# 5G NR Deployments Use Cases In Demand

A Note from Infovista Network Testing

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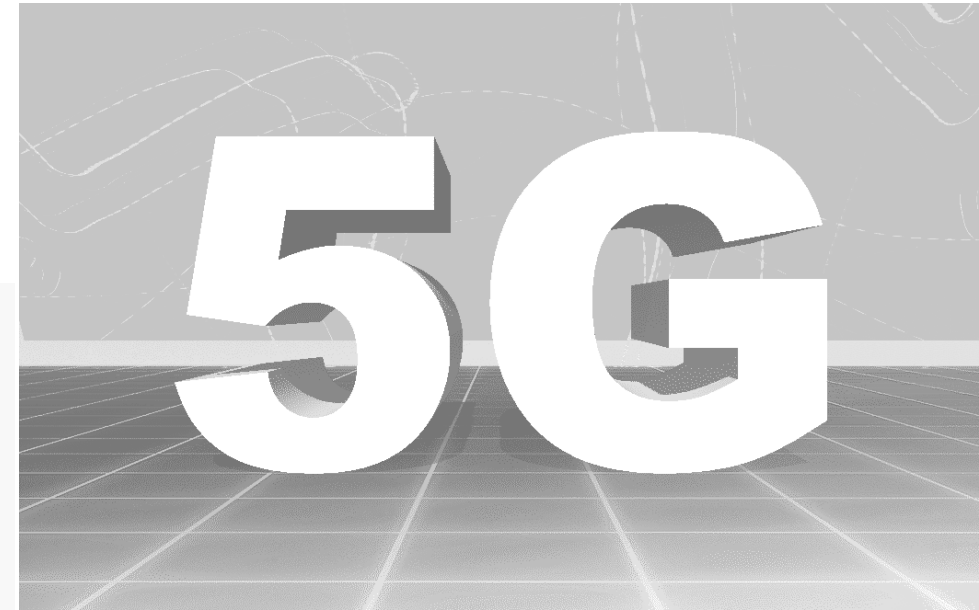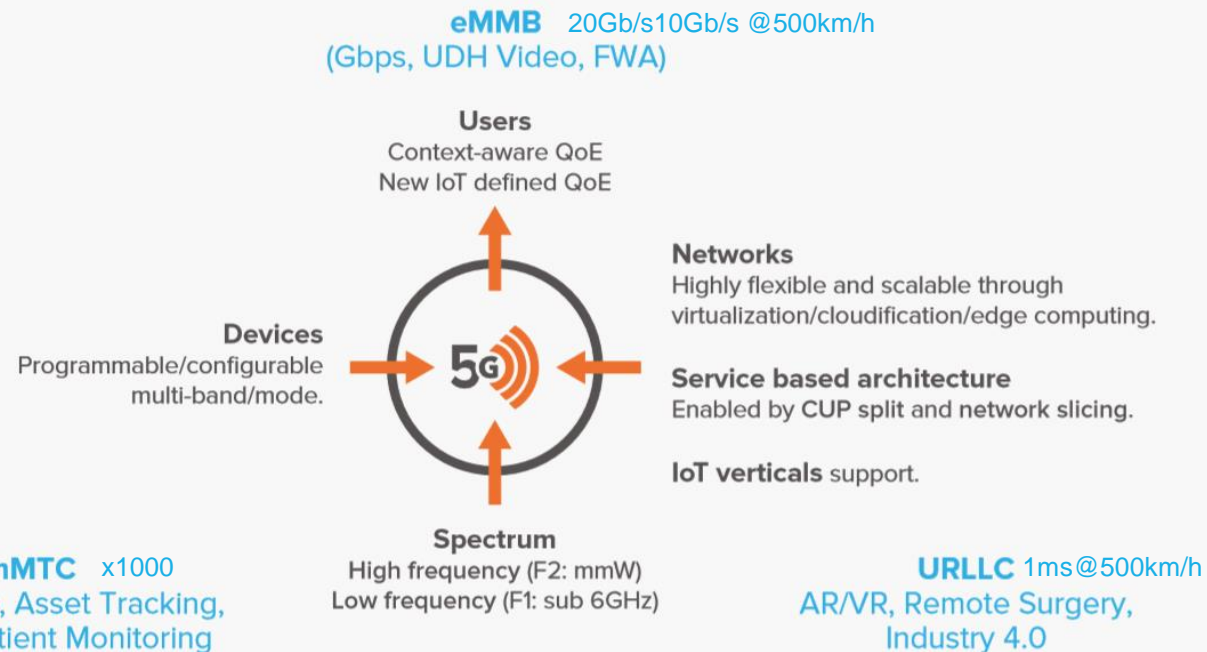
**KNOW YOUR NETWORK™**

