Introduction

Polaris Networks has a long history of providing test tools for emerging technologies at an early stage. This greatly helps technology leaders bring thoroughly tested new products to the market place. Indeed, availability of third party test tools is a necessary step in the implementation of any new technology. These tools help chipset and device manufacturers as well as service providers and system integrators absorb and deploy new technology.

Polaris Networks has developed test tools that are used today by a number of standards bodies and interoperability forums such as EPCglobal, WiMAX Forum, HomePlug Powerline Alliance and CP-TA.

Polaris Networks and LTE

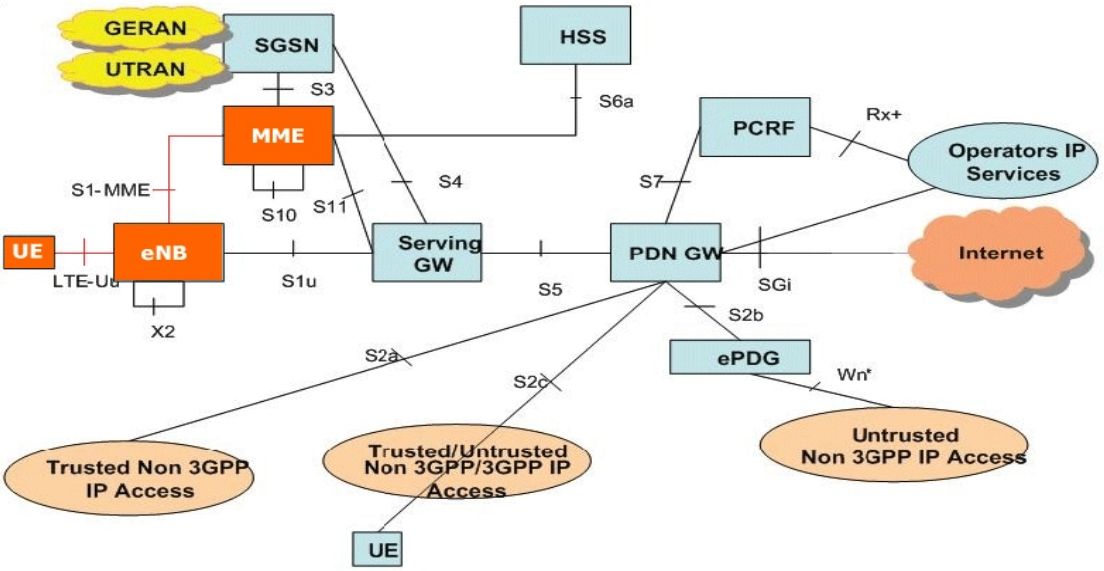

Figure 1: LTE Architecture

N.B. : Boxes in red shows devices tested by Polaris LTE Tester

LTE is a natural extension to Polaris's current activities in the wireless arena, particularly in test tools. A member of ETSI and 3GPP, Polaris is an active contributor to 3GPP RAN Working Groups that are working to define Conformance Test Cases for LTE equipment.

Polaris plans to adapt its test tool architecture, designed specifically for wireless technologies, for developing the Conformance Test Suite for LTE.

Conformance Testing

Conformance testing determines the extent to which a system or an implementation conforms to a specified standard. The conformance test suite includes test cases for all the requirements in that standard. The components of a conformance test suite are the Test Suite Structure and Test Purposes document, the Abstract Test Suite that includes the conformance test scripts specified using TTCN, and the Test Platform on which the test scripts are executed.

Conformance Tester

The conformance tester is designed to verify the response of the Device Under Test by creating different control message exchange scenarios. The tester verifies the mandatory requirements of the communication protocol standard as well as the optional features of the protocol.

Conformance Tester Framework

The figure below shows the framework architecture of the Conformance Tester. The blue boxes represent software components provided by Polaris Networks.

