3G-UMTS Call Flow (Originating Call)

User Equipment	UE-RNC Sessions		UTRAN	RNC-Core Network Sessions				Core Network	EventStudio System Designer
UE			RNC					MSC/VLR	06-Oct-13 07:24 (Page 1)

A 3G-UMTS originating call is described here. Setup radio bearers and RANAP signaling are covered in detail. You can click on most RANAP messages to see the full content of the message.

This call flow has been generated with from a Wireshark PCAP file using VisualEther (http://www.eventhelix.com/VisualEther/). The generated call flow was later modified with EventStudio (http://www.eventhelix.com/EventStudio/) to add comments and terminal level interactions.

3G Call Setup

RRC Connection Setup

RRC Connection Request (rrc → rrc)

UE Identity,
UE Capabilities,
Establishment Cause

UE wishes to establish a voice call so it requests a Radio Resource Control (RRC) connection.

RRC Connection Setup (rrc ← rrc)

Transport Channel Information,
Signaling Radio Bearer

The RNC accepts the RRC Connection Request and assigns a traffic channel. The message also creates a Signaling Radio Bearer (SRB).

RRC Connection Complete (rrc → rrc)

Ciphering Information

The UE responds back to signal the completion of the RRC Connection Setup.

RRC

RRC Connection Setup has been completed between the UE and the RNC. Signaling Radio Bearer (SRB) is also created at the time of the RRC connection setup.

CM Service Request

Initial UE Message [CM Service Request] (rrc → rrc)

The mobile sends an Initial UE Message that carries the CM Service Request as a NAS (Non Access Stratum) payload.

DTAP MM CM Service Request (ranap → ranap)

BCD Digits : 123456780000000

The CM Service Request is the first message to be received for the call from the RNC. This message also sets up the SCCP connection between the RNC and the Core Network. The "CM Service Request" also marks the start of an Iu connection.

SCTP SACK

The Core Network sends an SCTP level ack for the CM Service Request message.

SCCP Connection Confirm

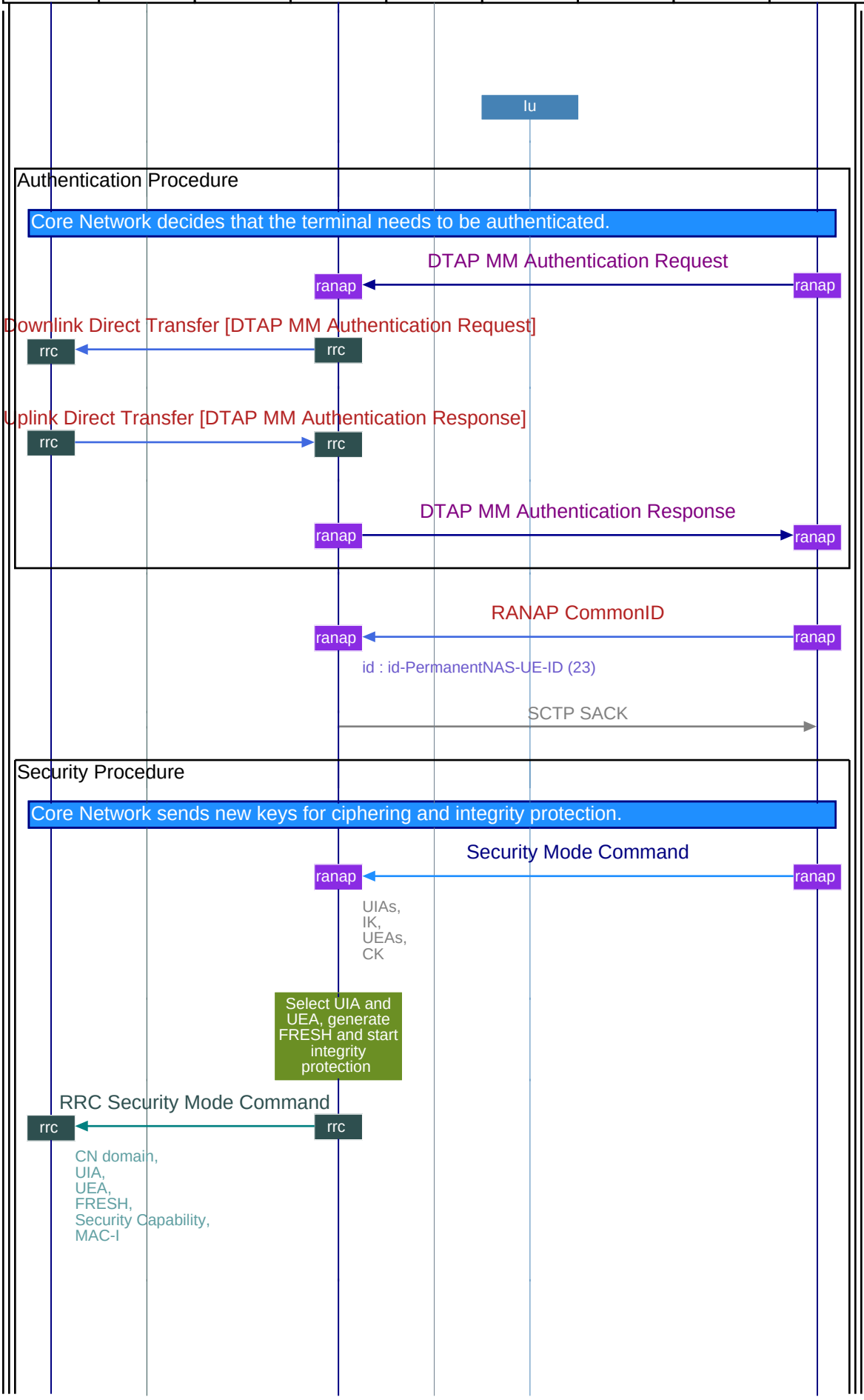
SCCP connection setup is confirmed.

