White Paper

NGN to Ip Multimedia Subsystem migration :

To understand the reason why it is the right timing now !

Edito

In the late 20th century, fixed operators undertook the migration of their networks from TDM commutation, to IP networks. By replacing their telephony switches with Softswitches and IP gateways, they could then offer triple-play: Voice over IP, Internet, and IPTV, at an affordable price.

Since then, 3GPP has defined an advanced telephony architecture, called IMS (IP MultiMedia Subsystem), and recommends it for various types of network access: 4G in mobile networks, 5G soon, but also for fixed broadband networks such as Cable, xDSL and fiber networks.

This article describes briefly the difference between Softswitch architecture and IMS, lists the reasons and benefits for a telecom operator to migrate to IMS, and explains how we at Cirpack can help you to achieve such migration.

Imad Tfaily, Cirpack Core Network Product Manager is a young engineer graduated from ENSEIRB MATMECA (87). Passionate about technologies, he has been working at Cirpack for almost eighteen years. Expert in his field, he explains you about IMS and why it's the right time to go!

Agenda

IMS Description

IMS Benefits

- Easy to deploy New Services
- Easy to operate
- Better media voice and video quality
- Offer mobile telephony
- Rich Communication Services (RCS)
- Scalability and resiliency
- Improve interoperability
- Virtualised core network

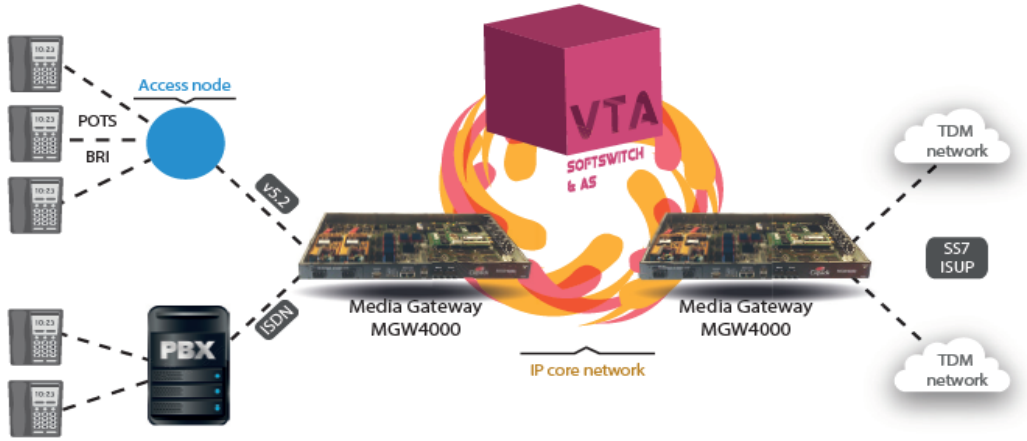
How does Cirpack help Fixed Operators to migrate to IMS

- Services Parity
- Leveraging some existing network elements
- Data migration tool
- Network monitoring application

IMS Description

In a lot of fixed networks, softswitches are still deployed to implement telephony through control of media gateways, and to ensure interconnection towards other TDM or IP networks.

Indeed, softswitches can connect very heterogeneous networks, with many signaling protocols such as ISUP, TUP, V5, R2, ISDN, MGCP, H.248, and finally SIP. Media gateways are used to connect TDM voice channels to the IP core network, and then to ensure the interconnection with carriers based on SS7 at the interconnection, and to connect legacy user equipment such as ISDN or POTS on the access side.



IMS Description

In IMS architecture, more layers are identified and clearly separated: media and control as with softswitches and gateways, but also applications and services. The SBC, core network and media layers are in charge to control the call and implements security, NAT traversal, subscriber authentication, while the application servers (AS) deliver added value services. Particularly, IMS is based on one unique protocol for signaling, SIP, and one for service data exchange, Diameter, with particular signaling protocols located in optional and isolated gateway functions.

