Technical Specification Group Services and System Aspects ***TSGS#15(02)0137***

Meeting #15, Jeju-do, Korea, 5-14 March 2002

Source: **TSG SA WG2**
Title: **CRs on 23.236 v.5.1.0**
Agenda Item: **7.2.3**

The following Change Request has been approved by TSG SA WG2 and is requested to be approved by TSG SA plenary #15. Note: the source of this CR is now S2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CR.

Tdoc #	**Title**	**Spec**	**CR #**	**cat**	**Rel**	**WI**
S2-020845	Selection of MSC/VLR node based on IDNSS derived from IMSI	23.236	011r1	B	5	IUFLEX

3GPP TSG-SA WG2 Meeting #23

Tdoc S2-020845
Revision of S2-020494

Sophia Antipolis, France, 18-22 February 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.236** **CR** **011** ⌘ **rev** **1** ⌘ Current version: **5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Selection of MSC/VLR node based on IDNNS derived from IMSI
Source:	⌘	Nokia
Work item code:	⌘	IUFLEX
Date:	⌘	21.02.2002
Category:	⌘	**B**
Release:	⌘	REL-5

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)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	This CR defines a mechanism for selection of CN node based on IMSI. The mechanism is presented in more details in S2-020058, S2#22 gave general support to the introduced principle.
Summary of change:	⌘	In Iu mode when the mobile provides the RAN node with a routing parameter of IDNNS derived from IMSI, it is a value (V) from 0 to 999. (*extract from 3GPP TS 25.331; The "Routing parameter" bit string consists of DecimalToBinary [(IMSI div 10) mod 1000]. The bits of the result are numbered from b0 to b9, with bit b0 being the least significant.).* It is proposed that in Iu mode RAN node shall use value (V) to select CN node. For this case RAN node have a configuration table where each value (V) corresponds a single CN node, typically many values of (V) may point to the same CN node. Accordingly when combined procedures are supported and the SGSN has to select an MSC at the Gs, the SGSN derives a value (V) from IMSI using algorithm [(IMSI div 10) modulo 1000] and uses this value (V) to select a MSC node. The configuration of the MSC node table should be the same as in same area RNC.
Consequences if not approved:	⌘	

Clauses affected:	⌘			
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	

Other comments: ⌘	

First modification

4.3 Pool-Area and Network Resource Identification

A pool-area is an area within which an MS may roam without a need to change the serving CN node. A pool-area is served by one or more CN nodes in parallel. The complete service area of a RAN node (RNC or BSC) belongs to the same one or more pool-area(s). A RAN node service area may belong to multiple pool-areas, which is the case when multiple overlapping pool-areas include this RAN node service area. The pool-areas of the CS and of the PS domain are configured independently with the granularity of RAN node service areas. Therefore, all uniqueness statements below apply to each of the domains (CS/PS) separately. If LAs or RAs span over multiple RAN node service areas then all these RAN node service areas have to belong to the same pool-area.

The Network Resource Identifier (NRI) identifies uniquely an individual CN node out of all CN nodes, which serve in parallel a pool-area. The length of the NRI shall be the same in all nodes of a domain in one pool-area. In areas where pool-areas overlap the NRI identifies uniquely a CN node out of all CN nodes, which serve all these overlapping pool-areas, i.e. an NRI identifies uniquely a CN node within a RAN node. In case of overlapping pool-areas the NRI length shall be configured to be the same in all the nodes of a specific domain serving these pool-areas. Note again, that the NRIs of the CS and the PS domain are independent of each other as the PS and the CS domain CN nodes are addressed independently. More than one NRI may be assigned to a CN node.

The NRI is part of the temporary identity TMSI (CS domain) or P-TMSI (PS domain), which is assigned by the serving CN node to the MS. Each CN node which supports the "Intra Domain Connection of RAN Nodes to Multiple CN Nodes" is configured with its specific one or more NRI(s). The (P-)TMSI allocation mechanism in the CN node generates (P-)TMSIs which contain a configured NRI in the relevant bit positions. The NRI has a flexible length between 10 and 0 bits (0 bits means the NRI is not used and the feature is not applied).

