



Accelerated Rollout of LTE Services

How a comprehensive framework for efficient network testing can help operators deploy LTE networks faster

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Introduction

3GPP LTE (Long Term Evolution) technology promises to deliver a supreme user experience with high data throughput, very low latency and higher capacity. It also creates a very compelling business proposition for telecom service providers with variable spectrum bandwidth, smooth migration and the ability to deliver low cost per bit voice and data services.

However migration to LTE brings its own set of challenges for telecom service providers during pre-deployment acceptance testing phase in the form of diversity in legacy GSM/UMTS/CDMA technologies, multiple combinations in core network deployment and multi-vendor node entity combinations. These challenges can be addressed with a comprehensive testing framework that can help operators roll out LTE services faster.

This paper brings out key challenges faced by telecom service providers for an efficient LTE network testing and discusses solutions for addressing these testing challenges through a focused and comprehensive testing approach.

Background

Mobile data communication has well and truly pervaded every aspect of our daily lives. From essential activities like banking and health monitoring, to leisure options such as TV and shopping, more and more services are being consumed over mobile devices which demands for higher data throughput networks with reduced latency. It is no surprise then, that data traffic on mobiles is estimated to grow 13-fold from 2012 to 2017 as per industry forecasts¹.

Mobile operators' existing networks (2G (GSM), 2.5 (GPRS, EDGE), 3G & CDMA) will soon be overwhelmed by the amount of data traffic they shall or can handle with the growing demand of mobile users with the "Anywhere, Anytime" access to the Internet. To address consumers' ever increasing need for data consumption on mobiles, telecom operators are investing heavily in high speed LTE networks. LTE technology has the potential to transmit data on average about five times as fast as 3G. With high peak data rates, LTE has the capabilities to greatly expand network capacity and offer large number of customers the ability to access a wide range of high-speed services. At the same time, additional spectrum available will enable operators to manage their networks more flexibly, offering greater coverage and better performance.

¹ Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013–2018

The number of LTE networks being deployed by telecom operators is constantly rising and currently, there are 204 operators in 93 countries with live LTE networks². Consumers too have embraced this technology which offers significantly higher data throughput with reduced latency. According to MIC Worldwide Mobile Subscriber database³, worldwide LTE subscribers will reach 205 Million in 2Q 2014.

For telecom operators, while LTE promises a fast growing and sustainable revenue stream, the field is highly competitive. To stay ahead of competition, operators need to ensure that they are able to rollout LTE services faster, while ensuring high levels of quality. However, in reality there are challenges which need to be addressed.

Challenges in LTE Deployment

Migration from Multiple Legacy Technologies

The telecom industry is experiencing migration from multiple existing technologies (GSM/GPRS, UMTS/HSPA, CDMA/EVDO, IMS Core and Wi-Fi) to LTE. This multiplicity and variety in legacy technologies brings out various deployment scenarios and combinations for the telecom service provider which can be a challenge to address when considering quality and faster network roll-out.

Heterogeneous Multi-Vendor Network Elements

LTE is an all IP-technology with open interfaces, and therefore there are a large number of telecom equipment vendors offering LTE solutions. This gives flexibility to the service provider to pick and choose competitive vendor solutions in their network in order to achieve deployment flexibility and lower costs. As a result, the current service provider networks comprise multiple vendor network elements which present an interoperability challenge.

The above complexities arising out of migration from multiple legacy technologies and deployment of equipment from different vendors mandates emphasis on extensive testing and certification.

^{2,3} MIC (Market Intelligence & Consulting Institute) <http://mic.iii.org.tw/>

Emphasis on LTE Network Testing

LTE networks involve a new architecture with a new set of protocols network nodes and IP service dynamics that will have to work with existing 2.5G, 3G and packet core networks. Thus LTE deployment should push for adequate emphasis on testing which enables:

Seamless Migration to LTE from 3GPP / 3GPP2

technologies: Most telecom service providers need seamless migration to LTE from legacy networks (GSM/GPRS, UMTS & CDMA) technologies to get the benefits of LTE services. The migration to LTE involves a major change in networking technology - from a circuit switched network to all-IP technologies. This requires a new approach to network planning and testing.

