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H. Schulzrinne
Columbia University

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The tel URI for Telephone Numbers

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Copyright Notice

Abstract

This document specifies the URI (Uniform Resource Identifier) scheme "tel". The "tel" URI describes resources identified by telephone numbers. This document obsoletes RFC 2806.

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1. Introduction

This document defines the URI scheme "tel", which describes resources identified by telephone numbers. A telephone number is a string of decimal digits that uniquely indicates the network termination point. The number contains the information necessary to route the call to this point. (This definition is derived from [E.164] but encompasses both public and private numbers.)

The termination point of the "tel" URI telephone number is not restricted. It can be in the public telephone network, a private telephone network, or the Internet. It can be fixed or wireless and address a fixed wired, mobile, or nomadic terminal. The terminal addressed can support any electronic communication service (ECS), including voice, data, and fax. The URI can refer to resources identified by a telephone number, including but not limited to originators or targets of a telephone call.

The "tel" URI is a globally unique identifier ("name") only; it does not describe the steps necessary to reach a particular number and does not imply dialling semantics. Furthermore, it does not refer to a specific physical device, only to a telephone number.

As commonly understood, telephone numbers comprise two related but distinct concepts: a canonical address-of-record and 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 termination point within a specific network. For the public network, these numbers follow the rules in E.164 [E.164], while private numbers follow the rules of the owner of the private numbering plan. Subscribers publish these identifiers so that they can be reached, regardless of the location of the caller. (Naturally, not all numbers are reachable from everywhere, for a

variety of technical and local policy reasons. Also, a single termination point may be reachable from different networks and may have multiple identifiers.)

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 an address-of-record or identifier (in the sense described above) so that a call can be routed. Dial strings may require prepended digits to exit the private branch exchange (PBX) the end system is connected to, and they may include post-dial dual-tone multi-frequency (DTMF) signaling that could control an interactive voice response (IVR) system or reach an extension. Dial strings are beyond the scope of this document.

Both approaches can be expressed as a URI. For dial strings, this URI is passed to an entity that can reproduce the actions specified in the dial string. For example, in an analog phone system, a dialer translates the dial string into a sequence of actions such as waiting for dial tone, sending DTMF digits, pausing, and generating post-dial DTMF digits after the callee picks up. In an integrated services digital network (ISDN) or ISDN user part (ISUP) environment, the signaling elements that receive protocol messages containing the dial string perform the appropriate protocol actions. As noted, this approach is beyond the scope of this specification.

The approach described here has the URI specify the telephone number as an identifier, which can be either globally unique or only valid within a local context. The dialling 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 dialling is needed; and what tones indicate call progress. The dialling application then converts the telephone number into a dial sequence and performs the necessary signaling actions. 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.

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

The identifier approach described in this document has the disadvantage that certain services, such as electronic banking or voicemail, cannot be specified in a "tel" URI.

The notation for phone numbers in this document is similar to that in RFC 3191 [RFC3191] and RFC 3192 [RFC3192]. However, the syntax differs as 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 URIs 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 [RFC3261].

The "tel" URI can be used as a request URI in SIP [RFC3261] 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 also use this URI scheme.

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.

This document obsoletes RFC 2806.

2. 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 BCP 14, RFC 2119, [RFC2119] and indicate requirement levels for compliant implementations.

3. URI Syntax

The URI is defined using the ABNF (augmented Backus-Naur form) described in RFC 2234 [RFC2234] and uses elements from the core definitions (appendix A of RFC 2234).

The syntax definition follows RFC 2396 [RFC2396], indicating the actual characters contained in the URI. If the reserved characters "+", ";", "=", and "?" are used as delimiters between components of the "tel" URI, they MUST NOT be percent encoded. These characters MUST be percent encoded if they appear in tel URI parameter values.

Characters other than those in the "reserved" and "unsafe" sets (see RFC 2396 [RFC2396]) are equivalent to their "% HEX HEX" percent encoding.

