IMS Originating to PSTN ISUP Call (IMS-PSTN(ISUP) Call; Megaco/H.248 Signaling; IMS Caller Initiated Call Release)

Calling UE	IMS Core Network		PSTN Interface			EventStudio System Designer 6
Caller User Equipment	Visited IMS	Home IMS	Signaling		Media	
Caller	Orig P-CSCF	Orig S-CSCF	BGCF	MGCF	IM-MGW	24-Feb-13 15:23 (Page 1)

This call flow describes the call setup from one IMS subscriber to ISUP PSTN termination. The call is routed via the BGCF (Border Gateway Control Function) to the MGCF (Media Gateway Control Function). The MGCF uses one context with two terminations in IM-MGW (Media Gateway). The termination RTP1 is used towards IMS Core network subsystem entity and the bearer termination TDM1 is used for bearer towards PSTN CS network element.

This sequence diagram was generated with EventStudio System Designer (http://www.EventHelix.com/EventStudio).

IMS to PSTN(ISUP) call setup

Initiate Call

```
Called PSTN Telephone
Number
```

An IMS user initiates a call to a PSTN phone number.

IMS to PSTN Call Routing via BGCF

Prepare a list of supported codecs

INVITE

```
tel:<called phone number>,
caller@hims1.net,
caller supported coded list,
UE RTP Port,
UE IP Address
```

The Calling SIP phone sends INVITE to P-CSCF. The message includes the codecs available, the UE RTP port number and IP address.

Make sure INVITE was received over IPSec Security Association

The INVITE was sent using registration time SA so P-CSCF accepts the request.

INVITE

```
tel:<called phone number>,
caller@hims1.net,
caller supported coded list,
Record-Route:<Orig P-CSCF>
```

The Orig P-CSCF forwards INVITE to Orig S-CSCF. The IP Address of Orig S-CSCF was obtained at the time of Registration in 200 OK response to REGISTER message.

100 Trying

Orig P-CSCF acknowledges INVITE to Caller UE.

Use DNS to translate tel:<called phone number> to terminating SIP URI.

The conversion from PSTN telephone number to SIP URI required for routing fails which indicates that we have to reach called party in CS network.

Route session request to Breakout Gateway Control Function in the same network

The S-CSCF concludes that the destination address is in a PSTN network. So, the Orig S-CSCF forwards the request to a local BGCF.

INVITE

```
tel:<called phone number>,
S-CSCF address,
<caller@hims1.net,
<caller supported coded list,
Record-Route:<Orig S-CSCF> <Orig
P-CSCF>
```

The S-CSCF forwards the INVITE to the local BGCF (Breakout Gateway Control Function) for further routing of the call.

100 Trying

Based on further analysis of the destination address, and PSTN network configuration, the BGCF either selects a local MGCF to perform the termination or it forwards the request to a BGCF in another network who selects the MGCF to perform the termination.

INVITE

```
tel:<called phone number>,
S-CSCF address,
<caller@hims1.net,
<caller supported coded list,
Record-Route:<BGCF> <Orig S-CSCF>
<Orig P-CSCF>
```

The BGCF selects MGCF in the same network to route the call to the PSTN network. The BGCF forwards the INVITE to MGCF but it does not add itself to the Record-Route header, as it has no need to remain in the signaling path once the session is established.

100 Trying

100 Trying

IM-MGW Initial Setup

Select IM-MGW with circuits to given destination based on received SDP and local configuration data

MGCF selects IM-MGW to reserve outgoing channel towards the PSTN called party.

H.248: ADD.req

```
Context ID = ?,
Termination ID = ?,
UE Codec List,
UE RTP Port,
UE IP Address
```

MGCF requests the IM-MGW for a new context. The UE codec, IP address and RTP port number is specified in the message.

Prepare the Common Codec List

Prepare the "Common Codec List" by including the codecs in the "UE Codec List" that are supported by the "IM-MGW".

