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Technical Report

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Contents

Foreword

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1 Scope

This Technical Report provides a study of the IMS impacts for providing a solution for determination of Inter-IMS Network to Network Interface (II-NNI) traversal scenario type. The document describes and analyses different II-NNI traversal scenarios. The present document describes requirements and investigates the implementation options to fulfil requirements for determination of II-NNI traversal scenario type.

Examples of scenarios to study are:

- the visited to home scenario;
- the home to visited scenario;
- the loopback scenario;
- the invocation of MRB/MRF in visited network from an AS in home network scenario; and
- a request sent from the home network on the originating side to the home network on the terminating side.

This Technical Report includes the study of the existing protocol mechanism and new protocol mechanism for further evaluation what is needed to identify a particular II-NNI traversal scenario type. The study also considers existing deployments.

The document analyses and evaluates different solutions.

2 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 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".

[3] 3GPP TS 24.237: "IP Multimedia (IM) Core Network (CN) subsystem IP Multimedia Subsystem (IMS) Service Continuity; Stage 3".

[4] 3GPP TS 24.292: "IP Multimedia (IM) Core Network (CN) subsystem Centralized Services (ICS); Stage 3".

[5] 3GPP TS 29.280: "Evolved Packet System (EPS); 3GPP Sv interface (MME to MSC, and SGSN to MSC) for SRVCC".

[6] 3GPP TS 29.292: "Interworking between the IP Multimedia (IM) Core Network (CN) Subsystem (IMS) and MSC Server for IMS Centralized Services (ICS)".

[7] 3GPP TS 32.260: "Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging".

[8] 3GPP TS 32.299: "Telecommunication management; Charging management; Diameter charging applications".

[9] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

[10] 3GPP TS 29.165: "Inter-IMS Network to Network Interface (NNI)".

[11] 3GPP TR 23.849: "Study on Stage 2 aspects of Optimised Service Charging and Allocation of Resources (OSCAR) in the IP Multimedia Subsystem (IMS) whilst roaming".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

implicit detection of the II-NNI traversal scenario type: a method to determine the II-NNI traversal scenario type by analysing the content of a received dialog creating SIP request or stand-alone SIP request without relying on an explicit indication of the II-NNI traversal scenario type.

explicit indication of the II-NNI traversal scenario type: a method to use a dedicated protocol element indicating the II-NNI traversal scenario type.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Ici Reference point between an IBCF and another IBCF belonging to a different IM CN subsystem network.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

AS Application Server
ATCF Access Transfer Control Function
ATU-STI Access Transfer Update - Session Transfer Identifier
B2BUA Back-to-Back User Agent
BGCF Border Gateway Control Function
CDR Charging Data Record
DNS Domain Name System
IBCF Interconnection Border Control Function
I-CSCF Interrogating CSCF
II-NNI Inter-IMS Network to Network Interface
IPXS Advanced IP Interconnection of Services
MRB Media Resource Broker
MSC Mobile-services Switching Centre
MSC-S MSC server
OSCAR Optimised Service Charging and Allocation of Resources
NNI Network to Network Interface
P-CSCF Proxy CSCF
SCC AS Service Centralization and Continuity AS
S-CSCF Serving CSCF
SRVCC Single Radio Voice Call Continuity
STN-SR Session Transfer Number - Single Radio

TF	Transit Function
TRF	Transit and Roaming Function
vSRVCC	Single Radio Video Call Continuity

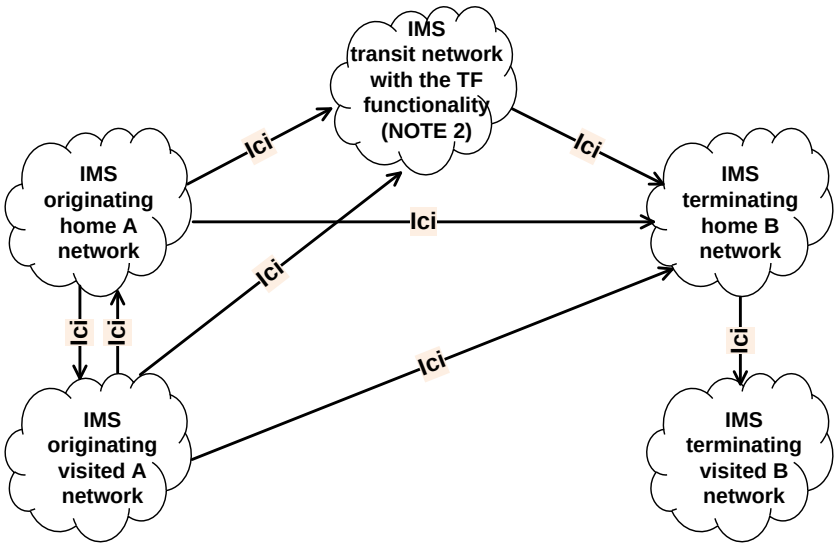
4 Scenarios

4.1 Introduction

The IBCF participates in a numerous number of II-NNI traversal scenarios but at the moment there is no safe way for an IBCF to identify the II-NNI traversal scenario at the II-NNI.

Clause 5 shows a list of requirements that indicates the benefits of identifying the II-NNI traversal scenario.

The figure 4.1.1 shows the II-NNI reference points within the scope of this study.



NOTE 1: Any Ici reference point can contain an intermediate transit networks and are not showed in the figure. The intermediate transit network can either be a non-IMS transit network using standards outside the scope of 3GPP or an IMS transit network as specified in 3GPP TS 24.229 [2] annex I.
NOTE 2: An IMS transit network can include the TF even if IBCF type of functionality is not required.
NOTE 3: The interface between IMS and 3rd party application servers is out of scope of this study.

Figure 4.1.1: Reference points within the scope of this study

The following high-level II-NNI traversal scenario types can be derived from the figure 4.1.1:

A) originating side II-NNI traversal scenario types;

B) signalling between originating and terminating side II-NNI traversal scenario types; and

C) terminating side II-NNI traversal scenario types.

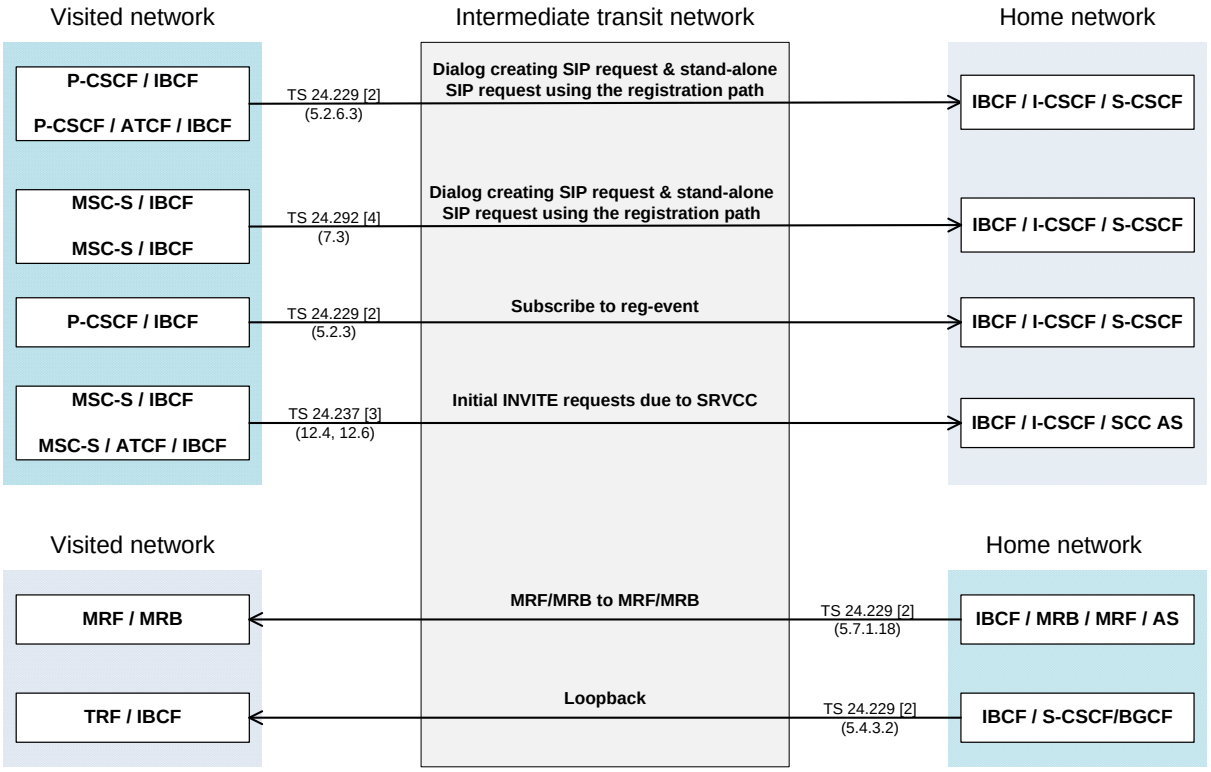
The following subclauses further break down the high-level II-NNI traversal scenario types into more detailed scenarios.

