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Title: **Restoration of Open Interfaces to 3GPP LCS Specifications**

Agenda Item: **XX**

Document for: **Discussion and Decision**

This paper discusses the changes that have occurred to the LCS specifications, as defined in GSM Release 1998 and Release 1999, as these LCS specifications have migrated to 3GPP Release 1999 and 3GPP Release 2000. In particular this paper illustrates how the various network elements and open interfaces that comprise the LCS functionality in GSM R'98/R'99 have been altered in such a way that only proprietary solutions are supported in the current 3GPP standards.

This paper will serve as the basis for a series of contributions to various 3GPP standards groups, in an attempt to return the flexibility established in the GSM R'98/R'99 specifications to the 3GPP R'99/R'00 specifications.

2 Purpose and Scope

Standards development organizations have recently completed the LCS standards to address 2G location-based services, including E9-1-1 Phase II. The 2G LCS specifications consist of requirements which,

- Allow for flexibility in technology selection and deployment, and
- Allow for the flexible application of technology based on an operators' choice.

Unfortunately, the 2G to 3GPP standards migration has removed some of this flexibility and replaced open interfaces with proprietary implementations. The authors recommend that it is essential to leverage the 2G LCS standards in the 3GPP LCS standards by,

- Maintaining the existing flexibility and allowing this flexibility to be adapted to new services, and
- Not prematurely precluding any options or limiting any operator's choice through the standardization process.

This paper discusses the changes that have occurred to the LCS specifications as defined in GSM Release 1998 and Release 1999 (LCS GSM R'99 simply mirrors GSM R'98) as the LCS specifications have migrated to 3GPP Release 1999 and 3GPP Release 2000 (LCS 3GPP R'99 is an academic starting point, as it may not actually be deployed; however, architectural changes started at this point). In particular, this paper illustrates how the various network elements and interfaces that comprise the LCS functionality in GSM R'98/R'99 have been altered in such a way that only proprietary solutions are supported.

The intent of this paper is to highlight these architectural changes such that these changes can be addressed or altered in such a way that open interfaces are supported in the 3GPP R'99/ R'00 specifications.

3 Recommendations

This paper explicitly proposes that the following changes are needed in the 3GPP R'99/R'00 specifications to return the LCS specifications back to a non-proprietary architecture.

- Separating the SMLC functionality from the SNRC and mapping the L_b interface into 3GPP R'99/R'00
- Mapping the CBC-BSC interface into 3GPP R'99/R'00
- Mapping RRLP defined in GSM 04.31 and GSM 04.35 into 3GPP R'99/R'00

In addition, this paper will briefly raise the issue of the removal of the NSS SMLC. There appears to be an architectural philosophy used in the RAN / CN separation that pushed a majority of the LCS functionality towards the air interface. We believe the 3GPP standards committees should discuss this issue further.

4 Standardization Principles

The lack of open interfaces is inconsistent with the architectural principles specified for 3GPP R'00 [1]. Two particular architectural principles are of interest:

- Decomposition of network functions and
- A list of separate functions that are likely to evolve independently. Specifically,
  - Bearer control in both access and network
  - Multimedia control for multimedia sessions
  - Switching and routing
  - PS Mobility management, session control and access security functions
  - CS Call Control, Mobility Management and access security functions
  - Security functions
  - Control for and the traffic processing e.g. voice
  - location-based service functionality
  - Service control
    - service capabilities, VHE for roamers
    - Mail services control
    - location-based services
    - Service features and applications

The decomposition principle states that operators shall have the freedom to provision, dimension, and upgrade network functionality in a modular fashion. Given that LCS is listed as one of the functions that will have its own evolution path, it is very important that network entities and interfaces associated with an LCS implementation follow this decomposition principle. This is consistent with what was done in the GSM R'98 and R'99 standards.

