Wi-Fi Network Monitoring with GÉANT WiFiMon

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GÉANT

Introduction

WiFiMon

FEEL, SEE AND UNDERSTAND YOUR WIFI

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WiFiMon GÉANT Service

- Monitoring Wi-Fi performance as experienced by end users
- Combination of crowdsourced & hardware probe measurements
- IEEE 802.1X networks (**eduroam**): Data from RADIUS & DHCP logs for richer analysis, e.g. per Access Point (AP)

Contribution:

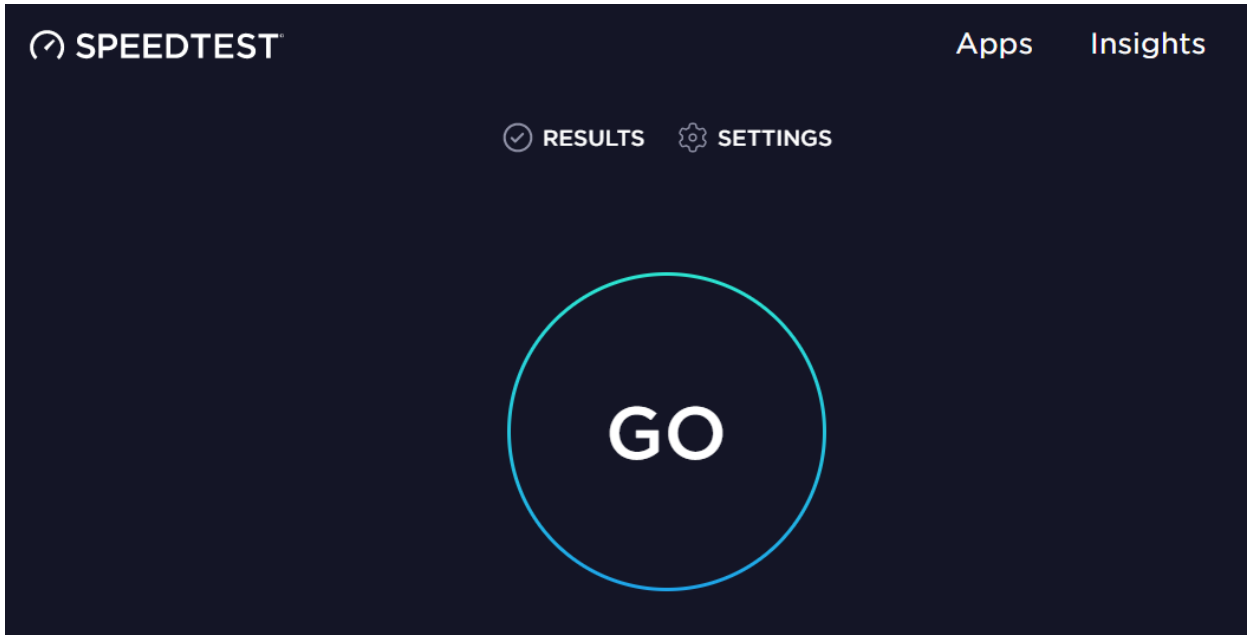
- Detection of Wi-Fi throughput degradation
- Determination of underperforming areas within a Wi-Fi network

→ Admins may enhance performance, e.g. by installing more APs

WiFiMon vs Related Monitoring Tools

- Monitoring from the end-user perspective (***end-user experience***)
- No requirements for app installation or end-user intervention
- Centralized view of Wi-Fi performance available to the administrator