4.2 Roaming user on the originating side II-NNI traversal scenario types

4.2.1 Overview

This subclause describes the details of II-NNI traversal scenarios used between a home network serving a roaming user on the originating side and a visited network where the roaming user is registered from.

Figure 4.2.1.1 shows the detailed content of the originating side II-NNI traversal scenarios with the exception of the registration II-NNI traversal scenario that is not shown.



NOTE: The intermediate transit network can be a non-IMS network (e.g. an IPX network) or an IMS network acting as a transit network.

Figure 4.2.1.1: Originating side II-NNI traversal scenarios

The roaming user is either registered in via a P-CSCF or via a MSC server in the visited network.

The TRF in the visited network is used in a roaming architecture for voice over IMS with local breakout.

The MRB/MRF in the visited network is handling media resources when the home network uses media resources in an external network, in this case media resources in the visited network are used.

The following subclauses describe the details of each II-NNI traversal scenario.

4.2.2 Dialog creating SIP request and stand-alone SIP requests using the registration path

The II-NNI traversal scenario is used to establish SIP dialogs (e.g. originate a call) or to send stand-alone SIP messages associated with the user.

The address of the S-CSCF is included as a URI in the Service-Route header field in the 200 (OK) response to the REGISTER request.

The URI received in the Service-Route header field is included by the UE in the Route header field in dialog creating and stand-alone SIP requests.

The procedures for registration of a roaming user and for establishing SIP dialogs and sending stand-alone SIP requests from a visited network to a home network are specified in 3GPP TS 24.229 [2], 3GPP 24.292 [4] and 3GPP TS 29.292 [6].

4.2.3 Subscription to user's registration-state event package

This II-NNI traversal scenario is used when the P-CSCF or the MSC server enhanced for ICS subscribes to the registration-state event package. The II-NNI traversal scenario is used to receive notifications of the registration status of the registered user.

Editor's note: Same II-NNI traversal scenario applies for the Subscription to the user's debug event package and is FFS.

The address of the S-CSCF is the default public user identity retrieved from the P-Associated-ID header field received in the 200 (OK) response to the REGISTER request.

The default public user identity is included in the Request-URI and in the From header field in the SUBSCRIBE request sent to the S-CSCF.

The procedure to subscribe to the reg-event is specified in 3GPP TS 24.229 [2] subclause 5.2.3 for the P-CSCF and in the 3GPP 24.292 [4] subclause 6.3.4 for the MSC server.

4.2.4 Initial INVITE request due to SRVCC

This II-NNI traversal scenario is established on a per call bases. The INVITE request is sent by the MSC server enhanced for ICS supporting CS to PS SRVCC, the MSC server enhanced for SRVCC using SIP interface or the ATCF and in some CS to PS dual radio access transfer use cases. The II-NNI traversal scenario is used for establishing a target access leg when a call is transferred using PS to CS SRVCC or PS to CS vSRVCC.

The address to the SCC AS is received:

- from the MME in the PS to PS transfer request as specified in 3GPP TS 29.280 [5] subclause 5.2.2. This URI is referred to as the STN-SR in 3GPP TS 24.237 [3] subclause 4.3 and included as the Request-URI by the MSC server when sending the INVITE request due to STN-SR as specified in 3GPP TS 24.237 [3] subclause 12.4.0 and subclause 12.6.1.1;

- from the SCC AS in a MESSAGE request as described in 3GPP TS 24.237 [3] subclause 6.5.3. This URI is referred to as the ATU-STI for PS to CS SRVCC or ATU-STI for CS to PS SRVCC in 3GPP TS 24.237 [3] subclause 4.3 and included as the Request-URI by the ATCF when sending the INVITE request due to ATU-STI as specified in 3GPP TS 24.237 [3] subclause 12.7.2.2; or

- in the Refer-To header field of an REFER request when more than one call is transferred. This URI is referred to as the additional transferred session SCC AS URI, the additional transferred session SCC AS URI for PS to CS SRVCC, the additional transferred session SCC AS URI for CS to PS SRVCC or the additional transferred session SCC AS URI for PS to CS dual radio in 3GPP TS 24.237 [3] subclause 4.3 and included as the Request-URI by the MSC server when sending the INVITE request due to additional transferred session as specified in 3GPP TS 24.237 [3] subclause 12.4A.

NOTE: In case of vSRVCC, the STN-SR can also be included in the OPTIONS request.

The procedure for sending the INVITE request is specified in 3GPP TS 24.237 [3] subclause 7.

4.2.5 MRF/MRB to MRF/MRB

This II-NNI traversal scenario is established on a per call basis. An INVITE request is sent by an AS, an MRF or an MRB in a home network to a MRF/MRB in an external network (e.g. a visited network or an enterprise network). The intention is to make use of media resources in the external network.

The address of the MRF/MRB is either included by the P-CSCF or the MSC server as a URI in the g.3gpp.mrb feature-capability indicator in a Feature-Caps header field or configured in the AS, the MRF or the MRB. The URI identifies the MRB/MRF in an external network.

The URI is included by the AS, the MRF or the MRB in a Request-URI of an INVITE request sent to the visited network A.

The procedure for including the MRF/MRB address in the g.3gpp.mrb feature-capability indicator is specified in 3GPP TS 24.229 [2] subclause 5.7.2 and 3GPP 24.292 [4] subclause 7.3. The procedure for sending the INVITE request to the MRF/MRB in the external network is specified in 3GPP TS 24.229 [2] subclause 5.7.18.

4.2.6 Loopback

This II-NNI traversal scenario is established on a per call basis. The II-NNI traversal scenario is used for returning an INVITE request to the visited network where the UE is registered according to the roaming architecture for voice over IMS with local breakout.

The address of the TRF is either included by the P-CSCF or the MSC server as a URI in the g.3gpp.trf feature-capability indicator in a Feature-Caps header field or configured in the S-CSCF or the BGCF. The URI identifies the TRF.

The URI is included by S-CSCF or BGCF in a Route header field of the INVITE request towards the visited network.

