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Technical Specification

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Foreword

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

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under www.etsi.org/key .

Contents

Foreword

This Technical Specification has been produced by the 3GPP.

This TS specifies the procedures used at the radio interface for: normal operation, registration, erasure, activation, deactivation, interrogation, and network invocation of the call offering supplementary services within 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 this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version 3.y.z

where:

x the first digit:

   1 presented to TSG for information;

   2 presented to TSG for approval;

   3 Indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the specification;

0 Scope

This European Standard (EN) specifies the procedures used at the radio interface (reference point Um as defined in 3GPP TS 24.002) for normal operation, registration, erasure, activation, deactivation, interrogation and network invocation of call offering supplementary services. Provision and withdrawal of supplementary services is an administrative matter between the mobile subscriber and the service provider and cause no signalling on the radio interface.

In 3GPP TS 24.010, the general aspects of the specification of supplementary services at the layer 3 radio interface are given.

3GPP TS 24.080 specifies the formats and coding for the supplementary services.

Definitions and descriptions of supplementary services are given in 3GPP TS 22.004 and 3GPP TS 22.08x and 3GPP TS 22.09x-series. 3GPP TS 22.082 is related specially to call offering supplementary services.

Technical realization of supplementary services is described in 3GPP TS 23.011 and 3GPP TS 23.08x and 3GPP TS 23.09x-series. 3GPP TS 23.082 is related specially to call offering supplementary services.

The procedures for Call Control, Mobility Management and Radio Resource management at the layer 3 radio interface are defined in 3GPP TS 24.007 and 3GPP TS 24.008.

The following supplementary services belong to the call offering supplementary services and are described in the present document:

-	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 22.001: "Principles of circuit telecommunication services supported by a Public Land Mobile Network (PLMN)".

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

[4]   3GPP TS 22.081: "Line identification supplementary services - Stage 1".

[5]   3GPP TS 22.082: " Call Forwarding (CF) supplementary services - Stage 1".

[6]   3GPP TS 22.083: " Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 1".

[7]   3GPP TS 22.084: " MultiParty (MPTY) supplementary services - Stage 1".

[8] 3GPP TS 22.085: " Closed User Group (CUG) supplementary services - Stage 1".

[9] 3GPP TS 22.086: " Advice of Charge (AoC) supplementary services - Stage 1".

[10] 3GPP TS 22.088: "Call Barring (CB) supplementary services - Stage 1".

[11] 3GPP TS 22.090: "Unstructured Supplementary Service Data (USSD) - Stage 1".

[12] 3GPP TS 23.002: "Network architecture".

[13] 3GPP TS 23.011: "Technical realization of supplementary services".

[14] 3GPP TS 23.081: "Line identification supplementary services - Stage 2".

[15] 3GPP TS 23.082: "Call Forwarding (CF) supplementary services - Stage 2".

[16] 3GPP TS 23.083: "Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 2".

[17] 3GPP TS 23.084: "MultiParty (MPTY) supplementary services - Stage 2".

[18] 3GPP TS 23.085: "Closed User Group (CUG) supplementary services - Stage 2".

[19] 3GPP TS 23.086: "Advice of Charge (AoC) supplementary services - Stage 2".

[20] 3GPP TS 23.088: "Call Barring (CB) supplementary services - Stage 2".

[21] 3GPP TS 23.090: "Unstructured supplementary services operation - Stage 2".

[22] 3GPP TS 24.002: "GSM-UMTS Public Land Mobile Network (PLMN) Access Reference Configuration".

[23] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[24] 3GPP TS 24.008: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[25] 3GPP TS 24.010: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 Supplementary services specification; General aspects".

[26] 3GPP TS 24.080: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 supplementary services specification Formats and coding".

0.2   Abbreviations

Abbreviations used in the present document are listed in 3GPP TR 21.905.

0.3   Cross phase compatibility

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

- Call forwarding unconditional;

- Call forwarding on mobile subscriber busy;

- Call forwarding on no reply;

- Call forwarding on mobile subscriber not reachable.

For these supplementary services, the main body of the present document assumes that all network entities comply with this version of the service. In each case, an additional subclause (subclause x.7) defines the additional requirements for when one or more network entities or the MS complies with the protocol version 1 specifications for the supplementary service procedures.

1 Call Forwarding Unconditional (CFU)

1.1 Normal operation

1.1.1 Served mobile subscriber side

When call forwarding unconditional is active, all incoming calls for the specified basic service(s) will be forwarded without being offered to the served mobile subscriber.

When CFU is active, the ability of the served mobile subscriber to originate calls is not affected. However, a NotifySS operation containing the SS-Status indicating that CFU is currently active and operative will be sent to the served mobile subscriber each time an outgoing call is made, see figure 1.1.

MS   Network

SETUP
--->

e.g. ALERTING
<--
Facility (Invoke = NotifySS (CFU, SS-Status))
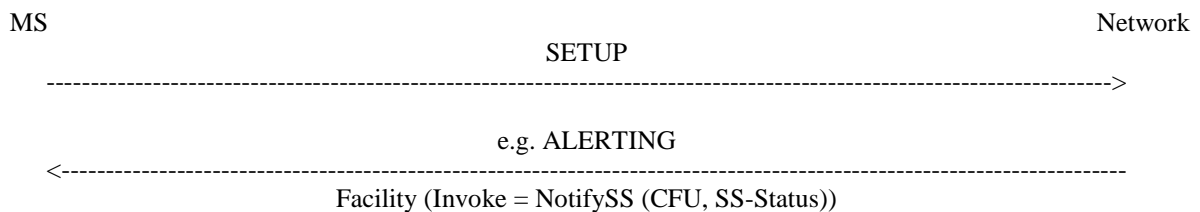
Figure 1.1: Notification to the served mobile subscriber that call forwarding is active

1.1.2 Forwarded-to mobile subscriber side

The forwarded-to mobile subscriber will receive a NotifySS operation containing the SS-Notification indicating that the incoming call is a forwarded call. When available, the SS-Code of the invoked forwarding service is also included, see figure 1.2.

When multiple forwarding occurs the value of the SS-Code shall relate to the last invoked forwarding service.

In addition the forwarded-to mobile subscriber will receive the redirecting party BCD number and optionally, a redirecting party subaddress.

The redirecting party BCD number information element is made up of a number of information units as indicated in 3GPP TS 24.008.

In addition to or instead of the redirecting party's digits, the subscriber may be given the following information:

- screening indicator;

- presentation indicator.

Indicator values are given in 3GPP TS 24.008.

The redirecting party subaddress information element is made up of a number of information units as indicated in 3GPP TS 24.008.

MS   Network

SETUP
<--
Facility (Invoke = NotifySS (CFU, SS-Notification))
Redirecting party BCD number (screening indicator, presentation indicator, redirecting party digits),

Redirecting party subaddress

NOTE: If the specific call forwarding service is not known the common SS-Code for all forwarding SS will be used.

Figure 1.2: Notification to the forwarded-to mobile subscriber that the incoming call is a forwarded call

1.1.3   Calling mobile subscriber side

As a subscription option, the served mobile subscriber can request that the calling mobile subscriber receives a NotifySS operation containing the SS-Notification indicating that the call has been forwarded. When available, the SS-Code of the invoked forwarding service is also included, see figure 1.3.
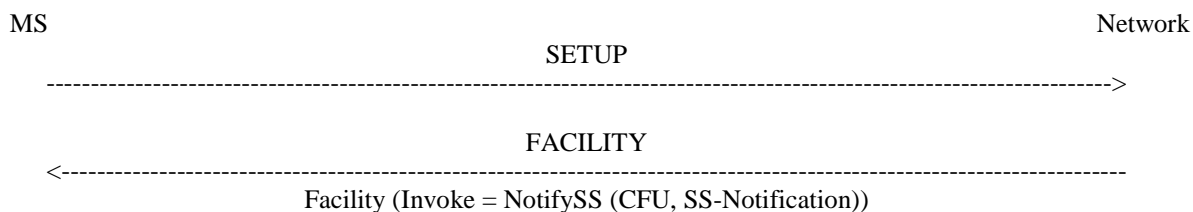
MS   Network

SETUP
-->

FACILITY
<--
Facility (Invoke = NotifySS (CFU, SS-Notification))

NOTE: If the specific call forwarding service is not known the common SS-Code for all forwarding SS will be used.

Figure 1.3: Notification to the calling mobile subscriber that the call is forwarded

1.2   Registration

The following information has to be registered in the network:

- the ForwardedToNumber which may be accompanied by a ForwardedToSubAddress;

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

1.2.1   Registration by the served mobile subscriber

A CFU registration request from a mobile user shall include the SS-Code of the forwarding service to be registered and possibly the BasicServiceCode the request applies to. If the BasicServiceCode is not included, the request applies to all basic services.

If the registration is successful, the CFU service will be registered and activated. The network will then send a return result indicating acceptance of the request including the ForwardedToNumber and possibly the BasicService (group) Code to which CFU is registered. If the request applied to a single elementary basic service group, the ForwardedToNumber may be accompanied by a ForwardedToSubAddress. In other cases, the result shall not contain a ForwardedToSubAddress. The result may also contain an SS-Status parameter. If the MS does not send an SS Version Indicator in the invocation request then the network shall send an SS-Status in the result. If the MS does send an SS Version Indicator in the invocation request then the inclusion of SS-Status in the result is optional. If the SS-Status is included the network shall set it to reflect the state of the service. The MS shall ignore the contents of the SS-Status parameter if one is received. See figure 1.4.

Note that the use of SS-Status is to provide backwards compatibility with phase 1.

If the system cannot accept a registration request, a corresponding error indication is returned to the served mobile subscriber that CFU registration was not successful. Error values are specified in 3GPP TS 24.080.
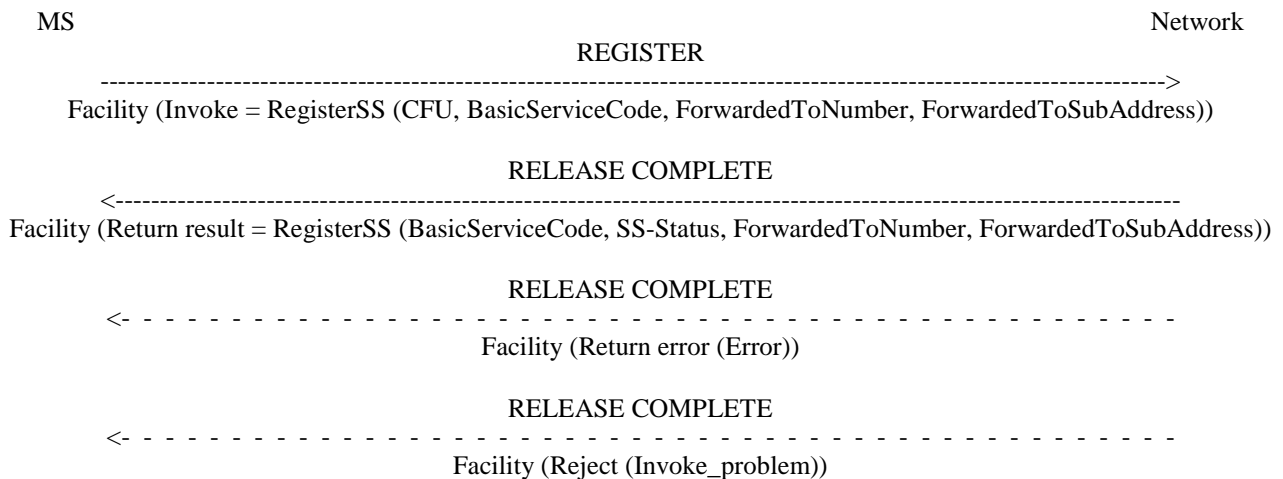
MS   Network

REGISTER

-->

Facility (Invoke = RegisterSS (CFU, BasicServiceCode, ForwardedToNumber, ForwardedToSubAddress))

RELEASE COMPLETE

<---

Facility (Return result = RegisterSS (BasicServiceCode, SS-Status, ForwardedToNumber, ForwardedToSubAddress))

RELEASE COMPLETE

<- -

Facility (Return error (Error))

RELEASE COMPLETE

<- -

Facility (Reject (Invoke_problem))

NOTE: If BasicServiceCode is not included it applies to all basic services. The ForwardedToNumber may be accompanied by a ForwardedToSubAddress. The SS-Status may not be included in all cases, see text.

Figure 1.4: Registration of call forwarding unconditional

When registering call forwarding, the SS-Code may indicate the code for "all forwarding SS". In this case, if the subscriber has CFU provisioned, the return result shall contain the information for CFU. If the subscriber does not have CFU provisioned, the return result shall contain the information for any conditional call forwarding services which the subscriber has provisioned.

1.3   Erasure

A previous registration can be erased in one of three ways:

- the subscriber can specifically erase a previous registration with an appropriate control procedure;

- the subscriber can register information for CFU for a specific basic service group to another directory number, thus causing the previous registration of CFU to be overridden;

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

1.3.1   Erasure by the served mobile subscriber

If the erasure is successful, the CFU service will be erased (and automatically deactivated). The network will then send a return result indicating acceptance of the request. The result is formatted according to the options shown below:

- The result includes the BasicService (group) Code for which CFU was erased. The result may also contain an SS-Status parameter. If the MS does not send an SS Version Indicator in the invocation request then the network shall send an SS-Status in the result. If the MS does send an SS Version Indicator in the invocation request then the inclusion of SS-Status in the result is optional. If the SS-Status is included the network shall set it to reflect the state of the service. The MS shall ignore the contents of the SS-Status parameter if one is received. See figure 1.5.

Note that the use of SS-Status is to provide backwards compatibility with GSM Phase 1.

- If the request did not include a BasicServiceCode, and the erasure was successful for all basic services, the network may send an empty return result to the MS. This option applies whether or not an SS Version Indicator is received from the MS.