Example: WiFiMon vs Ookla Speedtest

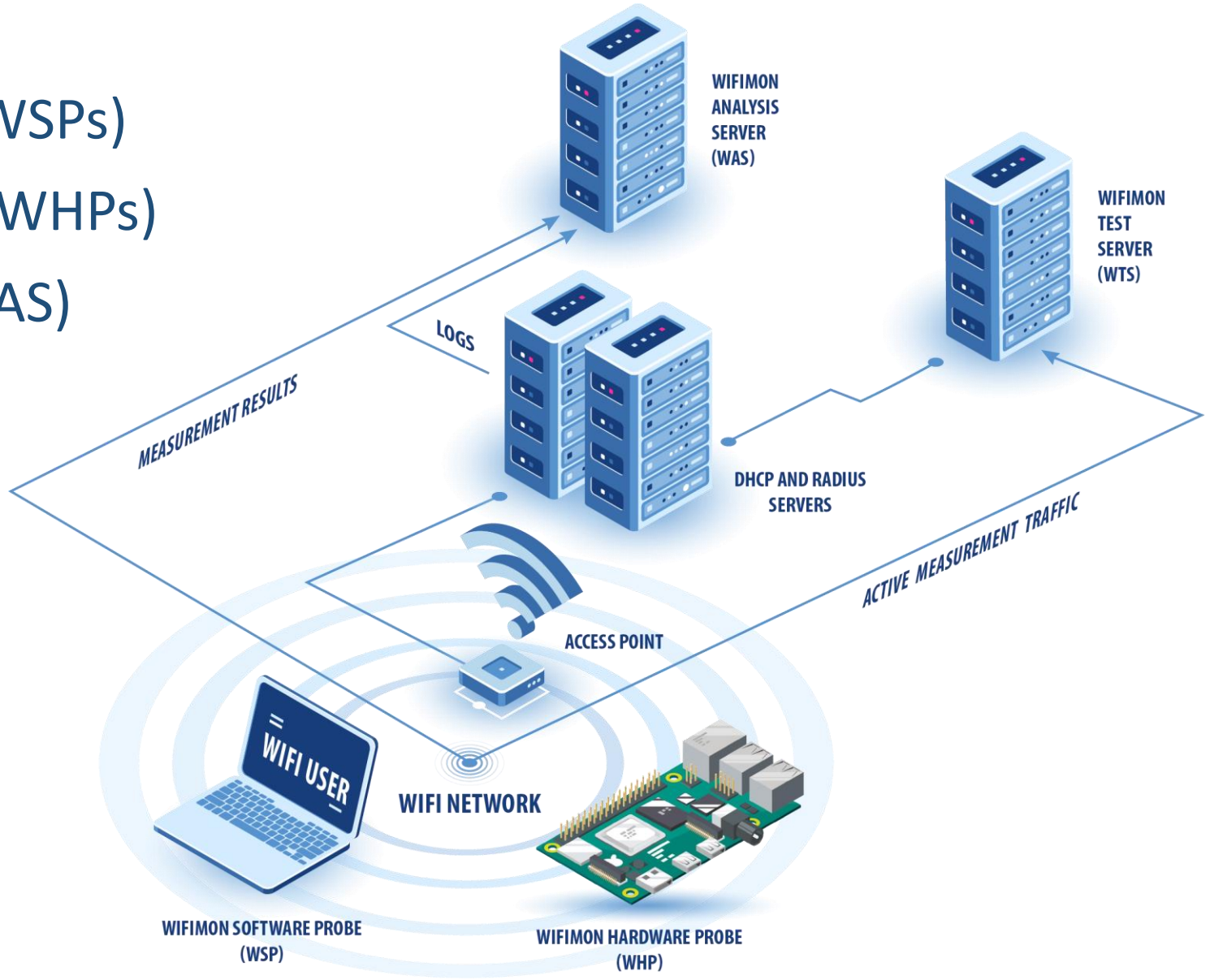


	WiFiMon	Ookla Speedtest
Measurements are triggered:	Automatically by visiting a site	By pressing “GO”
Results collected by:	Wi-Fi administrator	End users

WiFiMon Operation

WiFiMon Components:

- WiFiMon Software Probes (WSPs)
- WiFiMon Hardware Probes (WHPs)
- WiFiMon Analysis Server (WAS)
- WiFiMon Test Server (WTS)



Components

WiFiMon Test Server (WTS)

Purpose: Holds code and test data for performance measurements

- Based on **JavaScript (JS)** technology
- HTML script tags pointing to test tools added to frequently visited sites

2 available test tools:

Akamai Boomerang	LibreSpeed Speedtest

WTS Placement: Close to the monitored networks
(RTT between end devices and WTS included in results)

→ ***If impossible***: *WiFiMon* captures **relative** performance changes

WiFiMon Software Probes (WSPs)

End-user devices

- Crowdsourced measurements triggered against the WTS when users visit a WiFiMon-enabled site
- No requirement for additional software within user devices
- Repetitive measurements regulated via a cookie value