Inter-operability between Multi-vendor Network

Elements: Telecom Service Provider networks comprise multiple vendor network elements implementing multiple technologies. Need for exhaustive & careful interoperability testing between multiple vendors and across multiple technologies is the key to the success of any LTE deployment.

Faster Deployment:

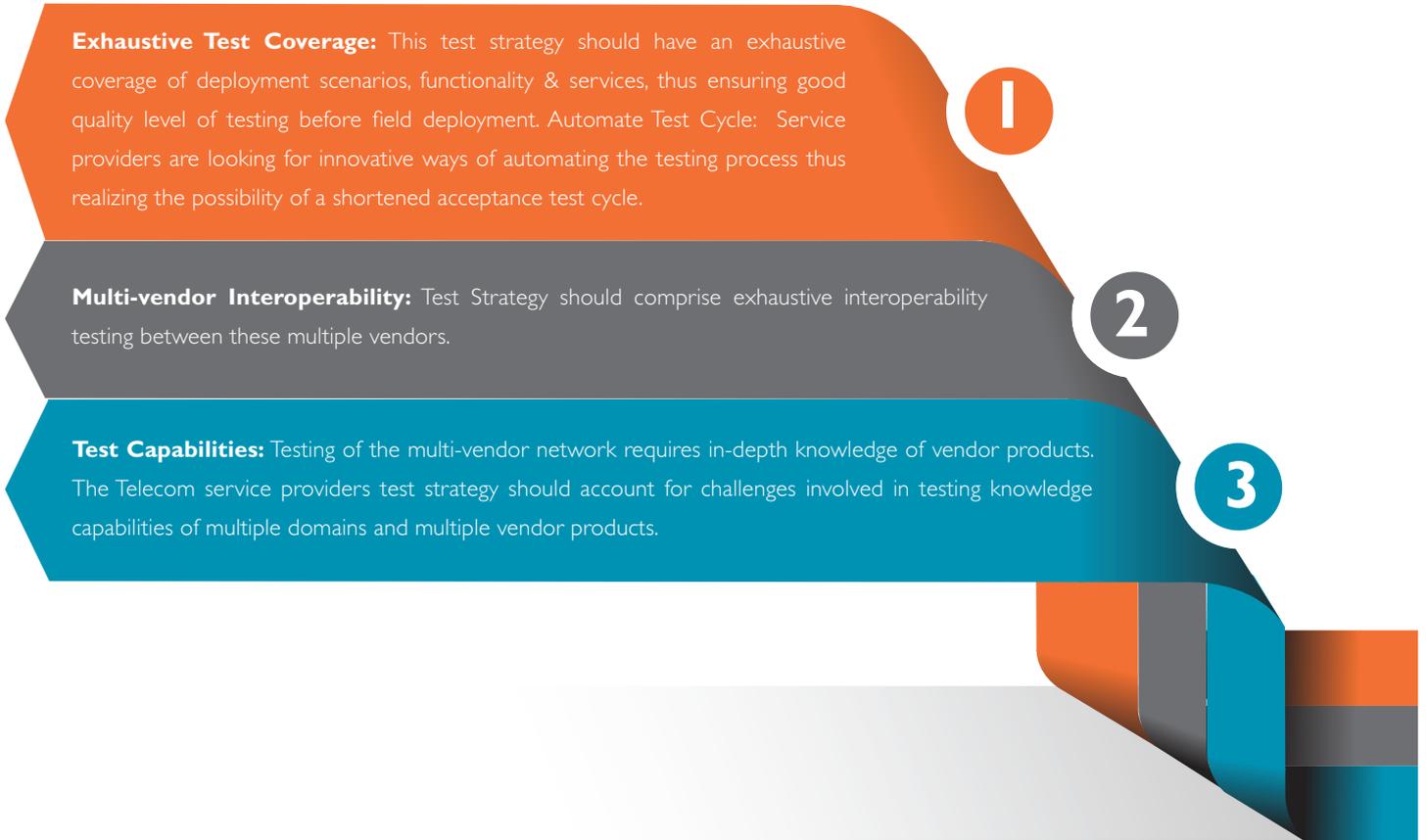
In order to ensure fast roll-out LTE Networks, mobile operators need innovative ways to shorten various stages of test cycle/test phases – Interoperability testing, Pre-deployment testing and Acceptance testing.

