Mobile Network Testing

Performance measurements in terrestrial and non-terrestrial networks

VDE ITG Workshop Antennenkonzepte für 3D Netze der Zukunft (01.02.2024)

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Make ideas real

AGENDA

- Network performance test methods
- 3D network coverage and performance
  - Testing aerial networks: use cases and testing needs
  - Drones to perform network testing tasks
- Evolution of test solution
- Outlook to NTN

Impact of bad end user experience

What quality do you expect from your operator’s mobile network?

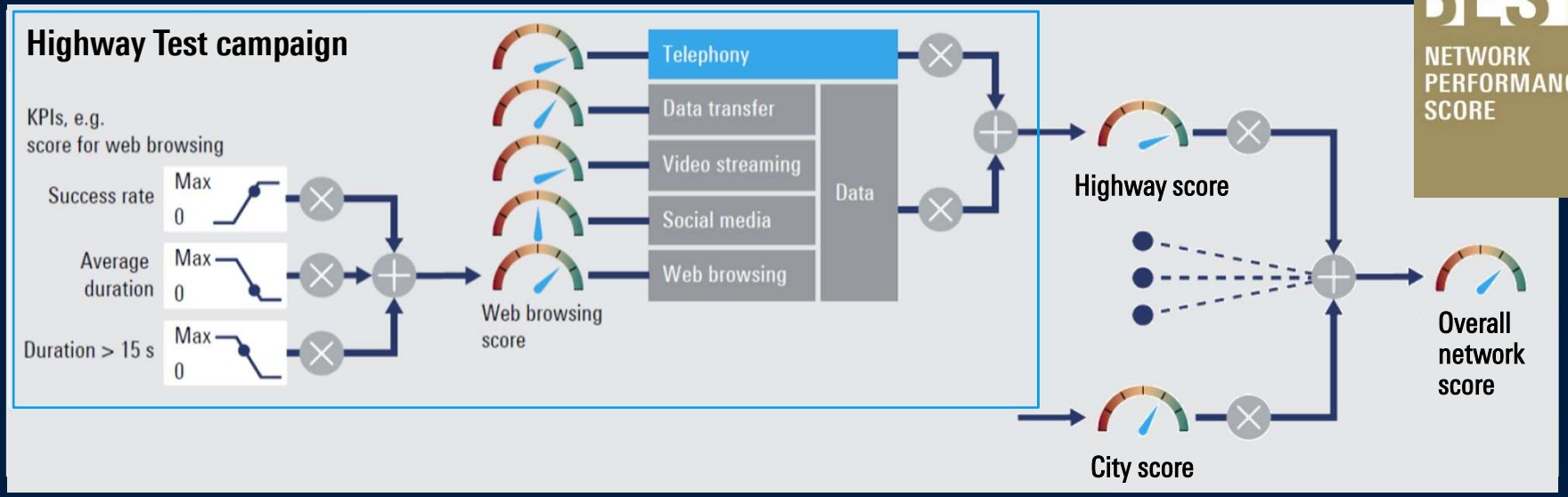
Your choice!

What if the bad quality happens regularly?

- **Bad QoE drives churn rate!**
- **Network benchmarking results are a valuable source for choosing the operator**
- **Monthly / quarterly measurements are the norm for quality-oriented operators**

Network Performance Score – public networks

Methodology approved and published by ETSI (TR 103 559)



- Network Performance Score is technology-agnostic and transparent
- Comparable results between networks/countries/regions and solid quality metrics / claims

QualiPoc Android measurement SW for active tests

Crosscall CORE-Z5
Specific for testing in private networks

Samsung Galaxy flag ships
Specific for testing in public networks

Active Network Measurements

- Data throughput DL / UL
- Call tests, voice quality
- Video streaming including video quality
- App service tests (web browsing, social media…)
- Roundtrip latency, packet delay variation and loss
- L1-L3 trace
- IP layer

- Active tests provide insights into user-perceived application quality and technical KPIs (latency,…)

