TSG-RAN Working Group 3 meeting #6

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Agenda item:	**8.2**
Source:	Ericsson~~Nokia~~
Title:	Ericsson comments to **Iu functions contributions**
Document for:	

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1 Introduction

This contribution lists the Iu functions of the Iu interface and the functional split between the CN and UTRAN. The list of Iu functions is currently missing from section 5 of [1].

Highlighted are the Ericsson comments to the Nokia contribution on Iu Functions. The contribution is supported to a large extent and complemented with additional functions and clarifications are made.

In addition, Ericsson believes that the function description should include the list of RANAP proceduress necessary to realize the function logic. Therefore, for every function, the list of RANAP procedures, if any has been added.

2 Iu functions and functional split

~~1.1~~2.1 General

This section defines the functional split between the core network and the UMTS radio access network. In addition, the possible interaction between the functions are defined. The functional split is shown in Table 1~~Table 1~~~~Table 1~~.

Table 1. The Iu interface functional split.

Function	UTRAN	CN
RAB management functions:		
RAB establishment, modification and releaseoverall management	X	X
RAB execution of setup, modification and release	X	
RAB characteristics mapping Iu to transmission bearers	X	
RAB characteristics mapping Uu bearers	X	
RAB setup queueing	X	
RAB queuing, pre-emption and priority	X	X
RAB release request	X	
Radio Resource Management functions	X	
Radio Resource admission control	X	
Broadcast Information	X	X
Rate Adaptation		
Rate Adaptation for External Network		X
Iu link Signalling Connection Management functions:		
Iu signalling link managementconnection establishment	X	X
ATM VC management	X	X
AAL2 establish and release	X	X
AAL5 management	X	X
GTP-U Tunnels management	X	X
Buffer Management	X	
Iu signalling connection release		X
Iu U-plane (RNL)Frame Protocol Management:		
Iu U-plane frame protocol managementmode selection		X
Iu U-plane frame protocol initialization	X	X
Mobility management functions:		
Mobility Management		X
Location information reporting	X	X
Handovers and & Relocation		
Active cell management, intra RNC	X	
Active cell management, inter RNC when Iur available (intra/inter MSC)	X	
Inter RNC hard HO, Iur not used or not available (intra/inter MSC)	X	X
Serving RNS Relocation (intra/inter MSC) (incl. MDC+RRC/MAC+Iu-link)	X	X
Inter system hard HO (UMTS-GSM)	X	X
Paging		
Paging triggering		X
Paging execution	X	
Location Management	X	X

Function	UTRAN	CN
Security Functions:		
Data confidentiality		
Radio interface ciphering	X	
Ciphering key management		X
User identity confidentiality	X	X
User Authentication		X
Data integrity		
Integrity checking	X	
Integrity key management		X
Service and Network Access functions:		
CN Signalling data	X	X
Transcoding		X
Call Control and Connection Management		X
CS Data- Network Interworking function		X
SMS Point to Point		X
Supplementary Services		X
Charging		X
UE Tracing	X	X
UE Positioning reporting	X	X
Multimedia		X
Iu Co-ordination functions:		
Paging coordination	X	
Ciphering coordination	X	
Relocation coordination	X	

2.2 RAB management Functions

2.2.1RAB overall management

2.2.1 RAB establishment, modification and release function

The RAB, Radio Access Bearer, is defined to be set-up between UE and CN. Depending on subscription, service, requested QoS etc. different types of RABs will be used. It is the CN that controls towards the UTRAN the establishment , modification or release of a RAB.

The RAB identity is allocated by CN and is locally significant over one Iu signalling instance.

RAB establishment, modification and release is a CN intiated function.

RAB establishment, modification and release is a UTRAN executed function.

RAB release request is a UTRAN initiated function, triggered when UTRAN fails to keep the RAB established with the UE.

This function uses the following RANAP Elementary Procedures:

- RAB Assignment

- RAB Release Request

- Relocation resource allocation

2.2.2   RAB characteristics mapping to Uu bearers function

The RAB characteristics mapping function is used to map the radio access bearers to the Uu bearers. The mapping is performed during the establishment of the RAB. UTRAN shall perform the mapping between the bearers.

RAB mapping to Uu transmission bearers is a UTRAN function.

