



WiFiMon ASNET-AM Pilot

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Exploring Virtualization & Monitoring Opportunities in Networking

Workshop, Yerevan, Armenia

October 5th, 2023

A circular icon for WiFiMon, divided into three segments. The top-right segment contains a white Wi-Fi signal symbol. The bottom segment is white, and the top-left segment is dark blue.

WiFiMon

FEEL, SEE AND UNDERSTAND YOUR WIFI

TNC19 (Tallinn, Estonia - June 2019)

- Monitored conference Wi-Fi network during TNC19 days
- Based on WiFiMon Hardware Probe (WHP) measurements – 5 WHP's
- More than 800 participants

Pilot Outcomes:

- **WiFiMon detects significant throughput drops and delivers useful insight about Wi-Fi performance**
- **First WiFiMon crash test was considered successful**

GÉANT Symposium 2020 (Ljubljana, Slovenia - February 2020)

- Monitored **eduroam** during the conference days
- Based on both crowdsourced and probe measurements (7 WHP's)
- Roughly 250 participants

Pilot Outcomes:

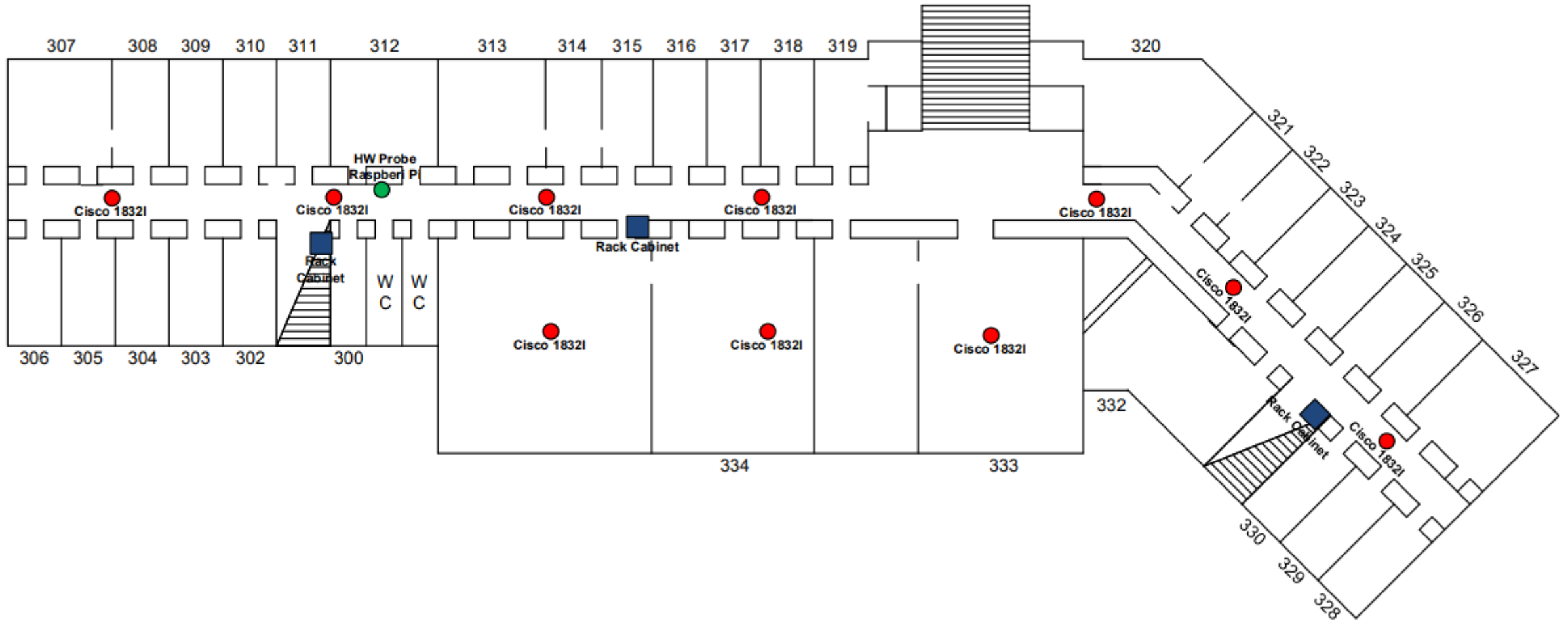
- WiFiMon detects Wi-Fi performance degradation
- Probe measurements verify the trends of crowdsourced measurements
- WiFiMon detects drops that are not reported by WLAN NIC measurements

The 3rd WiFiMon conference pilot

- Monitoring **eduroam** at the Institute for Informatics and Automation Problems (IIAP) - National Academy of Sciences of Armenia
- Monitoring since **September 21st**
- Monitoring about 50-100 people (researchers, professors, engineers, students)
- Measurements from 1 WHP (Raspberry Pi 4 Model B) – placed on the floor
- WAS/WTS installed in a single VM with 4 vCPU's, 8 GB RAM (WiFiMon v. 2.1.0)

Pilot Goal:

- Experiment with newly introduced WiFiMon features
- Help ASNET-AM Wi-Fi administrators identify interesting points requiring further inspection



Monitored area blueprints: WHP is placed at the green bullet

Overview of WiFiMon Measurements (1/8)



Overview

Guide Help Check for updates Logout

Overview

Measurements

Crowdsourced

HW Probes

TWAMP

Statistics

Maps

Configuration

Metrics: Measurements overview

318 Total Count	5,067.569 AvgDL (KBps)	99 MinDL (KBps)	8,684 MaxDL (KBps)	3,736.969 AvgUL (KBps)	0 MinUL (KBps)	12,386 MaxUL (KBps)	16.739 Avg ping	5 Min ping	141.5 Max ping	1 IPs count	0 Users count
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1 Clients MAC	1 APs MAC	3 Test Tools	1 Clients OS	1 Clients Browser
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The **Overview** tab summarizes received measurements on a daily basis



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Total number of received measurements (since midnight)

1 Clients MAC	1 APs MAC	3 Test Tools	1 Clients OS	1 Clients Browser
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Average download throughput reported

1	1	3	1	1
Clients MAC	APs MAC	Test Tools	Clients OS	Clients Browser

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Minimum download throughput reported

1	1	3	1	1
Clients MAC	APs MAC	Test Tools	Clients OS	Clients Browser

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Maximum download throughput reported

1 Clients MAC	1 APs MAC	3 Test Tools	1 Clients OS	1 Clients Browser
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Metrics for Upload Throughput

1 Clients MAC	1 APs MAC	3 Test Tools	1 Clients OS	1 Clients Browser
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Metrics: Measurements overview

