CHAPTER 2

Routing

Revised: July 2010, OL-23042-01

Introduction

This chapter provides a basic understanding of the Cisco BTS 10200 Softswitch routing types and an explanation of all routing types and how they function. Additionally examples of the routing types are provided. This chapter is divided into the following sections:

- Routing Types
- Call Types
- Policy-Based Flexible Routing

Routing Types

Call routing requires some basic information. That information is obtained from either the subscriber table or the trunk group table. The information gathered from the subscriber table or the trunk group table provides the starting point for routing a call. Additional information must be gathered from the dial-plan profile table and dial-plan identification (ID) tables. These are the main tables which determine call routing and are instrumental in determining other information needed to route a call, such as call type and destination.

This section provides the Cisco BTS 10200 routing type information. The following topics are covered in this section:

- Basic Subscriber Routing—This is the Cisco BTS 10200 routing type which is based on subscriber needs, Basic Subscriber Routing can be used for both line and trunk routing.
- Basic Trunk Routing—This is the Cisco BTS 10200 routing type which is used for basic trunk routing. Basic Trunk Routing can only be used for trunk routing.
- Service Provider Routing—This is the Cisco BTS 10200 routing type which is used in the wholesale network environment where the network operator owns the facility and provides transport facilities to carry voice calls on behalf of smaller service providers. Service Provider Routing can only be used for trunk routing.
- Carrier Based Routing—This is the Cisco BTS 10200 routing type which is based on specific carrier needs. Carrier Based Routing can be utilized for both line and trunk routing.
- Basic Dial Plan Routing—This is the Cisco BTS 10200 default routing type. Basic Dial Plan Routing can be utilized for both line and trunk routing.
- ANI Based Routing—This is the Cisco BTS 10200 routing type based on automatic number identification (ANI) as the call information comes in on a trunk on a hosted private branch exchange (PBX) configuration. ANI Based Routing can only be utilized for trunk routing.
- NOA Routing (ITU Local Number Portability)—Nature of address (NOA) routing is used to select separate dial plans for directory number (DN) and routing number (RN). The ISDN user part (ISUP) initial address message (IAM) called party number (CdPN) parameter contains a NOA value. The NOA value distinguishes the format of the digits, that is, DN only vs. RN+DN. In some countries, DN prefixes can be the same as some RNs. In these cases, NOA routing allows the use of different dial plans for DN routing and RN routing.
- Cluster Routing—A cluster is defined as two or more Cable Management Servers (CMSs) along with Media Gateway Controllers (MGCs) (or combined CMS/MGCs) deployed within a network. The cluster appears as one logical CMS/MGC looking towards the public switched telephony network (PSTN).
- On-Net Routing and LNP for Inter-CMS Routing—On-Net Routing and LNP for Inter-CMS routing provides ANSI LNP query support for carrier calls, LNP query for on-net routing (inter-CMS routing), on-net route bypass of carrier route, removal of LNP query result data when Carrier LNP-QUERY=N, and ignore inbound LNP information.
- International WZ1 (INTL_WZ1) Preferred Carrier Routing—Enhances the flexibility of preferred carrier routing for INTL_WZ1 calls.

Basic Subscriber Routing

Note When a customer is temporarily disconnected, all calls except 911 calls are routed to the customer support number.

This section describes the Cisco BTS 10200 basic subscriber routing. Refer to Figure 2-1 and review the following summary of subscriber routing flow.

Step 1 Subscriber incoming received or placed.

Step 2 Get the subscriber table (sub-profile ID).

Step 3 Get the subscriber-profile table (dial-plan identification (DP-ID)).

Step 4 Go to the dial-plan (based on DP-ID).

Step 5 Go to destination table and get the call type and destination.

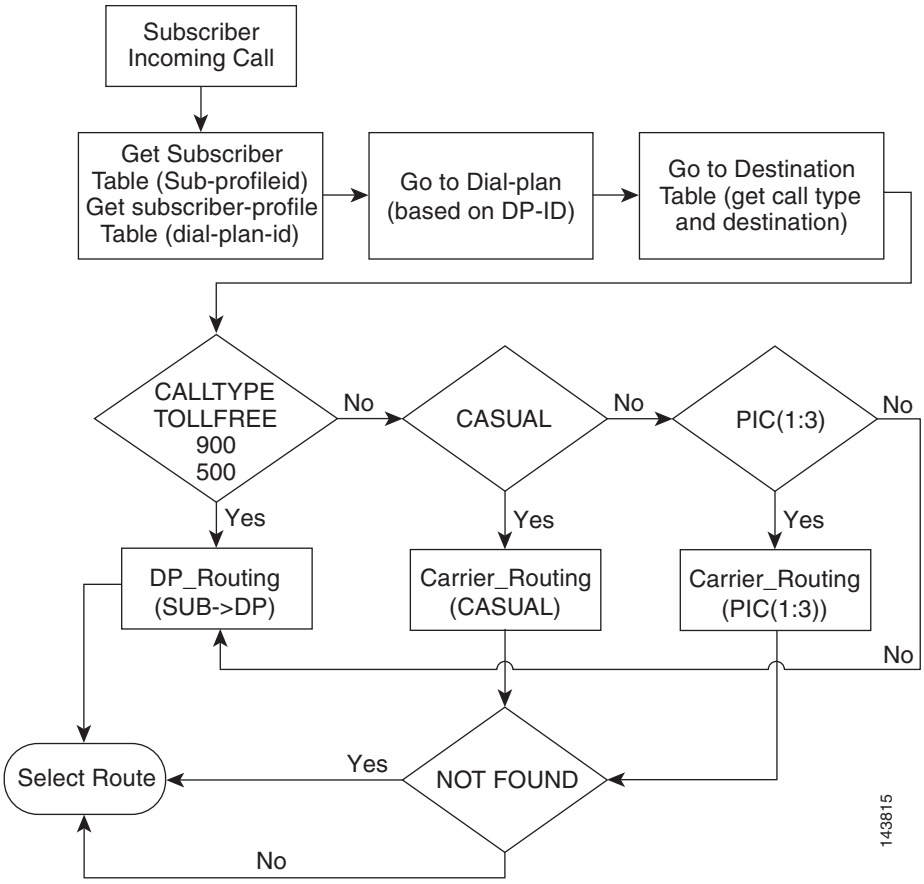
Step 6 Determine the call type. If the call type is toll free, 900, or 500, proceed to Step 7. If the call type is casual, proceed to Step 8. If the call type is via a presubscribed interexchange carrier (PIC), proceed to Step 9.

Step 7 If the call type is toll free, 900, or 500, the Cisco BTS 10200 uses the dial plan to select the call route and to route the call.

Step 8 If the call type is casual, the Cisco BTS 10200 uses the carrier routing information to select the call route and to route the call.

Step 9 If the call type is via a PIC, the Cisco BTS 10200 uses the PIC carrier routing information to select the call route and to route the call.

Figure 2-1 Basic Subscriber Routing



Basic Trunk Routing

This section describes the Cisco BTS 10200 basic trunk routing. Refer to Figure 2-2 and review the following summary of basic trunk routing flow.

Step 1 Trunk group (TG) call received or placed.

Step 2 Get the DP-ID from the TG.

Step 3 Go to the dial-plan and get the destination based on the digits and DP-ID.

Step 4 Go to the destination table and get the call type and the route.

Step 5 Determine the call type. If the call type is toll free, 900, or 500, proceed to Step 6. If the call type is local traffic, proceed to Step 7. If the call type is casual service provider (SP), proceed to Step 8. If the call type is transit network selection (TNS), proceed to Step 9. If the call type is TG carrier, proceed to Step 10. If the call type is TG SP, proceed to Step 11.

Step 6 If the call type is toll free, 900, or 500, the Cisco BTS 10200 uses the dial plan to select the call route and to route the call.

Step 7 If the call type is local traffic, the Cisco BTS 10200 uses the dial plan to select the call route and to route the call.

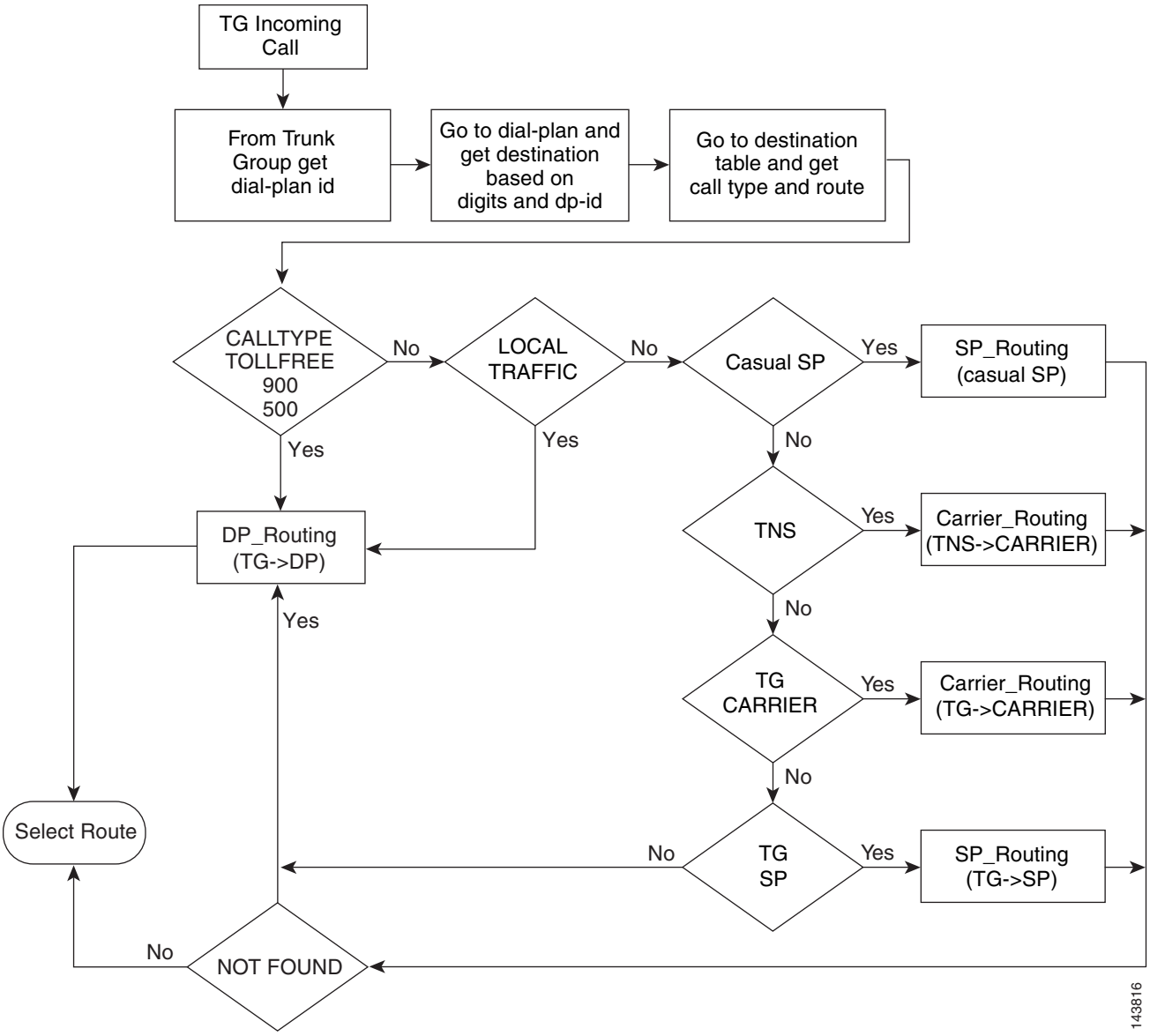
Step 8 If the call type is casual SP, the Cisco BTS 10200 uses the SP routing to select the call route and to route the call. If the SP routing is not found, the Cisco BTS 10200 uses the dial plan to select the call route and to route the call.

Step 9 If the call type is TNS, the Cisco BTS 10200 uses the carrier routing to select the call route and to select the call route and to route the call. If the carrier routing is not found, the Cisco BTS 10200 uses the dial plan to select the call route and to route the call.

Step 10 If the call type is TG carrier, the Cisco BTS 10200 uses the carrier routing to select the call route and to route the call. If the carrier routing is not found, the Cisco BTS 10200 uses the dial plan to select the call route and to route the call.

Step 11 If the call type is TG SP, the Cisco BTS 10200 uses the SP routing to select the call route and to route the call. If the SP routing is not found, the Cisco BTS 10200 uses the dial plan to select the call route and to route the call.

Figure 2-2 Basic Trunk Routing



Service Provider Routing

This section describes the Cisco BTS 10200 service provider routing. Refer to Figure 2-3 and review the following summary of service provider routing flow.

Step 1 Service provider call received.

Step 2 Determine if service provider routing is available. If service provider routing is available, proceed to Step 3. If service provider routing is not available, proceed to Step 4.

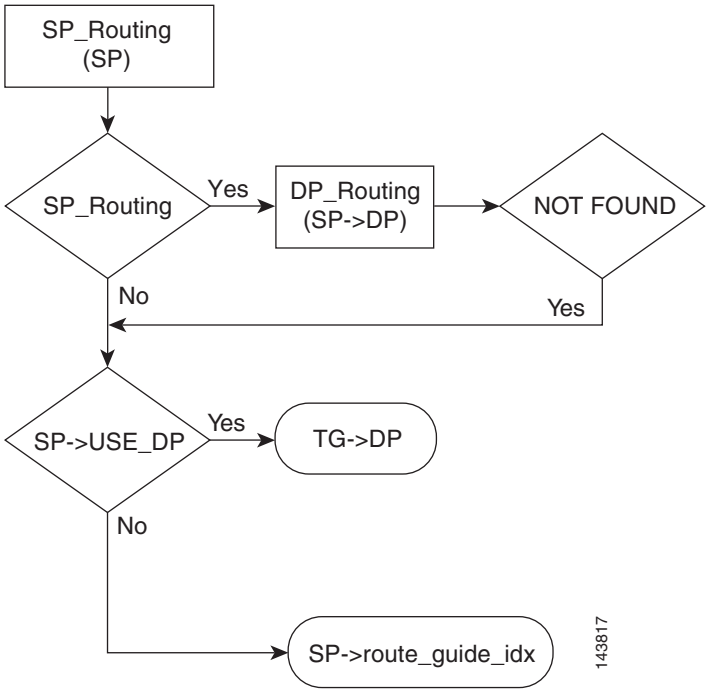
Step 3 If service provider routing is available, the Cisco BTS 10200 uses the service provider dial plan to select the call route and to route the call. If the service provider dial plan cannot be found, proceed to Step 4.

Step 4 If service provider routing is not available or if the service provider dial plan cannot be found, the Cisco BTS 10200 queries the service provider to determine which dial plan to use. If a trunk group dial plan is available, proceed to Step 5. If a trunk group dial plan is not available, proceed to Step 6.

Step 5 If a trunk group dial plan is available, the Cisco BTS 10200 uses the trunk group dial plan to select the call route and to route the call.

Step 6 If a trunk group dial plan is not available, the Cisco BTS 10200 queries the service provider route guide index to select the call route and to route the call.

Figure 2-3 Service Provider Routing



Carrier Based Routing

This section describes the Cisco BTS 10200 carrier based routing. Refer to Figure 2-4 and review the following summary of carrier-based routing flow.

Step 1 Carrier based routing call is received.

Step 2 Determine if the carrier is being screened. If the carrier is being screened, proceed to Step 3. If the carrier is not being screened, proceed to Step 4.

Step 3 If the carrier is being screened, the Cisco BTS 10200 determines if the carrier call processing is being remotely blocked (RTM_CP_BLOCK). If the carrier call processing is being remotely blocked, the call cannot be completed and will be dropped.

Step 4 If the carrier is not being screened, the Cisco BTS 10200 determines if the carrier is a recognized service provider. If the carrier is a recognized service provider, proceed to Step 5. If the carrier is not a recognized service provider, proceed to Step 6.

Step 5 If the carrier is a recognized service provider, the Cisco BTS 10200 uses the service provider routing to select the call route and to route the call.

Step 6 If the carrier is not a recognized service provider, the Cisco BTS 10200 determines if a carrier dial plan is configured. If a carrier dial plan is configured, proceed to Step 7. If a carrier dial plan is not configured proceed to Step 8.

Step 7 If a carrier dial plan is configured, the Cisco BTS 10200 uses the carrier dial plan to select the call route and to route the call.

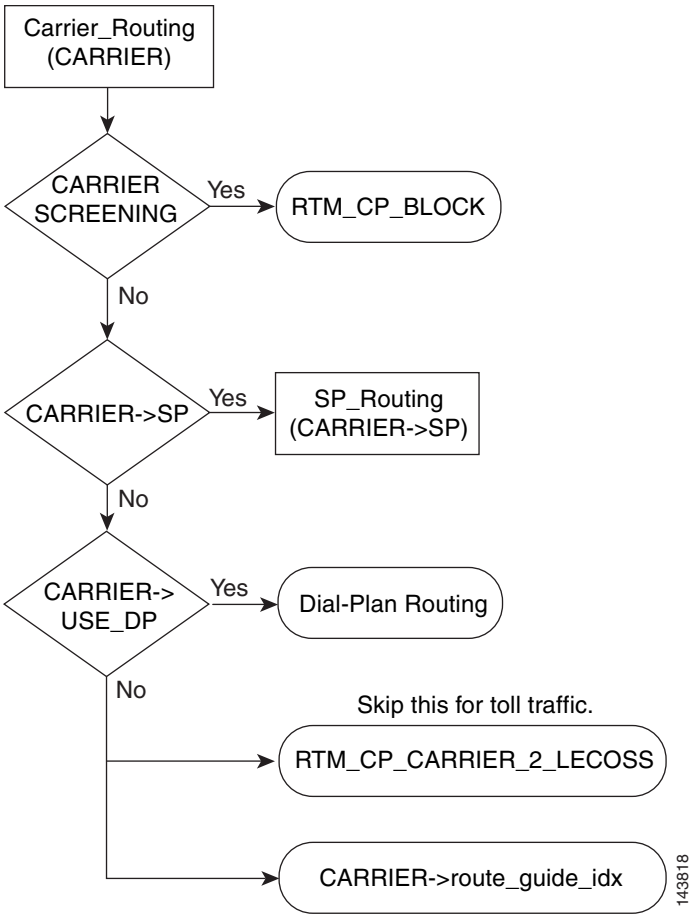
Step 8 If a carrier dial plan is not configured, the Cisco BTS 10200 determines if a carrier remote call processing to local exchange carrier operations support system is available (RTM_CP_CARRIER_2_LECOSS). If the RTM_CP_CARRIER_2_LECOSS is available, proceed to Step 9. If the RTM_CP_CARRIER_2_LECOSS is not available, proceed to Step 10.

Note Step 8 is skipped for toll traffic. For toll traffic, proceed to Step 10.

Step 9 If the RTM_CP_CARRIER_2_LECOSS is available and if the traffic is not toll traffic, the Cisco BTS 10200 uses the RTM_CP_CARRIER_2_LECOSS to select the call route and to route the call.

Step 10 If the RTM_CP_CARRIER_2_LECOSS is not available, the Cisco BTS 10200 uses the carrier guide index to select the call route and to route the call.

Figure 2-4 Carrier Based Routing



Basic Dial Plan Routing

This section describes the Cisco BTS 10200 basic dial plan routing. Refer to Figure 2-5 and review the following summary of basic dial plan routing flow.

Step 1 Basic dial plan routing call received.

Step 2 Determine if the NOA for the received call is an international call. If the call is an international call, the Cisco BTS 10200 uses the international dial plan to select the call route and to route the call. If the call is not an international call, proceed to Step 3.

Step 3 Determine if the call destination is found. If the call destination is not found, the Cisco BTS 10200 returns a destination not found response (not found) and will drop the call. If the call destination is found, proceed to the Step 4.

Step 4 Determine if a call destination subscriber is found. If a call destination subscriber is found, the Cisco BTS 10200 returns a subscriber (SUB) response and uses the subscriber information to select the call route and to route the call. If a call destination subscriber is not found, proceed to Step 5.

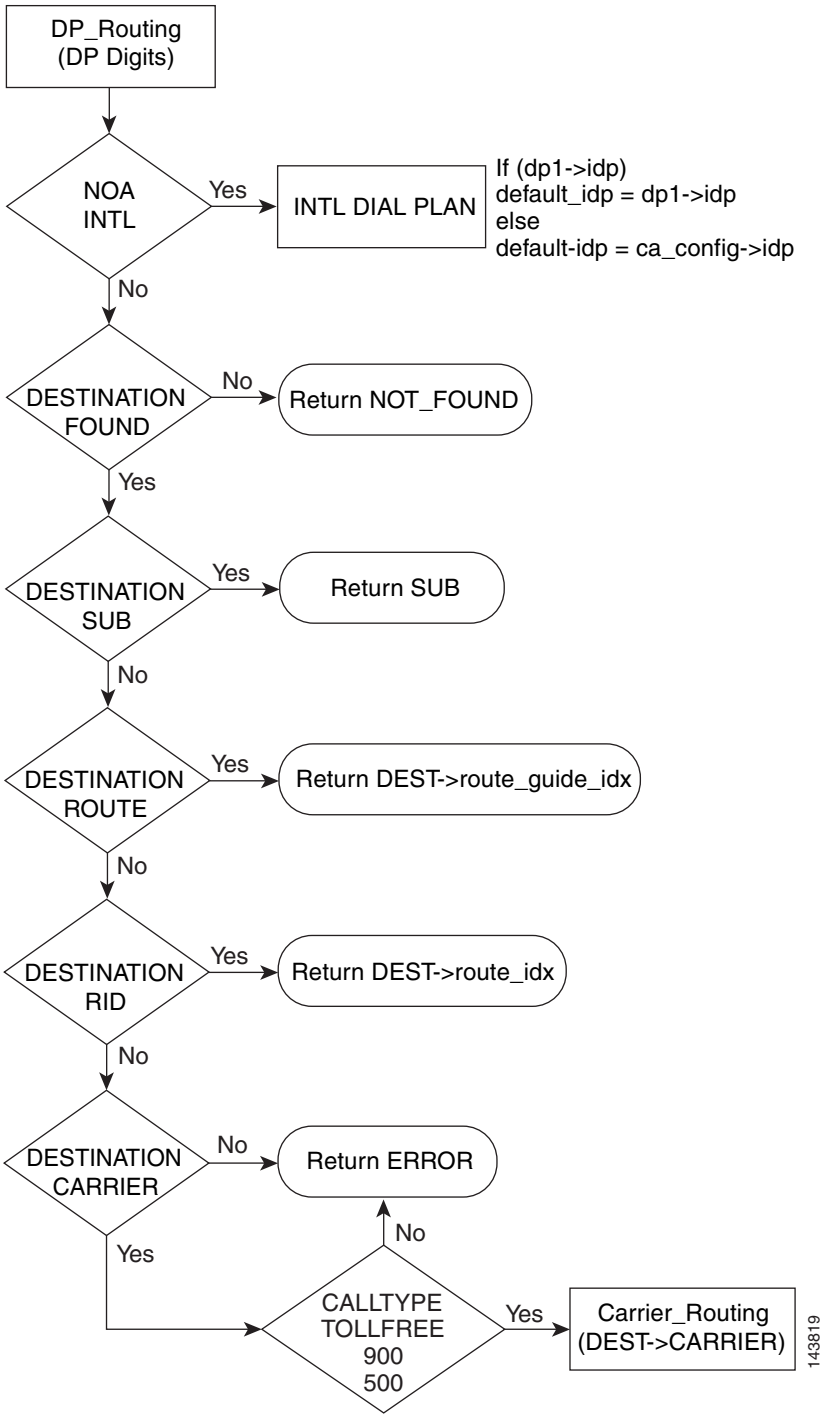
Step 5 Determine if a call destination route is found. If a call destination route is found, the Cisco BTS 10200 returns a destination (DEST) response and uses the route guide index to select the call route and to route the call. If a call destination route is not found, proceed to Step 6.