5 LCS Analysis

This section provides the relevant details from the various 2G and 3GPP LCS specifications necessary to understand the following key architectural modifications:

- The removal of the NSS SMLC
- The removal of the L_b Interface
  - This forces the SMLC to be an internal function of the SRNC
- The removal of the CBC-BSC Interface

5.1 GSM R'98 and R'99 LCS Architecture

Figure 1 shows the GSM R'98/R'99 LCS architecture [2]. It is important to note that all the interfaces have been specified and a true multi-vendor environment can be implemented. The next few sections will highlight some very important changes to 3GPP R'99/R'00 that result in implementations based on proprietary interfaces and technologies.

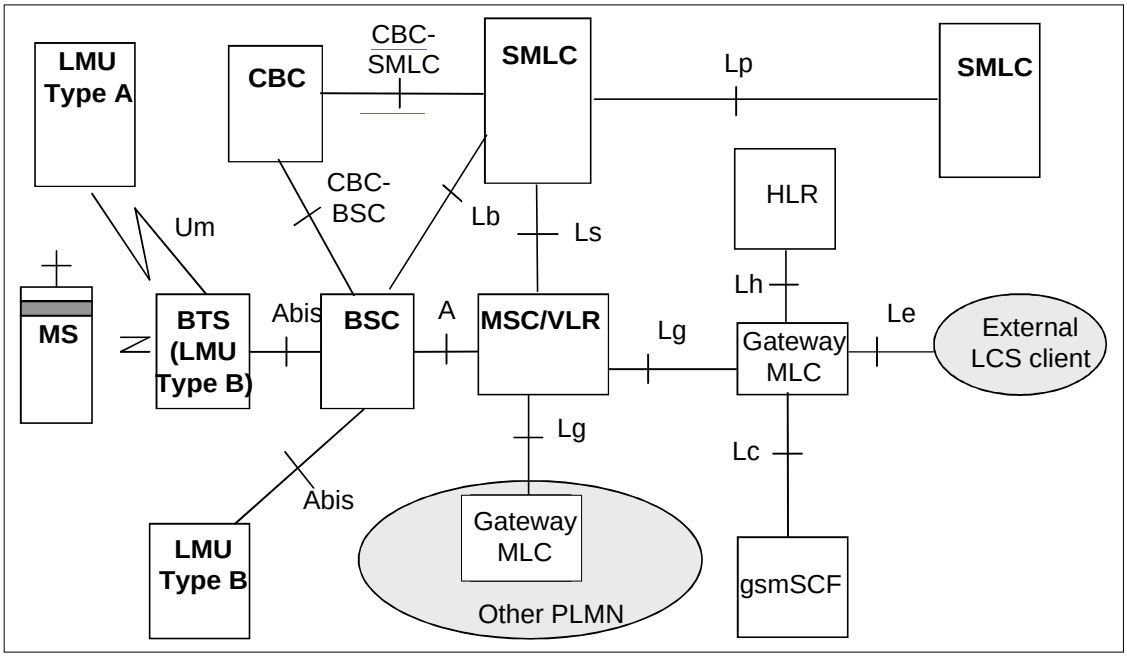

Figure 1 GSM Release 98 and Release 99 LCS Architecture

5.2 3GPP R'00 Architecture

Figure 2 shows the 3GPP R'00 LCS Architecture [3]. The most important change that can be seen from this figure is found by noting that the 2G-MSC is connected to the GERAN network by the A interface. This implies that only BSS elements reside in the GERAN. Thus the L_s interface has been removed. One could argue that for the 2G-MSC, the L_s interface is implicit, and the NSS SMLC can be deployed for 2G CS networks. We feel that the support of the NSS SMLC should be explicit.

Additionally we would like to propose expanding the scope of an NSS SMLC further into the CN. Specifically we see two architectural modifications that merit additional discussion. The first modification is to allow for an NSS SMLC to provide service to the 2G-SGSN, the 3G-SGSN, and the MSC Server as well as the 2G-MSC. The second modification we would like to propose is that an SMLC could reside even further in the core network: connected to the GMLC.

