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Technical Specification

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Universal Mobile Telecommunications System (UMTS);
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Foreword

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Contents

Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

The present document defines the stage 2 of the Call Forwarding (CF) supplementary services for the 3GPP system.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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0 Scope

The present document gives the stage 2 description of the call forwarding supplementary services.

The group of supplementary services call offering supplementary services is divided into 4 different supplementary services:

-   Call forwarding unconditional   (CFU)   (clause 1);

-   Call forwarding on mobile subscriber busy   (CFB)   (clause 2);

-   Call forwarding on no reply   (CFNRy)   (clause 3);

-   Call forwarding on mobile subscriber not reachable   (CFNRc)   (clause 4).

0.1 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

-   References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

-   For a specific reference, subsequent revisions do not apply.

-   For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3GPP TR 21.905: "Vocabulary for 3GPP specifications".

[2]   3GPP TS 22.004: "General on supplementary services".

[3]   3GPP TS 22.082: "Digital cellular telecommunications system (Phase 2+); Call Forwarding (CF) Supplementary Services - Stage 1".

[4]   3GPP TS 23.011: "Technical realization of Supplementary Services".

[5]   3GPP TS 23.015: "Technical realisation of Operator Determined Barring (ODB)".

[6]   3GPP TS 22.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL); Service description, Stage 1".

[7]   3GPP TS 23.018: "Basic Call Handling; Technical ealization".

[8]   3GPP TS 23.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3 – Stage 2".

[9]   3GPP TS 23.079: "Support of Optional Routeing (SOR); Technical realization".

[10]   3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[11]   3GPP TS 23.093: "Completion of Calls to Busy Subscriber (CCBS) ; Stage2".

0.2 Abbreviations

For the purposes of the present document, the abbreviations defined in 3G TR 21.905 apply.

0.3   The forwarded-to number

As indicated in 3GPP TS 22.082 the forwarded-to numbers are stored in the international format.

If according to 3GPP TS 22.082 the served subscriber is provided with a Translation Information Flag (TIF-CSI) then the HPLMN shall treat the forwarded-to number transparently at the time of registration, i.e. not perform any checks or translations. In this case the forwarded-to number shall be stored in the format as it was received from the MS.

Therefore, if transferred, the forwarded-to number is transferred from the HLR to other network entities and stored in the VLR always in the format as stored in the HLR..

0.4   Cross phase compatibility

For the following supplementary services, a number of changes exist between the present document and the Phase 1 specification:

- Call forwarding unconditional;

- Call forwarding on mobile subscriber busy;

- Call forwarding on no reply;

- Call forwarding on mobile subscriber not reachable.

The main body of the present document assumes that all network entities comply with this version of the service. In each case an additional clause (clause x.6) defines the additional requirements for when one or more network entities or the MS complies with the Phase 1 specifications for the supplementary service procedures.

0.5   Support of Long Forwarded-to Numbers

For the following supplementary services, it shall be possible to register a long forwarded-to number which was not possible in previous versions of the services:

- Call forwarding unconditional;

- Call forwarding on mobile subscriber busy;

- Call forwarding on no reply;

- Call forwarding on mobile subscriber not reachable.

The main body of the present document assumes that all network entities comply with this version of the service. In each case an additional clause (clause x.10) defines the additional requirements when one or more network entities and/or the mobile station does not support Long Forwarded-to Numbers.

The functionality specified in this document does not imply any constraint on the length of a forwarded to number, except where such a constraint is explicitly stated.

0.6   Data stored in the HLR for all call forwarding services

The following data are stored in the HLR in common for all call forwarding services:

- The "notification to CSE flag". This flag applies for all call forwarding services. When the data for any Call Forwarding are changed, the HLR checks this flag. If the flag is set, the change is reported to the gsmSCF(s) defined by the gsmSCF address list. See 3GPP TS 23.078.

- The "gsmSCF address list", which is a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list applies to all call forwarding services. See 3GPP TS 23.078.

1 Call forwarding unconditional (CFU)

1.1 Handling of call forwarding unconditional

1.1.1 Registration

At the beginning of registration subscription to the basic service, provision of the supplementary service and sufficiency of registration information has to be checked (see figure 1.2).

The following information has to be registered in the network:

1) the forwarded-to number (possibly including a sub-address);

2) information as to whether all calls or all calls of a specific basic service group should be forwarded.

The basic service group code

If the registration request received by the HLR does not contain any basic service group code, the registration shall be performed for all subscribed basic service groups for which CFU is provided, see figure 1.2.

The forwarded-to number

If the forwarded-to number is a number in the HPLMN country, it may be entered by the served mobile subscriber in three different formats, independent of his actual location, according to the schemes:

1) national (significant) number;

2) (trunk) prefix plus national (significant) number;

3) international prefix, country code, national (significant) number.

The received number may have to be converted to an international number before further processing.

The network may also validate the forwarded-to number before accepting the call forwarding registration request.

If a served mobile subscriber is provided with the Translation Information Flag (TIF-CSI) as part of the CAMEL subscriber data (refer to TS 23.078), the network shall accept and store the forwarded-to number transparently at the time of registration. In this case the network shall neither convert nor validate the received number. Therefore the forwarded-to number may not comply with the schemes indicated above.

For further details related to the handling of the forwarded-to number refer to figure 1.2.

Supplementary Service interaction

Possible interaction situations between CFU and other call forwarding and barring supplementary services must then be checked. This is described in figure 1.2. Also see technical specifications 3GPP TS 22.004 and 3GPP TS 22.082. For interaction between CFU and other supplementary services (ie not call barring or call forwarding services), the reader is referred to the respective technical specification for those supplementary services.

Interaction with CAMEL Phase 2 or higher

Possible interaction between CFU and CAMEL Phase 2 or higher is described in figure 1.2. If CAMEL Phase 2 or higher is not supported in the HLR, processing continues from the "No" exit of the test "Result=Pass".

Notifications to the subscriber

When the mobile subscriber registers CFU, the network shall attempt to register and activate the service. The network will return notification of acceptance of the request. This notification will include the forwarded-to number and possibly the basic service group code to which CFU is registered.

If the system cannot accept a registration request, the network sends a notification that CFU registration was not successful to the served mobile subscriber.

The information flow for registration of CFU is shown in figure 1.1.

```
    MS              MSC             VLR             HLR
   _____           _____           _____           _____
  |   |           |   |           |   |           |   |
  |   | Register CFU|   |           |   |           |   |
  |   |--------------->|   |           |   |           |   |
  |   |           |   | Register CFU|   |           |   |
  |   |           |   |----------->|   |           |   |
  |   |           |   |           |   | Register CFU|   |
  |   |           |   |           |   |----------->|   |
  |   |           |   |           |   | Acknowledge|CFU1|
  |   |           |   |           |   |<-----------|   |
  |   |           |   | Acknowledge|   |           |   |
  |   |           |   |<-----------|   |           |   |
  |   | Release complete|   |           |   |           |   |
  |   |<---------------|   |           |   |           |   |
  |   |   \Facility  |   |           |   |           |   |
  |   |           |   |           |   |           |   |
```
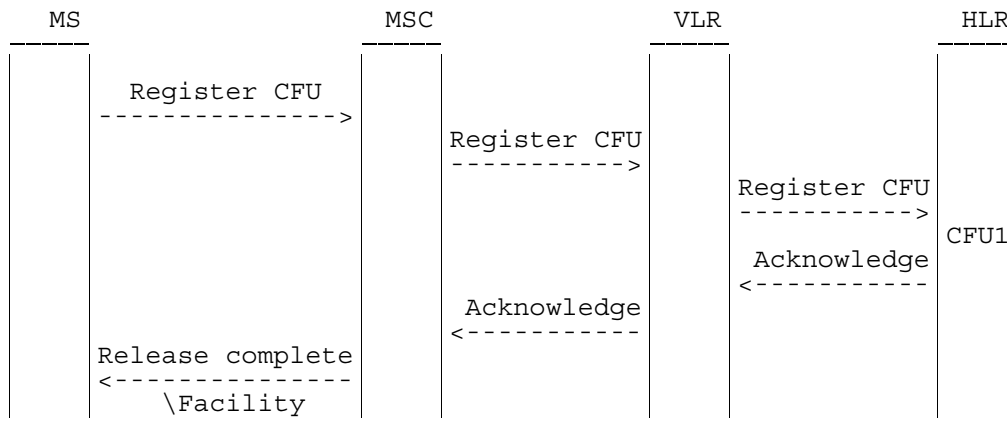
Figure 1.1: Registration of call forwarding unconditional
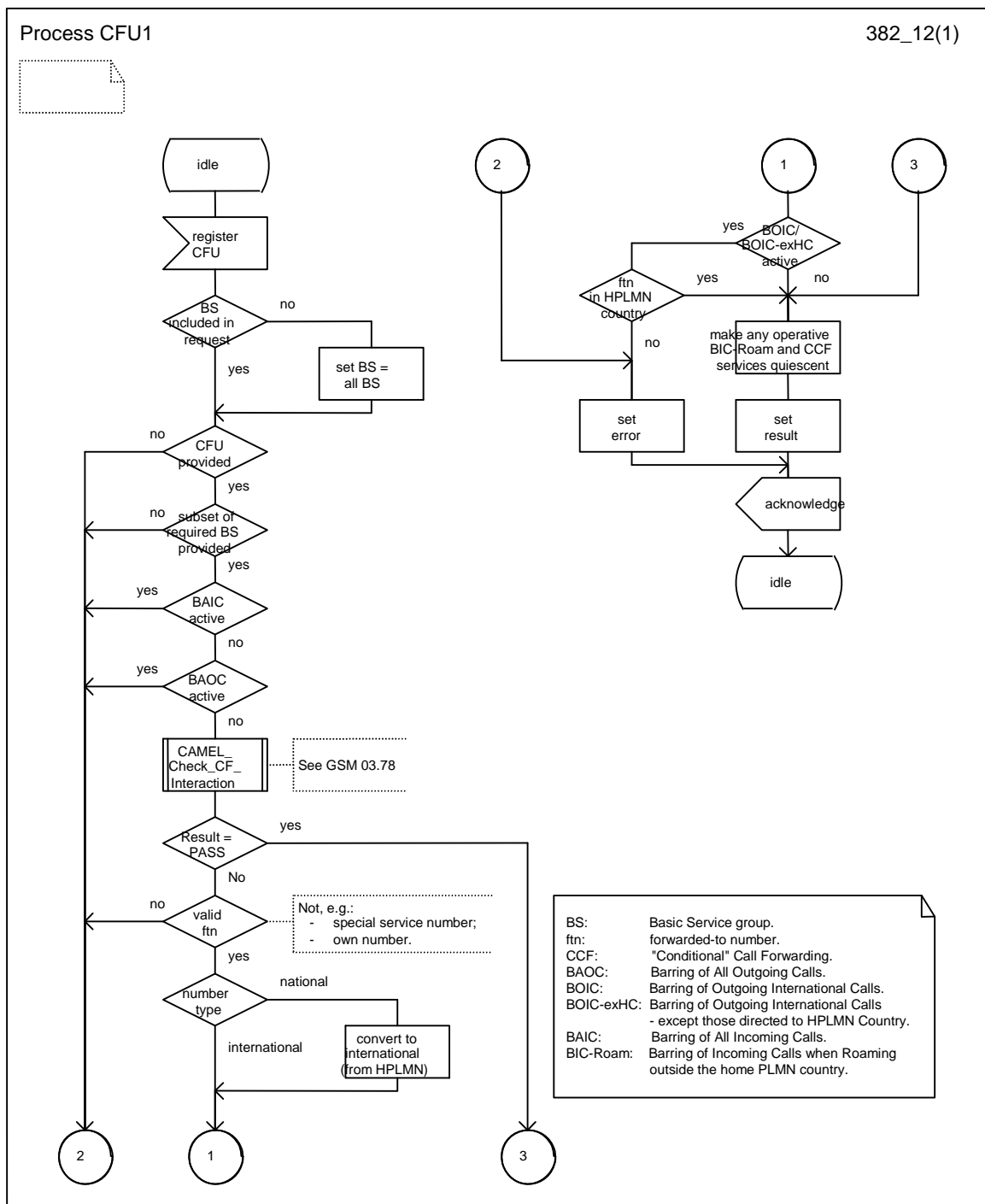
Figure 1.2: CFU1 Call forwarding unconditional registration process

1.1.2 Erasure

A previous registration can be erased in either of the following three ways:

- the subscriber can specifically erase a previous registration (to a basic service group) with an appropriate control procedure;

- the subscriber can register information for CFU (to a basic service group), thus causing previous registrations of CFU to be overridden (in the network this shall be handled as an erasure immediately followed by a registration);

- all information is erased as a result of withdrawal of the supplementary service (administrative handling).

The basic service group code

If the erasure request received by the HLR does not contain any basic service group code, the erasure request applies for all basic service groups for which CFU is registered. See figure 1.4.

Supplementary Service interaction

Possible interaction situations between CFU and other supplementary services must then be checked. This is shown in figure 1.4. Also see technical specifications 3GPP TS 22.004 and 3GPP TS 22.082. For interaction between CFU and other supplementary services (ie not call barring or call forwarding services), the reader is referred to the respective technical specification for those supplementary services.

Notifications to the subscriber

When the mobile subscriber erases CFU, the network shall attempt to erase (and thus deactivate) the service. The network shall send an indication of acceptance or rejection of the erasure request to the served mobile station.

The information flow for erasure of CFU is shown in figure 1.3.

```
     MS               MSC              VLR              HLR
   _____           _____           _____           _____
  |      |          |     |          |     |          |     |
  |      |Erase CFU |     |          |     |          |     |
  |      |--------------->|     |    |     |          |     |
  |      |          |     |Erase CFU|     |          |     |
  |      |          |     |---------->|    |          |     |
  |      |          |     |          |    |Erase CFU  |     |
  |      |          |     |          |    |----------->|    |
  |      |          |     |          |    |            |CFU2|
  |      |Release complete|     |    |    |Acknowledge |    |
  |      |<---------------|     |Acknowledge|<-----------|  |
  |      |    \Facility   |     |<----------|    |       |  |
  |      |          |     |          |    |           |     |
  |_____|          |_____|          |____|          |_____|
```
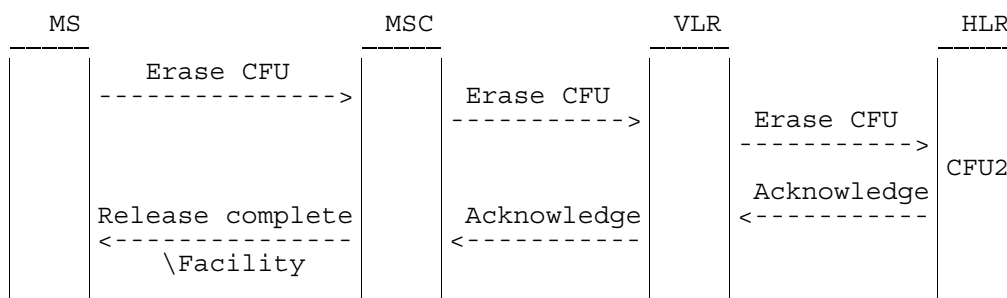
Figure 1.3: Erasure of call forwarding unconditional
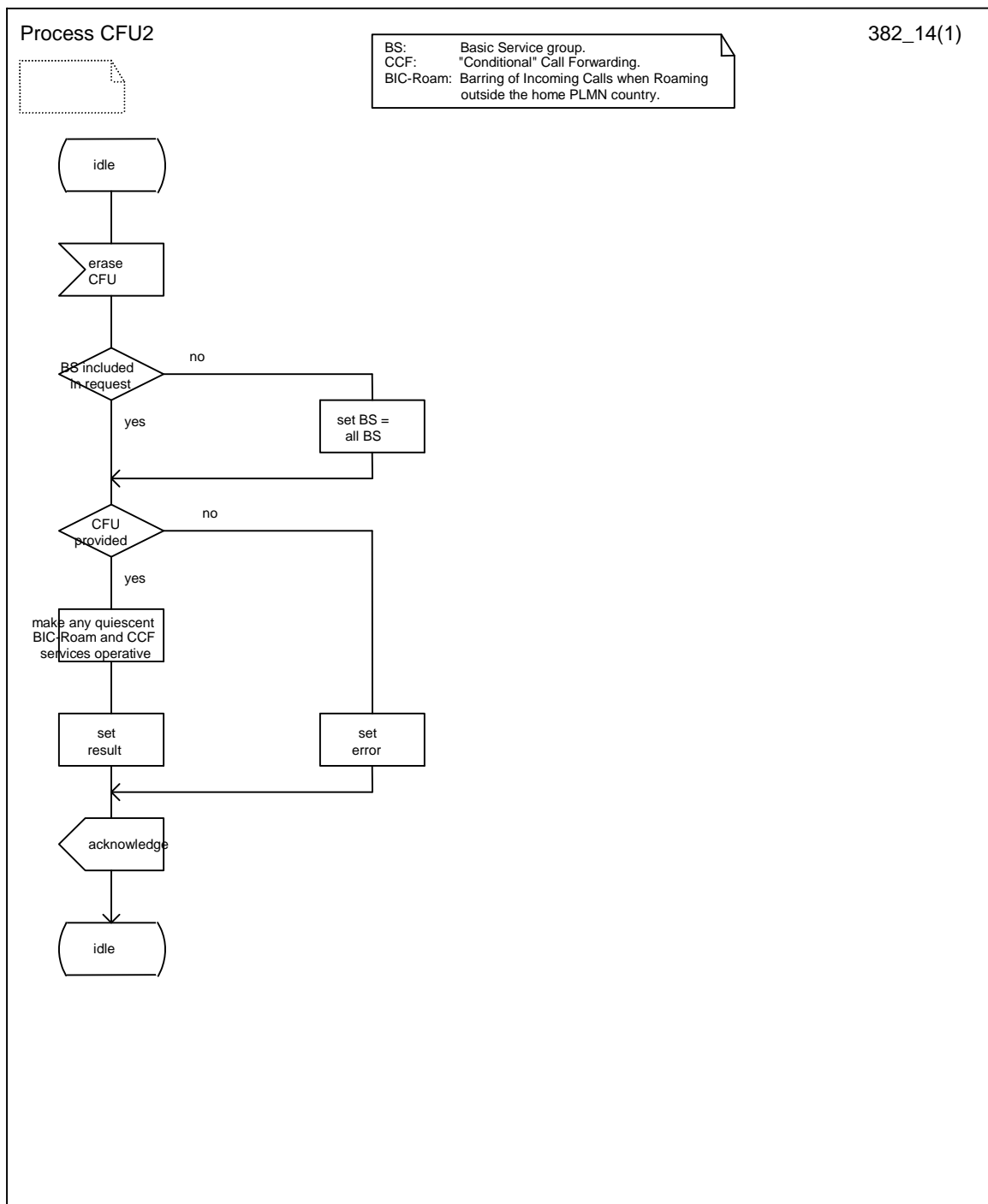
Figure 1.4: CFU2 Call forwarding unconditional erasure process

1.1.3   Activation

The network initially checks subscription to the basic service and registration status of the supplementary service, see figure 1.6.

Possible interaction situations between CFU and other supplementary services must then be checked. The SDL diagrams in figure 1.6 shows the function to be performed in the HLR in order to deal with the interactions between CFU and the call restriction and conditional call forwarding services. Also see 3GPP TS 22.004 and 3GPP TS 22.082. For interaction between CFU and other supplementary services (ie not call barring or call forwarding services), the reader is referred to the respective technical specification for those supplementary services.

The Basic Service Group Code

If the activation request received by the HLR doesn't contain any basic service group code, the activation request shall apply to all subscribed basic service groups against which a CFU forwarded-to number is registered. If a forwarded-to number is not registered against even a subset of the required basic service group, the request will be rejected.

Note that according to 3GPP TS 22.004, a request for activation shall still be accepted although the CFU supplementary service was already active for all basic service groups.

Notification to the subscriber

The network will return notification of acceptance, partial acceptance or rejection of the request to the mobile station.

The information flow for activation of CFU is shown in figure 1.5.

```
   MS                  MSC                 VLR                 HLR
  ----                -----               -----               -----
   |   Activate CFU    |                   |                   |
   |------------------>|   Activate CFU    |                   |
   |                   |------------------>|   Activate CFU    |
   |                   |                   |------------------>|
   |                   |                   |                   | CFU3
   |                   |                   |   Acknowledge     |
   |                   |                   |<------------------|
   |                   |   Acknowledge     |                   |
   | Release complete  |<------------------|                   |
   |<------------------|                   |                   |
   |      \Facility    |                   |                   |
```
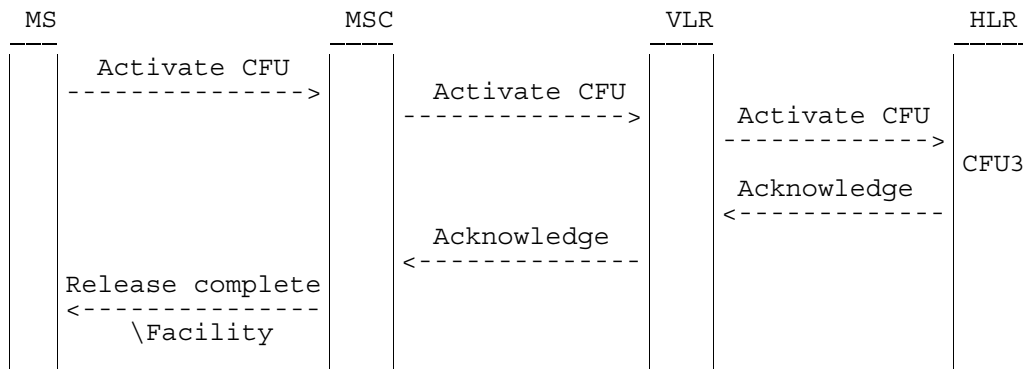
Figure 1.5: Activation of call forwarding unconditional

Process CFU3 382_16(1)

CCF: "Conditional" Call Forwarding.
BS: Basic Service group.
ftn: forwarded-to number.
BAIC: Barring of All Incoming Calls.
BAOC: Barring of All Outgoing Calls.
BOIC: Barring of Outgoing International Calls.
BOIC-exHC: Barring of Outgoing International Calls - except
those directed to HPLMN Country.

idle

activate
CFU

CFU registered
for required BS — no

yes

BAIC
active — yes

no

BAOC
active — yes

no

BOIC/
BOIC-exHC
active — yes

no

ftn in
HPLMN country — yes

no

make any operative
BIC-Roam and CCF services
quiescent

set
result

set
error

set
error

acknowledge

idle

Figure 1.6: CFU3 Call forwarding unconditional activation process

1.1.4   Deactivation

The previous activation can be deactivated in either of the following three ways:

- the subscriber can specifically deactivate a previous activation (to a basic service group) with an appropriate control procedure;

- the subscriber can register information for CFU (to a basic service group), thus causing previous registrations and activations of CFU to be overridden (this shall be handled in the same way as an erasure (implying deactivation) immediately followed by a registration (implying activation));

- the service is deactivated as a result of withdrawal of the supplementary service (administrative handling).

Possible interaction situations between CFU and other supplementary services must be checked. The SDL diagram in figure 1.8 shows the function to be performed in the HLR in order to deal with the possible interactions between CFU and the conditional call forwarding services.

The Basic Service Group Code

The CFU deactivation request may specify a basic service group for which deactivation is required. If the deactivation request received by the HLR doesn't contain any basic service group code, the deactivation request shall apply to all basic services for which CFU is active, see figure 1.8.

If the deactivation request received by the HLR contains a basic service group code, only information related to the specified basic service group(s) is affected. Note that according to 3GPP TS 22.004, a request for deactivation shall still be accepted even if the CFU supplementary service was already deactive for all basic service groups.

The user shall receive a notification of acceptance or rejection of the CFU deactivation request.

The information flow for deactivation of call forwarding unconditional is shown in figure 1.7.

```
     MS                    MSC                   VLR                  HLR
     ───                   ────                  ────                 ─────
      │Deactivate CFU       │                     │                    │
      │--------------->     │Deactivate CFU       │                    │
      │                     │------------->       │Deactivate CFU      │
      │                     │                     │------------->      │
      │                     │                     │                    │CFU4
      │                     │                     │  Acknowledge       │
      │Release complete     │  Acknowledge        │<-------------      │
      │<--------------      │<-------------       │                    │
      │     \Facility       │                     │                    │
```
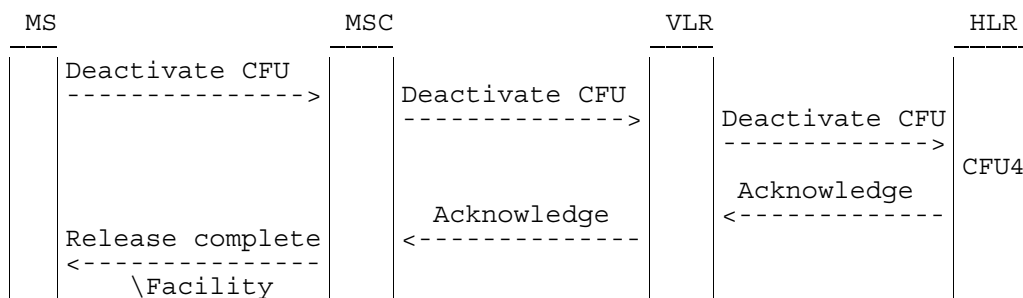
Figure 1.7: Deactivation of call forwarding unconditional

Process CFU4   382_18(1)

BS: Basic Service group.
BIC-Roam: Barring of Incoming Calls when
           Roaming outside the home PLMN country.

idle

deactivate
CFU

BS
included
in request   — no →   set BS =
                                all BS

yes

no ←   CFU
        active for
        subset BS

yes

BIC-Roam or
conditional forwarding   — no →
quiescent

yes

make quiescent
services
operative

set   set
error   result

acknowledge

idle
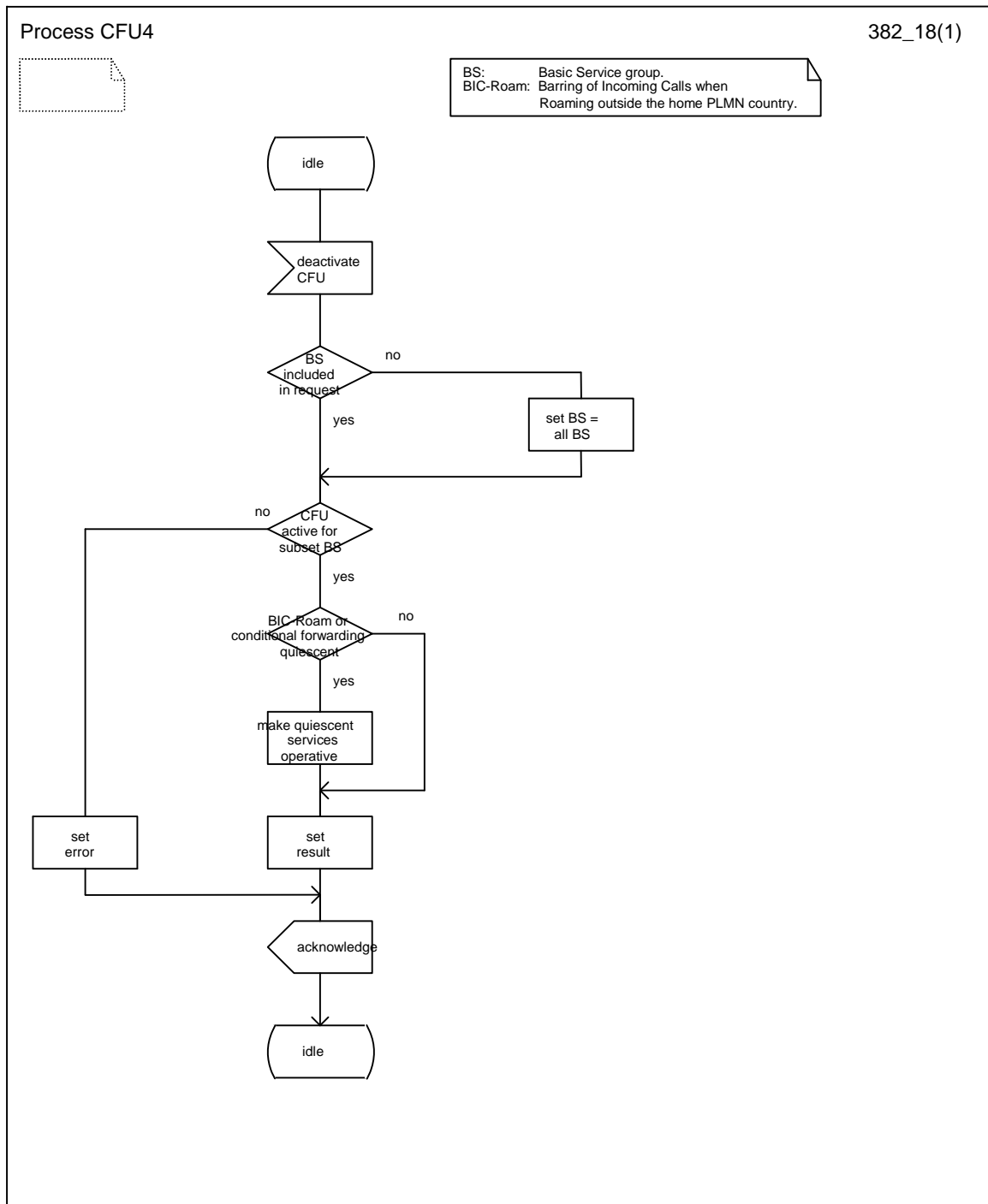
Figure 1.8: CFU4 Call forwarding unconditional deactivation process

1.1.5   Interrogation

Data request

The data request procedure enables the mobile subscriber to obtain information about the data stored in the PLMN. Interrogation of CFU is handled by the HLR which returns the required information or error to the MS, see figure 1.9.

```
    MS                 MSC                VLR                HLR
    ┬                   ┬                  ┬                  ┬
    │ Interrogate CFU   │                  │                  │
    │ -------------->   │                  │                  │
    │                   │ Interrogate CFU  │                  │
    │                   │ -------------->  │                  │
    │                   │                  │ Interrogate CFU  │
    │                   │                  │ -------------->  │
    │                   │                  │   Acknowledge    │
    │                   │                  │ <-------------   │
    │ Release complete  │   Acknowledge    │                  │
    │ <--------------   │ <-------------   │                  │
    │      \Facility    │                  │                  │
    ┴                   ┴                  ┴                  ┴
```
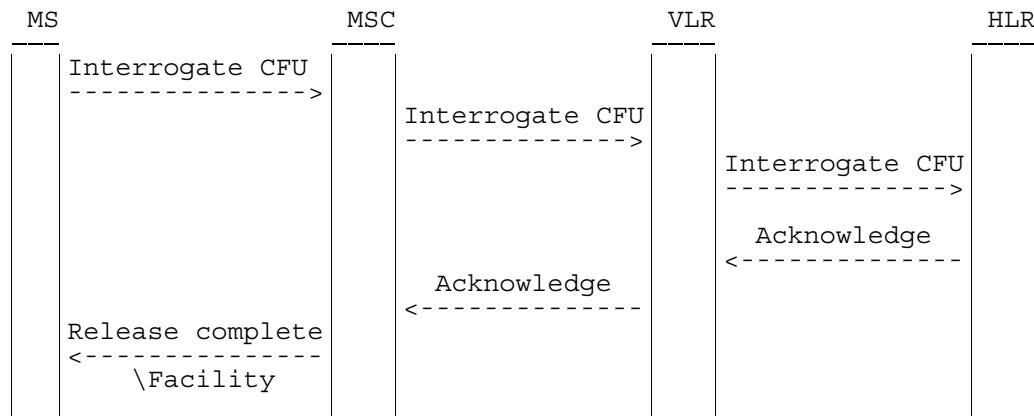
Figure 1.9: Interrogation of call forwarding unconditional

1.2   Functions and information flows

The following Mobile Additional Function has been identified for the PLMN:

MAF007

Call forwarding unconditional authorizations examination

The ability of a PLMN component to determine the authorizations relating to CFU.

See figure 1.10.

Location: HLR.

The information flow for call forwarding unconditional is shown in figure 1.11.

Process MAF007 382_1A(1)

```
                                 ┌─────────┐
                                 │  idle   │
                                 └────┬────┘
                                      │
                                ┌─────┴─────┐
                                │ initiate  │
                                │ handling  │
                                │  of CFU   │
                                └─────┬─────┘
                                      │
                                    ╱ active ╲         no
                                   ╱  for this ╲──────────────────────────┐
                                   ╲    BS     ╱                          │
                                    ╲        ╱                            │
                                      │ yes                               │
                           yes      ╱ number ╲                           │
              ┌────────────────────╱ of forwardings ╲                    │
              │                    ╲   reached      ╱                    │
              │                     ╲            ╱                       │
              │                        │ no                             │
              │                ┌───────┴──────────┐                     │
              │                │ increment counter│                     │
              │                │get forwarded-to number│                │
              │                │set forwarding cause=CFU│               │
              │                └───────┬──────────┘                     │
              │                        │                                │
              │                    ╱notification╲    yes                │
              │                   ╱ to calling   ╲──────────┐           │
              │                   ╲ subscriber   ╱          │           │
              │                    ╲          ╱             │           │
              │                        │ no          ┌──────┴──────┐    │
              │                        │             │set indicator=│    │
              │                        │             │notify calling│    │
              │                        │             │ subscriber'  │    │
              │                        │             └──────┬──────┘    │
              │                        │◄───────────────────┘           │
              │                    ╱served subscribers╲  yes            │
              │                   ╱ MSISDN can be      ╲──────┐         │
              │                   ╲   presented       ╱       │         │
              │                    ╲              ╱           │         │
              │                        │ no                   │         │
    ┌─────────┴──┐     ┌───────────────┴───┐   ┌──────────────┴──┐  ┌───┴──────────┐
    │    set     │     │ set redirecting   │   │ set redirecting │  │set indicator=│
    │   error    │     │ presentation =    │   │ presentation =  │  │  'set up     │
    │            │     │   restricted      │   │    allowed      │  │ normal call' │
    └─────────┬──┘     └───────────────┬───┘   └──────────────┬──┘  └───┬──────────┘
              │                        │                      │         │
              └────────────────────────┼──────────────────────┴─────────┘
                                       │
                                 ┌─────┴─────┐
                                 │ continue  │
                                 │   call    │
                                 │ handling  │
                                 └─────┬─────┘
                                       │
                                 ┌─────┴────┐
                                 │   idle   │          ┌──────────────────────┐
                                 └──────────┘          │ BS : Basic Service   │
                                                       │       group.         │
                                                       └──────────────────────┘
```

Figure 1.10: MAF007 Call forwarding unconditional authorisations examination (HLR)

```
  MSa/TEa            GMSC              HLRb            MSCb             LEc ß
 ‾‾‾‾‾‾‾‾           ‾‾‾‾‾             ‾‾‾‾‾           ‾‾‾‾‾            ‾‾‾‾‾
    |                 |                 |               |                |
    |     Set-up      |                 |               |                |
    |- - - - - - - - >|                 |               |                |
    |                 |  Info request   |               |                |
    |                 |- - - - - - - - >|               |                |
    |                 |   Info ack      | MAF007        |                |
    |                 |< - - - - - - - -|               |                |
    |                 |        Set-up   |               |                |
    |          OR1:N  |- - - - - - - - - - - - - - - - >|                |
    |                 |        Set-up   |               |                |
    |          OR1:Y  |- - - - - - - - - - - - - - - - - - - - - - - - >|
    |  Notification   |                 |               |                |
    |< - - - - - - - -| OR2:Y           |               |                |
    |                 |                 |               |                |
```

```
  MSa/TEa            GMSC              HLRb            MSCb    HLRc      SCcß
 ‾‾‾‾‾‾‾‾           ‾‾‾‾‾             ‾‾‾‾‾           ‾‾‾‾    ‾‾‾‾      ‾‾‾‾
    |                 |                 |               |      |         |
    |     Set-up      |                 |               |      |         |
    |- - - - - - - - >|                 |               |      |         |
    |                 |  Info request   |               |      |         |
    |                 |- - - - - - - - >|               |      |         |
    |                 |   Info ack      | MAF007        |      |         |
    |                 |< - - - - - - - -|               |      |         |
    |                 |        Set-up   |               |      |         |
    |          OR1:N  |- - - - - - - - - - - - - - - - >|      |         |
    |                 |  Information request             |     |         |
    |          OR1:Y  |- - - - - - - - - - - - - - - - - - - - - - >|    |
    |                 |  Information acknowledge         |     |         |
    |                 |< - - - - - - - - - - - - - - - - - - - - - -|    |
    |                 |        Set-up   |               |      |         |
    |                 |- - - - - - - - - - - - - - - - - - - - - - - - >|
    |  Notification   |                 |               |      |         |
    |< - - - - - - - -| OR2:Y           |               |      |         |
    |                 |                 |               |      |         |
```

NOTE: info: information   Y: Yes
        req: request   N: No
        ack: acknowledge
        OR1:   Forwarding requested
        OR2:   Notification to calling subscriber required

Figure 1.11: Information flow for call forwarding unconditional

1.3 Information stored in the HLR

**The following logical states are applicable for CFU
(refer to 3GPP TS 23.011 for an explanation of the notation):**

Provisioning State	Registration State	Activation State	HLR Induction State
(Not Provisioned,	Not Registered,	Not Active,	Not Induced)
(Provisioned,	Not Registered,	Not Active,	Not Induced)
(Provisioned,	Registered,	Not Active,	Not Induced)
(Provisioned,	Registered,	Active and Quiescent,	Not Induced)
(Provisioned,	Registered,	Active and Operative,	Not Induced)

The registration and activation state may be different for each applicable elementary basic service group.