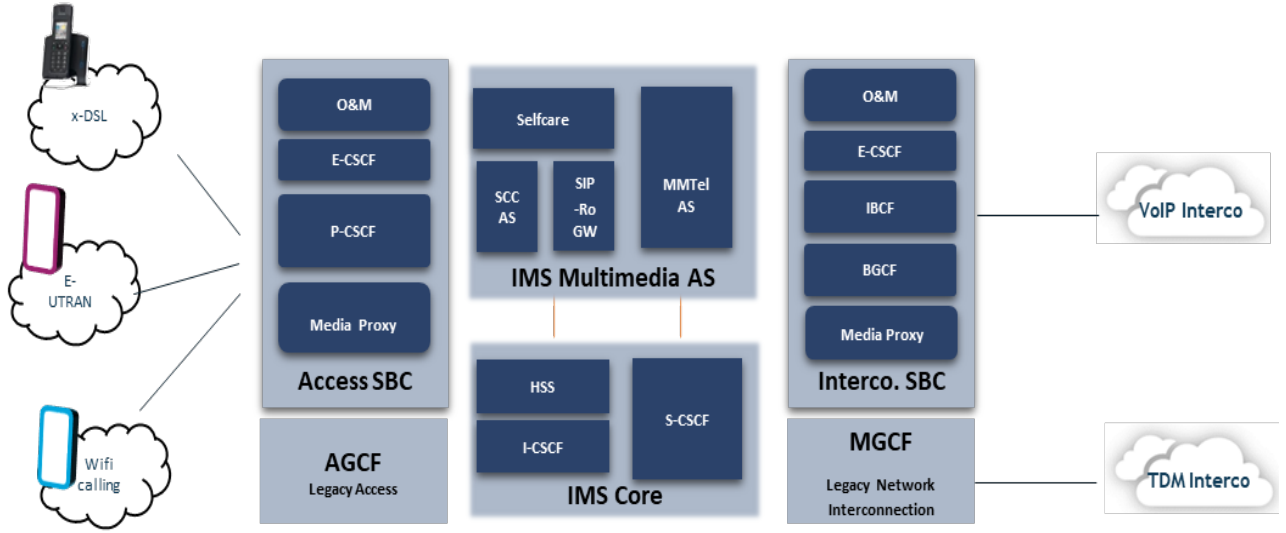
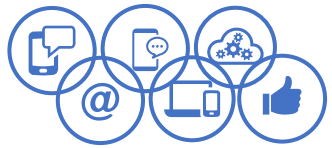


Figure 2: The IMS separates the control, services, and media layers

In the following chapters, we will describe how the operators can take advantages from this IMS architecture, on several levels: first the easiness to deploy new services, second, the improvements in operation and monitoring of the solution, but also the support for new codecs, new applications, and the facilities for modularity, scalability, resiliency and interoperability.

IMS Benefits

Easy to deploy new services



One crucial aspects of telecom companies remains new services Time To Market, or enrichment of services with additional features, and the easiness to deploy on top of the core infrastructure value added services from various software editors. IMS, benefits on this point of its architecture principles and inherent opened philosophy.

In IMS, end user services are rendered by Application Servers, and deploying a new service consists to add a new Application Server, which thanks to the IMS layering approach preserves the rest of the network.

Effectively, to deploy a new application server, the operator has only to provision a specific condition called Filter Criteria in the IMS database, the HSS. This Filter Criteria contains the hostname or IP address of the AS, the conditions upon which the AS should be invoked, such as video call, instant messaging, etc., and what to do in case of no answer from the AS, continuing or breaking the call.

For each subscriber in the HSS, the operator must select the right filter criteria then defining his/her level of service.

Finally, adding a new AS doesn't disturb neither the existing services nor end users, and the deployment benefits from the role of service broker implemented by the IMS core according to standards.

Along the same lines, the ISc/Ma interfaces between the core network and the several AS are well defined and ensure interoperability.

In conclusion, the IMS architecture allows the operator to acquire equipment from different vendors and even to develop its own services by itself, in order to enrich and differentiate its offer, and reduce its CAPEX.

IMS Benefits

Easy to operate

Let’s see how the IMS with its reduced number of protocols is easier to operate than a softswitch.

A softswitch handles many protocols: SS7 ISUP, ISDN, V5, SIP, MGCP in a single node, making it complex to operate and troubleshoot. Especially, protocols interworking has to be understood by the operator admins even if some protocols are not needed in their particular deployment. This is due to the classical softswitch architecture called half call, where all signaling protocols are converted to a unified internal call model. For instance, a softswitch admin has to understand SIP ISUP interworking even though ISUP is not used anymore, which is ironic when investigating a SIP to SIP call. In consequence, the operator technical team has to acquire and maintain a rather broad expertise in several signaling protocols.

On the other side, the IMS core network uses SIP and diameter protocols, the other legacy protocols such as SS7 and ISDN are handled by border nodes MGCF and AGCF, this simplifies the call flow within the core network easing its provisioning and troubleshooting. Thus, the technical team operating the IMS core network does not have necessary to know all protocols, only those who works on the border nodes have to.

