Canadian Radio – television and
Telecommunications Commission

Interconnection Steering Committee

Report to the CRTC

by the

Emergency Services Working Group (ESWG)
TIF #57 Sub-Committee

Wireless E9-1-1 Phase 2 Stage 1 Technical Specification Recommendation Version 1.5

Report Number: ESRE0047

June 18, 2009

OVERVIEW

This Report is provided as the first deliverable of the work undertaken by the Wireless Phase II sub-committee for TIF (task identification form) #57, which is comprised of the following participants:

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Please review the TIF 57 – “Wireless Phase II Rollout – Criteria, Priority, Schedule” document for full details of activities, action items, and contributions. The work of this sub-committee will continue as documented in the TIF.

Further Reports and contributions will be shared as they come available, with the goal to combine this report, plus other applicable reports and contributions, into a single ESWG Report that is due by May 2, 2009 (per Telecom Decision 2009-40). In addition, this work will also form the foundation for the Trial #2 Report which will be completed in the July/August 2009 timeframe.

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ESWG Wireless E9-1-1 Phase 2 Stage 1 Sub-committee Technical Specification Recommendation Version 1.5

June 18, 2009

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Revision History:

Version	Date	Author	Summary of Changes
1.0	March 25, 2009	Hong Chung	Initial version proposed to the ESWG.
1.1	March 27, 2009	Hong Chung	Updated Section 6.3.5 Heartbeat to clarify how msid should be selected and changed wording of the performance metric requirement. Added Appendix A – Deliberations and Considerations.
1.2	April 06, 2009	Chris Kellett	Updated the document Overview info by adding 2 participants. Change DOCTYPE and adjust the XML structure in response examples of section 3 [NOTE: this adjustment to the XML structures is important for developers to be aware of].
1.3	April 30, 2009	Chris Kellett	Page 8 and 9 ELIA examples updated from 'svc_init' to the correct 'svc_result' value. As well, it was noted that in the Format 1 example the '<time utc_off …' and 'result resid= …' were reversed – corrected. Appendix A – added item #5. NOTE: Approved ESWG May 1 version for submission to the CRTC CISC per the May 2nd, 2009 deadline detailed at paragraph 18 of Telecom Decision 2009-40.
1.4	May 8, 2009	Chris Kellett	Section 3, page 5 – Heartbeat description updated; Section 6.3.5, page 13 – Heartbeat function revised. Appendix A – Item #5 wording updated. **NOTE: The updates detailed above were flagged on the May 1, 2009 ESWG conference call as pending. The changes were approved on the May 7, 2009 TIF57 conference call and it was agreed the report would be finalized as the ESTF0047 (with no version letter) as the updated submission to the CRTC CISC on May 8.**

1.5	June 18, 2009	Chris Kellett	Add new Section 4.1 to provide an overview of the Default Location Determination Technology. Updated ELIA Positive and Error Response examples that showed MMHH versus the correct format of HHMM.

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1. Introduction

On March 3, 2009 the ESWG Wireless E9-1-1 Phase 2 sub-committee attended a face-to-face meeting with the goal of gaining consensus on the technical solution for Canadian Wireless E9-1-1 Phase 2 as defined by the CRTC in [2009-40]. This document consolidates the technical contributions to date with additions resulting from the face-to-face meeting and subsequent sub-committee discussions. It is intended to illustrate the solution specifications required to assist the ILECs and WSPs in proceeding with their Wireless E9-1-1 Phase 2 implementation.

2. Scope

The primary focus of this document is to standardize the ALI-MPC/GMLC interface definition for all of Canadian Wireless E9-1-1 Phase 2 Stage 1. Standardization of this external interface allows carriers to implement the interface once and reuse it for all E9-1-1 connections. This document does not make recommendations for interfaces internal to the ILECs and WSPs or Stage 2 but mention them to provide background information to help the reader understand the bigger picture and understand why certain recommendations have been made.

3. Quick Summary of Technical Requirements

This section provides readers a means to quickly identify the technical recommendations for the ALI-MPC/GMLC interface. More details are presented in the sections that follow.

ALI – MPC/GMLC Interface - Protocols

- OMA-MLP v3.2, refer to [OMA_MLP] for more detailed information.
    - ELIR – ALI to MPC/GMLC
    - ELIA – MPC/GMLC to ALI
- HTTP v1.1
- TCP, non-persistent, port 9210
- IPv4
- IPSec tunnel (if encryption is required by a carrier)

ALI – MPC/GMLC Interface – Message Flow

- ALI must send ELIR to all MPCs/GMLCs in the redundant configuration simultaneously.
    - Separate, non-Internet exposed Public IP addresses required for each MPC/GMLC
- All MPC/GMLC must respond.
    - MPC/GMLC not processing the ELIR request will respond with an expected error with *result resid=4*.
- MPC/GMLC will respond to the ALI IP address making the request.
    - ILEC is free to use 1 or multiple ALIs or source IP addresses to initiate the request.

ALI – MPC/GMLC Interface - Link

- "Redundant" link(s) (IP link requires dynamic routing protocol running over managed network(s)).
- Connection from each ALI to each MPC/GMLC must exist.
- ILEC will establish a POI where the WSPs must terminate to.
    - Minimum one POI per 9-1-1 provider.
- Heartbeats (Application Layer) via MLP
    - Heartbeat message is sent when the link is idle for 60 seconds or optionally, at a fixed 60-second interval.

Timeouts

- MPC/GMLC will have 30 seconds to response after receiving the ELIR
- ALI(s) will allow a maximum connection establishment time of 15 seconds to attempt to reach the MPC/GMLC to deliver the ELIR. If the ALI(s) cannot deliver the ELIR to either MPC/GMLC within 15 seconds, an error will be sent to the PSAP. (E.g. Unable to communicate with the WSP)
- ALI(s) must be configured so that the maximum wait time at the PSAP is 50 seconds for the reception of Phase 2 information.
    - Note that 50 seconds is the worst case scenario and very unlikely.

