

Torrent 6100 LTE Test System

Product Data Sheet

The Torrent 6100 is a Linux based high performance linearly scalable test solution that is targeted for use in testing the 3GPP LTE enhanced packet core (EPC) network.

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 millions of subscribers with tens of thousands of them streaming youtube data at 20Mbps each with the same ease:



Then scale that just by adding more servers.

Architecture Overview



Torrent 6100 consists of several high performance server applications that together can emulate the LTE EPC or just parts of it. Furthermore, although it is not shown, the system can also emulate the 3G/UMTS packet core network (e.g SGSNs and GGSNs).

This central controller for the system, called the CS-6100, 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-6100 traffic server authentically simulates 1 to 5M+ UEs and thousands of enhanced NodeBs (eNBs) on a Linux machine. The MME-6100 simulates the Mobility Management Entity, or alternatively can be replaced with the MME under test. Similarly the SGW-6100 and PGW-6100 simulate the Serving Gateway and PDN Gateways respectively, and like the MME-6100 may be replaced with their counterparts under test as desired. Finally, the NTS-6100 provides a convenient aggregation of network servers (MMS, HTTP, FTP, SMTP, DHCP, PoC, WAP, etc.) as well as acting as a PCRF, CGF, and Radius Server.

Both the SGW-6100 and PGW-6100 can scale such that each one can act as 100 or 1000+ SGW or PGW instances.





The system also features support for high speed streaming of many different types of popular traffic types including YouTube, Netflix, Facebook, Pandora, and the like, and for doing so at very high rates and with very low packet loss even at those rates. As can be seen above, this is accomplished by the addition of a new Stream Traffic Server (STS) component to the system. This new element of the system works in lock step with the control plane to allow mobiles to stream these new traffic types with very high precision; that is, packet transmission rates, and interarrival times are very authentic compared to how such streams appear in the field (in those respects).

Standard Server Platform

The standard platform for the 6100 is 2U and supports 2-4 10GE links depending on requirements:



Single-Server Performance (LTE)

Below are characteristic performance figures for the case for the in which all nodes are emulated:

Parameter	Value	Units
Attach Rate	10,000	Attaches/sec
Detach Rate	60,000	Detaches/sec
S1 Handover Rate	15,000	Handovers/sec
X2 Handover Rate	30,000	Handovers/sec
Data Throughput	20	Gbps
Attached Subscribers	5M	Subscribers
ENBs	5000	Radios
SGWs	1000	Gateways
PGWs	1000	Gateways

Single-Server Performance (3G)

The 6100 system can also emulate 3G mobiles, SGSNs and GGSNs with the following performance figures as follows:

Parameter	Value	Units
Activation Rate	30,000	Activations/sec
Deactivation Rate	60,000	Deactivations/sec
IRAU Rate	40,000	Handovers/sec
Data Throughput	20	Gbps
Attached Subscribers	7M	Subscribers
SGSNs	5000	Gateways
GGSNs	1000	Gateways

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
- Combined 3G-UMTS and 4G-LTE testing
- Realistic Mobile Subscriber Emulation
- IPv4 and IPv6 Support
- High Bandwidth Streaming (YouTube, Netflix, Pandora, etc)
- MILENAGE Authentication
- Test/XOR Authentication
- AES Ciphering (128-EEA2)
- Null-Ciphering (128-EEA0)
- VLAN Tagging (IEEE 802.1Q)
- VoIP Support, including SIP, RTP, and RTCP
- 10 Gigabit Ethernet Support (LR/SR)
- Multiple Primary Contexts
- Multiple Secondary Contexts

Mobile Protocols Supported

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

- IPv4
- IPv6
- TCP
- HTTP
- UDP
- FTP
- MMS
- SMTP
- POP3
- PTT
- 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 The SGW to PGW Interface
- S8 PLMN Variant of S5
- SGi The PDN / Internet Interface
- Gx The PGW to PCRF Interface
- Gn For SGSN to GGSN Communication

Scripted Mobile Behavior

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

Mobile Script Editor: setup.cycle	u א 🗙
attach enb <all> apn alpha.gprs gtp v2 detach</all>	
Insert Command: Attach (Network Entry)	V V 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:

E	Test Case Editor: BasicUP	<u>د</u> م 🗙
	<pre>public boolean runTest() throws Exception { int n = getRequiredIntParm("numHobiles"); int s = getRequiredIntParm("streamWindow"); int d = getRequiredIntParm("cduration") * 60; int w = getRequiredIntParm("controlWindow");</pre>	
	<pre>mobileAlloc(n); runScript("setup count "+n+" window "+w); runScript("stream.youtube count "+n+" window "+s+" duration "+0 runScript("del count "+n+" window "+w);</pre>	IJ;
	return true; } <	▼ ► 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:



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Save Close

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rest case free	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, also 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 🛛 😰 🛛 🔀
P-NTS
φ-SIS
P-PacKets
- ENB TX Packets
- SUW RX Packets
- SUW TX Packets
- FOW IN FALKELS
-54 891 600 000 (51 11(b)
- S(W RY Pytes
- SGW TX Bytes
- PGW RX Bytes
Packet Locs
- S(W Relay 0.00000%
Unlink Total (ENB->PGW)
©-Downlink Data
Ø- MTS
Ø-NTS
∳– STS
- Packets
∳-Bytes
PGW TX Bytes
- SGW RX Bytes
SGW TX Bytes
ENB RX Bytes
- SGW->ENB0.00701%
— SGW Relay0.00205%
Downlink Total (PGW->ENB)0.02619%
©- HTTP
op−Stream
- Stream Playback Attempts800,000
- 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:

Statistics		س م 🗙
		_
Summary Stats Current Rates Detailed Stats Stats History Sta	ts Graphs Histogram	S
	1 Oct 31, 16:41:07.7	54 Oct 31, 16:41:12.116
Attaches > Attach Completions	89,308	89,562
Attaches > Attach Failures	0	0
Detaches > Detach Attempts	89,296	89,550
Detaches > Detach Completions	89,296	89,550
Detaches > Detach Failures	0	0
Activations > Activation Attempts	0	0
A V	1 0# 21 16:41:07 7	54 Oct 31 16:41:13 116
Usedeffe - Usedeff Feilunes - T3 Timeseut	1 00 31, 16.41.07.7	04 001 31, 16.41.12.116
Handolis > Handoli Fallures > 15 Timeout	0	
Handon's > Handon Fallures > Script Error	5.071.014	5 092 171
Uplink Data > MTC > Packets	107550	120 570
Uplink Data > MTS > Packets > ICMP	127,550	120,570
Uplink Data > MTS > Packets > ICMP > Echo Request	0	0
Uplink Data > MTS > Packets > ICMP > Echo Response	0	
Uplink Data > MTS > Packets > ICMP > Prayments	0	0
Uplink Data > MTS > Packets > ICMP > Other	005.051	006.076
Uplink Data > MTC > Packets > UDP - Ethe Desuret	33,031	22.825
Uplink Data > MTS > Packets > UDP > Echo Request	23,373	23,833
Uplink Data > MTS > Packets > UDP > Etho Response	82 525	82.782
Uplink Data > MTS > Packets > UDP > MP	179.010	170.417
Uplink Data > MTS > Packets > UDP > MIP	699.657	699.657
Uplink Data > MTS > Packets > UDP > RTCP	21 289	21 289
Uplink Data > MTS > Packets > UDP > WAP	0	0
Uplink Data > MTS > Packets > UDP > MAP	0	0
Unlink Data > MTS > Packets > UDP > Ergaments	0	Ŏ.
Unlink Data > MTS > Packets > UDP > Other	0	0
Unlink Data > MTS > Packets > TCP	3 949 313	3 957 517
Unlink Data > MTS > Packets > TCP > HTTP	2 876 371	2 877 656
Uplink Data > MTS > Packets > TCP > FTP	0	0
Unlink Data > MTS > Packets > TCP > SMTP	386 974	390 563
Uplink Data > MTS > Packets > TCP > POP	486.015	489.345
Unlink Data > MTS > Packets > TCP > Fragments	0	0
Unlink Data > MTS > Packets > TCP > Other	199 953	199 953
Unlink Data > MTS > Pytes	513,221,321	514,726,899
approximate of the end of the second se	4	
	Absolute Time	Clear Close
<u>v</u>		

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:



opgs mT51 NTS1 SGW1 PGW1 Test Case => GTP Create Sestion Request	Logs		23
MTS1 NTS1 SGW1 PGW1 Test Case =>> CTP Create Session Request ==:	_ogs		
<pre>=> GTP Create Session Request 0000 45 00 00 EE 67 45 00 00 40 11 B5 60 AC 30 02 01 EgE8n= 0010 AC 30 03 01 08 48 08 48 00 AA 27 48 20 00 9E,K.K.'77 0020 00 00 00 00 00 01 00 10 00 68 00 13 20 20 00,K.K.'77 0000 01 00 06 11 41 00 05 00 12 14 00 01 04 50 06 06,K.K.'77 0000 01 00 06 97 09 00 00 00 02 04 05 00 00 AC 50 00,K.'. 0000 01 00 00 00 00 00 00 00 00 00 AC 50 00 0,K.'. 0000 01 00 00 00 00 00 00 00 00 00 AC 50 00,K.'. 0000 01 00 00 00 40 00 00 00 00 00 00 AC 50 00,K.'. 0000 01 00 00 00 40 00 00 00 00 00 00 00 AC 50 00,K.'</pre>	MTS1 NTS1 SGW1 PGW1 Test C	ase	
0000 45 00 00 BE 67 45 00 00 40 11 B5 6D AC 30 02 01 EgE.8m.= 0010 AC 30 03 10 04 48 08 48 00 AA 27 37 48 20 00 9E =K.K.'7H 0020 AC 30 03 10 00 48 00 10 01 10 06 80 01 32 20 00 K.'.'7H 0020 AC 30 03 01 00 01 00 11 00 05 00 11 20 20 00 K.'.'N'' 0020 AC 30 03 00 00 00 00 00 10 01 14 00 08 00 13 02 10 66 K.'.'N'' 0020 AC 30 03 00 00 00 00 00 10 14 00 00 00 00 00 14 20 00 NK.'.'N'' 0020 AC 30 03 00 00 00 00 00 12 14 00 03 00 00 14 20 00 NK.'.'N'' 0020 AC 30 03 00 00 00 00 00 00 00 00 00 00 00	=> GTP Create Session Request		-
[03-Jan-12 16:24:06.893 (0.000017)] Packet Info Length 190 bytes IP Header length 5 TOtal Length 190 I Total Length 190 Vision 1000 Protocol 1000 UP Source Port 2123 Destination Port 2123 Length 100 Version GTP V2 (2) Piggybacking 0 TEID Presence 1 Message Type Create Session Request (32) Length 8 I Tinstance 0 I NSI 310-26-200-100-0001 I INSI I Instance 0 I INSI I INSI I INSI <td>$\begin{array}{cccccccccccccccccccccccccccccccccccc$</td> <td>11 85 60 AC 3D 02 01 EgE@m.= AA 27 74 82 00 9E </td> <td>1111</td>	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11 85 60 AC 3D 02 01 EgE@m.= AA 27 74 82 00 9E	1111
Packet Info Length 190 bytes IP Version 4 Header length 5 TOS 0 Total Length 190 Identification 0x6745 Flags None (0x0) Fragment Offset 0 Time to live 64 Protocol UDP (0x11) Header checksum 0x8560 Source Port 2123 Destination Port 2123 Destination Port 2123 CTP Version GTP V2 (2) Piggybacking 0 TELD Presence 1 Message Type Create Session Request (32) Length 158 TELD 0x0 Sequence Number 1 INST 310-26-200-100-0001	03-Jan-12 16:24:06.893 (0.00001	.7)]	
Flags None (0x0) Fragent Offset 0 Thme to live 64 Protocol UDP (0x11) Header checksum 0x8560 Sr. c SGW (172.61.2.1) Dest SGW (172.61.3.1) UDP Source Port 2123 Destination Port 2123 Length 170 Checksum 0x2737 CTP Version Frequence 1 Message Type Create Session Request (32) Length 0x0 Sequence Number 1 INSI 310-26-200-100-0001 Instance 0	Packet Info Length 190 bytes IP Version 4 Header length 5 TOSA Length 190 I Total Length 190 I Identification 0x6745		
UDP I Source Port 2123 Destination Port 2123 Length 170 Checksum 0x2737 GTP Version TFLD Presence 1 170 Message Type Create Session Request (32) Length 158 TELD 0x0 Sequence Number 1 INSI 10-26-200-100-0001 Imstance 1 INSI 310-26-200-100-0001	Flags None (Ox0 Fragment Offset 0 0 Time to live 64 Protocol UDP (Ox11) Header checksum 0x8560 Src MME (172.) Dest SGW (172.))) () (1.2.1) (1.3.1)	
CTP CTP Version CTP V2 (2) Piggybacking 0 TELD Presence 1 Message Type Create Session Request (32) Length 158 TELD 0x0 Sequence Number 1 INSI I Type IMSI (1) Length 8 I Type IMSI (1) Length 8 I Instance 0 I INSI 310-26-200-100-0001	UDP Source Port 2123 Destination Port 2123 Length 170 Checksum 0x27	3	
Type INSI (1) Length 8 Instance 0 INSI 310-25-200-100-0001	CTP CTP Version CTP V2 (2 Piggybacking 0 TEID Presence 1 Nessage Type Create Se Length 158 TEID 0x0 Sequence Number 1 TWT	?) ession Request (32)	
Auto Scroll	I Type IMSI (1) I Length 8 I Instance 0 I IMSI 310-26-20	10-100-0001	Y
	Auto Scroll		lose

XML Configurable Messages

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 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

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

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



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