R&S®5G-STS (5G-Site Testing Solution) for passive tests

R&S®5G STS

Passive Network Measurements in

- ► Private & public networks
- ► 5G Non-Standalone & Standalone networks (NSA / SA)

- ► No Network Access / no SIM needed
- ► Network Scanner:
  - ► 5G / LTE Signal Decoding
  - ► 5G / LTE Downlink tests
  - ► Synchronization tests

► RF DL Tests (Coverage & Signal Quality) provide insights into reference RF environment

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3D network coverage and performance

Two ways how drones and mobile network testing intersect:

1. Aerial network coverage and performance:
   - The capability of aerial networks of guaranteeing safe and secure drone flights (also in BVLOS)
   - Subject of testing: good application performance

2. Perform network measurement tasks
   in a more cost-efficient way vs. legacy methods (e.g. drive and walk tests)
   - The ability to cover difficult areas with test equipment is the value add of drones
   - Subject of testing: public or private network performance (the drone is just the vehicle)

BVLOS: Beyond Visual Line Of Sight

Public safety (mission-critical)

Aerial network coverage and performance

- Drones can be used for inaccessible areas (first responders such as fire fighters, rescue services, etc.)
- Drones must rely on good data connections

Public security (mission-critical)

Aerial network coverage and performance

- Drones are used for rapid inspection of investigation scenes (police, etc.)
- Drones must rely on good connectivity

Public networks: high-rise building coverage verification

Perform network measurement tasks

- Drones can be effective to substitute time-consuming, hard-to-perform (access rights) and, ultimately, expensive indoor tests

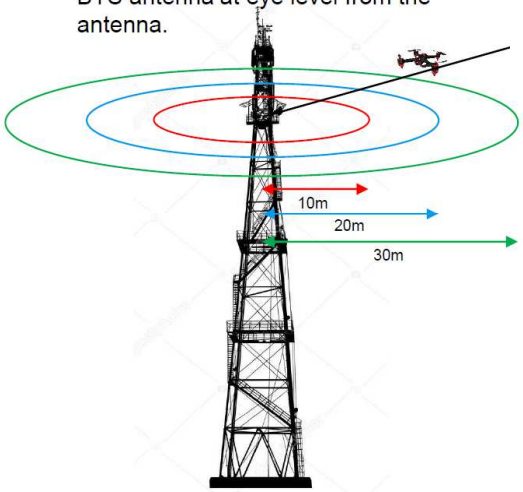
Public networks: tower site verification

Perform network measurement tasks

Tower site verification:

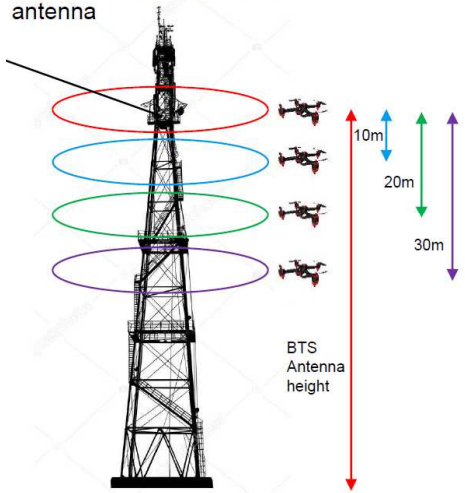
- Sector and tilt verification
- Antenna pattern and back lobe verification
- 5G beamforming verification

1. Drone carrying TSMA scanner is circled at different radius from the BTS antenna at eye level from the antenna.



3-sector LTE basestation
or
5G beamforming basestation

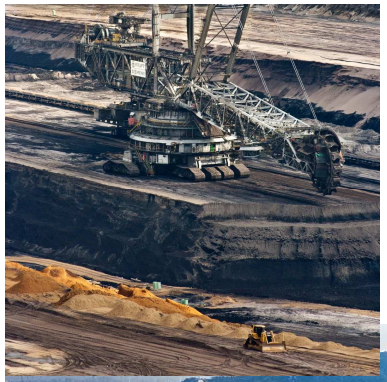
2. The drone is then repeatedly circled at different radius at each of the different heights from the BTS antenna



