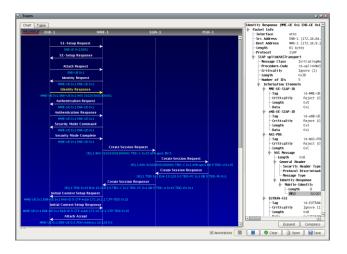
Torrent 6200 LTE Test System

Product Data Sheet (Preliminary)

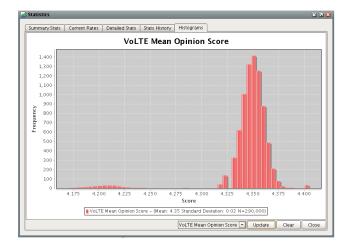
The Torrent 6200 is a Linux based real time system for testing 3GPP LTE eNBs and UEs both functionally and from a performance standpoint. It is well suited for both initial development of such systems, as well as for verification of them in an network operator lab.

The 6200 builds on ground breaking technology developed for its WiMAX counterpart that allowed for 4000+ mobiles on a single channel. It supports both TDD and FDD, and channel bandwidths of 10 and 20MHz.

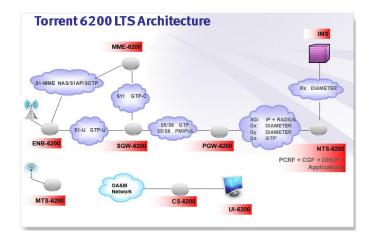
Packed with features from the award winning Torrent series, it adds numerous new ones of its own to bring you a state of the art test experience. Easily bring up a single session and trace it:



Or bring up thousands of subscribers running data and voice (VoLTE) applications to verify KPIs:



Architecture Overview



Torrent 6200 consists of several high performance server applications that together can emulate the LTE EPC or just parts of it.

This central controller for the system, called the CS-6200, automatically configures, starts, and directs the traffic servers in the system to run tests as directed by the user through a GUI interface.

The MTS-6200 traffic server authentically simulates thousands of UEs per channel. The optional ENB-6200 emulates an eNB for UE testing purposes. The MME-6200 simulates the Mobility Management Entity, or alternatively can be replaced with the MME under test. Similarly the SGW-6200 and PGW-6200 simulate the Serving Gateway and PDN Gateways respectively, and like the MME-6200 may be replaced with their counterparts under test as desired. Finally, the NTS-6200 provides a convenient aggregation of network servers (IMS-Core, MMS, HTTP, FTP, SMTP, DHCP, PoC, WAP, etc.) as well as acting as a PCRF, CGF, and Radius Server.

The system scales linearly so that more channels may be added seamlessly with additional servers.

Hardware Platform

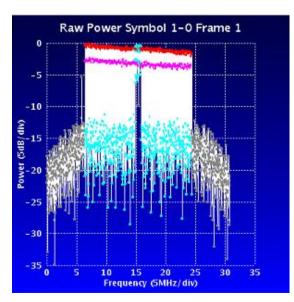
The 6200 runs on a Linux based 2U SDR platform featuring our 6200 LTE MAC and PHY layers as well as authentic emulators for the LTE EPC.

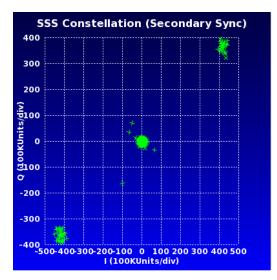


RF/PHY Hilights of this platform include the following:

- Channel Bandwidth Support to 20MHz
- RF Band Coverage 100MHz-6GHz
- FDD/TDD Support
- 2x2 MIMO Per Chassis
- Handover Support
- Realistic Fading on a per UE level
- Doppler Shift Emulation

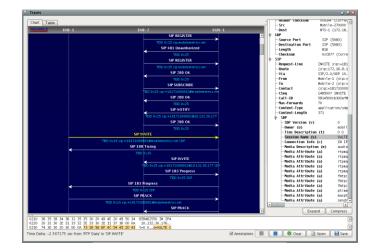
The first IOT test for the platform was in 2011 with a well known vendor's eNB at 20MHz channelization:





VoLTE Testing Support

The 6200 features comprehensive end to end VoLTE testing support:



With it you can saturate test your eNB with VoLTE calls (concurrently with numerous other types of traffic) to see how well they perform, view MOS score histograms, etc.