If the network cannot accept the erasure request, the status of CFU in the network remains unchanged. An error indication will then be returned to the served mobile subscriber that erasure of CFU was unsuccessful. Error values are specified in 3GPP TS 24.080.
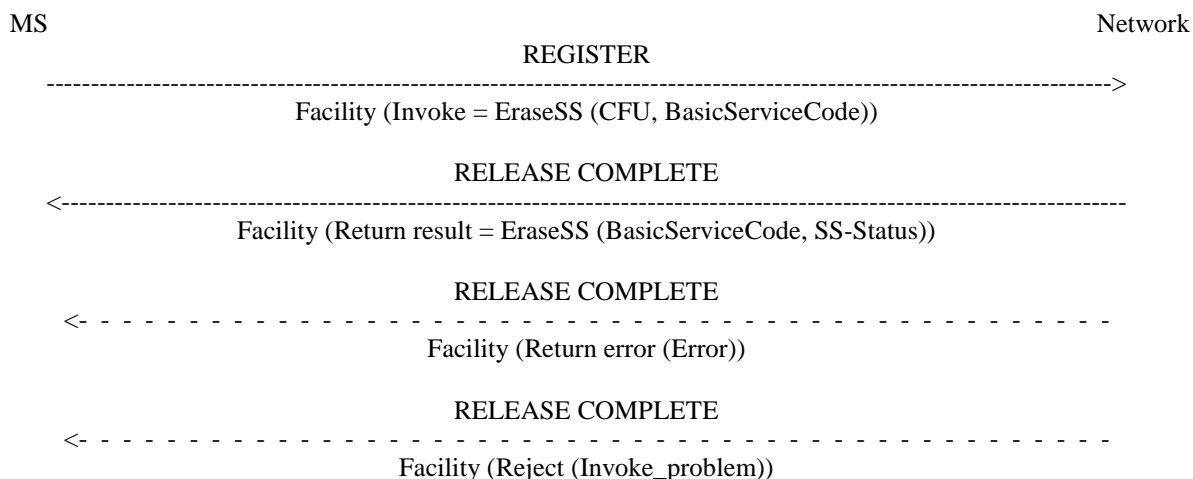
```
MS                                                                              Network
                                        REGISTER
---------------------------------------------------------------------------------------->
                     Facility (Invoke = EraseSS (CFU, BasicServiceCode))

                                   RELEASE COMPLETE
<---------------------------------------------------------------------------------------
              Facility (Return result = EraseSS (BasicServiceCode, SS-Status))

                                   RELEASE COMPLETE
   <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                            Facility (Return error (Error))

                                   RELEASE COMPLETE
   <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                          Facility (Reject (Invoke_problem))
```

NOTE: If BasicServiceCode is not included it applies to all basic services. The SS-Code may also indicate the code for "all forwarding SS". The SS-Status may not be included in all cases, see text.

Figure 1.5: Erasure of call forwarding unconditional

1.4   Activation

An explicit CFU activation request from a mobile user shall contain the supplementary service to be activated and possibly the basic service group the request applies to. If a basic service group is not included in the activation request the request applies to all basic services against which a CFU forwarded-to number is registered. The user shall receive appropriate notification of acceptance, rejection or partial acceptance of the CFU activation request, see figure 1.6.

Error values (which are used in the two latter situations) are specified in 3GPP TS 24.080.

```
MS                                                                              Network
                                        REGISTER
---------------------------------------------------------------------------------------->
                     Facility (Invoke = ActivateSS (CFU, BasicServiceCode))

                                   RELEASE COMPLETE
<---------------------------------------------------------------------------------------
                   Facility (Return result = ActivateSS (SS-Status))

                                   RELEASE COMPLETE
   <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                            Facility (Return error (Error))

                                   RELEASE COMPLETE
   <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                          Facility (Reject (Invoke_problem))
```
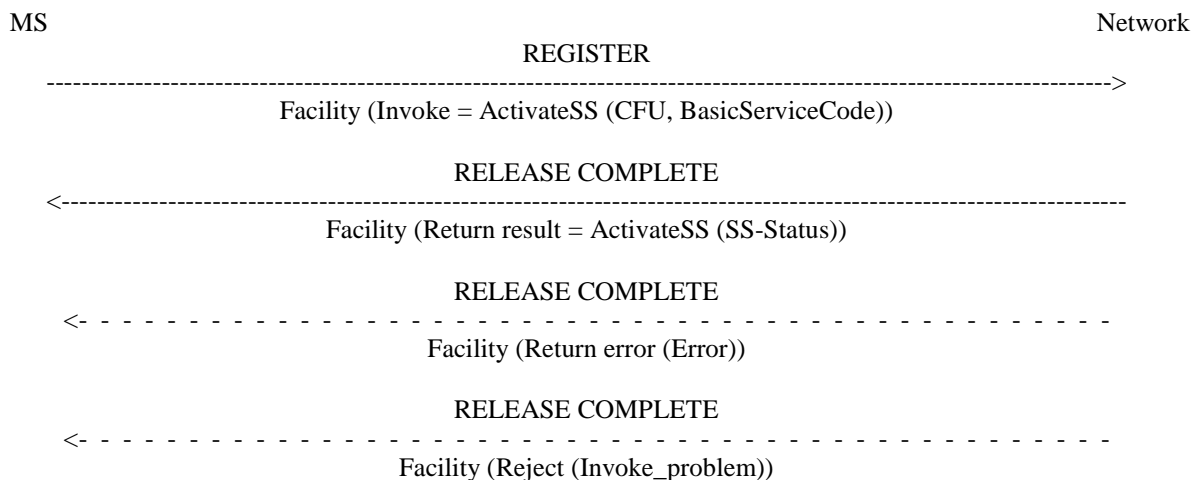
NOTE: The SS-Code may also indicate the code for "all forwarding SS", being handled as for registration (see subclause 1.2.1).

Figure 1.6: Activation of call forwarding unconditional

1.5 Deactivation

An explicit CFU deactivation request shall contain the supplementary service to be deactivated and possibly the basic service group the request applies to. If a basic service group is not included in the deactivation request the request applies to all basic services against which CFU is activated. The user shall receive appropriate notification of acceptance or rejection of the CFU deactivation request, see figure 1.7.

Error values to be used in the latter situation are specified in 3GPP TS 24.080.

Deactivation shall not lead to erasure of the information registered in the network.

```
MS                                                                                     Network
                                    REGISTER
   -------------------------------------------------------------------------------------->
                  Facility (Invoke = DeactivateSS (CFU, BasicServiceCode))

                                RELEASE COMPLETE
   <--------------------------------------------------------------------------------------
                  Facility (Return result = DeactivateSS (SS-Status))

                                RELEASE COMPLETE
   <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                         Facility (Return error (Error))

                                RELEASE COMPLETE
   <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                       Facility (Reject (Invoke_problem))
```
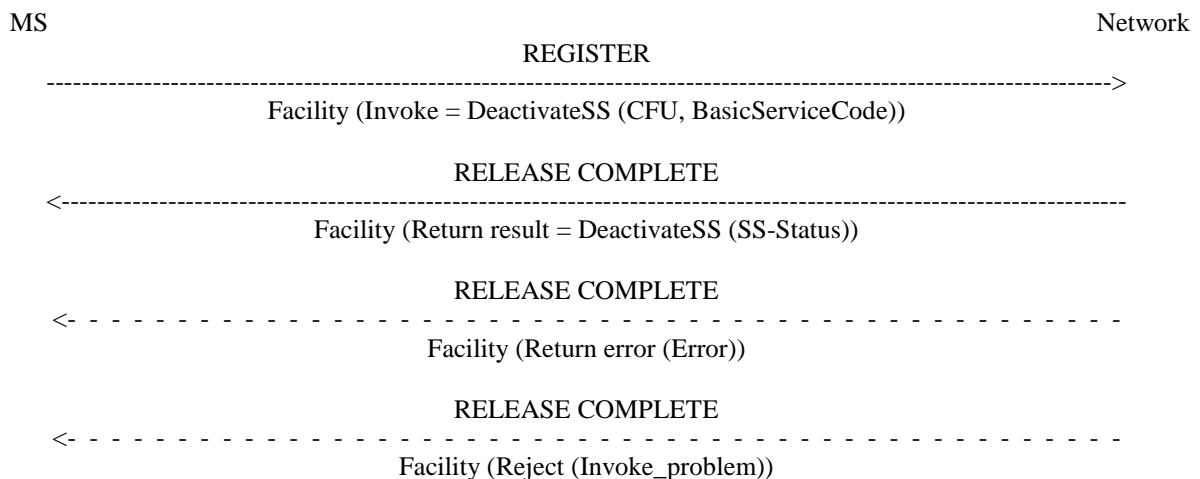
NOTE: The SS-Code may also indicate the code for "all forwarding SS".

Figure 1.7: Deactivation of call forwarding unconditional

1.6 Interrogation

Data request

The data request procedure enables the mobile subscriber to obtain information about the data stored in the PLMN. After having requested this procedure the network shall return the following information:

- in response to a general data request (i.e. not including a BasicServiceCode) the served mobile subscriber should be given the following data for each basic service group to which CFU is registered:

  - the SS-Status indicating whether the supplementary service is "not active", "active and operative" or "active and quiescent";

  - the associated ForwardedToNumber which shall not be accompanied by a ForwardedToSubAddress,

  see figure 1.8.

  If CFU is not registered for any basic service groups, only the SS-Status parameter indicating "not registered" is returned.

MS   Network
<div align="center">REGISTER</div>

-->
<div align="center">Facility (Invoke = InterrogateSS (CFU))</div>

<div align="center">RELEASE COMPLETE</div>
<--
<div align="center">Facility (Return result = InterrogateSS (BasicServiceCode, SS-Status, ForwardedToNumber))</div>

<div align="center">RELEASE COMPLETE</div>
<- -
<div align="center">Facility (Return error (Error))</div>

<div align="center">RELEASE COMPLETE</div>
<- -
<div align="center">Facility (Reject (Invoke_problem))</div>
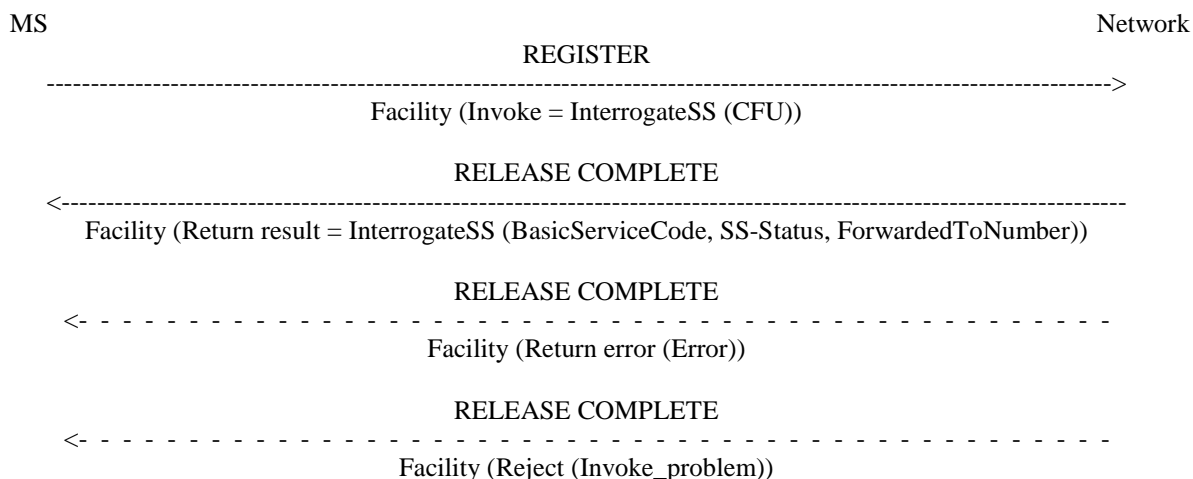
NOTE: The ForwardedToNumber shall not be accompanied by a ForwardedToSubAddress. The return result may
          consist of a list of parameters, each relating to a specific basic service group.

Figure 1.8: Interrogation of active call forwarding unconditional for all basic services

-   in response to a specific request concerning one particular basic service group, the served mobile subscriber
    should be informed whether or not CFU is registered, including information on whether or not it is active and
    operative or active and quiescent for that basic service group. If CFU is registered, the associated
    ForwardedToNumber shall be given, see figure 1.9. If the request applied to a single elementary basic service
    group, the ForwardedToNumber may be accompanied by a ForwardedToSubAddress. In other cases the result
    shall not contain a ForwardedToSubAddress.

    If CFU is not registered for the interrogated basic service group, only the SS-Status parameter indicating "not
    registered" is returned.

MS   Network
<div align="center">REGISTER</div>

-->
<div align="center">Facility (Invoke = InterrogateSS (CFU, BasicServiceCode))</div>

<div align="center">RELEASE COMPLETE</div>
<--
<div align="center">Facility (Return result = InterrogateSS (BasicServiceCode, SS-Status, ForwardedToNumber,
ForwardedToSubAddress))</div>

<div align="center">RELEASE COMPLETE</div>
<- -
<div align="center">Facility (Return error (Error))</div>

<div align="center">RELEASE COMPLETE</div>
<- -
<div align="center">Facility (Reject (Invoke_problem))</div>
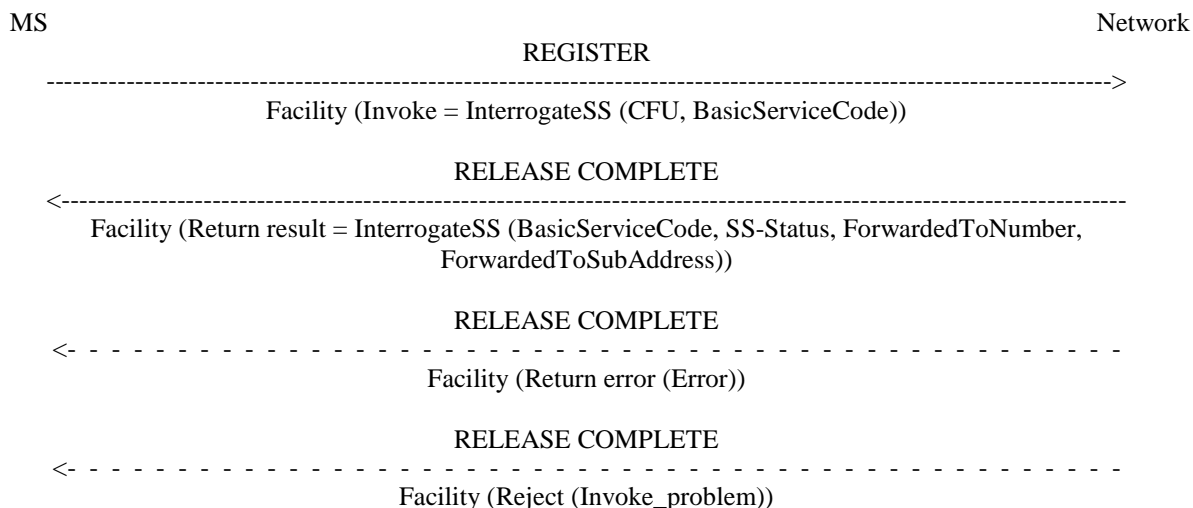
NOTE: The ForwardedToNumber may be accompanied by a ForwardedToSubAddress.