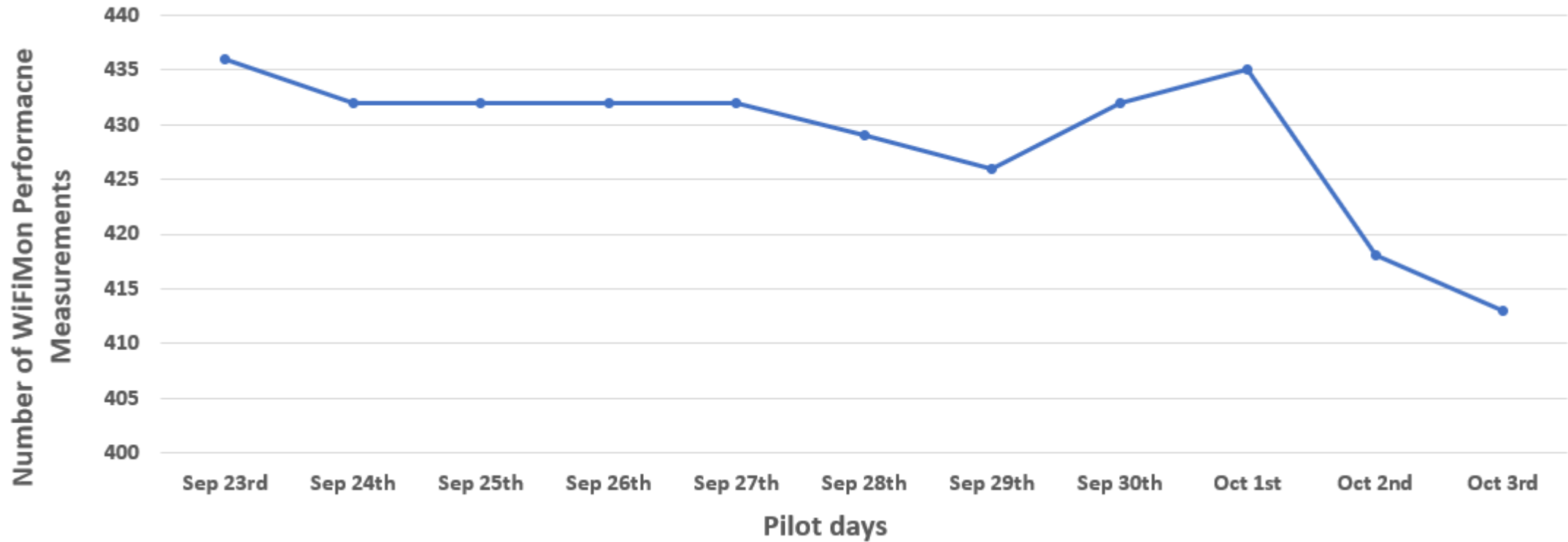
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HTTP ping metrics

1 Clients MAC	1 APs MAC	3 Test Tools	1 Clients OS	1 Clients Browser
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The **Overview** tab summarizes received measurements on a daily basis

Total number of WiFiMon performance measurements received daily between Sep 23rd and Oct 3rd



→ The WiFiMon Analysis Server (WAS) received 4717 total measurements on 11 days and 429 measurements per day on average

→ Loss of measurements is evident in various days (e.g. maximum loss on Oct 3rd)

WiFiMon may report various types of performance measurements (against the WiFiMon Test Server – WTS)

The most important are:

→ Download Throughput

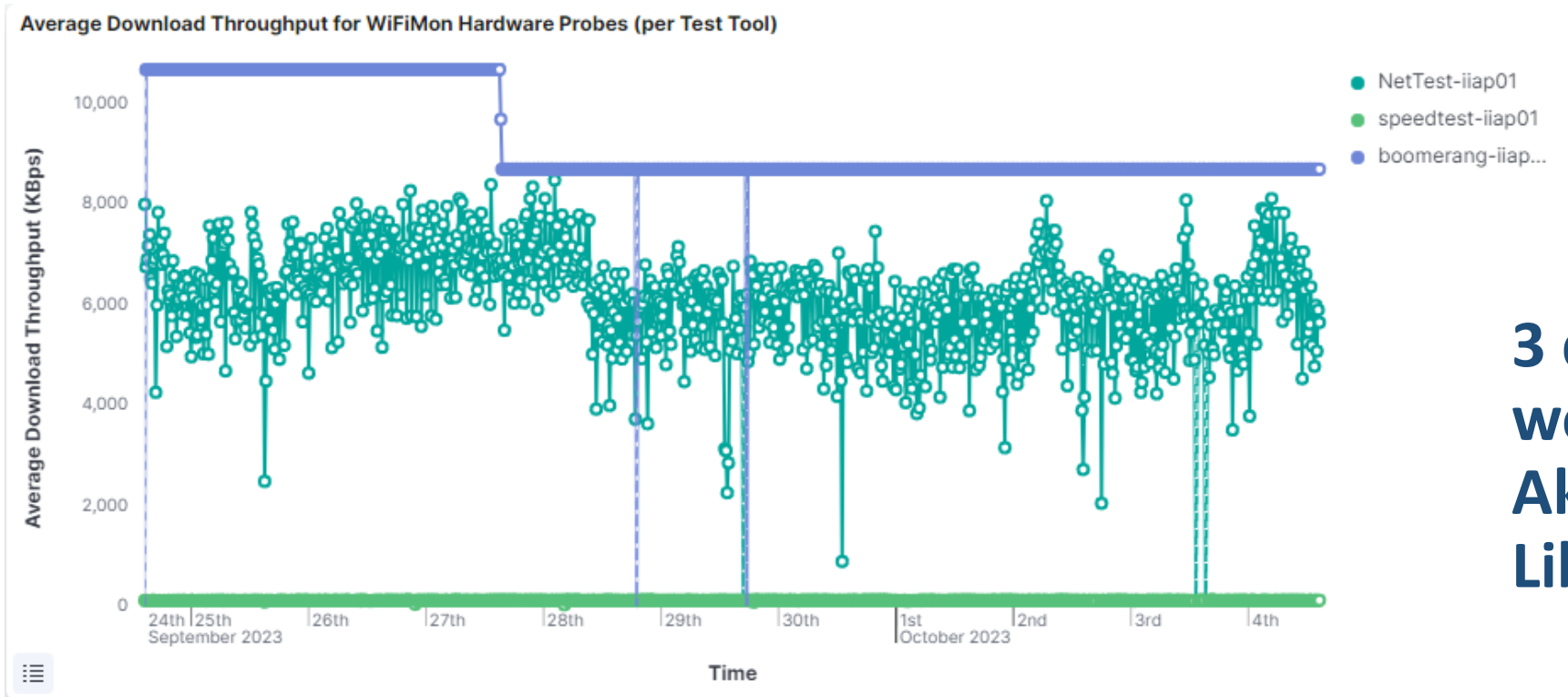
→ Upload Throughput

→ HTTP Ping Round-Trip Time (RTT)

