ACTA LTD
Advanced Communications Testing Applications

5G TOURS – Mobility Efficient City Network Performance Monitoring

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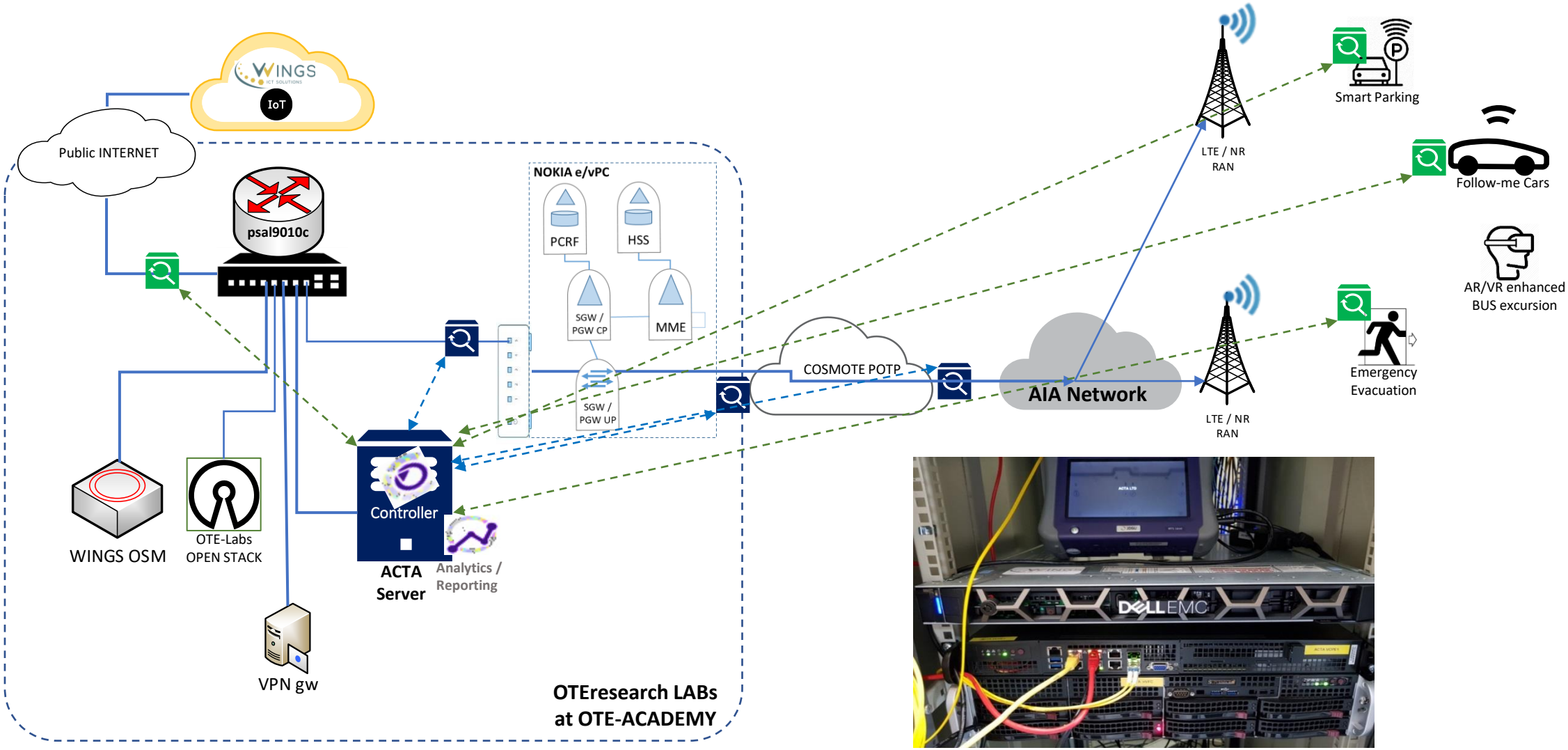
5G-TOURS at a glance*

The project will provide efficient and reliable close-to-commercial 5G services for tourists, citizens and patients in three different types of cities:

- *Rennes*, the safe city where e-health use-cases are 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 applications that are tested in Athens International Airport 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