5G QoS/QoE expectations and enablers

Use cases in demand for testing 5G NR enablers

Three take away

# 5G QoS/QoE expectations



**eMMB** 20Gb/s10Gb/s @500km/h
(Gbps, UDH Video, FWA)

**Users**
Context-aware QoE
New IoT defined QoE

**Networks**
Highly flexible and scalable through
virtualization/cloudification/edge computing.

**Devices**
Programmable/configurable
multi-band/mode.

**Service based architecture**
Enabled by CUP split and network slicing.

**IoT verticals** support.

**Spectrum**
High frequency (F2: mmW)
Low frequency (F1: sub 6GHz)

**mMTC** x1000
Smart Cities, Asset Tracking,
Remote Patient Monitoring

**URLLC** 1ms@500km/h
AR/VR, Remote Surgery,
Industry 4.0

*…operators will be very cautious with their 5G rollouts because they know they are based on pre-standard 3GPP Rel 15 network equipment and end point devices*

*… a lot of the hype is where things are going to be 10 years from now with 5G, not what it will be at launch*

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# 5G QoS/QoE enablers

for device/user centric throughput and latency, delivered by high network capacity with max. spectral efficiency and energy savings

| 5G Target Use Cases | 5G Key Enablers | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | mmWave (Mobile) | mMIMO 3D Beamforming | Device Centric | Self-contained Transmission | Flexible Numerology and Slot Structure | Network Slicing |
| FWA | Very Relevant | Very Relevant | | | | |
| eMBB | Very Relevant | Very Relevant | Very Relevant | Very Relevant | Applicable | Very Relevant |
| URLLC | Applicable | Very Relevant | Very Relevant | Very Relevant | Very Relevant | Very Relevant |
| Massive IoT | Applicable | Applicable | Applicable | Very Relevant | Very Relevant | Very Relevant |

Spectral Efficiency

| Capacity and Throughput | Capacity and Coverage | Content-aware QoE | Latency |
| --- | --- | --- | --- |

Capacity, Latency and Throughput

Flexibility: no size fits all dynamic management of QoS/QoE per slice and within the slice
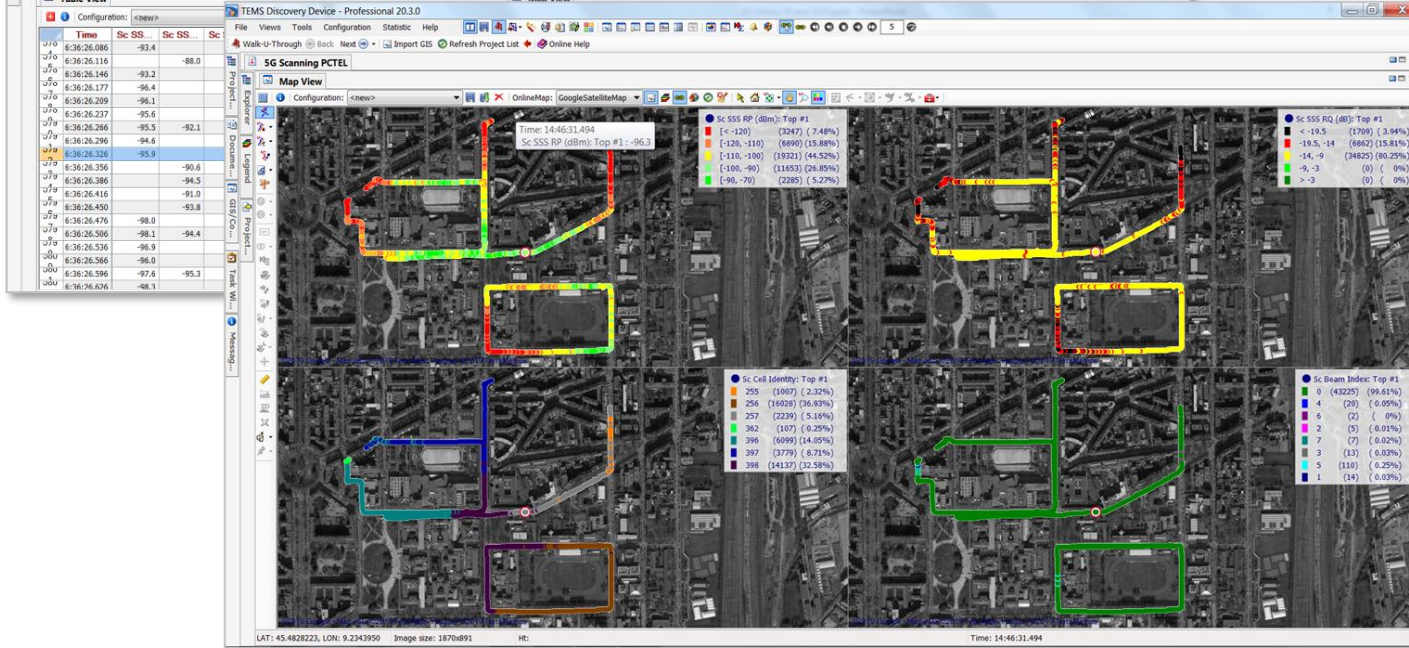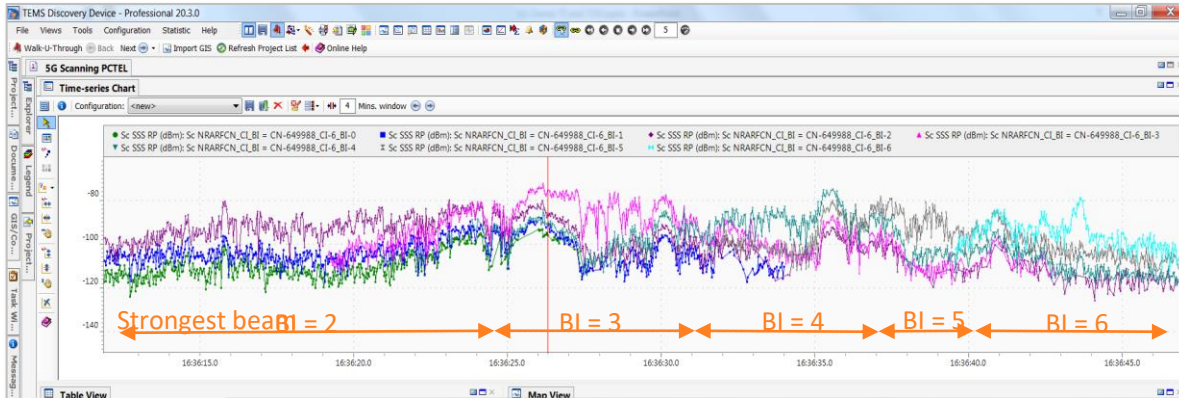
● Very Relevant   ● Applicable

