Feature Interactions

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

Service providers define the features and services for their system, 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 3, “Network Features” and Chapter 4, “Subscriber Features” for detailed descriptions of individual features.

Overview of Features and Services

Service providers use command-line interface (CLI) commands to provision the features and services for their system. The 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)

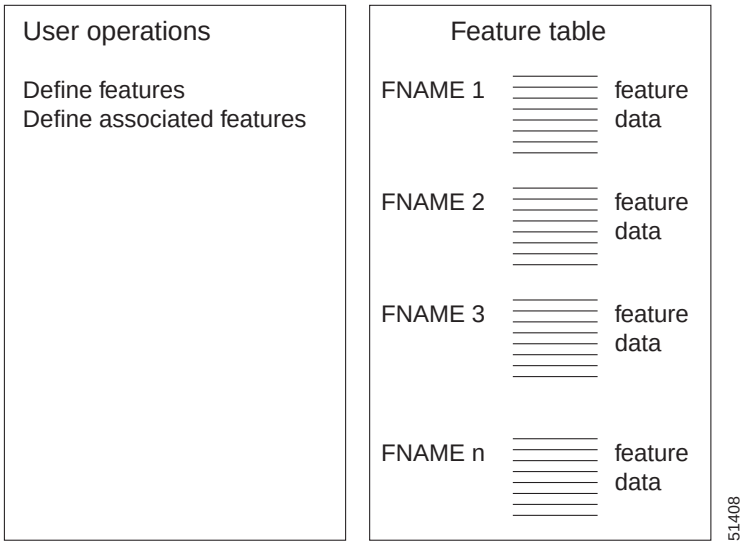
A service is a collection of one or more features (up to 10 features per service). Each service is identified by a unique service ID numeric value. Each feature within a service may have one or more triggers. When a service is created, the system automatically registers the triggers. During call processing,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

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

Creation of Features and Services

Figure 6-1 through Figure 6-3 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 using CLI commands. Feature provisioning steps are provided in the *Cisco BTS 10200 Softswitch Provisioning Guide*. Detailed reference information on commands and parameters (tokens) is provided in the *Cisco BTS 10200 Softswitch Command Line Interface Reference Guide*.

Figure 6-1 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 6-2 Assigning Features to Services

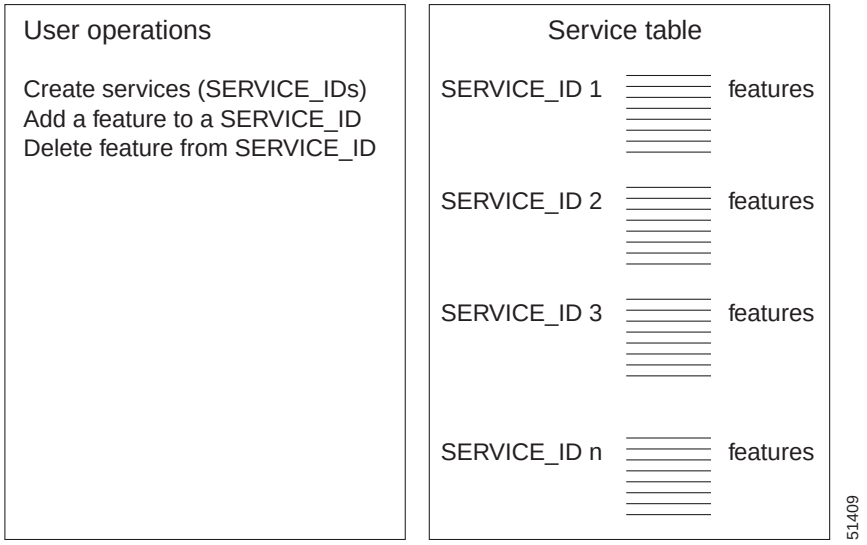
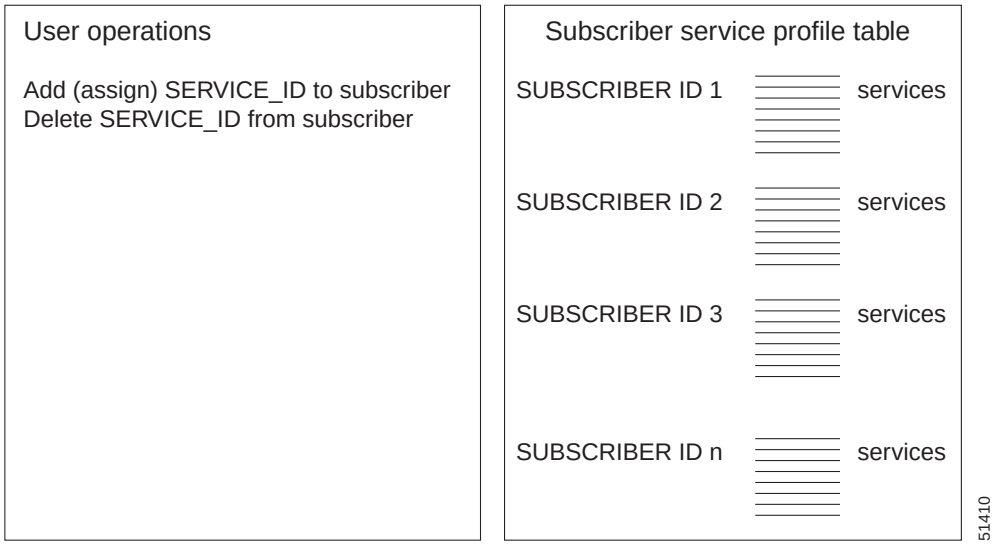