Example MLP Documents

ELIR (Initial Request)

```
<?xml version="1.0"?>
<!DOCTYPE svc_init SYSTEM "MLP_SVC_INIT_320.DTD">
<svc_init ver="3.2.0">
    <hdr ver="3.2.0">
       <client>
          <id>theali</id>
          <pwd>thepwd</pwd>
          <serviceid>assignedALIid</serviceid>
       </client>
    </hdr>
    <eme_lir res_type="SYNC" ver="3.2.0">
      <msid type="MSISDN">NPANXXXXXX</msid>
      <esrd>NPANXXXXXX</esrd>
      <eqop>
         <resp_timer>30</resp_timer>
      </eqop>
      <geo_info>
        <CoordinateReferenceSystem>
          <Identifier>
            <code>4326</code>
            <codeSpace>EPSG</codeSpace>
            <edition>6.1</edition>
          </Identifier>
        </CoordinateReferenceSystem>
      </geo_info>
      <loc_type type="INITIAL" />
    </eme_lir>
</svc_init>
```

MSISDN[1] highlighted above may be MDN. Both types of MSID (MSISDN and MDN) must be supported and selectable by the ALI on a per WSP (technology/ESRD) basis. For Phase 1, the length of the MSID will be 10 digits regardless of the type as the ALI will populate the parameter with the callback number received from the 9-1-1 tandem.

ELIR (Rebid Request – Stage 2)

Proposal subject to discussion in TIF59.

[1] It is understood that 3GPP 23.003 defines the MSISDN to include the country code prefix. However, it was consciously decided by the group that for the purpose of E9-1-1 Phase 2 Stage 1, WSPs requiring the use of the MSISDN MSID type will need to support a non-standard (10 digit) format without the country code prefix.

```
<?xml version="1.0"?>
<!DOCTYPE svc_init SYSTEM "MLP_SVC_INIT_320.DTD">
<svc_init ver="3.2.0">
    <hdr ver="3.2.0">
       <client>
          <id>theali</id>
          <pwd>thepwd</pwd>
          <serviceid>assignedALIid</serviceid>
       </client>
    </hdr>
    <eme_lir res_type="SYNC" ver="3.2.0">
      <msid type="MSISDN">NPANXXXXXX</msid>
      <esrd>NPANXXXXXX</esrd>
      <eqop>
         <resp_timer>30</resp_timer>
      </eqop>
      <geo_info>
        <CoordinateReferenceSystem>
          <Identifier>
            <code>4326</code>
            <codeSpace>EPSG</codeSpace>
            <edition>6.1</edition>
          </Identifier>
        </CoordinateReferenceSystem>
      </geo_info>
      <loc_type type="CURRENT" />
    </eme_lir>
</svc_init>
```

MSISDN highlighted above may be MDN – same as the request.

ELIA Example Positive Response

```
<?xml version="1.0"?>
<!DOCTYPE svc_result SYSTEM "MLP_SVC_RESULT_320.DTD">
<svc_result ver="3.2.0">
 <eme_lia ver="3.2.0">
   <eme_pos>
     <msid type="MSISDN">NPANXXXXXX</msid>
     <pd>
       <time utc_off="0000">YYYYMMDDHHMMSS</time>
       <shape>
         <CircularArea srsName="www.epsg.org#4326">
           <coord>
             <X>DD MM SS.sssN</X>
             <Y>DDD MM SS.sssW</Y>
           </coord>
           <radius>RRRRRR</radius>
         </CircularArea>
       </shape>
       <lev_conf>90</lev_conf>
     </pd>
     <esrd>NPANXXXXXX</esrd>
   </eme_pos>
 </eme_lia>
</svc_result>
```

ELIA Example Error Response

Depending on the error encountered, the MPC/GMLC may respond with two different formats:

Format 1

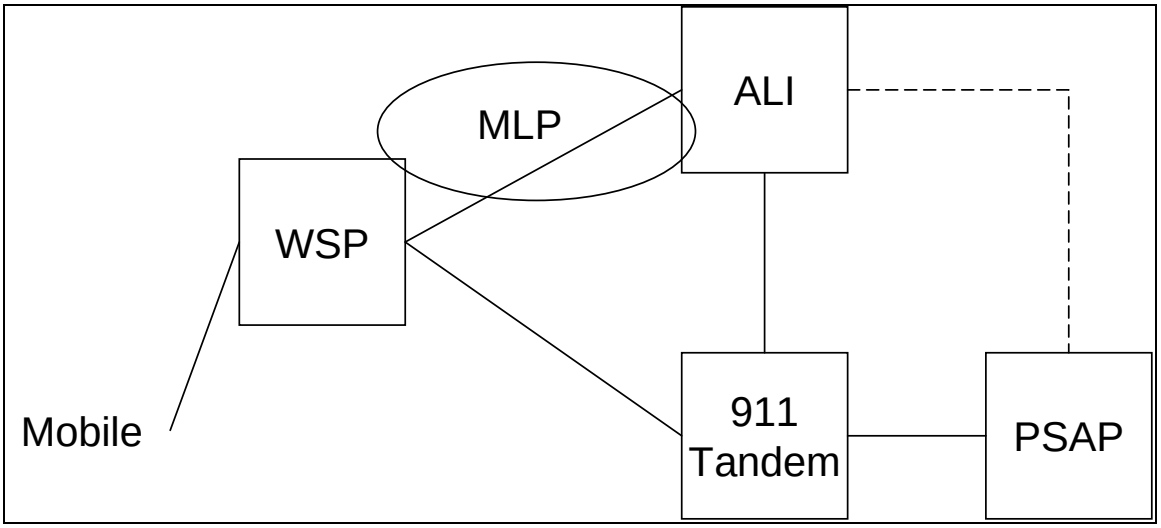
```
<?xml version="1.0"?>
<!DOCTYPE svc_result SYSTEM "MLP_SVC_RESULT_320.DTD">
<svc_result ver="3.2.0">
 <eme_lia ver="3.2.0">
   <eme_pos>
     <msid type="MSISDN">NPANXXXXXX</msid>
     <poserr>
       <result resid="4">UNKNOWN SUBSCRIBER</result>
       <time utc_off="0000">YYYYMMDDHHMMSS</time>
     </poserr>
     <esrd>NPANXXXXXX</esrd>
   </eme_pos>
 </eme_lia>
</svc_result>
```

Format 2

```
<?xml version="1.0"?>
<!DOCTYPE svc_result SYSTEM "MLP_SVC_RESULT_320.DTD">
<svc_result ver="3.2.0">
 <eme_lia ver="3.2.0">
   <result resid="1">SYSTEM FAILURE</result>
 </eme_lia>
</svc_result>
```

4. Wireless E9-1-1 Phase 2 Reference Architecture

The following is a high level architectural diagram for Wireless E9-1-1 Phase 2. This document's main focus is to provide detailed recommendations for the ALI-WSP interface.



