CHAPTER 6

Dial Plan Architecture

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This chapter defines and explains the key elements in designing a dial plan for an H.323 network. An H.323 video dial plan is a numbering scheme that allows H.323 video endpoints to dial other video endpoints or video services (multipoint control unit or gateway). This chapter discusses each of these components in the context of a single-zone or multi-zone scenario.

This chapter contains the following sections:

What's New in This Chapter

Table 6-1 lists the topics that are new in this chapter or that have changed significantly from previous releases of this document.

Table 6-1 New or Changed Information Since the Previous Release of This Document

New or Revised Topic	Described in:
Dial plan for connecting to external entities	Dial Plan for External IP Connectivity, page 6-11

Dial Plan Components

A well designed dial plan is a key component of a successful H.323 video network, and it is one of the first things you need to consider when designing an H.323 video network. Without a well constructed dial plan, it is impossible to scale the network.

H.323 dial plans consist of four key elements:

- E.164 address

  An E.164 address is a numeric identifier defined on each H.323 video endpoint, just as E.164 is used in telephony systems.

- H.323-ID

  An H.323-ID is an alphanumeric identifier defined on each H.323 video endpoint, and it can be used to dial the H.323 endpoint. An alias may also be used to refer to an H.323-ID. For example, email addresses are often used as H.323-IDs. H.323-IDs cannot be used to dial to the PSTN or to a Cisco IP/VC 3510 multipoint control unit (MCU).

- Zone prefix

  A zone prefix is a numeric prefix that identifies a zone. Zone prefixes are used for inter-zone call routing, the same way an area code is used in a telephony system. Each zone in an H.323 network has one unique zone prefix. Area codes are often used as zone prefixes in H.323 networks.

- Service or technology prefix

  A service prefix is a numeric prefix used in an H.323 dialing string to access a defined service on an MCU or gateway. The Cisco gatekeeper refers to the service prefix as a technology prefix, which is also used by H.323 voice gateways. (This document refers to these prefixes as *service prefixes*.) Service prefixes are used on video gateways and MCUs to define parameter settings and to route calls for the device. On a Cisco Unified Videoconferencing 352x video gateway, a service prefix defines the type of call being made (voice or video) and the data rate of the call. On a Cisco Unified Videoconferencing 351x and 3545 MCUs, service prefixes define the data rate of the call, number of participants, and picture format. When an MCU or video gateway registers with the gatekeeper, it registers all defined service prefixes. When an H.323 endpoint uses a video gateway or MCU, the dial string must start with the service prefix followed by the PSTN number being dialed (in the case of a gateway call) or the conference ID being created or joined (in the case of an MCU call).

Table 6-2 shows the correlation between components of a video and IP telephony dial string.

Table 6-2 Correlations Between Video and IP Telephony Dial Stings

Video Dial String	IP Telephony Dial String
Service prefix	Technology prefix
Zone prefix	Area code
E.164 address	Local exchange
	Unit ID

Service Prefix Design

Service prefixes are a very important part of the dial plan. Inter-zone and intra-zone calls to an MCU or gateway are routed using the service prefix. The single-zone and multi-zone models are very similar, and both are discussed in this section, with minor differences between them noted.

It is important to keep dial strings intuitive. For example, the models in this section use dial strings that are very similar to telephony dial strings. Dial strings are reviewed in the chapter on Call Routing.

In a single-zone network, Cisco recommends that you reserve a block of numbers for service prefixes, such as 8* for MCUs and 9* for gateways.

Note The asterisk is a wildcard that represents any dialed digits. For example, the string 8* represents any dialed string beginning with the digit 8 followed by any number. Users do not dial the asterisk (*) when placing a call.

Cisco also recommends that you add the local area code to the service prefixes of MCUs. For example, a San Jose MCU might have a service prefix of 40880. Gateway prefixes should remain 9* to keep dial strings consistent with telephony dial plans. This service prefix structure also allows an easy migration to a multi-zone dial plan.

E.164 addresses must not overlap with service prefixes. For example, if an MCU registers with a service prefix of 40880* and a video terminal registers with 4088011212, all calls made to the video terminal would be routed to the MCU instead.

In a multi-zone network, service prefixes need to route between zones. Therefore, all service prefixes must be unique across all zones. All inter-zone or intra-zone calls are routed based on the service prefix. Cisco recommends that you design service prefixes in a multi-zone network to allow user dial strings to be consistent. To achieve this consistency, use the different approaches outlined in the following sections for service prefixes on MCUs and gateways. Service prefixes, E.164 addresses, and zone prefixes must not overlap, or call routing issues will arise.

