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The tel URI for Telephone Calls

Status of this Memo

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Contents

Abstract

This document specifies the URI (Uniform Resource Identifier) scheme “tel”. The “tel” URI describes resources identified by telephone numbers.

1 Terminology

In this document, the key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” are to be interpreted as described in RFC 2119 [1] and indicate requirement levels for compliant implementations.

2 Introduction

This document defines the URI scheme “tel”. The “tel” URI describes resources identified by telephone numbers. A telephone number is “a string of decimal digits that uniquely indicates the public network termination point. The number contains the information necessary to route the call to this termination point.” [4]

The “tel” URI telephone number is not restricted in the type of termination point it refers to. The termination point can be in the public telephone network, a private circuit-switched network or the Internet.

The termination point can be a mobile terminal or a landline circuit. The terminal addressed can support voice, data or fax. The URI can refer to originators or targets of a telephone call.

The “tel” URI is an identifier only; it does not describe the steps necessary to reach a particular number and does not imply dialing semantics.

Telephone numbers as commonly understood actually comprise two related, but distinct concepts: as a canonical address-of-record and as a dial-string. We define the concepts below:

Address-of-record or identifier: The telephone number is understood here as the canonical address-of-record or identifier for a public network termination point. Generally, these numbers follow the rules in E.164 [4]. Subscribers publish such identifiers phone number as a universal means of being reached, independent of the location of the caller. (Naturally, not all numbers are reachable from everywhere, for a variety of technical and local policy reasons.)

Dial string: “Dial strings” are the actual numbers, symbols and pauses entered by a user to place a phone call. A dial-string is consumed by one or more network entities, and understood in the context of the configuration of these entities. It is used to generate a telephone number so that a call can be routed. Dial-strings may require pre-pended digits to handle local PBXs, and they may include post-dial DTMF signaling that could control an IVR or reach an extension. Dial strings are beyond the scope of this document.

To reach a telephone number from a particular terminal, the user of the terminal or the terminal itself has to know how to convert that the telephone number as identifier into a dial string appropriate for that terminal. The telephone number itself does not convey what needs to be done for a particular terminal. Instructions may include dialing “9” before placing a call or prepending a “00” to reach a number in a foreign country. The terminal may also need to strip area and country codes.

The notation for phone numbers in this document is similar to that in RFC 3191 [5] and RFC 3192 [6]. However, the syntax differs since this document describes URIs whereas RFC 3191 and RFC 3192 specify electronic mail addresses. RFC 3191 and RFC 3192 use “/” to indicate parameters (qualifiers). Since URI use the forward slash to describe path hierarchy, the URI scheme described here uses the semicolon, in keeping with Session Initiation Protocol (SIP) URI conventions [7].

There are at least two ways one can envision making a telephone connection. In the first approach, a URI contains the dial string, which is then passed to an entity that can reproduce the actions specified in the dial string, by sending DTMF digits, waiting for dial tone, pausing and generating post-dial DTMF digits after the callee picks up. Another approach has the URI specify the telephone number, which can be either globally unique or only be valid within a local context. A dialer application is aware of the local context, knowing, for example, whether special digits need to be dialed to seize an outside line, whether network, pulse or tone dialing is needed and what tones indicate call progress. The dialer then converts the telephone number into a dial string and performs the necessary signaling actions. The document below assumes the second model. The dialer does not have to be a user application as found in traditional desktop operating systems, but could well be part of an IP-to-PSTN gateway.

The approach pursued here has the disadvantage that certain services, such as extensions on a PBX (when direct inward dialing is not used) or electronic banking, cannot be specified in a URI.

The URI can be used as a request URI in SIP [7] requests. The SIP specification also inherits the subscriber part of the syntax as part of the user element in the SIP URI. Other protocols may use this URI for both query-based and prefix-based applications.

The "tel" URI does not specify the call type such as voice, fax, or data call and does not provide the connection parameters for a data call. The type and parameters are assumed to be negotiated either in-band by the telephone device or through a signaling protocol such as SIP.

2.1 Resolution

TBD

3 URI Syntax

The URI is defined using the ABNF (augmented Backus-Naur form) described in RFC 2234 [2] and uses elements from the core definitions (Appendix A of RFC 2234).

The syntax definition follows RFC 2396 [3], indicating the actual characters contained in the URI. Note that the reserved characters "+", ";", "=", and "?" MUST NOT be escaped if shown in the grammar definitions below as they are delimiters for the "tel" URI scheme. These reserved characters MUST be escaped if they appear in parameter values.