4.1. Default Mobile Location Determination Technology

WSPs will deploy one or more location determination methods, depending on their network and customers' handset configurations. It is recommended that in the event that a WSP has more than one location determination method, that the WSP's mobile location determination platform be configured to select the determination method on a per-call basis that provides the best estimate of subscriber's location during a wireless E9-1-1 call.

5. PSAP

As a result of Wireless E9-1-1 Phase 2 (Stage 1), the PSAP operators will receive the Latitude, Longitude, with a radius (meters) of uncertainty and a fixed level of confidence (percentage) for all Wireless E9-1-1 Phase 2 capable calls. It is important that the PSAP operators consider the radius of uncertainty in addition to the Latitude and Longitude. There will be scenarios where the WSP will provide a location based on the serving cell/sector with a large radius (up to 100s of km).

If the ALI cannot obtain Lat and Long coordinates from the WSP, an error will be presented to the PSAP. In the worst case scenario, the PSAP should receive an update on the location request (whether it be an error or location information) 50 seconds after receiving Wireless Phase 1 information. The 50 seconds consist of a 15 second timer for the ALI to attempt to successfully send the ELIR to the WSP, 30 seconds for the WSP to locate the mobile, and 5 seconds for the response to make it back to the PSAP.

6. Interface Recommendations

6.1. WSP switch to E9-1-1 Tandem switch Interface

The WSP switch to E9-1-1 Tandem switch Interface will continue to be ISUP using the existing redundant SS7 signalling links, no changes required for Stage 1.

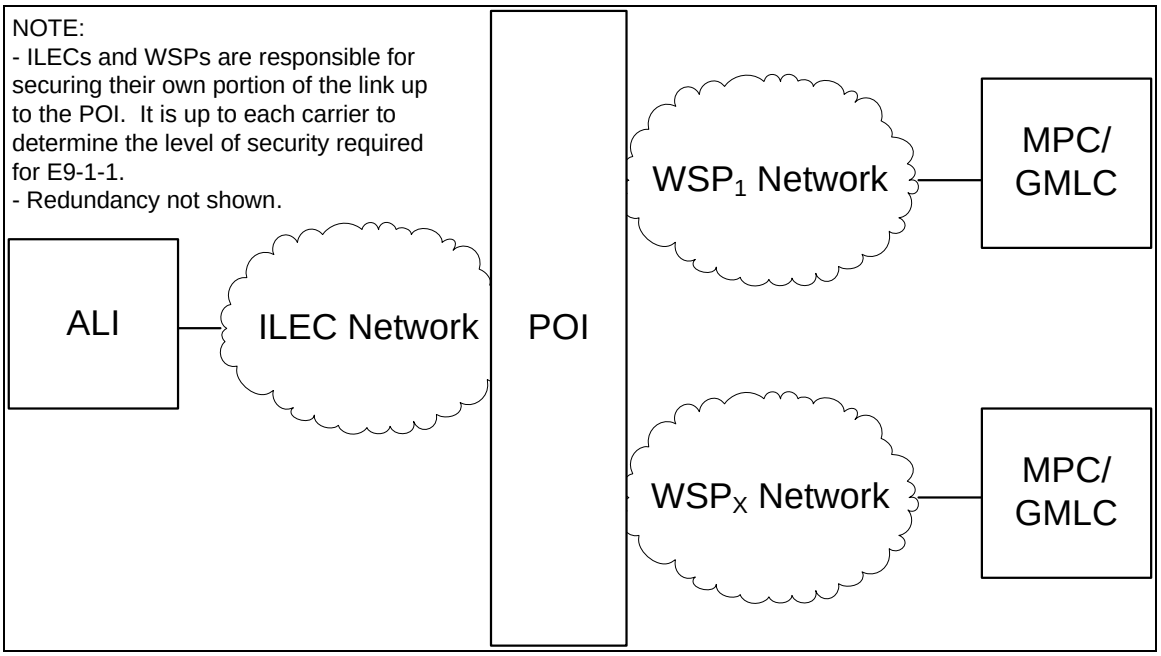
6.2. E9-1-1 Tandem – ALI Interface

The interface between the E9-1-1 Tandem and ALI will need to support a minimum of 2 parameters; the Callback Number and the ESRD. This information is required in order to support the Phase 1 and Phase 2 queries. The Callback Number and ESRD will be used to populate the MSID and ESRD values in the ELIR. The ESRD will also be used to provide the PSAPs with E9-1-1 Phase 1 information in the same fashion and timeframes as today. In addition ILECs may choose to use the ESRD to determine the originating WSP's MPC/GMLC IP address(es) and MSID type. It is understood the there are short comings of using only 10 digits for the Callback Number. This topic will be addressed for Stage 2 as part of TIF 59.

6.3. ALI to MPC/GMLC Interface

6.3.1. Network

The following diagram illustrates the standard interconnection model between the ALI and MPC/GMLC.



The interconnecting networks (ILEC Network and WSP Network clouds) do not need to be extensions of the carrier's own network. It is up to the carrier to select its connectivity solution of choice with proper considerations to the Grade of Service and security required.

The ILECs will define the Network-to-Network Interface (NNI) at the Point of Interconnection (POI[2]) in an Industry disclosed document.

