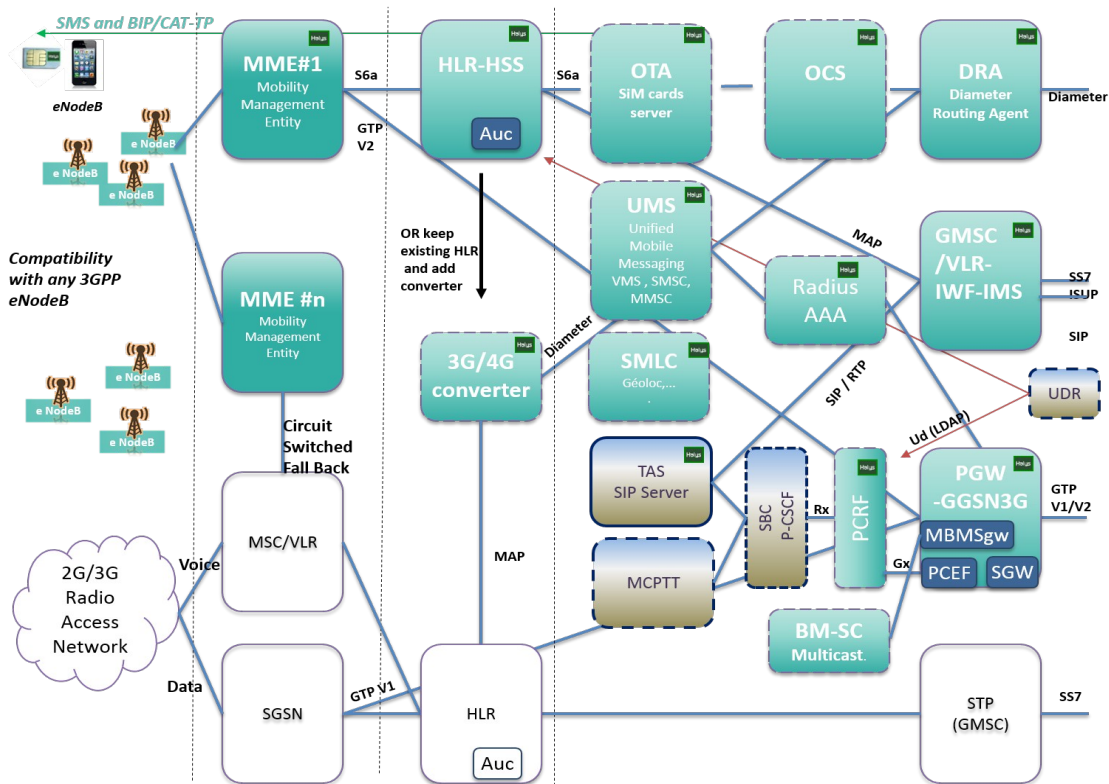


Going 4G with HALYS

Extending your 3G network to add 4G towards VoLTE services

As specialist of equipment and core networks for mobile operators, Halys provides a complete 4G/LTE solution based on its core EPC and partners for the RAN, whose distinctive feature is to have all internal interfaces fully standard (unlike some 'integrated EPCs'), each system being capable of full interoperability with other vendors. MNOs can implement 4G in their network and provide quickly optimal services for their end customers. VoLTE will be simple to implement once 4G is opened and VoLTE capable terminals significantly used.



Halys 4G solution general overview

- **e-NodeB** for LTE Radio access are provided by Halys through *selected partnerships* (Air-Lynx, AirSpan,...) to cover the various size and frequency spectrums (including special PMR frequencies). IOT performed with Ericsson, Huawei,....
- **The Halys MME** handles 4G signaling protocols GTP-C v2 towards the SGW Serving Gateway (included in PGW in Halys architecture) and S6a/Diameter towards HLR/HSS. MME also dialogs with 3G/core to enable Circuit Switched fall-back (CSFB) to 2G/3G network for voice call (if VoLTE not yet in place). CSFB is supported with 3G, as well as SMS 4G and LBS Diameter interfaces.
- **Halys HLR/HSS** fully replaces the existing HLR to support 4G network (with migration path defined). It supports several MVNO and multi-IMSI SIMs.

