GMSC-IWF-IMS: Standard GMSC with advanced IWF for SIP
For fix and mobile terminals (Voice and SMS)

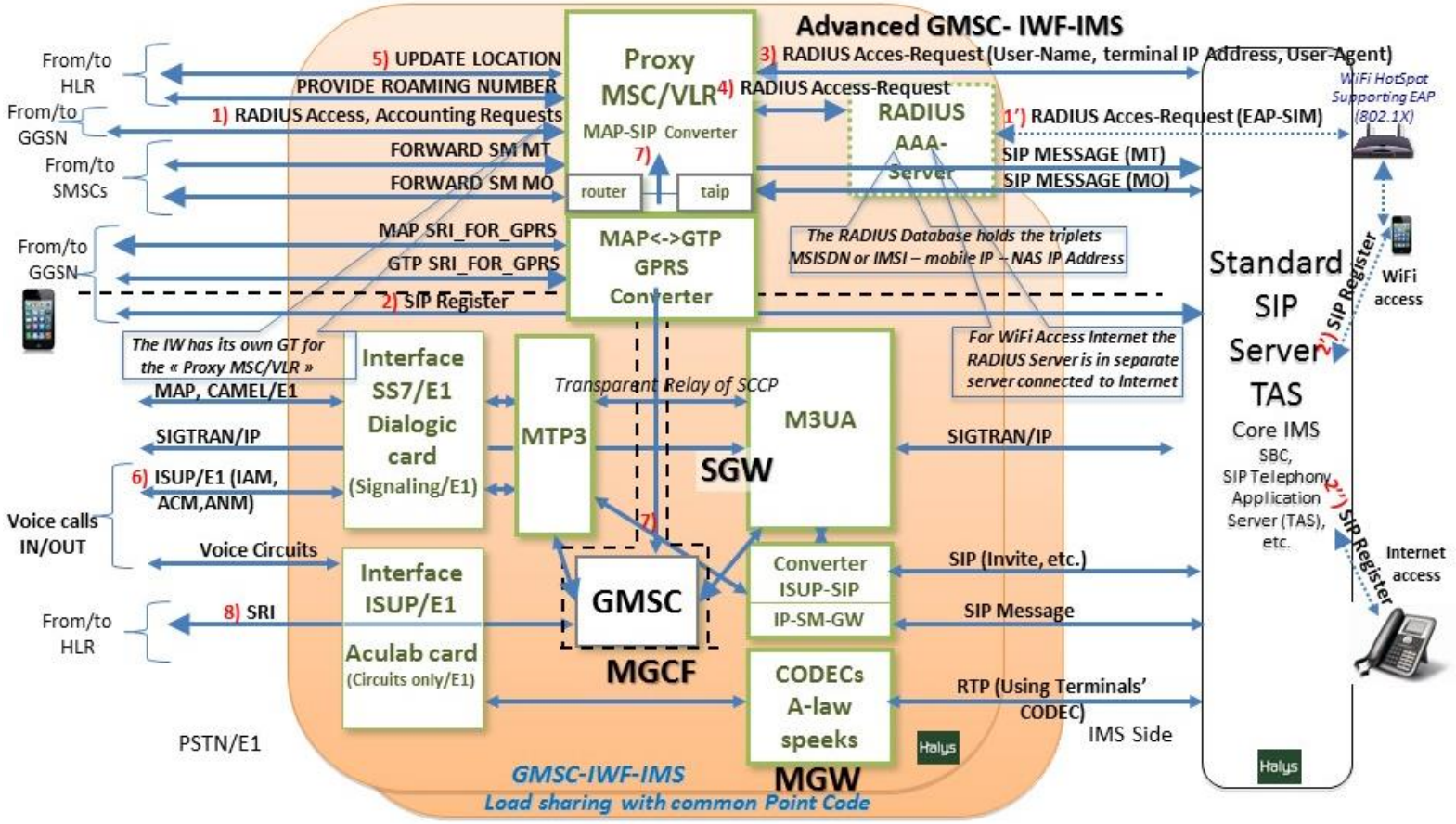

Fig 1 Architecture of Standard GMSC with advanced IWF for IMS fix and mobile terminals (Voice and SMS)

This can be used as *a standard GMSC for mobile networks*. But it is also an0 IWF for IMS equipped operators which allows *SIP <-> PSTN, SIP <-> mobiles* and of course mobile <-> PSTN (role of a GMSC) for voice and SMS services.

The GMSC-IWF-IMS allows to connect SIP services for fix-line terminals to an ISUP PSTN using TDM/E1 connections. It can also be used as a standard STP with conversion features such as ISUP<->SIP, E1<->SIGTRAN and GTP<->MAP (used to implement the Gc Interface between GGSN and a HLR).

