
Mobile Application Part (MAP)

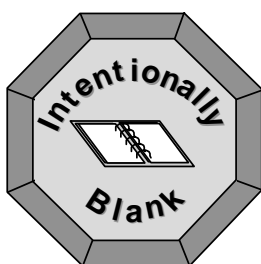
—— Chapter 12 ——

This chapter is designed to provide the student with an overview of the Mobile Application Part (MAP) protocol.

OBJECTIVES:

Upon completion of this chapter the student will be able to describe:

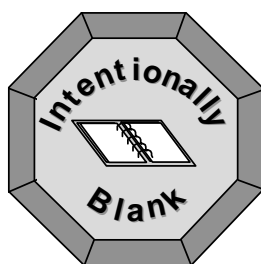
- when the Mobile Application Part (MAP) protocol is used in a signaling network.
- describe how the Transaction Capabilities Application Part (TCAP) message for the MAP “Send Parameters” message is built using the Abstract Syntax Notation (ASN.1).



12 Mobile Application Part (MAP)

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MOBILE APPLICATION PART (MAP)

INTRODUCTION

The Mobile Application Part (MAP) protocol is designed to support GSM signaling requirements in the Switching System part of the GSM network. MAP functions are implemented in the MSC, VLR, HLR, AUC, and EIR as well as in the SMS and MIN nodes. The protocol is used on all interfaces between the nodes with the exception of the B interface only (MSC—VLR) which is implemented internally in software in Ericsson implementation of the GSM system.

MAP protocols are used, for example, in case of:

- location registration/cancellation
- handling/management/retrieval of subscriber services
- inter-MSC handover
- transfer of security/authentication data

MAP uses TCAP to utilize dialog and component handling facilities for peer-to-peer communication between different nodes and NSP (Network Service Part, i.e. MTP and SCCP) for transmission of information and messages in SS7 network.

MAP uses SCCP connectionless mode only, both basic and sequenced classes.

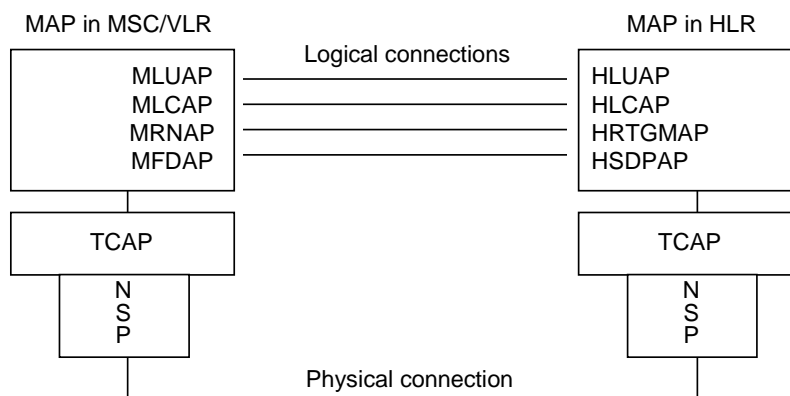
DESCRIPTION

To support different types of functions within GSM architecture the MAP is functionally divided into so called Application Entities (AE). They are identified by different SCCP Subsystem Number values:

- MAP-HLR, SSN=6
- MAP-VLR, SSN=7
- MAP-MSC, SSN=8
- MAP-EIR, SSN=9
- MAP-AUC, SSN=10
- MAP-FNR, SSN=253

Each AE is further divided into a number of Application Service Elements (ASE). The ASEs support the interworking of the AEs and consist of one or more operations with their associated parameters. TCAP is considered to be a common ASE included in every MAP-AE.

Figure 12-1 shows MAP with some of its function blocks in the MSC/VLR and the HLR.



NSP = Network Service Part (MTP+SCCP)

Figure 12-1 MAP allows software blocks in remote nodes to communicate with each other.

An ASE can only communicate with a compatible peer ASE. At location updating for example, the function block Mobile telephony Location Updating MAP (MLUAP) in the MSC communicates with the function block Home Location Updating MAP (HLUAP) in the HLR. Figure 12-2 shows some examples of MAP version 1 operations.