In Iu mode the MS provides an Intra Domain NAS Node Selector (IDNNS) [5] in the AS part of the RRC-Initial-direct-transfer message to the RAN node (RNC or BSC). The IDNNS contains a routing parameter with a fixed length of 10 bits. This routing parameter transports the NRI value. In addition the IDNNS contains an indication from which identity (TMSI, IMSI, IMEI, ...) the routing parameter is derived. The RAN node masks the significant bits out of the routing parameter part of the IDNNS to determine the NRI which is relevant to identify the CN node. The most significant bit of the NRI shall correspond with the most significant bit of the routing parameter in the IDNNS. When the IDNNS is derived from the IMSI, the IDNNS has a value (V) from the range 0 to 999 as defined in TS 25.331: "Radio Resource Control (RRC) Protocol Specification" [5]. The RAN node shall be configured to use the value (V) to select a CN node. Each value (V) corresponds a single CN node. Typically many values of (V) may point to the same CN node.

In A/Gb-mode for the A interface the RAN node derives the NRI from any initial NAS signalling message. The RAN node masks the significant bits out of the TMSI to determine the NRI, which identifies the CN node. In A/Gb-mode for the Gb interface the RAN node derives the NRI from the TLLI. The RAN node masks the significant bits out of the TLLI to determine the NRI, which identifies the CN node. For all three cases, Iu, A interface and Gb mode, it is configured in the RAN node which bits out of the information elements provided by the MS are significant for the NRI.

The whole network may be configured as one pool-area, a network may configure multiple pool-areas and the configuration of pool-areas may be combined with MSC or SGSN service areas which are not belonging to pool-areas. The change of a pool-area is not visible to the MS. In general there is no need to detect a pool-area change. It may be advantageous for load balancing purposes to detect pool-area changes in the network to distribute MSs entering a pool-area to CN nodes with an appropriate load status. MSs changing a pool-area may be detected by configuration of different NRI values for adjacent pool-areas. The pool-area change information potentially provided in the IDNNS by an MS in Iu mode is ignored by the network.

4.4 NAS Node Selection Function

This function is used in RAN nodes and potentially in CN nodes. In the RAN node the function selects the specific CN node (i.e. MSC or SGSN) to which initial NAS signalling messages or LLC frames are routed. The NRI identifies the specific CN node. If the NAS Node Selection Function has a CN node address configured for the NRI derived from the initial NAS signalling message or from the LLC frame then this message or frame is routed to this address. If no CN node address is configured for the derived NRI or if no NRI can be derived (e.g. the MS indicated an identity which contains no NRI) then the NAS Node Selection Function selects an available CN node (e.g. according to load balancing) and routes the message or LLC frame to the selected CN node.

The pool-area has no influence on the decisions of the NAS Node Selection Function as pool-areas may overlap. The NAS Node Selection Function in the RAN node derives the NRI from the IDNNS when the MS is supported in Iu mode. When the MS is supported in Gb mode the NRI is derived from the TLLI and for A interface mode the NRI is derived from the TMSI.

Note: A routing-area update after SRNS relocation is not an initial NAS signalling message, thus it is routed along the existing Iu-connection to the SGSN.

In A/Gb mode ~~I~~in case a MSC/VLR sends a paging-request/paging with IMSI (ie the paging message does not contain a TMSI), the NAS node selection function in the BSC ~~in A/ Gb mode~~ shall upon reception temporarily store the Global-CN- IDof the node that issued the paging-request/paging message. If the NAS node selection function in A/Gb mode receives a paging-response with an IMSI then it should check the temporarily stored Global-CN-ID on entries matching this IMSI and forward the paging-response to the node identified by this Global-CN-ID.

In Iu mode ~~I~~in case a MSC/VLR sends a paging-request/paging with IMSI (ie the paging message does not contain a TMSI), the NAS node selection function in the BSC/RNC ~~in Iu mode~~ may upon reception temporarily store the Global-CN-ID of the node that issued the paging-request/paging message. If the NAS node selection function in Iu mode receives an Initial Direct Transfer message with an IDNNS derived from IMSI as a result of IMSI paging:~~,~~

- and if ~~it~~ BSC/RNC has temporarily stored the Global-CN-ID then it should check the temporarily stored Global-CN-ID on entries matching this IDNNS and forward the paging-response to the node identified by this Global-CN-ID or
- the BSC/RNC shall use the IDNNS derived from IMSI to select a CN~~MSC~~ node. In this case the IDNNS has a value (V) from the range 0 to 999 as defined in TS 25.331: "Radio Resource Control (RRC) Protocol Specification" [5]. The RAN node shall be configured to use the value (V) to select a CN node. Each value (V) corresponds a single CN node. Typically many values of (V) may point to the same CN node.