Alternatively the *original* Halys “**3G/4G converter**” solution which handles 3G MAP to/from 4G S6a/Diameter conversion *allows to keep the existing MAP-interfaced 3G HLR*.

➤ **Halys PGW (Packet Data Network Gateway)** is also a GGSN 3G and handles 4G data(GTPv2) and 3G data (GTPv1) coming from SGSN thus enabling 3G/4G data hand-over. The Halys PGW embeds the **SGW** (Serving Gateway) and also the **PCEF** (Policy & Charging Enforcement Function) : through the Gx interface one can insure proper QoS settings and bearer establishment for VoLTE. Halys PGW also embeds **MBMS Gateway** functionality to implement multicast TV broadcast over LTE or for group communication (PMR).

It is also possible thanks to Halys **DPI** (Deep Packet Inspection) capabilities to detect the type of session (e.g VoIP) and set QoS (towards MME) *thus avoiding to introduce PCRF* (Policy & Charging Rules Function) in the case of simple “local loop 4G” networks.

➤ **PCRF** is needed to have a “canonical” Qos handling, parental control, etc. During the session creation the MME gets the QoS requirements in Update Location from HSS but may alter it when creating session (to PGW/SGW). Creation request is then transmitted to PCRF which takes decision, optionally getting from User Data Repository (UDR) the information associating subscriber and Qos parameters for different used medias. Decision is then transferred to PCEF Rx interface for enforcement.

➤ **Halys GMSC/VLR IWF-IMS enables** VoIP OTT services mobile originated or terminated: Calling and called party both know only their standard phone numbers to make call or to be called using a SIP softphone app (e.g. Linphone) on their mobile and an IP access which can be Wifi or 3G/4G. From the network point of view the subscriber will be seen like a standard mobile subscriber declared in the VLR of an MSC (same charging records) however, he will be registered on the **TAS SIP Server** (Halys’one based on openSIP) or any standard SIP server. Same solution supports also SMS OTT or video calls. VoLTE type tickets include the IMSI for the TAP billing converter.

➤ **WiFi WLAN access.** Authentication of Wifi subscribers is performed with Halys **RADIUS Server (AAA)** either via secured EAP-SIM / EAP-AKA protocol when the phone supports a “supplicant” (uses the SIM card for authentication) or via an individual password that can be provisioned by operator.

➤ **Halys Diameter Routing Agent (DRA)** is a fundamental piece of the 4G of course for internal routing but also a need for VoLTE and for roaming handling (acts also as Diameter Edge Agent). The DRA insures also the Halys 4G EPC redundancy solution.

➤ **Halys VAS** are not only 3G but support the 4G interfaces (Diameter). They include SMSC (SMS directly in 4G), MMSC, OTA Server for SIM provisioning , Steering of Roaming as well as location services platform (SMLC User Plane and Control Plane). Partner's TAS (MCPTT “push to talk”, Air-Lynx), and BM-SC(Multicast) are easily added using the standard interfaces provided.

Scaling of solutions, availability :

Halys equipment are virtualized in several virtual machines. Halys is using VMware /Vsphere and Linux OS (OpenSuse). Underlying hardware is COTS intel-based servers (Fujitsu-Siemens, HP,...)

Redundancy principle is of type active/active on separate hardware. Halys redundancy architecture is able to switch-over just the concerned virtualized function.

Typical configurations are from 100 subscribers(“tactical networks” up to 3M subscribers with 500K concurrent sessions with intermediate small network at 40000 subs. Throughput per PGW up to 10Gb/s.

Main standards references

Rx/Diameter (AS <-> PCRF) 3GPP TS 129 214 V12.9.0

MAP, 3GPP TS 29.002 v12.7.0

Camel, 3GPP TS 29.078 v12.0.0

S6a-S6d/Diameter, 3GPP TS 29.272 v12.7.0

RFC 3261, "SIP: Session Initiation Protocol", June 2002 or ISUP ITU Q763 12/1999 (Voice Call PSTN)

GTPv1, 3GPP TS 29.060 v12.9.0

GTPv2, 3GPP TS 29.274 v12.8.0

Gx/Diameter, 3GPP TS 29.212 v12.10.0 between PCRF and PGW-GGSN