Chapter 11

Architectures and Protocols for Location Services

Table 11.1 Elements of location data

Element	Description
Location	Represents the target's location, but not necessarily in the original format resulting from positioning.
Type of location	Indicates whether the location is the current, initial, or last known location.
Format of representation	Specifies the spatial reference system the location is based on.
Quality	Contains quality parameters such as accuracy of location and the time when it has been generated.
Identity	Specifies the target's identity and the identity type. Examples are MSISDN, IMSI, IP address, name or a pseudonym
Direction	Denotes the direction of the target's motion.
Speed	Denotes the speed of the target's motion.

- **Selection and control of positioning method**
- **Conversion to another reference system**
- **Tagging**
- **Quality indication**
- **Dissemination**
- **Protecting privacy**
- **Accounting**

11.1 GSM and UMTS Location Services

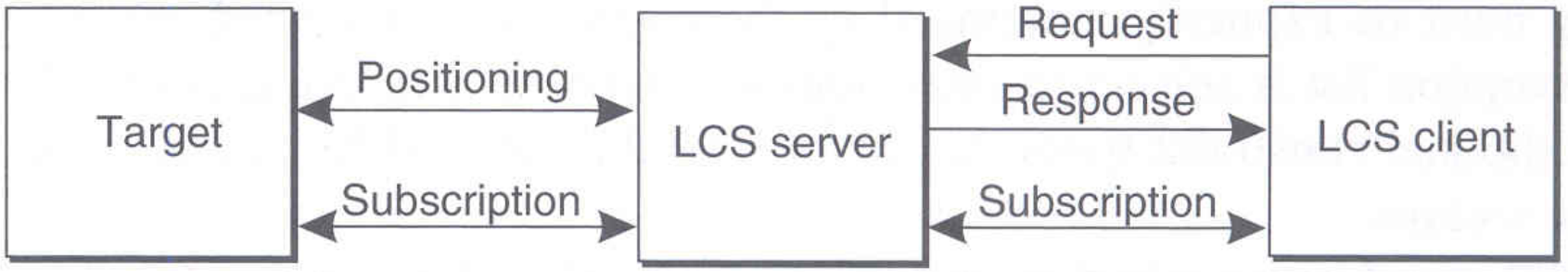


Figure 11.1 LCS logical reference model.

- **Immediate location request**
- **Deferred location request**

- **Basic self-location**
- **Autonomous self-location**
- **Transfer to third party**

11.1.1 LCS Network Architecture

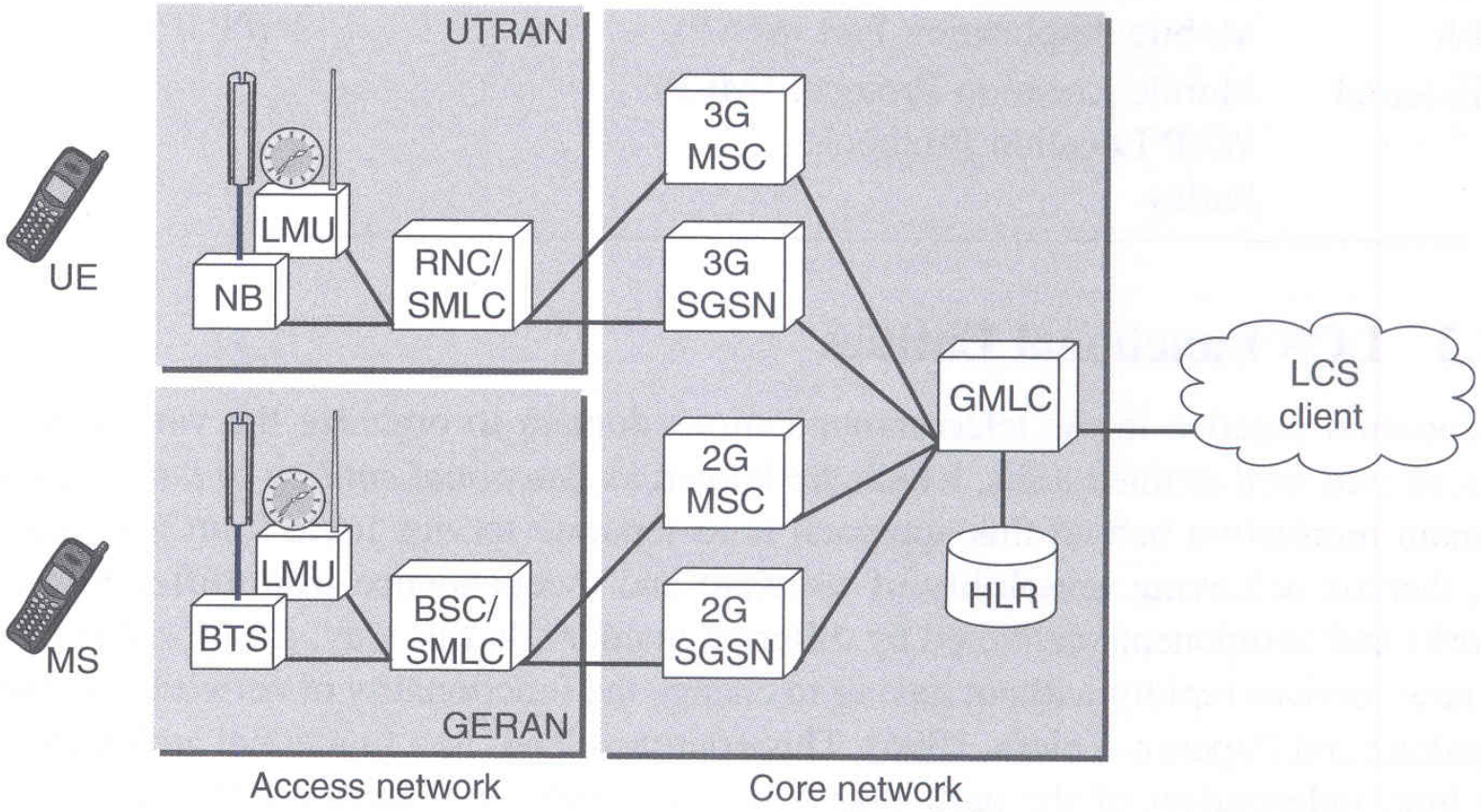
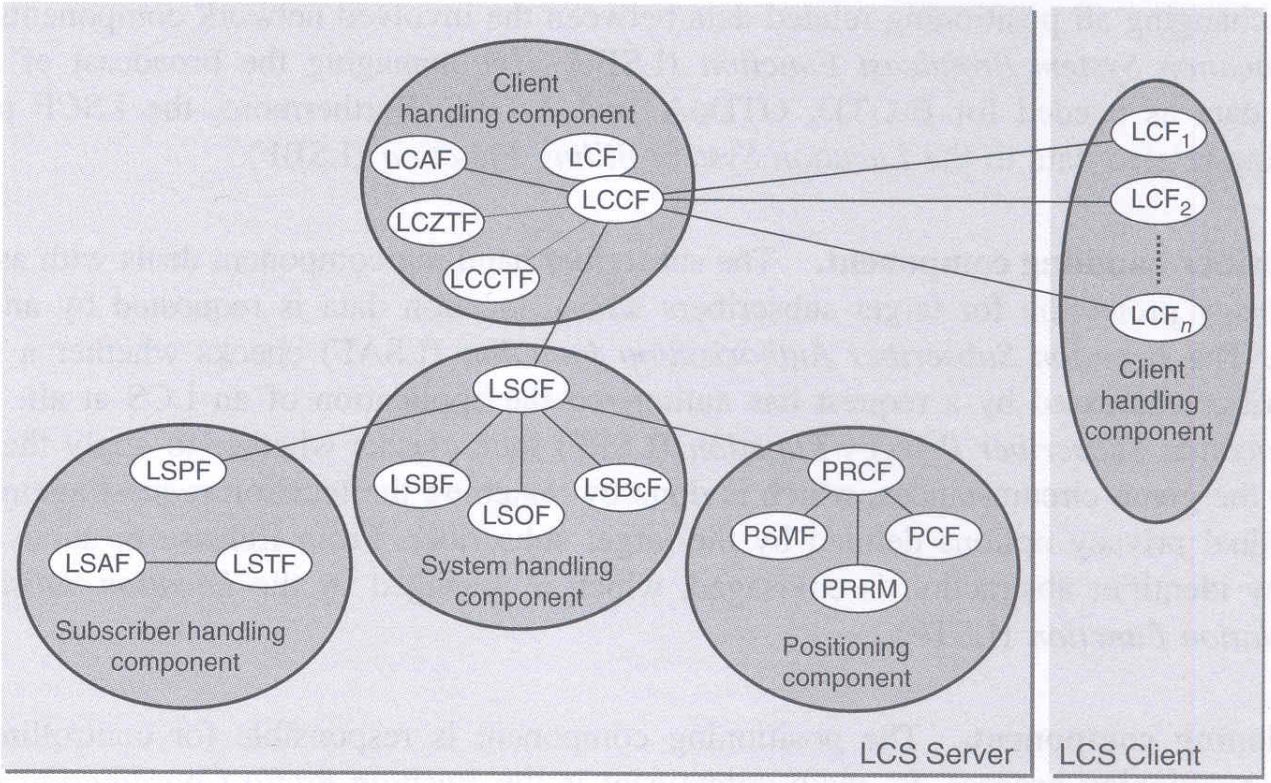


Figure 11.2 Overview of 3GPP LCS architecture.