Guaranteeing Quality of Service:

Service providers need a proven and robust test framework to ensure minimum field defects when an equipment is deployed. Adequate testing is thus critical for guaranteeing quality of service and ensuring a seamless and uninterrupted service to consumers.

Expectations and Recommended LTE Test Strategy

Any LTE Test Strategy adopted by Telecom service providers should address the following expectations:



In order to meet the above expectations telecom service providers LTE test strategy should involve a **Comprehensive Test Framework (CTF)**. This test framework needs to be modular and should have the provision for automation. Additionally it should offer flexibility with tailor made test packages based on the deployment model, thereby reducing test acceptance planning efforts. Further, it should also be re-usable across all the service provider test phases – Interoperability testing, Pre-deployment testing, Field testing & Sanity testing.

For all practical purposes, the test framework should include a comprehensive **Test suite** and **Test engine** to schedule the execution of the chosen modular test cases. Further, the Test Framework should consist of customized modular **Test Packages** suiting Telecom

operator's deployment model, chosen services, nodes and functions. The approach should be to arrive at different deployment combinations and functional complexities of LTE network covering various possible migration scenarios and strategies coupled with multiple access technologies convergence. Based on the deployment model, Telecom Service Provider should be able to pick modular packaged test suites.

In addition to the above mentioned test areas, vendor specific features needs to be carefully tested. The modular test suite needs to be continuously improved (by adding test cases from real field experiences) and also continually developed for additions to 3GPP standard features (Rel. 10, 11 and 12).

