Technical Specification for SIP User Equipment (UE) using the IMS platform of Telefónica Germany

Responsible
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1 Introduction

This Document describes the interface of the User Equipment (UE) connected to the fixed network IMS platform of Telefónica Germany.

The Telefónica Germany IMS network is based on national or international specifications. It is vital that the therein defined procedures are followed to avoid interoperability issues and to avoid breaking any related protocols.

All normative procedures of TS 23.228, TS 24.229, TS 29.328, TS 29.329, TS 32.275, TS 32.295, TS 32.297, TS 33.203 and TS 33.210 are mandated by this detailed interface specification for the interworking with the corresponding network elements, i.e. they must be supported. This includes any procedures or functionality that is specified by using the “shall” and “should” key word in the aforementioned specifications. Please be referred to the 3GPP definition of these key words (see also RFC 2119).

Deviations from and restrictions to this general rule are defined within this interface specification where applicable to tailor the procedures of 3GPP defined specifications. In addition, this interface specification will define additional functionality that may not be part of any 3GPP specification.

The UE should be specified as defined in TS 24.173. Several supplementary services have been standardized in 3GPP for MMTel. The general rule defined in this subsection also applies for any specification that is normatively referenced in this document.

2 User Equipment

2.1 General

An IMS system also includes from an end-to-end perspective a User Equipment (UE) as no services can be provided to the end-user otherwise. It is therefore of vital interest to also consider the UE in the system design (see TS 23.002 and TS 24.229). As a consequence thereof, this section will summarize the expected CPE behavior and procedures to ensure a correct service provision.

2.2 UE Types

This subsection will define the minimum UE functionality required for interoperability to Telefónica Germany's IMS System.
Note that it is the clear goal of Telefónica Germany to use network equipment that is compliant to 3GPP IMS Rel-7 or higher Thus, the UE should also be -as much as possible- compliant to the relevant IMS specifications listed the table below. This table contains the major 3GPP and IETF RFCs which are design relevant. They can be downloaded from https://www.ietf.org/rfc and https://www.3gpp.org/ftp/Specs/latest.

Title / ID	Description / Relevance	Version
TS 23.002	Network architecture	Rel-7, Plenary Release 06-2008
TS 23.003	Numbering, addressing and identification	Rel-7, Plenary Release 06-2008
TS 23.228	IP Multimedia Subsystem (IMS);Stage 2	Rel-7, Plenary Release 06-2008
TS 24.173	IMS multimedia telephony communication service and supplementary services; Stage 3	Rel-7, Plenary Release 06-2008
TS 24.229	IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3	Rel-7, Plenary Release 06-2008
TS 24.406	Message Waiting Indication (MWI): Protocol specification	Rel-7, Plenary Release 06-2008
TS 24.604	Communication Diversion (CDIV) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification	Rel-7, Plenary Release 06-2008
TS 24.605	Conference (CONF) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification	Rel-7, Plenary Release 06-2008
TS 24.607	Originating Identification Presentation (OIP) and Originating Identification Restriction (OIR) using IP Multimedia (IM) Core Network (CN) subsystem	Rel-7, Plenary Release 06-2008

Title / ID	Description / Relevance	Version
TS 24.608	Terminating Identification Presentation (TIP) and Terminating Identification Restriction (TIR) using IP Multimedia (IM)Core Network (CN) subsystem.	Rel-7, Plenary Release 06-2008
TS 24.610	“Communication HOLD (HOLD) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification”.	Rel-7, Plenary Release 06-2008
TS 24.611	Anonymous Communication Rejection (ACR) and Communication Barring (CB) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification	Rel-7, Plenary Release 06-2008
TS 24.615	Communication Waiting (CW) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification	Rel-7, Plenary Release 06-2008
TS 24.628	Common Basic Communication procedures using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification	Rel-7, Plenary Release 06-2008
[TS 24.629	Explicit Communication Transfer (ECT) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification.	Rel-7, Plenary Release 06-2008
TS 26.114	Multimedia Telephony; Media handling and interaction	Rel-7, Plenary Release 06-2008
TS 33.203	3G security; Access security for IP-based services	Rel-7, Plenary Release 06-2008
TS 33.210	3G Security; Network Domain Security; IP network layer security	Rel-7, Plenary Release 06-2008
RFC 2782	A DNS RR for specifying the location of services (DNS SRV)	Feb 2000
RFC 4733	RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals	Dez 2006
RFC 2976	The SIP INFO Method	Oct 2000
RFC 3261	SIP: Session Initiation Protocol	Jun 2002
RFC 3262	Reliability of Provisional Responses in the Session Initiation Protocol (SIP)	Jun 2002
RFC 3264	An Offer/Answer Model with the Session Description Protocol (SDP)	Jun 2002
RFC 3265	Session Initiation Protocol (SIP)-Specific Event Notification	Jun 2002
RFC 3311	The Session Initiation Protocol (SIP) UPDATE Method	Sep 2002

