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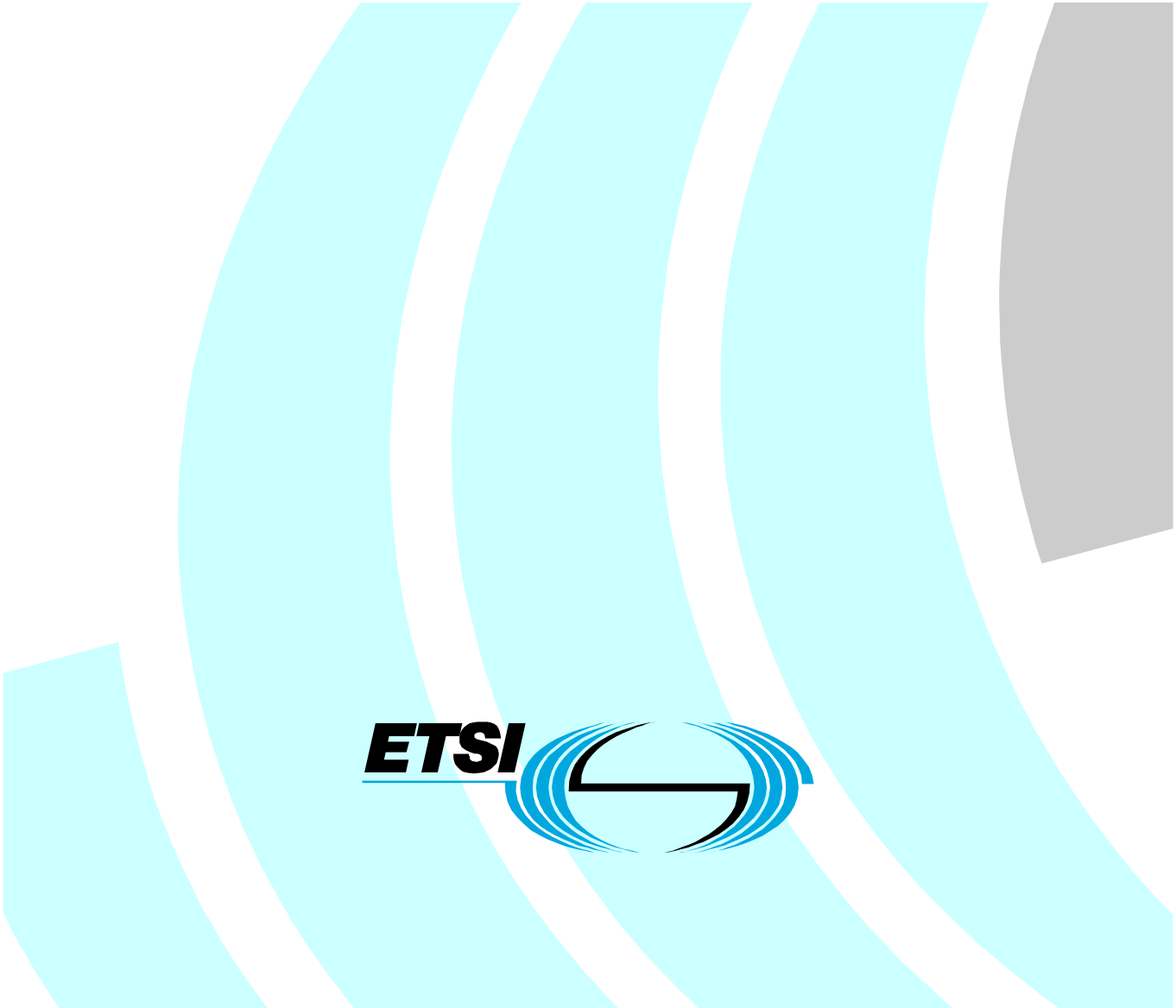
Technical Report

Fixed network Multimedia Messaging Service (F-MMS); PSTN/ISDN; Part 3: Network architecture and interconnection



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Contents

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

The present document is part 3 of a multi-part deliverable covering the Fixed network Multimedia Messaging Service (F-MMS), as identified below:

TS 102 314-1: "Overview";

ES 202 314-2: "PSTN/ISDN; Service description";

TR 102 314-3: "Network architecture and interconnection";

ES 202 314-4: "PSTN/ISDN; Multimedia Message communication between a fixed network Multimedia Messaging Terminal Equipment and a Multimedia Messaging Service Centre";

ES 202 314-5: "ISDN; Digital Subscriber Signalling System No. One (DSS1) protocol, Signalling System No.7 (SS7) - ISDN User Part (ISUP), and Interworking between DSS1 and ISUP";

TR 102 314-6: "Control strings (service codes) for MMS functions and MMS supplementary services";

TS 102 314-7: "Over-The-Line configuration of F-MMS terminal settings";

ES 202 314-8: "Service description";

ES 202 314-9: "Combined PSTN/ISDN & broadband access and broadband access only; Multimedia Message communication between a fixed network Multimedia Messaging Terminal Equipment and a Multimedia Messaging Service Centre".

NOTE: The parts above refer to the active work items and published standards within ETSI. These work items do not include MMS over NGN.

Introduction

The Short Message Service (SMS) has paved the way for a new approach to personal communication. Following the success in mobile telecommunication networks, SMS has also become in fixed line telecommunication networks a well-known feature. Based on ETSI standards, SMS offers the possibility of exchanging Short Messages within and between fixed line and mobile telecommunication networks.

The Multimedia Messaging Service (MMS) in the mobile networks was created to provide a sophisticated kind of messaging which combines the advantages of both SMS and email messaging. The Multimedia Messaging Service (MMS) allows users to send and receive messages exploiting the whole array of media types available today e.g. text, images, audio, video and even streaming contents, while also making it possible to support new content types as they become popular. Similar to the Short Message Service (SMS), the Multimedia Messaging Service (MMS) is a non-real-time delivery system providing a store-and-forward mechanism. A good overview about the Multimedia Messaging Service can be found in TS 102 314-1 [1].

A Multimedia Message (MM) consists of one or more media elements (such as text, voice, image and video), and it is the combination of these media elements in an ordered synchronized manner that creates a multimedia presentation. The non-real-time multimedia messaging service shall be capable of supporting current and future multimedia messaging based services, and exploit the advances being made in the world multimedia community.

The Multimedia Messaging Service for fixed telecommunication networks follows the philosophy of adopting the existing Multimedia Messaging Service of mobile networks as widely as possible. Following this philosophy, only the mobile network-specific transport mechanisms are replaced by transport mechanisms applicable to fixed networks. The higher, not mobile network-specific MMS protocol layers are used similar to their respective use in mobile networks.

Following this approach F-MMS interworking should be based on the experience and roadmap of the MMS approach in the mobile world. However, it needs to be recognized that there exist some major differences between mobile and fixed telecommunication networks. Due to these differences e.g. the routing problem in fixed networks may be more complex than in mobile networks, i.e. that the solution for number portability for MMS applications may be different.

Clarification is e.g. needed in realization of number databases and on which operator a recipient resides with a given address for mobile MMS; these problems can be solved by HLR lookups (SS7). For Fixed MMS, no such infrastructure exists, hence the need for new solutions.

The MMS is a service that shall make it possible to offer seamless MMS over different networks (PSTN, ISDN, PLMN).

To fulfil seamless interworking over different networks and/or via different service providers an interconnection between those parties is essential.

1 Scope

The present document gives a guideline about different network architectures and interconnection possibilities to allow interworking between different networks (PSTN, ISDN, PLMN) and/or via different service providers for messaging services (SMS/MMS) in fixed networks.

The present document describes the high level architecture for routing possibilities for the provision of non real-time Multimedia Messaging Services in fixed telecommunication networks between different MMSCs. Underlying specific technical solutions and their corresponding protocols are outside the scope of the present document and are described in separate specifications and standards which are based on the philosophy of adopting the existing MMS of mobile networks as far as possible. E.g. determination of the destination address should be based on TS 123 140 [2].

