



CHAPTER 5

Feature Interactions

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Introduction

This chapter describes the interactions among the various features offered by the Cisco BTS 10200 Softswitch. It includes the following topics:

- [Overview of Features and Services, page 5-2](#)
- [Creation of Features and Services, page 5-2](#)
- [Trigger Detection Points, Trigger IDs, and Call States, page 5-5](#)
- [Feature Precedence, page 5-7](#)
- [Feature Inhibition, page 5-9](#)
- [Special Interaction Scenarios, page 5-13](#)
- [Examples of Interactions, page 5-14](#)

Service providers define the features and services for their systems, and assign these services to subscribers. A service is a collection of features. Each feature has static information, stored in the feature table, regarding triggers, feature defaults, associated features, and vertical service codes. When a service is created, the system automatically maps the service with the triggers. The system uses internal information about triggers and trigger detection points (TDPs), based on the ITU-T CS-2 call model, to process features during a call. The system has internal information to handle features that interact with other features at specific detection points. The system also handles features that are inhibited when certain other features are already invoked on the subscriber line.



Note

See [Chapter 1, “Network Features”](#) and [Chapter 3, “Subscriber Features”](#) for detailed descriptions of individual features.



Caution

Some features involve the use of other network elements (NEs) deployed in the service provider network, for example, gateways, media servers, announcement servers, eMTAs, and SIP phones. See the [“Component Interoperability”](#) section of the *Release Notes* for a complete list of the specific peripheral platforms, functions, and software loads that have been used in system testing for interoperability with the Cisco BTS 10200 Softswitch Release 6.0.4 software. Earlier or later releases of platform software

might be interoperable, and it might be possible to use other functions on these platforms. That list certifies only that the required interoperation of these platforms, the functions listed, and the protocols listed have been successfully tested with the Cisco BTS 10200 Softswitch.

Overview of Features and Services

Service providers use command-line interface (CLI) commands to provision the features and services for their systems. The CLI feature table contains all the static information for a feature, such as:

- Trigger detection point (TDP).
- Trigger ID (TID).
- Trigger type.
- Vertical service code, if any.
- Feature Server.
- Feature defaults.
- Associated features, if any. For example, CFU_ACT and CFU_DEACT can be associated with CFU.

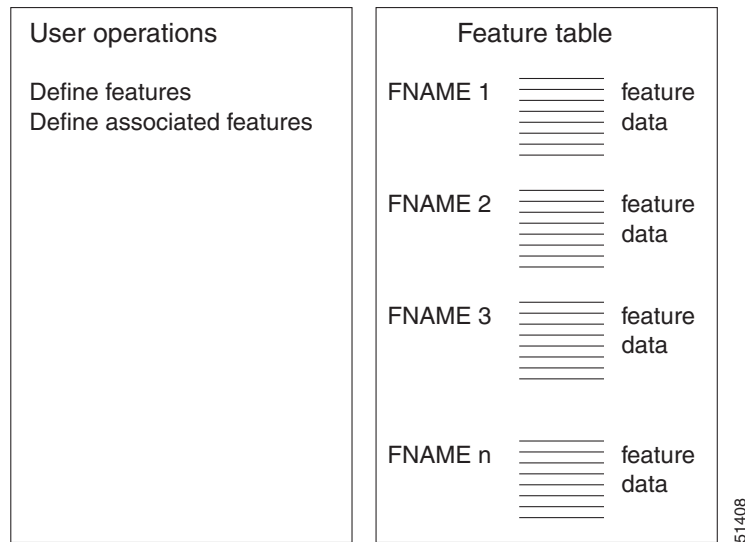
A service is a collection of one or more features (up to 10 features per service). Each service is identified by a unique service ID numeric value. Each feature within a service can have one or more triggers. When a service is created, the system automatically registers the triggers. During call processing, the services are triggered based on TDP and TID. The BTS 10200 supports provisioning of up to 50 services per subscriber.