WiFiMon Hardware Probes (WHPs)

- Wi-Fi performance measurements from **fixed points** within the network
- Baseline throughput that complements crowdsourced measurements
- Performance measurements similar to WSP ones
- Additional data about monitored and nearby ESSIDs
- TWAMP Measurements, System data (CPU, memory, etc)

Triggering measurements based on *crontabs*

Tested for Raspberry Pi v3 and v4

WiFiMon User Interface (1)

Results per WHP

Aggregated Results

WiFiMon User Interface (2)

Dashboards available for:

- Average values
- Median values
- Maximum values
- Minimum values
- 95th Percentile values

That may be:

- Uncorrelated
- Correlated with the available APs

Depicting estimations of:

- Download throughput
- Upload throughput
- HTTP ping Round Trip Time (RTT)

Sources:

- **Crowdsourced measurements**
- **Hardware Probe measurements**

Correlation with *RADIUS/DHCP* Logs

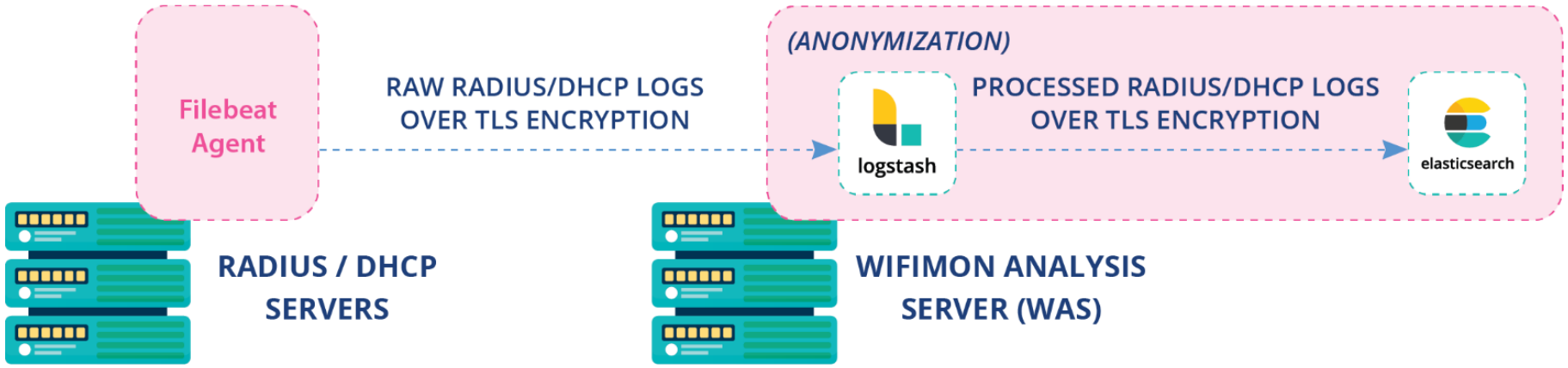
Logs are:

- Extracted from RADIUS/DHCP servers using **Filebeat**
- Processed and transformed by **Logstash** in WAS
- Stored in **Elasticsearch** of WAS

Correlation options:

- With end-user IP address (only RADIUS logs)
- With end-user MAC address (both RADIUS & DHCP logs)

Personally Identifiable Information: IP/MAC addresses secured in transit using TLS-encrypted channels and stored hashed in WAS (X-Pack)



Installation

WiFiMon Installation Options

- Institutions install all components **on their premises**
  - **Ansible playbook** for **WAS/WTS** automated installation
  - All data stay within the institution premises

NMaaS Portfolio

- ***NMaaS*** (simpler option for testing/trying WiFiMon)
  - Another GÉANT Service
  - WiFiMon WAS instance deployed on NMaaS
  - WTS installation still required by institutions
    (should be close to the monitored network)