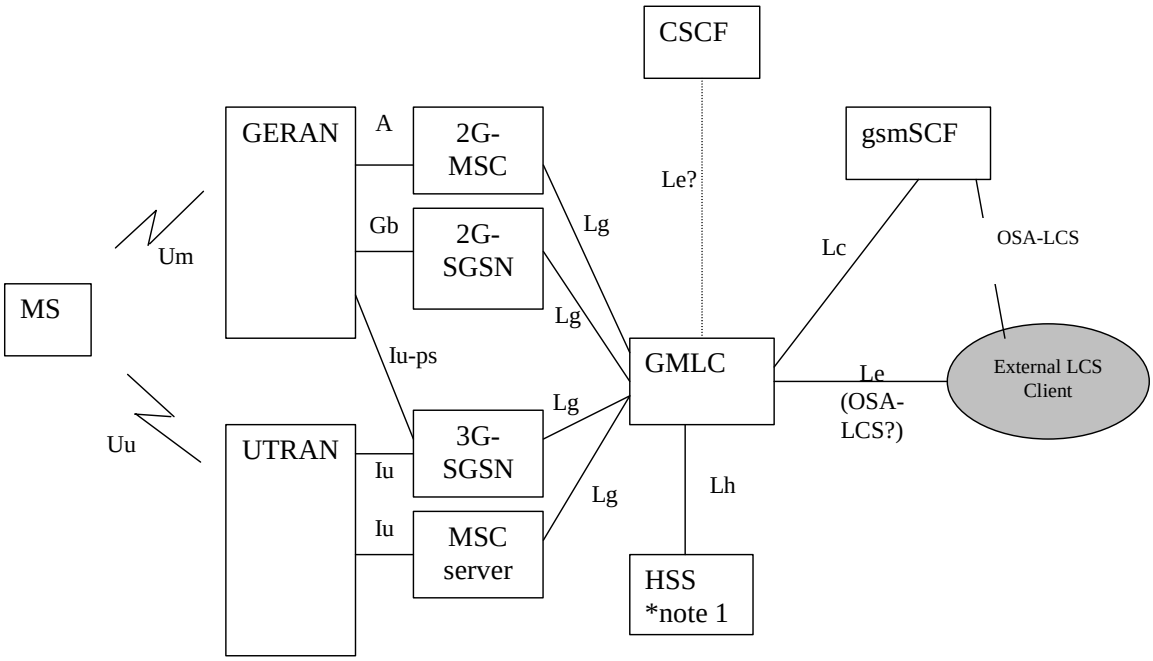

Figure 2 3GPP Release 2000 LCS Architecture

5.3 Proposed 3GPP R'00 TSG-GERAN

Figure 3 shows the proposed architecture for 3GPP R'00 GERAN [4]. As one can see, the L_b and CBC-BSC interfaces from GSM R'98/R'99 have been closed. Additionally, this architecture calls for the explicit removal of the NSS SMLC.

