CHAPTER 4

Call Progress Tones

Call progress tone signals provide information regarding the status or progress of a call to customers, operators, and connected equipment. In circuit-associated signaling, these audible tones are transmitted over the voice path within the frequency limits of the voice band. The four most common call progress tones are:

- Dial tone
- Busy tone
- Audible ringback
- Reorder tone

The VCO/4K generates a full range of call progress tones via Service Platform Cards (SPCs) configured for DTG operation. Call progress tone detection is performed by SPCs configured for call progress analysis (CPA). In addition to the standard tones above, the CPA can be used to detect several other audible signals, including:

- Cessation of ringback
- Presencecessation of voice
- Special Information Tones (SITs)
- Pager cue tones

Collectively, call progress tones and these other audible signals are referred to as call progress events.

Tone Generation

The system generates call progress tones as specified by inpulse and outpulse rule processing and command processing. A full range of single and combination tones is supported; however, only four tones (dial tone, busy tone, audible ringback and reorder tone) are discussed here in detail. Refer to the *Cisco VCO/4K System Administrator's Guide* for complete information about tone generation.

Inpulse Rule Processing

TONE NOW [xx], TONE ENAB [xx], and TONE FDIG [xx] inpulse rule tokens generate call progress tones during rule processing. The system presents the tone specified in the token's data entry field to the incoming port. Fifty-three system tones are available, including all DTMF and MF digits.
TONE NOW [xx], TONE ENAB [xx], and TONE FDIG [xx] values for the four primary call progress tones are shown in Table 4-1.

Table 4-1 Call Progress Tone Values for Inpulse Rules

Tone Value	Tone
3	Dial tone
17	Audible ringback
18	Busy tone
19	Reorder tone

When a TONE NOW token is processed, the port listens to the call progress tone indefinitely unless another TONE NOW token is encountered (such as TONE NOW 1, setting the port to listen to Quiet). Inpulse rule processing immediately continues once tone generation begins, and succeeding tokens (other than another TONE NOW) do not interfere with the tone.

TONE ENAB and TONE FDIG tokens are used in conjunction with MF/DTMF digit collection. When a TONE ENAB token is processed, the port listens to the call progress tone once the MF or DTMF receiver in the call's resource chain is enabled (receivers are enabled when an IP ANI [xx] or IP FIELD [xx] token is encountered). A TONE FDIG token presents a standard system tone to the port when the first digit is detected by a DTMF receiver (useful for going from dial tone to quiet when the user starts dialing). In both cases, inpulse rule processing immediately continues once tone generation begins, and the port listens to the call progress tone indefinitely unless a TONE NOW token is processed.

Command Processing

The Voice Path Control ($66) command can establish a voice path between an incoming or outgoing port and a system tone. System tones are classified as senders, and are designated by port address in the B address bytes in the command. Refer to the Voice Path Control [$66] command section in the *Cisco VCO/4K Standard Programming Reference* or *Cisco VCO/4K Extended Programming Reference.* A complete listing of system tones and their corresponding port addresses is contained in Appendix E of these manuals. Port addresses for the four primary call progress tones are shown in Table 4-2.

Table 4-2 Port Addresses for Primary Call Progress Tones

Port Address	Tone
$04 C2	Dial tone
$04 D0	Audible ringback
$04 D1	Busy tone
$04 D2	Reorder tone

The voice path between the port and system tone remains until a second $66 command tears downs the path or sets the port to listen to another tone. Because the $66 command does not affect call states or linkages, it is not recommended for use in call processing.

Call Progress Analysis

Detection of call progress events over standard system network interface circuits is performed by the SPC's CPA modules. Resource Allocation is controlled by a combination of supervision control outpulse rule tokens and answer supervision templates. Executing an outpulse rule containing a supervision control token can cause a CPA port to monitor the voice path between two ports involved in a call. Based on the configuration of the answer supervision template, the system reports specific call progress events detected during the call.

Tone Detection

Call progress tone generation/detection in the network is generally based on a Precise Tone Plan. In the plan, four distinctive tones are used singly or in combination to produce unique progress tone signals. These tones are 350 Hz, 440 Hz, 480 Hz and 620 Hz. Each call progress tone is defined by the frequencies used and a specific on/off temporal pattern.

The SPC's CPA functions detect four standard call progress tones (dial tone, busy tone, audible ringback, and reorder tone), human voice, Special Information Tones (SITs) and pager cues tones collectively. These signals are known as call progress events. Characteristics for the call progress events are shown in Table 4-3.