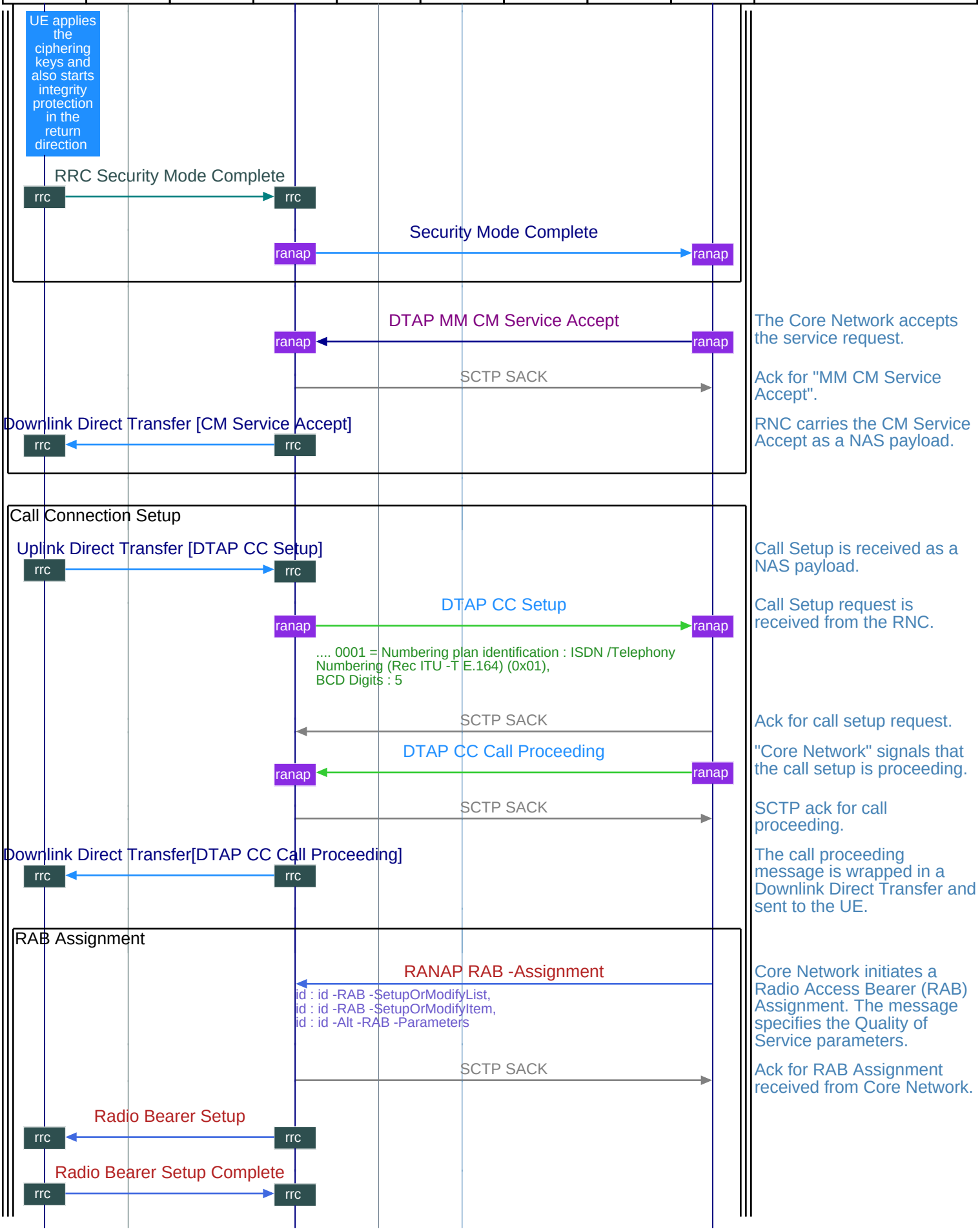
SCTP SACK