**Note**

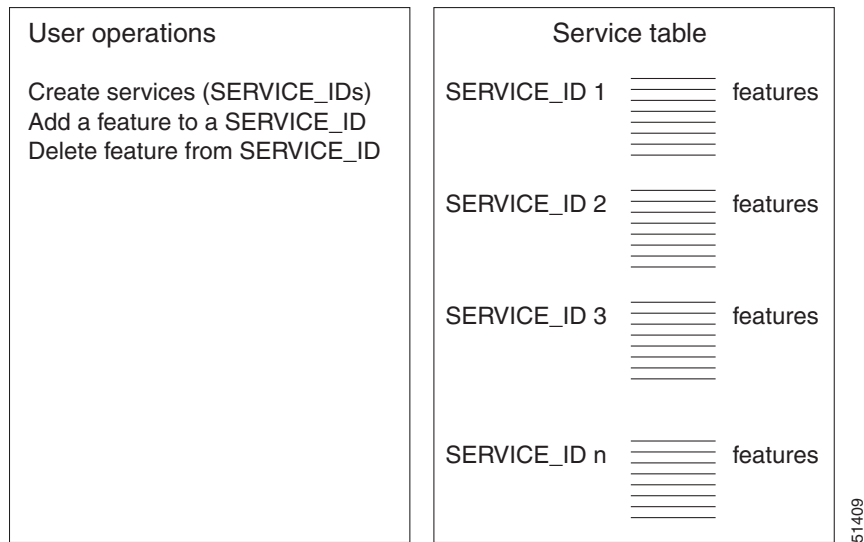
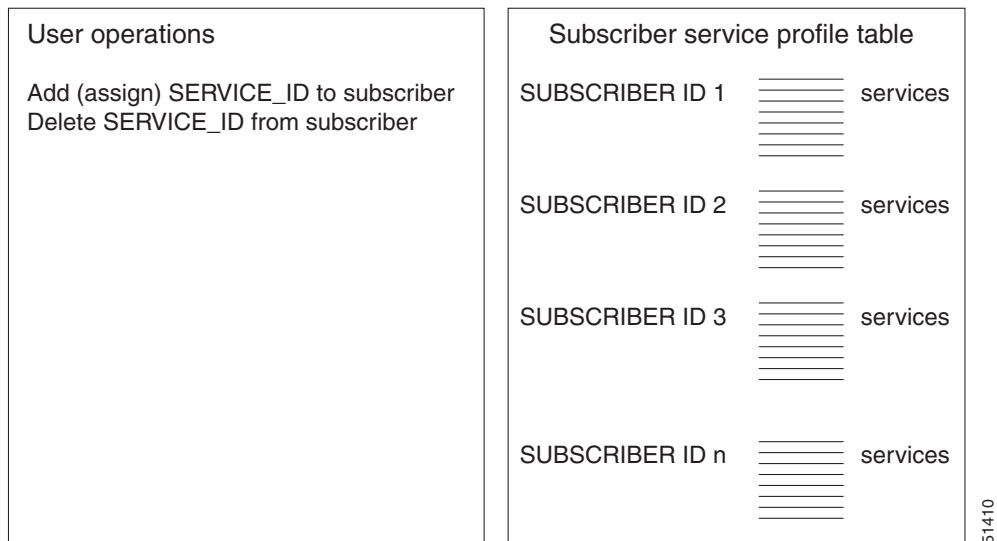
If services are defined (by the service provider) such that they share the same TDP-TID pair, the BTS 10200 supports a maximum of 10 services for that TDP-TID pair.

Creation of Features and Services

[Figure 5-1](#) through [Figure 5-3](#) show the process of creating features, assembling features into services, and assigning services to individual subscribers (or subscriber groups). The provisioning operations listed in these figures are performed by means of CLI commands. Feature provisioning steps are provided in the *Provisioning Guide*. Detailed reference information on commands and parameters (tokens) is provided in the [Cisco BTS 10200 Softswitch CLI Database](#).

Figure 5-1 **Defining Features and Associated Features****Note**

Associated features, such as CFU_ACT and CFU_DEACT, must be defined first, and then they can be linked (associated) with the main feature (CFU in this case).

Figure 5-2 *Assigning Features to Services***Figure 5-3** *Assigning Services to Subscribers*

Trigger Detection Points, Trigger IDs, and Call States

The call states and triggers for the BTS 10200 are illustrated in [Figure 5-4](#) and [Figure 5-5](#).


