

Sigtran LBS Gateway

Technical Overview v1.0d

Version control

Version	Date	Author	Comment
R0	2010/03/22	Alejandro Leib	Initial Version
V1.1b	2013/05/29	Alejandro Leib	Traps added
V1.1c	2015/04/08	Alejandro Leib	XML TCP IP examples
V1.1d	2015/04/09	Alejandro Leib	MAP Error Code listed

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Introduction

The UMTS/GSM Any Time Interrogation MAP function allows CellID and Subscriber Status queries between others.

It is primary used on real-time and instant phone services because location and status information can be used to enhance the service.

The response time of a LBS request is measured between 100 and 200ms.

The functionality of LBS Gateway make it ideal for CellID or Subscriber Status based information services.

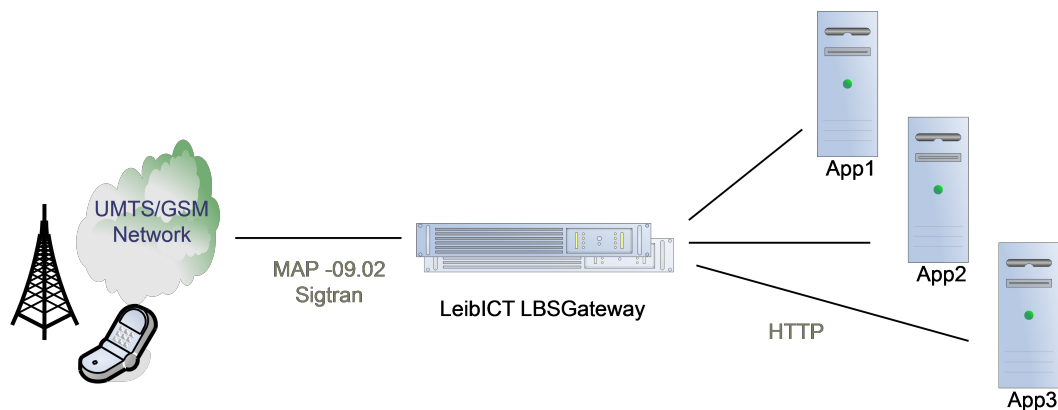
Capacity

The current Sigtran LBS-Gateway version supports 32768 simultaneous incoming and outgoing transactions being processed at the same time.

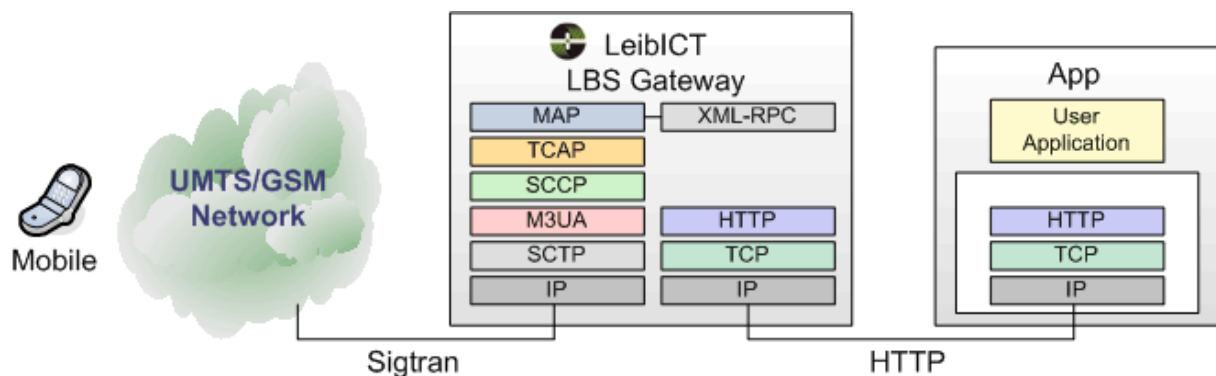
The modular architecture allows increasing system capacity as needed by adding more hardware.

Architecture

The next Implementation View shows the components of the Sigtran LBS Gateway based on a single server.

