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3RD GENERATION
PARTNERSHIP
PROJECT 2
"3GPP2"

Mobile Application Part (MAP) - VOICE FEATURE SCENARIOS: CALL DELIVERY

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REVISION HISTORY

Revision	Date	Remarks
X.S0004-321-E v1.0	January 2007	Initial publication.
X.S0004-321-E v2.0	January 2009	Addition of sections: 1.13, 1.14, 1.15, 1.16 based on Miscellaneous Enhancements 10.0

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1 Call Delivery

This section depicts the interactions between network entities in various situations related to automatic roaming and Call Delivery (CD). These scenarios are informative.

1.1 CD Demand Activation or De-Activation

For a description of the demand activation or deactivation of CD by an authorized MS, see Part 311 [Section 2.1](#).

1.2 CD Invocation to an Idle MS on Another MSC

This scenario describes call delivery to an MS that is outside the serving area of the MSC where the call originates. MSCs in the functional model described in *NAM* contain switching functions

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only and must interact with their associated HLR and VLR to obtain database information for an MS; in a real application, the HLR/VLR functions may be integrated with the MSC.

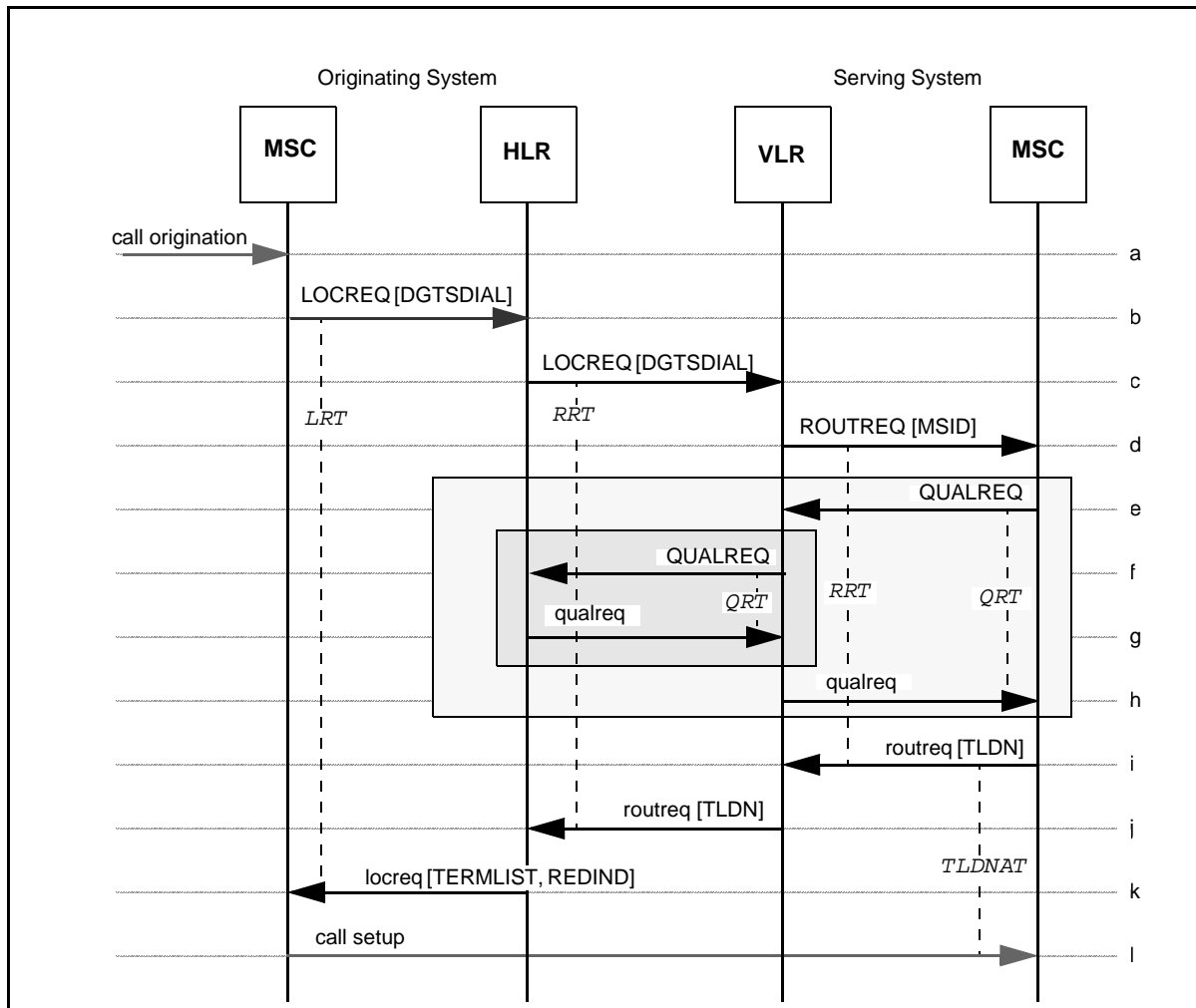


Figure 1 — CD Invocation to an Idle MS on Another MSC

- a. A call origination and the dialed MS address digits (i.e., directory number) are received by the Originating MSC.
 - b. The Originating MSC sends a LOCREQ to the HLR associated with the MS; this association is made through the dialed MS address digits (which may not be the MIN).
 - c. If the dialed MS address digits are assigned to a legitimate subscriber, the HLR sends a ROUTREQ to the VLR where the MS is registered.
 - d. The VLR then forwards the ROUTREQ to the current Serving MSC. Note that the MS may have roamed within the domain of the Serving VLR and reported its new location to that VLR (via the new Serving MSC); the Serving VLR may not have reported this change in location to the HLR.
- In reaction to the ROUTREQ, the Serving MSC consults its internal data structures to determine if the MS is already engaged in a call on this MSC. In this scenario, since the MS is idle, we are assuming that the MS is not known to the Serving MSC.
- e. The Serving MSC may then obtain the service profile of the MS from its VLR by sending it a QUALREQ.

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1 This step can be eliminated if the service profile is obtained by the Serving MSC prior
2 to the termination attempt (e.g., when the MS registers). Subsequent scenarios do not
3 explicitly show this step; they assume that the Serving MSC either already has the
4 profile available when the ROUTREQ arrives or obtains the profile in a manner similar
5 to that shown here.

- 6
- 7 f. If the MS is unknown to the VLR or if the information requested by the MSC is not
8 available at the VLR, the VLR sends a QUALREQ to the HLR associated with the MS.
- 9 g. The HLR sends a qualreq to the VLR.
- 10 h. The VLR sends a qualreq to the Serving MSC.
- 11 i. The Serving MSC allocates a TLDN (Temporary Local Directory Number) and returns
12 this information to the VLR in the routreq.
- 13 j. The VLR sends the routreq to the HLR.
- 14 k. When the routreq is received by the HLR, it returns a locreq to the Originating
15 MSC. The locreq includes routing information in the form of the TerminationList
16 parameter, along with an indication of the reason for extending the incoming call (i.e.,
17 for CD) in the DMH_RedirectionIndicator parameter.
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- 20 l. The Originating MSC establishes a voice path to the Serving MSC using existing
21 interconnection protocols (e.g. SS7) and the routing information specified in the
22 locreq.
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1.3 CD Invocation to an Idle, Local MS

This scenario describes CD invocation to an idle MS that is served by the MSC where the call originates.

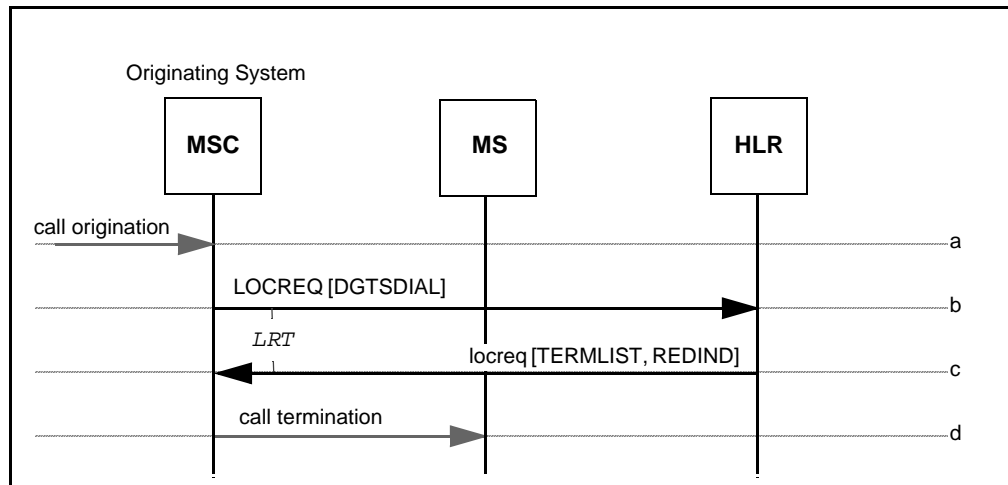


Figure 2 — CD Invocation to an Idle, Local MS

- a. A call origination and the dialed MS address digits (i.e., directory number) are received by the Originating MSC.
- b. The Originating MSC sends a LOCREQ to the HLR associated with the MS; this association is made through the dialed MS address digits (which may not be the MIN).
- c. If the dialed MS address digits are assigned to a legitimate subscriber and the HLR determines that the subscriber is currently served by the Originating MSC, the HLR sends a locreq to the Originating MSC.
- d. The Originating MSC, recognizing itself as the Serving MSC via the MSCID parameter contained in the TerminationList parameter, then attempts to terminate the call to the MS identified in the locreq.