Note

The basic call module of the BTS 10200 contains the triggers specified in the standard ITU-T CS-2 call model, as well as several additional triggers.

For illustration purposes, [Table 5-1](#) lists several examples of TDPs and TIDs for some features.


Note

For a complete list of TDPs and TIDs for all features, see the *Cisco BTS 10200 Softswitch CLI Database*, and use the “Feature Matrix” option from the pull-down menu.

Table 5-1 **Examples of Service Triggers**

Feature	Description	Trigger Detection Point	Trigger ID
911	Emergency service	COLLECTED_INFORMATION	911_TRIGGER
CFU	Call forwarding unconditional	TERMINATION_ATTEMPT_AUTHORIZED	TERMINATION_ATTEMPT_AUTHORIZED
CFUA	CFU activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CFUD	CFU deactivation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CHD	Call hold	O_MID_CALL	O_SWITCH_HOOK_FLASH_IMMEDIATE
		T_MID_CALL	T_SWITCH_HOOK_FLASH_IMMEDIATE
CIDCW	Caller ID with call waiting	T_BUSY	T_BUSY
CNAM	Calling name delivery	FACILITY_SELECTED_AND_AVAILABLE	TERMINATION_RESOURCE_AVAILABLE
CNDB	CND blocking (toggles the privacy indicator)	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
COS	Class of service screening	COLLECTED_INFORMATION	COS_TRIGGER
SCA	Selective call acceptance	TERMINATION_ATTEMPT_AUTHORIZED	TERMINATION_ATTEMPT_AUTHORIZED
SCA_ACT	SCA activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
		T_ANSWER	T_ANSWER

