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URI Scheme for Global System for Mobile Communications (GSM) Short Message Service (SMS)

Abstract

This memo specifies the Uniform Resource Identifier (URI) scheme "sms" for specifying one or more recipients for an SMS message. SMS messages are two-way paging messages that can be sent from and received by a mobile phone or a suitably equipped networked device.

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1. Introduction

1.1. What is GSM?

GSM (Global System for Mobile Communications) is a digital mobile phone standard that is used extensively in many parts of the world. First named after its frequency band around 900 MHz, GSM-900 has provided the basis for several other networks utilizing GSM technology, in particular, GSM networks operating in the frequency bands around 1800 MHz and 1900 MHz. When referring to "GSM" in this document, we mean any of these GSM-based networks that operate a short message service.

1.2. What is SMS?

The Short Message Service (SMS) [SMS] is an integral part of the GSM network technology. It has been very successful and currently is a major source of revenue for many GSM operators. SMS as a service is so successful that other Global Switched Telephone Network (GSTN) technologies have adopted it as well, in particular, the Integrated Services Digital Network (ISDN). Because of this development, this memo uses the term "SMS client" to refer to user agents that are able to send and/or receive SMS messages.

1.2.1. SMS Content

GSM SMS messages are alphanumeric paging messages that can be sent to and from SMS clients. SMS messages have a maximum length of 160 characters (7-bit characters from the GSM character set [SMS-CHAR]), or 140 octets. Other character sets (such as UCS-2 16-bit characters, resulting in 70-character messages) MAY also be supported [SMS-CHAR], but are defined as being optional by the SMS specification. Consequently, applications handling SMS messages as part of a chain of character-processing applications MUST make sure that character sets are correctly mapped to and from the character set used for SMS messages.

While the 160-character content type for SMS messages is by far the one most widely used, there are numerous other content types for SMS messages, such as small bitmaps ("operator logos") and simple formats for musical notes ("ring tones"). However, these formats are proprietary and are not considered in this memo.

SMS messages are limited in length (140 octets), and the first versions of the SMS specification did not specify any standardized methods for concatenating SMS messages. As a consequence, several proprietary methods were invented, but the current SMS specification does specify message concatenation. In order to deal with this

situation, SMS clients composing messages SHOULD use the standard concatenation method based on the header in the TP-User Data field as specified in the SMS specification [SMS]. When sending a message to an SMS recipient whose support for concatenated messages is unknown, the SMS client MAY opt to use the backwards-compatible (text-based) concatenation method defined in the SMS specification [SMS]. Proprietary concatenation methods SHOULD NOT be used except in closed systems, where the capabilities of the recipient(s) are always known.

1.2.2. SMS Infrastructure

SMS messages can be transmitted over an SMS client's network interface using the signaling channels of the underlying GSTN infrastructure, so there is no delay for call setup. Alternatively, SMS messages may be submitted through other front-ends (for example, Web-based services), which makes it possible for SMS clients to run on computers that are not directly connected to a GSTN network supporting SMS.

SMS messages sent with the GSTN SMS service MUST be sent as class 1 SMS messages, if the client is able to specify the message class.

1.2.2.1. SMS Centers

For delivery within GSTN networks, SMS messages are stored by an entity called SMS Center (SMSC) and sent to the recipient when the subscriber connects to the network. The number of a cooperative SMSC must be known to the SMS sender (i.e., the entity submitting the SMS message to a GSTN infrastructure) when sending the message (usually the SMSC's number is configured in the SMS client and specific for the network operator to which the sender has subscribed). In most situations, the SMSC number is part of the sending SMS client's configuration. However, in some special cases (such as when the SMS recipient only accepts messages from a certain SMSC), it may be necessary to send the SMS message over a specific SMSC. The scheme specified in this memo does not support the specification of SMSC numbers, so in case of scenarios where messages have to be sent through a certain SMSC, there must be some other context establishing this requirement or message delivery may fail.

1.2.3. Uniform Resource Identifiers

One of the core specifications for identifying resources on the Internet is [RFC3986], specifying the syntax and semantics of a Uniform Resource Identifier (URI). The most important notion of URIs are "schemes", which define a framework within which resources can be uniquely identified and addressed. URIs enable users to access resources and are used for very diverse schemes, such as access

protocols (HTTP, FTP), broadcast media (TV channels [RFC2838]), messaging (email [RFC2368]), and even telephone numbers (voice [RFC3966]).