Table 11.2 Overview of interfaces for LCSs

Interface	Signaling protocol	3GPP spec.
A	Base Station System Application Part (BSSAP)	3GPP TS 48.008
	Base Station System Application Part LCS Extension (BSSAP-LE)	3GPP TS 49.031
Gb	Base Station System GPRS Protocol (BSSGP)	3GPP TS 48.018
	Base Station System Application Part LCS Extension (BSSAP-LE)	3GPP TS 49.031
Iu	Radio Access Network Application Part (RANAP)	3GPP TS 25.413
Lg	Mobile Application Part (MAP)	3GPP TS 29.002
Lh	Mobile Application Part (MAP)	3GPP TS 29.002
External	Mobile Location Protocol (MLP) WAP Location Protocols Parlay	

11.1.2 LCS Functional Entities



LCAF	Location Client Authorization Function
LCCF	Location Client Control Function
LCCTF	Location Client Coordinate Transformation Function
LCF	Location Client Function
LCS	Location Service
LCZTF	Location Client Zone Transformation Function
LSAF	Location Subscriber Authorization Function
LSBF	Location System Billing Function
LSBcF	Location System Broadcast Function
LSCF	Location System Control Function
LSOF	Location System Operations Function
LSPF	Location Subscriber Privacy Function
LSTF	Location Subscriber Translation Function
PCF	Positioning Calculation Function
PRCD	Positioning Radio Coordination Function
PRRM	Positioning Radio Resource Management
PSMF	Positioning Signal Measurement Function

Figure 11.3 LCS functional architecture.

Client handling component

System handling component

Subscriber handling component

Positioning component

Table 11.3 Mapping of LCS functional entities onto network components

	MT/UE	BSS/RAN	GMLC	SGSN	MSC	HLR	Client
LCS client							
LCF	×			×	×		×
LCF int.		×					
Client handling component							
LCCTF			×				
LCCF			×				
LCAF			×				
LCZTF			×				
System handling component							
LSCF		×		×	×		
LSBF			×	×	×		
LSOF	×	×	×	×	×		
Subscriber handling							
LSAF				×	×		
LSPF				×	×	×	
Positioning component							
PRCF		×					
PCF	×	×					
PSMF	×	×					
PRCF		×					

11.1.3 Location Procedures

- Location preparation procedure
- Positioning measurement establishment procedure
- Location calculation and release procedure

11.1.3.1 Mobile Terminating Location Request

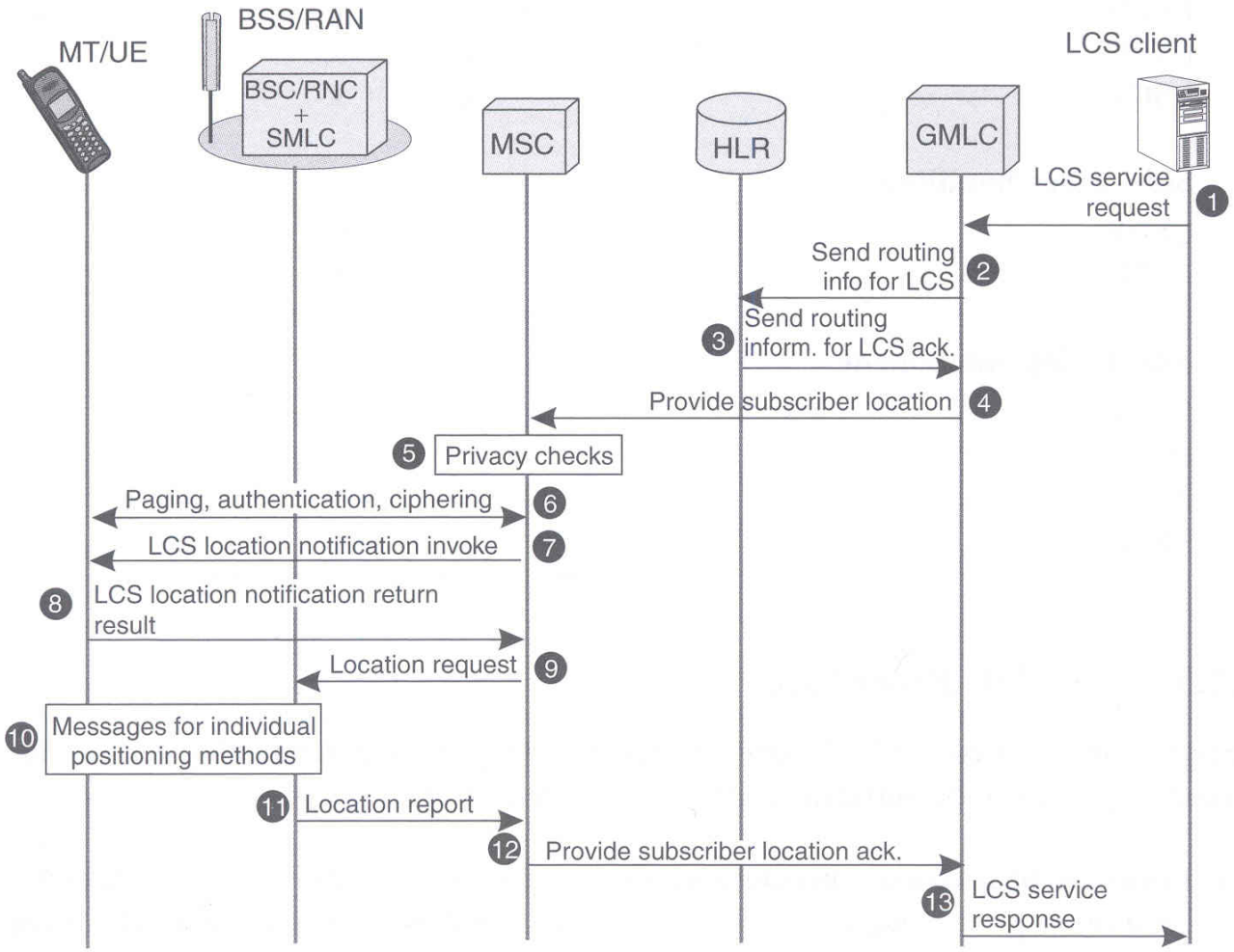


Figure 11.4 Mobile terminating immediate location request.

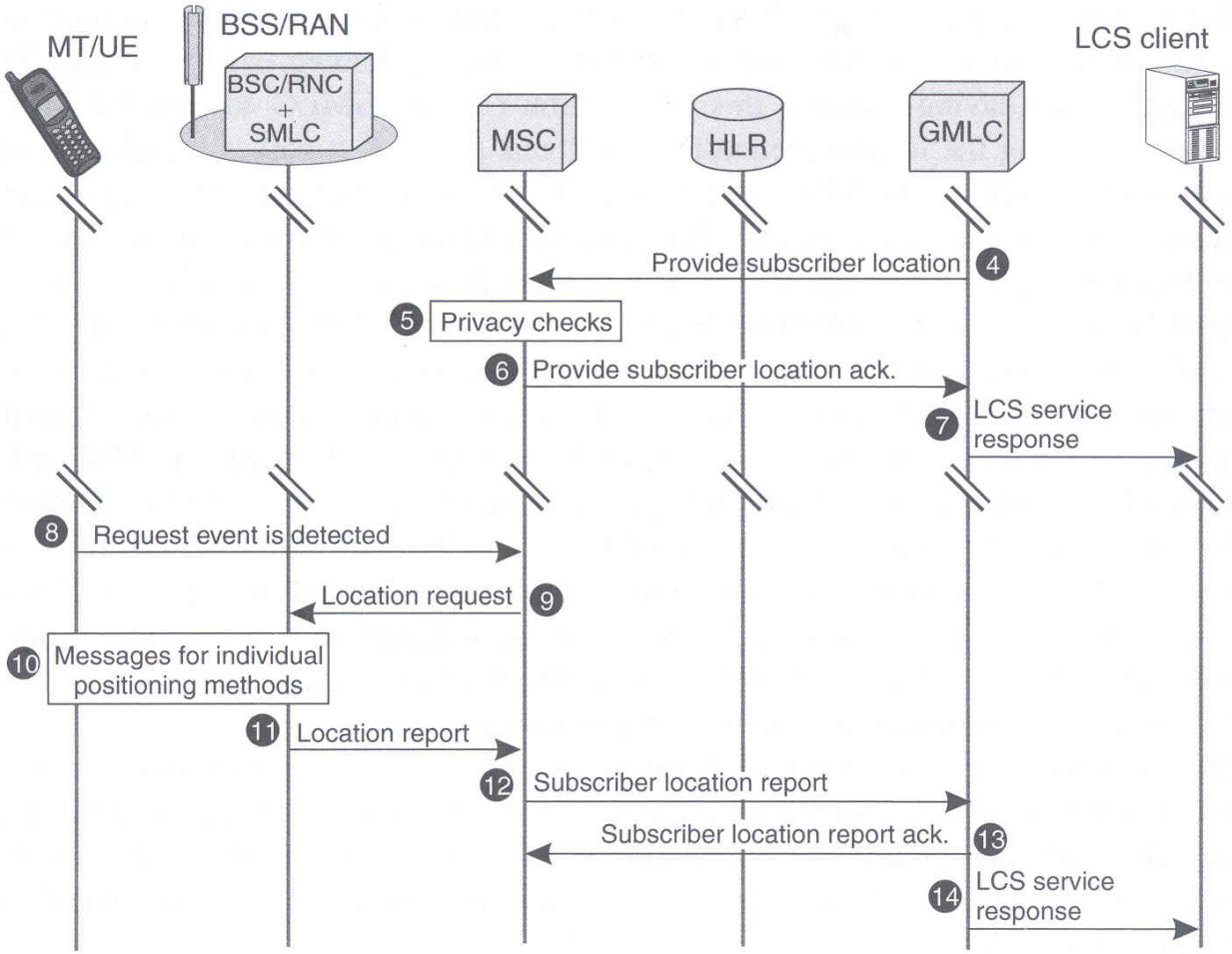


Figure 11.5 Mobile terminating deferred location request.