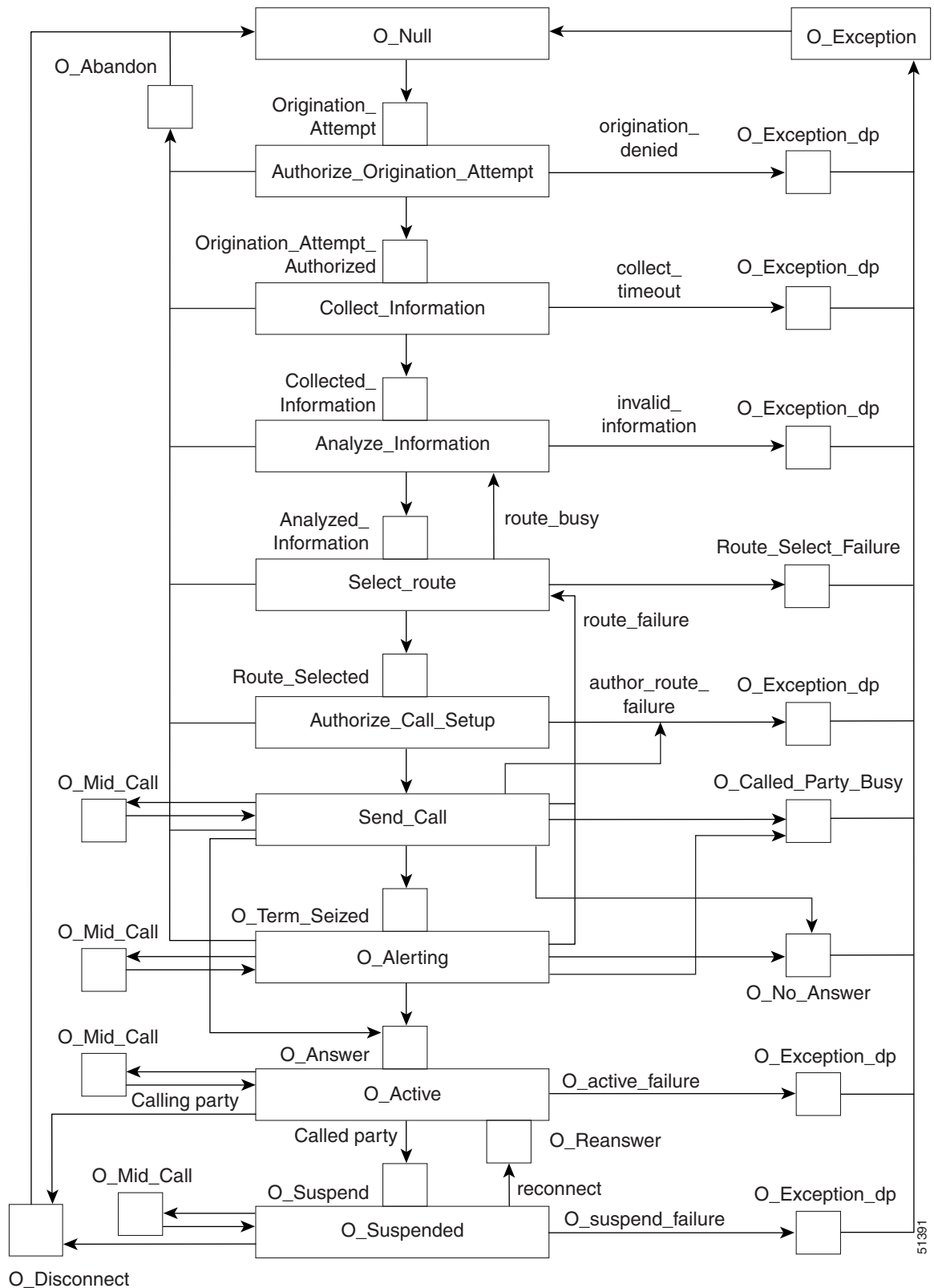
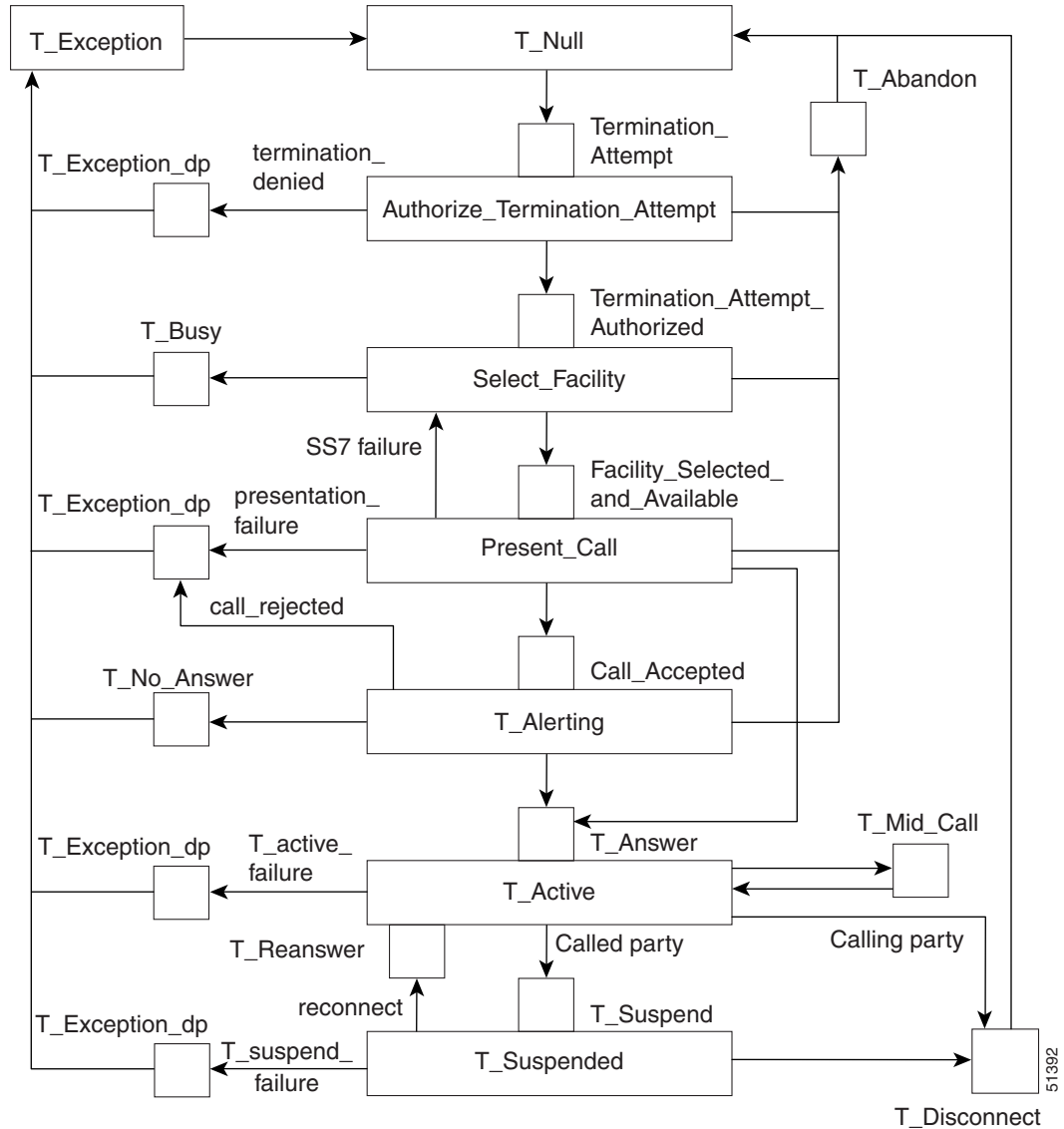
Figure 5-4 *BTS 10200 Originating Call States and Triggers*