Figure 6-3 Assigning Services to Subscribers



Trigger Detection Points and Trigger IDs

The TDPs for the Cisco BTS 10200 Softswitch are illustrated in Figure 6-4 and Figure 6-5.

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

Figure 6-4 Cisco BTS 10200 Softswitch Originating Call States and Triggers

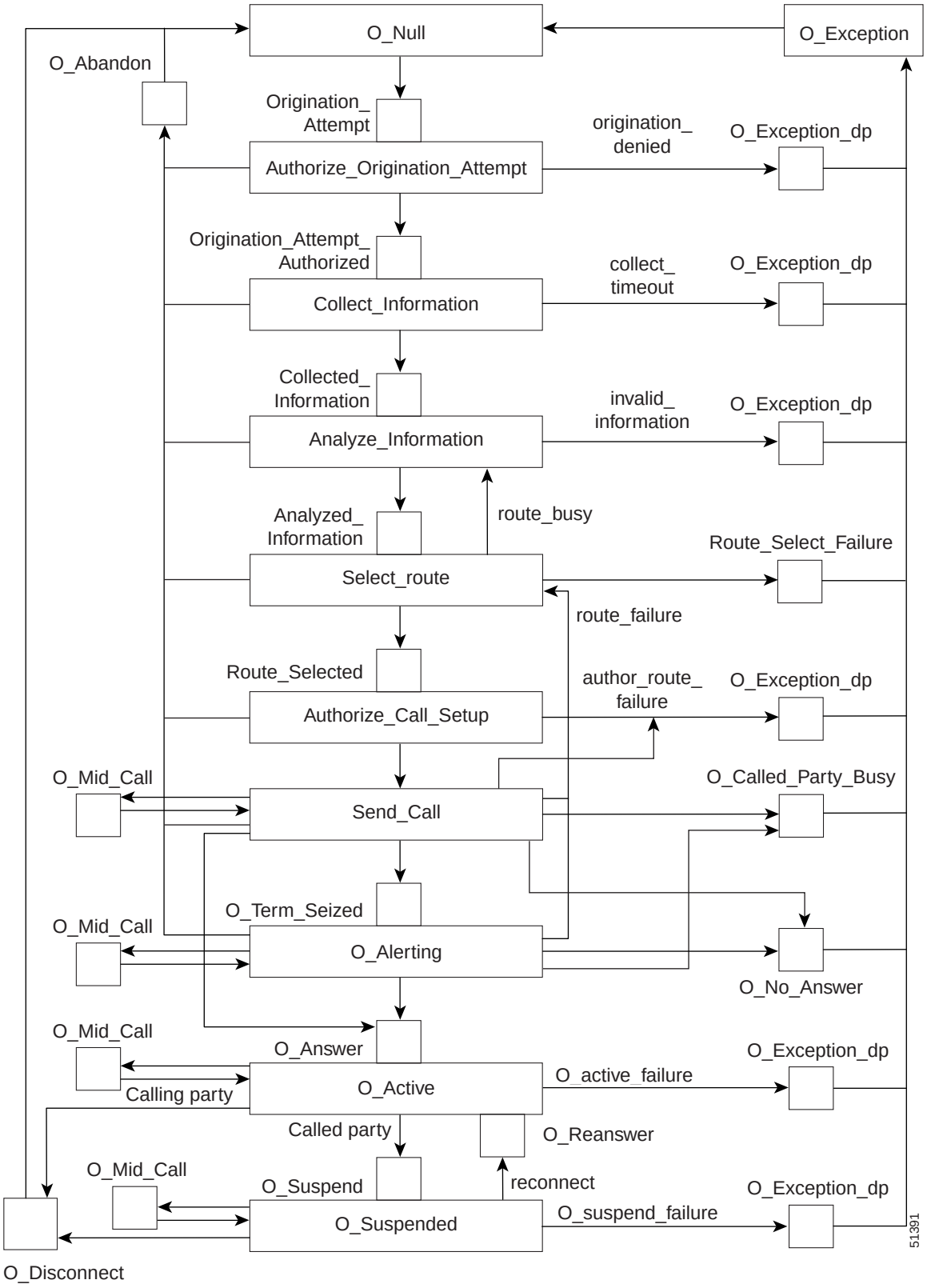


Figure 6-5 Cisco BTS 10200 Softswitch Terminating Call States and Triggers

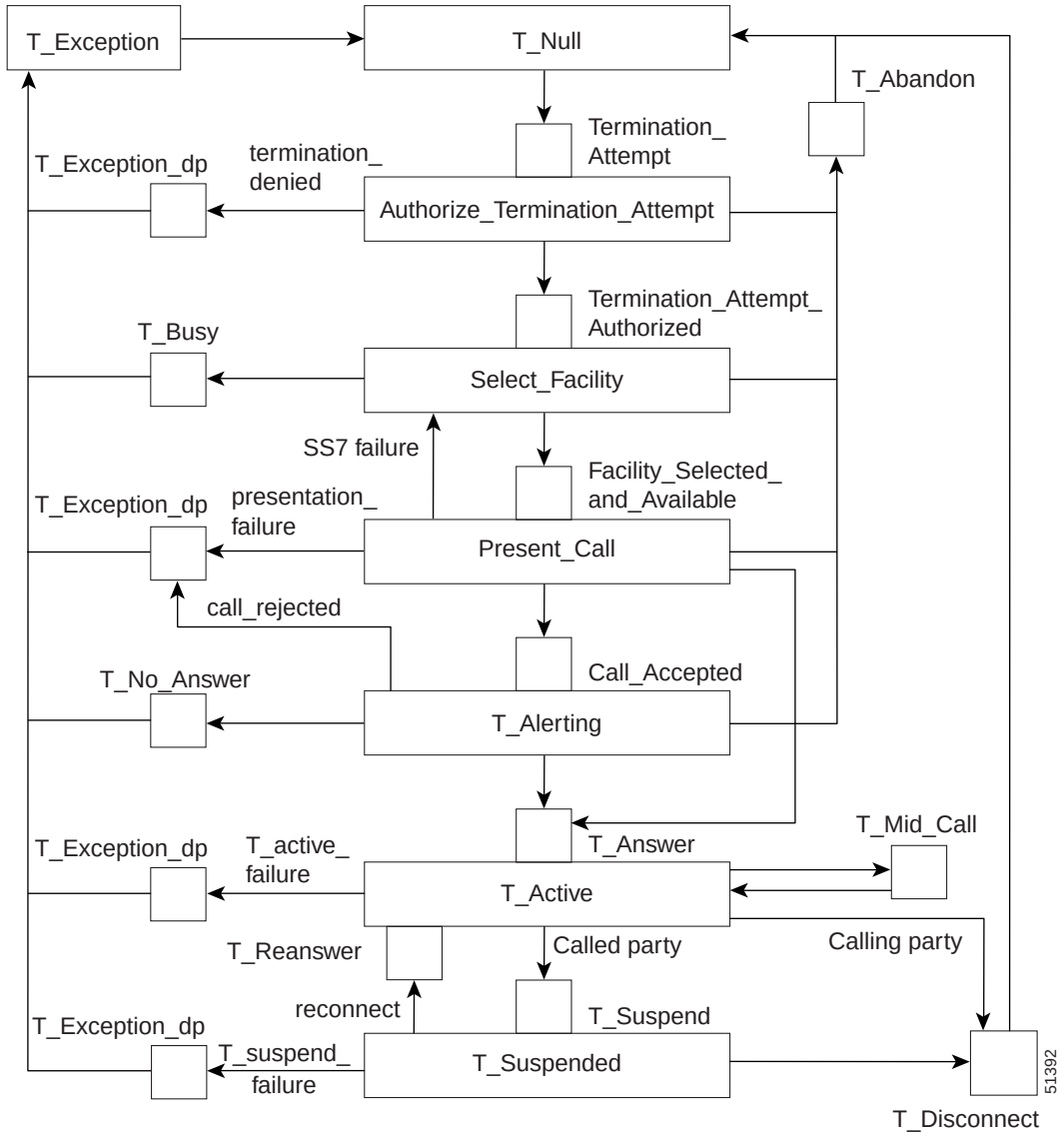


Table 6-1 lists the trigger detection points and trigger IDs for each feature.

Note Vertical service codes (VSCs) are assigned to some of these features. Refer to the Vertical Service Codes appendix of the *Cisco BTS 10200 Softswitch Command Line Interface Reference Guide* for VSC information.

Table 6-1 Features and Service Triggers

Feature	Description	Trigger Detection Point	Trigger ID
8XX	Toll free number	COLLECTED_INFORMATION	SPECIFIC_DIGIT_STRING
911	Emergency service	COLLECTED_INFORMATION	911_TRIGGER