The provisioning state shall be on a per subscriber basis, and hence the same for all basic service groups.

The HLR shall store:

- the state of CFU (which shall be one of the valid states listed above) for each applicable elementary basic service group;

- the subscription option "notification to the calling party" on a per subscriber basis;

  This subscription option takes one of the following values:

  - no notification;

  - notification.

- the subscription option "MSISDN of the served subscriber can be presented to the forwarded-to subscriber" on a per subscriber basis;

  This subscription option takes one of the following values:

  - presentation restricted;

  - presentation allowed.

- the registration parameter "forwarded-to number" (possibly including a forwarded-to sub-address) for each applicable elementary basic service group.

- the default forwarded-to number (containing less than 16 digits) for each applicable elementary basic service group.

Note that the value "Active and Quiescent" of the activation state is required in case of interaction with Operator Determined Barring (see 3GPP TS 23.015).

1.4 State transition model

The following figure shows the successful cases of transition between the applicable logical states of CFU. The state changes are either caused by actions of the service provider, the mobile user or the network.

Note that error cases are not shown in the diagram as they normally do not cause a state change. Additionally, some successful requests may not cause a state change. Hence, they are not shown in the diagram.

The diagram only shows operations on an elementary basic service group.
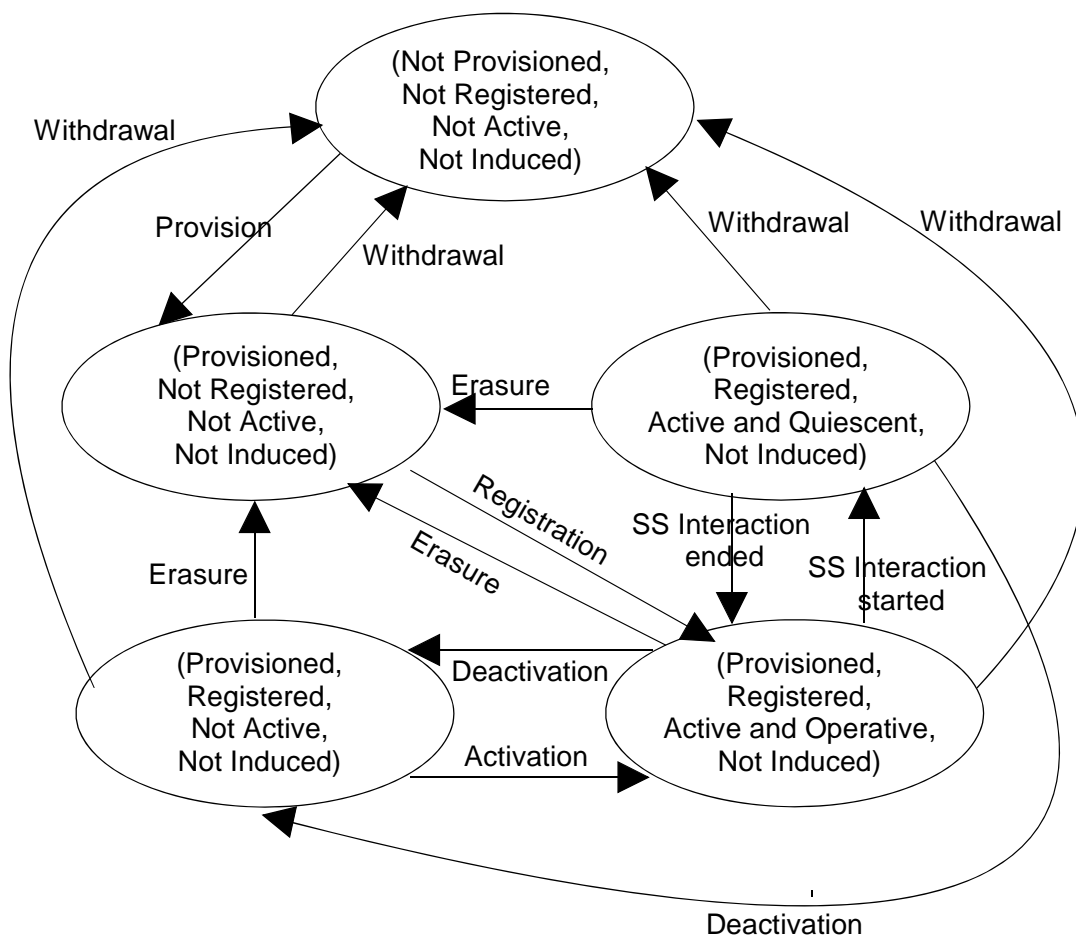
Figure 1.12: State transition model for CFU

1.5 Transfer of information from HLR to VLR

If the provisioning state for CFU is "Provisioned" then, when the subscriber registers on a VLR, the HLR shall send that VLR information about the logical state of CFU for all relevant elementary basic service groups.

If the logical state of CFU is changed while a subscriber is registered on a VLR then for the affected basic service groups, the HLR shall inform the VLR of the new logical state of CFU.

1.6 Information stored in the VLR

For CFU the VLR shall store the service state information received from the HLR for all relevant elementary basic service groups.

1.7 Handover

Handover will have no impact on the control procedure and the operation of the service.

1.8 Cross phase compatibility

1.8.1 MS, MSC, VLR or HLR only support Phase 1 control of SS by the subscriber

In response to a CFU interrogation request, if the MS or any network element involved is of Phase 1, only information concerning basic service groups for which the activation state has the value "Active and Operative" will be returned. This means, for example, that the subscriber will not be aware that the forwarded to number is registered if CFU is deactivated. A subaddress (if registered) will not be included in the response.

Note that if any network element involved is of Phase 1, CFU Registration requests which use a subaddress and all CFU Activation and Deactivation requests will be rejected, as these are not specified in Phase 1.

1.8.2 HLR only supports Phase 1 updating of subscriber information

The VLR shall ignore the subscription option "notification to the calling party" and the registration parameter "forwarded to number" when received from a Phase 1 HLR.

If the VLR receives the SS-Status parameter from a Phase 1 HLR it shall act if it has received the SS-Status parameter with the values shown in the following:

1) Activated   => A bit = 1, Q bit = 0;

2) Deactivated   => A bit = 0, Q bit = 0 or 1

1.8.3 VLR only supports Phase 1 updating of subscriber information

When passing CFU information to a Phase 1 VLR, the HLR shall send the service state information in a form which the VLR can accept, based on the logical state held in the HLR, as follows:

1) (Provisioned, Not Registered, Not Active, Not Induced)

    => Erased, Deactivated;

2) (Provisioned, Registered, Not Active, Not Induced)

    => Registered, Deactivated;

3) (Provisioned, Registered, Active and Operative, Not Induced)

    => Registered, Activated;

4) (Provisioned, Registered, Active and Quiescent, Not Induced)

    => Registered, Deactivated.

The HLR shall not pass a subaddress to a Phase 1 VLR.

1.8.4 GMSC only supports Phase 1 call handling

When a call is forwarded unconditionally, the HLR shall not pass the subaddress to a Phase 1 GMSC. Calls shall be forwarded without the subaddress.

1.8.5 GMSC does not support CAMEL or supports CAMEL Phase 1 only

If the activation state of CFU is "Active and Operative" and if the forwarded-to number is registered in a format other than international and if the GMSC does not support CAMEL or supports CAMEL Phase 1 only, then when a request for routeing information for a mobile terminated call is received in the HLR, CFU shall not be invoked, i.e. the mobile terminated call establishment will be continued towards the served mobile subscriber.

1.9 Contents of Messages

1.9.1 Messages on the C interface (MSC-HLR)

1.9.1.1 Send Routing Info

This message is specified in 3GPP TS 23.018.

**Send Routing Info contains the following IE
specific to Long Forwarded-to Numbers:**

Information element name	Required	Description
Long FTN supported	C	Shall be present if the GMSC supports Long Forwarded-to Numbers; otherwise shall be absent.

1.9.1.2 Send Routing Info ack

This message is specified in 3GPP TS 23.018.

**Send Routing Info ack contains the following amendment to the Forwarded-
to number IE and an additional IE specific to Long Forwarded-to Numbers:**

Information element name	Required	Description
Forwarded-to number	C	E.164 number of the C subscriber. Shall be present if the HLR has determined that the call is to be forwarded and at least one of the HLR and GMSC does not support Long Forwarded-to Numbers; otherwise shall be absent.
Long forwarded-to number	C	Number of the C subscriber. Shall be present if the HLR has determined that the call is to be forwarded and Long Forwarded-to Numbers are supported by the HLR and the GMSC; otherwise shall be absent.

1.9.2 Messages on the Um, B and D interfaces (MS – network)

1.9.2.1 RegisterSS

**This message corresponds to the MAP_REGISTER_SS service
specified in 3GPP TS 29.002.**

Information element name	Required	Description
Long FTN supported	C	Shall be present if the MS supports Long Forwarded-to Numbers; otherwise shall be absent.

1.9.2.2 ActivateSS

**This message corresponds to the MAP_ACTIVATE_SS service
specified in 3GPP TS 29.002.**

Information element name	Required	Description
Long FTN supported	C	Shall be present if the MS supports Long Forwarded-to Numbers; otherwise shall be absent.

1.9.2.3 InterrogateSS

**This message corresponds to the MAP_INTERROGATE_SS service
specified in 3GPP TS 29.002.**

Information element name	Required	Description
Long FTN supported	C	Shall be present if the MS supports Long Forwarded-to Numbers; otherwise shall be absent.

1.9.3 Information flows on the J interface (HLR – gsmSCF)

1.9.3.1 Any Time Subscription Interrogation

This IF is specified in 3GPP TS 23.078.

**Any Time Subscription Interrogation contains
the following IE specific to Long Forwarded-to Numbers:**

Information element name	Required	Description
Long FTN supported	C	Shall be present if the gsmSCF supports Long Forwarded-to Numbers; otherwise shall be absent.

1.9.3.2 Any Time Subscription Interrogation ack

This IF is specified in 3GPP TS 23.078.

**The Call forwarding SS data IE within the Any Time Subscription Interrogation ack IF contains the
following amendment to the Forwarded-to number IE and an additional IE specific to Long
Forwarded-to Numbers:**

Information element name	Required	Description
Forwarded-to number	C	Shall be present if at least one of the HLR and the gsmSCF does not support Long Forwarded-to Numbers; otherwise shall be absent.
Long forwarded-to number	C	Shall be present if the HLR and the gsmSCF support Long Forwarded-to Numbers; otherwise shall be absent.

1.9.3.3 Any Time Modification

This IF is specified in 3GPP TS 23.078.

Any Time Modification contains the following IE specific to Long Forwarded-to Numbers:

Information element name	Required	Description
Long FTN supported	C	Shall be present if the gsmSCF supports Long Forwarded-to Numbers; otherwise shall be absent.

1.9.3.4 Any Time Modification ack

This IF is specified in 3GPP TS 23.078.

The Call forwarding SS data IE within the Any Time Modification ack IF contains the following amendment to the Forwarded-to number IE and an additional IE specific to Long Forwarded-to Numbers.

Information element name	Required	Description
Forwarded-to number	C	Shall be present if at least one of the HLR and the gsmSCF does not support Long Forwarded-to Numbers; otherwise shall be absent.
Long forwarded-to number	C	Shall be present if the HLR and the gsmSCF support Long Forwarded-to Numbers; otherwise shall be absent.

1.10   Exceptional Procedures

1.10.1   MS does not support Long Forwarded-to Numbers

The MS shall indicate whether it supports Long Forwarded-to Numbers in the RegisterSS, ActivateSS and InterrogateSS messages.

If the MS does not support Long Forwarded-to Numbers, and a long forwarded-to number is registered, the acknowledgement message shall not contain a forwarded-to number.

1.10.2   HLR does not support Long Forwarded-to Numbers

The HLR shall not allow a subscriber to register a long forwarded-to number.

1.10.3   GMSC does not support Long Forwarded-to Numbers

The HLR can determine from the Send Routing Info message whether the GMSC supports Long Forwarded-to Numbers.

If the GMSC does not support Long Forwarded-to Numbers and the HLR identifies that CFU should be invoked, then:

- If the registered forwarded-to number contains a maximum of 15 digits then the HLR shall populate the Forwarded-to number parameter in the Send Routing Info ack message with the registered forwarded-to number.

- If the registered forwarded-to number contains more than 15 digits then

    - If a default forwarded-to number (containing a maximum of 15 digits) is stored in the HLR, the HLR shall populate the Forwarded-to number parameter in the Send Routing Info ack message with the default forwarded-to number

    - Otherwise, the HLR shall instruct the GMSC to release the call.

2   Call forwarding on mobile subscriber busy

2.1   Handling of call forwarding on mobile subscriber busy

2.1.1   Registration

The same rules apply for the registration of Call Forwarding on Mobile Subscriber Busy as were described for Call Forwarding Unconditional in clause 1.1.1 above, with the exception of the checking of interaction with other supplementary services. Basic registration of information is illustrated in figure 2.2.

Supplementary Service Interaction

Possible interaction situations between CFB and other supplementary services must then be checked. This is described in figure 2.2. Also see 3GPP TS 22.004 and 3GPP TS 22.082. For interaction between CFB and other supplementary services (ie not call barring or call forwarding services), the reader is referred to the respective technical specification for those supplementary services.

Interaction with CAMEL Phase 2 or higher

Possible interaction between CFB and CAMEL Phase 2 or higher is described in figure 2.2. If CAMEL Phase 2 or higher is not supported in the HLR, processing continues from the "No" exit of the test "Result=Pass".

The information flow for registration of CFB is shown in figure 2.1.

```
        MS                    MSC                  VLR                  HLR
      ------                 ------               ------               ------
     |                      |                    |                    |
     |    Register CFB      |                    |                    |
     | ---------------->    |                    |                    |
     |                      |   Register CFB     |                    |
     |                      | ---------->        |                    |
     |                      |                    |   Register CFB     |
     |                      |                    | ---------->        |
     |                      |                    |                    | CFB1
     |                      |                    |   Acknowledge      |
     |                      |                    | <----------        |
     |                      |   Acknowledge      |                    |
     |   Release complete   | <----------        |                    |
     | <----------------    |                    |                    |
     |       \Facility      |                    |                    |
     |                      |                    |                    |
```
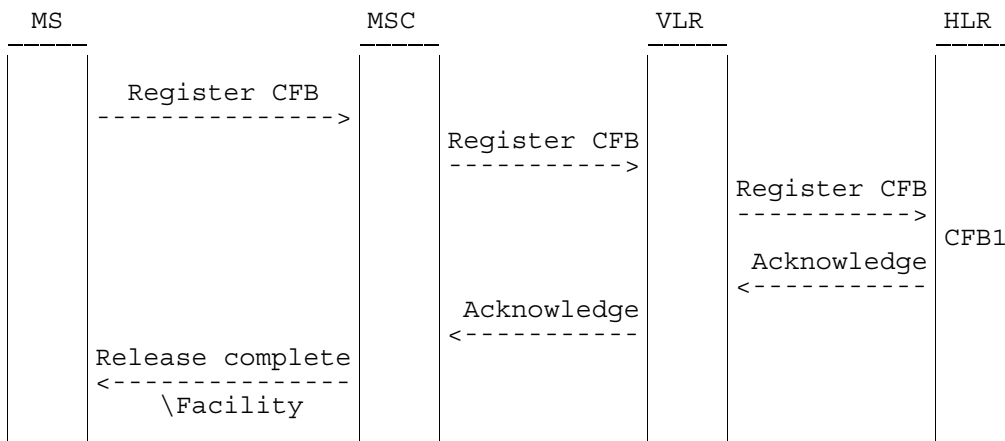
Figure 2.1: Registration of call forwarding on mobile subscriber busy
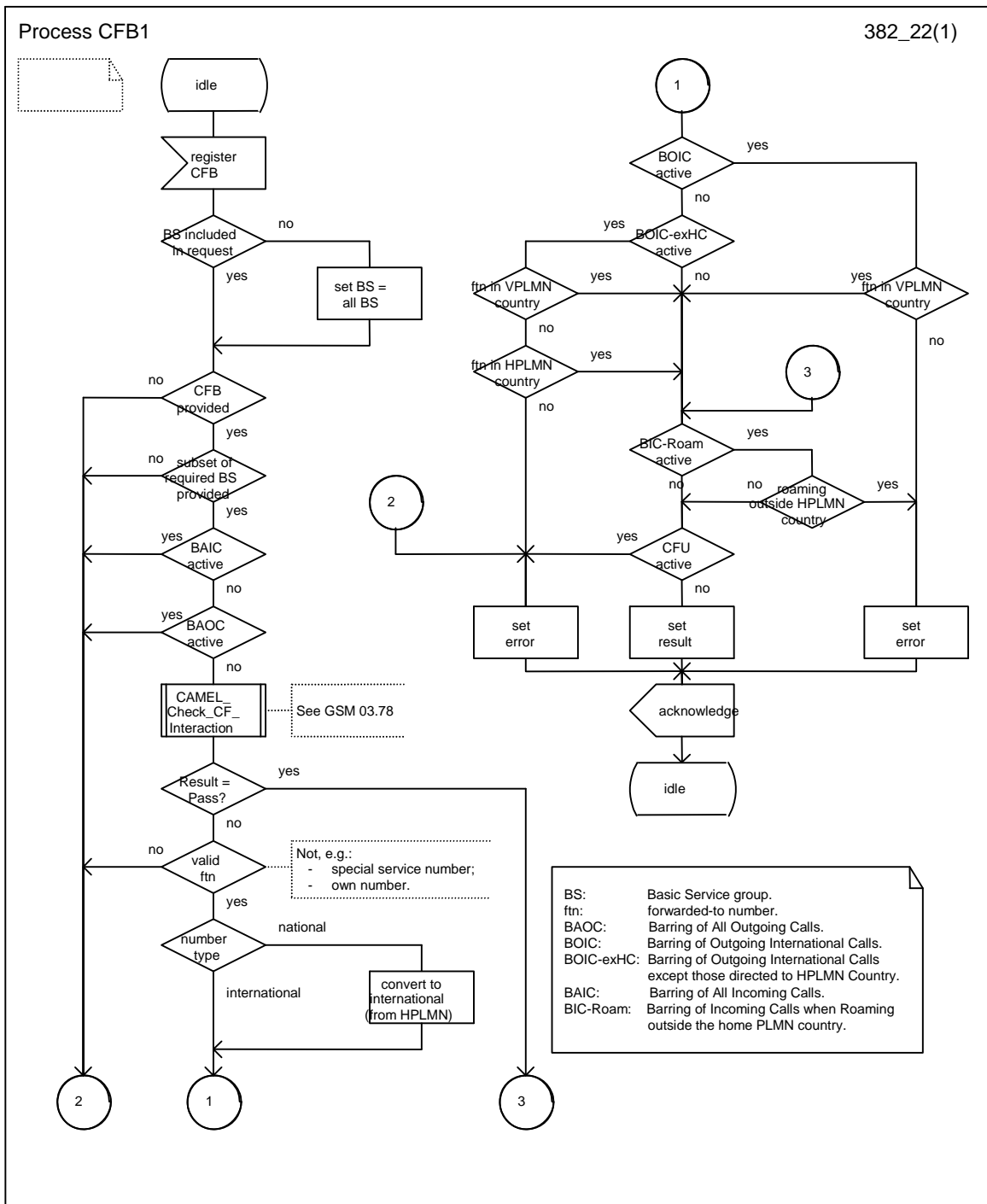
Figure 2.2: CFB1 Call forwarding on mobile subscriber busy registration process

2.1.2 Erasure

The same rules apply for the erasure of CFB as were described for CFU in clause 1.1.2 above. However, no checks for interaction with other supplementary services are required for erasure of CFB, see figure 2.4.

The information flow for registration of CFB is shown in figure 2.3.
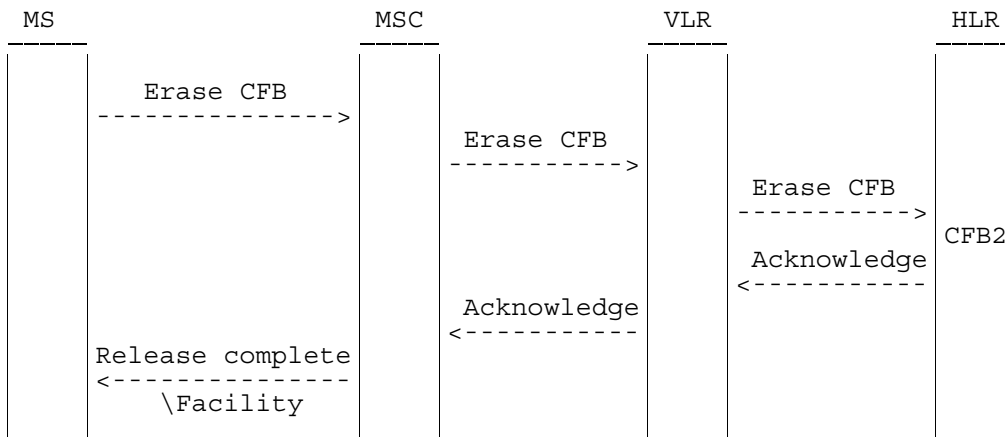
Figure 2.3: Erasure of call forwarding on mobile subscriber busy
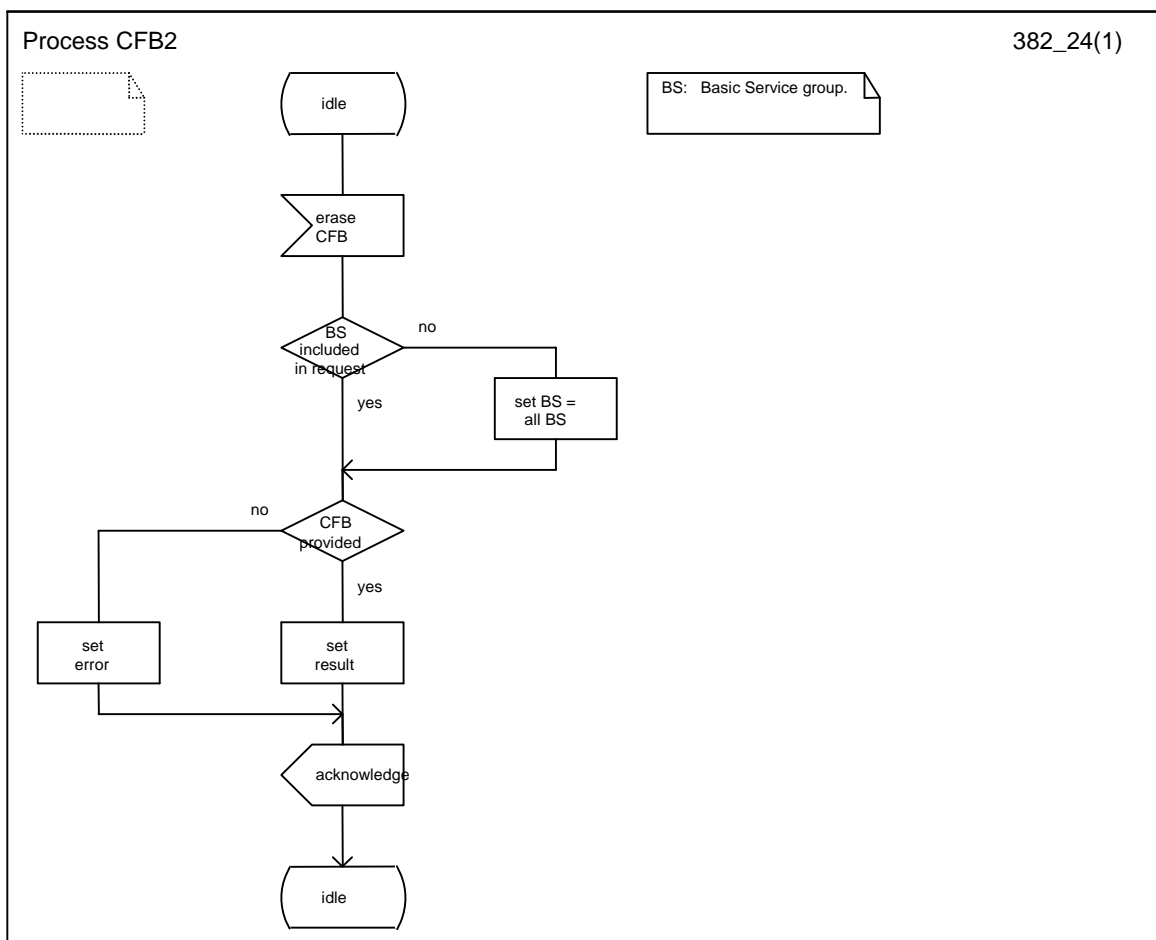
Figure 2.4: CFB2 Call forwarding on mobile subscriber busy erasure process

2.1.3   Activation

The same rules apply for the activation of CFB as were described for CFU in clause 1.1.3 above, with the exception of the checking of interaction with other supplementary services. Basic activation of CFNRc is illustrated in figure 2.6.

Supplementary Service Interaction

Possible interaction situations between CFB and other supplementary services must then be checked. This is described in figure 2.6. Also see 3GPP TS 22.004 and 3GPP TS 22.082. For interaction between CFB and other supplementary services (ie not call barring or call forwarding services), the reader is referred to the respective technical specification for those supplementary services.

The information flow for activation of call forwarding on MS busy is shown in figure 2.5.

```
   MS                    MSC                   VLR                   HLR
   ---                   ---                   ---                   ---
 |    Activate CFB     |                     |                     |
 | --------------->    |    Activate CFB     |                     |
 |                     | -------------->     |    Activate CFB     |
 |                     |                     | ------------>       |
 |                     |                     |                     | CFB3
 |                     |                     |    Acknowledge      |
 |   Release complete  |    Acknowledge      | <------------       |
 | <---------------    | <-------------      |                     |
 |      \Facility      |                     |                     |
```
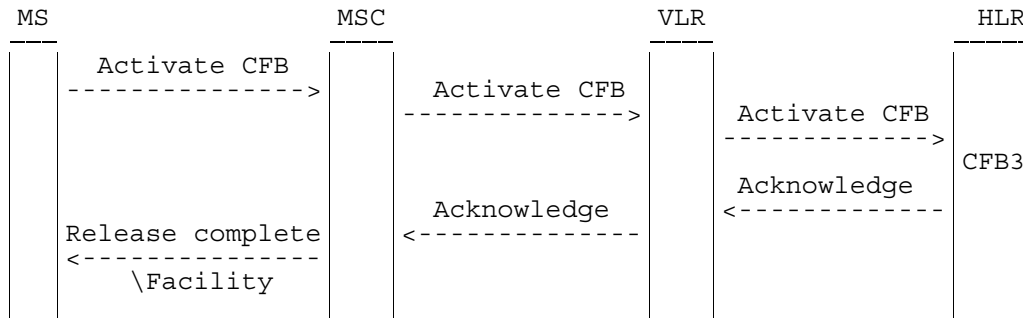
Figure 2.5: Activation of call forwarding on MS busy

Process CFB3   382_26(1)

BS: Basic Service group.
ftn: forwarded-to number.
BAOC: Barring of All Outgoing Calls.
BOIC: Barring of Outgoing International Calls.
BOIC-exHC: Barring of Outgoing International Calls - except
              those directed to HPLMN Country.
BAIC: Barring of All Incoming Calls.

idle

activate
CFB

CFB registered   no
for required BS

yes

BAIC   yes
active

no

BIC-Roam   yes
active

no   no   roaming
                   outside HPLMN
                   country

BAOC   yes   yes
active

no

BOIC   yes
active

no

BOIC-exHC   yes
active

yes   no   yes   ftn in VPLMN   no
ftn in VPLMN   country
country

no

yes
ftn in HPLMN
country

no   CFU   yes
            active

no

set   set   set   set   set
error   result   error   error   error

acknowledge

idle

Figure 2.6: CFB3 Call forwarding on mobile subscriber busy activation process

2.1.4 Deactivation

The same rules apply for the deactivation of CFB as were described for CFU in clause 1.1.4 above, see figure 2.8.

The information flow for deactivation of call forwarding on mobile subscriber busy is shown in figure 2.7.
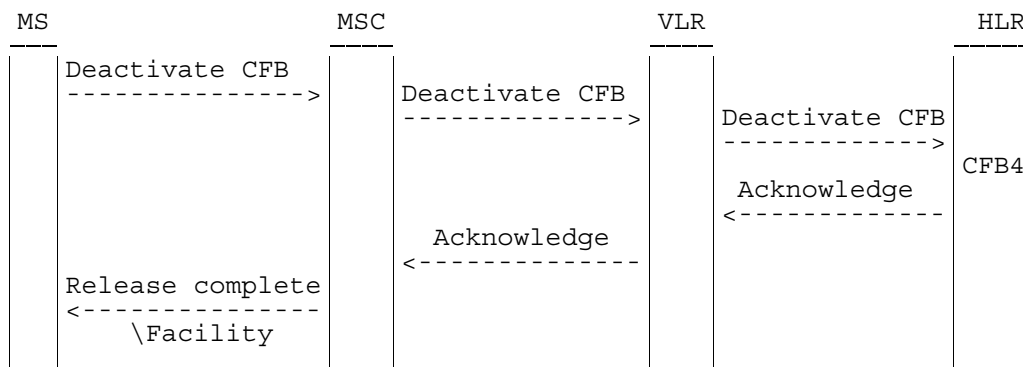
Figure 2.7: Deactivation of call forwarding on mobile subscriber busy
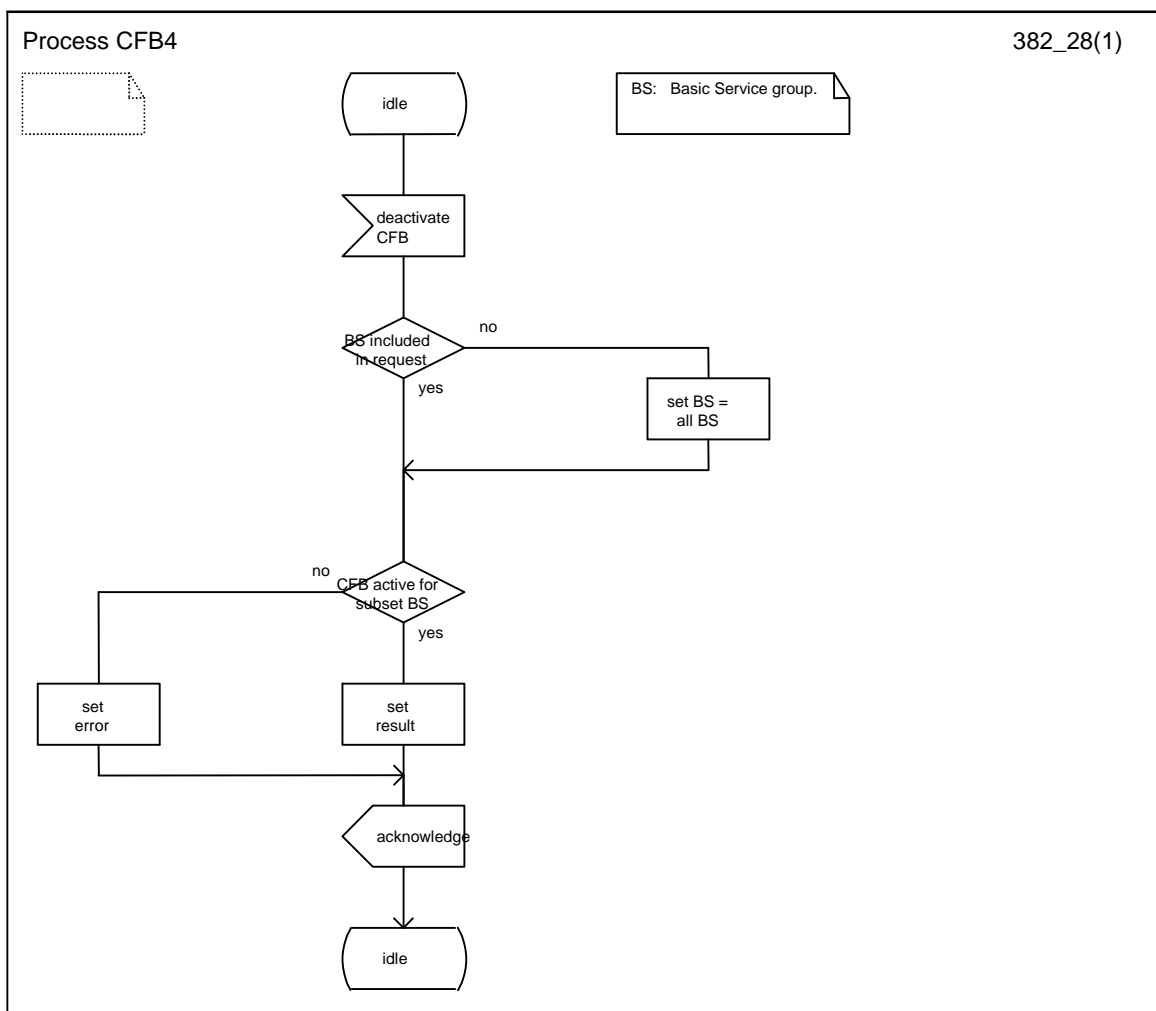
Figure 2.8: CFB4 Call forwarding on mobile subscriber busy deactivation process

2.1.5   Interrogation

Data request

The data request procedure enables the mobile subscriber to obtain information about the data stored in the PLMN. Interrogation of CFB is handled by the VLR which returns the required information or error to the MS, see figure 2.9.

```
   MS                    MSC                   VLR                   HLR
   ---                   ----                  ----                  ----

          Interrogate CFB
          --------------->
                                Interrogate CFB
                                -------------->

                                   Acknowledge
                                <--------------
          Release complete
          <--------------
                \Facility
```
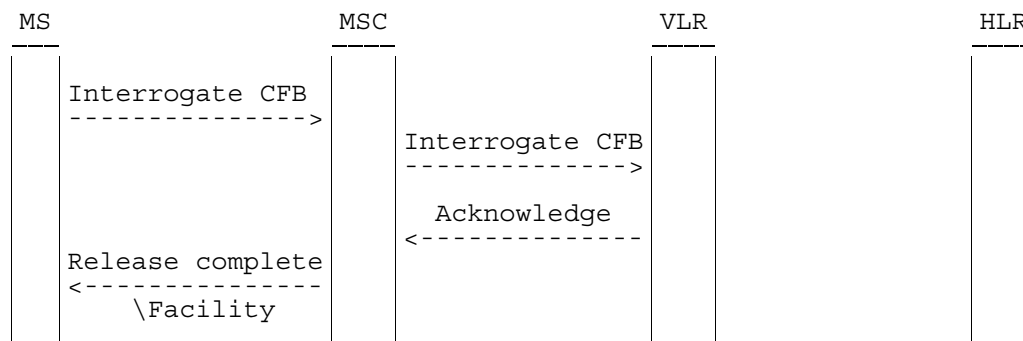
Figure 2.9: Interrogation of call forwarding on mobile subscriber busy

2.2   Functions and information flows

2.2.1   Call re-routed from VLR

The following Mobile Additional Function has been identified for the PLMN:

MAF008

Call forwarding on mobile subscriber busy authorizations examination

The ability of a PLMN component to determine the authorizations relating to call forwarding on mobile subscriber busy. See figure 2.10.

Location: VLR.

The information flows for forwarding to fixed terminal and to mobile station are shown in figures 2.11 & 2.12 and 2.13 & 2.14 respectively.

2.2.2   Call re-routed from HLR

The following Mobile Additional Function has been identified for the PLMN:

MAF008

Call forwarding on mobile subscriber busy authorizations examination

The ability of a PLMN component to determine the authorizations relating to call forwarding on mobile subscriber busy. See figure 2.10.

Location: HLR.