11.1.3.2 Mobile Originating Location Request

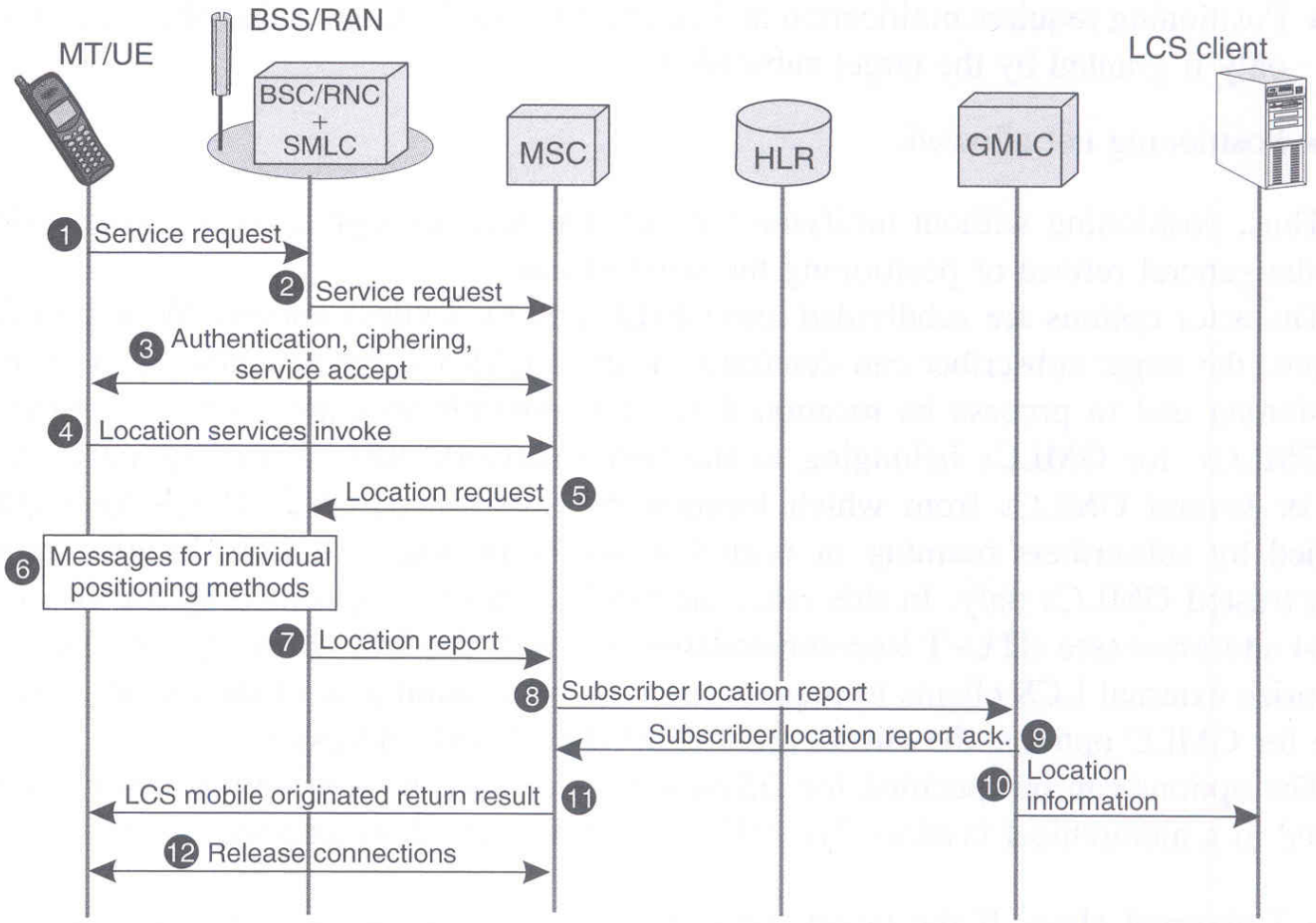


Figure 11.6 Mobile originating location request.

11.1.4 Privacy Options

- Universal class
- Call/session-related class
- Call/session-unrelated class
- PLMN operator class

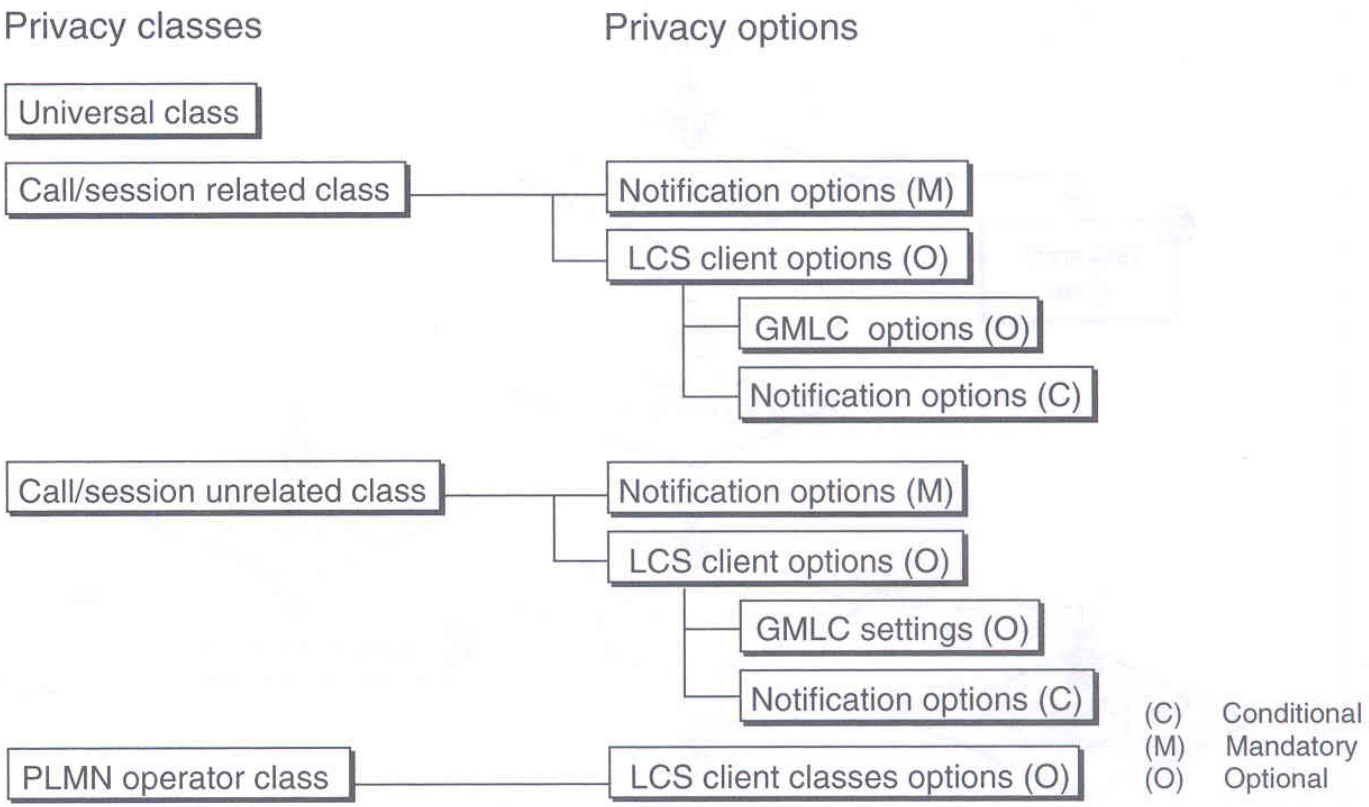


Figure 11.7 Relation between privacy classes and options.