The present document contains a recommendation towards MMS interworking issues.

Charging principles are outside the scope of the present document.

The present document includes guidelines applicable to network operators and service providers to provide a complete service for messaging services.

The present document describes two different interworking principles as well as different scenarios to come to a final solution.

The present document does not deal with interfaces and protocols between different entities.

2 References

For the purposes of this Technical Report the following references apply:

[1] ETSI TS 102 314-1: "Fixed network Multimedia Messaging Service (F-MMS); Part 1: Overview".

[2] ETSI TS 123 140: "Universal Mobile Telecommunications System (UMTS); Multimedia Messaging Service (MMS), Functional description; Stage 2".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

carrier: licensed telecommunication company who provides telecommunication services and services for call or message routing purposes

NOTE: Therefore, a carrier has got assigned ranges of E.164 numbers.

MMS provider: organization offering MMS to a group of customers which can be also a carrier but it is not necessarily limited to carriers

portability data: unique association of an E.164 number (MSISDN), the destination carrier (MCC and MNC) and an MMS address for the destination carrier

NOTE: The carriers choose an implementation based on their need (e.g. query for each call or query on demand which requires a complete database or Onward Routing that only requires database storage of out-ported and possibly in-ported numbers) which is according to national solutions for number portability.

portability database: carrier database containing local, in-ported and out-ported E.164 numbers of interconnect partners as well as E.164 numbers ported between different carriers of the same portability region

NOTE 1: Local numbers (typically ranges) are numbers belonging to the carrier; in-ported numbers are numbers ported from another carrier inside the portability region; out-ported numbers are numbers ported to another carrier inside the portability region; interconnect partner numbers (typically ranges) are numbers belonging to interconnect carriers outside the portability region.

NOTE 2: An originating carrier stores portability status for the dialled number locally if the destination operator is in the same portability region. The originating carrier does not store portability data locally for numbers of carriers in other portability regions.

NOTE 3: Either the carrier who "looses" (donor) or the carrier who "receives" a number in a portation has the responsibility to inform the other carriers of the new destination carrier. The same applies for numbers belonging to a number block of carrier "A" which have migrate to carrier "B" and then to the carrier "C".

NOTE 4: In practical implementations a country, a number block or a group of mobile operators are examples of portability regions.

portability region: group of carriers that share portability data

NOTE 1: Number migration is only allowed inside a given portability region.

NOTE 2: Each carrier stores number ranges assigned to its interconnect partners.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

3GPP	3rd Generation Partnership Project
DB	Data Base
ENUM	Electronic NUMbering
F-MMS	Fixed network MMS
F-MMSC	Fixed network MMSC
FQDN	Fully Qualified Domain Name
HLR	Home Location Register
ID	IDentification
ISDN	Integrated Services Digital Network
MM	Multimedia Message
MM4	Interface between two MMS Relay/Server
MMS	Multimedia Messaging Service
MMSC	Multimedia Messaging Service Centre
MNP	Mobile Number Portability
MCC	Mobile County Code
MNC	Mobile Network Code
MSISDN	Mobile Station International ISDN number
NPAC	Number Portability Administration Center
OMA	Open Mobile Alliance
PLMN	Public Land Mobile Network
PSTN	Public Switched Telecommunications Networks
SMS	Short Message Service
SS7	Signalling System #7
ZMRDB	Zentrale Master Routing-DatenBank (central master routing database)

4 Assumption

The routing of MM between carriers in fixed networks (F-MMSC) can only work if each F-MMS customer - at any given time - is using only one operator for F-MMS. In all the following concepts, it is assumed that this condition is fulfilled.

The following concepts describe F-MMS address resolution variants focussed on dedicated portability regions. Within the defined portability region a direct address resolution is assumed. Addressing of recipients from outside the portability region may require MM4 hopping (relaying) by using a local MMSC as gateway as far as no suitable solutions are available across the portability regions (e.g. ENUM).