# Still the coverage and connectivity .....

but for a 3D beam centric and 3D dimensional network - device/user perspective



Real time series of cell/beams identities and characteristics: configuration (radio ch; band, BWD, modulation schemes), performance (Signal strength and quality, physical layer throughput)

Map views of beam performers and their usage - strongest, failures/coverage gaps (automated planning tunning)



Drone based UE based indorr/outdoror coverage parameters (RSRP, RSRQ, CINR) – consumer and/or IoT

*FINDINGS: 3D Beam management is the key to smooth QoS/QoE connectivity , continuity and consistency*

# New co-existence EN-DC for 5G NSA



Real time: multitechnology workspace
LTE-NR common simultaneous views
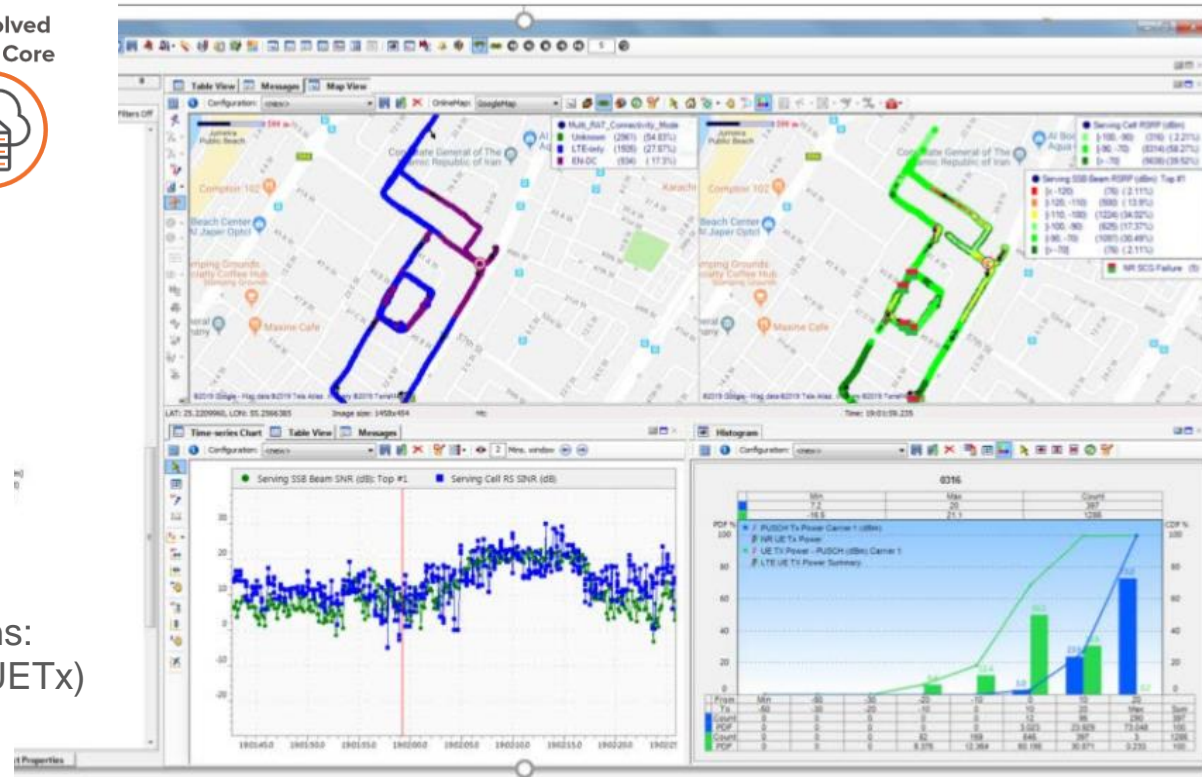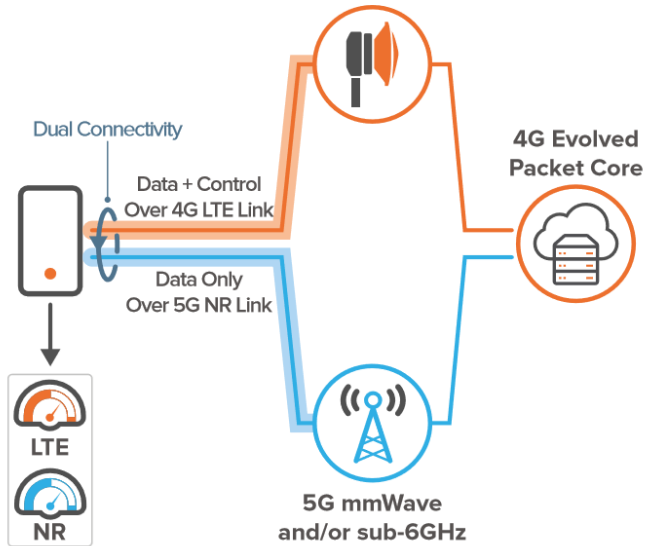
Analysis: multiRAT connectivity
and performance gain along a route

Maps: connectivity mode (e.g. LTE only/
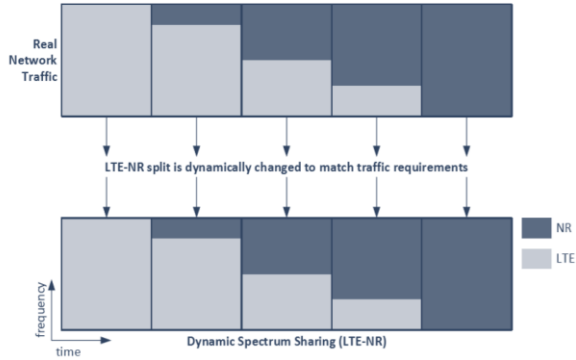EN-DC), % usage, failures and RF quality

- 17% EN-DC; 27% LTE only; 5 failures
  for SecondCellGroup (NR)
- EN-DC RF quality shows to be poorer
  than LTE (RSRP distribution centered
  around -110dBm to -100dBm only)

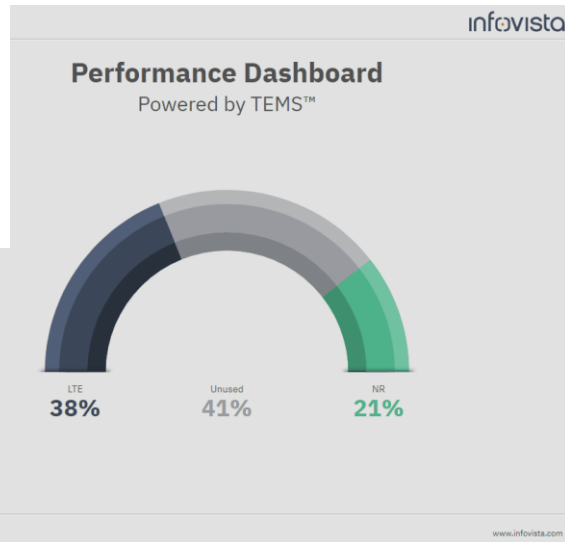Time Series and distributions:
 - coverage quality (SINR, UETx)

