

# ST AS Communication Diversion Management Guide

MTAS

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USER GUIDE

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# 1 Introduction

This document describes how to configure the SIP Trunking (ST) Communication Diversion (CDIV) service in the MTAS.

## 1.1 Prerequisites

This section describes the prerequisites that must be fulfilled. It is assumed that the user of this document is familiar with the Operation and Maintenance (O&M) area, in general.

### 1.1.1 Licenses

To enable the ST AS Communication Diversion feature, the ST AS Base license must be installed.

For more information about the ST AS Base license, refer to *MTAS Licenses*.

### 1.1.2 Documents

Before starting any procedure in this document, ensure that the following documents are available:

- *Ericsson Command-Line Interface User Guide*
- *Managed Object Model (MOM)*

### 1.1.3 Conditions

The following condition must apply:

- An Ericsson Command-Line Interface (ECLI) session in Exec mode is in progress.





## 2 Overview

The ST CDIV supplementary service enables a served Private Branch Exchange (PBX) to have the network redirect communication to another user. This applies to communication addressed to the served PBX that either meets conditions in the CDIV rule set of the served PBX, or, for the Communication Deflection (CD) service, depending on configuration data with a received 302 response from the served PBX. The ability of the served PBX to originate communications is unaffected by the CDIV supplementary service.

Configuration of the ST CDIV service mainly includes the following activities:

- Divert communication
- Manage subscription ST CDIV rules
- Configure ST CDIV on node level

The ST CDIV coexists with other simulation services on the same ST AS, for example, ST Communication Barring (CB).

ST CDIV determines if the communication is to be diverted by evaluating ST CDIV rules or for the CD service evaluating a CM attribute when a 302 response is received from the served PBX. The rules are built up with different conditions and a forward-to action together with other optional actions such play-announcement. They can be combined in many ways to express if a communication is to be diverted, and if notifications are to be sent.

The ST CDIV service is triggered by the initial SIP `INVITE` method and responses from the network and time-outs. The ST CDIV not-logged-in service is only valid if the ST AS is in dynamic mode and triggered on the SIP 480 Temporarily Unavailable response. The CD service is triggered on the SIP 302 Moved Temporarily response. The CDIV function is executed at the ST AS of the served PBX when a terminating communication is attempted.

The maximum number of diversions permitted for each communication is a service provider option determined by the ST AS configuration. The communication is rejected when the maximum is exceeded.

The following condition elements exist:

- `rule-deactivated`

Used to deactivate a rule, without losing information.

- `not-registered`

The served PBX is not registered.

- `not-reachable`



The served PBX is not reachable.

The action elements comprise the following items:

- `forward-to`

Indicating the target URI where the incoming communication is to be diverted to, and how the served PBX and the caller are to be handled.

- `play-announcement`

Specifies which operator-named announcement to be played to the caller.

The forward-to action has the following elements:

- `target`

Diversion target address.

- `notify-caller`

Caller can be notified.

- `reveal-identity-to-caller`

Identity of Diverted-to user can be revealed to caller.

- `reveal-identity-to-target`

Identity of Served PBX can be revealed to diverted-to party.

Traditional call forward services can be simulated by a subset of the following CDIV condition and action elements:

- Communication Forwarding Unconditional (CFU) — the first rule contains no conditions
- Communication Forwarding Not Logged in (CFNL) — `not-registered` condition
- Communication Forwarding Not Reachable (CFNR) — `not-reachable` condition

## 2.1 Subfunctions

This section describes the subfunctions provided by the ST CDIV service.





## 2.1.1 Rules Evaluation

Rules Evaluation is a subfunction that evaluates the subscription rules and conditions of a served PBX, that can actuate a diversion, see Section 3 on page 11.

## 2.1.2 Find the Target

Subfunction Find the Target constructs the Request URI in the outgoing INVITE, see Section 4 on page 15.

## 2.1.3 Handle to Headers

Subfunction Handle to Headers checks if the served PBX wishes to conceal their identity and updates the To header as required, see Section 5 on page 17.

## 2.1.4 Handle History-Information

Subfunction Handle History-Information evaluates and sets the History-Info header used for checking the maximum number of diversions allowed for the communication, see Section 6 on page 19.

## 2.1.5 Diversion Indication to Caller

Diversion Indication To Caller is a subfunction that indicates to the caller that the communication is being diverted. As a node level configuration option the subfunction Play Announcement is performed, see Section 7 on page 21.