MCU Service Prefixes

MCUs must be accessible from any H.323 endpoint on the network, which means that all service prefixes in all zones must be unique. In order to accommodate unique service prefixes without reserving large blocks of numbers, Cisco recommend that you design the MCU service prefixes to be a combination of the zone prefix and a service number. This design allows all the service prefixes for MCUs to be consistent in all zones.

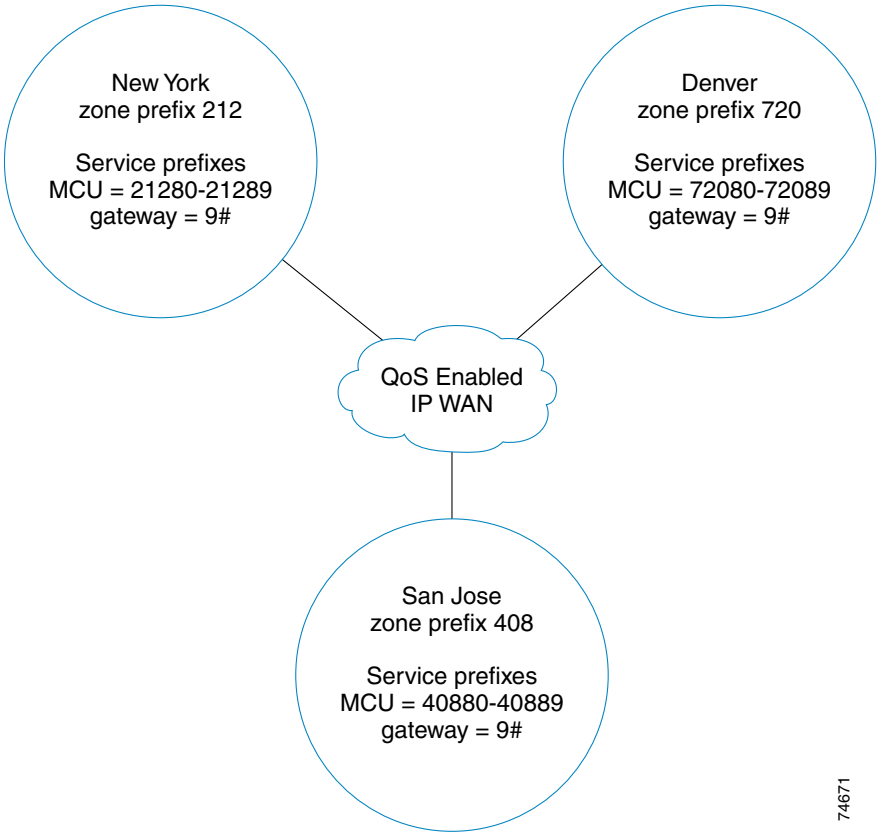
For example, if the reserved block of numbers is 8*, the service prefix for a 384 kbps call with five users could be 40880 in the 408 zone and 41580 in the 415 zone. The dial string for a 384 kbps conference call in zone 408 would be 40880<*conference ID*>. This design eliminates the need for hopoff entries, and it associates the service with the zone in which the service resides. (For more information on hopoffs, see the Call Routing chapter.)

Gateway Service Prefixes

Gateway services in a multi-zone network are similar to those in the single-zone model. Reserve a block of numbers for gateway services. In zones that contain gateways, off net calls always use the local gateway. For zones without a gateway, add a hopoff entry or use location request (LRQ) forwarding to route the call to a zone containing a gateway. (See the Call Routing chapter for more information regarding hopoffs, LRQ forwarding, and directory gatekeeper.)

For example, if the reserved block of numbers is 9*, the gateway service configured for all outbound calls could be 9#. Configure these service prefixes on all gateways in all zones. In zones that have a zone prefix starting with 9, ensure that the zone prefix and gateway service prefixes do not overlap. For example, if the zone prefix is 916, a gateway service prefix of 9 cannot be used in that zone, otherwise all calls in the zone would be routed to the gateway. To avoid this problem, Cisco recommends that you configure the gateway service prefixes to include a # sign, such as 9#. Figure 6-1 illustrates service prefix design in a multi-zone network.