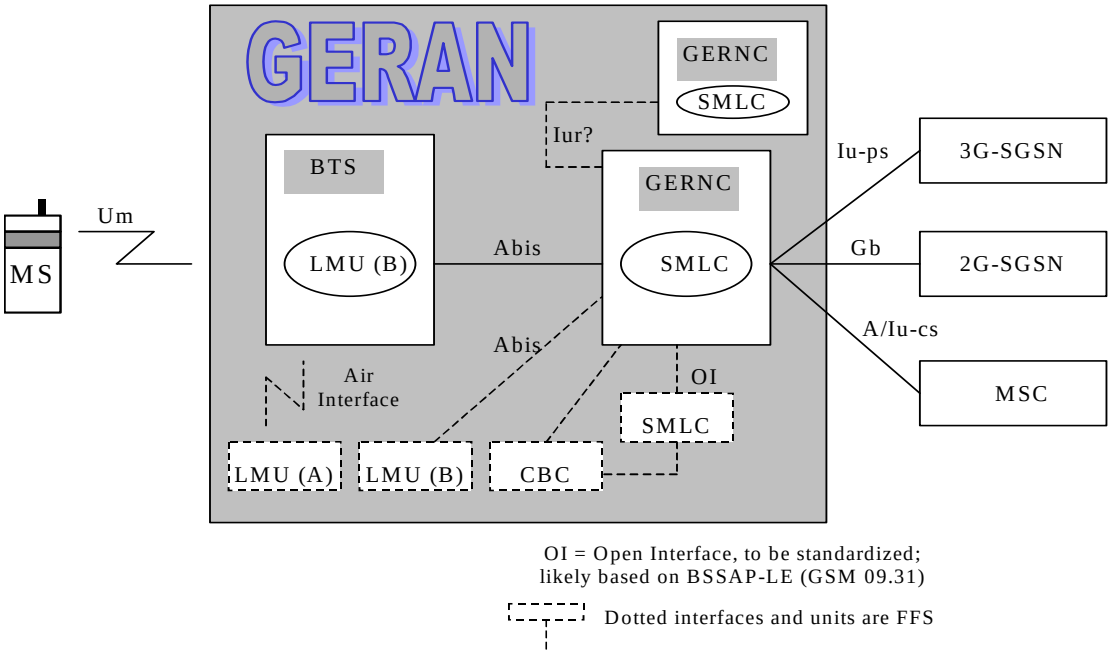

Figure 3 Proposed 3GPP Release 2000 GERAN LCS Architecture

In the GSM R'98/R'99 specifications, the SMLC or SMLC functionality can reside in different places. This paper proposes to retain such flexibility for the SMLC functionality in the GERAN R'00 specification. At a minimum, for purposes of backwards compatibility, the L_b Interface must be supported. In the context of Figure 3 the L_b Interface would be the interface between the GERNC and external SMLC. This interface is listed as "OI" and it is suggested that this interface could be based on GSM 09.31. Backwards compatibility would be achieved if this interface was open and was based exactly on GSM 09.31.

The following table highlights the issue. This table shows a systematic removal of standard interfaces and options with respect to SMLCs.

Table 1 Proposed SMLC Implementation Options

	Integrated to RNC/BSC	Connected to RNC/BSC	Integrated to SGSN/MSC	Connected to SGSN/MSC
SMLC in GSM Release 98	yes	yes	yes	yes
SMLC in GERAN Release 2000	yes	FFS	no	no
SMLC in UMTS Release 2000	yes	no	no	no

Similar modifications are being suggested for architectures that utilize LMUs. The following table shows a systemic removal of standard interfaces and options with respect to LMUs.

Table 2 Proposed LMU Implementation Options

	Integrated in NodeB/BTS	Air if LMU to NodeB/BTS	Fixed Connection to RNC (Abis/Iub)
LMU in GSM Release 98	yes	yes	yes
LMU in GERAN Release 2000	yes	FFS	FFS
LMU in UMTS Release 2000	yes	yes	no

5.4 3GPP R'99 UTRAN Architecture

Figure 4 shows the 3GPP R'99 UTRAN LCS Architecture [5]. As with the GERAN, the L_b interface has been removed. The CBC-BSC interface is shown as FFS.