1.4 CD Invocation to a Busy MS

This scenario describes CD invocation to an MS that is busy in a call outside of the serving area where the call originates.

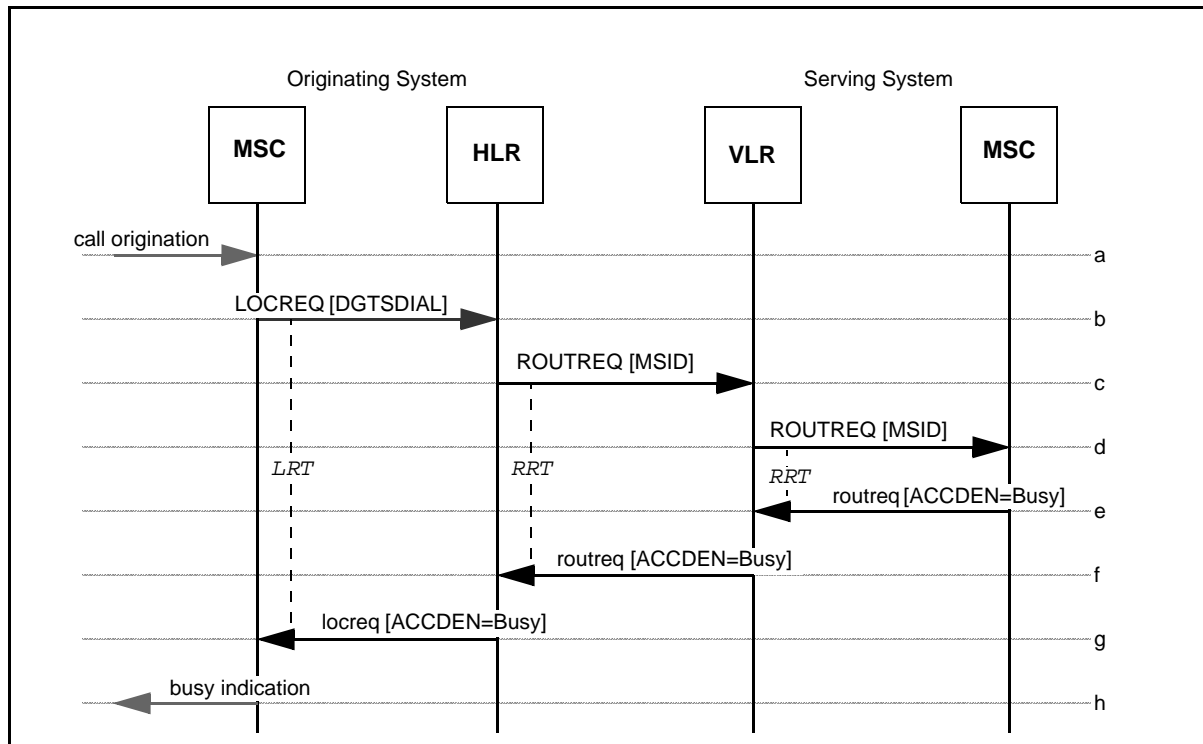


Figure 3 — CD Invocation to a Busy MS

- a-d. Same as CD, see Part 321, sec. 1.2, Steps a-d.
- e. In reaction to the ROUTREQ, the Serving MSC checks its internal data structures and determines that the MS is busy in another call. The status of the MS is returned to the VLR by the Serving MSC via the AccessDeniedReason parameter in the routreq.¹
- f. The VLR sends the routreq to the HLR.
- g. The HLR returns the busy status to the Originating MSC in the locreq.
- h. The Originating MSC then returns a busy indication to the calling party.

¹ In some environments it may be necessary to return a TLDN in addition to, or in place of, the MS status. Handling of these situations is not illustrated by the above figure.

1.5 CD Invocation with No Page Response or No Answer

This scenario describes CD invocation to an MS when no page response or no answer is received by the Serving MSC after TLDN call arrival.

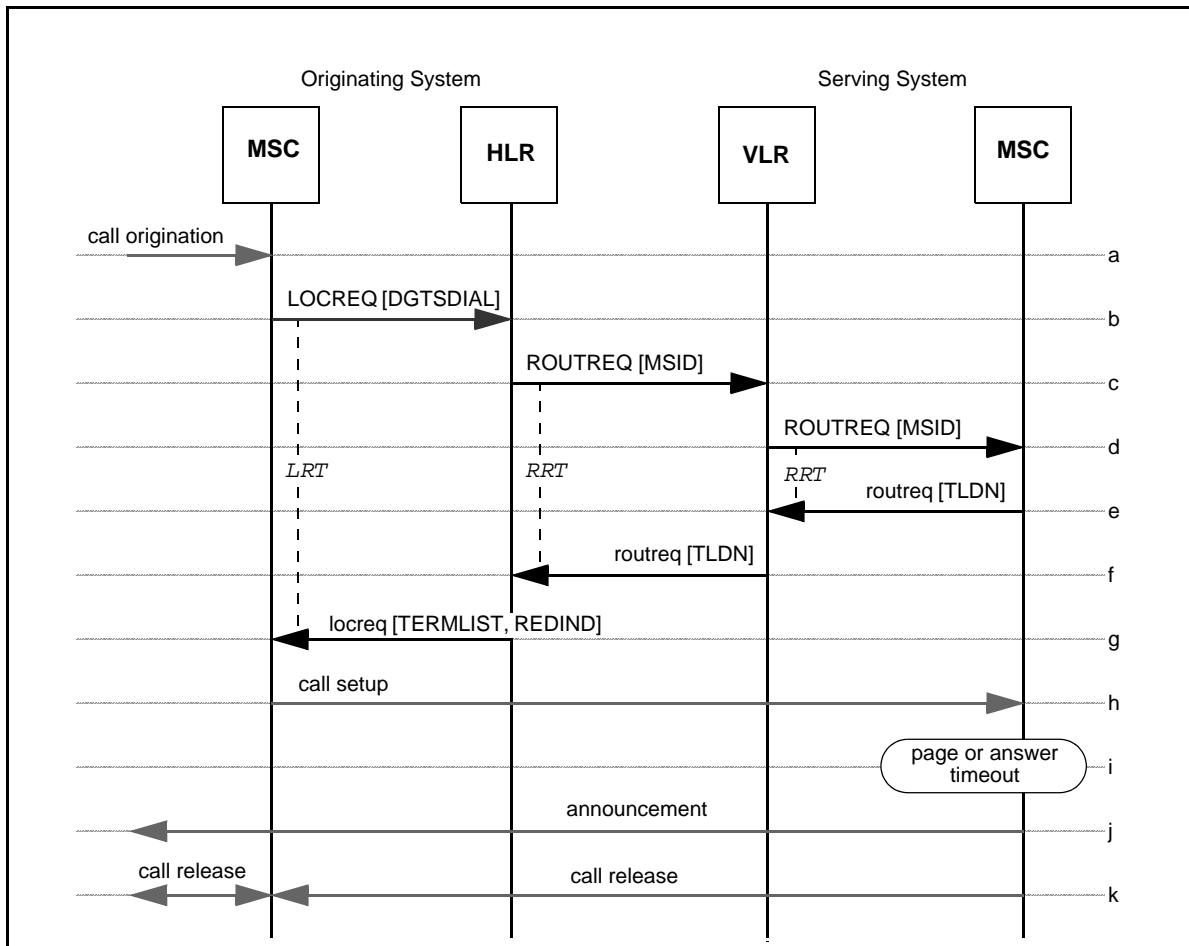


Figure 4 — CD Invocation with No Page Response or No Answer

- a-d. Same as CD, see Part 321, sec. 1.2, Steps a-d.
- e-h. Same as CD, see Part 321, sec. 1.2, Steps i-l, respectively.
- i. Either the MS fails to respond to the page or does not answer after alerting.
- j. The Serving MSC routes the call to an appropriate tone or announcement.
- k. The call is then disconnected using the protocols defined by the interconnection method.

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1.6 CD Invocation to an Inaccessible MS

This scenario describes CD invocation to an MS that is inaccessible due to:

- CD inactive,
- MS inactive
- MS unregistered.