The information flow for call forwarding on mobile subscriber busy with busy state as a result of CCBS blocking is shown in figure 2.14a.
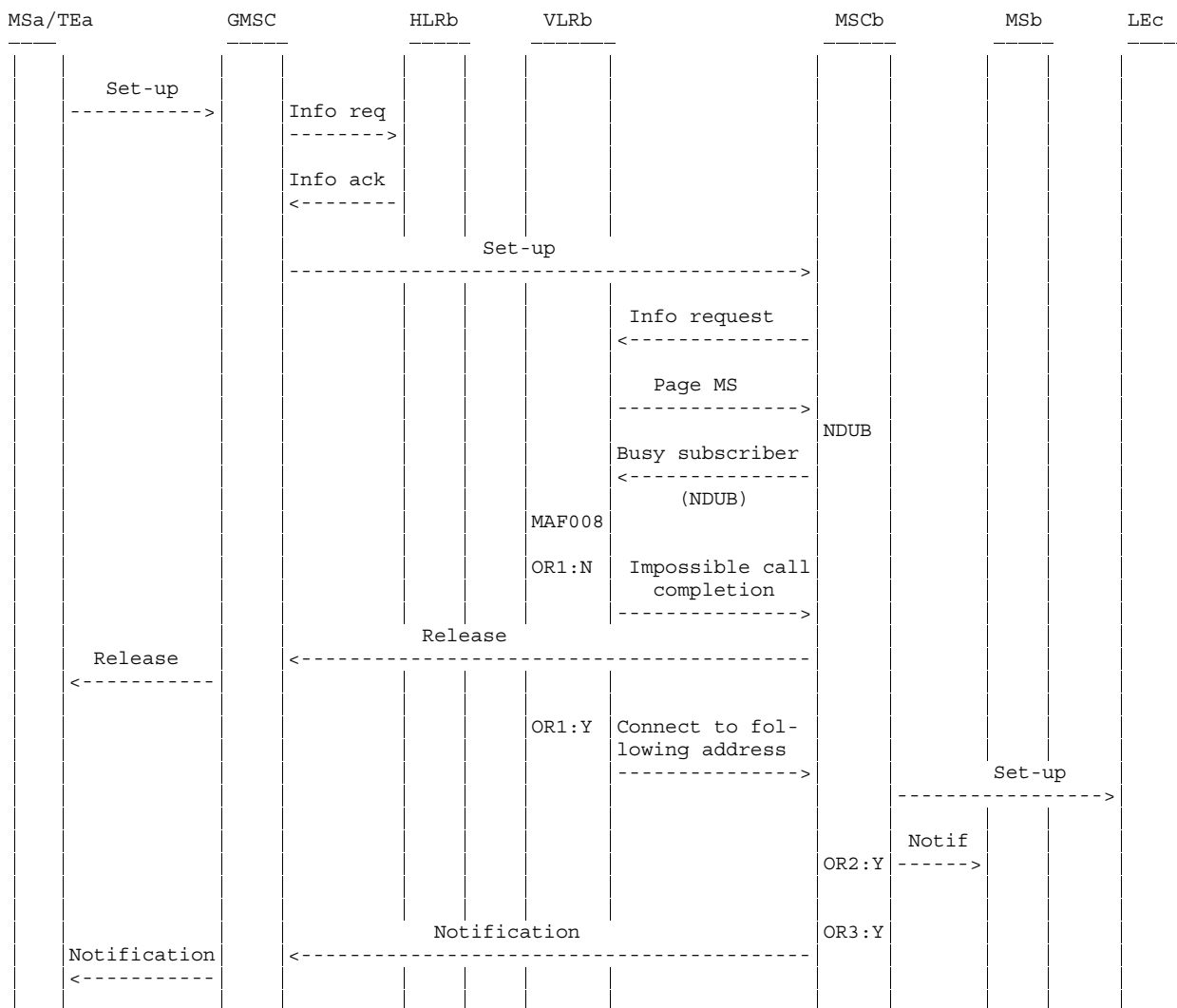
Figure 2.10: MAF008 Call forwarding on mobile subscriber busy authorisations examination (VLR and HLR)

```
MSa/TEa          GMSC        HLRb    VLRb                    MSCb         MSb        LEc
  ___            ____        ____    ____                    ____         ___        ___
 |  |           |  |        |  |    |  |                    |  |         |  |       |  |
 |  |  Set-up   |  |        |  |    |  |                    |  |         |  |       |  |
 |  |---------->|  | Info req|  |    |  |                    |  |         |  |       |  |
 |  |           |  |-------->|  |    |  |                    |  |         |  |       |  |
 |  |           |  |        |  |    |  |                    |  |         |  |       |  |
 |  |           |  | Info ack|  |    |  |                    |  |         |  |       |  |
 |  |           |  |<--------|  |    |  |                    |  |         |  |       |  |
 |  |           |  |        |  |    |  |                    |  |         |  |       |  |
 |  |           |  |      Set-up    |  |                    |  |         |  |       |  |
 |  |           |  |------------------------------------------>|  |      |  |       |  |
 |  |           |  |        |  |    |  |      Info request   |  |         |  |       |  |
 |  |           |  |        |  |    |  |<--------------------|  |         |  |       |  |
 |  |           |  |        |  |    |  |      Page MS        |  |         |  |       |  |
 |  |           |  |        |  |    |  |-------------------->|  |  NDUB   |  |       |  |
 |  |           |  |        |  |    |  |  Busy subscriber    |  |         |  |       |  |
 |  |           |  |        |  |    |  |<--------------------|  |         |  |       |  |
 |  |           |  |        |  |    |  |       (NDUB)        |  |         |  |       |  |
 |  |           |  |        |  | MAF008                      |  |         |  |       |  |
 |  |           |  |        |  | OR1:N  Impossible call      |  |         |  |       |  |
 |  |           |  |        |  |        completion           |  |         |  |       |  |
 |  |           |  |        |  |    |  |-------------------->|  |         |  |       |  |
 |  | Release   |  |    Release     |  |                    |  |         |  |       |  |
 |  |<----------|  |<------------------------------------------|  |      |  |       |  |
 |  |           |  |        |  |    |  | OR1:Y  Connect to fol-|  |       |  |       |  |
 |  |           |  |        |  |    |  |        lowing address |  |       |  |       |  |
 |  |           |  |        |  |    |  |-------------------->|  | Set-up |  |       |  |
 |  |           |  |        |  |    |  |                    |  |------------------->|  |
 |  |           |  |        |  |    |  |                    |  |  Notif  |  |       |  |
 |  |           |  |        |  |    |  |               OR2:Y |  |------>|  |       |  |
 |  |           |  |        |  |    |  |   Notification  OR3:Y|  |      |  |       |  |
 |  |Notification|  |<------------------------------------------|  |     |  |       |  |
 |  |<----------|  |        |  |    |  |                    |  |         |  |       |  |
 |__|           |__|        |__|    |__|                    |__|         |__|       |__|
```

NOTE: NDUB: Network Determined User Busy
            info: information   Y: Yes
            req: request   N: No
            ack: acknowledge
            notif: notification
            OR1:   Call to be forwarded
            OR2:   Notification to forwarding subscriber required
            OR3:   Notification to calling subscriber required

Figure 2.11: Information flow for call forwarding on mobile subscriber busy
(to fixed terminal) (NDUB)
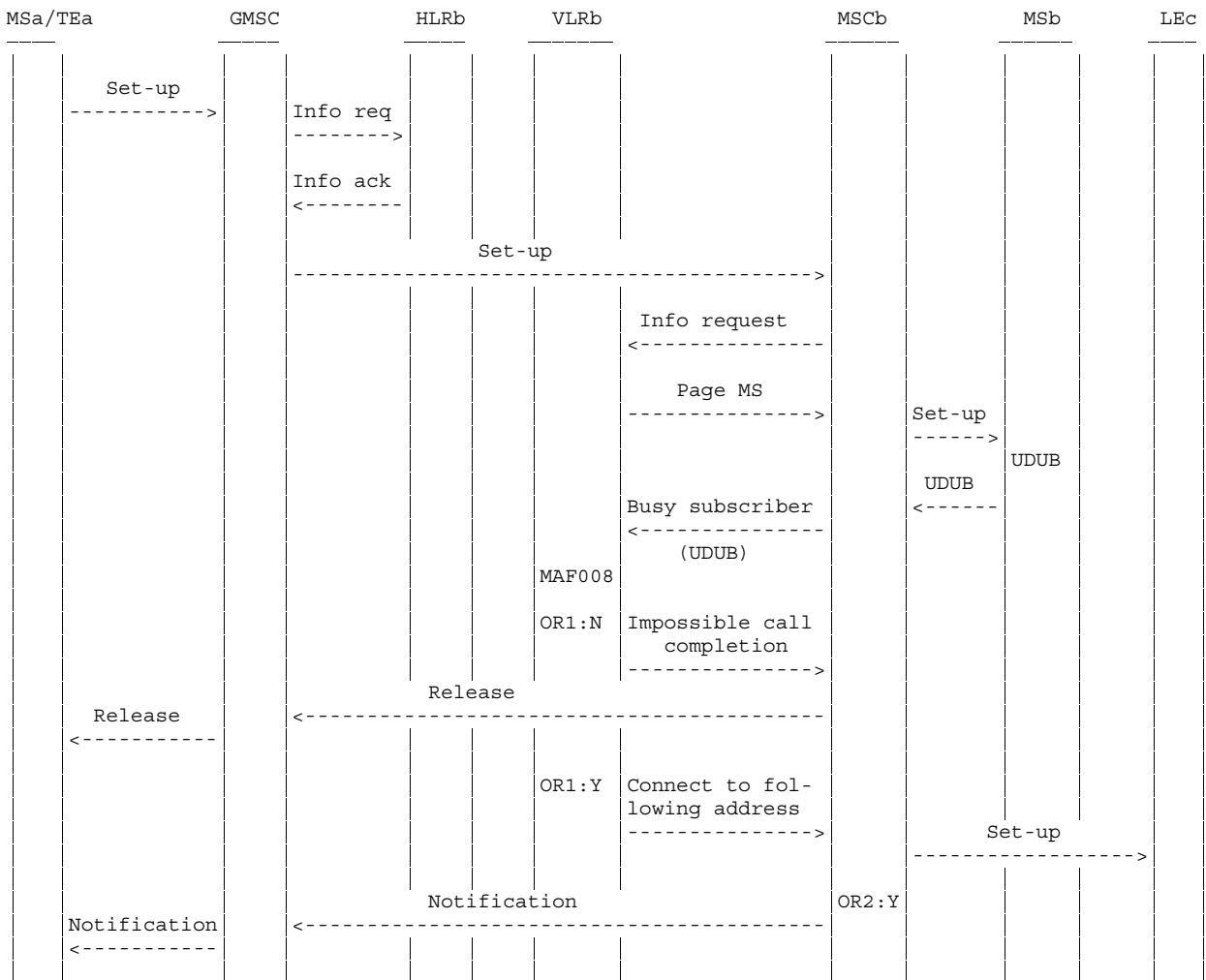
ETSI

```
 MSa/TEa          GMSC         HLRb        VLRb                    MSCb          MSb          LEc
 _____          _____       _____      _____                  _____       _____       _____
   |    |           |    |        |           |                      |            |            |
   |  Set-up        |    |        |           |                      |            |            |
   |----------->|   |    |  Info req          |                      |            |            |
   |            |   |    |-------->|           |                      |            |            |
   |            |   |    |        |            |                      |            |            |
   |            |   |    |  Info ack          |                      |            |            |
   |            |   |    |<--------|           |                      |            |            |
   |            |   |    |        |            |                      |            |            |
   |            |   |    |          Set-up                           |            |            |
   |            |   |----------------------------------------------->|            |            |
   |            |   |    |        |            |                      |            |            |
   |            |   |    |        |       Info request               |            |            |
   |            |   |    |        |<--------------                    |            |            |
   |            |   |    |        |            |                      |            |            |
   |            |   |    |        |       Page MS                     |  Set-up    |            |
   |            |   |    |        |-------------->                    |------>|     |            |
   |            |   |    |        |            |                      |     | UDUB |            |
   |            |   |    |        |            |                      |  UDUB |<------|           |
   |            |   |    |        |       Busy subscriber            |<------|      |            |
   |            |   |    |        |<--------------                    |            |            |
   |            |   |    |        |         (UDUB)                    |            |            |
   |            |   |    |  MAF008 |           |                      |            |            |
   |            |   |    |        |            |                      |            |            |
   |            |   |    |  OR1:N | Impossible call                   |            |            |
   |            |   |    |        |   completion                      |            |            |
   |            |   |    |        |-------------->                    |            |            |
   |            |   |    |          Release                          |            |            |
   |  Release   |   |<-----------------------------------------------|            |            |
   |<-----------|   |    |        |            |                      |            |            |
   |            |   |    |        |            |                      |            |            |
   |            |   |    |  OR1:Y | Connect to fol-                   |            |            |
   |            |   |    |        | lowing address                   |            |            |
   |            |   |    |        |-------------->                    |    Set-up               |
   |            |   |    |        |            |                      |------------------>|      |
   |            |   |    |        |            |                      |            |            |
   |            |   |    |          Notification             OR2:Y   |            |            |
   | Notification   |<-----------------------------------------------|            |            |
   |<-----------|   |    |        |            |                      |            |            |
   |            |   |    |        |            |                      |            |            |
```

NOTE: UDUB: User Determined User Busy
         info: information   Y: Yes
         req: request   N: No
         ack: acknowledge
         notif: notification
         OR1:   Call to be forwarded
         OR2:   Notification to calling subscriber required

Figure 2.12: Information flow for call forwarding on mobile subscriber busy
(to fixed terminal) (UDUB)
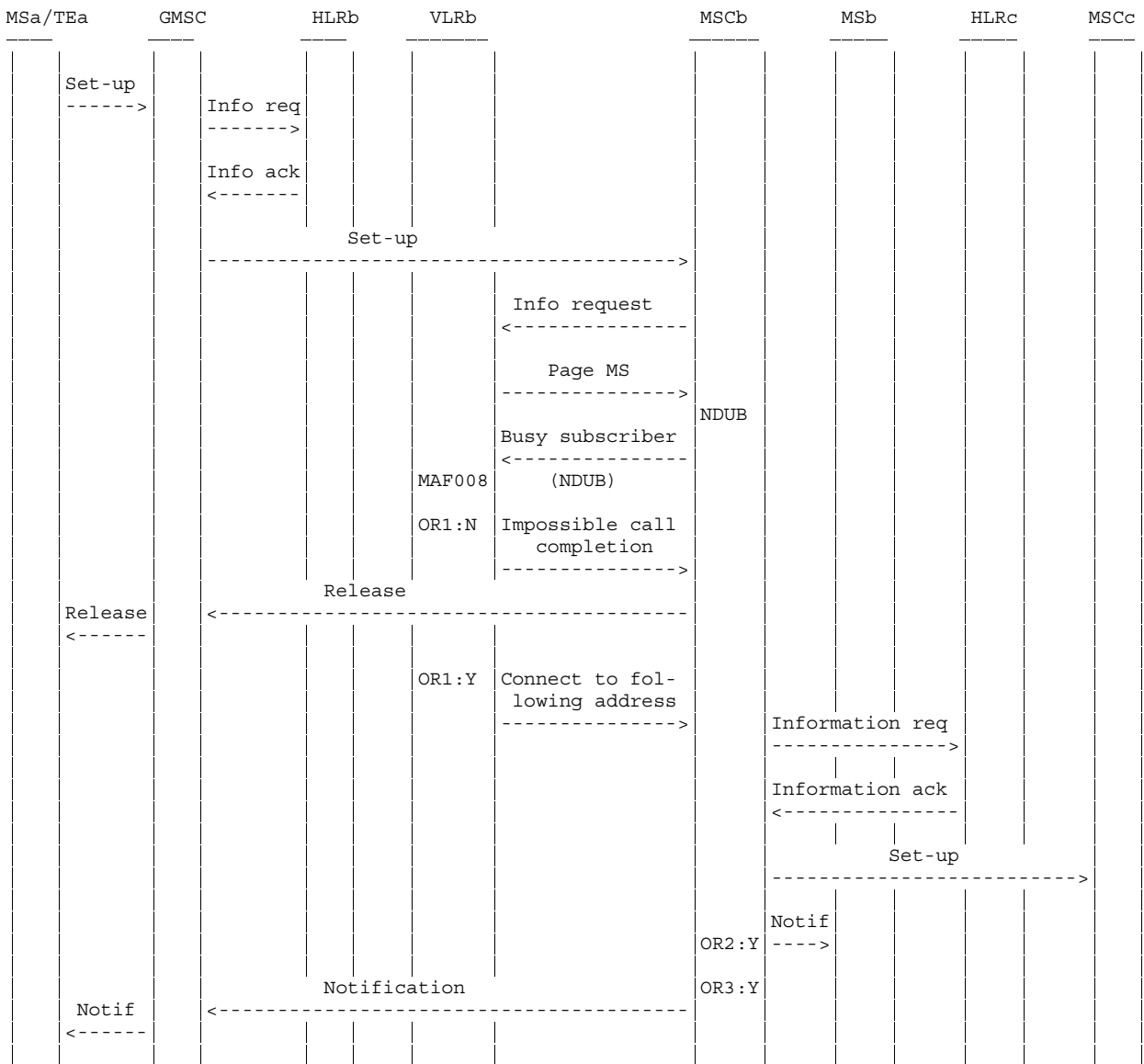
```
MSa/TEa    GMSC      HLRb     VLRb              MSCb      MSb      HLRc     MSCc
 ___       ___       ___      ____              ___       ___      ___      ___
  |         |         |        |                 |         |        |        |
  | Set-up  |         |        |                 |         |        |        |
  |-------->| Info req|        |                 |         |        |        |
  |         |-------->|        |                 |         |        |        |
  |         |         |        |                 |         |        |        |
  |         | Info ack|        |                 |         |        |        |
  |         |<--------|        |                 |         |        |        |
  |         |         |        |                 |         |        |        |
  |         |         |   Set-up                 |         |        |        |
  |         |----------------------------------->|         |        |        |
  |         |         |        |                 |         |        |        |
  |         |         |        | Info request    |         |        |        |
  |         |         |        |<--------------- |         |        |        |
  |         |         |        |                 |         |        |        |
  |         |         |        |    Page MS      |         |        |        |
  |         |         |        |---------------> |         |        |        |
  |         |         |        |                 | NDUB    |        |        |
  |         |         |        | Busy subscriber |         |        |        |
  |         |         |        |<--------------- |         |        |        |
  |         |         |   MAF008|   (NDUB)       |         |        |        |
  |         |         |        |                 |         |        |        |
  |         |         |   OR1:N| Impossible call |         |        |        |
  |         |         |        |    completion   |         |        |        |
  |         |         |        |---------------> |         |        |        |
  |         |         |  Release|                |         |        |        |
  |         |<----------------------------------- |        |        |        |
  | Release |         |        |                 |         |        |        |
  |<------  |         |        |                 |         |        |        |
  |         |         |        |                 |         |        |        |
  |         |         |   OR1:Y| Connect to fol- |         |        |        |
  |         |         |        | lowing address  |         |        |        |
  |         |         |        |---------------> |         |        |        |
  |         |         |        |                 | Information req |        |
  |         |         |        |                 |--------------->|        |
  |         |         |        |                 |         |        |        |
  |         |         |        |                 | Information ack|        |
  |         |         |        |                 |<---------------|        |
  |         |         |        |                 |         |        |        |
  |         |         |        |                 |   Set-up        |        |
  |         |         |        |                 |-------------------------->|
  |         |         |        |                 |         |        |        |
  |         |         |        |                 | OR2:Y   | Notif  |        |
  |         |         |        |                 |         |---->   |        |
  | Notif   |         | Notification            | OR3:Y   |        |        |
  |<------  |<----------------------------------- |        |        |        |
  |         |         |        |                 |         |        |        |
```

NOTE: NDUB: Network Determined User Busy
         info: information   Y: Yes
         req: request   N: No
         ack: acknowledge
         notif: notification
         OR1: Call to be forwarded
         OR2: Notification to forwarding subscriber required
         OR3: Notification to calling subscriber required

**Figure 2.13: Information flow for call forwarding on mobile subscriber busy
(to mobile station) (NDUB)**
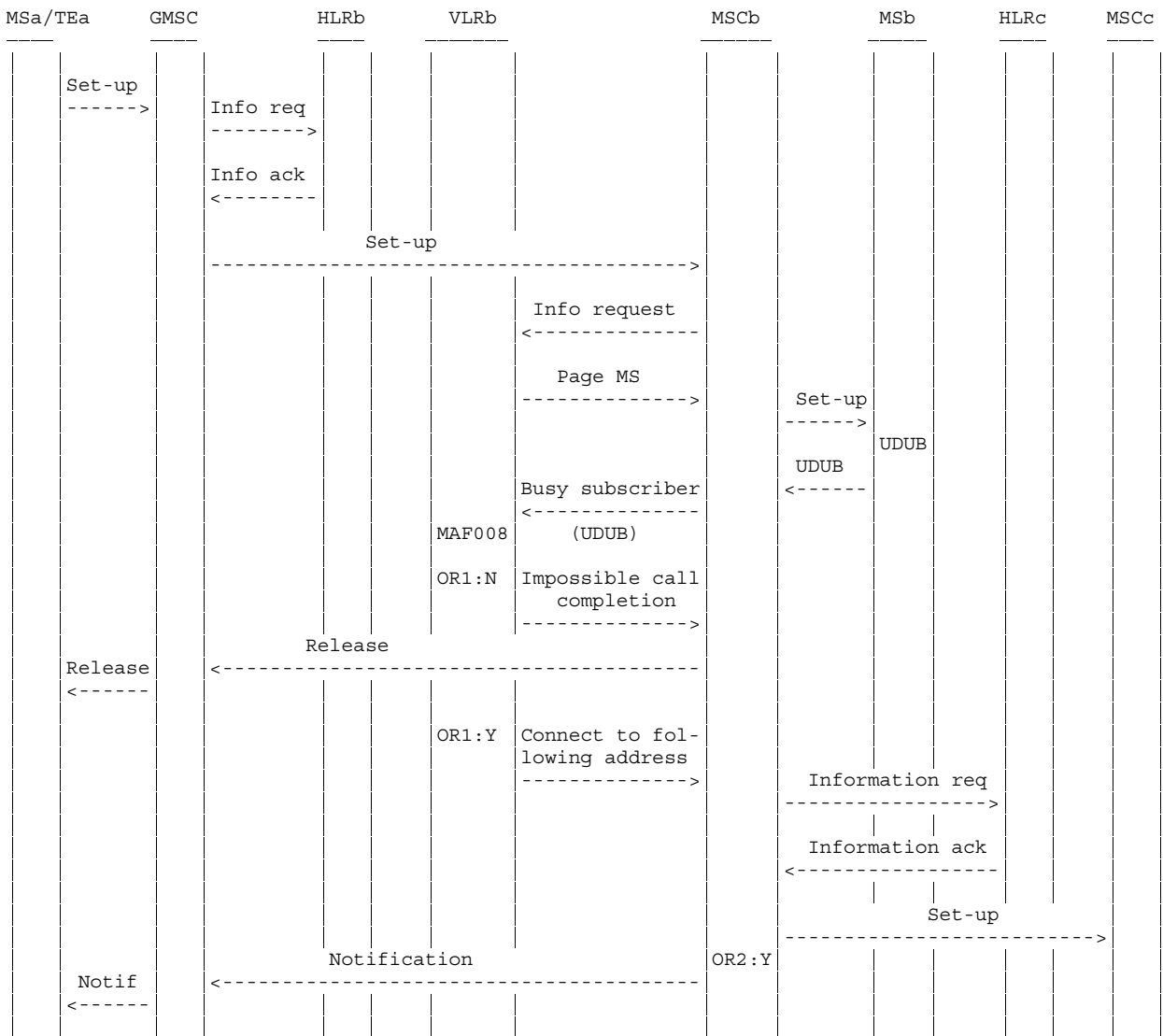
```
MSa/TEa      GMSC       HLRb      VLRb              MSCb         MSb       HLRc      MSCc
____         ____       ____      ____              ____         ____      ____      ____
 |            |          |         |                 |            |         |         |
 | Set-up     |          |         |                 |            |         |         |
 |------>     | Info req  |         |                 |            |         |         |
 |            |-------->  |         |                 |            |         |         |
 |            |          |         |                 |            |         |         |
 |            | Info ack  |         |                 |            |         |         |
 |            |<--------  |         |                 |            |         |         |
 |            |          |         |                 |            |         |         |
 |            |         Set-up     |                 |            |         |         |
 |            |---------------------------------------->            |         |         |
 |            |          |         |                 |            |         |         |
 |            |          |         |     Info request |            |         |         |
 |            |          |         |<--------------  |            |         |         |
 |            |          |         |                 |            |         |         |
 |            |          |         |     Page MS     |            |         |         |
 |            |          |         |-------------->  | Set-up      |         |         |
 |            |          |         |                 |------>      |         |         |
 |            |          |         |                 |          UDUB         |         |
 |            |          |         |                 | UDUB       |         |         |
 |            |          |         |  Busy subscriber |<------      |         |         |
 |            |          |         |<--------------  |            |         |         |
 |            |          |  MAF008 |     (UDUB)      |            |         |         |
 |            |          |         |                 |            |         |         |
 |            |          | OR1:N   | Impossible call  |            |         |         |
 |            |          |         |    completion   |            |         |         |
 |            |          |         |-------------->  |            |         |         |
 |            |         Release    |                 |            |         |         |
 | Release    |<---------------------------------------            |         |         |
 |<------     |          |         |                 |            |         |         |
 |            |          |         |                 |            |         |         |
 |            |          | OR1:Y   | Connect to fol-  |            |         |         |
 |            |          |         | lowing address  |            |         |         |
 |            |          |         |-------------->  |  Information req       |         |
 |            |          |         |                 |------------------>    |         |
 |            |          |         |                 |            |         |         |
 |            |          |         |                 |  Information ack       |         |
 |            |          |         |                 |<------------------    |         |
 |            |          |         |                 |            |         | Set-up   |
 |            |          |         |                 |            |------------------------>
 |            |        Notification |                 | OR2:Y      |         |         |
 | Notif      |<---------------------------------------            |         |         |
 |<------     |          |         |                 |            |         |         |
 |            |          |         |                 |            |         |         |
```

NOTE: UDUB: User Determined User Busy
        info: information   Y: Yes
        req: request   N: No
        ack: acknowledge
        notif: notification
        OR1: Call to be forwarded
        OR2: Notification to calling subscriber required

**Figure 2.14: Information flow for call forwarding on mobile subscriber busy
(to mobile station) (UDUB)**
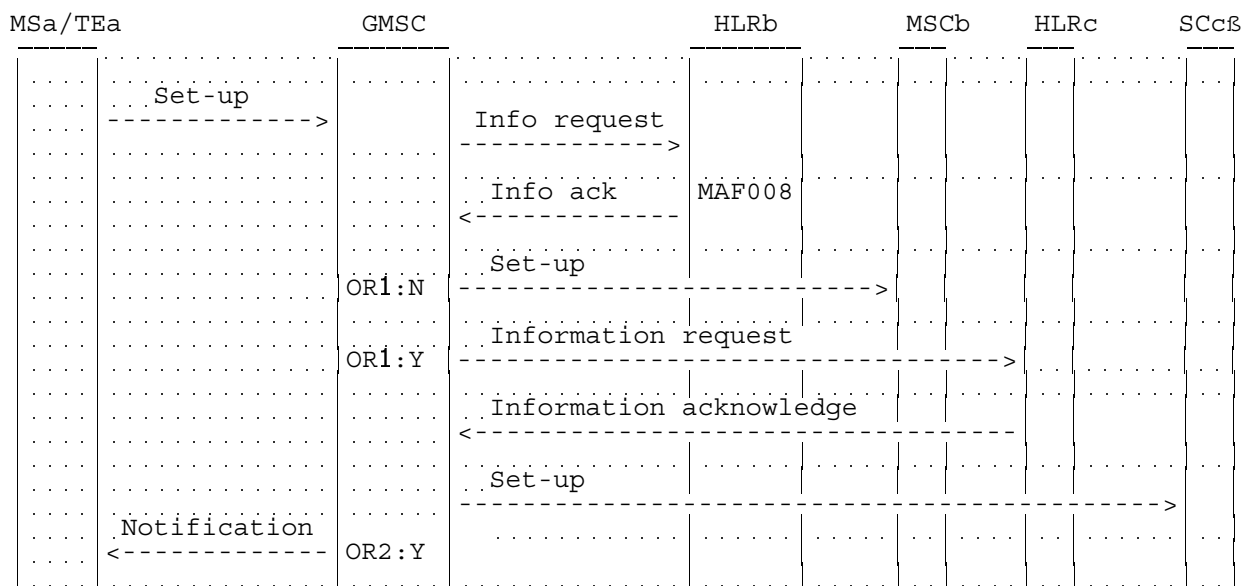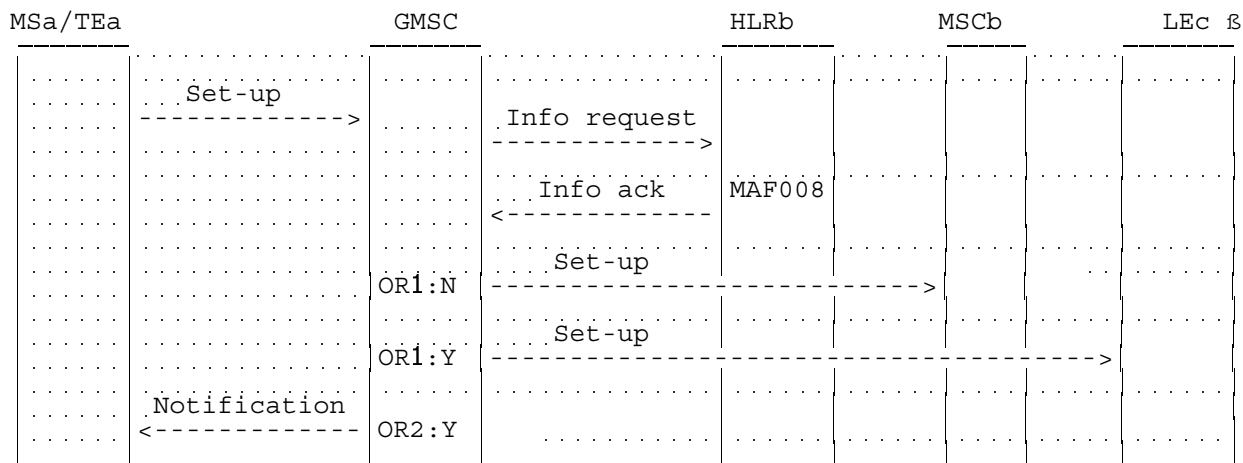
```
MSa/TEa              GMSC                  HLRb        MSCb              LEc ß
  ____                ____                 ____        ____              ____
 |    | . . . . . . .|    |. . . . . . . .|    |      |    |. . . . . . |    |
 | .  | . . .Set-up .|    |. . . . . . . .|    |      |    |. . . . . . |    |
 | .  |------------->|    |. .Info request|    |      |    |. . . . . . |    |
 | .  | . . . . . . .|    |-------------->|    |      |    |. . . . . . |    |
 | .  | . . . . . . .|    |. . . . . . . .|    |      |    |. . . . . . |    |
 | .  | . . . . . . .|    |. .Info ack .  |MAF008      |    |. . . . . . |    |
 | .  | . . . . . . .|    |<------------- |    |      |    |. . . . . . |    |
 | .  | . . . . . . .|    |. . . . . . . .|    |      |    |. . . . . . |    |
 | .  | . . . . . . .|    |. . Set-up . . |    |      |    |. . . . . . |    |
 | .  | . . . . . . .|OR1:N-----------------------------> |. . . . . . |    |
 | .  | . . . . . . .|    |. . . . . . . .|    |      |    |. . . . . . |    |
 | .  | . . . . . . .|    |. . Set-up . . |    |      |    |. . . . . . |    |
 | .  | . . . . . . .|OR1:Y----------------------------------------------->|
 | .  | . . . . . . .|    |. . . . . . . .|    |      |    |. . . . . . |    |
 | .  | .Notification|    |. . . . . . . .|    |      |    |. . . . . . |    |
 | .  |<-------------|OR2:Y. . . . . . . .|    |      |    |. . . . . . |    |
 |____| . . . . . . .|____|. . . . . . . .|____|      |____|. . . . . . |____|


MSa/TEa              GMSC              HLRb        MSCb      HLRc      SCcß
  ____                ____             ____        ____      ____      ____
 |    |. . . . . . . |    |. . . . . .|    |      |    |    |    |    |    |
 |    |. . .Set-up . |    |. . . . . .|    |      |    |    |    |    |    |
 |    |------------->|    |Info request|   |      |    |    |    |    |    |
 |    |. . . . . . . |    |----------->|   |      |    |    |    |    |    |
 |    |. . . . . . . |    |. . . . . .|    |      |    |    |    |    |    |
 |    |. . . . . . . |    |Info ack . |MAF008      |    |    |    |    |    |
 |    |. . . . . . . |    |<--------- |    |      |    |    |    |    |    |
 |    |. . . . . . . |    |. . . . . .|    |      |    |    |    |    |    |
 |    |. . . . . . . |    |. .Set-up .|    |      |    |    |    |    |    |
 |    |. . . . . . . |OR1:N-----------------------> |    |    |    |    |    |
 |    |. . . . . . . |    |. . . . . .|    |      |    |    |    |    |    |
 |    |. . . . . . . |OR1:Y Information request      |    |    |    |    |    |
 |    |. . . . . . . |    |---------------------------> |    |    |    |    |
 |    |. . . . . . . |    |. . . . . .|    |      |    |    |    |    |    |
 |    |. . . . . . . |    |Information acknowledge|      |    |    |    |    |
 |    |. . . . . . . |    |<--------------------------- |    |    |    |    |
 |    |. . . . . . . |    |. . . . . .|    |      |    |    |    |    |    |
 |    |. . . . . . . |    |. .Set-up .|    |      |    |    |    |    |    |
 |    |. . . . . . . |    |----------------------------------------------->|
 |    |. .Notification|   |. . . . . .|    |      |    |    |    |    |    |
 |    |<-------------|OR2:Y. . . . . .|    |      |    |    |    |    |    |
 |____|. . . . . . . |____|. . . . . .|____|      |____|    |____|    |____|
```

NOTE: info: information   Y: Yes
            req: request   N: No
            ack: acknowledge
            OR1:   Forwarding requested
            OR2:   Notification to calling subscriber required

Figure 2.14a: Information flow for call forwarding on mobile subscriber busy with busy state as a result of CCBS blocking (see 3GPP TS 23.093 [11] clause 11.2.2)

2.3 Information stored in the HLR

The following logical states are applicable for CFB
(refer to 3GPP TS 23.011 for an explanation of the notation):

Provisioning State	Registration State	Activation State	HLR Induction State
(Not Provisioned,	Not Registered,	Not Active,	Not Induced)
(Provisioned,	Not Registered,	Not Active,	Not Induced)
(Provisioned,	Registered,	Not Active,	Not Induced)
(Provisioned,	Registered,	Active and Quiescent,	Not Induced)
(Provisioned,	Registered,	Active and Operative,	Not Induced)

The registration and activation state may be different for each applicable elementary basic service group.

The provisioning state shall be on a per subscriber basis, and hence the same for all basic service groups.

The HLR shall store:

- the state of CFB (which shall be one of the valid states listed above) for each applicable elementary basic service group;

- the subscription option "notification to the calling party" on a per subscriber basis;

  This subscription option takes one of the following values:

  - no notification;

  - notification.

- the subscription option "notification to the forwarding party" on a per subscriber basis;

  This subscription option takes one of the following values:

  - no notification;

  - notification.

  the subscription option " MSISDN of the served subscriber can be presented to the forwarded-to subscriber" on a per subscriber basis;

  This subscription option takes one of the following values:

  - presentation restricted;

  - presentation allowed.

- the registration parameter "forwarded-to number" (possibly including a forwarded-to sub-address) for each applicable elementary basic service group.

- the default forwarded-to number (containing less than 16 digits) for each applicable elementary basic service group.

2.4 State transition model

The following figure shows the successful cases of transition between the applicable logical states of CFB. The state changes are either caused by actions of the service provider, the mobile user or the network.