Considering the nature of the service, the use of the public Internet and other types of un-managed network are unsuitable internetworking solutions.

Carriers may mutually agree to different interconnection schemes as long as it conforms to the targeted grade-of-service, security requirements and the statement above regarding un-managed network avoidance. However, the POI-based model should always be available if such agreement is not possible.

6.3.2. Logical (OSI Layers 3 to 7)

The interface between the ILEC (ALI) and WSP (MPC/GMLC) should use:

- IPv4
- TCP
  - port 9210 (standard lif-mlp port as identified by OMA-MLP)
  - Non-Persistent connections
- HTTP version 1.1
- OMA-MLP version 3.2

[2] "POI" is used as a general term in this document and does not equate to the POI as defined in CRTC Telecom Decision 97-008 (Local Competition).

- The ALI will have 15 seconds to successfully establish a connection to send the ELIR to the MPC/GMLC. If the 15 seconds expire, the ALI should send a response to the PSAP identifying that the ILEC was unable to communicate with the WSP.

6.3.3. Information Privacy and Integrity Protection

In a typical [OMA_MLP] transaction, the MLP Client (the ALI) will send a location request based on the wireless caller's mobile directory number and the MLP Server (the MPC/GMLC) will respond with the corresponding geodetic location information. While those 2 pieces of information taken separately may not constitute a threat to privacy, the association of both may very well be. This is further aggravated when time is factored in since an adversary third party could misuse the information to determine where a caller is located at a given time.

The location information supplied by the MPC/GMLC will assist in providing the most expedient response by the appropriate emergency response agency. For this reason, it is also important that precautions are taken to ensure the data is not altered in any fashion while in transit.

Given the above, it is recommended that the information transiting in MLP transactions over the IP links between the ALI and the MPC/GMLC be secured.

It is under the purview of each carrier to define the means as to how to secure the MLP transactions up to the POI.

6.3.3.1. Encryption

One method to secure data in transit between two nodes is to use encryption mechanisms. [OMA_MLP] specifies the use of HTTPS (HTTP over SSL or TLS) for encryption and authentication purposes end-to-end. However, this solution imposes on the ALI and MPC/GMLC to support HTTPS which may be a challenge for some carriers. To circumvent this issue and if encryption is deemed required by a carrier, it is recommended that a network-based encryption mechanism be utilized. The recommendation is to use IPSec tunnels to encrypt the links. This allows carriers the flexibility to choose between different IP providers to interconnect and leverages existing (common) network technology. This solution allows for the implementation of an encrypted or unencrypted model without any changes to the ALI or MPC/GMLC.

Although encryption via IPSec is recommended, it is up to the ILECs and WSPs to decide how to secure their networks up to the POI location with proper consideration to the sensitivity of the data being transmitted.

6.3.4. Application Security

The CRTC is not preventing WSPs from sharing their mobile location infrastructure with commercial services and as a result, additional measures should be taken to ensure these commercial services don't impact the GOS (Grade of Service) of Wireless E9-1-1 Phase 2. It is recommended that WSPs implement priority such that E9-1-1 requests are served with priority over commercial requests. As a result, additional security is required over and above the network level security. In order to implement priority, it is important for the MPC/GMLC to know the application requesting the location and ensure that a commercial application can't perform a "9-1-1" locate and bypass the E9-1-1 priority.

Additional consideration must be taken related to password aging guideline with careful consideration of the implications resulting from non-synchronized password changes. One suggestion is to configure the MPC/GMLC to support overlapping passwords (and usernames if required) for a short period of time. This should be handled on a per ILEC/WSP basis. The WSPs will be responsible for initiating and coordinating password changes with the ILECs. In order to minimize operational impacts, password changes should not occur more than once every 3 months. In the event that a WSP feels their passwords are in jeopardy, the frequency restraint does not apply.

6.3.5. Heartbeat

It is recommended that an application layer heartbeat be implemented to ensure that the link and services are available when required. The heartbeat should be end-to-end from the ALI to the MPC/GMLC. An OMA-MLP message originated by the ALI will be used as the heartbeat. The heartbeat messages should be sent to all MPCs/GMLCs; For each MPC/GMLC, the heartbeat messages can be triggered by:

1) A 60-second interval elapsed since the last message was received from the MPC/GMLC (preferred solution) or;
2) A 60-second heartbeat timer: one heartbeat message is periodically sent to the MPC/GMLC every 60 seconds.

In the event that the ALI does not receive any responses (for heartbeats or E9-1-1 messages) for a 10 minute period from one MPC/GMLC, the ILEC and WSP should take action to resolve the issue. If the ALI(s) cannot communicate with any MPC/GMLC that belongs to a WSP, action should be taken to resolve the issue ASAP.

The recommended heartbeat message will be a standard ELIR message with the *msid* value = 0000000000 (ten "0"s), the *esrd* = 0000000000 (ten "0"s), and the *loc_type* = CURRENT. As part of the initial implementation, the WSP will inform the ILEC which *msid type (msisdn* or *mdn*) is required in the heartbeat messages for each of their MPC/GMLC nodes (or pairs as applicable in geo-redundant scenarios). The *msid type* should be the same value used for normal location requests to that particular WSP ID. WSPs supporting multiple technologies requiring different *msid* types will be required to have multiple WSP IDs assigned in the ALI. In this scenario, it is up to the ILEC and WSP to decide whether one or multiple

heartbeats are required for the single MPC/GMLC platform. MLP parameters are discussed in a later section.

The heartbeat mechanism must be design so that it does not interfere with normal operations (a Callback Number of “0000000000” with an ESRD of “0000000000” can never ever happen on the network) and does not trigger a false call display at the PSAP.

When performance metrics are being captured by the ALI or MPC/GMLC and are used for purposes involving parties other than the originating carrier, heartbeat messages should not be factored into those metrics.