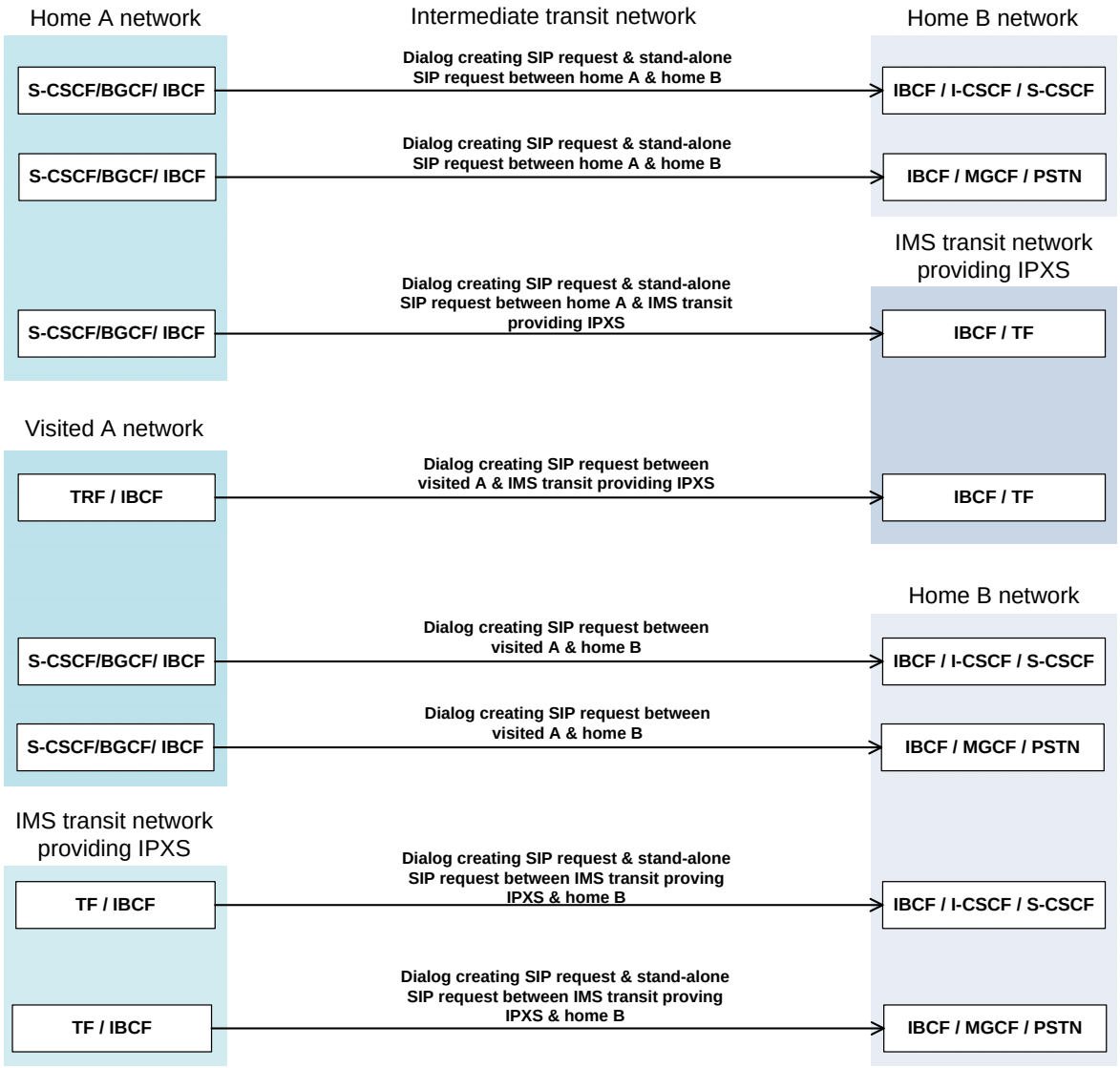
The procedure for including the TRF address in the g.3gpp.trf feature-capability indicator is specified in 3GPP TS 24.229 [2] subclause 5.2.7.2 and 3GPP 24.292 [4] subclause 7.3. The procedure for sending the INVITE request to the visited network is specified in 3GPP TS 24.229 [2].

4.3 Signalling between originating home and terminating home side II-NNI traversal scenario types

4.3.1 Overview

This subclause describes the details of II-NNI traversal scenarios used between a home network serving a non-roaming user or serving a roaming user on the originating side and the terminating home network.

Figure 4.3.1.1 shows the detailed content of the home to home II-NNI traversal scenarios.



NOTE: The intermediate transit network can be a non-IMS network (e.g. an IPX network) or an IMS network acting as a transit network.

Figure 4.3.1.1: Signalling between originating and terminating side II-NNI traversal scenarios

The served user is either registered directly to the home network (non-roaming user) or via a visited network (roaming user).

The home network can either route SIP requests via an IMS transit network or directly to home network serving the user at the destination (referred to as home routeing in the roaming architecture for voice over IMS with local breakout.

When the user is roaming the SIP request can either be routed via an IMS transit network providing Advanced IP Interconnection of Services (IPXS) for national interconnect, directly to home network serving the user at the destination or via the visited network (referred to as loopback routeing in the roaming architecture for voice over IMS with local breakout. The network serving the user at the destination can be IMS or PSTN.

The visited network can either route SIP requests via an IMS transit network providing Advanced IP Interconnection of Services (IPXS) for national interconnect or directly to home network serving the user at the destination.

4.3.2 Dialog creating SIP request and stand-alone SIP requests between home A and home B

This II-NNI traversal scenario is established on a per call basis. The II-NNI traversal scenario is used by the home network A to terminate calls towards a destination identified by an URI in the Request-URI of a dialog creating or stand-alone SIP requests.

The address of the home network B is retrieved from local databases or the DNS using the URI in the Request-URI.

The address of the home network B is used to send the SIP request directly to the address of home network B.

The procedure for sending a SIP request from the originating home network side to the terminating home network side is specified in 3GPP TS 24.229 [2].

4.3.3 Dialog creating SIP request and stand-alone SIP requests between home A and IMS transit network providing IPXS

This II-NNI traversal scenario is established on a per call basis. The II-NNI traversal scenario is used by the home network A when the home network A wants to use IPXS provided by TF in an IMS transit network.

The address of the TF in the IMS transit network providing IPXS is configured in the home network A.

The address of the TF in the IMS transit network providing IPXS is added as a URI in a Route header field by S-CSCF, BGCF or the IBCF according to local policy.

The procedure for sending a SIP request from the originating home network side to the IMS transit network providing IPXS is specified in 3GPP TS 24.229 [2].

4.3.4 Dialog creating SIP request between visited A and home B

This II-NNI traversal scenario is established on a per call basis. The II-NNI traversal scenario is used by the visited network A to terminate calls towards a destination identified by an URI in the Request-URI of a dialog creating SIP request.

The address of the home network B is retrieved from local databases or the DNS using the URI in the Request-URI.

The address of the home network B is used to send the SIP request directly to the address of home network B.

The procedure for sending a SIP request from the visited network on the originating side to the terminating home network side is specified in 3GPP TS 24.229 [2].

4.3.5 Dialog creating SIP request between visited A and IMS transit network providing IPXS

This II-NNI traversal scenario is established on a per call bases. The II-NNI traversal scenario is used by the visited network A when the visited network A wants to use IPXS provided by a TF in an IMS transit network.

The address of the TF in the IMS transit network providing IPXS is configured in the visited network A. The address of the TF in the IMS transit network providing IPXS is added as a URI in a Route header field by the TRF or the IBCF according to local policy.

The procedure for sending a SIP request from the visited network on the originating side to the IMS transit network providing IPXS is specified in 3GPP TS 24.229 [2] annex I.

4.3.6 Dialog creating SIP request and stand-alone SIP requests between IMS transit network and home B

This II-NNI traversal scenario is established on a per call basis. The II-NNI traversal scenario is used by the IMS transit network to terminate calls towards a destination identified by an URI in the Request-URI of a dialog creating or stand-alone SIP requests.

The address of the home network B is retrieved from local databases, e.g. in the BGCF, or the DNS using the URI in the Request-URI.

The address of the home network B is used to send the SIP request directly to the address of home network B.

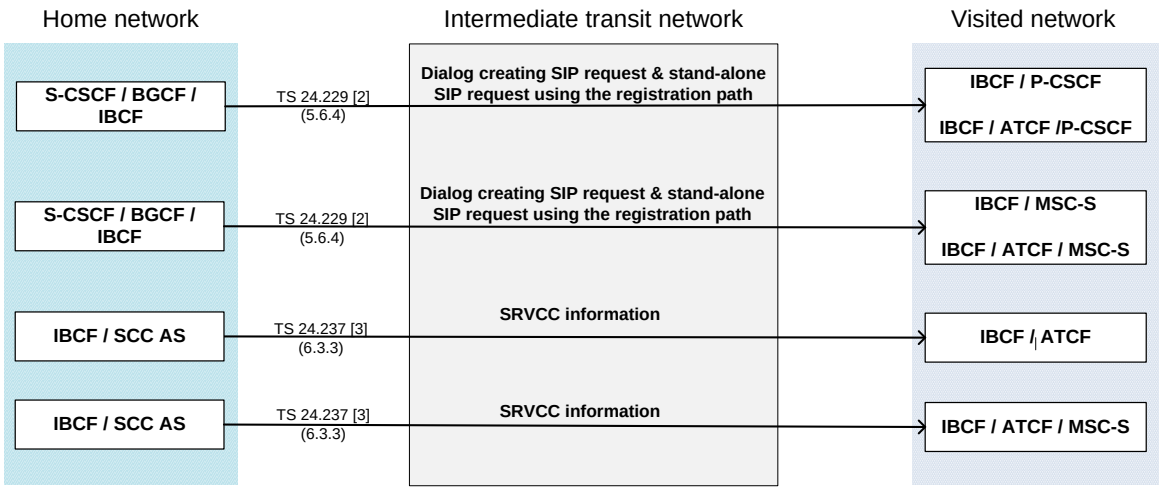
The procedure for sending a SIP request from the TF in the IMS transit network to the terminating home network side is specified in 3GPP TS 24.229 [2] annex I.