Reserve IMS Connection Point, Configure Remote Resources and Change IMS Connection=backward

Reserve resources for the RTP connection. The connection is marked as one way as the MGCF has not specified the other end of this connection.

H.248: ADD.Resp

```
Common Codecs List,
Selected local RTP Port,
Selected local IP address,
Context ID = C1,
Termination ID = RTP1
```

The IM-MGW responds with the allocated context, the common codecs, the local IP address and the RTP port.

183 Session Progress

```
Common Codecs List,
IM-MGW RTP Port,
IM-MGW IP Address,
Record-Route: <MGCF>, <BGCF>, <Orig S-CSCF>, <Orig P-CSCF>,
Contact: <MGCF>
```

The MGCF returns the media stream capabilities of the destination along the signaling path in a "183 Session Progress". The IM-MGW "Common Codec List", IP address and the RTP port number are included in the message.

H.248: ADD.req

```
Context ID = C1,
Termination ID = TDM1,
Request IM-MGW to reserve TDM
circuit
```

Now the MGCF requests the IM-MGW for a circuit switched port towards the PSTN network. Note that the this termination is being requested for the Context C1 that was setup for the RTP connection.

Allocate TDM-1 port and associate it with RTP-1 port.

Since the TDM circuit setup request was received for the same context id as the RTP-1 context, the IM-MGW associates the RTP-1 and TDM-1 ports.

Change TDM Through Connection = both

Mark this connection as bidirectional.

H.248: ADD.resp

```
Context ID = C1,
Termination ID = TDM1
```

IM-MGW responds with the circuit switched termination TDM1.

ISUP IAM

```
tel:<called phone number>
```

The MGCF sends IAM, containing the called party phone number digits, towards PSTN termination. The TDM-1 circuit information obtained from the IM-MGW is included in the message.

IMS Originating to PSTN ISUP Call (IMS-PSTN(ISUP) Call; Megaco/H.248 Signaling; IMS Caller Initiated Call Release)

Calling UE	IMS Core Network		PSTN Interface		
Caller User Equipment	Visited IMS	Home IMS	Signaling		Media
Caller	Orig P-CSCF	Orig S-CSCF	BGCF	MGCF	IM-MGW

Caller Media PDP Context Activation

Select the Codec indicated in 183 Session Progress

PRACK

Selected Codec

The Caller confirms the codec selection in PRACK towards MGCF.

begin Caller PDP Context Activation

H.248: MOD.req

Context = C1,
Termination = RTP1,
Selected Codec

The MGCF modifies the IM-MGW context to update the IM-MGW about the codec selected for the RTP session.

Configure IMS resources

H.248: MOD.resp

Context = C1,
Termination = RTP1

IM-MGW responds back.

200 OK (PRACK)

Selected Codec,
Selected UDP Port,
Selected IP Address

The codec selected is acknowledged to the UE.

end Caller PDP Context Activation

UPDATE

Since caller PDP Context Activation is over, notify the called end in UPDATE message.

200 OK (UPDATE)

The called end replies back with 200 OK.

ISUP COT

Based on the continuity support of the outgoing channel selected MGCF sends a COT message to the PSTN network.

Ringing

ISUP ACM

The path towards the called party is allocated in the PSTN network and address complete message, ACM containing subscriber free indication is sent to MGCF. The ACM message also indicates that the called party in the PSTN network is being alerted.

180 Ringing

The MGCF forwards called party alerting indication in 180 ringing message towards the Caller.

Ring Bac RTP: Ring Back Tone Ring Bac

The ring back tone is fed to the calling subscriber. The IM-MGW converts the tone into RTP. The UE converts it back to the ring back tone and feeds it to the calling subscriber.

PRACK

The Caller acknowledges the 180 ringing with PRACK message towards MGCF.

200 OK (PRACK)

The MGCF acknowledges the PRACK message with 200 OK message.

Conversation Mode

ISUP ANM

When the called party answers, the terminating PSTN network sends answer, ANM message towards MGCF.