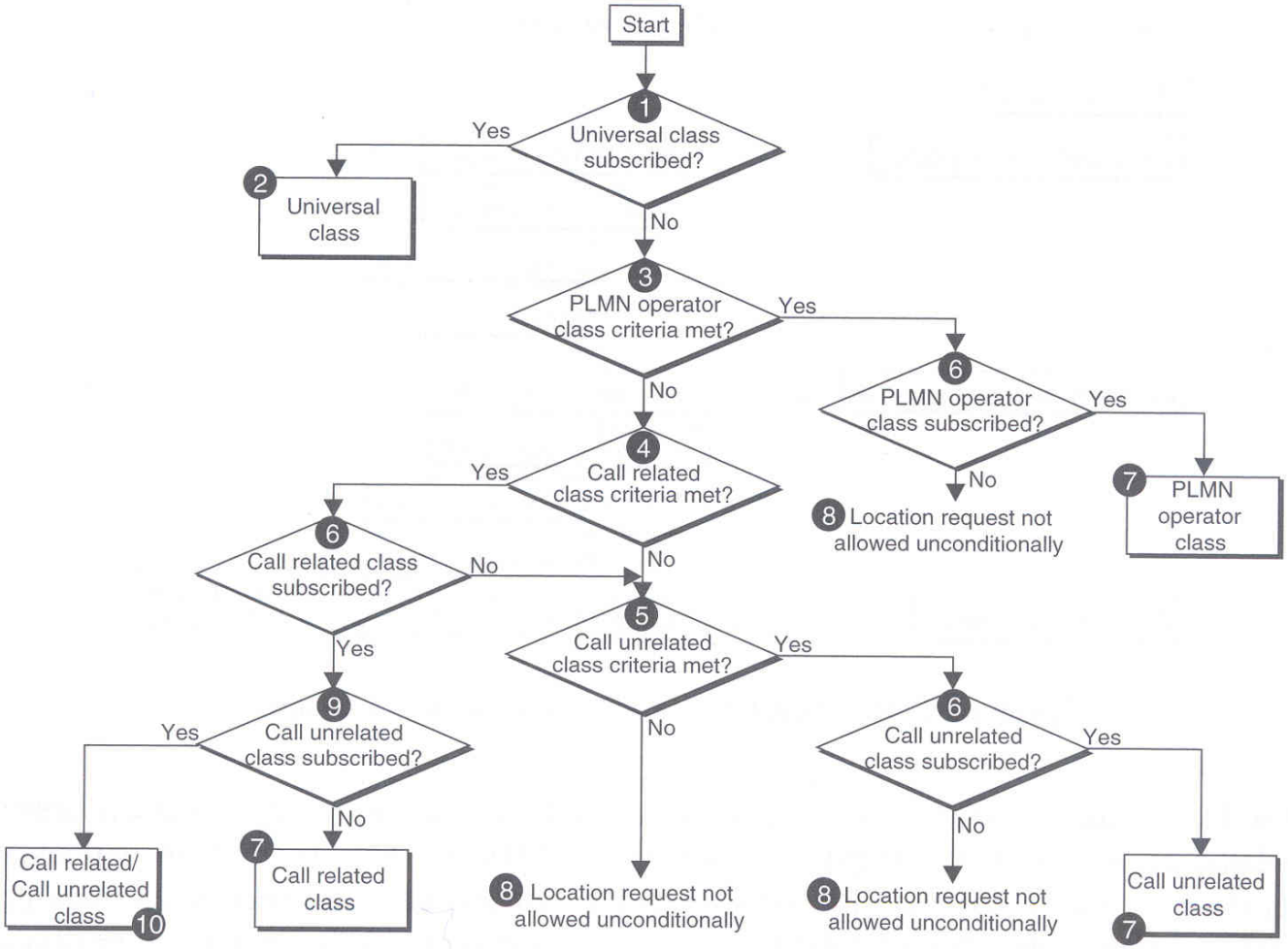


Figure 11.8 Privacy class selection rule (3GPP TS 23.271).

11.1.5 Outlook to Future Releases

Table 11.4 Schedule for the introduction of new LCS and positioning features

Release	New positioning and LCS features
99	Positioning: Cell-Id combined with TA/RTT, E-OTD, IPDL-OTDoA, A-GPS LCS: Immediate LCS, deferred LCS with periodic reporting and reporting upon subscriber registers with network Privacy: Notification, GMLC, LCS client options
4	–
5	Privacy: Service type options, requestor code word, and notifications including requestor identity
6[1]	Positioning: UL-TDoA LCS: Support of roaming subscribers, deferred LCS with zone-based reporting (change of area) Privacy: Anonymization by identifier abstraction, implementation of Pseudonym Mediation Device (PMD) and Privacy Profile Register (PPR)

[1] not frozen at the time of writing

Table 11.5 Standardized LBS types according to releases 5 and beyond of (3GPP TS 22.071)

LBS categories	Standardized LBS types
Public safety services	Emergency services Emergency alert services
Location sensitive charging	
Tracking services	Person tracking Fleet management Asset management
Traffic monitoring	Traffic congestion reporting
Enhanced call routing	Roadside assistance Routing to nearest commercial enterprise
Location-based information services	Traffic and public transportation information City sightseeing Localized advertising Mobile yellow pages Weather Asset and service finding
Entertainment and community services	Gaming Find your friend Dating Chatting Route finding Where-am-I
Provider specific services	

11.2 Enhanced Emergency Services

11.2.1 Wired Enhanced Emergency Services

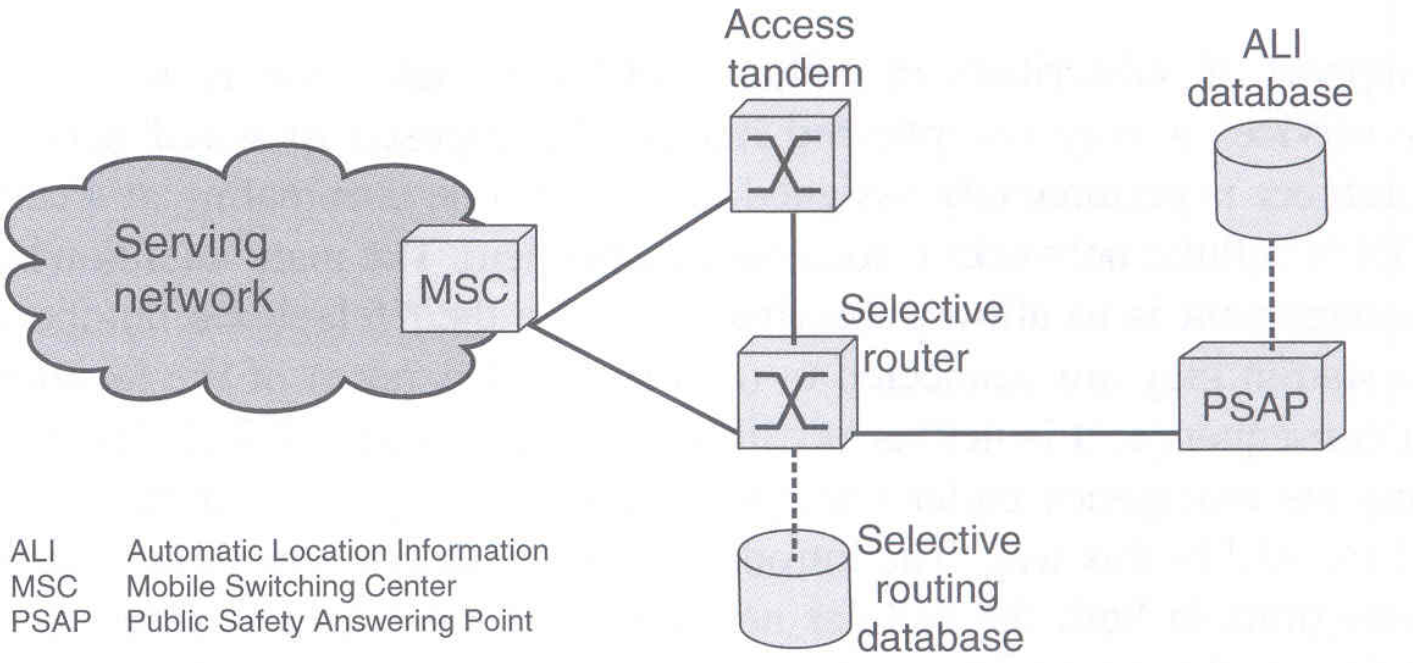


Figure 11.9 Basic configuration of emergency services network.

11.2.2 Wireless Enhanced Emergency Services

11.2.2.1 Phase I

11.2.2.2 Phase II

- CAS push
- NCAS pull

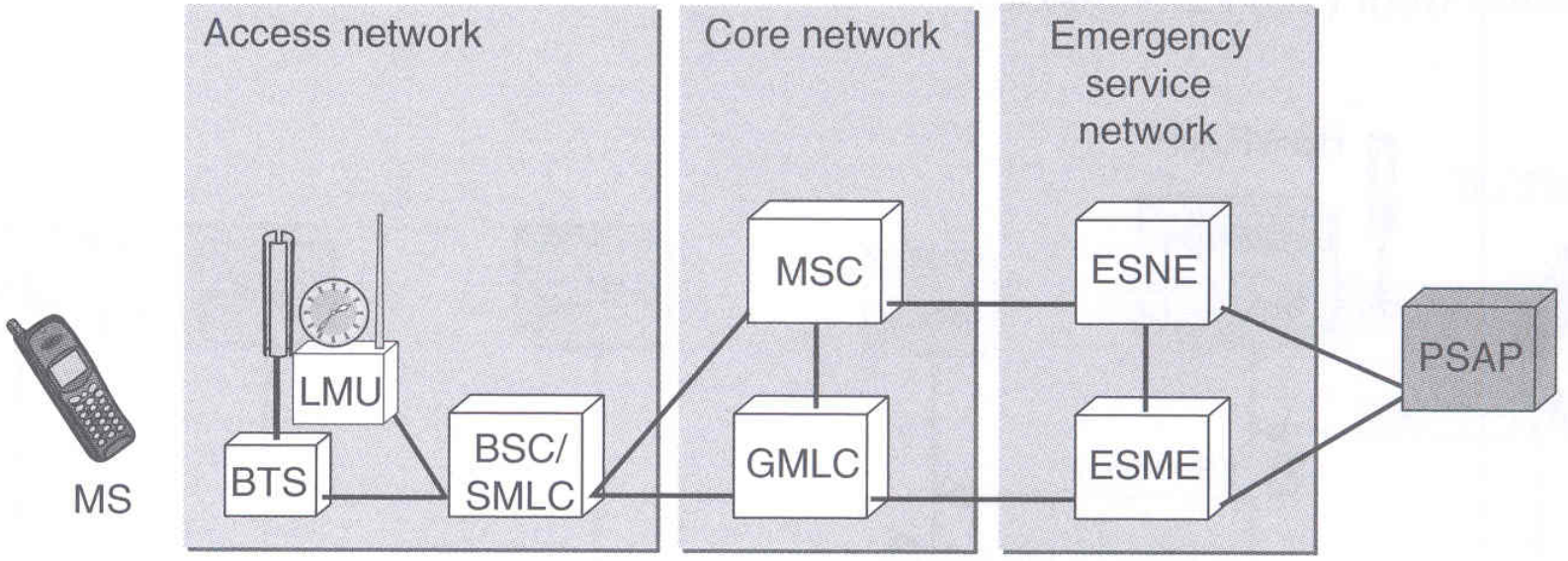


Figure 11.10 Network reference model for Phase II emergency services.