Figure 5-5 *BTS 10200 Terminating Call States and Triggers*

Feature Precedence

If the call processing function in the CA detects a TDP, it sends a trigger, if applicable, to the appropriate Feature Server (FS). After receiving the trigger, the FS controls the call as needed. With multiple features assigned to a single service package, it is possible for more than one feature to trigger at the same TDP. When that occurs, the BTS 10200 uses the feature precedence table (Table 5-2), along with the subscription information of the subscriber, to determine which feature to provide. If multiple features are included in a service package (as they often are), service providers must be able to tell their subscribers which feature takes precedence at a particular TDP. The TDPs for each feature and the precedence conditions for specific feature pairs are defined in the system and cannot be changed. Feature precedence is implemented in accordance with the LSSGR specification.

**Tip**

As shown in [Figure 5-4](#) and [Figure 5-5](#), a call reaches TDPs in a specified sequence in keeping with the CS-2 call model. A feature triggered at an earlier TDP is *not* said to have precedence over a feature triggered at a later TDP. Precedence refers to a scenario in which two features occur *at the same TDP*, and the BTS 10200 uses internally programmed rules to determine which feature takes precedence at that TDP.

Table 5-2 Feature Precedence at Specific TDPs

No.	TDP	Precedence
1	TERMINATION_ ATTEMPT_AUTHORIZED	• SCR has priority over: - SCF - DRCW - SCA - ACR - CFU - DND - MDN - DACWI • ISFG has priority over CFU • SCF has priority over: - DRCW - SCA - ACR - CFU - DND - MDN - DACWI • DRCW has priority over: - ACR ¹ - CFU ¹ - DND - MDN - DACWI
		• SCA has priority over: - ACR - CFU - DND - MDN - DACWI - DRCW • ACR has priority over: - CFU ¹ - DND - MDN - DACWI • CFU has priority over: - DND - MDN - DACWI • DND has priority over: - MDN - DACWI • MDN has priority over: - DACWI

Table 5-2 Feature Precedence at Specific TDPs (continued)

No.	TDP	Precedence
2	FACILITY_SELECTED _AND_AVAILABLE	CNAM has priority over CND. (CNAM includes CND. If a subscriber has both features, CNAM is provided.)
3	T_BUSY	- CIDCW has priority over: CW CFB - CW has priority over CFB.
4	O_ATTEMPT_AUTHORIZED	HOTLINE has priority over WARMLINE
5	COLLECTED_INFORMATION	- CDP and VSC are independent features, with different triggers. - CDP has priority over COS. - Call agent does not report COS trigger for VSC dialed.
6	O_MIDCALL and T_MIDCALL	CT has priority over: TWC TWCD

1. If all three features (DRCW, ACR, and CFU) are assigned to a subscriber, CFU takes precedence over ACR and DRCW.

Feature Inhibition

Feature inhibition is defined as an interaction where the subscriber's current feature status inhibits other features from being provided. The inhibition function is implemented in accordance with the LSSGR specification. This table is preset in the system and cannot be modified. [Table 5-3](#) shows how features are inhibited by various other features.