H.248: MOD.req

Context ID = C1,
Termination ID = RTP1

Request a bidirectional through connection

Change IMS Through Connection = both

H.248: MOD.resp

Context ID = C1,
Termination ID = RTP1

H.248: MOD.req

Context ID = C1,
Termination ID = TDM1

Request activation of TDM voice processing function.

Activate TDM Voice Processing Function

H.248: MOD.resp

Context ID = C1,
Termination ID = TDM1

200 OK (INVITE)

The final response, 200 OK, is sent by the MGCF over the signaling path when the subscriber has accepted the incoming session attempt.

ACK

The Caller sends the final acknowledgement in ACK message towards MGCF.

Voice RTP: Voice Voice

Bidirectional voice path is now through. The IM-MGW converts RTP to voice and vice versa. UE also maps audio to RTP and back.

BYE

The Caller sends BYE towards MGCF when the calling party hangs up.

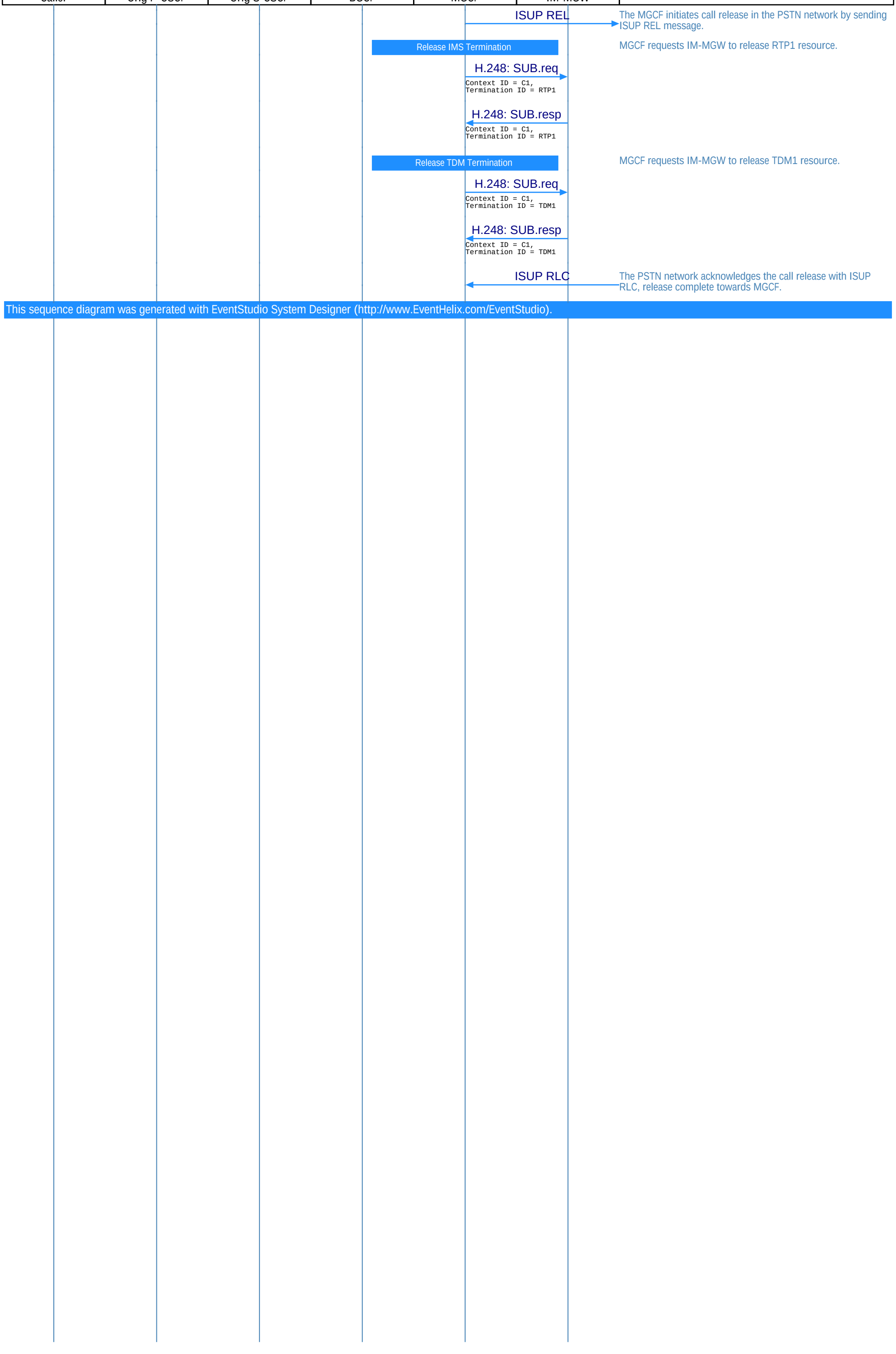
Drop media PDP context

200 OK (BYE)

The MGCF acknowledges with 200 OK message towards Caller.

IMS Originating to PSTN ISUP Call (IMS-PSTN(ISUP) Call; Megaco/H.248 Signaling; IMS Caller Initiated Call Release)

Calling UE	IMS Core Network		PSTN Interface			EventStudio System Designer 6
Caller User Equipment	Visited IMS	Home IMS	Signaling		Media	
Caller	Orig P-CSCF	Orig S-CSCF	BGCF	MGCF	IM-MGW	24-Feb-13 15:23 (Page 3)



IMS Originating to PSTN ISUP Call (Called PSTN Subscriber Initiates Release)

Calling UE	IMS Core Network		PSTN Interface			EventStudio System Designer 6
Caller User Equipment	Visited IMS	Home IMS	Signaling		Media	
Caller	Orig P-CSCF	Orig S-CSCF	BGCF	MGCF	IM-MGW	24-Feb-13 15:23 (Page 4)