Title / ID	Description / Relevance	Version
RFC 3312	Integration of Resource Management and Session Initiation Protocol (SIP)	Oct 2002
RFC 3323	A Privacy Mechanism for the Session Initiation Protocol (SIP)	Nov 2002
RFC 3325	Private Extensions to the Session Initiation Protocol (SIP) for Asserted Identity within Trusted Networks	Nov 2002
RFC 3455	Private Header (P-Header) Extensions to the Session Initiation Protocol (SIP) for the 3rd-Generation Partnership Project (3GPP)	Jan 2003
RFC 3680	A Session Initiation Protocol (SIP) Event Package for Registrations	Mar 2004
RFC 3959	The Early Session Disposition Type for the Session Initiation Protocol (SIP)	Dec 2004
RFC 3960	Early Media and Ringing Tone Generation in the Session Initiation Protocol (SIP)	Dec 2004
RFC 4028	Session Timers in the Session Initiation Protocol (SIP)	Apr 2005
RFC 4240	Basic Network Media Services with SIP	Dec 2005
RFC 4244	An Extension to the Session Initiation Protocol (SIP) for Request History Information	Nov 2005
RFC 4566	SDP: Session Description Protocol	Jul 2006
RFC 4722	Media Server Control Markup Language (MSCML) and Protocol	Nov 2006

2-1: 3GPP and IETF RFCs

2.2.1 UE Type One: Integrated Access Devices (IADs)

An Integrated Access Device (or IAD) is a Customer Premises Equipment, CPE, that provides access to wide area networks and the Internet. Specifically, it aggregates multiple channels of information including voice and data across a single shared access link towards Telefónica Germany's PoP (Point of Presence). The access link may be realized by a DSL connection, cable access or fiber connection.
An IAD provides several interfaces to communication devices that are also located in the customer premise. PSTN phones, ISDN phones and Fax devices can in general be attached to an IAD which provides the necessary interworking and protocol conversion towards the Telefónica Germany IMS system. The IAD is therefore - from an IMS network perspective - an IMS UE resp. SIP User Agent.

2.2.1.1 IP-CAN Functionality

The IAD must support the required functionality for broadband access as described in "Digital Broadband Access Interfaces.pdf".

2.2.1.2 P-CSCF Discovery Procedure

The UE is configured with a P-CSCF Domain Name either by automatic or manual configuration. After the UE established an IP-CAN connection and obtained an IP address, the UE shall perform the following procedure to obtain a list of available P-CSCFs IP addresses, transport protocol and port (see also RFC 3263 and TS 24.229, 5.1.1.2 and 5.2.2):

1. Send a DNS SRV request to the configured DNS sever to resolve the given P-CSCF Domain Name. SIP over UDP shall be queried for the configured P-CSCF Domain Name. The indicated transport protocol and port must be used in accordance with RFC 3263 and TS 24.229, 5.1.1.2 and 5.2.2.
2. Resolve the target host names that are part of the DNS SRV responses in accordance with the indicated priority/weight to a list of IP addresses via DNS A requests
3. Use the first IP address of the delivered list as P-CSCF IP address for registering on the IMS network

In case the default P-CSCF is not available the UE chooses the backup P-CSCF for registration purposes as advised by the DNS SRV response. It needs to be mentioned that the procedures described in TS 24.229 subsection 5.1.1.2, 5.1.1.4 and 5.1.2A.1 must be followed in any case for the treatment of SIP timer B, H and F. This means that the UE detects a P-CSCF failure by timed out SIP transactions (even INVITE transaction) in accordance with TS 24.229.
The UE shall support and use the TTL as indicated in the DNS SRV response. If the UE is power cycled, the cached DNS responses shall be considered as stale and a new P-CSCF discovery procedure shall be performed, i.e. any old P-CSCF addresses shall be overwritten/replaced.
If the UE has tried all P-CSCFs that are known from the last P-CSCF discovery procedure, the UE shall perform a new P-CSCF discovery procedure and shall use the newly received P-CSCF list in exactly the same way as described above, i.e. all previously disabled P-CSCF are valid again if they are part of the new DNS SRV response. Furthermore, the UE shall wait for an implementation specific time between 180 to 480 seconds before attempting a new initial registration.
The references to the UE procedures of TS 24.229 imply that the UE shall also support and honor the Retry-After header if returned in responses to a REGISTER request.

