

QualityAssurer

VALIDATING CELLULAR NETWORKS FOR INTERNET OF THINGS (IoT)

■ Flexible and powerful test solution for end-to-end and wrap-around testing of IoT network and network elements.



KEY FEATURES

Single solution for lab and live validation of IoT services

Available on physical and virtualized platforms (VMware and OpenStack)

High capacity and performance per virtual machine to meet present and future requirements

Extensive off-the-shelf features with a flexible platform to meet every unique test requirement

Diverse user plane capabilities to replicate service mix of IoT, mobile internet and voice over LTE (VoLTE) traffic

Validates an all-in-one evolved packet core (EPC) or a network with dedicated core networks

OVERVIEW

IoT devices and associated applications will dominate wireless networks and impose a new set of operating realities. From household devices in a smart home to massive robots in an industrial production line; whether visible or invisible to us, there will be smart devices everywhere. Not just stationary in design, they will be mobile too—in the form of wearables for people and sensors in automobiles.

These devices, or 'things', will soon outnumber people, requiring a massive increase in network capacity and posing a great challenge to the telecom industry. To address this upcoming paradigm shift—and specifically the requirements of IoT applications—the 3GPP Forum introduced significant changes to release 13 of the 3GPP reference architecture for mobile networks. One striking change is to the mobility management entity (MME) which is now tasked to receive and deliver IoT data inside control plane messages, deliver SMS directly to the SMS-GW and exchange IoT payload with the service capability exchange function (SCEF). These changes to the LTE architecture are meant to cost-effectively handle the massive scale of IoT traffic.

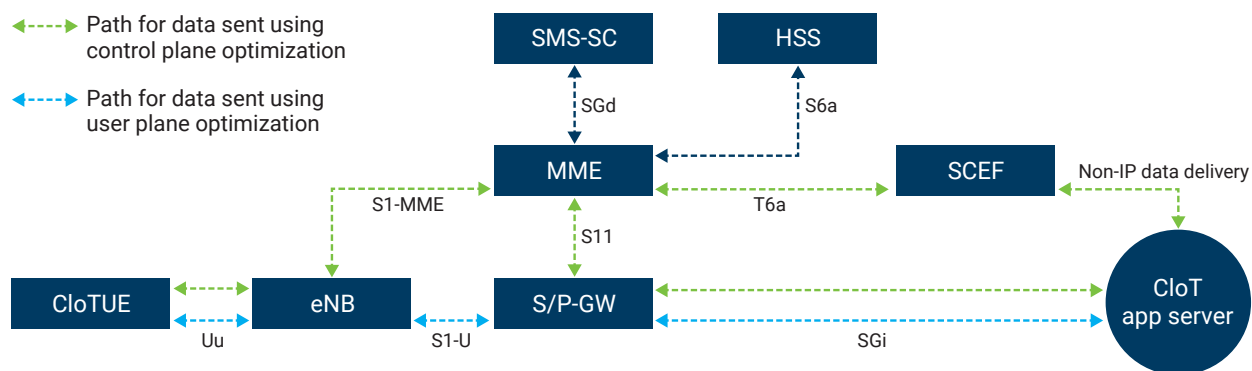


Figure 1. Architecture of a cellular IoT network

IoT devices are finding applicability in many vertical markets. Applications like agriculture and forestry deploy devices remotely—with no power supply for months or years. To conserve power use, these devices have no IP stack and go on to sleep for several minutes, hours or days. However, when they wake up for a limited duration, the network needs to ensure that these devices receive or deliver the required (and expected) information. It is evident that the traffic patterns from IoT devices are fundamentally different from that of the traffic generated by smartphones. Operators need to decide whether to deploy a dedicated core network for this service or roll out it out using existing infrastructure.

The promise of IoT involves new revenue streams and new business models. But even a single issue, either during or after the roll out of a new service, could have a catastrophic impact on existing revenue streams. Therefore, it becomes critical to ensure that equipment deployed can handle any abnormal failures and that the network is resilient and robust.

EXFO'S IoT NETWORK TEST SOLUTION

The nature of IoT traffic and the way the network will handle it, requires a comprehensive validation cycle. It starts with compliance verification, next moves towards capacity and performance validation, concluding with validating the impact of the IoT traffic on the existing services like mobile internet and VoLTE. Without complete testing coverage, unknown issues could arise causing major setbacks during the roll out of the service in the live network. Identification and troubleshooting of issues and subsequent network revalidation is much easier to manage in a controlled lab environment rather than on a live operational network.