This call flow describes the call setup from one IMS subscriber to ISUP PSTN termination. The call is routed via the BGCF (Border Gateway Control Function) to the MGCF (Media Gateway Control Function). The MGCF uses one context with two terminations in IM-MGW (Media Gateway). The termination RTP1 is used towards IMS Core network subsystem entity and the bearer termination TDM1 is used for bearer towards PSTN CS network element.

This sequence diagram was generated with EventStudio System Designer (http://www.EventHelix.com/EventStudio).

IMS to PSTN(ISUP) call setup

Voice

RTP: Voice

Voice

Bidirectional voice path is now through. The IM-MGW converts RTP to voice and vice versa. UE also maps audio to RTP and back.

ISUP REL

The call release initiated in the PSTN network is received by MGCF is ISUP REL message.

BYE

The MGCF responds with call release by sending BYE message towards the Caller.

Release IMS Termination

MGCF requests IM-MGW to release RTP1 resource.

H.248: SUB.req

```
Context ID = C1,
Termination ID = RTP1
```

H.248: SUB.resp

```
Context ID = C1,
Termination ID = RTP1
```

Release TDM Termination

MGCF requests IM-MGW to release TDM1 resource.

H.248: SUB.req

```
Context ID = C1,
Termination ID = TDM1
```

H.248: SUB.resp

```
Context ID = C1,
Termination ID = TDM1
```

ISUP RLC

After performing RTP1 and TDM1 resource release, MGCF sends release complete message, ISUP RLC towards the PSTN network.

Drop media PDP context

200 OK (BYE)

The Caller acknowledges the BYE by sending 200 OK towards MGCF.

This sequence diagram was generated with EventStudio System Designer (http://www.EventHelix.com/EventStudio).