*FINDINGS: 5G NR weak and/or fringe coverage area diminish EN-DC benefits, consequently lower 5G NSA QoS/QoE*

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# The perpetuum spectrum story ..... now Dynamic SS

## User perception



- overhead, shared LTE/NR RF links, scheduling complexity

- Capacity w/o re-farming or spectrum

LTE and NR data traffic dictates %  Physical Resource Block PRB used (aggregated over interval)
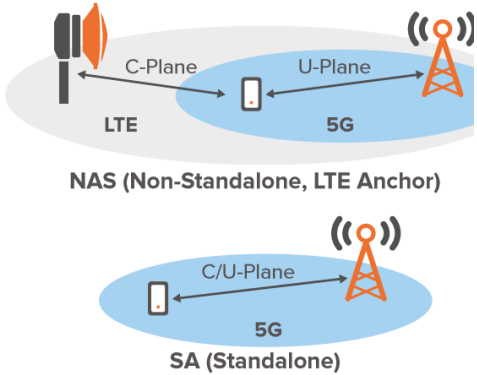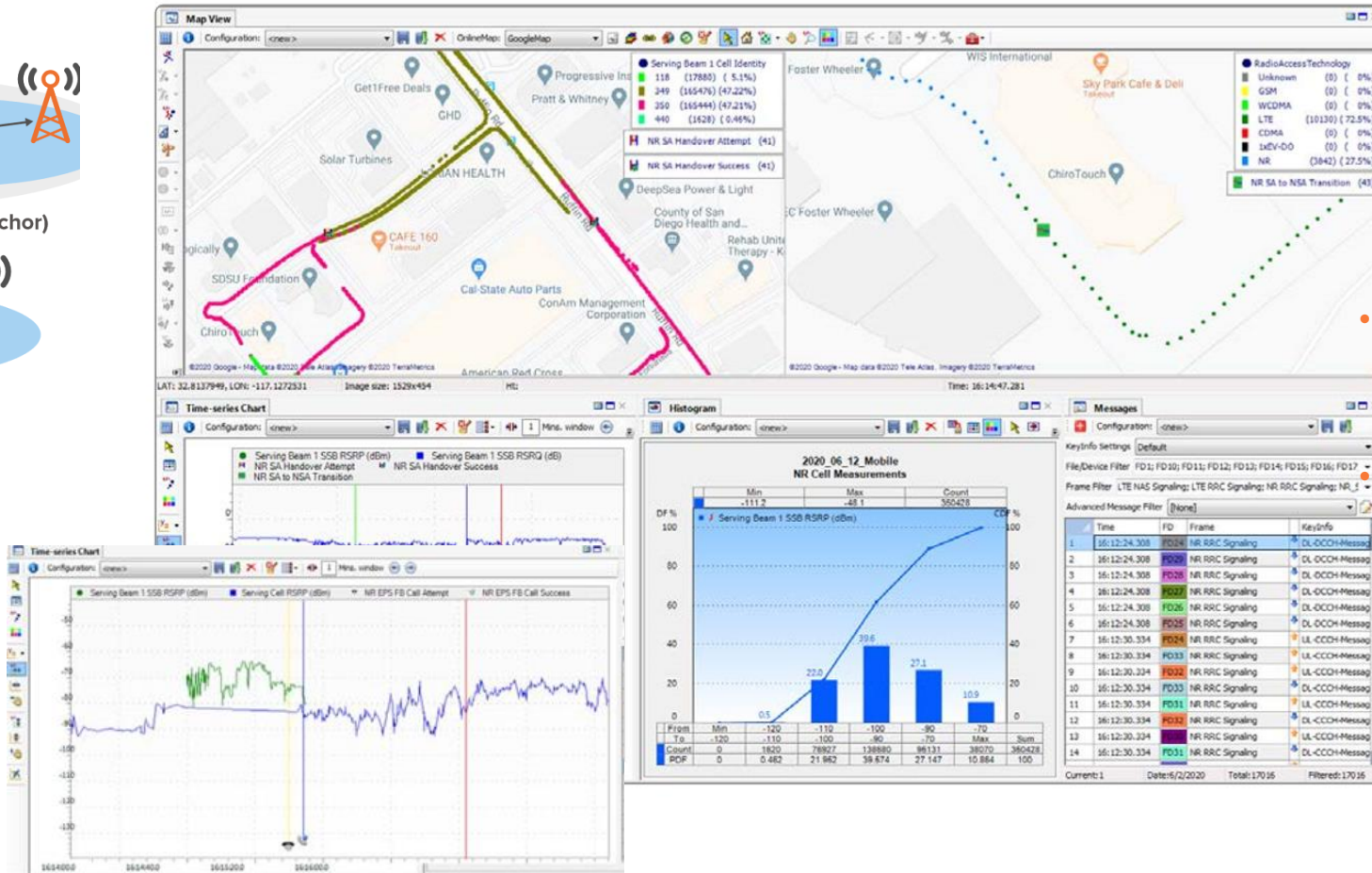
DSS scenario: mobile to mobile call with EQ1 in  NSA (EN-DC) configuration (LTE anchor in band 66 (1800MHz) and NR in band 71); EQ2 in LTE only (band71; 600MHz)