Table 6-1 Features and Service Triggers (continued)

Feature	Description	Trigger Detection Point	Trigger ID
AC	Automatic callback (includes AC_ACT and AC_DEACT)		
AC_ACT	Automatic callback activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
AC_DEACT	Automatic callback deactivation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
ACR	Anonymous call rejection	TERMINATION_ATTEMPT_ AUTHORIZED	TERMINATION_ATTEMPT_ AUTHORIZED
ACR_ACT	ACR activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
ACR_DEACT	ACR deactivation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
ANI	Automatic number ID	No TDPs	No triggers
AR	Automatic recall (includes AR_ACT and AR_DEACT)		
AR_ACT	AR activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
AR_DEACT	AR deactivation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
BLV	Busy line verification	TERMINATION_ATTEMPT	BLV
CBLK	Call block (reject caller)	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CCW	Cancel call waiting	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CDP	Customize dial plan	COLLECTED_INFORMATION	CUSTOMIZE_DIALING_PLAN
CFB[1]	Call forwarding busy	T_BUSY	T_BUSY
CFBVA	CFB variable activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CFBVD	CFB variable deactivation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CFNA[1]	Call forwarding no answer	CALL_ACCEPTED	CALL_ACCEPTED
CFNAVA	CFNA variable activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CFNAVD	CFNA variable deactivation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CFU[1]	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[2]	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
CIDS	Delivery function of calling identity delivery and suppression	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CIDSS	Suppression function of calling identity delivery and suppression	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE

Table 6-1 Features and Service Triggers (continued)

Feature	Description	Trigger Detection Point	Trigger ID
CNAB	Calling name delivery blocking	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CNAM	Calling name delivery	FACITLITY_SELECTED_AND_AVAILABLE	TERMINATION_RESOURCE_AVAILABLE
CND	Calling number delivery	FACITLITY_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
COT	Customer originated trace	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
CPRK	Call park access code	O_MID_CALL	O_SWITCH_HOOK_FLASH_IMMEDIATE
		T_MID_CALL	T_SWITCH_HOOK_FLASH_IMMEDIATE
CPRK_RET	CPRK retrieval access code	No TDPs	No triggers
CT	Call transfer	O_MID_CALL	O_SWITCH_HOOK_FLASH_IMMEDIATE
		T_MID_CALL	T_SWITCH_HOOK_FLASH_IMMEDIATE
CW	Call waiting	T_BUSY	T_BUSY
DACWI	DACWI on DID calls	TERMINATION_ATTEMPT_AUTHORIZED	TERMINATION_ATTEMPT_AUTHORIZED
DND	Do not disturb	TERMINATION_ATTEMPT_AUTHORIZED	TERMINATION_ATTEMPT_AUTHORIZED
DND_ACT	Do not disturb activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
DND_DEACT	Do not disturb deactivation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
DPN	Directed call pickup without barge-in	No TDPs	No triggers
DPU	Directed call pickup with barge-in	No TDPs	No triggers
DRCW	Distinctive ringing call waiting	TERMINATION_ATTEMPT_AUTHORIZED	TERMINATION_ATTEMPT_AUTHORIZED
DRCW_ACT [3]	DRCW activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
		T_ANSWER	T_ANSWER
GSC1D	1-digit group speed call	COLLECTED_INFORMATION	SC1D_TRIGGER
GSC2D	2-digit group speed call	COLLECTED_INFORMATION	SC2D_TRIGGER
HOTLINE	Hotline feature	O_ATTEMPT_AUTHORIZED	O_ATTEMPT_AUTHD
ISFG	Incoming simulated facility group (SFG) for Centrex	TERMINATION_ATTEMPT_AUTHORIZED	TERMINATION_ATTEMPT_AUTHORIZED
LNP	Local number portability	COLLECTED_INFORMATION	LNP_TRIGGER

Table 6-1 Features and Service Triggers (continued)

Feature	Description	Trigger Detection Point	Trigger ID
MDN	Multiple directory numbers	TERMINATION_ATTEMPT_ AUTHORIZED	TERMINATION_ATTEMPT_ AUTHORIZED
OSFG	Outgoing SFG for Centrex	ROUTE_SELECTED	ROUTE_SELECTED
RACF [4]	Remote activation of call forwarding	T_ANSWER	T_ANSWER
RACF_PIN	RACF PIN change	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
		T_ANSWER	T_ANSWER
RCF	Remote call forwarding	TERMINATION_ATTEMPT_ AUTHORIZED	TERMINATION_ATTEMPT_ AUTHORIZED
REFER	REFER feature	O_MID_CALL T_MID_CALL	REFER_TRIGGER
SC1D	1-digit speed call	COLLECTED_INFORMATION	SC1D_TRIGGER
SC1D_ACT	1-digit speed call activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
SC2D	2-digit speed call	COLLECTED_INFORMATION	SC2D_TRIGGER
SC2D_ACT	2-digit speed call activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
SCA	Selective call acceptance	TERMINATION_ATTEMPT_ AUTHORIZED	TERMINATION_ATTEMPT_ AUTHORIZED
SCA_ACT [5]	SCA activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
		T_ANSWER	T_ANSWER
SCF	Selective call forwarding	TERMINATION_ATTEMPT_ AUTHORIZED	TERMINATION_ATTEMPT_ AUTHORIZED
SCF_ACT [6]	SCF activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
		T_ANSWER	T_ANSWER
SCR	Selective call rejection	TERMINATION_ATTEMPT_ AUTHORIZED	TERMINATION_ATTEMPT_ AUTHORIZED
SCR_ACT [7]	SCR activation	COLLECTED_INFORMATION	VERTICAL_SERVICE_CODE
		T_ANSWER	T_ANSWER
TWC	Three way call	O_MID_CALL	O_SWITCH_HOOK_FLASH_ IMMEDIATE
		T_MID_CALL	T_SWITCH_HOOK_FLASH_ IMMEDIATE
USTWC	Usage sensitive three way call	O_MID_CALL	O_SWITCH_HOOK_FLASH_ IMMEDIATE
		T_MID_CALL	T_SWITCH_HOOK_FLASH_ IMMEDIATE
WARMLINE	Warmline feature	O_ATTEMPT_AUTHORIZED	O_ATTEMPT_AUTHD