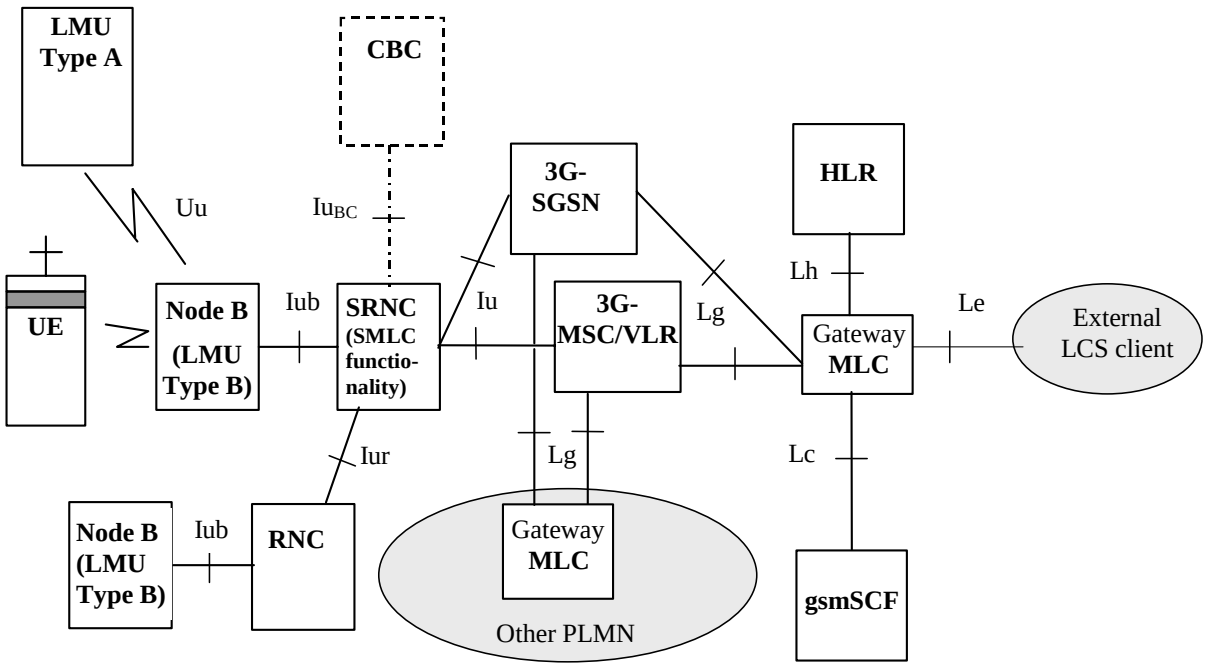

Figure 4 3GPP UTRAN LCS Architecture

Figure 5 shows the details of the SRNC [5]. The L_b Interface should be the interface between the SRNC Handling Entities and the Positioning Handling Entities shown in the center of the figure. Note that this interface (L_b) is not an open interface.

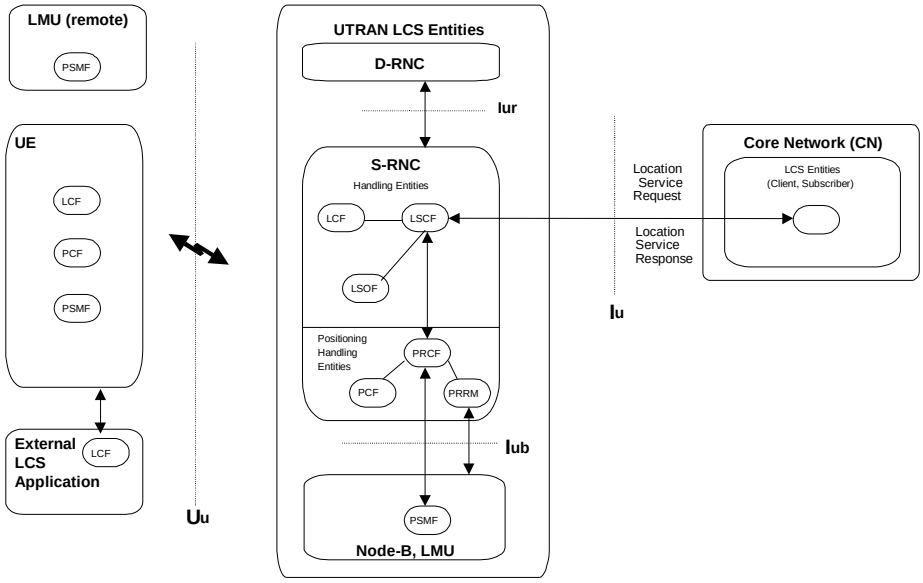

Figure 5 Detailed SRNC Architecture for UTRAN 2000

6 End-to-End protocol Issues

This section provides the details of the changes that have occurred between the 2G and 3GPP specifications with respect to the end-to-end protocols (between the SMLC functionality and the handset) used by handset based positioning technologies. The changes can be globally classified as follows:

- Termination of the RRLP at the SRNC (as opposed to the SMLC and CBC)

A brief overview of the details follow along with some suggested corrections to ensure open interfaces can be supported in 3GPP specifications.