Figure 6-1 Service Prefix Design in Multi-Zone Networks



Note Use a # in the service prefix for gateways to ensure that calls coming in from the PSTN network do not have the ability to hair-pin back onto the PSTN through the gateway. When a user dials a # from the PSTN to the gateway, the # is treated as a delimiter and the call fails.

Single-Zone Dial Plan

Dial plans for single-zone networks are straightforward. There are a few rules that you must follow to ensure that call routing in a single zone works properly. When developing a dial plan for a single-zone network, use the following components and guidelines:

- Incoming PSTN call routing method

  As a general rule, the incoming PSTN routing method is a good place to start when designing a dial plan because it determines the number strings and the E.164 numbering structure used in the dial plan. If Direct Inward Dialing (DID) is used, each H.323 endpoint is assigned a valid E.164 directory number (DN). If interactive voice response (IVR) or TCS4 is used, the administrator can choose the E.164 number structure. Cisco recommends using 10-digit numbers for E.164 addresses because 10-digit numbers allow for an easy migration to a multi-zone dial plan. (Endpoints should be configured with a local extension, and that extension plus the zone prefix together should consist of 10 digits.) Incoming PSTN routing methods, DID, IVR, and TCS4 are covered in detail in the Call Routing chapter.

- Service prefixes

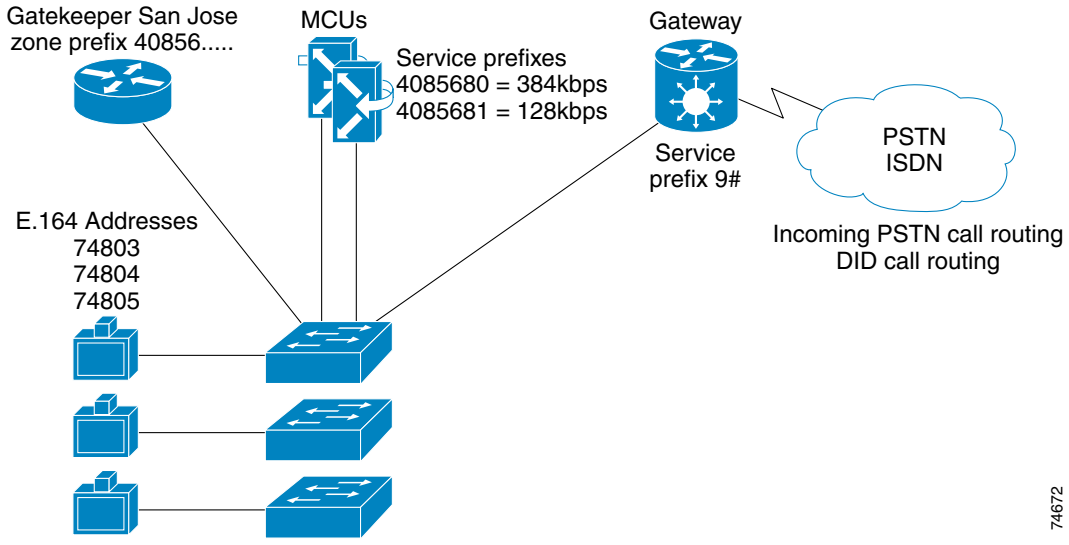
  Services prefixes must not overlap with E.164 addresses; therefore, it is a good idea to reserve a block of numbers for service prefixes. In Figure 6-2, the reserved block of numbers is 8* for MCUs, the zone prefix is 40856, and the two service prefixes for the MCU are 4085680 and 4085681. Gateway services are 9# and do not include the zone prefix.

- H.323-IDs

  H.323-IDs are alphanumeric strings used to identify an H.323 terminal. H.323-IDs are often email addresses of individual users or conference room names for room systems. Using H.323-IDs to place calls is intuitive, as long as the user-to-endpoint mapping is static. Some H.323 room systems are used in multiple conference rooms, and naming these units can be a challenge.

Figure 6-2 illustrates a single-zone design for a campus network.