→ Jitter

Average Download Throughput – Per Test-Tool

Average download throughput during the last 10 days:

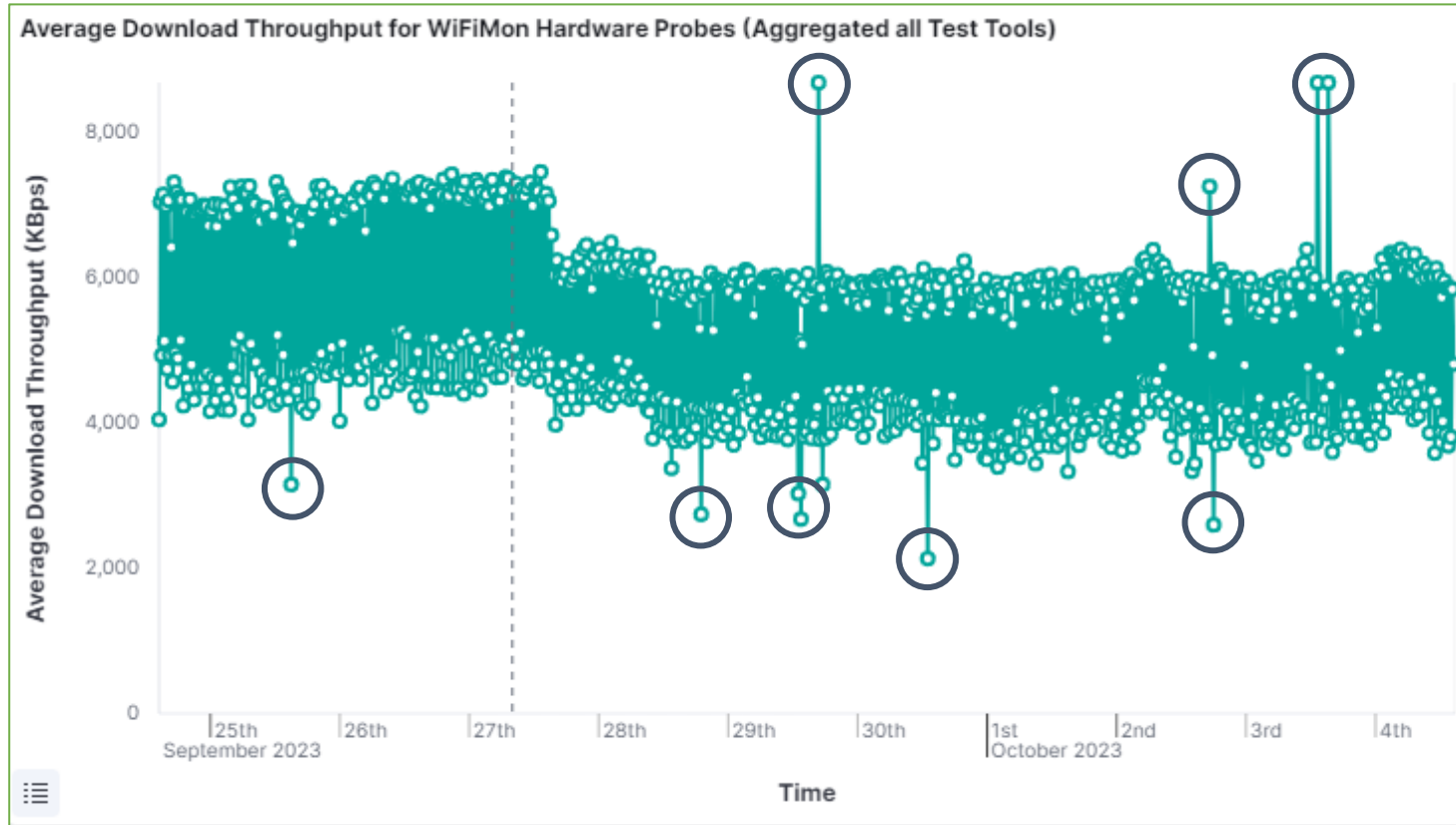


3 different test-tools were used (NetTest, Akamai Boomerang & LibreSpeed Speedtest)

- NetTest reports interesting performance drops
- LibreSpeed Speedtest reports rather stable performance
- Akamai Boomerang detects a very interesting performance drop during the 27th of September; performance suddenly drops and almost stabilizes on a lower value

Average Download Throughput – Aggregated

Average download throughput during the last 10 days:



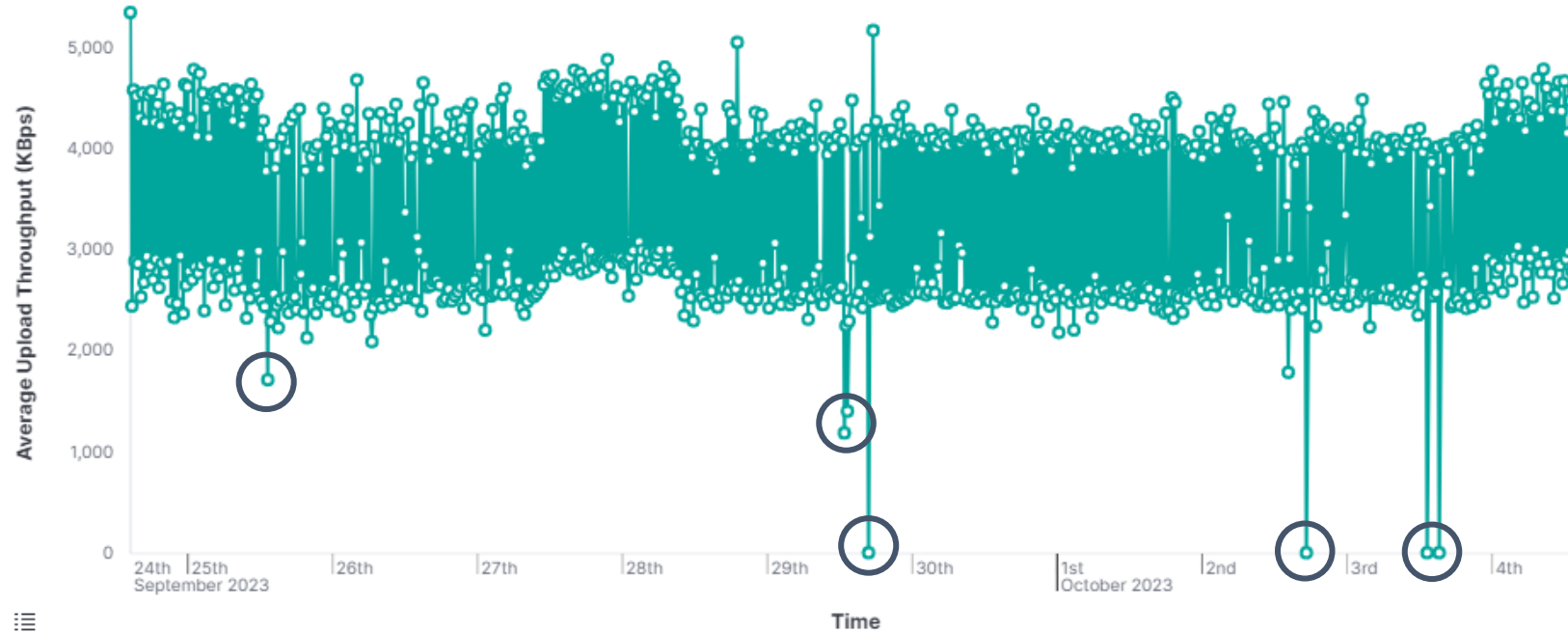
The results of all test-tools are aggregated

