

# POSITIVE CUSTOMER EXPERIENCE BASED ON **24X7** **ACTIVE TESTING & MONITORING**

Network Performance Experts



**CELLQUAL**  
COMMUNICATIONS  
A COMMSQUARE COMPANY



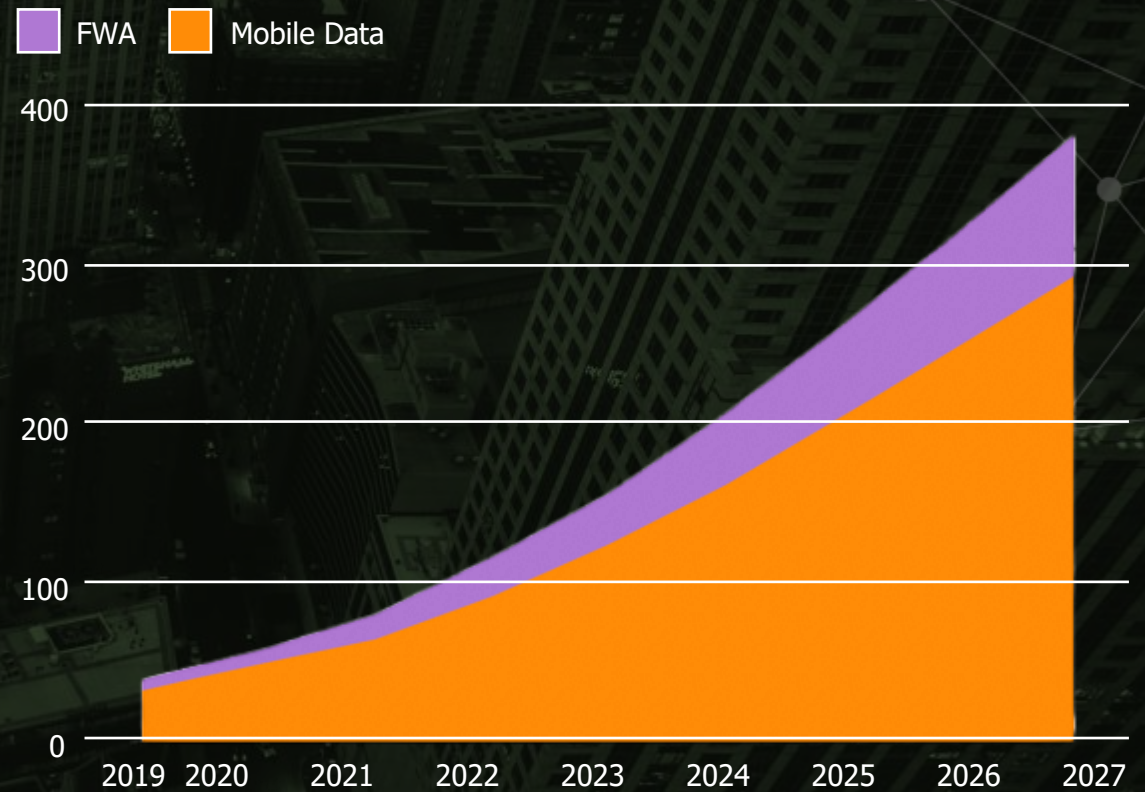
commsquare  
Experts in radio access and mobile data

ITU-TRC JORDAN WORKSHOP ON TELECOMMUNICATION SERVICE  
QUALITY - AMMAN, 17-18 OCTOBER, 2022

# PREFACE

## GLOBAL MOBILE NETWORKS DATA TRAFFIC SNAPSHOT

- Mobile Data Traffic hit 67EB/Month in 2021 & projected to grow to 282EB/Month in 2027
- This is EXCLUDING traffic generated by FWA!
- Mobile data traffic including FWA was 84EB/Month & also projected to reach 368EB/Month in 2027
- Current Video traffic accumulates to 69% of all mobile data traffic, this share is expected at 79% in 2027
- 5G share by the end of 2021 = 10% only! Projections for 60% in 2027
- Assuming that XR-type of services will grow in the latter part of the forecasts!