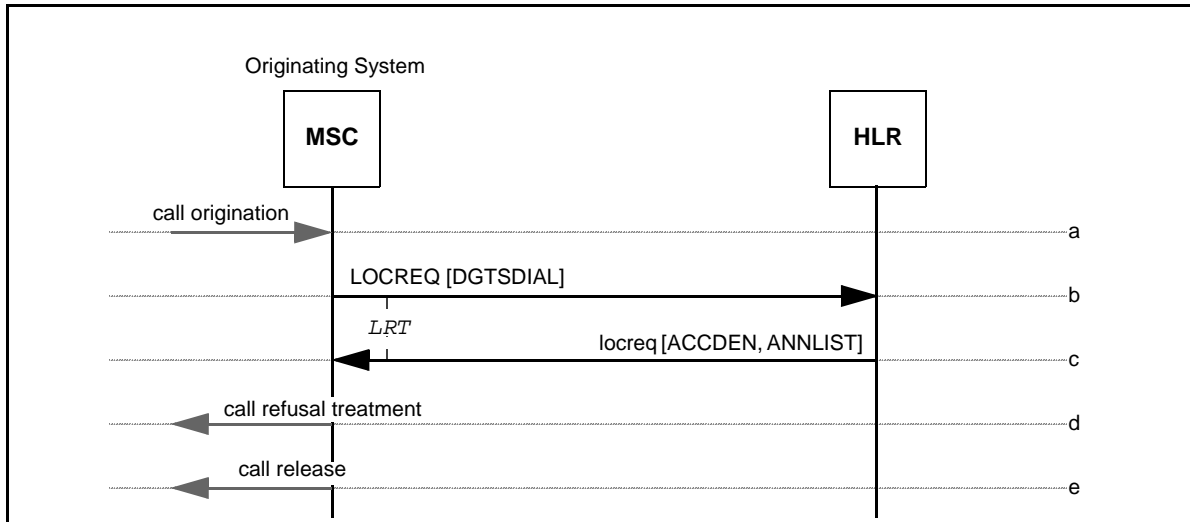


Figure 5 — CD Invocation to an Inaccessible MS

- Same as CD, see Part 321, sec. 1.2, Steps a-b.
- The HLR determines that the MS is not accessible (e.g., CD is inactive, MS is inactive, or MS is not registered). The HLR returns a locreq to the Originating MSC including the reason for denying access in the AccessDeniedReason parameter.
- The Originating MSC provides treatment to the served MS as implied by the AccessDeniedReason parameter and, if present, the AnnouncementList parameter. In this case, the treatment is to provide call refusal treatment.
- The Originating MSC releases the call.

1.7 CD Invocation with Intersystem Paging

This scenario describes CD invocation involving intersystem paging from the serving system to border systems. Intersystem paging may help overcome location uncertainties in border system

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areas allowing paging to be performed in border systems and by performing call routing towards the system where the subscriber is found.

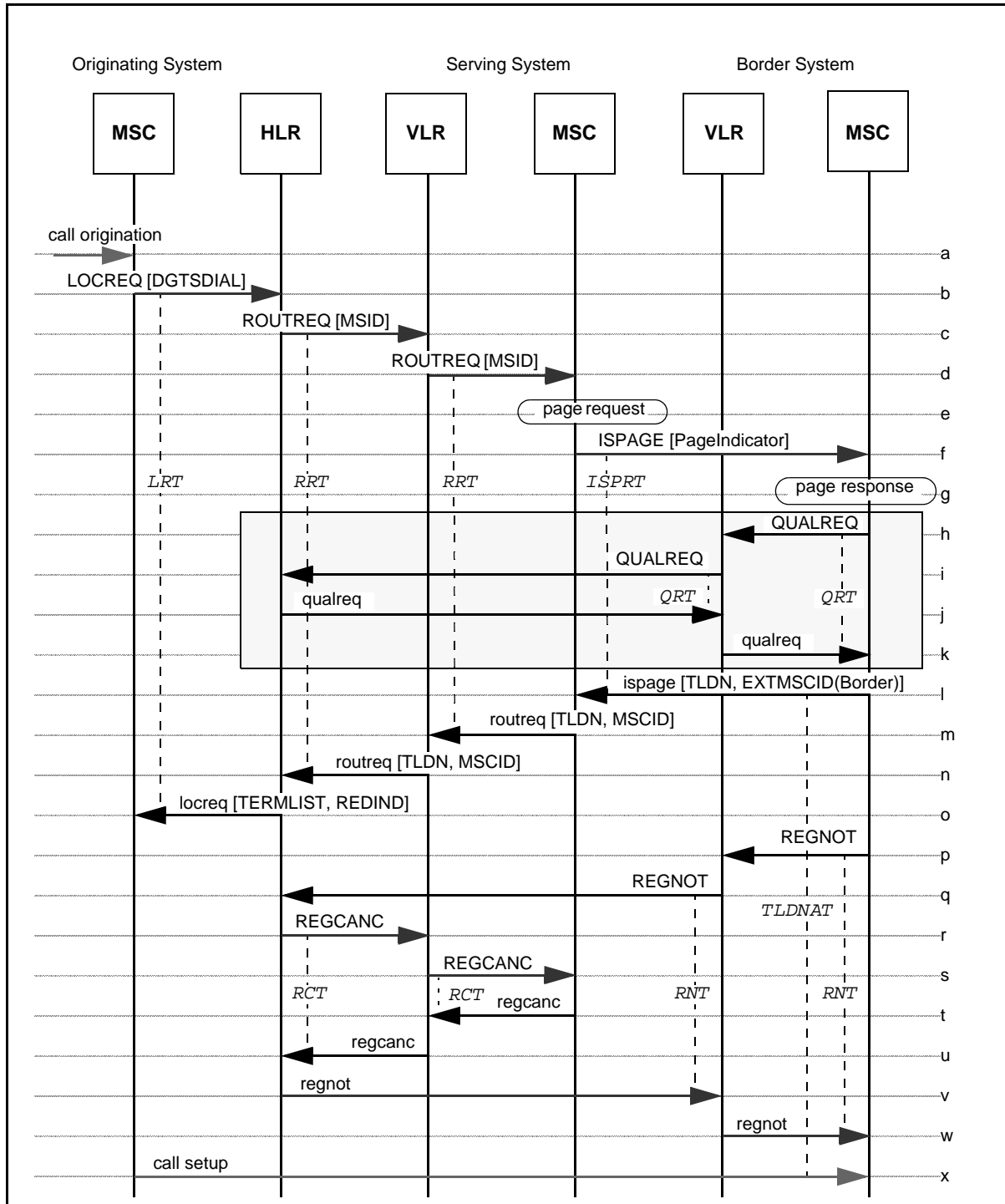


Figure 6 — CD Invocation with Intersystem Paging

- a-d. Same as CD, see Part 321, sec. 1.2, Steps a-d.
- e-f. Before initiating local paging, at the time of local page initiation or after first page time-out, the Serving MSC may send an ISPAGE to one or more bordering MSCs according to its “topographical map” with a parameter indicating an area where the

subscriber's presence was last detected and a parameter indicating whether to page or just listen for an unsolicited page response. This `ISPAGE` contains the MSCID of the Originating MSC in order that subsequent message exchanges work properly. The Serving MSC also passes the information needed if call redirection is required.

The Border MSC that receives the `ISPAGE` may initiate paging (i.e., if directed).

- g. If a page response is received at the Border MSC...
 - h. Optionally the Border MSC sends a `QUALREQ` to the VLR indicating Border Access.
 - i. If the service profile of the MS is unknown to the VLR, it sends a `QUALREQ` to the HLR associated with the MS.
 - j. The HLR sends a `qualreq` to the Border MSC's VLR, including the MS's service profile information.
 - k. The VLR sends a `qualreq` to the Border MSC, including the MS's service profile information. The Border MSC then assigns the MS to a traffic channel and allocates a TLDN. The Border MSC further confirms the MS's presence (e.g., via SAT detection, through a traffic channel audit, or both).
- If the MS is authentication capable, optionally authenticate it using a control channel, or a traffic channel (see Part 310).
- l. When the Border MSC assigns the MS to a traffic channel, the Border MSC sends an `ispage` containing a TLDN and the MSCID of the Border MSC to the Serving MSC.
 - m. The Serving MSC returns a `routreq` to the Serving VLR with the TLDN contained in the `ispage` and the MSCID of the Border MSC.
 - n. The Serving VLR returns the `routreq` to the HLR.
 - o. The HLR then sends a `locreq` to the Originating MSC. The `locreq` includes routing information in the form of the `TerminationList` parameter, along with an indication of the reason for extending the incoming call (i.e., for CD) in the `DMH_RedirectionIndicator` parameter.
 - p. After responding to the `ISPAGE`, the Border MSC sends a `REGNOT` to the Border VLR.
 - q. The Border VLR sends a `REGNOT` to the HLR.
 - r. The HLR cancels the registration at the visited serving system by sending a `REGCANC` to the Serving VLR.
 - s. The Serving VLR sends a `REGCANC` to the Serving MSC.
 - t. The Serving MSC returns a `regcanc` to the Serving VLR.
 - u. The Serving VLR returns a `regcanc` to the HLR.
 - v. The HLR returns a `regnot` to the Border VLR.
 - w. The Border VLR returns a `regnot` to the Border MSC.
 - x. The Originating MSC establishes a voice path to the Border MSC using existing interconnection protocols (e.g., SS7) and the routing information specified in the `locreq`.

Note: If the Border MSC must initiate call redirection, the `REDREQ` is sent from the Border MSC to the Originating MSC.

Note: This step is independent of steps p through w and may occur at any time after step o.

1.8 CD Invocation with Unsolicited Page Response

This scenario describes procedures to resolve the unsolicited page response problem for MSs in border systems during call delivery.