2.2.1.3 P-CSCF Service Interruption and UE Reaction

In case the default P-CSCF is not reachable anymore due to downtime or network issues, the UE is out of service as well. In order to increase the service availability, a failover strategy to a backup P-CSCF must be implemented in the UE. In summary, the UE detects a P-CSCF failure by timed out SIP transactions in accordance with TS 24.229 and subsection 2.2.1.2.

2.2.1.4 UE Fallback to the Default P-CSCF

To rebalance the load among all P-CSCFs after the unavailable P-CSCF is again reachable due to recovery, the shifted / fail overed UEs shall fall back from the backup to the primary P-CSCF. Different triggers can be differentiated that could cause the UE's fallback to the default P-CSCF:

A) Network initiated P-CSCF fallback

B) UE initiated P-CSCF fallback

The IMS Network related parts of the mechanisms are not relevant for this interface specification. The following UE procedures are defined in addition to enable the network initiated triggers:

1. The UE must support the procedure as defined in TS 24.229 subsection 5.1.1.2 and 5.1.1.4 for the handling of the responses to a REGISTER request.
2. If the UE's IP address of the IP-CAN bearer that is used for SIP signalling is reassigned/changed (e.g. due to interruption of the PPPoE session), the IMS/SIP stack shall be initialized as well resulting in performing a new P-CSCF discovery procedure and consequently in getting a fresh list of P-CSCF IP addresses. This leads to an implicit fallback when the UE was in failover state.

   This functionality should be an ordinary UE procedure it is however defined here as it is an essential function.

For item B) above the UE shall support the following:

1. The UE shall tear down and re-establish the IP-CAN bearer that is used for SIP signalling once during night-time ("Endgeräteseitige Zwangstrennung"). The IMS/SIP stack shall be initialized before the IP-CAN bearer is re-established so that a new P-CSCF discovery procedure is performed. In other words, the UE shall delete its internal states and shall start up the DNS and SIP/IMS procedures from scratch to guarantee an automatic fallback to the primary P-CSCF.

   The described signalling IP-CAN bearer reset shall not be performed by all UEs at the same point in time to avoid IMS network overload conditions. The UEs shall therefore uniformly distribute the reset execution during a time-window of 01:00 and 05:00 o'clock at night, e.g. by using a random reset timer within this window. In addition, an alignment of the reset execution time with the re-registration time is advisable.
   The described UE initiated IP-CAN bearer reset (e.g. PPPoE in case of xDSL IP-CAN) shall be suspended when there are established calls ongoing and shall be executed when all active dialogs have been terminated to avoid service degradation. However, the UE must perform the signalling IP-CAN bearer reset once during night-time, i.e. at the end of the day IMS sessions must get disconnected that are ongoing over a long period of time during the reset time window.

2.2.1.5 S-CSCF Service Interruption and UE Reaction

The UE must support the procedure as defined in TS 24.229 subsection 5.1.2A.1.6 (Rel-8). As stated there, the reception of a 504 (Server Time-Out) response with a 3GPP defined XML body to a non-REGISTER request triggers as part of the so-called IMS Restoration Procedures a new initial registration by the UE. Another S-CSCF will be assigned to the UE as a consequence thereof. This allows the UE to react on an S-CSCF failure for non-REGISTER requests.

2.2.1.6 Control Plane Functionality – IMS Registration

The UE shall support at least SIP Digest without TLS as the IMS access security mechanism (see TS 24.229 and TS 33.203). The UE must be prepared that every SIP request sent to the network is challenged and authenticated. Enhanced SIP Digest (next nonce mechanism) must also be supported.
The UE shall handle error responses to a REGISTER request in accordance with TS 24.229, especially subsection 5.1.1.2 and 5.1.1.4. This also includes the retry-after header usage. The procedures and guidelines defined in this document have preference over the ones in TS 24.229.
The UE shall deregister from the IMS network when it is switched off/powered down before it goes offline. This ensures that the IMS network is aware of the correct UE registration state.
The UE shall not add the IMPU in the user part of the SIP URI that is used as the Contact Address. This would reveal the IMPU to the called party even in case OIR is applied.

The UE shall NOT send REGISTER to fetch bindings in order to minimize load on IMS network elements.

For CPEs registering multiple SIP accounts, REGISTER messages for each IMPU shall be sent sequentially, either when previous IMPU has been registered successfully or with a minimum delay of 1sec.