Below is an example heartbeat message.

```
<?xml version="1.0"?>
<!DOCTYPE svc_init SYSTEM "MLP_SVC_INIT_320.DTD">
<svc_init ver="3.2.0">
    <hdr ver="3.2.0">
       <client>
          <id>theali</id>
          <pwd>thepwd</pwd>
          <serviceid>assignedALIid</serviceid>
       </client>
    </hdr>
    <eme_lir res_type="SYNC" ver="3.2.0">
      <msid type="MSISDN">0000000000</msid>
      <esrd>0000000000</esrd>
      <eqop>
         <resp_timer>5</resp_timer>
      </eqop>
      <geo_info>
        <CoordinateReferenceSystem>
          <Identifier>
            <code>4326</code>
            <codeSpace>EPSG</codeSpace>
            <edition>6.1</edition>
          </Identifier>
        </CoordinateReferenceSystem>
      </geo_info>
      <loc_type type="CURRENT" />
    </eme_lir>
</svc_init>
```

MSISDN highlighted above may be MDN.

Upon receipt of the ELIR the MPC/GMLC will send an ELIA message back to the ALI containing a *result* with *resid=4* (UNKNOWN SUBSCRIBER).

6.3.6. Reliability

Commission staff stated that a service level objective equivalent to what is being delivered with PSTN E9-1-1 service should be used. Commission staff referred to 99,999% availability (five 9s). Accordingly, the solution should provide as much reliability as reasonably possible.

In order to design a reliable service end-to-end, reliability solutions must be engineered in all systems and networks supporting the service.

6.3.6.1. System Reliability

In order to meet the targeted grade-of-service objectives, systems must be able to recover from any single failure. For the ALI and MPC/GMLC, this means that at a minimum, the platforms have redundancy built in (geo-redundancy neither mandatory nor ruled-out).

Carriers opting for single server MPC/GMLC must ensure those systems are fault tolerant by design (e.g. dual CPU, disks, memory, power supply, interfaces, etc.) in order to meet the five 9s requirement for the ALI-MPC/GMLC interface described in this document. The expectation is that the MPC/GMLC will continue to provide service and respond to the ALI during single failures and scheduled or ad-hoc maintenance windows.

6.3.6.2. Transaction Reliability

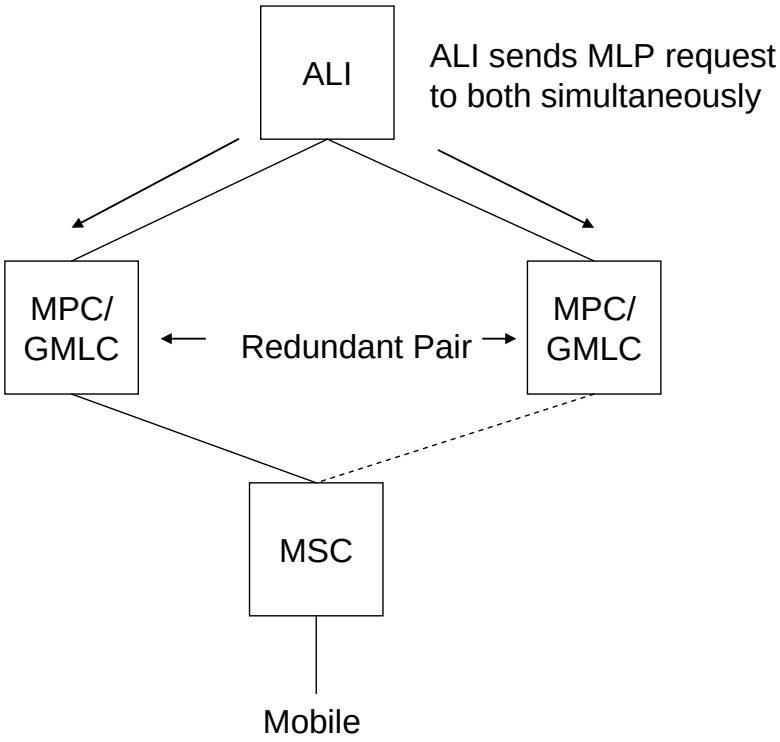
To minimize delays caused by retries in failure scenarios, the following architecture and call flow is recommended.

1. The ALI(s) receives a 9-1-1 request to acquire location information and sends an MLP request to BOTH MPCs/GMLCs simultaneously.
    a. MLP message is identical for both requests with the exception of the destination IP address.
2. Both MPC/GMLC will respond:
    a. In the architecture where one MPC/GMLC processes the location request, the MPC/GMLC not processing the request will respond with an error. In this situation the *result resid* will be equal to *4*[3] (Unknown Subscriber). The MPC/GMLC acting on the location request will provide a response containing the location information or a relevant error code[4].
3. The ALI(s) will act on the most appropriate response received based on logic defined further on in this section.

[3] resid=4 is being recommended but there is a slight chance that not all vendors can comply. As such, it is recommended that ALI vendors store the resid in a configuration file, preferably with the ability to have different values per WSP to avoid future re-development.

[4] Depending on the individual implementation one MPC/GMLC will respond with location information and the other will respond with an error (likely scenario in trigger based solutions). However, there are implementations where both MPCs/GMLCs will response with location information (likely in non-trigger based solutions).

a. For re-bids in Stage 2, it is recommended to apply the same principle of querying both systems but this will be explored further as part of TIF 59.



This design eliminates the need to implement retry logic in the ALI which would query both MPCs/GMLCs in a sequential fashion. In a failure scenario, this reduces the response time by up to 30 seconds. As an additional benefit, WSPs can perform maintenance on their MPCs/GMLCs without needing to coordinate with the PSAPs and the ILECs.