The "tel" URI has the following syntax:

```
telephone-uri        = "tel:" telephone-subscriber
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*uric
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     = "[" / "]" / "/" / ":" / "&" / "+" / "$"
phonedigit           = DIGIT / [ visual-separator ]
phonedigit-hex       = HEXDIG / "*" / "#" / [ visual-separator ]
visual-separator     = "-" / "." / "(" / ")"
alphanum             = ALPHA / DIGIT
reserved             = ";" / "/" / "?" / ":" / "@" / "&" /
                       "=" / "+" / "$" / ","
uric                 = reserved / unreserved / pct-encoded
```

Each parameter name ("pname"), the ISDN subaddress, the 'extension', and the 'context' MUST NOT appear more than once. The 'isdn-subaddress' or 'extension' MUST 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 [RFC3261].

4. URI Comparisons

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

- 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 (section 5.4) and the 'phone-context' and 'extension' parameters defined in this document, the 'phone-context' parameter value is compared 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.

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

Section 19.1.4 in the SIP specification [RFC3261] discusses one such case.

5. Phone Numbers and Their Context

5.1. Phone Numbers

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' (section 5.1.5).

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

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.

Although it complicates comparisons, this specification retains visual separators in order to follow the spirit of RFC 2396 [RFC2396], 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 [RFC3187] use visual separators in a manner similar to this specification.

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

5.1.2. Alphabetic Characters Corresponding to Digits

In some countries, it is common to write phone numbers with alphabetic characters corresponding to certain numbers on the telephone keypad. The URI format does not support this notation, as the mapping from alphabetic characters to digits is not completely uniform internationally, although there are standards [E.161][T1.703] addressing this issue.

5.1.3. Alphabetic, *, and # Characters as Identifiers

As called and calling terminal numbers (TNs) are encoded in BCD in ISUP, six additional values per digit can be encoded, sometimes represented as the hexadecimal characters A through F. Similarly, DTMF allows for the encoding of the symbols *, #, and A through D. However, in accordance with E.164, these may not be included in global numbers. Their meaning in local numbers is not defined here, but they are not prohibited.

5.1.4. 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 [E.123] and E.164 [E.164]. Globally unique numbers are unambiguous everywhere in the world and SHOULD be used.

5.1.5. 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 dialling software. Digits needed for accessing an outside line, for example, are not included in local numbers. Local numbers SHOULD NOT be used unless there is no way to represent the number as a global number.

Local numbers SHOULD NOT be used for several reasons. Local numbers require that the originator and recipient are configured appropriately so that they can insert and recognize the correct context descriptors. Since there is no algorithm to pick the same descriptor independently, labelling numbers with their context increases the chances of misconfiguration so that valid identifiers are rejected by mistake. The algorithm to select descriptors was chosen so that accidental collisions would 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 identify the local context within which the number is unique unambiguously. Thus, the combination of the descriptor in the 'phone-context' parameter and local number is again globally unique. The parameter value is defined by the assignee of the local number. 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 with these initial digits must be assigned to the same organization, and no such matching number can be used by any other organization. For example, +49-6151-16 would be a suitable context for the Technical University of Darmstadt, as it uses all numbers starting with those digits. 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 +1-212-555-0100 through +1-212-555-0149. +1-212-555-1 would not be a valid global number context, but +1-212-555-0100 would work.) It is not required that local numbers within the context actually begin with the chosen set of initial numbers.

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 may 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 it 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 understand the context and be able to place calls within that context.

5.2. ISDN Subaddresses

A phone number MAY also contain an ’isdn-subaddress’ parameter that indicates an ISDN subaddress.

ISDN subaddresses typically contain International Alphabet 5 (IA5 [T.50]) characters but may contain any octet value.

5.3. Phone Extensions

Phone extensions identify stations behind a non-ISDN PBX and are functionally 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 protocol 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 and 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, and "isub" and "ext" are optional.

New mandatory parameters must be described in a standards-track RFC, but an informational RFC is sufficient for optional parameters.

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.

Entities that forward protocol requests containing "tel" URIs with optional parameters MUST NOT delete or modify parameters they do not understand.