As there are only two protocols used in IMS, it is easier to develop monitoring tools, and many tools exist to help the operator to manage its network.

All of this helps the operator to minimize the operation tasks and reduce its OPEX.

IMS Benefits

Better media voice and video quality

The voice, and more generally media, quality closely depends on the codec used, obviously high definition codecs such as G.722, AMR-WB, OPUS , EVS, H.264, VP8 offer better media quality than narrowband codecs such as G.711 or G.729.

New services in the fixed network such as video calls, video conference use high definition codecs, it is important for operator to support those codecs.

Softswitches have been built initially to connect the TDM networks relying on G.711 codec, to the IP network, and it was then natural to continue to use G.711 over IP to simplify the interconnection. Then G.729, similar to G.711 in quality, and G.711/G.729 transcoding, have also been adopted to reduce the bandwidth consumption on the access side.

High definition or adaptive voice and video codecs such as G.722, AMR-WB, OPUS , H.264, VP8 were not initially supported in softswitches, because they were not yet specified, or not widely used, or simply because they are data consuming and irrelevant when the call goes on the TDM network.

On the other hand, IMS, which is natively designed to offer multimedia communications over different types of broadband accesses, supports very well high definition codecs and enables the operator to offer better media quality. Then, IMS allows state of the art quality, which allows the operator to better serve his subscribers, retain them or gain new ones.

IMS Benefits

Offer mobile telephony

More than simply codecs, IMS also support new network accesses. Especially, Voice over LTE is the name for telephony over 4G/LTE network, powered by IMS. With better voice quality, VoLTE also improves quality of experience by continuing 4G connection and its high speed during calls.

In the same vein, VoWifi enables a subscriber to connect to any Wifi hotspot in secure mode, and to benefit from the same services: making voice/video calls, sending and receiving SMS. This is particularly useful when no LTE coverage is available or even when on the go abroad to reduce the roaming fees.

A fixed operator can enrich its fixed telephony offer and delivers VoLTE/VoWifi services to his customers by setting up a bilateral agreement with a mobile network operator (MNO) and becoming then a mobile virtual network operator (MVNO).

The IMS implements all the technical solutions to setup such agreement with the MNO.

Home-Based Routing (S8HR) : Mobile device data is tunneled from the MNO to the home network, the IMS controls and renders services to the mobile users including emergency calls.

Local Breakout (LBO) : The SIP traffic of the mobile device is sent to the IMS core network of the fixed operator over a SIP trunk, the network to network interface. The IMS controls and renders services to the mobile users. Emergency calls are handled by the MNO.

IMS Benefits

RCS

Another application of IMS is pushed in the market via the mobile networks: Rich Communication Services (RCS). RCS enables end users to have richer services like sharing its mood and presence in the contacts, instant messaging, photo and file sharing, even discussion group.

RCS services requires SIP signaling dialogs (e.g subscribe/notify, message) different than the regular telephony ones. Those SIP messages are usually not well handled by softswitches, which were designed initially for telephony. On the other hand, IMS core products are designed from the start to handle such rich signaling, allowing operators to offer those new services.

Thus by migrating to IMS, a fixed operator can enrich its offer and increase his revenues.

IMS Benefits

Scalability 1/2

Scalability and resiliency are important aspects of the network. Scalability allows the operator to increase the size of the network as he gains subscribers. Network resiliency allows to ensure the service to the subscriber in case a network node breaks down.

Softswitch is considered in the network as a single node, when its capacity is reached and a second one should be deployed, many modifications in the network architecture and configuration should be done. Generally, a third equipment has to be deployed to centralize the serving softswitch of each user, and the routing tables should be modified to route adequately the calls.

In similar way if the operator wants to add a new application server, it has to modify the routing tables of each softswitch in the network. This is much easier in IMS.

IMS architecture is modular: each network function is implemented within a module, and modules can be easily deployed or withdrawn from the network on demand. For instance a MGCF implements the gateway function towards a legacy PSTN network, the operator can use it as long as he has such interconnection and once all his interconnection migrate to VoIP, he can easily withdraw it from the network without disturbing the other elements.

Likewise, as user services are implemented in the application servers; an application server can be easily added to render new services or to serve more customers.

IMS Benefits

Scalability 2/2

IMS architecture is very scalable, it scales from few thousands to millions of subscribers. To increase the number of subscribers the operator has just to add new modules within new virtual machines.

The HSS centralizes information about the network architecture and queried by the IMS nodes to find the next node to send the SIP signaling.

