



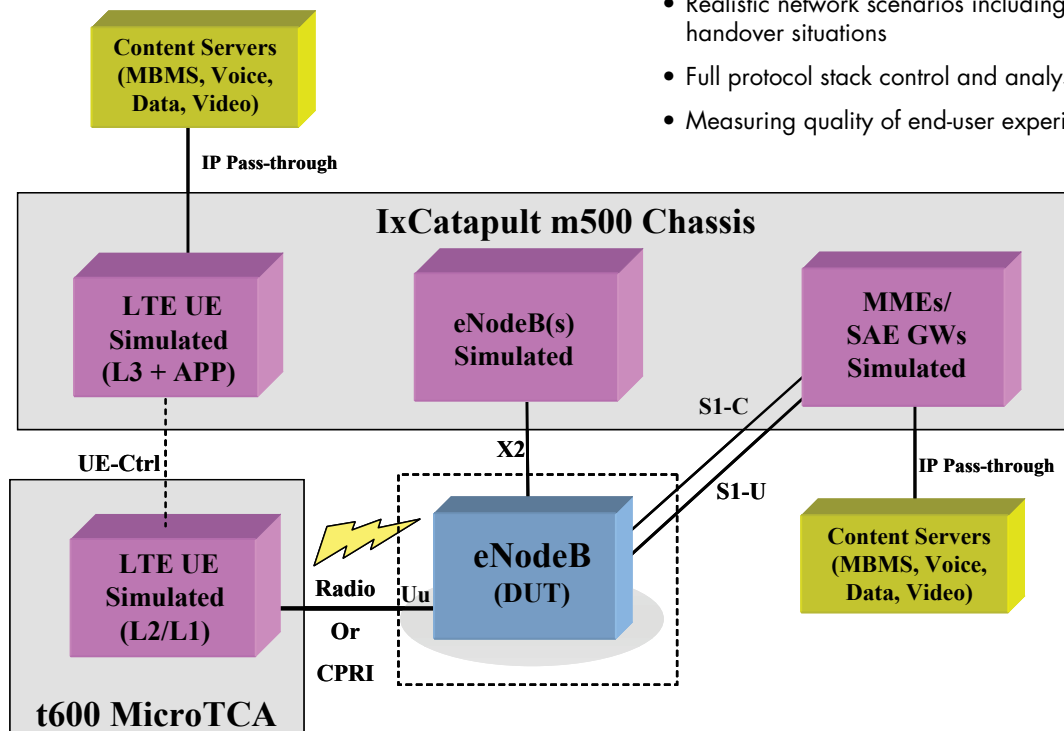
LTE Testing

IxCatapult LTE Testing

IxCatapult LTE testing solution is the industry's most cost-effective, comprehensive tool. It simulates any network element including LTE UEs, eNode B's and MME and SAE GW to totally surround the device under test.

Ixia LTE Test System:

- Functional testing
- Stress/soak/capacity testing
- Realistic network scenarios including negative and handover situations
- Full protocol stack control and analysis (all layers)
- Measuring quality of end-user experience



UE-Ctrl: PDCP-RLC Interface, Configuration, Logging
Ixia IxCatapult/LTE completely surrounding the ENode B

Ixia LTE Testing Benefits:

- The most cost effective UE load simulation
- Totally surrounds and loads all network elements
- Modular and easily scalable for high capacity
- Testbench, easy to use Eclipse based GUI
- Optional test suite packages for turn-key operation

Leader in Converged IP Testing

IxCatapult/LTE

Overview:

In response to growing customer demand for mobile data, the Third Generation Partnership Project (3GPP) defined Release 8 specifications for a new all IP-based network, the Long Term Evolution (LTE) network. LTE promises true mobile broadband by delivering peak user data rates of up to 300Mbps on the downlink and 150 Mbps on the uplink, with user plane latency of less than 5ms.

Comprehensive testing with realistic network scenarios and user traffic is critical in validating that the eNode B performs to specifications on initial deployment. This presents many new testing challenges, including a requirement for a wraparound testing configuration with previously unavailable multi-UE simulation with full sector capacity. A total LTE testing solution must also include verification of core network elements such as MME, ePDG, PCRF, SGW, HSS, PDN Gateway and interworking with more established network technologies.

