IMS: An Economic and Technological Evolution

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1 Executive summary

Today, the business success of carriers mostly depends on customers' satisfaction with the services they are offered. The evolution toward an IMS-enabled network brings new opportunities and challenges to all the parties involved.

Many of the new services are hosted and free to use with no guarantees for the quality of experience. As a result, carriers are losing the well-established position of offering package-bundled services, like mobile telephony, internet and TV. In the long-run, the package-bundle business model will not survive. Therefore, they need to offer their customers a new quality of experience with a combination of different services in a single interactive service.

In the established environment, services are delivered in the "stovepipe" manner (a single-purpose network). This means that each time a new service arrives on the market, new servers are put alongside many others and the operational costs continue to grow. The answer is to establish a common horizontal layer network, where the carrier has the ability to offer convergent services on a variety of access devices.

This change exposes the carrier's most sensitive problems:

- The high cost of developing new applications and services – they are not reused!
- A lack of interoperability.
- Not being able to take advantage of convergent networks.

The evolution to IMS results in several benefits, despite the specific difficulties that the carrier faces. The carrier benefits from an additional revenue stream, cost savings from the reduced OPEX and CAPEX, the lower risk profile, less churn, the gaining of new subscribers and the preservation of roaming revenue.

These economic benefits are achievable with the step-by-step approach of evolving the NGN architecture toward IMS. The service consolidation and evolution toward core IMS elements are closely related, but could be made independently.

The investment in services represents a complete set of service offers on the SI3000 OSAP platform. The platform opens application interfaces through the service bus to third parties for service creation and execution, and also for the service-orchestrating processes. The question of universal access to the application level is addressed by the SI3000 Multimedia Service Mediator (SI3000 MSM).

On the control part of the network a SIP-based session and media control for voice, video and data traffic is established. This is done in a gradual way with a software upgrade of the SI3000 CS NGN to a single network element, the SI3000 CS IMS Compact. Carriers can first choose which services to implement and then test them in the market. Consequently, the migration to IMS is gradual and deliberate, with a focus on the elements that make the most technological and economic sense.

2 Introduction

The users of telecommunications services have dramatically changed their everyday communication habits. Web 2.0 applications and social networking offered by Google, Facebook, Skype, Ebay and others, are becoming very popular and are the centre of the lives for most young and a lot of older people. Emerging communication services such as VoIP, IM (Instant Messaging), WebTV – offered by so called OTT (Over-the-Top) players – are gradually taking over the market share from traditional Voice, SMS and IPTV service providers.

Many carriers are threatened by:

- Becoming “bitpipe” providers, getting only standard broadband access, flat-rate cash from their subscribers.
- OTT players, who are hosting on top of the carriers’ infrastructure for free and use an advertising model for their revenue generation.
- Declining average revenue per user (ARPU), because of the rapid adoption of free communication suites.

