



Cisco Expressway ENUM Dialing

Deployment Guide

First Published: December 2013

Last Updated: November 2015

Cisco Expressway X8.7

Introduction

ENUM (E.164 Number Mapping) is a way of using DNS NAPTR (Name Authority PoinTeR) records to convert E.164 numbers into routable URIs. ENUM is defined in RFC 3761.

This document describes how to configure your network and your Cisco Expressway (Expressway) to enable calls to be placed from inside or outside your network using ENUM dialing to endpoints that have registered using a URI.

To support this deployment scenario:

- The Expressway must be configured with an ENUM zone and associated search rule that:
 - removes any suffixes, producing a digit-only dial string
 - specifies a DNS domain where the NAPTR records for that E.164 can be found
- The Expressway must be configured with the address of at least one DNS server that is capable of resolving the NAPTR search request.
- A DNS server must be configured with NAPTR records that:
 - define (using regular expressions) the way in which a presented E.164 number is converted to a routable URI
 - define the transport protocol to be used for the call (SIP or H.323)

These steps are described in detail in the sections that follow.

Configuring the Expressway

Configuring an ENUM Zone and Search Rule

An ENUM zone on the Expressway and its associated search rule are used to construct a query for a DNS server with NAPTR records that describe how to convert E.164 numbers into one or more URIs.

In this deployment scenario, we want to query DNS for NAPTR records based on the number that was dialed, ignoring any domain information that has been appended. This requires:

- an ENUM zone configured with a DNS domain suffix to be used for the lookup
- a search rule that transforms incoming dialed aliases into digit only numbers

To Configure an ENUM Zone:

1. Go to **Configuration > Zones > Zones**.
2. Click **New** to go to the **Create zone** page.
3. Configure the following fields, leaving everything else as its default value:

Name	Enter the name you want to give this zone, for example "ENUM lookup zone".
Type	Select <i>ENUM</i> .
DNS suffix	Enter the suffix of the DNS location where the NAPTR records for this ENUM lookup are held, for example enum.search.com.
H.323 mode	Select <i>On</i> if the result of the ENUM lookup is allowed to be used to generate an H.323 call.
SIP mode	Select <i>On</i> if the result of the ENUM lookup is allowed to be used to generate a SIP call.

4. Click **Create zone**.

Create zone You are here: [Configuration](#) > [Zones](#) > [Zones](#) > Create zone

Configuration

Name * i

Type * i

Hop count * i

DNS settings

DNS suffix i

H.323

Mode i

SIP

Mode i

To Configure a Search Rule:

1. Go to **Configuration > Dial plan > Search rules**.
2. Click **New** to go to the **Create search rule** page.
3. Configure the following fields, leaving everything else as its default value:

Rule name	Enter a name for the rule, for example “ENUM lookup”.
Description	Enter a longer description of what the rule does.
Priority	Enter 150.
Protocol	Select <i>Any</i> .
Source	Select <i>Any</i> .
Request must be authenticated	Configure this setting according to your authentication policy.
Mode	Select <i>Alias Pattern Match</i> .
Pattern type	Select <i>Regex</i> .
Pattern string	Enter a regular expression in the format (<digit string to accept> (@domain)? for example (557\d{3}) (@exp.domain)?
Pattern behavior	Select <i>Replace</i> .
Replace string	Enter a replace string in the format <ENUM digits to look up> for example \1
Target zone	Select the zone you created in the previous step.

4. Click **Create search rule**.

Create search rule You are here: [Configuration](#) > [Dial plan](#) > [Search rules](#) > Create search rule

Configuration

Rule name	* ENUM lookup i
Description	Prefixed with 557 and strip domain i
Priority	* 150 i
Protocol	Any i
Source	Any i
Request must be authenticated	No i
Mode	Alias pattern match i
Pattern type	Regex i
Pattern string	* (557\d{3})(@exp.domain)? i
Pattern behavior	Replace i
Replace string	\1 i
On successful match	Continue i
Target	* ENUM lookup zone i
State	Enabled i

In this example, the search rule filters requests to the ENUM zone so that it is only queried for certain digit strings. A transform is also applied to remove any domain that may have been added by a SIP device or by a transform in the Expressway to make E164 numbers into URIs.

The above configuration means that when a call is made to 557123 or 557123@exp.domain then this ENUM zone will perform a lookup of NAPTR records at: 3.2.1.7.5.5.enum.search.com

Configuring the Expressway with a DNS Server

For the Expressway to perform a DNS query for an ENUM zone, it must be configured with at least one DNS server that can resolve the query for the DNS location where the NAPTR records for that particular ENUM lookup are held.