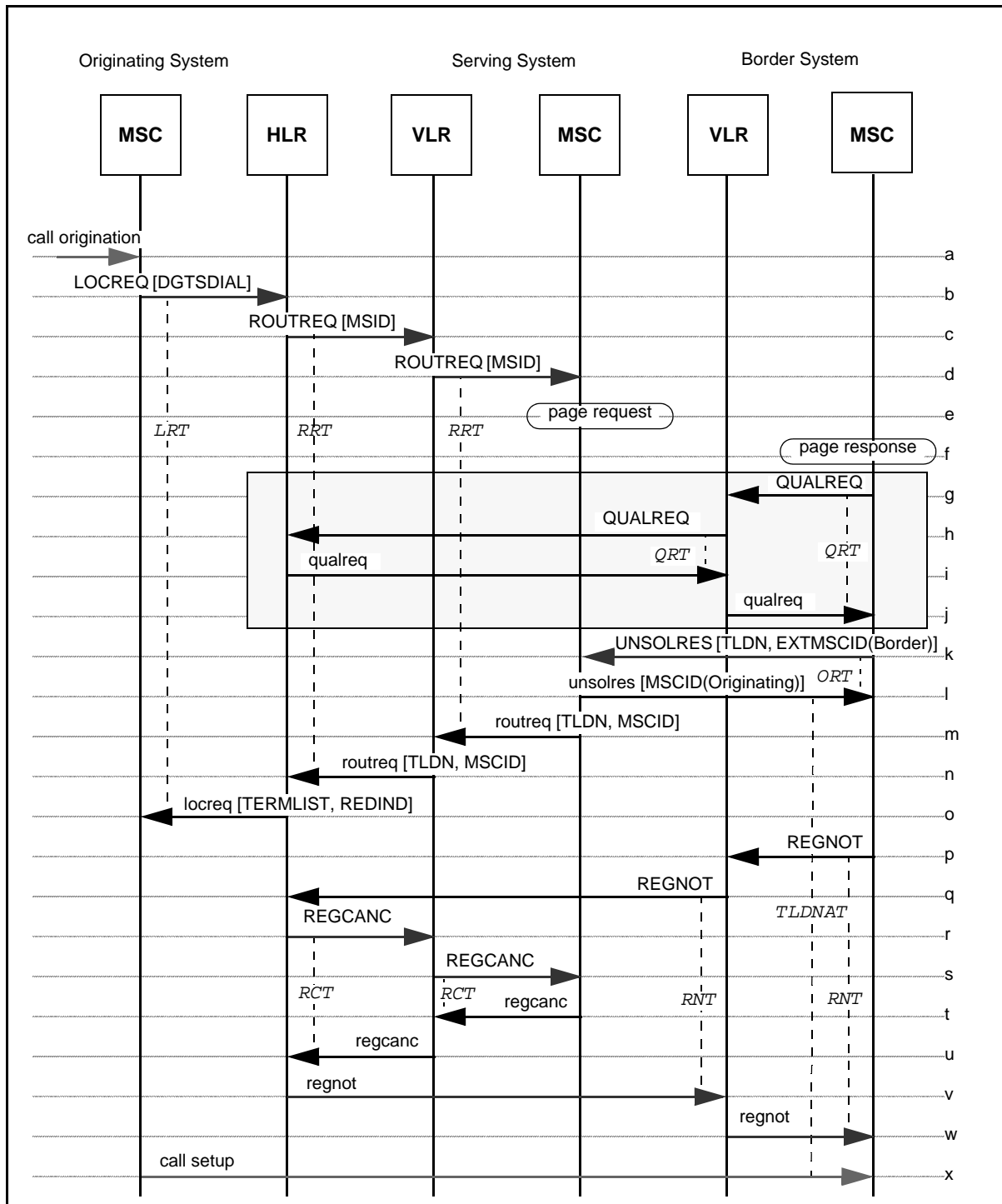


Figure 7 — CD Invocation with Unsolicited Page Response

a-d. Same as CD, see Part 321, sec. 1.2, Steps a-d.

- e. When the serving system receives a ROUTREQ it initiates paging in its serving area.
- f. The Border MSC receives an unsolicited page response.
After the Border MSC receives a page response it can assign the MS to a traffic channel. The Border MSC verifies the presence of the MS in its serving area (e.g. via SAT detection, through a traffic channel audit or both).
- g. Optionally the Border MSC sends a QUALREQ to the VLR indicating Border Access.
- h. If the service profile of the MS is unknown to the VLR, it sends a QUALREQ to the HLR associated with the MS.
- i. The HLR sends a qualreq to the Border MSC's VLR, including the MS's service profile information.
- j. The VLR sends a qualreq to the Border MSC, including the MS's service profile information.
If the MS is authenticable, optionally authenticate it using a control channel or a traffic channel (see Part 310).
- k. The Border MSC then allocates a routing alias (TLDN) and sends an UNSOLRES to one or more neighboring MSC's.
When the Serving MSC receives this UNSOLRES, it stops the paging process.
- l. The Serving MSC then responds with the unsolres sent to the Border MSC.
- m-x. Same as CD, see Part 321, sec. 1.7, Steps m-x.

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1.9 TLDN Call Arrival with Intersystem Paging

This scenario describes TLDN Call Arrival at the serving system involving intersystem paging from the serving system to border systems.

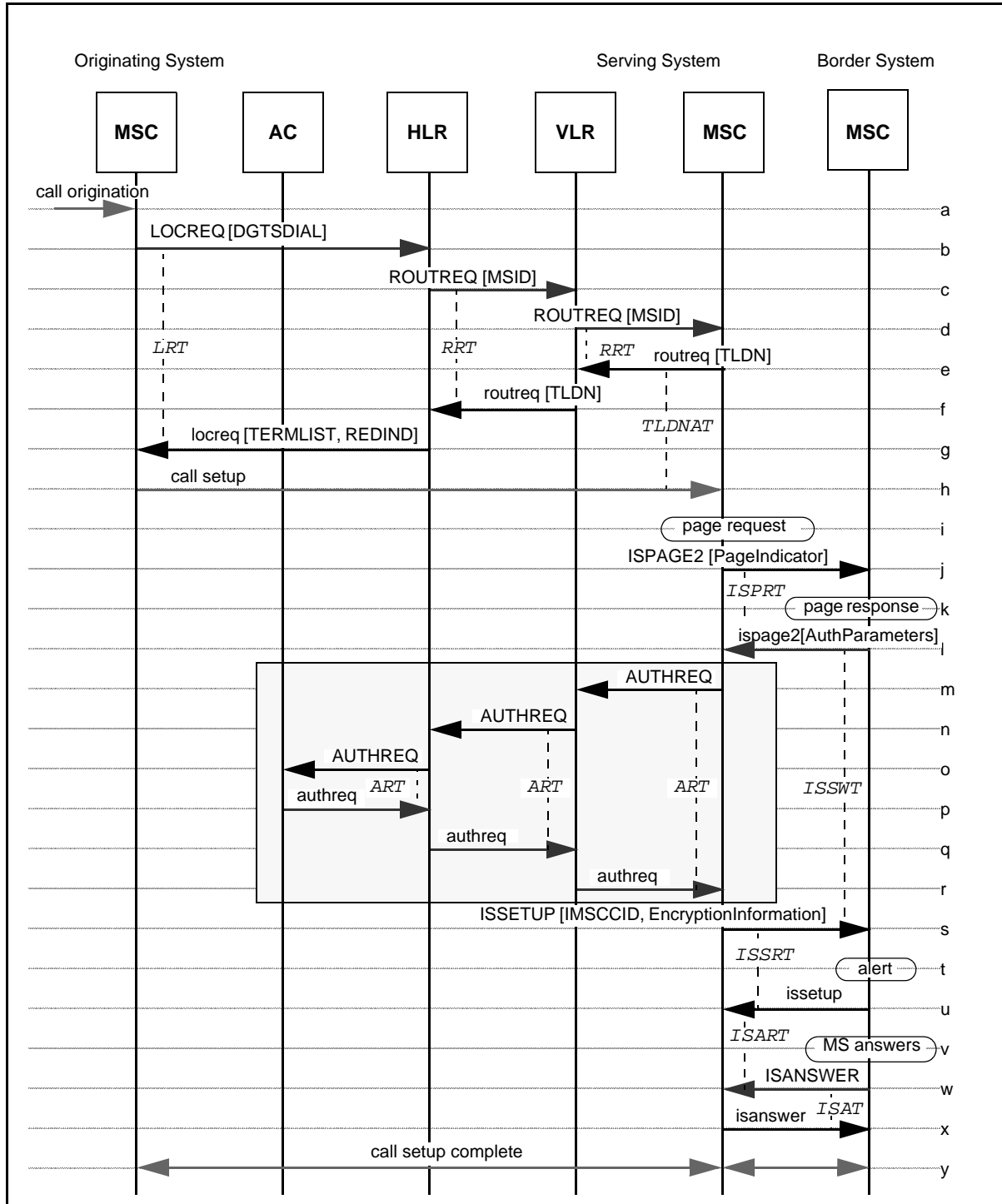


Figure 8 — TLDN Call Arrival with Intersystem Paging

a-d. Same as CD, see Part 321, sec. 1.2, Steps a-d.

e-h. Same as CD, see Part 321, sec. 1.2, Steps i-l.

NOTE: The events described in Steps i-j could happen at any time in relation to the events described in Steps e-h.

i-j. Before initiating local paging, at the time of local page initiation or after first page time-out, the Serving MSC may send an `ISPAGE2` to one or more bordering MSCs according to its “topographical map” with a parameter indicating an area where the subscriber's presence was last detected and a parameter indicating whether to page or just listen for an unsolicited page response.

The Border MSC that receives the `ISPAGE2` may initiate paging (i.e., if directed).

k. If a page response is then received at the Border MSC, it assigns the MS to a traffic channel. The Border MSC further confirms the MS's presence (e.g., via SAT detection, through a traffic channel audit or both).

l. When the Border MSC assigns the MS to a traffic channel, the Border MSC sends an `ispage2` to the Serving MSC. If authentication is to be performed, the `ispage2` contains the appropriate authentication parameters received from the MS.

m. If authentication is indicated, the Serving MSC then sends an `AUTHREQ` to the VLR.

n. The VLR may send the `AUTHREQ` to the HLR.

o. If received, the HLR forwards the `AUTHREQ` to the AC.

p. The AC sends an `authreq` to the HLR, including the Voice Privacy Mask (VPMASK) and Signaling Message Encryption Key (SMEKEY) associated with this system access.

q. The HLR forwards the `authreq` to the VLR.

r. The VLR sends the `authreq` to the serving MSC.

s. The serving MSC sends an `ISSETUP` to the Border MSC to perform call setup actions. The `ISSETUP` contains the circuit ID of the intersystem trunk facility. The `ISSETUP` may also contain EncryptionInformation.