## 2.1.6 Play Announcement

Subfunction Play Announcement plays an announcement to the caller when the communication has been diverted.

There are two different ways of playing an announcement, as follows:

- Playing the operator-named announcement indicated in the play-announcement action element within the matched ST CDIV rule.
- Playing the operator-named announcement indicated in the CM `mtasStCDivCallingPartyAnnName` attribute.

For more information about announcement handling and attributes for the CDIV service, refer to *MTAS Generic Announcement Management Guide*.



## 2.2 ST CDIV Interaction with Other ST Services

The ST CDIV interaction with other ST services is described in this section.

The ST AS is by default configured to execute originating services of the diverted user in the same ST AS instance. For network configurations that require AS chaining, Originating AS chaining configuration option must be enabled in the ST AS.

For more information about Originating AS chaining, refer to *MTAS SIP Management Guide*.

### 2.2.1 ST Call Admission Control

The ST AS can be configured to exert access control over diverted communication by including or excluding diverted calls from the CAC counts. When counting diverted sessions, the ST CAC service treats the sessions as originating sessions.

For more information about the ST CAC service, refer to *ST AS Call Admission Control Management Guide*.

### 2.2.2 ST Carrier Select Rn and Carrier Pre-Select Rn

When the target address of a diversion contains a phone number, the `INVITE` to the target is subject to the same ST Carrier Select Rn and ST Carrier Pre-Select Rn logic as if the served user originated the call to the target.

For more information about the ST CSRn services, refer to *ST AS Carrier Select Rn and Carrier Pre-Select Rn Management Guide*.

### 2.2.3 ST Charging

Terminating charging is performed on incoming leg (A to B) and originating charging is performed on outgoing leg (B to C).

The IMS Charging Identifier (ICID) and the originating Inter-Operator Identifier (IOI) in the `P-Charging-Vector` header within the initial `INVITE` request received by the diverting ST AS, are used for charging on incoming leg (A to B). The originating IOI received in the `P-Charging-Vector` header in responses from the diverted to party is used as the terminating IOI for charging on incoming leg (A to B).

The diverting ST AS allocates a new ICID for charging on outgoing leg (B to C). The diverting ST AS generates a `P-Charging-Vector` header containing the new ICID and the original ICID received on the incoming leg and includes it in the initial `INVITE` sent to the diverted-to party. The Originating IOI (O-IOI) and Terminating IOI (T-IOI) received in the `P-Charging-Vector` header in



responses from the diverted-to party are used for charging on outgoing leg (B to C).

For more information about the Charging service, refer to *Diameter Offline Charging in MTAS*.

## 2.2.4 ST Communication Barring

ST Incoming Communication Barring (ICB) is performed on the terminating `INVITE` before the ST CDIV. ST Outgoing Communication Barring (OCB) is performed on the diverted outgoing `INVITE`. When OCB holds up the diverted outgoing `INVITE`, because of a rule or a CDIV blacklist, the initial `INVITE` is answered with `486 Busy Here` response to Caller A.

For more information about the CB services, refer to *ST AS Communication Barring Service Management Guide*.

## 2.2.5 ST Identity Presentation

This section describes the ST CDIV interactions with the following ST Identity Presentation services:

- Originating Identity Presentation (OIP)
- Originating Identity Restriction (OIR)

### Originating Identity Presentation

The `P-Asserted-Identity` remains unchanged by the ST CDIV.

### Originating Identity Restriction

If the served PBX has OIR, then the `Privacy` header “history” is escaped within the `hi-targeted-to-uri` field, in the `History-Info` header, containing the identity of the diverting PBX in the `INVITE` message.

**Note:** No conversion from tel URI is required since the last `History-Info` entry containing the identity of the diverting PBX always contains a SIP URI.

The `To` header is changed to the target URI if the served PBX has OIR.

For more information about the Identity Presentation services, refer to *ST AS Identity Presentation Service Management Guide*.



## 2.2.6 Communication Completion

This section describes the interaction between the Communication Completion services and the ST CDIV service.

The interaction can occur if the Communication Completion Busy Subscriber (CCBS), Communication Completion No Reply (CCNR), or Communication Completion Not Logged-in (CCNL) service is supported at the forwarded-to user.

CCBS/CCNR/CCNL possible indications are removed if received by the forwarded-to network.