In UMTS, an MS answering a paging with IMSI includes in its response an IDNNS derived from its TMSI, if the MS has a valid TMSI. Temporarily storing the IMSI in the RNC increases the success rate to reach the MS that have both lost their TMSI and are paged with IMSI. In GSM, an MS paged with IMSI always answers with IMSI.

If the MSC/VLR initiates the paging procedure via Gs-interface the SGSN has to add the MSC/VLR-identity to the paging-request/paging message.

An MS will return an Attach Request containing the IMSI parameter as a response to a PS IMSI paging. Also, a PS IMSI paging is not time supervised from the SGSN sending the message. Therefore the RAN node receiving such a paging request does not have to buffer the associated SGSN identity. This again means that the NAS Node Selection Function in the RAN node selects an available SGSN (e.g. according to load balancing) when it receives an Attach Request containing the IMSI parameter.

4.5 Load Balancing

Preferably, the NAS Node Selection Function in the RAN node balances the load between the available CN nodes. This is performed by an appropriate selection of the CN node for an MS which was not yet assigned to a CN node, i.e. when there is no CN node configured for the NRI indicated by the MS, when no NRI can be derived or in exceptional cases, e.g. when the CN node corresponding to an NRI cannot be reached. The load-balancing algorithm is implementation specific.

In case of handover/relocation into a pool-area a load balancing between all the target CN nodes serving this pool-area is gained by configuration. Source CN nodes which support Intra Domain Connection of RAN Nodes to Multiple CN Nodes may be configured with all possible target CN nodes for each handover/relocation target. Source CN nodes which do not support the Intra Domain Connection of RAN Nodes to Multiple CN Nodes can configure only one target CN node per handover/relocation target. In this case each of source CN nodes which handover/relocate to the same pool-area may be configured with another target CN node out of all target CN nodes serving the same handover/relocation target. The mechanism for distribution of the traffic between the handover/relocation target CN nodes is implementation specific. This load balancing is complemented by the NAS Node selection Function in the RAN, which distributes MSs between the CN nodes when these MSs enter the pool-area in idle mode.

As more than one SGSN may send downlink data at the same time for a cell or a BVCI the total possible downlink traffic has to shared between the SGSNs as described in ~~chapter 0~~subclause "5.3.2 Gb mode".

4.6 Mobility Management

An MS performs LA or RA Updates and Attachments, which may result in a change of the serving CN node. In these procedures the new CN node requests from the old CN node MS specific parameters. If multiple CN nodes are configured in the new CN node for the old RA or LA indicated by the MS then the new CN node derives the NRI from the old (P-)TMSI indicated by the MS. The new CN node uses the old RA or LA together with the NRI to derive the signalling address of the old CN node from its configuration data. If the network contains nodes that cannot derive the old CN node from LAI/RAI and NRI a default CN node for each RA or LA (as described below) shall be used to resolve the ambiguity of the multiple CN nodes serving the same area.

4.7 Default CN node and Backwards Compatibility

CN nodes that can only derive one CN node from the LAI or RAI (e.g. because they do not support the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, or no detailed knowledge of the NRIs is configured) are not aware, that multiple CN nodes may serve a LA or RA. These nodes can therefore contact only one CN node per LA or RA, respectively. This node will further on be referred to as default node.

A default node resolves the ambiguity of the multiple CN nodes per LA or RA by deriving the NRI from the TMSI and P-TMSI. The default node relays the signalling between the new CN node and the old CN node.

Note that the default node is configured per LA or RA. So different CN nodes in a network might have configured different default nodes for a LA or RA. With this approach more than one of the CN nodes that serve a pool-area can be used as default-node, so load concentration on one node and a single point of failure can be avoided.

Note further, that it may be required to keep information on ongoing MAP/GTP dialogues in the default nodes.

The handover/relocation from CN nodes which do support the Intra Domain Connection of RAN Nodes to Multiple CN Nodes to CN nodes not supporting this features does not need a NAS Node Selection Function in the originating CN node as there is only one target CN node. The originating CN node discovers from its configuration data, that there is only one target CN node for the requested handover/relocation target ID.

