3GPP TSG-SA Meeting #26 **TSGS#26(04)0759**
13th – 16th December 2004. Athens, Greece.

Source: **TSG SA WG2**
Title: **CRs on 23.251 (Network Sharing)**
Agenda item: **7.2.3**
Document for: **APPROVAL**

The following CRs have been agreed by TSG SA WG2 and are requested to be approved by TSG SA plenary #26.

Note: *the source of all these CRs is now SA2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CRs.*

Tdoc	Title	Spec	CR	Rev	Cat	C_Ver	Rel	WI
S2-043120	Inclusion of informative Annex "NRI allocation examples"	23.251	007	1	F	6.1.0	Rel-6	NTSHAR
S2-043692	Indication of selected CN operator in connected mode	23.251	008	3	F	6.1.0	Rel-6	NTSHAR

3GPP TSG-SA WG2 Meeting #42
Sophia Antipolis, France, 11-15 October 2004

Tdoc ⌘S2-043120
revision of S2-043112

CR-Form-v7.1

CHANGE REQUEST

⌘ **23.251** **CR** **007** ⌘**rev** **1** ⌘ Current version: **6.1.0** ⌘

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Proposed change affects: UICC apps⌘ [ ] ME [ ] Radio Access Network [X] Core Network [X]

Title:	⌘	Inclusion of informative Annex "NRI allocation examples"
Source:	⌘	Nokia
Work item code:	⌘	NetShare
Date:	⌘	14/10/2004
Category:	⌘	**F**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
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Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

Ph2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*
Rel-7	*(Release 7)*

Reason for change:	⌘	It has been discussed in the previous meetings that it may be beneficial to include some examples in the TS of how Network Resource Identifier (NRI) could be coordinated between the core network operators in a shared network.
Summary of change:	⌘	TS 23.236 (Iu-Flex) is added to references. It is proposed to include an informative Annex "NRI allocation examples" to TS.
Consequences if not approved:	⌘	In large networks it may be difficult to utilize all the benefits of "Intra-domain connection of RAN nodes to multiple Core Network nodes (Iu-Flex) if the NRI allocation is not taken into account in the initial network planning phase. The Annex gives some guidelines of what needs to be agreed between the sharing operators.

Clauses affected:	⌘	2; New Annex X,

Other specs affected: ⌘	Y	N		⌘
		X	Other core specifications	
		X	Test specifications	
		X	O&M Specifications	

Other comments:	⌘	

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 22.951: "Service Aspects and Requirements for Network Sharing".

[2] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[3] 3GPP TS 25.331: "RRC Protocol Specification".

[4] 3GPP TS 23.122: "NAS Functions related to Mobile Station (MS) in idle mode".

[5] 3GPP TS 32.250: "Telecommunication management; Charging management; Circuit Switched (CS) domain charging".

[6] 3GPP TS 32.251: "Telecommunication management; Charging management; Packet Switched (PS) domain charging".

[7] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3"

[x] 3GPP TS 23.236: "Intra-domain connection of Radio Access Network (RAN) nodes to multiple Core Network (CN) nodes"

**********NEXT CHANGE**********

Annex X (informative): Network Resource Indicator (NRI) allocation examples

This annex contains examples for NRI co-ordination in shared networks.

x.1 NRI in shared networks

The Network Resource Identifier (NRI) is specified in Rel-5 for Intra Domain Connection of RAN Nodes to Multiple CN nodes (see 3GPP TS 23.236 [x]). NRI is part of the temporary indentity TMSI (CS domain) or P-TMSI (PS domain), which is assigned by the serving CN node to the MS.

Within the shared network NRIs has to be coordinated between the operators at least due to following reasons:

- to avoid redirection when the non-supporting UE performs LA/RA update.
- to guarantee that correct UE answers to paging (TMSI/P-TMSI shall be unique within shared network).

- to guarantee that a non-supporting UE in visited PLMN will not change network due LA/RA update or Detach/Attach function.

NRI coordination is also required between the shared network and the dedicated networks of the sharing partners:

- to guarantee that non-supporting UE in visited PLMN remain registered in the same operators network when the UE moves from dedicated network to a shared network.
- to avoid redirection when the non-supporting UE in home PLMN performs LA/RA update from dedicated network to a shared network.

In the Figure below operators A, B and C have both shared and dedicated networks, operator D has only dedicated network and operator E only shared network.