- Interesting points (blue circles) can be seen in the diagram
- Wi-Fi administrators may further inspect what happened at these points

Average Upload Throughput – Aggregated

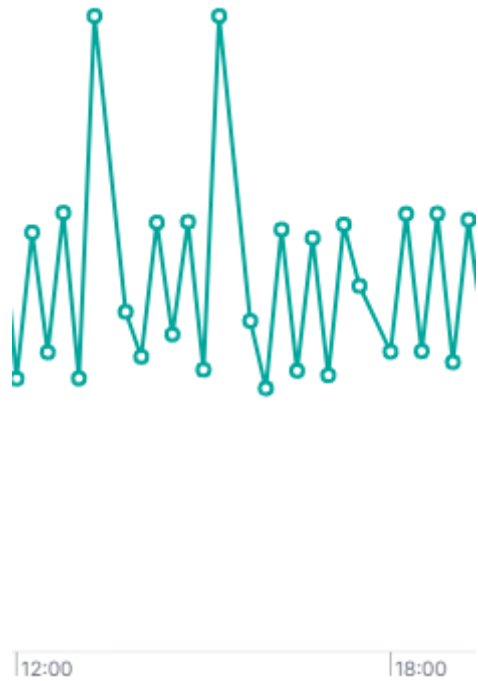
Average upload throughput during the last 10 days:

Average Upload Throughput for WiFiMon Hardware Probes (Aggregated all Test Tools)