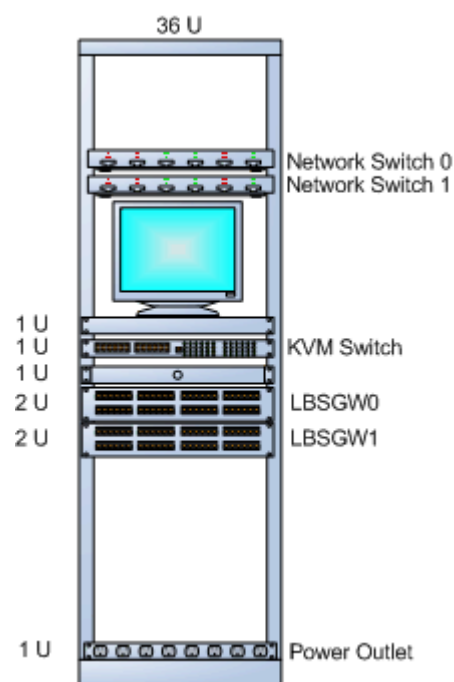


All the software components are Unix daemons that are started at boot time:



Hardware

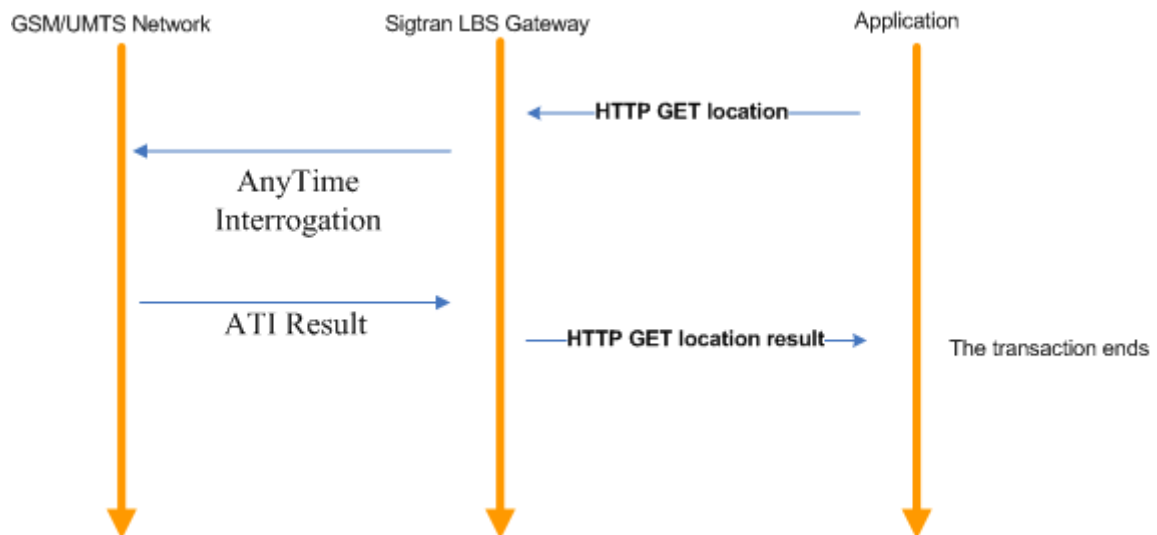
The Sigtran LBS Gateway is based on standard x86 Servers from HP or Sun. The Operating System can be either Linux (RedHat or CentOS). The next picture shows a dual module configuration:



Typical HP/RedHat Solution is based on DL 380 with Intel Core 2 Quad and 4Gb of RAM. Hard disk space depends on customer needs of traffic logging storage. Up to 8Kb bytes are needed per transaction.