1. Multiple call forwarding is enabled by default, but can be disabled.
2. For Centrex users, an access code (typically provisioned as *52) can be used in conjunction with the CHD feature.
3. DRCW_ACT provides access to interactive voice response (IVR) server for activation, screening list setup and editing, and deactivation of DRCW.

4. RACF is an IVR-based function that can be used with CFU.
5. SCA_ACT provides access to IVR server for activation, screening list setup and editing, and deactivation of SCA.
6. SCF_ACT provides access to IVR server for activation, screening list setup and editing, and deactivation of SCF.
7. SCR_ACT provides access to IVR server for activation, screening list setup and editing, and deactivation of SCR.

Note The features DRCW_ACT, SCA_ACT, SCF_ACT, and SCR_ACT are collectively referred to as screening list editing (SLE) functions.

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 Cisco BTS 10200 Softswitch uses the feature precedence table (Table 6-2), 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), it is important for the service provider to be able to identify to 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. The precedence functionality is implemented in accordance with the LSSGR specification.

Note Refer to the *Cisco BTS 10200 Softswitch Command Line Interface Reference Guide*, service-trigger table, for additional information about triggers for multiple features that are grouped into a service package.

Tip As shown in Figure 6-4 and Figure 6-5, a call reaches TDPs in a specified sequence consistent 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 Cisco BTS 10200 Softswitch uses internally programmed rules to determine which feature takes precedence at that TDP.

Table 6-2 Feature Precedence

No.	Trigger Detection Points (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
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

Table 6-2 Feature Precedence (continued)

No.	Trigger Detection Points (TDP)	Precedence
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.

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

Feature Inhibition

Feature inhibition is defined as an interaction where the subscriber's current feature status inhibits other features from being provided. The inhibition functionality is implemented in accordance with the LSSGR specification. This table is preset in the system and cannot be modified. Table 6-3 shows how features are inhibited by various other features.

Tip If a call is released at a particular TDP, the later TDPs will not be reached, and the features associated with those later TDPs will 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 6-3, MDC is treated as an internal feature, with the following meaning:

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 6-3 Feature Inhibition

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 MCF flag for CFU in the feature table is set to no (N).
	Deactivated	CFU	
CFB	Invoked	CFB	Applicable only if MCF flag for CFB in the feature table is set to no (N).
	Deactivated	CFB	
CFNA	Invoked	CFNA	Applicable only if MCF flag for CFNA in the feature table is set to no (N).
	Deactivated	CFNA	

Table 6-3 Feature Inhibition (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 6-3 Feature Inhibition (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 6-3 Feature Inhibition (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	

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 will be rung back and connected to the held party on answer. If the initiator's CW was disabled prior to hanging up on the held party, it 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 will be ignored.

Call Waiting Interaction

The following interactions pertain to call waiting (CW):

- If a line has call forwarding on busy (CFB) and CW, the CW service normally takes precedence over CFB.
- Given a line that 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 will be 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 via CCW, it only applies to calls terminating at the subscriber line. It does not affect calls terminating at other subscriber lines.
- 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.