EXFO's QualityAssurer is a wireless core testing solution used to validate 2G/3G and 4G networks. It supports off-the-shelf packages that can simulate almost all the scenarios and traffic conditions that might occur in a live network. Anticipating a traffic mix, then simulating and validating it in a lab can ensure that a system is ready for deployment. The QualityAssurer's wireless core testing solution provides powerful traffic shaping capabilities that allow high-fidelity recreation of live network traffic patterns.

3GPP specifications are upgraded every quarter. Keeping pace with both those upgrades and ever-changing customer requirements can be daunting tasks. QualityAssurer gives network equipment manufacturers (NEMs) the ability to make changes to test logic, message structure and call flows. A big advantage, it delivers unmatched flexibility and adaptability to handle the unforeseen requirements of QA engineers, as NEMs no longer have to tie modifications of their test plans to test tool release cycles.

An all-in-one test solution, QualityAssurer enables functional, negative and load validation of individual elements (by simulating the surrounding elements) and of the entire end-to-end network. The test configurations supported by this solution are shown below.

a. End-to-end testing

End-to-end testing is available for the EPC only or both the EPC and the IMS together.

EXFO simulates end-points (IoT devices, smartphones with mobile internet traffic or VoLTE traffic), eNodeBs and application servers to verify the entire network end-to-end.

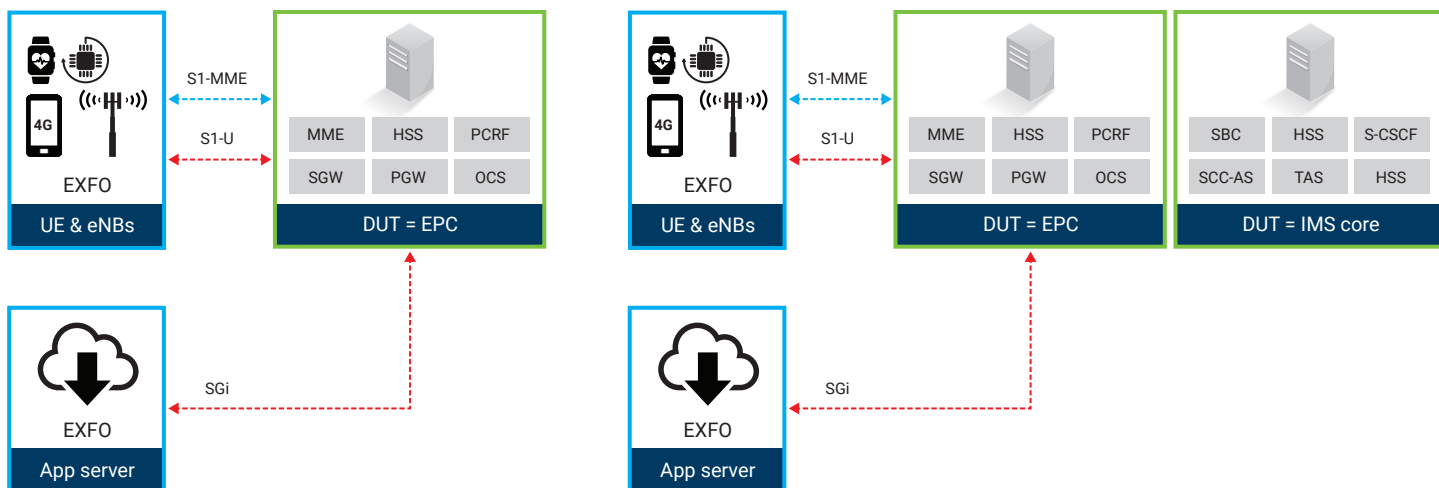


Figure 2. EPC as device under test

Figure 3. EPC and IMS as device under test

b. Wrap-around testing

EXFO simulates the eNodeBs, IoT devices, smartphones, HSS, MME, PGW, application server and MSC to test either the C-SGN (combined MME, SGW and PGW) or MMEs and SGWs combined.