Interactivity View

The next scenario shows a LBS transaction



Configuration

LeibICT Sigtran LBS Gateway has its configuration files deployed in a configurable directory.
The default config directory is:

/sugw/cfg

The main configuration of the SS7 Stacks is implemented within a XML file:

```
<siggw name="LeibICT">
  <sctp id="0" addr="localhost" port="5400" name="sctp">
    <association id="0" server="0" name="asso0">
      <local id="0" addr="192.168.1.100" port="2905" name="local-ep"/>
      <remote id="0" addr="192.168.1.20" port="2905" name="remote-ep"/>
    </association>
  </sctp>
  <m3ua id="0" addr="localhost" port="5401" name="m3ua">
    <user id="0" opc="321" name="stack">
      <destination id="0"
        dpc="123"
        name="destination0">
        <route id="0" associationId="0" name="route0"/>
      </destination>
    </user>
    <sctp_module id="0"/>
  </m3ua>
  <sccp id="0" addr="localhost" port="5402" name="sccp">
    <user id="0"
      addressIndicator="18"
      pointCode="0"
      subsystemNumber="146"
      natureOfAddress="4"
      translationType="0"
      numberingPlan="1"
      encodingScheme="1"
      globalTitle="5001205280001"/>
    <translator id="0"
      prefix=""
      loadsharing="0">
      <mtp3_destination id="0"/>
    </translator>
    <mtp3_module id="0"/>
  </sccp>
  <tcap id="0" addr="localhost" port="5403" name="tcap">
    <sccp_module id="0"/>
  </tcap>
</siggw>
```


</tcap>
</siggw>

The XML configuration file consists in four parts, each referring a single stack: SCTP, M3UA, SCCP and TCAP.

.1 Sctp

The Sctp layer is a wrapper of the OS Sctp Stack, thus it only contains the operative configuration.

The Sctp Layer has the next parameters:

Field	Description	Example
id	Identification Number of the Stack	"0"
addr	DN or IP Address of the machine where the Stack runs	"localhost"
port	TCP Port where the Stack listen	"5400"
name	Name of the Stack	"sctp0"
association	Sctp Association (s)	

The Association field has the next parameters:

Field	Description	Example
id	Identification Number of the Association	"0"
server	Indicates if the host acts as Server or Client	"0"
name	Name of the Association	"asso0"
local	Local End Point (s) of the Association	*
remote	Remote End Point (s) of the Association	*

The Local and Remote fields has the next parameters:

Field	Description	Example
id	Identification Number of the End Point	"0"
addr	DN or IP Address of the machine where the	"localhost"
port	Sctp Port of the End Point	"2905"
name	Name of the End Point	*

.2 M3UA

The M3UA Stack implements the M3UA Protocol and State Machines:

The M3UA Layer has the next parameters:

Field	Description	Example
id	Identification Number of the Stack	"0"
addr	DN or IP Address of the machine where the Stack runs	"localhost"
port	TCP Port where the Stack listen	"5401"
name	Name of the Stack	"m3ua0"
user	M3UA User (s)	*

The M3UA User field has the next parameters:

Field	Description	Example
id	Identification Number of the User	"0"
opc	Originating Point Code	"321"
name	Name of the User	"user0"
destination	M3UA Destination (s)	*

The M3UA Destination field has the next parameters:

Field	Description	Example
id	Identification Number of the Destination	"0"
dpc	Destination Point Code	"123"
name	Name of the User	"dest0"
route	M3UA Route (s)	*

The M3UA Route field has the next parameters:

Field	Description	Example
id	Identification Number of the Route	"0"
associationId	Identification Number of the Association	"0"
name	Name of the Route	"route0"

.3 SCCP

The SCCP Stack implements the SCCP Protocol and State Machines:

The SCCP Layer has the next parameters:

Field	Description	Example
id	Identification Number of the Stack	"0"
addr	DN or IP Address of the machine where the Stack runs	"localhost"
port	TCP Port where the Stack listen	"5402"
name	Name of the Stack	"sccp0"
user	SCCP User (s)	*
translator	SCCP Translator (s)	*

The SCCP User field has the next parameters:

Field	Description	Example
id	Identification Number of the User	"0"
addressIndicator	ITUT Q.713 SCCP Address parameters	"18"
pointCode		"0"
subsystemNumber		"146"
NatureOfAddress		"4"
translationType		"0"
numberingPlan		"1"
encodingScheme		"1"
globalTitle		"205280001"