# THE SITUATION

## MOBILE DATA TRAFFIC GROWTH ACROSS REGIONS

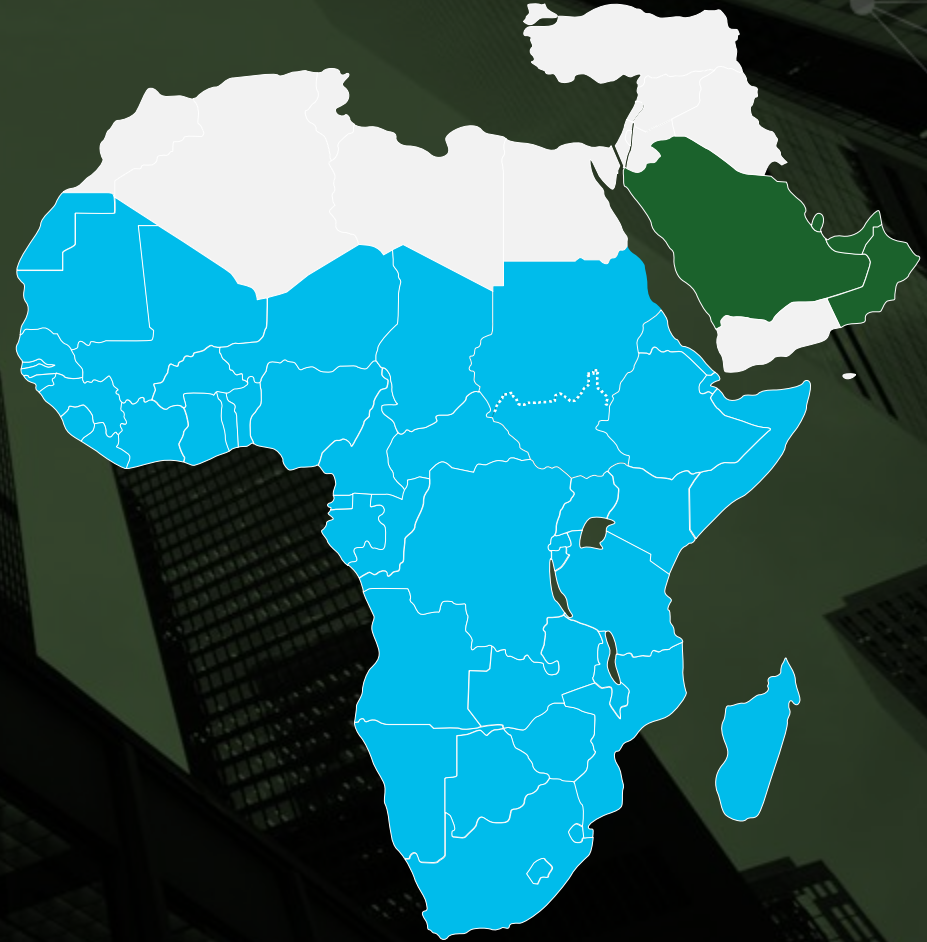
Mobile Data traffic growth can volatile significantly between countries and overtime for a certain country. Fully depending on market dynamics and new trends.

- Example: Sub-Sahara vs GCC countries
  - ▶ SS: Avg Mobile Data Traffic/Month was 3GB in 2021
  - ▶ GCC Avg Mobile Data Traffic/Month was 22GB in 2021

Traffic growth contributors;

- ▶ Improved handset capabilities & features
- ▶ User generated content volume
- ▶ Continued improvement in networks performance

- 🌐 By the end of 2021, global avg data usage / subscriber was 12GB in a month
  - ▶ Is expected to hit 15GB / month by the end of 2022
  - ▶ Is also expected to hit 40GB / month in 2027





# THE SITUATION

## MEETING THE NETWORK QOS/QOE IN TODAY'S LANDSCAPE

Traditionally, companies like us conduct sample tests across various cities, trains, highways & indoor locations as part of audit for operators and assess mobile network performance. This is done via **Drive & Walk** tests