4.4 Roaming user on the terminating side II-NNI traversal scenario types

4.4.1 Overview

This subclause describes the details of II-NNI traversal scenarios used between a home network serving a roaming user on the terminating side and a visited network where the roaming user is registered from.

Figure 4.4.1.1 shows the detailed content of the terminating side II-NNI traversal scenarios.



NOTE: The intermediate transit network can be a non-IMS network (e.g. an IPX network) or an IMS network acting as a transit network.

Figure 4.4.1.1: Terminating side II-NNI traversal scenarios

The roaming user is either registered via a P-CSCF or via a MSC server in a visited network.

If the visited network supports the use of an ATCF the home network will send SRVCC information to the ATCF and, if the visited network supports CS to PS SRVCC, the SCC AS sends SRVCC information to the MSC server.

4.4.2 Dialog creating SIP request and stand-alone SIP requests using the registration path

This II-NNI traversal scenario is established when an UE or a MSC server (on behalf of the user) registers. This II-NNI traversal scenario is used to send dialog creating (e.g. terminating a call) or stand-alone SIP requests to the UE associated with the registered user.

The address of the P-CSCF or the MSC server is included as a URI in the Path header field in the REGISTER request.

The URI received in the Path header field is included by the S-CSCF in the Route header field in dialog creating and stand-alone SIP requests.

The procedures for registration of a roaming user and for establishing SIP dialogs and sending stand-alone SIP requests from the home network towards the visited network involving the P-CSCF are specified in 3GPP TS 24.229 [2]. The procedures for registration of the roaming user and for establishing SIP dialogs from the home network towards the visited network involving the MSC server are described in 3GPP TS 24.292 [4] and 3GPP TS 29.292 [6].

4.4.3 SRVCC information

This II-NNI traversal scenario is used during PS to CS SRVCC access transfer registration. A MESSAGE request is used by SCC AS to send the SRVCC-related information to the ATCF.

The address of the ATCF is included by the ATCF as a URI in the g.3gpp.atcf-mgmt-uri feature-capability indicator in a Feature-Caps header field. The URI identifies the ATCF and is referred to as the ATCF management URI in 3GPP TS 24.237 [3] subclause 4.3.

The ATCF management URI is included by the SCC AS in the Request-URI in the MESSAGE request sent directly to the ATCF i.e. not over the path created by the UE registration.

The procedures for sending the ATCF address to SCC AS and to send the MESSAGE request containing SRVCC-related information to the ATCF are specified in 3GPP TS 24.237 [3] subclause 6.3.5 and subclause 6.5.3.

4.5 Usages of information on II-NNI traversal scenario types

4.5.1 Screening of SIP signalling

3GPP TS 23.228 [9], subclause 4.14 states that the functions provided by an IBCF include "*Screening SIP signalling information based on source/destination and operator policy (e.g. remove information that is of local significance to an operator) and optionally, for an IBCF located in the home network, policing the IMS Communication Service ID*". Stage 3 screening procedures are described in 3GPP TS 24.229 [2] subclause 5.10.6.

Screening policies may take into account information from 3GPP TS 29.165 [10]. 3GPP TS 29.165 [10] keeps apart home NNI, originating roaming NNI, loopback NNI traversal scenario, and terminating roaming NNI. IBCFs supporting different NNI traversal scenario types (varying between calls) between two IMS networks could apply a less restrictive screening, allowing the union set of all SIP capabilities required for any of those NNI types.

As a possible enhancement of the existing procedures, IBCF could alternatively identify the applicable II-NNI traversal scenario for a call and apply different screening policies for different NNI traversal scenario types (typically with more restrictive policing on a home NNI). 3GPP TS 23.228 [9] also mentions some policing only applicable on a home NNI.

4.5.2 Disallowing communication related to certain II-NNI traversal scenario types

As a possible enhancement of the existing procedures to protect against errors, an IBCF may reject requests relating to certain NNI types, e.g. if no corresponding interoperability agreements with peer operators exist.

4.5.3 Tracking of interoperability errors

3GPP TS 29.165 [10] also aims to provide guidance for an inspection of SIP signalling to identify interoperability related errors; this has been one of the motivations listed for a finalised Rel-10 work item to provide a detailed "dynamic view" of SIP messages in annex B of 3GPP TS 29.165 [10]. The knowledge of the II-NNI traversal scenario types would allow a more stringent check for and analysis of interoperability errors.

4.5.4 Enabling or disabling of OMR

Requirements that various core IMS nodes can request an IBCF acting as exit point to provide or remove OMR related signalling information from requests have already been agreed for the Roaming Architecture for Voice over IMS with Local Breakout (see subclause 4.15a of 3GPP TS 23.228 [9]). Related procedures are already defined in subclause 5.10.9 of 3GPP TS 24.229 [2].

Within the study on Optimised Service Charging and Allocation of Resources (OSCAR) in 3GPP TR 23.849 [11], it has been concluded that existing specifications already allow a usage of an MRF in the visited network for transcoding or for inserting tones and announcements. However, to enable this functionality a need to apply OMR on the related NNI traversal scenarios has been identified. Related procedures are not yet defined.

4.5.5 Transcoding control

The IBCFs may also apply transcoding control procedures as defined in subclause 5.10.7 of 3GPP TS 24.229 [2]. However offering transcoding or modifying codec information may be harmful for certain types of NNI traversal scenarios, in particular for the media control related NNI used for Optimised Service Charging and Allocation of Resources (OSCAR) (see 3GPP TR 23.849 [11]). In addition, to improve speech quality, it is desirable to apply transcoding not more than one time for a given call. As a possible enhancement of the existing procedures, operators may only offer transcoding for a certain NNI traversal scenarios, for instance only at the ingress IBCF of H-PLMN B.

4.5.6 Collection of CDRs

IBCFs may generate charging events that will record the applicable II-NNI traversal scenario type in CDRs which may be used for inter-operator accounting. Inter-operator accounting is likely to depend on the applicable NNI traversal scenario, and a collection of related information is therefore desirable. In 3GPP TS 32.299 [8], an "NNI-Type AVP"

that allows to include the applicable II-NNI traversal scenarios in CDRs is already defined, but procedures how the IBCF derives the values for this AVP are not described.

4.5.7 Allowing the forwarding of incoming communication only to suitable nodes

As a possible enhancement of existing procedures, IBCFs may check if SIP requests received from external networks are directed to nodes which are suitable for the II-NNI traversal scenario types (e.g. TRF for loopback II-NNI traversal scenario, or MRF).

4.6 Summary of identified issues

Editor's note: This subclause provides the summary of identified issues of the II-NNI traversal scenarios described in the previous subclauses.

Editor's note: II-NNI impacts on transit networks for voice interconnection scenarios, if any, are FFS.

4.6.1 IBCF acting as an exit point and IBCF acting as an entry point determines incorrect II-NNI traversal scenario type

IBCF acting as an exit point and IBCF acting as an entry point on each side of an II-NNI shall use the II-NNI traversal scenario type when determine which local policy to use when handling a received SIP request and SIP response.

If an incorrect II-NNI traversal scenario type is used the following problems may occur:

- inconsistent charging if one side uses the Request-URI as the base for charging while the other side uses the Route header field as base for charging;
- inconsistent statistics per II-NNI traversal scenario type between operators;
- communication is rejected unnecessary e.g. if the incorrect II-NNI traversal scenario type is not supported; and
- the related subscription, the SIP dialog state information and the duration information are not retained, when they should have been.

Regardless if the conclusion of the study results in that an implicit detection of the II-NNI traversal scenario type or an explicit indication of the II-NNI traversal scenario type shall be used the 3GPP TS 24.229 [2] and/or the 3GPP TS 29.165 [10] need to be updated to include:

- if implicit detection of the II-NNI traversal scenario type is used, the logic to be used by IBCF; or
- if explicit indication of the II-NNI traversal scenario type is used, the procedure to include the explicit indication.

4.6.2 Malicious networks

An indirectly connected malicious network can include in dialog creating SIP requests or in SIP stand-alone requests:

- information (e.g. a header field or a MIME body) that can be misleading if implicit detection of II-NNI traversal scenario type is used; or
- an incorrect II-NNI traversal scenario type indicator if explicit indication of II-NNI traversal scenario type is used.