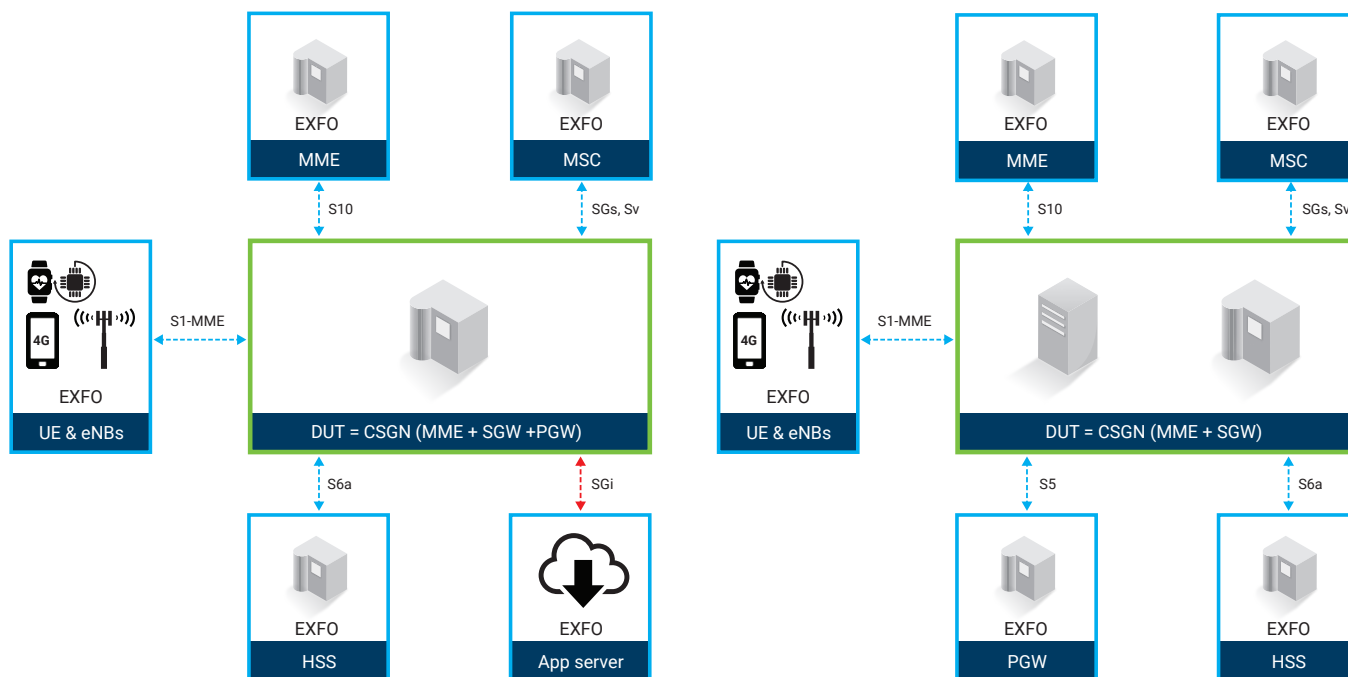


Figure 4. C-SGN or the MME+SGW as the device under test

c. eNodeB testing

EXFO simulates the entire EPC and IMS to verify eNodeBs. It can simulate multiple dedicated core networks connected to the same eNodeB to support MBB and IoT services.