Coverage and performance in critical infrastructure

Perform network measurement tasks

- Large and not easily accessible areas can be effectively covered with drones



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QualiPoc mobile networks measurement SW – the evolution

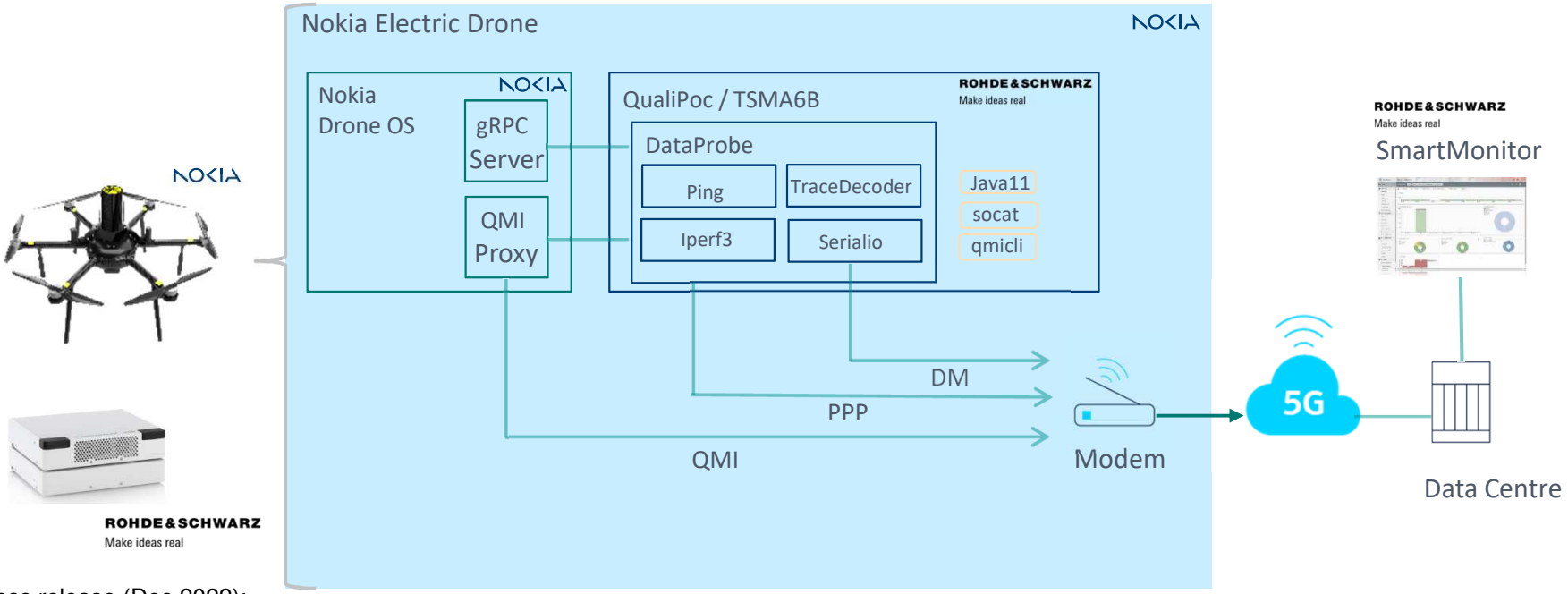
The past:

- QualiPoc Android measurement SW runs on Android devices (smartphones and tablets)

Today:

- QualiPoc measurement SW decoupled from Android OS
- QualiPoc measurement SW can now run on various third party HW platforms (e.g. industrial router, CPE, also embedded in a drone)
- “QualiPoc embedded” runs within a Docker container in a Linux environment

Embedded QualiPoc in Nokia drone architecture with optional scanner TSMA6B as payload