6.1 GSM R'98/R'99 End-to-End Protocols

As discussed in the previous section, for GSM R'98/R'99, the SMLC is not part of the BSS (SRNC) and the broadcast LCS messages are transported through a CBC. GSM 04.31 defines the Radio Resource LCS Protocol (RRLP) to support point-to-point LCS services. GSM 04.35 defines the broadcast LCS assistance message contents using the Cell Broadcast (CB) messages sent out from a Cell Broadcast Center (CBC). The detailed CB service protocol can be found in GSM 03.41. Lastly, GSM 09.31 defines the BSSAP-LE protocol used between SMLC and BSS, and between SMLC and NSS.

The end-to-end messages defined in GSM 04.31 and GSM 04.35 are encapsulated in different protocols when transmitted between different interfaces. Figure 6 [1] shows the encapsulation of point-to-point RRLP messages between SMLC and target MS as defined for a BSS based SMLC.

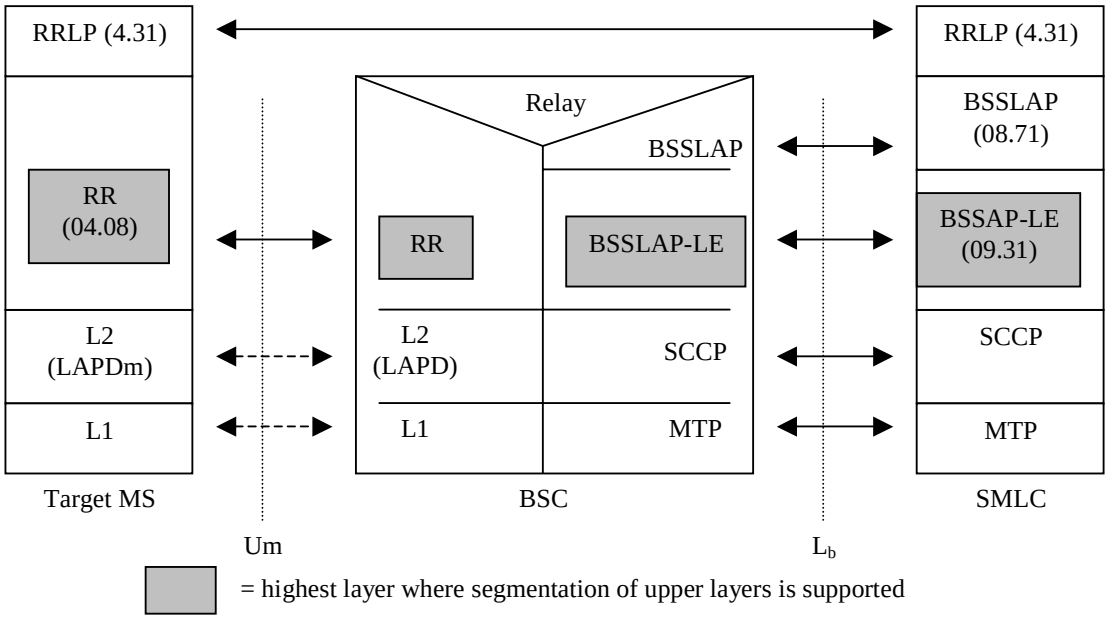

Figure 6 Signaling between an SMLC and Target MS with BSS based SMLC

6.2 R'99/R'00 End-to-End Protocol

Unlike GSM R'98/R'99, where there are separate documents (4.31 and 4.35) for point-to-point and broadcast end-to-end LCS messages, there is only one document for 3GPP R'99/R'00: TS25.331. TS25.331 uses Radio Resource Control (RRC) messages to carry point-to-point LCS contents and uses System Information Blocks (SIB) on the BCCH for broadcast assistance. This is a deviation from the GSM R'98/R'99 architecture and perhaps is an end result of the "integration" that has occurred.