5 Solution 1 - Network Operator Database

5.1 Solution 1a - Local number database without references

5.1.1 Concept

In this solution it is assumed that F-MMS is a carrier related service and that the F-MMS service for a specific customer can only be provided by this customer's telephony access carrier.

Therefore, the already existing number database (including voice portability information) can be used as shown below:

- Local numbers.
- In-ported numbers.
- Out-ported numbers with pointers to the recipient operators.
- Numbers ported between other carriers.

NOTE: To support interworking for numbers ported from non MMS-carriers and to avoid unnecessary MM4-hops a carrier needs to know at any point in time the current carrier for a certain number.

5.1.2 Consequences for MMS providers

- The database is maintained by each local carrier.
- This concept is based on the assumption that a voice operator (carrier) controls routing information for MM transmission.
- Only local provisioning is involved; the MMS provider does not need MMS related data per number from any peer MMS provider to provision the data.

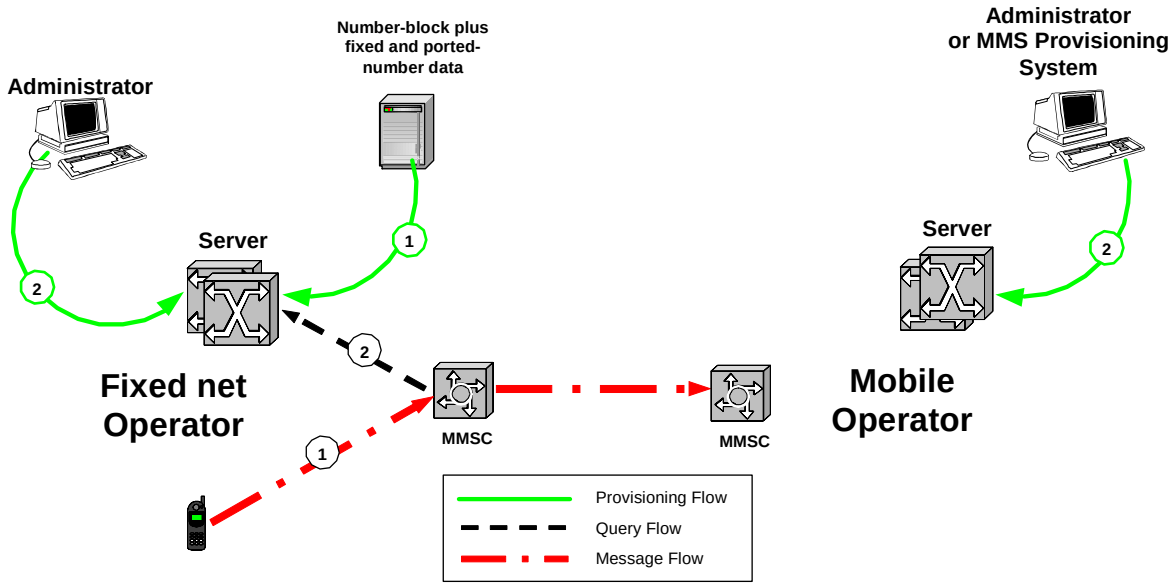

Figure 1: Example of solution 1a

5.1.3 MMS Address Resolution Logic

Address resolution is described in a two step process:

- Step A: Determine for a given E.164 number at which destination carrier does the recipient reside.
- Step B: Determine the appropriate MMS address for the destination carrier (MMSC FQDN).

Inside a portability region:

- Each MMS provider (in this case: carrier) can discover the recipient portability corrected carrier ID, issuing a query to its own portability DB, thus part a) of the problem is solved.
- Each MMS provider (in this case: carrier) can discover the MMS address associated with the recipient portability corrected carrier ID, issuing a query to its own portability DB or to the recipient carrier DB, thus part b) of the problem is solved. The MMS address could be the one of an MMSC operator's MMSC.

