

MAXIMIZE NETWORK QUALITY AND PERFORMANCE

Mobile Network Testing Solutions Overview

ROHDE & SCHWARZ

Make ideas real



MOBILE NETWORK TESTING

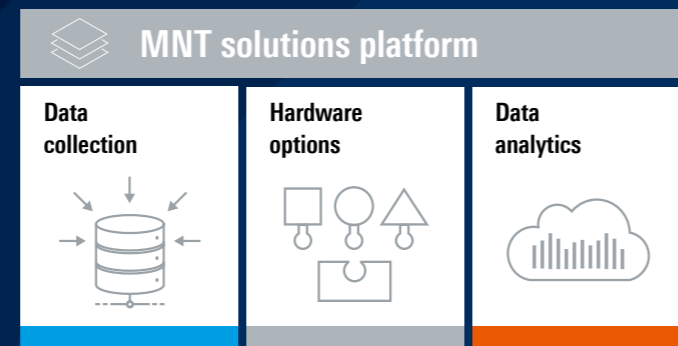
Optimum network and service performance are critical for the reliability and profitable operation of mobile networks – both public and private. Delivering superior quality of experience (QoE) is a key business success factor for mobile network operators, and businesses depend on the error-free operation of private networks. This is why ongoing active and passive network testing, as well as regular performance verification and optimization, are key to meeting the evolving expectations of human end-users and fulfilling the communication needs of machines.

INTEGRATED TEST SOLUTIONS FOR THE ENTIRE NETWORK LIFECYCLE

Rohde&Schwarz offers a complete portfolio consisting of standalone products, integrated solutions and network analytics services. We cover

- ▶ The entire lifecycle of public and private networks.
- ▶ All cellular technologies, up to 5G
- ▶ All network architectures, including Open RAN
- ▶ A wide range of test and measurement scenarios to assess and optimize network performance, from the RF layer to Quality of Experience (QoE)/Quality of Service (QoS).

We offer the industries most advanced testing solutions in an integrated, modular and flexible software and hardware platforms.



Rohde & Schwarz modular solution platform.

WE EMPOWER CUSTOMERS ACROSS THE WORLD TO MAXIMIZE NETWORK QUALITY & PERFORMANCE

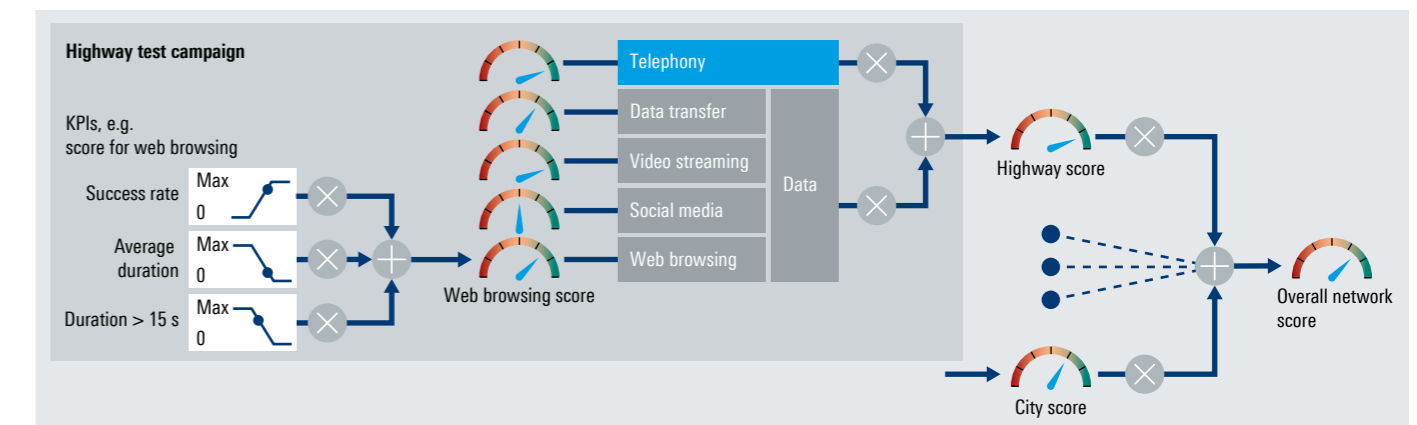


HARMONIZED TEST METHODS

NETWORK PERFORMANCE SCORE (NPS)