4.8 Support of combined mobility management procedures

4.8.1 Attach

In case of 'combined GPRS/IMSI attach' or 'GPRS attach when already IMSI attached', the SGSN sends the Location Update Request message to the MSC/VLR. The SGSN selects an MSC/VLR from the available MSC/VLRs which serve the current LA of the MS. The selection bases on a hash value derived from the IMSI. It is configured in the SGSN which range of the hash values relates to which MSC/VLR. This selection mechanism avoids a random change of the MSC/VLR for MSs using combined procedures when an SGSN fails. The new SGSN will select the same MSC/VLR.

4.8.2 Routing area update

The CN node changes in the following considerations result from pool-area changes (when pool-areas are configured) or from CN node service area changes (when no pool-areas are configured). For each domain (PS or CS) it is configured independently whether pool-areas are used or not.

When neither the MSC nor the SGSN are changed, the association for an MS between both CN nodes will also not change.

When the MSC changes but the SGSN does not change, the SGSN selects a new MSC because the new LA is not served by the old MSC/VLR. The selection mechanism is as described for the attach above.

When the SGSN changes but the MSC does not change, the new SGSN selects the old MSC to establish a Gs association because the new SGSN uses the same selection mechanism as described above for the attach with the same parameters as configured in the old SGSN.

When both the MSC and the SGSN change, the new SGSN selects a new MSC to establish a Gs association. The selection mechanism is as described for the attach above.

5 Functional Description

5.1 MS Functions

In Iu mode the MS provides the IDNNS to the RNC in the access stratum part of the *RRC_initial_DT* message as described in [5].

When the MS in Iu mode replies to IMSI paging, it shall derive IDNNS from (P)TMSI if valid one is available. If (P)TMSI is not available, the MS shall derive IDNNS from IMSI.

No changes are expected in the MS for Gb or A interface mode.

5.2 RNC Functions

The RNC provides the NAS Node Selection Function. It masks the significant number of bits out of the IDNNS provided by the MS together with the initial NAS signalling message. The significant number of bits is configured in the RNC. The NAS Node Selection Function derives from the NRI the address of the specific CN node for the relevant domain (CS or PS). The association between NRI values and CN node addresses is configured in the RNC (O&M).

The RNC routes the initial NAS signalling messages according to the NRI and the "domain indicator" (CS or PS) to the relevant CN node if a CN node address is configured in the RNC for the specific NRI and the requested domain (CS or PS).

When IDNNS is derived from the IMSI, the IDNNS has a value (V) from the range 0 to 999 as defined in TS 25.331: "Radio Resource Control (RRC) Protocol Specification" [5]. The RAN node shall be configured to use the value (V) to select a CN node. Each value (V) corresponds a single CN node. Typically many values of (V) may point to the same CN node.

If the selected CN node is not available or if no CN node address is configured in the RNC for the requested NRI or if the provided identity contains no NRI then the RNC routes the initial NAS signalling message to a CN node selected from the available CN nodes which serve the related domain (CS or PS). The selection mechanism is implementation dependent and should enable load balancing between the available CN nodes.

Note: A routing-area update after SRNS relocation is not an initial NAS signalling message, thus it is routed along the existing Iu-connection to the SGSN.

In case a MSC sends a paging with IMSI (ie the paging message does not contain a TMSI), the RNC may, for purposes to increase the paging success rate, upon reception temporarily store the Global-CN-IDof the node that issued the paging message. If the MSC/VLR initiates the paging procedure via Gs-interface the SGSN has to add the Global-CN-IDto the paging message.

5.3 BSC Functions

5.3.1 A interface mode

The BSC provides the NAS Node Selection Function. It is aware whenever a new RR connection is established. In particular, the BSC always examines the content of the Initial Layer 3 message sent by the MS in order to determine the position of the MS Classmark and to extract its contents. The examination of the Initial Layer 3 message content allows the BSC to observe the TMSI+LAI or IMSI or IMEI.

The BSC derives from Initial Layer 3 messages the NRI from the TMSI. It is configured in the BSC (O&M) which bits of the TMSI are significant for the NRI. The BSC routes the Initial Layer 3 message according to the NRI to the relevant MSC if an MSC address is configured in the BSC for the specific NRI. The association between NRI values and MSC addresses is configured in the BSC (O&M).

If no MSC address is configured in the BSC for the requested NRI, or if no TMSI is sent by the MS (e.g. an IMSI or IMEI), then the BSC routes the initial NAS signalling message to an MSC selected from the available MSCs. In addition, the BSC may route the initial NAS signalling message to an MSC selected from the available MSCs if this message is a Location Update Request messages and the PLMN ID in the LAI is not one of the PLMN IDs served by

the BSC (FFS). The selection mechanism is implementation dependent and should enable load balancing between the available MSCs.