Step 6 Determine if a call destination route identification (RID) is found. If a call destination RID is found, the Cisco BTS 10200 returns a DEST response and uses the route index to select the call route and to route the call. If a call destination RID is not found, proceed to Step 7.

Step 7 Determine if a destination carrier is found. If a destination carrier is found, proceed to Step 8. If a destination carrier is not found, the Cisco BTS 10200 returns an error and will drop the call.

Step 8 Determine the call type. If the call type is toll free, 900, or 500, the Cisco BTS 10200 selects the call route and routes the call using the destination carrier routing. If the call type is not toll free, 900, or 500, the Cisco BTS 10200 returns an error and will drop the call.

Figure 2-5 Basic Dial Plan Routing



ANI Based Routing

This section describes the Cisco BTS 10200 ANI based routing. Refer to Figure 2-6 and review the following summary of ANI-based routing flow.

Step 1 A TG incoming call is received.

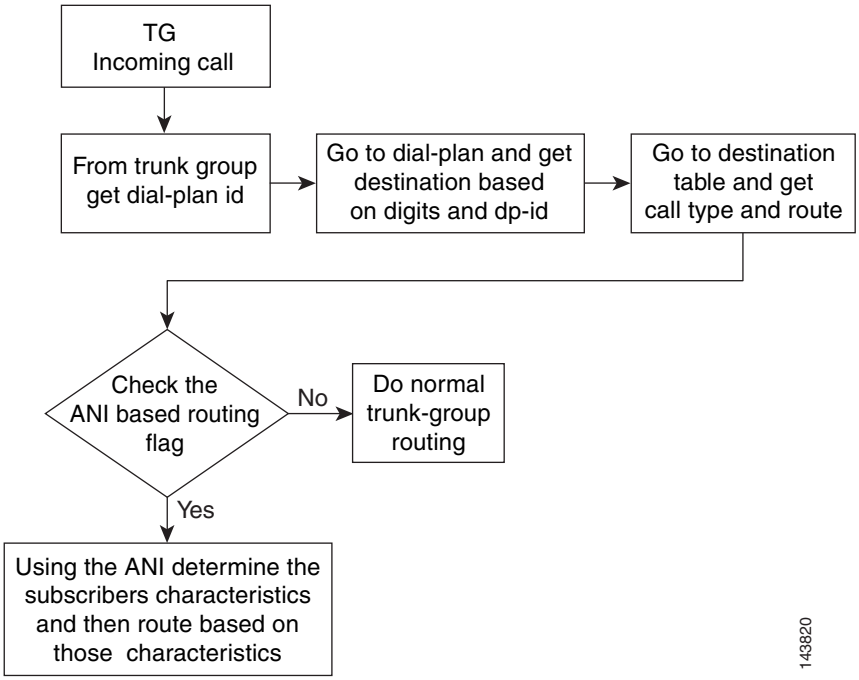
Step 2 Get the dial plan ID from the TG.

Step 3 Go to the dial plan and get the call destination based on the digits and the dial plan ID.

Step 4 Go to the destination table and the get the call type and call route.

Step 5 Check for the ANI based routing flag. If the ANI based routing flag is available, the Cisco BTS 10200 uses the ANI to determine the subscriber characteristics and then routes the call based on those characteristics. If the ANI based routing flag is not available, the Cisco BTS 10200 selects the call route and routes the call using normal TG routing.

Figure 2-6 ANI-based Routing



NOA Routing (ITU Local Number Portability)

NOA routing is used to select separate dial plans for DN and RN. The ISUP IAM CdPN parameter contains a NOA value. The NOA value distinguishes the format of the digits, that is, DN only vs. RN+DN. In some countries, DN prefixes can be the same as some RNs. In these cases, NOA routing allows the use of different dial plans for DN routing and RN routing.

For a call where the CdPN is a normal DN, the NOA is set to the ITU Q.769 value of 3, meaning national (significant) number. After a local number portability (LNP) query for a ported number, the CdPN consists of the RN and DN concatenated together. The ITU Q.769 NoA value of 8 is used to indicate that the CdPN is in the RN + DN format.

Routing Number

A RN, also known as a network routing number, is used to route the call to a ported number after an LNP query to the recipient network or switch. In some countries, the RN consists of a network ID plus an equipment ID. For example, in some countries, the RN consists of a 2-digit operator code plus a 2-digit equipment code. Together, the operator code and equipment code, combined as the RN, can be used to route to any possible recipient switch. In some countries, for example, Sweden, the RN contains only the network ID. The call is routed to the recipient, and then another LNP query is required in order for an RN to be obtained that identifies the specific recipient switch.

Switch Types

In LNP call scenarios, the Cisco BTS 10200 can be considered one of the following switch types:

- Originating Switch—Subscriber origination. An originating switch is the end office where a subscriber dials a ported directory number (DN). A switch that initiates call forwarding (CFU/CFB/CFNA) is considered the originating switch with respect to the forwarded leg of the call.
- Transit Switch—An incoming trunk call is routed out to another switch. Also known as an intermediate switch.
- Donor Switch—Processes a call originating from a subscriber or trunk to a called directory number (DN) of a subscriber ported out of the given Cisco BTS 10200 donor switch to a recipient switch. In some cases, the donor switch might also be the originating or intermediate switch.
- Recipient Switch—Receives a call originating from a subscriber or trunk and has a called DN of a subscriber ported in to the given Cisco BTS 10200. In some cases, the recipient switch might also be the originating switch.

Query Types

The Cisco BTS 10200 performs queries of the LNP database in order to route a call. It may also be configured to perform queries for another switch that is not capable of LNP queries.

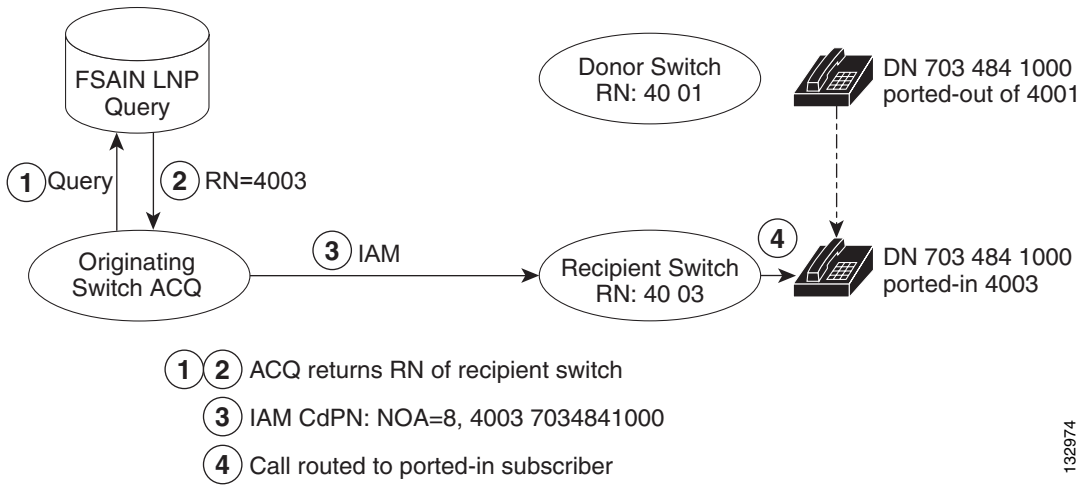
ITU LNP supports the following query types:

- ACQ—An LNP query is performed by the Cisco BTS 10200 on all originating calls by Cisco BTS 10200 subscribers. In some cases, the Cisco BTS 10200 performs an ACQ for another switch that does not have the capability. This method is efficient for networks with many ported subscribers.
- Query on Release—A call is routed without a query. When it reaches the donor switch, the call is released backward with the QOR cause code of OOR: Ported Number (14). The originating switch receives the REL with QOR, performs the LNP query, and routes the call on to the recipient switch. This method is efficient for networks with few ported subscribers.
- Onward Donor Based Routing, also known as Onward Call Routing (OCR)—LNP queries are only performed in a donor switch when it is determined that the called party is ported-out of the switch. The donor switch performs the query and routes the call onward to the recipient switch. This method is efficient for networks with very few ported subscribers.

ACQ

ACQ, shown in Figure 2-7, usually applies to a subscriber origination (originating switch). A subscriber is ported out of the donor switch and ported in to the recipient switch. The ACQ is performed on the originating switch before the call is routed to the recipient switch. The originating switch queries the LNP database for the routing number of the ported switch.

Figure 2-7 ACQ



ACQ might also be performed by an intermediate or donor switch for another switch or network.

Intermediate or Donor Switch Performs ACQ for Another Switch or Network

The Cisco BTS 10200 might be required to perform ACQ for another switch that does not have that capability. For example, an international gateway exchange might not have access to the local country LNP database, so the ACQ is performed at the point of interconnect (POI) by the intermediate switch.

To configure the Cisco BTS 10200 to perform ACQ on incoming calls from a particular trunk group, set the ALL-CALL-QUERY=Y in the LNP Profile table and the token PERFORM-LNP-QUERY=Y in the incoming Trunk Group table.

A query is then performed on each call received from that trunk group unless the query is not allowed by the destination used for a particular call. For more information, see the "Destination Table ACQ Controls" section.

Destination Table ACQ Controls

- ACQ-LNP-QUERY=NA in the Destination table is used when an ACQ is not applicable, for example, when the country does not support LNP or ACQ or when the operator does not want the Destination table to have any effect on LNP queries as configured in the LNP Profile tabke and the Trunk Group table.

- ACQ-LNP-QUERY=LNP-QUERY-BASED-ON-CALL-TYPE in the Destination table is provided to allow or prevent ACQ queries for certain call types. For example, LNP queries should not be performed for emergency calls. When the ACQ-LNP-QUERY token is set to LNP-QUERY-BASED-ON-CALL-TYPE in the Destination table, the value of the LNP-QUERY token in the Call Type Profile table determines whether a query will be allowed for a given call type (and the value of the PERFORM-LNP-QUERY in the Trunk Group table, if the call is an incoming trunk group). For additional information on call types, refer to Appendix A, "Call Types and Subtypes."

Note For call types emergency (EMG), fire, police, or ambulance an ACQ query is not performed under any circumstances.

- ACQ-LNP-QUERY=PERFORM-LNP-QUERY and ACQ-LNP-QUERY=NO-LNP-QUERY—ACQ queries are performed for a subset of calls based on the called number prefix. To support this requirement, ALL-CALLS-QUERY=Y in the LNP Profile table. In addition, calls to the specific prefixes requiring ACQ have dial-plan entries pointing to destinations with ACQ-LNP-QUERY, in the Destination table, set to PERFORM-LNP-QUERY. For calls to these ACQ destinations, if the call originates on a trunk, then the Trunk Group table PERFORM-LNP-QUERY also must be set to Y for a query to be performed.
- ACQ-LNP-QUERY=NO-LNP-QUERY—There is a requirement to block queries on outgoing carrier calls. The value ACQ-LNP-QUERY=NO-LNP-QUERY, in the Destination table, indicates that a query is not to be performed on any call to this destination.

ACQ and Call Forwarding

A call to a Cisco BTS 10200 subscriber can be forwarded to another number, for example, in the case of CFU, CFB, or CFNA. For the purposes of LNP, the forwarded call is considered a new subscriber origination, and the switch where the forwarding occurs is the originating switch. If ACQ is configured, a query is performed on the forwarding leg through use of the forwarded-to DN.

ACQ Matrix

Table 2-1 and Table 2-2 illustrate which token combinations result in a query. In general, a query must be allowed at all applicable levels for a query to be performed. For each row in the table, the particular combination of LNP-Profile table ALL-QUERY=Y/N, Destination table ACQ-LNP-QUERY value, plus Call Type Profile value, where applicable, result in a Cisco BTS 10200 ACQ query being performed or not performed.

Table 2-1 Subscriber Origination ACQ Matrix

LNP Profile ALL-CALL-QUERY	Destination ACQ-LNP-QUERY= NA	Destination ACQ-LNP-QUERY= PERFORM-LNP-QUERY	Destination ACQ-LNP-QUERY= NO-LNP-QUERY	Destination (ACQ-LNP-QUERY= ACQ-BASED-ON-CALL-TYPE) and (Call-Type-Profile for Call Type LNP-QUERY=Y	Destination (ACQ-LNP-QUERY = ACQ-BASED-ON-CALL-TYPE) and (Call-Type-Profile for Call Type Not Present or LNP-QUERY=N	BTS ACQ Query Per-formed ?
Y	X					Y
Y		X				Y
Y			X			N
Y				X		Y
Y					X	N
N	X					N
N		X				N
N			X			N
N				X		N
N					X	N

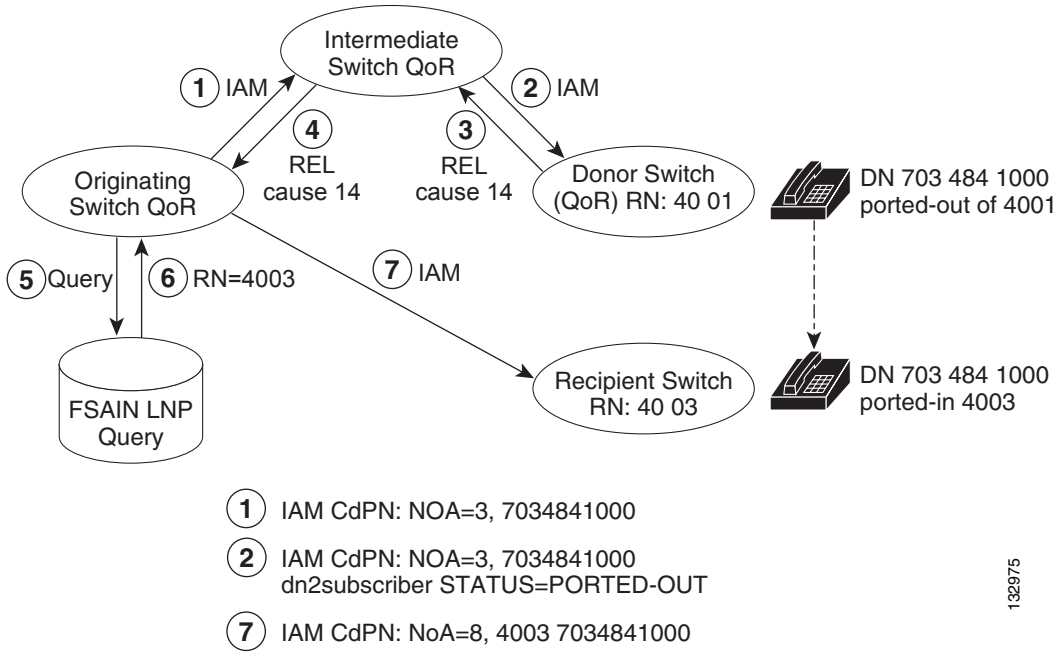
Table 2-2 Trunk Origination ACQ Matrix

LNP Profile ALL-CALL -QUERY	Incoming Trunk Grp PERFORM-LNP-QUERY	Destination ACQ-LNP-QUERY=NA	Destination ACQ-LNP-QUERY= PERFORM-LNP-QUERY	Destination ACQ-LNP-QUERY= NO-LNP-QUERY	Destination (ACQ-LNP-QUERY= ACQ-BASED-ON-CALL-TYPE) and (Call-Type-Profile for Call Type LNP-QUERY=Y	Destination (ACQ-LNP-QUERY= ACQ-BASED-ON-CALL-TYPE) and (Call-Type-Profile for Call Type Not Present or LNP-QUERY=N	BTS ACQ Query Performed?
Y	Y	X					Y
Y	Y		X				Y
Y	Y			X			N
Y	Y				X		Y
Y	Y		-	-	-	X	N
Y	N	X					N
Y	N		X				N
Y	N			X			N
Y	N				X		N
Y	N					X	N
N	Y	X					N
N	Y		X				N
N	Y			X			N
N	Y				X		N
N	Y		-	-	-	X	N
N	N	X					N
N	N		X				N
N	N			X			N
N	N				X		N
N	N					X	N

Query on Release

For Query on Release (QOR), illustrated in Figure 2-8, calls are routed normally, with no LNP query, until a call is received for a ported-out subscriber at the donor switch. The donor switch supporting QOR clears the call and sends backward release (REL) with the QOR cause code specified by the network. The cause value QOR: Ported Number (14) is in ITU/ETSI networks. Each intermediate/transit switch in turn clears backward with the same QOR release cause until finally the originating switch receives the backward REL. This originating switch performs the QOR query and re-routes the call onward towards the recipient switch.

Figure 2-8 QOR



A Cisco BTS 10200 is configured for QOR when the LNP Profile Table's QUERY-ON-RELEASE token is set to Y.

Note For a call terminating to a ported-out subscriber (donor switch), ODBR takes precedence over QOR. For a subscriber origination (originating switch), ACQ takes precedence over QOR, so the call will be initially correctly routed to the recipient switch, and no REL with cause value QOR: Ported Number (14) is received (other than for a network routing error).

The Cisco BTS 10200 performs one of the following functions for QoR:

- Donor Switching
- Intermediate or Transit Switching
- Originating Switching

Donor Switching

- Normal case—When the Cisco BTS 10200 receives a call to a DN with a DN2subscriber record, if the status has a value of PORTED-OUT, and if the LNP Profile table indicates QUERY-ON-RELEASE=Y, then a backward release (REL) is sent with the QOR ported number release cause defined in the LNP Profile table (defaults to cause value QOR: Ported Number (14)).
- QOR not supported by backward switch—For a trunk originated call to a ported-out subscriber, the incoming trunk group may indicate that QOR is not supported by the previous switch or network and that the Cisco BTS 10200 is expected to perform the QOR query (LNP Profile table QUERY-ON-RELEASE=Y and Trunk Group table PERFORM-LNP-QUERY =Y). In this case, a QOR query is performed by the Cisco BTS 10200 and the call is re-routed onward to the recipient switch.

- Misrouted call or configuration error—If the dn2subscriber record status has a value of PORTED-OUT, but the LNP Profile table QUERY-ON-RELEASE=N and ONWARD-CALL-ROUTING=N, a network routing error has occurred (for example, the CRD LNP database is incorrect, the originating switch performing ACQ misrouted the call, or the Cisco BTS 10200 DN2subscriber or LNP Profile flags are incorrect). For a misrouted call where the CdPN contained a regular non-ported DN, the Cisco BTS 10200 will clear the call with a non-LNP release cause indicating an unallocated number; otherwise, if the CdPN contained the ported NOA as a result of the incoming trunk call or subscriber origination on this switch, then the cause misrouted ported number is used.

Intermediate or Transit Switching

- Normal case—When the Cisco BTS 10200 receives a backward REL with the QOR ported number release cause, the Cisco BTS 10200 clears the call and sends a backward REL with the same release cause.
- QOR not supported by backward switch—If the incoming trunk group indicates that QOR is not supported by the previous switch or network and that the Cisco BTS 10200 is expected to perform the QOR query (LNP Profile table QUERY-ON-RELEASE =Y and Trunk Group table PERFORM-LNP-QUERY=Y), a QOR query is performed by the Cisco BTS 10200 and the call is re-routed onward to the recipient switch.

Originating Switching

- Normal case—When the Cisco BTS 10200 receives a backward REL with the QOR ported number release cause, if the LNP Profile table QUERY-ON-RELEASE=Y, a query is performed. The call is then re-routed onward to the recipient switch.
- When the Cisco BTS 10200 receives a backward REL with cause QOR: Ported Number (14), if the LNP Profile table QUERY-ON-RELEASE=N, this cause value is not defined as a QOR ported number cause value.
- When the Cisco BTS 10200 receives a backward REL with the QoR ported number release cause, and the LNP Profile table QUERY-ON-RELEASE=Y, if the Cisco BTS 10200 determines that a query was done previously (ACQ) and did not find an RN and the call was routed with the DN, the call is cleared with a cause unallocated number.
- When the Cisco BTS 10200 receives a backward REL with the QOR Ported Number release cause, if the Cisco BTS 10200 determines that a query was done previously (ACQ) that returned an RN, and the call was routed using the RN and NOA for ported number, then the call is cleared with a cause 31 unspecified. This case is normally not expected to occur. If the Cisco BTS 10200 is the donor switch in this case and receives a called party number with ported NOA, then REL with cause unallocated number is sent back to the originating switch. Cause QoR: Ported Number (14) is not used for an incoming call containing a ported number NOA.

Intermediate or Donor Switch Performing QoR for Another Switch or Network

For QoR, the LNP query is only done on the originating switch, unless the Cisco BTS 10200 is required to perform the QoR query for another switch that does not have that capability. For example, an international gateway exchange might not have access to the local country-specific LNP database, so the query is performed by the intermediate switch.

QoR and Call Forwarding

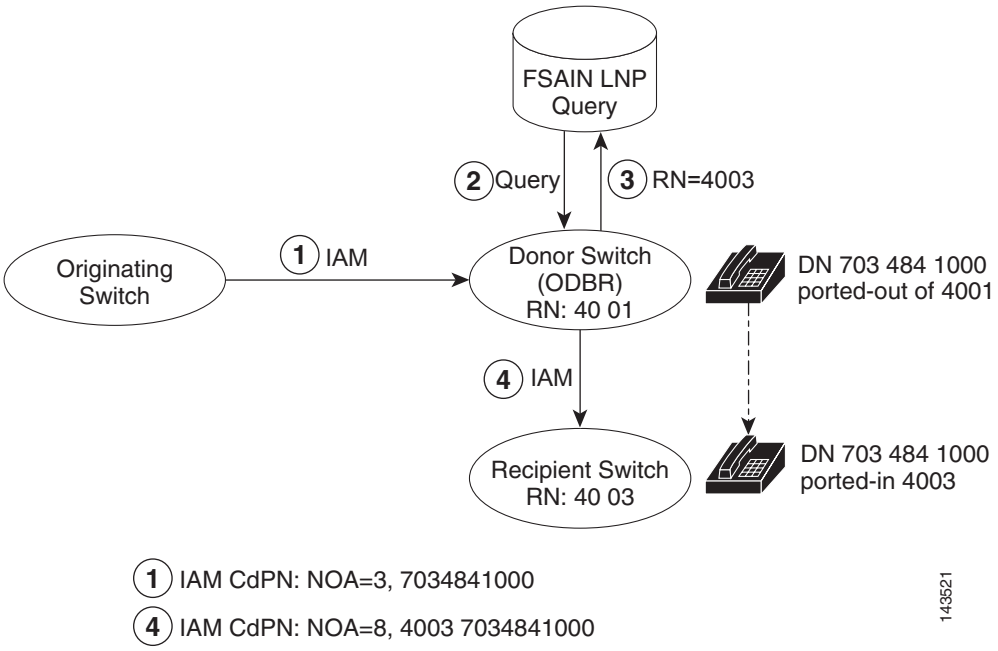
A call terminating to a Cisco BTS 10200 subscriber might be forwarded to another number, for example, in the case of CFU, CFB, or CFNA. In the case of LNP, the forwarded call is considered a new subscriber. If a backward REL with the ported number release cause is received, and QoR is configured, a query is performed to route the forwarding leg to the new recipient switch.