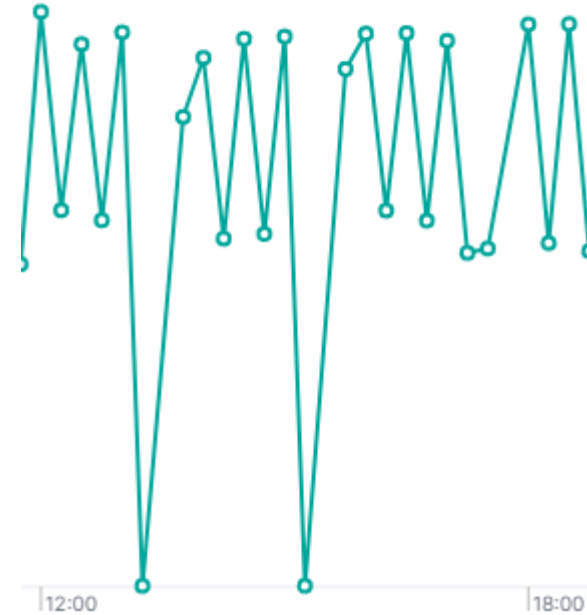


The results of all test-tools are aggregated

Significant drops (blue circles) are also visible in the chart



Average download throughput

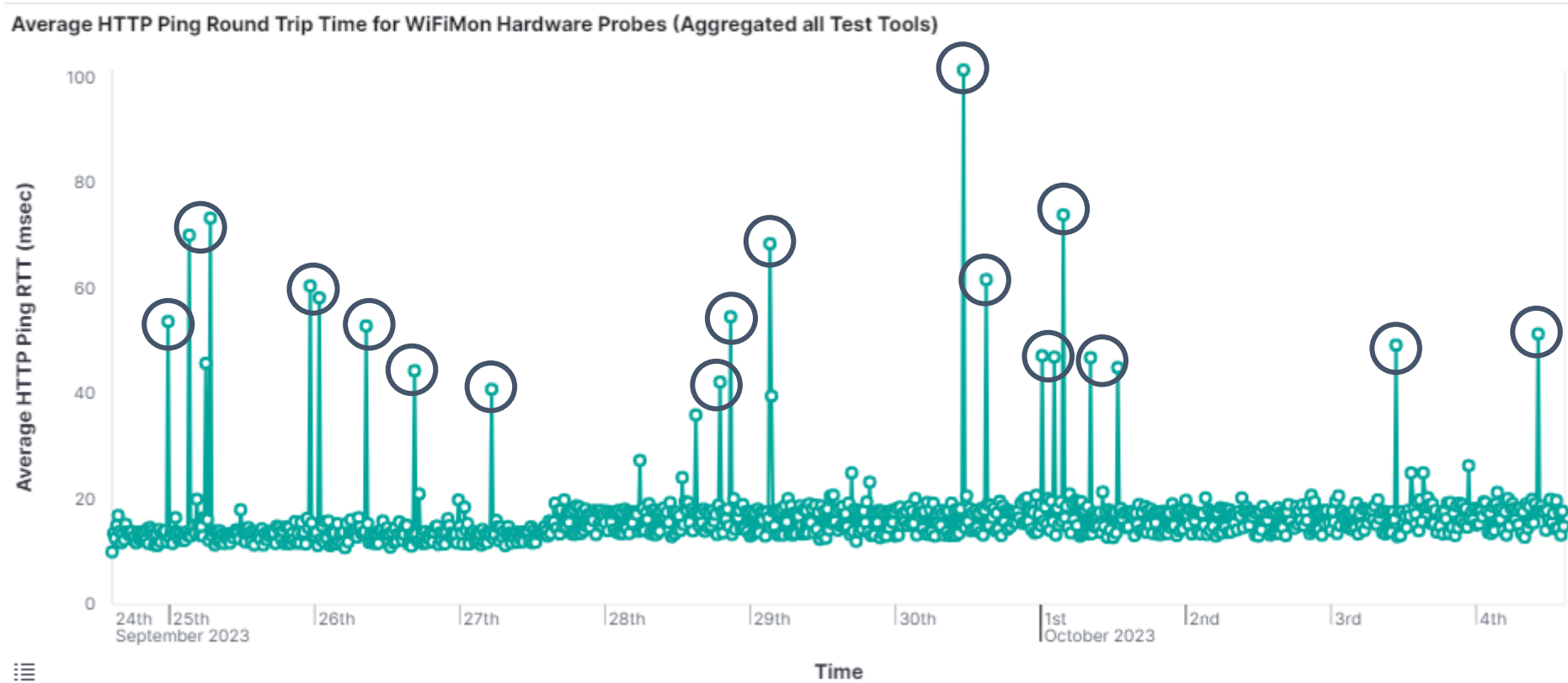


Average upload throughput

Download throughput presumably dropped because of data uploads

Average HTTP Ping RTT - Aggregated

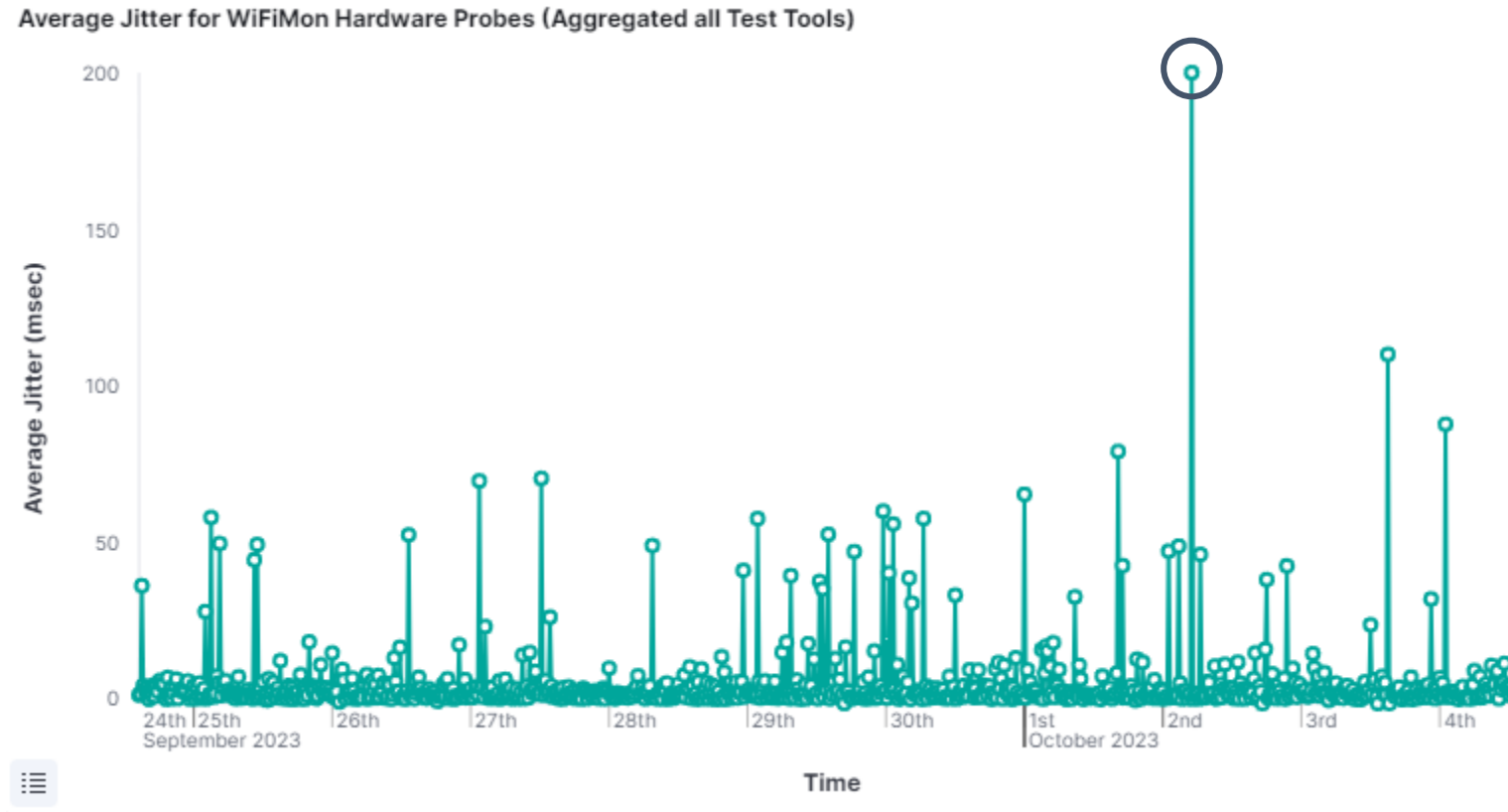
Average HTTP Ping RTT during the last 10 days:



The results of all test-tools are aggregated

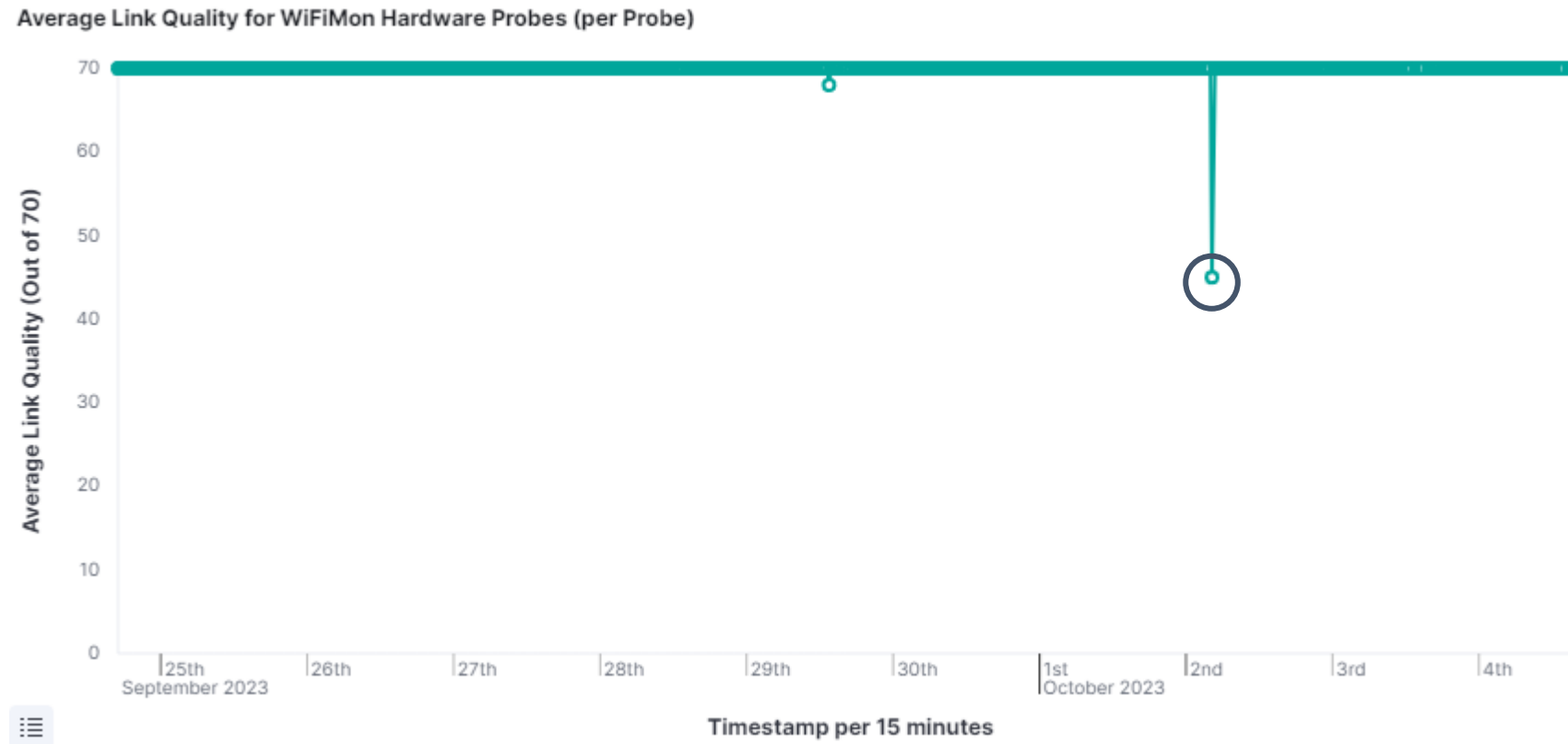
Higher RTT's are visible (blue circles) in the chart

Average Jitter during the last 10 days:



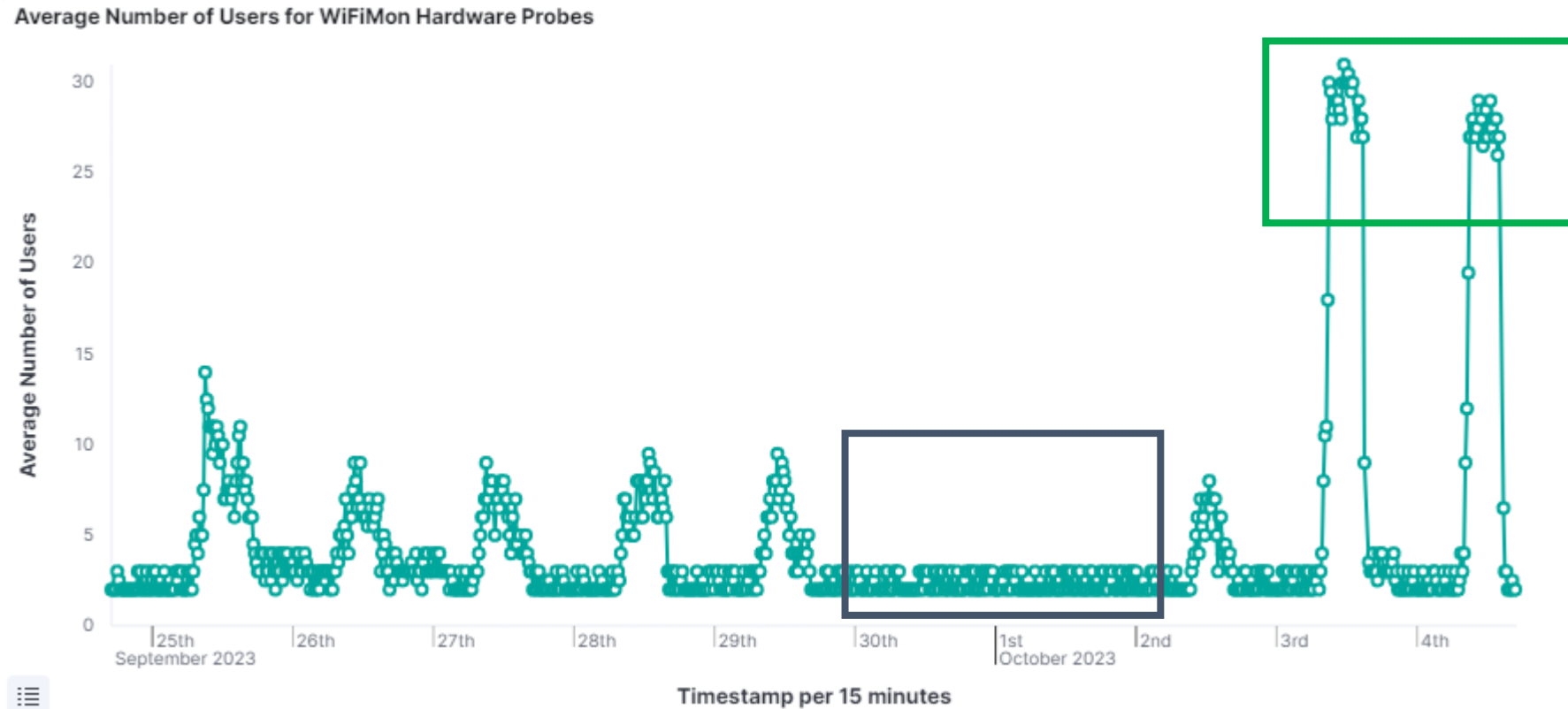
A very high jitter measurement (blue circle) is visible on October 2nd

Average link quality during the last 10 days reported from the WLAN NIC of the probe:



- Link quality (WLAN NIC) does not capture the drops reported by WiFiMon
- A major drop on October 2nd matches the jitter increase (previous slide)

Average number of Wi-Fi users during the last 10 days (reported by arp-scan):



- Almost no users during the weekend (blue rectangle)
- Higher number of users during the conference days (green rectangle)

Apart from average measurements, WiFiMon may also report:

→ Median values

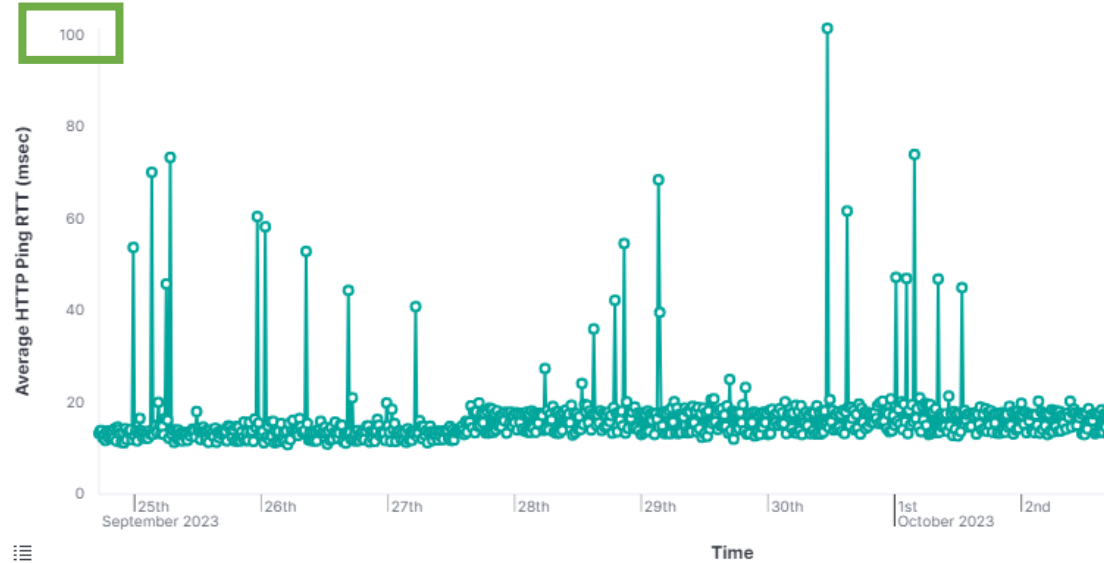
→ Maximum values

→ Minimum values

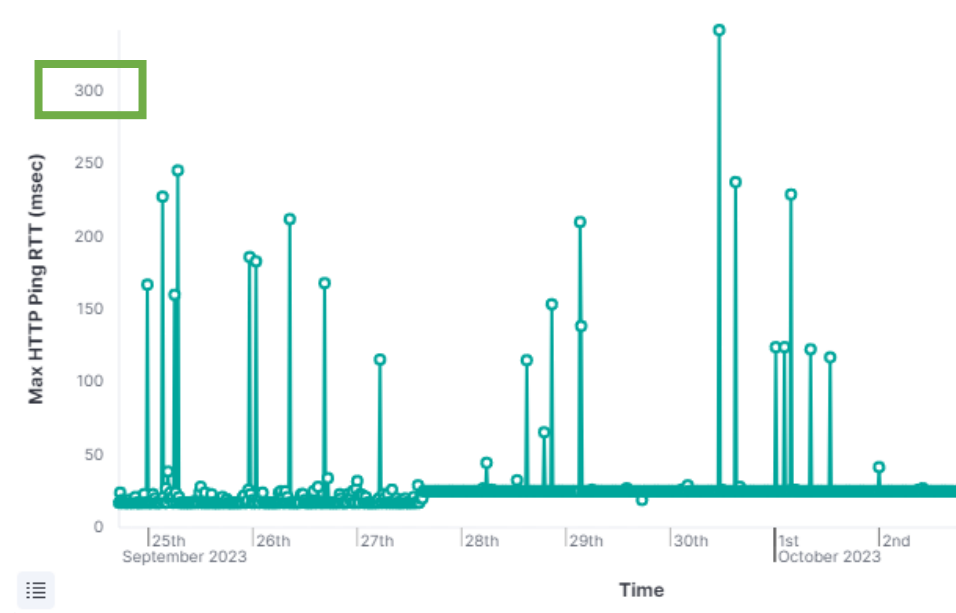
→ 95th percentile values

Comparison between the average and the maximum HTTP Ping RTT:

Average HTTP Ping Round Trip Time for WiFiMon Hardware Probes (Aggregated all Test Tools)



Max HTTP Ping Round Trip Time for WiFiMon Hardware Probes (Aggregated all Test Tools)



Maximum values of RTT are much higher than the reported average

A Glance in the Future of WiFiMon

Version 2.2.0
(expected November 2023)



Currently (version 2.1.1):

- WiFiMon administrators are expected to **manually** inspect measurements
- No mechanisms to automatically detect important throughput deviations

WiFiMon v2.2.0 will introduce mechanisms to analyze throughput time series

- Anomalies will be detected using the **Hampel** method
- Hampel method assesses deviations from a median value evaluated on specified measurement windows
- WiFiMon UI has been enriched to support the new feature
- Still **under improvement**

Fill the following information to request analysis of results

Step 1

The window size specifies how many past measurements to consider

Insert the window size (integer, 1 to 30):

Step 1: Specification of the window size, i.e. how many previous measurements to use for median value calculation

Step 2

The standard deviation parameter specifies how sensitive the analysis will be

Insert standard deviation (float, 1 to 20):

Step 2: What deviation from the median is considered an anomaly?

Step 3

How many days in the past do you want to look at?

Insert number of days (integer number):

Step 3: How many days to include in the analysis?

Step 4

Which time series do you want to inspect?

Insert "Download-Throughput", "Upload-Throughput", "Local-Ping" or "Jitter-Msec":

