

Application of two-way active measurements for 5G-network monitoring (a 5G-TOURS project innovation)

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5G-Tours project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 856950

5G-TOURS at a glance*

The **5G-TOURS project** is one of the main ICT19/22 projects that will deploy full end-to-end trials to bring 5G to real users

The project will provide efficient and reliable close-to-commercial services for tourists, citizens and patients in three different types of cities:

- *Rennes*, the safe city where e-health use cases will be demonstrated;
- *Turin*, the touristic city focused on media and broadcast use cases;
- Athens, the mobility-efficient city that brings 5G to users in motion as well as to transport related service providers.

5G-TOURS will fully demonstrate pre-commercial 5G technologies at a large scale, **showing the ability of the 5G network to meet extreme and conflicting KPIs while supporting very diverse requirements on the same infrastructure**.



^{* 5}G-TOURS Cartoon Video: https://www.youtube.com/watch?v=OIKJBMyd02o

Contents of this Presentation

- 1. Introduction on KPI measurement/monitoring and validation
- 2. Brief 5G-TOURs Project Overview
- 3. Quick Suggestion of the KPI measurement that is planned for 5G-TOURs Athens Site



Why Active Real-Time Measurements

- 5G delivers much higher throughput (10 Gbps) and much shorter latencies (sub msec in the RAN) compared to 4G technology (over and above the other innovations in the Radio Access and Core networks).
- Validation of the claims/performance is needed while:
 a. the deployment and rollout is happening
 b. the 5G is operational and Services are being delivered to end-users/customers.
- Due to virtualization separate Network KPIs* and Service KPIs should be considered (why? Next slide).
- Therefore, real-time (while the services are being delivered) KPI measurement and validation is needed.
- Furthermore, improved tools and method should be deployed in order to achieve the desired submillisecond accuracy, resolution and dynamic range.
- Synchronization should also be considered a must.

* KPIs provide a way to measure how well technologies, companies, business units, projects or individuals are performing in relation to their goals and objectives i.e. in 5G if it will deliver sub-ms latency



Types of KPIs and performance metrics



Network Metrics (Active and Passive monitoring of performance, availability etc.)

- **Service Metrics** (Service layer KPIs used to mirror network metrics, but **no longer, since** the drive for virtualization. They can be service specific like, pickup-rate, user attention time, battery drain-rate, etc.)
- End User Quality of Experience or measurable KPIs/Metrics where the end-device of the User and the User her/himself is part of the (measurement/monitoring and evaluation) process

WHY we NEED both Network and Service KPI validation (?)

In a traditional, physical network, routing of services was carefully engineered with the service topology typically mirroring the network topology. Because of this, it was easy to infer service quality from network quality and as a result, many services were simply not monitored at all. However, virtualized networks break this 1:1 relationship, potentially leaving many services essentially invisible to the operations teams.

So, the role of service monitoring needs to change from that of a tool for monitoring and policing just the high revenue, SLA (service level agreement) based services, to become, essentially, the "eyes and ears" of the network and service operations teams.



Active (Synthetic) vs. Passive Monitoring/Measurement(s)

- Active = simulates user behavior to determine potential network performance happens in real-time at set intervals, your monitor will always be <u>analyzing simulated performance</u> data takes a proactive approach to network troubleshooting. Usually no sync is needed.
- **Passive =** gathers actual user data and analyzes it over a specific period of time it pulls real user data from specific points in the network the analysis happens off-line after the collection A sync is needed for passive measurement in order to correlate events
- Both active and passive monitoring are essential tools for building and maintaining a competitive advantage in virtual networks. Virtualization, through its use of white-box appliances, virtual network functions (VNFs) and open service models and APIs, has become the great "democratizer" of networks and Communication Service Providers (CSPs), must now focus on metrics like QoE and customer satisfaction as true differentiators.
- The continuous generation and storing of active and passive monitoring results creates the very large data-lakes
 of correlated performance indicators and test results needed to drive these systems, all of which would **not** work
 without synchronization.



5G-TOURS and Relation with other 5G-Projects



5G-TOURS scope

Most of the efforts conducted so far to evaluate 5G have focused on individual vertical use cases. 5G-TOURS aims to fill this gap by demonstrating the ability of 5G to support multiple vertical use cases concurrently on the same infrastructure

5G slices

5G applications / slices that will be tested in AIA include:

- Smart Parking Service Offering
- Ground based "Follow-me Cars" Remote Monitoring and Guidance
- AR/VR multimedia Services while on the move
- Emergency Analytics and decision making, e.g. Airport evacuation

Availability (= Planned Uptime - Planned Downtimes / Uptime x 100%) .

Example: TWAMP vs. ICMP Echo ("ping") comparison

Capability	ТWAMP	ICMP echo (ping)
Original Scope	Performance monitoring across IP networks	Connectivity check, Crude round-trip delay capability
Monitoring of existing Infrastructure	Available in certain routers, NIDs, probes	Yes (almost universal support in every NE, Operating System)
Transparency through network elements allowing generic, robust, predictable test methodology	Yes (UDP traffic based test, passes through network)	In some installations, routers block or rate limit ICMP
Round Trip Delay KPI	Yes	Insufficient accuracy due to slow ICMP processing in network elements
1-way Loss KPI	Yes	No
1-way Delay KPI	Yes	No
1-way delay variation (PDV) KPI	Yes	No

[1] Introduction to TWAMP: <u>https://www.slideshare.net/nirc1963/what-istwamp</u>

[2] Kahraman Zaim, Cemal Kocak, "Performance Analysis of IP Network Using Two-Way Active Measurement Protocol (TWAMP) and Comparison with ICMP (Ping) Protocol in a Saturated Condition," 4th International Symposium on Innovative Technologies in Engineering and Science (ISITES2016) 3-5 Nov 2016 Alanya/Antalya – Turkey

Innovative suggestion(s)

The innovative aspect of the suggested approach is:

- Real-time monitoring of network KPIs (plus some Service KPIs) in parallel
- Utilization of both active and passive monitoring tools
- Integration of existing (legacy) as well as new / open-source tools for measurement acquisition
- Continuous feed of the measurements for analysis and decision making (i.e. deploy a new slice, or establish a new VNF to the edge-cloud etc.)
- Extension of the above approach even to end-user-devices/CPEs like Smartphones & APP Servers

Q & A

http://5gtours.eu/

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