Onward Donor Based Routing

For Onward Donor Based Routing (ODBR), also known as Onward Call Routing (OCR), LNP queries are performed in a donor switch. The called party number is used to access the DN2subscriber table and, if the STATUS=PORTED-OUT or LNP-TRIGGER=Y, an LNP query is performed. After the query, the donor switch routes the call onward to the recipient switch.

ODBR is illustrated in Figure 2-9.

Figure 2-9 ODBR Routing



Subscriber Based LNP Trigger on a Donor Switch

The LNP-TRIGGER token in the DN2subscriber table provides an alternative to porting. The alternative method in enabled by changing the DN2subscriber status token to PORTED-OUT. It allows a seamless transition on a donor switch. However, it is not recommended if porting procedures normally require provisioning changes at the time the porting becomes effective.

During the transition period of a local subscriber porting out, the DN2subscriber record LNP-TRIGGER token might be set to Y, which forces an LNP query to determine whether the LNP database indicates the subscriber's DN is ported out or not.

If the LNP query returns an RN for a different switch, then the subscriber has ported out. In this case, if the switch performs ODBR queries, the call is routed onward to the recipient switch; otherwise, if the switch is configured for QoR queries, the donor switch sends backward REL with the QoR cause code.

If the LNP query does not find an RN, or returns the RN of this switch, then the subscriber is not ported yet (or has ported out and back in again), so the call is routed to the subscriber.

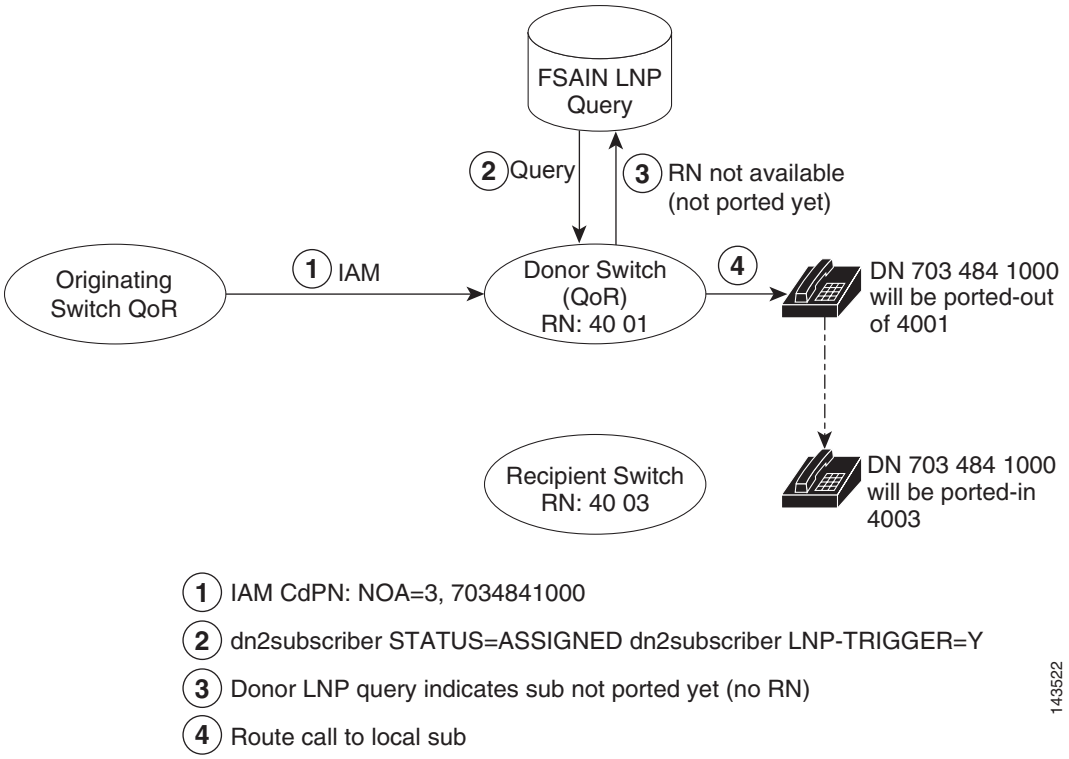
The subscriber-based LNP trigger makes it easy for the operator because configuring of the subscriber ported status is not required to be synchronized with the porting window. The operator sets the subscriber query (LNP-TRIGGER) flag in advance of the porting time window and can set the subscriber status to PORTED-OUT sometime later, after the porting.

Note The LNP-TRIGGER flag is not applicable for ACQ.

Example 1: QoR Donor Transition Period

Figure 2-10 and Figure 2-11 illustrate a call scenario for a QoR donor transition period. In Figure 2-10, the subscriber is ported out, the LNP-TRIGGER token has been set to Y, and the local database has no entry.

Figure 2-10 Before Subscriber Porting

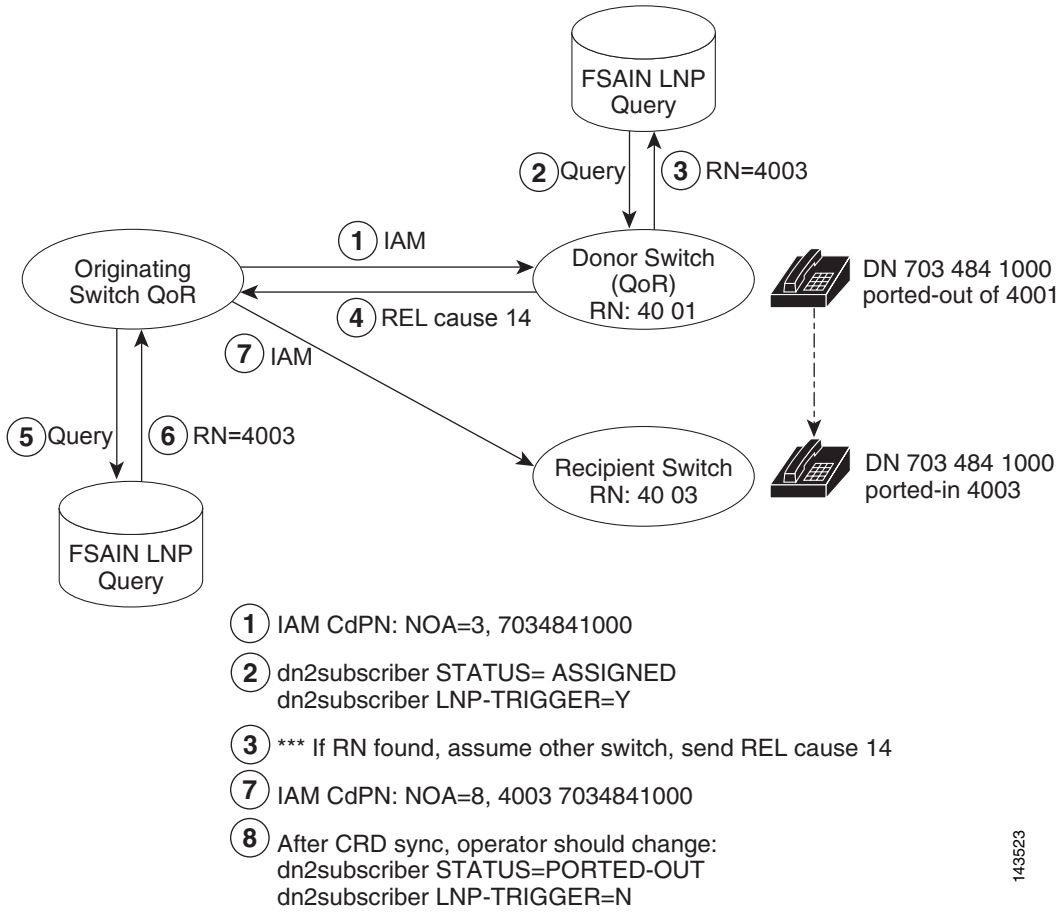


1. The originating switch sends an IAM to the donor switch with NOA=3 and DN=7034841000.
2. In the DN2subscriber table on the donor switch, STATUS=ASSIGNED and LNP-TRIGGER=Y. Since the LNP-TRIGGER=Y, the donor switch performs a query.
3. The query does not return an RN to the donor switch, indicating that the subscriber is not yet ported out.
4. The donor switch routes the call to the local subscriber.

Example 2: QOR Donor Transition Period

In Figure 2-11, it is after the start of the porting window. The subscriber is ported out, and the LNP-TRIGGER token has been set to Y. The local database now shows the subscriber as ported out (contains an RN for the subscriber).

Figure 2-11 After Subscriber Porting



1. The originating switch sends an IAM to the donor switch with NOA=3 and DN=7034841000.
2. In the DN2subscriber table on the donor switch, STATUS=ASSIGNED and LNP-TRIGGER=Y. Since the LNP-TRIGGER=Y, the donor switch performs a query.
3. The query returns RN=4003.
4. The donor switch sends REL cause QoR: Ported Number (14) to the originating switch.
5. The originating switch performs an LNP query of its local database.
6. The query returns RN of the recipient switch.
7. The originating switch sends an IAM to the recipient switch.

Precedence of Query Types

Operators can choose different options among ACQ, ODBR, QoR, and a combination of these. Countries starting with only ODBR or QoR may eventually transition to ACQ as more numbers become ported. Therefore, during the transition, a given network or switch may be a combination of ACQ plus QoR or ACQ plus ODBR.

The Cisco BTS 10200 LNP Profile tokens for ALL-CALLS-QUERY (ACQ), ONWARD-CALL-ROUTING (ODBR), and QUERY-ON-RELEASE (QoR) give the operator complete flexibility to configure the Cisco BTS 10200 for any possible combination in a mixed network by simply changing the LNP Profile tokens.

In general, ACQ takes precedence over ODBR, which takes precedence over QoR, and finally LNP-TRIGGER. A query due to ODBR or QoR requires the called DN status, in the dn2subscriber table, to be PORTED-OUT. For a query to result from LNP-TRIGGER=Y, the dn2subscriber status cannot be PORTED-OUT (and either the ONWARD-CALL-ROUTING or QUERY-ON-RELEASE must be Y).

Table 2-3 illustrates query type precedence. The first five columns indicate configuration values, and the last four columns indicate whether a query is performed or another action on the respective originating, intermediate, donor, and recipient switches. Note the following for Table 2-3:

- N values (for example, LNP Profile table ALL-CALL-QUERY=N) are shown as a blank cell in the table, to improve readability.
- ODBR indicates an all call query is performed, and the call is routed onward to the recipient switch.
- REL indicates the donor switch detects that the subscriber is ported-out, so the call is cleared (REL with cause QoR: Ported Number (14)).
- REL QOR indicates the originating switch receives REL with cause QoR: Ported Number (14), does a query, and routes the call onward to the recipient switch.

Table 2-3 Precedence of Query Matrix

LNP Profile ALL-CALL-QUERY	LNP Profile ONWARD-CALL-ROUTING	LNP Profile QUERY-ON-RELEASE	DN2SUB-SCRIBER Status PORTED-OUT)	DN2SUB-SCRIBER LNP-TRIGGER (and not PORTED-OUT)	Trunk Grp PERFORM-LNP-QUERY	Originating Switch Query?	Inter-mediate Switch Query?	Donor Switch Query?	Recipient Switch Query?
Y						ACQ			
	Y		Y					ODBR	
		Y				REL QOR		REL	
				Y				Note 3[1]	
					Y				
Y	Y		Y			ACQ		ODBR	
Y		Y	Y			ACQ		REL	
Y				Y		ACQ		Note 3	
Y					Y	ACQ	ACQ	ACQ	
	Y	Y	Y					ODBR	
	Y			Y				Note 1[2]	
	Y		Y		Y			ODBR	
		Y		Y				Note 2[3]	
		Y			Y	REL QOR	REL QOR	REL QOR	
Y	Y	Y	Y			ACQ		ODBR	
Y	Y	Y		Y		ACQ		Note 1	
Y	Y	Y			Y	ACQ	ACQ	ACQ	
Y	Y	Y		Y	Y	ACQ	ACQ	ACQ	

1. Donor switch dn2subscriber LNP-TRIGGER=Y, but not ODBR or QoR. Route call to subscriber with no query.
2. Case A: Donor switch dn2subscriber LNP-TRIGGER=Y and dn2subscriber STATUS=PORTED-OUT with ONWARD-CALL-ROUTING=Y: ODBR query. If query result returns an RN and if the RN is for another switch, the call is routed onward to the recipient switch; otherwise, the call cannot be routed to the ported-out subscriber, so the call fails with unallocated number cause.

   Case B: Donor switch dn2subscriber table LNP-TRIGGER=Y and dn2subscriber table STATUS=ASSIGNED with ONWARD-CALL-ROUTING=Y: LNP-TRIGGER query. If query result returns an RN and if the RN is for another switch, the call is routed onward to the recipient switch; otherwise, the call is routed to the local subscriber
3. Case A: Donor switch dn2subscriber table LNP-TRIGGER=Y with QUERY-ON-RELEASE=Y and dn2subscriber STATUS=PORTED-OUT: Call is cleared backward with REL and QOR: ported number cause.

   Case B: Donor switch dn2subscriber table LNP-TRIGGER=Y with QUERY-ON-RELEASE=Y and dn2subscriber table STATUS=ASSIGNED: LNP-TRIGGER query. If query result returns any RN or other switch, then the call is failed with QoR release cause such as unallocated number (not cause QoR: Ported Number (14)). Otherwise, an attempt is made to route the call to the local subscriber.

Dial Plan and NOA Routing

In some countries, there may be an overlap between the RNs and the leading digits of a DN; that is, the beginning digits of an RN and DN may be the same. The NOA is used to distinguish a DN from a concatenated RN + DN combination. A new capability, NOA routing, is added to the Cisco BTS 10200 for LNP in order to associate different dial plans for DN routing and RN routing.

Normal dial plans for subscriber and trunk originations are used to route to DNs. The new NOA Route table contains ported NOA values and destination IDs which point to RN dial plans.

Examples illustrating NOA routing are provided below. For the dial plan used for the subscriber or trunk origination, the dial-plan-profile table new NOA-ROUTING field is set to Y, with an associated NOA-ROUTE-PROFILE-ID. The new NOA Route table associated with the NOA Route Profile table has entries for the ported NOA. The NOA Route ITU Q.769 value 8, specified as PORTED-NUMBER-WITH-RN in the NOA Route table entry). If a matching NOA is found in the NOA Routing table, then the destination in the NOA Routing entry is used to route the call, and possibly point to a new dial plan for routing based on the RN. The call scenarios in the following sections show how this works.

Normal Routing for Called Party Number with a Non-Ported Nature of Address with Directory Number

An incoming trunk call is received with the Called Party Number containing the NOA associated with a DN. There will be no matching entry in the NOA Route entry. The normal dial-plan associated with the incoming trunk group is used to route the call.

Routing Number Routing for Called Party Number With Ported Nature of Number and Routing Number + Directory Number

An incoming trunk call is received with the Called Party Number containing the NOA associated with a ported DN. There is a matching entry in the NOA Route entry and a destination ID. That is, the NOA Route entry matches with the NOA entry of PORTED-NUMBER-WITH-RN (which is the value associated with NOA ITU Q.769 value 8). This destination ID may then contain a dial-plan ID for a dial plan for RN routing.

Local Number Portability Query Returns Routing Number for Ported Directory Number

When the Cisco BTS 10200 performs an LNP query and finds an RN for a ported number that is not in this switch, the call is routed onward. The dial-plan-profile associated with the originating subscriber or trunk has NOA-ROUTING=Y, and the NOA Route Profile ID of the NOA Route that contains a destination ID. Note that for a country such as France, which uses an RN prefix but with a standard NOA (3, National), after an LNP query on the Cisco BTS 10200, digit manipulation must be used to replace the NOA value ported- number with RN value to national.

Cluster Routing

A cluster is defined as two or more Cable Management Servers (CMSs) along with Media Gateway Controllers (MGCs) (or combined CMS/MGCs) deployed within a network. The cluster appears as one logical CMS/MGC looking towards the public switched telephony network (PSTN). The following assumptions are made:

- Each CMS, MGC, or combined CMS/MGC has its own SS7 Point Code.
- A trunk group cannot be split across multiple MGCs.
- All CMSs within a cluster share a common Location Routing Number (LRN) (referred as Cluster LRN).
- The npa-nxx of the ported-in numbers is not split across multiple CMSs (unless there is a NRS in the network).
- The subscriber DNs cannot be ported-out within a cluster.

A Cluster LRN is a shared LRN across multiple CMS/MGCs within a cluster.

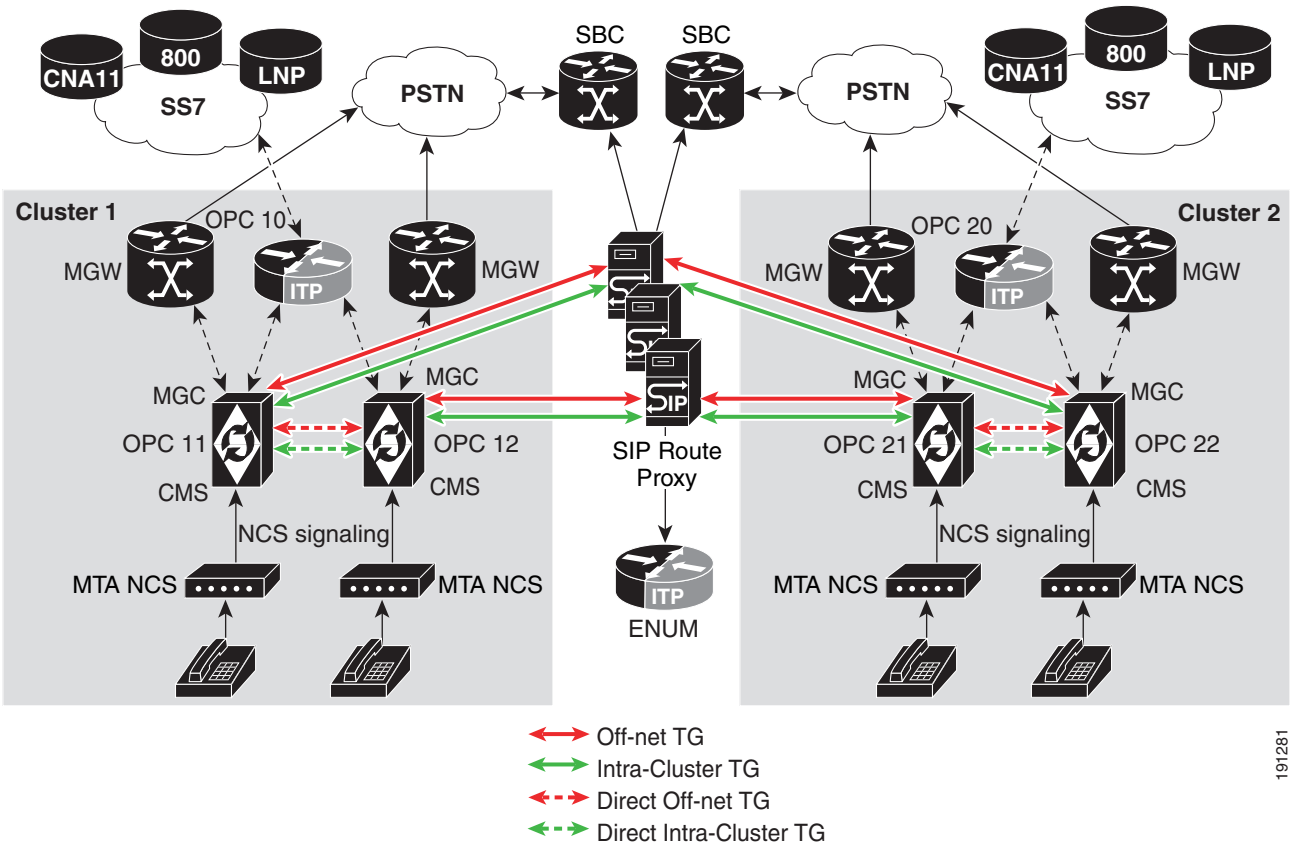
When a call with cluster LRN is received by one of the CMSs (or MGCs) within a Cluster, the call is routed to the terminating CMS by a SIP route proxy with ENUM querying capability or by the npa-nxx of the called number. For additional information on ENUM, refer to Chapter 4, “Electronic Number Mapping and Routing.”

For Automatic Recall (AR) and Automatic Callback (AC) feature support, the ITP performs 6-digit GTT (npa-nxx) to route AR or AC requests to the appropriate CMS.

The CLRN is treated as admin-DN for purposes of Numbering Resource Utilization/Forecast (NRUF) reporting.

Figure 2-12 illustrates the cluster routing scenarios.

Figure 2-12 Cluster Routing Scenarios Overview



Subscriber Originated Call at CMS

When a subscriber originates a call and the dialed DN is not within the CMS, the call processing logic performs an LNP query if required. Here are the call processing steps:

Step 1 If dialed DN exists in the Dn2Subscriber table and unconditional LNP Trigger is not set and status not equal to ported-out, then complete the call locally to the dialed DN. If status is not equal to assigned, then provide necessary treatment (for example, changed number, disconnect number, and so forth).

Step 2 If dialed DN exists in the Dn2Subscriber table with unconditional LNP Trigger set (LNP-TRIGGER=Y), then perform LNP query.

- If received LRN is MY-LRN or CLRN, then complete the call locally to the dialed DN. Otherwise, route the calls based on the LRN.
- If no LRN is returned and route-type=SUB in the Destination table, then complete the call locally to the dialed DN. Otherwise, route the call based on the Dialed DN.

Step 3 If dialed DN exists in Dn2Subscriber table and STATUS=PORTED-OUT, then perform LNP query. The call is routed based on the received LRN. If My-LRN or CLRN is received, treat it as an error condition.

Step 4 If dialed DN does not exist in the Cisco BTS 10200 (after an LNP query is completed), the LRN Type is MY-LRN and the call is rejected.

Step 5 If the dialed DN does not exist in the Cisco BTS 10200 and the ROUTE-TYPE=SUB in the Destination table, then provide unallocated number treatment.

Step 6 If dialed DN does not exist in Cisco BTS 10200 and LRN Type is CLRN, then call is routed based on the dialed DN and not the CLRN. If Cluster Dial Plan ID is provisioned, then retranslate the call based on npa-nxx of the dialed number using Cluster Dial Plan ID. Otherwise route the calls based on the original Dial Plan ID.

Note If a SIP route proxy is included in the cluster, then Cluster Dial Plan ID is not required. The subscriber dial plan ID should point all outgoing calls towards the SIP route proxy.

Note In any case, the call should be routed with LNP information (M-bit, GAP, RN).

Step 7 If the dialed DN does not exist in Cisco BTS 10200 and,

- If the received LRN is not MY-LRN or CLRN, then the call is routed based on the received LRN.
- If an LNP query is performed, but no LRN is received, then the call is routed based on the dialed number.
- If no LNP query is performed, then the call is routed based on the dialed number

Call Processing at Terminating CMS/MGC

Here are the call processing steps at the terminating CMS (or combined CMS/MGC):

Step 1 When an inbound call is received over an intra-cluster TG and the LRN Type is MY-LRN or CLRN, and DN appears in the DN2Subscriber table, complete the call locally.

Step 2 When an inbound call is received over an intra-cluster TG and LRN Type is MY-LRN or CLRN and DN does not appear in the DN2Subscriber table, and the ROUTE-TYPE does not equal SUB, return cause code (26), misrouted ported number.