URIs often are mentioned together with Uniform Resource Names (URNs) and/or Uniform Resource Locators (URLs), and it often is unclear how to separate these concepts. For the purpose of this memo, only the term URI will be used, referring to the most fundamental concept. The World Wide Web Consortium (W3C) has issued a note [uri-clarification] discussing the topic of URIs, URNs, and URLs in detail.

1.2.4. SMS Messages and the Internet

One of the important reasons for the universal access of the Web is the ability to access all information through a unique interface. This kind of integration makes it easy to provide information as well as to consume it. One aspect of this integration is the support of user agents (in the case of the Web, commonly referred to as browsers) for multiple content formats (such as HTML, GIF, JPEG) and access schemes (such as HTTP, HTTPS, FTP).

The "mailto" scheme has proven to be very useful and popular because most user agents support it by providing an email composition facility when the user selects (e.g., clicks on) the URI. Similarly, the "sms" scheme can be supported by user agents by providing an SMS message composition facility when the user selects the URI. In cases where the user agent does not provide a built-in SMS message composition facility, the scheme could still be supported by opening a Web page that provides such a service. The specific Web page to be used could be configured by the user, so that each user could use the SMS message composition service of his choice.

The goal of this memo is to specify the "sms" URI scheme so that user agents (such as Web browsers and email clients) can start to support it. The "sms" URI scheme identifies SMS message endpoints as resources. When "sms" URIs are dereferenced, implementations MAY create a message and present it to be edited before being sent, or they MAY invoke additional services to provide the functionality necessary for composing a message and sending it to the SMS message endpoint. In either case, simply activating a link with an "sms" URI SHOULD NOT cause a message to be sent without prior user confirmation.

1.2.4.1. SMS Messages and the Web

SMS messages can provide an alternative to "mailto" URIs [RFC2368], or "tel" or "fax" URIs [RFC3966]. When an "sms" URI is activated, the user agent MAY start a program for sending an SMS message, just as "mailto" may open a mail client. Unfortunately, most browsers do not support the external handling of internally unsupported URI schemes in the same generalized way as most of them support external handling of content for media types that they do not support internally. Ideally, user agents should implement generic URI parsers and provide a way to associate unsupported schemes with external applications (or Web-based services).

The recipient of an SMS message need not be a mobile phone. It can be a server that can process SMS messages, either by gatewaying them to another messaging system (such as regular electronic mail), or by parsing them for supplementary services.

SMS messages can be used to transport almost any kind of data (even though there is a very tight size limit), but the only standardized data formats are character-based messages in different character encodings. SMS messages have a maximum length of 160 characters (when using 7-bit characters from the SMS character set), or 140 octets. However, SMS messages can be concatenated to form longer messages. It is up to the user agent to decide whether to limit the length of the message, and how to indicate this limit in its user interface if necessary. There is one exception to this; see Section 2.6.

1.2.4.2. SMS Messages and Forms

The Hypertext Markup Language (HTML) [HTML401] provides a way to collect information from a user and pass it to a server for processing. This functionality is known as "HTML forms". A filled-in form is usually sent to the destination using the Hypertext Transfer Protocol (HTTP) or email. However, SMS messages can also be used as the transport mechanism for these forms. Depending on the network configuration, the sender's telephone number may be included in the SMS message, thus providing a weak form of authentication.

1.3. Requirements Language

The capitalized key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2. The "sms" URI Scheme

Syntax definitions are given using the Augmented BNF (ABNF) for syntax specifications [RFC5234].

2.1. Applicability

This URI scheme provides information that can be used for sending SMS message(s) to specified recipient(s). The functionality is comparable to that of the "mailto" URI, which (as per [RFC2368]) can also be used with a comma-separated list of email addresses.

The notation for phone numbers is taken from [RFC3966] and its Erratum 203 [Err203]. Appendix A provides a corrected syntax of the telephone number. Refer to that document for information on why this particular format was chosen.

How SMS messages are sent to the SMSC or other intermediaries is outside the scope of this specification. SMS messages can be sent over the GSM air interface by using a modem and a suitable protocol or by accessing services over other protocols, such as a Web-based service for sending SMS messages. Also, SMS message service options like deferred delivery and delivery notification requests are not within the scope of this document. Such services MAY be requested from the network by the user agent if necessary.

SMS messages sent as a result of this URI MUST be sent as class 1 SMS messages, if the user agent is able to specify the message class.