In case a 486/600/603 busy response including a Call-Info header including a CCBS possible indication is received from the forwarded-to network as response to the `INVITE`, the ST AS removes the CCBS possible indication from the 486/600/603 response before sending it to the caller A.

In case a 180 Ringing including a Call-Info header including a CCNR possible indication is received from the forwarded-to network as response to the `INVITE`, the ST AS removes the CCNR possible indication from the 180 Ringing before sending it to the caller A.

In case a 480 error response including a Call-Info header including a CCNL possible indication is received from the forwarded-to network as response to the `INVITE`, the ST AS removes the CCNL possible indication from the 480 response before sending it to the caller A.

## 2.3 Traffic View

CDIV traffic is handled in the following steps:

- **Service Invocation** — an event triggers the execution of CDIV. One example is initial `INVITE` from the caller triggers Communication Forwarding Unconditional. Another example is 302 error response from a terminating PBX user that triggers CD.
- **Rule Evaluation** — the CDIV evaluates the rule set of the served PBX and determines if the communication is diverted unconditional, or can be diverted if certain events occur, or is not diverted. An exception is the CD service that is not diverted based on rule evaluation but based on configuration data with the SIP 302 event.
- **Diversion Actuation** — either the Rules Evaluation step decides that the communication is to be diverted immediately, or an event identified in Rules Evaluation occurs.
- **Send Indications** — when the communication is going to be diverted indications can be sent to the caller.
- **Diversion** — the communication is diverted to the target address.



Indication to the caller is an `INVITE` method provisional response `181`.

The communication is diverted with a terminating `INVITE` to the target address.

After diversion, the terminating AS of the served PBX remains in the message path with a terminating and an originating session.

## 2.4 Configuration View

Node level configuration is performed by the operator where the ST CDIV function is customized. For example, by defining if an announcement is to be used as indication to the caller, in addition to the SIP response (`181 Call Is Being Forwarded`).

The subscription rules are managed through the XDMS interface CAI3G by the operator. XDMS uses Sh (Diameter) to update the Home Subscriber Server (HSS). Through the CAI3G interface, the service data can be provisioned individually for each PBX.



### 3 Subscription Rules

CD is a subservice of CDIV which does not require any rules but if it is enabled always diverts when triggered by a “deflection” redirect response from the UA of the served user.

Otherwise, CDIV determines if the communication is diverted by evaluating CDIV rules. The rules are built up with different conditions and a forwarded-to action together with other optional actions such as play announcement.

The subscription rules are part of the PBX service data and are expressed with XML, defined by a schema and following the structure illustrated in Figure 1.

The rule set consists of zero or many rules, and one rule consists of zero or many conditions and one action.

The number of rules cannot exceed the limit defined by the `<rule-limit>` element in the operator part of the service.

The number of rules is also limited by the `<rule-global-limit>` element of the `<st-common-data>`.