### Upcoming challenges;

- Smartphone users demand for Interactive & Realtime XR-type services
- Businesses working alongside robots and smart machines (Industry 4.0 & maybe 5.0 sooner than expected)



### NETWORK ENGINEERING (QOS)

Verification of new RAN features  
Functionality testing  
Mobility parameters check  
Network troubleshooting



### CUSTOMER EXPERIENCE (QOE)

Coverage validation  
Reliability & availability  
Cont. Streaming services



### NEW FOCUS

Virtualization?  
Extremely short latency time?  
Cont. high & available data rates

# THE SITUATION

## DAILY CHALLENGES WHEN RUNNING A MOBILE NETWORK

FROM PERFORMANCE POV

- Quick detection of network incidents
- Service unavailability & underperformance
- What is the QoE distribution per KPI
- Different QoS profiles provisioning Application/IP/Role
- Customer SLA
- Changes Impact
- QoE Trends over time/location
- How do networks in a market compare to each other?



# ACTIVE TESTING & MONITORING

## WHAT IS ACTIVE NETWORK MONITORING & TESTING

- Grid or specific location probe
- Cont. 24x7 live testing, monitoring & reporting
- Unattended measurements (pre-loaded scripts)
- Probe includes embedded uplink modem with cont. connectivity to management backend
- SIM switch module
- Management, monitoring & reporting backend





# ACTIVE TESTING & MONITORING

## OPERATIONAL REASONS WHY ACTIVE TESTING & MONITORING IS IMPORTANT

# 1

### Early Detection of Performance Issues

- Detect service impacting issues before they happen & before customer complains
- Verification of network features are activated
- Effective resources utilization

# 2

### Need for Automation & Centralization

- Cut down time & labor consuming methodologies in complex networks
- Managing unlimited tests, analysis & reporting with automated, seamless & unlimited tests campaigns