Rohde&Schwarz has developed the QoE-centric Network Performance Score (NPS) which is a single metric that characterizes the overall network performance from the user perspective. The NPS compares the quality of mobile

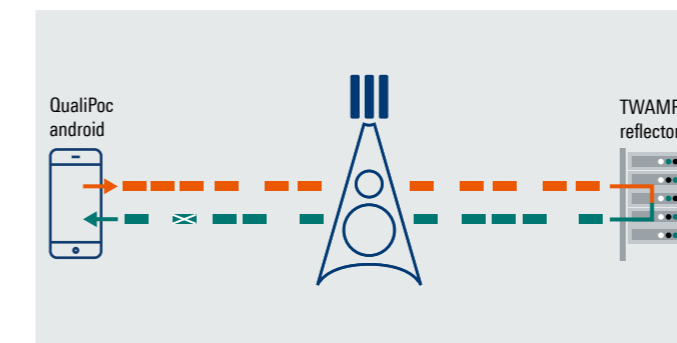
networks and visualizes the quality of experience (QoE) that the end users perceive when using common applications. This benchmarking approach covers all mobile networks in the tested area.



INTERACTIVITY TEST

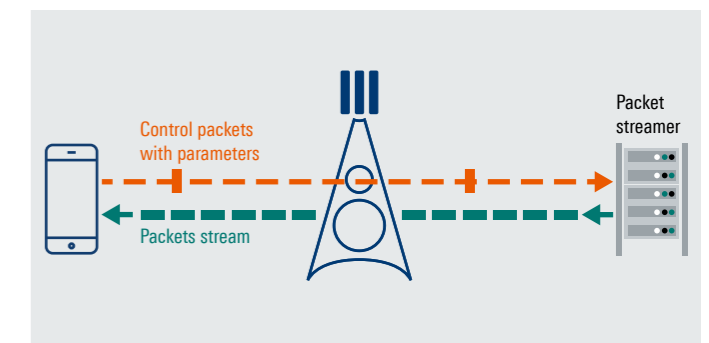
In order to measure bit rate, latency and continuity at the same time, an integrative test concept was developed and implemented: the interactivity test. The interactivity test has been recognized by ITU-T and forms the Recommendation G.1051 'Latency measurement and interactivity scoring under real application data traffic patterns'.

The implemented test case is designed to emulate real traffic patterns and create data streams as in real-time applications.



UDP STREAM TEST

Probably the most common type of traffic in industrial scenarios is a constant stream of real-time information delivered in one direction via the UDP transport protocol which is underlying certain latency and reliability requirements. A generic test for emulating such a stream is the UDP Stream test based on the method for UDP IP capacity measurements described as UDPST in Recommendation ITU-T Y.1540. This test can create a UDP stream of defined data rate in one direction with sparse acknowledgement packets in the reverse direction.



BUSINESS-CRITICAL NETWORKS

5G brings the possibility of faster and safer operation as well as new capabilities and efficiencies in industrial processes. But it also comes with increased complexity and performance demands for the network.

Societies worldwide depend on the performance, reliability and security of critical infrastructures and networks. There are many “new verticals” or use cases in manufacturing, mining, warehouses and ports – among many others.

Due to the high complexity of 5G networks, it is important to conduct tests at every deployment step of business-critical networks.

A set of typical use cases in business-critical networks should be tested. Some use cases require strict latency requirements, while other use cases may accept short interruptions in the traffic flow.

MISSION-CRITICAL NETWORKS

Mission-critical networks (MCX), or Public Safety, is a common term for various communication networks, often classified as secure private networks, where users are government agencies and first responders. Those networks play a crucial role in ensuring safety of society, while enabling communication for various agencies who deal with Public Safety. Those can be any of various groups such as police, firefighters, medics, railways, transportation, utilities, mining, and anyone else relying on safe group communications in their daily work.

To address mentioned data transfer limitation from narrow-band solutions, mission-critical entities have been thinking about broadband solutions and benefiting from wide range of capabilities that current 3GPP technologies offer. That resulted in a new 3GPP defined MCX standard. The Mission-critical, or MCX, stands for standardized 3GPP mission-critical communication (MCX) standards. It is one standard for the entire world where the same communication capabilities from Public Sector are now available to governments and public safety agencies



Here are some examples of use cases

- ▶ Industry 4.0 process controlling or watchdog
- ▶ Automated guided vehicle (AGV) or mobile robot
- ▶ Remote support/maintenance (Augmented Reality)
- ▶ Tablet connectivity