2.2. Formal Definition

The URI scheme's keywords specified in the following syntax description are case-insensitive. The syntax of an "sms" URI is formally described as follows, where the URI base syntax is taken from [RFC3986]:

```
sms-uri        = scheme ":" sms-hier-part [ "?" sms-fields ]
scheme         = "sms"
sms-hier-part  = sms-recipient *( "," sms-recipient )
sms-recipient  = telephone-subscriber ; defined in RFC 3966
sms-fields     = sms-field *( "&" sms-field )
sms-field      = sms-field-name "=" escaped-value
sms-field-name = "body" / sms-field-ext ; "body" MUST only appear once
sms-field-ext  = 1*( unreserved )
escaped-value  = *( unreserved / pct-encoded ) ; defined in RFC 3986
```

Some illustrative examples using this syntax are given in Section 2.5.

The syntax definition for <telephone-subscriber> is taken from Section 5.1 of [RFC3966]. Please consider Erratum 203 [Err203] in that specification. For the reader's convenience, Appendix A contains a fixed syntax of the telephone number URI scheme, including Erratum 203, but RFC 3966 (plus all applicable errata) is the normative reference. The description of phone numbers in RFC 3966 (Section 5.1) states: "The 'telephone-subscriber' part of the URI indicates the number. The phone number can be represented in either global (E.164) or local notation. All phone numbers MUST use the global form unless they cannot be represented as such. Numbers from private numbering plans, emergency ("911", "112"), and some directory-assistance numbers (e.g., "411") and other "service codes" (numbers of the form N11 in the United States) cannot be represented in global (E.164) form and need to be represented as a local number with a context. Local numbers MUST be tagged with a 'phone-context'."

This specification defines a single <sms-field>: "body". Extensions to this specification MAY define additional fields. Extensions MUST NOT change the semantics of the specifications they are extending. Unknown fields encountered in "sms" URIs MUST be ignored by implementations.

The "body" <sms-field> is used to define the body of the SMS message to be composed. It MUST not appear more than once in an "sms" URI. It consists of percent-encoded UTF-8 characters. Implementations MUST make sure that the "body" <sms-field> characters are converted to a suitable character encoding before sending, the most popular being the 7-bit SMS character encoding, another variant (though not as universally supported as 7-bit SMS) is the UCS-2 character encoding (both specified in [SMS-CHAR]). Implementations MAY choose to discard (or convert) characters in the <sms-body> that are not supported by the SMS character set they are using to send the SMS message. If they do discard or convert characters, they MUST notify the user.

The syntax definition for <escaped-value> refers to the text of an SMS where all <reserved> (as per [RFC3986]) characters in the SMS text are percent-encoded, please refer to [RFC3986] for the definitions of <unreserved> and <pct-encoded> and for details about percent-encoding.

User agents SHOULD support multiple recipients and SHOULD make it clear to users what the entire list of recipients is before committing the user to sending all the messages.

2.3. Processing an "sms" URI

The following list describes the steps for processing an "sms" URI:

1. The phone number of the first <sms-recipient> is extracted. It is the phone number of the final recipient and it MUST be written in international form with country code, unless the number only works from inside a certain geographical area or a network. Note that some numbers may work from several networks but not from the whole world -- these SHOULD be written in international form. According to [RFC3966], all international numbers MUST begin with a "+" character. Hyphens, dots, and parentheses (referred to as "visual separators" in RFC 3966) are used only to improve readability and MUST NOT convey any other meaning.

2. The "body" <sms-field> is extracted, if present.

3. The user agent SHOULD provide some means for message composition, either by implementing this itself or by accessing a service that provides it. Message composition SHOULD start with the body extracted from the "body" <sms-field>, if present.

4. After message composition, a user agent SHOULD try to send the message first using the default delivery method employed by that user agent. If that fails, the user agent MAY try another delivery method.

5. If the URI contains a comma-separated list of recipients (i.e., it contains multiple <sms-recipient> parts), all of them are processed in this manner. Exactly the same message SHOULD be sent to all of the listed recipients, which means that the message resulting from the message composition step for the first recipient is used unaltered for all other recipients as well.

2.4. Comparing "sms" URIs

Two "sms" URIs are equivalent according to the following rules. Since the definition of the <telephone-subscriber> is taken from [RFC3966], equivalence of individual values of <telephone-subscriber> is based on the rules defined in Section 4 of [RFC3966], repeated here for convenience:

- Both must be either a <local-number> or a <global-number<, i.e., start with a "+".

- The <global-number-digits> and the <local-number-digits> must be equal, after removing all visual separators.