Step 3 When an inbound call is received over an intra-cluster TG with MY-LRN or CLRN, and DN does not appear in the DN2Subscriber table, and the ROUTE-TYPE equals SUB, return cause code (1), unallocated number.

Step 4 When an inbound call is received over an intra-cluster TG and LRN Type is not MY-LRN or CLRN, route the call based on the Called Party Number (CdPN).

Step 5 When an inbound call is received over an offnet TG and LNP query has not been performed by the originating CMS, the MGC performs an LNP query if required. The calls are routed as specified in the "Inbound Call Processing at MGC from PSTN" section.

Inbound Call Processing at MGC from PSTN

Note IntraCluster TG flag is not set here.

The call processing steps at an MGC are very similar to those for the originating CMS. The call routing is configured based on the origin of the call. If the call originates from PSTN, configure the Cisco BTS 10200 as follows:

Step 1 If CLRN is received and the dialed DN (GAP number) exists in the DN2Subscriber table, terminate the call locally.

Step 2 If CLRN is received, route the call based on the npa-nxx of the dialed DN (GAP number) using Cluster Dial Plan ID if it exists or the original dial plan ID assigned to the inbound TG.

Step 3 If an MY-LRN is received, the dialed DN must belong to the Cisco BTS 10200. Terminate the call to the dialed DN within the Cisco BTS 10200 (existing processing).

Step 4 If no LRN is received, route the call based on the npa-nxx of the CdPN.

Step 5 If an inbound call is received from PSTN and LNP query has not been performed, the MGC performs an LNP query if required. The calls are routed as follows:

- If CLRN is received, see Steps 1 and 2.
- If MY-LRN is received, see Step 3.
- If no-LRN is received, see Step 4.
- If LRN TYPE is not MY-LRN or CLRN, the call is routed based on the received LRN.

Note If the digits could not be found in the cluster dial plan or the default dial plan, the call is torn down.

Support for ietf Trunk Group Draft

The Cisco BTS 10200 is enhanced to support standards-based TGID for SIP trunks without affecting the existing proprietary TGID feature. The draft-ietf-iptel-trunk-group-08.txt specifies support for both originating and terminating trunk groups. Only originating trunk groups are supported in Cisco BTS 10200 Release 5.0. The originating trunk group is specified in the trunk group parameter in a SIP contact header.

Define DN as a Cluster LRN

The DN STATUS=CLRN is defined in the Dn2Subscriber table. The CLRN indicates to call processing that this is a cluster LRN (CLRN).

DN to Subscriber

The Element Management System (EMS) automatically generates the DN to Subscriber table. A user can show data or change the Status field to vacant if the EMS is in the disconnected (DISC) or connected (CN) state. The DN2Subscriber table determines the subscriber ID of a DN during termination processing. The table is populated when a subscriber DN is added to the Subscriber table. The table is

queried when the called number is translated by use of the dial plan and the type of subscriber field indicates Subscriber; that is, it takes a DN and maps it to a subscriber. The DN to Subscriber table also displays the administrative status of the DN. For token names and description details for the DN to Subscriber table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Define Cluster Dial Plan ID

When the dialed number is recognized as an intracluster DN (based on the returned LRN), the call is routed within the cluster by translation of the npa-nxx of the dialed DN by means of the cluster Dial Plan ID. The cluster Dial Plan ID is defined in the CA_CONFIG table.

Call Agent Configuration

The Call Agent Configuration (ca-config) table defines the values that a service provider is allowed to change. The Call Agent Configuration Base defines the defaults for each Call Agent and is used unless the Call Agent Configuration table is added with a different value. For token names and description details for the Call Agent Configuration table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Define Intracluster TG Flag

The intracluster TG flag is defined in the Trunk Group table. When this flag is set, and calls with MY-LRN or CLRN are received over this TG, the Cisco BTS 10200 should not reroute the calls to another Cisco BTS 10200 or to SIP Route Proxy if the DN is not found. Instead, it should return a cause code 1 or 26. For Trunk Group table details, refer to the "Trunk Group" section on page 1-24.

Softswitch Trunk Group Profile Table

The SEND-STD-TRK-GRP-URI token is used to indicate if the trunk group parameters defined by draft-ietf-iptell-trunk-group should be used when an invite request and the trunk_sub_grp_type field is set to TGID. The default value is N.

Softswitch Trunk Group Profile

The Softswitch Trunk Group Profile (softsw-tg-profile) table holds all the information specific to a Softswitch trunk, such as ID, protocol, indicators and echo suppression. The softsw-tg-profile record can be shared by multiple softswitch trunk groups. An ID must be created in this table before entries can be added to the Trunk Group table. For token names and description details for the Trunk Group Profile table, refer to the Cisco BTS 10200 Softswitch CLI Database.

SIP-INBOUND-POLICY-PROFILE Table

The SIP-INBOUND-POLICY-PROFILE table has two new POLICY-TYPE values: CONTACT-TGRP and CONTACT-TRUNK-CONTEXT. The Action field is also split into two different files: MISSING-ACTION and NOMATCH-ACTION.

SIP Inbound Policy Profile

The SIP Inbound Policy Profile (sip-inbound-policy-profile) table determines the inbound trunk group based on various SIP headers and parameters. For token names and description details for the SIP Inbound Policy Profile table, refer to the Cisco BTS 10200 Softswitch CLI Database.

On-Net Routing and LNP for Inter-CMS Routing

On-Net Routing and LNP for Inter-CMS routing provide the following capabilities:

- ANSI LNP Query Support for Carrier Calls—Conditionally allow LNP queries on carrier calls, as determined by the Carrier LNP-QUERY flag
- LNP Query for On-net Routing, Inter CMS Routing—Provide control of LNP queries based on the dialed digit-string prefix and Destination. The operator can allow or deny LNP queries for different calls and routing scenarios. For example, queries should be unconditionally blocked for some CMS originations, and for some MGC cases queries should be performed. When a Cisco BTS 10200 is acting as both CMS and MGC, the query should be prevented on the subscriber origination towards the NRS, but performed when a call terminates to the MGC on a SIP or PSTN trunk. For traditional Cisco BTS 10200 on-net routing scenarios, a query might be desired on subscriber originations to DNs potentially on the same switch (SUB-ONLY), or on other on-net switches (ALL-CALLS).
- On-net Route Bypass of Carrier Route—For interLATA or toll calls, allow an on-net route, as defined in the Destination table, to override the carrier routing. On-net refers to facilities owned by an operator which includes one or more Cisco BTS 10200 switches (or other switches). SUB-ONLY allows carrier bypass to route the call to a local subscriber on the same Cisco BTS 10200. ALL-CALLS allows carrier bypass for all calls which have a valid on-net route. LNP query results are taken into account in the routing decision.
- Remove LNP Query result data when Carrier LNP-QUERY= N—For an outgoing carrier call with Carrier LNP-QUERY=N, remove the LNP query result data, if present. The LRN, FCI, and GAP are destroyed as if a query were not performed.
- Ignore Inbound LNP information—For an incoming trunk call with LNP data including forward call indicators, and so forth. When forward call indicators (FCI) bit-M indication "number translated" and Location Routing Number (LRN) and Generic Address Parameter (GAP) are included, the LNP data is ignored, resulting in call delivery based on the called DN (from the GAP).

On-Net Routing

Figure 2-13 shows On-net Routing in a multiple Cisco BTS 10200 environment for ALL-CALLS. The goal for the operator is to route all calls within the operator’s network which will eventually terminate within the operator's network. That is, carrier routing is bypassed in favor of the on-net route. So, the Destination BYPASS-CARRIER-ROUTING is set to ALL-CALLS. In this scenario, LNP queries are performed on the originating switch (if ported office code and other criteria indicate a query should be performed). Therefore, the destination NANP-LNP-QUERY value PERFORM-LNP-QUERY is used.

Figure 2-13 On-net Routing ALL-CALLS Scenarios

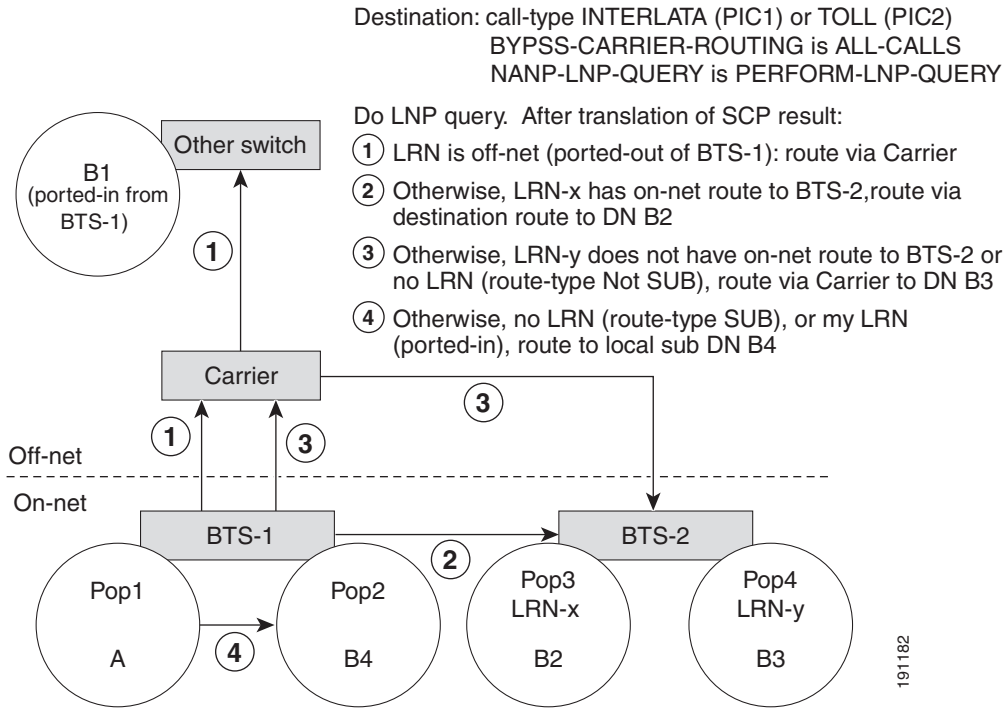


Figure 2-14 shows on-net routing in a multiple Cisco BTS 10200 environment for calls which terminate in the same Cisco BTS 10200 that originated the call, for which no LNP query is needed. That is, the operator can avoid carrier routing for calls that terminate on the same switch. For this scenario, the operator is willing to make a trade-off for DNs during the porting transition. That is, in order to avoid extra LNP queries, any DN in the porting transition phase (marked Dn2subscriber status ASSIGNED and LNP-TRIGGER=Y) is routed to the carrier. The carrier performs the LNP query, and if necessary, routes the call back. The trade-off is fewer LNP queries versus unnecessary carrier routing in some cases.

Figure 2-14 On-net Routing SUB-ONLY (Not Ported Subs Only) Scenarios

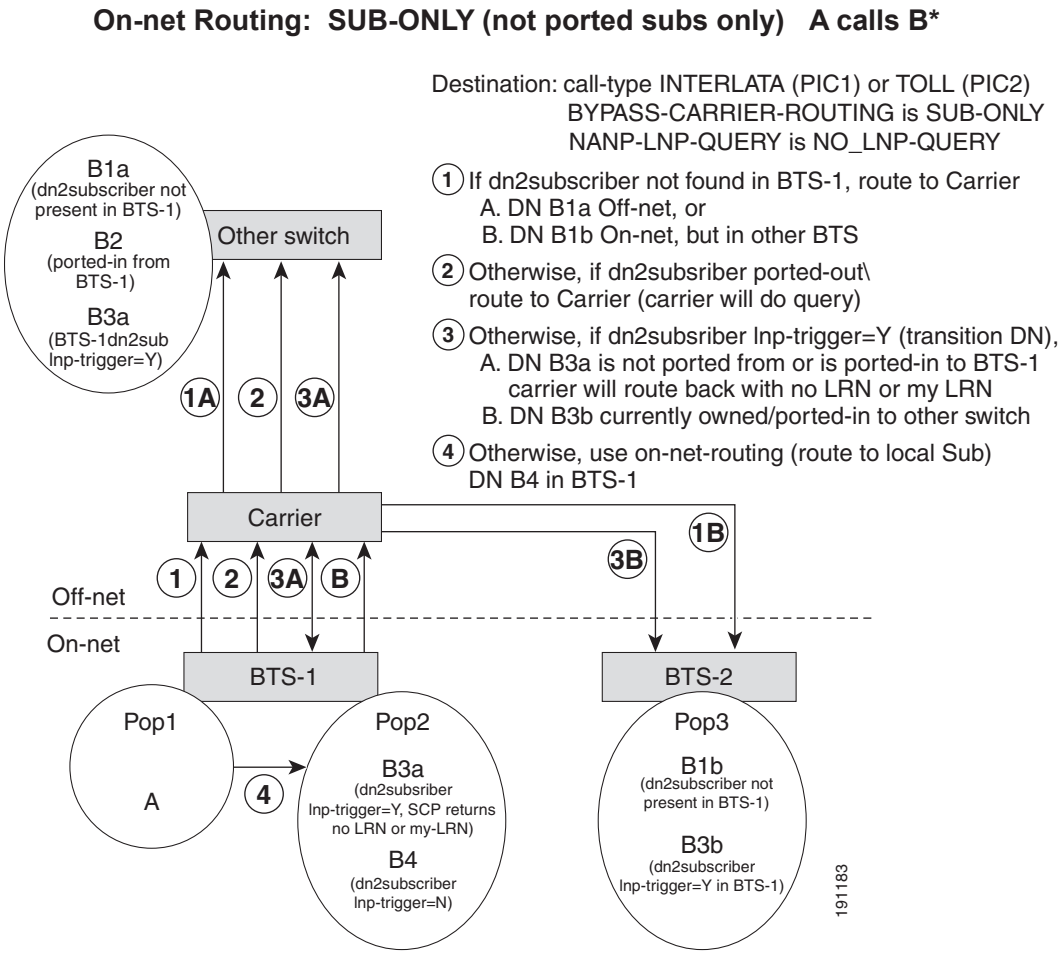
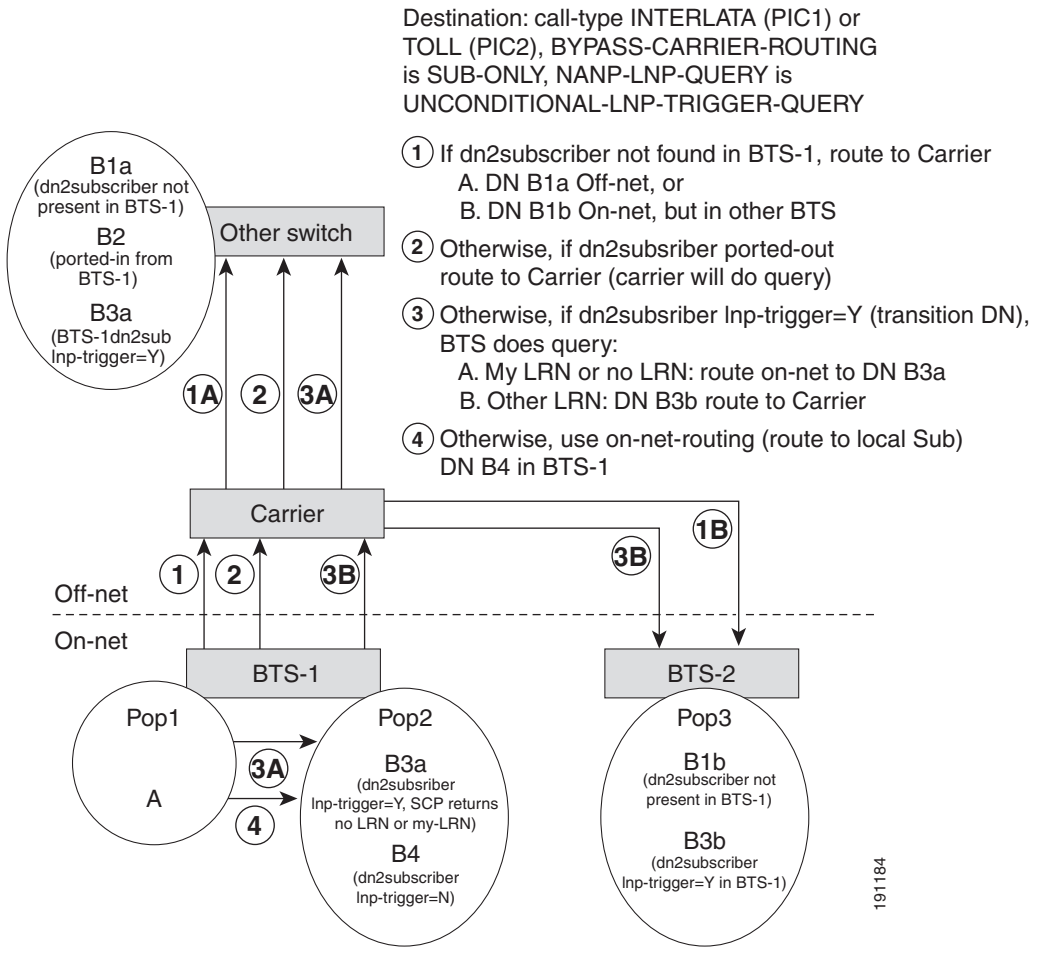


Figure 2-15 shows on-net routing in a multiple Cisco BTS 10200 environment for calls which terminate in the same Cisco BTS 10200 that originated the call, for which the originating Cisco BTS 10200 does an LNP query for transition DNs. The operator can avoid carrier routing for calls that terminate on the same switch. In this case, the operator is willing to accept additional LNP queries to be sure to avoid carrier routing for all cases of local subscribers. For any carrier call to the DN which is in the porting transition on this switch (Dn2subscriber status assigned and LNP-TRIGGER=Y), an LNP query is done. This is determined by the Destination NANP-LNP-QUERY UNCONDITIONAL-LNP-TRIGGER-QUERY value. After the query, the call is routed to the local subscriber, or to the carrier, depending on the query result.

Figure 2-15 On-net Routing SUB-ONLY (Cisco BTS 10200 Queries for Transition Subs) Scenarios



The above illustrations and descriptions give an overview of some of the LNP query and routing scenarios. For a detailed itemization of the various use cases, please see Table 2-5 on page 2-44.

Inter-CMS Routing

Descriptions of all the possible configurations for inter-CMS routing are not included here. In principle, the scenarios shown in the "On-Net Routing" section on page 2-31 can be applied to an individual CMS or MGC in an inter-CMS configuration. An overview is provided below.

Figure 2-16 illustrates an inter-CMS configuration with an NRS and separated CMS and MGC. CMS refers to a PacketCable Cable Management Server, which serves cable subscribers. The MGC refers to the Media Gateway Controller, which in PacketCable terminology refers to the node that interfaces with the PSTN. An MGC can also serve as the PSTN interface for SIP endpoints behind an NRS and Service Engine (SE), and Edge Proxy (EP).

The originating CMS, for example, CMS-1, routes the call to the NRS without an LNP query. So subscriber dial plans on CMS-1 will have destinations for which NANP-LNP-QUERY is NO-LNP-QUERY. The NRS can then route the call to either the MGC or CMS-2. MGC and CMS-2 incoming trunk dial plans might have destinations which allow LNP queries. So these destinations may have NANP-LNP-QUERY values of NA or PERFORM-LNP-QUERY.

Figure 2-16 Inter-CMS Routing: Separated CMS/MGC

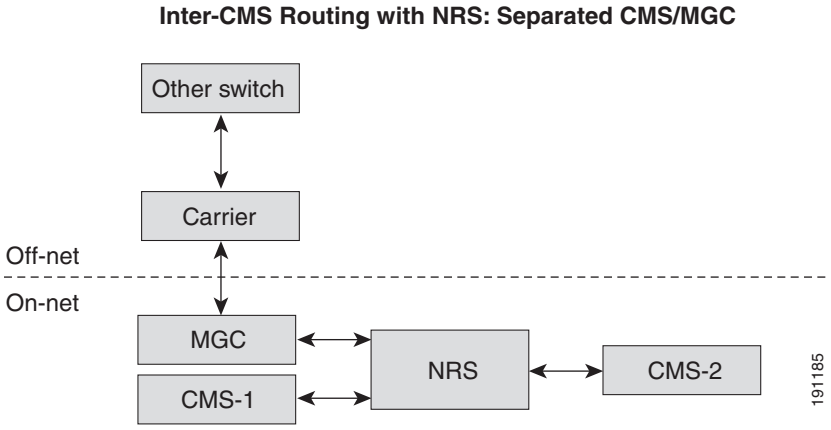


Figure 2-17 illustrates an inter-CMS configuration with an NRS and a single Cisco BTS 10200 acting as both a CMS and MGC. In principle, there is nothing different from the instance above where the CMS and MGC are separated. But this configuration drove the requirement to control LNP queries by the NANP-LNP-QUERY field based on subscriber dial plan separately from trunk dial plans on a per destination basis.

Figure 2-17 Inter-CMS Routing: CMS and MGC on Same Cisco BTS 10200

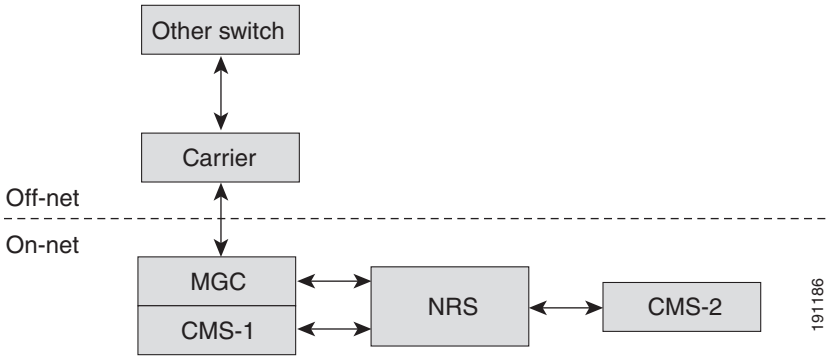


Table 2-4 shows destination NANP-LNP-QUERY and BYPASS-CARRIER-ROUTING settings for the various configurations.

ANSI LNP Query Support for Carrier Calls

LNP queries are now to be conditionally allowed on interLATA and intraLATA (toll) carrier calls. When carrier routing applies (for either casual dialing, or presubscribed Preferred Interexchange Carrier (PIC), Carrier LNP-QUERY=Y/N is used to indicate whether an LNP query is allowed. This capability exists for ITU LNP, and is added for ANSI/North America.

Note LNP query capability is supported for interLATA (PIC1) and toll (PIC2) calls; however, queries are not supported in international (call-type INTL, PIC3) calls, because number portability is not supported for international calls.

For an interLATA/toll or casual carrier call, there is an interaction of the carrier LNP-QUERY flag and the NANP-LNP-QUERY flag:

- Carrier LNP-QUERY is applicable only when Carrier USE-DIAL-PLAN=N
- Carrier LNP-QUERY is applicable only when Destination NANP-LNP-QUERY=NA. When NANP-LNP-QUERY=NA:
  - If Carrier LNP-QUERY=N, then there is no query.
  - If Carrier LNP-QUERY=Y and NANP-LNP-QUERY value NA, then there may be a query depending on Ported Office Code and other criteria. For example, if a Ported Office Match is not found, or Dn2subscriber data criteria do not allow a query, then there is no query.
  - If both Carrier LNP-QUERY=Y, and NANP-LNP-QUERY criteria allow a query, then there is a query.