Characters other than those in the "reserved" and "unsafe" sets (see RFC 2396 [3]) are equivalent to their "% HEX HEX" encoding.

The "tel" URI has the following syntax:

```
telephone-uri         =  "tel:" subscriber
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*uric
extension             =  ";ext=" 1*phonedigit
context               =  ";phone-context=" descriptor *("," descriptor)
descriptor            =  domainname / global-number-digits
global-number-digits  =  "+" 1*phonedigit
local-number-digits   =  1*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 / escaped
unreserved            =  alphanum / mark
escaped               =  "%" HEXDIG HEXDIG
param-unreserved      =  "[" / "]" / "/" / ":" / "&" / "+" / "$"
phonedigit            =  DIGIT [ visual-separator ]
phonedigit-hex        =  HEXDIG [ visual-separator ]
visual-separator      =  "-" / "." / "(" / ")"
alphanum              =  ALPHA / DIGIT
```

Each parameter name ("pname"), the ISDN subaddress, the extension and the context MUST NOT appear more than once. The order of the URL parameters is immaterial. The ISDN subaddress or extension SHOULD appear first, if present, followed by the context parameter, if present, followed by any other parameters in lexicographical order.

This simplifies comparison when the "tel" URI is compared character-by-character, such as in SIP URIs [7].

4 URI Comparisons

Two "tel" URIs are equivalent according to the following rules:

- URI are not equal if one is a local-number and the other a global-number.
- For mandatory extension parameters and the phone-context and extension parameters defined in this document, phone-number parameter values are compared digit-by-digit after removing all visual-separators from consideration.
- 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.

All parameter names and values SHOULD use lower-case characters since tel URIs may be used within contexts where comparisons are case-sensitive.

Section 19.1.4 in the SIP specification [7] discusses one such case.

5 Phone Numbers and Their Context

5.1 Phone Numbers

The 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 (Section 5.1.4).

Implementations MUST NOT assume that telephone numbers have a maximum, minimum or fixed length, or that they always begin with a certain number.

E.164 limits numbers to 15 digits. For geographic numbers, one to three digits are the country code, with the remainder divided into area or city code (national destination code) and subscriber number. Alternatively, there is a global three-digit service code, followed by a global subscriber number of up to 12 digits. Finally, a "international public telecommunication number for networks is composed of decimal digits arranged in three code fields. The code fields are the 3-digit shared Country Code (CC) field, the IC field, which varies in length between 1 to 4 digits, and the Subscriber Number (SN) which can be up to 15 minus the number of digits in the CC and IC fields." [4]

5.1.1 Separators in Phone Numbers

Phone numbers MAY contain visual separators. Visual separators (visual-separator) merely aid readability and are not used for URI comparison or placing a call.

Despite complicating comparisons, this specification retains the visual separators to follow the spirit of RFC 2396 [3], which remarks that "A URI often needs to be remembered by people, and it is easier for people to remember a URI when it consists of meaningful components." Also, ISBN URNs documented in RFC 3187 [8] use visual separators in a manner similar to this specification.

Even though ITU-T E.123 [9] recommends the use of space characters as visual separators in printed telephone numbers, "tel" URIs cannot use spaces to avoid excessive escaping.

5.1.2 Alphabetic Characters

In some countries, it is popular to write phone numbers using alphabetic characters which correspond to certain numbers on the telephone keypad. The URI format does not support this notation since the mapping from alphabetic characters to digits is not completely uniform internationally, although there are standards [10, 11] addressing this issue.

Since called and calling terminal numbers (TNs) are encoded in BCD in ISUP, this allows for six additional values per digit, sometimes represented as the hexadecimal characters A through F. However, in accordance with E.164, they may not be included in global numbers. Their use in local numbers is not defined, but is not prohibited.

5.1.3 Global Numbers

Globally unique numbers are identified by the leading "+" character. Global numbers MUST be composed with the country (CC) and national (NSN) numbers as specified in E.123 and E.164 [9, 4]. Globally unique numbers have the property of being unambiguous everywhere in the world and are RECOMMENDED.

5.1.4 Local Numbers

Local numbers are unique only within a certain geographical area or a certain part of the telephone network, e.g., a private branch exchange (PBX), a state or province, a particular local exchange carrier or a particular country. URIs with local phone numbers should only appear in environments where all local entities can successfully set up the call by passing the number to the dialing software. Digits needed for accessing an outside line, for example, are not included in local numbers. Local numbers SHOULD NOT be used.