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

ACTA at Athens Site



ACTA's KMVaP ecosystem at OTE Labs

ACTA Real-Time Measurements

- ACTA is using TWAMP (RFC 5357) for L3 Performance Measurements running between SFPs and virtual probes, that define network segments under observation, at specific locations in OTE Labs and AIA. These provide L3 KPIs such as Latency, Jitter and Packet Loss. NOKIA BBUs are acting also as TWAMP reflectors. The use of the improved TWAMP protocol provides better accuracy than ICMP (Ping).
- The Viavi MTS-5800 network tester installed at OTE Labs is used for Service Activation Testing, such as throughput testing with TrueSpeed (RFC 6349).

The Viavi MTS-5800 probe

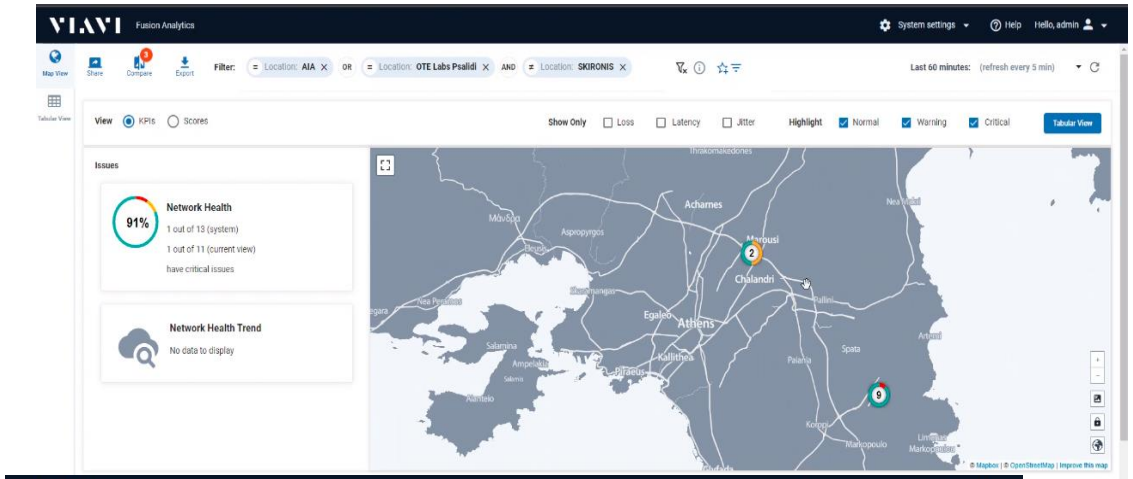
The Viavi SFP network probe

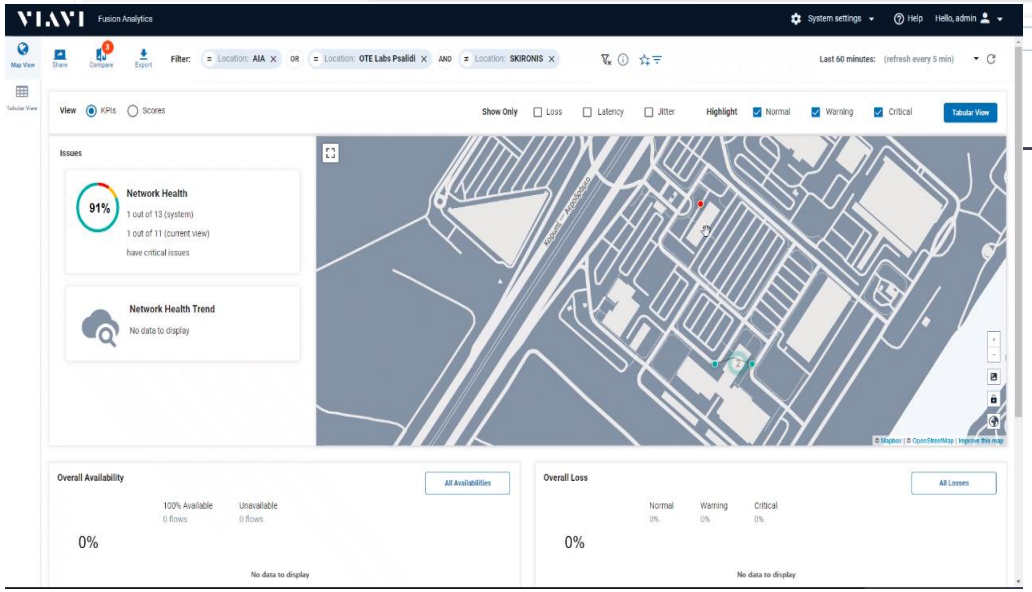
The Virtual CPE/ Software Probe hardware used in the KMVaP platform