To avoid that behaviour of the malicious network results in that the IBCF uses the wrong local policy when receiving a SIP request, a verification procedure of the II-NNI traversal scenario type is needed. The verification procedure shall only be based on information generated by trusted networks.

5 Requirements

5.1 Introduction

Based on the scenarios described in the previous clause, the following high level requirements have been identified:

1) the solution shall enable the IBCF to identify an Inter-IMS Network to Network Interface (II-NNI) traversal scenario type during the session establishment and session modification;

2) the solution shall fulfil security consideration aspects (application of trust policy and/or possibility of fraud shall be minimized);

3) the solution shall enable backward compatibility; and

4) the solution shall reuse or enhance the existing SIP signalling information.

5.2 Interconnection requirements

The following requirements shall apply for determination of Inter-IMS Network to Network Interface (II-NNI) traversal scenario:

a) the solution shall provide an information on what II-NNI traversal scenario type the SIP request is part of; and

b) an indication of the II-NNI traversal scenario type shall be available in dialog creating SIP requests and stand-alone SIP requests.

Inter operator agreement to support a particular the II-NNI traversal scenario type and the indication of the II-NNI traversal scenario type can be used to determine:

Editor's Note: the following requirements need to be revised once the scenario details are analysed and related issues are identified. For example some SIP headers which are specified as optional in 3GPP TS 24.229 [2] may be mandatory required within a SIP request or a SIP response, or a network topology hiding policy may be based on the interoperator agreements to support a particular the II-NNI traversal scenario type although such use cases are currently not identified.

a) if the screening of SIP signalling shall be applied;

b) if the transcoding control shall be applied; and

c) the media anchoring point.

The indication of the II-NNI traversal scenario type may be used to:

a) identify interoperability related errors;

b) reject communication if no corresponding interoperability agreement with a peer operator exist; and

c) collect new statistics.

6 Charging considerations

The solution for determination of the Inter-IMS Network to Network Interface (II-NNI) traversal scenario type shall:

1) not interfere with the existing inter-operator accounting by providing the NNI routeing scenario indication to a CDR;

2) have minimal impact on the IMS interconnection charging described in 3GPP TS 32.260 [7];

3) have minimal impact on the roaming charging procedures for Roaming Architecture for Voice over IMS with Local Breakout described in 3GPP TS 32.260 [7]; and

4) be compatible with the existing Rel-11 3GPP Attribute Value Pairs (AVPs): the NNI-Information AVP and the NNI-Type AVP i.e. values "non-roaming", "roaming without loopback routing" or "roaming with loopback routing" which are used for interconnection and roaming and are defined in 3GPP TS 32.299 [8].

7 Possible solutions

Editor's note: This clause describes identified solutions.

7.1 Implicit detection of II-NNI traversal scenario type

IBCFs analyse existing SIP signalling to identify the applicable II-NNI traversal scenario type may use the identified II-NNI traversal scenario type for the purposes outlined in subclause 4.4.

Editor's note: This clause will study to which extent existing information within SIP signalling allows to distinguish different II-NNI traversal scenario types. It will consider e.g. SIP header field, and SIP feature capability indicators such as the "g.3gpp.trf", "g.3gpp.loopback", "g.3gpp.home-visited", and "g.3gpp.mrb".

7.2 Explicit indication of II-NNI traversal scenario type

7.2.1 Procedures

An indication about the II-NNI traversal scenario type is added to the SIP signalling (for the encoding, see subclause 7.2.2).

IMS network entities that decide to route the call over an NNI (e.g. S-CSCF, P-CSCF, AS, TRF, and BGCF) supply the II-NNI traversal scenario type indication.

An IBCF acting as entry point may use the indicated II-NNI traversal scenario type for the purposes outlined in subclause 4.4 and should forward the indicated II-NNI traversal scenario type within the SIP call setup signalling without modifications.

An IBCF acting as exit point:

- shall check if a indicated II-NNI traversal scenario type is received from a trusted network and otherwise discard this indication;
- if no II-NNI traversal scenario type was indicated for a SIP request outside an existing dialogue, or if the indication was discarded due to a lack of trust:
  a) should try to derive the II-NNI traversal scenario type from analysis of other parts of the SIP signalling (see subclause 7.1); or
  b) if the II-NNI traversal scenario type cannot be determined, should assume the II-NNI traversal scenario type from originating to terminating home network;
- may use the indicated II-NNI traversal scenario type for the purposes outlined in subclause 4.4; and
- shall either remove the indication, or include it the signalling they forward to core network nodes with subscriber profiles (e.g. I-SCSF, S-CSCF) and resulting extended capabilities for checking if the indicated II-NNI traversal scenario type is permissible.

Core network nodes with extended capabilities for checking if the indicated II-NNI traversal scenario type is permissible that receive an II-NNI traversal scenario type indication:

- should reject SIP requests that are not permissible due to the indicated II-NNI traversal scenario type; and
- shall remove the received II-NNI traversal scenario type indication.

7.2.2 Encoding Options

7.2.2.1 New SIP header field

Editor's note: Detailed encoding proposals are FFS.

7.2.2.2 Enhancing P-Charging-Vector SIP header field

Editor's note: Detailed encoding proposals are FFS.

7.2.2.3 New value(s) for the SIP Feature-Caps header field

Editor's note: Detailed encoding proposals are FFS.

7.2.2.4 URI parameters

Editor's note: Detailed encoding proposals are FFS.

8 Other interfaces that requires identification

Editor's note: This clause describes interfaces other than the II-NNI that could need to be identified.

9 Conclusion

Editor's note: This clause provides the choice of solutions based on the study in this document, which will be followed by the TS work.

Annex A (informative): Determine II-NNI traversal scenario type

A.1 Scope

This annex contains some examples on how to determine the II-NNI traversal scenario type in the IBCF acting as an exit point or in the IBCF acting as an entry point.

A.2 Introduction

When receiving a dialog creating SIP request or when receiving a stand-alone SIP request the IBCF acting as an exit point or the IBCF acting as an entry point need to determine which local policy to use.

Figure A.2.1 illustrates the II-NNI traversal scenarios model used in this annex.

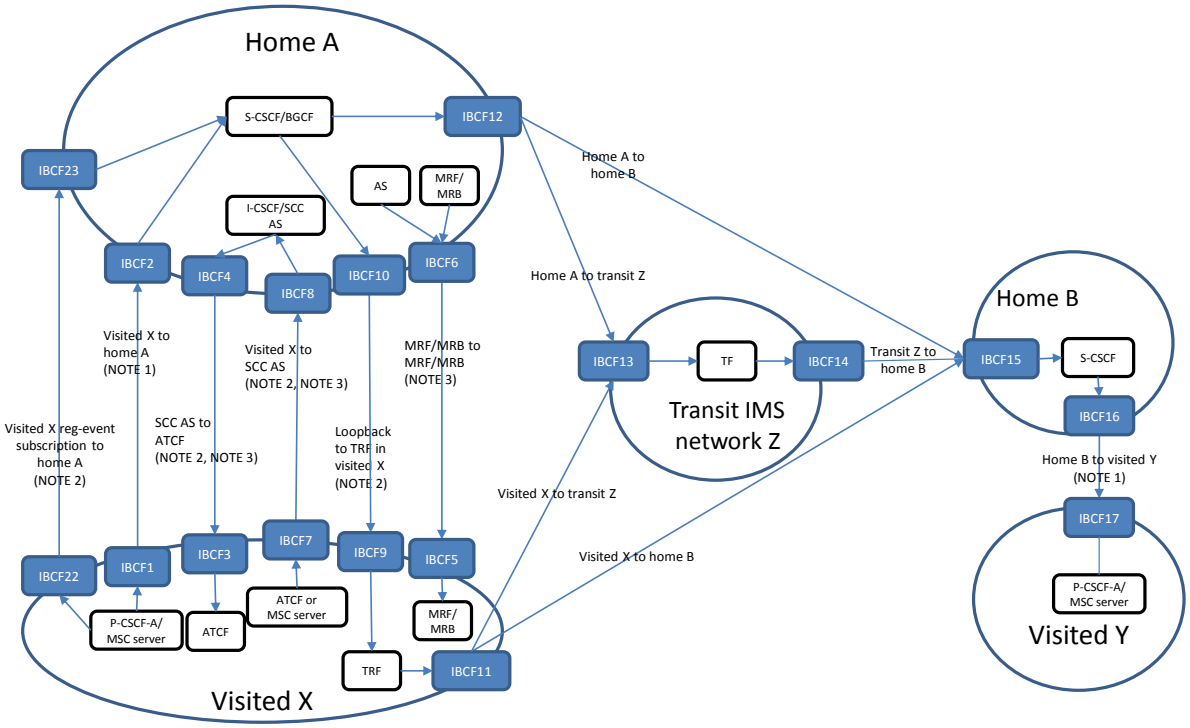


Figure A.2.1: II-NNI traversal scenarios model

The line between two blue boxes is an Inter-IMS Network to Network Interface (II-NNI) that needs to be identified by the IBCF on each side of the line.