The SCCP Translator field has the next parameters:

Field	Description	Example
id	Identification Number of the Translator	"0"
prefix	Prefix of the Global Title to be translated	"205"
loadsharing	Enable load sharing between entities	"0"

mtp3_destination	M3UA Destination (s)	*
-------------------------	----------------------	---

The M3UA Destination field has the next parameters:

Field	Description	Example
id	Identification Number of the M3UA Destination	"0"

.4 TCAP

The TCAP Stack implements the TCAP Protocol and State Machines:

The TCAP Layer has the next parameters:

Field	Description	Example
id	Identification Number of the Stack	"0"
addr	DN or IP Address of the machine where the Stack runs	"localhost"
port	TCP Port where the Stack listen	"5403"
name	Name of the Stack	"tcap0"

XML Messages

If XML/TCP/IP interface is used, these are example of messages:

This examples shows a AnyTimeInterrogation routed on MSISDN as the destination (the STP will select the correct HLR to process the call)

```
<siggw>
<msg type="begin">
<user id="1"/>
<dialog id="9"/>
<destination
id="-1"
addressIndicator="18"
encodingScheme="1"
globalTitle="243999964007"
natureOfAddress="4"
numberingPlan="1"
pointCode="0"
subsystemNumber="6"
translationType="0"/>
<stack id="0"/>
<context v="04000001001D03"/>
<component id="0" op="any_time_interrogation" type="invoke">
<param name="subscriber_identity">
<param nai="1" name="msisdn" npi="1" number="243999964007"/>
</param>
<param name="requested_info">
<param name="location_information"/>
</param><param nai="1" name="gsm_scf_address" npi="1" number="243996100496"/>
</component>
</msg>
</siggw>
```


This examples shows a request sent to a sugw.xml configured estination (destination id=0)

```
<siggw>
<msg type="begin">
<user id="1"/>
<dialog id="9"/>
<destination id="0"/>
<stack id="0"/>
<context v="04000001001D03"/>
<component id="0" op="any_time_interrogation" type="invoke">
<param name="subscriber_identity">
<param nai="1" name="msisdn" npi="1" number="243999964007"/>
</param>
<param name="requested_info">
<param name="location_information"/>
</param><param nai="1" name="gsm_scf_address" npi="1" number="243996100496"/>
</component>
</msg>
</siggw>
```

The successfull result example:

```
<siggw>
<msg type="end">
<stack id="0"/>
<user id="1"/>
<dialog id="2"/>
<context v="04000001001D03"/>
<component type="return_l" id="0" op="any_time_interrogation">
<param name="subscriber_info">
<param name="location_information">
<param name="age_of_location_information" v="4"/>
<param name="vlr_number" number="27829100724" nai="1" npi="1"/>
<param name="location_number" v="8493722819802107"/>
<param name="cell_glob_id_or_lai">
<param name="cell_glob_id_or_serv_area_fixed_length" mcc="655" mnc="01" lca="93"
cid="22625"/>
</param>
<param name="msc_number" number="27829100724" nai="1" npi="1"/>
</param>
</param>
</component>
</msg>
</siggw>
```

A common error is the HLR not allowing the LBS GW to perform the query:

```
<siggw>
  <msg type="end">
    <stack id="0"/>
    <user id="1"/>
    <dialog id="2"/>
    <context v="04000001001D03"/>
    <component type="return_error" id="0">
      <error_code v="31"/>
    </component>
  </msg>
</siggw>
```

Error 0x31 (49 in decimal format) is "Ati Not Allowed".

Traps

The system is capable of sending traps to multiple NOC SNMP Agents.