- For mandatory additional parameters and the <phone-context> and <extension> parameters defined in [RFC3966], the <phone-context> parameter value is compared either as a host name if it is a <domainname> or digit-by-digit if it is <global-number-digits>. The latter is compared after removing all <visual-separator> characters.

- Parameters are compared according to <pname>, regardless of the order they appeared in the URI. If one URI has a parameter name not found in the other, the two URIs are not equal.

- URI comparisons are case-insensitive.

Since "sms" URIs can contain multiple <telephone-subscriber>s as well as <sms-fields>, in addition to adopting the rules defined for comparing <telephone-subscriber>s as defined by [RFC3966], two "sms" URIs are only equivalent if their <sms-fields> are identical, and if all <telephone-subscriber>s, compared pairwise as a set (i.e., without taking sequence into consideration), are equivalent.

2.5. Examples of Use

```
sms:+15105550101
```

This indicates an SMS-message-capable recipient at the given telephone number. The message is sent using the user agent's default SMS delivery method.

```
sms:+15105550101,+15105550102
```

This indicates SMS-message-capable recipients at the given telephone numbers. The identical message should be sent to both recipients using the user agent's default SMS delivery method.

```
sms:+15105550101?body=hello%20there
```

In this case, a message (initially being set to "hello there", which may be modified by the user before sending) will be sent via SMS using the user agent's default SMS delivery method.

2.6. Using "sms" URIs in HTML Forms

When using an "sms" type URI as an action URI for HTML form submission [HTML401], the form contents MUST be packaged in the SMS message just as they are packaged when using a "mailto" URI [RFC2368], using the "application/x-www-form-urlencoded" media type (as defined by HTML [HTML401]), effectively packaging all form data into URI-compliant syntax [RFC3986]. The SMS message MUST NOT

contain any HTTP header fields, only the form data. The media type is implicit. It MUST NOT be transferred in the SMS message. Since the SMS message contains the form field values, the body <sms-field> of an "sms" type URI used for an HTML form will be ignored.

The character encoding used for form submissions MUST be UTF-8 [RFC3629]. It should be noted, however, that user agents MUST percent-encode form submissions before sending them (this encoding is specified by the URI syntax [RFC3986]).

The user agent SHOULD inform the user about the possible security hazards involved when submitting the form (it is probably being sent as plain text over an air interface).

If the form submission is longer than the maximum SMS message size, the user agent MAY either concatenate SMS messages, if it is able to do so, or it MAY refuse to send the message. The user agent MUST NOT send out partial form submissions.

3. URI Scheme Registration

This memo requests the registration of the Uniform Resource Identifier (URI) scheme "sms" for specifying one or more recipients for an SMS message. The registration request complies with [RFC4395].

3.1. URI Scheme Name

sms

3.2. Status

Permanent

3.3. URI Scheme Syntax

See Section 2.

3.4. URI Scheme Semantics

The "sms" URI scheme defines a way for a message to be composed and then transmitted using the SMS message transmission method. This scheme can thus be compared to be "mailto" URI scheme [RFC2368]. See Section 2.3 for the details of operation.

3.5. Encoding Considerations

The optional body field of "sms" URIs may contain a message text, but this text uses percent-encoded UTF-8 characters and thus can always be represented using URI characters. See Section 2 for the details of encoding.

3.6. Applications/Protocols That Use This URI Scheme Name

The "sms" URI scheme is intended to be used in a similar way as the "mailto" URI scheme [RFC2368]. By using "sms" URIs, authors can embed information into documents that can be used as a starting point for initiating message composition. Whether the client is sending the message itself (for example, over a GSM air interface) or redirecting the user to a third party for message composition (such as a Web service for sending SMS messages) is outside of the scope of the URI scheme definition.

3.7. Interoperability Considerations

No interoperability issues have been identified.

3.8. Security Considerations

See Section 4.

3.9. Contact

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4. Security Considerations

SMS messages are transported without any provisions for privacy or integrity, so SMS users should be aware of these inherent security problems of SMS messages. Unlike electronic mail, where additional mechanisms exist to layer security features on top of the basic infrastructure, there currently is no such framework for SMS messages.

SMS messages very often are delivered almost instantaneously (if the receiving SMS client is online), but there is no guarantee for when SMS messages will be delivered. In particular, SMS messages between

different network operators sometimes take a long time to be delivered (hours or even days) or are not delivered at all, so applications SHOULD NOT make any assumptions about the reliability and performance of SMS message transmission.

In most networks, sending SMS messages is not a free service. Therefore, SMS clients MUST make sure that any action that incurs costs is acknowledged by the end user, unless explicitly instructed otherwise by the end user. If an SMS client has different ways of submitting an SMS message (such as a Web service and a phone line), then the end user MUST have a way to control which way is chosen.