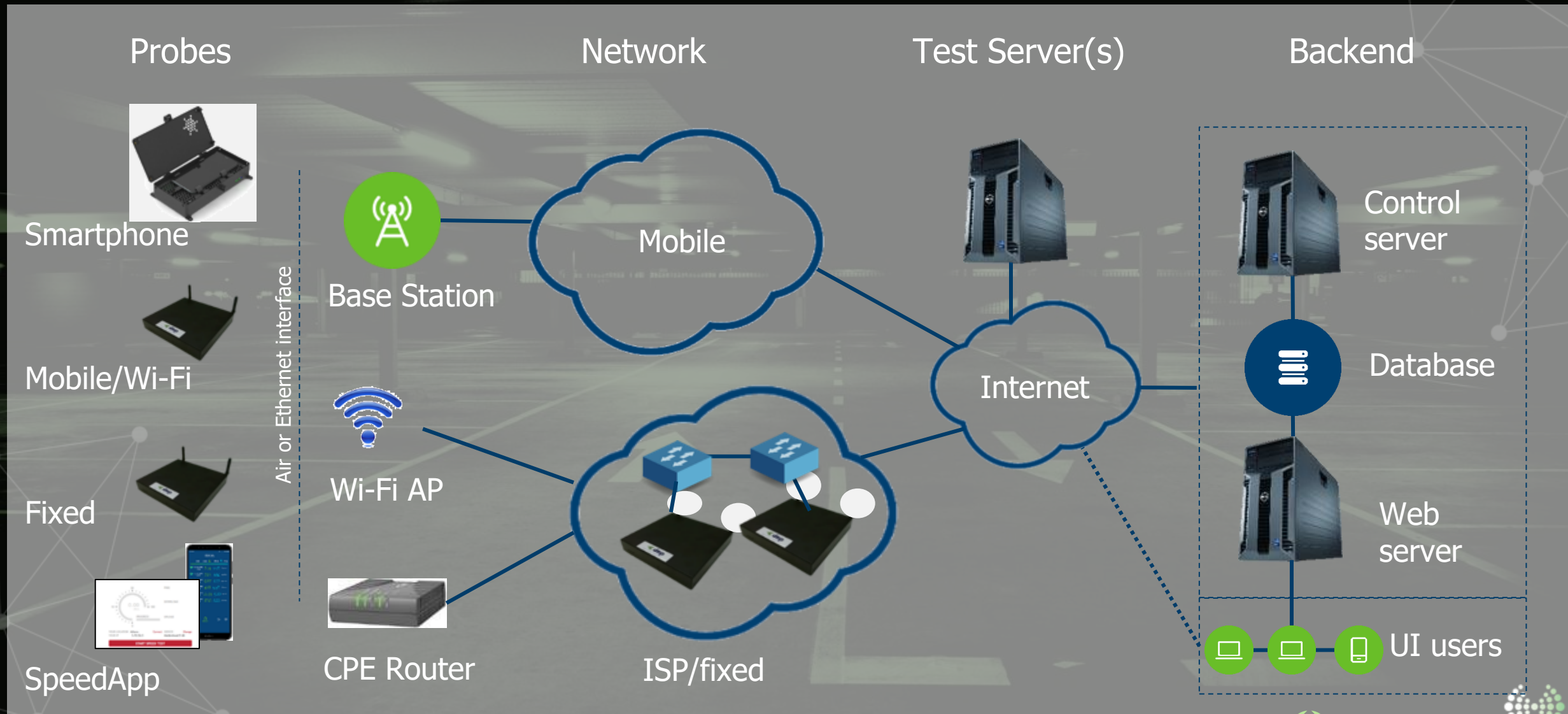
# 3

### Key-Location Monitoring, A Strategic Significance

- Ensuring SLA with key-customers → longer customer lifetime
- Critical situation with new 5G networks → more monitoring → more alarms

# ACTIVE TESTING & MONITORING

## HOW DOES IT WORK?





# ACTIVE TESTING & MONITORING USE MODELS & ADDED VALUES

## A

### INVESTIGATOR GROUP

- Long-term performance evaluation, e.g. throughput, latency, etc.

## B

### SERVICE MONITORING GROUP

- Short repeat cycles, e.g. every 5 minutes
- Near real-time dashboard for fast detection of issues

## C

### BENCHMARKING GROUP

- Long-term performance evaluation, e.g. throughput, latency, etc.



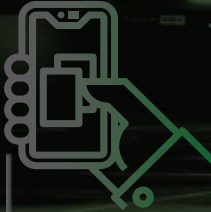
# ACTIVE TESTING & MONITORING DEPLOYMENT SCENARIOS



## Permanent Monitoring Grid

Deploy a grid of Probes in different locations

*Get insights in all network segments, obtain real-time alerting & alarming. Establish a reference basis for historical trending*



## Drifting Testing Fleet

Maintain a fleet of Probes to

*Low-cost/easy to deploy probes are a great alternative to costly Drive Test and on-site works.*



## SpeedAPP

App or embedded SDK, controlled by the user





# ACTIVE TESTING & MONITORING

## PRE-INTEGRATED FEATURES OF AN ACTIVE TESTING SOLUTION



- ✓ Plug-n-play: only needs power
- ✓ 24/7 periodic testing with continuous monitoring
- ✓ Unattended measurements
- ✓ Managed GUI & control servers
- ✓ Remote central control
- ✓ Different user profiles
- ✓ Alarms & notifications
- ✓ Raw data export in .csv files
- ✓ IP tracing – TCP/IP analysis (IPPM)
- ✓ GPS tracking
- ✓ Multi-SIM operation
- ✓ Watchdog functionality on probes
- ✓ Remote probe SW upgrades

# ACTIVE TESTING & MONITORING

## SELECTED USE CASES: REGULATORY ASSESSMENT OF QOE / MVNO VS HMNO

### 1 Subscriber QoE Service Level Evaluation

- Testing popular Services and Apps
- Testing possibly different Handsets/CPEs types, even at household level