The ALI will need to be able to handle the following scenarios:

- Location response from both MPCs/GMLCs (receives <*pd*> information)
  - The ALI immediately acts on the first location response and discard the second. Waiting for the second response in not recommended as it is possible that the second response does not come or results in an error. In these situations, the PSAP will be forced to wait longer than required with no added benefits.
- Error received from both MPCs/GMLCs
  - Upon the reception of the first error, the ALI waits for the second response. In the event that one response contains *resid*=4 (the error expected from the MPC/GMLC not processing the location request) it will discard this error and act on the other. If both responses contain *resid*=4, the ALI will only discard one and act on the other. If both errors contain a *resid* other than 4, then the second error is acted on as it is possible that an offlined system will respond with a system error.
- Timeout on both MPCs/GMLCs
  - Upon timeout, the ALI sends an error message to the PSAP.
- Location response from first MPC/GMLC, error received from the other

    - The ALI immediately acts on the first location response and discards the second.
- Error response from first MPC/GMLC, location from the other
    - Upon reception of the first error (regardless of the *resid* received), the ALI waits for the second response and acts on it.
- Location response from first MPC/GMLC, timeout from the other
    - The ALI immediately acts on the first location response and gracefully closes the second connection.
- Timeout from first MPC/GMLC, location from the other
    - Upon timeout, the ALI waits for the second response and passes the response to the PSAP. This scenario could happen if ALIs contain individual timers for each MPC/GMLC. One MPC/GMLC may accept the connection earlier than the other (e.g. latency differences or the 15 second connection establishment timer expires) and therefore timing out before the second MPC/GMLC responds.
- Error from first MPC/GMLC and a timeout from the other
    - Upon reception of the first error, the ALI waits for the second response. When the request times out on the second node, the ALI sends an error message and derived from the first error received to the PSAP if the error doesn't contain *resid*=4, otherwise, the timeout error will be display to the PSAP.
- Timeout from first MPC/GMLC, error from the other
    - Upon timeout, the ALI will wait for the second response. The ALI will act on error response if it's not *resid*=4, otherwise, the timeout error is passed to the PSAP.

6.3.6.3. Network Reliability

The link between the ALI and MPC must be redundant. From an IP perspective, this implies that no segment, router, switch, firewall, etc. can be a single point of failure. The IP links must be configured such that an alternate path is automatically taken in the event of a single failure (dynamic routing protocol should be used in place of static routes). In the event that a packet in transit is dropped due to a failure, standard TCP packet retransmission procedures shall apply.

6.3.7. IP Addressing

The ILECs and WSPs must expose to each other public registered IP addresses for the ALIs and MPCs/GMLCs. These addresses should not be exposed to the public Internet. The selection of public addresses will remove the possibility of address re-use conflicts between the WSPs and ILECs. The ILEC is free to use a common IP address for a redundant pair/cluster of ALIs or use one address per ALI. The MPC/GMLC will simply respond to the source IP address of the ALI sending the request.

To support the simultaneous query solutions, each individual MPC/GMLC will have its own Public IP address exposed to the ILEC.

Since each WSP will have their own set of IP addresses, the ALI will need a mechanism to determine which IP address(es) to send its request to based on the carrier. One possibility is that this determination be made based on the ESRD received by the 9-1-1 tandem.

7. MLP Parameter Recommendation

The support of two OMA-MLP 3.2 messages is required for Phase 2:

- Emergency Location Immediate Request (ELIR) is the request sent from the ALI to the MPC/GMLC
- Emergency Location Immediate Answer (ELIA) is the response containing the location information or error message sent from MPC/GMLC to the ALI.

In addition to the ELIR information, the request will contain the header.

```
<hdr ver="3.2.0">
   <client>
      <id>theasp</id>
      <pwd>thepwd</pwd>
      <serviceid>assignedALIid</serviceid>
   </client>
</hdr>
```

The *id* and *pwd* will contain the username and password assigned by the WSP to the ILEC and will be common to all ALIs within the redundant configuration. The *id* and *pwd* will each be a maximum of 24 (PCDATA) characters in length. The valid characters for PCDATA are defined in [XML-1.0]. It is mandatory that the *id* and *pwd* be included in the ELIR request from the ALI to the MPC/GMLC.

The *serviceid* may optionally be used by the ILEC to identify the individual ALI making the request and therefore the presence of the *serviceid* tag in the request is also optional. This parameter should only be used for informational purposes and can assist the ILECs in troubleshooting as it is possible that multiple ALIs will share the same IP address. The ILECs will be responsible for assigning and communicating their selected *serviceid* with the WSPs before putting it in service. The *serviceid* will be a maximum of 24 (PCDATA) characters in length.

A unique *serviceid* per ILEC is not required. It is however, recommended that the combination of the *id* and *serviceid* together be unique at the MPC/GMLC.

The ALIs and MPCs/GMLCs are required to handle a request/response as valid if all elements/attributes defined as mandatory in this document are contextually present with the correct format and values as defined in [OMA_MLP] DTDs (unless otherwise stated in this document). All other elements/attributes are considered optional and if present and XML-valid, should not cause the request/response to fail being processed as a valid one.

7.1. Emergency Location Immediate Request

The following is an extract from the OMA-MLP 3.2 standard.

5.2.3.3.1 Emergency Location Immediate Request DTD

```
<!-- MLP_EME_LIR -->
<!--
MLP V3.2 Document Type Definition

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MLP is an XML language. Typical usage:
   <?xml version="1.0"?>
   <!DOCTYPE svc_init PUBLIC "-//OMA//DTD {abbrev x.y}//EN"
             "http://www.openmobilealliance.org/DTD/{filename}"
             [<?oma-{ref}-ver supported-versions="{versions}"?>]>
   <svc_init>
      ...
   </svc_init>

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Open Mobile Alliance Ltd. web site at
http://www.openmobilealliance.org/
-->

<!ENTITY    % extension.param          "">

<!ELEMENT   eme_lir                   ((msids | (msid, gsm net param, trans id?, esrd?, esrk?)+),
                                      eqop?, geo_info?, loc_type? , pushaddr? %extension.param;)>
<!ATTLIST   eme_lir
            ver CDATA                 #FIXED "3.2.0"
            res_type (SYNC | ASYNC)   "SYNC">
```

The proposed mandatory tags for Canadian Wireless E9-1-1 Phase 2 are:

- *msid*
- *esrd*
- *eqop*
- *geo_info*
- *loc_type*

Although the DTD specifies that the *gsm_net_param* is a mandatory tag, it has been determined that it is not applicable for all technologies and therefore will NOT be included in the *eme_lir*.