6. Examples

tel:+1-201-555-0123: This URI points to a phone number in the United States. The hyphens are included to make the number more human readable; they separate country, area code and subscriber number.

tel:7042;phone-context=example.com: The URI describes a local phone number valid within the context "example.com".

tel:863-1234;phone-context=+1-914-555: 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 E.164 number ("ENUM") translation [RFC3761], some other signaling protocols such as H.323, or a traditional circuit-switched call initiated on the client side via, say, the Telephony Application Programming Interface (TAPI). Thus, in spirit, it is 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 negotiating the call type and parameters, making the very basic indication within the URI 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 because it is widely recognized that none of the other suggestions appeared appropriate. "Callto" was discarded because URI schemes locate a resource and do not specify an action to be taken. "Telephone" and "phone" were considered too long and not easily recognized internationally.

7.4. Do Not Confuse Numbers with How They Are Dialed

As an example, in many countries the E.164 number "+1-212-555-3141" will be dialed as 00-1-212-555-3141, where the leading "00" is a prefix for international calls. (In general, a "+" symbol in E.164 indicates that an international prefix is required.)

8. Usage of Telephone URIs in HTML

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

```
Dial <a href="tel:+1-212-555-0101">+1-212-555-0101</a> for
assistance.
```

instead of

```
Dial <a href="tel:+1-212-555-0101">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 dialling in the United States):
  <a href="tel:+1-201-555-0111">(201) 555-0111</a>
```

or even

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

9. Use of "tel" URIs with SIP (Informative)

SIP can use the "tel" URI anywhere a URI is allowed, for example 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., before the @ symbol (section 19.1.6 in [RFC3261]).

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 [RFC3219]. However, a proxy server could also delegate this translation task to any other proxy server, as proxy servers are free to apply whatever routing logic they desire. For local numbers, the proxy MUST NOT translate "tel" URIs whose contexts it does not understand.

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.

Although 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 dialling shorter strings, e.g., for PBX extensions or local numbers. These so-called dial strings (section

1) are not directly represented by "tel" URIs, as noted. We refer to the rules that govern the translation of dial strings into SIP and "tel" URIs, global or local, as the dial plan. Currently, translations from dial strings to "tel" URIs have to take place in end systems. Future efforts may provide means to carry dial strings in a SIP URI, for example, but no such mechanisms exist as of this writing.

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, 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 his home network. Generally, dialed numbers 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 dialling 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 without 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 in the "tel" or SIP URI 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 receiving a tel URI with a context they do not understand are obligated to return a 404 (Not Found) status response 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 for that phone context. In that case, the translation fails, and the outbound proxy returns a 404 (Not Found) error response.

10. Acknowledgments

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11. Security Considerations

The security considerations parallel those for the mailto URL [RFC2368].

Web clients and similar tools MUST NOT use the "tel" URI to place telephone calls without the explicit consent of the user of that client. 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 an e-mail or IP address.

This is particularly important for "tel" URIs embedded in HTML links, as a malicious party may hide the true nature of the URI in the link text, as in

```
<a href="tel:+1-900-555-0191">Find free information here</a>
<a href="tel:+1-900-555-0191">tel:+1-800-555-0191</a>
```

"tel" URIs may reveal private information, similar to including phone numbers as text. However, the presence of the tel: schema identifier may make it easier for an adversary using a search engine to discover these numbers.

12. Changes Since RFC 2806

The specification is syntactically backwards-compatible with the "tel" URI defined in RFC 2806 [RFC2806] but has been completely rewritten. This document more clearly distinguishes telephone numbers as identifiers of network termination points from dial strings and removes the latter from the purview of "tel" URIs.

Compared to RFC 2806, references to carrier selection, dial context, fax and modem URIs, post-dial strings, and pause characters have been removed. The URI syntax now conforms to RFC 2396 [RFC2396].

A section on using "tel" URIs in SIP was added.

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Author’s Address

Henning Schulzrinne
Columbia University
Department of Computer Science
450 Computer Science Building
New York, NY 10027
US

Phone: +1 212 939 7042
EMail: hgs@cs.columbia.edu
URI: http://www.cs.columbia.edu

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