For instance, a new S-CSCF can be easily added by mean of a simple configuration of the HSS The operator has just to provision the new Customers in the HSS and associate them the hostname or IP address of the newly deployed S-CSCF. When the Customer's device sends a register to the core network the I-SBC queries the HSS to retrieve the S-CSCF associated to the customer and sends the register to. In case of a module fails, the SIP traffic can be routed to its counterpart to ensure the user services. For instance, two core networks can be installed in two different sites and if one of them fails the P-CSCF can route SIP registrations to the other to ensure the user calls and services.

The operator can take advantage from the IMS scalability to increase the size of the network as he gains subscribers and phases his investments over the time. In the meantime, he benefits from the IMS network resiliency, which is always usefull for service resilience and limits churn.

IMS Benefits

Improve Interoperability 1/2

Ensuring the interoperability between the different functions within its network and with other networks is very important to ensure the service, in the following we will see how IMS improve interoperability in the network and how the operator can take advantage from it.

Softswitches handle many call control protocols, they generally use an internal interface to map each of them to the application layer. When a SIP call crosses the softswitch, the SIP signaling is converted into an internal message by the middleware before being conveyed to the application which handles the call and sends back an internal message to be converted into SIP signaling to convey on the network.

The double conversion in the softswitch can alter the SIP signaling and causes interoperability issues.

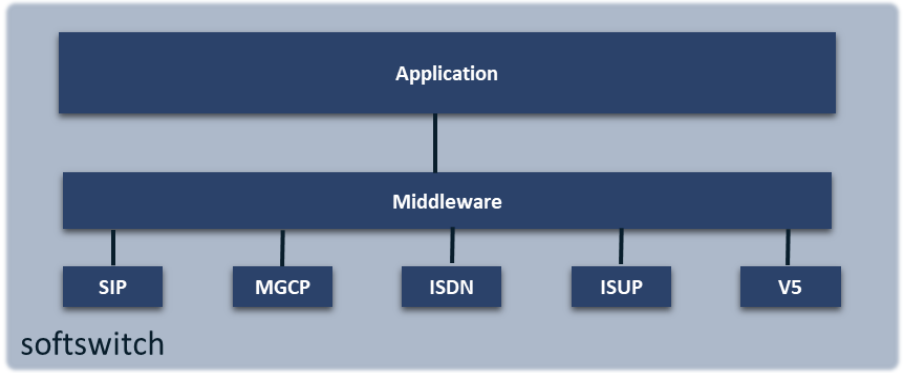


Figure 3: Heterogeneous protocols have to be adapted to protocol unaware application

IMS Benefits

Improve Interoperability 2/2

In IMS, SIP is the only call control protocol, the SIP signaling is not converted internally to a proprietary internal protocol, and then not altered when a call crosses an IMS node.

IMS is specified by 3GPP, those specifications have also been taken by some national regulatory organism such as FFT in France, AKNN in Germany, and AGCOM in Italy as a base to define the SIP profile to be used for the interconnection between operators.

Softswitches complies with the RFC 3261 SIP standard and not fully compliant with 3GPP. To obey to the interconnection specification, they rely on the interconnect SBC which then manipulates the SIP signaling and headers to fit the SIP profile used at the interconnection.

On the other hand, an IMS core network implements natively the 3GPP specifications which reduces dramatically the manipulations to do in the SBC.

Thus, having an IMS core network is a great advantage to achieve interoperability with other networks, user equipment and application servers, it allows the operator to have network functions from different vendors to enrich his offer and optimize his CAPEX. Reducing interoperability issues also helps the operator to reduce his OPEX.

IMS Benefits

Virtualized core network

The IMS core network is built on software modules and can be fully virtualized, it is deployed as virtual machines running on any commercial off-the-shelf servers. The operator can choose the more appropriate servers to meet its needs in term of performance, and it can modernize it easily to ensure the reliability of its network.

How does Cirpack help Fixed Operators to migrate to IMS?

Having seen the IMS advantages, let's see how Cirpack helps fixed operator to migrate to IMS.

Services Parity

An important aspect of the migration is that subscribers should be able to continue to use the same services after the migration.

Cirpack has implemented all the residential services rendered by its softswitch into its IMS as well as the way to activate them by dialing feature codes to ensure the quality of experience to the users after the migration.

