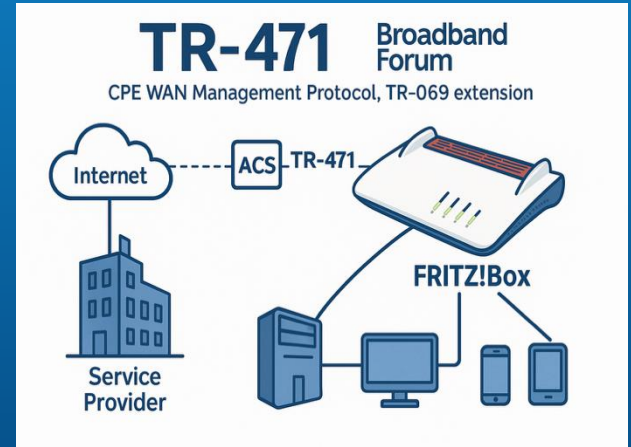
Issue: 4
Date: September 2024

Measurement Reference Architecture



TR-471

- Uses Native UDP
- Based on OB-UDPST (Opensource GitHub)
- Can be used with TR-69 and TR-369 (full automated)
- Main goal, Acces Link Testing
- Packet loss, Packet Reordering, delay etc.
- Also suitable for XGS.Pon and above Networks (High Speed)



Measurement with USP (TR-369)

The command in the USP data model controlling TR-471 (IPLayerCapacity) is placed under:

Device.IP.Diagnostics.IPLayerCapacity()

ADD "Device.LocalAgent.Subscription."

{

Enable = "1",

NotifType = "OperationComplete",

ReferenceList = "Device.IP.Diagnostics.IPLayerCapacity()"

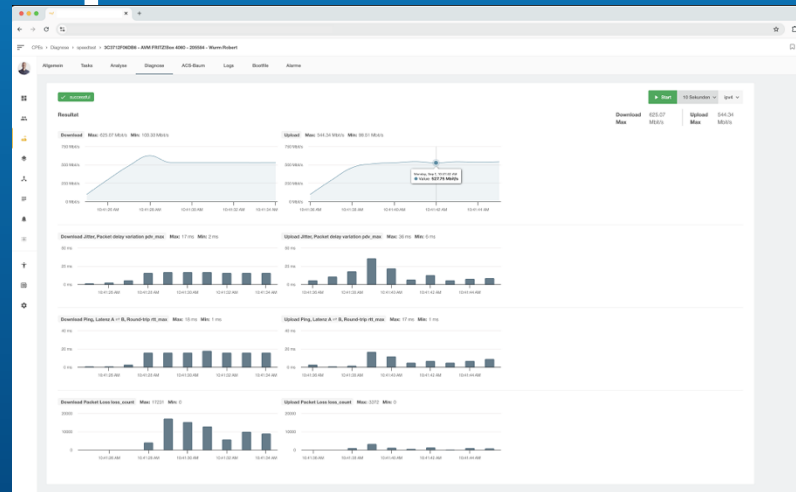
}

Measurement with USP (TR-369)

- The command can be executed more than once, eg.: once with Role='Receiver' (Downstream-Test) and once with Role='Sender' (Upstream-Test)
- Note: Only the ["Host"] input argument is mandatory, others are optional (if not set, default is used)
- *After the test has finished, you will retrieve a "OperationComplete"*
-Message containing the JSON-Result test results.

```
1 |  
2 | "command_key": "speedtest",  
3 | "protocol_version": "IPv6",  
4 | "speed_test_diagnostics_task_id": "83aabc6-bf3e-4ac4-ae00-854d0985081d",  
5 | "send_response": true,  
6 | "host": "192.168.1.1",  
7 | "role": "Sender",  
8 | "x_auth_key": " " |
```

TR-471 Measurement (Example GUI)



STATUS	HOSTNAME	TYPE	IP VERSION	DURATION	DOWNLOAD		UPLOAD		USERS	CREATED AT	
					AVG	MAX	AVG	MAX			
(All)									(All)		
✔ successful	2a03:b0c0:3:f0:fc03:2000	download_upload	ipv6	10 sec	52.08 Mbit/s	53.87 Mbit/s	8.48 Mbit/s	9.24 Mbit/s	Eric van Uden	< 1 minute	
✔ successful	2a03:b0c0:3:f0:fc03:2000	download_upload	ipv6	10 sec	51.49 Mbit/s	53.83 Mbit/s	8.46 Mbit/s	9.55 Mbit/s	Eric van Uden	1 day	
✔ successful	2a03:b0c0:3:f0:fc03:2000	download_upload	ipv6	10 sec	52.05 Mbit/s	53.86 Mbit/s	8.46 Mbit/s	9.08 Mbit/s	Eric van Uden	18-07-2025	
✔ successful	46.101.113.189	download_upload	ipv4	10 sec	52.05 Mbit/s	53.85 Mbit/s	8.61 Mbit/s	9.59 Mbit/s	Eric van Uden	18-07-2025	
✔ successful	2a03:b0c0:3:f0:fc03:2000	download_upload	ipv6	10 sec	51.99 Mbit/s	53.85 Mbit/s	8.46 Mbit/s	9.2 Mbit/s	Eric van Uden	14-07-2025	
✔ successful	2a03:b0c0:3:f0:fc03:2000	download_upload	ipv6	10 sec	52.01 Mbit/s	53.85 Mbit/s	8.55 Mbit/s	9.44 Mbit/s	Eric van Uden	11-07-2025	
✔ successful	2a03:b0c0:3:f0:fc03:2000	download_upload	ipv6	10 sec	52.03 Mbit/s	53.85 Mbit/s	8.48 Mbit/s	9.27 Mbit/s	Eric van Uden	08-07-2025	
✔ successful	2a03:b0c0:3:f0:fc03:2000	download_upload	ipv6	10 sec	52.07 Mbit/s	53.85 Mbit/s	8.53 Mbit/s	9.43 Mbit/s	Eric van Uden	04-07-2025	

Network X Vienna

Stand J4

And at BBF Stand



13 – 15 October, 2026
Vienna, Austria



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Thanks!

**Your freedom.
Your home.
Your FRITZ!**

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