Manual WAS installation: Abandoned by WiFiMon

WiFiMon Evolution

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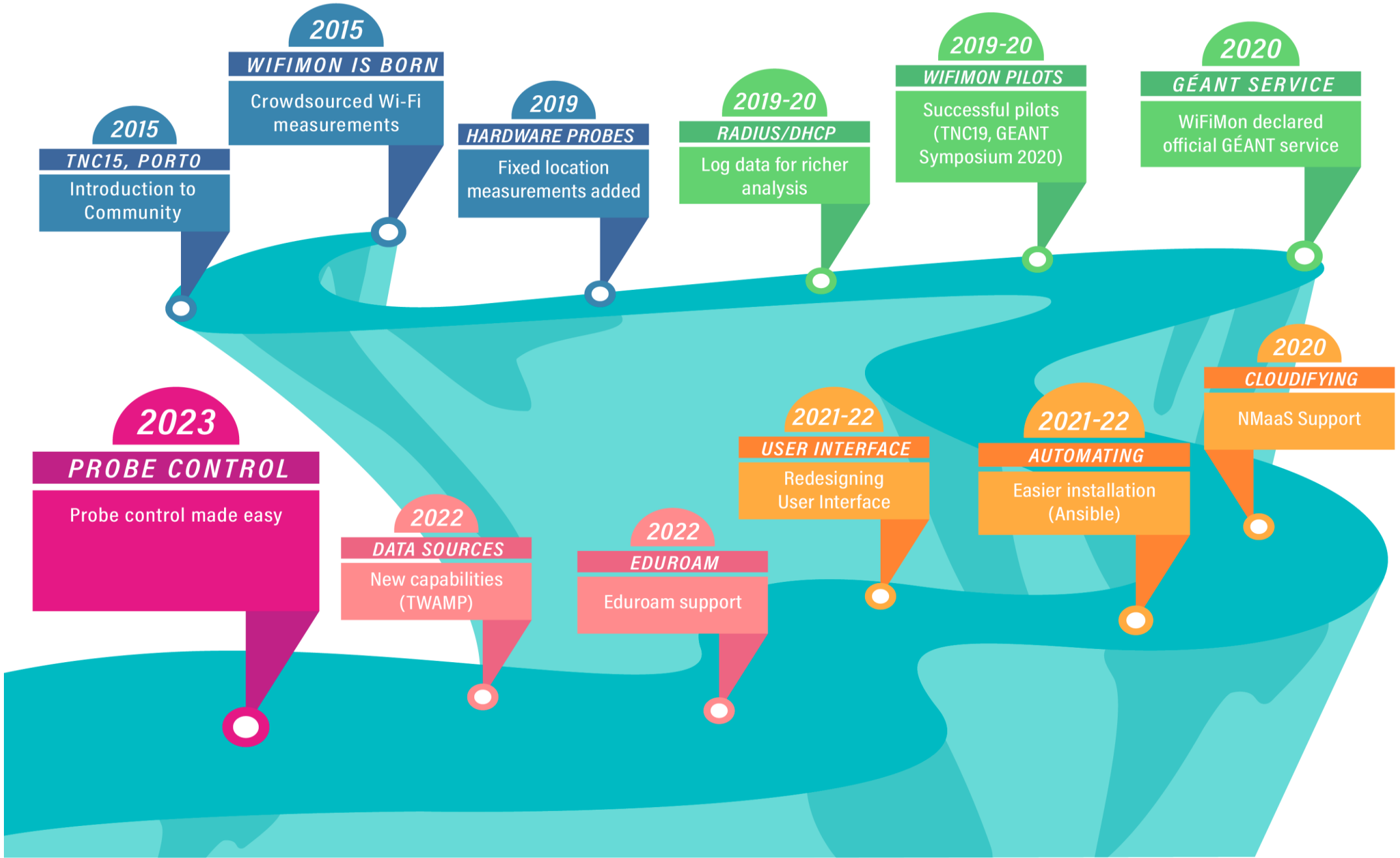
WiFiMon Evolution