To configure the Expressway with details of a DNS server to use:

1. Go to **System > DNS**.
2. In one of the available **Address** fields, enter the IP address of the DNS server that will be used to resolve the NAPTR query. This could be:
 - an internal DNS server that holds the NAPTR records - for example, use this if you are implementing ENUM dialing for calls within your network only
 - an internal DNS server that directs the query to an external DNS server
 - an external DNS server

DNS You are here: [System](#) > [DNS](#)

DNS settings

Local host name: ⓘ

Domain name: ⓘ

DNS requests port range: ⓘ

Default DNS servers

Address 1: ⓘ

Address 2: ⓘ

Address 3: ⓘ

Address 4: ⓘ

Address 5: ⓘ

Per-domain DNS servers

Address 1:	<input type="text"/> ⓘ	Domain names:	<input type="text"/> ⓘ	<input type="text"/>
Address 2:	<input type="text"/> ⓘ	Domain names:	<input type="text"/> ⓘ	<input type="text"/>
Address 3:	<input type="text"/> ⓘ	Domain names:	<input type="text"/> ⓘ	<input type="text"/>
Address 4:	<input type="text"/> ⓘ	Domain names:	<input type="text"/> ⓘ	<input type="text"/>
Address 5:	<input type="text"/> ⓘ	Domain names:	<input type="text"/> ⓘ	<input type="text"/>

Configuring NAPTR on a DNS Server

A DNS server that can be queried by the Expressway for ENUM lookups needs to be configured with NAPTR records containing a <reverse digit order dotted E164 number> mapped to a routable address or regular expression to convert the dialed number into a routable address + transport specification (SIP or H.323)

BIND Style Configuration

For example, setting up:

- 557120 to call john.smith@example.com using SIP or H.323
- 557121 to call mary.jones@example.com using SIP
- 557122 to call peter.archibald@myco.com using H.323

/etc/named.conf File

The named.conf file specifies (among other things) zones with specific domains and the files (in the /var/named directory) that specify the zones' configuration.

For example:

```
zone "enum.search.com." IN {
    type master;
    file "enum.enumlookups";
};
```

/var/named/<filename>

Contained in the file /var/named/enum.enumlookups are the details of the configuration of the zone; for an enum zone this contains the Start Of Authority header followed by the NAPTR records containing the reverse ordered dotted digit lookups, their translations and details of the protocol to use to route the call.

For example:

```
$TTL 60
@INSOA<server name> root (
2009041201 ; serial number !!! change this to update record
60 ; refresh period
60 ; retry time
120 ; expire time
60 ; min ttl
)

SOA = Start of Authority record

INNS<server name>

NS = Name Server name

0.2.1.7.5.5 IN NAPTR 10 100 "u" "E2U+sip" "!^.*$!john.smith@example.com!" .
           IN NAPTR 12 100 "u" "E2U+h323" "!^.*$!john.smith@example.com!" .
1.2.1.7.5.5 IN NAPTR 10 100 "u" "E2U+sip" "!^.*$!mary.jones@example.com!" .
2.2.1.7.5.5 IN NAPTR 10 100 "u" "E2U+h323" "!^.*$!peter.archibald@myco.com!" .

<digits dotted and reversed>
    IN = Internet routing
    NAPTR = record type
        10 = order value (use lowest order value first)
        100 = preference value if multiple entries have the same
            order value
        "u" = the result is a routable URI
            "E2U+sip" to make SIP call
```

```
"E2U+h323" to make h.323 call
Regular expression:
! = delimiter
replace 'from start to end'
with name@domain
usual Regex expressions can be used
. NAPTR replace field not used
```

Appendix 1: Troubleshooting

Wireshark

TCPDUMP traces taken on Expressway or in the network through which Expressway's DNS requests traverse provide a good mechanism for seeing the DNS (ENUM) request and the relevant response.

Dig

Dig is a command that allows the DNS server to be interrogated to check its configuration. Use this command from a Linux system, or download dig for Windows and run that.

Dig of a Specific Entry

```
dig -t NAPTR 1.2.1.7.5.5.enum.search.com.
```

Should result in a response like this:

```
; <<> DiG 9.4.1 <<> -t NAPTR 1.2.1.7.5.5.enum.search.com.
;; global options: printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 61653
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 2

;; QUESTION SECTION:
1.2.1.7.5.5.enum.search.com. IN      NAPTR

;; ANSWER SECTION:
1.2.1.7.5.5.enum.search.com. 15 IN      NAPTR    10 100 "u" "E2U+sip" "!^.*$!mary.jones@example.com!" .

;; AUTHORITY SECTION:
enum.search.com. 15      IN      NS      <Authoritative DNS Server domain>.

;; ADDITIONAL SECTION:
<Authoritative DNS Server domain>.3600 IN A<Authoritative DNS Server IPv4 address>
<Authoritative DNS Server domain>.3600 IN AAAA<Authoritative DNS Server IPv6 address>

;; Query time: 1 msec
;; SERVER: <Local DNS Server IP address>#53(<Local DNS Server IP address>)
;; WHEN: Mon Oct 6 16:17:33 2008
;; MSG SIZE rcvd: 182
```


Appendix 2: Using Regex Features of NAPTR

The incoming information to the NAPTR lookup is:

`\d\.\d\.\d\.\d\.\d`

For example `1.2.1.7.5.5`

Normal regular expression commands can be used to use these digits in the URI if required.

Document Revision History

The following table summarizes the changes that have been applied to this document.

Date	Description
November 2015	New template applied. Republished for X8.7.
December 2014	Republished for X8.5.
June 2014	Republished for X8.2.
December 2013	Initial release.

Cisco Legal Information

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

All printed copies and duplicate soft copies are considered un-Controlled copies and the original on-line version should be referred to for latest version.

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco website at www.cisco.com/go/offices.

© 2015 Cisco Systems, Inc. All rights reserved.

Cisco Trademark

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: www.cisco.com/go/trademarks. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)