Within the LNP query criteria decision checks, carrier routing is detected by any of the following conditions:

- Presence of a Carrier Identification Code (CIC), for example as a result of casual dialing, or from ISUP Transit Network Selection (TNS) parameter.
- Call-type TOLL, appropriate Nature of Dial (NOD) value and origination with valid subscriber data PIC2 Call-type interLATA, appropriate Nature of Dial (NOD) value and origination with valid subscriber data PIC1

After any of the above checks for a valid carrier are satisfied, if the carrier database record has USE-DIAL-PLAN=Y, then by default the route from the destination is used, rather than routing specified in the carrier record. USE-DIAL-PLAN=Y implies that the Cisco BTS 10200 operator is itself the acting carrier for the call.

So, for carrier USE-DIAL-PLAN=Y, the normal LNP query decision criteria are used. For example, according to the preexisting LNP criteria logic, queries are still not allowed on a carrier call when any of the following apply:

- Operator (carrier) call
- When a ported-office-code match is not found
- When a dn2subscriber record is not found and the destination route-type is SUB
- When dn2subscriber status is not PORTED-OUT and LNP-TRIGGER=N

Otherwise, when Carrier LNP-QUERY=Y and USE-DIAL-PLAN=N, existing LNP query criteria allow queries on carrier calls when a ported-office-code match is found, and any of the following are true:

- Called DN does not appear in the office-code table.
- dn2subscriber entry for the DN is not found and either destination entry is not found or destination ROUTE-TYPE is not SUB.
- Dn2subscriber entry has status PORTED-OUT, or LNP-TRIGGER=Y.

LNP Query for On-net Routing, Inter-CMS Routing

LNP and ported-in and ported-out subscribers must be taken into account for Cisco BTS 10200 On-net Routing, inter-CMS Routing. This requirement provides precise control of LNP queries based on the dialed digit-string prefix and destination. The operator is given flexibility to allow or deny LNP queries for different calls and routing scenarios.

A new Destination schema field, NANP-LNP-QUERY is added with the following values:

- NA: support preexisting Cisco BTS 10200 LNP query capability (Release 4.5), with two additions:
  - Conditionally allow LNP queries on Carrier calls, in conjunction with the Carrier LNP-QUERY field.
  - Queries are now allowed on World Zone 1 calls (to Canada, Hawaii, Alaska, and so forth), that is, when call-type is INTL-WZ1.
- NO-LNP-QUERY: unconditionally prevents an LNP query on any call reaching this destination. This is useful for inter-CMS routing, or for any case where the originating CMS subscriber dial-plan prevents queries (because the query is performed by the NRS, MGC, terminating CMS, or Carrier).
- PERFORM-LNP-QUERY: Similar to NA value, except that the Carrier LNP-QUERY field is ignored, and a query can be allowed on any call-type. Prior to Release 5.0, the Cisco BTS 10200 allowed queries only for call-type local, interLATA, or toll. This value can be used in an on-net routing or inter-CMS scenario where a given CMS/MGC should perform LNP queries, especially prior to on-net routing.
- UNCONDITIONAL-LNP-TRIGGER-QUERY: Conditionally allows an LNP query for DNs during the porting in or out transition (Dn2subscriber LNP-TRIGGER=Y). This value is useful for an on-net routing scenario where carrier bypass is allowed for DNs assigned on the originating Cisco BTS 10200 (BYPASS-CARRIER-ROUTING SUB-ONLY). This value allows a query regardless of the call type.

Table 2-4 shows routing scenarios and suggested provisioning values.

Table 2-4 Routing Scenarios and Provisioning

Scenario	BYPASS-CARRIER-ROUTING	NANP-LNP-QUERY	Carrier LNP-QUERY
Normal - like Release 4.5.	NONE	—	N
Like Release 4.5, but queries are also to be allowed depending on the Carrier LNP-QUERY value.	NONE	—	Y
Carrier bypass (on-net route) only for local calls terminating on this switch which don't need an LNP query.	SUB-ONLY	NO-LNP-QUERY. but routing logic must route to carrier for PORTED-OUT and LNP-TRIGGER=Y cases.	—
Carrier bypass (on-net route) only for local calls terminating on this switch with queries allowed for DNs during porting transition.	SUB-ONLY	UNCONDITIONAL-LNP-TRIGGER-QUERY	—
Multi-Cisco BTS 10200—Carrier bypass (on-net route) to all on-net switches.	ALL-CALLS	PERFORM-LNP-QUERY	—
Inter-CMS no NRS.	ALL-CALLS	PERFORM-LNP-QUERY	—
Inter-CMS with NRS.	SUB-ONLY	UNCONDITIONAL-LNP-TRIGGER-QUERY	—

For more examples of provisioning combinations, and LNP query results and routing results, see Table 2-5.

Carrier Calls

See the "On-net Route Bypass of Carrier Route" section on page 2-40 and Destination NANP-LNP-QUERY value NA below.

Destination NANP-LNP-QUERY value NA:

This value is similar to previous Release 5.0 LNP query criteria, except that a query can be allowed for carrier calls. For value NA, there will be an LNP query if the following conditions are satisfied:

- An LNP query has not been done already by this Cisco BTS 10200 or another switch on the call.
- "Nature of Dial" (derived from nature of address), is one of the following:
  - 7-digit National, 10-digit National, 7-digit Local, 10-digit National, Casual-7-digit National, Casual 10-digit National, Casual 7-digit Local, Casual 10-digit Local, Network Specific 1, Network Specific 2, Network Specific 3, Network Specific 4, Network Specific 5, Network Specific 6, or Network Specific 7.
- Destination call-type:
  - Value is either local, interLATA, toll, toll-free, or INTL-WZ1.
  - Or, for a different call-type value, a matching entry is found in the Call Type Profile with LNP-QUERY=Y.
- If Carrier Identification Code (CIC) is present, and one of the following is true:
  - Carrier USE-DIAL-PLAN=Y, or Carrier LNP-QUERY=Y
  - Or, call-type toll,
    - The subscriber's Pop supports intraLATA toll pre-subscription (ITP=Y), and either PIC2 Carrier USE-DIAL-PLAN=Y or Carrier LNP-QUERY=Y,
    - Or, if the subscriber's Pop does not support intraLATA toll pre-subscription (ITP=N), then the Destination has route-type carrier, then if Carrier USE-DIAL-PLAN=Y, or Carrier LNP-QUERY=Y
  - Or call-type interLATA
- If PIC1 Carrier USE-DIAL-PLAN=Y, or Carrier LNP-QUERY=Y.
- Ported Office Code match found on 10-, 9-, 8-, 7-, 6-, or 3-digit prefix (longest match), and either:
  - Or Dn2subscriber record found and status is PORTED-OUT, or LNP-TRIGGER=Y
  - Or Dn2subscriber record not found, and either
    - Destination not found (this case might not actually be possible).
    - Or Destination route-type is not SUB.

Destination NANP-LNP-QUERY Value NO-LNP-QUERY

When digit translation results in reaching a destination with value NO-LNP-QUERY, then there is no LNP query in any case.

Destination NANP-LNP-QUERY Value PERFORM-LNP-QUERY

This value works exactly the same as value NA, except for these exceptions:

- PERFORM-LNP-QUERY allows a query on any call-type (rather than just for call-types local, interLATA, toll, and toll-free as for NA). The Call Type Profile is not checked.
- For carrier calls, PERFORM-LNP-QUERY allows a query without checking the Carrier LNP-QUERY value. So, even if LNP-QUERY=N, a query can be performed.

Destination NANP-LNP-QUERY Value UNCONDITIONAL-LNP-TRIGGER-QUERY

For value UNCONDITIONAL-LNP-TRIGGER-QUERY, there will be an LNP query if the following conditions are satisfied:

- An LNP query has not been done already by this Cisco BTS 10200 or another switch on the call.
- Nature of Dial (derived from nature of address), is one of the following:
  - 7-digit National, 10-digit National, 7-digit Local, 10-digit National, Casual 7-digit National, Casual 10-digit National, Casual 7-digit Local, Casual 10-digit Local, Network Specific 1, Network Specific 2, Network Specific 3, Network Specific 4, Network Specific 5, Network Specific 6, Network Specific 7
- Dn2subscriber record is found, and status is assigned, and LNP-TRIGGER=Y.

Retranslation After an LNP Query

After an LNP query, there might be a new translation based on the SCP result. Routing scenarios after an LNP query result are as follows:

- SCP returns no LRN: in this case, the original translation applies, and the call is routed appropriately.
- SCP returns an LRN:
  - LRN is off-net: the call is routed to the appropriate switch, by means of the routing specified by the new Destination reached through translation, and if applicable, the Carrier.
  - LRN is my LRN and carrier routing not applicable: The LRN is considered to be my LRN if either the LRN digits have a Dn2subscriber record with STATUS=LRN, or the calling party's POP contains MY-LRN digits which match the LRN from the SCP. In either case, the original called party digits (from GAP parameter received from the AIN Feature Server) are used to find the dn2subscriber entry, and the call is routed to the subscriber. This is also the case when the Destination has route-type not SUB; the Destination routing is overridden and the call is offered to the subscriber on the Cisco BTS 10200.
  - For a carrier call for which there is an on-net route and the LRN is on-net:
    - My LRN and the Dn2subscriber record exist with status assigned (LNP-TRIGGER=Y): route to the local subscriber, and ignore (bypass) carrier routing, and ignore the routing specified in the original Destination.
    - On-net LRN of another on-net switch: bypass carrier routing, and use the on-net route specified in the destination.

Call-type After Multiple Digit Translations

Normally after a digit translation, the call-type is retrieved from the resulting destination. It is possible that further digit translations will occur, for example, the retranslation on the LRN after an LNP query. Normally the call-type from the original translation is used after subsequent translations. So the call-type in the destination resulting from the LRN translation is ignored, in favor of the original call-type resulting from the original called DN translation.

An exception is that the call-type can change from a translation for policy-nxx. For example, dialed digits 611 translate to a destination with call-type repair, which has a route-guide containing policy-type=NXX, with a policy-nxx containing a new translated-dn. In this case, a new translation on the translated-dn occurs, and the new destination call-type is used subsequently during the call. This is necessary to prevent problems related to a possible NXX (800 toll-free) translation.

On-net routing is not supported for ITU LNP.

Removal of Ported Office Code IN-CALL-AGENT Field

As part of this feature, all checking of the Ported Office Code IN-CALL-AGENT flag is removed. Essentially within all logic for which there is a Ported Office Code match, the logic functions as if the IN-CALL-AGENT=Y.

Non-carrier call Routing to Ported-in DNs

Prior to Release 5.0, implicit routing was allowed for calls to ported-in subscribers. The DN of a ported-in subscriber is owned by another switch, so the dial-plan for the DN prefix goes to a destination which has a route to the donor switch (owning the DN block). During the Cisco BTS 10200 routing and translation, prior to routing using the destination route to the donor switch, if it is determined that the DN is for an assigned subscriber in the Cisco BTS 10200, and the DN or prefix has a Ported Office Code match, then the destination route is ignored, and the call is routed directly to the local subscriber.

In Release 5.0, the above routing logic is still applicable for destination NANP-LNP-QUERY values NA, PERFORM-LNP-QUERY, and UNCONDITIONAL-LNP-TRIGGER-QUERY.

However, destination NANP-LNP-QUERY value NO-LNP-QUERY has been added to block queries for network configurations where it is desirable for all CMS originations to route to an NRS. For such a configuration, the operator might want the explicit route from the dial plan and destination to be honored, even for ported-in subscribers. With this in mind, specifically for cases where the destination specifies NO-LNP-QUERY and the route-type is not SUB, the call is routed via the destination. This is the case for calls which do not have call-type interLATA or toll; for interLATA and toll carrier calls, the Destination BYPASS-CARRIER-ROUTING field determines whether carrier routing (value none) or routing to the local subscriber is desired (value SUB-ONLY or ALL-CALLS).

On-net Route Bypass of Carrier Route

Provide the capability to selectively override, or bypass, carrier routing if an on-net route exists to a subscriber on the same switch, or on another on-net switch within the same operator's network.

Specifically, for interLATA and intraLATA calls, that is, calls with destination call-type of interLATA or TOLL, carrier routing is normally bypassed in favor or the destination routing when:

- Destination BYPASS-CARRIER-ROUTING is ALL-CALLS, or
- Destination BYPASS-CARRIER-ROUTING is SUB-ONLY and a dn2subscriber record exists.

In addition to carrier bypass for the above scenarios, under certain conditions, carrier routing is allowed instead of routing to a local subscriber. For example, even if the subscriber appears to be ported-in to the CMS (Destination BYPASS-CARRIER-ROUTING=NONE and ROUTE-TYPE not SUB, dn2subscriber STATUS=ASSIGNED and LNP-TRIGGER=Y, and the query result contains my LRN of the same Cisco BTS 10200), carrier routing is used instead of routing directly to the local subscriber.

The operator owning the Cisco BTS 10200 may itself be a carrier, as defined by a carrier route with Carrier USE-DIAL-PLAN=Y. Essentially this is the same as On-net Routing, because the dial plan and destination routing are used for the call. Checks for On-net Routing carrier bypass only apply for carriers which do not use the dial plan routing (USE-DIAL-PLAN=N).

On-net routing does not apply to operator calls, and is also not supported for casual carrier calls.

Some sample values of the new Destination BYPASS-CARRIER-ROUTING field are shown in Table 2-4.

Carrier Bypass in favor of an On-net Route applies under the following conditions:

- A PIC1 or PIC2 Carrier Identification Code (CIC) is present.
- Destination call-type is interLATA or toll.
- It is not an operator call.
- Carrier USE-DIAL-PLAN=N (see description of this below).
- Destination route-type is not carrier.
- It is not a casual carrier call (based on Nature of Dial, NOD).
- Dn2subscriber record for the DN does not exist, and the Destination BYPASS-CARRIER-ROUTING is ALL-CALLS.
- Dn2subscriber record exists, BYPASS-CARRIER-ROUTING is SUB-ONLY or ALL-CALLS, and any of the following is true:
  - Dn2subscriber status is PORTED-OUT and an LNP query was done. This condition implies that the SCP either returned no LRN, or my LRN (LRN matching either Dn2subscriber record with status LRN, or Pop MY-LRN). This is an error case, because the switch has marked the subscriber as PORTED-OUT, but the SCP has returned my LRN. There is no chance to complete this call, so we bypass carrier and route on-net, and the call fails. During the porting transition, our Cisco BTS 10200 has probably already marked the DN as ported-out, but the SCP has not updated the database with the correct LRN of the recipient switch.
  - Dn2subscriber status assigned, and LNP-TRIGGER=N: this is the normal case for carrier bypass to an on-net subscriber of this switch, for which LNP porting has not occurred.
  - Dn2subscriber status assigned, LNP-TRIGGER=Y, LNP query was done, route-type is SUB (donor transition case): We bypass carrier and route on-net, because our subscriber is in transition to being ported-out, but the SCP does not yet have the LRN of the recipient switch.
  - Dn2subscriber status assigned, LNP-TRIGGER=Y, LNP query was done, and route-type is Not SUB, and the SCP returned my LRN (recipient transition case): We bypass carrier and route on-net, because this DN is in transition to being ported-in to this switch, and the SCP has provided our LRN, indicating that the porting-in transition is complete.

Note If the SCP query results in no LRN provided, it must assume that the porting-in transition has not completed, so we do not bypass carrier, because carrier routing is required to route the call to the switch owning the DN block range of the called DN.

  - Dn2subscriber status not PORTED-OUT and not assigned, LNP query was done, and route-type is SUB: There is no chance to route this call. Because route-type is SUB, we know the DN's DN block (for example, NPA-NXX) is owned by this switch. Perhaps somebody has dialed a disconnected or vacant number, or accidentally dialed LRN. In any case, we bypass the carrier and route locally for the call to fail.

In a few cases, we do not bypass carrier routing because a necessary LNP query was not done, or for other reasons we may not be able to correctly route the call. For example:

- Dn2subscriber record exists, BYPASS-CARRIER-ROUTING is SUB-ONLY or ALL-CALLS, Dn2subscriber status is PORTED-OUT, and an LNP query was not done. For status PORTED-OUT, an LNP query is needed to route the call. Probably there is a provisioning discrepancy, for example, in a switch with a ported-out DN, a destination which specifies BYPASS-CARRIER-ROUTING of either SUB-ONLY or ALL-CALLS should have the NANP-LNP-QUERY set to NA or PERFORM-LNP-QUERY. Also, the Ported Office Code might be missing. In any case, the carrier bypass without an LNP query prevents the call from completing to the DN on the recipient switch, so the call is routed to the carrier, who is expected to do the query and complete the call to the recipient switch.
- Dn2subscriber record exists, BYPASS-CARRIER-ROUTING is SUB-ONLY or ALL-CALLS, Dn2subscriber status is assigned, LNP-TRIGGER=Y, and an LNP query was not done. For status assigned with LNP-TRIGGER=Y, an LNP query is expected in order to determine whether the DN during the porting transition is still on our switch or not. Probably there is a provisioning discrepancy, for example, in a switch with a DN in porting transition, a Destination which specifies BYPASS-CARRIER-ROUTING of either SUB-ONLY or ALL-CALLS should have the NANP-LNP-QUERY set to NA, PERFORM-LNP-QUERY, or UNCONDITIONAL-LNP-TRIGGER-QUERY. Also, the Ported Office Code might be missing. In any case, the carrier bypass without an LNP query routes the call to the subscriber on this switch, which might be incorrect. So carrier bypass is not allowed, and we let the carrier take care of routing the call properly.
- Dn2subscriber record exists, BYPASS-CARRIER-ROUTING is SUB-ONLY or ALL-CALLS, Dn2subscriber status is not assigned, LNP-TRIGGER=N, and route-type is not SUB. This is an unusual case, because we have a dn2subscriber record, but the Destination route-type is Not SUB. Possibly a DN ported-in to this switch, but the DN has since been marked as vacant, disconnected, and so forth. Since the NPA-NXX DN block is not owned (implied by route-type not SUB), the carrier routing is allowd to route the call to the number block owner.

Remove LNP Query Result Data When Carrier LNP-QUERY= N

For an outgoing carrier call after an LNP query in the same switch, with Carrier LNP-QUERY=N, remove the LNP query result data, if present. The LRN, FCI, and GAP are destroyed as if a query were not performed. That is, the outgoing IAM Forward Call Indicators (FCI) bit-M is set to not translated, and if Generic Address Parameter (GAP) is present, then the Called Party Number (CdPN) digits are set to the (ported) called DN from the Generic Address Parameter (GAP). Additionally, the GAP parameter is destroyed.

Existing Cisco BTS 10200 operators might have agreements with their carriers that the carrier does the LNP query. Before this feature was introduced, the Cisco BTS 10200 did not allow an LNP query on carrier calls. Now, as a result of this feature, LNP queries might be required in order to determine whether an on-net route exists. If a query is needed but then it is determined that the call needs to be routed to the carrier, and the carrier expects to perform queries (Carrier LNP-QUERY=N), the LNP data is removed. This ensures that the carrier's expectation that it can do the query is met, and the carrier is not aware that a query was already done.

The LNP data is removed only if the LNP query occurred on the same switch. This ensures that valid LNP data as a result of a query that was done by any switch prior to routing to this Cisco BTS 10200 is not removed.

Removing the LNP data affects only the outgoing signaling message (that is, SS7 ISUP IAM). The LNP data is retained in the Cisco BTS 10200, so billing and other functions are not affected by removal of the LNP data from the signaling message. The LNP data is removed if all of the following conditions are met:

- An ANSI LNP query was performed in this switch.
- The outgoing signaling message contains the Transit Network Selection (TNS) parameter, which has a Carrier Identification Code (Carrier ID, or CIC).
- Carrier record (accessed by Carrier ID from the TNS) has LNP-QUERY=N.
- Carrier record has USE-DIAL-PLAN=N.

Note that an alternative method to remove the LNP data is pre-existing. That is, if the outgoing trunk group SIGNAL-PORTED-NUMBER=Y, then the LNP data is removed in the same way as described above.

Ignore Inbound LNP Information

When an incoming trunk call is received on a trunk group with IGNORE-INBOUND-LNP=Y, ignore any received LNP data as if it were not received. Specifically, the FCI bit-M is set to “number not translated.” and if the GAP and LRN are present, the GAP digit string is inserted in the Called Party Number digit string, and the GAP and LRN are destroyed.

The LNP data received on an incoming call as the result of an LNP query on another switch might consist of:

- ANSI ISUP forward call indicators (FCI) bit-M set indicating "translated number", and is present if an LNP query was performed.
- LRN and GAP are present if provided by the SCP as a result of an LNP query when the DN is ported; LRN and GAP are not present if the DN is not ported:
  - The Generic Address Parameter (GAP) might contain the original called party digits (GAP type of address indicates ported dialed number), and
  - The Called Party Number (CdPN) parameter might contain the Location Routing Number (LRN) which addresses the recipient switch.

This requirement adds the capability to let the LNP information be ignored and process the call as if the called party digits were dialed without an LNP query.

When a call is received on a trunk group and the trunk group IGNORE-INBOUND-LNP=Y, and if the FCI indicates translated number and a GAP is present, then the GAP (original called party) digits are copied into the CdPN digits (destroying the LRN). The GAP parameter is then destroyed and the FCI is reset to indicate that the number is not translated. Then the call is allowed to proceed.

Note that this requirement has the following side effects on other existing LNP functionality:

1. The billing record does not show the LRN and GAP.
2. If the call fails and LNP-specific measurements and notifications are not received, the system performs as if the LRN and GAP were not received.

Warning **IGNORE-INBOUND-LNP=Y should be used with care, and is not recommended for normal routing scenarios. Clearing the FCI could minimally result in extra, unneeded queries, and at worst, result in routing loops during porting transitions. For example, if a DN is ported twice, and different switches/operators use different SCPs, which don't have LRNs exactly synchronized, then each switch will query their SCP and route the call to the other. Such a routing loop ("shoelaces") would continue until one of the hops expires or all available trunks are exhausted. Once the hop count expires or all trunks are seized, then everything immediately clears. Nevertheless, such routing loops are a reason for concern, and the normal FCI checks with IGNORE-INBOUND-LNP=N will prevent them from occurring.**

If IGNORE-INBOUND-LNP=Y is used, we recommend that you tailor the appropriate trunk group profile(s) (for example, ss7-ansi-tg-profile) hop-counter to a reasonable (small) value such that a routing loop, should it occur, does not busy out too many trunk circuits.

On-net Routing Use Case Matrix

Table 2-5 provides a matrix of on-net routing use cases.