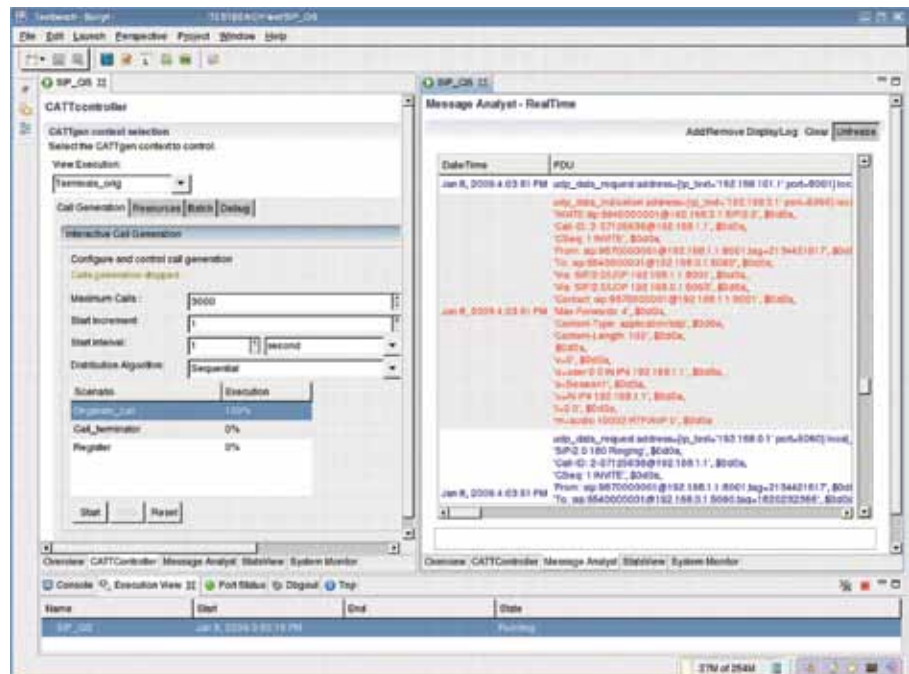
Key areas of concern for network equipment manufacturers (NEM) and service providers include:

- Cost effectively simulating UE traffic to full capacity
- Managing complex user plane and control plane traffic multiplexed on the same connection
- Interworking of new elements (E-UTRAN and Evolved Packet Core) with existing networks
- Verifying new LTE network elements supporting simultaneous voice, data and video traffic streams
- Generating high data throughput with lower latency that meet or exceed LTE standards

Ixia addresses all LTE test concerns by providing the most cost-effective and complete test system. IxCatapult/LTE includes full LTE protocol library, tools, hardware and prepackaged test scenarios. Ixia test systems provide realistic network scenarios and user traffic simulating multiple UEs to full eNode B capacity.

Ixia LTE testing capabilities include:

- Simulation of all network elements and verification of all interfaces (S1 through S12, Uu and X2):
 - Completely surround the eNode B as the device under test by simulating other eNode Bs, MMEs, SAE GW and thousands of UEs
 - Core Network testing includes MME, ePDG, PCRF, SGW, HSS and PDN Gateway as devices under test by simulating eNode B and other network elements as required
 - Interworking tests the LTE MME with the UTRAN and GERAN networks (2G and above)
 - Test interworking with trusted and non-trusted non 3GPP networks (IMS and WiMAX)
 - End-to-end testing
- Real world mix of voice, video and data:
 - Incremented until the eNode B's capacity has been exceeded
 - Validates concurrent support of multiple media streams per UE
 - AMR NB/WB, G.711, G.723, G.726, G.729 for voice/audio
 - H.261, H.263, MPEG-2, MPEG-4 for video
 - IPv4, IPv6 and IPsec
 - QoS analysis
 - QoE measurements
- Performance characteristic measurements of the eNode B and other network elements (SGW, MME)
- Negative testing to confirm system reaction to error conditions
- Security validation (PDCP, ROHC, RRC ciphering and integrity protection, NAS signaling security)
- Full handover testing – Inter/Intra eNode B, IRAT
- LTE Direct provides ability to run NAS, RRC, PDCP over IP directly
- Interface to 3rd party UE simulators (Signalon and Aeroflex)