### 2 Benchmarking Networks

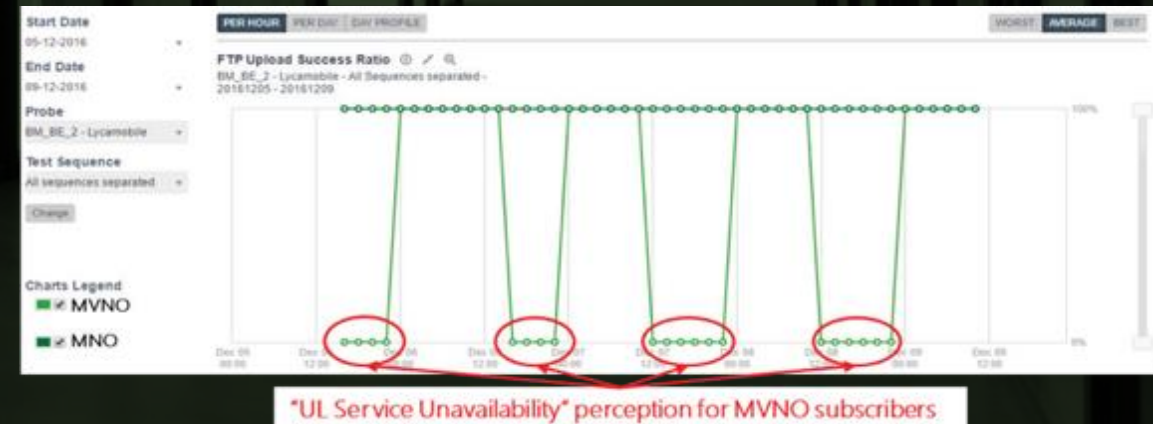
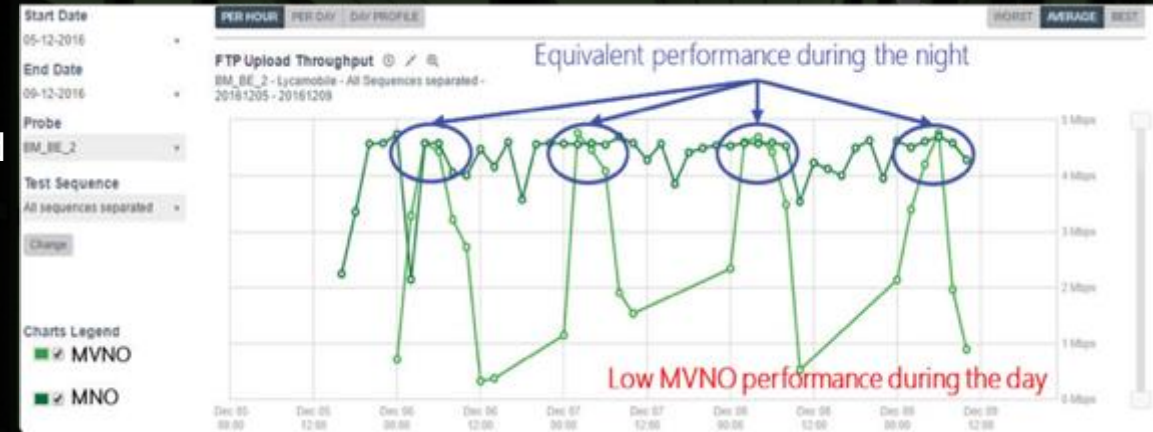
- Comparison between networks (Even within same probe)
- Mobile & fixed networks