Type	Probe type	Direction	KPI L2/L3	KPI L4
SAT - RFC2544 - Y.1564	MTS 5800	Bidirectional		Service Activation Testing
			Throughput	peak throughput
			Latency	Latency
			packet loss	packet loss
				Availability
PM - TWAMP - RFC5357	SFP & Virtual	Bidirectional		
			Latency	
			packet loss	
			Delay variation (jitter)	
WireSpeed - RFC6349 (TrueSpeed)		Bidirectional		peak throughput (TCP)

ACTA – FUSION KMVaP interface

- The network probes and their measurements are managed via ACTA's in-house developed (VIAVI FUSION based) KPI Measurement and Validation Platform (KMVaP). This allows for automated collection of data, running 24x7, with 1min monitoring granularity and 10 ms sampling granularity.
- Typical views are shown in the images, that allow the operator to monitor in real time the progression of the selected KPIs along the selected flows (network segments).
- Certain thresholds can be set to allow for cockpit view of KPIs, in accordance to the 5G TOURS specified performance targets.

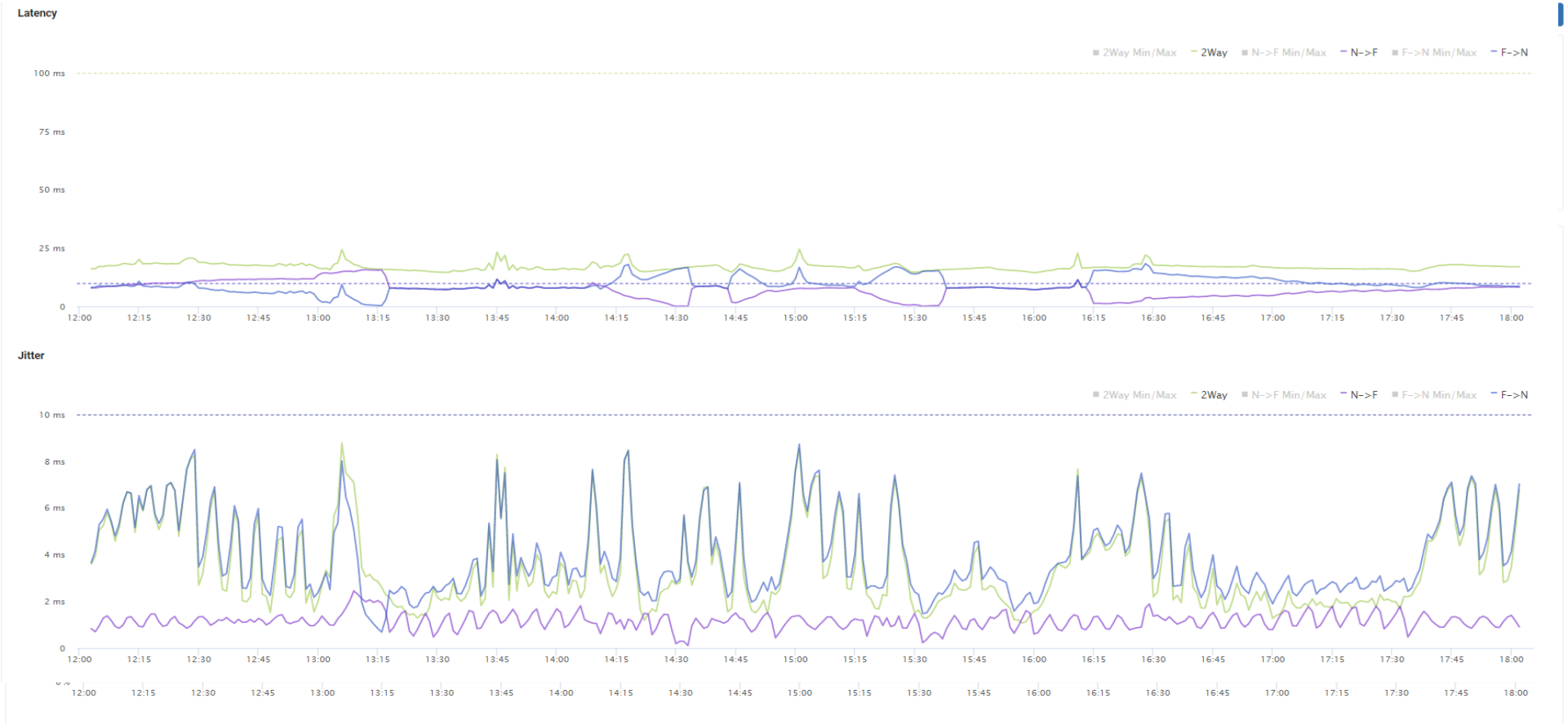




AIA –Field tests (Latency and Jitter)

Below the average latency figures, at around 25 ms, with the RAN part contributing almost 1 ms are shown.
Jitter remains on average very low, in the order of 6 ms, where the contribution of the RAN part is infinitesimally small.