To provide the SIP services for mobile terminals, it also allows to connect to a GMSC using MAP and ISUP for voice both over SIGTRAN and TDM/E1 connections. It can also be used as a *Stand-alone full GMSC* (6), (7), (8) .

The GMSC-IWF-IMS *provides the full Media and Signaling conversion Gateways for an IMS System in a clearly identified function.* It can be used with any standard Core IMS with any SIP servers such as Asterix, Halys uses Kamaïlo, etc., *having a RADIUS interface for authentication.*

1-Principle for mobile terminals

This case is the most complicated as it uses the "Proxy VLR" integrated in the converter which has then its own GT. First the mobile registers for GPRS in the Data Network and the GGSN uses the RADIUS server to authenticate the mobile using a RADIUS request (1) from a 3G or 4G Access, (1') from a WiFi Access with EAP 802.1X. The terminal attempts to register on the SIP server (2), (2'), (2'').

The RADIUS server keeps a Data base of triplets for the mobile MSISDN or IMSI-mobile IP address – NAS IP Address which is used by the IW for all procedures.

When the terminal registers on the SIP server, the SIP server accesses the integrated RADIUS for authentication and sends an Access–Request (3) as shown at the top right of the diagram. The RADIUS server then triggers (4) an Update Location to the HLR (5) using the "Proxy VLR" function.
As a result any request for incoming calls or SMS-MT to this terminal will be sent to the "Proxy VLR" of the IWF-IMS when the HLR will send it the Provide Roaming Number. A SMSC will also send the FORWARD_SM_MT to the "Proxy VLR". The "Proxy VLR" is a major patented feature of the IWF-IMS to provide the reception of calls and SMS from the GSM world to mobile terminals which need only to be registered in the SIP server. This could be using a mobile network (the SIP server is connected on the Gi Interface of the GMSC), or a simple WiFi access, *or SIP fix terminal*. For SMS the IWF-IMS is able to convert MAP SMS to SIP messages both way. The IWF-IMS includes the MAP<->GTP conversion to allow a GGSN to interrogate the HLR to obtain the address of the serving SGSN and *implement the Network Initiated Context Establishment procedure*.
The subscribers can select with a profile in their HLR to receive calls and SMS over GSM although there are registered in the IMS Core. Simply the GT of the IWF-IMS is barred when the Update Location from the "Proxy VLR" comes to the HLR. The previous *real VLR* is then kept.

2-Use with WiFi connected terminals

The WiFi boxes will use the RADIUS server of the IWF-IMS as it provides the EAP-SIM authentication which avoids to have to distribute passwords as the EAP-SIM protocol allows to read the IMSI in the SIM card of mobile terminals while using WiFi. *The RADIUS will send in addition a Send Authentication Info to the HLR.* In order to separate the public Internet access from the IWF-IMS, *the RADIUS server* (and the IMS Core) connected to public accesses *must be in a separate physical server* with the proper Firewalls.

3-Use with fixed terminals

The IWF-IMS in association with an advanced HLR-HSS such as HALYS can be used to provide *the fixed-mobile convergences automatically*. The subscriber can have a mobile terminal (connected to GSM or WiFi) and a fix terminal with different numbers (MSISDN in one case, DDI in the other). When he connects either one, he receives calls and SMS-MT to the last activated terminal. Both terminals are handled by the HLR-HSS.
The fixed terminals have a number (DDI) and the GMSC-IWF-IMS *works as a GMSC* interrogating the HLR-HSS for the incoming calls from the PSTN. The HLR-HSS returns as MSRN the DDI number *without needing a PRN* to the "Proxy VLR".
For outgoing calls from the terminals to PSTN numbers, the SIP server sends an Invite to the IWF-IMS which converts to ISUP with the inclusion of the calling party number.
An advanced HLR-HSS can also provide the automatic search: if the DDI does not answer, it calls automatically the mobile number.

4-Requirements for the SIP Server

Today, many handsets: IoS, recent Androïd use a power saving mode, they must be reactivated with a "notification Server" before receiving a SIP call. With the GMSC-IWF-IMS, the switchover for the reception of SIP calls to the normal 3G reception is automatic when the SIP Server does not receive regular SIP messages and stops sending regular keepalive "Access Request" to the GMSC-IWF-IMS. Thus it is required if the SIP phone uses TCP that the SIP Server sends regular "TCP keepalive" as it keeps the handset sending regular SIP REGISTER; it also avoids to have a notification Server.

Patents:
« Système de terminaisons d'appels vers des numéros de mobiles par IP avec authentification », Halys European patent N°07301546.3 ;
« Système de communication téléphonique par VoIP », Halys European patent N°130040041.

Technical Data:
Linux OS on Fujitsu Servers (Intel CPUs) or Virtual Machines
Scalability: up to 1000 transactions per sec
Licensing: Pay-as-you-grow capacity license based on the number of home networks and transactions per sec