Table 2-5 On-net Routing Use Case Matrix

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
1	NO-LNP-QUERY	N	DC[1]	DC	DC	DC	N		Normal call routing.
2	NO-LNP-QUERY	N	DC	DC	DC	Y	N		Normal call routing.
3	NO-LNP-QUERY	N	DC	DC	DC	Y	N		Normal call routing.
4	NO-LNP-QUERY	N	DC	DC	Y	N	N		Destination routing.
5	NO-LNP-QUERY	N	DC	DC	N	Y	N		Error case.
6	NO-LNP-QUERY	N	DC	DC	Y	Y	N		Destination routing.
7	NO-LNP-QUERY	Y	DC (N)	NONE	DC (Y)	N	N		Carrier routing.
8	NO-LNP-QUERY	Y	DC (Y)	NONE	DC (Y)	DC (N)	N		Carrier routing.
9	NO-LNP-QUERY	Y	DC (Y)	NONE	DC	DC (Y)	N		Carrier routing.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
10	NO-LNP-QUERY	Y (PIC2)	DC (Y)	NONE	DC	DC (Y)	N		Carrier routing.
11	NO-LNP-QUERY	Y	DC (Y)	NONE	DC	DC (Y)	N		Carrier routing.
12	NO-LNP-QUERY	Y	DC (Y)	SUB-ONLY	Y	N	N		Carrier routing.
13	NO-LNP-QUERY	Y	DC (Y)	SUB-ONLY	Y	N	N		Bypass carrier and route on-net to local sub.
14	NO-LNP-QUERY	Y	DC (Y/N)	SUB-ONLY	Y	Y	N		Carrier routing.
15	NO-LNP-QUERY	Y	DC (Y/N)	SUB-ONLY	Y	Y	N		Carrier routing.
16	NO-LNP-QUERY	Y	DC (Y/N)	SUB-ONLY	Y	Y	N		Carrier routing.
17	NO-LNP-QUERY	Y	DC (Y)	ALL-CALLS	Y	N	N		Bypass carrier and route on-net to local sub.
18	NO-LNP-QUERY	Y	DC (Y/N)	ALL-CALLS	Y	Y	N		Bad provisioning.
19	NO-LNP-QUERY	Y	DC (Y/N)	ALL-CALLS	Y	Y	N		Bypass carrier.
101	—	N	DC	DC	Y	N	Y/N		Normal call routing.
102	—	N	DC	DC	Y	N	Y/N		Normal call routing.
103	—	N	DC	DC	Y	Y	Y	DC	Normal call routing.
100	—	N	DC (N)	DC	Y	Y	Y	Any LRN	Retranslate on received LRN.
100a	A[2]	Local		DC				My LRN	Same destination after query.
100b	B[3]	Local		DC				On-net LRN	Route on-net via LRN destination.
100c	C[4]	Local		DC				Off-net LRN	Route via LRN destination.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
104	—	Y	Y	NONE	Y	N	Y	No LRN	Carrier routing.
105	—	Y	Y	NONE	Y	Y	Y	No LRN	Carrier routing after LNP query
106	—	Y	Y	NONE	Y	Y	Y	Any LRN	Carrier allows LNP QUERY—retranslate on received LRN.
106a	A	Carrier		NONE				My LRN	Error case.
106b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
106c	C	Carrier		NONE OR SUB-ONLY				Off-net LRN	New destination after LRN translation. Route to Carrier.
107	—	Y	Y (PIC2)	NONE	Y	Y	Y	No LRN	Carrier routing after LNP query.
108	—	Y	Y	NONE	Y	Y	Y	Any LRN	Carrier allows LNP QUERY—retranslate on received LRN.
108a	A	Carrier		NONE				My LRN	Carrier routing.
108b	B	Carrier		ALL-CALLS				On-net LRN	New destination after LRN translation.
108c	C	Carrier		NONE OR SUB-ONLY				Off-net LRN	New destination after LRN translation.
109	—	Y	DC (Y)	SUB-ONLY	Y	N	N		Route on-net (carrier bypass) to local sub.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
110	—	Y	DC (Y)	SUB-ONLY	N	N	N		Route on-net (carrier bypass) to local sub .
111a	—	Y	Y	SUB-ONLY	DC (Y)	N	N		Carrier routing.
111b	—	Y	N	SUB-ONLY	DC (Y)	N	N		Carrier routing.
111c	—	Y	Y	SUB-ONLY	DC (Y)	N	N		Carrier routing.
112	—	Y	Y	SUB-ONLY	Y	N	N		Carrier routing.
113	—	Y	Y	SUB-ONLY	Y	N	N		Carrier routing.
114	—	Y	Y	SUB-ONLY	Y	N	Y	No LRN	Carrier routing.
115	—	Y	N	SUB-ONLY	Y	Y	N		Carrier routing.
116	—	Y (PIC2)	N	SUB-ONLY	Y	Y	N		Carrier routing.
117	—	Y	Y	SUB-ONLY	Y	Y	Y	No LRN	Route on-net (carrier bypass).
118	—	Y (PIC2)	Y	SUB-ONLY	Y	Y	Y	No LRN	Route on-net (carrier bypass).
119	—	Y (PIC2)	Y	SUB-ONLY	Y	Y	Y	No LRN	Route to carrier.
120	—	Y	Y	SUB-ONLY	Y	Y	Y	Any LRN	Carrier allows LNP QUERY—retranslate on received LRN.
120a	A	Carrier		SUB-ONLY				My LRN	On-net route to local sub.
120b	B	Carrier		ALL-CALLS				On-net LRN	New destination after LRN translation.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
120c	C	Carrier		NONE OR SUB-ONLY				Off-net LRN	New destination after LRN translation—carrier routing.
121	—	Y	Y	SUB-ONLY	Y	Y	Y	Any LRN	Carrier allows LNP QUERY—retranslate on received LRN.
121a	A	Carrier		SUB-ONLY				My LRN	Same destination after query.
121b	B	Carrier		ALL-CALLS				On-net LRN	New destination after LRN translation.
121c	C	Carrier		NONE or SUB-ONLY				Off-net LRN	New destination after LRN translation—carrier routing.
122	—	PIC1 or PIC2	Y	ALL-CALLS	N	N	N		On-net route (carrier bypass) to local sub.
123	—	PIC1 or PIC2	Y	ALL-CALLS	Y	N	N		On-net route (carrier bypass).
124	—	Y	N	ALL-CALLS	Y	Y	N		Bad provisioning.
125	—	Y (PIC2)	N	ALL-CALLS	Y	Y	N		Bad provisioning.
126	—	Y (PIC2)	N	ALL-CALLS	Y	Y	N		Bad provisioning.
127	—	Y	Y	ALL-CALLS	Y	Y	Y	No LRN	On-net routing to local sub.
128	—	Y (PIC2)	Y	ALL-CALLS	Y	Y	Y	No LRN	On-net routing to local sub.
129	—	Y (PIC2)	Y	ALL-CALLS	Y	Y	Y	No LRN	On-net routing (carrier bypass).

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
130	—	Y	Y	ALL-CALLS	Y	Y	Y	Any LRN	Carrier allows LNP QUERY—retranslate on received LRN.
130a	A	Carrier		ALL-CALLS				My LRN	Same destination after query.
130b	B	Carrier		ALL-CALLS				On-net LRN	New destination after LRN translation.
130c	C	Carrier		NONE or SUB-ONLY				Off-net LRN	New destination after LRN translation.
201	PERFORM-LNP-QUERY	N	DC (Y)	DC	Y	N	Y/N		Normal call routing.
202	PERFORM-LNP-QUERY	N	DC (N)	DC	Y	Y	Y	DC	Normal call routing.
203	PERFORM-LNP-QUERY	Y	DC (Y)	NONE	Y	N	N		Carrier routing.
204	PERFORM-LNP-QUERY	Y	DC (Y)	NONE	Y	N	N		Carrier routing.
205	PERFORM-LNP-QUERY	Y	DC (N)	NONE	Y	N	N		Carrier routing.
206	PERFORM-LNP-QUERY	Y	DC (N)	NONE	Y	Y	Y	No LRN	Carrier routing.
207	PERFORM-LNP-QUERY	Y	DC (N)	NONE	Y	Y	Y	Any LRN	Re-translate on received LRN.
207a	A	Carrier		NONE				My LRN	Error case.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
207b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
207c	C	Carrier		NONE OR SUB-ONLY				Off-net LRN	Retranslate on LRN.
208	PERFORM-LNP-QUERY	Y	DC	NONE	Y	Y	Y	No LRN	On-net routing to local sub.
209	PERFORM-LNP-QUERY	Y	DC	NONE	Y	Y	Y	Any LRN	Carrier allows LNP QUERY—retranslate on received LRN.
209a	A	Carrier		NONE				My LRN	ERROR case.
209b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
209c	C	Carrier		NONE OR SUB-ONLY				Off-net LRN	Retranslate on LRN—after LRN translation, make new routing decision based on new destination.
210	PERFORM-LNP-QUERY	Y	DC	SUB-ONLY	N	N	N		Route on-net (carrier bypass) to local sub.
211	PERFORM-LNP-QUERY	Y	DC	SUB-ONLY	Y	N	N		Route on-net (carrier bypass) to local ported-in sub.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
212	PERFORM-LNP-QUERY	Y	DC (N)	SUB-ONLY	Y	Y	Y	No LRN	On-net routing to local sub.
213	PERFORM-LNP-QUERY	Y	DC (N)	SUB-ONLY	Y	Y	Y	No LRN	Route on-net (carrier bypass) to local sub.
214	PERFORM-LNP-QUERY	Y	Y	SUB-ONLY	Y	Y	Y	Any LRN	Retranslate on received LRN.
214a	A	Carrier		SUB-ONLY				My LRN	Error case.
214b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
214c	C	Carrier		NONE OR SUB-ONLY				Off-net LRN	Retranslate on LRN—after LRN translation, make new routing decision based on new destination.
215	PERFORM-LNP-QUERY	Y	Y	SUB-ONLY	Y	Y	Y	Any LRN	Retranslate on received LRN.
215a	A	Carrier		SUB-ONLY				My LRN	Same destination after query.
215b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
215c	C	Carrier		NONE OR SUB-ONLY				Off-net LRN	Retranslate on LRN—after LRN translation, make new routing decision based on new destination.
216	PERFORM-LNP-QUERY	Y	DC (Y)	ALL-CALLS	N	N	N		On-net route (carrier bypass) to local sub.
217	PERFORM-LNP-QUERY	Y	DC (Y)	ALL-CALLS	N	N	N		Case 1: If dn2sub does exist, but is not assigned, route to the carrier. Case 2: If dn2sub does not exist, on-net route (carrier bypass), using route from destination.
218	PERFORM-LNP-QUERY	Y	DC (N)	ALL-CALLS	Y	Y	Y	No LRN	If dn2sub does exist, but is not assigned, route to the carrier.
219	PERFORM-LNP-QUERY	PIC1 or PIC2		ALL-CALLS	Y	Y	Y	Any LRN	Retranslate on received LRN.
219a	A	Carrier		SUB-ONLY				My LRN	Error case.
219b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
219c	C	Carrier		NONE OR SUB-ONLY				Off-net LRN	Retranslate on LRN—after LRN translation, make new routing decision based on new destination.
220	PERFORM-LNP-QUERY	Y		ALL-CALLS	Y	Y	Y	No LRN	On-net routing to local sub.
221	PERFORM-LNP-QUERY	Y		ALL-CALLS	Y	Y	Y	Any LRN	Retranslate on received LRN.
221a	A	Carrier		ALL-CALLS				My LRN	Error case.
221b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
221c	C	Carrier		NONE OR SUB-ONLY				Off-net LRN	Retranslate on LRN.
301	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	N	DC	DC	Y	N	Y/N		Normal call routing.
302	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	N	DC (Y)	DC	Y	Y	N		Normal call routing.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
303	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	N	DC	DC	Y	N	N		Route to local ported-in sub.
304	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	N	DC (N)	DC	Y	Y	Y	No LRN	Normal call routing.
305	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	N	DC (N)	DC (NONE)	Y	Y	Y	Any LRN	Retranslate on received LRN.
305a	A	Local		DC				My LRN	Route call to local ported-in sub.
305b	B	Local		DC				On-net LRN	Route via LRN destination.
305c	C	Local		DC				Off-net LRN	Route via LRN destination.
306	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y)	NONE	Y	N	N		Carrier routing.
307	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y)	NONE	Y	Y	Y	No LRN	Carrier routing.
308	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y (Inter LATA)	DC (Y)	NONE	Y	Y	Y	Any LRN	Retranslate on received LRN.
308a	A	Carrier		NONE				My LRN	Carrier routing.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
308b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
308c	C	Carrier		NONE or SUB-ONLY				Off-net LRN	After LRN translation, make new routing decision based on new destination.
309	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y)	NONE	DC	Y	Y	No LRN	Carrier routing.
310	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y)	NONE	DC	Y	Y	Any LRN	Retranslate on received LRN.
310a	A	Carrier		NONE				My LRN	Carrier routing.
310b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
310c	C	Carrier		NONE or SUB-ONLY				Off-net LRN	After LRN translation, make new routing decision based on new destination.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
311	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y)	SUB-ONLY	Y	N	N		Terminate call locally (bypass carrier) if my subscriber (status=assigned), otherwise normal carrier routing.
312	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y)	SUB-ONLY	Y	Y	N		Normal carrier routing.
313	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y (Inter LATA)	DC (Y)	SUB-ONLY	Y	Y	Y	no LRN	Bypass carrier; route on-net to local not ported (yet) subscriber.
314	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y)	SUB-ONLY	Y	Y	Y	any LRN	Retranslate on received LRN.
314a	A	Carrier		SUB-ONLY				My LRN	Bypass carrier, and route on-net to not ported local sub.
314b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
314c	C	Carrier		NONE or SUB-ONLY				Off-net LRN	After LRN translation, make new routing decision based on new destination.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
315	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y/N)	SUB-ONLY	Y	Y	Y	No LRN	Normal carrier routing.
316	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y)	SUB-ONLY	Y	Y	Y	Any LRN	Retranslate on received LRN.
316a	A	Carrier		SUB-ONLY				My LRN	Bypass carrier, and route on-net to ported in local sub.
316b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
316c	C	Carrier		NONE or SUB-ONLY				Off-net LRN	After LRN translation, make new routing decision based on new destination.
317	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y)	ALL-CALLS	Y	N	N		Bypass carrier.
318	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y/N)	ALL-CALLS	Y	Y	N		Bad provisioning.

Table 2-5 On-net Routing Use Case Matrix (continued)

Use Case No.	NANP-LNP-QUERY	Carrier Call? (InterLATA or Toll, use-dial-plan=N)	Carrier LNP-QUERY	BYPASS-CARRIER	Ported-Office-Code Match?	LNP-TRIGGER or PORTED-OUT?	LNP Query?	LNP Query LRN?	Action
319	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y/N)	ALL-CALLS	Y	Y	Y	No LRN	Bypass carrier; route on-net to local not ported (yet) subscriber.
320	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y/N)	ALL-CALLS	Y	Y	Y	No LRN	Bypass carrier; route on-net to switch owning the DN block.
321	UNCONDI-TIONAL-LNP-TRIGGER-QUERY	Y	DC (Y/N)	ALL-CALLS	Y	Y	Y	Any LRN	Retranslate on received LRN.
321a	A	Carrier		ALL-CALLS				My LRN	Bypass carrier, and route on-net to ported in local sub.
321b	B	Carrier		ALL-CALLS				On-net LRN	After LRN translation, make new routing decision based on new destination.
321c	C	Carrier		NONE or SUB-ONLY				Off-net LRN	After LRN translation, make new routing decision based on new destination.

1. DC: Don't care
2. A. (Result of Translated LRN)
3. B. (Result of Translated LRN)
4. C. (Result of Translated LRN)

Feature Interactions

There are no new, modified, or deleted feature interactions related to the Cisco BTS 10200 on-net routing and LNP for the Inter-CMS routing feature described in this document. In principle, it should not matter whether or not an LNP query or carrier bypass occurs on the forwarding leg of a forwarded call (for example, for CFU, CFB, and CFNA). Likewise, it should not matter whether the query is on a second leg of a multi-party call, such as for CT or TWC.

It is possible that an 8xx toll free service query and LNP query occur on the same call. For example, an 8xx number might be dialed which initially needs an 8xx query, and perhaps also an LNP query. The 8xx query is performed first, and then retranslation on the returned number (if present) occurs, and LNP checks are performed again, resulting in the following scenarios:

When the 8xx query returns a carrier and translated DN the carrier checks occur first:

- If the translated DN has a dial plan entry and destination, the LNP checks look at the carrier + translated DN, as applicable.
- If the translated DN does not have a dial plan entry and destination, the original destination is used during the LNP checks on carrier (if present) and translated DN.

Again, for the above scenarios, there is nothing different from normal LNP criteria checks. In the same way, the logic for checking the translated LRN, and for the carrier routing after the second translation.

Configuring

This section explains how to perform the following tasks:

- Configuring LNP Queries
- Configuring an LNP Query on a Carrier Call
- Configuring Carrier Bypass (On-net Route)—No LNP Queries
- Configuring Carrier Bypass (On-net Route)—LNP Queries
- Configuring Carrier Bypass (On-net Route)—Multiple Cisco BTS 10200 Switches
- Configuring Inter-CMS—Subscriber Origination (If No NRS), or Trunk Origination on MGC or Terminating CMS (ALL-CALLS + LNP Query)
- Configuring Inter-CMS with NRS—Same Cisco BTS 10200 Acting as CMS and MGC
- Selectively Configuring LNP Queries (Allow or Disallow) for a Particular Call Type

Configuring LNP Queries

For all destinations resulting from dial plan translations for which an LNP query is allowed, use the Destination NANP-LNP-QUERY default value NA. For all carrier entries, use LNP-QUERY default value N.

Specify the NANP-LNP-QUERY value either implicitly using the **add destination** command without specifying NANP-LNP-QUERY parameter, or explicitly set it.

For example:

```
change destination dest-id=local_call; nanp-lnp-query=NA;
```

Specify Carrier LNP-QUERY=N implicitly by omitting the LNP-QUERY parameter, or explicitly.

For example:

```
change carrier id=0333; lnp-query=N;
```

Configuring an LNP Query on a Carrier Call

For all destinations resulting from dial plan translations which could result in carrier routing (for example, destination call-type interLATA, toll, or carrier), the destination NANP-LNP-QUERY should have value PERFORM-LNP-QUERY or NA. If value NA is used, then the appropriate carrier entry should have either USE-DIAL-PLAN=Y or LNP-QUERY=Y.

For example either:

```
add destination dest-id=dest_carrier; call-type=interLATA; route-type=route;
route-guide-id=carrier_rg; nanp-lnp-query=PERFORM-LNP-QUERY; description=Allow LNP query
on Carrier calls;
```

Or:

```
add destination dest-id=dest_carrier; call-type=interLATA; route-type=route;
route-guide-id=carrier_rg; description=nanp-lnp-query has default value NA!;

add carrier id=0333; inter=Y; intra=Y; intl=Y; use-dial-plan=N; route-guide-id=dpc1-rg;
cut-thru=N; status=INS; lnp-query=Y; description=Allow an LNP query on calls to this
carrier;

add ported-office-code digit-string=703-484;

add dial-plan id=dp_nanp_sub; digit-string=703-484; min-digits=10; max-digits=10;
dest-id=dest_carrier;
```

Configuring Carrier Bypass (On-net Route)—No LNP Queries

The Cisco BTS 10200 will route a call to the carrier unless the called DN is a subscriber assigned on this switch and not in a porting transition state. For this scenario, the operator wants carrier bypass for local subscribers, but does not want to incur the overhead of LNP queries for DNs which are in the process of porting in or porting out (LNP-TRIGGER=Y). The operator might know that either A) there are no transition DNs in this switch (or perhaps all are ported-out), or B) there are very few, and the operator would prefer that the Carrier do the LNP query, and route calls back to our switch for a very few calls.

The destination has call-type interLATA for carrier routing, SUB-ONLY to allow carrier bypass for local subs, and NO-LNP-QUERY to force calls needing a query to go to the carrier.

For example:

```
add destination dest-id=carrier_or_sub; call-type=interLATA; route-type=SUB;
bypass-carrier-routing=SUB-ONLY; nanp-lnp-query=NO-LNP-QUERY; description=carrier route
unless SUB assigned (no query);
```

Configuring Carrier Bypass (On-net Route)—LNP Queries

The Cisco BTS 10200 routes this call to the carrier unless the called DN is a subscriber assigned on this switch. This includes DNs which are in the process of either porting in or porting out. For these transition DNs requiring an unconditional (ATIS document terminology), which are marked with Dn2subscriber LNP-TRIGGER=Y, the marked DNs will get an LNP query before the routing decision is made. For the transition DNs for which there is an LNP query, the LNP query results determine whether the call is routed to the carrier or bypasses the carrier if the subscriber is in this switch.

The destination has call-type interLATA for carrier routing, SUB-ONLY to allow carrier bypass for local subs, and UNCONDITIONAL-LNP-TRIGGER-QUERY to allow a query for DNs during the transition period.

For example:

```
add destination dest-id=carr_or_sub_lnp; call-type=interLATA; route-type=SUB;
bypass-carrier-routing=SUB-ONLY; nanp-lnp-query=UNCONDITIONAL-LNP-TRIGGER-QUERY;
description=Carrier unless local SUB (query DNs during porting transition);
```

To mark the DN 703-765-4449 number as a transition DN in the process of porting in or porting out:

```
change dn2subscriber office-code-index=1; dn=4449; lnp-trigger=Y;
```

Configuring Carrier Bypass (On-net Route)—Multiple Cisco BTS 10200 Switches

For an operator with multiple Cisco BTS 10200 switches that are all interconnected over an IP network, it is more efficient to route calls on-net and avoid routing a call to a carrier, which will only be routed back to another on-net switch. This is the scenario for which the On-net Routing feature was requested. However, to gain the advantage of all-IP on-net routing, there is the cost of additional LNP queries. LNP queries might be required before on-net routing to make sure that the called DN has not ported out of the network.

The Destination NANP-LNP-QUERY PERFORM-LNP-QUERY value is used to ensure that an LNP query is done before on-net routing. Of course, this query is still conditional, depending on whether the Ported Office Code entry exists and other related criteria. The destination call-type is either interLATA or toll, and the BYPASS-CARRIER-ROUTING value is ALL-CALLS. Three routing scenarios are possible:

1. Route to carrier for off-net call.
2. Route using destination for on-net call to another on-net switch.
3. Route on-net to subscriber in the same switch. Ignore carrier and destination routes.

For example:

```
add destination dest-id=carrier_or_bypass; call-type=interLATA; route-type=route;
route-guide-id=on_net_rg; nanp-lnp-query=PERFORM-LNP-QUERY;
bypass-carrier-routing=ALL-CALLS; description=LNP query, and route to carrier, or on-net;
```

Configuring Inter-CMS—Subscriber Origination (If No NRS), or Trunk Origination on MGC or Terminating CMS (ALL-CALLS + LNP Query)

There are various Inter-CMS scenarios where a Cisco BTS 10200, upon receiving an incoming trunk call, should perform an LNP query, and if an on-net route exists, bypass carrier routing. Or for an Inter-CMS network with no NRS, it might be desirable to do LNP queries on the originating CMS.

For example:

- MGC, acting as a PSTN gateway:
  - Call originated from a CMS, within the network—MGC can do an LNP query, and route either off-net or on-net.
  - Incoming call from the PSTN—Normally, the LNP query is done by the PSTN; however, if that does not happen, then the MGC can do an LNP query before routing the call within the network.
- Terminating CMS—A call originated on-net from a CMS can be routed directly to the terminating CMS, where perhaps an LNP query is needed.
- Originating CMS, for example, without NRS—It may be desirable to do an LNP query on the originating CMS, in order to route calls to a terminating CMS directly, and avoid routing through the MGC (or Carrier). In particular, doing the LNP query and on-net routing from the originating CMS can be helpful in an Inter-CMS network configuration without an NRS.

The provisioning for this scenario is exactly the same as for multiple Cisco BTS 10200 switches—Carrier bypass, above.