We observe asymmetry with worse figures on the upstream part, which deteriorates the total values.
Peaks up to 40 ms for delay and 20 ms for jitter were also observed, depending on the instantaneous radio conditions.



Transport + RAN path: Latency and Jitter

This graph bellow displays (average) 1 ms latency and 0,01 ms jitter for the traffic up to the BBU, shows how stable the fixed part of the network is It leads to the conclusion derived from the previous set of measurements (up to UE in B17), that the segment which affects the KPIs heavily is, as would be expected, the radio part from BBU to the UE.

AIA –Field tests (Packet Loss)

In addition, via the use of TWAMP (RFC 5357) protocol, L3 Performance Measurements running between SFP and virtual probes placed at specific locations in OTE Labs and AIA, we measured loss figures less than 0.03 %, in all flows involved.

* SLA is set at 100% which is parametrisable, so the orange and red values are not really alarming.

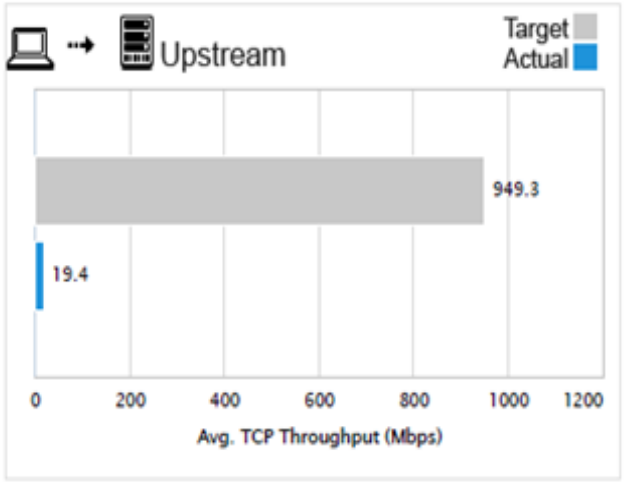
AIA –Field tests (Throughput)

- VIAVI speed tests, (Wirespeed - RFC6349)

https://10.10.9.20:9443/assurance/etherx/public/#/test

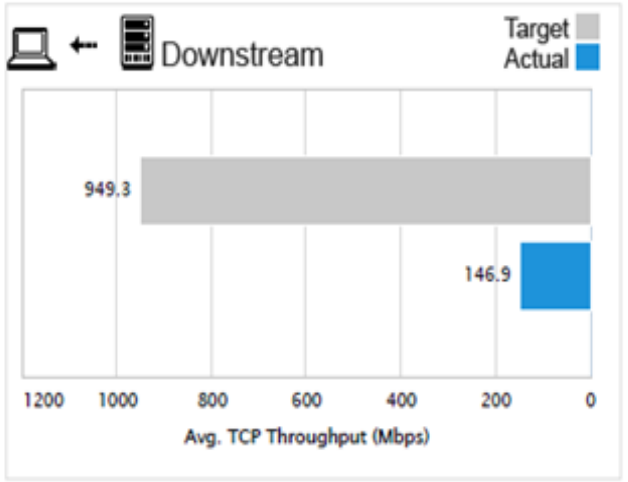
which measure L4 peak throughput to/from the point of measurement (indicative of the user experience).