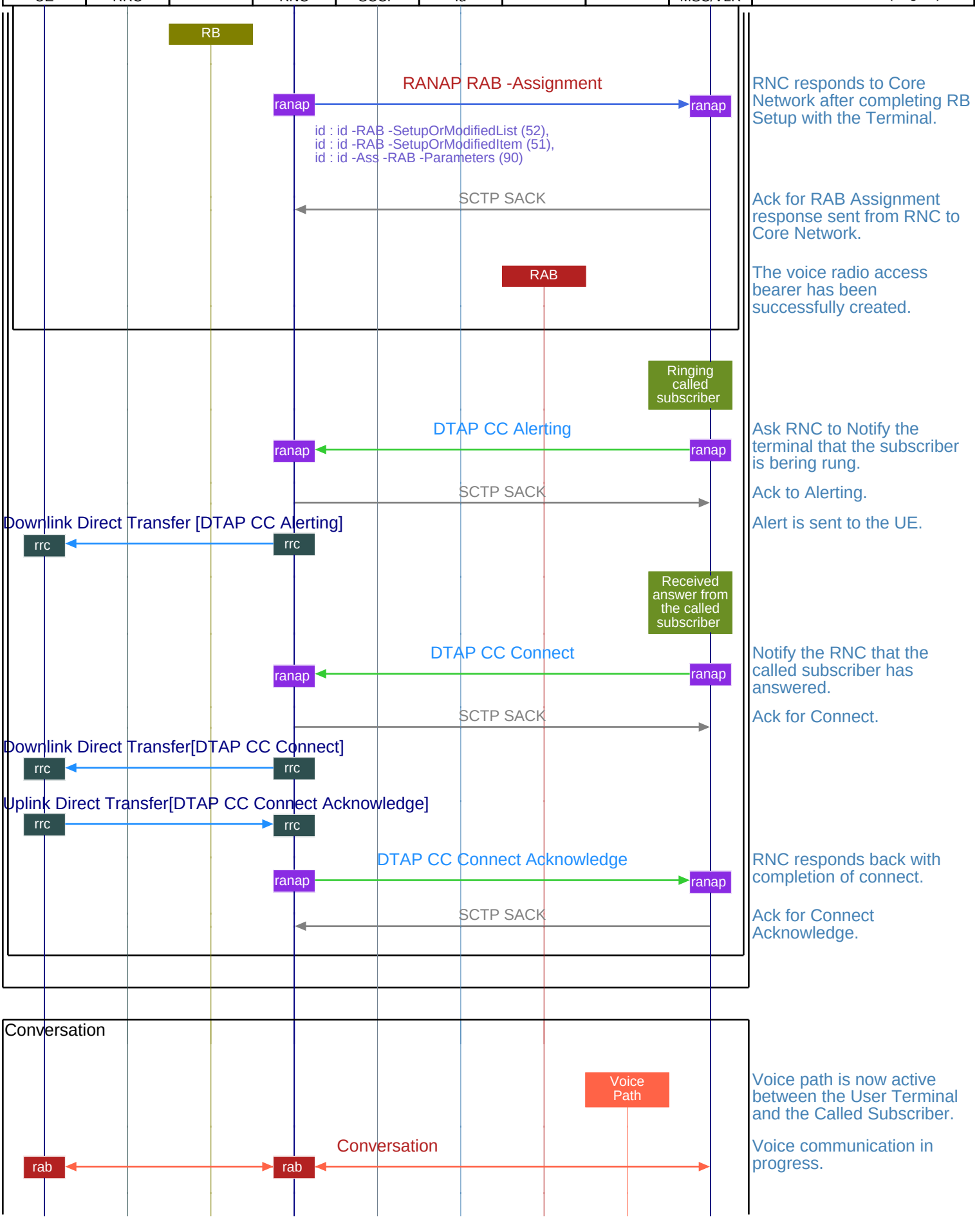
SCTP ack for SCCP Connection Confirm message.

