USSD Interworking Guidelines
Version 1.0
10 July 2013

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1 Introduction

1.1 Overview
This document introduces guidelines for usage of Unstructured Supplementary Service Data (USSD) inter-Public Land Mobile Network (PLMN) connections and requirements for establishing USSD interworking between PLMN operators.

1.2 Scope
This document gives guidance to USSD related issues such as addressing and routing to ensure interoperable USSD services and networks concerning interworking cases between different PLMN operators.

Definitions given in this document are considered as the prerequisites for interoperable USSD interworking scenarios.

Radio interface, core network backbone and billing issues are not in the scope of this document. Aim of this document is not to give an elementary level introduction to USSD, see for example, 3GPP TS 22.090 [1], 3GPP TS 23.090 [2] and 3GPP TS 24.090 [3] documents for this purpose.

1.3 Abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACK</td>
<td>Acknowledgment</td>
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<tr>
<td>GT</td>
<td>Global Title</td>
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<tr>
<td>HLR</td>
<td>Home Location Register</td>
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<tr>
<td>MNO</td>
<td>Mobile Network Operator</td>
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<tr>
<td>MS</td>
<td>Mobile Station</td>
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<tr>
<td>MSC</td>
<td>Mobile Switching Center</td>
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<td>MSU</td>
<td>Message Signal Unit</td>
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<tr>
<td>PLMN</td>
<td>Public Land Mobile Network</td>
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<tr>
<td>PSSR</td>
<td>Process Supplementary Service Request</td>
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<td>SCCP</td>
<td>Signalling Connection Control Part</td>
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<tr>
<td>USSD</td>
<td>Unstructured Supplementary Service Data</td>
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<tr>
<td>USSN</td>
<td>Unstructured Supplementary Service Notify</td>
</tr>
<tr>
<td>USSR</td>
<td>Unstructured Supplementary Service Request</td>
</tr>
<tr>
<td>VLR</td>
<td>Visiting Location Register</td>
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1.4 References

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<tr>
<td>[1]</td>
<td>3GPP TS 22.090</td>
<td>Unstructured Supplementary Service Data (USSD) - Stage 1</td>
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<td>[2]</td>
<td>3GPP TS 23.090</td>
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<td>[3]</td>
<td>3GPP TS 24.090</td>
<td>Unstructured Supplementary Service Data (USSD) - Stage 3</td>
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2 USSD Interworking Scenarios

Figure 1 describes how Mobile Network Operators (MNO) exchange USSD messages, whether mobile or network initiated.

<table>
<thead>
<tr>
<th>GT</th>
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<tbody>
<tr>
<td>GT 1 (USSD GW)</td>
<td>MNO A USSD Interworking service origination Global Title</td>
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<tr>
<td>GT 2 (MSC/VLR or HLR)</td>
<td>MNO A USSD Interworking service termination Global Title</td>
</tr>
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<td>GT 3 (MSC/VLR or HLR)</td>
<td>MNO B USSD Interworking service termination Global Title</td>
</tr>
<tr>
<td>GT 4 (USSD GW)</td>
<td>MNO B USSD Interworking service origination Global Title</td>
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Figure 1: USSD Interworking overview

Basic idea for USSD interworking is to exchange USSD related Signalling Connection Control Part (SCCP) Message Signal Units (MSU) using separate Global Titles (GT) for USSD service origination and termination. In the example above, MNO A uses GT 1 for USSD service origination and GT 2 for USSD service termination. Analogously, MNO B uses GT 3 for USSD service termination and GT 4 for USSD service origination.

Reason behind using two (2) separate GTs is for the MNO’s ability to actually count the MSUs exchanged for either mobile or network intiated USSD service so that the interworking service can be charged.

USSD Interworking service origination GT is presumably always USSD Gateway (GW), while the USSD Interworking service termination GT is presumably either Mobile Switching Center/ Visiting Location Register (MSC/VLR) or Home Location Register (HLR).
2.1 Network Initiated USSD Interworking

Figure 2 describes the Network Initiated USSD interworking with MSC/VLR included.