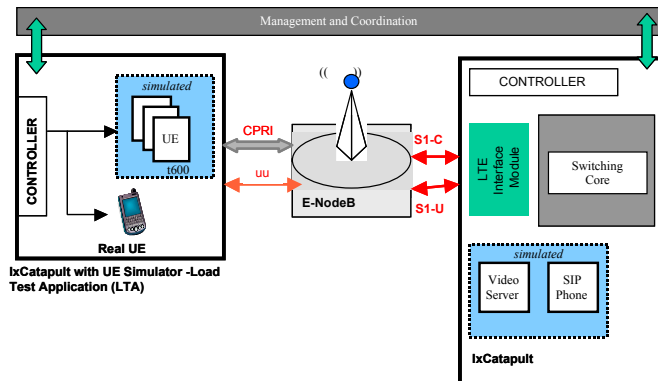
IxCatapult/LTE

IxCatapult/LTE test system includes:

- Comprehensive LTE protocol support including: S1, GTPv1/v2, PHY, MAC, RLC, PDCP, RRC, NAS, X2
IxCatapult/LTE software includes:
 - Encoders/decoders allows scripts to construct and parse LTE protocol messages
 - LTE Procedure libraries are scripted solutions that may be edited by the user. They are packages of common procedures such as Bearer Setup, Cell Configuration, UE Attach used to abstract protocol message handling into higher-level procedures that a script may access using an API. Protocol libraries are included with protocols S1AP, RRC, MME NAS, UE NAS.
 - State machines are drag and drop objects to communicate with scripts, procedure library contexts and other state machines using an API.
 - Quickstarts are scripted simulations that illustrate how protocol encoder/decoders, procedure libraries and state machines are all used to create representative call flows. Quickstarts may be edited and used as the basis for user's own specific test scripts.

• Tools:

- BERT/BLERT - bit level testing for either predefined or user-defined patterns. Supports various modes such as TxRx, Tx only and Rx only.
- Traffic generator - voice and video bearer traffic (up to 300 Mbps per sector)
- X•Stream - replicates and transmits data packets to generate very high load packet capacity (up to 3.5 Gb/s per Gigabit Ethernet interface card)
- IP Pass-through - allows any external IP client or server application to transmit payload traffic such as FTP and HTTP sessions to the device under test
- PESQ for voice quality as part of quality of experience (QoE)



LTE Applications:

Complement the IxCatapult LTE hardware, software, protocol and tools complete with ready-to-run LTE test scenarios, eliminating the need for scripting resources. Ixia has developed these pre-packaged applications to assist users in configuring and executing various LTE test scenarios.

LTE UE Load Test Application (LTA) - Verifies E-UTRAN by providing necessary configuration and control tools to simulate multiple UEs and execute high load test scenarios.

LTE Core Network (CN) Load Test Application (LTA) - Verifies LTE UE and E-UTRAN by providing necessary configuration and control tools to execute high load test simulating LTE Core Networks including MMEs and SGWs.

eNode B Wraparound Load Test Application - Combines LTE UE and CN LTA Applications to totally surround and verify the eNode B by enabling the configuration and simulation of LTE UE and Core Network elements.

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- **IxCatapult hardware platform** options provide a range of high-performance Linux-based systems supporting a variety of network interface cards. These platforms are price-performance scalable and support a broad range of test environments and applications. The IxCatapult LTE test systems are multi-user, high-performance, scalable and versatile. Users may easily configure a system to simultaneously test other technologies on a single platform.
 - **p250** - Versatile platform that can be transportable, desktop or rackmount, supports up to 4 PPCI cards
 - **p400** - High performance rackmounted platform supports up to 9 PPCI cards
 - **m500** - Highest performance rackmount platform supporting up to 18 cPCI cards. Maximum scalability is achieved through traffic aggregation from multiple mCU5s.



p250



p400



m500



Network Interface Card Options:
Gigabit Ethernet (10/ 100 Base-T Ethernet, 1000
BASE-T/ SX Ethernet)

• **Peripherals:**

- **t600 MicroTCA** - Together with the IxCatapult platforms, simulates LTE UE (patent pending) traffic generating thousands of calls to full eNode B capacity (up to 3 sectors per t600).



t600 MicroTCA Peripheral



Sector Card Set