Each SNMP server is defined in the file [/sugw/sugwsnmp.properties](#)

[destination0=udp\:172.20.1.147/162](#)

[destination1=udp\:172.20.2.129/162](#)

[destination2=udp\:172.20.150.1/162](#)

[\[...\]](#)

The traps are:

Name	Description	Severity
notification	Used for notifications about system status *	Notice
congestionDetected	System congestion detected	Warning
congestionAbated	System congestion abated	Notice
serviceUp	System is running	Notice
serviceDown	System is not running	Emergency
linkup	SS7 link is up	Notice
linkDown	SS7 link is down	Critical
trunkUp	SS7 trunk is up **	Notice
trunkDown	SS7 trunk is down **	Critical
routeUp	SS7 route is up	Notice
routeDown	SS7 route is down	Critical
destinationUp	SS7 destination is up	Notice
destinationDown	SS7 destination is down	Critical
resourceWarning	System resource has reached warning status *	Warning
resourceCritical	System resource has reached critical status *	Critical
applicationConnected	Application has bound the System	Notice
applicationDisconnected	Application has disconnected the System	Emergency
applicationWarning	Application is not responding requests in time	Warning
applicationCritical	Application is not responding requests	Critical
applicationNormal	Application is in normal condition	Notice

* Not implemented on current Sigtran LBS Gateway version: for future usage

** Not implemented on Sigtran LBS Gateways.

.1 Severity Table

Severity Name	System Response
Emergency	System unusable
Alert	Immediate action needed
Critical	Critical conditions exist
Error	Error conditions exist
Warning	Warning conditions exist
Notice	Normal but significant conditions exist
Informational	Informational messages
Debug	Debug messages

Logs Files

All the process modules have a standard, debug and error logs. All the logs are generated in a configurable directory. The default log directory is:

`/sugw/logs`

Debug logs are disabled by default, enabling them may cause a performance decrease.

Scalability Plan

The scalability of the solution can be performed by increasing the hardware modules in multiple ways: sharing the same SS7 network addresses (SCCP and MTP) or not and sharing the same TCP/IP network address or not.

By sharing the same SS7 network addresses, up to four nodes can be paired.

Beyond four nodes, more SS7 network addresses must be defined.

By sharing the same TCP/IP network address, a load balancer must be deployed like the one provided in the RedHat Cluster Suite.

Annex A – 3GPP 29.002 Errors

This is a sorted by error code list of errors described on the 3GPP 29.002 standard.

- 1 unknownSubscriber
- 3 unknownMSC
- 5 unidentifiedSubscriber
- 7 unknownEquipment
- 6 absentSubscriberSM
- 8 roamingNotAllowed
- 9 illegalSubscriber
- 10 bearerServiceNotProvisioned
- 11 teleserviceNotProvisioned
- 12 illegalEquipment
- 13 callBarred
- 14 forwardingViolation
- 15 cug-Reject
- 16 illegalSS-Operation
- 17 ss-ErrorStatus
- 18 ss-NotAvailable
- 19 ss-SubscriptionViolation
- 20 ss-Incompatibility
- 21 facilityNotSupported
- 22 ongoingGroupCall
- 25 noHandoverNumberAvailable
- 26 subsequentHandoverFailure
- 27 absentSubscriber
- 28 incompatibleTerminal
- 29 shortTermDenial
- 30 longTermDenial
- 31 subscriberBusyForMT-SMS
- 32 sm-DeliveryFailure
- 33 messageWaitingListFull
- 34 systemFailure
- 35 dataMissing
- 36 unexpectedDataValue
- 37 pw-RegistrationFailure
- 38 negativePW-Check
- 39 noRoamingNumberAvailable
- 40 tracingBufferFull
- 42 targetCellOutsideGroupCallArea

43 numberOfPW-AttemptsViolation
44 numberChanged
45 busySubscriber
46 noSubscriberReply
47 forwardingFailed
48 or-NotAllowed
49 ati-NotAllowed
50 noGroupCallNumberAvailable
51 resourceLimitation
52 unauthorizedRequestingNetwork
53 unauthorizedLCSCClient
54 positionMethodFailure
58 unknownOrUnreachableLCSCClient
59 mm-EventNotSupported
60 atsi-NotAllowed
61 atm-NotAllowed
62 informationNotAvailable
71 unknownAlphabet
72 ussd-Busy