PBX connection has been implemented and enhanced with more services to the users behind the PBX which can benefit from the same services as the residential users. The specification "SIP Connect 2.0" has been implemented to improve PBX interoperability. Serial SIP forking has been implemented for PBX connectivity resiliency; a PBX can register from two locations, the IMS core network forks an incoming call towards the two locations in serial mode, so that if the connectivity breaks with one location, the second location will be contacted.

Thanks to services' parity operators can ensure the quality of experience of their residential as well as corporate customers.

How does Cirpack help Fixed Operators to migrate to IMS?

Leveraging some existing network elements

Cirpack has developed its IMS portfolio SBC and IMS core network since 2006 and has brought some IMS concepts in its softswitch..

The SBC deployed with the softswitch architecture has been designed according to IMS/3GPP specification and it can be kept when the IMS core network is deployed.

The softswitch and its media gateways can act as MGCF and kept in the IMS architecture, if the operator still has some TDM interconnections.

The Routing Policy Enabler (RPE) which ensures the number portability service within the softswitch architecture can be kept to do the same in IMS.

Thus, operators can migrate their networks to IMS, while leveraging some existing elements, which eases the migration and optimizes their CAPEX.

How does Cirpack help Fixed Operators to migrate to IMS?

Smooth migration scenario

Migrating all the users from softswitch to IMS in one night might be a tough and risky operation. That why Cirpack has defined an architecture where the softswitch may coexist with the IMS core network.

Then the operator can migrate its customers gradually from the softswitch to the IMS.

Although the IMS charging Rf interface has been implemented, the Cirpack IMS can generate Call Detailed Record (CDR) compatible with the softswitch facilitating the integration of the IMS in the existing billing system.

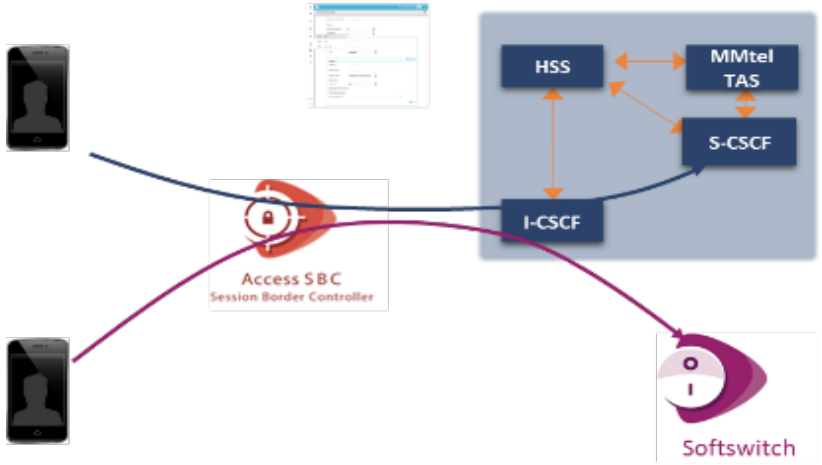


Figure 4: The softswitch is defined in the IMS as a special S-CSCF and keep serving its users.

How does Cirpack help Fixed Operators to migrate to IMS?

Data migration tool

To migrate users from the softswitch to IMS, Cirpack has developed a migration tool, which extracts users data from the softswitch database to the HSS and TAS databases, so that users can keep their services profiles after the migration.

Network monitoring application

An application has been developed for troubleshooting and monitoring the network based on signaling capture on the SBC, core network and TAS. It allows to filter and display call flows for troubleshooting and raises KPI related to call volume and QoS to monitor the network.

CEO’s words – Patrick Bergougnou

Cirpack has been founded twenty years ago to help alternative Telcos grow their business by using this new and very disruptive Voice Over IP technology. They became the world leaders. It’s now time, twenty years later, to move to the next step. This is the main reason that led me, when tooking over the company four years ago, to set up the next step of this strategy by going to « Full IP » & « Full Software ».

Here we are! Right now! Ready to efficiently serve our customers and prospects on their way to the next twenty years ultimate « communication over IP » technology. With this IMS technology they will better serve their customers by developping new multimedia services based on mobile and lanline convergent commnunication tools.

Cirpack has been present alongside its customers for the past twenty years. We carefully listened to them. We better understood them. Using this deep knowledge we developed the best adequate technology to continue to accompany them for the next twenty years.

Entrepreneur and Business Developer, Patrick Bergougnou led and developed several companies and business units in various environments in France and abroad, in the areas of consulting, software editon, equipment manufacturing, system integration and IT services. Patrick Bergougnou is graduated Telecom Engineer from Telecom SudParis, graduated MBA from ISG Paris and HEC Executive.