*FINDINGS: Maximized resources utilization on band 71 (600MHz) at the cost of additional overhead and lower user throughput, consequently  lower 5G QoS/QoE*

# NSA to SA transition: SA mobility and EPS FallBack



- Map coverage availability (serving beam CI) and handover performance (number of NSA to SA HO attempts and successes; 100% in this case) along the route

- % and space distribution of the measurements on NR SA (27.5%) and on LTE (72.5%)

- 43 transitions NR SA to NSA

- Overall coverage: serving beam SSB RSRSP distribution centered (-100dBm to -90dBm), more than 40% of the measurements above -110dBm.

  - Ensured 100% SA HO success rate.

EPS fall back (FB), whenever the device perceives weaken NR coverage/performance and/or enters fringe areas

*FINDINGS: -100dBm signal strength ensures smooth SA mobility for 5G QoS/QoE continuity*
*EPS FB to play a significant roll for consistent 5G QoS/QoE in the near future; thus impacting performance expectations*
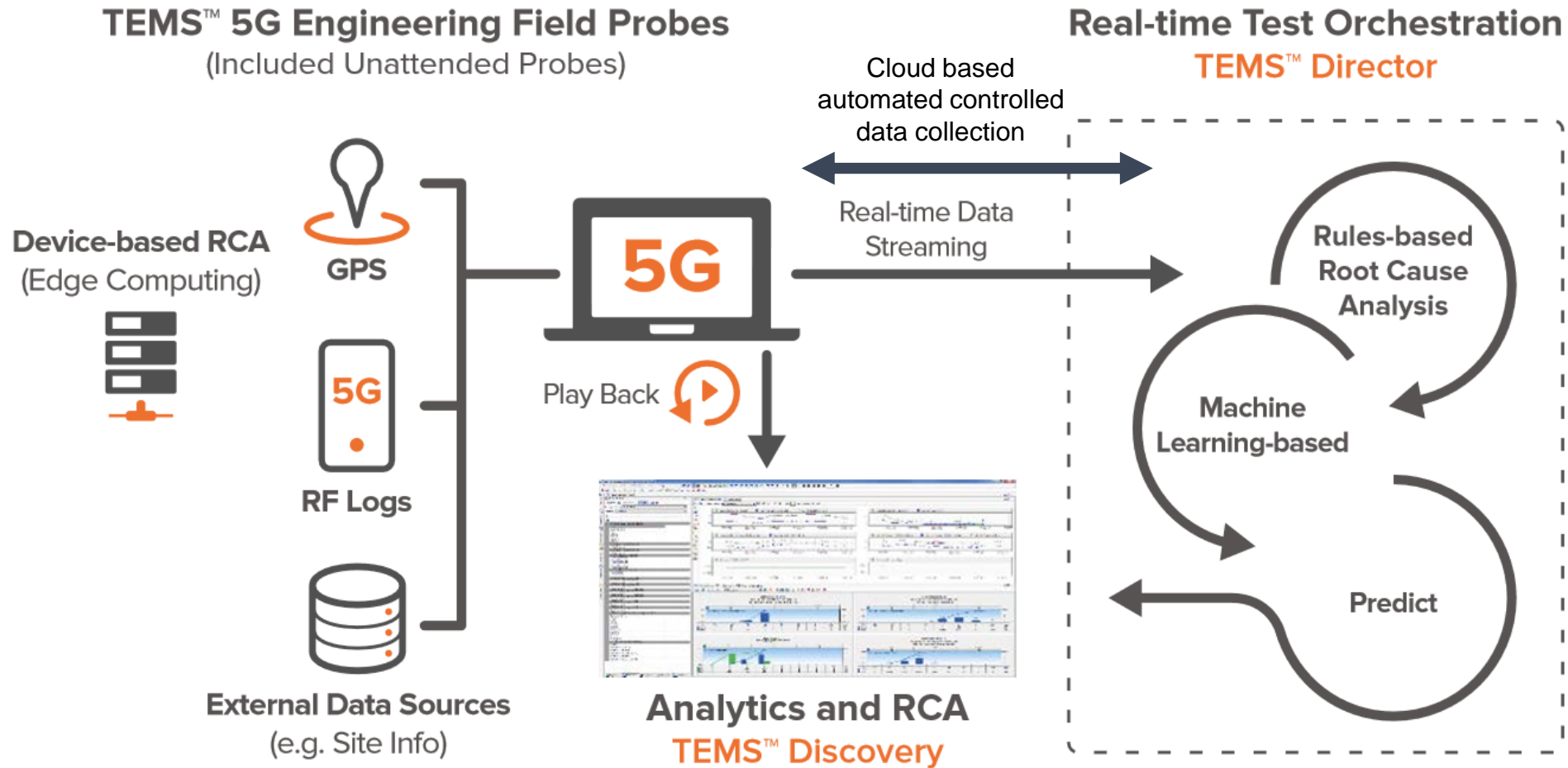
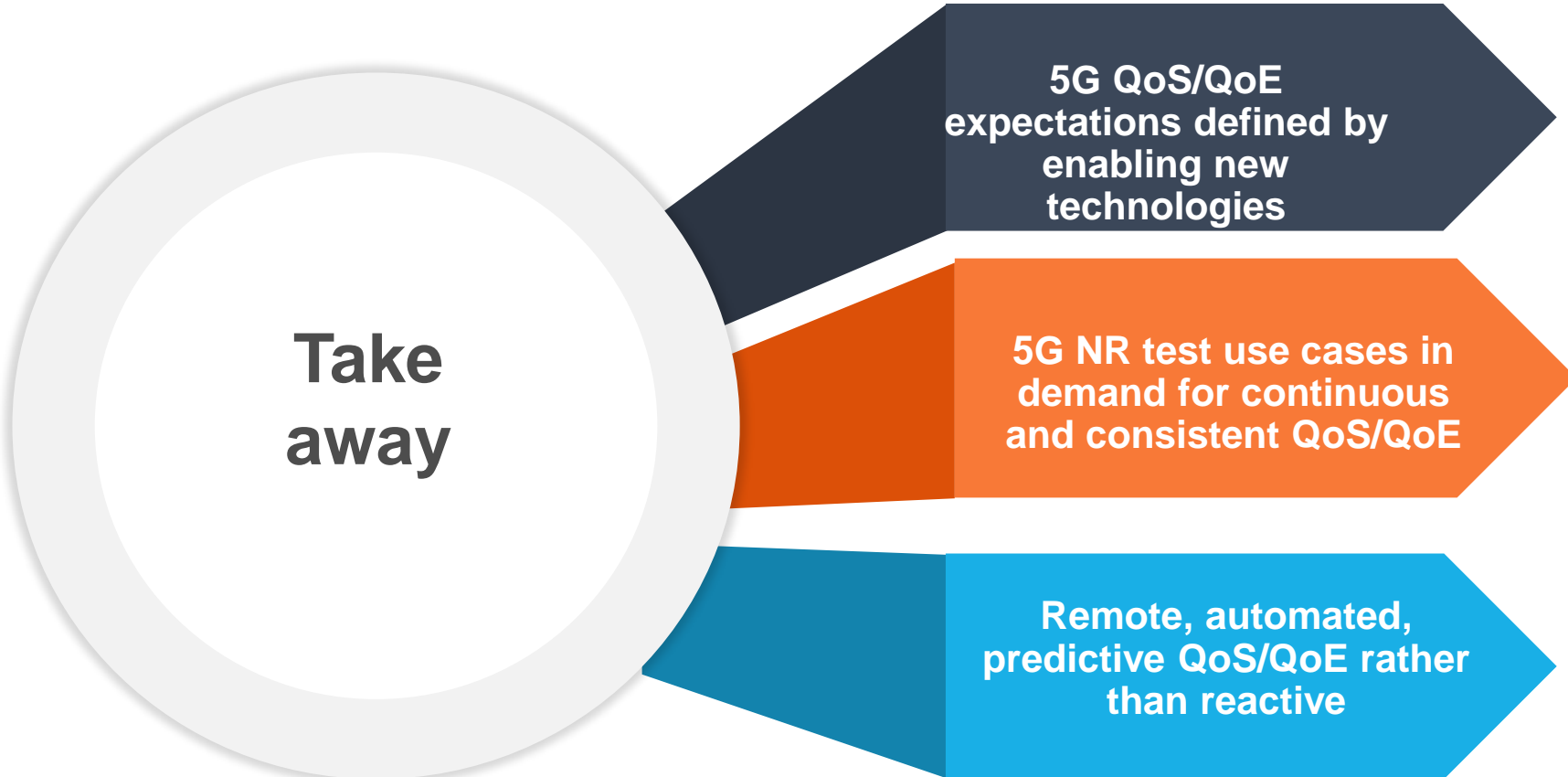# Predictive preferred to reactive whenever possible ......
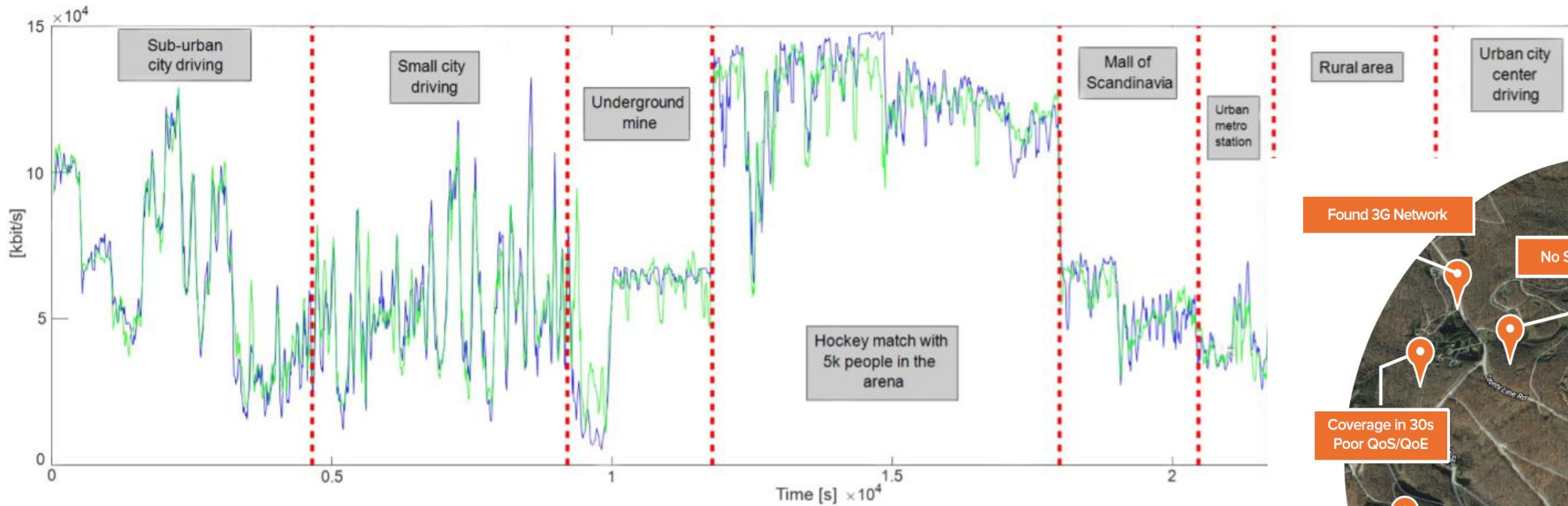


Predictive QoE/QoS performed in the network edge (measurement agent inside car module)

*FINDINGS: Case by case based, QoE modelling is likely to transition from estimations to short term predictions; moving from exactly estimated values of the present to predicted trends*

# The need for mobile test probes rethinking

**TEMS™ 5G Engineering Field Probes**
(Included Unattended Probes)

Cloud based automated controlled data collection

**Real-time Test Orchestration**
**TEMS™ Director**

**Device-based RCA**
(Edge Computing)

GPS

**5G**

Real-time Data Streaming

Play Back

RF Logs

External Data Sources
(e.g. Site Info)

**Analytics and RCA**
**TEMS™ Discovery**

Rules-based Root Cause Analysis

Machine Learning-based

Predict

*FINDINGS: Mobile based test probes with augmented measurements using predictive analytics*

**Take away**

5G QoS/QoE expectations defined by enabling new technologies

5G NR test use cases in demand for continuous and consistent QoS/QoE

Remote, automated, predictive QoS/QoE rather than reactive

# Thank you!

Find out more https://www.infovista.com/resources/tems/initial-5g-nr-drive-testing-with-infovista