Note that error cases are not shown in the diagram as they normally do not cause a state change. Additionally, some successful requests may not cause a state change. Hence, they are not shown in the diagram. The diagram only shows operations on an elementary basic service group.
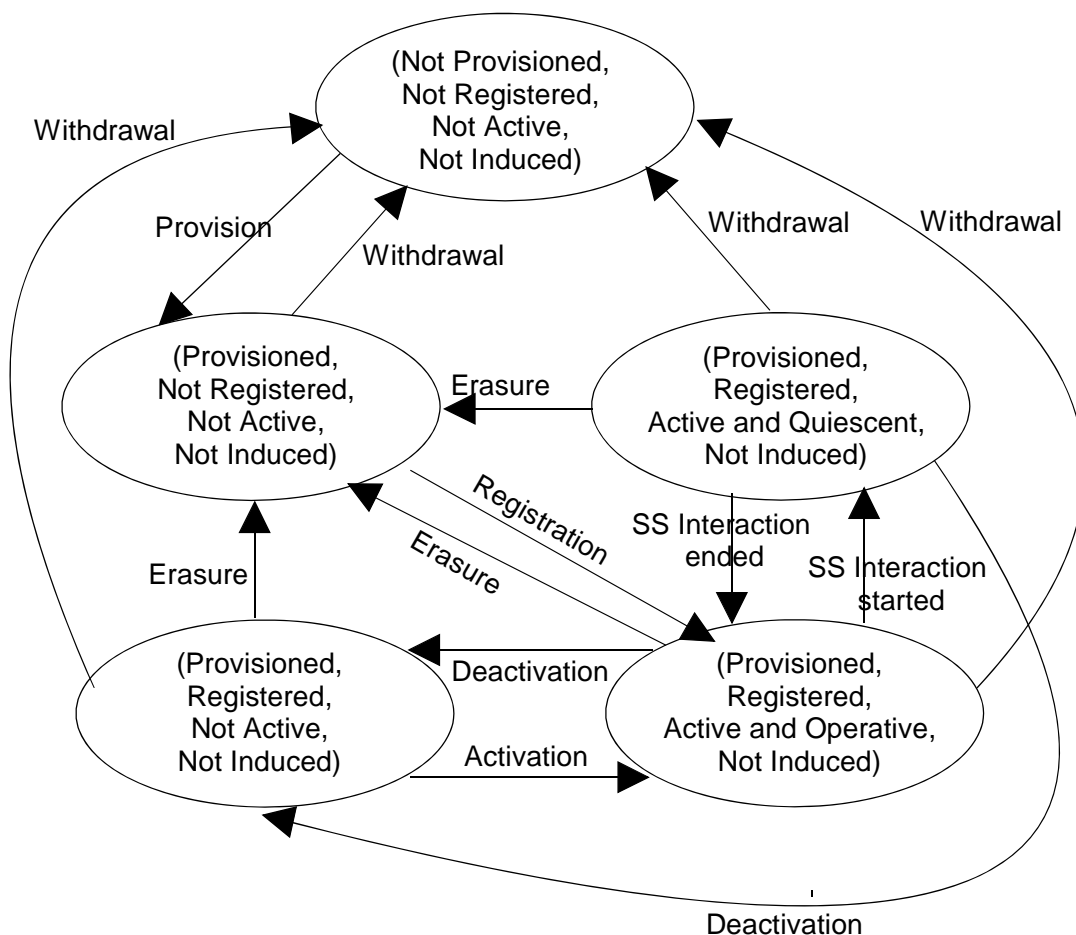
Figure 2.15: State transition model for CFB

2.5 Transfer of information from HLR to VLR

If the provisioning state for CFB is "Provisioned" then, when the subscriber registers on a VLR, the HLR shall send that VLR information about the logical state of CFB for all relevant elementary basic service groups.

If the registration state for CFB is "Registered" then, when the subscriber registers on a VLR, the HLR shall send that VLR the registration parameter "forwarded-to number" for all relevant elementary basic service groups and information about the subscription options "notification to the calling party", "notification to the forwarding party" and "MSISDN of the served subscriber can be presented to the forwarded-to subscriber".

If the logical state or the registration parameter "forwarded-to number" of CFB is changed while a subscriber is registered on a VLR then for the affected basic service groups, the HLR shall inform the VLR respectively of the new logical state or the new registration parameter of CFB.

If information about the subscription options "notification to the calling party" and "notification to the forwarding party" of CFB is changed while a subscriber is registered on a VLR and the registration state of CFB is "Registered" then the HLR shall inform the VLR of the new information about the subscription options of CFB.

2.6 Information stored in the VLR

For CFB the VLR shall store the service state information, the registration parameter "forward-to number" and the subscription options received from the HLR.

2.7 Handover

Handover will have no impact on the control procedure and the operation of the service.

2.8 Cross phase compatibility

2.8.1 MS, MSC, VLR or HLR only support Phase 1 control of SS by the subscriber

In response to a CFB interrogation request, if the MS or any network element involved is of Phase 1, only information concerning basic service groups for which the activation state has the value "Active and Operative" will be returned. This means that the subscriber will not be aware that the forwarded to number is registered if CFB is deactivated or active (quiescent). A subaddress (if registered) will not be included.

Note that if any network element involved is of Phase 1, CFB Registration requests which use a subaddress and all CFB Activation and Deactivation requests will be rejected, as these are not specified in Phase 1.

2.8.2 HLR only supports Phase 1 updating of subscriber information

If the VLR receives the SS-Status parameter from a Phase 1 HLR it shall act if it has received the SS-Status parameter with the values shown in the following:

1) Registered, Activated => P bit =1, R bit = 1, A bit = 1, Q bit = 0;

2) Registered, Deactivated => P bit =1, R bit = 1, A bit = 0, Q bit = 0 or 1;

3) Erased => P bit =1, R bit = 0, A bit = 0, Q bit = 0 or 1.

2.8.3 VLR only supports Phase 1 updating of subscriber information

When passing CFB information to a Phase 1 VLR, the HLR shall send the service state information in a form which the VLR can accept, based on the logical state held in the HLR, as follows:

1) (Provisioned, Not Registered, Not Active, Not Induced)

=> Erased, Deactivated;

2) (Provisioned, Registered, Not Active, Not Induced)

=> Registered, Deactivated;

3) (Provisioned, Registered, Active and Operative, Not Induced)

=> Registered, Activated;

4) (Provisioned, Registered, Active and Quiescent, Not Induced)

=> Registered, Deactivated.

The HLR shall not pass a subaddress to a Phase 1 VLR.

2.8.4 VLR only supports Phase 1 call handling

When a call is forwarded on busy, as the HLR does not pass the subaddress to the VLR, calls shall be forwarded without the subaddress.

2.8.5 VLR does not support CAMEL or supports CAMEL Phase 1 only

When passing CFB information to a VLR not supporting CAMEL or supporting CAMEL Phase 1 only, the HLR shall send the registration parameter "forwarded-to number" only if it is registered in a format which the VLR can accept, i.e. international format.

If the registration state for CFB is "Registered" and the forwarded-to number is registered in a format other than international, then when updating a VLR not supporting CAMEL or supporting CAMEL Phase 1 only the HLR shall modify the service state information of CFB as follows.

1) (Provisioned, Registered, Not Active, Not Induced)

    => (Provisioned, Not Registered, Not Active, Not Induced)

2) (Provisioned, Registered, Active and Operative, Not Induced)

    => (Provisioned, Not Registered, Not Active, Not Induced)

3) (Provisioned, Registered, Active and Quiescent, Not Induced)

    => (Provisioned, Not Registered, Not Active, Not Induced)

According to the definitions in clause 2.5 no forwarded-to number will be passed to the VLR in these cases. The modification of the service state information sent to the VLR shall have no impact on the service state information stored in the HLR.

If the VLR supports Phase 1 updating of subscriber information only, a further translation of the service state information as defined in clause 2.8.3 shall be performed by the HLR.

2.8.6 GMSC only supports Phase 1 call handling

When a call is forwarded on busy, the HLR shall not pass the subaddress to a Phase 1 GMSC. Calls shall be forwarded without the subaddress.

2.8.7 GMSC does not support CAMEL or supports CAMEL Phase 1 only

If the activation state of CFB is "Active and Operative" and if the forwarded-to number is registered in a format other than international and if the GMSC does not support CAMEL or supports CAMEL Phase 1 only, then when a request for routeing information for a mobile terminated call is received in the HLR, CFB shall not be invoked. The HLR shall return a busy subscriber error.

2.9 Contents of messages

The same additions apply for CFB as for CFU, see clause 1.9. The following additions are specific to CFB.

2.9.1 Messages on the B interface (MSC-VLR)

2.9.1.1 Send Info For Incoming Call ack

This message is specified in 3GPP TS 23.018.

Send Info For Incoming Call ack contains the following amendment to the Forwarded-to number IE, specific to Long Forwarded-to Numbers:

Information element name	Required	Description
Forwarded-to number	M	Number of the C subscriber.

2.9.2 Messages on the D interface (VLR-HLR)

2.9.2.1 Insert Subscriber Data

This message corresponds to the MAP-INSERT-SUBSCRIBER-DATA service specified in 3GPP TS 29.002.

**Insert Subscriber Data contains the following IE
specificto Long Forwarded-to Numbers:**

Information element name	Required	Description
Long forwarded-to number	C	Shall be present if the subscriber has a long forwarded-to number registered; otherwise shall be absent.

2.9.2.2 Update Location

This message corresponds to theMAP_UPDATE_LOCATION service specified in 3GPP TS 29.002.

**Update Location contains the following IE specific
to Long Forwarded-to Numbers:**

Information element name	Required	Description
Long FTN supported	C	Shall be present if the VLR supports Long Forwarded-to Numbers; otherwise shall be absent.

2.9.2.3 Provide Roaming Number

This message is specified in 3GPP TS 23.018.

**Provide Roaming Number contains the following IE specific
to Long Forwarded-to Numbers:**

Information element name	Required	Description
Long FTN supported	C	Shall be present if the GMSC and the HLR both support Long Forwarded-to Numbers; otherwise shall be absent.

2.9.2.4 Restore Data

This message corresponds to the MAP_RESTORE_DATA service specified in 3G TS 29.002.

Restore Data contains the following IE specific to Long Forwarded-to Numbers:

Information element name	Required	Description
Long FTN supported	C	Shall be present if the VLR supports Long Forwarded-to Numbers; otherwise shall be absent.

2.9.3 Messages on the E interface (VMSC-GMSC)

2.9.3.1 Resume Call Handling

This message is specified in 3GPP TS 23.079.

**Resume Call Handling contains the following amendment to the Forwarded-to number IE and an
additional IE specific to Long Forwarded-to Numbers:**

Information element name	Required	Description
Forwarded-to number	C	E.164 number of the C subscriber. Shall be present if the VMSC does not support Long Forwarded-to Numbers; otherwise shall be absent.
Long forwarded-to number	C	Number of the C subscriber. Shall be present if the VMSC supports Long Forwarded-to Numbers; otherwise shall be absent.

2.9.4 Messages on the MSC internal interface

2.9.4.1 Perform Call Forwarding

This message is specified in 3GPP TS 23.018.

Perform Call Forwarding contains the following amendment to the Forwarded-to number IE specific to Long Forwarded-to Numbers:

Information element name	Required	Description
Forwarded-to number	M	Number of the C subscriber.

2.9.4.2 Perform Call Forwarding ack

This message is specified in 3GPP TS 23.018.

Perform Call Forwarding ack contains the following amendment to the Forwarded-to number IE specific to Long Forwarded-to Numbers:

Information element name	Required	Description
Forwarded-to number	M	Number of the C subscriber. NOTE: This number may be different from the Forwarded-to number received in the Perform Call Forwarding, as a result of CAMEL handling.

2.10 Support of Long Forwarded-to Numbers

2.10.1 MS does not support Long Forwarded-to Numbers

The handling for CFB is the same as that for CFU, see clause 1.10.1.

2.10.2 HLR does not support Long Forwarded-to Numbers

The handling for CFB is the same as that for CFU, see clause 1.10.2.

2.10.3 GMSC does not support Long Forwarded-to Numbers

The MSC/VLR can determine from the PRN whether the GMSC supports Long Forwarded-to Numbers. If the GMSC does not support Long Forwarded-to Numbers and a long forwarded-to number is registered for CFB, then on invocation of CFB, ORLCF shall not be invoked.

2.10.4 MSC/VLR does not support Long Forwarded-to Numbers

The handling for CFB in the HLR is the same as that for CFU, see clause 1.10.3.

The VLR shall indicate whether it supports Long Forwarded-to Numbers in the Update Location and Restore Data messages to the HLR. If the VLR does not support Long Forwarded-to Numbers and a Long Forwarded-to Number is registered for CFB, then:

- If a default forwarded-to number (containing a maximum of 15 digits) is stored in the HLR, the HLR shall send to the VLR an Insert Subscriber Data message containing the default forwarded-to number in the Forwarded-to number parameter.

- Otherwise, the HLR shall send the VLR the following service state information:

    (Provisioned, Not Registered, Not Active, Not Induced)

For an MT call, if the following conditions are met then the HLR shall include the Forwarding interrogation required parameter in the first Send Routing Info ack:

- The GMSC supports Optimal Routeing and Long Forwarded-to Numbers, and

- The MSC/VLR does not support Long Forwarded-to Numbers,and

- CFB is active and operative, and

- A long forwarded-to number is registered for CFB.

According to the rules of Optimal Routeing, when the GMSC receives a Resume Call Handling message from the MSC/VLR, it shall send a second Send Routing Info message to the HLR allowing the HLR to insert the correct long forwarded-to number.

3 Call forwarding on no reply

3.1 Handling of call forwarding on no reply

3.1.1 Registration

The same rules apply for the registration of Call Forwarding on No Reply as were described for Call Forwarding Unconditional in clause 1.1.1 above, with the exceptions described below. Basic registration of information is illustrated in figure 3.2.

The No Reply Condition Timer

If a value for the no reply condition timer is not included in the registration request received from the MS, then the previous value set by the mobile user or the network operator applies.

Supplementary Service Interaction

Possible interaction situations between CFNRy and other supplementary services must then be checked. This is described in figure 3.2. Also see 3GPP TS 22.004 and 3GPP TS 22.082. For interaction between CFNRy and other supplementary services (ie not call barring or call forwarding services), the reader is referred to the respective technical specification for those supplementary services.

Interaction with CAMEL Phase 2 or higher

Possible interaction between CFNRy and CAMEL Phase 2 or higher is described in figure 3.2. If CAMEL Phase 2 or higher is not supported in the HLR, processing continues from the "No" exit of the test "Result=Pass".

The information flow for registration of call forwarding on no reply is shown in figure 3.1.

```
       MS                   MSC                  VLR                   HLR
      ____                  ____                  ____                 _____

        |   Register CFNRy    |                    |                     |
        |-------------------->|                    |                     |
        |                     |  Register CFNRy    |                     |
        |                     |------------------->|                     |
        |                     |                    |  Register CFNRy     |
        |                     |                    |------------------->|
        |                     |                    |                    CFNRy1
        |                     |                    |  Acknowledge        |
        |                     |                    |<-------------------|
        |                     |   Acknowledge      |                     |
        |                     |<-------------------|                     |
        |  Release complete   |                    |                     |
        |<--------------------|                    |                     |
        |      \Facility      |                    |                     |
        |                     |                    |                     |
```
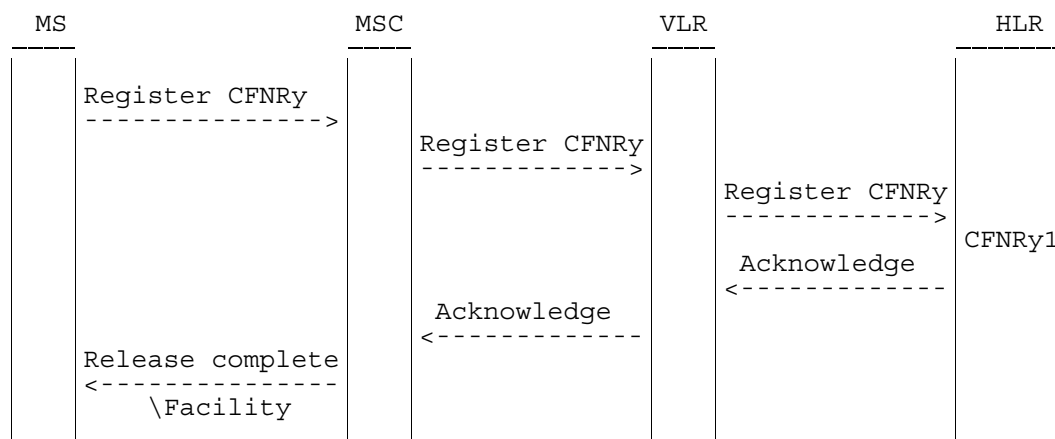
Figure 3.1: Registration of call forwarding on no reply
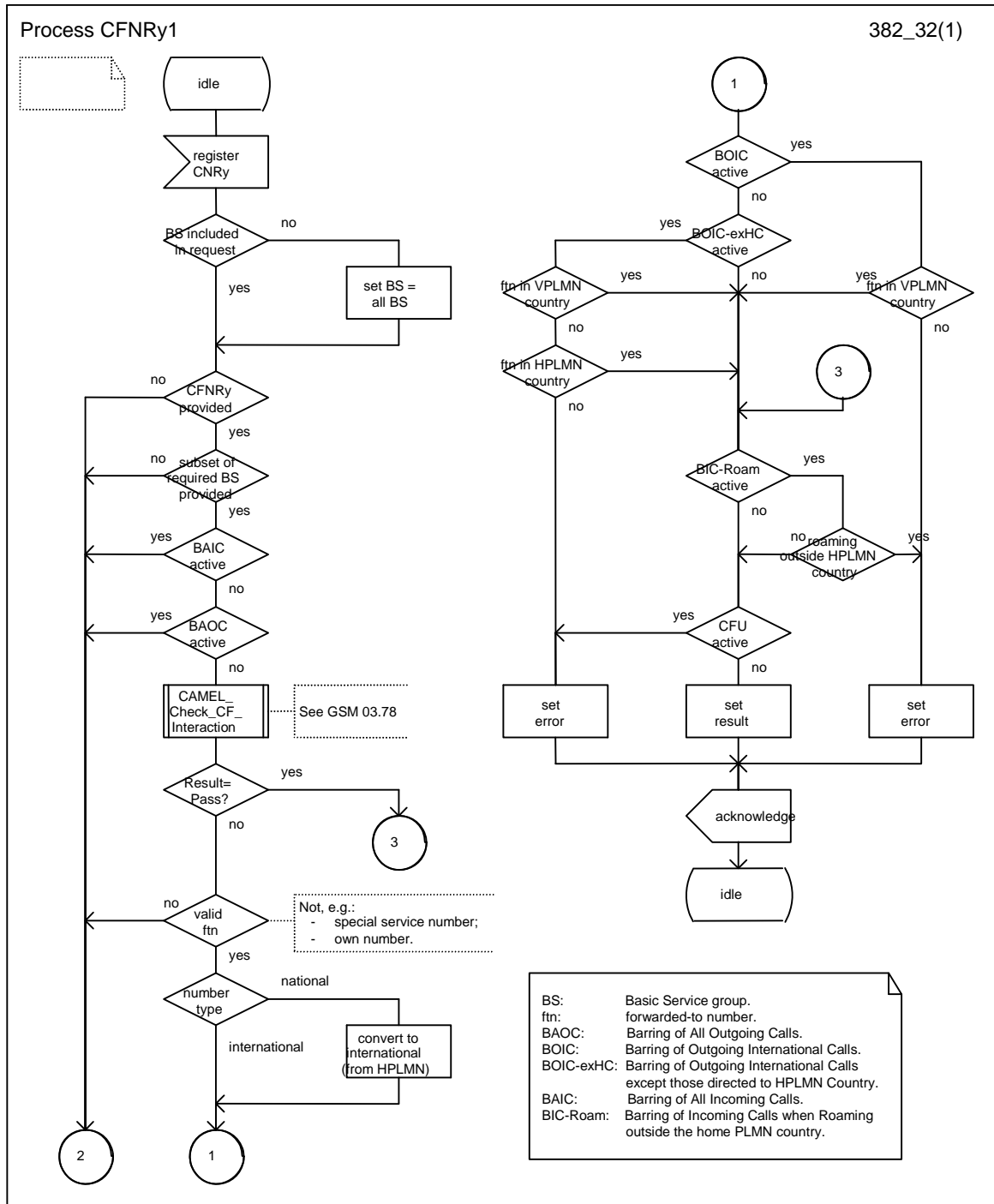
Figure 3.2: CFNRy1 Call forwarding on no reply registration process

3.1.2 Erasure

The same rules apply for the erasure of Call Forwarding on No Reply as were described for Call Forwarding Unconditional in clause 1.1.2 above. However, no checks for interaction with other supplementary services are required for erasure of CFNRy, see figures 3.3 and 3.4.
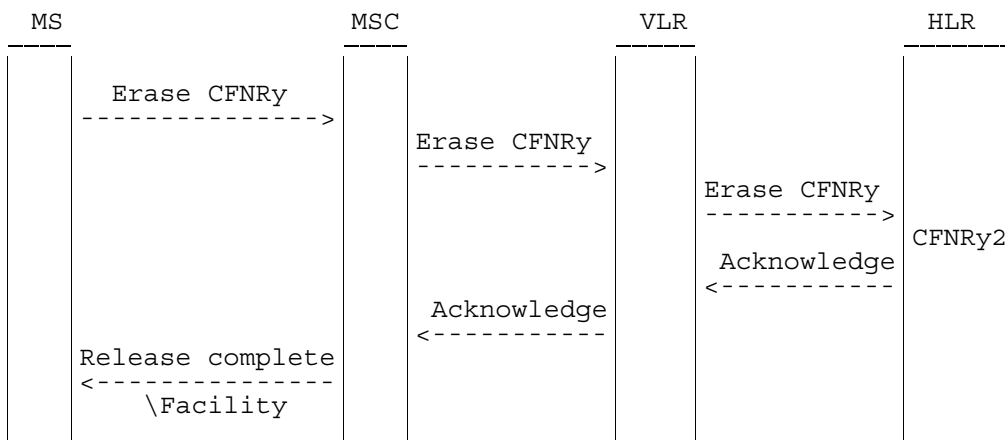
Figure 3.3: Erasure of call forwarding on no reply
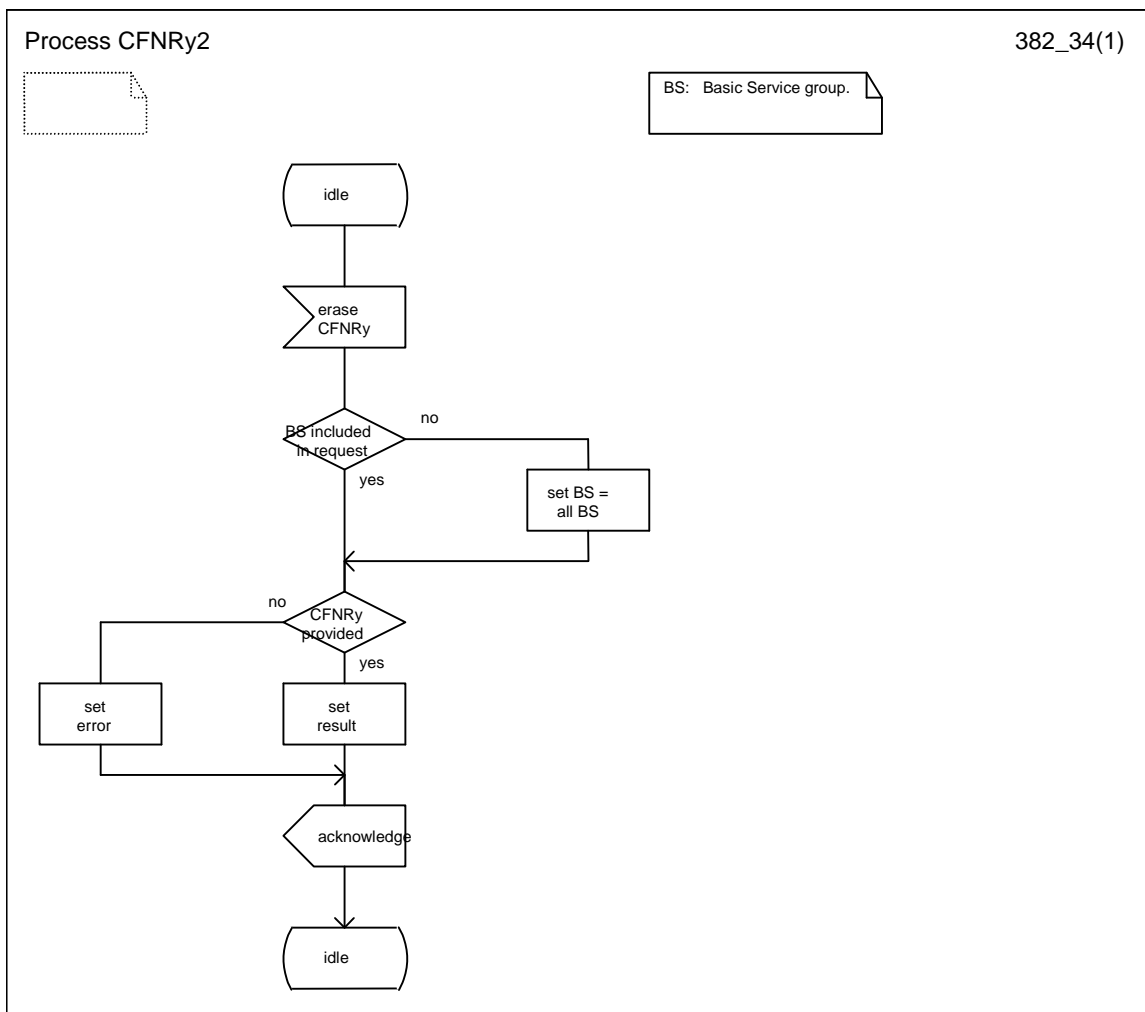
Figure 3.4: CFNRy2 Call forwarding on no reply erasure process

3.1.3   Activation

The same rules apply for the activation of Call Forwarding on No Reply as were described for Call Forwarding Unconditional in clause 1.1.3 above, with the exception of the checking of interaction with other supplementary services. Basic activation of CFNRy is illustrated in figure 3.6.

Supplementary Service Interaction

Possible interaction situations between CFNRy and other supplementary services must then be checked. This is described in figure 3.6. Also see 3GPP TS 22.004 and 3GPP TS 22.082. For interaction between CFNRy and other supplementary services (ie not call barring or call forwarding services), the reader is referred to the respective technical specification for those supplementary services.

The information flow for activation of CFNRy is shown in figure 3.5.

```
    MS                  MSC                 VLR                 HLR
   ───                  ───                 ────                ───────
    │   Activate CFNRy   │                   │                   │
    │--------------->│                   │                   │
    │                   │Activate CFNRy │                   │
    │                   │------------>│                   │
    │                   │                   │ Activate CFNRy │
    │                   │                   │ ------------>│
    │                   │                   │                   │CFNRy3
    │                   │                   │  Acknowledge   │
    │                   │  Acknowledge   │<-------------│
    │ Release complete │<-------------│                   │
    │<---------------│                   │                   │
    │      \Facility    │                   │                   │
    │                   │                   │                   │
```
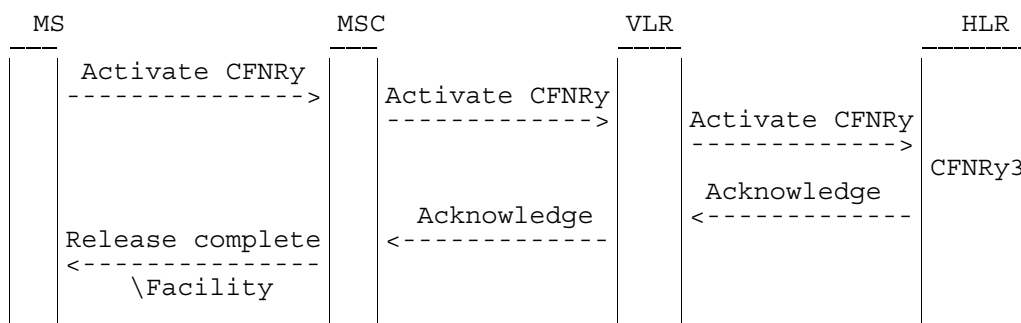
Figure 3.5: Activation of call forwarding on no reply
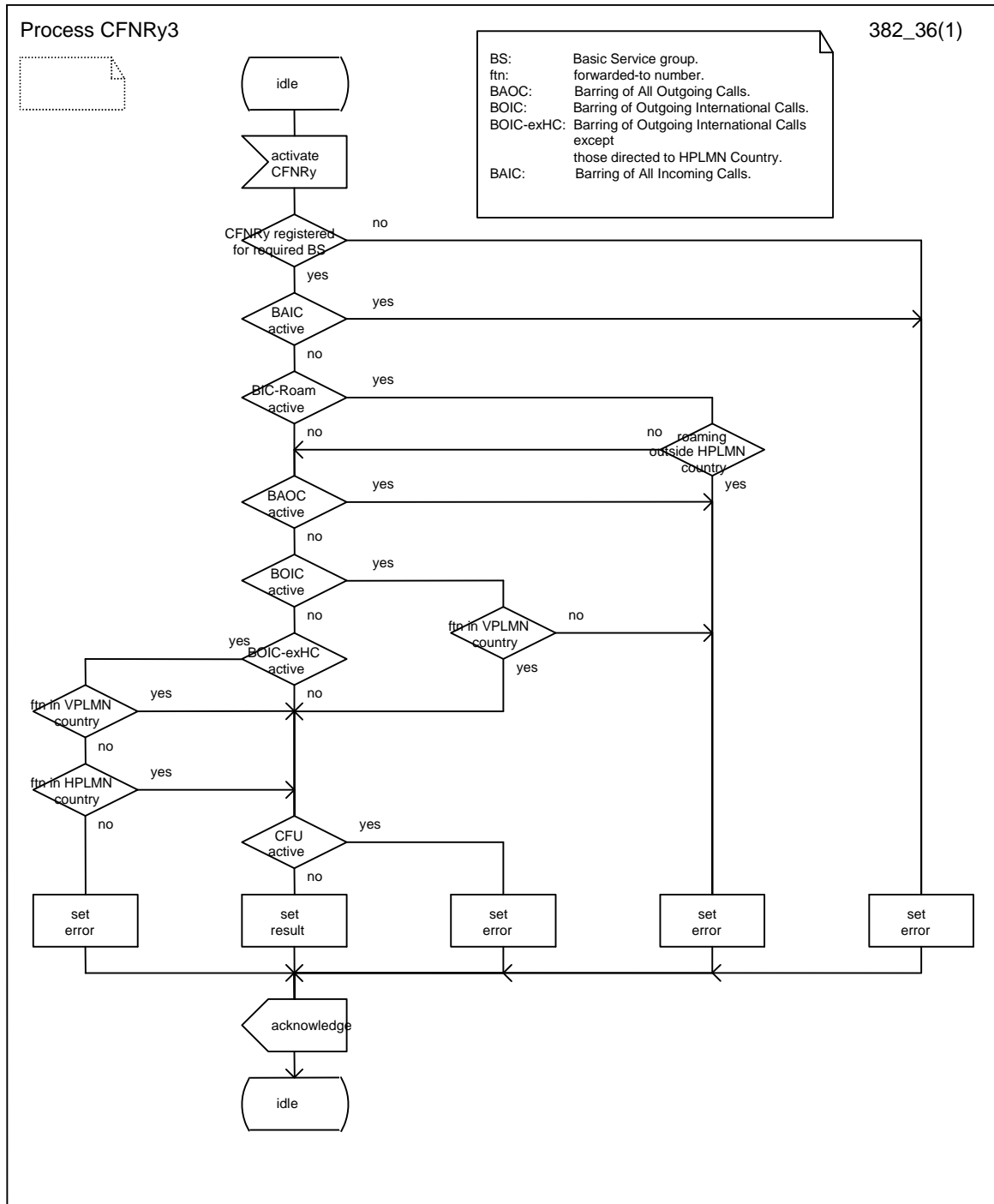
Figure 3.6: CFNRy3 Call forwarding on no reply activation process

3.1.4   Deactivation

The same rules apply for the deactivation of CFNRy as were described for CFU in clause 1.1.4 above, see figure 3.7 and 3.8.

```
MS                    MSC                   VLR                   HLR
___                   ___                   ___                   ___
 |  Deactivate CFNRy   |                     |                     |
 |-------------------->|  Deactivate CFNRy   |                     |
 |                     |-------------------->|  DeactivateCFNRy    |
 |                     |                     |-------------------->|
 |                     |                     |                     | CFNRy4
 |                     |                     |    Acknowledge      |
 |                     |                     |<--------------------|
 |                     |    Acknowledge      |                     |
 |  Release complete   |<--------------------|                     |
 |<--------------------|                     |                     |
 |        \Facility    |                     |                     |
```
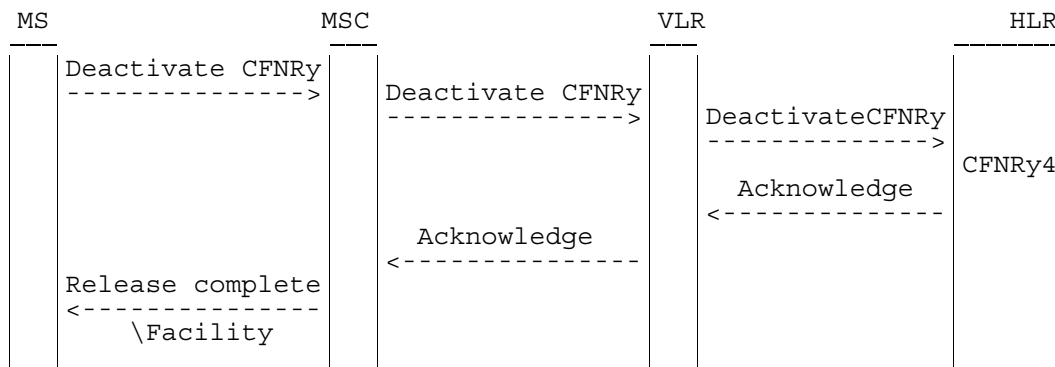
Figure 3.7: Deactivation of call forwarding on no reply
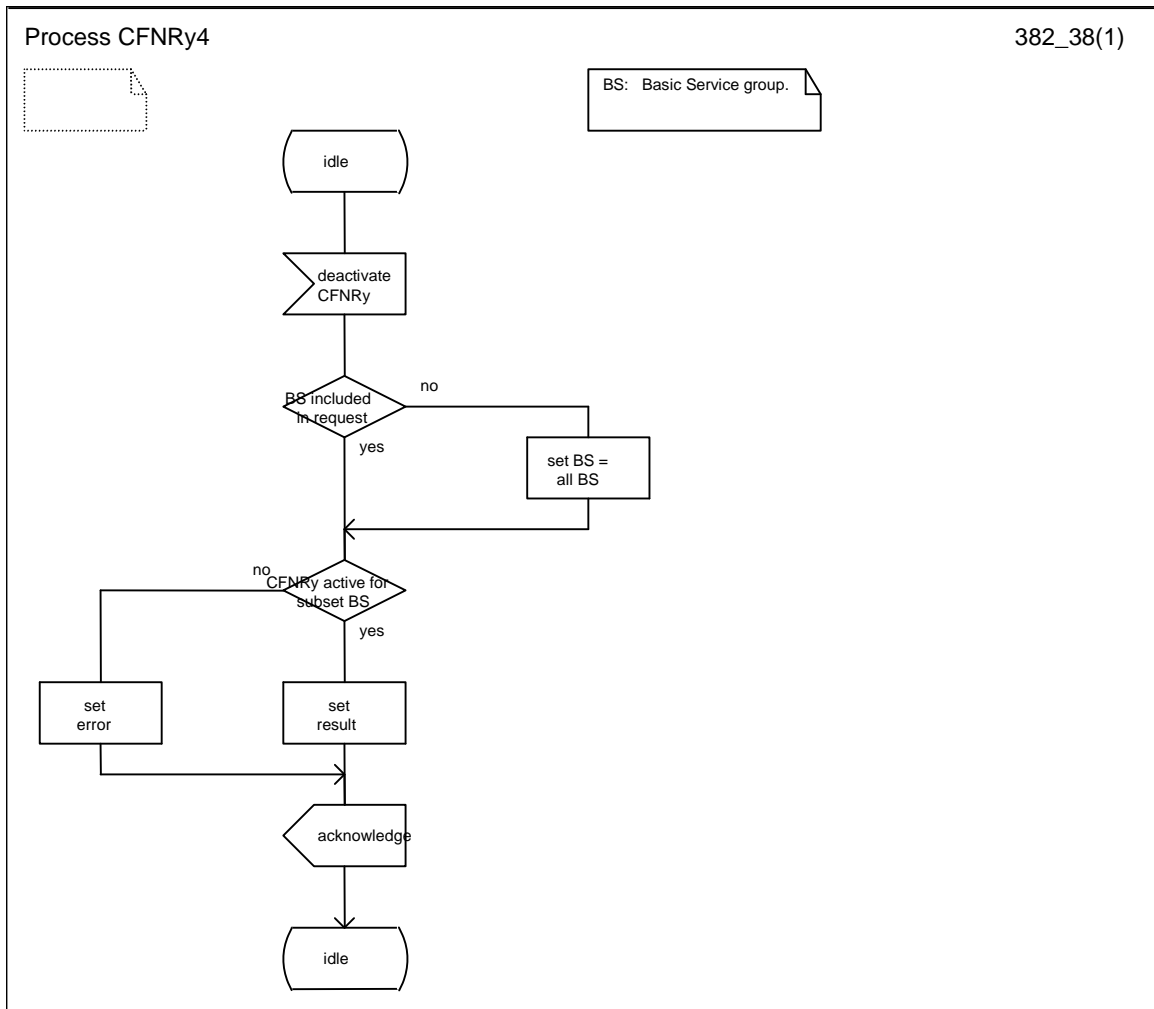
Figure 3.8: CFNRy4 Call forwarding on no reply deactivation process

3.1.5 Interrogation

Data request

The data request procedure enables the mobile subscriber to obtain information about the data stored in the PLMN. Interrogation of CFNRy is handled by the VLR which returns the required information or error to the MS, see figure 3.9.

```
MS                      MSC                     VLR                     HLR
──                      ───                     ───                     ───
 │    Interrogate CFNRy │                        │                       │
 │───────────────>      │                        │                       │
 │                      │    Interrogate CFNRy   │                       │
 │                      │───────────────>        │                       │
 │                      │       Acknowledge      │                       │
 │                      │<───────────────        │                       │
 │   Release complete   │                        │                       │
 │<───────────────      │                        │                       │
 │       \Facility      │                        │                       │
```
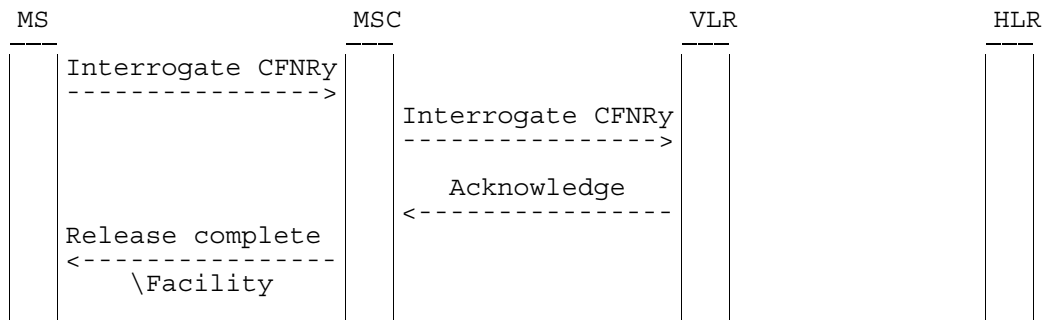
Figure 3.9: Interrogation of call forwarding on no reply

3.2 Functions and information flows

The following Mobile Additional Function has been identified for the PLMN:

MAF009

> Call forwarding on no reply authorizations examination

> The ability of a PLMN component to determine the authorizations relating to call forwarding on no reply. See figure 3.10.