Outside a portability region:

- Case 1: Carrier A is in the originating region; carrier B is the recipient and is inside a region where portability is not deployed.
  - Carrier A can discover the recipient (not portability corrected) carrier ID issuing a query to its own portability DB, thus part a) of the problem is solved.
  - Carrier A can discover the MMS address associated with the recipient (not portability corrected) carrier ID, issuing a query to the recipient carrier DB, thus part b) of the problem is solved. The MMS address could be the one of an MMS provider's MMSC.
- Case 2: Carrier A is in the originating region; carrier B is the recipient and is inside a region where portability is deployed.
  - Carrier A can discover the recipient portability corrected carrier ID issuing a query to the recipient carrier DB, thus part a) of the problem is solved.
  - Carrier A can discover the MMS address associated with the recipient portability corrected carrier ID, issuing a query to the recipient carrier DB, thus part b) of the problem is solved. The MMS address could be the one of an MMS provider's MMSC.

5.1.4 Use Cases

1) Portability Region A -> Portability Region A (MMS User)

   - The sender and the recipient are customers of carriers in the same portability region. The originating MMSC after receiving the MM determines the carrier where the destination number resides from the local portability database. It statically assigns each carrier an MM4 domain name to which the MM is forwarded eventually.

2) Portability Region A -> Portability Region A (legacy service)

   - Same procedure as use case 1). The distinction between MMS capable / non-MMS capable devices on the receiver side is made in the destination MMSC rather that in the originating MMSC.

3) Portability Region A -> Portability Region B (MMS User)

   - By definition it is assumed that the originating carrier only stores portability data for the portability region it is part of. The only way to route messages to another portability region is to forward all MMS directly to a partner MMSC in portability region B to relay messages to the correct destination.

4) Portability Region A -> Portability Region B (legacy service)

   - See use case 3). Same behaviour for MMS / non-MMS devices due to the fact that no device information of the recipients are visible for the originating MMSC.

5.2 Solution 1b - Local number database with references

5.2.1 Concept

This solution is an extension of solution 1a. The essential new aspect is that the databases are open and they contain references to each other. The most important aspect of this solution is that:

- the carriers exchange address information; and
- MMS providers access each other's databases.

In a scenario where not all carriers offer MMS or they offer MMS but do not have interworking agreements with all carriers the sending MMSC takes these circumstances into consideration before submitting the message.

How the lookups in other databases are done is a matter of implementation, which depends on the technology. See the example below for details.

Possible lookup mechanisms to perform database lookups (not exhaustive):

- Lookups to a central national database for number portability.
- Lookups to all F-MMS operator's portation databases (hardly acceptable to do in the message handling).
- Lookups to a database owned by the sending carrier, containing data from all F-MMS operators or all carriers in the country.
- Lookups to databases that are not F-MMS related but are still open for F-MMS related queries even if the database belongs to a carrier not handling F-MMS.

5.2.2 Consequences for MMS providers

- The database is maintained by each local MMS provider.
- Each carrier shall provide his own local database with referral records ("references") to other carriers.
- Portability of carriers (voice operators) is reflected in changes of the referrals. Service specific information (in this case MMSC domain names) is stored in records in the local databases.