The following subclauses show examples on the logic to determine the II-NNI traversal scenario type for some SIP requests using either:

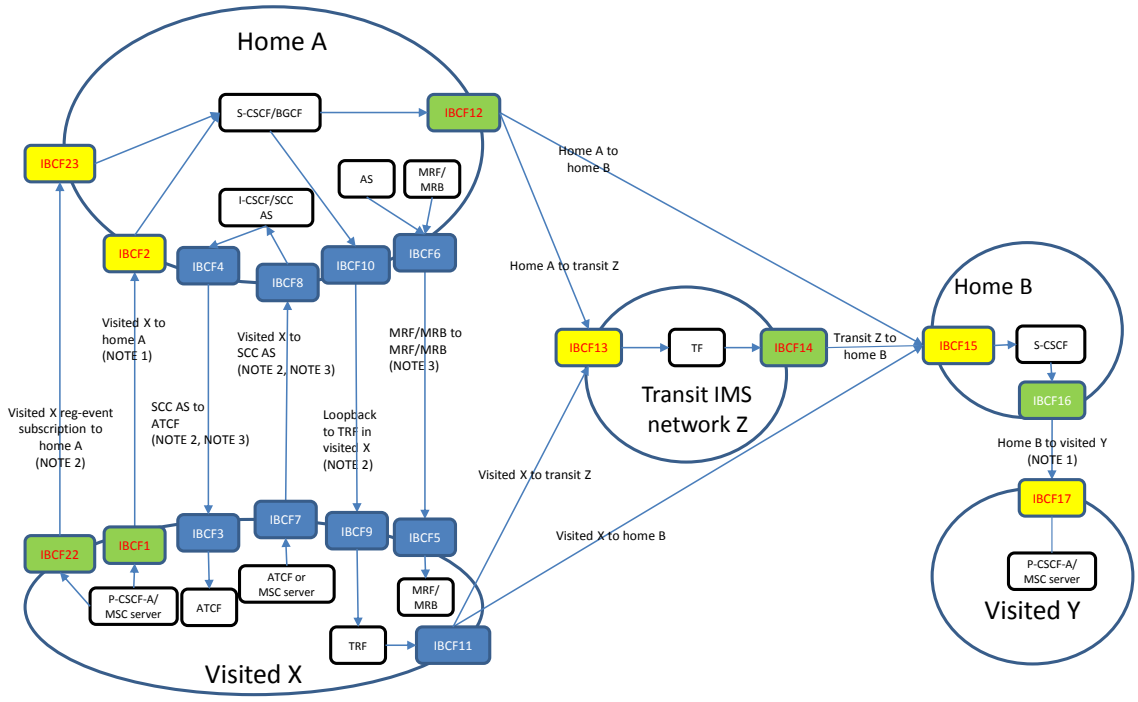
- implicit detection of the II-NNI traversal scenario type; or
- explicit indication of the II-NNI traversal scenario type.

A.3 SUBSCRIBE request example

A.3.1 Introduction to the example

The SUBSCRIBE request is a SIP request that can appear in several II-NNI traversal scenario types.

In figure A.3.1 the lines between the green marked IBCF acting as an entry point boxes and the yellow marked IBCF acting as an exit point boxes represents II-NNI traversal scenario types where a SUBSCRIBE request can be sent and received. The lines between blue boxes are II-NNI traversal scenario types outside the scope of this example.



NOTE: For readability reasons the above figure does not contain any IMS network acting as a transit network. An IMS network acting as a transit network can appear at any II-NNI traversal scenario type in the figure.

Figure A.3.1: II-NNI traversal scenario types, SUBSCRIBE example

The IBCF resides in a network that can act as the home A, home B, visited X and visited Y and the same IBCF can participate in any of the II-NNI traversal scenario types shown in figure A.3.1.

This means that at any point in time the IBCF can be:

- the IBCF22 or IBCF23 in the "Subscribe to reg-event" II-NNI traversal scenario type between visited X and home A;
- the IBCF1 or IBCF2 in the "Dialog creating SIP request and stand-alone SIP requests using the registration path" II-NNI traversal scenario type between visited X and home A;
- the IBCF12 or IBCF15 in the "Dialog creating SIP request and stand-alone SIP requests between home A and home B" II-NNI traversal scenario type between home A and home B;
- the IBCF12 or IBCF13 in the "Home A to transit Z" II-NNI traversal scenario type;
- the IBCF14 or IBCF15 in the " Transit Z to home B" II-NNI traversal scenario type; and

- the IBCF16 or IBCF17 in the "Dialog creating SIP request and stand-alone SIP requests using the registration path" II-NNI traversal scenario type between home B and visited Y.

When the IBCF receives a SUBSCRIBE request the IBCF can use either:

- implicit detection of the II-NNI traversal scenario type as described in subclause A.3.2; or
- explicit indication of the II-NNI traversal scenario type as described in A.3.3;

to determine if the tasks related to IBCF22/IBCF23, IBCF1/IBCF2, IBCF12/IBCF15, IBCF12/IBCF13, IBCF14/IBCF15 or IBCF16/IBCF17 local policy shall be performed.

For simplicity reasons the examples in the following subclauses assumes that there are no intermediate networks (e.g. an IPX network) involved.

A.3.2 Implicit detection of the II-NNI traversal scenario type

A.3.2.1 SUBSCRIBE request content at different II-NNI traversal scenario types

Editor's note: The table below does not include any IMS network acting as a transit network. The complexity this would add to the determination of II-NNI traversal scenario type is FFS.

Editor's note: Whether the reg-event in the SUBSCRIBE request is suitable to use or not when determine the II-NNI traversal scenario type is FFS.

Table A.3.2.1.1: SUBSCRIBE request content at different II-NNI traversal scenario types

Header field	II-NNI traversal scenario type					
	Subscribe to reg-event	**Dialog creating SIP request and stand-alone SIP requests using the registration path (Visited X to home A)**	**Dialog creating SIP request and stand-alone SIP requests between home A and home B**	**Home A to transit Z**	**Transit Z to home B**	**Dialog creating SIP request and stand-alone SIP requests using the registration path (Home B and visited Y)**
Request-URI	An user identity belonging to home A (NOTE 1)	An user identity belonging to home A or as specified by a service	PSI or an user identity of the user belonging to the home B operator (NOTE 1)	PSI or an user identity of the user belonging to the home B operator (NOTE 1, NOTE 4)	PSI or an user identity of the user belonging to the home B operator (NOTE 1)	Contact address belonging to the visited network Y (e.g. an IP address) or the user identity of the user belonging to the home B operator
Route (of any interest)	-	S-CSCF in home A URI (NOTE 2)	-	TF	-	P-CSCF URI (NOTE 2)
Via	P-CSCF, (ATCF,) exit IBCF	P-CSCF/MSC server URI, * (NOTE 3)	*, S-CSCF/BGCF, * (NOTE 3)	* (NOTE 3)	*,TF (NOTE 3)	*, S-CSCF, * (NOTE 3)
P-Asserted-Identity (NOTE 5)	P-CSCF URI	The registered user identity that can be either a SIP URI a tel URI	An user identity of the user belonging to the home A operator	An user identity of the user belonging to the home A operator	An user identity of the user belonging to the home A operator	An user identity that belong to the A, B, X or Y operator that can be a SIP URI or a tel URI
Event	"reg"	"reg" or as specified by a service	According to a service	According to a service	According to a service	According to a service
Called-Party-ID	-	-	-	-	-	URI of the called party that can be either a SIP URI or a tel URI.