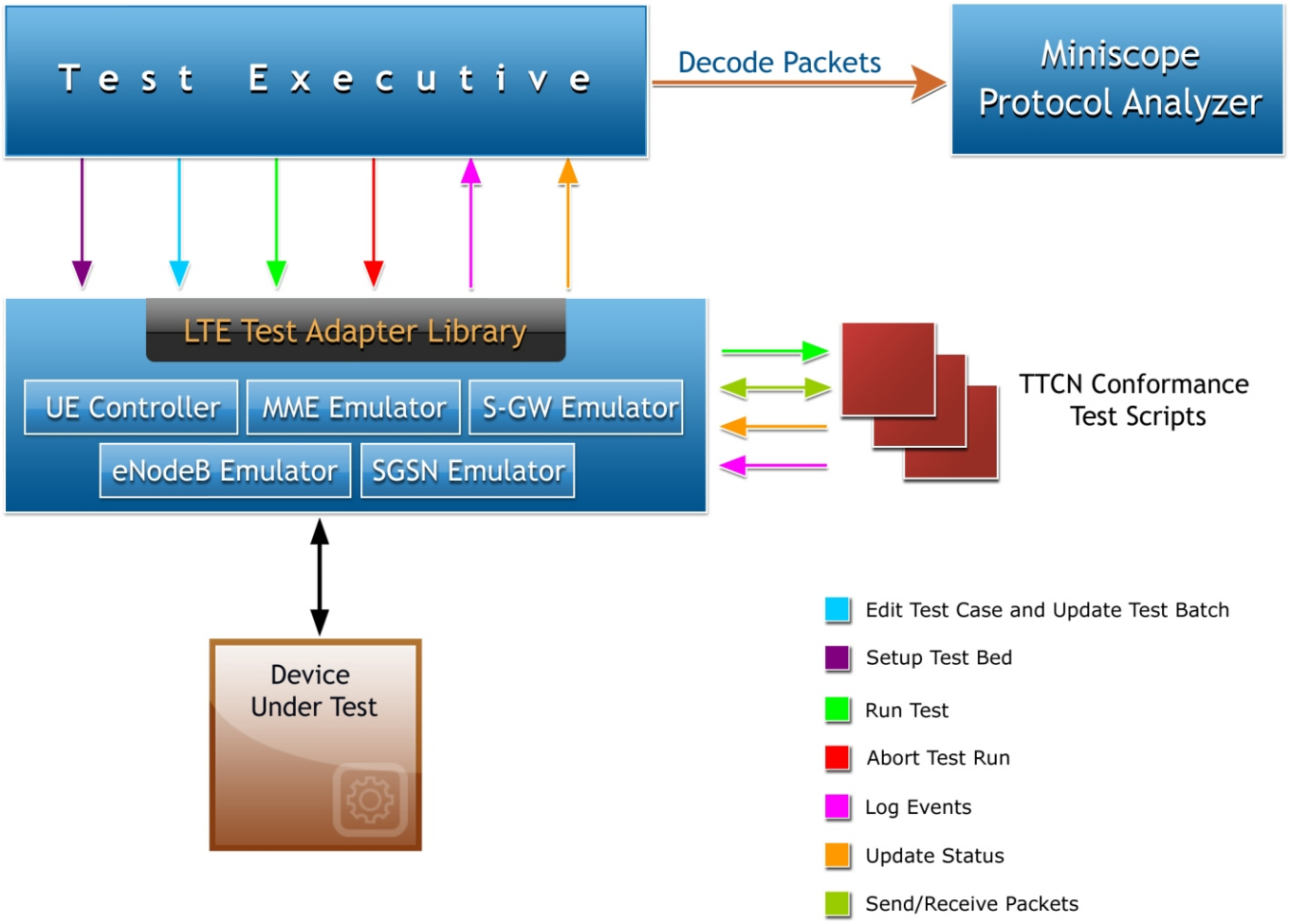

Figure 2 : Conformance Tester Framework

UE Conformance Tester

The LTE User Equipment (UE) is the device that enables an LTE subscriber to access an LTE service. The tester controls an eNodeB in order to generate real-life radio access scenarios and verifies if the UE behavior conforms to the 3GPP specifications.