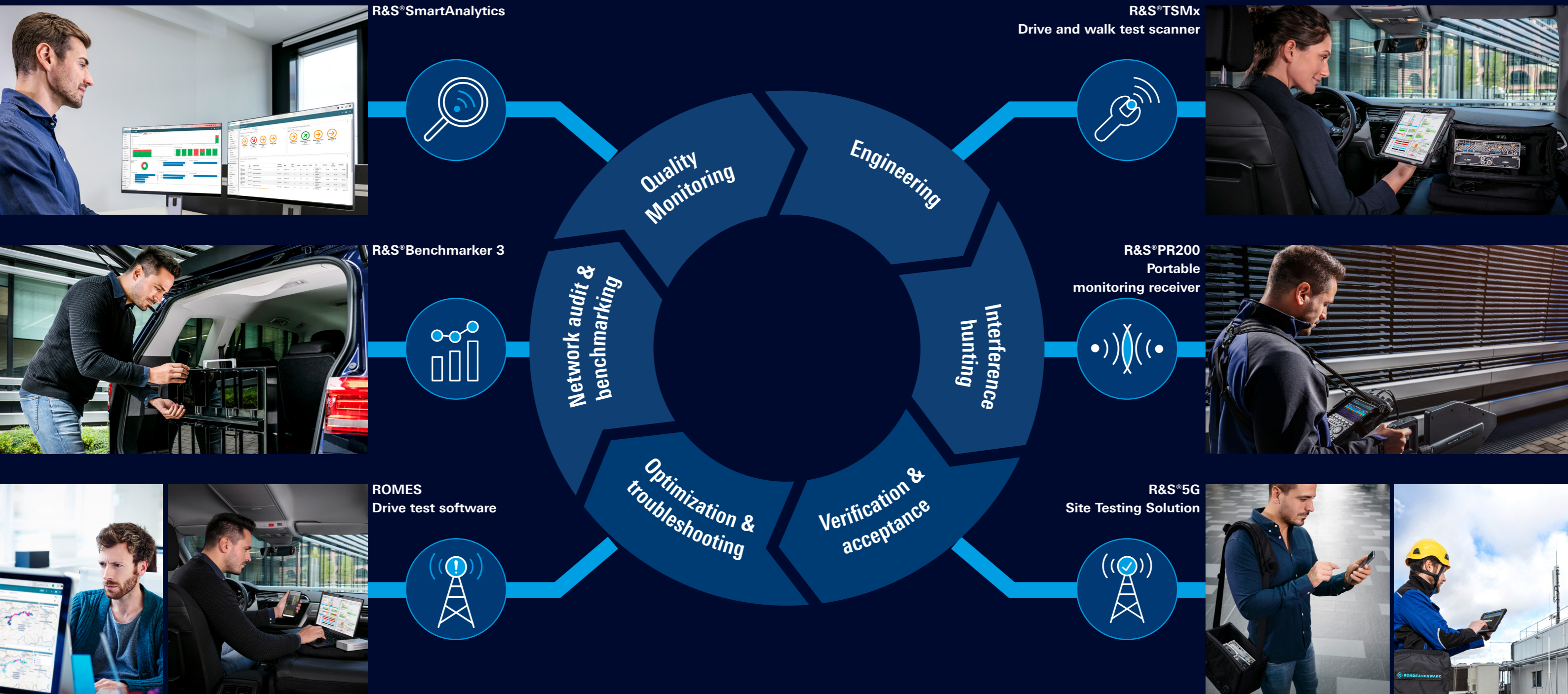
The 3GPP standard specifies services such as

- ▶ MCPTT (Mission-critical push-to-talk)
- ▶ MCVideo and
- ▶ MCDData

where some of the extensive narrowband technology features, like group calls from TETRA, are now transferred to the broadband standard, based on LTE or 5G.

Reliable MCX networks are critical for first responders to save lives. So, testing is essential.

SOLUTIONS TO TEST AND IMPROVE THE QUALITY AND PERFORMANCE FOR ALL USE CASES IN THE PUBLIC AND PRIVATE NETWORK LIFECYCLE



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- ▶ Uncompromising quality
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Rohde & Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test & measurement, technology systems and networks&cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Mobile network testing

The company's broad and diverse product portfolio for mobile network testing addresses every test scenario in the network lifecycle – from base station installation to network acceptance and network benchmarking, from optimization and troubleshooting to interference hunting and spectrum analysis, from IP application awareness to QoS and QoE of voice, data, video and app based services.

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