Update Location	(VLR => HLR)
Cancel Location	(HLR => VLR)
Provide Roaming Number	(HLR => VLR)
Insert Subscriber Data	(HLR => VLR)
Delete Subscriber Data	(HLR => VLR)
Send Parameters	(VLR => HLR)
Register Supplementary Services	(VLR => HLR)
Erase Supplementary Services	(VLR => HLR)
Activate Supplementary Services	(VLR => HLR)
Deactivate Supplementary Services	(VLR => HLR)
Interrogate Supplementary Services	(VLR => HLR)
Forward Supplemenatry Services notification	(HLR => VLR)
Register Password	(VLR => HLR)
Get Password	(HLR => VLR)
Process unstructured Supplementary Services data	(VLR => HLR)
Services Indication	(HLR => VLR)
Perform Handover	(MSC-A => MSC-B)
Send End Signal	(MSC-B => MSC-A)
Perform Subsequent Handover	(MSC-B => MSC-A)
Process Access Signaling	(MSC-B => MSC-A)
Forward Access Signaling	(MSC-A => MSC-B)
Note Internal Handover	(MSC-B => MSC-A)
Reset	(HLR => VLR)
Check IMEI	(MSC => EIR)
Forward Short Message	(SMS-GMSC => MSC)
Note Subscriber Activity	(VLR => HLR)
Begin Subscriber Activity	(VLR => HLR)
Send Routing Information	(GMSC => HLR)

Figure 12-2 MAP v.1 operations in MSC/VLR/GMSC.

DEFINITIONS AND FORMATTING

The protocol information within MAP (operations and their elements) is described in ASN.1, defined in CCITT recommendations X.208. Figure 12-3 shows parts of a description for the Send Parameters operation. Compare it with an example TCAP frame picture from previous chapter.

The MAP operation definition is divided into three parts:

- ARGUMENT: used when a request to perform an operation is sent in TCAP INVOKE component
- RESULT: used when response is sent
- ERROR: to indicate a problem.

The actual operation parameters in the message are coded according to the Basic Encoding Rules defined in CCITT recommendations X.209 and the GSM MAP specifications (GSM TS 09.02).

```
sendParameters OPERATION
ARGUMENT
  sendParametersArg SEQUENCE {
    subscriberId CHOICE {
      imsi [0] IMPLICIT OCTET STRING (SIZE (3..8)),
      tmsi [1] IMPLICIT OCTET STRING (SIZE (1..4))},
    requestParameterList SEQUENCE SIZE (1..2) OF
      ENUMERATED {
        requestIMSI (0),
        requestAuthenticationSet (1),
        requestSubscriberData (2),
        requestKi (4)}
  }
RESULT
  -- this part not shown
ERRORS {
  -- unexpectedDataValue -- localValue 36,
  -- unknownSubscriber -- localValue 1,
  -- unidentifiedSubscriber -- localValue 5}
:= localValue 9
```

Figure 12-3 ASN.1 for “Send Parameters” MAP message

VERSIONS AND VARIANTS

MAP protocol has evolved along with the whole GSM system. As new services are added, new versions of MAP protocol are developed. Currently there are three versions of MAP protocol:

- MAP version 1 (MAP 1) – corresponding to GSM phase 1
- MAP version 2 (MAP 2) – corresponding to GSM phase 2/2+
- MAP version 3 (MAP 3) – corresponding to GSM phase 3

During development of new versions of Ericsson GSM system, some non-standard services have been created, which have resulted in implementation of Ericsson Variants of MAP containing Ericsson-specific messages to handle services like Single Personal Number, Intelligent Networks, Immediate Call Itemization, etc. However, MAP version 2 specifications have been made more flexible and all information on non-standard services can now be transferred between nodes in a standardized way. Using MAP version 3, there is no more need for Ericsson Variants of MAP as all service data can now be sent in the standard protocol.

As versions of new MAP protocol are not immediately introduced in all networks, immediately, all versions and variants must be implemented and version selection mechanisms used to decide which version of MAP is to be used in specific cases. This helps to maintain good interworking between different networks. This is important as one network can utilize the equipment from different manufacturers and must also communicate with other networks when subscribers are roaming internationally.

In Ericsson GSM systems the following mechanisms are used to select the appropriate MAP protocol version:

- in the GMSC during the HLR interrogation at call setup, software route parameters are used to choose a protocol version.
- in the MSC/VLR when a new subscriber is being registered, an IMSI series analysis result decides what MAP version is used.
- in the HLR when data is sent to a serving MSC/VLR, the address of the VLR is analyzed to select MAP version.

When cases of doubt the newest MAP version is used and a fallback procedure is applied when the other node does not support this version.