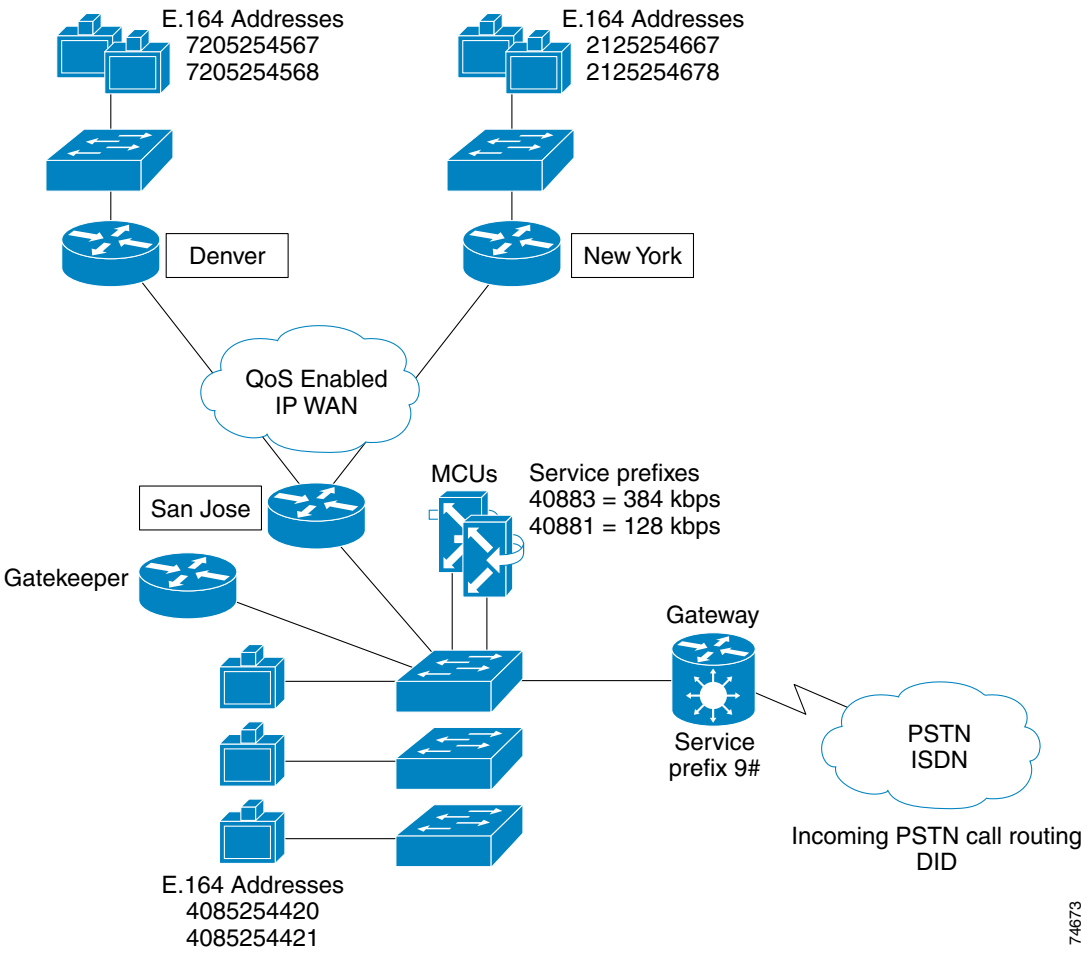
Figure 6-2 Single-Zone Configuration for a Campus Network



When creating a dial plan for a single zone in a WAN environment, it is always a good idea to use a numbering scheme that allows an easy migration to a multi-zone dial plan. For this purpose, Cisco recommends that you use fully qualified E.164 addresses for the video terminals.

Figure 6-3 illustrates a single-zone WAN dial plan. All video terminals, gateways, and MCUs register in one zone and are routed according to the E.164 address, H.323-ID, or service prefix registered by each device.