Encryption Information:		
[CDMAPLCM]	CDMAPPrivateLongCodeMask. Include if available.	<input type="radio"/>
[SMEKEY]	SignalingMessageEncryptionKey. Include if available.	<input type="radio"/>
[VPMASK]	VoicePrivacyMask. Include if available.	<input type="radio"/>

t. The Border MSC connects the path and alerts the mobile.

u. The Border MSC then sends an `issetup` to the Serving MSC. The Serving MSC then connects the backward call path to the inter-MSC trunk.

v. The MS answers the alert.

w. The Border MSC sends an `ISANSWER` to the Serving MSC.

x. The Serving MSC sends an `isanswer` to the Border MSC.

y. The Serving MSC then connects the call path in both directions to the inter-MSC trunk to the Border MSC, completing the call setup process.

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1.10 TLDN Call Arrival with No Page Response to Intersystem Paging

This scenario describes intersystem paging from the serving system to border systems, when a call has arrived at the serving system via a TLDN and the result is no page response from either the serving system or border system.

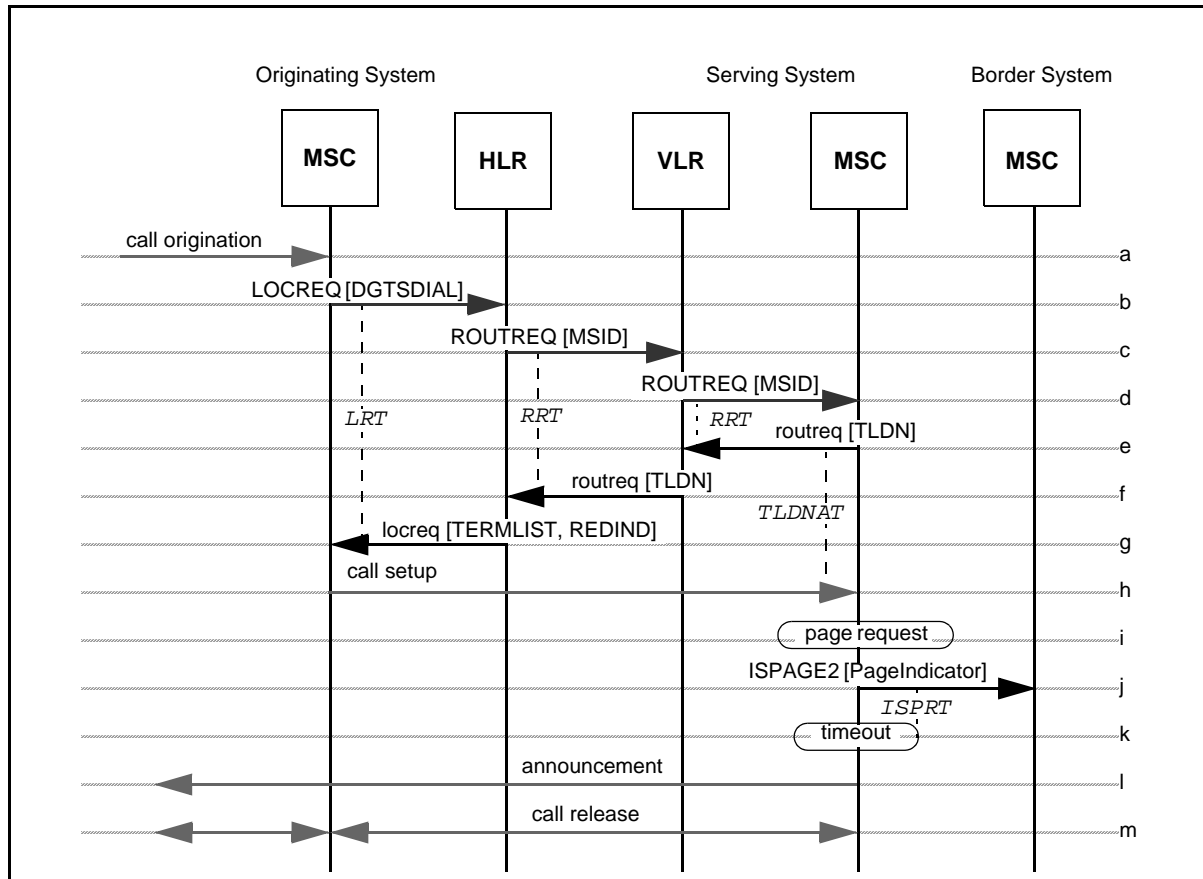


Figure 9 — TLDN Call Arrival with No Page Response to Intersystem Paging

- a-j. Same as CD, see Part 321, sec. 1.9, Steps a-j.
- k. The Serving MSC times out waiting for a page response from both the border system and itself.
- l. The Serving MSC provides an appropriate announcement to the calling party.
- m. The calling party releases the call.

1.11 TLDN Call Arrival with No Answer After Intersystem Paging, Call Release Initiated by Serving MSC

This scenario describes intersystem paging from the serving system to border systems, when a call has arrived at the Serving MSC via a TLDN and the Serving MSC time-outs waiting for answer notification from the Border MSC.

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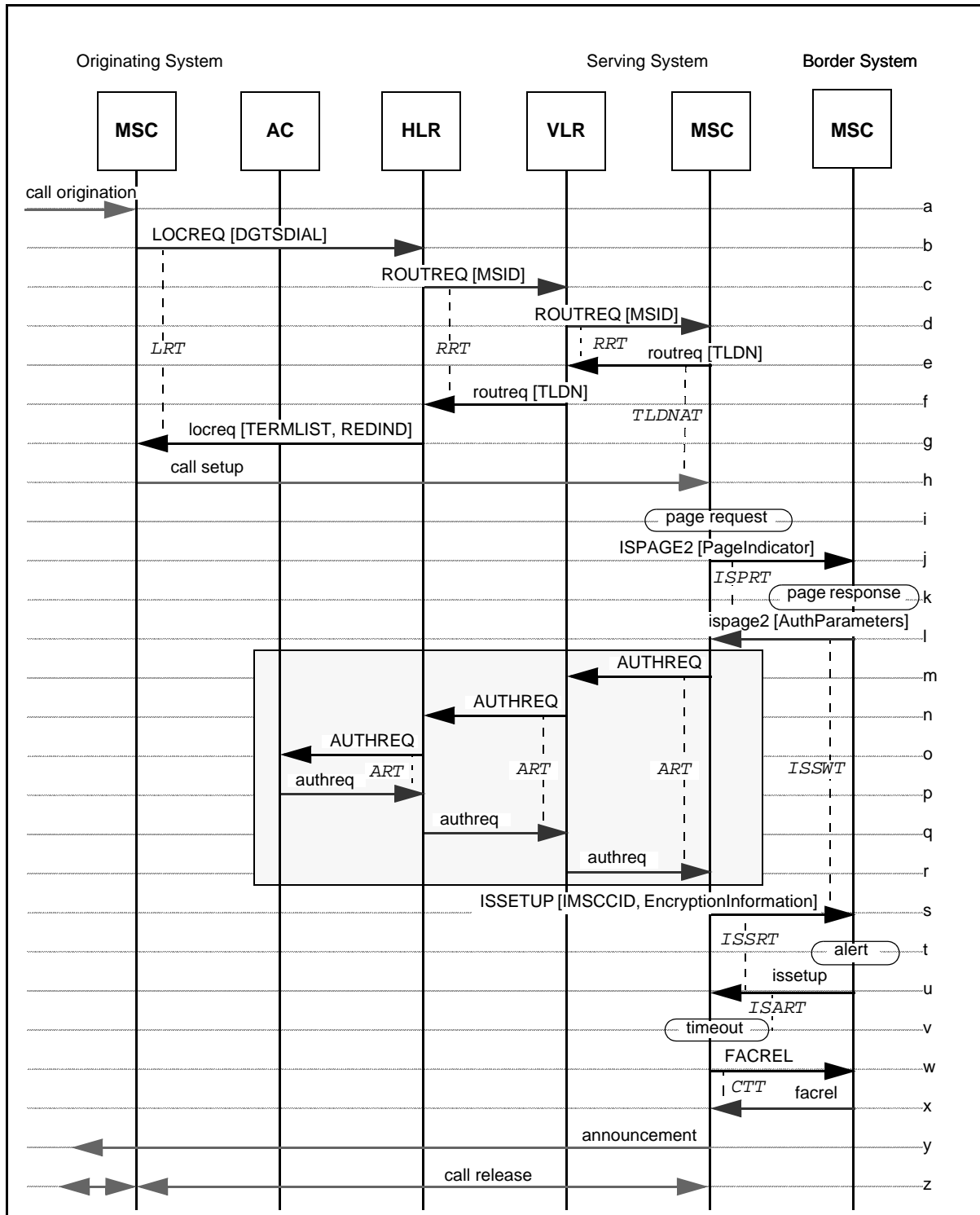


Figure 10 — TLDN Call Arrival with No Answer After Paging, Call Release Initiated by Serving MSC

- a-u. Same as CD, see Part 321, sec. 1.9, Steps a-u.
- v. The Serving MSC times out waiting for answer notification from the Border MSC.