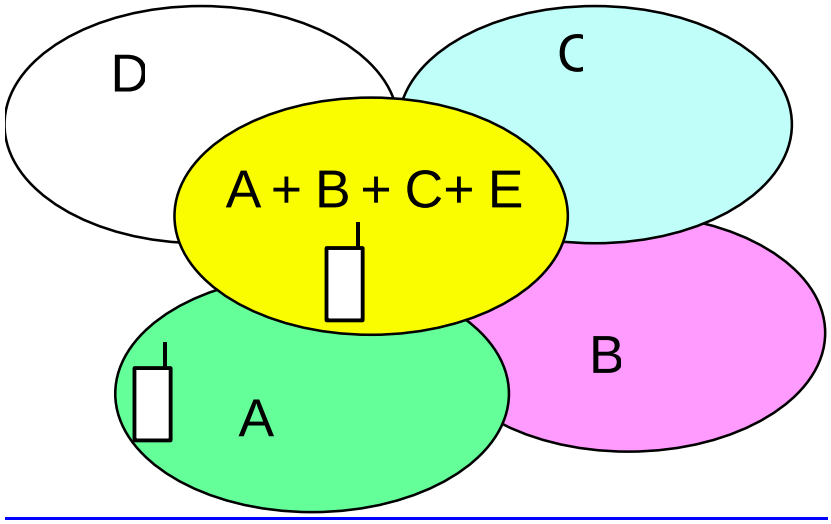

Figure x 1: Shared and Dedicated network example

In the above, one or more of the operators in the shared network may deploy Iu-Flex between that shared radio access network and their core networks. Additionally, operators may deploy Iu-Flex within their dedicated core networks. For non-supporting UEs, NRI coordination is needed not only within the shared network, but also between the shared network and the dedicated networks.

x.2 Alternatives for NRI split

Sharing operators need to coordinate the used NRI, following alternatives are considered:

1) even split of NRI space, 1…3 most significant bits of NRI is used to identify the CN operator.

2) individual NRI values used to identify the CN operator.

Alternative 1; even split of NRI space

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CS/ PS		'VLR-restart'						CN operator ID		Non shared NRI for CN operator internal use.																					

A calculation for the possible number of subscribers in this scenario is:

- With max 4 sharing CN operators, two most significant bits of NRI is required to identify the CN operator.
- 3 bits are used for the restart counter.
- 5 bits of NRI allows 32 independent NRI values for each CN operator.
- This leaves 20 bits for every MSC that is 1 M non-purged TMSI .

Following aspects need to be considered for this solution

- If more bits are needed for the restart counter or CN operator ID, each additional bit reduces the available TMSI space half.
- The basic configuration allows 32 M TMSI values for each CN operator, a lot of TMSI values are wasted if some sharing partners have substantially less subscribers than others.
- It may not be feasible in large networks that use Iu-Flex for load balancing (see Annex A, network configuration examples in 3GPP TS 23.246 [x]).
- The number of NRI bits used for CN operator ID may need to be fixed in the initial planning. Otherwise configuration of all existing nodes must be changed when new partners join the shared network.

Alternative 2; individual NRI values used to identify the CN operator

This could be considered in the case where a network is shared between one big and many small CN operators.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CS/ PS		'VLR-restart'						Shared NRI space																							

- The biggest CN operator who needs more pool areas and TMSI space takes NRI values 32…63, [1xxxxx], this means 32M TMSI values when 4 bit is used for restart counter.
- Rest of shared NRI space is allocated to other CN operators in blocks of 4M TMSI values like NRI = 28 - 31 [0111xx], 24 - 27 [0110xx] …. 0 – 3 [000xx]. Initially gaps can be left between allocated NRI range that can be used for expansion.

Following aspects need to be considered for this solution:

- If more bits are needed for the restart counter or NRI, each additional bit reduces the available TMSI space half.
- The initial planning of NRI length should take into account the pool area configurations of all sharing operators.

TMSI per LA:

Taking the example configurations mentioned above but changing the TMSI allocation per LA would result in an increase of the addressing space, then the same TMSI value can be used multiple times in the same VLR. More considerations with this TMSI per LA approach can be found in 3GPP TS 23.246 [x].

3GPP TSG-SA2 Meeting #43
Seoul, Korea, November 15-19, 2004

Tdoc ⌘S2-043692

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CHANGE REQUEST

⌘ **23.251** **CR** **008** ⌘ **rev** **3** ⌘ Current version: **6.1.0** ⌘

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Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Indication of selected CN operator in connected mode
Source:	⌘	Network sharing drafting session
Work item code:	⌘	NTShar
Date:	⌘	18/11/2004
Category:	⌘	**F**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
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Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*
Rel-7	*(Release 7)*

Reason for change:	⌘	In order to satisfy the requirements for indicating the selected core network operator to the RNC in connected mode in relation to handover the selected core network identity need to be indicated to the target core network node.
Summary of change:	⌘	Text clarifying that the core network operator identity shall be selected and transferred from the source RAN node to the target RAN node via the target core network node at inter-MSC handovers and inter-SGSN relocations, if supported, is added in Section 5.2, 5.3 and 5.4. The text also states that if the source RAN node does not support this selection, the target core network node selects the core network operator.
Consequences if not approved:	⌘	The functionality of the RNC as described in Section 5.3 cannot be satisfied in a shared network.