SMS Testing Support

The system also allows mobiles to send and receive text messages via an SMS/SIGTRAN interface (MAP/TCAP/SCCP/MTP3/M2PA/SCTP):

Key System Features

The Torrent system has numerous features field proven features, some of which are listed below:

- Functional Testing
- Load Testing
- Full Automation
- Linear Scalability
- Graphs
- Histograms
- Detailed Hierarchical Statistics
- Realistic Mobile Subscriber Emulation
- IPv4 and IPv6 Support
- MILENAGE Authentication
- Test/XOR Authentication
- AES Ciphering (128-EEA2)
- Null-Ciphering (128-EEA0)
- VLAN Tagging (IEEE 802.1Q)
- VoLTE Support
- 10 Gigabit Ethernet Support (LR/SR)
- S1/X2 Handover During Streaming
- Multiple PDN Connections
- Multiple Dedicated Bearers

Mobile Protocols Supported

Each mobile has its own protocol stack and supports the following protocols:

- IPv4
- IPv6
- TCP
- HTTP
- UDP
- FTP
- SMS
- MMS
- SMTP
- POP3
- Volte
- SIP/RTP/RTCP
- ICMP
- DNS
- PPP
- SSL

Streaming (Youtube, Netflix, Pandora)

3GPP Interfaces Supported

- S11 The MME to SGW Control Interface
- S1-U The ENB to SGW Data Interface
- S1AP/S1-MME The ENB to MME Control Interface
- NAS The UE to MME Interface
- S5/S8 The SGW to PGW Interface
- SGi The PDN / Internet Interface
- Gx The PGW to PCRF Interface
- Gn For SGSN to GGSN Communication
- C The HLR to SMSC-GMSC Interface
- E The MSC to SMSC-GMSC Interface

Scripted Mobile Behavior

Virtually everything mobiles do can be scripted down to the single-mobile level:

Mobile Script Editor: setup.cycle	e a 🗙
attach enb <all> apn alpha.gprs gtp v2 detach</all>	
Insert Command: Attach (Network Entry)	▼ ▼ Save Close

Java Based Test Cases

Typically, traffic is generated in the system through the use of automated, Java-based test cases which can invoke mobile scripts on arbitrary ranges of mobiles, and which can also run other test cases:

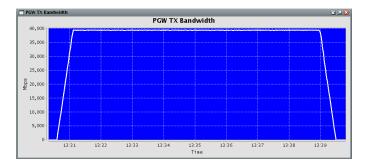
Test Ca	ise Editor: BasicUP 🗾 🖉
public	boolean
runTest	() throws Exception
{	<pre>int n = getRequiredIntParm("numWobiles"); int s = getRequiredIntParm("streamWindow"); int d = getRequiredIntParm("duration") * 60; int w = getRequiredIntParm("controlWindow");</pre>
	<pre>mobileAlloc(n);</pre>
	<pre>runScript("setup count "+n+" window "+w); runScript("stream.youtube count "+n+" window "+s+" duration "+d); runScript("del count "+n+" window "+w);</pre>
	return true:
}	
4	
	🛃 Save Close

These tests may be run for short durations, or they may be run for days or even weeks to soak the system under test. Test cases are associated with a pass/fail result, the criteria for which can be adjusted per your requirements:

Test Case	TC #	State
BasicUP (numMobiles=200000,controlWi	1	🥝 PASSED

Real-Time Graphs

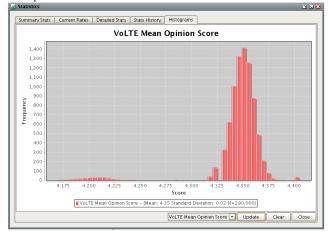
The system allows a wide variety of level and rate metrics to be graphed in real time:



Standard features such as zoom, pan, save, and print are available for all of them.

