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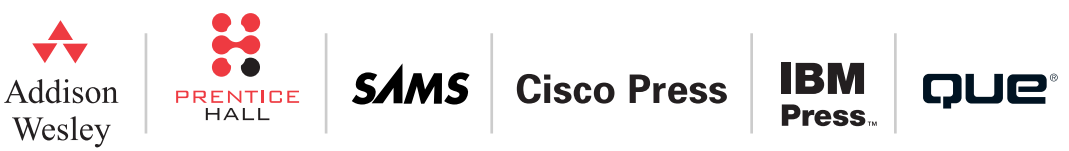


Chapter 6

Working with Dial Plans

A dial plan determines how calls are routed through a VoIP network. In this chapter, you will see what a dial plan contains and how to create a dial plan that points outward to the public switched telephone network (PSTN). Having multiple sites can add complexity to a dial plan (for example, because of overlapping number ranges). This chapter also covers potential solutions for such design challenges.

Dial-Plan Characteristics

Dial plans typically organize a group of phone numbers in a hierarchical fashion. Consider the North American dialing plan, which consists of 10 digits, an example of which follows:

859-555-1212

The first three digits (that is, 859) indicate an area code, which is typically associated with a geographic location within North America. The following three digits (that is, 555) are the central office (CO) code (that is, the NXX code), which identifies a central office location within the area that is specified by the area code. The final four digits (that is, 1212) point the local CO to a specific local loop that goes out to a subscriber's physical location.

This section identifies the characteristics of a dial plan. Each of these characteristics is then discussed in more detail.

 Please see page 130 for more details.

Dial-Plan Elements

A dial plan contains elements that perform the following functions:

- **Assigning endpoint addresses**: Endpoint addressing determines the format of phone numbers.
- **Selecting a path**: You might, for example, configure a dial plan to place calls over an IP WAN (as a preferred path), but calls might be routed over the PSTN as a backup.
- **Manipulating digits**: Dialed digits and the digits making up a caller ID string might need to be manipulated when calling between phones. For example, digits such as area code and office code digits might need to be added when calling out to the PSTN, or one dial string (for example, a 0 to reach a company operator) might need to be replaced with another dial string (for example, the actual directory number of the operator's phone).
- **Applying call restrictions**: Call restrictions can be configured to control which destinations phones are allowed to call. For example, you might not want a lobby phone calling an international number.
- **Supporting call coverage**: The call coverage feature allows a group of phones, sometimes called a *hunt group*, to handle incoming calls (for example, calls coming into a call center).

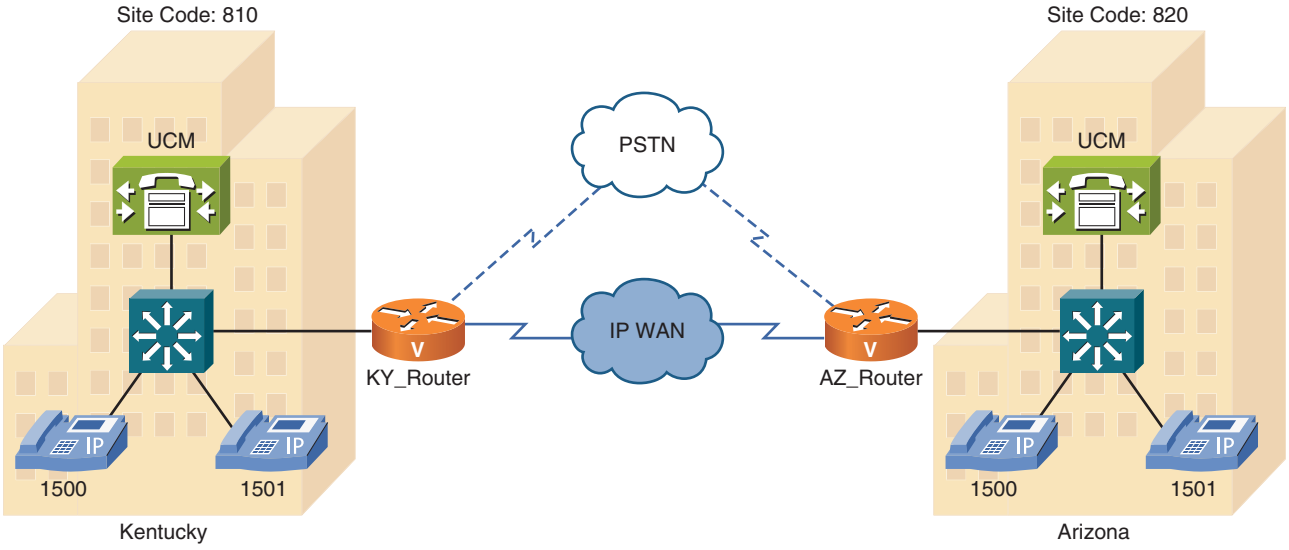
Assigning Endpoint Addresses

Endpoint addressing assigns directory numbers (DNs) to devices, such as phones. Also, endpoint addressing maps internal extensions to incoming direct inward dial (DID) numbers. However, if you do not have a DID number to map to each internal DN, an auto attendant can be used to take an incoming call and route that call to an appropriate internal DN.