Figure 1.9: Interrogation of active call forwarding unconditional for one particular basic service

The values "all forwarding SS" and "all conditional forwarding SS" shall not be sent over the air interface by the MS in
an interrogation. If an interrogation is received containing one of these codes the network shall send a return error
component.

1.7 Cross phase compatibility

1.7.1 Network only supports protocol version 1 control of SS by the subscriber

A CFU registration request which contains a ForwardedToSubaddress shall be rejected by the network if any network element involved is of protocol version 1.

Note that a CFU activation or deactivation request will be rejected by the network is any network element involved is of protocol version 1.

1.7.2 MS only supports protocol version 1 control of SS by the subscriber

In response to a CFU interrogation request, where the SS Version Indicator is not received from the MS, the network shall only return data for basic service groups to which CFU is activated and operative. Data shall not be returned for basic service groups to which CFU is deactivated. This means that the subscriber is not always aware of the true state of the service.

In response to a CFU registration or erasure request, where the SS Version Indicator is not received from the MS, the network shall always include the SS-Status parameter.

2 Call Forwarding on mobile subscriber Busy (CFB)

2.1 Normal operation

2.1.1 Served mobile subscriber side

When call forwarding on mobile subscriber busy is active, the following actions are taken by the network:

- If the mobile is Network Determined User Busy (NDUB as defined in 3GPP TS 22.001), incoming calls for the specified basic service(s) will be forwarded without being offered to the served mobile subscriber.

- If the mobile is not NDUB, the incoming call is offered (as a normal or waiting call) to the served mobile subscriber.

  - if the call is subsequently released by the mobile with the first clearing message containing the cause = "User Busy" before the CONNECT message is received, it will be forwarded by the network, see figure 2.0;

  - if any other release causes are given, the call will be released;

  - if one of the call control timers (T303 or T310) elapse, the call will be released.

```
MS                                                                                              Network
                                          SETUP
   <--------------------------------------------------------------------------------------------------
                            ....Transaction Identifier (A-B)....

                      RELEASE COMPLETE/RELEASE/DISCONNECT
   -------------------------------------------------------------------------------------------------->
                            ....Transaction Identifier (A-B)....
                            ....Cause # 17 (User Busy)....
```
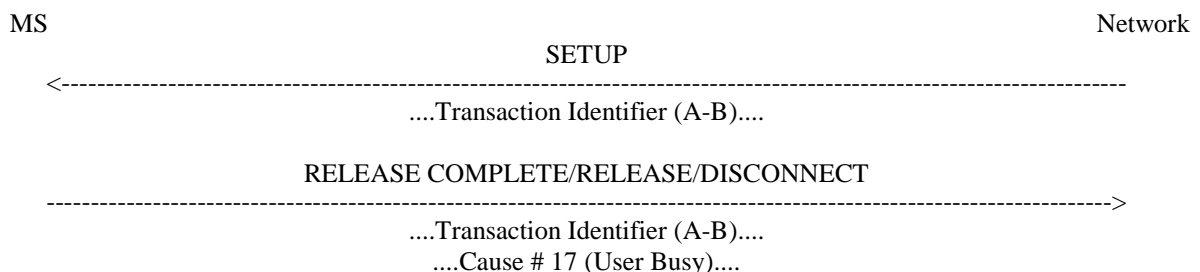
**Figure 2.0: Call which is offered to the served mobile subscriber being released.
The network will invoke call forwarding on mobile subscriber busy in this case,
if CFB is active for the requested basic service**

When an incoming call is forwarded on mobile subscriber busy due to NDUB the served mobile subscriber can, as a subscription option, receive a NotifySS operation containing the SS-Notification indicating that a call has been forwarded, see figure 2.1. He will not be able to answer the incoming call.

The transaction identifier employed shall correspond to any call B is having.

MS   Network

FACILITY (TI=B-X)

<---

Facility (Invoke = NotifySS (CFB, SS-Notification))
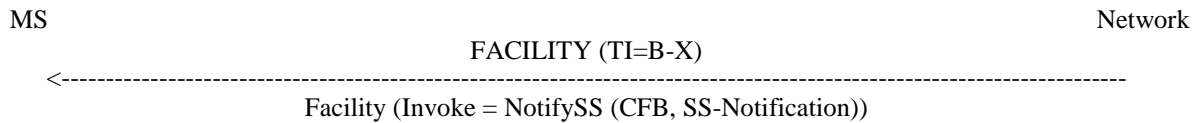
NOTE: X is any party with which B has a call.

Figure 2.1: Notification to the served mobile subscriber that a call is forwarded on mobile subscriber busy

When CFB is active, the ability of the served mobile subscriber to originate calls is not affected. However, a NotifySS operation containing the SS-Status indicating that a conditional call forwarding supplementary service is currently active and operative will be sent to the served mobile subscriber each time an outgoing call is made, see figure 2.2.
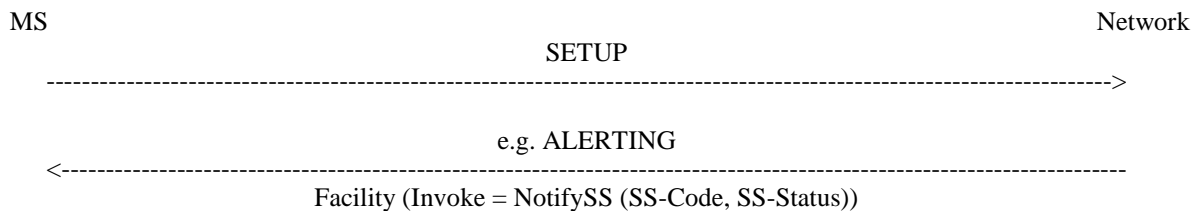
MS   Network

SETUP

-->

e.g. ALERTING

<---

Facility (Invoke = NotifySS (SS-Code, SS-Status))

NOTE: The SS-Code will be the common SS-Code for all conditional call forwarding services.

Figure 2.2: Notification to the served mobile subscriber that a conditional call forwarding service is active

2.1.2   Forwarded-to mobile subscriber side

The forwarded-to mobile subscriber will receive a NotifySS operation containing the SS-Notification indicating that the incoming call is a forwarded call. When available, the SS-Code of the invoked forwarding service is also included, see figure 2.3.

When multiple forwarding occurs the value of the SS-Code shall relate to the last invoked forwarding service.

In addition the forwarded-to mobile subscriber will receive the redirecting party BCD number and optionally, a redirecting party subaddress.

The redirecting party BCD number information element is made up of a number of information units as indicated in 3GPP TS 24.008.

In addition to or instead of the redirecting party's digits, the subscriber may be given the following information:

- screening indicator;

- presentation indicator.

Indicator values are given in 3GPP TS 24.008.

The redirecting party subaddress information element is made up of a number of information units as indicated in 3GPP TS 24.008.

MS   Network
                                                          SETUP
<---
                        Facility (Invoke = NotifySS (CFB, SS-Notification))
        Redirecting party BCD number (screening indicator, presentation indicator, redirecting party digits),

                                    Redirecting party subaddress

>   NOTE: If the specific call forwarding service is not known the common SS-Code for all forwarding SS will be used.

Figure 2.3: Notification to the forwarded-to mobile subscriber that the incoming call is a forwarded call

2.1.3   Calling mobile subscriber side

As a subscription option, the served mobile subscriber can request that the calling mobile subscriber receives a NotifySS operation containing the SS-Notification indicating that the call has been forwarded. When available, the SS-Code of the invoked forwarding service is also included, see figure 2.4.
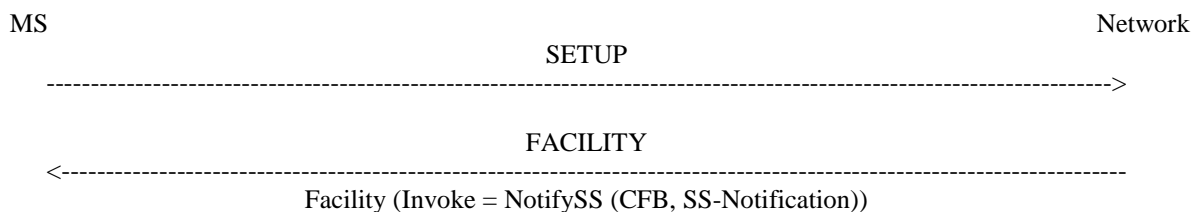
MS   Network
                                                          SETUP
-->

                                                        FACILITY
<---
                        Facility (Invoke = NotifySS (CFB, SS-Notification))

>   NOTE: If the specific call forwarding service is not known the common SS-Code for all forwarding SS will be used.

Figure 2.4: Notification to the calling mobile subscriber that the call is forwarded

2.2   Registration

The following information has to be registered in the network:

-    the ForwardedToNumber which may be accompanied by a ForwardedToSubAddress;

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

2.2.1   Registration by the served mobile subscriber

A CFB registration request from a mobile user shall include the SS-Code of the forwarding service to be registered, and possibly the BasicServiceCode the request applies to. If the BasicServiceCode is not included, the request applies to all basic services.

If the registration is successful, the CFB service will be registered and activated. The network will then send a return result indicating acceptance of the request, including the ForwardedToNumber and possibly the BasicService (group) Code to which CFB is registered. If the request applied to a single elementary basic service group, the ForwardedToNumber may be accompanied by a ForwardedToSubAddress. In other cases the result shall not contain a ForwardedToSubAddress. The result may also contain an SS-Status parameter. If the MS does not send an SS Version Indicator in the invocation request then the network shall send an SS-Status in the result. If the MS does send an SS Version Indicator in the invocation request then the inclusion of SS-Status in the result is optional. If the SS-Status is included the network shall set it to reflect the state of the service. The MS shall ignore the contents of the SS-Status parameter if one is received. See figure 2.5.

Note that the use of SS-Status is to provide backwards compatibility with phase 1.

If the system cannot accept a registration request, a corresponding error indication is returned to the served mobile subscriber that CFB registration was not successful. Error values are specified in 3GPP TS 24.080.
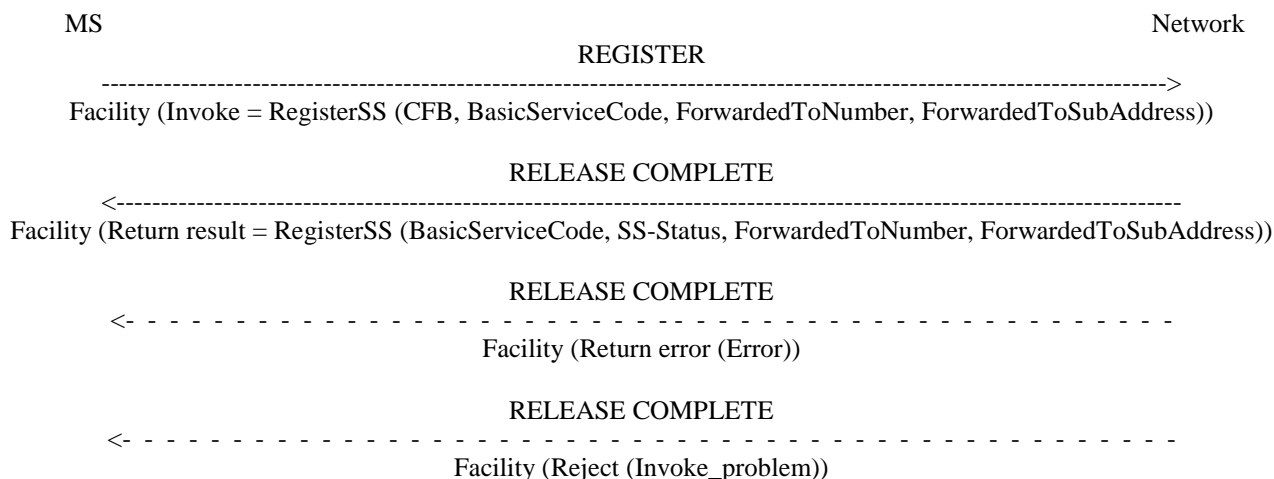
MS   Network
                                                         REGISTER
-->
Facility (Invoke = RegisterSS (CFB, BasicServiceCode, ForwardedToNumber, ForwardedToSubAddress))

                                                  RELEASE COMPLETE
<--
Facility (Return result = RegisterSS (BasicServiceCode, SS-Status, ForwardedToNumber, ForwardedToSubAddress))

                                                  RELEASE COMPLETE
<- -
Facility (Return error (Error))

                                                  RELEASE COMPLETE
<- -
Facility (Reject (Invoke_problem))

NOTE: If BasicServiceCode is not included it applies to all basic services. The ForwardedToNumber may be
              accompanied by a ForwardedToSubAddress. The SS-Status may not be included in all cases, see text.

Figure 2.5: Registration of call forwarding on mobile subscriber busy

The SS-Code may indicate the code for "all forwarding SS", as specified in subclause 1.2.1.

The SS-Code may indicate the code for "all conditional forwarding SS". In this case the return result shall contain the information for any conditional call forwarding services which the subscriber has provisioned.

2.3   Erasure

A previous registration can be erased in one of three ways:

-    the subscriber can specifically erase a previous registration with an appropriate control procedure;

-    the subscriber can register information for CFB for the specific basic service to another directory number, thus causing the previous registration of CFB to be overridden;

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

2.3.1   Erasure by the served mobile subscriber

A CFB erasure request from a mobile subscriber may include the BasicServiceCode. If this is not the case, the erasure applies to all basic services.

If the erasure is successful, the CFB service will be erased (and automatically deactivated). The network will then send a return result indicating acceptance of the request. The result is formatted according to the options shown below:

-    The result includes the BasicService (group) Code for which CFB was erased. The result may also contain an SS-Status parameter. If the MS does not send an SS Version Indicator in the invocation request then the network shall send an SS-Status in the result. If the MS does send an SS Version Indicator in the invocation request then the inclusion of SS-Status in the result is optional. If the SS-Status is included the network shall set it to reflect the state of the service. The MS shall ignore the contents of the SS-Status parameter if one is received. See figure 2.6.

Note that the use of SS-Status is to provide backwards compatibility with phase 1.

