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## The ENUM Dip Indicator Parameter for the "tel" URI

### Status of This Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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### Abstract

This document defines a new parameter "enumdi" for the "tel" Uniform Resource Identifier (URI) to support the handling of ENUM queries in Voice over Internet Protocol (VoIP) network elements. A VoIP network element may receive a URI containing an E.164 number, where that URI contains an "enumdi" parameter. The presence of the "enumdi" parameter indicates that an ENUM query has already been performed on the E.164 number by a previous VoIP network element. Equally, if a VoIP network element sends such a URI, it asserts that an ENUM query has been carried out on this number.

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## 1. Introduction

VoIP network elements (including User Agent Servers and User Agent Clients) may be set up in different ways to handle E.164 [3] numbers during call setup, depending on the capabilities provided. One common approach is to query ENUM as defined in RFC 3761 [4], and to use the set of NAPTR resource records that is returned.

If the ENUM query leads to a result, the call is set up accordingly. If the ENUM query does not lead finally to a result, another database may be queried and/or the call may finally be routed to the Public Switched Telephone Network (PSTN). In doing so, the call may be routed to another VoIP network element. To indicate in signalling to this next VoIP element that an ENUM query has already been made for the "tel" URI (specified in RFC 3966 [5]), the "enumdi" parameter is used, to prevent the next VoIP network element from repeating redundant queries.

## 2. Terminology

The 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 BCP 14, RFC 2119 [1].

### 3. Formal Syntax

The following syntax specification uses the Augmented Backus-Naur Form (ABNF) as described in RFC 4234 [2] to extend the syntax of the "par" production defined in the ABNF of RFC 3966 [5].

```
par =/ enum-dip-indicator
```

```
enum-dip-indicator = ";enumdi"
```

The enum-dip-indicator is an optional parameter for the "tel" URI. Note also that enum-dip-indicator can appear at most once in any "tel" URI.

### 4. Normative Rules

#### 4.1. Options for ENUM Domain Providers

A domain provider can, at its choosing, populate a NAPTR record with a "tel" URI that contains the enum dip indicator. This would, as a consequence of the rules stated below, inform the client that it should not bother performing a query and pass the request on.

#### 4.2. Client Behaviour for VoIP Network Elements

This section discusses how a VoIP network element handles a received "tel" URI that contains the "enumdi" parameter or has queried ENUM in e164.arpa. for a given E.164 number.

##### 4.2.1. Handling a URI with the "enumdi" Parameter

If a VoIP network element receives a "tel" URI containing the "enumdi" parameter, the VoIP network element SHOULD NOT retrieve the related information for this number from ENUM in e164.arpa. even if it would normally do so.

Note that the recipient network element may reasonably choose to query ENUM if it does not have a trust relationship with the immediate sender of the URI.

If the "tel" URI (received from a trusted entity) is to be passed to the next network element, the VoIP network element MUST pass on the received URI containing the "enumdi" parameter unchanged.

If, however, the URI has been received from an untrusted entity, then the recipient entity may either strip it before sending the URI onwards or instead carry out its own ENUM query and add the parameter accordingly to the URI (see next).

#### 4.2.2. Adding the "enumdi" Parameter to URIs

When a VoIP network element queries ENUM in e164.arpa. for a given E.164 number and the result of the query is DNS error code 3 (commonly known as "NXDOMAIN"), then if that network element chooses to pass the call to another network element by using a "tel" URI, the "enumdi" parameter MUST be set.

#### 4.2.3. Handling a URI Retrieved from ENUM

When a VoIP network element queries ENUM in e164.arpa. for a given E.164 number and either:

- o the result of the query includes a NAPTR resource record containing a "tel" URI that has the same E.164 number, or
- o the result of the query includes a NAPTR resource record containing a "tel" URI with the "enumdi" parameter set,

then if that retrieved "tel" URI is chosen to be passed to another network element, the sending VoIP network element MUST pass on the retrieved URI with the "enumdi" parameter set.

When a VoIP network element queries ENUM in e164.arpa. for a given E.164 number and the result is a "tel" URI with a different E.164 number that lacks the enum dip indicator, the client can either perform another query against that number or pass the request on, as a matter of local policy.

### 5. Examples

- a. A VoIP network element called server.example.com receives a "tel" URI tel:+441632960038. The VoIP network element queries the DNS for NAPTR resource records in 8.3.0.0.6.9.2.3.6.1.4.4.e164.arpa., and gets an error response with code = 3 (commonly known as "NXDOMAIN"). The VoIP network element decides to route the call to the PSTN via another VoIP network element called gw.example.com.

It therefore signals to the next VoIP network element with:  
tel:+441632960038;enumdi  
or (using the procedures of RFC 3261 [6] section 19.1.6):  
sip:+441632960038;enumdi@gw.example.com;user=phone

- b. A VoIP network element called server.example.com receives a "tel" URI tel:+441632960038. The VoIP network element queries the DNS for NAPTR resource records in 8.3.0.0.6.9.2.3.6.1.4.4.e164.arpa., and receives the same "tel" URI in reply (i.e., tel:+441632960038).

The VoIP network element decides to route the call to the PSTN via another VoIP network element called gw.example.com.

It therefore signals to this next VoIP network element with:  
tel:+441632960038;enumdi  
or (using the procedures of RFC 3261 [6] section 19.1.6):  
sip:+441632960038;enumdi@gw.example.com;user=phone

## 6. Security Considerations

In addition to those security implications discussed in the "tel" URI [5] specification, there are new security implications associated with the defined parameter.

If the "enumdi" is illegally inserted into the "tel" URI when the signalling message carrying the "tel" URI is en route to the destination entity, the call may be routed to the PSTN network, incurring unexpected charges or causing a downstream VoIP network element to reject the call setup. Many network elements that will process URIs containing this parameter will maintain trust relationships with others. If such a URI is received from an entity outside the trust boundary of the recipient, then that recipient entity may reasonably ignore it and make an ENUM query itself. In so doing, it can avoid this potential attack.

It is less a problem if the "enumdi" is illegally removed. An additional ENUM query may be performed to retrieve the routing number information and have the "enumdi" included again.

It is RECOMMENDED that protocols carrying the "tel" URI ensure message integrity during the message transfer between the two communicating network elements so as to detect any unauthorised changes to the content of the "tel" URI and other information.

## 7. IANA Considerations

This document does not itself require any IANA actions.

It does define a parameter for the "tel" URI. Further information on a registry for such parameters is covered in the IANA "tel" URI Parameter Registry [7].

## 8. Acknowledgements

Many thanks for the thorough review provided by Alex Mayrhofer.

## 9. References

### 9.1. Normative References

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- [5] Schulzrinne, H., "The tel URI for Telephone Numbers", RFC 3966, December 2004.
- [6] Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley, M., and E. Schooler, "SIP: Session Initiation Protocol", RFC 3261, June 2002.

### 9.2. Informative References

- [7] Jennings, C. and V. Gurbani, "The Internet Assigned Number Authority (IANA) tel Uniform Resource Identifier (URI) Parameter Registry", Work in Progress, May 2006.

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