One of the biggest challenges with endpoint addresses occurs when you have multiple sites, and those sites have overlapping DNs, as illustrated in Figure 6-1. Notice that both the Kentucky and Arizona locations have DNs of 1500 and 5101.

 Please see page 130 for more details.

FIGURE 6-1
Overlapping DNs



To allow callers in Kentucky and Arizona to have their calls extended to the appropriate locations, the administrator could require the use of site codes, where the dialed number is prepended with a site code when calling a remote site. In this example, if a caller at DN 1501 in Kentucky wants to call DN 1502 in Arizona, the caller can dial 8201502. Digit manipulation must then be performed to strip the 820 site code from the dialed number. Also, a good practice is to manipulate the caller ID number to prepend the Kentucky site code of 810 to 1501. As a result, the recipient of the call, at DN 1502 in Arizona, would look at his phone and see 8101501 displayed as the caller ID. This provides the called party with the exact number he should dial to call back the calling party.

Selecting a Path

The call routing and path selection component of a dial plan dictates where and how calls should be routed through a network. Usually, how a call is routed depends on the dialed number. For example, was the dialed number on-net or off-net?

 Please see page 130 for more details.

An IOS router acting as an H.323 gateway makes these call routing decisions based on dial peers. As a result, in some larger deployments, the number of dial peers can be large. Recall that multiple dial peers can be configured to point to the same destination, and the **preference** command can be issued in dial-peer configuration mode to influence which dial peer is used. The preferred dial peer could therefore point across an IP WAN, while a lesser-preferred dial peer could point outward to the PSTN.

Manipulating Digits

Dial plans also need to accommodate for digit manipulation. For example, when a call comes in, the called number needs to match a destination pattern that the router knows how to reach. Also, you might want the caller ID of the calling number to appear as the number that the called party would have to dial to call back the calling party.

For outbound calls, you need to present a valid dial string to, perhaps, the PSTN. In addition, you might need to support 911 calls, which might require Centralized Automatic Message Accounting (CAMA) trunks. A CAMA trunk can help preserve caller ID information being sent out on an analog trunk. For example, suppose a university spans several square miles and has several buildings. If a caller in Building Z calls 911, but the analog trunks coming in from the PSTN are located in Building A, the location information sent out to the 911 public-safety answering point (PSAP) will reflect the location of Building A rather than Building Z. CAMA can help solve this issue by transmitting the original caller ID over an analog trunk to the PSAP.

Applying Call Restrictions

You probably do not want your users calling any destination they choose, such as international numbers, 900 numbers (that is, premium service numbers), or perhaps even 411 calls (that is, directory assistance calls). In a PBX environment, the feature that supports setting call limitations is commonly referred to as *class of service* (CoS). In a Cisco Unified Communications Manager (UCM) environment, partitions and calling search spaces are commonly used to apply call restrictions. Also, the class of restriction (CoR) feature adds call restriction support for IOS-based voice gateways.

 Please see page 130 for more details.

Supporting Call Coverage

The call coverage component of a dial plan helps minimize the number of dropped incoming calls. If you are not at your desk, for example, you might have your phone forwarded to another phone.

In a call center environment, the goal is to intelligently distribute incoming calls across multiple customer service agents. The phones of these customer service agents can belong to a hunt group. However, callers do not directly dial one of the customer service agents. Instead, they dial a hunt *pilot number*, which distributes incoming calls among the hunt group members.

PSTN Dial Plans

Configuring a dial plan to point outward to the PSTN can be a complex task. Often, you need to use solutions provided by Cisco UCM, Cisco UCM Express, or an IOS-based voice gateway. This section discusses PSTN dial-plan design considerations, and it examines syntax used to configure PSTN dial plans.

PSTN Dial-Plan Design Considerations

Call routing and path selection should be set up in both the incoming and outgoing directions. To make the linkage between the PSTN and the internal VoIP network transparent to the end users, and to present appropriate caller ID information to both the called and calling parties, digit manipulation might be required.

Consider the example shown in Figure 6-2. The topology shows an outbound call coming from DN 1500 in the Kentucky office and destined for a phone on the PSTN with a phone number of 480-555-1345.

 Please see page 130 for more details.