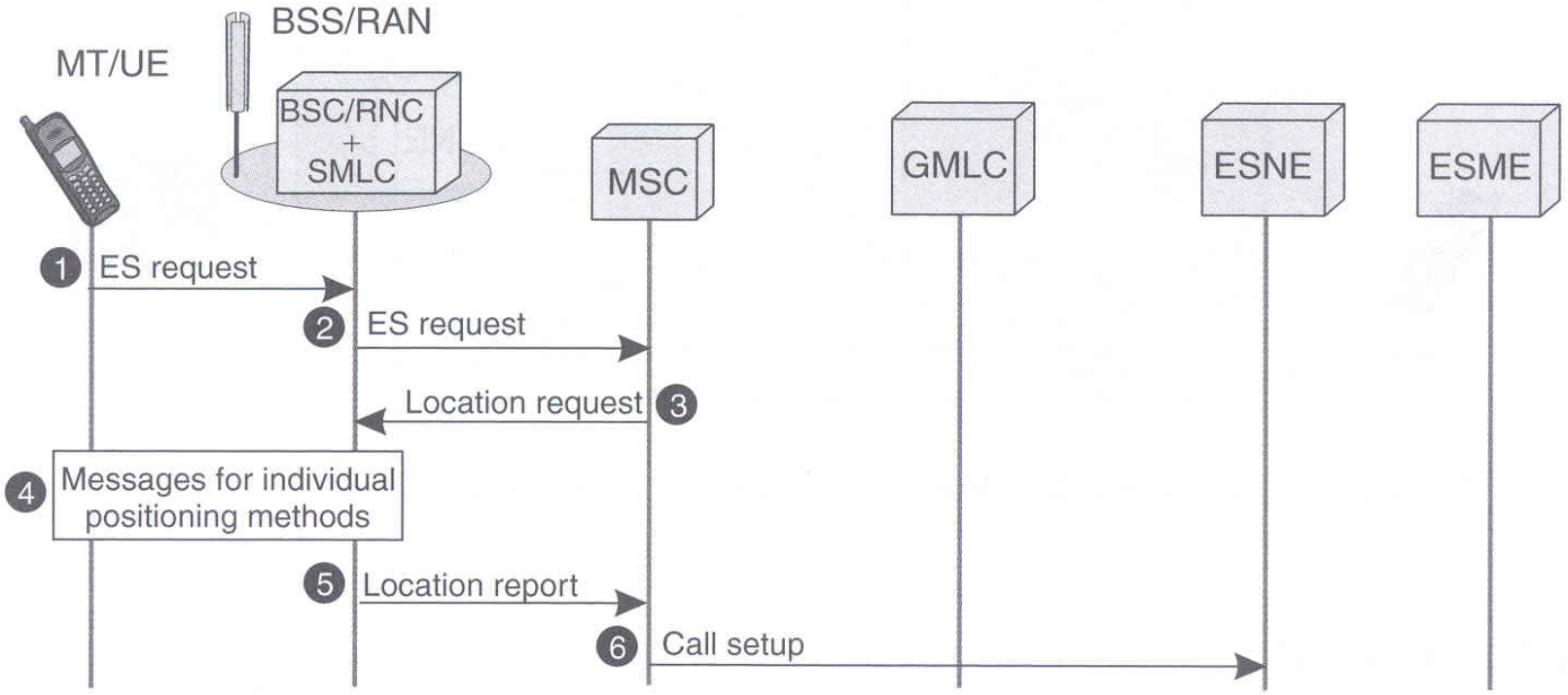


Figure 11.11 Emergency LCS with CAS push.

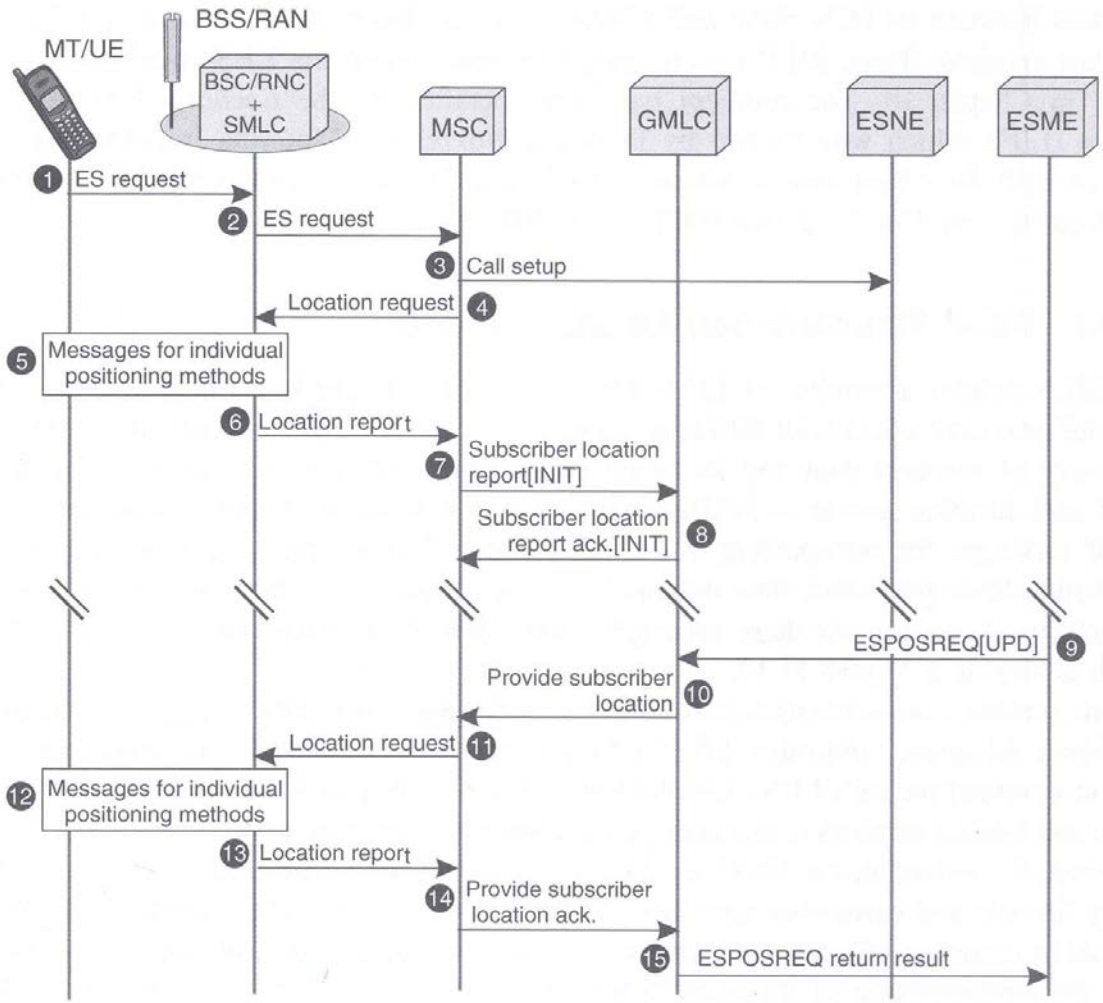


Figure 11.12 Emergency LCS with NCAS pull.