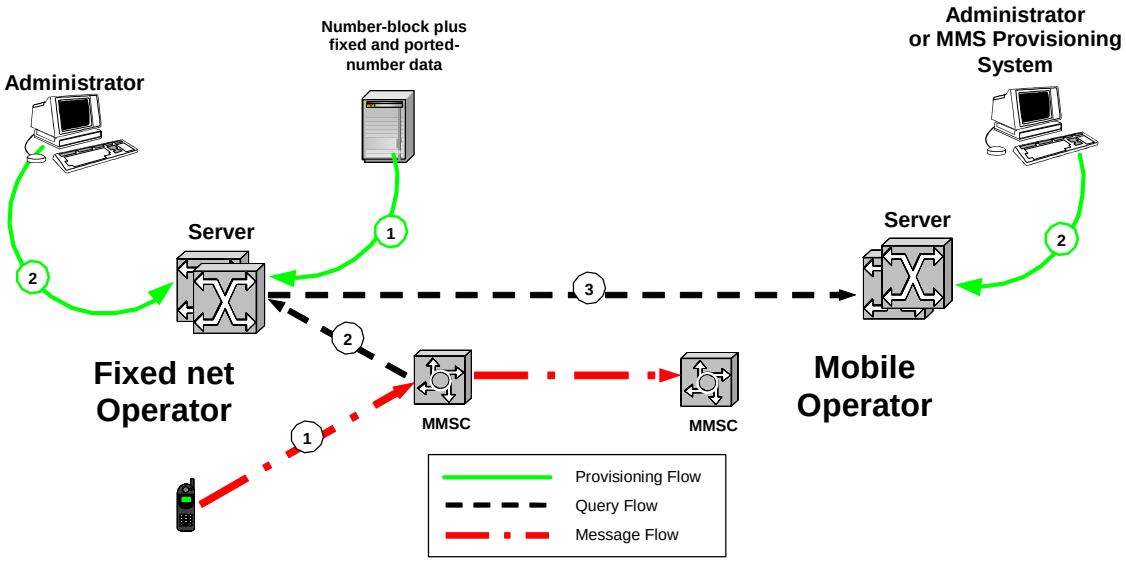

Figure 2: Example of solution 1b

5.2.3 Provisioning number database

This clause explains how the number databases are provisioned, i.e. filled with information. By using this solution, the MMS provider shall provision his own database with data he obtains from other MMS providers.

NOTE: Importantly, this does not necessarily require an exchange of all ported subscriber records.

The following options exist for provisioning accurate database references:

a) Number-block references: References for interconnect partners located in non-ported networks can be provisioned on the number-block assignment level. Accurate number-block assignment data is available for many countries/markets today from third party sources. Carriers can also choose to exchange number-block assignment data directly, if third party data sources are not available. Routing by number block is also called "static routing".

b) Local portability data - central database model: References for interconnect partners inside a given portability region can often be obtained from a centralized portability database. Examples of centralized portability databases are the NPAC database in North America and the ZMRDB database in Germany.

c) Donor network portability region: The originating carrier manually provides a reference to the database of the donor network. The donor network is then responsible for providing a referral to the correct "ported network" database in case that a number has been ported.

Paragraph b) should not be confused with having a central number database. There is a central database present, but it is NOT being directly queried here. The role of central database is only to provide a regular feed (update) of portability data of the porting region (country).

5.2.4 Agreements between MMS providers

All MMS providers in one portability region need to define a common database standard or utilize existing open standards including commercial agreements for MM routing and termination. MMS Providers outside the portability region need agreements with (at least) one MMS provider inside the portability region.

5.2.5 Use Cases

1) Portability Region A -> Portability Region A (MMS User)

   After having successfully received an MM the originating MMSC queries the local porting database for the carrier of the recipient. The carrier information tells the source MMSC where to get the MMSC address of the recipient. In other words the source MMSC queries the database of the carrier where the destination number resides to get the MMSC FQDN for that individual number. It can either refer to the MMSC domain of the carrier itself or the MMSC of a third party (e.g. a carrier independent MMS providers). Subsequently the MM is forwarded to the domain determined.

2) Portability Region A -> Portability Region A (legacy service)

   See use case 1). Same procedure for MMS / non-MMS capable devices. Legacy services depend on the destination MMSC.

3) Portability Region A -> Portability Region B (MMS User)
   (e.g. subscriber A and subscriber B reside in different countries)

   The source MMSC in portability region A does not have portability data for users of other portability regions. Therefore, MMS are relayed through a partner MMSC of portability region B for relay. The partner MMSC does address resolution and forwarding according the solution (1a, 1b or 2) present in the portability region.

4) Portability Region A -> Portability Region B (legacy service)

   See 3). No difference between legacy and MMS device.

6 Solution 2 - Shared F-MMS Subscriber Database

6.1 Concept

The following solution does not presume that F-MMS is a carrier related service. Porting of service related information is implemented with a shared database shared by all F-MMS operators within the portability region.

This solution does not exclude the usage similar to solution 1b but may also be used for data exchange with MMS providers.

Of course, this requires co-operation between the MMS providers and carriers, some agreements and involvement of the national regulators.