-    If the request did not include a BasicServiceCode, and the erasure was successful for all basic services, the network may send an empty return result to the MS. This option applies whether or not an SS Version Indicator is received from the MS.

If the network cannot accept the erasure request, the status of CFB in the network remains unchanged. An error indication will then be returned to the served mobile subscriber that erasure of CFB was unsuccessful. Error values are specified in 3GPP TS 24.080.

MS   Network
                                          REGISTER
--->
                      Facility (Invoke = EraseSS (CFB, BasicServiceCode))

                                     RELEASE COMPLETE
<---
                 Facility (Return result = EraseSS (BasicServiceCode, SS-Status))

                                     RELEASE COMPLETE
<- -
                           Facility (Return error (Error))

                                     RELEASE COMPLETE
<- -
                          Facility (Reject (Invoke_problem))

NOTE: If BasicServiceCode is not included it applies to all basic services. The SS-Code may also indicate the
         code for "all conditional forwarding SS" or the code for "all forwarding SS". The SS-Status may not be
         included in all cases, see text.

Figure 2.6: Erasure of call forwarding on mobile subscriber busy

2.4 Activation

An explicit CFB activation request shall contain the SS-Code of the supplementary service to be activated and possibly
the BasicServiceCode the request applies to. If a BasicServiceCode is not included in the activation request the request
applies to all basic services against which CFB forwarded-to number is registered. The user shall receive appropriate
notification of acceptance, rejection or partial acceptance of the CFB activation request, see figure 2.7.

Error values to be used in the two latter situations are specified in 3GPP TS 24.080.

MS   Network
                                          REGISTER
--->
                      Facility (Invoke = ActivateSS (CFB, BasicServiceCode))

                                     RELEASE COMPLETE
<---
                      Facility (Return result = ActivateSS (SS-Status))

                                     RELEASE COMPLETE
<- -
                           Facility (Return error (Error))

                                     RELEASE COMPLETE
<- -
                          Facility (Reject (Invoke_problem))

NOTE: The SS-Code may also indicate the code "all conditional forwarding SS" group, as specified in subclause
         2.2.1, or the "all forwarding SS" group, as specified in subclause 1.2.1.
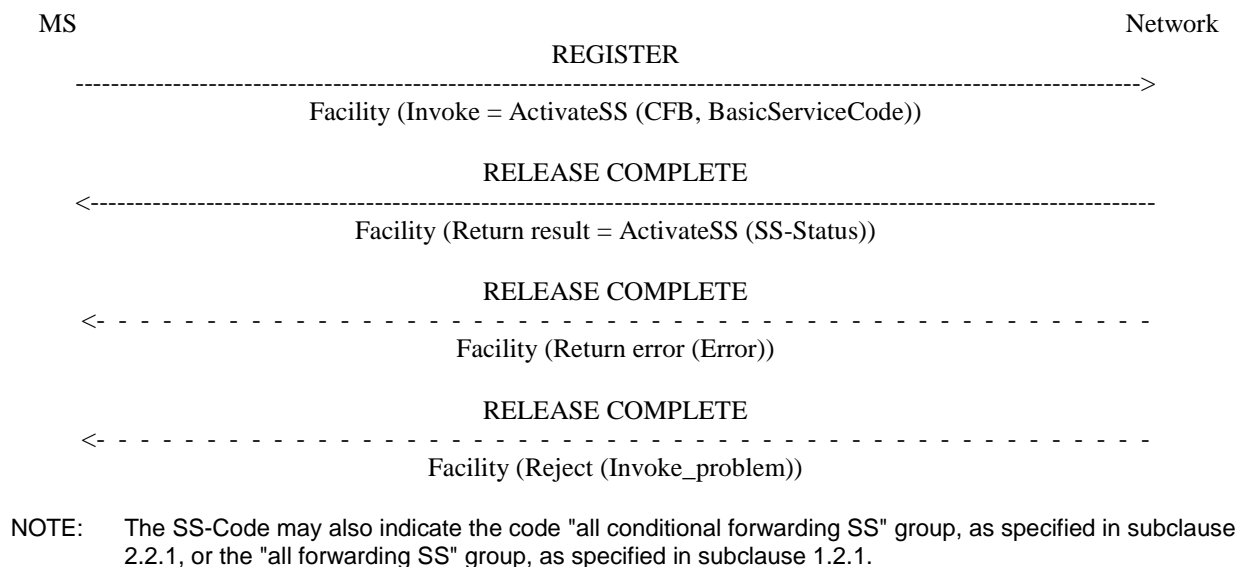
Figure 2.7: Activation of call forwarding on mobile subscriber busy

2.5 Deactivation

An explicit CFB deactivation request shall contain the SS-Code of the supplementary service to be deactivated and
possibly the BasicServiceCode the request applies to. If a BasicServiceCode is not included in the deactivation request
the request applies to all basic services against which CFB is activated. The user shall receive appropriate notification of
acceptance or rejection of the CFB deactivation request, see figure 2.8.

Error values to be used in the latter situation are specified in 3GPP TS 24.080.

Deactivation shall not lead to erasure of the information registered in the network.

```
     MS                                                                                     Network
                                         REGISTER
    ------------------------------------------------------------------------------------------->
                   Facility (Invoke = DeactivateSS (CFB, BasicServiceCode))

                                     RELEASE COMPLETE
    <-------------------------------------------------------------------------------------------
                   Facility (Return result = DeactivateSS (SS-Status))

                                     RELEASE COMPLETE
        <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                            Facility (Return error (Error))

                                     RELEASE COMPLETE
        <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                          Facility (Reject (Invoke_problem))
```
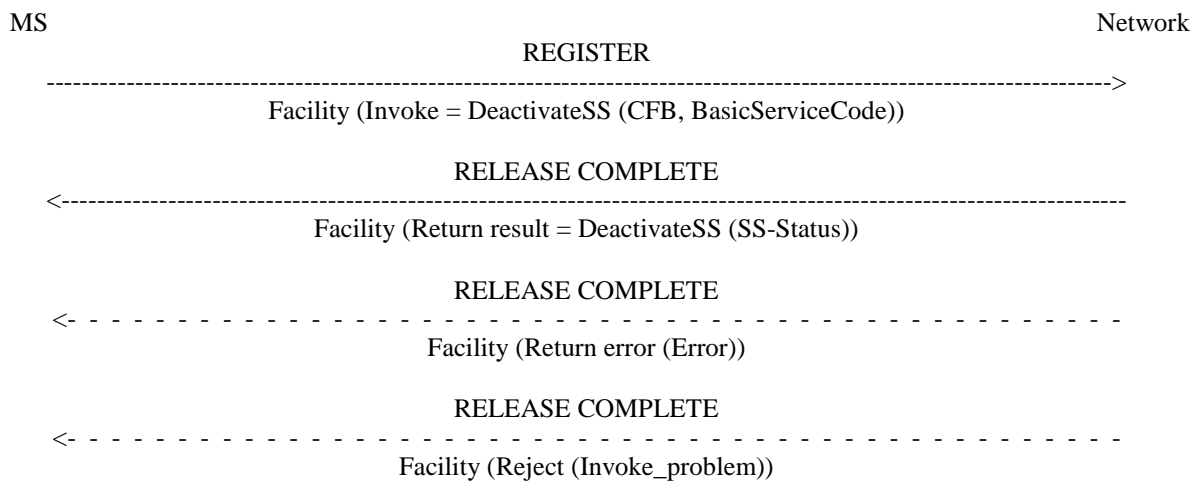
NOTE: The SS-Code may also indicate the "all conditional forwarding SS" group or the "all forwarding SS" group.

Figure 2.8: Deactivation of call forwarding on mobile subscriber busy

2.6 Interrogation

Data request

The data request procedure enables the mobile subscriber to obtain information about the data stored in the PLMN. After having requested this procedure the network shall return the following information:

- in response to a general data request (i.e. not including a BasicServiceCode) the served mobile subscriber should be given the following data for each basic service group to which CFB is registered:

    - the SS-Status indicating whether the supplementary service is "not active", "active and operative" or "active and quiescent";

    - the associated ForwardedToNumber which shall not be accompanied by a ForwardedToSubAddress,

    see figure 2.9.

    If CFB is not registered for any basic service groups, only the SS-Status parameter indicating "not registered" is returned.

MS   Network
                                                      REGISTER
--->
                                    Facility (Invoke = InterrogateSS (CFB))

                                                 RELEASE COMPLETE
<--
                Facility (Return result = InterrogateSS (BasicServiceCode, SS-Status, ForwardedToNumber))

                                                 RELEASE COMPLETE
<- -
                                         Facility (Return error (Error))

                                                 RELEASE COMPLETE
<- -
                                      Facility (Reject (Invoke_problem))
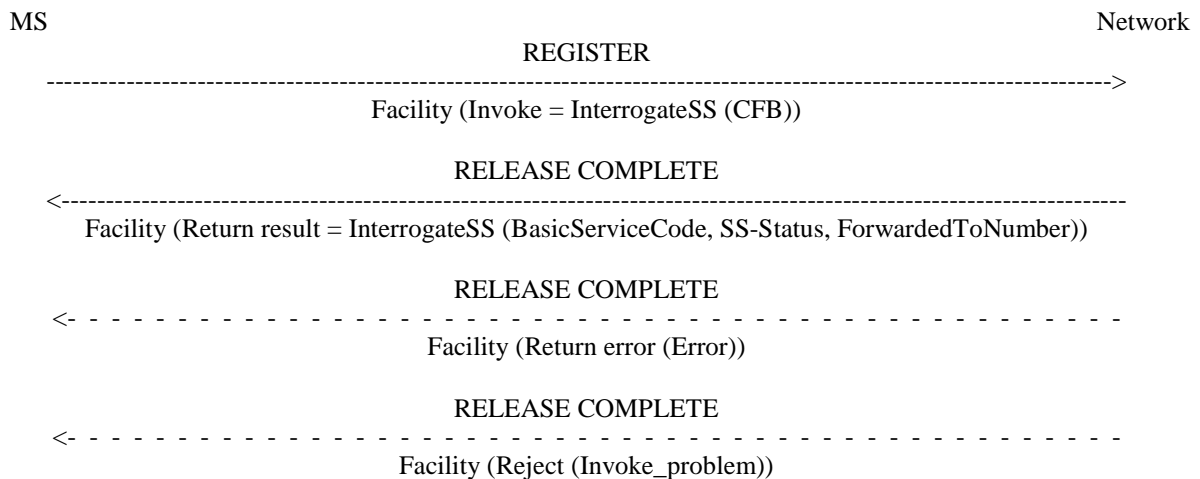
NOTE: The ForwardedToNumber shall not be accompanied by a ForwardedToSubAddress. The return result may
          consist of a list of parameters, each relating to a specific basic service group.

Figure 2.9: Interrogation of active call forwarding on mobile subscriber busy for all basic services

-    in response to a specific request (i.e. containing one particular BasicService (group) Code, the served mobile
     subscriber should receive the SS-Status parameter, indicating whether or not CFB is registered, including
     information as to whether or not it is active and operative or active and quiescent for that basic service group. If
     CFB is registered, the associated ForwardedToNumber shall be given, see figure 2.10. If the request applied to a
     single elementary basic service group, the ForwardedToNumber may be accompanied by a
     ForwardedToSubAddress. In other cases the result shall not contain a ForwardedToSubAddress.

     If CFB is not registered for the interrogated BasicService (group) code, only the SS-Status parameter indicating
     "not registered" is returned.

MS   Network
                                                      REGISTER
--->
                               Facility (Invoke = InterrogateSS (CFB, BasicServiceCode))

                                                 RELEASE COMPLETE
<--
                 Facility (Return result = InterrogateSS (BasicServiceCode, SS-Status, ForwardedToNumber,
                                                 ForwardedToSubAddress))

                                                 RELEASE COMPLETE
<- -
                                         Facility (Return error (Error))

                                                 RELEASE COMPLETE
<- -
                                      Facility (Reject (Invoke_problem))
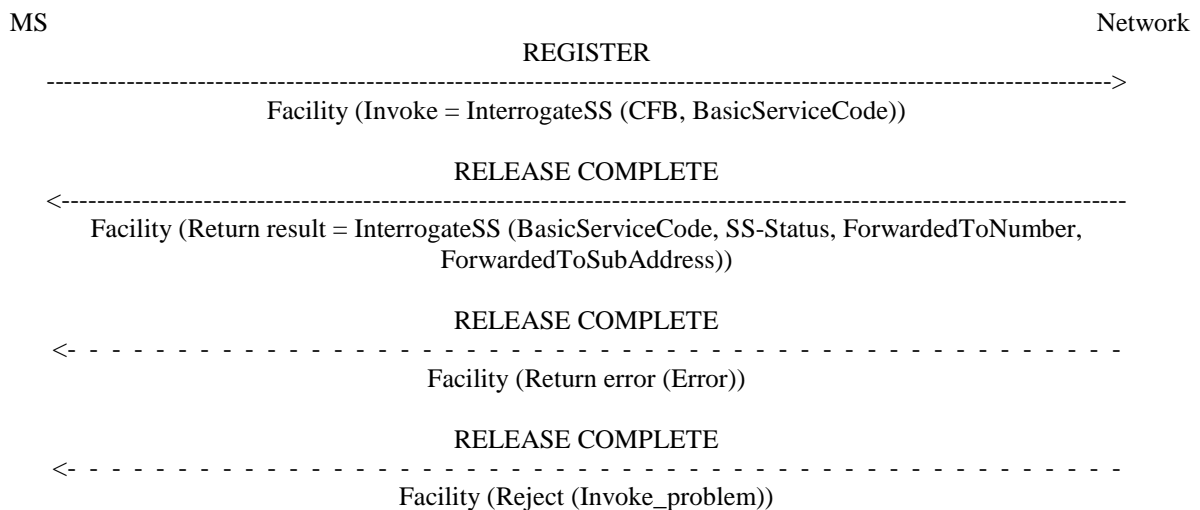
NOTE: The ForwardedToNumber may be accompanied by a ForwardedToSubAddress.

Figure 2.10: Interrogation of active call forwarding on mobile subscriber busy for one particular basic service

The values "all forwarding SS" and "all conditional forwarding SS" shall not be sent over the air interface by the MS in
an interrogation. If an interrogation is received containing one of these codes the network shall send a return error
component.

2.7 Cross phase compatibility

2.7.1 Network only supports protocol version 1 control of SS by the subscriber

A CFB registration request which contains a ForwardedToSubaddress shall be rejected by the network if any network element involved is of protocol version 1.