Figure 6-3 Single-Zone WAN Dial Plan



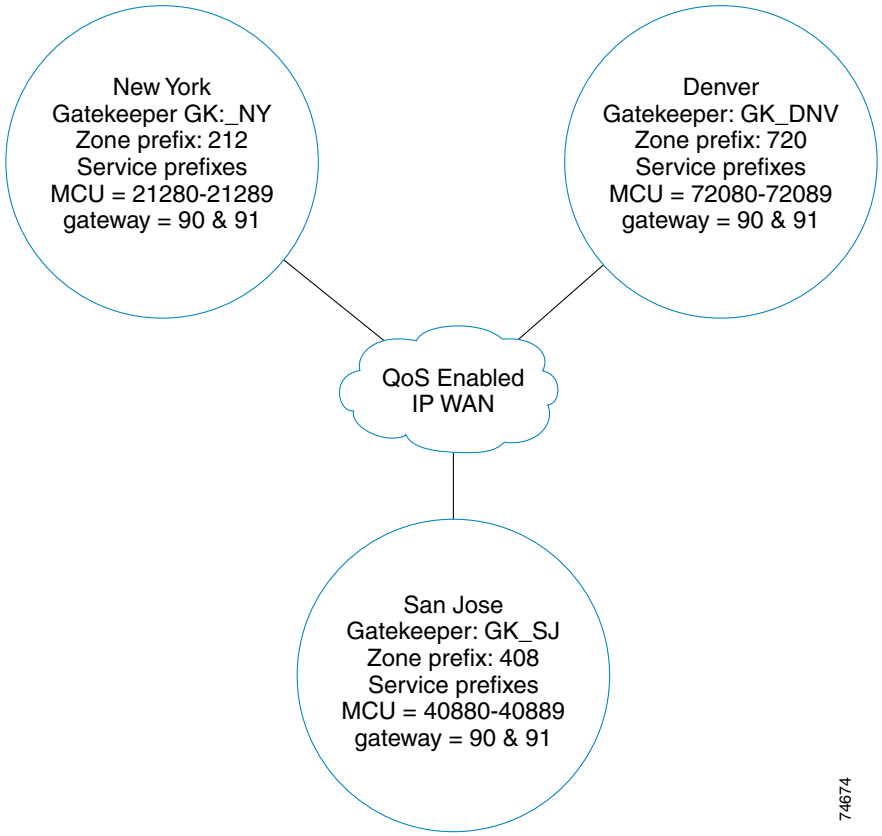
Zone Prefix Design

Zone prefixes are used in an H.323 video network to allow inter-zone call routing between H.323 endpoints, in the same way an area code is used in the PSTN. Each zone on the network must have a unique zone prefix that is used to identify the zone. Cisco recommends using the local area code for the zone prefix. For example, in Figure 6-4 there are three zones: San Jose campus zone 408*, New York 212*, and Denver 720*.

Zone prefixes can be configured with a wildcard (408*) or with dots (408…….). Cisco recommends that you use the dot method when configuring zone prefixes because this method lets you specify the exact number of digits to match, whereas the wildcard matches any number of digits. Zone prefixes can vary in length, and using more digits in the zone prefix reduces the number of available terminal addresses.

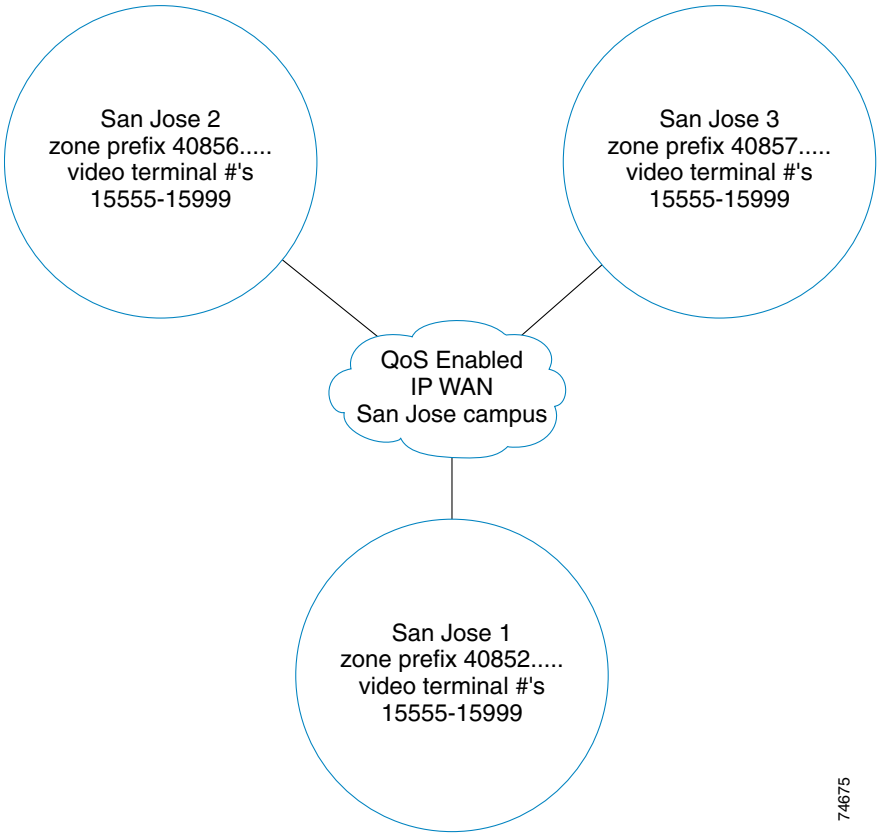
Note Never use a wildcard for the zone prefix of a Directory gatekeeper zone prefix. Doing so would cause all calls, including local calls, to be forwarded to the Directory gatekeeper. Instead, use the dot (.) method to specify the zone prefix of the Directory gatekeeper. For more information on using the Directory gatekeeper, refer to the chapter on Call Routing.

