

Unstructured Supplementary Services Data (USSD)- A Detailed Overview

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1. Introduction to USSD

GSM Recommendation 02.90 describes Unstructured Supplementary Service Data (USSD) messages between a mobile station and the HLR. USSD provides an ideal way for subscribers to request changes to their class of service or to request that enhanced services are performed.

The advantages of USSD message for these purposes include the following:

- Flexibility

There is considerable flexibility both in terms of the length and content of the message. USSD makes use of all the digits plus the * and # characters.

Formatting of USSD messages (the parameters) can be summarized as follows:

- An asterisk is used to separate each of the parameters
- A service code of 2 or 3 digits is entered
- Supplementary information can then be entered. This may be of variable length.

As an example, a Personal Identification Number may be used as a measure of security.

- The # key terminates a request.

A valid USSD message request may, therefore, look something like this:

*14*123*123456789#

- Ease of Use

Creating and sending a USSD message is as easy as making a call. Indeed, most handsets allow a subscriber to store USSD strings under quick dial keys.

Creating a USSD message can be easier than creating a mobile originating short message.

- Seamless Roaming

Because messages can be exchanged with the Home Location Register (HLR), subscribers can send USSD messages back to your network even when they are roaming on other networks. Providing the visited network supports the necessary functionality, USSD provides a way of delivering value added services to your subscribers seamlessly - even when they are roaming and as such, USSD provides an alternative to CAMEL.

2. USSD and the HLR

The fact that USSD messages may terminate in the HLR (Home Location Register) has several disadvantages including the following:

- Cost

An HLR is an expensive platform on which to implement enhanced services. Commercial computing platforms provide significant cost savings, in terms of capital, service development and service enhancements.

- Time-to-Market

Experience shows that extending the functionality of an HLR is a slow process. Developing and deploying new services on commercial computing platforms is generally acknowledged to be significantly quicker.

- Capacity Considerations

Although HLRs necessarily support a high throughput of signaling messages, the interfaces on the other side of an HLR typically have less capacity and this is often loaded with provisioning traffic.

- Exhaustive Testing

Any changes to a mission critical application like an HLR need to be exhaustively tested. The last thing you want to do is to have to regression test your HLR every time you introduce or make a minor change to a USSD based enhanced service.

3. Routing of Messages to Multiple External Applications

3.1 A Clearly Defined Upgrade Path

USSD messages can trigger services provided by a wide variety of systems including the following:

- Information Providers Hosts

- Existing Applications such as voice mail
- Automated Customer Care and Billing Systems

Although you may only wish to implement one type of service initially, it is important that a USSD gateway is capable of supporting multiple External Applications. It is also important to be able to migrate USSD traffic easily from one External Application to another to provide an upgrade path.

3.2 Routing by Service Code

Despite its use of the term "unstructured", GSM recommendation 02.90 provides optional rules for the formatting of USSD messages. These can be summarized as follows, although the original recommendations should be referred to for a complete description:

- A start indicator of between 1 and 3 characters selected from the set * and #
- Service Code (SC) of 2 or 3 digits - you choose what each code means.
- A separator character *
- Supplementary Information (SI) of Variable Length.

You define what this part of the message means. You might wish for example to include a Personal Identification Number (PIN) in certain requests for security purposes.

- # to indicate the end of the message.

3.3 Additional Data Accompanying the USSD

In addition to passing the USSD message to the external application, the USSD Gateway also passes the following associated data:-

- The originating subscriber's MSISDN

This is clearly essential for the External Application to respond to the correct subscriber.

- The number of the HLR which handled the USSD

This can be useful if the USSD message is a request to change class of service.

- The originating subscriber's IMSI (optional)

This provides an alternative method of identifying the subscriber which may be more convenient for certain applications, for example, those relating to billing.

- The VLR Number (Optional)

This could be relevant to certain types of location dependent enhanced service.

The USSD Gateway thus provides External Applications with sufficient information to perform a wide range of enhanced services.

3.4 Reliable Data Communications

Messages are communicated to External Applications via an interface with data communications over TCP/IP.