NOTE 1: The URI in the Request-URI is used as the destination in the ACR.
NOTE 2: The top most URI in the Route header field is used as the destination in the ACR.
NOTE 3: The "*" represents a number of URIs of no interest for this example.
NOTE 4: The URI in the Request-URI may be a URI without geographical significance that is translated by TF to another URI with geographical significance as part of the IPXS.
NOTE 5: In the case the P-Served-ID header field is included in a SIP request, the P-Server-ID header field overrides the P-Asserted-Identity header field.

A.3.2.2 IBCF acting as an exit point

The logic in the IBCF acting as an exit point to determine the II-NNI traversal scenario type would be:

Figure A.3.2.2.1: IBCF acting as an exit point

NOTE: The use of Called-Party-ID header field to determine the II-NNI traversal scenario type can cause problems in the future if the Called-Party-ID header field is used in another context.

A.3.2.3 IBCF acting as an entry point

The logic in the IBCF acting as an entry point to determine the II-NNI traversal scenario type would be:

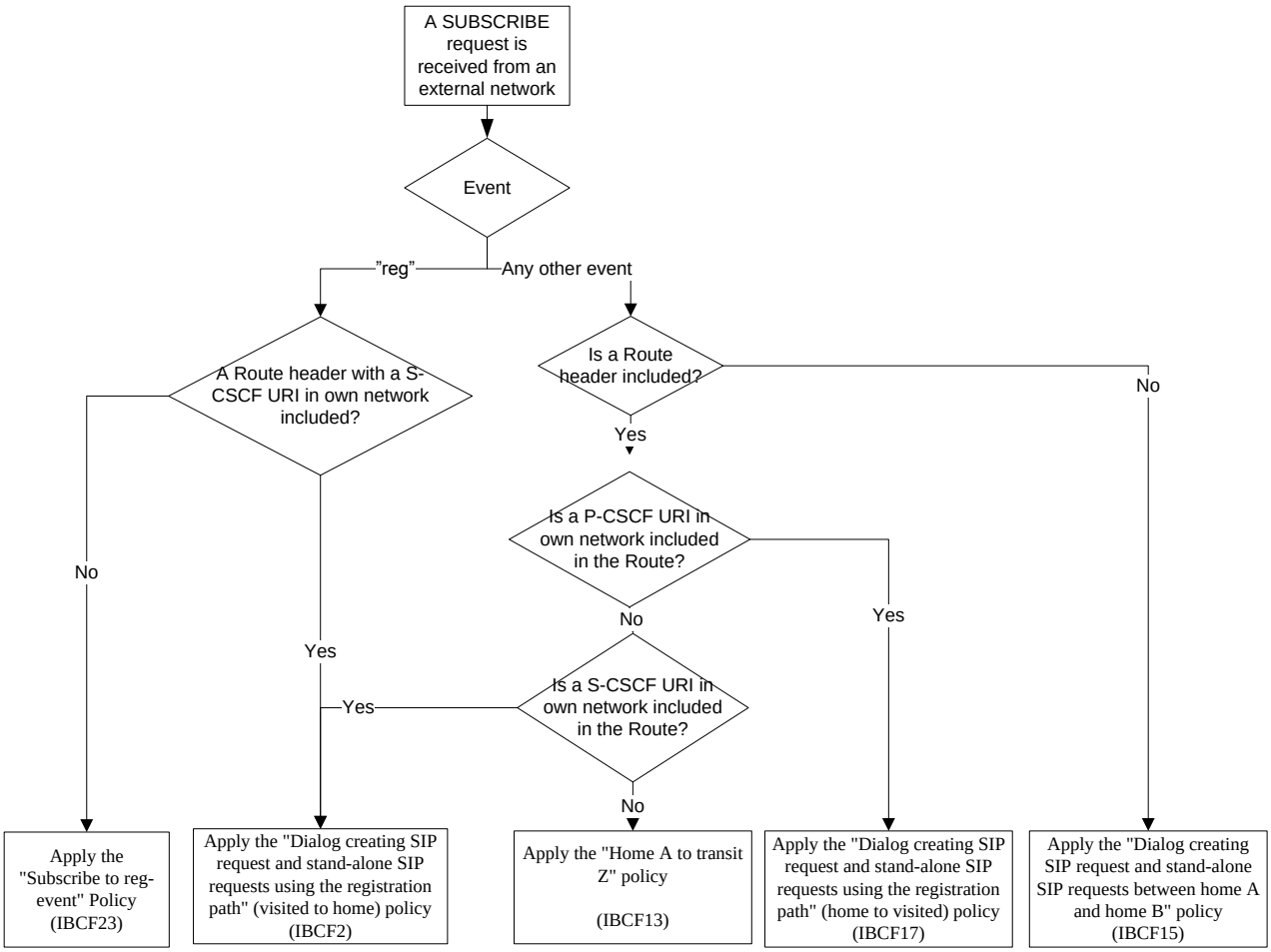


Figure A.3.2.3.1: IBCF acting as an entry point

Editor's note: Whether the reg-event in the SUBSCRIBE request is suitable or not to use when determine the II-NNI traversal scenario type is FFS.

A.3.3 Explicit indication of the II-NNI traversal scenario type

A.3.3.1 The "Subscribe to reg-event" II-NNI traversal scenario type between visited X and home A

When the P-CSCF sends a SUBCRIBE request in order to subscribe to registration-state event package for a registered user, the P-CSCF adds an indication in the outgoing SUBSCRIBE request that this is the "Subscribe to reg-event" II-NNI traversal scenario type.

Both the IBCF22 and IBCF23 uses the indication to perform the tasks associated with this II-NNI traversal scenario type according to local policy.

A.3.3.2 The "Dialog creating SIP request and stand-alone SIP requests using the registration path" II-NNI traversal scenario type between visited X and home A

When the P-CSCF receives a SUBCRIBE request from the UE, the P-CSCF adds an indication in the outgoing SUBSCRIBE request that this is the "Dialog creating SIP request and stand-alone SIP requests using the registration path" between visited and home II-NNI traversal scenario type.

When the MSC server enhanced for ICS sends a SUBCRIBE request, the MSC server enhanced for ICS adds an indication in the outgoing SUBSCRIBE request that this is the "Dialog creating SIP request and stand-alone SIP requests using the registration path" between visited and home II-NNI traversal scenario type.

Both the IBCF1 and IBCF2 uses the indication to perform the tasks associated with this II-NNI traversal scenario type according to local policy.

A.3.3.3 The "Dialog creating SIP request and stand-alone SIP requests between home A and home B" II-NNI traversal scenario type

When the S-CSCF sends a SUBSCRIBE request towards the destination that is not an UE or an AS, the S-CSCF adds in the outgoing SUBSCRIBE request that this is the "Dialog creating SIP request and stand-alone SIP requests between home A and home B" II-NNI traversal scenario type.

Both the IBCF12 and IBCF15 uses the indication to perform the tasks associated with this II-NNI traversal scenario type according to local policy.

A.3.3.4 The "Dialog creating SIP request and stand-alone SIP requests using the registration path" II-NNI traversal scenario type between home B and visited Y

When the S-CSCF sends a SUBSCRIBE request towards an UE, the S-CSCF adds in the outgoing SUBSCRIBE request that this is the "Dialog creating SIP request and stand-alone SIP requests using the registration path" II-NNI traversal scenario type between home and visited.

Both the IBCF16 and IBCF17 uses the indication to perform the tasks associated with this II-NNI traversal scenario type according to local policy.

A.3.3.5 The "Home A to transit Z" II-NNI traversal scenario type

When the BGCF sends the SUBSCRIBE request routed via an IPXS service in a transit network, the BGCF adds in the outgoing SUBSCRIBE request that this is the "Home A to transit Z" II-NNI traversal scenario type between home and a transit network.

Both the IBCF12 and IBCF13 uses the indication to perform the tasks associated with this II-NNI traversal scenario type according to local policy.

A.3.3.6 The "Transit Z to home B" II-NNI traversal scenario type

When the TF sends the SUBSCRIBE request towards the home B, the TRF adds in the outgoing SUBSCRIBE request that this is the "Transit Z to home B" II-NNI traversal scenario type between a transit network and a home network.

Both the IBCF14 and IBCF15 uses the indication to perform the tasks associated with this II-NNI traversal scenario type according to local policy.

A.3.3.7 Summary detection of the II-NNI traversal scenario types using explicit indication for the SUBSCRIBE request

The II-NNI traversal scenario type is added by the P-CSCF, the S-CSCF, the BGCF and the MSC server.