### 3 Regulators Reporting

### 4 Monitor Important Events in Ad-hoc & Systematic Modes

### 5 Fairness Assessment Mechanism

- MVNO vs HMNO





# ACTIVE TESTING & MONITORING

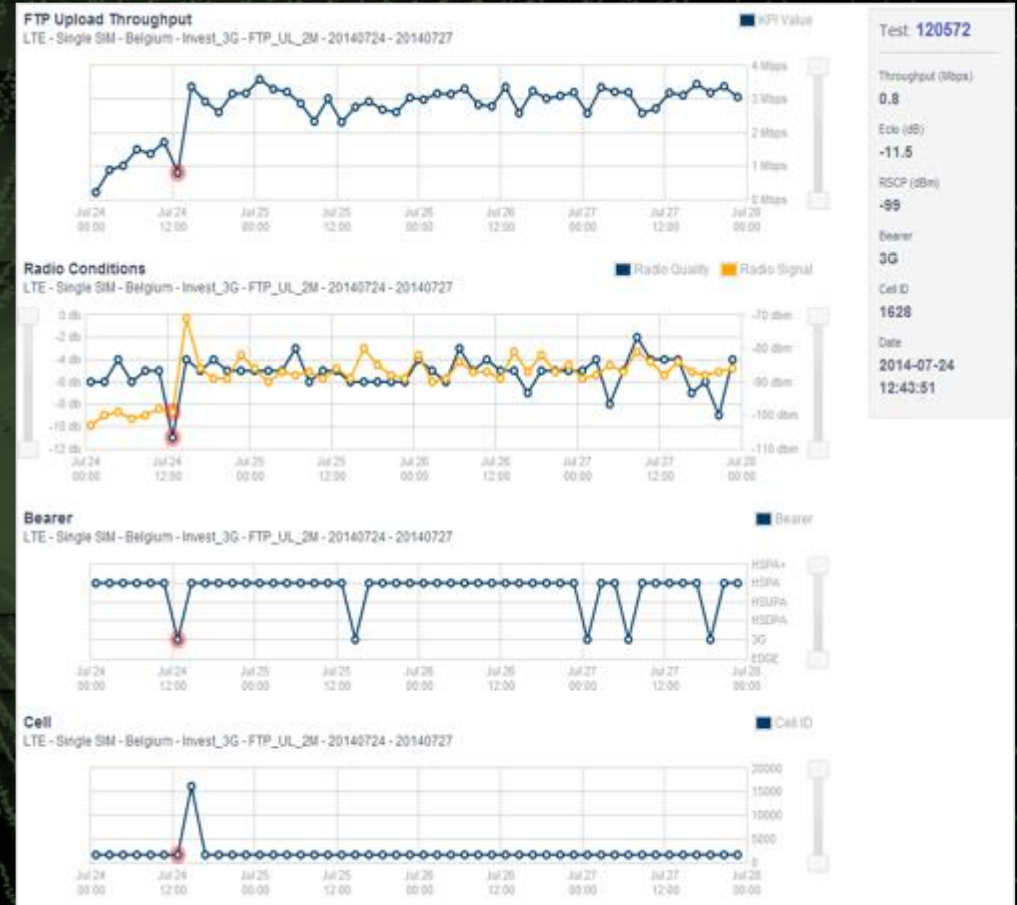
## SELECTED USE CASES: OPERATIONS TEAM

### 1 Real-Time Monitoring of Performance

- Quick detection of incidents leading to service unavailability & poor performance

### 2 Troubleshooting

- Perform targeted tests during resolution of incidents
- Validate QoS provisioning