> Location: VLR.

The information flows for forwarding to fixed terminal and to mobile station are shown in figures 3.11 and 3.12 respectively.
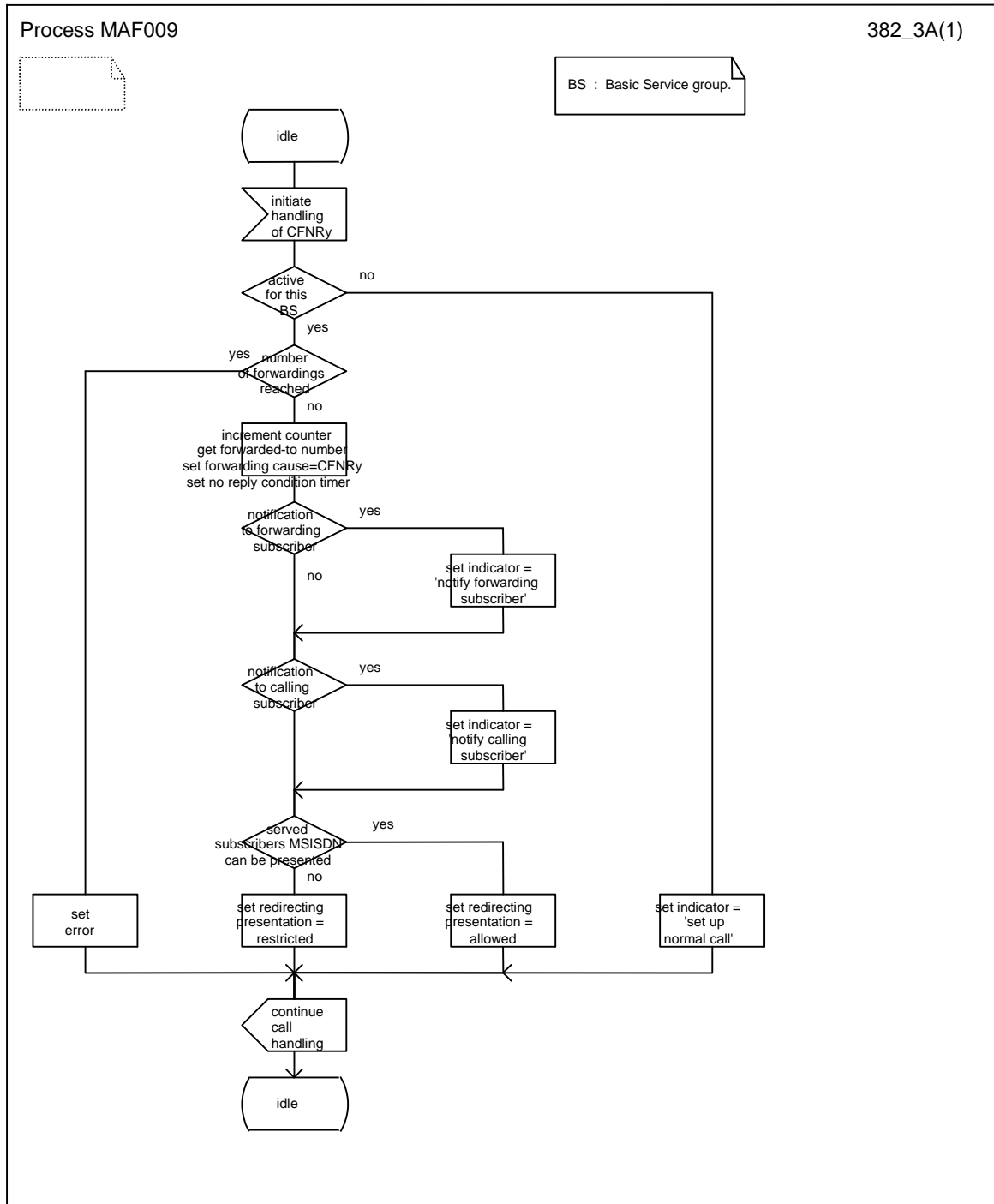
Figure 3.10: MAF009 Call forwarding on no reply authorisations examination (VLR)
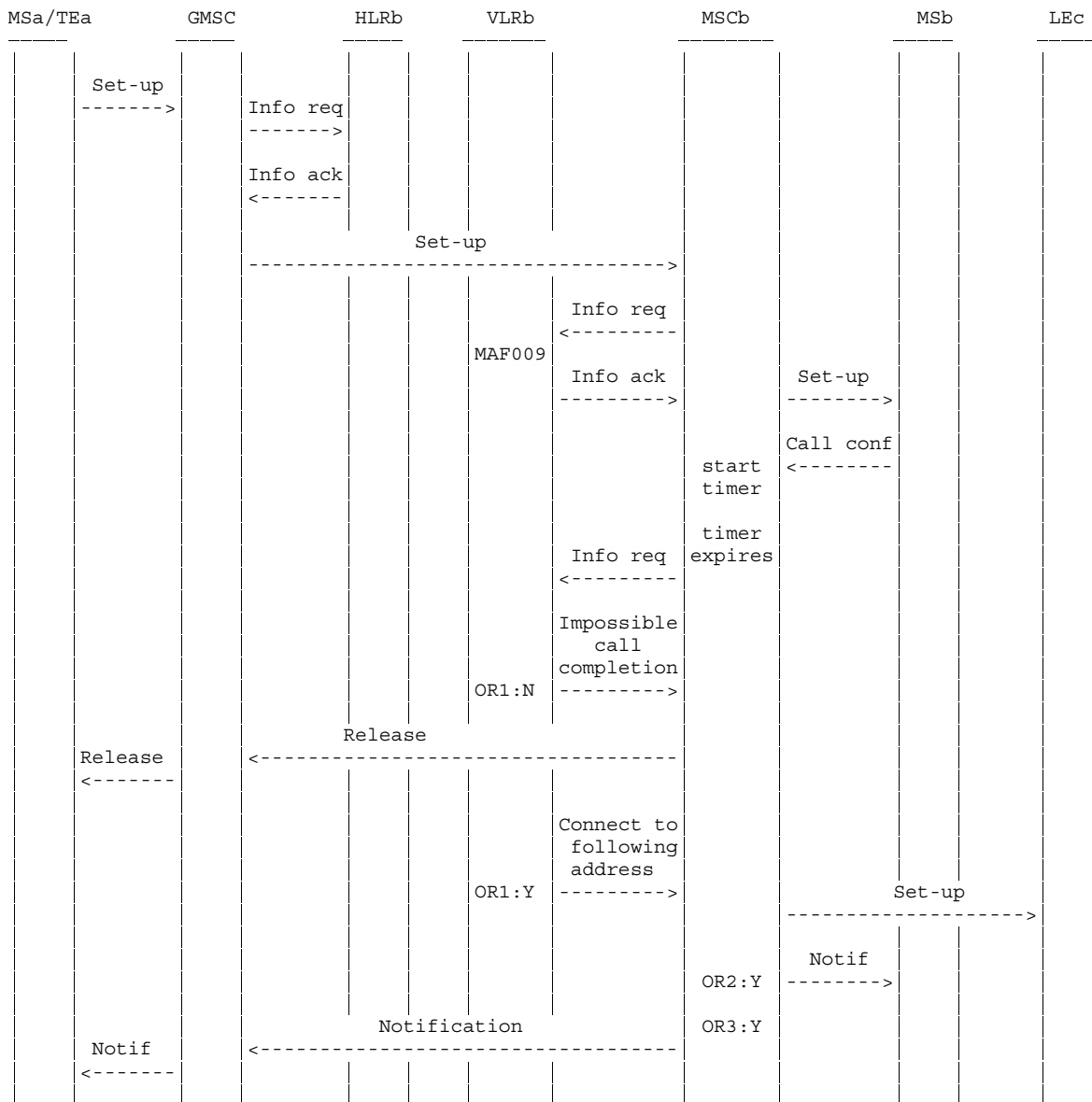
```
MSa/TEa      GMSC       HLRb      VLRb              MSCb              MSb        LEc
 _____      _____     _____    _____          _____         _____     _____
   |            |          |         |                |                |          |
   |  Set-up    |          |         |                |                |          |
   |------->    |          |         |                |                |          |
   |            | Info req |         |                |                |          |
   |            |------->  |         |                |                |          |
   |            |          |         |                |                |          |
   |            | Info ack |         |                |                |          |
   |            |<-------  |         |                |                |          |
   |            |          |         |                |                |          |
   |            |               Set-up                |                |          |
   |            |----------------------------------->  |                |          |
   |            |          |         |                |                |          |
   |            |          |         |     Info req    |                |          |
   |            |          |         |  <---------     |                |          |
   |            |          |  MAF009 |     Info ack    |   Set-up       |          |
   |            |          |         |  --------->     |  -------->     |          |
   |            |          |         |                |                |          |
   |            |          |         |                |   Call conf    |          |
   |            |          |         |           start |  <--------     |          |
   |            |          |         |           timer |                |          |
   |            |          |         |                |                |          |
   |            |          |         |     Info req    timer            |          |
   |            |          |         |  <---------    expires           |          |
   |            |          |         |                |                |          |
   |            |          |         |   Impossible   |                |          |
   |            |          |         |      call      |                |          |
   |            |          |         |   completion   |                |          |
   |            |          |         |OR1:N --------->  |                |          |
   |            |          |         |                |                |          |
   |            |          |   Release               |                |          |
   |            |  <-----------------------------------              |          |
   |  Release   |          |         |                |                |          |
   |  <-------  |          |         |                |                |          |
   |            |          |         |   Connect to   |                |          |
   |            |          |         |   following    |                |          |
   |            |          |         |    address     |                |          |
   |            |          |         |OR1:Y --------->  |                |          |
   |            |          |         |                |      Set-up     |          |
   |            |          |         |                |  -------------------->     |
   |            |          |         |                |      Notif      |          |
   |            |          |         |            OR2:Y|  -------->     |          |
   |            |          |    Notification         OR3:Y             |          |
   |   Notif    |  <-----------------------------------              |          |
   |  <-------  |          |         |                |                |          |
   |            |          |         |                |                |          |
```

NOTE: info: information   Y: Yes
         req: request   N: No
         ack: acknowledge
         notif: notification
         conf: confirmation
         OR1:   Call to be forwarded
         OR2:   Notification to forwarding subscriber required
         OR3:   Notification to calling subscriber required

Figure 3.11: Information flow for call forwarding on no reply
(to fixed terminal)
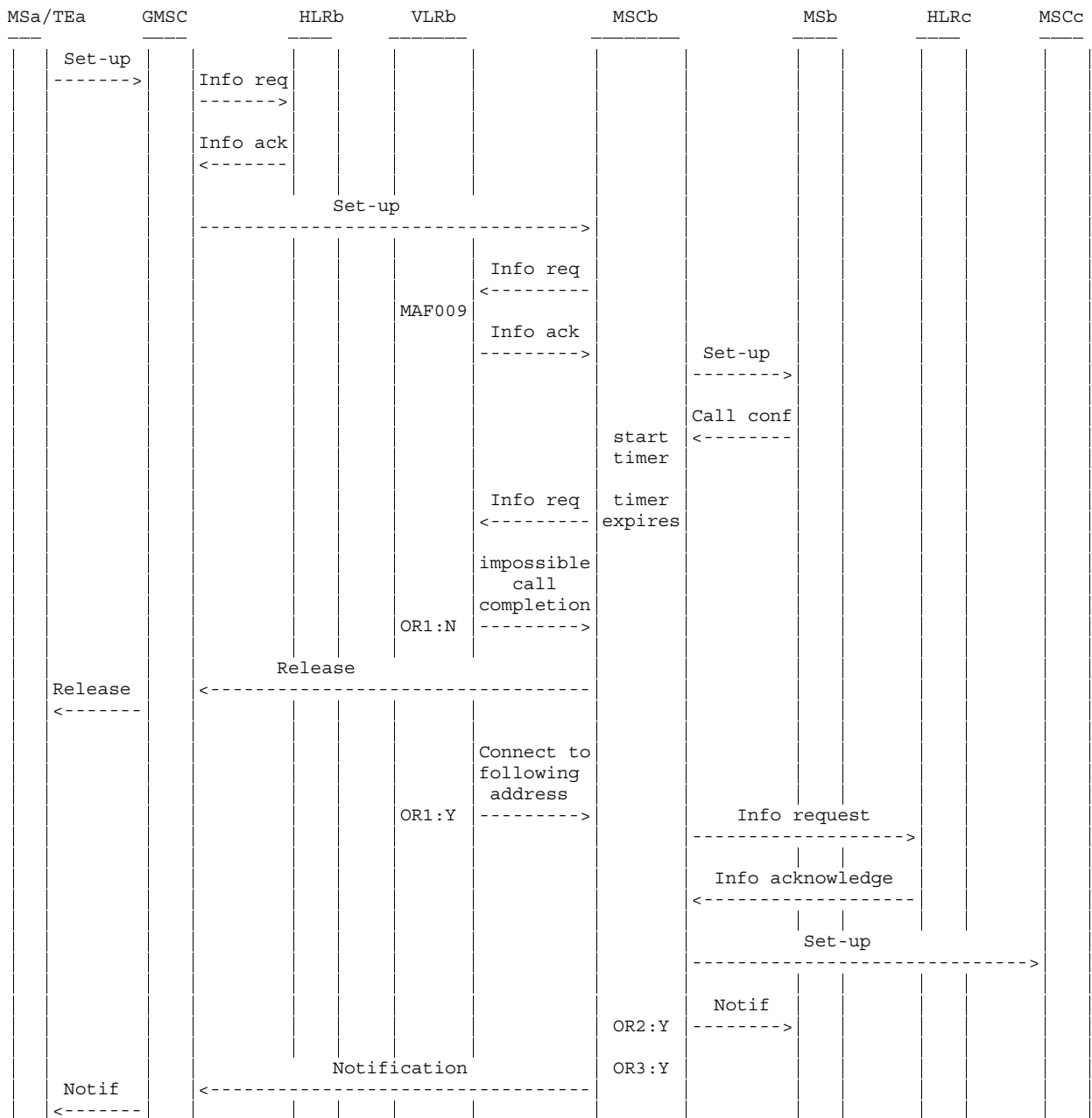
```
MSa/TEa    GMSC         HLRb     VLRb              MSCb          MSb        HLRc      MSCc
 ___        ___          ___      ___               ___          ___        ___       ___
 |   Set-up  |            |        |                 |            |          |         |
 | ------->  | Info req   |        |                 |            |          |         |
 |           | ------->   |        |                 |            |          |         |
 |           |            |        |                 |            |          |         |
 |           | Info ack   |        |                 |            |          |         |
 |           | <-------   |        |                 |            |          |         |
 |           |            |        |                 |            |          |         |
 |           |         Set-up      |                 |            |          |         |
 |           | ------------------------------------> |            |          |         |
 |           |            |        |                 |            |          |         |
 |           |            |        |    Info req     |            |          |         |
 |           |            |        |    <---------   |            |          |         |
 |           |            |  MAF009|    Info ack     |   Set-up   |          |         |
 |           |            |        |    --------->   | -------->  |          |         |
 |           |            |        |                 |            |          |         |
 |           |            |        |                 |  Call conf |          |         |
 |           |            |        |                 | start <--------       |         |
 |           |            |        |                 | timer      |          |         |
 |           |            |        |    Info req     | timer      |          |         |
 |           |            |        |    <--------- expires        |          |         |
 |           |            |        |                 |            |          |         |
 |           |            |        |    impossible   |            |          |         |
 |           |            |        |      call       |            |          |         |
 |           |            |        |    completion   |            |          |         |
 |           |            |        | OR1:N --------->  |           |          |         |
 |           |            |        |                 |            |          |         |
 |           |         Release     |                 |            |          |         |
 |  Release  | <------------------------------------ |            |          |         |
 | <-------  |            |        |                 |            |          |         |
 |           |            |        |                 |            |          |         |
 |           |            |        |   Connect to    |            |          |         |
 |           |            |        |   following     |            |          |         |
 |           |            |        |    address      |            |          |         |
 |           |            |        | OR1:Y --------->  |           |          |         |
 |           |            |        |                 |  Info request          |        |
 |           |            |        |                 | ------------------->   |        |
 |           |            |        |                 | Info acknowledge       |        |
 |           |            |        |                 | <-------------------    |        |
 |           |            |        |                 |     Set-up             |        |
 |           |            |        |                 | ------------------------------> |
 |           |            |        |                 |   Notif    |          |         |
 |           |            |        |                 | OR2:Y -------->        |         |
 |           |            |        |  Notification   | OR3:Y      |          |         |
 |   Notif   | <------------------------------------ |            |          |         |
 | <-------  |            |        |                 |            |          |         |
```

NOTE: info: information   Y: Yes
            req: request   N: no
            ack: acknowledge
            notif: notification
            conf: confirmation
            OR1:   Call to be forwarded
            OR2:   Notification to forwarding subscriber required
            OR3:   Notification to calling subscriber required

**Figure 3.12: Information flow for call forwarding on no reply
(to mobile station)**

3.3 Information stored in the HLR

The following logical states are applicable for CFNRy (refer to 3GPP TS 23.011 for an explanation of the notation):

Provisioning State	Registration State	Activation State	HLR Induction State
(Not Provisioned,	Not Registered,	Not Active,	Not Induced)
(Provisioned,	Not Registered,	Not Active,	Not Induced)
(Provisioned,	Registered,	Not Active,	Not Induced)
(Provisioned,	Registered,	Active and Quiescent,	Not Induced)
(Provisioned,	Registered,	Active and Operative,	Not Induced)

The registration and activation state may be different for each applicable elementary basic service group.

The provisioning state shall be on a per subscriber basis, and hence the same for all basic service groups.

The HLR shall store:

- the state of CFNRy (which shall be one of the valid states listed above) for each applicable elementary basic service group;

- the subscription option "notification to the calling party" on a per subscriber basis;

    This subscription option takes one of the following values:

    - no notification;

    - notification.

- the subscription option "notification to the forwarding party" on a per subscriber basis;

    This subscription option takes one of the following values:

    - no notification;

    - notification.

- the subscription option "MSISDN of the served subscriber can be presented to the forwarded-to subscriber" on a per subscriber basis;

    This subscription option takes one of the following values:

    - presentation restricted;

    - presentation allowed.

- the registration parameter "forwarded-to number" (possibly including a forwarded-to sub-address) for each applicable elementary basic service group;

- the registration parameter "no reply condition timer" for each applicable elementary basic service group.

    This parameter may take values in the range 5 - 30 seconds in steps of 5 seconds.

- the default forwarded-to number (containing less than 16 digits) for each applicable elementary basic service group.

3.4 State transition model

The following figure shows the successful cases of transition between the applicable logical states of CFNRy. The state changes are either caused by actions of the service provider, the mobile user or the network.

Note that error cases are not shown in the diagram as they normally do not cause a state change. Additionally, some successful requests may not cause a state change. Hence, they are not shown in the diagram. The diagram only shows operations on an elementary basic service group.
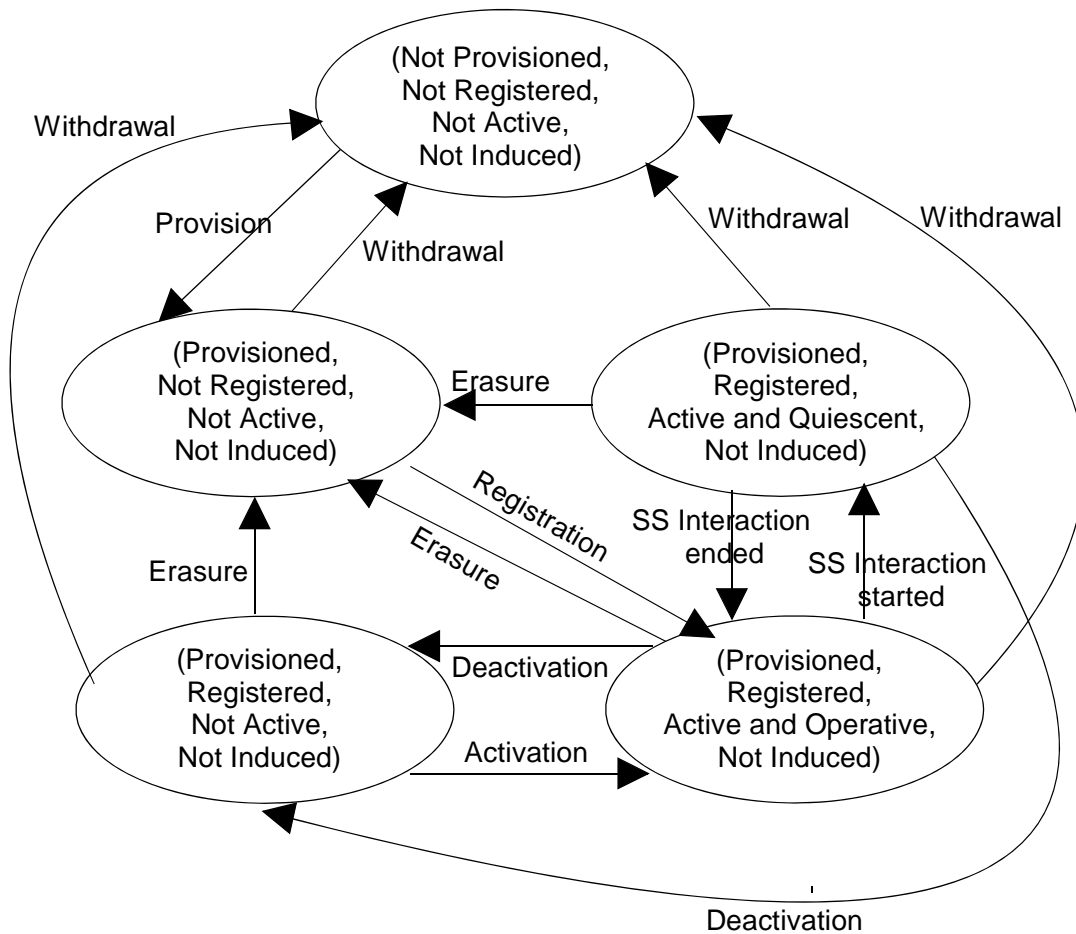
Figure 3.13: State transition model for CFNRy

3.5 Transfer of information from HLR to VLR

If the provisioning state for CFNRy is "Provisioned" then, when the subscriber registers on a VLR, the HLR shall send that VLR information about the logical state of CFNRy for all relevant elementary basic service groups.

If the registration state for CFNRy is "Registered" then, when the subscriber registers on a VLR, the HLR shall send that VLR the registration parameter "forwarded-to number" and "no reply condition timer" for all relevant elementary basic service groups and information about the subscription options "notification to the calling party", "notification to the forwarding party" and "MSISDN of the served subscriber can be presented to the forwarded-to subscriber".

If the logical state, the registration parameter "forwarded-to number" or the registration parameter "no reply condition timer" of CFNRy is changed while a subscriber is registered on a VLR then for the affected basic service groups, the HLR shall inform the VLR respectively of the new logical state or the new registration parameter of CFNRy.

If information about the subscription options "notification to the calling party" and "notification to the forwarding party" of CFNRy is changed while a subscriber is registered on a VLR and the registration state of CFNRy is "Registered" then the HLR shall inform the VLR of the new information about the subscription options of CFNRy.

3.6 Information stored in the VLR

For CFNRy the VLR shall store the service state information, the registration parameter "forward-to number", the registration parameter "no reply condition timer" and the subscription options received from the HLR.

3.7 Handover

Handover will have no impact on the control procedure and the operation of the service.

3.8 Cross phase compatibility

3.8.1 MS, MSC, VLR or HLR only support Phase 1 control of SS by the subscriber

In response to a CFNRy interrogation request, if the MS or any network element involved is of Phase 1, only information concerning basic service groups for which the activation state has the value "Active and Operative" will be returned. This means that the subscriber will not be aware that the forwarded to number is registered if CFNRy is deactivated or active (quiescent). A subaddress (if registered) will not be included.

Note that if any network element involved is of Phase 1, CFNRy Registration requests which use a subaddress and all CFNRy Activation and Deactivation requests will be rejected, as these are not specified in Phase 1.

3.8.2 HLR only supports Phase 1 updating of subscriber information

If the VLR receives the SS-Status parameter from a Phase 1 HLR it shall act if it has received the SS-Status parameter with the values shown in the following:

1) Registered, Activated   => P bit =1, R bit = 1, A bit = 1, Q bit = 0;

2) Registered, Deactivated => P bit =1, R bit = 1, A bit = 0, Q bit = 0 or 1;

3) Erased => P bit =1, R bit = 0, A bit = 0, Q bit = 0 or 1.

3.8.3 VLR only supports Phase 1 updating of subscriber information

When passing CFNRy information to a Phase 1 VLR, the HLR shall send the service state information in a form which the VLR can accept, based on the logical state held in the HLR, as follows:

1) (Provisioned, Not Registered, Not Active, Not Induced)

    => Erased, Deactivated;

2) (Provisioned, Registered, Not Active, Not Induced)

    => Registered, Deactivated;

3) (Provisioned, Registered, Active and Operative, Not Induced)

    => Registered, Activated;

4) (Provisioned, Registered, Active and Quiescent, Not Induced)

    => Registered, Deactivated.

The HLR shall not pass a subaddress to a Phase 1 VLR.

3.8.4 VLR only supports Phase 1 call handling

When a call is forwarded on no reply, as the HLR does not pass the subaddress to the VLR, calls shall be forwarded without the subaddress.

3.8.5 VLR does not support CAMEL or supports CAMEL Phase 1 only

When passing CFNRy information to a VLR not supporting CAMEL or supporting CAMEL Phase 1 only, the HLR shall send the registration parameter "forwarded-to number" only if it is registered in a format which the VLR can accept, i.e. international format.

If the registration state for CFNRy is "Registered" and the forwarded-to number is registered in a format other than international, then when updating a VLR not supporting CAMEL or supporting CAMEL Phase 1 only the HLR shall modify the service state information of CFNRy as follows.

> 1) (Provisioned, Registered, Not Active, Not Induced)
>
> => (Provisioned, Not Registered, Not Active, Not Induced)
>
> 2) (Provisioned, Registered, Active and Operative, Not Induced)
>
> => (Provisioned, Not Registered, Not Active, Not Induced)
>
> 3) (Provisioned, Registered, Active and Quiescent, Not Induced)
>
> => (Provisioned, Not Registered, Not Active, Not Induced)

According to the definitions in clause 3.5 no forwarded-to number will be passed to the VLR in these cases. The modification of the service state information sent to the VLR shall have no impact on the service state information stored in the HLR.

If the VLR supports Phase 1 updating of subscriber information only, a further translation of the service state information as defined in clause 3.8.3 shall be performed by the HLR.

3.9 Contents of messages

The same additions apply for CFNRy as for CFB, see clause 2.9 (additions to Send Routing Info and Send Routing Info ack are not used in this case).

3.10 Support of Long Forwarded-to Numbers

The handling for early CFNRc is the same as that for CFU, see clause 1.10.

The handling for late CFNRy is the same as that for CFB, see clause 2.10.

4 Call forwarding on mobile subscriber not reachable

4.1 Handling of call forwarding on mobile subscriber not reachable

4.1.1 Registration

The same rules apply for the registration of Call Forwarding on Mobile Subscriber Not Reachable as were described for Call Forwarding Unconditional in clause 1.1.1 above, with the exception of the checking of interaction with other supplementary services. Basic registration of information is illustrated in figure 4.2.

Supplementary Service Interaction

Possible interaction situations between CFNRc and other supplementary services must then be checked. This is described in figure 4.2. Also see 3GPP TS 22.004 and 3GPP TS 22.082. For interaction between CFNRc and other supplementary services (ie not call barring or call forwarding services), the reader is referred to the respective technical specification for those supplementary services.

Interaction with CAMEL Phase 2 or higher

Possible interaction between CFNRc and CAMEL Phase 2 or higher is described in figure 4.2. If CAMEL Phase 2 or higher is not supported in the HLR, processing continues from the "No" exit of the test "Result=Pass".

The information flow for registration of call forwarding on mobile subscriber not reachable is shown in figure 4.1.

```
        MS                   MSC                  VLR                  HLR
      -----                -----                -----                -----

       Register CFNRc
      --------------->
                         Register CFNRc
                        ------------->
                                              Register CFNRc
                                             ------------->
                                                                  CFNRc1
                                               Acknowledge
                                             <-------------
                           Acknowledge
                         <-------------
       Release complete
      <---------------
          \Facility
```
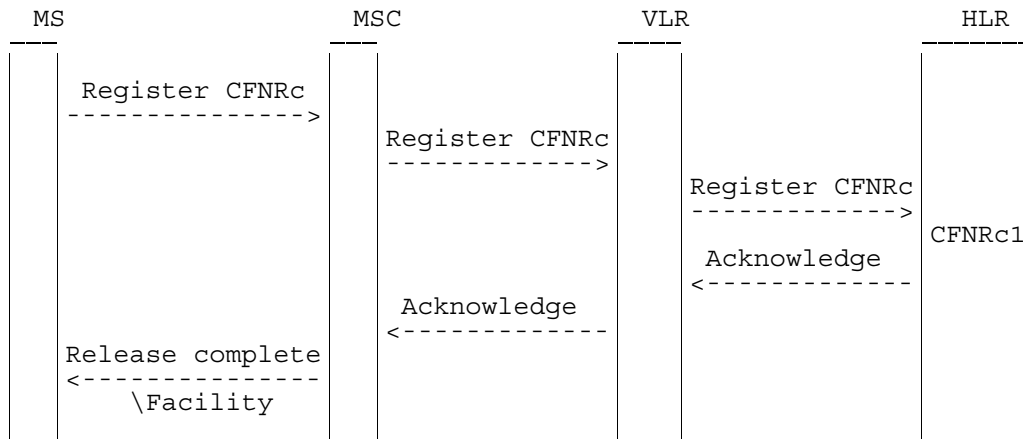
Figure 4.1: Registration of call forwarding on mobile subscriber not reachable
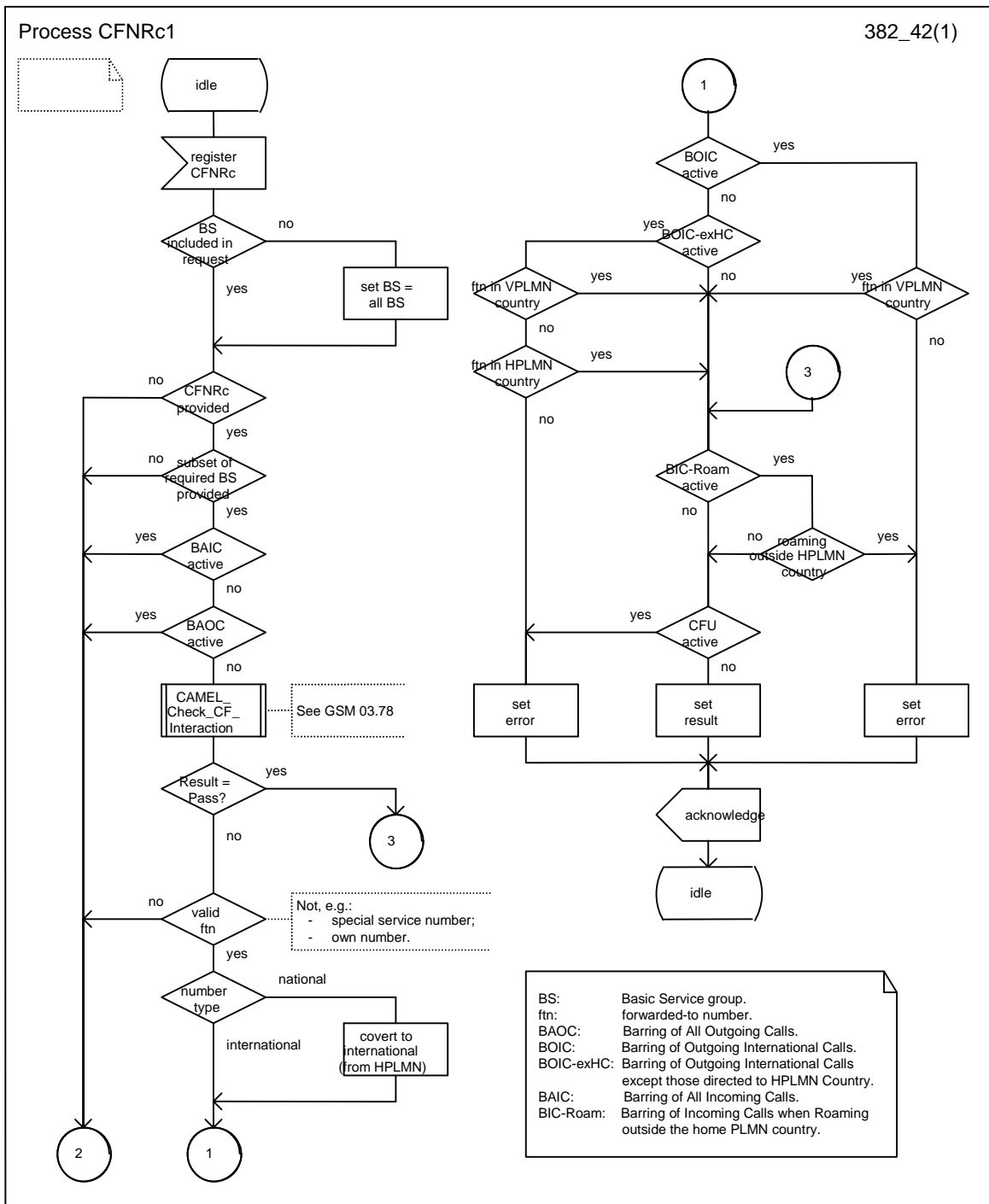
Figure 4.2: CFNRc1 Call forwarding on mobile subscriber not reachable registration process

4.1.2   Erasure

The same rules apply for the erasure of CFNRc as were described for CFU in clause 1.1.2 above. However, no checks for interaction with other supplementary services are required for erasure of CFNRc, see figure 4.4.