The IBCF acting as an exit point and the IBCF acting as an entry point uses the indication to perform the tasks associated with this II-NNI traversal scenario type according to local policy.

Annex B (informative): Requirement for an explicit indication of the II-NNI traversal scenario type

B.1 Scope

The purpose with this annex is to document the requirement for an explicit indication solution.

If an explicit indication solution is selected as the result of the study, this annex can be used as a first input in an IETF draft.

B.2.1 Use cases

An user can be either attached to the radio access network of its own operator or attached to the radio network of another operator. In the latter case the user is referred to as a roaming user. The services available to a roaming user are based on bilateral agreements between the operators.

3GPP IMS defines an Inter IMS Network to Network Interface, referred to as II-NNI. Depending on different routeing methods and existing charging models a number of use cases are identified.

Below follows a number of important use cases where the SIP signalling and media path between different operator networks are shown.

Use case 1: The involved users are not roaming

SIP: User A – home A operator – home B operator – user B

Media:User A – home A operator – home B operator – user B

When the user is attached to another operator the signalling and media paths are more complex and can either be home routed, loopback routed or loopback routed using media resources in the visited network.

Use case 2: The calling user is roaming and the called user is not roaming

SIP: User A – visited X operator – home A operator – home B operator – user B

Media:User A – visited X operator – home A operator – home B operator – user B

The scenario applies when supplementary services in the home A network requires access to media (e.g. for providing tones and announcements or providing conference resources) or if the home A network determines that it is more cost/resource efficient to route the call directly to the destination.

Use case 3: The calling user is roaming and the call is routed back to the visited network

SIP: User A – visited X operator – home A operator – visited X operator – home B operator – user B

Media:User A – visited X operator – home B operator – user B

This scenario applies if there are no supplementary services that require access to media in the home A operator network and if the home network determines that it is more efficient to route the call from the visited X network to the called user.

Use case 4: The calling user is roaming and media resources in the visited network is used by the home network

SIP (1): User A – visited X operator – home A operator – visited X operator – home B operator – user B

Media:User A – visited X operator – visited network X media resource – home B operator – user B

SIP (2): supplementary service in home A – visited network X media resource

The first signalling path, SIP (1), is used to establish the call. The second signalling path, SIP (2), is used to insert media resources in the visited network X in the media path.

This scenario applies when supplementary services in the home network require access to the media and the visited network, according to bilateral agreements between the operators, can provide the necessary media resources.

Use case 5: The calling user is not roaming and the called user is roaming

SIP: User A – home A operator – home B operator – visited network Y – user B

Media:User A – home A operator – home B operator – visited network Y – user B

Any of the above calling user side uses cases can be combined with any of the called user side use cases.

Use case 6: None of the users are roaming but there is a transit network between the home A and home B networks

Between operators there may be intermediate SIP based networks that interconnects operators. The intermediate SIP based networks are referred to as transit networks.

SIP: User A – home A operator – transit network – home B operator – user B

Media:User A – home A operator – transit network – home B operator – user B

Transit networks may be involved between any of the operator networks in all uses cases in this subclause.

Normally dialog creating requests and stand-alone requests between the home network and the visited network, where a roaming user is attached, are sent following the path created when the user registers. However, there are also other use cases where the visited or the home network sends requests outside the path created during registration.

B.2.2 II-NNI traversal scenario types

The signalling path in the network between a calling user and a called user can be divided into smaller parts, referred to as II-NNI traversal scenario types. Each II-NNI traversal scenario type will have its own characteristics that can be different from other II-NNI traversal scenario types in the same call.

NOTE: Even if the call is broken up into several II-NNI traversal scenario types the Call-ID can be the same in all II-NNI traversal scenario types associated with the call i.e. no B2BUA is needed to change the Call-ID between the II-NNI traversal scenario types.

Examples of II-NNI traversal scenario types in the uses cases described in subclause 4.1:

Use case 1: The involved users are not roaming

II-NNI traversal scenario 1: home A network – home B network

Use case 2: The calling user is roaming and the called user is not roaming

II-NNI traversal scenario 1: visited A network – home A network

II-NNI traversal scenario 2: home A network – home B network

Use case 3: The calling user is roaming and the call is routed back to the visited network

II-NNI traversal scenario 1: visited A network – home A network

II-NNI traversal scenario 2: home A network – visited X network

II-NNI traversal scenario 3: visited X network – home B network

Use case 4: The calling user is roaming and media resources in the visited network is used by the home network

II-NNI traversal scenario 1: visited A network – home A network

II-NNI traversal scenario 2: home A network – visited X network (to be used for controlling media resources)

II-NNI traversal scenario 3: home A network – visited X network (for setting up the call)

II-NNI traversal scenario 4: visited X network – home B network

Use case 5: The calling user is not roaming and the called user is roaming

II-NNI traversal scenario 1: home A network – home B network

II-NNI traversal scenario 2: home B network – visited Y network

Use case 6: None of the users are roaming but there is a transit network between the home A and home B networks

II-NNI traversal scenario 1: home A network – transit network – home B network

The exit/entry points on each side of a II-NNI traversal scenario type between two operator networks (e.g. visited and home), applies a local policy associated with the II-NNI traversal scenario type (e.g. shall media be anchored or not) and the exit point and the entry point need to reach a common understanding of the II-NNI traversal scenario type to avoid inconsistencies in a call.

B.2.3 Requirements

Based on the use cases in subclauses 4.1 and 4.2 the following requirements can be derived:

REQ-1: It MUST be possible for a SIP proxy/B2BUA to indicate, and convey to other SIP entities in the signalling path of a registration request, an II-NNI traversal scenario type indication.

REQ-2: It MUST be possible for a SIP proxy/B2BUA to indicate, and convey to other SIP entities in the signalling path of a dialog-forming request, an II-NNI traversal scenario type indication.

REQ-3: It MUST be possible for a SIP proxy/B2BUA to indicate, and convey to other SIP entities in the signalling path of a stand-alone request, an II-NNI traversal scenario type indication.

REQ-4: A SIP proxy/B2BUA MUST NOT, when adding an II-NNI traversal scenario type indication make any assumptions that SIP entities in the signalling path that receive the indication will support, or understand the meaning of, the II-NNI traversal scenario type indication, or even support the II-NNI traversal scenario type indication mechanism as a whole.

REQ-5: The mechanism MUST be backward compatible such that the indication of the II-NNI traversal scenario type is removed by the SIP entity at the end of the II-NNI traversal scenario without the SIP entity at the end of the II-NNI traversal scenario supports the identification of the II-NNI traversal scenario type mechanism as a whole.

REQ-6: A SIP proxy/B2BUA MUST be able to indicate the II-NNI traversal scenario type to other SIP entities in the signalling path, even if some SIP entities in the signalling path do not support, or understand the meaning of, the II-NNI traversal scenario type indication, or even support the II-NNI traversal scenario type indication mechanism as a whole.

REQ-7: If a SIP entity that does not support the II-NNI traversal scenario type indication mechanism receives an II-NNI traversal scenario type indication, it MUST act as if it hadn't received the indication.

REQ-8: SIP entities on the path of the SIP message MUST be able to inspect the II-NNI traversal scenario type indication introduced by other entities.

REQ-9: A II-NNI traversal scenario type indicator MUST only be used to identify the II-NNI traversal scenario, and MUST NOT be used to indicate whether procedures associated with the II-NNI traversal scenario type indication have been applied or not.

REQ-10: The solution MUST fulfil security consideration aspects and application of trust policy and/or possibility of fraud MUST be minimized.

REQ-11: A procedure for II-NNI traversal scenario type indication values, which prevents name collisions of indicators, with IANA MUST be defined.

REQ-12: Any solution MUST be backward compatible with existing methods of identifying the II-NNI traversal scenario type.

Annex C: Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2013-01	CT3#72				Initial skeleton provided by rapporteur	-	0.0.0
2013-02	CT3#72	C3-130339			Inclusion of text agreed in the following contribution: - C3-130296.	0.0.0	0.1.0
2013-05	CT3#73	C3-130919			Inclusion of text agreed in the following contributions: - C3-130588 - C3-130651 - C3-130652 - C3-130653 - C3-130877	0.1.0	0.2.0
2013-09	CT3#74	C3-131319			Inclusion of text agreed in the following contributions: - C3-131153 - C3-131156 - C3-131157 - C3-131287 - C3-131288 - C3-131289	0.2.0	0.3.0