This function uses the following RANAP Elementary Procedures:

- -

2.2.3   RAB characteristics mapping to Iu transport bearers

The RAB characteristics mapping function is used to map the radio access bearers to the Iu interface transport bearers. The mapping is performed during the establishment of the RAB.

UTRAN shall perform this mapping between the bearers if AAL2 is used, since it is the UTRAN that establish the AAL2 connections.

In case of RAB towards the IP domain, UTRAN shall perform the mapping between the radio access bearers and the IP layer.

RAB characteristics mapping to Iu transport bearers is a UTRAN function.

This function uses the following RANAP Elementary Procedures:

- -

RAB overall management is performed by the CN, which requests RABs. The CN is the owner of the RABs it has requested and thus has the overall control.

1.1.2RAB execution of setup, modification and release

RAB execution is done by the RNC. This includes the setup, modification and release of RAB.

1.1.3RAB mapping to transmission bearers

The bearer mapping function is used to map the radio bearers to the Iu interface transmission bearers. RNC shall perform the mapping between the bearers.

1.1.4RAB setup queueing

The RNC can place some requested RABs into a queue.

1.1.52.2.4   RAB queuing, pre-emption and priority function

The priority level of a RAB is determined by the CN based on e.g. subscription information , QoS information etc.. Accordingly, the CN shall request RAB establishment or modification with an indication of the priority level and the pre-emption capability of that RAB and the queuing vulnerability. Queuing and resource pre-emption shall be performed by UTRAN accordingly.

RAB queuing, pre-emption and priority handling is a UTRAN controlled function.

RAB queuing, pre-emption and priority setting is a CN function.

This function uses the following RANAP Elementary Procedures:

- RAB Assignment
- RAB Release Request
- Relocation resource allocation

The CN can optionally set a pre-emption for a requested RAB. The RNC decides the usage of priority based on information received from the CN.

1.1.6 RAB release request

The RNC can request the CN to release some RABs, if the connection to the UE has been lost.

2.3 Radio Resource Management over Iu

Radio resource management shall be performed by the UTRAN.

2.3.1 Radio resource admission control

This function is used at radio access bearer establishment and it is divided in two parts:

a) Subscription based admission control

> When CN receives a request to establish or modify a radio access bearer, the CN verifies if the subscriber is allowed to use a radio access bearer with the requested parameters. Based on the verification the CN will accept or reject the request. This part is called "Subscription based admission control" and it is handled by the CN.

b) Radio resource admission control

> When UTRAN receives a request to establish or modify a radio access bearer from the CN, the current radio resource situation is analysed and the admission control either accepts or rejects the request. This part is called "Radio resource admission control" and it handled by the UTRAN. If the request is queued, this part is handled by the RAB queuing, pre-emption and priority function.

Part b) is only performed if CN accept the request to establish a radio access bearer

2.3.2 Broadcast information management

This function consists in the broadcast from network toward UE of some information in the coverage area of the whole network or different parts of the network.

There are two kinds of Broadcast information management. UTRAN broadcast information and CN broadcast information management. All UTRAN broadcast information management shall be be handled locally within UTRAN. All CN related broadcast information is controlled by CN. UTRAN executes the broadcast of CN information.

The CN Broadcast Information Management function uses the following RANAP Elementary Procedures:

- CN Broadcast Information

2.4 Rate adaptation for external networks

The rate adaptation function is used to adapt the radio interface data transmission rates with the terrestrial link transmission rates and with the external networks (such as PSTN and ISDN) rates.

The Rate adaptation for external network is a CN function.

This function uses the following RANAP Elementary Procedures:

- -

2.42.5 Iu link Signalling Connection Management functions

2.5.1 Iu Signalling Link Management function

The Iu signalling link management function provides a reliable transfer of the radio network signalling between UTRAN and CN. Both CN and UTRAN manage the function.

This function is in particular responsible for Iu signalling connection establishment, which

~~Iu signalling connection~~ can be established either by the CN or the RNC and for Iu signalling connection release, which is controlled by CN possibly upon UTRAN request~~.~~.

This function uses the following RANAP Elementary Procedures:

- Initial UE

- Relocation resource allocation

- Iu Release

- Iu Release Request

2.5.2   ATM Virtual Connection Management function

This function refers to handling of ATM Virtual Connections (VCs) between CN and UTRAN.

This function shall be used to establish, maintain and release the ATM VCs. For permanent VCs, it is regarded to be an O&M function.