Figure 6-4 Example Network with Unique Zone Prefixes



Large sites that need more than one zone can still use the local area code and expand the zone prefix to include some of the E.164 address. For example, the San Jose campus in Figure 6-5 has three zones: one configured as (40852…..), the second as (40856…..), and the third as (40857…..). Video terminals can then register with five-digit extensions, allowing extension-based dialing within the local zone, but 10-digit dialing is still required between zones.

Figure 6-5 Using a Single Area Code for Multiple Zones



Multi-Zone Dial Plan

Dial plans for multi-zone networks have the added complexity of zone prefixes and inter-zone call routing. When developing a dial plan for a multi-zone network, consider the following components and guidelines:

- Incoming PSTN Call Routing

  Again, it is a good idea to start with the incoming PSTN routing method when developing the dial plan because the routing method determines which E.164 numbering structure is used in the dial plan. Unless there is at least one gateway in each PSTN area code, direct inward dialing (DID) is not recommended for use as the primary incoming PSTN routing method in a multi-zone network because the DID number is within one area code but the remote zone prefix may be in a different area code.

Rather than configuring your remote zone prefixes to match the area code, which would confuse the dial plan, Cisco recommends that you place a gateway in each area code. It is important that you order enough DID numbers for all zones located in the area code serviced by the gateway. Because the Cisco gatekeeper does not support digit manipulation, it is very difficult to route incoming DID calls between zones. There are cases in a multi-zone network where you might want to use a mix of incoming call routing methods; for example, you could use DID for endpoints but use IVR for MCU meet-me conferences.

If interactive voice response (IVR) or TCS4 is used, the administrator can choose the E.164 number structure. Cisco recommends using 10-digit numbers for E.164 addresses because 10-digit numbers allow for an easy migration to a multi-zone dial plan. (Endpoints should be configured with a local extension, and that extension plus the zone prefix together should consist of 10 digits.) Incoming PSTN routing methods, DID, IVR, and TCS4 are covered in detail in the Call Routing chapter.

- Service Prefixes

  Service prefixes must not overlap with E.164 addresses; therefore, it is a good idea to reserve a block of numbers for service prefixes. When a range of numbers is reserved for MCUs (for example, 8*), append the zone prefix to the reserved number to create a unique service prefix. For example, if the zone is 408 and the reserved block of numbers is 8*, the first service prefix might be 40880. In this case, an H.323 endpoint may not register with an E.164 address that starts with 40880-40889. If an MCU registers with a service prefix of 40880 in the zone and an H.323 endpoint registers with 4088012, all calls to 4088012 would be routed to the MCU.

- Zone Prefixes

  Zone prefixes are also very important in the development of the dial plan. Zone prefixes are much like area codes in a telephony system. Cisco recommends that you use local area codes for zone prefixes because area codes are unique, already defined, and people are familiar with them. Again, it is up to the administrator to choose the zone prefixes, but it is also important that the prefixes be intuitive and capable of growing with the network. Zone prefixes must not overlap with service prefixes, otherwise call routing issues will arise. (If you use a zone prefix plus a service prefix for MCUs, overlap with MCUs will not be an issue.) See Service Prefix Design, page 6-3, for details.

- H.323-IDs

  H.323-IDs are alphanumeric strings used to identify an H.323 terminal. H.323-IDs are often email addresses of individual users or conference room names for room systems. Using H.323-IDs to place calls is intuitive, as long as the user-to-endpoint mapping is static. Some H.323 room systems are used in multiple conference rooms, and naming these units can be a challenge.

If IVR is the chosen method for incoming PSTN call routing, observe the following guidelines:

- All systems dialing in from the PSTN must support Dual Tone Multi-Frequency (DTMF).
- Implement a private numbering plan.