7.1.1. MSID

The *msid* parameter will contain the callback number sent to the ALI. The ALI will populate the *msid* value with the callback number it receives from the E9-1-1 Tandem. For Stage 1, the *msid* will be the callback number as the ALI receives it from the E9-1-1 Tandem (no digit manipulation will occur at the ALI). For Stage 1, the length will be 10 digits.

Within the *msid* element a *type* attribute needs to be defined. Two different values are possible, the *msisdn* for 3GPP technologies, and the *mdn* for 3GPP2 technologies but only

one will be used per ELIR. This implies that the ALI will need to know when to use each value. The WSP is responsible for identifying to the ILEC their preferred *type* value. The selection process of the type can be similar to the selection process of the MPC/GMLC IP address(es). Note that a single WSP may support multiple technologies and therefore require both *msid* types. However, it is expected that ESRD could be used to determine the appropriate *type* for the *msid* as the same ESRD cannot be used for both a 3GPP and 3GPP2 cell/sector.

The *enc* attribute will be set to the default value of "ASC".

Multiple *msids* in single request is not supported and therefore each location request must contain only one *msid* value.

7.1.2. ESRD

The *esrd* parameter will contain the 10-digit ESRD delivered by the MSC to the E9-1-1 Tandem. No *type* parameter is required as the default is set to "NA" - North America. Including the ESRD is required as the WSPs may choose to use this in conjunction with the MSID to provide additional uniqueness for the subscriber profile stored in the MPC/GMLC.

7.1.3. EQOP

The *eqop* element should contain the following sub-elements:

- *resp_timer* set to 30 (seconds)
    - This value sets the maximum time the MPC/GMLC has before it must respond to the request.

7.1.4. GEO_INFO

The *geo_info* is used to define the reference coordinate system. Canadian Wireless E9-1-1 Phase 2 will use WGS 84 represented by the following values:

- *code* = 4326
- *codeSpace = EPSG*
- *edition = 6.1*

7.1.5. LOC_TYPE

Some WSP implementations will need to know if a location request is the initial request or a rebid, therefore two different location types will be used in the MLP 3.2 ELIR message.

- For initial location requests, the *loc_type* element will be set to "INITIAL". For Stage 1, all location requests will be set to "INITIAL".
- For rebid location requests (Stage 2), the *loc_type* element will be set to "CURRENT" (to be confirmed during ESWG TIF59 discussions).

For rebids, "CURRENT" will be used to allow PSAP call takers to request new location information without delay in the event the first location response didn't meet their accuracy needs (to be confirmed during ESWG TIF59 discussions).

7.2. Emergency Location Immediate Response

The following is an extract from the [OMA_MLP] standards specification.

5.2.3.3.2 Emergency Location Immediate Answer DTD

```
<!-- MLP_EME_LIA -->
<!--
MLP V3.2 Document Type Definition

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MLP is an XML language. Typical usage:
   <?xml version="1.0"?>
   <!DOCTYPE svc_result PUBLIC "-//OMA//DTD {abbrev x.y}//EN"
             "http://www.openmobilealliance.org/DTD/{filename}"
             [<?oma-{ref}-ver supported-versions="{versions}"?>]>
   <svc_result>
      ...
   </svc_result>

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Open Mobile Alliance Ltd. web site at
http://www.openmobilealliance.org/
-->
```

```
<!ENTITY    % extension.param          "">

<!ELEMENT   eme_lia                   ((eme pos+ | req id | (result, add info?))
                                      %extension.param;)>
<!ATTLIST   eme_lia
            ver CDATA                 #FIXED "3.2.0">
```

The proposed mandatory tags for the ELIA are:
- *eme_pos* when the MPC/GMLC was able to process the request or,
- *result* if the MPC/GMLC was unable to process the request.

7.2.1. EME_POS

The *eme_pos* element will contain the *msid* (as defined in the request), the *pd* (position data) or *poserr* (error code in the event of an error), and *ersd*.

Within the *pd* element the following values are expected:
- *time* – the time the locate was established with *utc_off* = 0 (Zulu time) and format YYYYMMDDhhmmss.
- *shape* – The shape will be set to "CircularArea" with *coord* containing *X (DD MM SS.sssN), Y (DDD MM SS.sssW),* and *radius* (in meters).
- *lev_conf* – The percentage of confidence of the returned location. This value will always be 90. If the MPC/GMLC can't return a location with 90% confidence, it will return an error code. There is more than one reason why this could occur and therefore one of several error codes could be returned.

NOTE: If the MPC/GMLC cannot obtain a location via high accuracy technologies, it will pass back location information based on the coverage area of the cell site. The radius of uncertainty in this scenario can be up to 100s of km (rural sites with repeaters).

If a location error occurs, the response will contain a *poserr* element in place of the *pd* element. The *poserr* element will contain the following:

- *result* – the error code (discussed in next section)
- *time* - the time the locate was attempted with *utc_off* = 0

7.2.2. RESULT

If the MPC/GMLC was able to process the location request which yielded an error, *result* must appear as a child of *poserr*. If an error occurs and the MPC/GMLC was not able to process the location request, *result* must appear as a child of *eme_lia*.

The *result* element is composed of a *resid* attribute which contains a 1-3 digit numerical result code with the value of the element containing text explaining the result code.

The following is an extract of the *resid*s identified by OMA-MLP 3.2.