- The observed values vary according to the radio conditions on the field (i.e at the AIA parking area and in B2 and Satellite terminal where UCs will be performed).
- Further investigation is on-going with OTE and NOKIA to optimize throughput, towards the optimal value of >200 Mbps, which has been estimated in other Horizon projects as target for our 40 MHz channel bandwidth.



CIR: 1000 Mbps
Target TCP Throughput: 949.3 Mbps
Average TCP Throughput: 19.4 Mbps

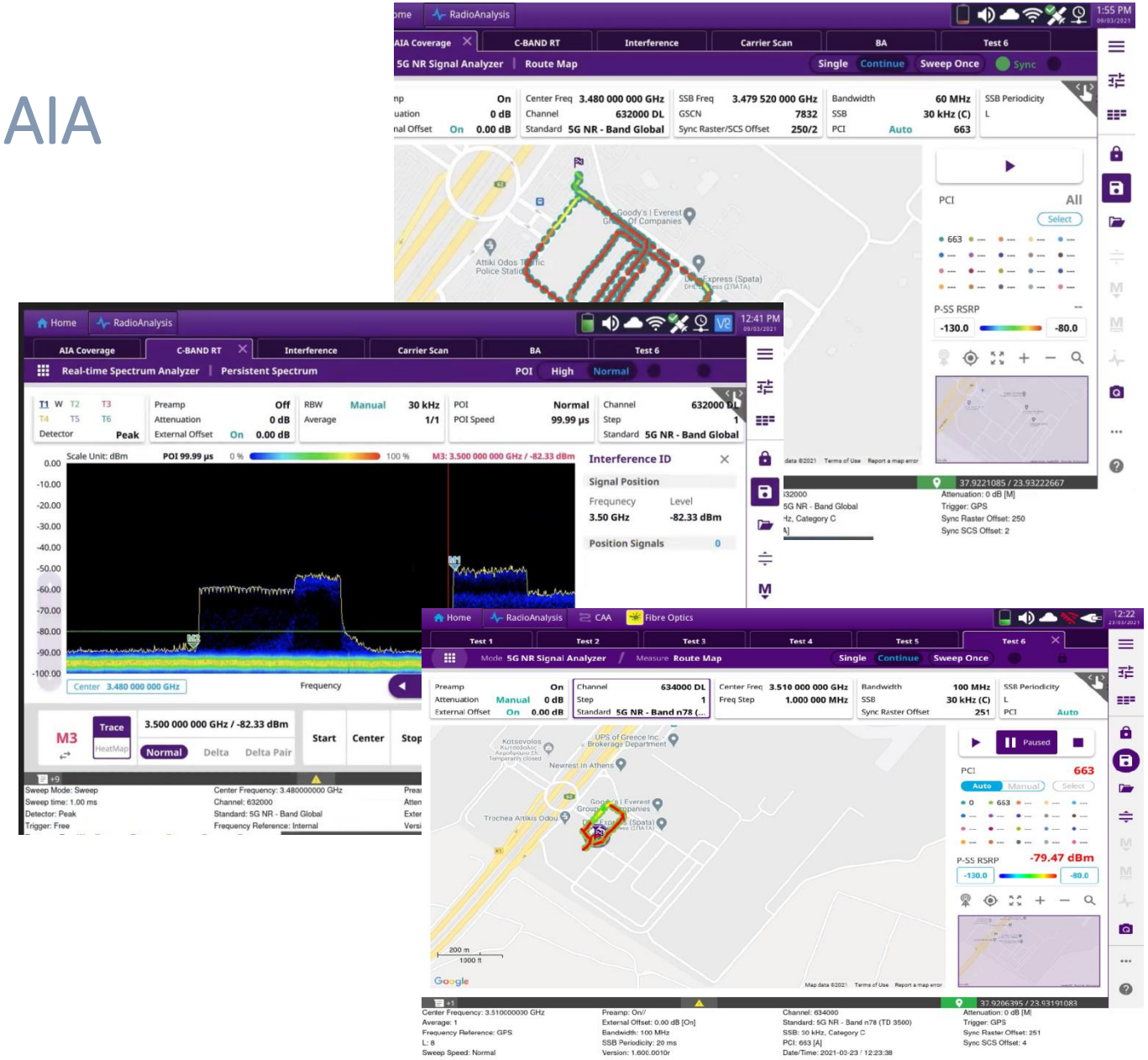
Round Trip Time: 18.16 ms (HTTPS: 28.82 ms)