If DID is the chosen method for incoming PSTN call routing, observe the following guidelines:

- Gateways must reside in each area code for zone prefix consistency.
- Use IVR to route MCU calls.

Figure 6-6 illustrates a multi-zone design using IVR, and Figure 6-7 illustrates a multi-zone design using DID.

Figure 6-6 Using IVR in a Multi-Zone Configuration

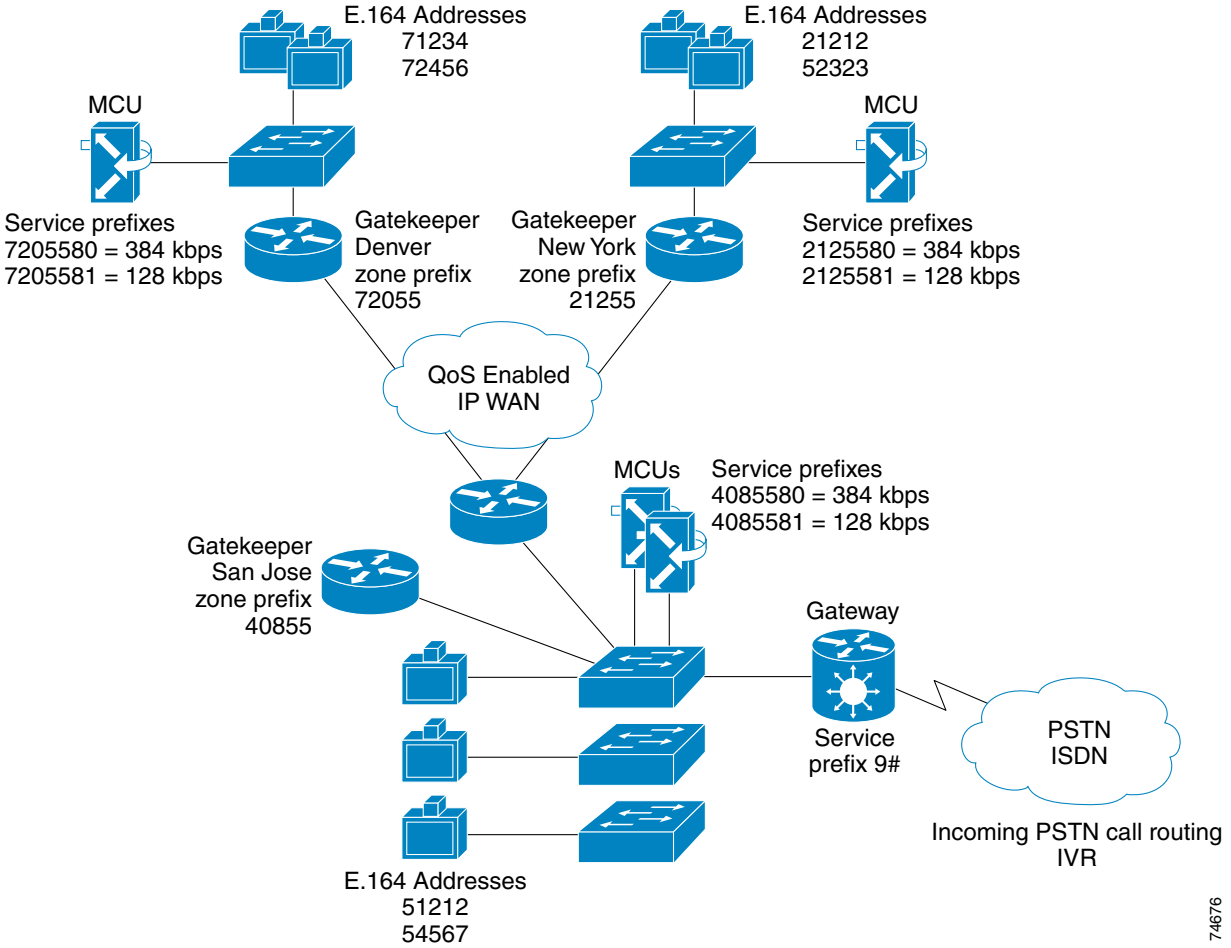
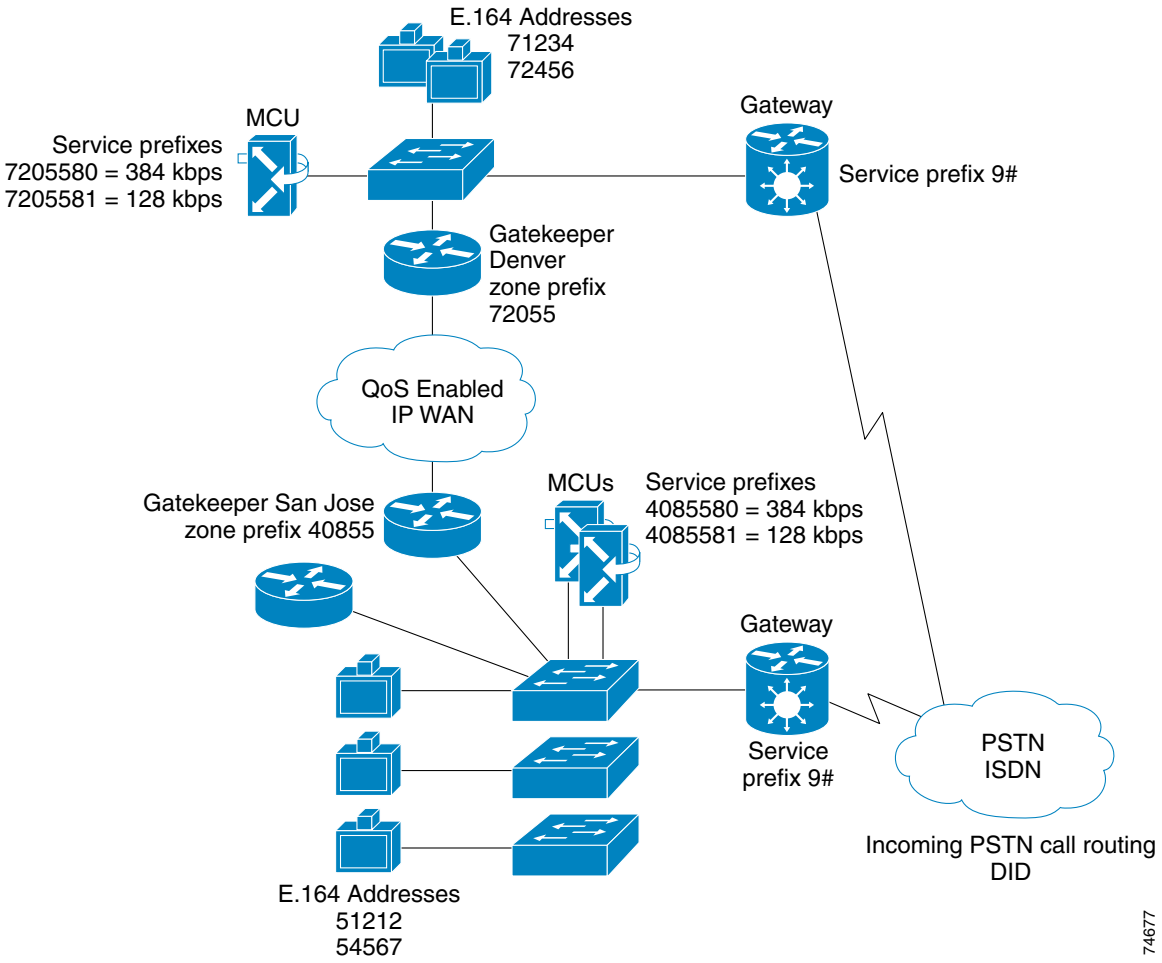


Figure 6-7 Using DID in a Multi-Zone Configuration



Note In Figure 6-7, the IVR is still enabled for access from the PSTN to the MCUs.

Dial Plan for External IP Connectivity

The enterprise dial plan will likely need to reach external entities such as vendors, suppliers, or other businesses. Connecting to them can be done using the PSTN, as discussed above, but connectivity on the IP network presents challenges for the dial plan. Cisco recommends that enterprises use E.164 addresses for the dial plan between organizations. This provides a non-overlapping unique E.164 address that can be configured easily in each enterprise. Enterprises then can use number translations to normalize the addresses to its internal dial plan.

When connecting numerous independent external units such as sales personnel or small remote locations over untrusted networks, Cisco strongly recommends making them part of the internal network for registration so that their dial plan can be controlled by the enterprise.