11.3 Mobile Location Protocol

11.3.1 MLP Structure and Location Service

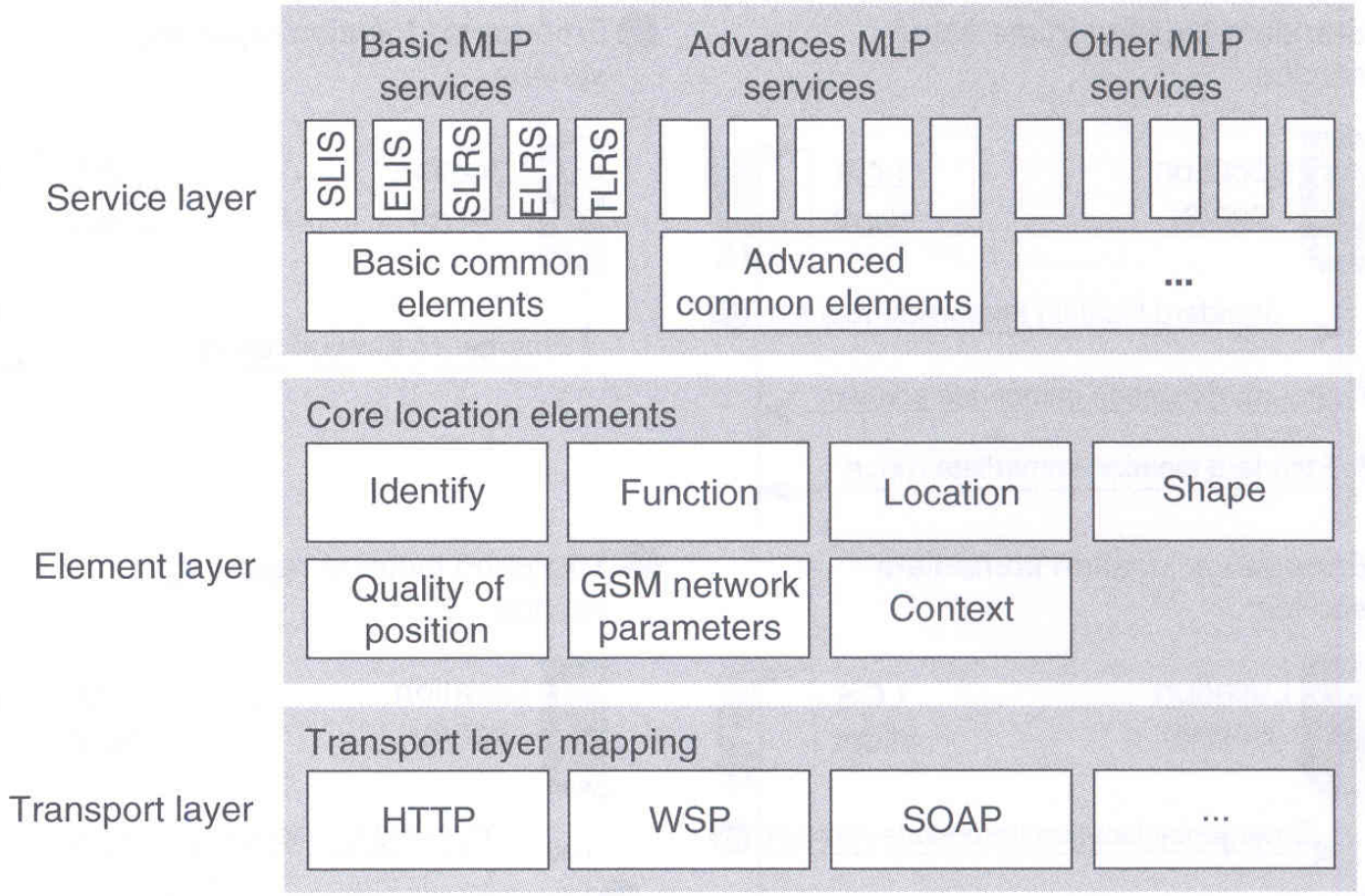


Figure 11.13 MLP structure.

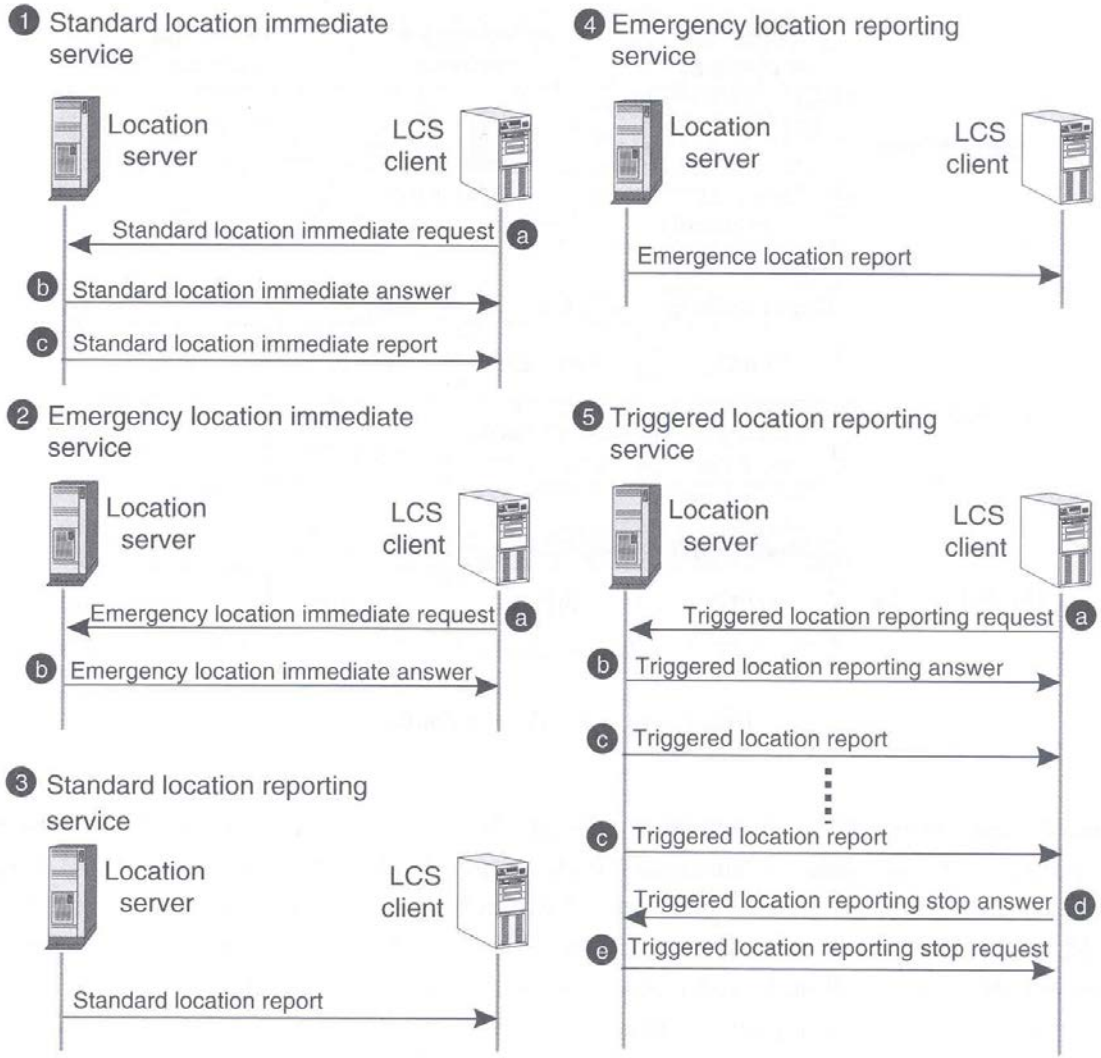


Figure 11.14 MLP location services overview.

- Standard location immediate request (SLIR)
- Emergency Location Immediate Request (ELIS)
- Standard Location Reporting Service (SLRS)
- Emergency Location Reporting Service (ELRS)
- Triggered Location Reporting Service (TLRS)

- Identity element definitions
- Function element definitions
- Location element definitions
- Shape element definitions
- Quality of position elements definitions
- Network parameters element definitions
- Context element definitions

11.3.2 Example

11.3.3 Outlook to Future Releases

11.4 WAP Location Framework

11.4.1 WAP Overview

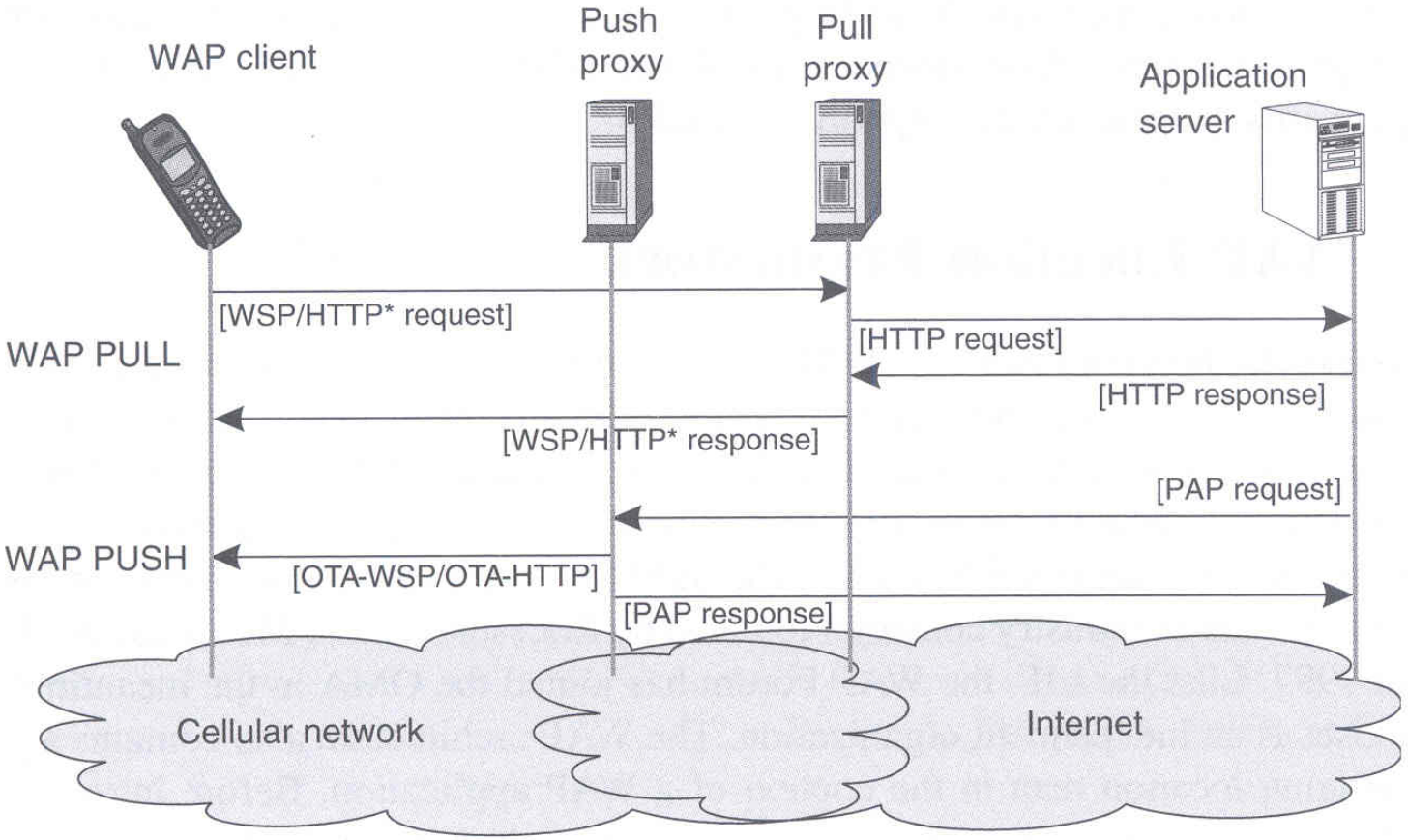


Figure 11.15 WAP architecture (WAP Forum 2001c).