Clauses affected:	⌘	5.2, 5.3, 5.4

Other specs affected: ⌘	Y	N		⌘	
	X		Other core specifications	⌘	25.413
		X	Test specifications		
		X	O&M Specifications		

Other comments: ⌘

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.1 UE functions

A supporting UE selects the core network operator and provides the PLMN-id of this operator to the network for routing purposes.

5.2 RNC functions

Network sharing information, i.e. available core network operators in the shared network, shall be transmitted in broadcast system information. If system information is transmitted to a supporting UE in dedicated signalling, the RNC shall indicate the PLMN-id of the core network operator towards which the UE already has a signalling connection (if a PLMN-id is included in the signalling). If the UE is non-supporting, the RNC shall indicate the common PLMN (if a PLMN-id identity is included in the signalling)

The RNC shall indicate the selected core network operator to the CN for supporting UEs when transferring initial layer 3 signalling. The selected CN operator is (i) indicated by the UE in RRC signalling or (ii) known implicitly from an already existing signalling connection. For non-supporting UEs, the RNC shall not indicate any selected core network operator to the CN.

In case of relocation to a GWCN or a MOCN:

If the source RNC can determine a core network operator to be used in the target network based on available shared networks access control information, current PLMN in use, or similar information present in the node, the source RNC shall at relocation indicate that selected core network operator to the target core network node.

5.3 MSC functions

When a UE accesses an MSC the first time, i.e. when there is no VLR entry for this UE, the MSC verifies whether the UE belongs to one of the operators sharing the MSC or their roaming partners. For that purposes the MSC derives the IMSI from another MSC/VLR or from the UE. The MSC determines a serving CN operator unless the old MSC/VLR or the UE have indicated a core network operator. The MSC/VLR shall also store the identity of the serving core network operator.

In case of a MOCN configuration, an MSC may not able to provide service to the UE. The UE may then have to be redirected to a MSC of another core network operator. The MSC/VLR that finally serves the UE assigns a NRI to the UE. This will allow the RAN to route any subsequent UE accesses the to the serving MSC/VLR.

For supporting UEs, i.e. when a selected core network operator has been indicated to the MSC by the RNC, the MSC indicates the selected core network operator PLMN-id in the LAI signalled to the UE in dedicated signalling.

In case of relocation to a GWCN or a MOCN:

- There is no functionality in the source MSC to select a target core network operator or to modify the target core network operator selected by the RNC.

- If the source MSC has the capability to indicate the core network operator selected by the source RNC to the target MSC, the source MSC shall forward the selected core network operator chosen by the source RNC to the target MSC, which relays this information unchanged to the target RNC so that the appropriate PLMN-id can be signalled to the UE in dedicated system information signalling, as described in Section 5.2.

- If the source RNC did not have the capability to determine a core network operator, the target MSC selects a core network operator and indicates it to the Target RNC.

5.4 SGSN functions

When a UE accesses an SGSN the first time, i.e. when the UE is not yet known by the SGSN, the SGSN verifies whether the UE belongs to one of the operators sharing the SGSN or their roaming partners. For that purposes the

SGSN derives the IMSI from another SGSN or from the UE. The SGSN determines a serving core network operator unless the old SGSN or the UE have indicated a core network operator. The SGSN shall also store the identity of the serving core network operator.

In case of a MOCN configuration, a SGSN may not able to provide service to the UE. The UE may then have to be redirected to a SGSN of another core network operator. The SGSN that finally serves the UE assigns a NRI to the UE. This will allow the RAN to route any subsequent UE accesses the to the serving SGSN.

For supporting UEs, i.e. when a selected core network operator has been indicated to the SGSN by the RNC, the SGSN indicates the selected core network operator PLMN-id in the LAI/RAI signalled to the UE in dedicated signalling.

In case of relocation to a GWCN or a MOCN:

- There is no functionality in the source SGSN to select a target core network operator or to modify the target core network operator selected by the RNC. The source SGSN shall forward the selected core network operator chosen by the source RNC to the target SGSN.

- The target SGSN indicates the selected core network operator chosen by the source RNC to the target RNC so that the appropriate PLMN-id can be signalled to the UE in dedicated system information signalling, as described in Section 5.2.

- If the source RNC did not have the capability to determine a target core network operator, the target SGSN selects a core network operator and indicates it to the Target RNC.