SCCP

The SCCP connection has


been established between the RNC and the Core Network.
Iu
An Iu signaling connection is now active between the RNC and the Core Network.
Authentication Procedure
Core Network decides that the terminal needs to be authenticated.
DTAP MM Authentication Request
ranap
ranap
Downlink Direct Transfer [DTAP MM Authentication Request]
rrc
rrc
The Authentication Request is carried as NAS payload in a Downlink Direct Transfer RRC message.
Uplink Direct Transfer [DTAP MM Authentication Response]
rrc
rrc
The Authentication Response is carried as NAS payload in a Uplink Direct Transfer RRC message.
DTAP MM Authentication Response
ranap
ranap
RANAP CommonID
ranap
ranap
IMSI is sent to the RNC.
id : id-PermanentNAS-UE-ID (23)
SCTP SACK
SCTP level ack for Command ID.
Security Procedure
Core Network sends new keys for ciphering and integrity protection.
Security Mode Command
ranap
ranap
Core Network initiates ciphering and integrity Protection. The "MSC/VLR" sends the Security Mode Command message to RNC.
UIAs,
IK,
UEAs,
CK
Select UIA and UEA, generate FRESH and start integrity protection
RRC Security Mode Command
rrc
rrc
The RNC generates the RRC message Security mode command. The message includes the UE security capability, the ciphering capability, the UIA and FRESH to be used and if ciphering shall be started also the UEA to be used. This is the first message to be integrity protected. It contains the MAC-I integrity protection "checksum".
CN domain,
UIA,
UEA,
FRESH,
Security Capability,
MAC-I


UE applies the ciphering keys and also starts integrity protection in the return direction
RRC Security Mode Complete
rrc
rrc
Security Mode Complete
ranap
ranap
DTAP MM CM Service Accept
ranap
ranap
SCTP SACK
Downlink Direct Transfer [CM Service Accept]
rrc
rrc
Call Connection Setup
Uplink Direct Transfer [DTAP CC Setup]
rrc
rrc
DTAP CC Setup
ranap
ranap
.... 0001 = Numbering plan identification : ISDN /Telephony Numbering (Rec ITU -T E.164) (0x01),
BCD Digits : 5
SCTP SACK
DTAP CC Call Proceeding
ranap
ranap
SCTP SACK
Downlink Direct Transfer[DTAP CC Call Proceeding]
rrc
rrc
RAB Assignment
RANAP RAB -Assignment
id : id -RAB -SetupOrModifyList,
id : id -RAB -SetupOrModifyItem,
id : id -Alt -RAB -Parameters
SCTP SACK
Radio Bearer Setup
rrc
rrc
Radio Bearer Setup Complete
rrc
rrc
The Core Network accepts the service request.
Ack for "MM CM Service Accept".
RNC carries the CM Service Accept as a NAS payload.
Call Setup is received as a NAS payload.
Call Setup request is received from the RNC.
Ack for call setup request.
"Core Network" signals that the call setup is proceeding.
SCTP ack for call proceeding.
The call proceeding message is wrapped in a Downlink Direct Transfer and sent to the UE.
Core Network initiates a Radio Access Bearer (RAB) Assignment. The message specifies the Quality of Service parameters.
Ack for RAB Assignment received from Core Network.



RNC responds to Core Network after completing RB Setup with the Terminal.

Ack for RAB Assignment response sent from RNC to Core Network.

The voice radio access bearer has been successfully created.

Ask RNC to Notify the terminal that the subscriber is bering rung.

Ack to Alerting.

Alert is sent to the UE.

Notify the RNC that the called subscriber has answered.