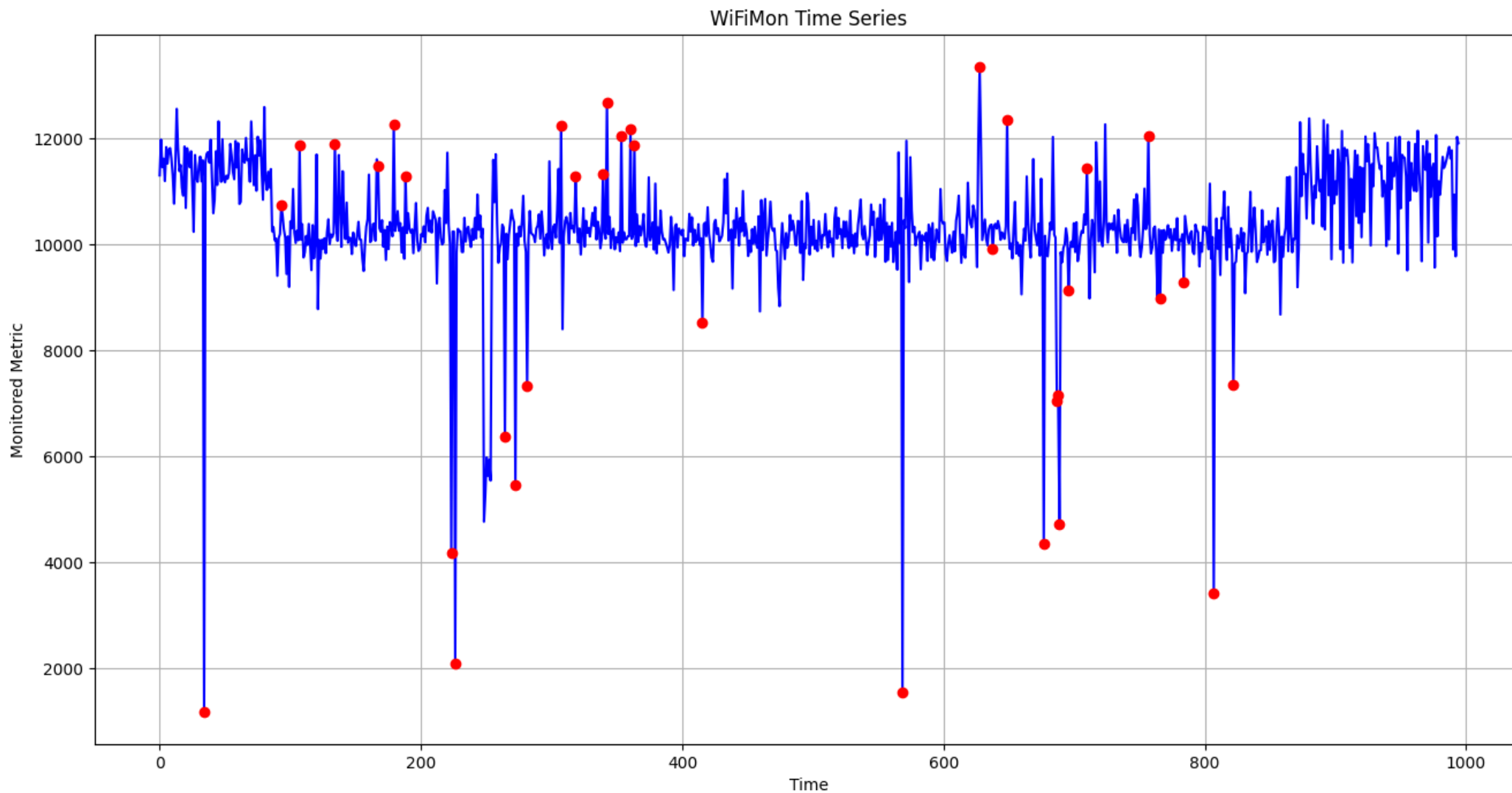
Step 4: Which time series do we want to inspect?

Step 5

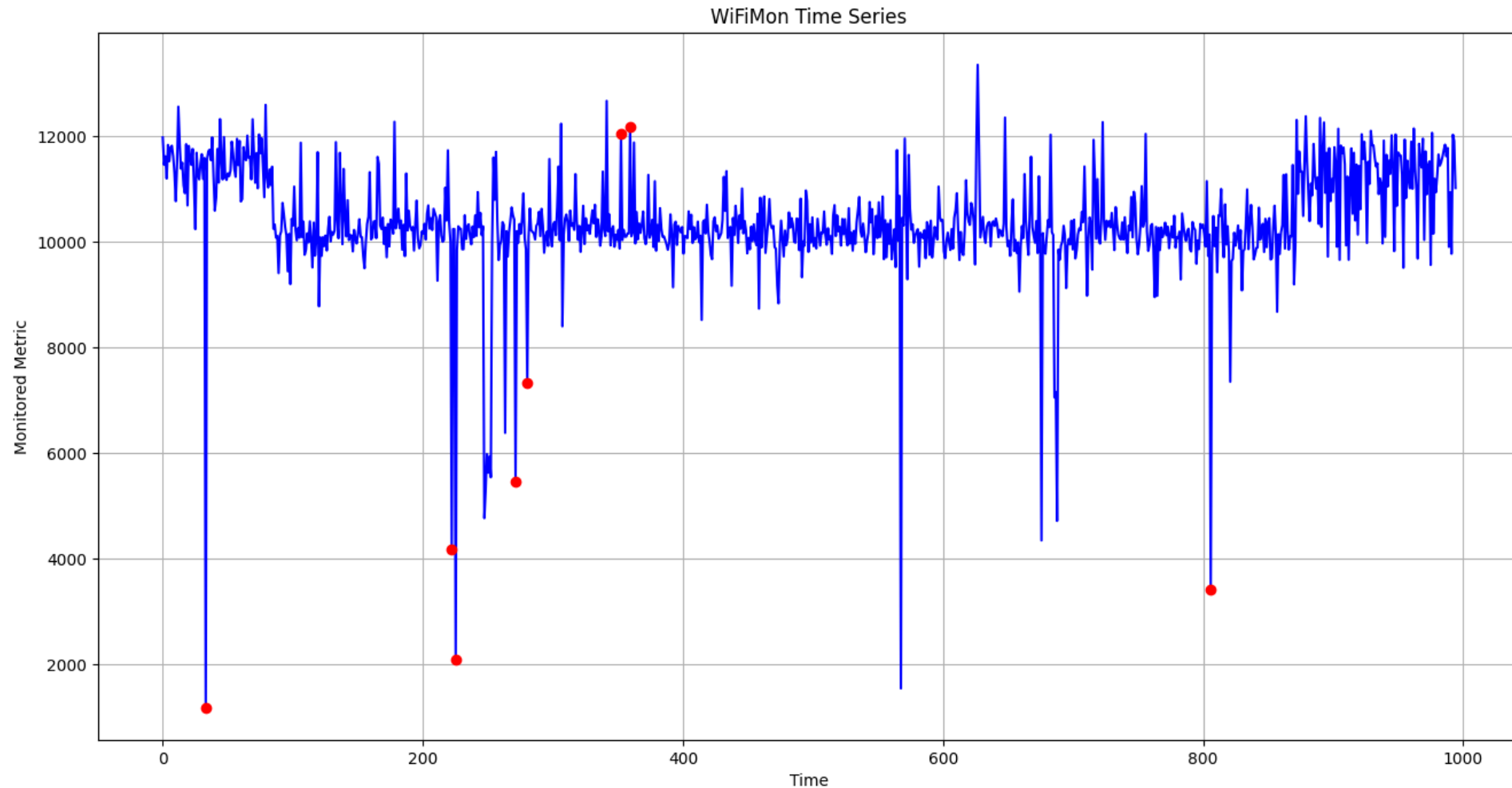
What is the name of the test tool that you want to inspect?

Insert test-tool name (string):

Step 5: Symbolic name of the considered test-tool



Red dots indicate points that should be further inspected



Stricter Hampel method parameters (e.g. “10” in step 2) may return less red dots, i.e. anomaly indications that are more serious



Thank You

Homepage: <https://wiki.geant.org/display/WIF>

WiFiMon mailing list: wifimon-ops@lists.geant.org

www.geant.org



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