Note that a CFB activation or deactivation request will be rejected by the network is any network element involved is of protocol version 1.

2.7.2 MS only supports protocol version 1 control of SS by the subscriber

In response to a CFB interrogation request, where the SS Version Indicator is not received from the MS, the network shall only return data for basic service groups to which CFB is activated and operative. Data shall not be returned for basic service groups to which CFB is deactivated. This means that the subscriber is not always aware of the true state of the service.

In response to a CFB registration or erasure request, where the SS Version Indicator is not received from the MS, the network shall always include the SS-Status parameter.

3 Call Forwarding on No Reply (CFNRy)

3.1 Normal operation

3.1.1 Served mobile subscriber side

When call forwarding on no reply is active, all incoming calls for the specified basic service(s) that are not answered within the period defined by the no reply condition timer, will be forwarded.

When an incoming call is forwarded on no reply the served mobile subscriber can, as a subscription option, receive a NotifySS operation containing the SS-Notification indicating that a call has been forwarded, see figure 3.1.

MS   Network
                                                              FACILITY
    <---
                              Facility (Invoke = NotifySS (CFNRy, SS-Notification))
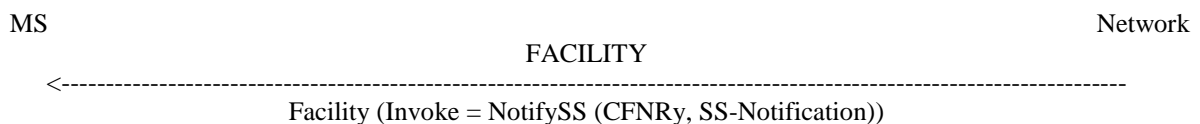
Figure 3.1: Notification to the served mobile subscriber that the call is forwarded on no reply

When CFNRy is active, the ability of the served mobile subscriber to originate calls is not affected. However, a NotifySS operation containing the SS-Status indicating that a conditional call forwarding supplementary service is currently active and operative will be sent to the served mobile subscriber each time an outgoing call is made, see figure 3.2.
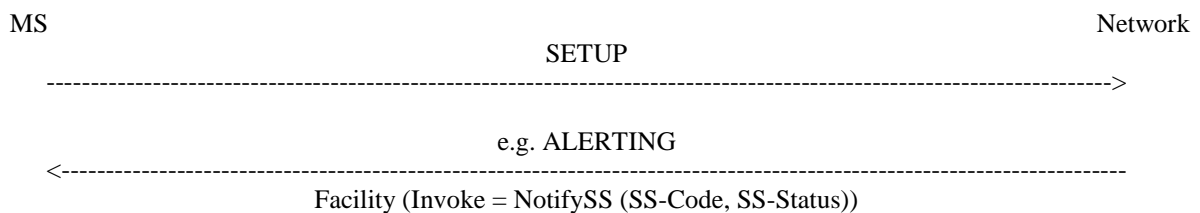
MS   Network
                                                               SETUP
    --->

                                                         e.g. ALERTING
    <---
                              Facility (Invoke = NotifySS (SS-Code, SS-Status))

    NOTE: The SS-Code will be the common SS-Code for all conditional call forwarding services.

Figure 3.2: Notification to the served mobile subscriber that a conditional call forwarding service is active

3.1.2 Forwarded-to mobile subscriber side

The forwarded-to mobile subscriber will receive a NotifySS operation containing the SS-Notification indicating that the incoming call is a forwarded call. When available, the SS-Code of the invoked forwarding service is also included, see figure 3.3.

When multiple forwarding occurs the value of the SS-Code shall relate to the last invoked forwarding service.

In addition the forwarded-to mobile subscriber will receive the redirecting party BCD number and optionally, a redirecting party subaddress.

The redirecting party BCD number information element is made up of a number of information units as indicated in 3GPP TS 24.008.

In addition to or instead of the redirecting party's digits, the subscriber may be given the following information:

- screening indicator;

- presentation indicator.

Indicator values are given in 3GPP TS 24.008.

The redirecting party subaddress information element is made up of a number of information units as indicated in 3GPP TS 24.008.

```
MS                                                                              Network
                                    SETUP
    <---------------------------------------------------------------------------------------
                    Facility (Invoke = NotifySS (CFNRy, SS-Notification))
        Redirecting party BCD number (screening indicator, presentation indicator, redirecting party digits),

                            Redirecting party subaddress
```

NOTE: If the specific call forwarding service is not known the common SS-Code for "all forwarding SS" will be used.

Figure 3.3: Notification to the forwarded-to mobile subscriber that the incoming call is a forwarded call

3.1.3 Calling mobile subscriber side

As a subscription option, the served mobile subscriber can request that the calling mobile subscriber receives a NotifySS operation containing the SS-Notification indicating that the call has been forwarded. When available, the SS-Code of the invoked forwarding service is also included, see figure 3.4.

```
MS                                                                              Network
                                    SETUP
    ------------------------------------------------------------------------------------------->

                                   FACILITY
    <---------------------------------------------------------------------------------------
            Facility (Invoke = NotifySS (CFNRy, SS-Notification))
```

NOTE: If the specific call forwarding service is not known the common SS-Code for "all forwarding SS" will be used.

Figure 3.4: Notification to the calling mobile subscriber that the call is forwarded

3.2 Registration

The following information has to be registered in the network:

- the ForwardedToNumber, which may be accompanied by a ForwardedToSubAddress;

- information as to whether all calls or all calls of a specific basic service should be forwarded;

- the duration of the no reply condition timer.

3.2.1 Registration by the served mobile subscriber

A CFNRy registration request from a mobile user shall include the SS-Code of the forwarding service to be registered and possibly the applicable BasicServiceCode and NoReplyConditionTime. If the BasicServiceCode is not included, the request applies to all basic services. If the NoReplyConditionTime is not included, the previous value set by the mobile user or network operator applies.

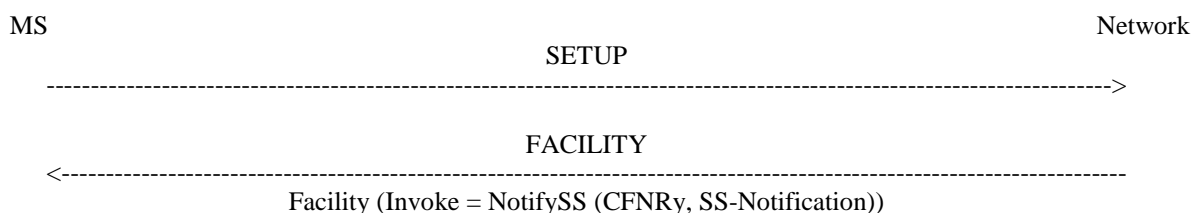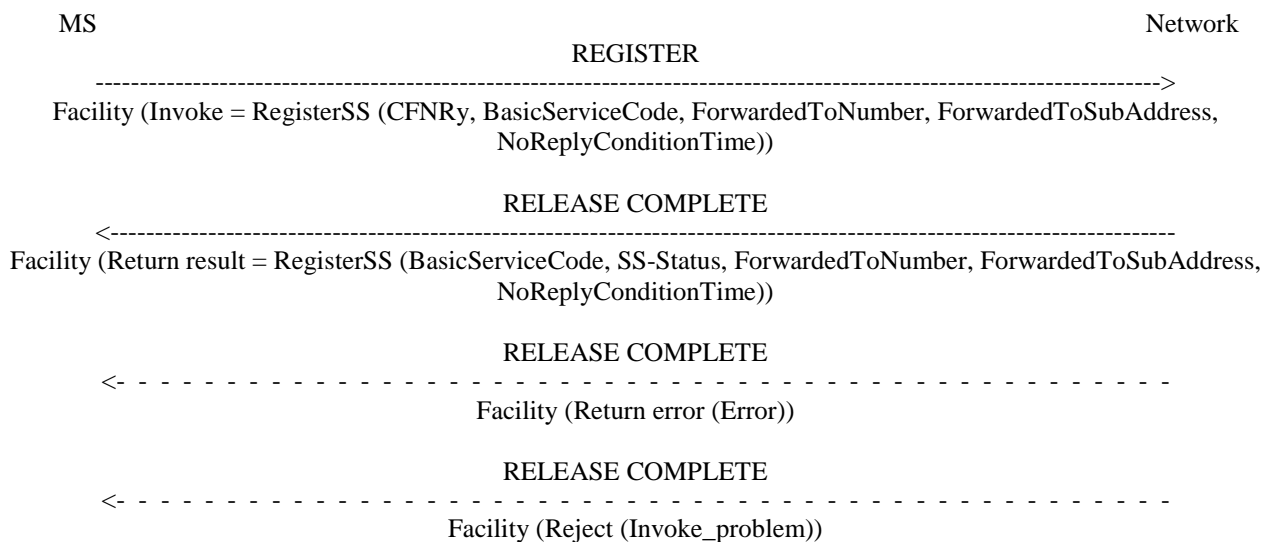If the registration is successful, the CFNRy service will be registered and activated. The network will then send a return result indicating acceptance of the request, including the ForwardedToNumber and possibly the applicable BasicService (group) code and NoReplyConditionTime. If the request applied to a single elementary basic service group, the ForwardedToNumber may be accompanied by a ForwardedToSubAddress. In other cases the result shall not contain a ForwardedToSubAddress. The result may also contain an SS-Status parameter. If the MS does not send an SS Version Indicator in the invocation request then the network shall send an SS-Status in the result. If the MS does send an SS Version Indicator in the invocation request then the inclusion of SS-Status in the result is optional. If the SS-Status is included the network shall set it to reflect the state of the service. The MS shall ignore the contents of the SS-Status parameter if one is received. See figure 3.5.

Note that the use of SS-Status is to provide backwards compatibility with phase 1.

If the system cannot accept a registration request, a corresponding error indication is returned to the served mobile subscriber that CFNRy registration was not successful. Error values are specified in 3GPP TS 24.080.

```
     MS                                                                                         Network
                                           REGISTER
     ----------------------------------------------------------------------------------------------->
       Facility (Invoke = RegisterSS (CFNRy, BasicServiceCode, ForwardedToNumber, ForwardedToSubAddress,
                                     NoReplyConditionTime))


                                      RELEASE COMPLETE
     <--------------------------------------------------------------------------------------------
     Facility (Return result = RegisterSS (BasicServiceCode, SS-Status, ForwardedToNumber, ForwardedToSubAddress,
                                     NoReplyConditionTime))


                                      RELEASE COMPLETE
     <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                                 Facility (Return error (Error))


                                      RELEASE COMPLETE
     <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                                Facility (Reject (Invoke_problem))
```

NOTE: If BasicServiceCode is not included it applies to all basic services. If NoReplyConditionTime is not included the value previously registered in the network applies. The ForwardedToNumber may be accompanied by a ForwardedToSubAddress. The SS-Code may also indicate the code for "all conditional forwarding SS", as specified in subclause 2.2.1, or the code for "all forwarding SS", as specified in subclause 1.2.1. The SS-Status may not be included in all cases, see text.

Figure 3.5: Registration of call forwarding on no reply

3.3 Erasure

A previous registration can be erased in one of three ways:

- the subscriber can specifically erase a previous registration with an appropriate control procedure;

- the subscriber can register information for CFNRy for the specific basic service to another directory number, thus causing the previous registration of CFNRy to be overridden;

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

3.3.1 Erasure by the served mobile subscriber

A CFNRy erasure request from a mobile subscriber may include the BasicServiceCode. If this is not the case, the erasure applies to all basic services.

If the erasure is successful, the CFNRy service will be erased (and automatically deactivated). The network will then send a return result indicating acceptance of the request. The result is formatted according to the options shown below:

- The result includes the BasicService (group) Code for which CFNRy was erased. The result may also contain an SS-Status parameter. If the MS does not send an SS Version Indicator in the invocation request then the network shall send an SS-Status in the result. If the MS does send an SS Version Indicator in the invocation request then the inclusion of SS-Status in the result is optional. If the SS-Status is included the network shall set it to reflect the state of the service. The MS shall ignore the contents of the SS-Status parameter if one is received. See figure 3.6.

Note that the use of SS-Status is to provide backwards compatibility with phase 1.

- If the request did not include a BasicServiceCode, and the erasure was successful for all basic services, the network may send an empty return result to the MS. This option applies whether or not an SS Version Indicator is received from the MS.

If the network cannot accept the erasure request, the status of CFNRy in the network remains unchanged. An error indication will then be returned to the served mobile subscriber that erasure of CFNRy was unsuccessful. Error values are specified in 3GPP TS 24.080.
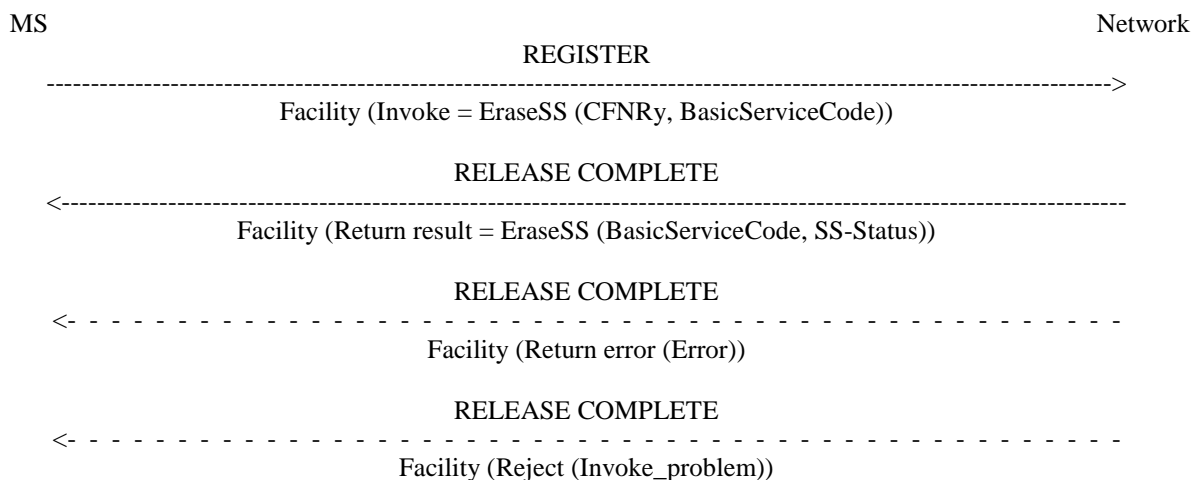
```
MS                                                                              Network
                              REGISTER
 ------------------------------------------------------------------------------->
              Facility (Invoke = EraseSS (CFNRy, BasicServiceCode))

                          RELEASE COMPLETE
 <------------------------------------------------------------------------------
           Facility (Return result = EraseSS (BasicServiceCode, SS-Status))

                          RELEASE COMPLETE
 <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                      Facility (Return error (Error))

                          RELEASE COMPLETE
 <- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                      Facility (Reject (Invoke_problem))
```

NOTE: If BasicServiceCode is not included it applies to all basic services. The SS-Code may also indicate the code for "all conditional forwarding SS" or the code for "all forwarding SS". The SS-Status may not be included in all cases, see text.