Local numbers require that the originator and recipient are configured appropriately, so that they can insert and recognize the correct descriptors. Since there is no algorithm to independently pick the same descriptor, labeling numbers with their context increases the chances of mis-configuration, so that valid identifiers are rejected by mistake. The algorithm to select descriptors was chosen that accidental collisions should be rare, but they cannot be ruled out.

Local numbers MUST have a phone-context parameter that identifies the scope of their validity. The parameter MUST be chosen to unambiguously identify the local context within which the number is unique. Thus, the combination of any one of the descriptors in the phone-context parameter and local number is again globally unique. The parameter value is defined by the assignee of the local number. The parameter can contain a list of contexts that enumerate all the contexts where this number is unique. It does NOT indicate a prefix that turns the local number into a global (E.164) number.

There are two ways to label the context: via a global number or any number of its leading digits (e.g., "+33") and via a domain name, e.g., "houston.example.com". The choice between the two is left to the "owner" of the local number and is governed by whether there is a global number or domain name that is a valid identifier for a particular local number.

The domain name does not have to resolve to any actual host, but MUST be under the administrative control of the entity managing the local phone context.

A global number context consists of the initial digits of a valid global number. All global numbers matching these initial digits must be assigned to the same organization that is describing the context and no such matching number can be used by any other organization. If such an initial string of digits does not exist, the organization should use the lowest number of the global number range assigned to it. (This can occur if two organizations share the same decimal block of numbers. For example, assume an organization owns the number range +1-212-939-7000 through +1-212-939-7199. +1-212-939-7 would not be a valid global number context, but +1-212-939-7000 would work.)

It is not required that numbers within the context actually begin with the chosen set of initial numbers.

For a local number defined within a PBX, the organization can choose any number under its control to identify the context. For example, a context consisting of any of the organization's global numbers may be suitable, or a substring that is completely occupied by the organization. For example, +49-6151-16 would be a suitable context for the TU Darmstadt, as it uses all numbers starting with those digits.

For example, ";phone-context=+31,+49" indicates that the number is valid in country codes 31 (Holland) and 49 (Germany).

A context consisting of the initial digits of a global number does not imply that adding these to the local number will generate a valid E.164 number. It might do so by coincidence, but this cannot be relied upon. (For example, "911" should be labeled with the context "+1", but "+1-911" is not a valid E.164 number.)

National freephone numbers do not need a context, even though they are not necessarily reachable from outside a particular country code or numbering plan. Recall that "tel" URIs are identifiers; it is sufficient that a global number is unique, but it is not required that it be reachable from everywhere.

> Even non-freephone numbers may be out of date or not be reachable from a particular location. For example, premium services such as "900" numbers in the North American numbering plan are often not dialable from outside the particular country code.

> The two label types were chosen so that, in almost all cases, a local administrator can pick an identifier that is reasonably descriptive and does not require a new IANA-managed assigned number. It is up to the administrator to assign an appropriate identifier and to use it consistently. Often, an organization can choose among several different identifiers.

If the recipient of a "tel" URI uses the URI simply for identification, the receiver does not need to know anything about the context descriptor. It simply treats it as one part of a globally unique identifier, with the other being the local number. If a recipient of the URI intends to place a call to the local number, it MUST verify that it is within the same context as one of the descriptors. If it is not within the same context, it MUST NOT initiate the call and treat the URI like an invalid destination.

5.2 ISDN Subaddresses

A phone number MAY also contain an `isdn-subaddress` parameter which indicates an ISDN subaddress.

ISDN subaddresses typically contain IA5 characters, but may contain any octet value.

5.3 Extensions

Extensions identify stations behind a PBX and are roughly equivalent to ISDN subaddresses. They are identified with the `extension` parameter. At most one of the `isdn-subaddress` and `extension` parameters can appear in a tel URI, i.e., they cannot appear both at the same time.

5.4 Other Parameters

Future extensions to this URI scheme may add other parameters (parameter in the ABNF). Such parameters can be either mandatory or optional. Mandatory parameters start with “m-”. An implementation MAY ignore optional parameters. An implementation MUST NOT use the URI if it contains unknown mandatory parameters. The “m-” prefix cannot be added to parameters that were already registered (except to create a new, logically distinct parameter). The “phone-context” parameter in this document is mandatory.

For example, parameter parameters can be used to store application-specific additional data about the phone number, its intended use, or any conversions that have been applied to the number.