The information flow for registration of CFNRc is shown in figure 4.3.

```
       MS                    MSC                   VLR                   HLR
     ┌─────┐               ┌─────┐               ┌─────┐               ┌──────┐
     └─────┘               └─────┘               └─────┘               └──────┘
       │ Erase CFNRc          │                     │                     │
       │ --------------->     │                     │                     │
       │                  Erase CFNRc               │                     │
       │                  ---------->               │                     │
       │                      │                  Erase CFNRc              │
       │                      │                  ---------->              │
       │                      │                      │                  CFNRc2
       │                      │                  Acknowledge              │
       │                      │                  <----------              │
       │                  Acknowledge             │                     │
       │                  <----------              │                     │
       │ Release complete     │                     │                     │
       │ <---------------     │                     │                     │
       │      \Facility       │                     │                     │
```
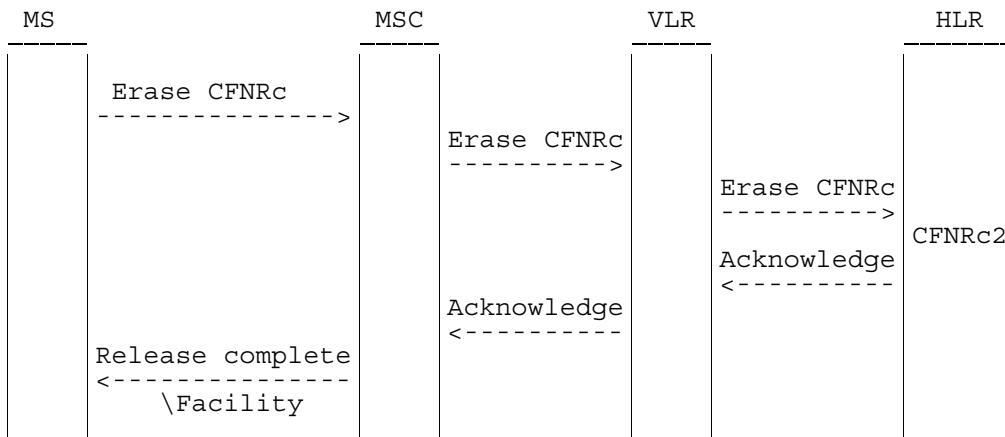
Figure 4.3: Erasure of call forwarding on mobile subscriber not reachable
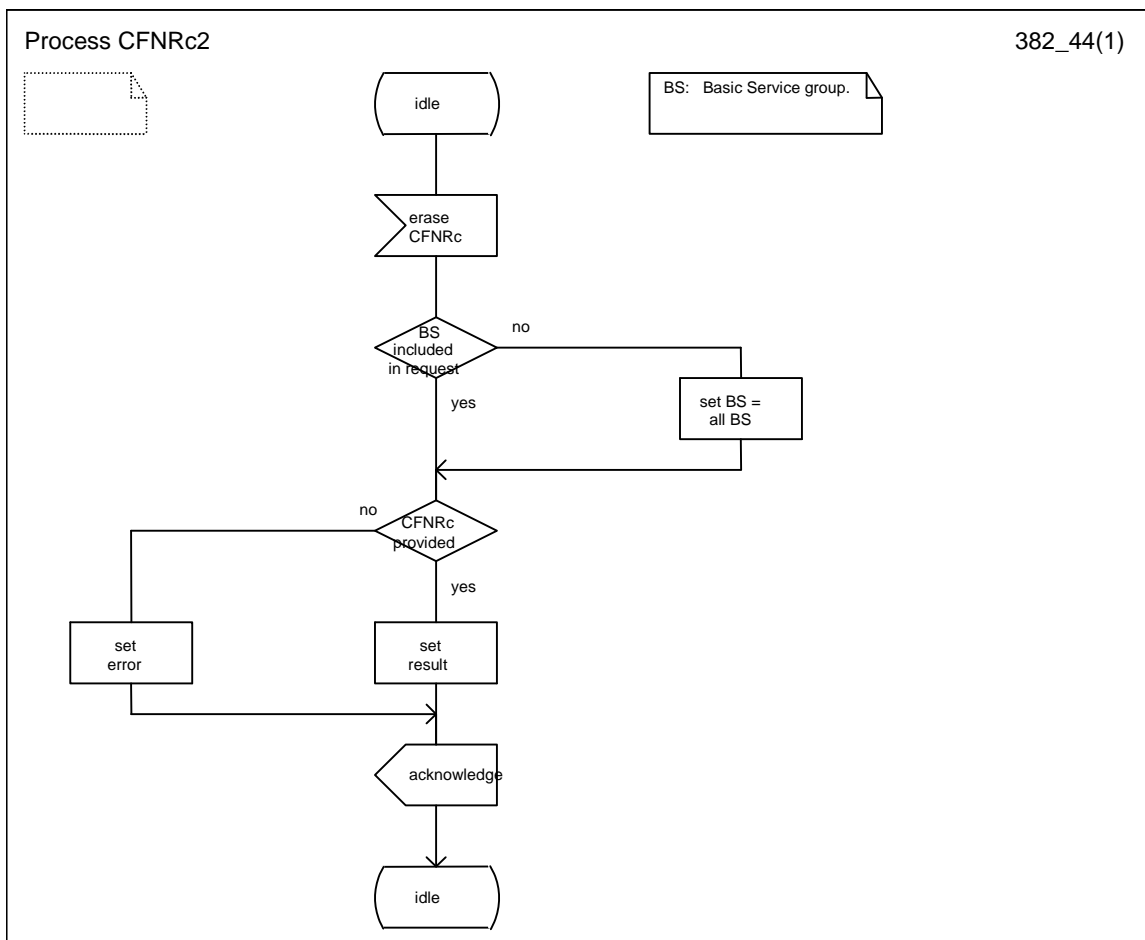
Figure 4.4: CFNRc2 Call forwarding on mobile subscriber not reachable erasure process

4.1.3   Activation

The same rules apply for the activation of CFNRc as were described for CFU in clause 1.1.3 above, with the exception of the checking of interaction with other supplementary services. Basic activation of CFNRc is illustrated in figure 4.6.

Supplementary Service Interaction

Possible interaction situations between CFNRc and other supplementary services must then be checked. This is described in figure 4.6. Also see 3GPP TS 22.004 and 3GPP TS 22.082. For interaction between CFNRc and other supplementary services (i.e. not call barring or call forwarding services), the reader is referred to the respective technical specification for those supplementary services.

The information flow for activation of call forwarding on MS not reachable is shown in figure 4.5.

```
     MS                  MSC                  VLR                  HLR
     ──                  ───                  ───                  ───
     │  Activate CFNRc    │                    │                    │
     │ ──────────────>    │  Activate CFNRc    │                    │
     │                    │ ─────────────>     │  Activate CFNRc    │
     │                    │                    │ ─────────────>     │ CFNRc3
     │                    │                    │    Acknowledge     │
     │                    │    Acknowledge     │ <─────────────     │
     │  Release complete  │ <─────────────     │                    │
     │ <──────────────    │                    │                    │
     │      \Facility     │                    │                    │
```
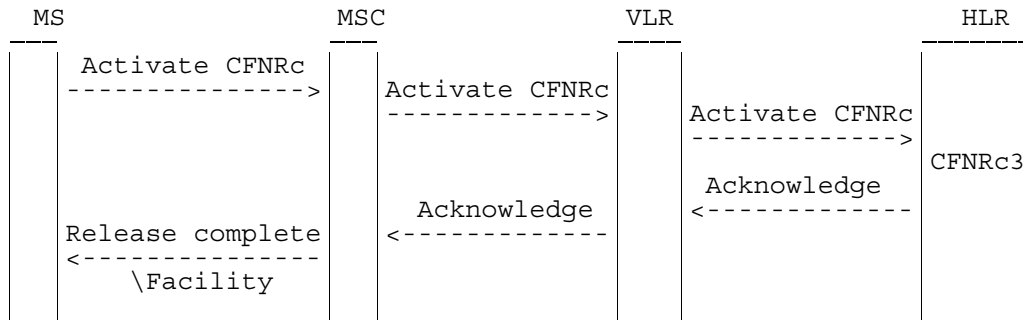
Figure 4.5: Activation of call forwarding on MS not reachable
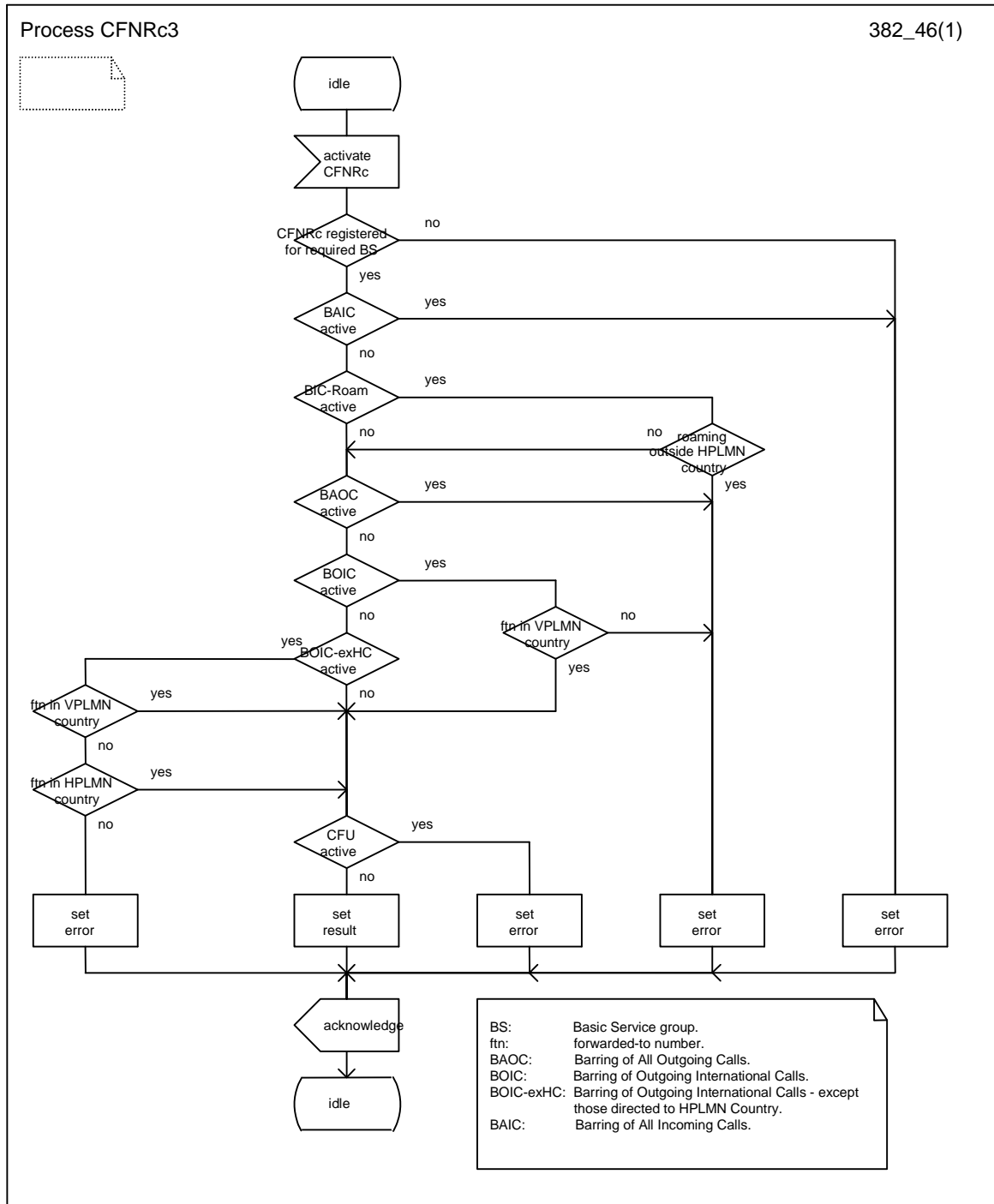
Figure 4.6: CFNRc3 Call forwarding on mobile subscriber not reachable activation process

4.1.4   Deactivation

The same rules apply for the deactivation of CFNRc as were described for CFU in clause 1.1.4 above, see figure 4.8.

The information flow for deactivation of call forwarding on mobile subscriber not reachable is shown in figure 4.7.

```
     MS                    MSC                   VLR                   HLR
  ___                   ___                   ___                   _____
   |  Deactivate CFNRc   |                     |                     |
   |-------------------->|  Deactivate CFNRc   |                     |
   |                     |-------------------->|  Deactivate CFNRc   |
   |                     |                     |-------------------->|
   |                     |                     |                     | CFNRc4
   |                     |                     |     Acknowledge     |
   |                     |                     |<--------------------|
   |                     |     Acknowledge     |                     |
   |  Release complete   |<--------------------|                     |
   |<--------------------|                     |                     |
   |     \Facility       |                     |                     |
```
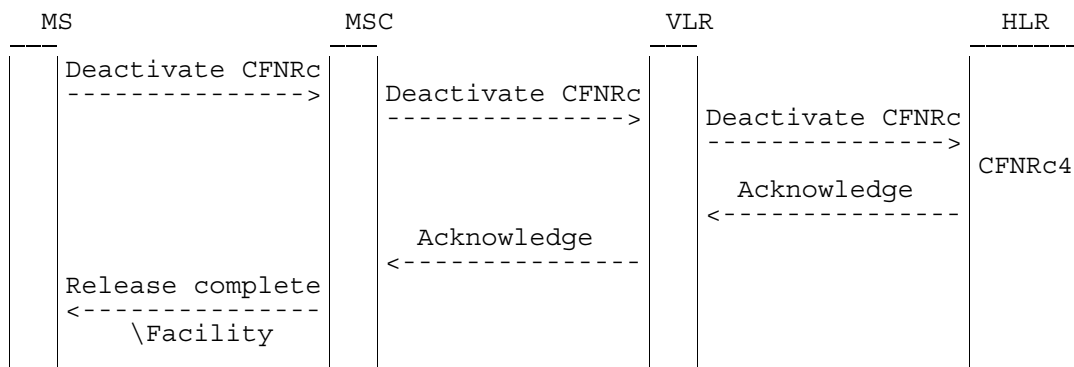
Figure 4.7: Deactivation of call forwarding on mobile subscriber not reachable
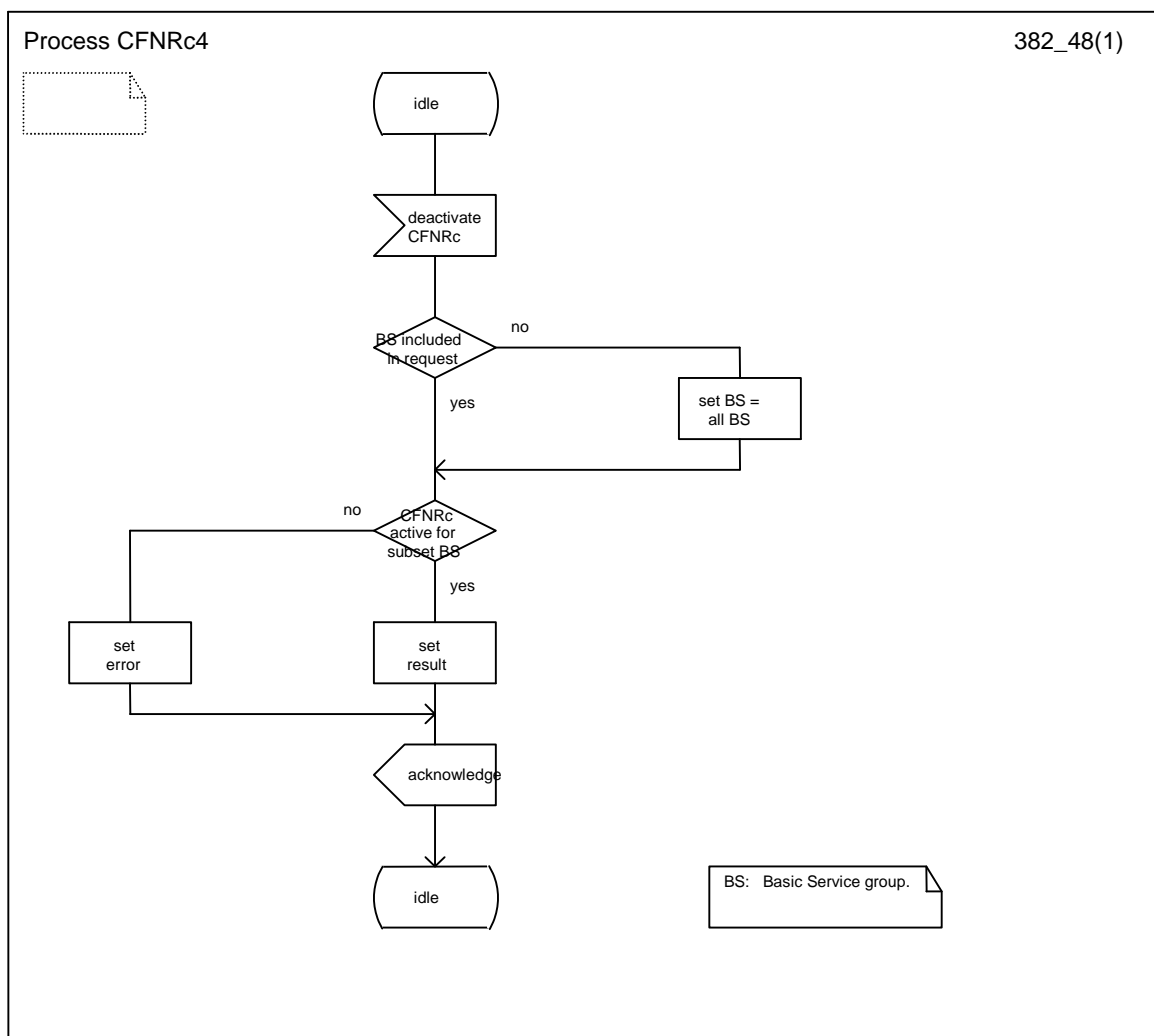
Figure 4.8: CFNRc4 Call forwarding on mobile subscriber not reachable deactivation process

4.1.5 Interrogation

Data request

The data request procedure enables the mobile subscriber to obtain information about the data stored in the PLMN. Interrogation of CFNRc is handled by the VLR which returns the required information or error to the MS, see figure 4.9.

```
    MS                      MSC                     VLR                     HLR
    ----                    ----                    ----                    ----
     |                       |                       |                       |
     |   Interrogate CFNRc   |                       |                       |
     |---------------->      |                       |                       |
     |                       |   Interrogate CFNRc   |                       |
     |                       |---------------->      |                       |
     |                       |      Acknowledge      |                       |
     |                       |<----------------      |                       |
     |   Release complete    |                       |                       |
     |<----------------      |                       |                       |
     |        \Facility      |                       |                       |
     |                       |                       |                       |
```
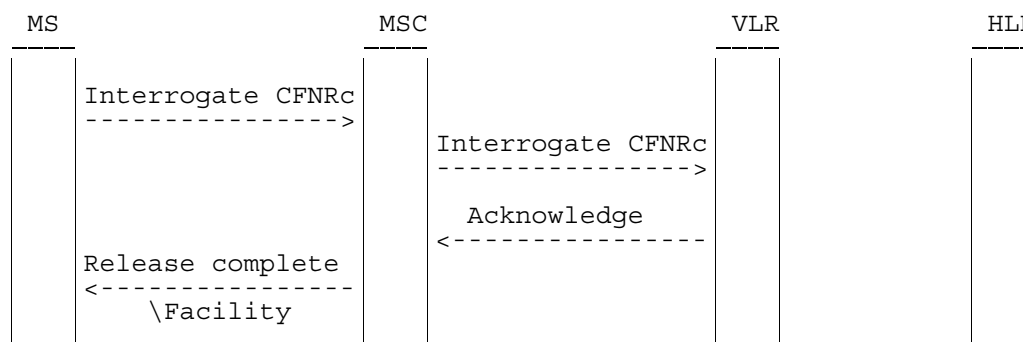
Figure 4.9: Interrogation of call forwarding on mobile subscriber not reachable

4.2 Functions and information flows

4.2.1 Call re-routed from VLR

The following Mobile Additional Function has been identified for the PLMN:

MAF010

    Examination of call forwarding on mobile subscriber not reachable authorizations

    The ability of a PLMN component to determine the authorizations relating to call forwarding on mobile subscriber not reachable in case the mobile subscriber is not reachable in the VLR, in case of no paging response or radio congestion. See figure 4.10.

    Location: VLR.

The information flows for forwarding to fixed terminal and to mobile station are shown in figures 4.11 and 4.12 respectively. These flows represent the case where the mobile subscriber is not reachable in the VLR, and that this fact was not detected at interrogation from the HLR. This situation occurs if the MSC requests the VLR to provide information for a mobile terminating call towards a subscriber who is detached in the VLR.

Figures 4.13 and 4.14 show the information flows in case of no paging response.

Figures 4.15 and 4.16 show the information flows in case of radio congestion.

4.2.2 Call re-routed from HLR

The following Mobile Additional Function has been identified for the PLMN:

MAF010

    Examination of call forwarding on mobile subscriber not reachable authorizations

    The ability of a PLMN component to determine the authorizations relating to call forwarding on mobile subscriber not reachable in case the mobile subscriber is deregistered or purged in the HLR or not reachable in the VLR. See figure 4.10.

    Location: HLR.

The information flows for forwarding to fixed terminal and to mobile station are shown in figures 4.17 and 4.18 respectively. These flows represent the case where the call is re-routed from the HLR because information from the VLR indicates that the subscriber cannot be reached in the VLR. This situation occurs if the VLR detects at roaming number request time that the subscriber concerned is detached or that there is no roaming number available.

Figures 4.19 and 4.20 show the information flows for forwarding to fixed terminal and to mobile station respectively in case where the call is re-routed by the HLR because the subscriber is deregistered or purged in the HLR.
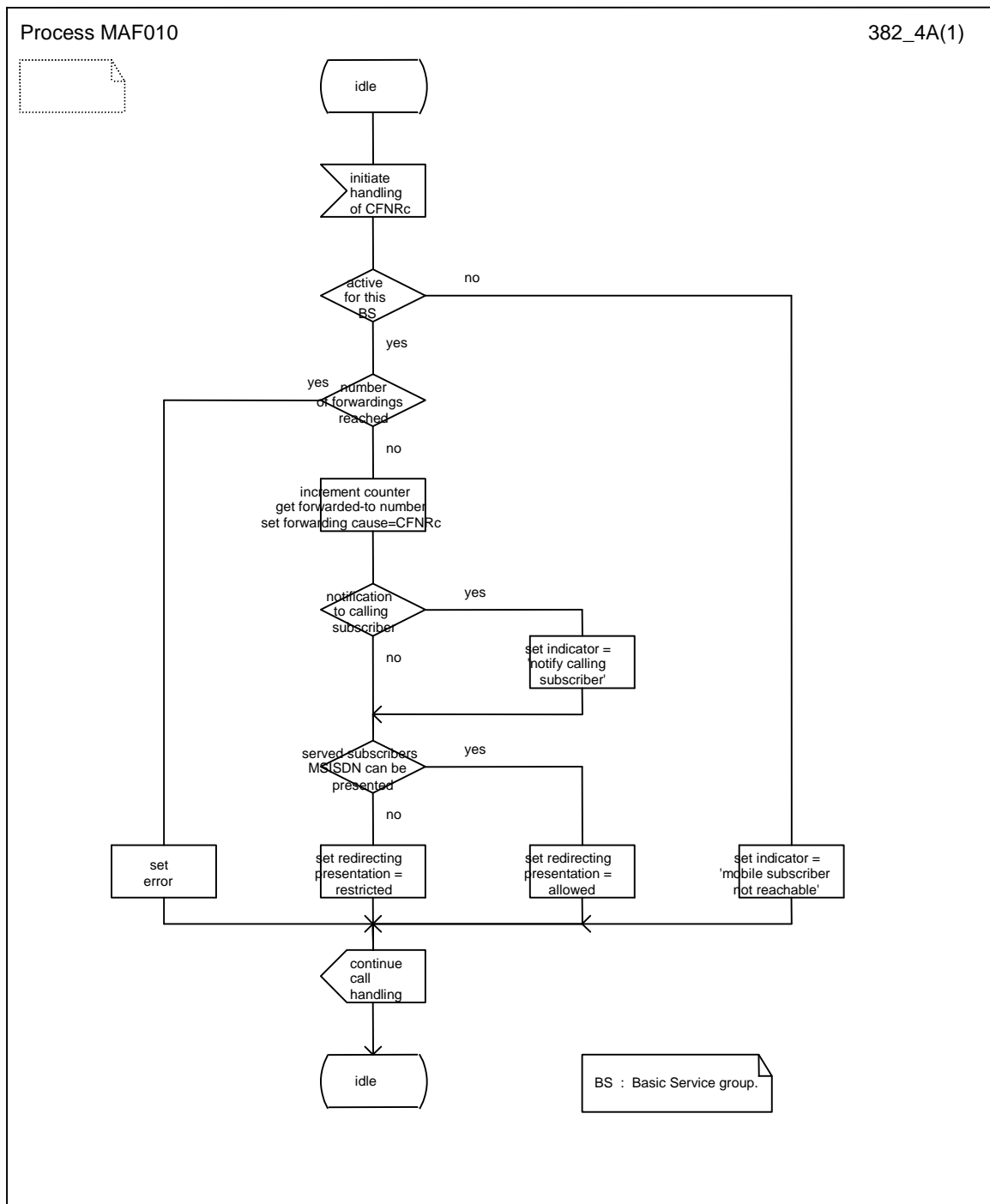
Figure 4.10: MAF010 Call forwarding on mobile subscriber not reachable authorisations examination (VLR and HLR)
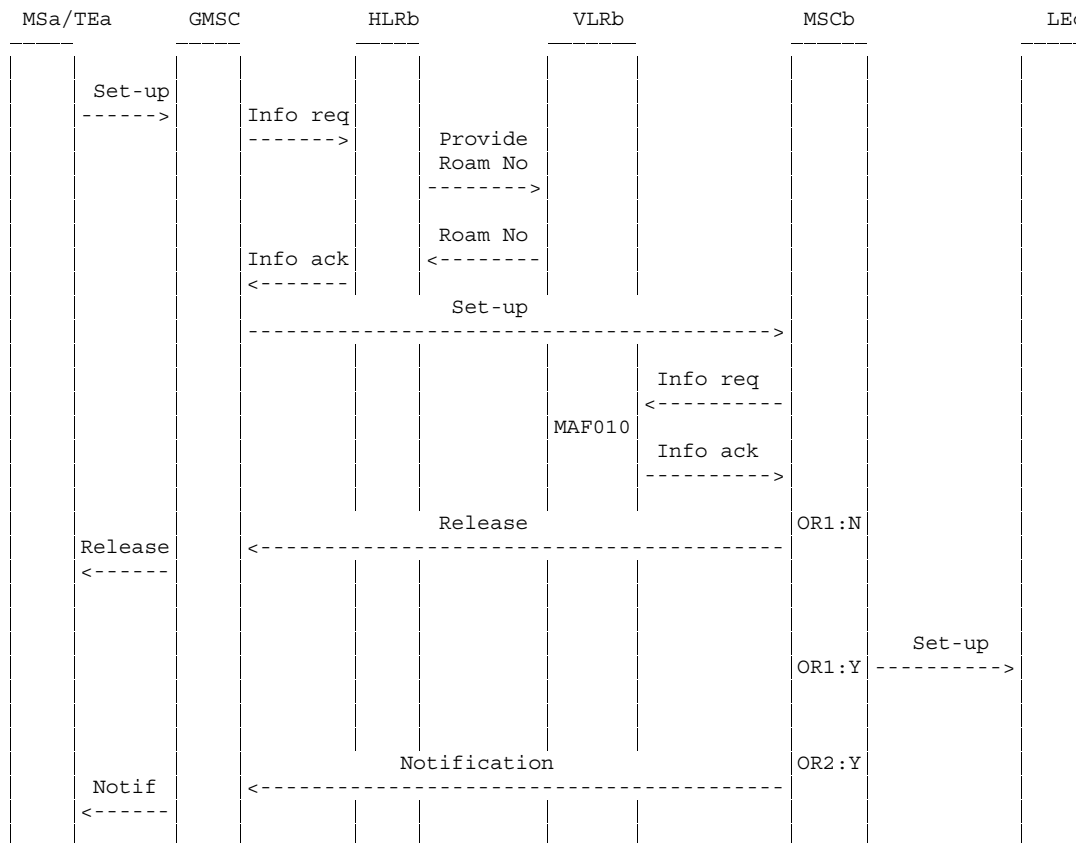
```
   MSa/TEa      GMSC         HLRb         VLRb          MSCb          LEc
   ┌─────┐     ┌─────┐      ┌─────┐      ┌─────┐       ┌─────┐      ┌─────┐

        │ Set-up   │            │            │             │            │
        ├──────>   │            │            │             │            │
        │      │ Info req │     │            │             │            │
        │      ├───────>  │     │            │             │            │
        │      │      │ Provide  │           │             │            │
        │      │      │ Roam No  │           │             │            │
        │      │      ├────────> │           │             │            │
        │      │      │      │ Roam No  │     │             │            │
        │      │ Info ack │ <────────  │     │             │            │
        │      │ <─────── │     │            │             │            │
        │      │      │      Set-up │        │             │            │
        │      ├──────────────────────────────────────────>│            │
        │      │      │      │     │     │ Info req │       │            │
        │      │      │      │     │     │ <──────────      │            │
        │      │      │      │     │ MAF010   │             │            │
        │      │      │      │     │     │ Info ack │       │            │
        │      │      │      │     │     ├──────────>       │            │
        │      │      │      Release │        │      │ OR1:N │           │
        │ Release │ <───────────────────────────────────   │            │
        │ <────── │    │     │            │             │            │
        │      │      │      │     │            │      │ Set-up │         │
        │      │      │      │     │            │ OR1:Y ├──────────>      │
        │      │      │      Notification │         │ OR2:Y │           │
        │ Notif │ <──────────────────────────────────────  │            │
        │ <────── │    │     │            │             │            │
   └─────┘     └─────┘      └─────┘      └─────┘       └─────┘      └─────┘
```

NOTE: info: information   Y: Yes
        req: request   N: No
        ack: acknowledge
        notif: notification
        Roam No: roaming number
        OR1:   Call to be forwarded
        OR2:   Notification to calling subscriber required

Figure 4.11: Information flow for call forwarding on mobile subscriber not reachable in case of mobile subscriber not reachable in the VLR (to fixed terminal) (re-routing by VLR)

```
MSa/TEa      GMSC         HLRb         VLRb         MSCb         HLRc      MSCc
 ___         ___          ___          ___          ___         ___       ___
  |           |            |            |            |           |         |
  |  Set-up   |            |            |            |           |         |
  |---------->| Info req   |            |            |           |         |
  |           |----------->|  Provide   |            |           |         |
  |           |            |  Roam No   |            |           |         |
  |           |            |----------->|            |           |         |
  |           |            |            |            |           |         |
  |           |            |  Roam No   |            |           |         |
  |           | Info ack   |<-----------|            |           |         |
  |           |<-----------|            |            |           |         |
  |           |            |        Set-up           |           |         |
  |           |------------------------------------->|           |         |
  |           |            |            |            |           |         |
  |           |            |            |         Info req        |         |
  |           |            |            |          <---------     |         |
  |           |            |            | MAF010     |           |         |
  |           |            |            |         Info ack        |         |
  |           |            |            |          --------->     |         |
  |           |            |            |            |           |         |
  |           |            |       Release           | OR1:N     |         |
  | Release   |<-------------------------------------|           |         |
  |<----------|            |            |            |           |         |
  |           |            |            |            |           |         |
  |           |            |            |            | OR1:Y  Info req      |
  |           |            |            |            |        --------->    |
  |           |            |            |            |        Info ack      |
  |           |            |            |            |        <---------    |
  |           |            |            |            |         Set-up       |
  |           |            |            |            |        -------------------->
  |           |            |       Notification      | OR2:Y     |         |
  | Notif     |<-------------------------------------|           |         |
  |<----------|            |            |            |           |         |
  |           |            |            |            |           |         |
```
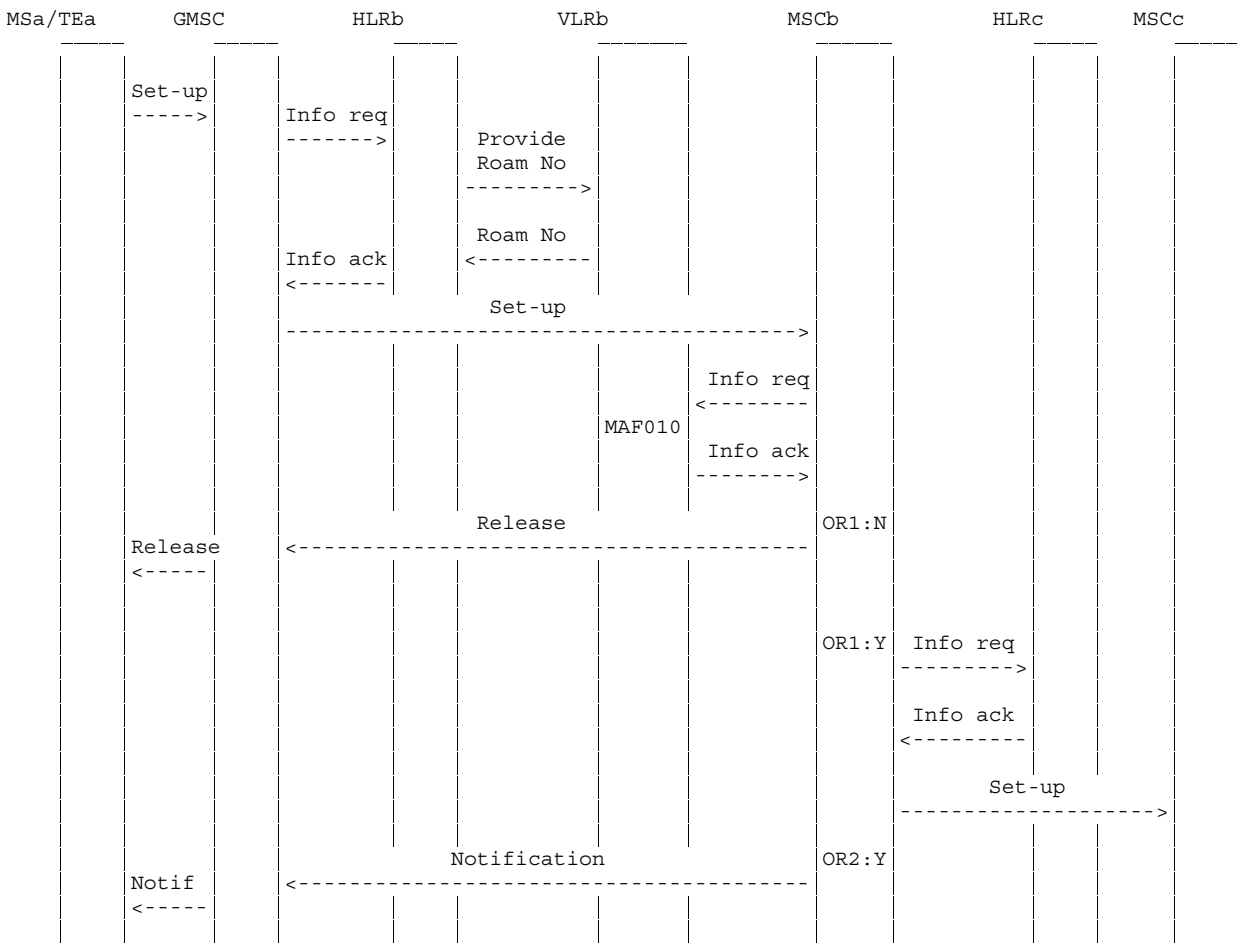
NOTE: info: information   Y: Yes
         req: request   N: No
         ack: acknowledge
         notif: notification
         Roam No: roaming number
         OR1: Call to be forwarded
         OR2: Notification to calling subscriber required

Figure 4.12: Information flow for call forwarding on mobile subscriber not reachable in case of mobile subscriber not reachable in the VLR (to mobile station) (re-routing by VLR)