2.2.1.7 IMS Session Setup - Initial Request for a Dialog or Standalone Transaction

The UE should support the Rel-8 enhancements regarding “IMS Restoration Procedures”. Thus, the UE shall support the procedures as described in subsection 5.1.2A.1.6 in TS 24.229-8.7.0 (or later). However, this does not mean that this relaxes any other requirements/procedures described in the related subsections of TS 24.229.
Special attention must be given to error conditions and how to recover from UE and network failures. However, TS 24.229 already covers some of the failure conditions and contains procedures for recovery, i.e. as part of the IMS restoration procedures. It is important in this regard that the UE detects a P-CSCF failure and reacts in this case as required. Thus special attention must be paid to the following sentence of TS 24.229 in subsection 5.1.2A.1.1:
“When a SIP transaction times out, i.e. timer B, timer F or timer H expires at the UE, the UE may behave as if timer F expired, as described in subclause 5.1.1.4.”
The design at hand mandates this behavior, i.e. “may” is overwritten with a “must”. This leads to the UE performing a new initial registration or even P-CSCF discovery when non-REGISTER transactions time out.

2.2.1.8 MMTel Service support in the UE

3GPP’s MMTel service consists basically of a voice service and several supplementary services. The umbrella specification for MMTel is TS 24.173. The different supplementary services are specified in dedicated 3GPP specifications that are also listed in subsection 2.2.. However, the following supplementary services must be supported by the UE:

- CLIP/OIP: Calling Line Presentation/Originating Identification Presentation in accordance with TS 24.607
- CLIR/OIR: Calling Line Restriction/Originating Identification Restriction in accordance with TS 24.607
- COLP/TIP: Connected Line Presentation/Terminating Identification Presentation (new term) in accordance with TS 24.608
- COLR/TIR: Connected Line Restriction/Terminating Identification Restriction (new term) in accordance with TS 24.608
- CDIV: Communication Diversion in accordance with TS 24.604

- CFB: Call Forwarding Busy in accordance with TS 24.604
- CFNR: Communication Forwarding No Reply in accordance with TS 24.604
- CFU: Communication Forwarding Unconditional in accordance with TS 24.604
- CW: Call Waiting in accordance with TS 24.615
- HOLD: Call Hold in accordance with TS 24.610
- CB: Call Barring in accordance with TS 24.611
- OCB: Outgoing Call Barring in accordance with TS 24.611
- ACR: Anonymous Call Rejection in accordance with TS 24.611
- CONF: Conference (3-party conferencing): Despite that TS 24.605 specifies this supplementary service, only UE mixed conferences are supported. This means that each UE in the 3-party conference has an active session with the other two parties. No conference focus resp. centrally mixed conferences are supported.

Services that are realized solely by the UE without any IMS network involvement may be supported as long as a certain service is not explicitly forbidden by the IMS network. A UE-only service may be for instance ECT that is completely handled by the UE and which does not make use of 3PCC procedures provided by the MMTEL Application Server.
In general, Telefónica Germany requires the UE not to contain and execute services as this may result in interoperability problems with the same or similar services provided by the IMS network. Communication Forwarding (CFx) is an example for such a service.
No special SIP procedures are defined for the UE for the MMTel service and the supported supplementary services while taking the above referenced 3GPP specifications into account. Important is in this respect that the UE supports the SIP privacy mechanism as specified in TS 24.229, subsection 5.1 (RFC 3323 and RFC 3325). Subsection 1 is also valid for the UE.

Video telephony is not supported in the current IMS network even when covered by TS 24.173. IMS Communication Service and Application Identifiers as specified in TS 24.229 are not supported.
Mobile devices are not in scope of this interface specification so that the UE shall at least support the following codecs:

- G.711 a-law

It is recommended that the CPE supports more codecs than are explicitly required in this subsection, the more the better. The support of the G.722 codec (wideband codec) is recommended to foster the usage of high quality speech communications.
The UE shall support “symmetric RTP” in accordance with RFC 4961.

2.2.2 DTMF

The UE shall support RFC 4733 based DTMF. In case the remote party does not support it the UE shall also be able to send and received DTMF inband.

2.2.3 FAX Service support in the UE

The UE shall be able to send and receive Fax inband.
The UE may support T.38 for sending and receiving FAX messages but T.38 support in the network cannot be guaranteed as it depends on the support of T.38 in IP-CAN.

2.2.4 MMTel Service Configuration

The Ut interface is not supported for Telefónica Germanys fixed network IMS Voice Service. Configuration of supplementary service settings are done via so-called Feature Access Codes (FAC). The UE must transparently forward the dialed FAC towards the network as part of the Request URI.

2.2.5 UE Type Two: Softphones

Softphones are Software Phones, i.e. a software program that uses a general purpose computer for making phone calls (e.g. IMS Sessions/Calls). The capabilities and supported services of Softphones vary but they are in general more feature rich than devices connected to an IAD (PSTN/ISDN phones).
There is no difference from SIP or IMS signalling perspective between IADs and Softphones besides any beyond the used IP-CAN bearer. Softphones are NOT in scope of the current MMTel System.