In case a MSC sends a paging-request with IMSI, the NAS node selection function in the BSC shall upon reception temporarily store the MSC/VLR-identity of the node that issued the paging-request message.

5.3.2 Gb mode

The BSC provides the NAS Node Selection Function. The MS sends the TLLI to the BSC. The NRI is part of the P-TMSI and therefore also contained in the 'local TLLI' or in the 'foreign TLLI'. The number of bits out of the TLLI which are significant for the NRI is configured in the BSC (O&M).

A 'local TLLI' indicates to the BSC that the TLLI is derived from a P-TMSI which was assigned for the current RA, i.e. the 'local TLLI' contains an NRI which is valid for routing to an SGSN. A 'foreign TLLI' indicates to the BSC that the TLLI is derived from a P-TMSI which was assigned for another RA than the current RA. The BSC does not know whether the other RA and therefore the related P-TMSI belongs to the same pool-area or not unless this is configured in the BSC (which is not intended). Consequently, the BSC assumes, that the 'foreign TLLI' contains a NRI which is valid for routing to an SGSN.

For 'local TLLIs' and for 'foreign TLLIs' the BSC masks the NRI out of the TLLI which is indicated in each LLC frame. The BSC routes the uplink LLC frame to the relevant SGSN if an SGSN address is configured in the BSC for the specific NRI. The association between NRI values and SGSN addresses is configured in the BSC (O&M).

If no SGSN address is configured in the BSC for the requested NRI, which may happen for NRIs masked out of a 'foreign TLLI', or if the BSC received a 'random TLLI' which contains no NRI at all then the RNC routes the uplink LLC frame to an SGSN selected from the available SGSNs. The selection mechanism is implementation dependent and should enable load balancing between the available SGSNs.

Note: For the selection mechanism in the BSC it is probably sufficient, that the algorithm is 'slow moving'. If the selection algorithm changes the SGSN to be assigned for 'random TLLIs' or for 'foreign TLLIs' whose NRI value is not used in the current SGSN pool area during a MS's Attach procedure or RA update procedure, then the Attach procedure or RA update procedure is likely to fail, but the MS will reattempt the procedure at T3310/T3330 expiry (=15 seconds).

As more than one SGSN may send downlink data at the same time for a cell or a BVCI, the BSC has to share the total possible downlink traffic between the SGSNs that can access a cell. The BSC should use the existing flow control procedure on cell level to control each of the SGSNs in a way not to violate the total possible traffic for the cell. How the BSC decides to share the downlink traffic between each of the SGSNs is an implementation specific issue; e.g. the possible downlink traffic can be equally shared between the SGSNs, or the share of each SGSN can be proportional to the capacity of the SGSN. In case a MSC sends a paging-request with IMSI via Gs-interface the SGSN has to add the MSC/VLR-identity to the paging-request message. The NAS node selection function in the BSC/RNC shall upon reception temporarily store the MSC/VLR-identity.

5.3.3 Iu mode

To support MSs in Iu mode the BSC provides the same functionality as described under "RNC Functions".

5.4 MSC Functions

5.4.1 TMSI Allocation

Every MSC is configured with its one or more specific NRI (O&M). One of these specific NRIs is part of every temporary identity (TMSI) which the MSC assigns to an MS. The TMSI allocation mechanism in the MSC generates TMSIs which contain one of the specific NRIs in the relevant bit positions. An NRI has a flexible length between 10 and 0 bits (0 bits means the NRI is not used and the feature is not applied). The use of the bits not used to encode the NRI is implementation dependent (e.g. to extent the TMSI space). An MSC applying “Intra Domain Connection of RAN nodes to multiple CN nodes” shall allocate TMSIs to the served MSs.

5.4.2 Mobility Management and Handover/Relocation

For MAP signalling between two MSCs which both support the Intra Domain Connection of RAN Nodes to Multiple CN Nodes the new MSC derives the address of the old MSC from the old LAI and the NRI contained in the old TMSI. The MSC addresses for each LAI and NRI combination are configured in the MSC (O&M). If the network contains MSCs that cannot derive the old MSC from LAI and NRI the default MSC per LAI as described below shall be used (e.g. to reduce the configuration effort). Some redundancy may be required as the default MSC is a single point of failure.