SMS clients often are limited devices (typically mobile phones), and the sending SMS client SHOULD NOT make any assumptions about the receiving SMS client supporting any non-standard services, such as proprietary message concatenation or proprietary content types. However, if the sending SMS client has prior knowledge about the receiving SMS client, then he MAY use this knowledge to compose non-standard SMS messages.

There are certain special SMS messages defined in the SMS specification [SMS] that can be used, for example, to turn on indicators on the phone display or to send data to certain communication ports (comparable to UDP ports) on the device. Certain proprietary systems (for example, the Wireless Application Protocol [WAP]) define configuration messages that may be used to reconfigure the devices remotely. Any SMS client SHOULD make sure that malicious use of such messages is not possible, for example, by filtering out certain SMS User Data header fields. Gateways that accept SMS messages (e.g., in email messages or Web forms) and pass them on to an SMSC SHOULD implement this kind of "firewalling" approach as well.

Because of the narrow bandwidth of the SMS communications channel, there should also be checks in place for excessively long concatenated messages. As an example, it may take two minutes to transfer thirty concatenated text messages.

Unchecked input from a user MUST NOT be used to populate any other fields in an SMS message other than the User Data field (not including the User Data header field). All other parts, including the User Data header, of the short message should only be generated by trusted means.

By including "sms" URIs in unsolicited messages (a.k.a. "spam") or other types of advertising, the originator of the "sms" URIs may attempt to reveal an individual's phone number and/or to link the identity (i.e., email address) used for messaging with the identity (i.e., phone number) used for the mobile phone. This attempt to

collect information may be a privacy issue, and user agents may make users aware of that risk before composing or sending SMS messages. Users agents that do not provide any feedback about this privacy issue make users more vulnerable to this kind of attack.

A user agent SHOULD NOT send out SMS messages without the knowledge of the user because of associated risks, which include sending masses of SMS messages to a subscriber without his consent, and the costs involved in sending an SMS message.

As suggested functionality, the user agent MAY offer a possibility for the user to filter out those phone numbers that are expressed in local format, as most premium-rate numbers are expressed in local format, and because determining the correct local context (and hence the validity of the number to this specific user) may be very difficult.

When using "sms" URIs as targets of forms (as described in Section 2.6), the user agent SHOULD inform the user about the possible security hazards involved when submitting the form (it is probably being sent as plain text over an air interface).

5. IANA Considerations

IANA has registered the "sms" URI scheme, using the template in Section 3, in accordance with [RFC4395].

6. Acknowledgements

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Appendix A. Syntax of 'telephone-subscriber'

The following syntax is reproduced from Section 3 of [RFC3966]. It defines the <telephone-subscriber> part used in the "sms" URI scheme syntax. Please note that it includes Erratum 203 [Err203] for RFC 3966, which changes the definition of <isdn-subaddress>.

```
telephone-subscriber = global-number / local-number
global-number        = global-number-digits *par
local-number         = local-number-digits *par context *par
par                  = parameter / extension / isdn-subaddress
isdn-subaddress      = ";isub=" 1*paramchar
extension            = ";ext=" 1*phonedigit
context              = ";phone-context=" descriptor
descriptor           = domainname / global-number-digits
global-number-digits = "+" *phonedigit DIGIT *phonedigit
local-number-digits  =
   *phonedigit-hex (HEXDIG / "*" / "#")*phonedigit-hex
domainname           = *( domainlabel "." ) toplabel [ "." ]
domainlabel          = alphanum
                       / alphanum *( alphanum / "-" ) alphanum
toplabel             = ALPHA / ALPHA *( alphanum / "-" ) alphanum
parameter            = ";" pname ["=" pvalue ]
pname                = 1*( alphanum / "-" )
pvalue               = 1*paramchar
paramchar            = param-unreserved / unreserved / pct-encoded
unreserved           = alphanum / mark
mark                 = "-" / "_" / "." / "!" / "~" / "*" /
                       "'" / "(" / ")"
pct-encoded          = "%" HEXDIG HEXDIG
param-unreserved     = "[" / "]" / "/" / ":" / "&" / "+" / "$"
phonedigit           = DIGIT / [ visual-separator ]
phonedigit-hex       = HEXDIG / "*" / "#" / [ visual-separator ]
visual-separator     = "-" / "." / "(" / ")"
alphanum             = ALPHA / DIGIT
```

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