- w. The Serving MSC sends a FACREL to the Border MSC. 1
- x. The Border MSC sends a facrel to the Serving MSC. 2
- y. The Serving MSC provides an appropriate announcement to the calling party. 3
- z. The Serving MSC releases the call. 4

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1.12 TLDN Call Arrival with No Answer After Intersystem Paging, Call Release Initiated by Border MSC

This scenario describes intersystem paging from the serving system to border systems, when a call has arrived at the Serving MSC via a TLDN and the Border MSC does not receive answer from an alerting MS.

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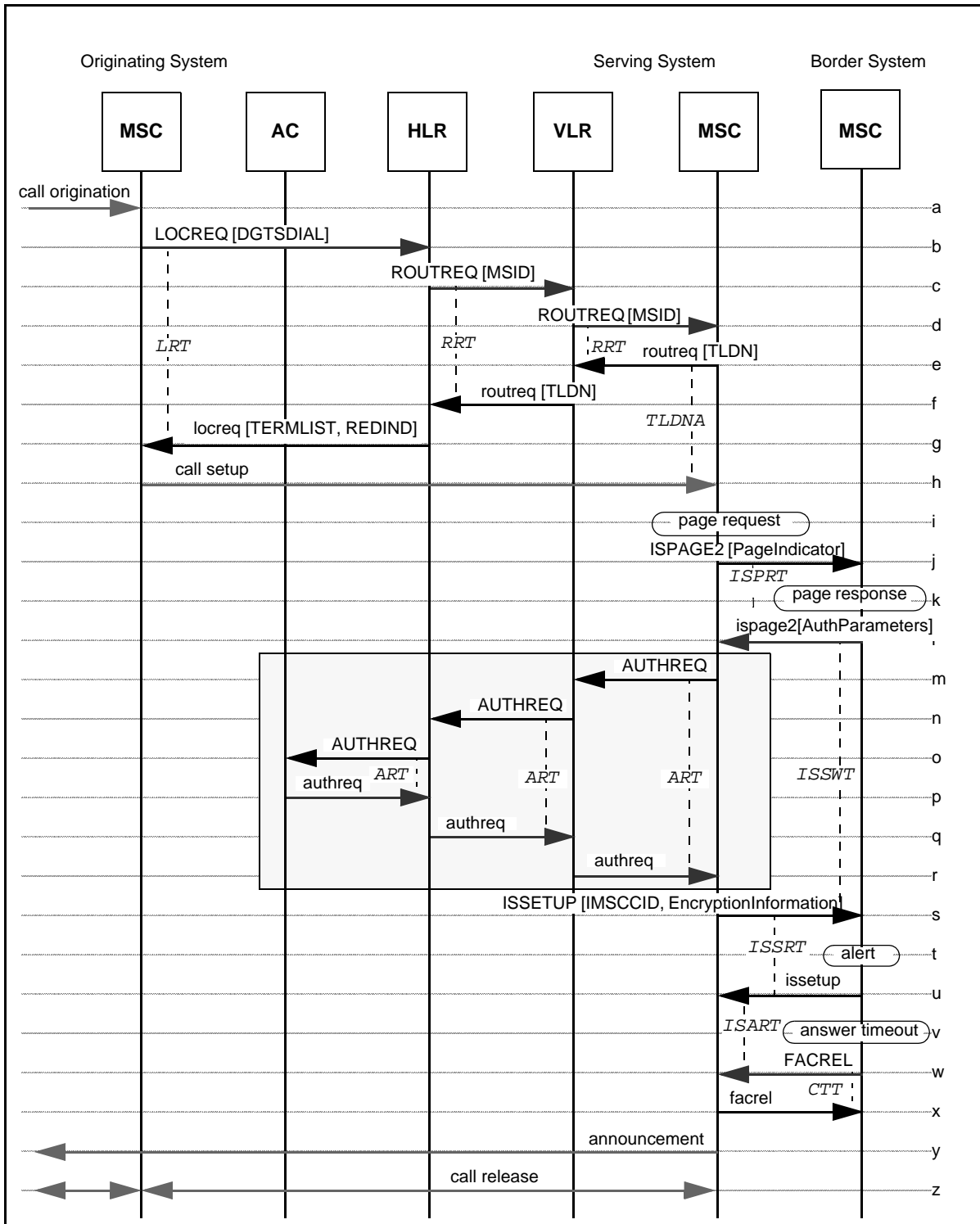


Figure 11 — TLDN Call Arrival with No Answer After Intersystem Paging, Call Release Initiated by Border MSC

- a-u. Same as CD, see Part 321, sec. 1.9, Steps a-u.
- v. The Border MSC times out waiting for the MS to answer the alert.

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- w. The Border MSC then sends a FACREL to the Serving MSC, to release the intersystem trunk facility. The Border MSC also releases the traffic channel.
- x. The Serving MSC sends a facrel to the Border MSC.
- y. The Serving MSC provides an appropriate announcement to the calling party.
- z. The Serving MSC releases the call.

1.13 CD Invocation with No Answer or No Page Response plus Transfer to HLR Inhibited

This scenario describes CD invocation to an MS when no page response or no answer is received by the Serving MSC after TLDN call arrival. The Originating MSC transfer to the HLR was inhibited, and announcements are based on the Serving MSC provided RedirectionReason.

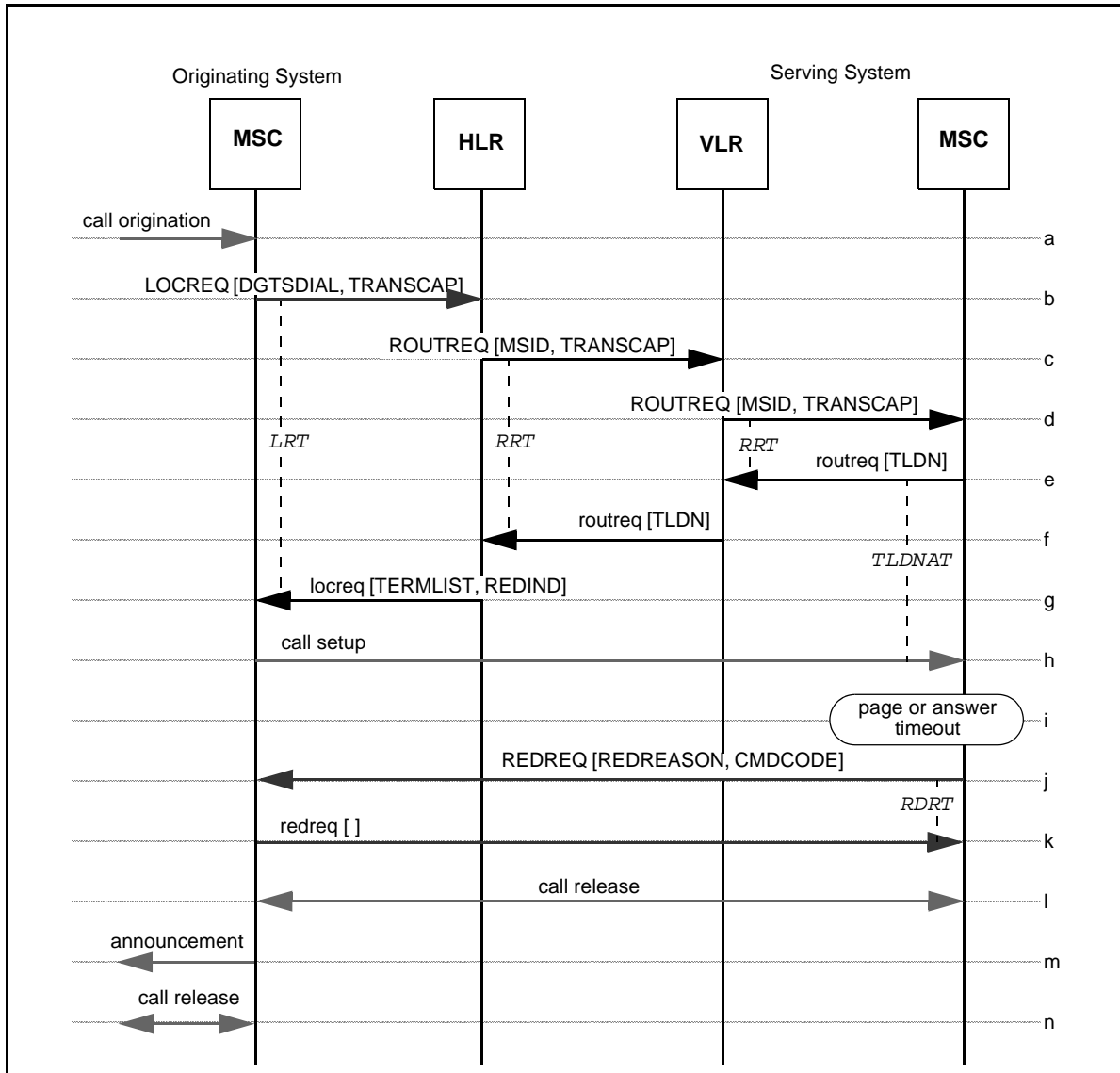


Figure 12 — CD Invocation with No Answer or No Page Response plus Transfer to HLR Inhibited

- a. A call origination and the dialed MS address digits (i.e., directory number) are received by the Originating MSC.
- b. The Originating MSC sends a LOCREQ to the HLR associated with the MS; this association is made through the dialed MS address digits (which may not be the MIN), in this case also included is TRANSCAP set to indicate the Originating System is capable of supporting enhanced call redirection (e.g., generating tones and announcements).