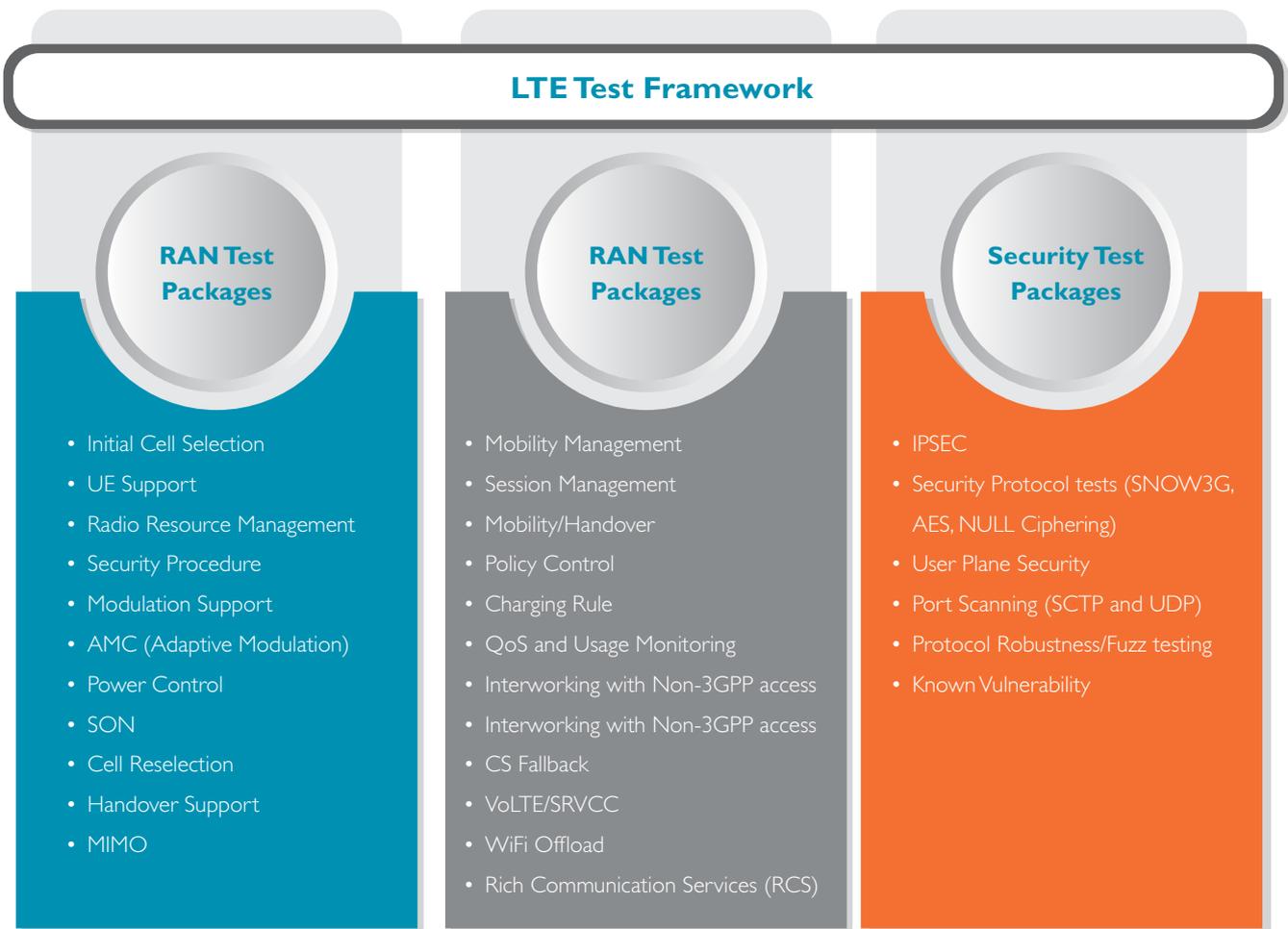


Figure: Reference LTE Test Framework:⁴

Such a comprehensive test framework for LTE network testing can help operators significantly reduce time and effort spent on testing, thus reducing their test lifecycle time. Practical experiences have shown that the reduction in effort can be up to 17-20%.

Conclusion and Way Forward

Timely deployment of LTE networks is crucial for Telecom Service Providers to remain competitive and launch new services, support faster data speeds, provide greater capacity, and benefit from quicker return on investment (ROI).

New services and devices, evolution from multiple technologies, and multiple-vendor deployments lead to complexities that call for Telecom service providers to adopt a comprehensive, modular & automated test framework that shall accelerate LTE network deployment with greater customer experience.

In most cases service provider testing is done by product vendor teams where test teams would select sub-set of test cases from vendor test phases and execute them in service provider test labs which might result in narrow range of tests and slippage of critical interoperability test areas. One way to address this would be to have the tests undertaken in an independent, neutral and un-biased test environment with know-how of multiple technologies (GSM / UMTS / LTE), multiple domains and multiple vendors experience focusing on Interoperability testing, Pre-deployment testing and Field acceptance testing mimicking field reference configurations.

⁴Wipro LTE Assurance Test Suite <http://www.wipro.com/mwc-2014/pdf/LTE-network-assurance-test-suite.pdf>

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Nagendra Prabhu Kumble is a Lead Architect in Wireless Networks working for Wipro Technologies, having 13+ Years of experience with Telecom Service Providers and Telecom Equipment Vendors on Wireless Radio Access Network, Wireless Packet Core, IMS Core Testing & LTE testing. He was instrumental in setting up multiple test labs for Network verification & Node level testing.



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