This function also ncludes the selection of a Virtual Circuit to be used for a particular RAB. The selection of ATM VC upon an Iu radio access bearer service request, shall be done by UTRAN. The selected VC shall fulfil the requirements of the request. AAL5 adaptation layer will be used over a virtual circuit for signalling. AAL5 and AAL2 adaptation layers will be ued over virtual connections for used data. The VC may consist of several sublinks: such as SCCP connections, AAL2 connections or IP flows.

The virtual connection selection function uses the following RANAP Elementary Procedures:

- RAB Assignment

- Relocation resource allocation

- RAB Release

~~1.1.2Iu signalling connection release~~

~~Iu signalling connection is released by the CN.~~

2.5.3   AAL2 connection establish and release function

This function is used to establish and release the AAL type 2 connections between CN and UTRAN upon an Iu radio access bearer service request. Both UTRAN and CN are taking part in the establishment of AAL2 connection. UTRAN shall initiate the establishment . UTRAN shall perform the release of the AAL2 connection upon request of the CN. The use of AAL2 for Iu transmission bearers depends on type of CN.

This function uses the following RANAP Elementary Procedures:

- RAB Assignment

- Relocation resource allocation

- RAB Release

2.5.4   AAL5 management function

AAL5 connections between CN and UTRAN shall be pre-configured at system initialisation. Basic configuration is PVCs. For user data, SVC is possible.

The AAL5 management is a function handled by both the CN and the UTRAN.

This function uses the following RANAP Elementary Procedures:

- RAB Assignment

- Relocation resource allocation

- RAB Release

2.5.5   GTP-U tunnels management function

This function is used to establish and release GTP-U tunnels between CN and UTRAN upon a radio access bearer service request. This involves assigning a tunnel identifier for each direction and the creation of a context containing the tunnel information. The use of GTP-U for Iu transport bearers depends on type of CN.

This function uses the following RANAP Elementary Procedures:

- RAB Assignment

- Relocation resource allocation

- RAB Release

2.5.6   Buffer Management

This function includes buffers to store received packet data units that at reception can not be processed due to e.g. congestion. In UTRAN, there must be a buffer management function handling received packets from the peer CN node.

The used mechanism is not in the scope of this document and not relevant to be standardised.

Buffer management is a UTRAN function.

This function uses the following RANAP Elementary Procedures:

- -

2.52.6   Iu U-plane (RNL)Frame Protocol Management Functions

2.5.12.6.1   Iu U-plane frame protocol mode selection function

The Iu UP in the Radio Network Layer provides modes of operation that can be activated on RAB basis. For a given RAB, the Iu UP operates either in a Transparent or in Support mode. Iu U-plane frame protocol mode is selected by the CN. The available modes are the transparent mode and the support mode.

This function is a CN function.

This function uses the following RANAP Elementary Procedures:

- RAB Assignment

- Relocation resource allocation

1.1.22.6.2   Iu U-plane frame protocol initialization

Iu U-plane frame protocol is initialised by the UTRANCN.

2.62.7   Mobility Management Functions

2.6.12.7.1   Mobility Management

Mobility Management messages that are core network specific and are used between mobile terminal and core network shall be handled transparently by the Iu interface.

Alternative text:

The mobility management is used to maintain the information in the CN about the location of the terminal. The function is needed for support of UE roaming and for support of UE terminating traffic. All Mobility Management signalling between UE and CN are transferred transparently through UTRAN, except paging.

For Mobility Management purposes, the location information shall be at Location and Routing Area level.

2.7.2 Location information update function

Functionality within the CN, such as Charging, needs information about the present location of active UE, i.e. UE with established signalling connection. The Location information update function is used to transfer this information from the UTRAN to the CN. It is the UTRAN responsibility to send this information initially at the signalling connection establishment for an UE and at any change of the UE location as long as the signalling connection exists. For Mobility Management purposes, the location information shall be at Location and Routing Area level.

This function uses the following RANAP Elementary Procedures:

- Initial UE

- RAB Assignment

1.1.22.7.3 Handover &and Relocation functions

2.6.2.12.7.3.1 Active Cell Management, intra RNC

This functionality includes procedures for adding and removing cells controlled by one RNC to and from the active set. The handovers may be hard or soft. This functionality is handled by UTRAN and it does not involve the CN.