The database in principle includes the following data:

- Telephone number.
- F-MMS operator information.

The most important aspect of this solution is that lookups for numbers in a certain portability region are handled by a shared database.

Implementation (centralized/decentralized) of the database is out of the scope of the present document.

An originating MMSC queries the shared database for address resolution within the dedicated geographical area and then forward the message to the destination MMSC.

It may be expected that in most cases a portability region for F-MMS equate a country.

6.2 Consequences for MMS providers

All F-MMS address queries for a given portability region refer to a portability region specific shared database, shared by all MMS providers.

6.3 Use Cases

1) Portability Region A -> Portability Region A (MMS User)

   The user sends an MMS, which is transmitted to his F-MMSC (source F-MMSC).

   The source F-MMSC processes the standard address resolution to analyze, whether the MMS shall be sent to an external entity or within the portability region.

   The last case is detected.

   The source F-MMSC interrogates the shared database using the MSISDN of the recipient(s) (similar to MNP interrogation).

   The shared database provides information about the F-MMSC to which the subscriber belongs to and the source F- MMSC forwards the message via MM4 to the destination MMSC.

2) Portability Region A -> Portability Region A (Legacy Service):

   The user sends an MMS, which is transmitted to his F-MMSC (source F-MMSC).

   The source F-MMSC processes the standard address resolution to analyze, whether the MMS shall be sent to an external entity or within the portability region.

   The last case is detected.

   The source F-MMSC interrogates the shared database using the MSISDN of the recipient(s) (similar to MNP interrogation).

   The shared database does not provide information about the F-MMSC, as the user is not registered as MMS user.

   The source F-MMSC tries to provide a legacy use case to the user.

3) Portability Region A -> Portability Region B (MMS User)

   The user sends an MMS, which is transmitted to his F-MMSC (source F-MMSC).

   The source F-MMSC processes the standard address resolution to analyze, whether the MMS shall be sent to an external entity or within the portability region.

   The first case is detected.

   No direct route can be used, as the destination is also a portability region.

   The source F-MMSC sends the message to a partner F-MMSC, as far as no direct interrogation of a shared database in portability region B is possible.

   The partner F-MMSC is responsible for a proper interrogation of the shared database and forwarding to the related F-MMSC.

   The shared database of portability region B provides information about the F-MMSC to which the subscriber belongs to and the partner F-MMSC forwards the message via MM4 to the destination MMSC.

4) Portability Region A -> Portability Region B (Legacy Service)

   The user sends an MMS, which is transmitted to his F-MMSC (source F-MMSC).

The source F-MMSC processes the standard address resolution to analyze, whether the MMS shall be sent to an external entity or within the portability region.

The first case is detected.

No direct route can be used, as the destination is also a portability region.

The source F-MMSC sends the message to a partner F-MMSC, as far as no direct interrogation of a shared database in portability region B is possible.

The partner F-MMS is responsible for a proper interrogation of the shared database and forwarding to the related F-MMSC.

The shared database does not provide information about the F-MMSC, as the user is not registered as MMS user. The partner F-MMSC tries to provide a legacy use case to the user.

6.4 Example related to solution 2

As an example see figure 3. A subscriber of MMS provider A sends a message to another MM user of MMS provider B, who resides at some domain outside the MMS provider A. The local F-MMSC queries the local number database. For that recipient, the local database contains a reference to the shared database. The local F-MMSC then queries that database, obtains the recipient information, resolves the number and delivers the message.