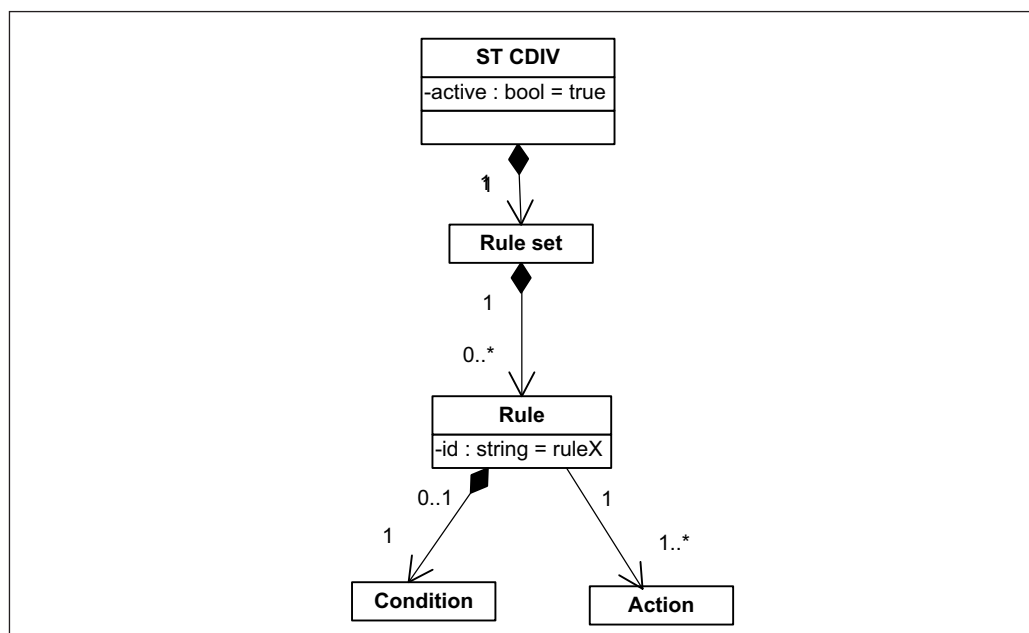


Figure 1 ST CDIV Subscription Elements

Element Rule has one attribute ID that identifies the rule. It has nothing to do with the evaluation order.

The top-level ST CDIV element has an attribute `active` of type Boolean. If `active=true`, then the rule set is evaluated.

The following conditions apply to ST CDIV:

- `not-registered`: This condition evaluates to true when none of the configured links have been registered by the served PBX (valid only in dynamic mode). In all other cases, the condition evaluates to false.
- `not-reachable`: This condition evaluates to true when the served PBX cannot be reached during the session setup. In all other cases, this condition evaluates to false.

The rule can contain the following actions:

- `forward-to`: This is the standard ST CDIV action defined in [3GPP TS 24.604 V8.4.0](#)
- `play-announcement`: When present in the rule, it indicates which operator-named announcement to be played to the caller.

The `forward-to` action can have the following action elements:

- `target`: Specifies the address of the forwarding rule. It must be a valid SIP URI or tel URI.
- `notify-caller`: An optional element that can be used to disable the default behavior that the caller is notified that the call is being forwarded.
- `reveal-identity-to-caller`: An optional element that can be used to disable the default behavior that the caller receives the `diverted-to` users identity information.
- `reveal-identity-to-target`: An optional element that can be used to disable the default behavior that the `diverted-to` party receives the identity information of the served PBX.

**Note:** For CD service the `notify-caller`, `reveal-identity-to-caller`, and `reveal-identity-to-target` are always enabled.

The format of the rules is checked by the XDMS.

If the service is active, then ST CDIV evaluates the rules. The rules are evaluated from top to bottom, for example, rule `n` precedes rule `n + 1`, where `n` is the order of appearance.

A rule is matched if all its conditions evaluate to true. This means that the evaluation of conditions stops when the first condition is false (lazy evaluation). Only the first matching rule and its specified `forward-to` action elements apply.





## 3.1 Rule Evaluation Points

The rules are evaluated at the appropriate actuation point, as follows:

1. `INVITE` for the PBX
2. `Not-reachable` time-out
3. `Not-reachable` response

Each rule in the full set of rules is evaluated, from top to bottom, each time an actuating event arrives. Each time the rules are evaluated, the current values of the state of the call are used in the comparison.

All conditions cannot be evaluated to `true` at all actuation points, as follows:

- `not-registered` can only be true for rule 1 (only dynamic mode).
- `not-reachable` can only be true for rule 2 or 3.





## 4 Find the Target

If the target action element contains a SIP URI or a tel URI, the ST CDIV replaces the Request URI of the incoming `INVITE` with the value from the target action element when constructing the outgoing `INVITE`.

If the request URI is in a tel format, it is converted to an equivalent SIP URI format, where the domain portion is extracted from the main PBX identity.

### Example of tel URI Conversion:

Main PBX identity: `userC@domain1.com`

Request URI: `tel:+44247633333`

SIP URI included in History-Info header:

`sip:+44247633333@domain1.com;user=phone`

A `cause-param` SIP URI attribute is added to the Request URI. The `cause-param` is embedded in the Request URI.

The value is set according to the diversion conditions as follows:

- Communication Forwarding Unconditional, the cause value is 302
- Communication Forwarding Not Logged in, the cause value is 404
- Communication Forwarding on Not Reachable, the cause value is 503
- Communication Deflection (Immediate response), the cause value is 480
- Communication Deflection (during alerting), the cause value is 487





## 5 Handle to Headers

If the served PBX does not want to reveal its identity to the `diverted-to` party, then the `To` header is to be changed to the target URI. The served PBX does not want to reveal its identity when one of the following conditions holds `true` if the served PBX has the subscription option `reveal-identity-to-target` set to `false`.