# ACTIVE TESTING & MONITORING

## SELECTED USE CASES: ENGINEERING TEAMS

**1** Mid-Long Term Performance Assessment

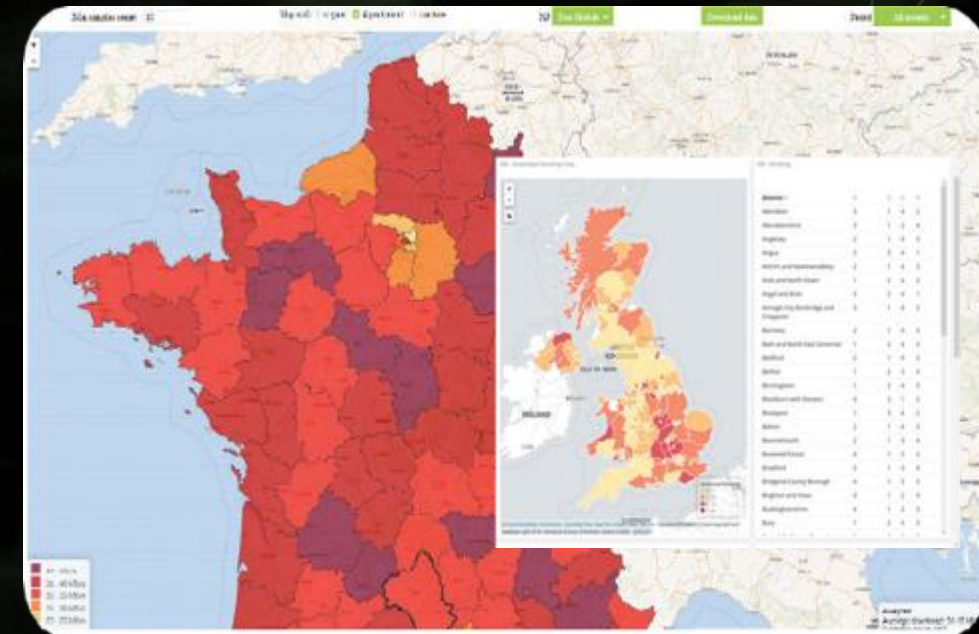
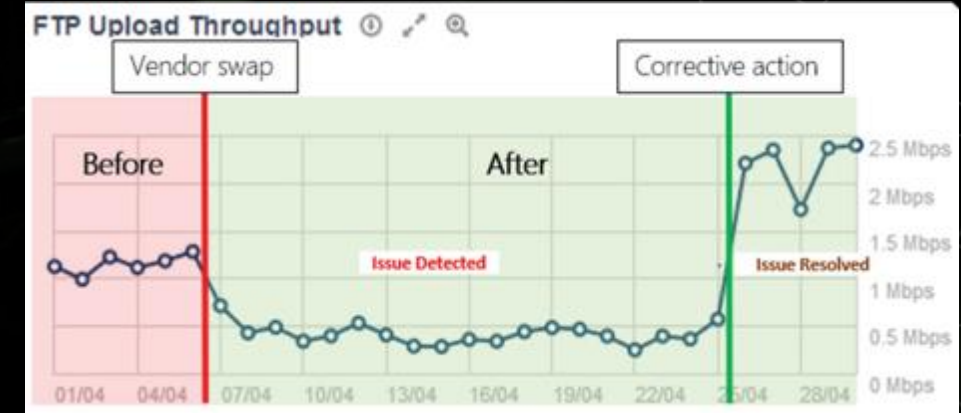
**2** Immediate Feedback Upon Network Change

**3** Compliment to Drive Test

➤ E.g. bottleneck detection: non-busy hour vs. busy hour performance

**4** Value from analytics on large-scale SpeedApp data

➤ Coverage and network availability assessment





# ACTIVE TESTING & MONITORING

## SELECTED USE CASES: ALARMS & NOTIFICATIONS

### An effective alarming mechanism

- Sending automatic email notifications for both humans or integration into existing NMS tools
- Immediate issue detection in terms of:
  - ▶ Low network performance
  - ▶ Low service availability
  - ▶ Probe operation loss

Severity	Description	KPI Name	Threshold	Probe	Command	Latest Trigger	Latest Measurement	KPI Value
1	FTP_DL_5M (Demo_Invest_HSPA) at HSPA	Ftp Download Throughput Bps	5 Mbps	Single SIM - Greece	FTP_DL_5M	2014-06-12 12:37:07	2014-06-12 12:37:07	3.72 Mbps
0	FTP_DL_5M (Demo_Invest_HSPA) at Benchmarkar	Ftp Download Throughput Bps	5 Mbps	Multi SIM - Belgium	FTP_DL_5M	2014-07-17 13:23:56	2014-07-17 15:24:56	9.04 Mbps
0	FTP_DL_5M (Demo_Invest_HSPA) at LTE	Ftp Download Throughput Bps	5 Mbps	Single SIM - Belgium	FTP_DL_5M	2014-07-17 04:45:44	2014-07-17 14:45:45	8.55 Mbps
0	FTP_DL_5M (Demo_Invest_LTE_Base) at LTE	Ftp Download Throughput Bps	10 Mbps	Single SIM - Belgium	FTP_DL_5M	2014-07-16 20:43:56	2014-07-17 14:43:47	12.8 Mbps