The load balancing between multiple target MSCs at handover/relocation into a pool area is described in "4.5 Load Balancing". The handover/relocation from an MSC that supports the Intra Domain Connection of RAN Nodes to Multiple CN Nodes to an MSC not supporting the feature needs no new functionality, as there is only one MSC that serves the handover/relocation target.

5.4.3 Backward Compatibility and Default MSC

If a default MSC that is serving a pool-area receives MAP signalling (e.g. to fetch the IMSI or to get unused cipher parameters) it has to resolve the ambiguity of the multiple MSCs per LAI by deriving the NRI from the TMSI. The MSC relays the MAP signalling to the old MSC identified by the NRI in the old TMSI unless the default MSC itself is the old MSC. For every NRI value that is used in the pool-area an MSC address is configured in the default MSC (O&M).

Note, that it might be required to keep information on ongoing MAP dialogues in the default MSC.

5.4.4 Support of Combined Procedures

If the SGSN does not support the Intra Domain Connection of RAN Nodes to Multiple CN Nodes then only one default out of the MSCs serving the related LA can be used for the combined procedures. A relaying or diverting from the default MSC to another is FFS. Distributing the associations of the combined procedures according to the LAs would result in MSC changes when the MS is still in the old MSC service area.

5.5 SGSN Functions

5.5.1 P-TMSI Allocation

Every SGSN is configured with its specific one or more NRI (O&M). One of these specific NRIs is part of every temporary identity (P-TMSI) which the SGSN assigns to an MS. The P-TMSI allocation mechanism in the SGSN generates P-TMSIs which contain one of the specific NRIs in the relevant bit positions. An NRI has a flexible length between 10 and 0 bits (0 bits means the NRI is not used and the feature is not applied). The use of the bits not used to encode the NRI is implementation dependent (e.g. to extent the TMSI space). An SGSN applying “Intra Domain Connection of RAN nodes to multiple CN nodes” shall allocate P-TMSIs to the served MSs.

5.5.2 Mobility Management and Handover/Relocation

For the GTP signalling between two SGSNs supporting the Intra Domain Connection of RAN Nodes to Multiple CN Nodes the new SGSN derives the address of the old SGSN from the old RAI and the NRI contained in the old P-TMSI/TLLI. The SGSN addresses are configured in the SGSN (O&M) or in DNS for each RAI and NRI combination. If the network contains SGSNs that cannot derive the old SGSN from RAI and NRI the default SGSN per RAI as described below shall be used (e.g. to reduce the configuration effort).

The load balancing between multiple target SGSNs at handover/relocation into a pool area is described in "4.5 Load Balancing". The handover/relocation from an SGSN that supports the Intra Domain Connection of RAN Nodes to Multiple CN Nodes to an SGSN not supporting the feature needs no new functionality, as there is only one SGSN that serves the handover/relocation target.

5.5.3 Backward Compatibility and Default SGSN

If a default SGSN that is serving a pool-area receives GTP signalling (e.g. to fetch the IMSI or to get unused cipher parameters) it has to resolve the ambiguity of the multiple SGSNs per RAI by deriving the NRI from the P-TMSI. The

SGSN relays the GTP signalling to the old SGSN identified by the NRI in the old P-TMSI unless the default SGSN itself is the old SGSN. For every NRI value that is used in the pool-area an SGSN address is configured in the relaying SGSN (O&M) or in DNS.

Note, that it might be required to keep information on ongoing GTP dialogues in the default SGSN.

5.5.4 Support of Combined Procedures

The SGSN has to select an MSC at the Gs interface for the combined procedures if multiple MSCs are configured for the relevant LAI. ~~Preferably, the~~The MSC out of the available MSCs is selected based on the IMSI. This prevents an MSC change for many MSs if an SGSN fails and the re-attaching MSs would get assigned another MSC by the new SGSN. Two HLR updates instead of one would be the result.

From the IMSI the SGSN derives a value (V) using algorithm [(IMSI div 10) modulo 1000]. Every value (V) from the range 0 to 999 corresponds to a single MSC node. Typically many values of (V) may point to the same MSC node. The configuration of the MSC node should be the same in the same RNC area.

~~Note, that the algorithm based on which the SGSN derives the MSC from the IMSI needs to be unique in all SGSNs and therefore should be standardized.~~

5.5.5 CS Paging

If a CS paging is received via the Gs interface from MSC with mobile identity type IMSI then the SGSN should include the MSC/VLR-id in the paging / paging-request message to RNC/BSC.