In all other cases, the `To` header must not be changed.





## 6 Handle History-Info Headers

This section describes the handling of the `History-Info` header.

### 6.1 Check Maximum Number of Diversions in Network

The ST CDIV checks if diverting the communication exceeds the number of diversions allowed within the network, defined by attribute `mtasStCDivMaxNoOfDiversions`. The number of diversions is calculated by counting the `History-Info` entries with an ST CDIV `cause-param SIP URI` attribute. For an explanation of Cause attributes that are valid for CDIV, see Section 6.1.1 on page 19.

If the number of diversions is equal to or greater than the specified limit, defined by attribute `mtasStCDivMaxNoOfDiversions`, the communication is released.

The following responses apply:

- 480 (Temporarily unavailable) is sent.
- A `Warning` header field indicating that the communication is released owing to the extension of diversion hops is sent. For example, 480, warning: 399 `mtas.operator1.com`, "Too many diversions".

#### 6.1.1 Set History-Info Header

Two entries are added to the `History-Info` header field if there is no `History-Info` header present or the last entry does not contain the served PBX identity. Only the second type of entry is added if it is a subsequent diversion.







## 7 Diversion Indication to Caller

When CDIV occurs and if action element `notify-caller` is `true`, then a `181` (Call Is Being Forwarded) response is sent to the caller (A). The `181` response contains the `P-Asserted-Identity` header field, the `History-Info` header field, and conditionally the `Privacy` header field.

The `P-Asserted-Identity` includes the URI of the served PBX.

The `181` response is sent on the existing SIP dialogue if one exists.

**Note:** The ST CDIV information in the `History-Info` header field is identical to the ST CDIV information in the `History-Info` SIP `INVITE` message sent in the forward direction, see Section 6 on page 19.

The ST AS does not require a provisional reliable acknowledgment to the `181` response. This minimizes the number of messages processed by the ST AS. If the `INVITE` contains `100rel` in the `Required` header, the ST AS requires a provisional reliable acknowledgment to the `181` response.

Also, the ST CDIV can initiate an announcement to be included to the caller to inform about the diversion.





## 8 ST CDIV Service Configuration

The ST CDIV service of the MTAS is controlled by the *MtasStCDiv* Managed Object (MO) and its attributes. The MO structure of the ST CDIV service is shown in Figure 2.

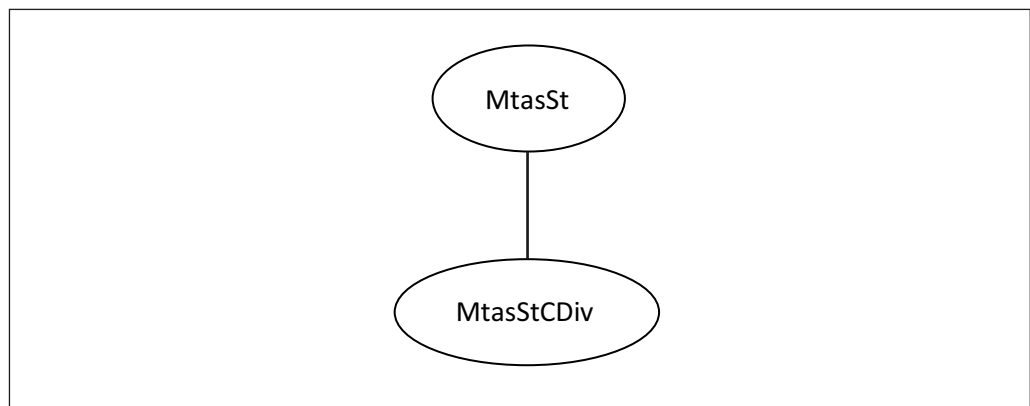


Figure 2 CDIV MO Structure

For configurable MOs and attributes related to the ST CDIV service, refer to *Managed Object Model (MOM)*.

### 8.1 CDIV Administrative State Configuration

The ST CDIV service is enabled by setting the `mtasStCDivAdministrativeState` attribute in the *MtasStCDiv* MO to 1 (Unlocked). If the `mtasStCDivAdministrativeState` is set to 0 (Locked), no ST CDIV service is provided by the MTAS.