All new parameters MUST be registered with IANA.

6 Examples

tel:+358-555-1234567 This URI points to a phone number in Finland. The hyphens are included to make the number more human-readable; they separate country, area codes and subscriber number.

tel:7042;phone-context=cs.columbia.edu The URI describes a local phone number valid within the context “cs.columbia.edu”.

tel:863-1234;phone-context=+1-914-784 The URI describes a local phone number that is valid within a particular phone prefix.

7 Rationale

7.1 Why Not Just Put Telephone Numbers in SIP URIs?

The “tel” URI describes a service, reaching a telephone number, that is independent of the means of doing so, be it via a SIP-to-PSTN gateway, a direct SIP call via ENUM translation, some other signaling protocols such as H.323 or a traditional circuit-switched call initiated on the client side via, say, TAPI. It is thus, in spirit, closer to the URN schemes that also leave the resolution to an external mechanism. The same “tel” URI may get translated to any number of other URIs in the process of setting up the call.

7.2 Why Not Distinguish Between Call Types?

Signaling protocols such as SIP allow to negotiate the call type and parameters, making the very basic indication within the URL scheme moot. Also, since the call type can change frequently, any such indication in a URI is likely to be out of date. If such designation is desired for a device that directly places calls without a signaling protocol such as SIP, mechanisms such as the “type” attribute for the “A” element in HTML may be more appropriate.

7.3 Why “tel”?

“Tel” was chosen since it is widely recognized none of the other suggestions appeared appropriate. “Callto” was discarded since URI schemes locate a resource and do not specify an action to be taken. “Telephone” and “phone” were considered too long and not as internationally recognized.

7.4 Do Not Confuse Numbers with How They Are Dialed

As an example, the E.164 number "+1-212-555-3141" will be dialed in many countries as 00-1-212-555-3141, where the leading "00" is a prefix for international calls. (In general, "+" in E.164 indicates that an international prefix is required.) Tel URIs MUST NOT contain the local dialing prefixes in numbers such as +1-212-555-3141, as the transformation back to an international number is not guaranteed to be correct or unique.

If a network entity receives a "tel" URI containing a local number, it MUST make sure that it knows the context in which the local phone number is to be processed, or else the number MUST NOT be used. Equally, the originator of a "tel" URI must take into consideration that the recipient may have insufficient information about the phone number's context.

8 Usage of Telephone URIs in HTML

Links using the "tel" URL SHOULD enclose the telephone number, so that users can easily predict the action taken when following the link.

```
Dial <a href="tel:+3585551234567">+358-555-1234567</a> for assistance.
```

instead of

```
Dial <a href="tel:+3585551234567">this number</a> for assistance.
```

On a public HTML page, the telephone number in the URI SHOULD always be in the global form, even if the text of the link uses some local format.

```
Telephone (if dialing in Finland):
  <a href="tel:+3585551234567">(0555) 1234567</a>
```

or even

```
For having RFCs read aloud, call
<a href="tel:+1-555-438-3732">1-555-IETF-RFC</a>.
```

9 IANA Considerations

"Tel" URI parameters (parameter) MUST be registered with IANA. Mandatory parameters must be described in a standards-track RFC, while an informational RFC is sufficient for other parameters.

The registration must indicate:

- the parameter name;
- a description of its applicability;
- whether the parameter is mandatory or not (Only the names of mandatory parameters must start with "m-" as described in Section 5.4.);

- restrictions on the syntax of the parameter value in ABNF form;
- a reference to the specification that defines it.

10 Security Considerations

The security considerations parallel those for the mailto URL [12].

A recipient of a “tel” URI SHOULD NOT place calls without the consent of its owner. Placing calls automatically without appropriate user confirmation may incur a number of risks, such as those described below.

- Calls may incur costs.
- The URI may be used to place malicious or annoying calls.
- A call will take the user’s phone line off-hook, thus preventing its use.
- A call may reveal the user’s, possibly unlisted, phone number to the remote host in the caller identification data, and may allow the attacker to correlate the user’s phone number with other information such as the e-mail or IP address.
- A call may use the same local number in different contexts, in which the number may have a different meaning.

