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Cisco IOS Digit Manipulation

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Introduction

You will probably encounter a situation where you will need to control the actual digits contained in the telephone number that enter or leave a gateway. You might need to add the area code to a call that is routed out to the public switched telephone network (PSTN), or remove a site code from an intercompany call, for instance. Digit manipulation encompasses adding, subtracting, and changing telephone numbers. You can manipulate calling numbers, called numbers, and redirecting numbers, in addition to the numbering plan and Integrated Services for Digital Network (ISDN) number type. You can use techniques that are applied to incoming or outgoing calls, or globally to all calls. You can manipulate telephone numbers before a dial peer is matched or afterwards.

In this paper, we will cover:

- Basic digit manipulation techniques
- Number expansion
- Number translation
- Ways to troubleshoot

Basic Digit Manipulation Techniques

There are several digit manipulation techniques; each controls telephone calls in different ways and is applied at a specific point in the call flow. The following table summarizes the techniques covered in this white paper.

Digit Manipulation Techniques

Technique	Where you apply it	When the action is taken	What can be manipulated
Digit Stripping	Plain old telephone service (POTS) dial peer	After the outbound dial peer is matched, but before digits are sent out	Called number only
Forward digits	Dial peer	After the outbound dial peer is matched, but before digits are sent out	Called number only
Prefix digits	Dial peer	After the outbound dial peer is matched, but before digits are sent out	Called number only
Calling Line Identification (CLID)	Dial peer	After the outbound dial peer is matched, but before digits are sent out	Calling number, calling name
Number Expansion	Globally, applies to all calls	Before outbound dial peer is matched	Called number only
Voice Translation Profiles	Dial peer, voice ports, trunk groups, all incoming VoIP calls, source P group, NFAS interfaces	Can translate before incoming dial peer is matched, before an outgoing dial peer is matched	Calling, called, redirected numbers, number plan, number type

Digit Striping

VoIP dial peers forward all digits by default; however, POTS dial peers strip any outbound digits that explicitly match their destination pattern. For instance, given the destination pattern of 55512, the called number transmitted to the PSTN would contain just the last two digits. The first five digits (, 55512) would be striped because they are explicitly matched digits. Given the destination pattern of 555[2-9]... and a digit string of 555422, only the 555 would be stripped.

Digit stripping is the default behavior of POTS dial peers, which can work to your advantage if you understand its effect. For instance, if a user dials nine to reach an outside number, you do not want the number nine sent to the PSTN—you can configure a POTS dial peer with a destination pattern of 9T—and so the nine is matched and stripped. Only the remaining digits are transmitted.

You can disable digit stripping with the command **[no] digit strip** under the post dial-peer configuration mode. The relevant command syntax is as follows:

```
Dial-peer voice 1 pots
[no] digit strip
```

Forward Digits

You can achieve more precise control over the number of digits that are transmitted to the PSTN with the following command:

```
Forward-digits [number|all|extra]
```

Where:

- *Number* gives the number of digits to forward
- **All** means to forward all digits
- **Extra** tells the gateway to forward any digits that are longer than the length of the destination pattern

This command allows you to specify the exact number of digits to be forwarded. The following examples show which digits are sent when you dial the number 111-222-3333 and use various options of the **forward-digits** command.

The first case, the right most seven digits are sent:

```
# dial-peer voice 111 pots
# destination-pattern 111222....
# forward-digits 7
```

With this next configuration the entire number is sent:

```
# dial-peer voice 111 pots
# destination-pattern 111222....
# forward-digits all
```

Prefix Digits

In some cases you, might need to transmit more numbers than what was dialed. For example, a call that would normally go across your IP network needs to be routed through the PSTN, requiring the addition of the appropriate area code and prefix. You can use the **prefix** command to replace some of those digits. This command is given under the dial-peer configuration mode. The prefix string can be any number from zero through nine and a comma that inserts a one-second pause. The gateway prefixes digits after the outgoing dial peer are matched, which is after digits are stripped and before it sends the call out.

In the example below, the dial peer matches long distance calls with a destination pattern of 91T. The 91 will be stripped first, and then followed by prefixing the one in front of the remaining digits.

```
# dial-peer voice 91 pots
# destination-pattern 91T
# prefix 1
```

So when a user dials 9-1-111-222-3333, the digits are manipulated before being sent to the PSTN. The original digits (nine and one) are stripped, and a one is prefixed to the remaining number. Thus, the PSTN receives the number 1-111-222-3333

CLID

You can manipulate the Caller ID information by a set of **clid** commands. These commands allow you to remove or change the calling party information that is transmitted with a call, and also allow you to send it but prevent it from being displayed. **Clid** commands apply to specific dial peers when assigned with the dial peer configuration mode. They apply globally when assigned under the voice service VoIP configuration mode. The commands include the following:

- **clid network-number *number*** – Specified the network number to be sent in the **clid** information. Available in both dial peer and voice service VoIP configuration modes.
- **clid restrict** – Transmits the calling party information but sets the presentation indicator to “N” so that it is not displayed.
- **clid strip** – Removes the number and sets the presentation bit to “N”.
- **clid substitute name** – Substitutes the calling number for the display name.