Histograms

Histograms are available as well (e.g. delay, jitter, latency), with pan and zoom functions:



Detailed Statistics

The system tracks numerous statistics system wide and they're available to be viewed in tree form:

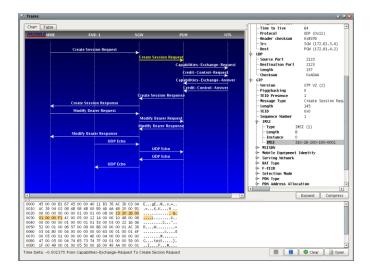
🗖 Statistics 😰 🛽 🛛 🖉
©~NTS ©~STS
o-Packets
- SGW RX Packets
- SGW TX Packets
- PGW RX Packets
Ø-Bytes
ENB TX Bytes
- SGW RX Bytes
- SGW TX Bytes
└─ PGW RX Bytes
- ENB->SGW0.00000%
- SGW->PGW0.00000%
- SGW Relay0.000000%
Downlink Data
- MTS
Ø- NTS
0- STS
• Packets
©-Bytes
⊢PGW TX Bytes
- SGW RX Bytes1,237,466,472,642 (1.13Tb)
- SGW TX Bytes1,237,441,626,748 (1.13Tb)
└─ENB RX Bytes
- PGW->SGW0.01713%
- SGW->ENB
- SGW Relay0.00205% - Downlink Total (PGW->ENB)0.02619%
- Downink Total (PGW->ENB)0.02019%
- HTTP
©-Stream
- Stream Playback Attempts
- Stream Playback Completions800,000
Stream Playback Failures0
Expand Compress Clear Close

As well as spreadsheet form, the underlying information for which is also saved in CSV format for arbitrary post processing:

Summary Stats	Current Rates	Detailed Stats	Stats History	Stats	Graphs	Histograms		
				1	Oct 31,	16:41:07.754	Oct 31, 1	5:41:12.116
Attaches > Attach	Completions				89,308		89,562	
Attaches > Attach	Failures				0		0	
Detaches > Detac	h Attempts				89,296		89,550	
Detaches > Detac	h Completions				89,296		89,550	
Detaches > Detac	h Failures				0		0	
Activations > Activ	ation Attempts				0		0	
A V.				1	0# 21	16:41:07.754	0.04.21.1	5:41:10.116
Handoffs > Hando	ff Foilures > T2	Timeout			0	16.41.07.75*	0	5.41.12.110
Handoffs > Hando				_	0		0	
Uplink Data > MT:		JUEITOI		_	5,071,9	14	5,082,171	
Uplink Data > MT:		40		_	127,550		128,578	
Uplink Data > MT:			ct.	_	127,550		128,578	
Uplink Data > MT:				_	0		0	
Uplink Data > MT:			libe	_	0		0	
Uplink Data > MT				_	0		0	
Uplink Data > MT:				_	995.051		996.076	
			+	_	23.575		23.835	
Uplink Data > MTS > Packets > UDP > Echo Request Uplink Data > MTS > Packets > UDP > Echo Response			_	0		0		
Uplink Data > MTS > Packets > UDP > Ecro Response Uplink Data > MTS > Packets > UDP > SIP			_	82,525		82.783		
Uplink Data > MT:				_	178.910	1	179.417	
Uplink Data > MT:					688,652		688.652	
Uplink Data > MT:					21.389		21.389	
Uplink Data > MT					0		0	
Uplink Data > MT	> Packets > UE	P > DNS			0		0	
Uplink Data > MT:	5 > Packets > UE	P > Fragments			0		0	
Uplink Data > MT:					0		0	
Uplink Data > MT:	5 > Packets > TO	Р			3,949,3	13	3,957,517	
Uplink Data > MT:	5 > Packets > TO	P > HTTP			2,876,3	71	2,877,656	
Uplink Data > MT:	5 > Packets > T(P > FTP			0		0	
Uplink Data > MTS > Packets > TCP > SMTP				386,974	ł	390,563		
Uplink Data > MTS > Packets > TCP > POP				486,015	i	489,345		
Uplink Data > MTS > Packets > TCP > Fragments				0		0		
Uplink Data > MTS > Packets > TCP > Other				199,953	3	199,953		
Uplink Data > MT:	5 > Bytes				513,221	,321	514,726,8	99
				4	1			

Graphical Tracing

As far as we know, the Torrent system was the first wireless test system to incorporate graphical tracing; allowing you to see "the big picture" with greater ease:



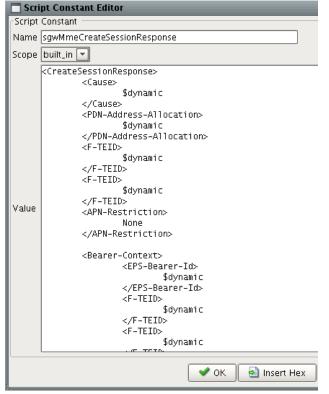
Text Based Tracing

In some cases it's useful to have a text based representation of a captured message flow (e.g. for detailed study), which the system offers as well:

ogs		≝ 2
ogs		
MTS1 NTS1 SGW1 PGV	V1 Test Case	
=> GTP Create Session Requ	est	-
0010 AC 3D 03 01 08 4 0020 00 00 00 00 00 00 0030 01 00 00 11 4C 0050 52 00 01 00 00 01 01 0050 52 00 01 00 06 5 0060 02 01 57 00 090 0070 00 40 00 00 00 00 0070 00 40 00 00 00 00 0080 01 00 00 00 00 0090 00 44 65 73 0040 00 00 00 00 00 00	5 00 00 40 11 B5 60 AC 30 02 01 EgE@m.= 8 08 48 00 AA 27 37 48 20 00 9E =K.K'H 0 01 00 01 00 08 00 13 20 26 00	
[03-Jan-12 16:24:06.89	3 (0.000017)]	
TP I Header length TOS Total Length I dentification Fragment Offset Time to live Protocol Header checksum S rc	bytes 4 5 0 190 0x6745 Nome (0x0) 0 64 UDP (0x11) 0x8560 MHE (172.61.2.1)	
Dest UDP Source Port Destination Port Length Checksum	SGW (172.61.3.1) 2123 2123 170 0x2737	
GTP Version Piggybacking TEID Presence Length TEID Sequence Sequence Number INSI Jype Length Instance INSI	GTP V2 (2) 0 1 Create Session Request (32) 158 0x0 1 IMSI (1) 8 0 310-26-200-100-0001	
l `		
Auto Scroll		Close

Configurable Message Templates

One of the biggest changes in the 6100 as compared to its predecessors in the Torrent series is an innovative XML Template Engine which allows you to specify the content of messages (an ordering of that content for that matter):



Fields may be hard coded, omitted, or re-arranged as desired. Certain ones, tagged as "\$dynamic" are filled in intelligently in real time.

Specification Compliance

3GPP TS 36.211 - Physical Channels & Modulation 3GPP TS 36.212 - Multiplexing & Channel Coding 3GPP TS 36.331 - RRC 3GPP TS 29.060 - GTPv1 3GPP TS 29.274 - GTPv2 3GPP TS 29.281 - GTP-U 3GPP TS 29.273 - EPS AAA 3GPP TS 24.301 - NAS 3GPP TS 36.413 - S1AP 3GPP TS 29.212 - Policy and Charging over Gx 3GPP TS 32.299 – Diameter Charging / Telecom Mgmt 3GPP TS 32.296 - Online Charging System 3GPP TS 29.212 - SGW to PCRF Interface 3GPP TS 29.212-214 - Gx 3GPP TS 23.040 - SMS 3GPP TS 29.02 - MAP 3GPP TS 33.401 – LTE Security 3GPP TS 23.228-229 - IMS

ITU Q.713-714 – SCCP ITU X.691 – ASN.1 PER ITU Q.704 – MTP3 ITU Q.772-775 - TCAP

RFC 791 – IPv4 RFC 2460 – IPv6 RFC 6733 – Diameter RFC 5516 – Diameter 3GPP Codes RFC 3261 - SIP RFC 3550 – RTP RFC 3605 – RTCP RFC 2616 – HTTP 1.1 RFC 2960 – SCTP RFC 1034 – DNS RFC 1939 – POP3 RFC 2821 – SMTP RFC4165 – M2PA

Note that the system complies with **Release 10** of the 3GPP specifications unless otherwise note



12 Greenway Plaza, Suite 1100 Houston, TX 77046 877-404-2600 281-836-4600 214-594-2700 FAX www.mobilemetrics.net