11.4.2 WAP Location Services

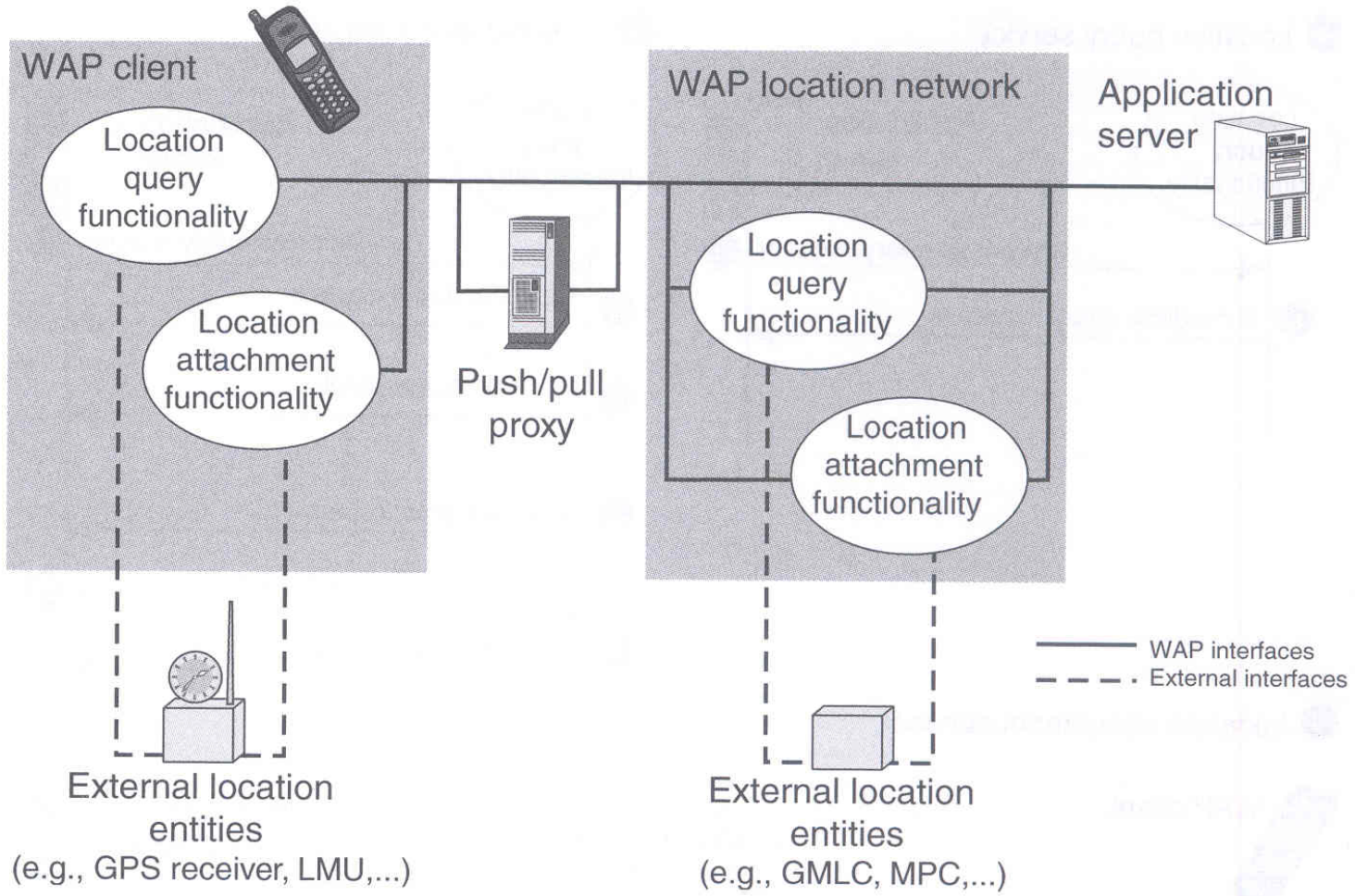


Figure 11.16 WAP Location Framework architecture (WAP Forum 2001c).

- **Immediate query service**
- **Deferred query service**
- **Attachment service**

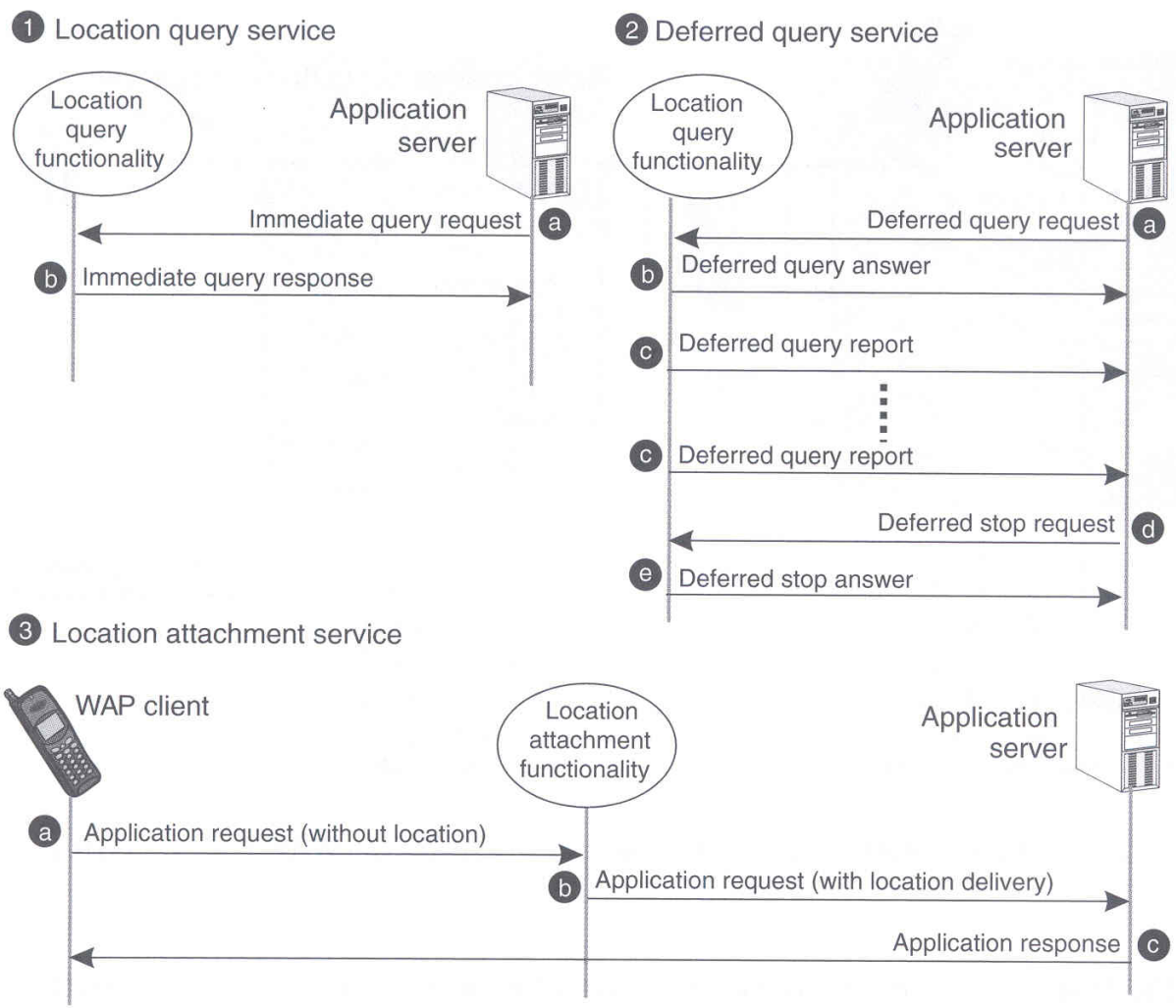


Figure 11.17 WAP location services overview (WAP Forum 2001c).