IMS Originating to PSTN ISUP Call (IMS Network Initiates Call Release)

Calling UE	IMS Core Network		PSTN Interface			EventStudio System Designer 6
Caller User Equipment	Visited IMS	Home IMS	Signaling		Media	
Caller	Orig P-CSCF	Orig S-CSCF	BGCF	MGCF	IM-MGW	24-Feb-13 15:23 (Page 5)

This call flow describes the call setup from one IMS subscriber to ISUP PSTN termination. The call is routed via the BGCF (Border Gateway Control Function) to the MGCF (Media Gateway Control Function). The MGCF uses one context with two terminations in IM-MGW (Media Gateway). The termination RTP1 is used towards IMS Core network subsystem entity and the bearer termination TDM1 is used for bearer towards PSTN CS network element.

This sequence diagram was generated with EventStudio System Designer (http://www.EventHelix.com/EventStudio).

IMS to PSTN(ISUP) call setup

Voice → RTP: Voice → Voice

Bidirectional voice path is now through. The IM-MGW converts RTP to voice and vice versa. UE also maps audio to RTP and back.

BYE → BYE → BYE

The Orig S-CSCF initiates call release by sending BYE towards MGCF and the Caller.

Drop media PDP context

200 OK (BYE) ← 200 OK (BYE) ← 200 OK (BYE)

ISUP REL →

The MGCF initiates call release in the PSTN network by sending ISUP REL message.

Release IMS Termination

MGCF requests IM-MGW to release RTP1 resource.

H.248: SUB.req →

```
Context ID = C1,
Termination ID = RTP1
```

H.248: SUB.resp ←

```
Context ID = C1,
Termination ID = RTP1
```

Release TDM Termination

MGCF requests IM-MGW to release TDM1 resource.

H.248: SUB.req →

```
Context ID = C1,
Termination ID = TDM1
```

H.248: SUB.resp ←

```
Context ID = C1,
Termination ID = TDM1
```

ISUP RLC ←

The PSTN network acknowledges the call release with ISUP RLC, release complete towards MGCF.

This sequence diagram was generated with EventStudio System Designer (http://www.EventHelix.com/EventStudio).

IMS Originating to PSTN ISUP Call (MGCF Initiated Call Release)

Calling UE	IMS Core Network		PSTN Interface			EventStudio System Designer 6
Caller User Equipment	Visited IMS	Home IMS	Signaling		Media	
Caller	Orig P-CSCF	Orig S-CSCF	BGCF	MGCF	IM-MGW	24-Feb-13 15:23 (Page 6)

This call flow describes the call setup from one IMS subscriber to ISUP PSTN termination. The call is routed via the BGCF (Border Gateway Control Function) to the MGCF (Media Gateway Control Function). The MGCF uses one context with two terminations in IM-MGW (Media Gateway). The termination RTP1 is used towards IMS Core network subsystem entity and the bearer termination TDM1 is used for bearer towards PSTN CS network element.

This sequence diagram was generated with EventStudio System Designer (http://www.EventHelix.com/EventStudio).

IMS to PSTN(ISUP) call setup

Voice

RTP: Voice

Voice

Bidirectional voice path is now through. The IM-MGW converts RTP to voice and vice versa. UE also maps audio to RTP and back.

BYE

The MGCF initiates the call release by sending BYE towards the Caller.

ISUP REL

The MGCF initiates call release in the PSTN network by sending ISUP REL message.

Release IMS Termination

MGCF requests IM-MGW to release RTP1 resource.

H.248: SUB.req

```
Context ID = C1,
Termination ID = RTP1
```

H.248: SUB.resp

```
Context ID = C1,
Termination ID = RTP1
```

Release TDM Termination

MGCF requests IM-MGW to release TDM1 resource.

H.248: SUB.req

```
Context ID = C1,
Termination ID = TDM1
```

H.248: SUB.resp

```
Context ID = C1,
Termination ID = TDM1
```

ISUP RLC

The PSTN network acknowledges the call release with ISUP RLC, release complete towards MGCF.

Drop media PDP context

200 OK (BYE)

The Caller acknowledges the BYE message with 200 OK towards MGCF.

This sequence diagram was generated with EventStudio System Designer (http://www.EventHelix.com/EventStudio).