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- c. If the dialed MS address digits are assigned to a legitimate subscriber, the HLR sends a ROUTREQ (including MSID and TRANSCAP) to the VLR where the MS is registered.
 - d. The VLR then forwards the ROUTREQ (including MSID and TRANSCAP) to the current Serving MSC.
 - e-h Same as CD, Section 1.2, Steps i-l.
 - i. In this case, the called MS either does not answer the page or does not answer after alerting.
 - j. Since the received TRANSCAP has informed the Serving MSC that the Originating MSC is capable of supporting enhanced call redirection. The Serving MSC sends (to the Originating MSC) a REDREQ with REDREASON set to identify the redirection reason and CMDCODE set to deny TRANUMREQ initiation.
 - k. The Originating MSC acting on the received CMDCODE returns a redreq (without attempting a TRANUMREQ toward the HLR).
 - l. The Originating MSC releases the inter-MS voice path.
 - m. The Originating MSC provides the appropriate tone or announcement (per the received REDREASON) to the calling party.
 - n. The Originating MSC releases the call.

1.14 CD Invocation with No Answer or No Page Response plus Transfer to HLR Inhibited and Serving MSC Identified Announcements

This scenario describes CD invocation to an MS when no page response or no answer is received by the Serving MSC after TLDN call arrival. The Originating MSC transfer to the HLR was inhibited, and announcements are based on the Serving MSC provided RedirectionReason and AnnouncementList.

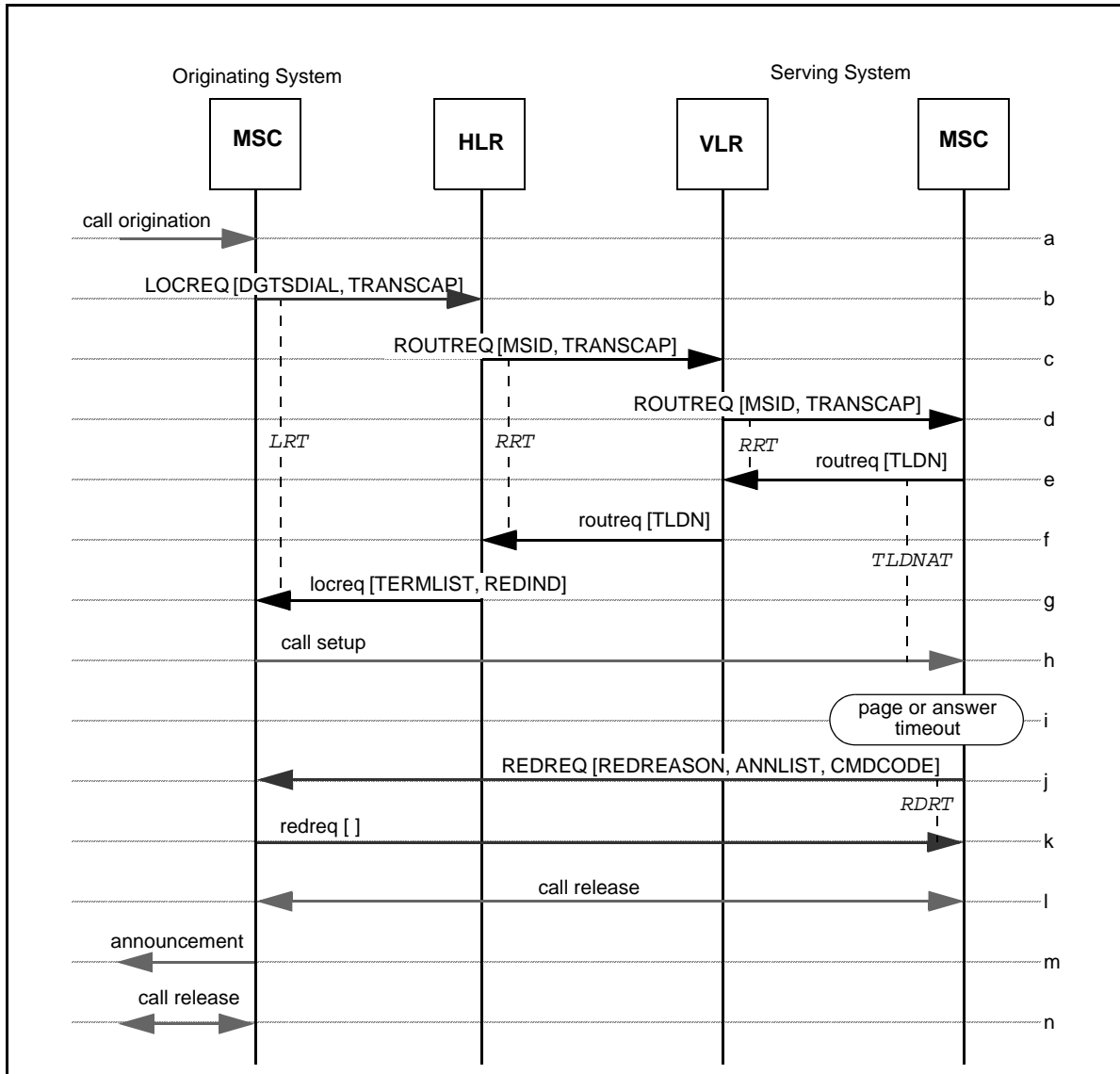


Figure 13 — CD Invocation with No Answer or No Page Response plus Transfer to HLR Inhibited and Serving MSC Identified Announcements

- a-i Same as CD, Section 1.13.
- j. Since the received TRANSCAP has informed the Serving MSC that the Originating MSC is capable of supporting enhanced call redirection. The Serving MSC sends (to the Originating MSC) a REDREQ with REDREASON set to identify the redirection reason, ANNLIST set to identify the calling party announcement, and CMDCODE set to deny TRANUMREQ initiation.

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- k. The Originating MSC acting on the received CMDCODE returns a redreq (without attempting a TRANUMREQ toward the HLR) and applies the calling party announcement(s) identified by the received ANNLIST.
- l-n Same as CD, Section 1.13.

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1.15 CD Invocation with No Answer or No Page Response plus Transfer to HLR Inhibited and Serving MSC Identified Announcements in the Called Party Preferred Language

This scenario describes CD invocation to an MS when no page response or no answer is received by the Serving MSC after TLDN call arrival. The Originating MSC transfer to the HLR was inhibited, and announcements are based on the Serving MSC provided RedirectionReason, AnnouncementList, and called party PreferredLanguage.

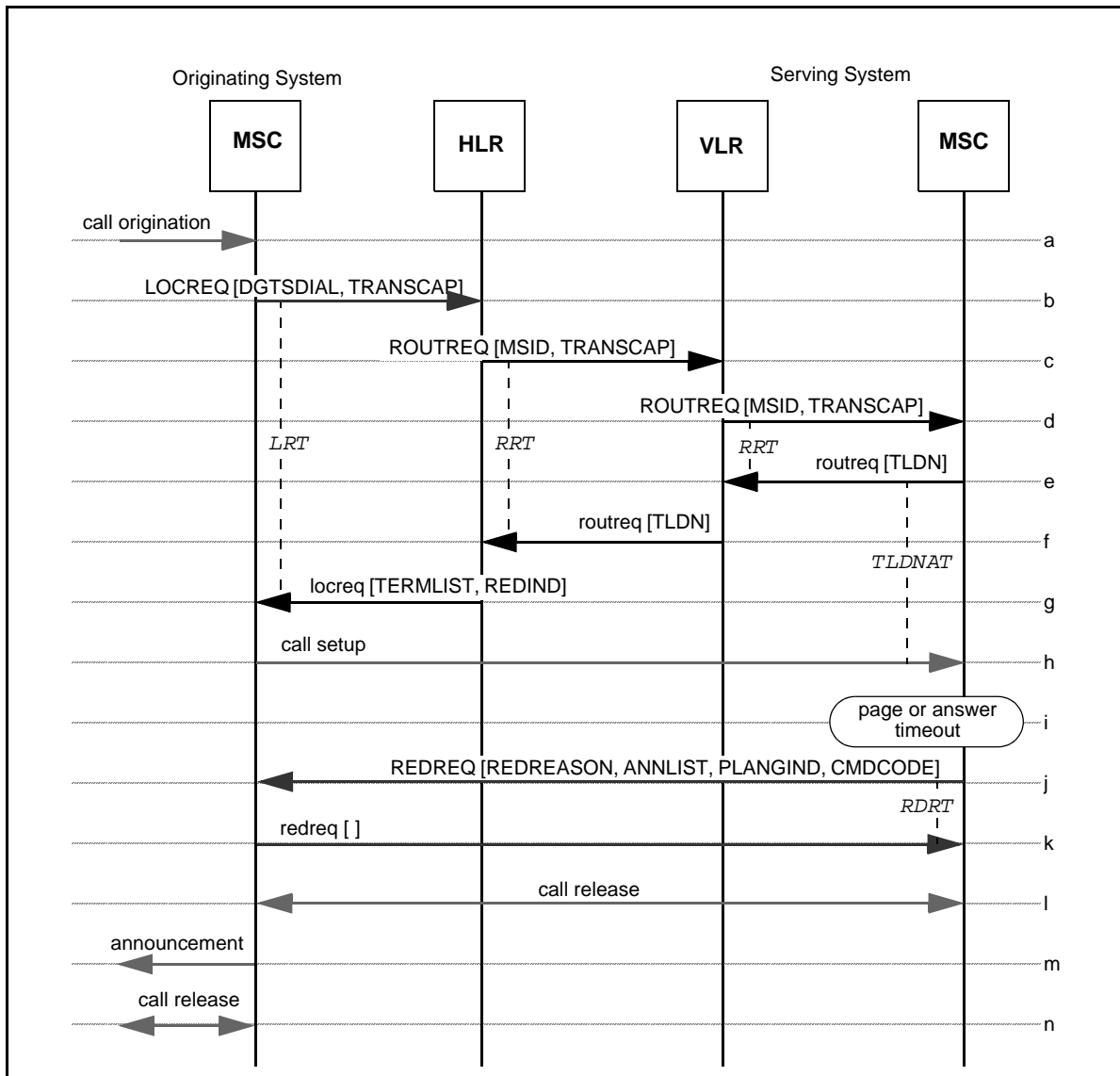


Figure 14 — CD Invocation with No Answer or No Page Response plus Transfer to HLR Inhibited and Serving MSC Identified Announcements in the Called Party Preferred Language