This function uses the following RANAP Elementary Procedures:

- -

1.1.1.22.7.3.2 Active Cell Management, inter RNC, when Iur is available

This functionality includes procedures for adding and removing cells controlled by an other RNC to and from the active set. This is possible only when Iur interface is available between the RNCs in question. As long as the Iur is available, the RNCs may be controlled by different MSCs, i.e. both intra and inter MSC cases are applicable. The handovers may be hard or soft. This functionality is handled by UTRAN and it does not involve the CN.

This function uses the following RANAP Elementary Procedures:

- -

1.1.1.32.7.3.3 Inter RNC hard HO function, Iur not used or not available

This functionality includes procedures for handover from one RNC to other RNC when Iur interface is not used or is not available, i.e. soft handover is not possible. The connection is switched in the CN, so both UTRAN and CN are involved. Both intra and inter CN entity cases are applicable.

This function uses the following RANAP Elementary Procedures:

- Relocation preparation

- Relocation resource allocation

- Relocation Detect

- Relocation Complete

- Relocation Cancel

- Iu Release

- Iu Release Request

1.1.1.42.7.3.4   Serving RNS Relocation function

This functionality allows moving the Serving RNS functionality from one RNC to an other RNC, e.g. closer to where the UE has moved during the communication. The Serving RNS Relocation procedure may be applied when active cell management functionality has created a suitable situation for it. Both UTRAN and CN are involved.

This function uses the following RANAP Elementary Procedures:

- Relocation preparation

- Relocation resource allocation

- Relocation Detect

- Relocation Complete

- Relocation Cancel

- Iu Release

- Iu Release Request

1.1.1.52.7.3.5   Inter system Handover (e.g. GSM-UMTS) function

Inter system handover is performed when a mobile hands over between a cell belonging different systems such as GSM and UMTS. This may imply also a change of radio access type. For intersystem handover between UMTS and GSM, the GSM procedures are used with the GSM network. Both UTRAN and CN are involved.

This function uses the following RANAP Elementary Procedures:

- Relocation preparation

- Relocation resource allocation

- Relocation Detect

- Relocation Complete

- Relocation Cancel

- Iu Release

- Iu Release Request

Note: The GSM BSSMAP procedures are outside the scope of this specification.

1.1.32.7.4   Paging

2.6.3.12.7.4.1   Paging triggering function

The Core Network shall, when considered necessary, trigger the paging in the UTRAN system.

1.1.1.22.7.4.2   Paging execution function

The paging function shall be executed by UTRAN.

2.7.5   Location Management

The location management is used to maintain the information about the location of the terminal.

The location management of an idle terminal is handled within the CN at the level of Location/Routing Area. The UTRAN controls the location management of active terminals, i.e. the UTRAN knows which cells/URA are used by the active terminal.

2.72.8   Security Functions

2.7.12.8.1   Data Confidentiality

2.7.1.12.8.1.1   Radio interface ciphering function

The radio interface shall be ciphered upon request of the Core Network. Both Signalling and user data may be subject to ciphering. The ciphering shall be done within UTRAN.

This function uses the following RANAP Elementary Procedures:

- Cipher Mode Control

1.1.1.22.8.1.2   Ciphering key management function

The ciphering key and the used algorithm shall be supplied by the CN.

This function uses the following RANAP Elementary Procedures:

- Cipher Mode Control

1.1.1.32.8.1.3   User identity confidentiality function

Over a radio path a temporary identity shall be used instead of the permanent identity. The translation of the temporary identity to permanent identity shall mainly be handled by CN. Also the RNC has ability to use temporary identity for the user (RNTI).

Alternative text:

The UMTS user identity confidentiality is obtained by using a temporary UE identity rather than the permanent UE identity (i.e. IMSI) over the radio path.

The CN allocates to each visiting UE a temporary identity. This identity is used by the UE when establishing a new connection between the CN and the UE. It is used by the CN when requesting a page.

In addition, UTRAN allocates to each UE with established RRC connection a temporary identity (Radio Network Temporary Identity, RNTI). This identity is used to identify an UE when on common radio channels.

This function uses the following RANAP Elementary Procedures:

- Paging

2.8.2   Terminal identity check function

The terminal identity check be provided by the CN. The Iu interface is required to transport necessary request and response messages between the CN and UE.

This function uses the following RANAP Elementary Procedures:

- -

1.1.22.8.3 User Authentication function

The user authentication shall be provided by the CN. The authentication functions are transparent for the Iu Interface, and therefore outside the scope of Iu Interface documents.