Figure 3.6: Erasure of call forwarding on no reply

3.4 Activation

An explicit CFNRy activation request shall contain the SS-Code of the supplementary service to be activated and possibly the BasicServiceCode the request applies to. If a BasicServiceCode is not included in the activation request the request applies to all basic services against which a CFNRy forwarded-to number is registered. The user shall receive appropriate notification of acceptance, rejection or partial acceptance of the CFNRy activation request, see figure 3.7.
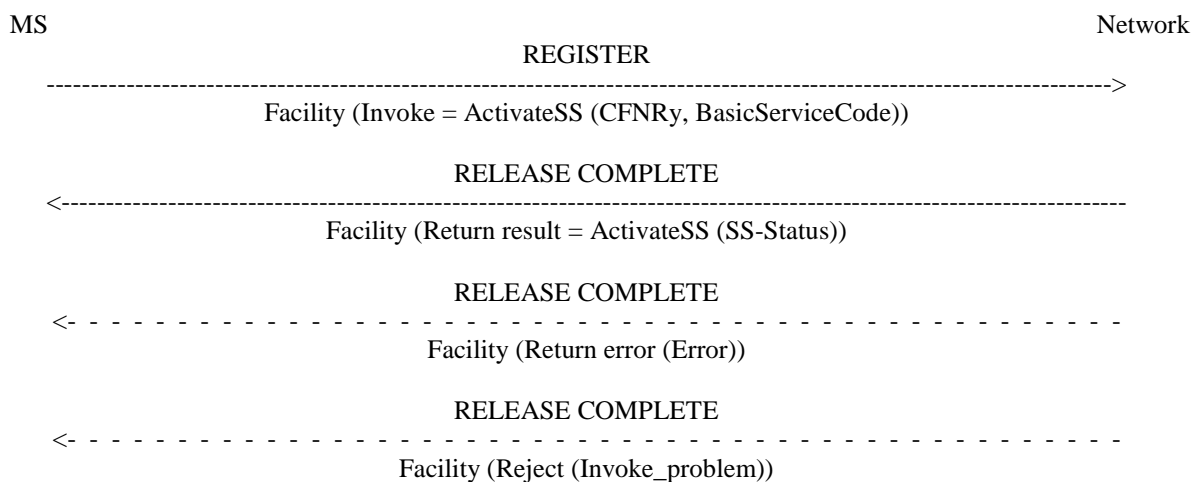
Error values (which are used in the two latter situations) are specified in 3GPP TS 24.080.

MS   Network
                                                     REGISTER
--->
                    Facility (Invoke = ActivateSS (CFNRy, BasicServiceCode))

                                                RELEASE COMPLETE
<--
                    Facility (Return result = ActivateSS (SS-Status))

                                                RELEASE COMPLETE
<- -
                            Facility (Return error (Error))

                                                RELEASE COMPLETE
<- -
                            Facility (Reject (Invoke_problem))

NOTE: The SS-Code may also indicate the code "all conditional forwarding SS" group, as specified in subclause 2.2.1, or the "all forwarding SS" group, as specified in subclause 1.2.1.

Figure 3.7: Activation of call forwarding on no reply

3.5 Deactivation

An explicit CFNRy deactivation request shall contain the SS-Code of the supplementary service to be deactivated and possibly the BasicServiceCode the request applies to. If a BasicServiceCode is not included in the deactivation request the request applies to all basic services against which CFNRy is activated. The user shall receive appropriate notification of acceptance or rejection of the CFNRy deactivation request, see figure 3.8.

Error values to be used in the latter situation are specified in 3GPP TS 24.080.

Deactivation shall not lead to erasure of the information registered in the network.

MS   Network
                                                     REGISTER
--->
                    Facility (Invoke = DeactivateSS (CFNRy, BasicServiceCode))

                                                RELEASE COMPLETE
<--
                    Facility (Return result = DeactivateSS (SS-Status))

                                                RELEASE COMPLETE
<- -
                            Facility (Return error (Error))

                                                RELEASE COMPLETE
<- -
                            Facility (Reject (Invoke_problem))
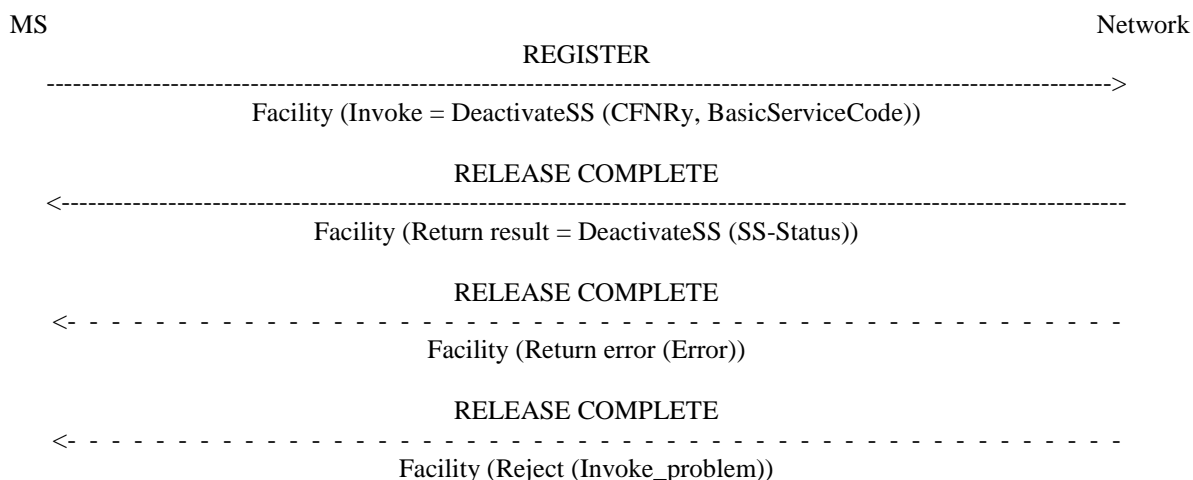
NOTE: The SS-Code may also indicate "all conditional forwarding SS" group or the "all forwarding SS" group.

Figure 3.8: Deactivation of call forwarding on no reply

3.6   Interrogation

Data request

The data request procedure enables the mobile subscriber to obtain information about the data stored in the PLMN. After having requested this procedure the network shall return the following information:

- in response to a general data request (i.e. not including a BasicServiceCode) the served mobile subscriber should be given the following data for each basic service group to which CFNRy is registered:

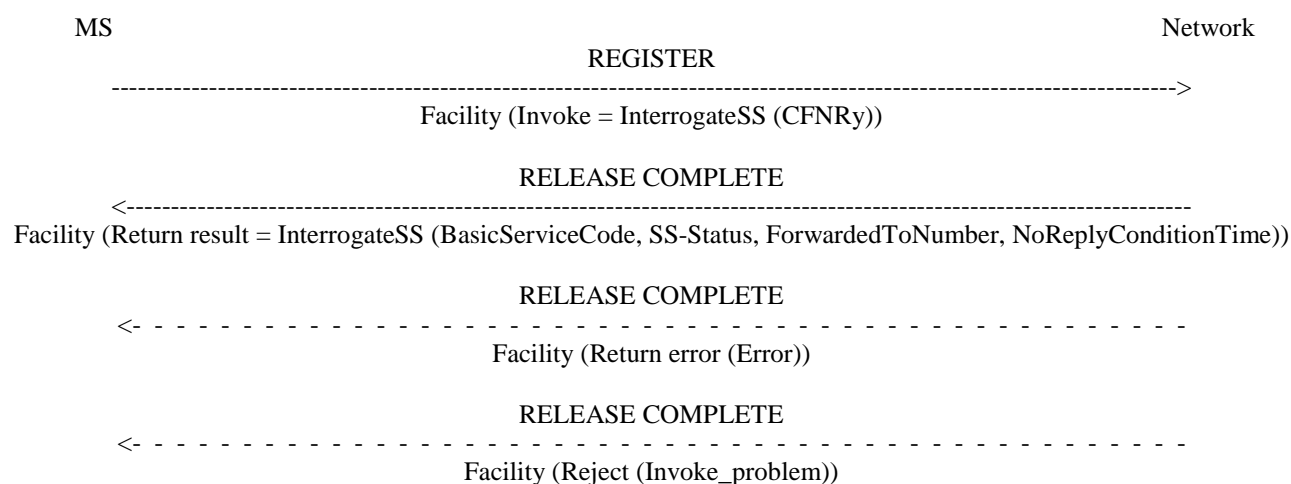   - the SS-Status indicating whether the supplementary service is "not active", "active and operative" or "active and quiescent";

    - the associated ForwardedToNumber which shall not be accompanied by a ForwardedToSubAddress;

    - the duration of the no reply condition timer,

    see figure 3.9.

    If CFNRy is not registered for any basic service groups, only the SS-Status parameter indicating "not registered" is returned.

MS   Network
<div align="center">REGISTER</div>

--->
<div align="center">Facility (Invoke = InterrogateSS (CFNRy))</div>

<div align="center">RELEASE COMPLETE</div>

<--
Facility (Return result = InterrogateSS (BasicServiceCode, SS-Status, ForwardedToNumber, NoReplyConditionTime))

<div align="center">RELEASE COMPLETE</div>

<- -
<div align="center">Facility (Return error (Error))</div>

<div align="center">RELEASE COMPLETE</div>

<- -
<div align="center">Facility (Reject (Invoke_problem))</div>

NOTE: The ForwardedToNumber shall not be accompanied by a ForwardedToSubAddress. The return result may consist of a list of parameters, each relating to a specific basis service group.

Figure 3.9: Interrogation of active call forwarding on no reply for all basic services

- in response to a specific request (i.e. containing one particular BasicService (group) code, the served mobile subscriber should receive the SS-Status parameter, indicating whether or not CFNRy is registered, including information as to whether or not it is active and operative or active and quiescent for that basic service group. If CFNRy is registered for the interrogated basic service group, the associated ForwardedToNumber and the duration of the no reply condition timer shall be given, see figure 3.10. If the request applied to a single elementary basic service group, the ForwardedToNumber may be accompanied by a ForwardedToSubAddress. In other cases the result shall not contain a ForwardedToSubAddress.

    If CFNRy is not registered for the interrogated BasicService (group) code, only the SS-Status parameter indicating "not registered" is returned.

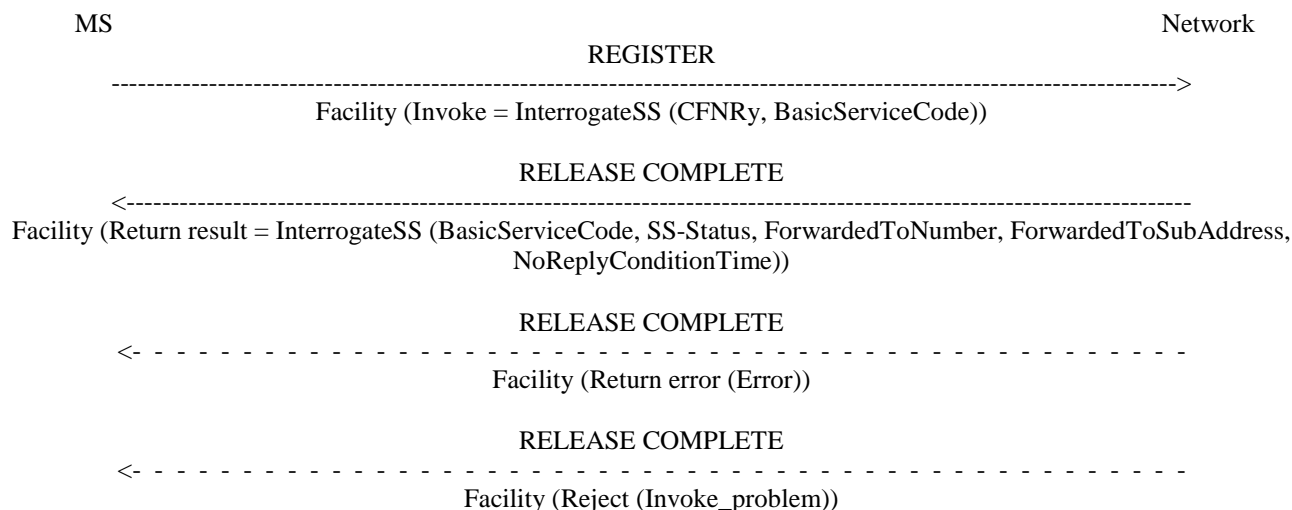MS   Network

REGISTER

-->

Facility (Invoke = InterrogateSS (CFNRy, BasicServiceCode))

RELEASE COMPLETE

<---

Facility (Return result = InterrogateSS (BasicServiceCode, SS-Status, ForwardedToNumber, ForwardedToSubAddress,
NoReplyConditionTime))

RELEASE COMPLETE

<- -

Facility (Return error (Error))

RELEASE COMPLETE

<- -

Facility (Reject (Invoke_problem))

NOTE: The ForwardedToNumber may be accompanied by a ForwardedToSubAddress.

Figure 3.10: Interrogation of active call forwarding on no reply for one particular basic service

The values "all forwarding SS" and "all conditional forwarding SS" shall not be sent over the air interface by the MS in an interrogation. If an interrogation is received containing one of these codes the network shall send a return error component.

3.7 Cross phase compatibility

3.7.1 Network only supports protocol version 1 control of SS by the subscriber

A CFNRy registration request which contains a ForwardedToSubaddress shall be rejected by the network if any network element involved is of protocol version 1.

Note that a CFNRy activation or deactivation request will be rejected by the network is any network element involved is of protocol version 1.