- a-i Same as CD, Section 1.13.
- j. Since the received TRANSCAP has informed the Serving MSC that the Originating MSC is capable of supporting enhanced call redirection. The Serving MSC sends (to the Originating MSC) a REDREQ with REDREASON set to identify the redirection reason, ANNLIST set to identify the calling party announcement, PLANGIND set to identify the called party preferred language, and CMDCODE set to deny TRANUMREQ initiation.

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k. The Originating MSC acting on the received CMDCODE returns a redreq (without attempting a TRANUMREQ toward the HLR) and applies the calling party announcement(s) identified by the received ANNLIST in the called party preferred language identified by the received PLANGIND.

l-n Same as CD, Section 1.13.

1.16 CD Invocation with improved Intersystem Paging to an Idle MS

This scenario describes CNIP invocation to a idle, authorized MS that is the forwarded-to party of a call redirection.

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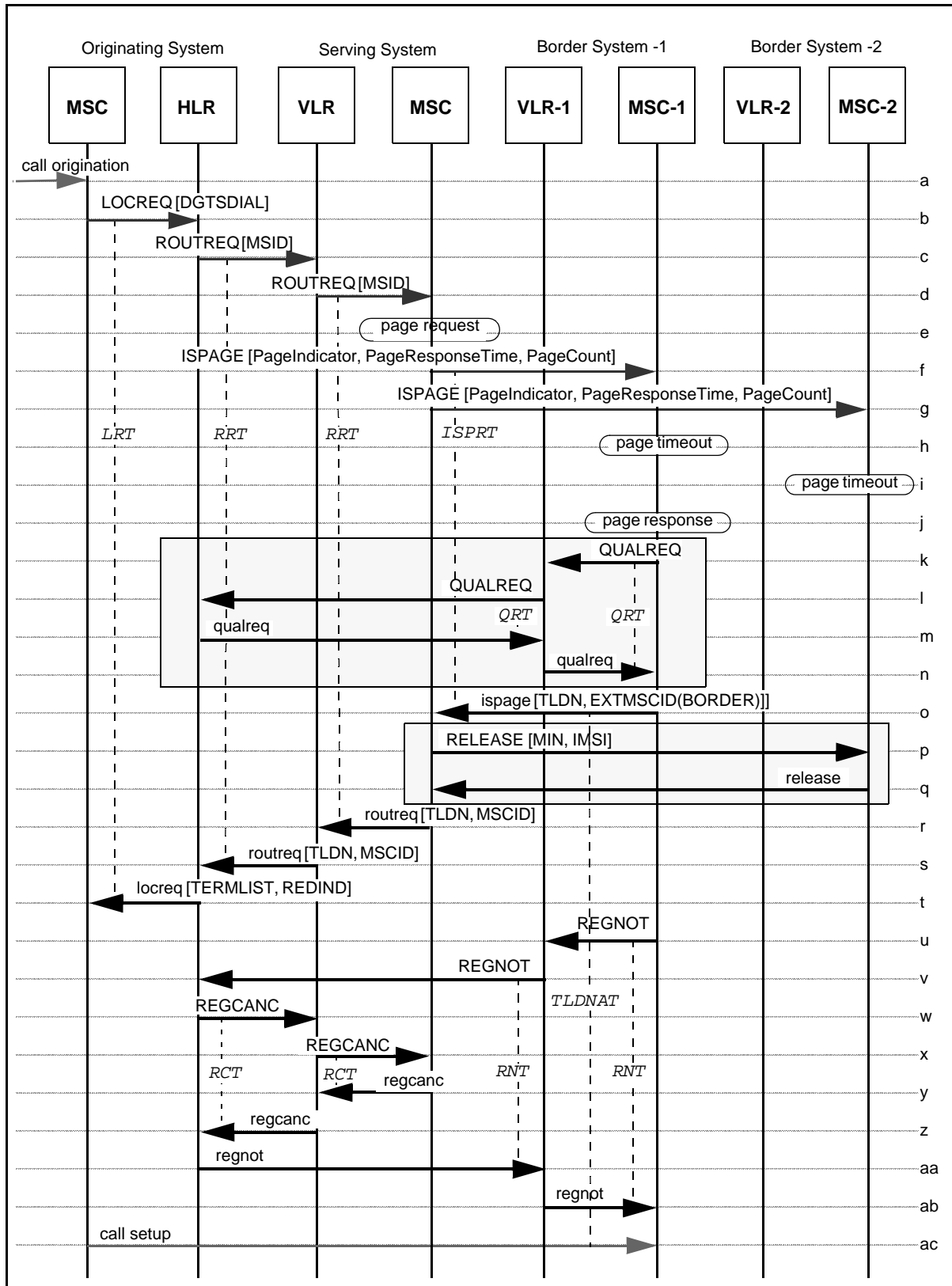


Figure 15 — CD Invocation with improved Intersystem Paging to an Idle MS

- a-d. Same as CD, see Part 321, sec. 1.2, Steps a-d.
- e-g. Before initiating local paging, at the time of local page initiation or after first page time-out, the Serving MSC may send an `ISPAGE` to one or more bordering MSCs (e.g., Border Systems-1 and -2) according to its “topographical map” with a parameter indicating an area where the subscriber’s presence was last detected and a parameter indicating whether to page or just listen for an unsolicited page response. This `ISPAGE` contains the MSCID of the Originating MSC in order that subsequent message exchanges work properly; the `PageResponseTime` and the `PageCount` parameters respectively inform the border of the maximum time it has to complete the paging process, and the recommended maximum number of pages that it is expected to do it in.
- h-i. No page responses are received by any of the Border MSCs during the first page attempt, so the Border MSCs attempt a second page...
- j. When a page response is received at the Border MSC-1...
- k. Optionally the Border MSC-1 sends a `QUALREQ` to the VLR indicating Border Access.
- l. If the service profile of the MS is unknown to the VLR, it sends a `QUALREQ` to the HLR associated with the MS.
- m. The HLR sends a `qualreq` to the Border MSC’s VLR, including the MS’s service profile information.
- n. The VLR sends a `qualreq` to the Border MSC, including the MS’s service profile information. The Border MSC-1 then assigns the MS to a voice/traffic channel and allocates a TLDN. The Border MSC further confirms the MS’s presence (e.g., via SAT detection, through a voice channel audit, or both).
If the MS is authentication capable, optionally authenticate it using a control channel (see Part 310), or a voice channel (see Part 310).
- o. When the Border MSC-1 assigns the MS to a voice/traffic channel, the Border MSC-1 sends an `ispage` containing a TLDN and the MSCID of the Border MSC to the Serving MSC.
- p. Optionally, the Originating MSC sends a `RELEASE` to the Border MSC (e.g., MSC-2) that may still be paging the MS, in order to free paging resources identified per the MIN/IMSI. This `RELEASE` stops ongoing paging and frees related resources.
- q. The Border MSC-2 responds with a `release`, in replacement of the `ispage`.
- r. The Serving MSC returns a `routreq` to the Serving VLR with the TLDN contained in the `ispage` and the MSCID of the Border MSC.
- s. The Serving VLR returns the `routreq` to the HLR.
- t. The HLR then sends a `locreq` to the Originating MSC. The `locreq` includes routing information in the form of the `TerminationList` parameter, along with an indication of the reason for extending the incoming call (i.e., for CD) in the `DMH_RedirectionIndicator` parameter.
- u. After responding to the `ISPAGE`, the Border MSC sends a `REGNOT` to the Border VLR.
- v. The Border VLR sends a `REGNOT` to the HLR.
- w. The HLR cancels the registration at the visited serving system by sending a `REGCANC` to the Serving VLR.
- x. The Serving VLR sends a `REGCANC` to the Serving MSC.
- y. The Serving MSC returns a `regcanc` to the Serving VLR.
- z. The Serving VLR returns a `regcanc` to the HLR.
- aa. The HLR returns a `regnot` to the Border VLR.
- ab. The Border VLR returns a `regnot` to the Border MSC.
- ac. The Originating MSC establishes a voice path to the Border MSC using existing interconnection protocols (e.g., SS7) and the routing information specified in the `locreq`.
Note: If the Border MSC must initiate call redirection, the `REDREQ` is sent from the Border MSC to the Originating MSC.

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