Even though we think incorporating the broadcast messages in the control plane may be a good idea, it is beneficial to the industry, that as an option, the CBC should be capable of broadcasting the LCS assistance using the FACH in UTRAN (seeTS23.041, the counterpart to GSM 03.41). One benefit is that, doing so will free up the congested BCCH. Moreover, the CBC-BSS interface should also be defined for GERAN for backward compatibility reasons.

If the closing of the various interfaces is reversed, a corresponding change is necessary in various standards such that the messages destined for the CBC or the SMLC can be managed in an open fashion by the SRNC. Table 3 summarizes the future standardization work required to ensure forward compatibility between GSM R'98/R'99 LCS and 3GPP R'99/R'00 LCS.

Table 3 – Required End-to-End Protocol Standardization Work

Release	Point-to-Point LCS messages	Broadcast LCS assistance messages		L_b interface	L_s interface
		Without CBC	With CBC		
GSM R'98/R'99	GSM 04.31	---	GSM 04.35	GSM 09.31	GSM 09.31
3GPP R'99/R'00	TS25.331	TS25.331	**Add new paragraphs in TS23.041 for contents of LCS messages**	**Define new Standard analogous to section 6 of GSM 09.31**	**Define new Standard analogous to section 7 of GSM 09.31**

The message identifier for LCS messages is currently standardized in TS23.041. Once the actual message contents are defined, the CBC can broadcast LCS assistance to the MS. We propose to insert a few paragraphs into TS 23.041 to refer to the LCS SIB from TS 25.331 for the actual LCS assistance IEs. This insertion is the counterpart to GSM4.35 in R'99/R'00.

As mentioned in the previous section, GSM 09.31 defines the BSSAP-LE protocol used between the SMLC and the BSS (L_b), and between the SMLC and the NSS (L_s). For the L_b interface, we propose to define a new standard analogous to GSM 09.31 section 6. The new protocol will encapsulate both point-to-point and broadcast LCS messages to the MS.

In addition, to standardize the L_s interface within 3GPP, a new standard analogous to GSM 09.31 section 7 is required. This new protocol will also encapsulate both point-to-point and broadcast LCS messages to the MS.

7 Conclusions

Clearly, the network elements and interfaces that comprise the GSM R'98/R'99 LCS specifications have been significantly modified in the 3GPP R'99/R'00 LCS specifications in such a way as to limit the openness of the standards. The most significant impact is associated with the SMLC. In particular, the current specifications do not support any open interfaces to the SMLC. Open interfaces promote competition and provide different choices of SMLC product/vendors to operators.

In addition to the lack of open interfaces associated with the 3GPP R'99/R'00 LCS specifications this paper has detailed another significant modification: The removal of the NSS SMLC. This paper suggests the restoration of the NSS SMLC. At a minimum, this will allow for backwards compatibility with GSM R'98/R'99.

This paper will serve as the basis for a series of contributions to the various 3GPP standards groups in an attempt to return the flexibility established in the GSM R'98/R'99 specifications to the 3GPP R'99/R'00 specifications.

8 References

[1] 3G TR 23.821 V1.0.1 7/00 – 3GPP; Technical Specification Group Services and System Aspects; Architecture Principles for Release 2000

[2] ETSI TS 101 724 V7.3.0 2/00.- Digital cellular communications systems (Phase 2+); Location Services (LCS); (Functional Description) – Stage 2 (GSM 03.71 version 7.3.0 Release 1998)

[3] 3G TS 23.271 V0.0.0 5/00 – 3GPP; Technical Specification Group Services and System Aspects - Functional stage 2 description of LCS (Release 2000)

[4] Tdoc 2G00-011 – SMG2/SMG12/3GPP S2 Workshop on GERAN Architecture 2/00

[5] 3G TS 25.305 V3.21.0 6/00 – 3GPP; Technical Specification Group Radio Access Network; Stage 2 Functional Specification of Location service in UTRAN (Release 1999) (NOT APPROVED)