Number Expansion

Number expansion is another way to add digits to an outgoing called number; however, number expansion is applied to the gateway as a whole and acts on all calls—not just those matching a destination dial peer. As with the previous examples, this technique manipulates only the called number. Number expansion occurs before any outbound dial peer is matched, therefore, outbound dial peers are configured to match the expanded number (not the original ones).

The command for number expansion is **num-exp *original-number, expanded-number***, configured at a global configuration mode. Although the command is called number expansion, the manipulated number may contain fewer or more digits than the original.

The first command manipulates any four-digit number that begins with one and expands it to a 10-digit number beginning with 800555. The second command changes any seven-digit number beginning with 5551 to a four-digit number beginning with a one.

```
# num-exp 1... 800555...  
# num-exp 5551... 1...
```

Translation Profiles

Translation profiles are the powerhouse digit manipulation tool of the IOS. With translation profiles, you can modify the called number, the calling number, the call-back number, and the redirected called or redirected calling number. No other tool in the IOS can manipulate the calling, call-back, or redirected number.

In addition to all the numbers they can modify, they also have great flexibility in how they can be applied. They can be applied on the voice port, trunk group, or the dial-peer in either direction (inbound or outbound). Using voice translation profiles for digit manipulation requires these three steps:

1. Create one or more voice translation rules and a prioritized list of up to 15 translation associated with each rule.
2. Create one or more translation profiles and associate the translation rule to the profile. Within each profile, you can apply one voice translation rule to the calling numbers, one to the called numbers, and one to the redirected called number.
3. Apply the voice translation profile to all VoIP calls globally, an individual dial peer, voice port, trunk group, source IP interface, or interface.

Creating Voice Translation Rules

To create a voice translation rule, use the command **voice translation-rule** *tag* in the global configuration mode. Next, create an ordered list of one or more rules with the following command:

```
# voice translation-rule 1  
# rule precedence /match pattern/ /replace pattern/
```

You can enter rules in any order; the precedence value determines the order in which the rules are executed. You can configure up to 15 rules within a single voice translation rule.

The basic voice translation rule replaces one group of digits with another. Each group is delineated with // (forward leaning slashes) characters. In the example below with voice translation-rule 1, the rule is looking for the string "101" so it can replace it with "5551001".

```
#voice translation-rule 1  
#rule 1 /101/ /5551001/
```

Voice translation-rule 2 demonstrates the use of multiple rules. In this example, the voice translation-rule 2 is looking for three different strings (1004, 1005, and 1006) and will replace those strings with 8015551000, 2145557000, and 7135559000, respectively.

```
#voice translation-rule 2  
# rule 1 /1004/ /8015551000/  
# rule 2 /1005/ /2145557000/  
# rule 3 /1006/ /7135559000/
```

Voice translation-rule 3 uses regular expressions that look for a string beginning with 2145551... and will replace it with 8005551... In this example, the () identifies three sub strings that can be reused in the replacement string via \2 (referring to sub string 2 and \3 referring to substring 3).

```
#Voice translation-rule 3
#rule 1 /^^(214)\(555)\(1...)/ /800\2\3/
```

Using regular expressions in translation rules expands our capabilities tremendously. The topic of regular expressions is a topic beyond the scope of this article, and so we will not examine it further. I mentioned it just to let you know it is possible.

Creating Voice Translation Profiles

Voice translation rules are associated with voice translation profiles. Using a translation profile gives you flexibility and scalability by allowing multiple translation rules. You can apply voice translation rules to called numbers, calling numbers, and redirected numbers in the same profile. A voice translation profile is typically associated with a dial peer, a voice port, or all VoIP calls globally.

Create a translation profile and enter the profile configuration mode with the voice command **voice translation-profile** *name*. Next, specify what type of number will be translated, and then enter the rule to apply to that number. The following example shows a translation profile called TEST. This translation profile will translate the called number with rule 2 and will translate the calling number with rule 3.

```
# voice translation-profile TEST
# translate called 2
# translate calling 3
```

After you create a translation profile, you can assign it to a dial peer, voice port, trunk group, or all VoIP calls globally. The place in which the voice translation profile is applied affects the matching of inbound or outbound dial peers. Meaning, a profile that is applied to:

- A voice port—is carried out *before* the inbound dial peer is matched
- An inbound dial peer—is carried out *before* the outbound dial peer is matched
- An outbound dial peer—is carried out *before* the call is transmitted

Be sure to consider this when placing your voice profiles and configuring the dial peers.

Conclusion

In conclusion, we know that there are several reasons we might need to perform digit manipulation on our phone calls as they traverse the gateway. We have covered the use of several tools that allow us to modify the called number, and one tool—the translation profile tool—allows us to modify the called number, the calling number, and the redirected number as well. We also reviewed the order in which digit manipulation occurs, and how we should consider the order of digit manipulation in achieving the desired outcome.

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