Tip

If a call is released at a particular TDP, the later TDPs are not reached, and the features associated with those later TDPs do not occur. This is a direct result of the TDP sequencing, and is not defined as inhibition. Feature inhibition occurs when a trigger is reached, but one of the features associated with the TDP has been inhibited by a feature that occurred at an earlier TDP.



Note

MDC refers to midcall, which is a function activated when the user presses the **Flash** button or **hookswitch** during a call. In [Table 5-3](#), MDC is treated as an internal feature, and it has the following behavior:

Certain features inhibit MDC. This means that when one of those features is invoked, the Cisco BTS 10200 Softswitch ignores the **Flash** and **hookswitch** functions.

MDC inhibits several features. This means that those features cannot be supplied to the user after the user presses the **Flash** button or **hookswitch**.

Table 5-3 Feature Inhibition—Features that Inhibit Other Features

Feature	Feature State	Inhibited Features	Remarks
911	Invoked	CIDCW COS CW MDC	
ACR	Deactivated	ACR	
BLV	Invoked	ACR CFB CFNA CFU CIDCW CNAM CND COS CT CW DND DRCW ISFG MDC MDN OSFG RACF SCA SCF SCR TWC USTWC	
CCW	Invoked	CIDCW, COT, CW	
CFU	Invoked	CFU	Applicable only if the MCF flag for CFU in the feature table is set to no (N).
	Deactivated	CFU	
CFB	Invoked	CFB	Applicable only if the MCF flag for CFB in the feature table is set to no (N).
	Deactivated	CFB	
CFNA	Invoked	CFNA	Applicable only if the MCF flag for CFNA in the feature table is set to no (N).
	Deactivated	CFNA	

Table 5-3 Feature Inhibition—Features that Inhibit Other Features (continued)

Feature	Feature State	Inhibited Features	Remarks
CHD	Invoked	911 AC, AC_ACT, AC_DEACT AR, AR_ACT, AR_DEACT CBLK CFBVA, CFBVD CFNAVA, CFNAVD CFUA, CFUD CIDCW CNDB COT CPRK, CPRK_RET CW DPN DPU	
CIDCW	Invoked	CIDCW CNAM CND CW MDC TWC	
CNDB	Invoked	CNDB	
COT	Invoked	CIDCW CT CW MDC TWC USTWC	
CT	Invoked	AC, AC_ACT, AC_DEACT AR, AR_ACT, AR_DEACT CBLK CIDCW COT CPRK_RET CT CW MDC TWC	
CW	Invoked	CIDCW CNAM CND CW MDC TWC	
DND	Deactivated	DND	
DRCW	Deactivated	DRCW	

Table 5-3 *Feature Inhibition—Features that Inhibit Other Features (continued)*

Feature	Feature State	Inhibited Features	Remarks
DRCW_ACT	Invoked	CHD CIDCW CT CW MDC TWC	
HOTLINE	Assigned (provisioned by service provider)	CT MDC TWC USTWC VSC based features	
MDC	Invoked	AC, AC_ACT, AC_DEACT ACR_ACT, ACR_DEACT AR, AR_ACT, AR_DEACT CBLK CFBVA, CFBVD CFUA, CFUD CIDCW CNDB COT CPRK_RET CW DND_ACT, DND_DEACT DPN DPU MDC SC1D_ACT, SC2D_ACT	
SC1D_ACT	Invoked	CFUA	
SC2D_ACT	Invoked	CFUA	
SCA	Activated	ACR, DND	
	Deactivated	SCA	
SCA_ACT	Invoked	CHD CIDCW CT CW MDC TWC	
SCF	Deactivated	SCF	
SCF_ACT	Invoked	CHD CIDCW CT CW MDC TWC	
SCR	Deactivated	SCR	

Table 5-3 Feature Inhibition—Features that Inhibit Other Features (continued)

Feature	Feature State	Inhibited Features	Remarks
SCR_ACT	Invoked	CHD CIDCW CT CW MDC TWC	
TWC	Invoked	AC, AC_ACT, AC_DEACT AR, AR_ACT, AR_DEACT CBLK CIDCW COT CPRK_RET CT CW MDC TWC	
WARMLINE	Assigned (provisioned by service provider)	CT MDC TWC USTWC VSC-based features	

Special Interaction Scenarios

This section describes special interaction scenarios.