A Use of “tel” URIs with SIP (Informative)

SIP can use the “tel” URI as a Request-URI, along with “sip” and “sips” URIs. For brevity, we will imply “sips” URIs when talking about SIP URIs. Both tel and ‘SIP URIs can contain telephone numbers. In SIP URIs, they appear as the user part, i.e., in front of the @ symbol. While

Unless a SIP UA connects directly to a PSTN gateway, one of the SIP proxy servers has to translate the tel URI to a SIP URI, with the host part of that URI pointing to a gateway. Typically, the outbound proxy server, as the first proxy server visited by a call request, performs this translation. A proxy server can translate all tel URIs to the same SIP host name or select a different gateway for different tel prefixes, based, for example, on information learned from TRIP. However, a proxy server could also delegate this translation task to any other proxy server since proxy servers are free to apply whatever routing logic they desire.

As noted earlier, all phone numbers MUST use the global form unless they cannot be represented as such. If the local-number format is used, it MUST be qualified by the phone-context parameter. Effectively, the combination of local number and phone context makes the tel URI globally unique.

While web pages, vCard business cards, address books and directories can easily contain global tel URIs, users on twelve-button (IP) phones cannot dial such numbers directly and are typically accustomed to dialing shorter strings, e.g., for PBX extensions or local numbers. These so-called dial-strings (Section refsec:intro) are not directly represented by tel URIs, as noted. We refer to the translation of dial strings into SIP and tel URIs, global or local, as the *dial plan*. There are at least two appropriate ways to deal with dial strings in SIP terminals:

Local translation: A SIP UA can use a dial plan to translate dial strings into SIP or tel URIs. The dial plan can be manually configured or, preferably, be downloaded as part of a device configuration mechanism. (At this time, there is no standardized mechanism for this.)

A mobile user can use at least two dial plans, namely the dial plan for the network that he is currently visiting and the dial plan for the user's home network. Generally, dialed numbers that are meant to represent global numbers will look the same after the translation regardless of the dial plan, even if, say, the visited network uses '0' for dialing an 'outside' number and the user's home network uses '9', as long as the user is aware of the current dial plan. However, local extensions that do not have a direct global equivalent may well behave differently. To avoid any ambiguity, the dial plan MUST insert a suitable phone-context string when performing the translation. If the phone-context is a domain name, there are three cases:

1. The outbound proxy recognizes the domain name as its local context and can route the request to a gateway that understands the local number.
2. The outbound proxy does not use the same phone context, but can route to a proxy that handles this phone context. This routing can be done via a lookup table or the domain name of the phone context might be set up to reflect the SIP domain name of a suitable proxy. For example, a proxy may always route calls with tel URIs like

   ```
   tel:1234;phone-context=munich.example.com
   ```

   to the SIP proxy located at `munich.example.com`.
   (Proxies that receive a tel URI with a context they do not understand are obligated to return a 404 (Not Found) status resonse, so that an outbound proxy may decide to attempt such a heuristic.)
3. The outbound proxy does not recognize the phone context and cannot find the appropriate proxy cognizant of that phone context. In that case, the translation fails and the outbound proxy returns a 404 (Not Found) error response.

Proxy translation: In proxy translation mode, the SIP UA simply turns the dialed digits into the user part of the SIP URI and appends a `;user=phone` parameter. The host name or IP address of the outbound proxy becomes the host part of the SIP request URI. The outbound proxy can then apply its local dial plan to translate the SIP URI into a tel URI or other SIP URI. Translation into a tel URI makes sense only if the proxy wants to delegate finding the PSTN gateway to another proxy.

B Change History

B.1 Changes Since -07

- Added section on using tel URIs in SIP.

B.2 Changes Since -06

- Clarified semantics.
- Removed context from freephone numbers.
- Added phone extensions.

B.3 Changes Since -05

- URI comparisons are case-insensitive.
- Specified recommended order of parameters to simplify use within SIP URIs.

B.4 Changes Since -04

- ISDN subaddresses can contain any IA5 character or even binary data; represented now as “uric”.

B.5 Changes Since -03

- Clarified use of multiple contexts and how to express this, as a comma-separated list.

B.6 Changes Since -02

- Clarifications and editorial fixes.
- Now, mandatory parameters are labeled, to avoid making [13] obsolete.

B.7 Changes Since -01

The draft has been greatly simplified to reflect parts that have actually been implemented.

- Removed references to carrier selection.
- Removed dial context.
- Removed fax and modem URIs.
- Removed post-dial strings.
- Removed pause characters.

B.8 Changes Since RFC 2806

The specification is backwards-compatible with RFC 2806.

- Editorial changes and clarifications. The document has been shortened and reorganized. Most paragraphs have been rewritten to be more concise.
- Syntax now conforms to RFC 2396 [3], in particular related to escaping.

C Acknowledgments

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