Figure 2: Network Initiated USSD Interworking - MSC/VLR

Figure 3 describes the Network Initiated USSD interworking with HLR included.

Figure 3: Network Initiated USSD Interworking - HLR
Clarification of Figure 2 and Figure 3 (specific application triggers a network initiated USSD session to a mobile user):

1. Application hosted on the USSD GW sends out a Unstructured Supplementary Service Request (USSR) to mobile user located in MNO B.
2. USSR origination is the GT of MNO A USSD GW.
3. USSR goes through the MNO A SCCP signalling provider to MNO B SCCP signalling provider.
4. USSR reaches MNO B and terminates on the destination GT that is, MSC/VLR or HLR and finally on the Mobile Station (MS) of the mobile user.
5. When the mobile user replies, USSR Acknowledgement (ACK) travels the same way back as described above.
6. Entire process of exchanging USSR and USSR ACK messages is repeatable and depends on network timers or length of the USSD session or user preference.
7. Final message going from the application that initiated the USSD session is Unstructured Supplementary Service Notify (USSN), with which the application sends the final USSD message to the mobile user and terminates the session.
8. When the mobile user acknowledges end of session it sends out USSN ACK to the application.

NOTE: Figure 2 and Figure 3 have been somewhat simplified.

2.2 Mobile Initiated USSD Interworking

Figure 4 describes the Mobile Initiated USSD interworking with MSC/VLR included.

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**Figure 4: Mobile Initiated USSD Interworking - MSC/VLR**
Figure 5 describes the Mobile Initiated USSD interworking with HLR included.

![Diagram of Mobile Initiated USSD Interworking - HLR](image-url)

**Figure 5: Mobile Initiated USSD Interworking - HLR**

Clarification of Figure 4 and Figure 5 (user triggers the USSD session by using a USSD service code):

1. Mobile user initiates the USSD session by utilizing the USSD service code (for example, *222#).
2. MNO B sends a Process Unstructured Supplementary Service Request (PSSR) towards its SCCP signalling provider.
3. PSSR reaches MNO A and terminates on the destination GT that is, USSD GW.
4. When the application hosted on the USSD GW replies with USSR, the signalling MSU travels the same way as PSSR above.
5. At this moment the application hosted at the USSD GW and the mobile user enter into a repeatable process of exchanging USSR and USSR ACK signalling messages.
6. Final message going from the application hosted on the USSD GW is PSSR ACK, with which the application sends the final USSD message to the mobile user and terminates the session.

**Note:** Figure 4 and Figure 5 have been somewhat simplified.

### 3 Assignment and implementation of USSD service codes

For the mobile user to be able to initiate a USSD session, he needs to know the USSD service code for example *222#. These codes need to be known to both PLMN networks that will establish a USSD interworking relationship, so they know where to route a mobile initiated USSD request with a specific service code.

3GPP document TS 22.090 **Error! Reference source not found.** defines that codes from 100 - 149 are to be used by the home PLMN for internal services. This leaves all other service codes free to use for the interworking relationship.
4 Requirements for USSD Interworking

For the PLMN networks to be able to exchange USSD interworking traffic, they need to implement the following:

- USSD in their networks (phase 2 to be able to support network initiated USSD)
- Exchange information regarding the USSD service origination and termination GT’s
- Assign and implement the USSD short codes that will be used for the USSD interworking

5 Instructions for completing the IR.21 document

In order to provide all information needed for USSD interworking, MNOs should provide USSD GW information in IR.21 “Network Elements Information” part, Section ID: 13.

6 Conclusion

Successful interworking is crucial for better worldwide adoption of USSD. There is a huge potential for the use of USSD, but the PLMN networks haven’t really utilized it for other services other than internal services.

USSD Interworking guidelines should outline and help PLMN networks to establish USSD service between themselves in a more easier fashion.
Document Management

Document History

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Other Information

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<td>Editor / Company</td>
<td>Renata Đurić / Infobip Tomislav Gojević / Infobip</td>
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