DND and CFB Interaction

If a called party (subscriber) is assigned both the DND and CFB features and has activated them, an incoming call is forwarded to the CFB forward-to DN whether the called party is busy or not.

CHD, CFNA, and CW Interaction for Centrex Subscriber

There is an interaction when a Centrex subscriber has all three of the following features assigned and active:

1. Call hold—CHD.
2. Call waiting—CW or CIDCW or both.
3. Call forwarding on no answer—CFNA, VM (or VMA), or any combination of these.

The system behavior is illustrated in the following example. In this example, CFNA is assigned and active on subscriber (A) along with CHD and CW.

- A and B are on an active call.
- C calls A.

- A hears the CW tone. (C hears ringback.)
- If A presses the **Flash** button or **hookswitch**, B is put on hold and A hears a dial tone.
- If A dials *52, A is connected to C.
- If A ignores the CW tone, C continues to hear ringback until the CFNA timer expires, then the call from C is forwarded per CFNA.

Examples of Interactions

Feature interaction examples are presented in this section for the following scenarios:

- Three-way calling
- Call waiting
- Calling number delivery

Three-Way Call Interaction

The following interactions pertain to three-way calling (TWC):

- TWC can interact with itself. Given three parties involved in a call, any party with the TWC feature who has not already added can flash and add on another party. In other words, TWC can be recursively used to join more than three parties.
- A customer who has initiated TWC cannot initiate TWC again while in a TWC conference call.
- The use of TWC does not restrict the call-waiting capabilities of the customers who did not initiate TWC.
- The initiator of TWC does not receive CW calls or the CW tone while in a TWC mode or while a party is on hold.
- When a line that is not the initiator of TWC receives a CW call, a flash is not interpreted as a request for TWC (that is, CW takes precedence over TWC in this case).
- TWC can be used to disable CW during an existing conversation.
- When CW is in effect, it takes precedence over TWC. When CW is disabled, TWC treatment is given when the customer flashes.
- If a customer activates cancel call waiting (CCW) and then originates TWC, CW remains disabled until all connections are torn down. If either of the noncontrolling parties of TWC disconnect (or are disconnected by the controller), CW remains disabled for the remaining two-way connection.
- If the initiator of TWC hangs up with a party on hold, the initiator is rung back and connected to the held party on answer. If the initiator's CW was disabled prior to his or her hanging up on the held party, CW remains disabled after the customer answers the ringback.
- Flashes are ignored after a two-way call has been set up to a 911 attendant. This means that for the duration of the 911 call, the TWC feature cannot be used.
- A customer involved in a two-way call can flash and use TWC to add-on a 911 attendant. All subsequent flashes are ignored.

Call Waiting Interaction

The following interactions pertain to CW:

- If a line has call forwarding on busy (CFB) and CW, the CW service takes precedence over CFB except as explained further in this section.
- If a line has both CFB and CW and is in a talk state, the first call attempting to terminate is treated as a CW call. Subsequent termination attempts are call forwarded (that is, CFB is invoked only if a call is already waiting).
- If CW treatment cannot be given (for example, because the line is dialing or ringing), then CFB takes effect.
- CW and CCW cannot be invoked simultaneously.
- When CW is disabled by CCW, only calls terminating at the subscriber line are affected. Calls terminating at other subscriber lines are not affected.
- During a call to a 911 attendant, the CW service is inhibited (that is, no CW tone).

Calling Number Delivery Interaction

The following interactions pertain to the calling number delivery (CND) feature:

- No CND data is sent during or after a CW tone.
- CND data is sent for held and waited parties during the first silent interval of ringback that results from the customer going on hook in response to a CW tone.