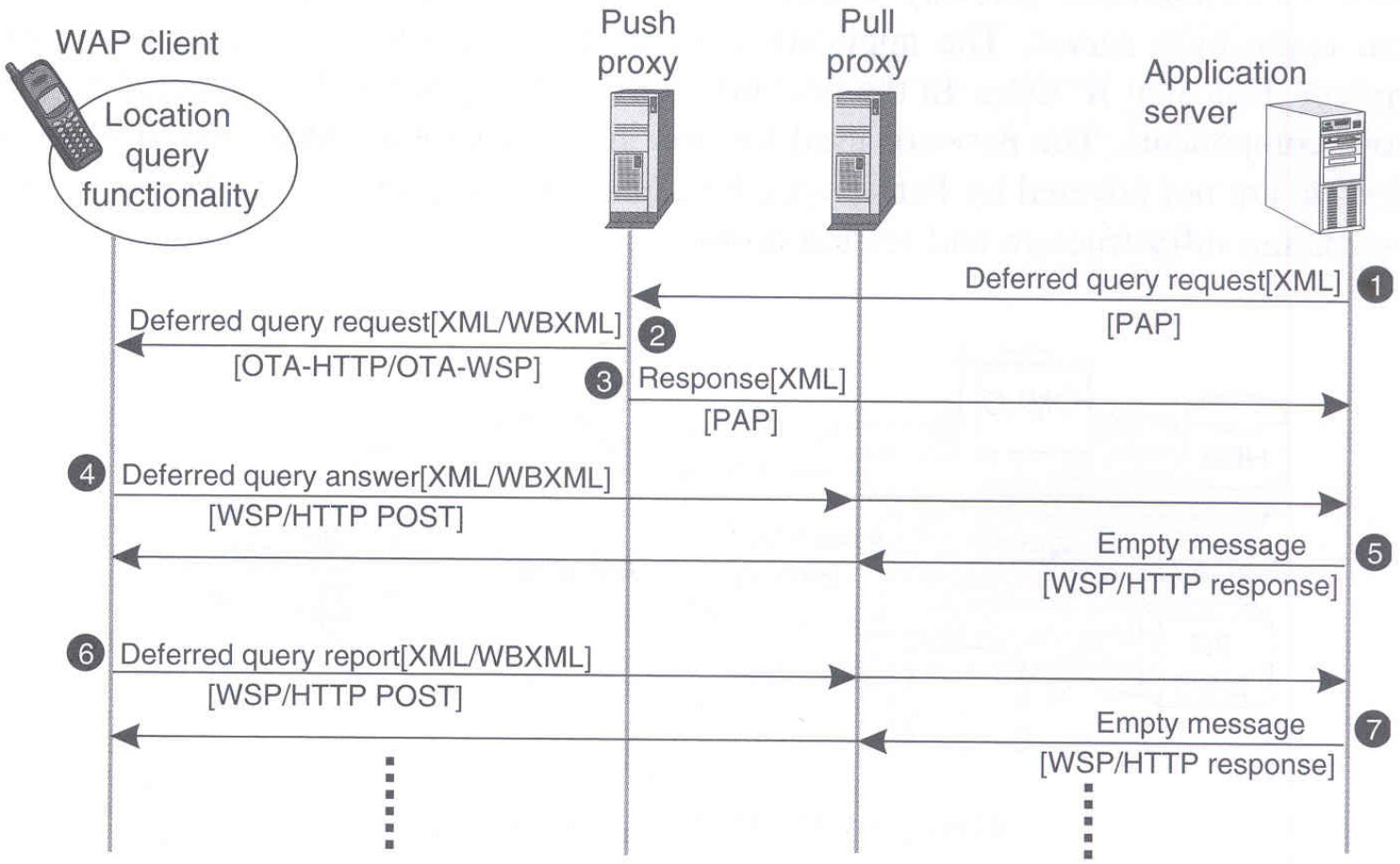


Figure 11.18 Deferred query service with content push.

11.5 Parlay/OSA

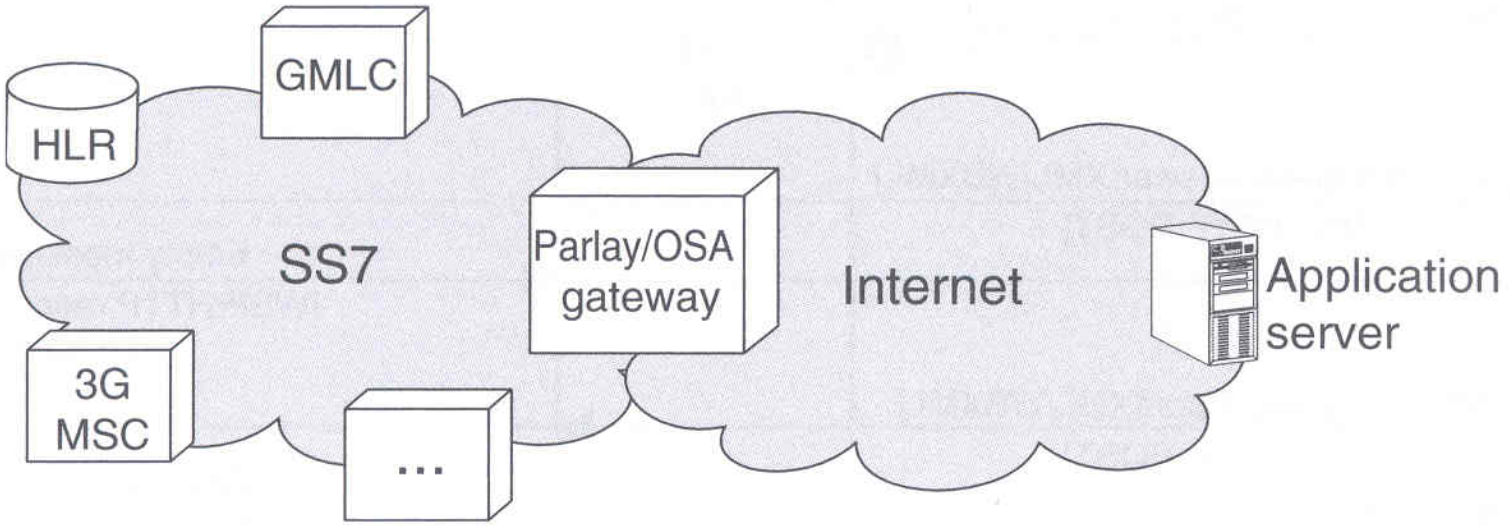


Figure 11.19 Parlay/OSA gateway.

11.6 Geopriv

11.6.1 Geopriv Entities

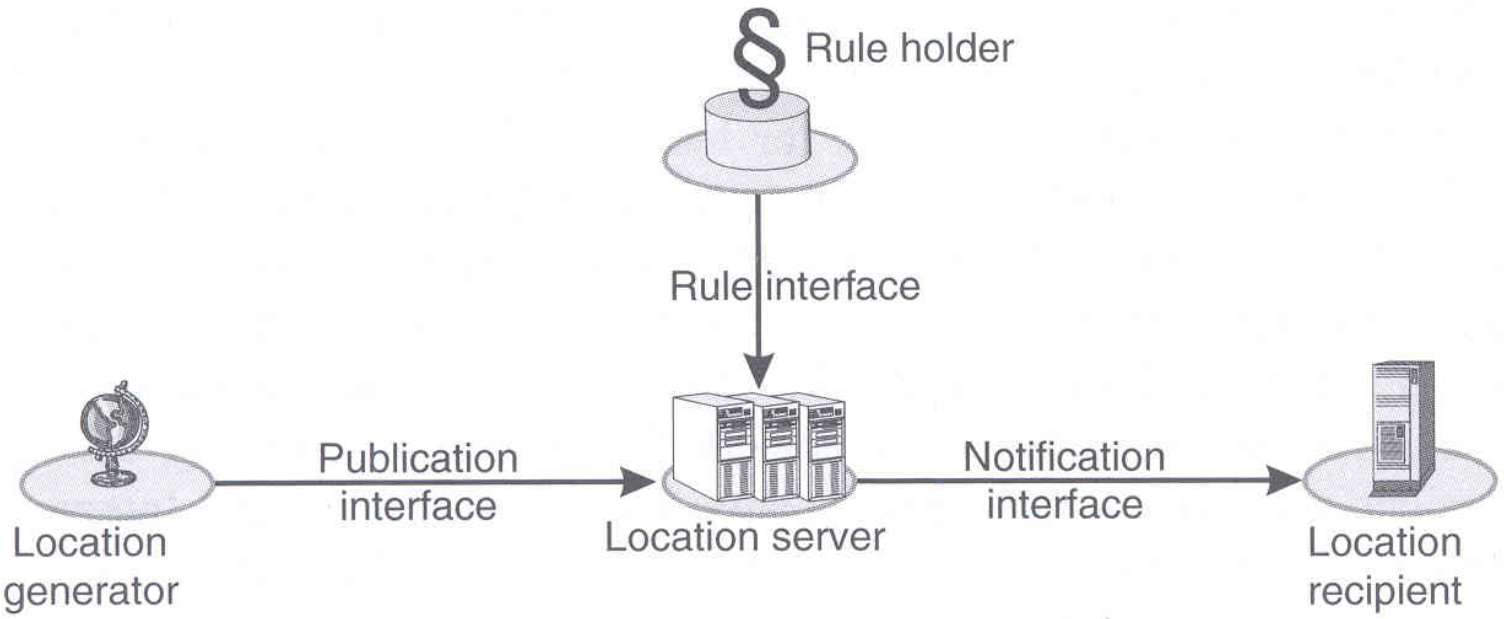


Figure 11.20 Geopriv entities.

11.6.2 Location Objects

11.6.3 Geopriv Outlook

11.7 Conclusion