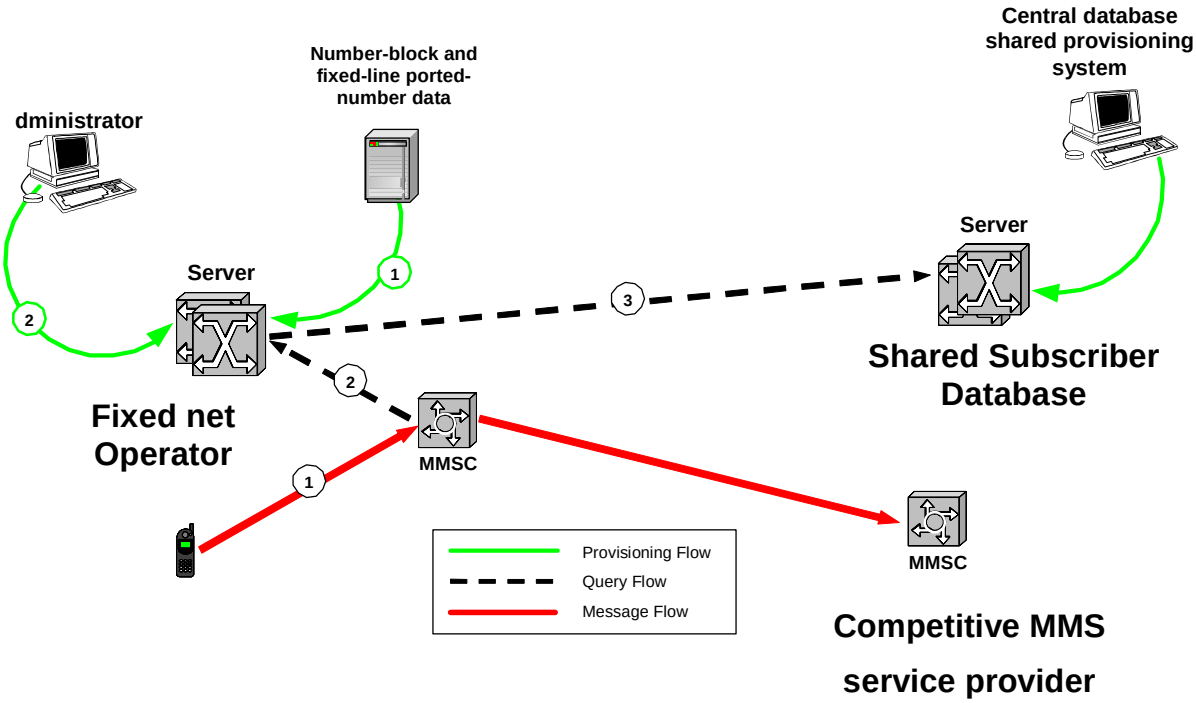

Figure 3: Example of solution 2

6.5 MMS Address Resolution Logic

The only difference with the address resolution of solution 1b is that the references do not point to another MMS provider's database but to a shared database. The returned record and the received information is the same.

7 Migration

The solutions defined here show a clear migration path. In short terms, carriers have already started with solution 1a, because it is easy to implement and only local. As a next step they may exchange database information per country or per carrier group (i.e. move to solution 1b). Introducing centralized number databases (i.e. the portability region "grows"), means migration to solution 2.

Migrating from solution 1a to solution 1b requires the carrier to start co-operating with his peer carrier and exchanging number information with them.

Migrating from solution 1b to solution 2 in a given country (which might involve non carrier MMS providers) is achieved by simply directing all queries for a given country-code (to be more specific: portability region) to the address of the shared database for that country.

8 Conclusion

Summarising, there are three solutions:

- Solution 1a - Each carrier maintains its own number database, without references and using any specific technology. In a portability region without number portability this solution provides full interconnectivity between carriers. In regions with number portability interconnectivity cannot be achieved with this solution.
- Solution 1b - Each carrier maintains its own number database, with references; the carriers exchange number portability information.
- Solution 2 - There is a shared number database per portability region / country and all MMS providers are synchronized with it.
- MMS providers are free to choose their solution, but solution 1b requires co-operation with other carriers. Solution 2 would probably be introduced per country because it involves common infrastructure, and the national regulator might be involved also.

9 Recommendation

All described scenarios in the present document are based on existing technologies and can provide proper MMS interconnections between different networks, where interworking itself is mainly dependent on bilateral agreements between the different MMS providers.

As far as applicable, routing data should be shared between MMS providers, both mobile and fixed line. Only this approach will ensure the best possible end user experience and service transparency to drive MMS overall usage.

History

Document history		
V1.1.1	March 2005	Publication