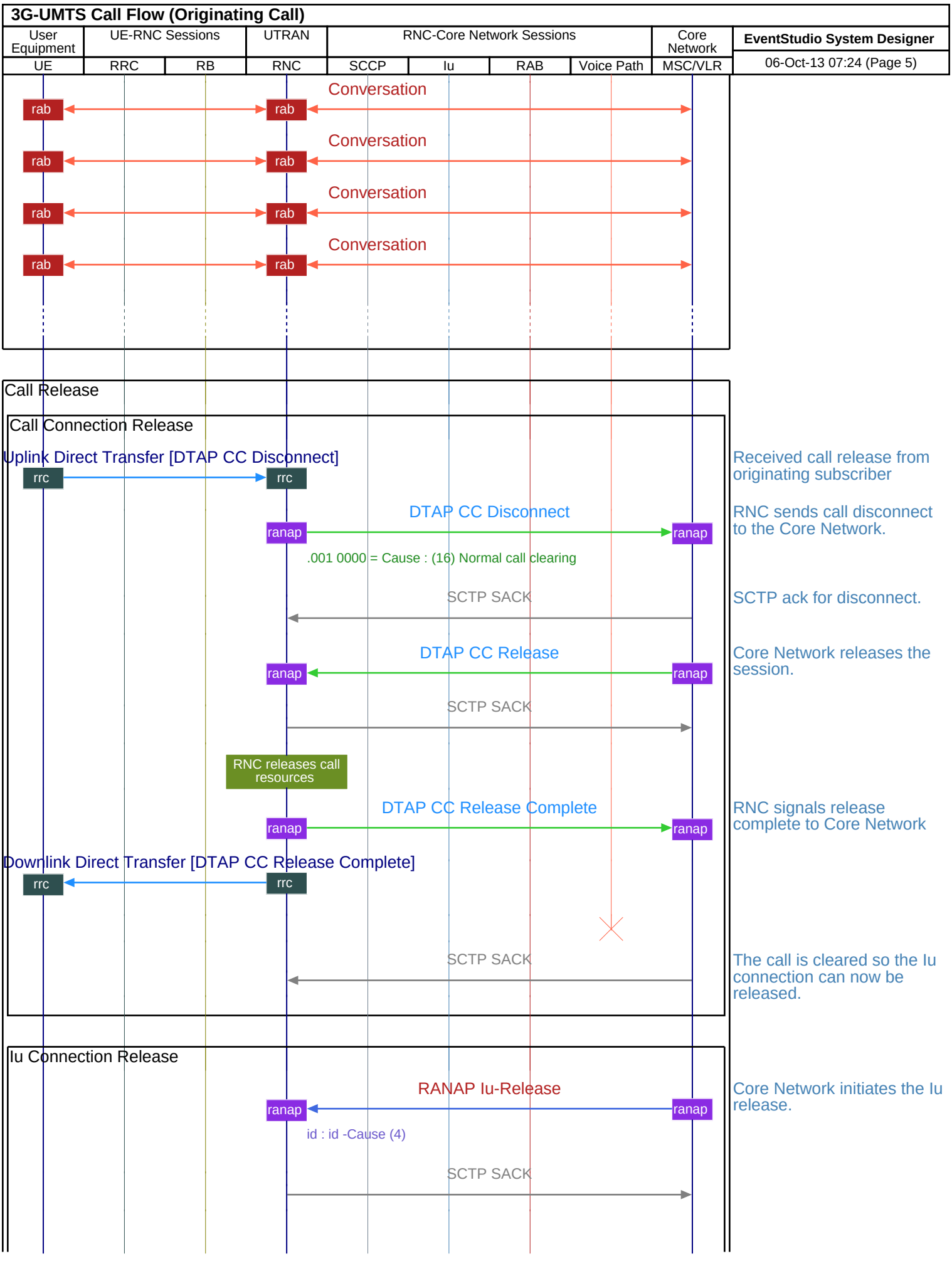
Ack for Connect.

RNC responds back with completion of connect.

Ack for Connect Acknowledge.

Voice path is now active between the User Terminal and the Called Subscriber.

Voice communication in progress.