CIR: 1000 Mbps
Target TCP Throughput: 949.3 Mbps
Average TCP Throughput: 146.9 Mbps

ACTA's RF measurements at AIA

- ACTA provided RF measurement equipment, which was used together with NOKIA to optimize the network and resolve issues on the field.
- Measurements were taken in April and again in September, following reconfigurations of the network .
- The results were:
  - ✓ the elimination of a timing error,
  - ✓ and the reduction of the available 5G spectrum from 100 MHz to 40 MHz within the 3450-3500 MHz band (to avoid interference from commercial 5G networks in the area)



Innovation approach

The complete measurements files can be correlated and further analyzed in relation to application level measurements using the 5G EVE KAFKA communication setup between ACTA and WINGS (through appropriate translator from VIAVI Fusion format to 5G-EVE format) .

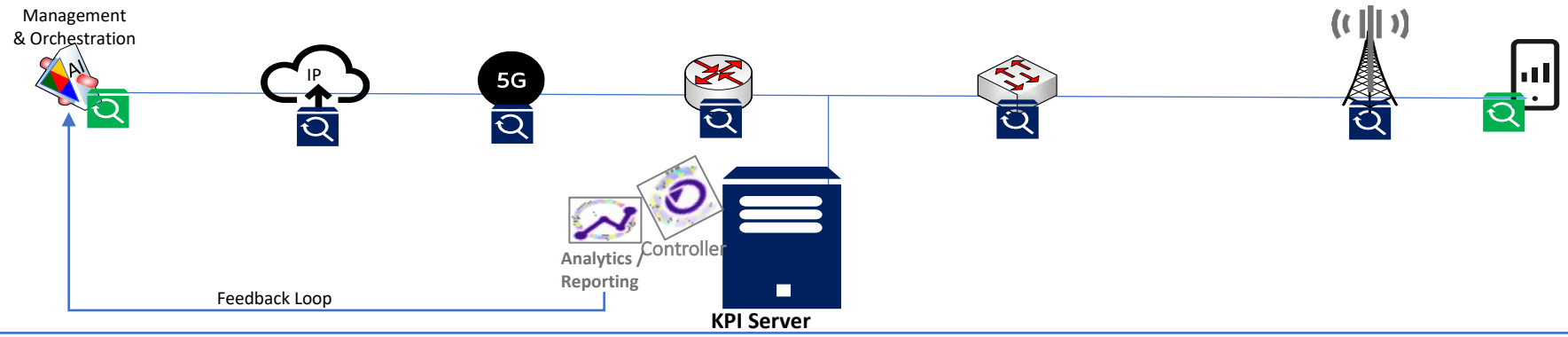
The innovative aspect of the suggested approach is:

- 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.)

```python
import calendar, datetime, time, json
from colorama import Fore, Back, Style
from kafka import KafkaConsumer, KafkaProducer


# Open Kafka Stream from ACTA Server
# ACTA Server Kafka topic, for csv use fusion_pm_csv
topic = 'fusion_pm_json'
bootstrap_servers = '10.11.10.2:9092'
eve_kafka_servers = '10.10.9.8:9092'
# !!IMPORTANT don't use 'earliest' auto_offset_reset for production, user 'latest instead'
consumer = KafkaConsumer(topic, bootstrap_servers=bootstrap_servers, auto_offset_reset='latest')
producer =KafkaProducer(bootstrap_servers=eve_kafka_servers)
# Debug
#for msg in consumer:
#    print (msg)

# Open metrics message
for msg in consumer:
    # Decode ConsumerRecord
    metric_dict = json.loads(msg.value.decode("utf-8"))
    # Open mapping file
```



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http://acta.com.gr

Q & A

http://5gtours.eu/

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