Table 4-3 Call Progress Event Characteristics

Name	Frequencies (Hz)	Temporal Pattern	Event Reported After
Dial Tone	350 + 440	Steady tone	Approximately 0.75 seconds
Busy Tone	480 + 620	0.5 seconds on/ 0.5 seconds off	2 cycles of precise, 3 cycles of nonprecise
Detection Audible Ringback	440 + 480	2 seconds on/ 4 seconds off	2 cycles of precise or nonprecise
Cessation	—	—	3 to 6.5 seconds after ringback detected
Reorder	480 + 620	0.25 seconds on/ 0.25 seconds off	2 cycles of precise, 3 cycles of nonprecise
Detection Voice	200 to 3400	—	Approximately 0.25 to 0.50 seconds
Cessation	—	—	Approximately 0.5 to 1.0 seconds after voice detected
Special Information Tones (SITs)	See Table 4-4.	See Table 4-4.	Approximately 0.25 to 0.75 seconds
Pager Cue Tones	1400	3 to 4 tones at 0.1 to 0.125 intervals	2 cycles of precise or any pattern of 1400-Hz signals

Dial Tone

Dial tone indicates that the CO is ready to accept digits from the subscriber. In the precise tone plan, dial tone consists of 350 Hz plus 440 Hz. The system reports the presence of precise dial tone after approximately 0.75 seconds of steady tone. Nonprecise dial tone is reported after the system detects a burst of raw energy lasting for approximately 3 seconds.

Busy Tone

Busy tone indicates that the called line has been reached but it is engaged in another call. In the precise tone plan, busy tone consists of 480 Hz plus 620 Hz interrupted at 60 ipm (interruptions per minute) with a 0.5 seconds on/0.5 seconds off temporal pattern. The system reports the presence of precise busy tone after approximately two cycles of this pattern. Nonprecise busy tone is reported after three cycles.

Audible Ringback

Audible ringback (ring tone) is returned to the calling party to indicate that the called line has been reached and power ringing has started. In the precise tone plan, audible ringback consists of 440 Hz plus 480 Hz with a 2 seconds on/4 seconds off temporal pattern. The system reports the presence of precise audible ringback after two cycles of this pattern.

Outdated equipment in some areas may produce nonprecise, or dirty ringback. Nonprecise ringback is reported after two cycles of a 1 to 2.5 seconds on, 2.5 to 4.5 seconds off pattern of raw energy.

Note The system may report dirty ringback as voice detection (unless voice detection is ignored in the answer supervision template used). You should determine the quality of the call progress tones produced by connected equipment during the development phase and configure templates accordingly.

The system reports ringback cessation after 3 to 6.5 seconds of silence once ringback has been detected (depending at what point in the ringback cycle the CPA starts listening).

Reorder

Reorder (Fast Busy) tone indicates that the local switching paths to the calling office or equipment serving the customer are busy or that a toll circuit is not available. In the precise tone plan, reorder consists of 480 Hz plus 620 Hz interrupted at 120 ipm (interruptions per minute) with a 0.25 seconds on/0.25 seconds off temporal pattern. The system reports the presence of precise reorder tone after two cycles of this pattern. Nnonprecise reorder tone is reported after three cycles.

Reorder tone is also used by the system to force ports to idle during call disconnect. Disconnect processing is discussed in Chapter 3, “Call Supervision Signaling and Supervision Timing.”

Voice

Voice detection has multiple uses in supervision processing. The CPA can be used to detect voice as an answer condition, and also to detect machine-generated announcements that may indicate an error condition. The system reports the presence of voice after approximately 0.25 to 0.5 seconds of continuous human speech falling within the 200-Hz to 3400-Hz voiceband (although the network only guarantees voice performance between 300 Hz to 800 Hz).

Once voice detection has been reported, the CPA cannot recognize voice again for a 4-second period. Applications requiring multiple instances of voice detection must allow for a 4-second pause between detection attempts.

The system reports voice cessation after approximately 0.5 to 1.0 seconds of silence once the presence of voice has been detected. Applications must also allow for a 4-second pause between voice cessation detection attempts. Because the system responds to such small samples of voice presence/cessation, applications employing voice cessation should be designed to respond to single spoken words or voice prompts.

Special Information Tones

Special Information Tones (SITs) indicate network conditions encountered in both the Local Exchange Carrier (LEC) and Inter-Exchange Carrier (IXC) networks. The tones alert the caller that a machine-generated announcement follows (this announcement describes the network condition). Each SIT consists of a precise three-tone sequence: the first tone is either 913.8 Hz or 985.2 Hz, the second tone is either 1370.6 Hz or 1428.5 Hz, and the third is always 1776.7 Hz. The duration of the first and second tones can be either 274 ms or 380 ms, while the duration of the third remains a constant 380 ms.

The CPA does not distinguish between the four different SITs. Because the first and second tones vary in frequency and duration, the CPA focuses on the third tone for SIT detection. The system reports the presence of a SIT after detecting approximately 0.25 to 0.75 seconds of a 1776.7-Hz signal. The names, descriptions and characteristics of the four most common SITs are summarized in Table 4-4.