3.7.2 MS only supports protocol version 1 control of SS by the subscriber

In response to a CFNRy interrogation request, where the SS Version Indicator is not received from the MS, the network shall only return data for basic service groups to which CFNRy is activated and operative. Data shall not be returned for basic service groups to which CFNRy is deactivated. This means that the subscriber is not always aware of the true state of the service.

In response to a CFNRy registration or erasure request, where the SS Version Indicator is not received from the MS, the network shall always include the SS-Status parameter.
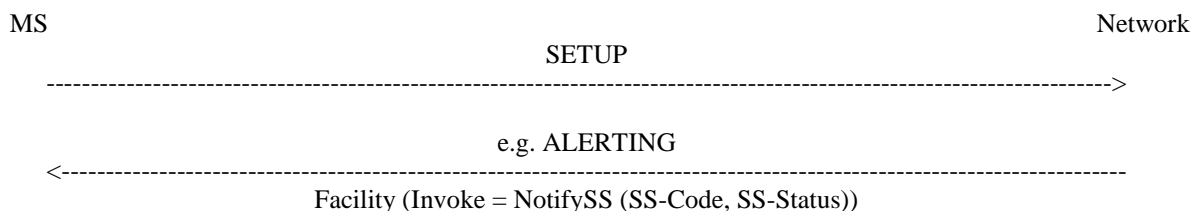
4 Call Forwarding on mobile subscriber Not Reachable (CFNRc)

4.1 Normal operation

4.1.1 Served mobile subscriber side

When call forwarding on mobile subscriber not reachable, all incoming calls for the specified basic service(s) when the mobile subscriber is not reachable, will be forwarded without being offered to the served mobile subscriber.

When CFNRc is active, the ability of the served mobile subscriber to originate calls is not affected. However, a NotifySS operation containing the SS-Status indicating that a conditional call forwarding service is currently active and operative will be sent to the served mobile subscriber each time an outgoing call is made, see figure 4.1.

MS   Network

SETUP

-->

e.g. ALERTING

<---

Facility (Invoke = NotifySS (SS-Code, SS-Status))

NOTE: The SS-Code will be the common SS-Code for all conditional call forwarding services.

Figure 4.1: Notification to the served mobile subscriber that a conditional call forwarding service is active

4.1.2   Forwarded-to mobile subscriber side

The forwarded-to mobile subscriber will receive a NotifySS operation containing the SS-Notification indicating that the incoming call is a forwarded call. When available, the SS-Code of the invoked forwarding service is also included, see figure 4.2.

When multiple forwarding occurs the value of the SS-Code shall relate to the last invoked forwarding service.

In addition the forwarded-to mobile subscriber will receive the redirecting party BCD number and optionally, a redirecting party subaddress.

The redirecting party BCD number information element is made up of a number of information units as indicated in 3GPP TS 24.008.

In addition to or instead of the redirecting party's digits, the subscriber may be given the following information:

-    screening indicator;

-    presentation indicator.

Indicator values are given in 3GPP TS 24.008.

The redirecting party subaddress information element is made up of a number of information units as indicated in 3GPP TS 24.008.

MS   Network

SETUP

<---

Facility (Invoke = NotifySS (CFNRc, SS-Notification))

Redirecting party BCD number (screening indicator, presentation indicator, redirecting party digits),

Redirecting party subaddress

NOTE: If the specific call forwarding service is not known the common SS-Code for call forwarding SS will be used.

Figure 4.2: Notification to the forwarded-to mobile subscriber that the incoming call is a forwarded call

4.1.3   Calling mobile subscriber side

As a subscription option, the served mobile subscriber can request that the calling mobile subscriber receives a NotifySS operation containing the SS-Notification indicating that the call has been forwarded. When available, the SS-Code of the invoked forwarding service is also included, see figure 4.3.

MS   Network

SETUP
--->

FACILITY
<--
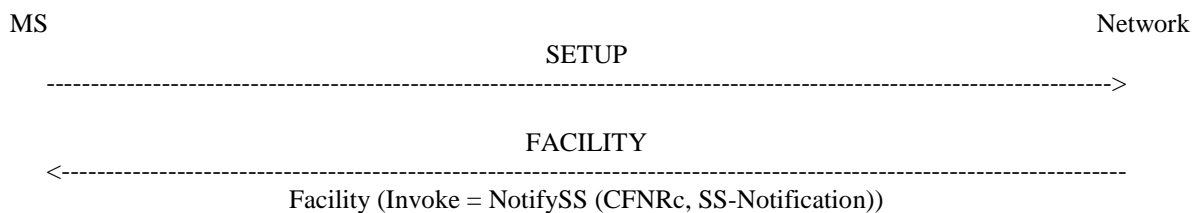Facility (Invoke = NotifySS (CFNRc, SS-Notification))

NOTE: If the specific call forwarding service is not known the common SS-Code for all forwarding SS will be used.

Figure 4.3: Notification to the calling mobile subscriber that the call is forwarded

4.2   Registration

The following information has to be registered in the network:

- the ForwardedToNumber which may be accompanied by a ForwardedToSubAddress;

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

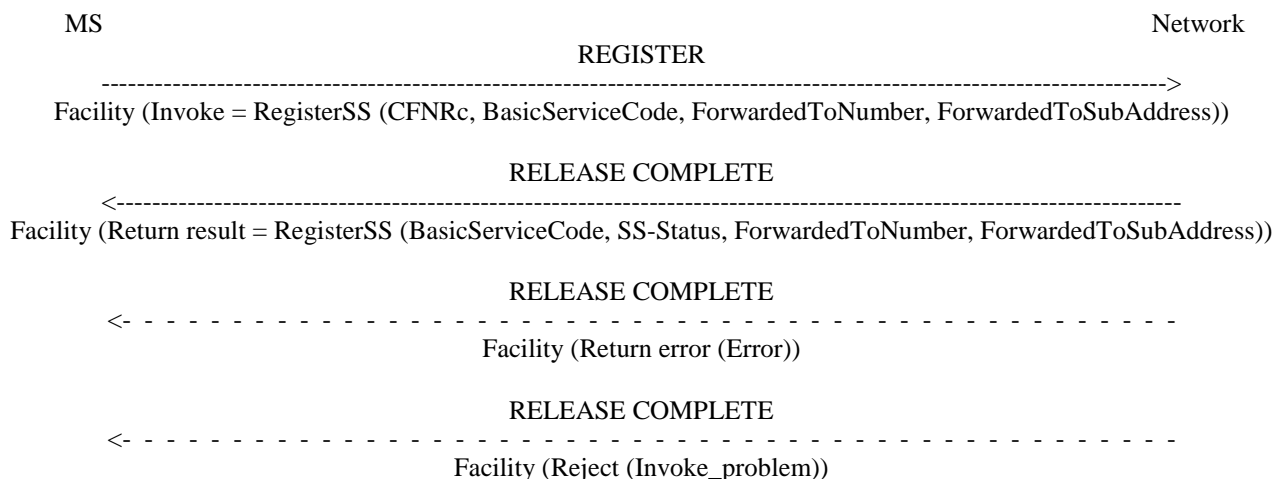## 4.2.1   Registration by the served mobile subscriber

A CFNRc registration request from a mobile user shall include the SS-Code of the forwarding service to be registered and possibly the BasicServiceCode the request applies to. If the BasicServiceCode is not included, the request applies to all basic services.

If the registration is successful, the CFNRc will be registered and activated. The network will then send a return result indicating of acceptance of the request, including the ForwardedToNumber and possibly the applicable BasicService (group) code to which CFNRc is registered. If the request applied to a single elementary basic service group, the ForwardedToNumber may be accompanied by a ForwardedToSubAddress. In other cases the result shall not contain a ForwardedToSubAddress. The result may also contain an SS-Status parameter. If the MS does not send an SS Version Indicator in the invocation request then the network shall send an SS-Status in the result. If the MS does send an SS Version Indicator in the invocation request then the inclusion of SS-Status in the result is optional. If the SS-Status is included the network shall set it to reflect the state of the service. The MS shall ignore the contents of the SS-Status parameter if one is received. See figure 4.4.

Note that the use of SS-Status is to provide backwards compatibility with phase 1.

If the registration is successful, the CFNRc will be registered and activated. The network will then send a return result indicating of acceptance of the request, including the ForwardedToNumber to which CFNRc is registered. If no BasicServiceCode was included in the registration request it is not included in the return result either, see figure 4.4.

If the system cannot accept a registration request, a corresponding error indication is returned to the served mobile subscriber that CFNRc registration was not successful. Error values are specified in 3GPP TS 24.080.

MS   Network
<div align="center">REGISTER</div>

-->

Facility (Invoke = RegisterSS (CFNRc, BasicServiceCode, ForwardedToNumber, ForwardedToSubAddress))

<div align="center">RELEASE COMPLETE</div>

<--

Facility (Return result = RegisterSS (BasicServiceCode, SS-Status, ForwardedToNumber, ForwardedToSubAddress))

<div align="center">RELEASE COMPLETE</div>

<- -

<div align="center">Facility (Return error (Error))</div>

<div align="center">RELEASE COMPLETE</div>

<- -

<div align="center">Facility (Reject (Invoke_problem))</div>

NOTE: If BasicServiceCode is not included it applies to all basic services. The ForwardedToNumber may be accompanied by a ForwardedToSubAddress. The SS-Code may also indicate the code for "all conditional forwarding SS", as specified in subclause 2.2.1, or the code for "all forwarding SS", as specified in subclause 1.2.1. The SS-Status may not be included in all cases, see text.

<div align="center">**Figure 4.4: Registration of call forwarding on mobile subscriber not reachable**</div>

4.3   Erasure

A previous registration can be erased in one of three ways:

- the subscriber can specifically erase a previous registration with an appropriate control procedure;

- the subscriber can register information for CFNRc for the specific basic service to another directory number, thus causing the previous registration of CFNRc to be overridden;

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

4.3.1   Erasure by the served mobile subscriber

A CFNRc erasure request from a mobile subscriber may include the BasicServiceCode. If this is not the case, the erasure applies to all basic services.

If the erasure is successful, the CFNRc service will be erased (and automatically deactivated). The network will then send a return result indicating acceptance of the request. The result is formatted according to the options shown below:

- The result includes the BasicService (group) Code for which CFNRc was erased. The result may also contain an SS-Status parameter. If the MS does not send an SS Version Indicator in the invocation request then the network shall send an SS-Status in the result. If the MS does send an SS Version Indicator in the invocation request then the inclusion of SS-Status in the result is optional. If the SS-Status is included the network shall set it to reflect the state of the service. The MS shall ignore the contents of the SS-Status parameter if one is received. See figure 4.5.

Note that the use of SS-Status is to provide backwards compatibility with phase 1.

- If the request did not include a BasicServiceCode, and the erasure was successful for all basic services, the network may send an empty return result to the MS. This option applies whether or not an SS Version Indicator is received from the MS.

If the network cannot accept the erasure request, the status of CFNRc in the network remains unchanged. An error indication will then be returned to the served mobile subscriber that erasure of CFNRc was unsuccessful. Error values are specified in 3GPP TS 24.080.
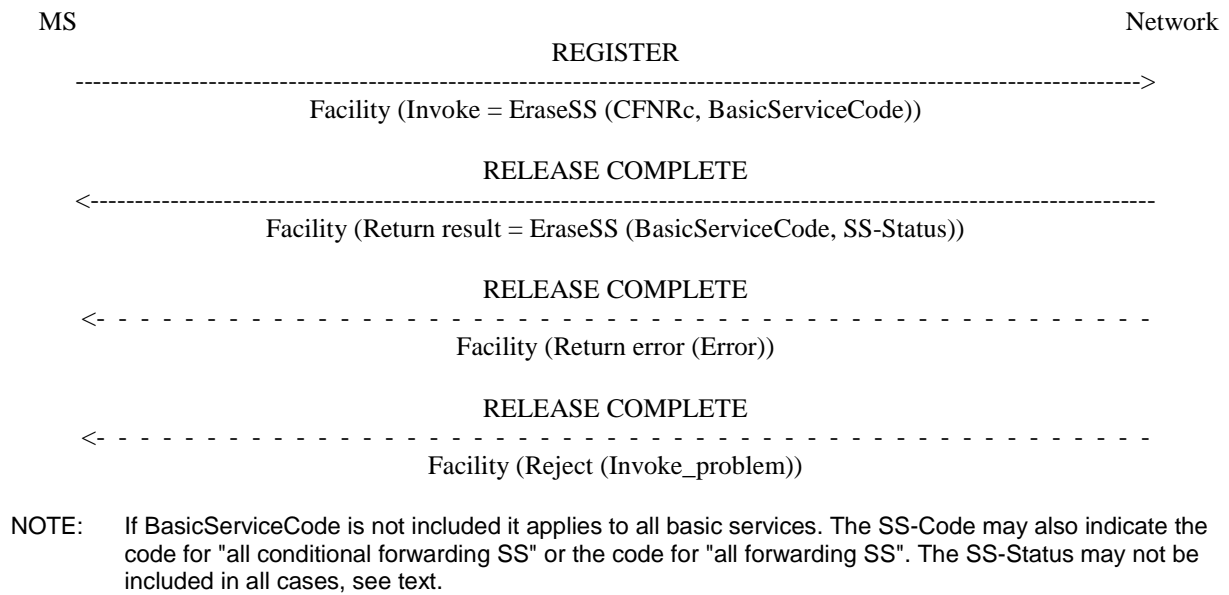
MS   Network
REGISTER
```
-------------------------------------------------------------------------------------------------->
```
Facility (Invoke = EraseSS (CFNRc, BasicServiceCode))

RELEASE COMPLETE
```
<-------------------------------------------------------------------------------------------------
```
Facility (Return result = EraseSS (BasicServiceCode, SS-Status))

RELEASE COMPLETE
```
<- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```
Facility (Return error (Error))

RELEASE COMPLETE
```
<- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```
Facility (Reject (Invoke_problem))

NOTE: If BasicServiceCode is not included it applies to all basic services. The SS-Code may also indicate the code for "all conditional forwarding SS" or the code for "all forwarding SS". The SS-Status may not be included in all cases, see text.

Figure 4.5: Erasure of call forwarding on mobile subscriber not reachable

4.4   Activation

An explicit CFNRc activation request shall contain the SS-Code of the supplementary service to be activated and possibly the BasicServiceCode the request applies to. If a BasicServiceCode is not included in the activation request the request applies to all basic services against which a CFNRc forwarded-to number is registered. The user shall receive appropriate notification of acceptance, rejection or partial acceptance of the CFNRc activation request, see figure 4.6.