Configuring Inter-CMS with NRS—Same Cisco BTS 10200 Acting as CMS and MGC

Intermediate phases of inter-CMS routing can have a single Cisco BTS 10200 acting as the CMS for NCS subscribers, and also acting as an MGC PSTN interface. Essentially this is a combination of cases already shown above. For subscriber originations (CMS), the subscriber dial plans should not allow a query, and ensure that the call is routed on-net to the NRS (if applicable). Incoming trunk calls can be routed from the NRS to this Cisco BTS 10200 in case the final destination is a CMS subscriber or PSTN subscriber.

The key to understanding this configuration is realizing that for a subscriber origination, the subscriber dial plan will result in a Destination which does not allow an LNP query and may have an on-net route to the NRS. But for a trunk origination on the same Cisco BTS 10200, the incoming trunk dial plan, for the same DN, has a different destination, which will allow an LNP query, and will not bypass the Carrier for calls to the PSTN.

For example:

In the subscriber destination and dial plan; 703-484 is on-net and 301-444 is off-net.

- 703-484 may have DNs ported-out (needs queries).
- 301-444 (off-net) has no ported-in DNs Cisco BTS 10200, and does not need dial-plan entry (always carrier routing)

```
add destination dest-id=cms_sub_nrs; call-type=interLATA; route-type=route;
route-guide-id=nrs_rg; bypass-carrier-routing=ALL-CALLS; nanp-lnp-query=NO-LNP-QUERY;
description=Route all sub originations to NRS with no LNP query;

add dial-plan id=dp_nanp_sub; digit-string=703-484; min-digits=7; max-digits=10;
dest-id=cms_sub_nrs;
```

The incoming trunk group destination and dial plan:

```
add destination dest-id=carrier_or_bypass; call-type=interLATA; route-type=route;
route-guide-id=on_net_rg; nanp-lnp-query=PERFORM-LNP-QUERY;
bypass-carrier-routing=ALL-CALLS; description=LNP query, and route to carrier, or on-net;

add destination dest-id=dest_carrier; call-type=interLATA; route-type=route;
route-guide-id=on_net_rg; nanp-lnp-query=NO-LNP-QUERY; bypass-carrier-routing=ALL-CALLS;
description=Carrier will do LNP query;

add ported-office-code digit-string=703-484

add dial-plan id=dp_nanp_sub; digit-string=703-484; min-digits=7; max-digits=10;
dest-id=carrier_or_bypass;

add dial-plan id=dp_nanp_sub; digit-string=301-444; min-digits=7; max-digits=10;
dest-id=dest_carrier;
```

Selectively Configuring LNP Queries (Allow or Disallow) for a Particular Call Type

A Call Type Profile entry with LNP-QUERY=Y can be added to allow an LNP query for a particular call-type, for example, weather. However, by changing destination LNP criteria, it is possible to allow a query for some weather calls, but not others.

For example:

Allow a query on weather DN 703-569-2198

```
add call-type-profile call-type=weather; lnp-query=Y;

add destination dest-id=weather_query; call-type=weather; route-type=route;
route-guide-id=dpc2-rg; nanp-lnp-query=NA;

add dial-plan id=dp-1; digit-string=703-569-2198; min-digits=10; max-digits=10;
dest-id=weather_query;

add ported-office-code digit-string=703-569-2198;
```

Do not allow a query on weather DN 703-569-2197

```
add destination dest-id=weather_no_query; call-type=weather; route-type=route;
route-guide-id=dpc2-rg; nanp-lnp-query=NO-LNP-QUERY;

add dial-plan id=dp-1; digit-string=703-569-2197; min-digits=10; max-digits=10;
dest-id=weather_no_query;
```

Destination

The NANP-LNP-QUERY token used to define LNP criteria requirements for the USA. For complete Destination table details, refer to the "Destination" section on page 1-24.

Carrier Existing LNP-QUERY=Y/N

When a LNP query was previously used for ITU LNP only and is now activated for ANSI, LNP query is allowed before routing outbound to a carrier, based on the Carrier LNP-QUERY value.

When the call is routed to the outbound carrier, if the Carrier LNP-QUERY=N, indicating that the carrier does not expect a query prior to carrier routing, but a query is done anyway on this switch, then the LNP information (LRN, FCI, and GAP) is destroyed.

Call Type Profile

The following items apply to an existing table for ITU LNP which is now activated for ANSI/North America LNP.

- Prior to this feature, an LNP query was allowed only for calltypes local, interLATA, toll, and toll-free. Now, for NANP-LNP-QUERY values PERFORM-LNP-QUERY and UNCONDITIONAL-LNP-TRIGGER-QUERY, a query can be performed for any call-type. For these NANP-LNP-QUERY values, the Call Type Profile is not checked.
- For NANP-LNP-QUERY value NA, a query is allowed for the existing call-types (local, interLATA, toll, and toll-free), and now also INTL-WZ1 (World Zone 1). However, it is possible now to selectively allow an LNP query for other call-types by adding a Call Type Profile entry for the call-type, and setting the Call Type Profile LNP-QUERY=Y. Of course, other criteria, such as Ported Office Code match, are still required in order for a query to be performed.
- For NANP-LNP-QUERY value NA, for call-types other than local, interLATA, toll, toll-free and INTL-WZ1, if a Call Type Profile entry for the given call-type (for example, national) is not present, or the Call Type Profile entry has LNP-QUERY=N, a query will not be performed.

For additional information on call types, refer to Appendix A, "Call Types and Subtypes."

LNP-QUERY

This flag is used if the ALL-CALL-QUERY flag in the LNP-PROFILE table is set to Y and the ACQ-LNP-QUERY token in the Destination table is set to ACQ-BASED-ON-CALL-TYPE.

International WZ1 (INTL_WZ1) Preferred Carrier Routing

This section describes the preferred carrier (PIC) routing for an international world zone 1 call. In the past releases, the BTS 10200 supported preferred carrier (PIC) routing based on the routing application defined for the North America PSTN environment. Table 2-6 lists the general preferred carrier routing behavior in prior releases of the BTS 10200.

Table 2-6 General Preferred Routing

CALL TYPE	PIC	Description
CALLTYPE_INTERLATA CALLTYPE_INTL_WZ1	PIC1	Uses SUBSCRIBER.PIC1 to route the call. If PIC1 is not provisioned then route the call to POP.LECOSS.
CALLTYPE_TOLL	PIC2	If POP.ITP is set to Y then uses SUBSCRIBER.PIC2 to route the call. Otherwise, route the call according to the provisioning defined in DIAL_PLAN.
CALLTYPE_INTL	PIC3/PIC1	Uses SUBSCRIBER.PIC3 to route the call if PIC3 is provisioned. If PIC3 is not provisioned then use SUBSCRIBER.PIC1 to route the call. If neither PIC1 nor PIC3 is provisioned then route the call to POP.LECOSS.

Because different customers have different needs regarding the routing for INTL_WZ1 calls, the flexibility of preferred carrier routing for INTL_WZ1 calls has been enhanced as shown in Table 2-7.

Table 2-7 Enhanced Preferred Routing

CALL TYPE	PIC	Description
CALLTYPE_INTERLATA	PIC1	Uses SUBSCRIBER.PIC1 to route the call. If PIC1 is not provisioned then route the call to POP.LECOSS. Filter: CARRIER: INTER

Table 2-7 Enhanced Preferred Routing (continued)

CALL TYPE	PIC	Description
CALLTYPE_INTL_WZ1	PIC1	CA-CONFIG:INTL_WZ1_USE_PIC3 = N Uses SUBSCRIBER.PIC1 to route the call. If PIC1 is not provisioned then route the call to POP.LECOSS. Filter: CARRIER: INTER or CARRIER: INTL (Allow call goes through if either one set to Y)
	PIC3/PIC1	CA-CONFIG:INTL_WZ1_USE_PIC3 = Y Uses SUBSCRIBER.PIC3 to route the call if PIC3 is provisioned. If PIC3 is not provisioned then use SUBSCRIBER.PIC1 to route the call. If neither PIC1 nor PIC3 is provisioned then route the call to POP.LECOSS. Filter: CARRIER: INTER or CARRIER: INTL (Allow call goes through if either one set to Y)
CALLTYPE_TOLL	PIC2	If POP.ITP is set to Y then uses SUBSCRIBER.PIC2 to route the call. Otherwise, route the call according to the provisioning defined in DIAL_PLAN. Filter: CARRIER: INTRA
CALLTYPE_INTL	PIC3/PIC1	Uses SUBSCRIBER.PIC3 to route the call if PIC3 is provisioned. If PIC3 is not provisioned then use SUBSCRIBER.PIC1 to route the call. If neither PIC1 nor PIC3 is provisioned then route the call to POP.LECOSS. Filter: CARRIER: INTL

There is no change to CALLTYPE_INTERLLATA, CALLTYPE_TOLL, and CALLTYPE_INTL. The CALLTYPE_INTL_WZ1 has two different flavors of preferred carrier routing controlled by the CA-CONFIG:INTL_WZ1_PIC3 flag.

For operator assisted calls, there are minor differences between PIC2 and PIC1/PIC3. A call associated with PIC1 or PIC3 is routed to the PIC1/PIC3 carrier if the SUB_PROFILE.EA_USE_PIC1 is set to Y, otherwise the call is routed to POP.LECOSS. A associated with PIC2 is routed to the PIC2 carrier.

Note When a call is routed to any PICx carrier but the specific carrier does not support it (CARRIER.OP-SERVICES=N), the will be rerouted to POP.LECOSS.

Casual calls are routed to PICx carrier according to the call type if the specified carrier supports casual calls (CARRIER.CASUAL=N), otherwise the call is blocked.

Note Enhanced preferred routing affects the entire system for CALL TYPE INTL_WZ1 routing. All subscriber originated CALL TYPE INTL_WZ1 calls use preferred carrier routing. In another words, the BTS 10200 does not allow one subscriber to use PIC1 while other subscribers use PIC3 for CALL TYPE INTL_WZ1 calls.

Call Types

This section provides detailed information on the Cisco BTS 10200 call types. Information on the following call types is provided:

- 1+ InterLATA Call
- 1+ IntraLATA Call
- 0+ InterLATA Call
- 0+ IntraLATA Call
- Ported-In Call Processing
- Operator Services

For additional information on call types, refer to Appendix A, "Call Types and Subtypes."

1+ InterLATA Call

This section provides a detailed description of the Cisco BTS 10200 routing and call flow for 1+ interLATA calls. Refer to Figure 2-18 for visual representation of the 1+ interLATA call routing flow and review the following detailed 1+ interLATA call routing flow.

Step 1 A 1+ interLATA call is received.

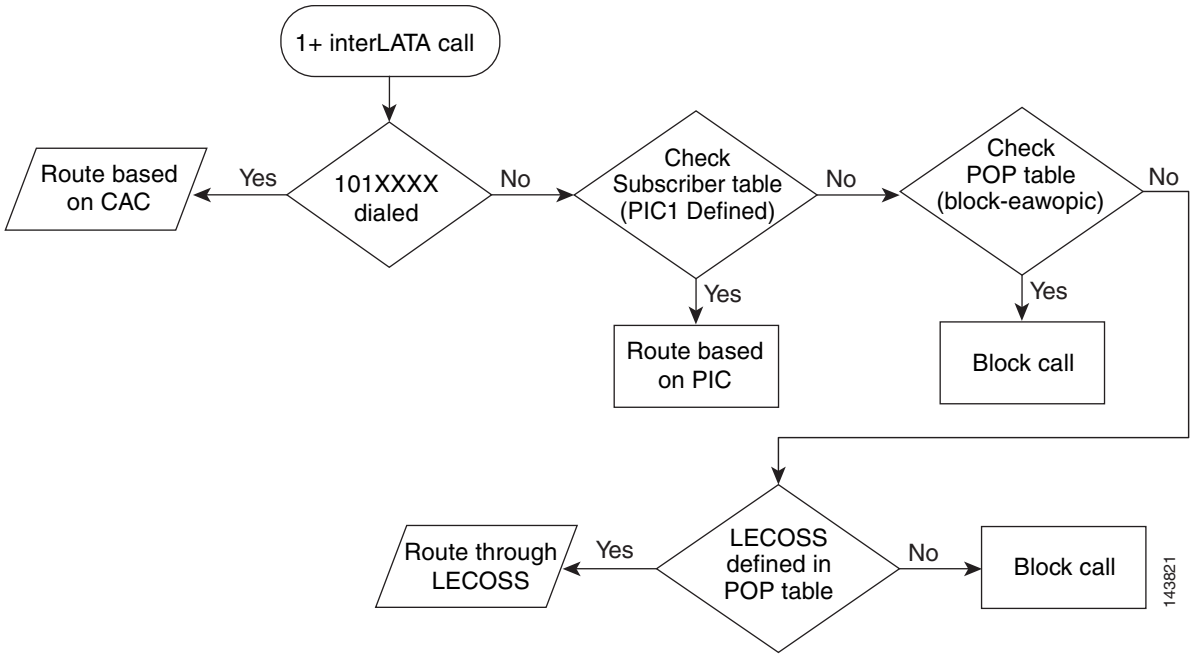
Step 2 Determine if a 101XXXX number has been dialed. If a 101XXXX number has been dialed, the Cisco BTS 10200 will select the call route and routes the call based on the carrier access code (CAC). If a 101XXXX number has not been dialed, proceed to Step 3.

Step 3 Check the subscriber table to determine if a PIC is defined. If a PIC is defined, the Cisco BTS 10200 will select the call route and route the call based on the PIC information. If a PIC is not defined, proceed to Step 4.

Step 4 Check the point of presence (POP) table and verify if a block-eawopic is configured. If the block-eawopic is configured, the Cisco BTS 10200 will block the call. If a block-eawopic is not configured, proceed to Step 5.

Step 5 Determine if a local exchange carrier operations support system (LECOSS) is defined in the POP table. If a LECOSS is defined in the POP table, the Cisco BTS 10200 will select to route the call via the LECOSS. If a LECOSS is not defined in the POP table, the Cisco BTS 10200 will block the call.

Figure 2-18 1+ InterLATA Call



1+ IntraLATA Call

This section provides a detailed description of the Cisco BTS 10200 routing and call flow for 1+ intraLATA calls. Refer to Figure 2-19 for visual representation of the 1+ intraLATA call routing flow and review the following detailed 1+ intraLATA call routing flow.

Step 1 An 1+ intraLATA call is received.

Step 2 Determine if 101XXXX number has been dialed. If a 101XXXX number has been dialed proceed to Step 3. If a 101XXXX number has not been dialed, proceed to Step 4.

Step 3 Check the carrier table for a carrier access code (CAC). If a CAC is available, the Cisco BTS 10200 will select the call route and route the call based on the CAC. If a CAC is not available, proceed to Step 3a.

a. Determine if a LECOSS is defined in the POP table. If a LECOSS is defined in the POP table, the Cisco BTS 10200 will select the call route and route the call via the LECOSS. If a LECOSS is not defined in the POP table, the Cisco BTS 10200 will block the call.

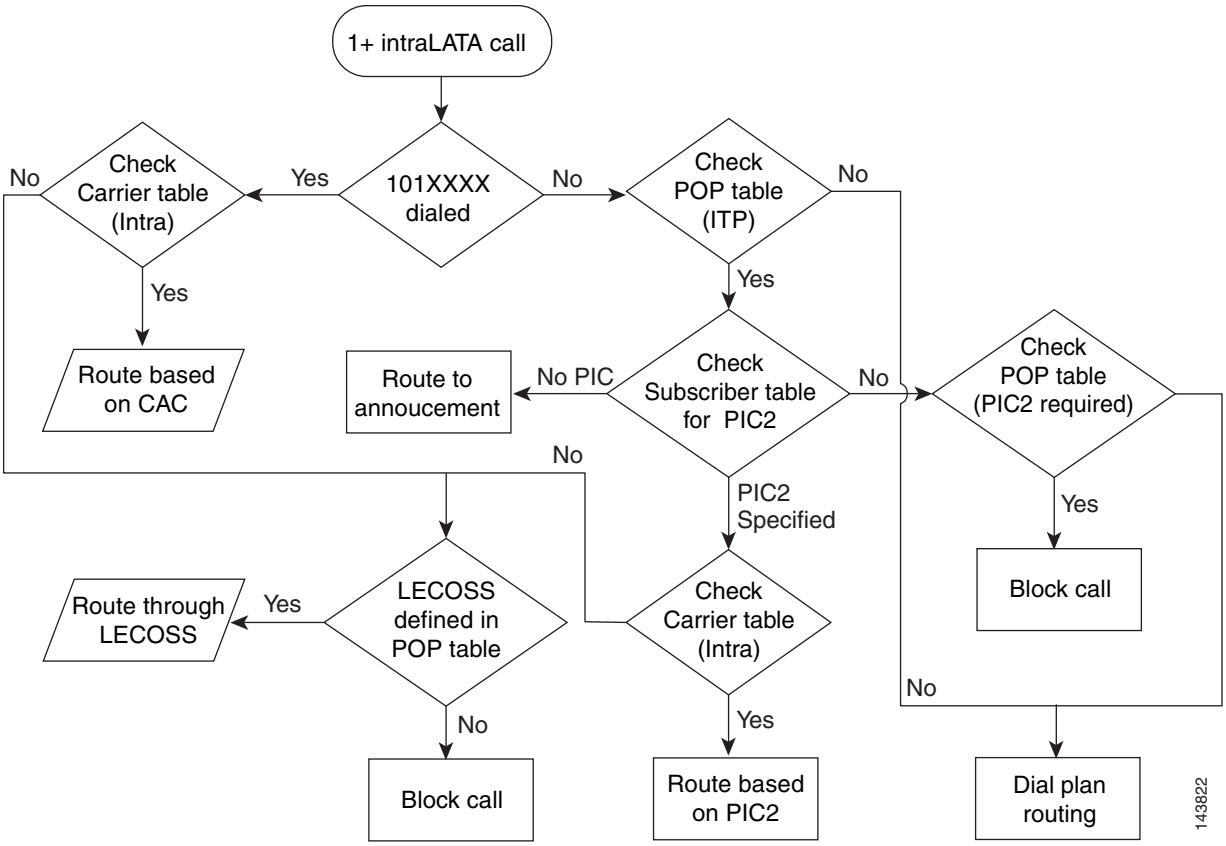
Step 4 Check the POP table for a configured IP transfer point (ITP). If an ITP is configured, proceed to Step 4a. If an ITP is not configured, the Cisco BTS 10200 will route the call via dial plan routing.

a. Check the subscriber table for a specified PIC. If a PIC is specified, proceed to Step 4b. If a PIC is not specified, the Cisco BTS 10200 will route the call to the announcement server and will check the POP table for a specified PIC. If a PIC is not specified, the Cisco BTS 10200 will block the call or if a dial plan is available, the Cisco BTS 10200 will select the call route and route the call according to the dial plan routing information.

b. Check the intracarrier table for a specified PIC. If a PIC is specified in the intra carrier table, the Cisco BTS 10200 will select the call route and routes the call based on the PIC information. If a PIC is not specified in the intra carrier table, proceed to Step 4c.

c. Determine if a LECOSS is defined in the POP table. If a LECOSS is defined in the POP table, the Cisco BTS 10200 will select the call route and route the call via the LECOSS. If a LECOSS is not defined in the POP table, the Cisco BTS 10200 will block the call.

Figure 2-19 1+ IntraLATA Call



0+ InterLATA Call

This section provides a detailed description of the Cisco BTS 10200 routing and call flow for 0+ interLATA calls. Refer to Figure 2-20 for visual representation of the 0+ interLATA call routing flow and review the following detailed 0+ interLATA call routing flow.

Step 1 A 0+ interLATA call is received.

Step 2 Determine if a 101XXXX number has been dialed. If a 101XXXX number has been dialed proceed to Step 3. If a 101XXXX number has not been dialed proceed to Step 5.

Step 3 Check the carrier table for a CAC. If a CAC is available, the Cisco BTS 10200 will select the call route and route the call based on the CAC. If a CAC is not available, proceed to Step 4.

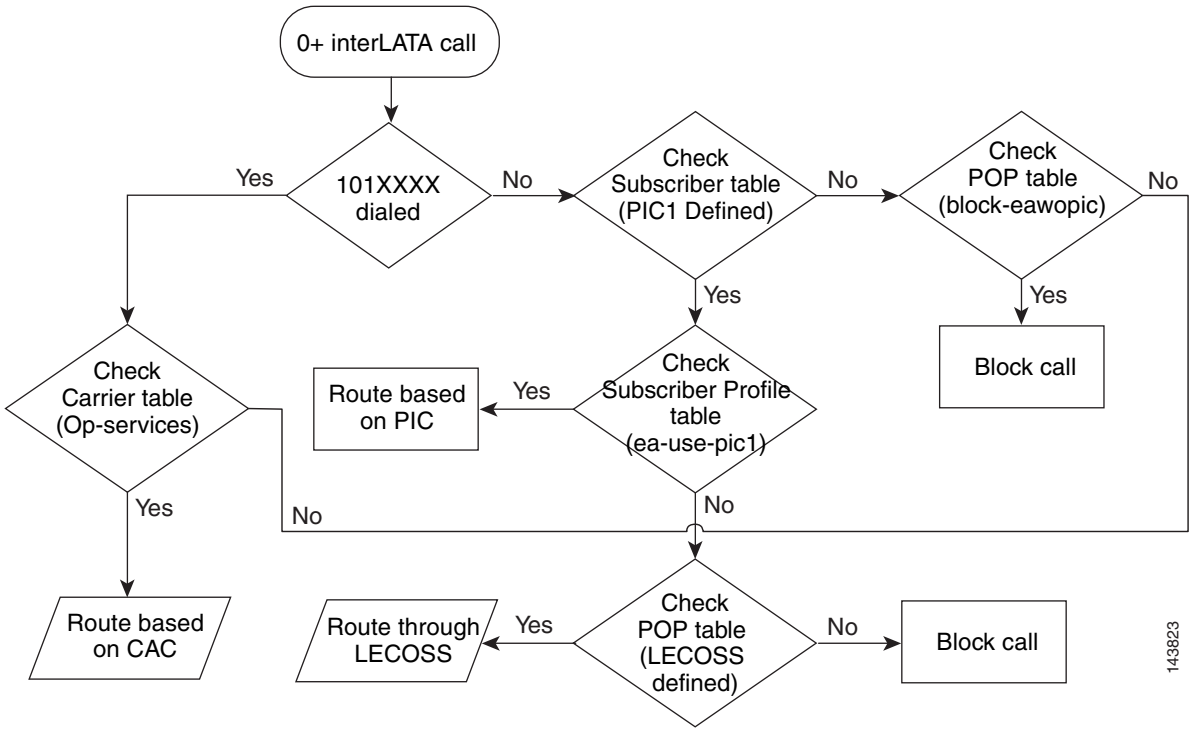
Step 4 Check the POP table for a defined LECOSS. If a LECOSS is defined in the POP table, the Cisco BTS 10200 will route the call via the LECOSS. If a LECOSS is not defined in the POP table, the Cisco BTS 10200 will block the call.

Step 5 Check the subscriber table for a defined PIC. If a PIC is defined in the subscriber table, proceed to Step 6. If a PIC is not defined in the subscriber table, proceed to Step 7.

Step 6 Check the subscriber profile for ea-use-pic entry. If the subscriber profile contains an ea-use-pic entry, the Cisco BTS 10200 will select the call route and route the call based on the PIC information. If the subscriber profile does not contain an ea-use-pic entry, return to Step 4.

Step 7 Check the POP table for a block-eawopic entry. If the POP table contains a block-eawopic entry, the Cisco BTS 10200 will block the call. If the POP table does not contain a block-eawopic entry, return to Step 4.