Table 4-4 Special Information Tones (SITs)

		First Tone Frequency Duration		Second Tone Frequency Duration		Third Tone Frequency Duration	
Name	**Description**	**(Hz)**	**(ms)**	**(Hz)**	**(ms)**	**(Hz)**	**(ms)**
NC[1]	No circuit found	985.2	380	1428.5	380	1776.7	380
IC	Operator intercept	913.8	274	1370.6	274	1776.7	380
VC	Vacant circuit (nonregistered number)	985.2	380	1370.6	274	1776.7	380
RO[1]	Reorder (system busy)	913.8	274	1428.5	380	1776.7	380

1. Tone frequencies shown indicate conditions that are the responsibility of the BOC intra-LATA carrier. Conditions occuring on inter-LATA carriers generate SITs with different first and second tone frequencies. The system treats both categories (BOC and inter-LATA) of SITs identically.

Pager Cue Tones

Pager cue tones are used by pager terminal equipment to signal callers or connected equipment to enter the callback number (this number is then transmitted to the paged party). Most pager terminal equipment manufacturers use a 3- or 4-tone burst of 1400 Hz at 100- to 125-ms intervals. The system identifies three cycles of 1400 Hz at these approximate intervals as pager cue tones.

To accommodate varying terminal equipment signals, tone bursts of 1400 Hz in a variety of patterns are also reported as pager cue tones. Voice prompts sometimes accompany pager cue tones to provide instructions. Detecting combinations of prompts and tones is performed by configuring an answer supervision template to respond to both voice detection and pager cue tone detection (refer to Chapter 5, “Answer Supervision Template Processing,” for additional information on template design).

Allocation and Processing

When an outpulse rule is processed during call processing, the system performs a lookahead at the rule to determine if a CPA port should be allocated to a call. If the outpulse rule includes a WAIT SUP [xx] or FINAL SUP [xx] token, the system examines the answer supervision template specified in the token's additional data entry field. Templates with condition tokens assigned to call progress tone and/or voice events cause a CPA port to be allocated to the call (placed in the call's resource chain). Refer to Chapter 5, “Answer Supervision Template Processing” for more information on supervision control outpulse rule tokens and answer supervision templates.

Command Processing

When an Outgoing Port Control ($69) command is executed that specifies an outpulse rule requiring tone detection, a CPA port is selected from the resource group and allocated to the call when rule processing begins. If no CPA ports are available, the $69 command is returned to the host with a network status byte value of $3A, followed by a Resource Limitation ($D6) report (reported only for the first resource limitation encountered until the condition has been cleared).

Rule Processing

When inpulse rule processing encounters a DO ORULE token, call processing performs a lookahead to determine if a CPA port is required. If so, the CPA port is selected from the resource group and allocated to the call when outpulse rule processing begins. If no CPA ports are available, the inpulse rule is aborted. An Inpulse Rule Complete ($DD) report is generated indicating the rule was aborted because no CPA ports were available, followed by a Resource Limitation ($D6) report (for the first resource limitation encountered until the condition has been cleared).

Enabling CPA Ports

The CPA port is enabled (begins detecting or reporting events) when the WAIT SUP [xx] or FINAL SUP [xx] token is encountered and remains enabled until template processing ends or the calling party goes on-hook. Generally, the CPA is released when outpulse rule processing has ended and the outgoing port is considered to be answered (which may occur immediately after the rule ends as determined by the template processed). If, at the end of the outpulse rule, the port is not considered answered, a FINAL SUP A token is processed automatically. When the port is considered to be answered, the CPA port is released.

System Administration Support

Add SPC cards to the system database using the system administration Card Maintenance menu. This menu can also be used to deactivate/activate each of the CPA ports on the card. When an SPC is added, the system controller assigns the first available contiguous block of port addresses to the card.

As with all other service circuits, all CPA ports must be added to a single resource group to be used for call processing. System administration allows only one resource group to be created for each service circuit type.

A minor alarm condition is set when all CPA ports go out-of-service (No Call Progress Analyzers Present). Additional logfile, printer, and on-screen messages are provided for CPA support. These messages are listed in the *Cisco VCO/4K System Administrator's Guide*.

CPA ports are compatible with the Set Up Path, Card Display, Port Display, Test Service Circuits and Monitor Call Progress Tones diagnostic utilities. When used to set up a voice path, the CPA must be used as a receiver only. The Call Progress Tone Monitor screen allows a CPA port to monitor the call progress tones during an active call, specifying the signaling events detected. Refer to the *Cisco VCO/4K System Administrator's Guide* for instructions on using these menus and utilities.

Application and Template Downloads

To perform call progress tone detection, the SPCs must be configured for CPA operation. For more information concerning this configuration process, refer to the *Cisco VCO/4K Card Technical Descriptions*.