This function uses the following RANAP Elementary Procedures:

- -

1.1.32.8.4 Data integrity

2.7.3.12.8.4.1 **Integrity checking**

The purpose of the integrity check is to make sure that the signalling continues between the same elements as by authentication. The integrity check shall be done within the UTRAN.

1.1.1.22.8.4.2 **Integrity key management**

The integrity key and the used algorithm shall be supplied by the CN.

2.82.9 **Service and Network Access Functions**

2.9.1 Core Network signalling data transfer function

The PS respective the CS CN signalling data such as Call Control (CC), Session Management (SM), Mobility Management (MM) and Supplementary Services (SS) shall be transparently conveyed over the Iu interface. The signalling information shall be conveyed transparently over the same Iu interface channel that is used for the UTRAN-CN signalling.

This function uses the following RANAP Elementary Procedures:

- Direct Transfer
- Initial UE

2.8.12.9.2 Transcoding function

The transcoding functionality is needed for changing the coding of a voice call from one coding scheme to another. The transcoder placement is within the CN. Theis transcoding functionality is therefore placed in the CN only. Over the Iu interface, transcoded speech shall be treated a data service with specific Quality of Service requirement.

This function uses the following RANAP Elementary Procedures:

- -

2.8.22.9.3 Call Control and Connection Management function

CC/CM messages shall be handled transparently by the Iu interface. The Iu interface provides a transportation link between the core network and the UE.

This function uses the following RANAP Elementary Procedures:

- Direct Transfer

2.9.4 CS data – Network Interworking function

The network interworking function is used to modify the Iu UP frames to match the requirements of the external network such as PSTN or ISDN. The network interworking function may consist of rate adaptation and/or error correcting link protocol such as GSM RLP.

The network interworking function between the CN and external networks (such as PSTN and ISDN) shall be handled by CN.

This function uses the following RANAP Elementary Procedures:

- -

2.9.5 SMS Point to Point transfer function

SMS Poin to point is a NAS service. SMS PP PDU are transparentlyy transferred accross UTRAN.

Usage of SAPI or priority indicator on SMS is FFS.

This function uses the following RANAP Elementary Procedures:

- Direct Transfer

2.8.32.9.6 Supplementary Services transfer function

Supplementary Services that are core network specific shall be handled transparently by the Iu interface.

Usage of priority indicator on SS is FFS.

This function uses the following RANAP Elementary Procedures:

- Direct Transfer

2.8.42.9.7 Charging

Charging shall be handled by CN. The charging may be based on the used radio resources, received Quality of Service or on the amount of transmitted data.

2.9.8 UE Tracing

This feature allows tracing of various events related to the UE and its activities. This is an O&M functionality.

This function uses the following RANAP Elementary Procedures:

- Trace Invocation

2.9.9 Location reporting function

The positioning function performs the determination of the geographical position for an UE. The location reporting function transfer the positioning information between the UTRAN and the CN according to CN commands. This function involves UTRAN and CN.

This function uses the following RANAP Elementary Procedures:

- Location Reporting Control
- Location Report

2.10 Coordination Functions

2.10.1 Paging Coordination function

The two CN domain architecture implies need for a page co-ordination, i.e. handling of page triggered by one CN node when MS has a signalling connection to the other CN node. This page co-ordination is performed by UTRAN. The Common ID is used for this co-ordination. The CN provides the UTRAN with the IMSI.

The paging coordination is a UTRAN function.

This function uses the following RANAP Elementary Procedures:

- Common ID

2.10.2 Relocation Coordination function

The two CN domain architecture implies need for relocation co-ordination, i.e etc…

The relocation coordination is a UTRAN function.

This function uses the following RANAP Elementary Procedures:

- Relocation Resource allocation
- Relocation preparation

2.10.3 Ciphering Coordination function

The two CN domain architecture implies need for ciphering co-ordination, i.e etc…

The ciphering coordination is a UTRAN function.

This function uses the following RANAP Elementary Procedures:

- Cipher Mode Control
- Relocation resource allocation (?)

3 Proposals

It is proposed to add the text and structure in section 2 of this contribution to section 5 of [1].

4 Reference

[1] 3GPP UMTS 25.410, *UTRAN Iu Interface, General Aspects and principles*, v.0.2.1, Source: Editor