Resid	Slogan	Description
0	OK	No error occurred while processing the request.
1	SYSTEM FAILURE	The request can not be handled because of a general problem in the location server.
2	UNSPECIFIED ERROR	An unspecified error used in case none of the other errors apply. This can also be used in case privacy issues prevent certain errors from being presented
3	UNAUTHORIZED APPLICATION	The requesting location-based application is not allowed to access the location server or a wrong password has been supplied.
4	UNKNOWN SUBSCRIBER	Unknown subscriber. The user is unknown, i.e. no such subscription exists.
5	ABSENT SUBSCRIBER	Absent subscriber. The user is currently not reachable.
6	POSITION METHOD FAILURE	Position method failure. The location service failed to obtain the user's position.
7	TIMEOUT	Timer expiry for the requested event trigger
101	CONGESTION IN LOCATION SERVER	The request can not be handled due to congestion in the location server.
103	UNSUPPORTED VERSION	The Location server does not support the indicated protocol version.
104	TOO MANY POSITION ITEMS	Too many position items have been specified in the request.
105	FORMAT ERROR	A protocol element in the request has invalid format. The invalid element is indicated in ADD_INFO.
106	SYNTAX ERROR	The position request has invalid syntax. Details may be indicated in ADD_INFO.
107	PROTOCOL ELEMENT NOT SUPPORTED	A protocol element specified in the position request is not supported by the Location Server, or the position result is not supported by the LCS Client. The element is indicated in ADD_INFO.
108	SERVICE NOT SUPPORTED	The requested service is not supported in the Location Server. The service is indicated in ADD_INFO.
109	PROTOCOL ELEMENT ATTRIBUTE	A protocol element attribute is not supported in the Location

	NOT SUPPORTED	Server. The attribute is indicated in ADD_INFO.
110	INVALID PROTOCOL ELEMENT VALUE	A protocol element in the request has an invalid value. The element is indicated in ADD_INFO.
111	INVALID PROTOCOL ELEMENT ATTRIBUTE VALUE	A protocol element attribute in the request has a wrong value. The element is indicated in ADD_INFO.
112	PROTOCOL ELEMENT VALUE NOT SUPPORTED	A specific value of a protocol element is not supported in the Location Server. The element and value are indicated in ADD_INFO.
113	PROTOCOL ELEMENT ATTRIBUTE VALUE NOT SUPPORTED	A specific value of a protocol element attribute is not supported in the Location Server. The attribute and value are indicated in ADD_INFO.
114	CANCELLATION OF TRIGGERED LOCATION REQUEST	The requested triggered location report is cancelled
201	QOP NOT ATTAINABLE	The requested QoP cannot be provided.
202	POSITIONING NOT ALLOWED	The subscriber does not allow the application to position him/her for whatever reason (privacy settings in location server, LCS privacy class).
203	CONGESTION IN MOBILE NETWORK	The request can not be handled due to congestion in the mobile network.
204	DISALLOWED BY LOCAL REGULATIONS	The location request is disallowed by local regulatory requirements.
207	MISCONFIGURATION OF LOCATION SERVER	The location server is not completely configured to be able to calculate a position.
208	TARGET MOVED TO NEW MSC/SGSN	The triggered Location Request has been aborted due to that target has moved to another MSC/SGSN. This result code shall only be used towards The Home Location Server. Restrictions: - This code SHALL only be used in RLP. - This result code shall only be used towards The Home Location Server.
500 -599		Vendor specific errors
601	STANDARD LOCATION REPORT SERVICE NOT SUPPORTED	The MLS Client does not support the standard location report service.
602	MLS CLIENT ERROR	An error occurred in the MLS Client.
603	STANDARD LOCATION REPORT SERVICE NOT ACCEPTED	The standard location report was not accepted by the MLS Client
604	SUBSCRIBER IN IN STANDARD LOCATION REPORT SERVICE NOT VALID	The subscriber in the Standard Location Report is not valid to the MLS Client
605	INVALID SERVICE ID IN STANDARD LOCATION REPORT SERVICE	The service identity in the Standard Location Report is not valid to the MLS Client

8. Phase 2, Stage 2 (For Future Consideration)

8.1. Rebid (In call updates)

8.2. Roamers

8.3. Unregistered Mobiles

9. References

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Appendix A – Deliberations and Considerations

The following items were reviewed in detail during the design of this specification, however determined that they would not form part of the Stage 1 document. A number of these may have implications for the other Stage 2 TIFs 58, and 59. They are captured here to ensure they are factored in as we move forward.

1. To meet the Stage 2 requirements to support roaming, parameters changes in the IAM message may be required for international roamer numbers which may be different from 10 digits in length. Carriers are to investigate what is being sent to the E9-1-1 Tandems and PSAPs for inbound international roamers in the current Phase 1 implementation.

2. There have been discussions about prefixing a 1 to the front of the North American 10 digit callback number in order to standardize the inclusion of the country codes. This would allow the WSPs to prepare for Stage 2 where support of inbound (international) roamers is required. However, in discussions between the ILECs and WSPs, it was deemed too risky to expect the ALI to manipulate the callback number before sending it in the ELIR.

3. During the discussions at the face to face meeting, it was believed that all responses from the MPC/GMLCs would contain a <result> tag. Through further investigations, it was determined that the <result> tag only appears in error responses. Adding the <result> tag in a positive response would result in a deviation from the OMA MLP 3.2 standards.

4. [OMA MLP] supports a variety of msid types including MSISDN (as the default value) and MDN. MSISDN is specified in 3GPP 23-003 while MDN is specified in ITU-T IS41D. According to 3GPP 23-003, an MSISDN must conform to the international format of ITU-T E.164 which includes the country code whereby, according to ITU-T IS-41D, MDN can be expressed as the national variant of ITU-T E.164 (without the country code). During the TIF57 discussions, it has been determined that only 10-digit calling numbers are presented to the ALI. As such, the ALI can only expose a 10-digit msid to the MPC/GMLC in the ELIR. This situation causes issues to some wireless carriers that natively support MSISDN. For those, 2 options were available, both of which necessitate development work on MPCs/GMLCs. The first option is to support msid type MDN to conform to the standard 10-digit format and the second is to support a non-standard 10-digit MSISDN format. The wireless carriers' opted to go with the second option in anticipation of a resolution of the calling number length limitations during the TIF59 discussions.

5. On April 23, 2009, Bell reported that during Stage 1 ALI platform testing, they determined that for short duration planned and unplanned switchovers, it was possible that a location request triggered by the active ALI 'A' would see the response going back to the now inactive ALI 'A' being lost. This is not a frequent occurrence, and when it occurs, Phase 2 data will not be delivered to the PSAP. It was decided to flag this for Stage 2 considerations.