Figure 4.13: Information flow for call forwarding on mobile subscriber not reachable in case of no paging response (to fixed terminal) (re-routing by VLR)

```
  MSa/TEa      GMSC         HLRb         VLRb                  MSCb            MSb       HLRc      MSCc
  ____         ____         ____         ____                  ____            ____      ____      ____
    |            |            |            |                     |               |         |         |
    | Set-up     |            |            |                     |               |         |         |
    | ------>    | Info req   |            |                     |               |         |         |
    |            | -------->  |            |                     |               |         |         |
    |            |            | Provide    |                     |               |         |         |
    |            |            | roam No    |                     |               |         |         |
    |            |            | -------->  |                     |               |         |         |
    |            |            |            |                     |               |         |         |
    |            |            | Roam No    |                     |               |         |         |
    |            | Info ack   | <--------  |                     |               |         |         |
    |            | <--------  |            |                     |               |         |         |
    |            |            |   Set-up   |                     |               |         |         |
    |            | -------------------------------------------------->          |         |         |
    |            |            |            |                     |               |         |         |
    |            |            |            |       Info req      |               |         |         |
    |            |            |            | <----------         |               |         |         |
    |            |            |            |                     |               |         |         |
    |            |            |            |       Page MS       |   Paging      |         |         |
    |            |            |            | ---------->         |   ----->      |         |         |
    |            |            |            |                     |               |         |         |
    |            |            |            |                     |  no           |         |         |
    |            |            |            |                     |  response     |         |         |
    |            |            |            |       Absent        |               |         |         |
    |            |            |            |       subscriber    |               |         |         |
    |            |            |            | <----------         |               |         |         |
    |            |            |        MAF010                    |               |         |         |
    |            |            |            |                     |               |         |         |
    |            |            |        OR1:N   Impossible        |               |         |         |
    |            |            |            |    call             |               |         |         |
    |            |            |            |    completion       |               |         |         |
    |            |            |            | ---------->         |               |         |         |
    |            |            |   Release  |                     |               |         |         |
    | Release    | <------------------------------------------------------      |         |         |
    | <------    |            |            |                     |               |         |         |
    |            |            |        OR1:Y   Connect to        |               |         |         |
    |            |            |            |    following        |               |         |         |
    |            |            |            |    address          |               |         |         |
    |            |            |            | ---------->         |   Info req    |         |         |
    |            |            |            |                     | -------------->          |         |
    |            |            |            |                     |   Info ack    |         |         |
    |            |            |            |                     | <--------------          |         |
    |            |            |            |                     |   Set-up      |         |         |
    |            |            |            |                     | ---------------------->  |         |
    |            |            |            |   Notification      |  OR2:Y        |         |         |
    | Notif      | <------------------------------------------------------      |         |         |
    | <------    |            |            |                     |               |         |         |
    |            |            |            |                     |               |         |         |
```

NOTE: info: information   Y: Yes
        req: request   N: No
        ack: acknowledge
        notif: notification
        roam: roaming
        OR1:   Call to be forwarded
        OR2:   Notification to calling subscriber required

Figure 4.14: Information flow for call forwarding on mobile subscriber not reachable in case of no paging response (to mobile station) (re-routing by VLR)

```
     MSa/TEa      GMSC        HLRb        VLRb                    MSCb           MSb         LEc
     ------      ------      ------      -------                 ------         -----       -----
       |           |           |           |                       |             |           |
       |  Set-up   |           |           |                       |             |           |
       | ------>   |           |           |                       |             |           |
       |           | Info req  |           |                       |             |           |
       |           | -------->|            |                       |             |           |
       |           |           | Provide   |                       |             |           |
       |           |           | roam No   |                       |             |           |
       |           |           | --------->|                       |             |           |
       |           |           |           |                       |             |           |
       |           |           | Roam No   |                       |             |           |
       |           | Info ack  | <---------|                       |             |           |
       |           | <--------|            |                       |             |           |
       |           |                Set-up                         |             |           |
       |           | ------------------------------------------->  |             |           |
       |           |           |           |            Info req   |             |           |
       |           |           |           |          <-----------|              |           |
       |           |           |           |         Complete call |             |           |
       |           |           |           |          ----------->|              |           |
       |           |           |           |                       | radio       |           |
       |           |           |           |                       | congestion  |           |
       |           |           |           |            Radio      |             |           |
       |           |           |           |          congestion   |             |           |
       |           |           |           |          <-----------|              |           |
       |           |           |           | MAF010                |             |           |
       |           |           |           |                       |             |           |
       |           |           |           | OR1:N   Impossible    |             |           |
       |           |           |           |           call        |             |           |
       |           |           |           |         completion     |             |           |
       |           |           |           |         ----------->  |             |           |
       |           |              Release                           |             |           |
       | Release   | <--------------------------------------------|               |           |
       | <------   |           |           |                       |             |           |
       |           |           |           | OR1:Y   Connect to    |             |           |
       |           |           |           |         following     |             |           |
       |           |           |           |         address       |             |           |
       |           |           |           |         ----------->  |   Set-up    |           |
       |           |           |           |                       | ----------->|           |
       |           |              Notification                      | OR2:Y       |           |
       |  Notif    | <--------------------------------------------|               |           |
       | <------   |           |           |                       |             |           |
       |           |           |           |                       |             |           |
```

NOTE: info: information   Y: Yes
        req: request   N: No
        ack: acknowledge
        notif: notification
        roam: roaming
        OR1:   Call to be forwarded
        OR2:   Notification to calling subscriber required

Figure 4.15: Information flow for call forwarding on mobile subscriber not reachable in case of radio congestion (to fixed terminal) (re-routing by VLR)

```
   MSa/TEa   GMSC       HLRb        VLRb                 MSCb            MSb      HLRc     MSCc
   ___       ___        ___         ___                  ___            ___      ___      ___

   | Set-up  |          |           |                    |              |        |        |
   |------>  | Info req  |           |                    |              |        |        |
   |         |------->   | Provide   |                    |              |        |        |
   |         |           |  roam No  |                    |              |        |        |
   |         |           |--------->  |                    |              |        |        |
   |         |           |            |                    |              |        |        |
   |         |           | Roam No    |                    |              |        |        |
   |         | Info ack  | <--------- |                    |              |        |        |
   |         | <-------  |            |                    |              |        |        |
   |         |           |   Set-up   |                    |              |        |        |
   |         |-------------------------------------------------->         |        |        |
   |         |           |            |                    |              |        |        |
   |         |           |            | Info req           |              |        |        |
   |         |           |            | <------------      |              |        |        |
   |         |           |            |                    |              |        |        |
   |         |           |            | Complete call      |              |        |        |
   |         |           |            | ------------>      |              |        |        |
   |         |           |            |                    | radio        |        |        |
   |         |           |            |                    | congestion   |        |        |
   |         |           |            | Radio              |              |        |        |
   |         |           |            | congestion         |              |        |        |
   |         |           |            | <------------      |              |        |        |
   |         |           |            | MAF010             |              |        |        |
   |         |           |            |                    |              |        |        |
   |         |           |            | OR1:N  Impossible  |              |        |        |
   |         |           |            |         call       |              |        |        |
   |         |           |            |       completion   |              |        |        |
   |         |           |            | ------------>      |              |        |        |
   |         |           |    Release |                    |              |        |        |
   | Release | <------------------------------------------------------    |        |        |
   | <------ |           |            |                    |              |        |        |
   |         |           |            |                    |              |        |        |
   |         |           |            | OR1:Y  Connect to  |              |        |        |
   |         |           |            |        following   |              |        |        |
   |         |           |            |         address    |              |        |        |
   |         |           |            | ------------>      |              |        |        |
   |         |           |            |                    | Info req     |        |        |
   |         |           |            |                    | ------------>|        |        |
   |         |           |            |                    |              |        |        |
   |         |           |            |                    | Info ack     |        |        |
   |         |           |            |                    | <------------|        |        |
   |         |           |            |                    |   Set-up     |        |        |
   |         |           |            |                    | ---------------------->        |
   |         |           |  Notification                   | OR2:Y        |        |        |
   | Notif   | <------------------------------------------------------    |        |        |
   | <------ |           |            |                    |              |        |        |
```

NOTE: info: information   Y: Yes
        req: request   N: No
        ack: acknowledge
        notif: notification
        roam: roaming
        OR1:   Call to be forwarded
        OR2:   Notification to calling subscriber required

Figure 4.16: Information flow for call forwarding on mobile subscriber not reachable in case of radio congestion (to mobile station) (re-routing by VLR)

```
     MSa/TEa           GMSC              HLRb              VLRb              LEc
     ───────           ────              ────              ────              ───
       │                 │                 │                 │                 │
       │     Set-up      │                 │                 │                 │
       │ ───────────>    │  Info request   │                 │                 │
       │                 │ ───────────>    │                 │                 │
       │                 │                 │    Provide      │                 │
       │                 │                 │   roaming No    │                 │
       │                 │                 │ ───────────>    │                 │
       │                 │                 │                 │                 │
       │                 │                 │      Not        │                 │
       │                 │                 │   reachable     │                 │
       │                 │                 │ <───────────    │                 │
       │                 │           MAF010│                 │                 │
       │                 │      Info ack   │                 │                 │
       │     Release     │ OR1:N │ <───────────              │                 │
       │ <───────────    │                 │                 │                 │
       │                 │                 │                 │                 │
       │                 │ OR1:Y │                      Set-up                 │
       │                 │ ─────────────────────────────────────────────────> │
       │                 │                 │                 │                 │
       │  Notification   │ OR2:Y │         │                 │                 │
       │ <───────────    │                 │                 │                 │
       │                 │                 │                 │                 │
```
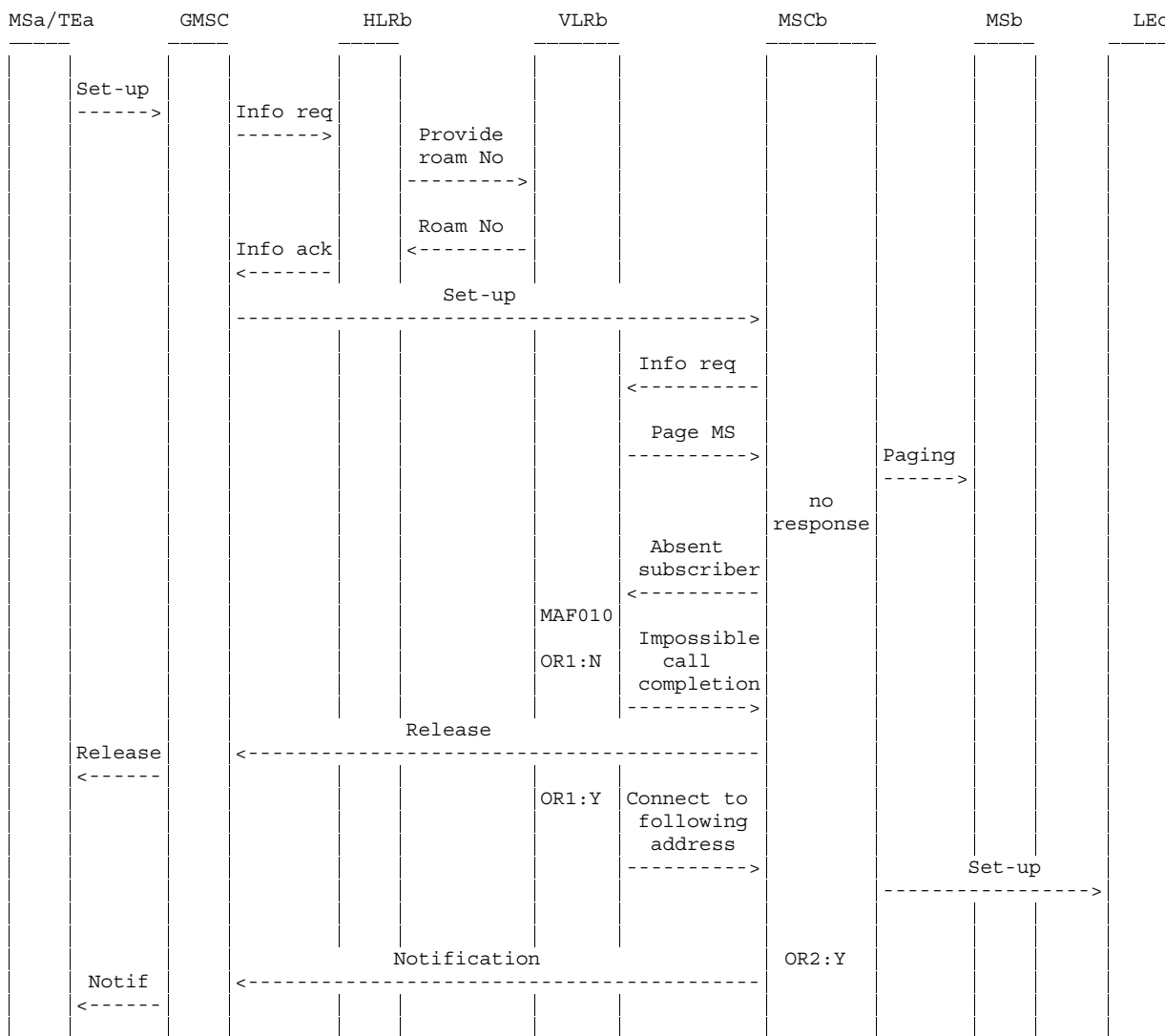
NOTE: info: information   Y: Yes
        ack: acknowledge   N: No
        OR1:   Call to be forwarded
        OR2:   Notification to calling subscriber required

Figure 4.17: Information flow for call forwarding on mobile subscriber not reachable in case of mobile subscriber not reachable in the VLR (to fixed terminal) (re-routing by HLR)
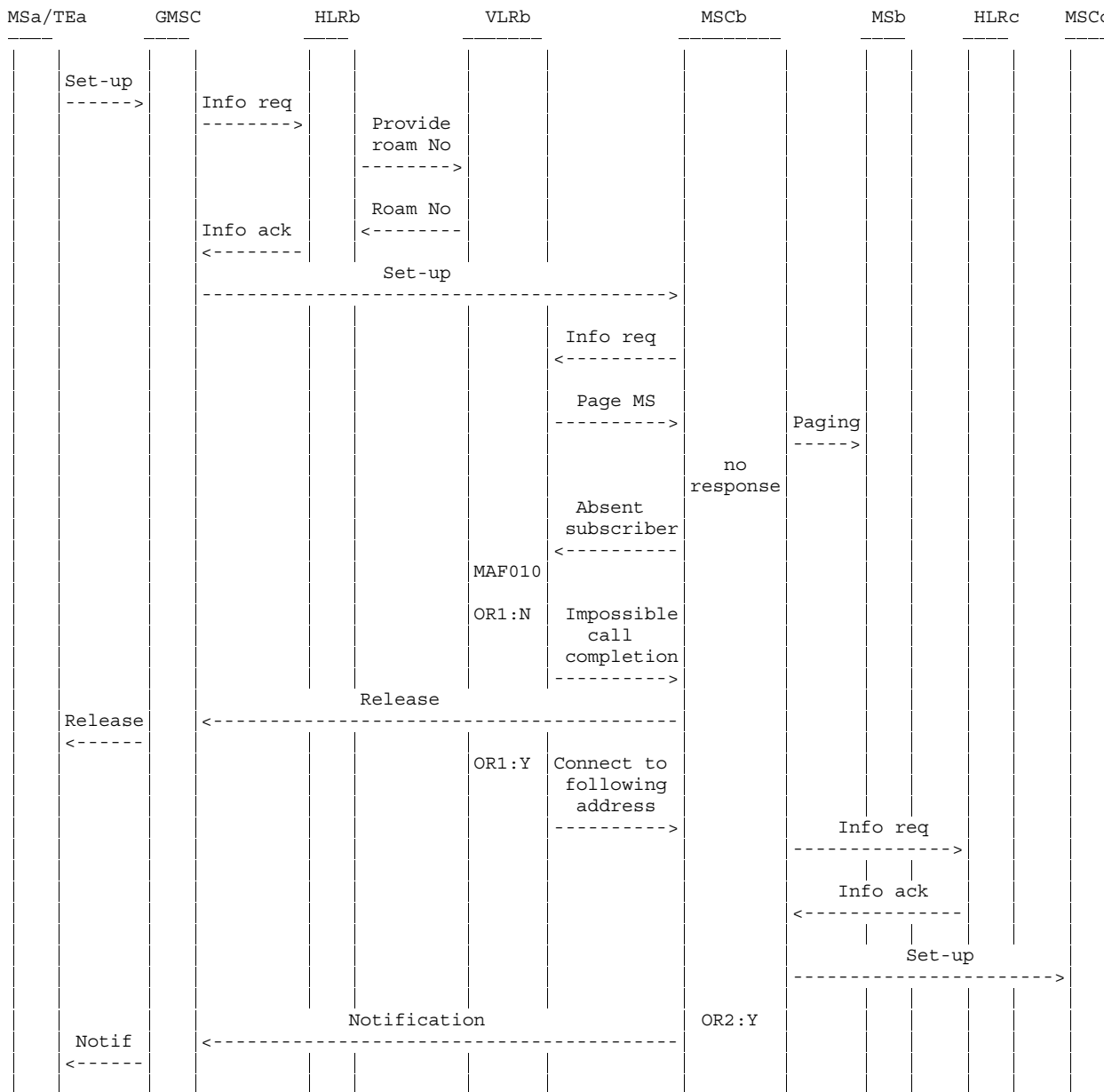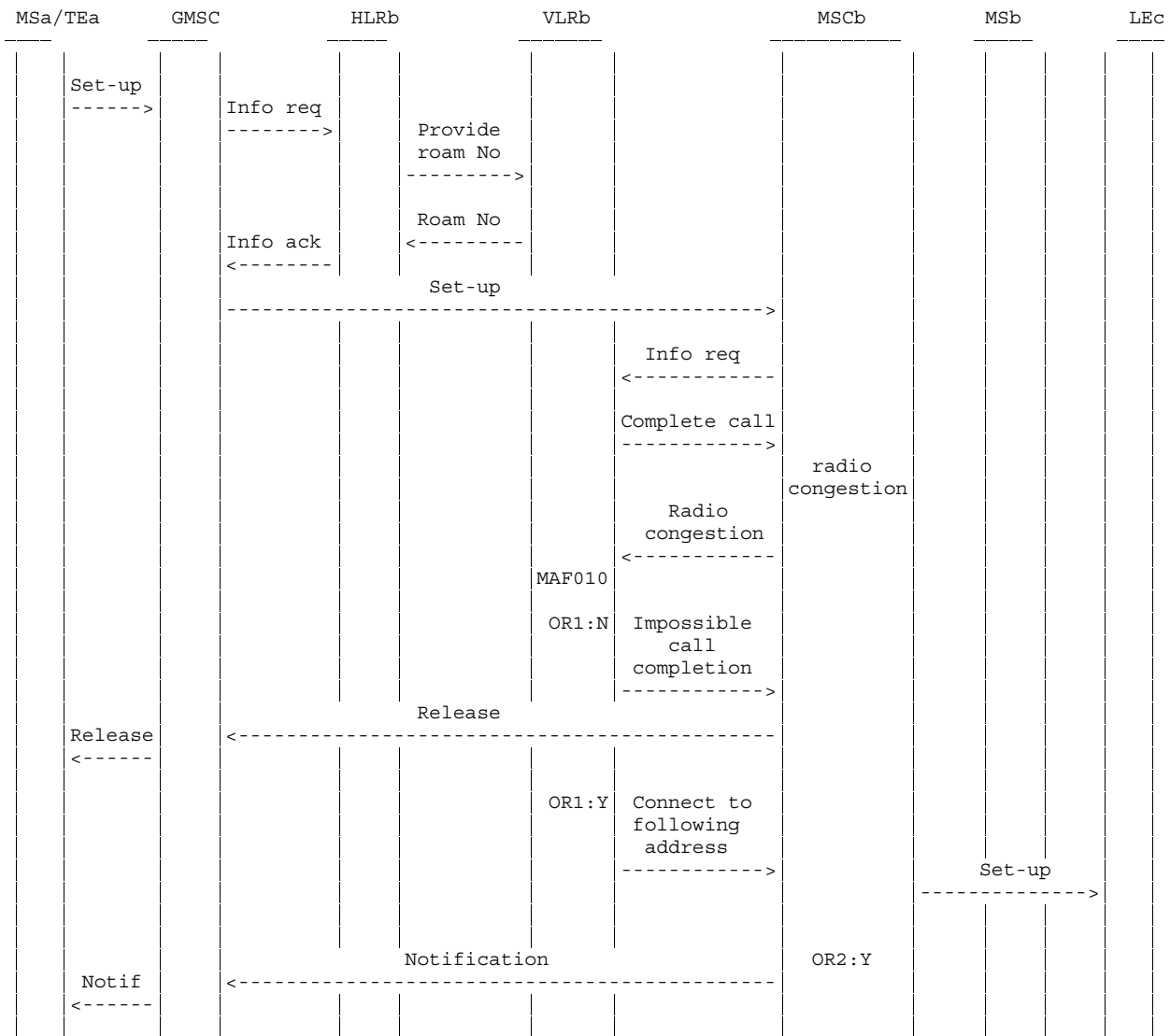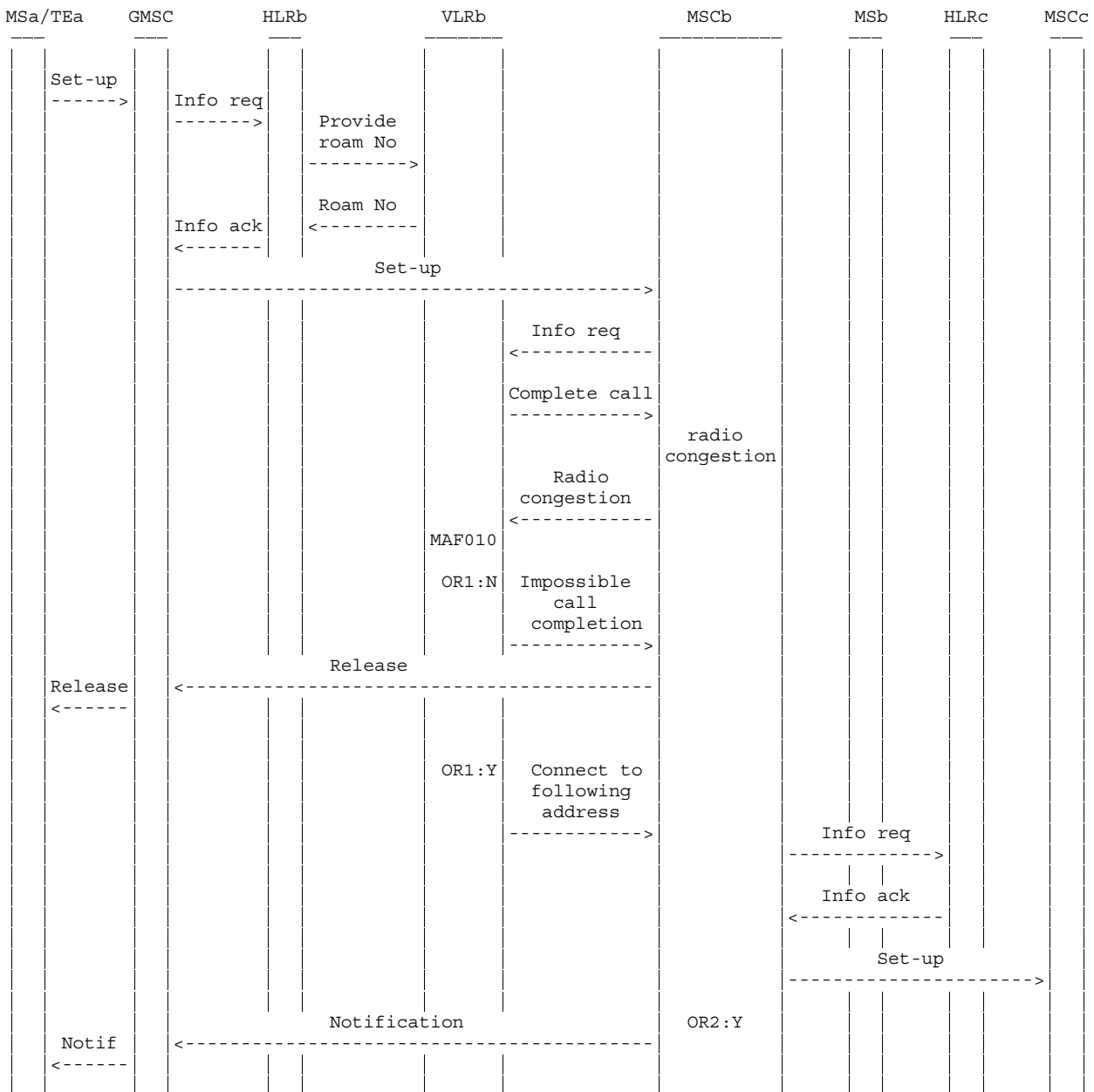
```
  MSa/TEa       GMSC       HLRb       VLRb       HLRc       VLRc       MSCc
  ───────       ────       ────       ────       ────       ────       ────
     │            │          │          │          │          │          │
     │   Set-up   │          │          │          │          │          │
     │ ───────>   │ Info req │          │          │          │          │
     │            │ ─────>   │ Provide  │          │          │          │
     │            │          │roaming No│          │          │          │
     │            │          │───────>  │          │          │          │
     │            │          │          │          │          │          │
     │            │          │   Not    │          │          │          │
     │            │          │reachable │          │          │          │
     │            │          │<─────────│          │          │          │
     │            │    MAF010│          │          │          │          │
     │            │ Info ack │          │          │          │          │
     │  Release   │ <─────   │          │          │          │          │
     │ <───────── │ OR1:N    │          │          │          │          │
     │            │          │          │          │          │          │
     │            │ OR1:Y    │  Information request │          │          │
     │            │ ─────────────────────────────> │ Provide  │          │
     │            │          │          │          │roaming No│          │
     │            │          │          │          │───────>  │          │
     │            │          │          │          │          │          │
     │            │          │          │          │Roaming No│          │
     │            │          │          │          │<───────  │          │
     │            │          │  Information acknowledge         │          │
     │            │ <───────────────────────────── │          │          │
     │            │          │          │          │          │          │
     │            │          │          │          Set-up      │          │
     │            │ ────────────────────────────────────────────────────> │
     │   Notif    │ OR2:Y    │          │          │          │          │
     │ <───────── │          │          │          │          │          │
     │            │          │          │          │          │          │
```

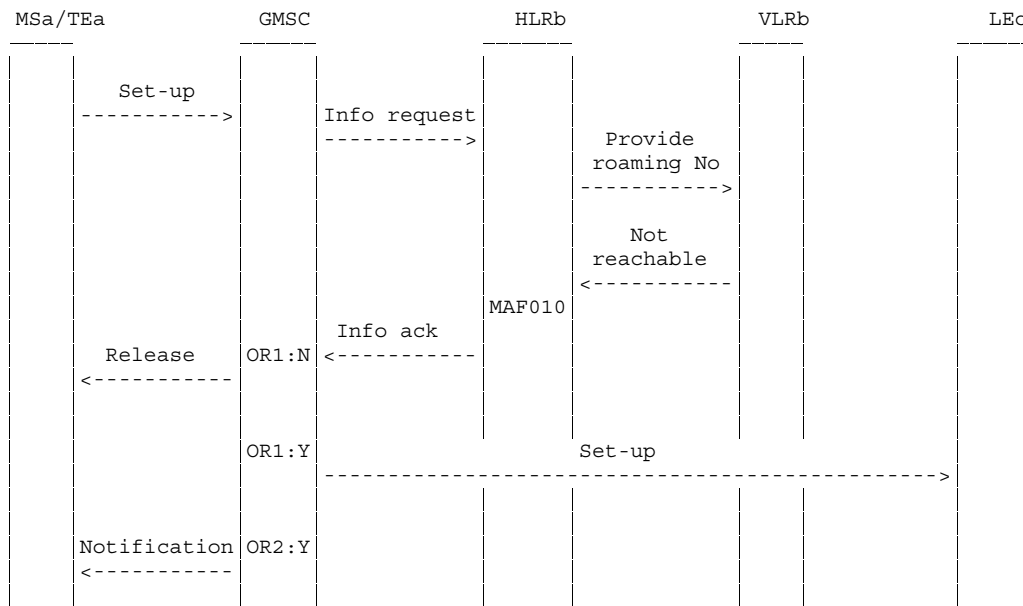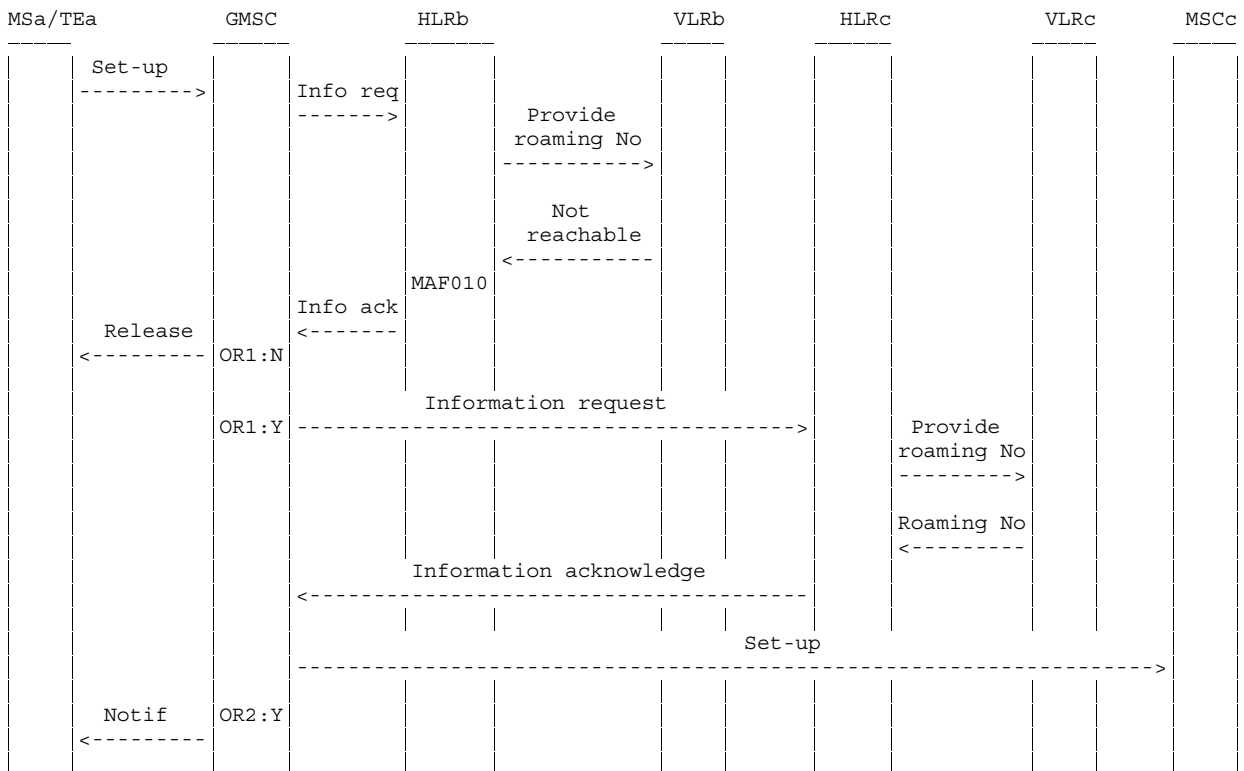NOTE: info: information   Y: Yes
        req: request   N: No
        ack: acknowledge
        notif: notification
        OR1:   Call to be forwarded
        OR2:   Notification to calling subscriber required

Figure 4.18: Information flow for call forwarding on mobile subscriber not reachable in case of mobile subscriber not reachable in the VLR (to mobile station) (re-routing by HLR)

```
   MSa/TEa          GMSC            HLRb            VLRb            LEc
   _____          _____          _____          _____          _____
   |    |          |    |          |    |          |    |          |    |
   |    |  Set-up  |    |          |    |          |    |          |    |
   |    |----------->|    | Info request            |    |          |    |
   |    |          |    |----------->|    |          |    |          |    |
   |    |          |    |          |    |          |    |          |    |
   |    |          |    |          |    |          |    |          |    |
   |    |          |    |          |    |          |    |          |    |
   |    |          |    |          |    |          |    |          |    |
   |    |          |    |       MAF010             |    |          |    |
   |    | Release  |OR1:N| Info ack |    |          |    |          |    |
   |    |<----------|    |<----------|    |          |    |          |    |
   |    |          |    |          |    |          |    |          |    |
   |    |          |OR1:Y|          |    |  Set-up  |    |          |    |
   |    |          |    |-------------------------------------------------->|
   |    |          |    |          |    |          |    |          |    |
   |    |Notification|OR2:Y|        |    |          |    |          |    |
   |    |<----------|    |          |    |          |    |          |    |
   |    |          |    |          |    |          |    |          |    |
   |____|          |____|          |____|          |____|          |____|
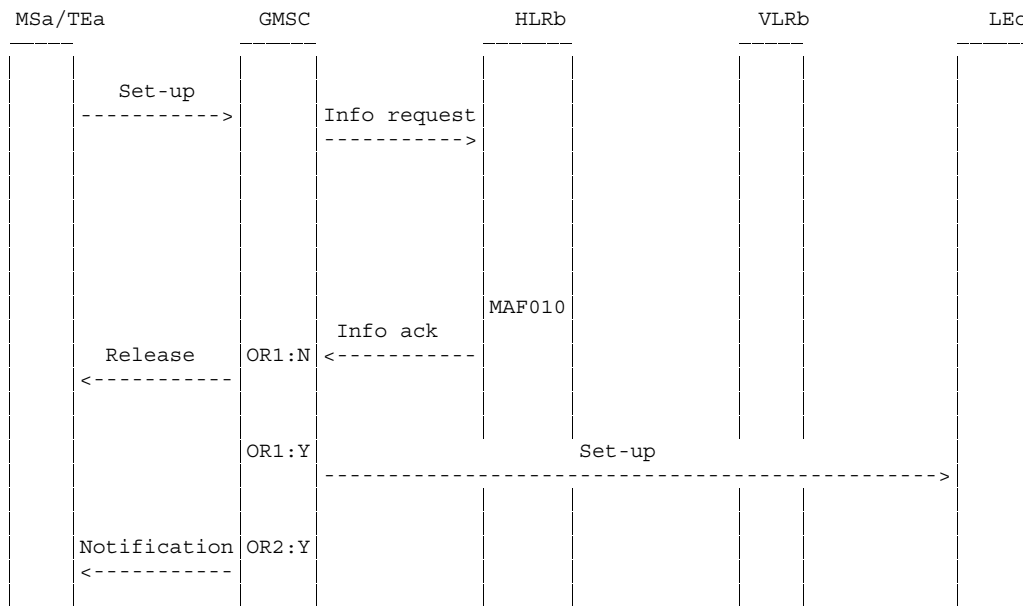```

NOTE:    info:    information        Y: Yes
         ack:     acknowledge        N: No
         OR1:  Call to be forwarded
         OR2:  Notification to calling subscriber required

**Figure 4.19: Information flow for call forwarding on mobile subscriber not reachable in case of mobile subscriber deregistered or purged (to fixed terminal) (re-routing by HLR)**