Description	KPI Name	KPI Value	Threshold	APN	Last Change	Time Window Start	Time Window End
Ping_RTT_Proximus	Ping RTT Ms	99	80	internet.proximus.be	2014-03-18 17:25:51	2014-03-18 16:40:00	2014-03-18 17:04:59
Ping_RTT_Mobistar	Ping RTT Ms	112	80	internet.be	2014-03-18 17:25:51	2014-03-18 16:45:00	2014-03-18 17:04:59
Ping_RTT_Base	Ping RTT Ms	42	80	gprs.base.be	2014-03-15 22:16:52	2014-03-18 16:45:00	2014-03-18 17:09:59
PDP_Proximus	Pdp Success Ratio	100	90	internet.proximus.be	2014-03-16 10:46:58	2014-03-18 16:40:00	2014-03-18 17:04:59
PDP_Mobistar	Pdp Success Ratio	100	90	internet.be	2014-03-17 19:06:24	2014-03-18 16:45:00	2014-03-18 17:04:59
PDP_Base	Pdp Success Ratio	100	90	gprs.base.be	2014-03-13 20:46:42	2014-03-18 16:45:00	2014-03-18 17:09:59
Ping_RTT_Wind	Ping RTT Ms	102	80	gint.b-online.gr	2014-01-27 17:15:36	2014-03-18 16:55:00	2014-03-18 17:14:59
PDP_Wind	Pdp Success Ratio	100	90	gint.b-online.gr	2014-01-28 10:15:31	2014-03-18 16:55:00	2014-03-18 17:14:59

**Alarm Definition** x

**KPI** Pdp Success Ratio

**Description** PDP\_Mobistar

**Severity** Critical

**Threshold** 90

**Recovered Threshold** 100

**Sample # Threshold** 2

**Time Window (min.)** 30

**APN** internet.be



# ACTIVE TESTING & MONITORING

## SELECTED USE CASES: VIP CUSTOMERS & EVENTS

### Monitor the SLA or QoS delivered to important customers or during important events

Strategic key location monitoring can also include mobile operators deploying active testing at their retail stores to continuously validate that voice and data service quality is at the highest level.

Another example is stadiums. With no traffic in stadiums when they are empty often network issues aren't detected until game time which is then too late to resolve any problems. With an active testing approach issues can be highlighted and fixed before the crowds descend, and active testing can also be used to validate user experience when the stadium is full, and the network is under pressure. Other contributors;

- Monitor corporate APNs or WiFi SSIDs
- Easy to deploy
- Fast overview in GUI
- Possibility to integrate raw data into customer internal database tools and feed custom GUIs

“ Enterprise, VIP, Key-customers are not only profitable, but are also expensive to acquire”  
Ensuring SLA means longer lifetime of this customer.



# ACTIVE TESTING & MONITORING

## SELECTED USE CASES: FIXED LINE & FTTH TESTING

Active Testing can be effectively used by ISPs for performance and service availability monitoring of their broadband fixed line networks

- Monitor fixed-line data performance at strategic locations, per city, etc.
- Compare and verify data performance over fixed-lines with:
  - Different QoS
  - Different vendor equipment
- Regular reporting to Regulators for data network performance and VoIP services

# ACTIVE TESTING & MONITORING

## TAKEAWAYS & CONCLUSIONS

An Active Testing & Monitoring approach is an added-value to regulatory monitoring & mobile networks verification techniques to achieve;

- ▶ A fully automated & remotely managed monitoring service in real-time with validated data sets from fixed locations around the network providing continuous insights about performance & quality
- ▶ A feasible and comprehensive managed solution that requires insignificant efforts to relocate and switch on
- ▶ Scalable and handy solution to deliver numerous number of samples & trends for decisions based on statistically viable number of samples for decision making
- ▶ Monitoring VIP locations, Festivals and Events at key locations seamlessly and around the clock
- ▶ A convincing ROI in terms of CAPEX & OPEX compared to conventional measurements techniques





# THANK YOU FOR BEING GREAT LISTENERS



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