The tester emulates multiple neighboring eNodeB entities to create the handover scenario for the UE under test.

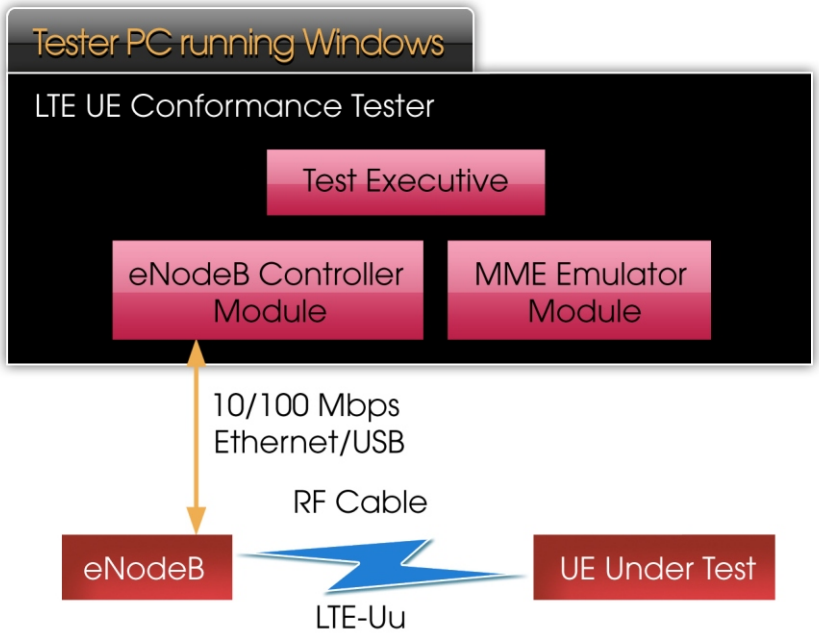

Figure3 : Conformance Tester Framework

eNodeB Conformance Tester

The eNodeB is the entry point to the LTE network from the user (radio access) side. It is also the exit point from the network side to the user (radio access) side. The tester controls a UE and emulates the network side to generate real-life test scenarios and verifies the eNodeB behavior on the radio access and network interfaces.

The tester emulates multiple neighboring eNodeB entities to test some of the functions of the eNodeB Under Test.

enodeB conformance test categories

- ✓ **LTE-Uu Test Cases**
  - **MAC**
  - **RLC**
  - **PDCP**
  - **RRC**
- ✓ **S1-MME Test Cases**
- ✓ **X2-CP Test Cases**