Error values (which are used in the two latter situations) are specified in 3GPP TS 24.080.

MS   Network
REGISTER
```
-------------------------------------------------------------------------------------------------->
```
Facility (Invoke = ActivateSS (CFNRc, BasicServiceCode))

RELEASE COMPLETE
```
<-------------------------------------------------------------------------------------------------
```
Facility (Return result = ActivateSS (SS-Status))

RELEASE COMPLETE
```
<- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```
Facility (Return error (Error))

RELEASE COMPLETE
```
<- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```
Facility (Reject (Invoke_problem))

NOTE: The SS-Code may also indicate the code "all conditional forwarding SS" group, as specified in subclause 2.2.1, or the "all forwarding SS" group, as specified in subclause 1.2.1.

Figure 4.6: Activation of call forwarding on mobile subscriber not reachable

4.5   Deactivation

An explicit CFNRc deactivation request shall contain the SS-Code of the supplementary service to be deactivated and possibly the BasicServiceCode the request applies to. If a BasicServiceCode is not included in the deactivation request the request applies to all basic services against which CFNRc is activated. The user shall receive appropriate notification of acceptance or rejection of the CFNRc deactivation request, see figure 4.7.

Error values to be used in the latter situation are specified in 3GPP TS 24.080.

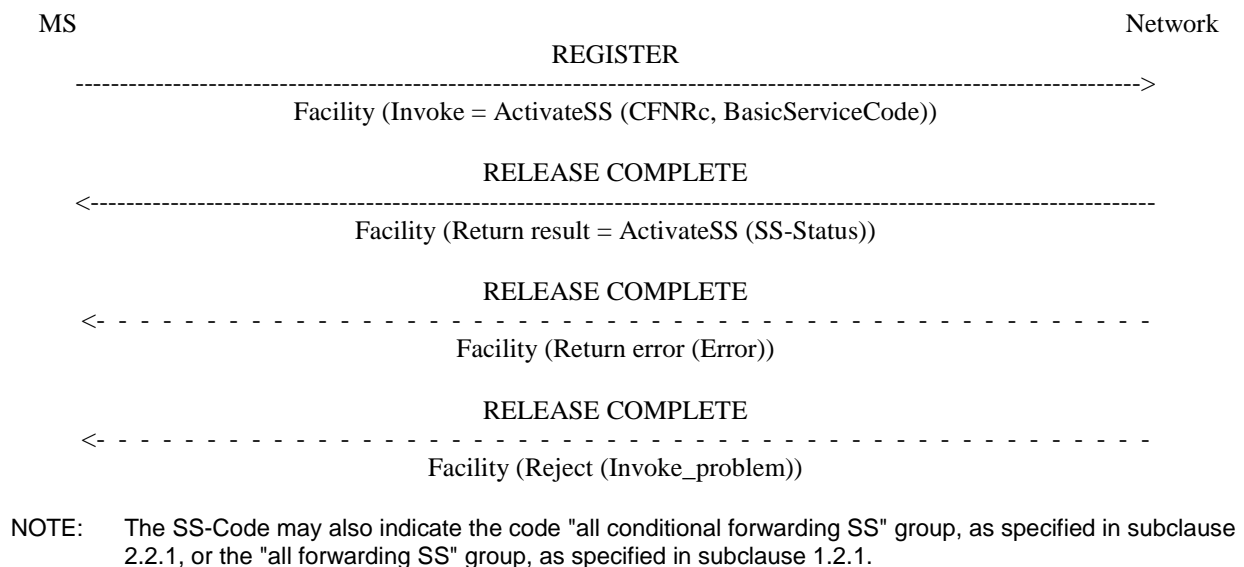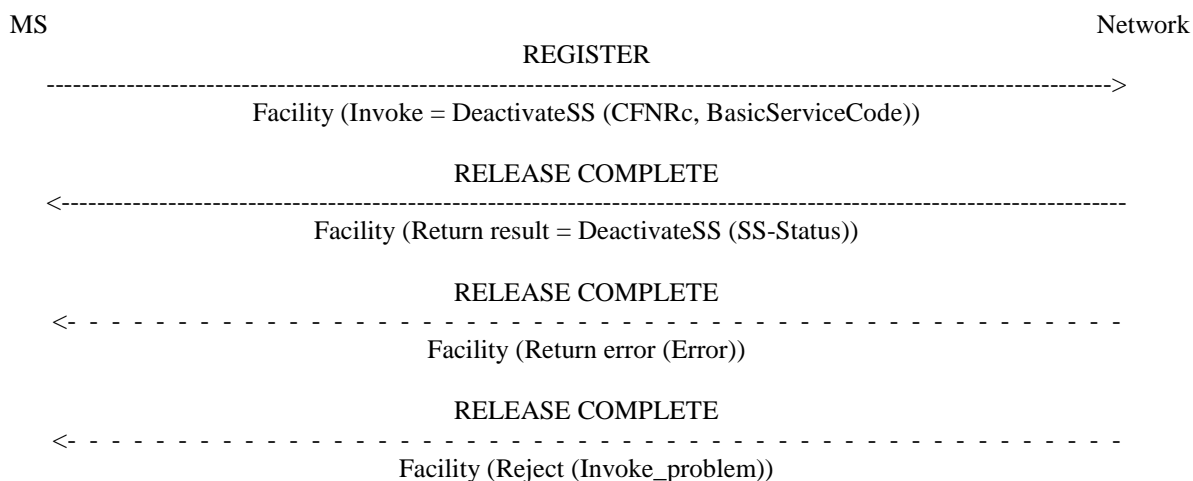Deactivation shall not lead to erasure of the information registered in the network.

MS   Network

REGISTER

-->

Facility (Invoke = DeactivateSS (CFNRc, BasicServiceCode))

RELEASE COMPLETE

<--

Facility (Return result = DeactivateSS (SS-Status))

RELEASE COMPLETE

<- -

Facility (Return error (Error))

RELEASE COMPLETE

<- -

Facility (Reject (Invoke_problem))

NOTE: The SS-Code may also indicate the "all conditional forwarding SS" group or the "all forwarding SS" group.

Figure 4.7: Deactivation of call forwarding on mobile subscriber not reachable
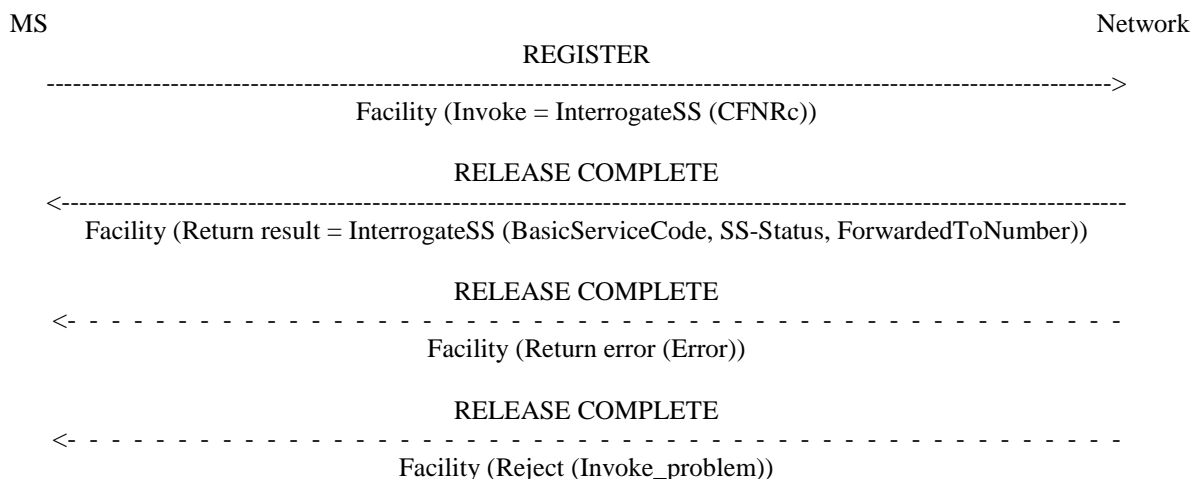
4.6   Interrogation

Data request

The data request procedure enables the mobile subscriber to obtain information about the data stored in the PLMN. After having requested this procedure the network shall return the following information:

- in response to a general data request (i.e. not including a BasicServiceCode) the served mobile subscriber should be given the following data for each basic service group to which CFNRc is registered:

  - the SS-Status indicating whether the supplementary service is "not active", "active and operative" or "active and quiescent";

  - the associated ForwardedToNumber which shall not be accompanied by a ForwardedToSubAddress,

  see figure 4.8.

  If CFNRc is not registered for any basic service groups, only the SS-Status parameter indicating "not registered" is returned.

MS   Network
<div align="center">REGISTER</div>
-->
<div align="center">Facility (Invoke = InterrogateSS (CFNRc))</div>

<div align="center">RELEASE COMPLETE</div>
<---
<div align="center">Facility (Return result = InterrogateSS (BasicServiceCode, SS-Status, ForwardedToNumber))</div>

<div align="center">RELEASE COMPLETE</div>
<- -
<div align="center">Facility (Return error (Error))</div>

<div align="center">RELEASE COMPLETE</div>
<- -
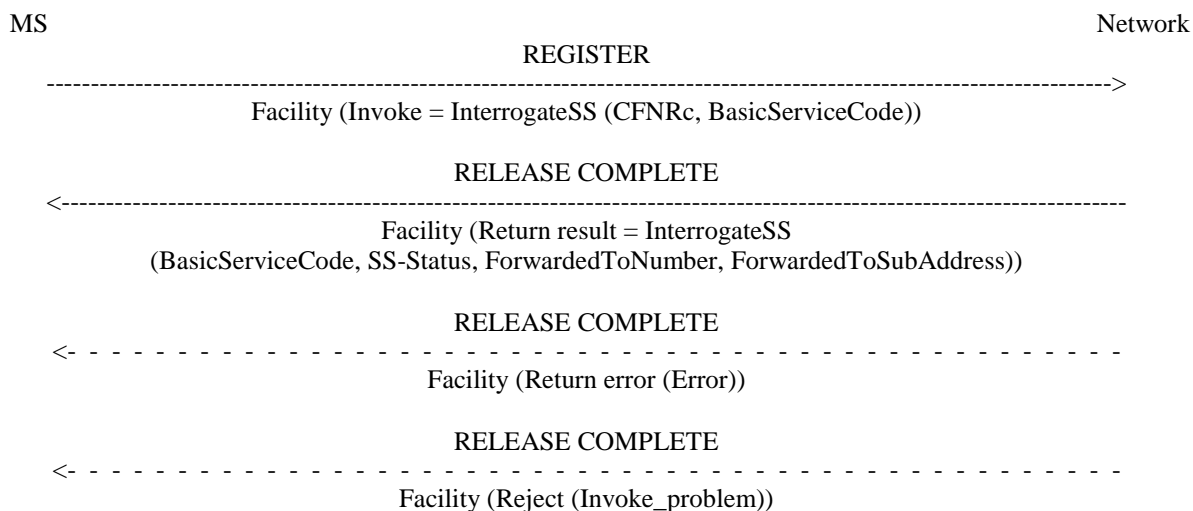<div align="center">Facility (Reject (Invoke_problem))</div>

NOTE: The ForwardedToNumber shall not be accompanied by a ForwardedToSubAddress. The return result may consist of a list of parameters, each relating to a specific basic service group.

Figure 4.8: Interrogation of call forwarding on mobile subscriber not reachable active for all basic services

- in response to a specific request (i.e. containing one particular BasicService (group) code), the served mobile subscriber should receive the SS-Status parameter, indicating whether or not CFNRc is registered, including information as to whether or not it is active and operative or active and quiescent for that basic service group. If CFNRc is registered, the associated ForwardedToNumber shall be given, see figure 4.9. If the request applied to a single elementary basic service group, the ForwardedToNumber may be accompanied by a ForwardedToSubAddress. In other cases the result shall not contain a ForwardedToSubAddress.

  If CFNRc is not registered for the interrogated BasicService (group) code, only the SS-Status parameter indicating "not registered" is returned.

MS   Network
<div align="center">REGISTER</div>
-->
<div align="center">Facility (Invoke = InterrogateSS (CFNRc, BasicServiceCode))</div>

<div align="center">RELEASE COMPLETE</div>
<---
<div align="center">Facility (Return result = InterrogateSS
(BasicServiceCode, SS-Status, ForwardedToNumber, ForwardedToSubAddress))</div>

<div align="center">RELEASE COMPLETE</div>
<- -
<div align="center">Facility (Return error (Error))</div>

<div align="center">RELEASE COMPLETE</div>
<- -
<div align="center">Facility (Reject (Invoke_problem))</div>

NOTE: The ForwardedToNumber may be accompanied by a ForwardedToSubAddress.

Figure 4.9: Interrogation of active call forwarding on mobile subscriber not reachable for one particular basic service

The values "all forwarding SS" and "all conditional forwarding SS" shall not be sent over the air interface by the MS in an interrogation. If an interrogation is received containing one of these codes the network shall send a return error component.

4.7 Cross phase compatibility

4.7.1 Network only supports protocol version 1 control of SS by the subscriber

A CFNRc registration request which contains a ForwardedToSubaddress shall be rejected by the network if any network element involved is of protocol version 1.

Note that a CFNRc activation or deactivation request will be rejected by the network is any network element involved is of protocol version 1.

4.7.2 MS only supports protocol version 1 control of SS by the subscriber

In response to a CFNRc interrogation request, where the SS Version Indicator is not received from the MS, the network shall only return data for basic service groups to which CFNRc is activated and operative. Data shall not be returned for basic service groups to which CFNRc is deactivated. This means that the subscriber is not always aware of the true state of the service.

In response to a CFNRc registration or erasure request, where the SS Version Indicator is not received from the MS, the network shall always include the SS-Status parameter.

Annex A (informative): Change history

TSG CN#	Spec	Version	CR	\<Phase\>	New Version	Subject/Comment
Apr 1999	GSM 04.82	7.0.0				Transferred to 3GPP CN1
CN#03	24.082			R99	3.0.0	Approved at CN#03
CN#11	24.082	3.0.0		Rel-4	4.0.0	Release 4 after CN#11
CN#16	24.082	4.0.0		Rel-4	4.0.1	References updated
CN#16	24.082	4.0.1		Rel-5	5.0.0	Release 5 after CN#16

History

Document history		
V5.0.0	June 2002	Publication