4. Overview

4.1 Sequence of Operations

USSD provides an ideal way for subscribers to request changes to their class of service or to request that enhanced services are performed. To achieve this, the sequence of operations is as follows:-

- A Subscriber sends a mobile originating USSD message
- The USSD message is routed to the subscriber's HLR in accordance with the GSM recommendations
- The HLR forwards the USSD message to the USSD Gateway
- The USSD Gateway communicates the message to external applications using TCP/IP - a protocol which is more convenient for integration with commercial computing platforms.
- The external system interprets the message and, where appropriate, performs the value added service indicated by the content of the message.
- Within a time-out period, the external system acknowledges successful receipt of the message to the mobile via the USSD Gateway. The external system can later asynchronously send further information to the mobile as a Short Message via an SMS.

Not all GSM mobile network equipment manufacturers currently support USSD.

4.2 Why USSD?

The inevitable question from network operators is "what does USSD offer that cannot be achieved with MO-SMS?"

In summary, the key benefits of USSD are:

- Easy to use.

Keying a digit string can be easier for a user than formatting a short message. Strings may be stored under abbreviated dial keys on the handset.

- USSD messages are very flexible in both length and content.
- Almost all handsets can send USSD messages (* and # need to be available) whereas many existing handsets do not support MO SM. In many markets this means the population addressable with these services are hugely increased.
- USSD is faster than MO-SMS.
- Roaming supported. Because messages are exchanged with your HLR, services are still available when roaming.
- Service access codes and service names may be downloaded to the handset using Over the Air Programming. This makes it even easier for the user to get started.

There are a number of differences between MO-SMS and USSD:

USSD is not store and forward, and does not offer retries, so it is simpler and faster than SMS. Clearly, the service does not offer guaranteed delivery, but any failures are reported back to the originator.

Against this, USSD should achieve many times the speed of SMS due to its simplicity and much-reduced reliance on non-volatile storage. In addition, it offers a simple TCP/IP interface to external applications, which need know nothing of the SS7 network. Routing to applications is achieved via a simple service code which is contained in the USSD message. The interpretation of the Service Code is achieved by configuration of the USSD Gateway and by the actions of the External Application to which the Service Code relates. The External Applications can be on any machine reachable by a TCP/IP network.

5. Frequently asked Questions

Q What do I see on my handset?

A That depends on the response that the External Application passes back when it acknowledges the request. It may contain text (e.g. "OK", or the answer to your query), which will be displayed. In the case of errors, the handset normally displays "command error", "network problem" or "unknown application".

Q How long does a request take?

A That depends on how long the External Application takes to respond. Typical times at SmarTone were about 4 seconds, although on Phase 2 handsets, the requests took longer (presumably because they were negotiating down to Phase 1).

Q Can I send a USSD request whilst I'm making a call?

A Yes.

Q Can I make a call whilst waiting for the response from a USSD request?

A Yes.

Q Can I use USSD when I'm roaming?

A Yes, if there is a roaming agreement.

Q Can I send more than one USSD request at once?

A No.

Q What happens if I go out of coverage before I receive the response?

A The handset displays "network problem". The USSD gateway does not try to resend the response if the user comes back into coverage. For this reason, it is recommended that External Applications send the information requested in Short Messages, which will be retried.

Q Can I send a Short Message whilst I'm waiting for a USSD request to be acknowledged?

A No. USSD uses the same channel as SMS.

Q Can I receive a Short Message whilst I'm waiting for a USSD request to be acknowledged?

A Probably not until the acknowledgement has been received. In tests, the handset beeped twice in quick succession, once for the USSD response, once for the SM. The SM could only be viewed by selecting the "Read messages" option from the handset (as the screen was displaying the USSD response).

Q What is the maximum amount of USSD data possible?

A In theory 200 characters ASCII, although in practice at SmarTone, the limit can be 196 or 197.

Q Billing?

A The USSD gateway generates traffic events for successful and failed USSD requests which can be used for billing purposes.

Q What can it be used for?

A Anything - provided you can write an External Application to do it. The USSD gateway will only pass on requests and send back immediate responses, but External Applications can be written to submit Short Messages containing more information either immediately or at a later date, or send faxes, emails - or even flowers.