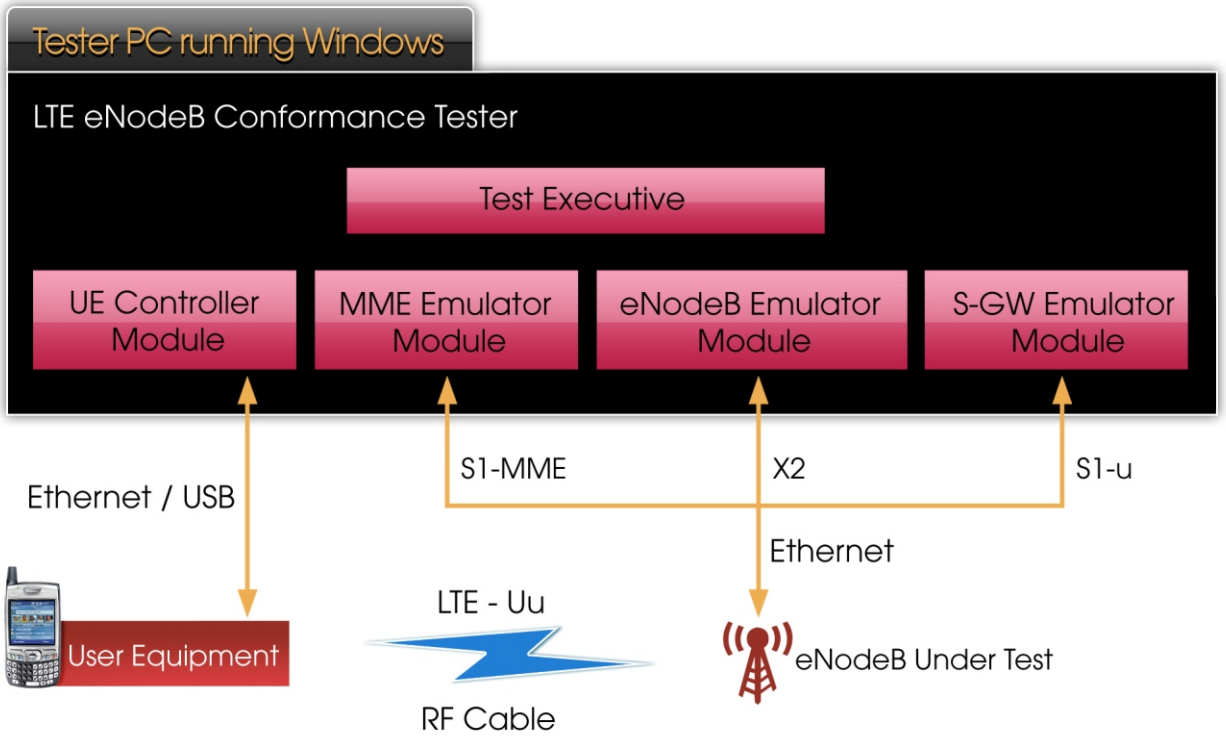

Figure 4 : eNodeB Conformance Test Bed Architecture

MME Conformance Tester

The MME is an important entity in the LTE network as it is the entry/exit point for the EPC. The tester emulates all the other adjacent entities, i.e. eNodeB, 3GPP SGSN and 3GPP Anchor. The tester then creates the test conditions using all of the MME interfaces to test the response of the MME.

The first release of the MME conformance tester will focus on testing the S1AP interface. A later release will include S3 and S5 interface testing.

MME Conformance Test Categories

- ✓ **S1-MMC**
  - **SAE Bearer Management**
  - **Initial Context Transfer**
  - **UE Capability Info Indication**
  - **Mobility and Handover**
  - **Paging**
  - **S1 Interface Management**
  - **NAS Signaling Transport**