Press release (Dec 2022):
https://www.rohde-schwarz.com/about/news-press/all-news/nokia-and-rohde-schwarz-jointly-explore-feasibility-of-drone-based-network-measurement-solution-press-release-detailpage_229356-1308484.html

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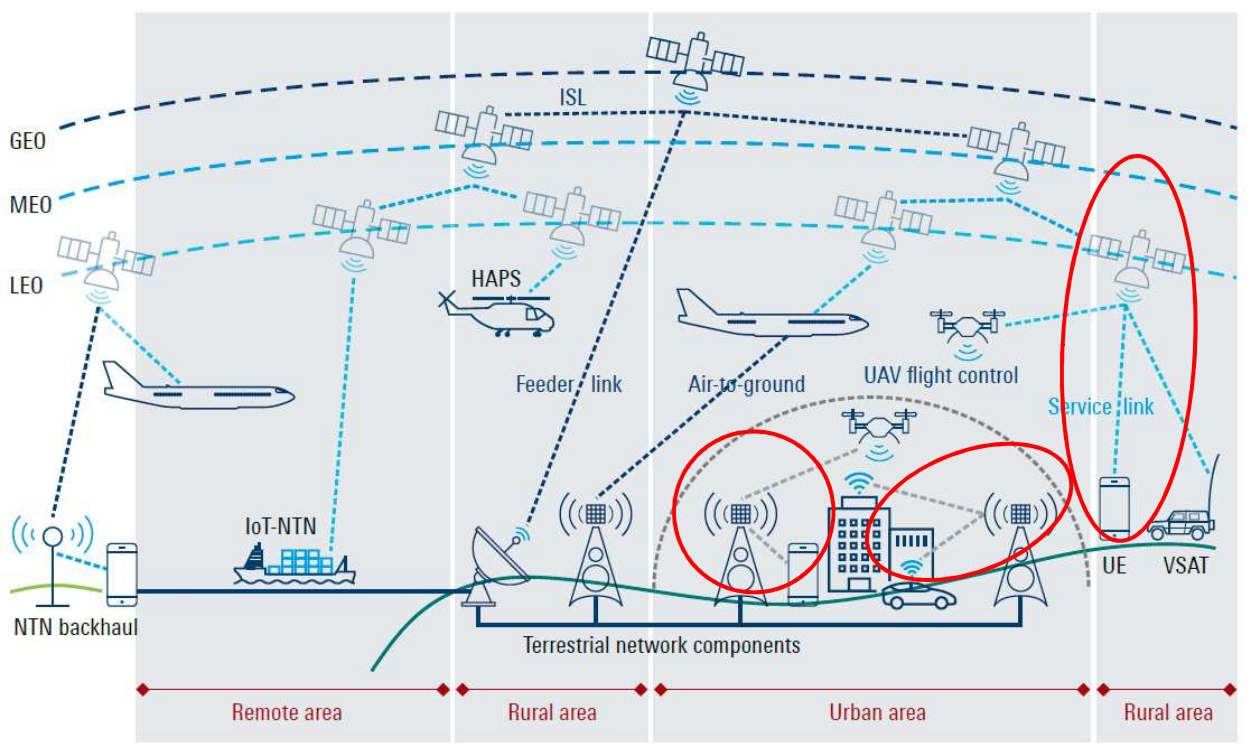
NOKIA

5G NR NTN – Non-Terrestrial Networks



A UE or smartphone communicates with the terrestrial networks and with LEO / MEO / GEO satellites (or HPAS or drones).

<u>Measurement tasks:</u>

- Coverage of TN and NTN (passive tests)
  - Network Scanner 
  - Reference measurement
- Application quality (QoE in active tests)
  - QualiPoc smartphone-based incl. mobility 

Conclusion: Key takeaways

- Drones: clearly a booming market
- 2 use cases: drone as a flying UE + drone as network measurement tool
- Drones can be very helpful in mission-critical and business-critical use cases
- Drones enable 3D mobile network performance measurements
- R&S QualiPoc measurement SW can now run on various third party HW platforms (e.g. industrial router, CPE, also embedded in a drone)

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