### 8.2 Announcement Configuration

There are two different ways of playing announcement, as follows:

- Playing the generic announcement indicated in the `play-announcement` action element within the matched ST CDIV rule in the subscription.
- Playing announcement by looking up the generic announcement name configured in the CM attribute `mtasStCDivCallingPartyAnnName`

### 8.3 Additional Configuration Activities

Additional configuration activities are listed in Table 1.

*Table 1 Additional Configuration Activities*

Activity	Attribute
ST CDIV service is not reachable when any of the response codes are received.	mtasStControlAccessProfile ErrorCodes
ST CDIV service is not reachable when the timer expires.	mtasStControlAccessProfile Timeouts
Defining the global Communication Forwarding blacklist for the MTAS.	mtasStCDivBlackList
Setting the maximum number of times the same communication is allowed to be forwarded.	mtasStCDivMaxNoOfDiversions
Determining if the INVITE method response 302 causes a redirect generated by the ST AS, or if the 302 is to be passed on to the UA.	mtasStCDivDeflection

For more information about the CDIV attributes, refer to *Managed Object Model (MOM)*.

## 8.4 Service Data Configuration

This section describes how to configure the service data.

### 8.4.1 Operator Subscription Level Service Configuration

The operator can activate or deactivate the ST CDIV service subscription for the PBX by setting the PBX data using the CAI3G protocol.

For more information about the CAI3G protocol, refer to *MTAS CAI3G Interface for ST AS*.

### 8.4.2 Subscriber Subscription Level Service Configuration

For a PBX subscriber data is set by the operator using the CAI3G protocol.



## 9 Performance Management

For measurements related to the ST CDIV service, refer to *Managed Object Model (MOM)*.





## 10 Fault Management

There are no alarms related to the ST CDIV service.







## 11 Example Configuration

This section shows examples of rule configurations that can be applied for the ST CDIV service.

### 11.1 Forward All Calls

In the rule configuration the following applies for the served PBX:

- If the target is included in the configured `mtasStCDivBlacklist` or in the `mtasStOcbBlacklist`, the provision is successful but no diversion occurs until the target is deleted from the configured list.

The input in Example 1 is added to the service document for the PBX.



```

<st:st-communication-diversion>
  <st:operator-configuration>
    <st:activated>true</st:activated>
    <st:cdiv-op-conditions>
      <st:not-registered-condition>activated</st:not-registered-condition>
    <st:not-reachable-condition>activated</st:not-reachable-condition>
    </st:cdiv-op-conditions>
    <st:cdiv-op-actions>
      <st:notify-caller-action>activated</st:notify-caller-action>
      <st:reveal-identity-to-caller-action>activated</st:reveal-identity-to-caller-action>
      <st:reveal-identity-to-target-action>activated</st:reveal-identity-to-target-action>
      <st:play-announcement-action>activated</st:play-announcement-action>
    </st:cdiv-op-actions>
  </st:operator-configuration>
  <st:user-configuration>
    <st:active>true</st:active>
    <st:cdiv-ruleset>
      <st:cdiv-rule id="cfu">
        <st:id>cfu</st:id>
      <!--note that if there are no conditions, the <st:cdiv-conditions> element can be empty or left out, as here-->
      <st:cdiv-actions>
        <st:forward-to>
          <st:target>sip:cfu@example-com</st:target>
        </st:forward-to>
      </st:cdiv-actions>
    </st:cdiv-rule>
    <!--note the 2 cdiv rules below will not be evaluated when the first rule is unconditional-->
    <st:cdiv-rule id="cf-not-registered">
      <st:id>cf-not-registered</st:id>
      <st:cdiv-conditions>
        <st:cdiv-call-state>not-registered</st:cdiv-call-state>
      </st:cdiv-conditions>
      <st:cdiv-actions>
        <st:forward-to>
          <st:target>tel:+442476435353</st:target>
        </st:forward-to>
      </st:cdiv-actions>
    </st:cdiv-rule>

    <st:cdiv-rule id="cfnrc">
      <st:id>cfnrc</st:id>
      <st:cdiv-conditions>
        <st:cdiv-call-state>not-reachable</st:cdiv-call-state>
      </st:cdiv-conditions>
      <st:cdiv-actions>
        <st:forward-to>
          <st:target>tel:+442476435353</st:target>
        </st:forward-to>
      </st:cdiv-actions>
    </st:cdiv-rule>
  </st:cdiv-ruleset>
</st:user-configuration>
</st:st-communication-diversion>

```

### Example 1 Service Document Input for PBX