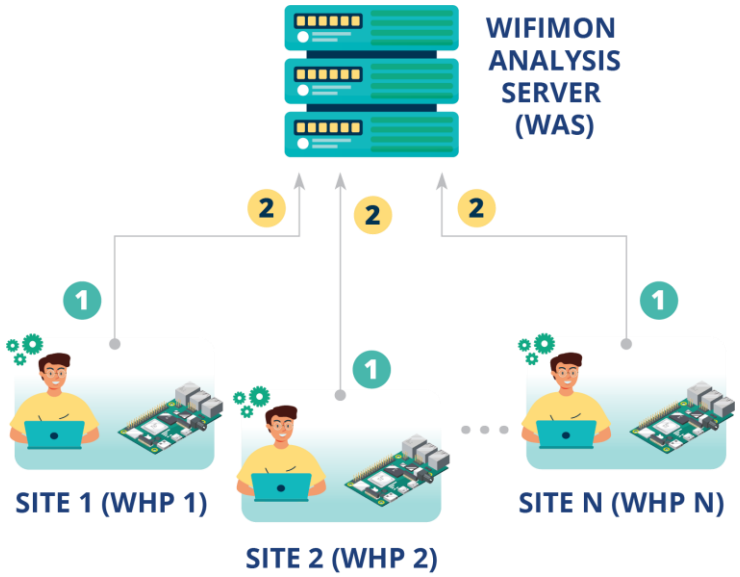


WHP Configuration & Control

Old approach

Administrator feedback demonstrated **limitations**:

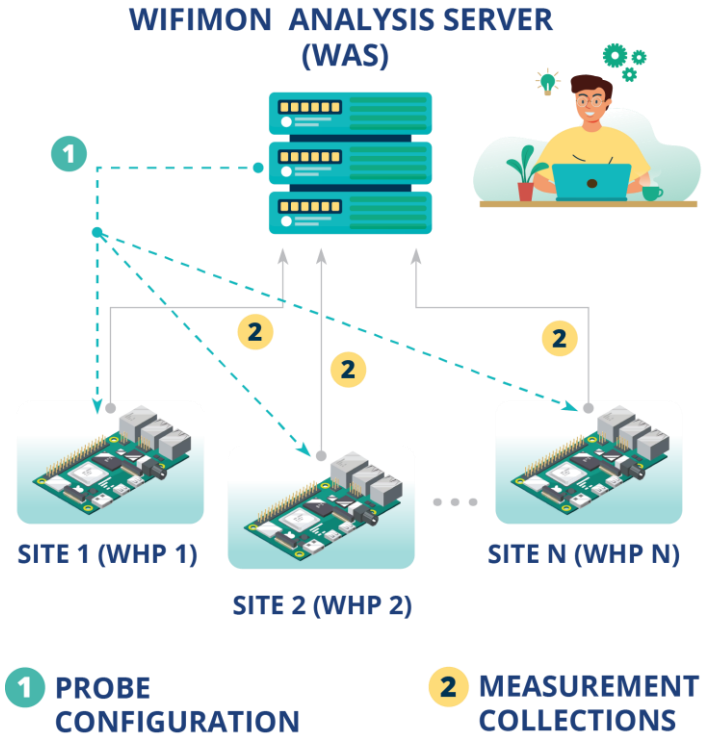
- In **NAT networks**
- In **public networks**
- Administrators edit config directly



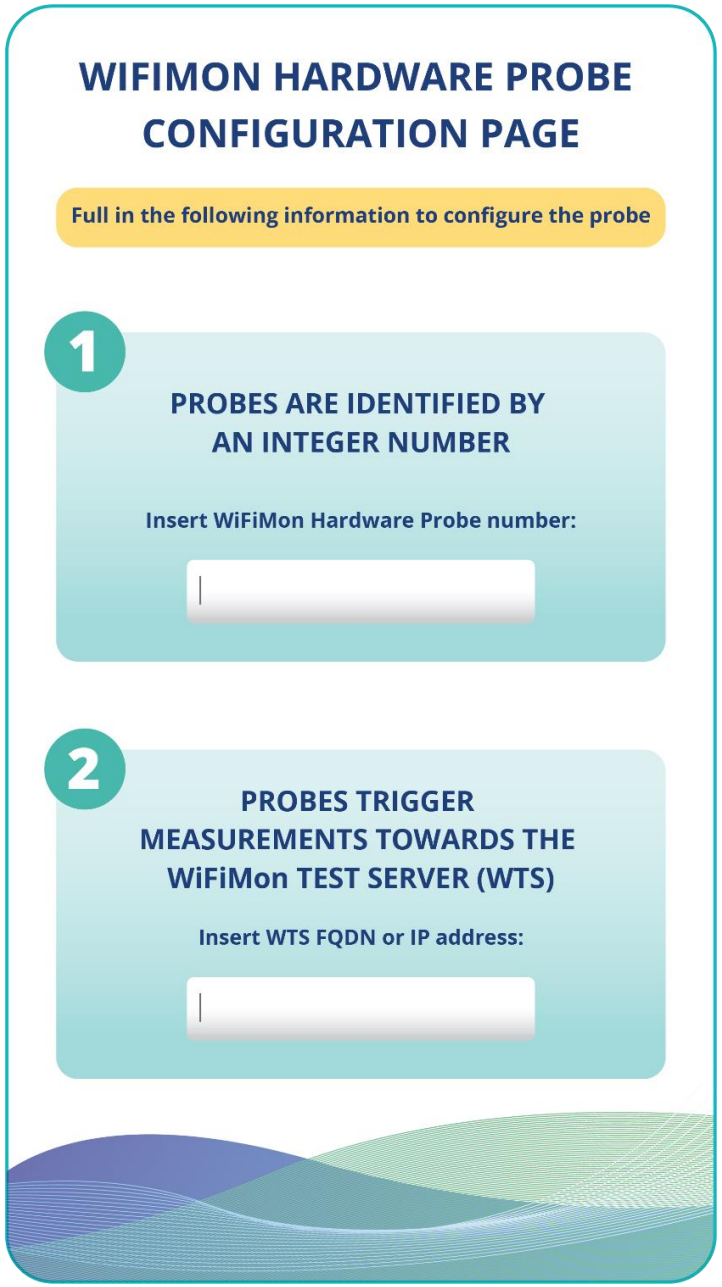
Novel approach required!!!