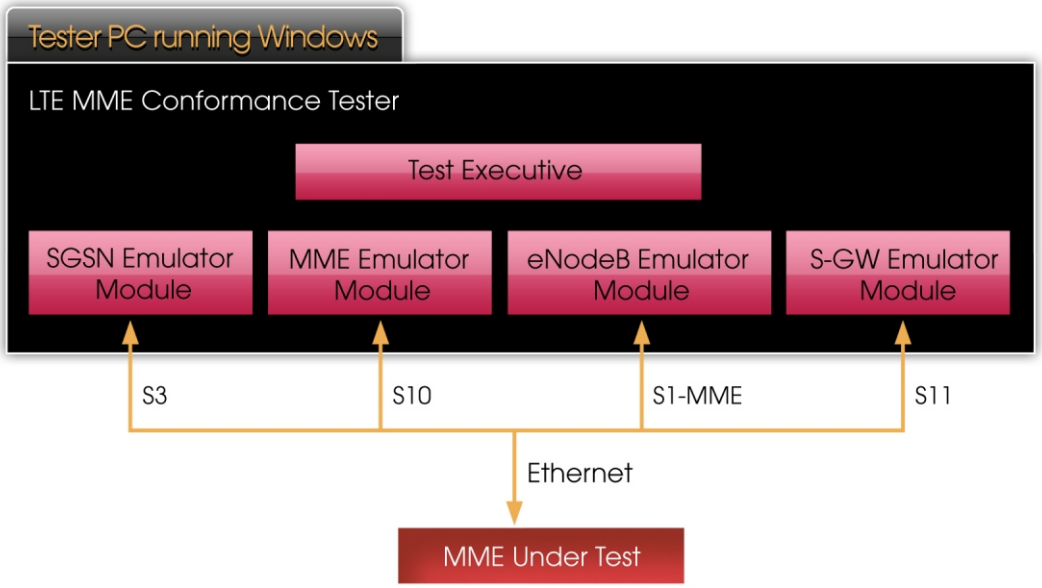

Figure 5 : MME Conformance Test Bed Architecture

LTE Future Product Plans

While the conformance test suites are already under development, Polaris also plans to bring out a number of other products related to LTE testing. These include stress testing tools designed to measure various performance metrics of LTE network devices such as **eNodeB** and **MME**.

The Stress Tester creates a real-life load in the lab by emulating multiple UEs and generating radio access traffic according to the user-specified network dynamics. The tester measures various performance metrics simultaneously and provides a comprehensive report on the ability of the device under test to handle control plane stress conditions.

The diagram below shows the architecture of Polaris's **eNodeB Stress Tester**.

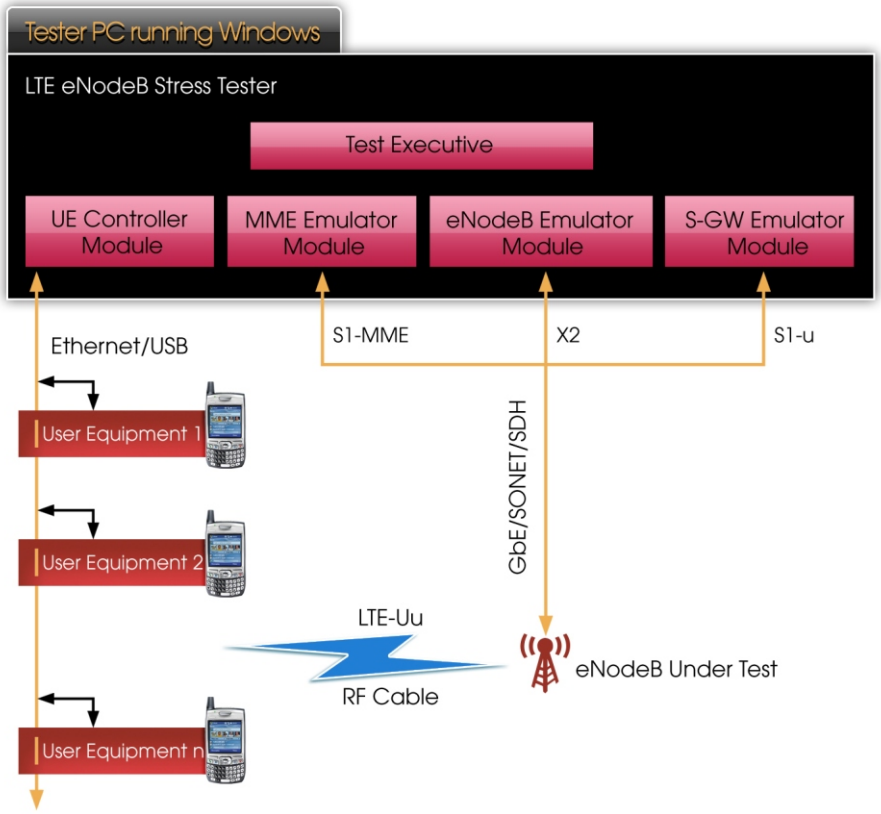

Figure 6 : eNodeB Performance Tester

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