```
   MSa/TEa         GMSC           HLRb            VLRb           HLRc            VLRc           MSCc
   ------         ------         ------          ------         ------         ------         ------
     |               |              |               |              |              |              |
     |    Set-up     |              |               |              |              |              |
     | ---------> | Info req     |               |              |              |              |
     |               | ------->    |               |              |              |              |
     |               |              |               |              |              |              |
     |               |              |               |              |              |              |
     |               |              |               |              |              |              |
     |               |              |  MAF010       |              |              |              |
     |   Release     | Info ack     |               |              |              |              |
     | <--------- | <-------     |               |              |              |              |
     |               | OR1:N        |               |              |              |              |
     |               |              |               |              |              |              |
     |               | OR1:Y        | Information request          |              |              |
     |               | ---------------------------------------> |  Provide     |              |
     |               |              |               |              |  roaming No  |              |
     |               |              |               |              | --------->  |              |
     |               |              |               |              |              |              |
     |               |              |               |              |  Roaming No  |              |
     |               |              |               |              | <---------  |              |
     |               |              |  Information acknowledge     |              |              |
     |               |              | <--------------------------------------- |              |
     |               |              |               |              |              |              |
     |               |              |               |     Set-up   |              |              |
     |               |              | -------------------------------------------------------> |
     |   Notif       | OR2:Y        |               |              |              |              |
     | <--------- |              |               |              |              |              |
     |               |              |               |              |              |              |
```

NOTE: info: information   Y: Yes
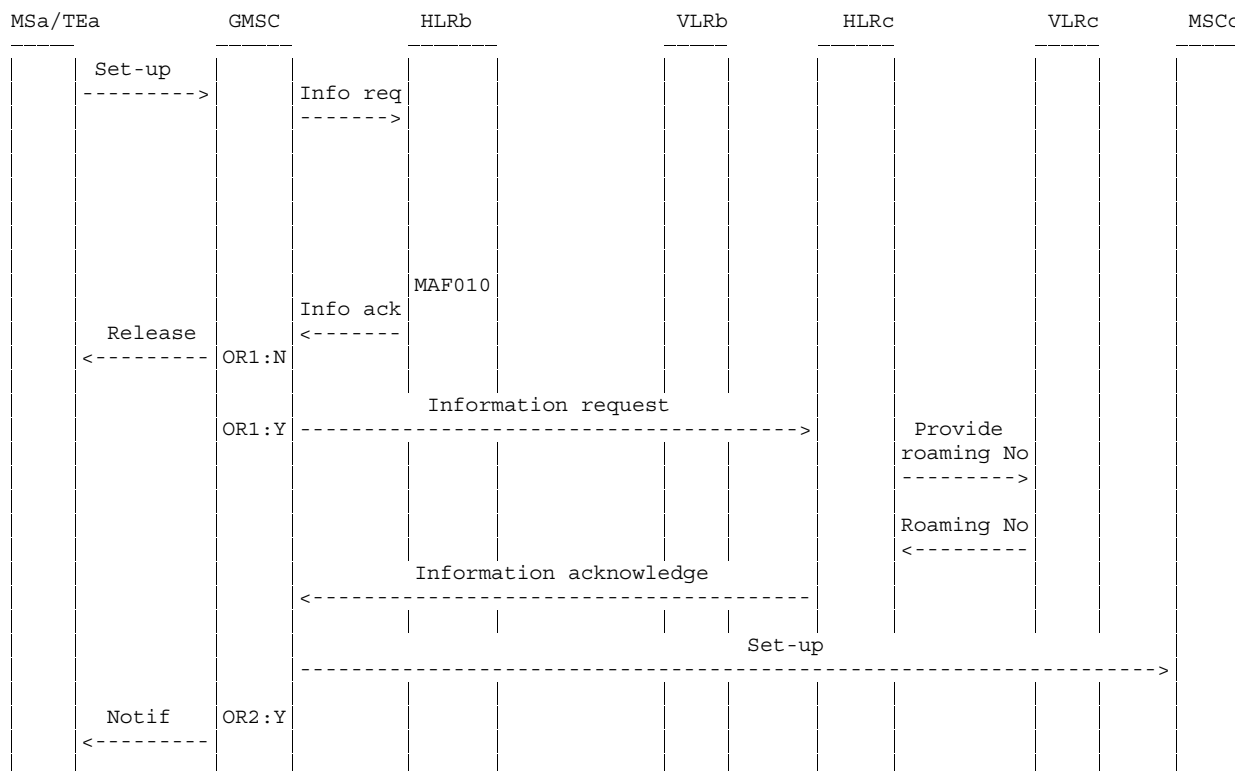   req: request   N: No
        ack: acknowledge
        notif: notification
        No: number
        OR1:   Call to be forwarded
        OR2:   Notification to calling subscriber required

Figure 4.20: Information flow for call forwarding on mobile subscriber not reachable in case of mobile subscriber deregistered or purged (to mobile station) (re-routing by HLR)

4.2.3   Call re-routed from HLR for Pre-Paging

If the Pre-Paging is performed by the VPLMN, in addition to clause 4.2.2, the following Mobile Additional Function has been identified for Pre-Paging in the PLMN. In this case, the clause 4.2.1 is not identified for Pre-Paging in the PLMN:
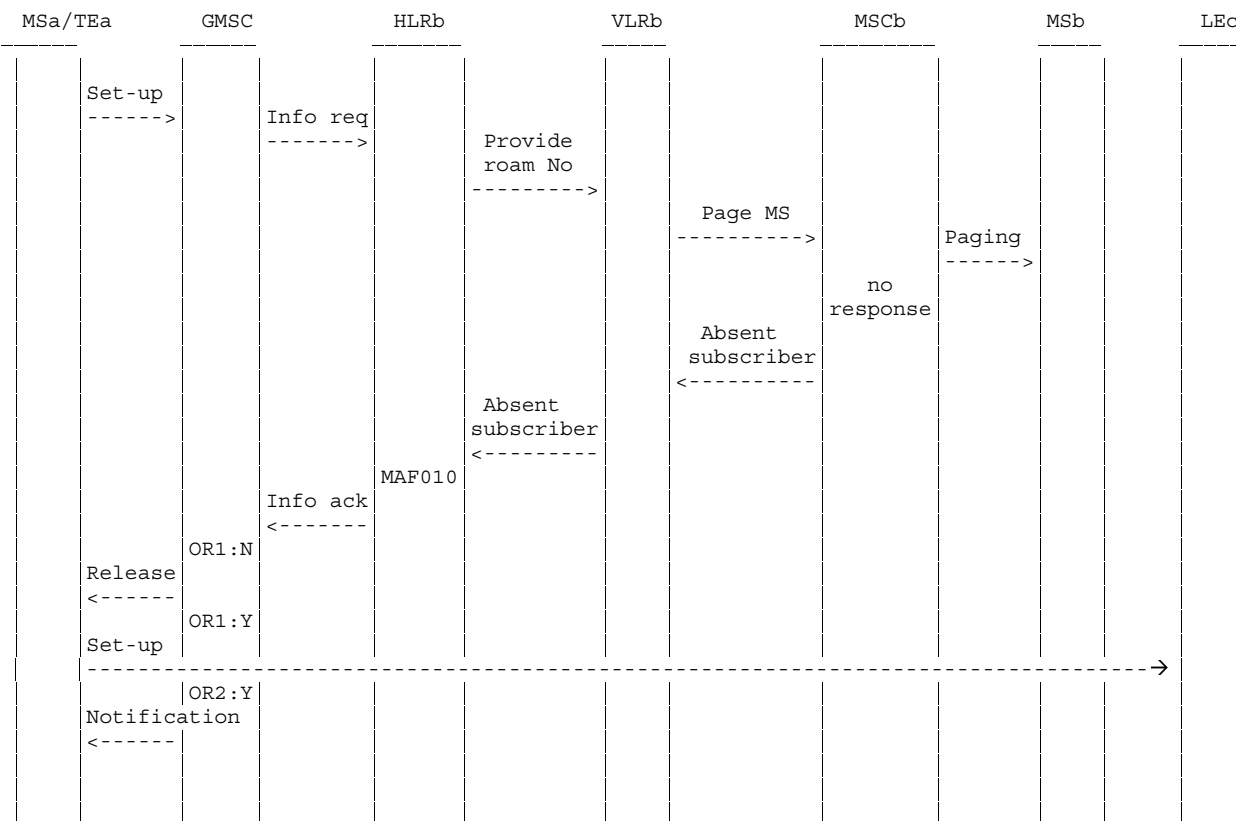
MAF010

   Examination of call forwarding on mobile subscriber not reachable authorizations

   The ability of a PLMN component to determine the authorizations relating to call forwarding on mobile subscriber not reachable in case of no paging response or radio congestion for Pre-Paging in the VLR. See figure 4.10.

   Location: HLR.

The information flows for forwarding to fixed terminal and to mobile station are shown in figures 4.21 and 4.22 respectively. These flows represent the case where the call is re-routed from the HLR because of no paging response for Pre-Paging from the MSC

Figures 4.23 and 4.24 show the information flows in case of radio congestion for Pre-Paging.

```
   MSa/TEa      GMSC        HLRb        VLRb        MSCb        MSb         LEc
   _____      _____      _____      _____      _____      _____      _____
     |           |           |           |           |           |           |
     | Set-up    |           |           |           |           |           |
     |------>|   |           |           |           |           |           |
     |       | Info req      |           |           |           |           |
     |       |------->|      |           |           |           |           |
     |       |        | Provide          |           |           |           |
     |       |        | roam No          |           |           |           |
     |       |        |--------->|       |           |           |           |
     |       |        |          | Page MS           |           |           |
     |       |        |          |---------->|       |           |           |
     |       |        |          |           |       | Paging    |           |
     |       |        |          |           |       |------>|    |           |
     |       |        |          |           | no    |           |           |
     |       |        |          |           | response          |           |
     |       |        |          | Absent    |           |           |           |
     |       |        |          | subscriber|           |           |           |
     |       |        |          |<----------|           |           |           |
     |       |        | Absent   |           |           |           |           |
     |       |        | subscriber           |           |           |           |
     |       |        |<---------|           |           |           |           |
     |       | MAF010 |           |           |           |           |           |
     |       | Info ack|          |           |           |           |           |
     |       |<-------|           |           |           |           |           |
     |     OR1:N      |           |           |           |           |           |
     | Release        |           |           |           |           |           |
     |<------|        |           |           |           |           |           |
     |     OR1:Y      |           |           |           |           |           |
     | Set-up         |           |           |           |           |           |
     |----------------------------------------------------------------------->|
     |     OR2:Y      |           |           |           |           |           |
     | Notification   |           |           |           |           |           |
     |<------|        |           |           |           |           |           |
     |       |        |           |           |           |           |           |
```

NOTE: info: information   Y: Yes
         req: request   N: No
         ack: acknowledge
         roam: roaming
         OR1:   Call to be forwarded
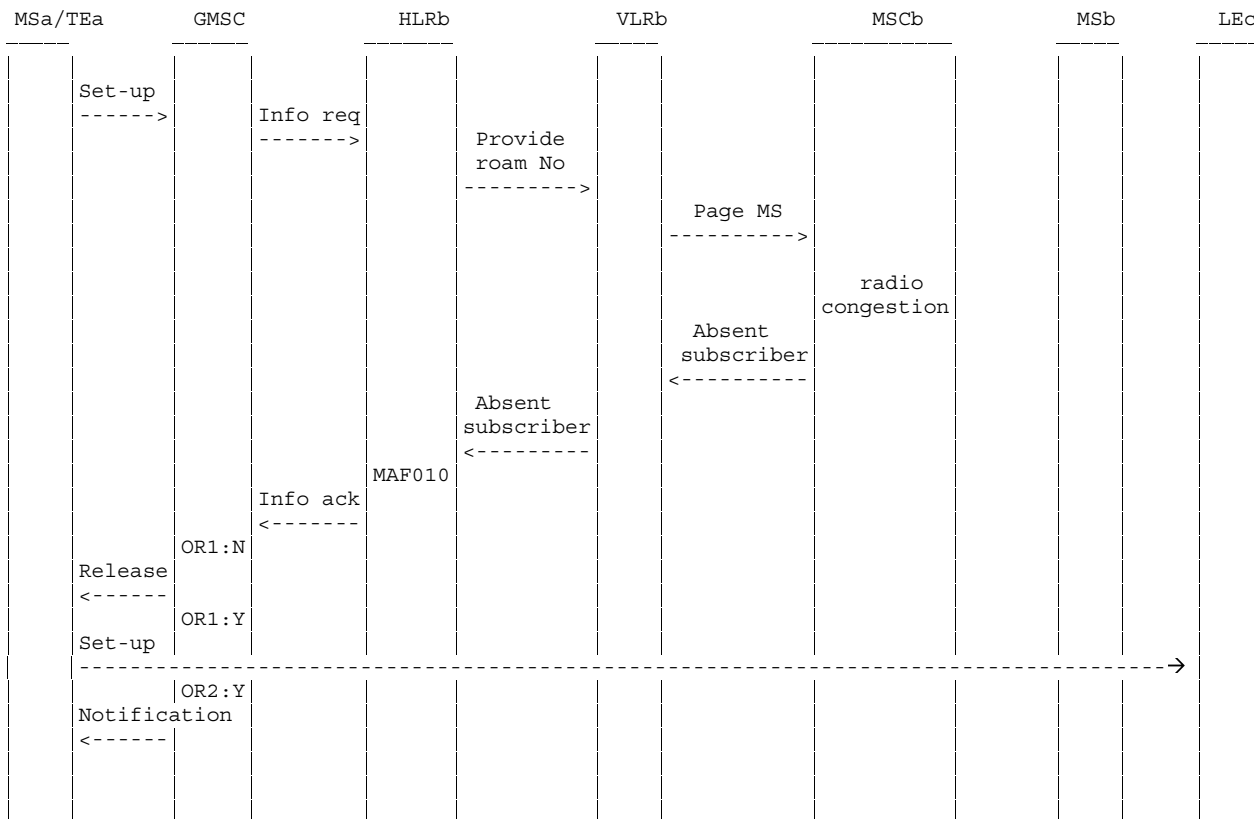   OR2:   Notification to calling subscriber required

Figure 4.21: Information flow for call forwarding on mobile subscriber not reachable in case of no paging response for Pre-Paging (to fixed terminal) (re-routing by HLR)
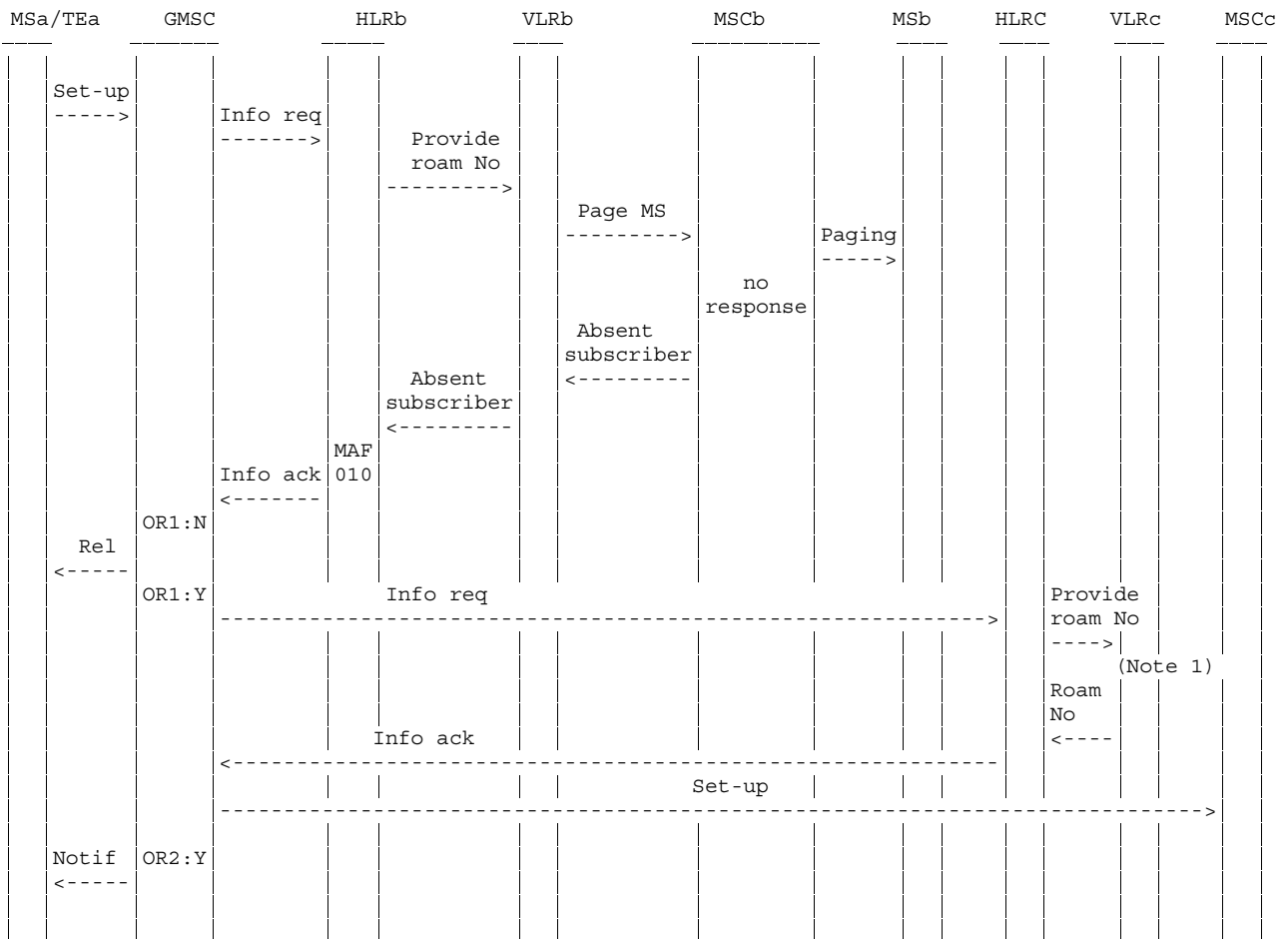
NOTE: info: information   Y: Yes
         req: request   N: No
         ack: acknowledge
         Rel: Release
         roam: roaming
         Notif: Notification
         OR1: Call to be forwarded
         OR2: Notification to calling subscriber required
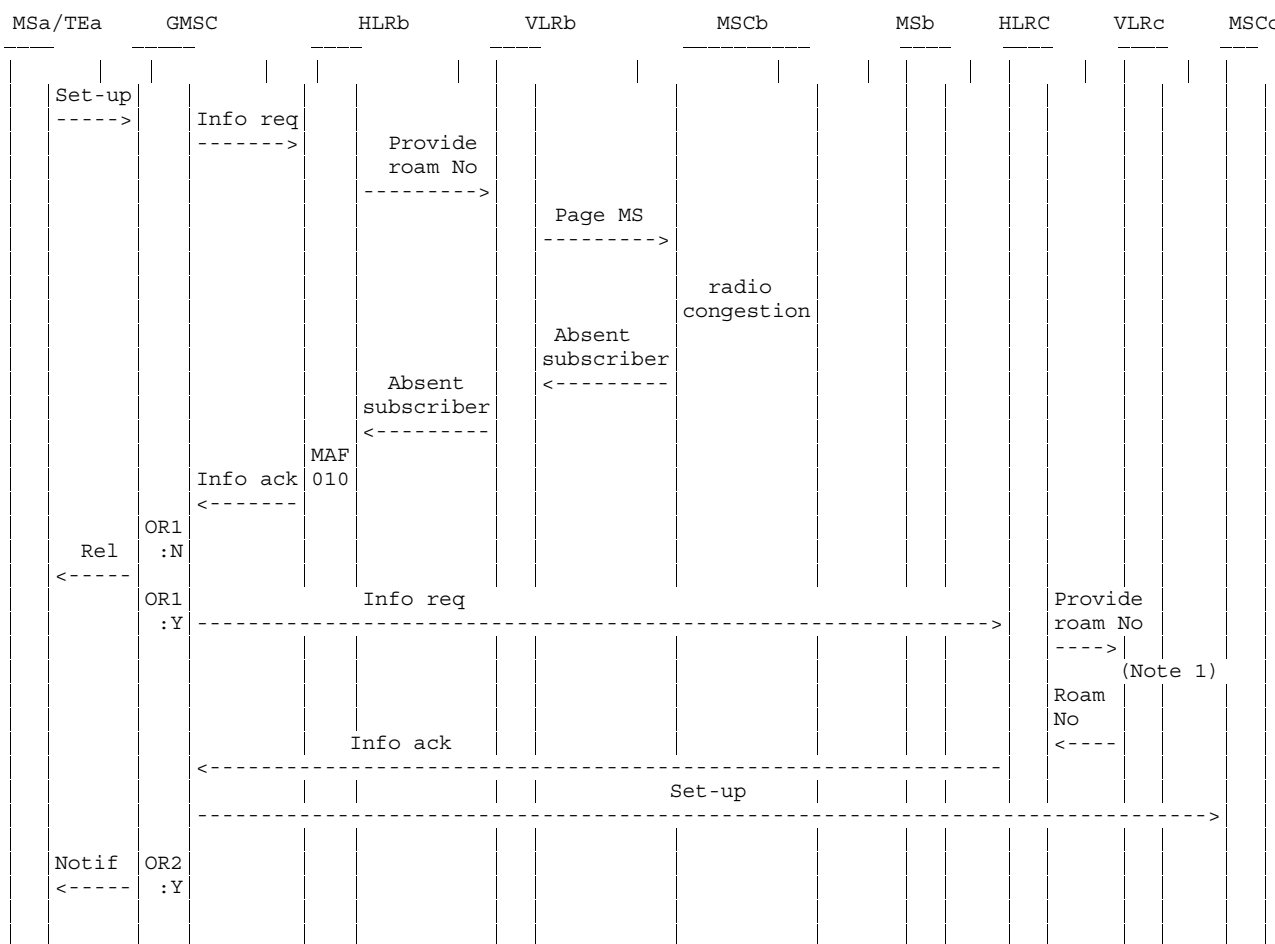**NOTE 1:** The procedure of the paging would be performed.

Figure 4.22: Information flow for call forwarding on mobile subscriber not reachable in case of no paging response (to mobile station) (re-routing by HLR)

```
   MSa/TEa        GMSC          HLRb          VLRb          MSCb          MSb           LEc
   _____        _____        _____        _____        _____        ____          ____
     |             |             |             |             |             |             |
     | Set-up      |             |             |             |             |             |
     | ------>     | Info req    |             |             |             |             |
     |             | ------->    |             |             |             |             |
     |             |             | Provide     |             |             |             |
     |             |             | roam No     |             |             |             |
     |             |             | --------->  |             |             |             |
     |             |             |             | Page MS     |             |             |
     |             |             |             | ---------->  |             |             |
     |             |             |             |             | radio       |             |
     |             |             |             |             | congestion  |             |
     |             |             |             | Absent      |             |             |
     |             |             |             | subscriber  |             |             |
     |             |             |             | <---------- |             |             |
     |             |             | Absent      |             |             |             |
     |             |             | subscriber  |             |             |             |
     |             |             | <---------  |             |             |             |
     |             |           MAF010          |             |             |             |
     |             | Info ack    |             |             |             |             |
     |             | <-------    |             |             |             |             |
     |          OR1:N            |             |             |             |             |
     | Release     |             |             |             |             |             |
     | <------     |             |             |             |             |             |
     |          OR1:Y            |             |             |             |             |             |
     | Set-up      |             |             |             |             |             |             |
     | ----------------------------------------------------------------------------------------------> |
     |          OR2:Y            |             |             |             |             |
     | Notification|             |             |             |             |             |
     | <-------    |             |             |             |             |             |
     |             |             |             |             |             |             |
```

NOTE: info: information   Y: Yes
       req: request   N: No
       ack: acknowledge
       roam: roaming
       OR1:   Call to be forwarded
       OR2:   Notification to calling subscriber required

Figure 4.23: Information flow for call forwarding on mobile subscriber not reachable in case of radio congestion for Pre-Paging (to fixed terminal) (re-routing by HLR)

```
MSa/TEa    GMSC        HLRb       VLRb        MSCb       MSb      HLRC       VLRc      MSCc
 ----       ----        ----       ----        ----       ----     ----       ----      ---|
  |          |           |          |           |          |        |          |         |
  | Set-up   |           |          |           |          |        |          |         |
  | ----->   | Info req  |          |           |          |        |          |         |
  |          | ------->  |          |           |          |        |          |         |
  |          |           | Provide  |           |          |        |          |         |
  |          |           | roam No  |           |          |        |          |         |
  |          |           | -------->|           |          |        |          |         |
  |          |           |          | Page MS   |          |        |          |         |
  |          |           |          | -------->|           |        |          |         |
  |          |           |          |           | radio    |        |          |         |
  |          |           |          |           | congestion|       |          |         |
  |          |           |          | Absent    |          |        |          |         |
  |          |           |          | subscriber|          |        |          |         |
  |          |           | Absent   | <---------|          |        |          |         |
  |          |           | subscriber|          |          |        |          |         |
  |          |           | <---------|          |          |        |          |         |
  |          |      MAF   |          |           |          |        |          |         |
  |          | Info ack| 010         |          |           |        |          |         |
  |          | <-------  |          |           |          |        |          |         |
  |       OR1 |          |          |           |          |        |          |         |
  | Rel   :N  |          |          |           |          |        |          |         |
  | <-----    |          |          |           |          |        |          |         |
  |       OR1 |          |          |           |          |        | Provide  |         |
  |       :Y  | Info req |          |           |          |        | roam No  |         |
  |          | ------------------------------------------------------------->| ---->|    |
  |          |          |          |           |          |        |          | (Note 1)|
  |          |          |          |           |          |        |   Roam   |         |
  |          |          |          |           |          |        |   No     |         |
  |          | Info ack |          |           |          |        | <----    |         |
  |          | <-------------------------------------------------------------|         |
  |          |          |          | Set-up    |          |        |          |         |
  |          | ------------------------------------------------------------------------>|
  | Notif OR2 |         |          |           |          |        |          |         |
  | <----- :Y |         |          |           |          |        |          |         |
  |          |          |          |           |          |        |          |         |
 ----       ----        ----       ----        ----       ----     ----       ----      ---|
```

NOTE: info: information   Y: Yes
        req: request   N: No
        ack: acknowledge
        Rel: Release
        roam: roaming
        Notif: Notification
        OR1:   Call to be forwarded
        OR2:   Notification to calling subscriber required
NOTE 1: The procedure of the paging would be performed.

Figure 4.24: Information flow for call forwarding on mobile subscriber not reachable in case of radio congestion (to mobile station) (re-routing by HLR)

4.3   Information stored in the HLR

The following logical states are applicable for CFNRc (refer to 3GPP TS 23.011 for an explanation of the notation):

Provisioning State	Registration State	Activation State	HLR Induction State
(Not Provisioned,	Not Registered,	Not Active,	Not Induced)
(Provisioned,	Not Registered,	Not Active,	Not Induced)
(Provisioned,	Registered,	Not Active,	Not Induced)
(Provisioned,	Registered,	Active and Quiescent,	Not Induced)
(Provisioned,	Registered,	Active and Operative,	Not Induced)

The registration and activation state may be different for each applicable elementary basic service group.

The provisioning state shall be on a per subscriber basis, and hence the same for all basic service groups.

The HLR shall store:

- the state of CFNRc (which shall be one of the valid states listed above) for each applicable elementary basic service group;

- the subscription option "notification to the calling party" on a per subscriber basis;

    This subscription option takes one of the following values:

    - no notification;

    - notification.

- the subscription option " MSISDN of the served subscriber can be presented to the forwarded-to subscriber" on a per subscriber basis;

    This subscription option takes one of the following values:

    - presentation restricted;

    - presentation allowed.

    - the registration parameter "forwarded-to number" (possibly including a forwarded-to sub-address) for each applicable elementary basic service group.

- the default forwarded-to number (containing less than 16 digits) for each applicable elementary basic service group.

4.4 State transition model

The following figure shows the successful cases of transition between the applicable logical states of CFNRc. The state changes are either caused by actions of the service provider, the mobile user or the network.

Note that error cases are not shown in the diagram as they normally do not cause a state change. Additionally, some successful requests may not cause a state change. Hence, they are not shown in the diagram.

The diagram only shows operations on an elementary basic service group.
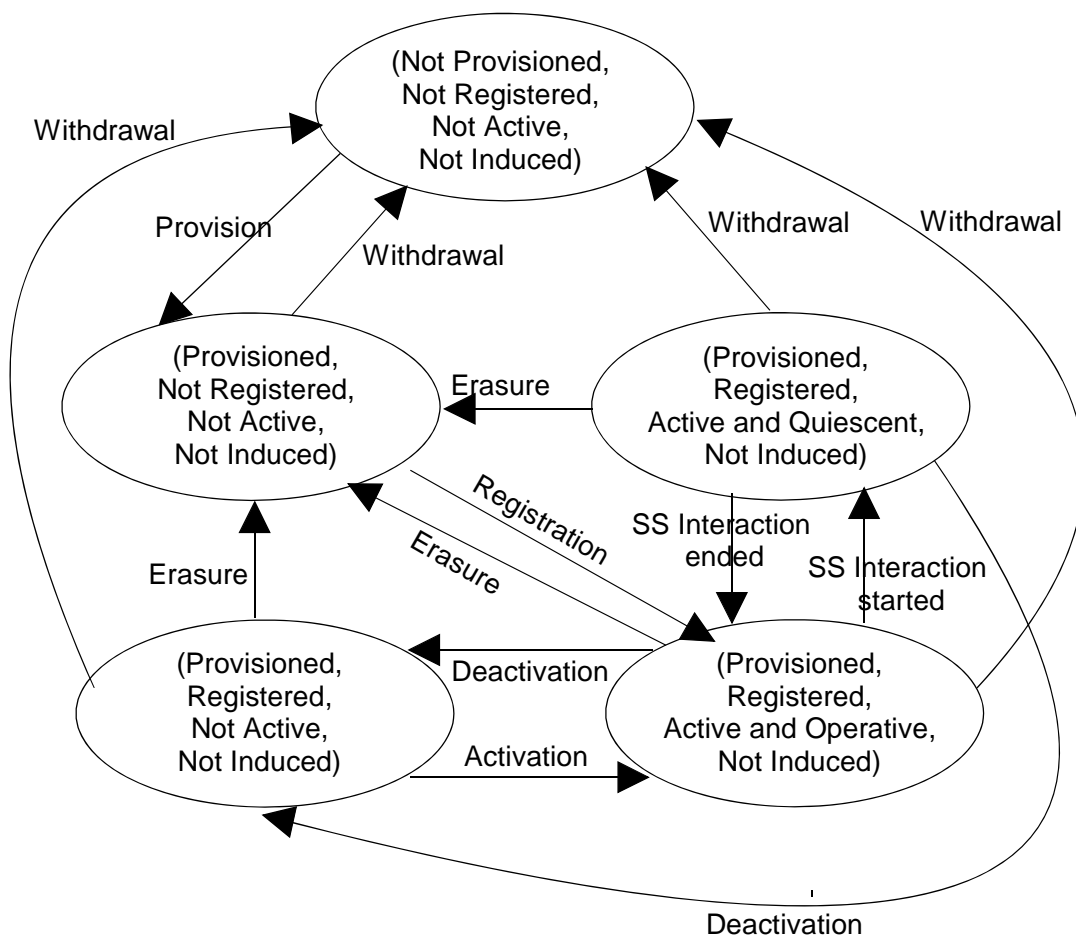
Figure 4.25: State transition model for CFNRc

4.5   Transfer of information from HLR to VLR

If the provisioning state for CFNRc is "Provisioned" then, when the subscriber registers on a VLR, the HLR shall send that VLR information about the logical state of CFNRc for all relevant elementary basic service groups.

If the registration state for CFNRc is "Registered" then, when the subscriber registers on a VLR, the HLR shall send that VLR the registration parameter "forwarded-to number" for all relevant elementary basic service groups and information about the subscription options "notification to the calling party"" and "MSISDN of the served subscriber can be presented to the forwarded-to subscriber".

If the logical state or the registration parameter "forwarded-to number" of CFNRc is changed while a subscriber is registered on a VLR then for the affected basic service groups, the HLR shall inform the VLR respectively of the new logical state or the new registration parameter of CFNRc.

If information about the subscription option "notification to the calling party" of CFNRc is changed while a subscriber is registered on a VLR and the registration state of CFNRc is "Registered" then the HLR shall inform the VLR of the new information about the subscription option of CFNRc.

4.6   Information stored in the VLR

For CFNRc the VLR shall store the service state information, the registration parameter "forward-to number" and the subscription options received from the HLR.

4.7   Handover

Handover will have no impact on the control procedure and the operation of the service.

4.8 Cross phase compatibility

4.8.1 MS, MSC, VLR or HLR only support Phase 1 control of SS by the subscriber

In response to a CFNRc interrogation request, if the MS or any network element involved is of Phase 1, only information concerning basic service groups for which the activation state has the value "Active and Operative" will be returned. This means that the subscriber will not be aware that the forwarded to number is registered if CFNRc is deactivated or active (quiescent). A subaddress (if registered) will not be included.

Note that if any network element involved is of Phase 1, CFNRc Registration requests which use a subaddress and all CFNRc Activation and Deactivation requests will be rejected, as these are not specified in Phase 1.

4.8.2 HLR only supports Phase 1 updating of subscriber information

If the VLR receives the SS-Status parameter from a Phase 1 HLR it shall act if it has received the SS-Status parameter with the values shown in the following:

1) Registered, Activated => P bit =1, R bit = 1, A bit = 1, Q bit = 0;

2) Registered, Deactivated => P bit =1, R bit = 1, A bit = 0, Q bit = 0 or 1;

3) Erased => P bit =1, R bit = 0, A bit = 0, Q bit = 0 or 1.

4.8.3 VLR only supports Phase 1 updating of subscriber information

When passing CFNRc information to a Phase 1 VLR, the HLR shall send the service state information in a form which the VLR can accept, based on the logical state held in the HLR, as follows:

1) (Provisioned, Not Registered, Not Active, Not Induced)

=> Erased, Deactivated;

2) (Provisioned, Registered, Not Active, Not Induced)

=> Registered, Deactivated;

3) (Provisioned, Registered, Active and Operative, Not Induced)

=> Registered, Activated;

4) (Provisioned, Registered, Active and Quiescent, Not Induced)

=> Registered, Deactivated.

The HLR shall not pass a subaddress to a Phase 1 VLR.

4.8.4 GMSC only supports Phase 1 call handling

When a call is forwarded on not reachable at the GMSC, the HLR shall not pass the subaddress to a Phase 1 GMSC. Calls shall be forwarded without the subaddress.

4.8.5 VLR only supports Phase 1 call handling

When a call is forwarded on not reachable at the VMSC, as the HLR does not pass the subaddress to the VLR, calls shall be forwarded without the subaddress.

4.8.6 VLR does not support CAMEL or supports CAMEL Phase 1 only

When passing CFNRc information to a VLR not supporting CAMEL or supporting CAMEL Phase 1 only, the HLR shall send the registration parameter "forwarded-to number" only if it is registered in a format which the VLR can accept, i.e. international format.

If the registration state for CFNRc is "Registered" and the forwarded-to number is registered in a format other than international, then when updating a VLR not supporting CAMEL or supporting CAMEL Phase 1 only the HLR shall modify the service state information of CFNRc as follows:

   1) (Provisioned, Registered, Not Active, Not Induced)

       => (Provisioned, Not Registered, Not Active, Not Induced);

   2) (Provisioned, Registered, Active and Operative, Not Induced)

       => (Provisioned, Not Registered, Not Active, Not Induced);

   3) (Provisioned, Registered, Active and Quiescent, Not Induced)

       => (Provisioned, Not Registered, Not Active, Not Induced).

According to the definitions in clause 4.5 no forwarded-to number will be passed to the VLR in these cases. The modification of the service state information sent to the VLR shall have no impact on the service state information stored in the HLR.

If the VLR supports Phase 1 updating of subscriber information only, a further translation of the service state information as defined in clause 4.8.3 shall be performed by the HLR.

4.8.7 GMSC does not support CAMEL or supports CAMEL Phase 1 only

If the activation state of CFNRc is "Active and Operative" and if the forwarded-to number is registered in a format other than international and if the GMSC does not support CAMEL or supports CAMEL Phase 1 only, then when a request for routeing information for a mobile terminated call is received in the HLR, CFNRc shall not be invoked in the HLR. The mobile terminated call establishment shall be continued towards the MSCb.

   NOTE: CFNRc will be handled in the VLRb according to the service state information for CFNRc stored there.

4.9 Contents of messages

The same additions apply for CFNRc as for CFB, see clause 2.9.

4.10 Support of Long Forwarded-to Numbers

The handling for CFNRc is the same as that for CFB, see clause 2.10.

Annex A (informative):
Change history

TSG CN#	Spec	Version	CR	<Phase>	New Version	Subject/Comment
Apr 1999	GSM 03.82	8.0.0				Transferred to 3GPP CN1
CN#03	23.082			R99	3.0.0	Approved at CN#03
CN#05	23.082	3.0.0	001	R99	3.1.0	Addition of the description related to Pre-Paging in case of 'Absent Subscriber'
CN#07	23.082	3.1.0	003r3	R99	3.2.0	Introduction of "Notification to CSE flag" to the call forwarding supplementary service.
CN#07	23.082	3.1.0	004r2	R99	3.2.0	Addition of Long Forwarded-to Numbers
CN#07	23.082	3.1.0	005	R99	3.2.0	Inclusion of TIF-CSI
CN#08	23.082	3.2.0	006	R99	3.3.0	Indication in PRN of support of Long FTNs
CN#08	23.082	3.2.0	007r1	R99	3.3.0	Interworking cases for Long Forwarded-to Numbers
CN#09	23.082	3.3.0	008r1	R99	3.4.0	SDL refresh
CN#10	23.082	3.4.0	009r1	R99	3.5.0	Correction of message between VLR and HLR
CN#11	23.082	3.5.0		Rel-4	4.0.0	Release 4 after CN#11
CN#12	23.082	4.0.0	010	Rel-4	4.1.0	Interworking cases for Long Forwarded-to Numbers
CN#13	23.082	4.1.0	012	Rel-4	4.2.0	Clarifications on long forwarded-to numbers
CN#16	23.082	4.2.0	014	Rel-4	4.3.0	'Long FTN Supported' to be transferred from VLR to HLR with Restore Data
CN#16	23.082	4.3.0		Rel-5	5.0.0	Release 5 after CN#16
CN#26	23.082	5.0.0		Rel-6	6.0.0	Release 6 after CN#26
CT#36	23.082	6.0.0		Rel-7	7.0.0	Upgraded unchanged from Rel-6
CT#37	23.082	7.0.0	0015r1	Rel-7	7.1.0	
CT#38	23.082	7.1.0	0016	Rel-7	7.2.0	Information flows for Call Forwarding on Busy handling in HLR

History

Document history		
V7.0.0	June 2007	Publication
V7.1.0	October 2007	Publication
V7.2.0	January 2008	Publication