→ Remote & user-friendly configuration of WHPs from a central point (WAS)

→ Flexibility to control WHPs behind NAT networks



WHP Configuration Made easy



Administrators (re)configure WHPs from the WiFiMon UI

Provided data:

- Device ID
- FQDNs/IP addresses of WiFiMon components
- Location information

Configuration files are generated based on Jinja2 templates

Remote WHP Configuration Made Possible

1

Salt establishes application layer communication:

- WHPs remotely configured from the WAS
- Reconfiguration easier for WHPs behind NAT
- Public IP addresses not required

→ IP space is conserved

Based on Salt

WAS → Salt Master

WHPs → Salt Minions

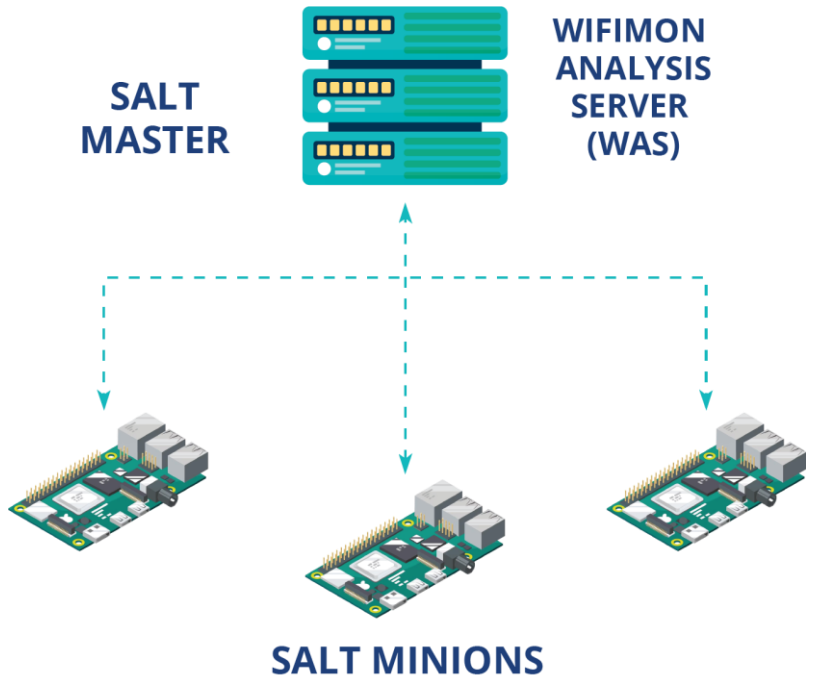
2

Salt includes a ZeroMQ message broker:

Parallel configuration regardless of the WHP number

3

Configuration files generated from **templates** transferred from the WAS to WHPs



Thank You

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

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

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