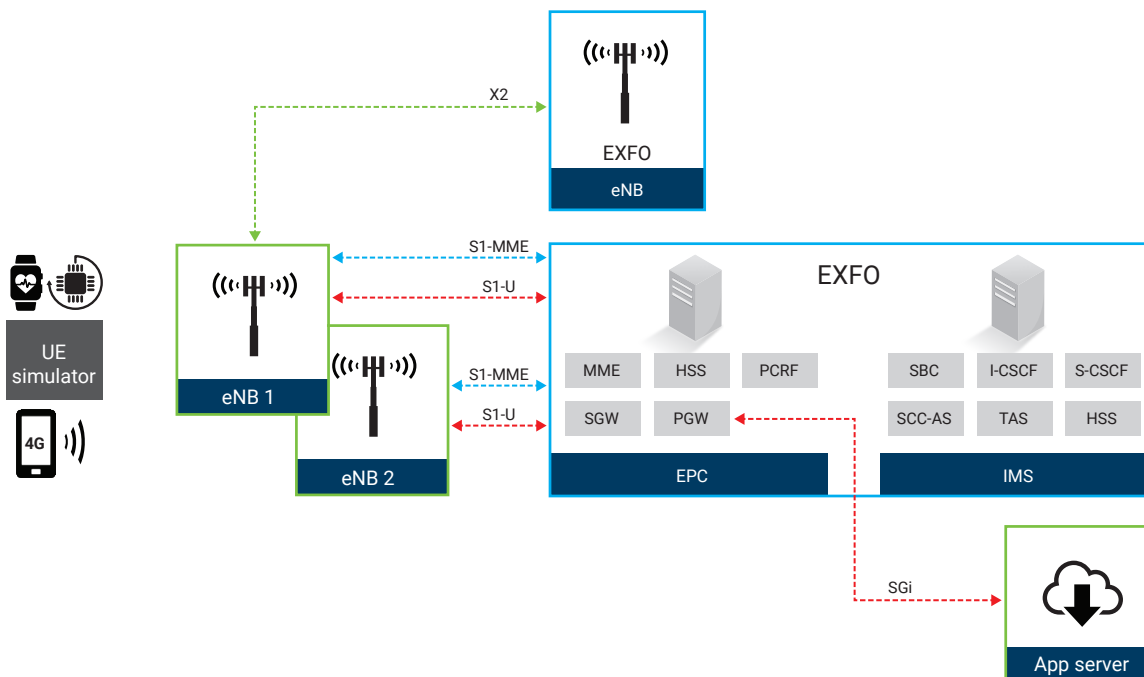


Figure 5. eNB as the device under test

KEY LOAD-TESTING USE CASES

- Simulate millions of IoT devices and thousands of eNBs to verify the capacity of the EPC, CSGN or the MME. Measure the attach rate and simultaneously attached users.
- Verify if a single EPC can handle a mix of IoT, mobile internet and VoLTE traffic or if dedicated core networks per traffic type are required. Measure busy hour call attempts (BHCA), success rate and failure rate to identify the breaking point.
- Verify if traffic from millions of devices will impact priority services such as VoLTE that have guaranteed quality of service (QoS) requirements. Provide extensive set of QoS statistics like MOS, delay and jitter for all active subscribers.
- Identify the degradation or improvement in the capability of the MME or CSGN when IoT traffic is sent with robust header compression (ROHC). Benchmark the compression efficiency achieved for different profiles configured.
- Count the maximum number of IoT devices in the network that can be active or in power saving mode (PSM). Check if the network correctly buffers the traffic for all devices in power saving mode and correctly delivers the traffic once devices become active.
- Introduce errors or failures in the call flow and verify if the equipment or network handles it by activating the correct failure handling mechanism.
- Perform high-availability tests to determine how resilient the EPC is under overload conditions and when nodes fail and failover occurs.
- Test that a virtualized EPC can scale out to accommodate a growth in traffic without any performance/capacity degradation and scale back once traffic patterns revert back to normal.

SPECIFICATIONS

PLATFORM	SPECIFICATIONS
Virtual	VMware 6.0/6.5 OpenStack: Newton, Ocata, Pike Hypervisors: • KVM over Ubuntu 16.04.3 LTS, Red Hat 7.3 and CentOS 7.4 • ESXi v6.0 and v6.5 Guest OS: EXFO's package for the CentOS distribution
Physical	ATCA chassis: QA-805, QA-813 Physical cards: PEv2, PEv1 and W ² CM Modules and interfaces: • W ² CM-10GigE (8 x 1 GbE and 2 x 10 GbE) • W ² CM-10GigE-Lite (8 x 1 GbE and 2 x 10 GbE) • NPU (4 x 1 GbE)
Supported Interfaces	S1, S6a, SGs, S5, S10, SGi
Application protocols	S1AP, NAS, RoHC, SGsAP, Diameter, GTP
RoHC profiles	UDP/IP (RFC3095) UDP/IP RoHCv2 (RFC 5225)
Transport and IP protocols	UDP, TCP, SCTP, IPv4, IPv6
ClOT capacity (under lab conditions)	# of UEs: 2.25M # of eNBs: 64K Message rate: 61k msgs/sec
Statistics and logging	Signaling trace monitor, call records, user-defined key performance indicators (KPIs), summary and call-flow statistics, table, histogram and chart format, and report generation in HTML and .CSV
Call profiling	Mix of real-world network traffic like signaling only, signaling with data/media, handover, VoLTE, IRAT
Negative testing	Create invalid messages, create invalid and error call flows, and mix valid and invalid calls, etc.
Automation	Command-line interface (CLI), Test Suite

ORDERING INFORMATION

For ordering information, please contact: isales@EXFO.com.

EXFO headquarters T +1 418 683-0211 **Toll-free** +1 800 663-3936 (USA and Canada)

EXFO serves over 2000 customers in more than 100 countries. To find your local office contact details, please go to www.EXFO.com/contact.

For the most recent patent marking information, please visit www.EXFO.com/patent. EXFO is certified ISO 9001 and attests to the quality of these products. EXFO has made every effort to ensure that the information contained in this specification sheet is accurate. However, we accept no responsibility for any errors or omissions, and we reserve the right to modify design, characteristics and products at any time without obligation. Units of measurement in this document conform to SI standards and practices. In addition, all of EXFO's manufactured products are compliant with the European Union's WEEE directive. For more information, please visit www.EXFO.com/recycle. **Contact EXFO for prices and availability or to obtain the phone number of your local EXFO distributor.**

For the most recent version of this spec sheet, please go to www.EXFO.com/specs.

In case of discrepancy, the web version takes precedence over any printed literature.