3G-UMTS Call Flow (Originating Call)
User Equipment
UE-RNC Sessions
UTRAN
RNC-Core Network Sessions
Core Network
EventStudio System Designer
UE
RRC
RB
RNC
SCCP
Iu
RAB
Voice Path
MSC/VLR
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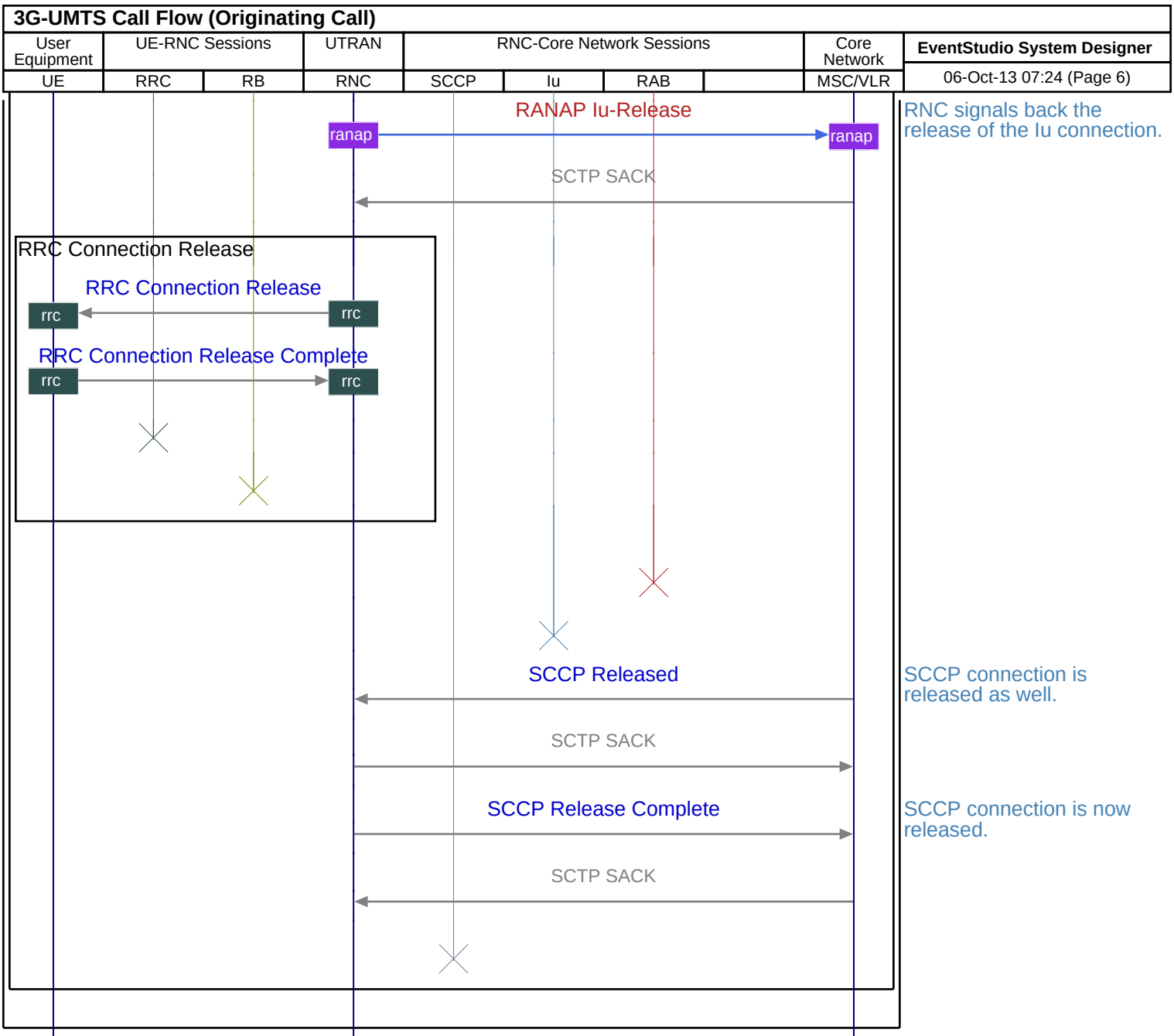
Conversation
rab
Conversation
rab
Conversation
rab
Conversation
rab
Call Release
Call Connection Release
Uplink Direct Transfer [DTAP CC Disconnect]
rrc
Received call release from originating subscriber
DTAP CC Disconnect
ranap
RNC sends call disconnect to the Core Network.
.001 0000 = Cause : (16) Normal call clearing
SCTP SACK
SCTP ack for disconnect.
DTAP CC Release
Core Network releases the session.
SCTP SACK
RNC releases call resources
DTAP CC Release Complete
RNC signals release complete to Core Network
Downlink Direct Transfer [DTAP CC Release Complete]
SCTP SACK
The call is cleared so the Iu connection can now be released.
Iu Connection Release
RANAP Iu-Release
Core Network initiates the Iu release.
id : id -Cause (4)
SCTP SACK



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Explore more call flow diagrams at: http://www.eventhelix.com/realtimemantra/telecom/