Figure 2-20 0+ InterLATA Call



0+ IntraLATA Call

This section provides a detailed description of the Cisco BTS 10200 routing and call flow for 0+ intraLATA calls. Refer to Figure 2-21 for visual representation of the 0+ intraLATA call routing flow and review the following detailed 0+ intraLATA call routing flow.

Step 1 A 0+ intraLATA call is received.

Step 2 Determine if a 101XXXX number was dialed. If a 101XXXX number was dialed, proceed to Step 3. If a 101XXXX number was not dialed, proceed to Step 5.

Step 3 Check the carrier table for a CAC. If a CAC is available, the Cisco BTS 10200 will select the call route and route the call based on the CAC. If a CAC is not available, proceed to Step 4.

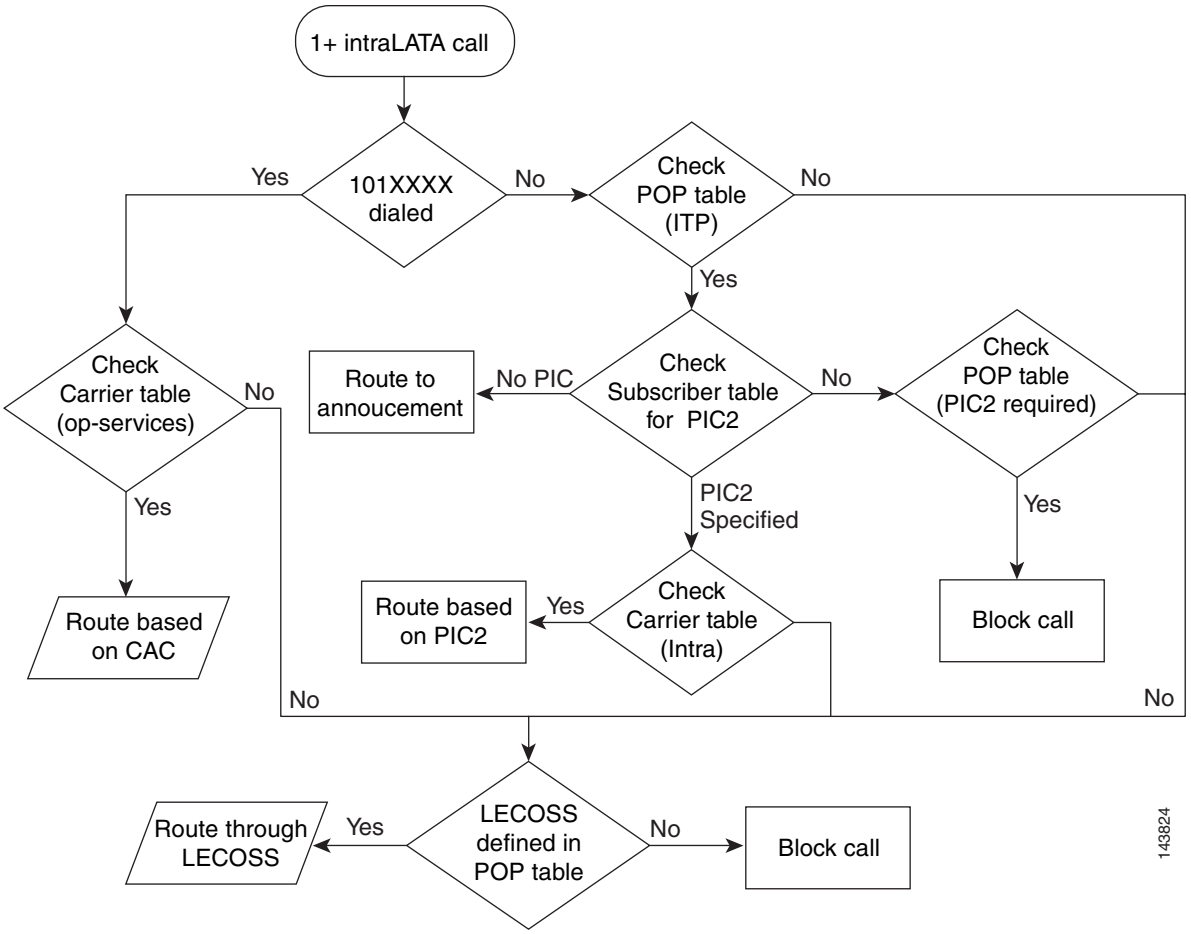
Step 4 Check the POP table for a defined LECOSS. If a LECOSS is defined in the POP table, the Cisco BTS 10200 will route the call via the LECOSS. If a LECOSS is not defined in the POP table, the Cisco BTS 10200 will block the call.

Step 5 Check the POP table for a configured ITP. If an ITP is configured, proceed to Step 6. If an ITP is not configured return to Step 4.

Step 6 Check the subscriber table for a specified PIC. If a PIC is specified, proceed to Step 7. If a PIC is not specified, the Cisco BTS 10200 will route the call to the announcement server. Additionally, if a PIC is not specified in the subscriber table, the Cisco BTS 10200 will check the POP table for a specified PIC. If a PIC is specified in the POP table, the Cisco BTS 10200 will block the call. If a PIC is not specified in the POP table, return to Step 4.

Step 7 Check the intracarrier table for the specified PIC. If the specified PIC is included in the intracarrier table, the Cisco BTS 10200 will select the call route and route the call based on the PIC information. If the specified PIC is not included in the intra carrier table, return to Step 4.

Figure 2-21 0+ IntraLATA Call



Ported-In Call Processing

This section provides a detailed description of the Cisco BTS 10200 routing and call flow for ported-in call processing calls. Refer to Figure 2-22 for visual representation of the ported-in call processing call routing flow and review the following detailed ported-in call processing call routing flow. Note that in Figure 2-22 the call flow logic applies to American National Standards Institute (ANSI)/North America; for International Telecommunication Union (ITU) local number portability (LNP), the logic is different. For a complete explanation of the call processing logic for ITU LNP, refer to the "NOA Routing (ITU Local Number Portability)" section on page 2-12.

Step 1 A ported-in call is received.

Step 2 The office code is not assigned to the Cisco BTS 10200.

Step 3 Determine if the office code is in the ported-in office code table. If the office code is in the ported-in office code table, proceed to Step 4. if the office code is not in the ported-in office code table, perform normal call processing.

Step 4 Determine if the in-call agent flag is set. If the in-call agent flag is set, proceed to Step 5. If the in-call agent flag is not set, the Cisco BTS 10200 will perform an LNP query.

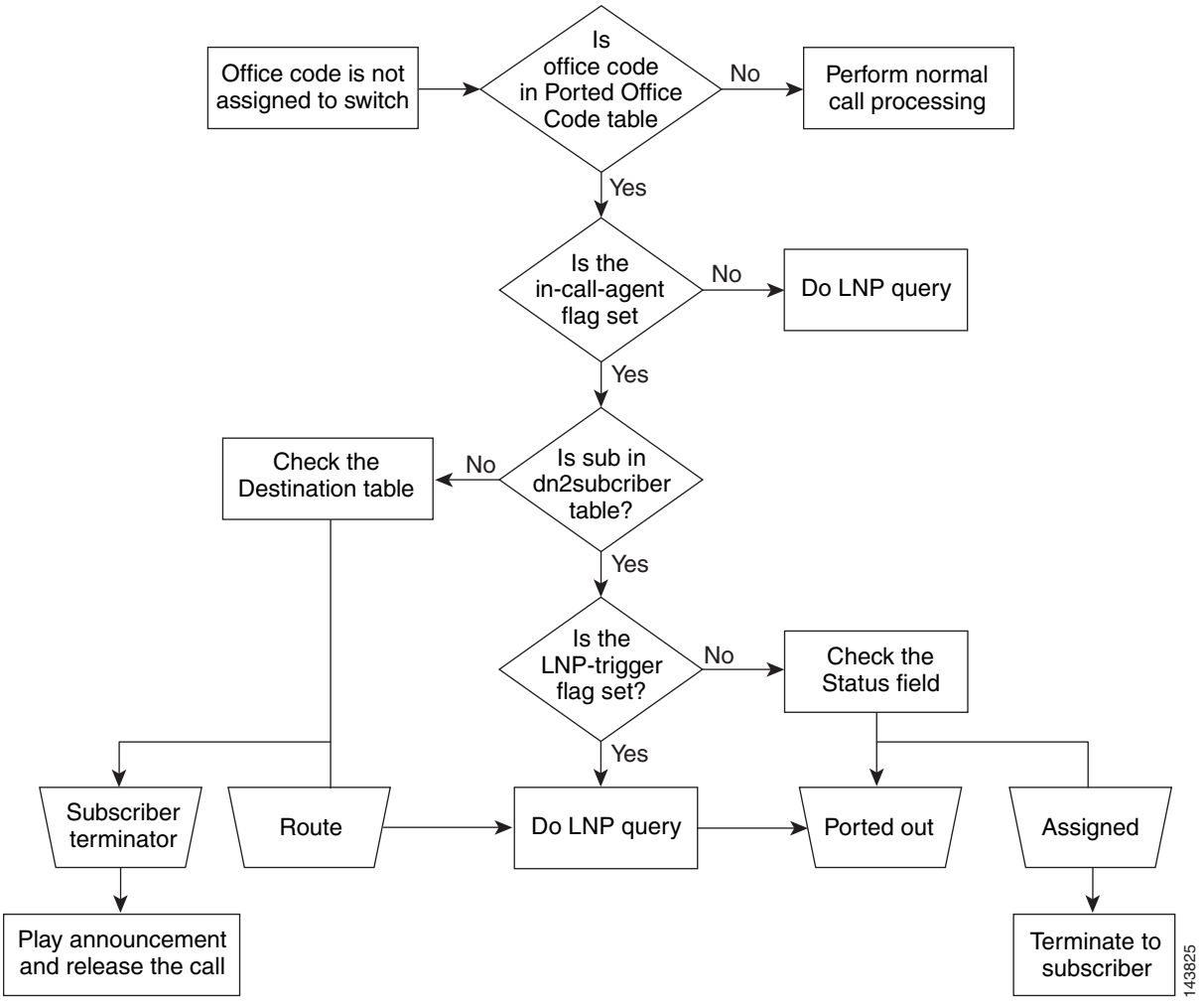
Step 5 Determine if the subscriber is included the dn2subscriber table. If the subscriber is included in the dn2sunscriber table, proceed to Step 6. If the subscriber is not included in dn2subscriber table, proceed to Step 7.

Step 6 Determine if the LNP trigger flag is set. If the LNP trigger flag is set, the Cisco BTS 10200 will perform an LNP query and port out the call. If the LNP trigger flag is not set, the Cisco BTS 10200 will check the status field to determine if a LNP trigger has been assigned and will port out the call or terminate the call to the subscriber.

Alternately, if dn2subscriber STATUS=PORTED-OUT, or LNP-TRIGGER=Y an LNP query is performed, and depending upon the result of the query (whether or not an local routing number (LRN)/RN is found), the call may be routed to a ported-in DN, routed out to a DN ported-in to another switch, or routed in or out if the DN is not ported at all. Additionally, the call may fail if routing is not possible.

Step 7 Check the destination table for the subscriber information. Based on the destination table information, the Cisco BTS 10200 will route the call or issue a subscriber terminator, release the call, and play the released call announcement. As part of routing the call, the Cisco BTS 10200 will perform an LNP query and, if necessary, port out the call.

Figure 2-22 Ported-In Call Processing



Operator Services

The Operator Services feature allows routing of operator calls to a Feature Group D Operator Trunk (FGD OS) using the CAS MF Operator Package (MO). The following operator calls are included:

- 0-
- 0+
- 00
- 01+CC+NN
- 10XXXXX + 0-
- 10XXXXX + 0+
- 10XXXXX + 00
- 10XXXXX + 01+CC+NN

The operator call is routed to a CAS MO trunk group by sending the called number followed by information digits (I or II) and the calling number (ANI) to the trunk group. All of these digits are outpulsed to the CAS MO trunk group by use of multifrequency (MF) signaling. The information digits and ANI can be delivered in any one of these formats (configurable on a per terminating trunk basis):

- I + 7 digit ANI
- I + 10 digit ANI
- II + 7 digit ANI
- II + 10 digit ANI

Prerequisites

The Dial Plan table must be provisioned with a dial plan for operator calls.

An operator CAS MO terminating trunk group must be provisioned.

Supported Interfaces

Table 2-8 shows the interface support between call origination and termination.

Table 2-8 Operator Services Supported Interfaces

Originations	RGW Termination	CAS Termination	SS7 Termination	ISDN Termination	SIP Termination
RGW		X			
CAS		X			
SS7		X			
ISDN		X			
SIP		X			

Note These calls can be terminated to another type of trunk group such as ISDN, SS7, or SIP, but in these cases the calls are treated as regular calls.

Provisioning Operator Services

To provision operator services, perform the following steps:

Step 1 Add the CAS trunk group profile and the operator trunk group.

```
add cas-tg-profile id=cas-OPS0; type=MO-10II; oss-sig=y; test-line=n;

add trunk-grp id=1500; tg-type=CAS; dial-plan-id=dpcas; sel-policy=LRU;
direction=outgoing; glare=ODD; tg-profile-id=cas-OPS0; call-agent-id=CA166; status=oos;
```

Step 2 Add the operator trunk terminations to the Termination Prefix table.

```
add termination prefix=cas/ops/mo/; mgw-id=224.14:2434; type=TRUNK; mgcp-pkg-type=MO;
port-start=1; port-end=24;

add trunk cic-start=5; cic-end=8; tgn-id=1500; termination-prefix=cas/ops/mo/;
mgw-id=224.14:2434; termination-port-start=5; termination-port-end=8;
```

Step 3 Add the operator routes.

```
add route id=ops1500; tgn1-id=1500; lcr=y;

add route-guide id=ops1500; policy-type=route; policy-id=ops1500;
```

Step 4 Add the carrier ID and put the carrier in service.

```
add carrier id=0510; intra=y; intl=y; route-guide-id=ops1500; use-dial-plan=y;

change carrier id=0510; status=ins;
```

Step 5 Add the destination IDs.

```
add destination dest-id=ops-toll; call-type=toll; route-type=route;
route-guide-id=ops1502; zero-plus=y;

add destination dest-id=ops-interLATA; call-type=interLATA; route-type=route;
route-guide-id=ops1501; zero-plus=y;

add destination dest-id=ops-intl; call-type=intl; route-type=route;
route-guide-id=ops1503; zero-plus=y;
add dial-plan id=dpcas; digit-string=817-313; reqd-digits=10; dest-id=ops-toll;
```

Step 6 Add the dial plan and international dial plan.

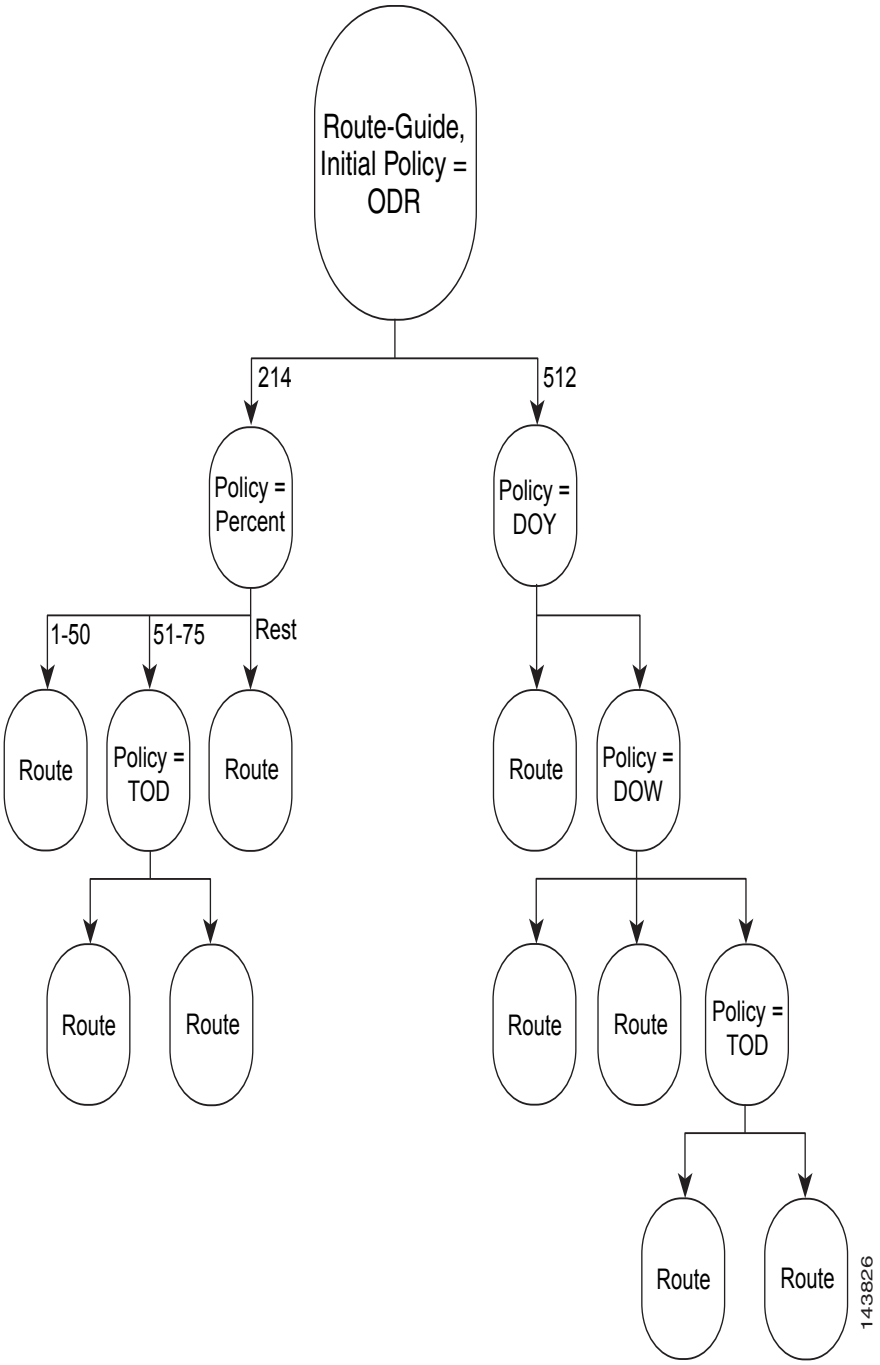
```
add dial-plan id=dpcas; digit-string=404-313; reqd-digits=10; dest-id=ops-interLATA;

add intl-dial-plan cc=42; min-digits=6; max-digits=16; dest-id=ops-intl;
```

Policy-Based Flexible Routing

The Cisco BTS 10200 policy-based flexible routing use policy based routing tree decisions to select the call route and to route the call. Flexible routing allows service providers to provision policy based flexible routing by configuring the route guide table using the policy variables. The order of the policies is provisionable and one or more policies can be assigned. Figure 2-23 illustrates the Cisco BTS 10200 flexible routing tree structure. This section includes information describing each of the Cisco BTS 10200 policy types.

Figure 2-23 Flexible Routing Tree Structure



Each of the following policies is described:

- Day of Year, Day of Week, and Time of Day Policy
- Origin Dependent Routing Policy
- Originating Line Information Policy
- NXX Policy
- Percent Policy
- Point of Presence Policy
- Prefix Policy
- Region Profile
- Region Policy
- Call Type Policy
- Circuit Code Policy
- Server Policy

Day of Year, Day of Week, and Time of Day Policy

The Policy Day of Year, Day of Week, and Time of Day enables the flexible routing of calls via the Cisco BTS 10200 by day of year (DOY), day of week (DOW), or time of day (TOD). The Policy Time of Day (policy-tod) table provides routing information based on the following values, in order of preference (highest preference to lowest):

- Day of year
- Day of week
- Time of day

For token names and description details for the Policy Time of Day table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Origin Dependent Routing Policy

The Policy Origin Dependent Routing (policy-odr) table is used for origin-dependent routing. The NPA (or NPA-NXX) of the calling party number selects a route. If no match is found based on the calling party number, the route marked as default routes the call. For token names and description details for the Policy Origin Dependent Routing table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Originating Line Information Policy

The Policy Originating Line Information policy enables the flexible routing of calls via the Cisco BTS 10200 by the use of originating line information (OLI). The Policy Originating Line Information enables routing to be performed based on the originating line information of the calling party number. For token names and description details for the Policy Originating Line Information table, refer to the Cisco BTS 10200 Softswitch CLI Database.

NXX Policy

The Policy NXX (policy-nxx) table is used when a number service calls result in a translated number, translated carrier ID, translated number and carrier ID, or translated route ID. For token names and description details for the Policy NXX table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Note The original call type is preserved in billing when the routing number is changed by the use of the Policy NXX table.

Percent Policy

The Policy Percent (policy-percent) table distributes traffic based on percent allocation. This type of traffic distribution is used primarily for local 8XX routing and Tandem applications. For token names and description details for the Policy Percent table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Point of Presence Policy

The Policy Point of Presence enables the flexible routing of calls via the Cisco BTS 10200 based on the point of presence (POP). The POP based policy routing routes a call to the nearest trunk group when there are multiple trunk groups. There are several situations where a policy POP can be used. If a Call Agent serves several POPs, each POP can have its own announcement server. A POP-specific announcement server can be more efficient than a centralized announcement server. interLATA carriers also have a point of presence in each POP. Route interLATA or international calls to the nearest carrier location using policy POP routing. For token names and description details for the Policy Point of Presence table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Prefix Policy

The Policy Prefix enables the flexible routing of calls via the Cisco BTS 10200 based on prefix (type of call). Typical call types include 1+ dialing, international calls, toll-free, and so on. The Policy Prefix is used mainly for carrier routing. For token names and description details for the Policy Prefix table, refer to the Cisco BTS 10200 Softswitch CLI Database. For additional information on call types, refer to Appendix A, “Call Types and Subtypes.”

Region Profile

The Region Profile (region-profile) table groups North American Numbering Plan (NANP) digits to an originating region. There can be many ID and digit-string combinations for a given region. In this conceptual relationship, a number of digit patterns (digit-string) can belong to a given region and a number of originating regions make up a region profile (ID). Use the value specified in the ca-config record as the default region where type=default-region. For token names and description details for the Region Profile table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Region Policy

The Policy Region enables the flexible routing of calls via the Cisco BTS 10200 based on the call region. The region is derived using the Region Profile table from the Route Guide table and the calling party number ANI. If ANI is not available or the Region Profile table is not provisioned, the region assigned to the trunk group is used for trunk origination. If a record cannot be found based on the region, the record with region=default (if provisioned) is used for routing. For token names and description details for the Policy Region table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Call Type Policy

The Policy Call Type (policy-call-type) table defines a route based on the call type. For token names and description details for the Policy Call Type table, refer to the Cisco BTS 10200 Softswitch CLI Database.

For additional information on call types, refer to Appendix A, "Call Types and Subtypes."

Circuit Code Policy

The Policy Circuit Code (policy-circuit-code) table defines a route based on the Circuit Code received in the TNS parameter. For token names and description details for the Policy Circuit Code table, refer to the Cisco BTS 10200 Softswitch CLI Database.

Server Policy

The Policy Server (policy-server) table defines a route based on the Circuit Code received in the TNS parameter. For token names and description details for the Policy Server (AGGR) table, refer to the Cisco BTS 10200 Softswitch CLI Database.