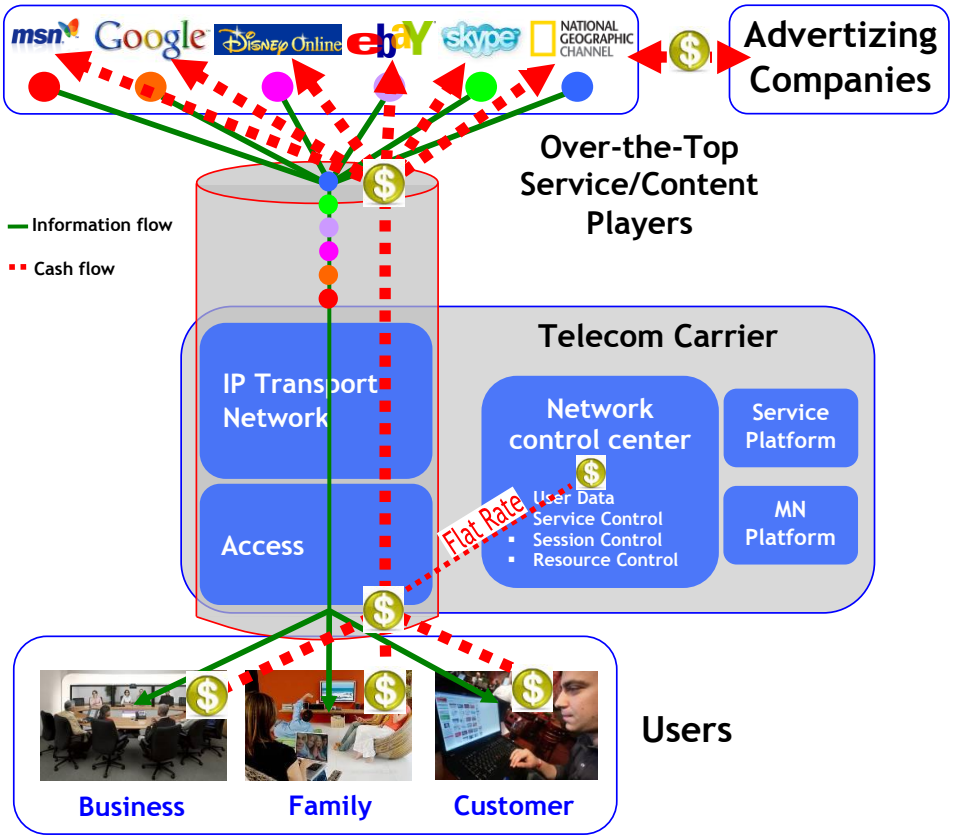

Figure 1: Money bypasses the Telecom carrier in today's value chain

Improving the user experience

Today's "digital live" is a mixture of a co-existing multi-technology, which is not easy to use, and has a tendency to complicate the process. For example, users who actively use services on one device are not able to simply change the device (from PC to mobile phone) or even network (from wired to wireless) and at the same time stay online using the same services without being interrupted.

A user-centric paradigm will bring together a consumer's:

- **mobility domain (on the go),**
- **enterprise domain (at work),**
- **residential domain (in the home),**
- **wireless domain (when remote).**

To overcome the complicated "digital live", a consistent user experience in the look, feel and behavior of applications from home, to road, to office, is needed. A user-centric paradigm will bring together the consumer's mobility domain (on the go), the enterprise domain (at work), the residential domain (in the home) and the wireless domain (when remote). Along with the simplification of usage, services have to include the "connectivity" portion of an overall solution, such as policy control, billing, a quality of experience and carrier-to-carrier compatibility.

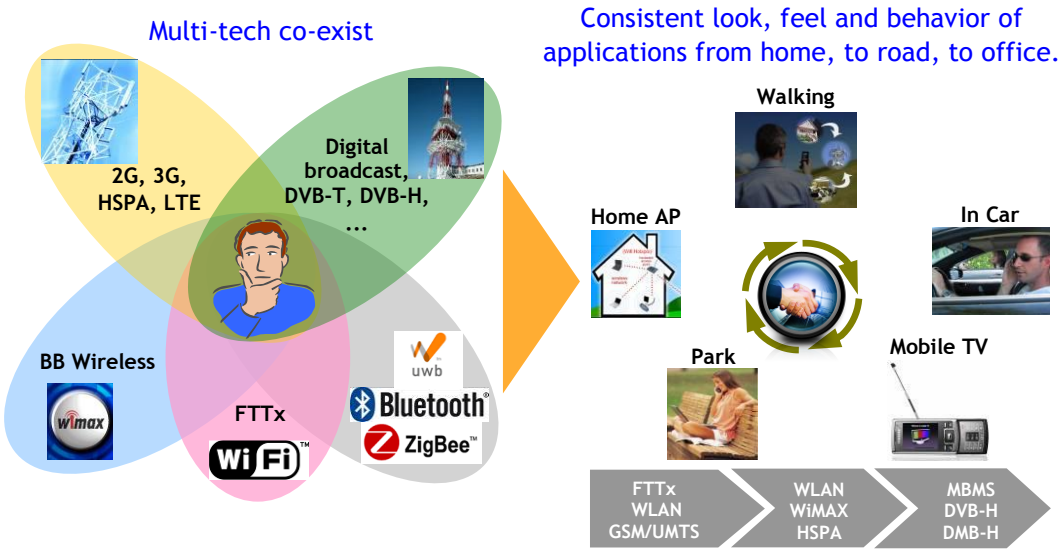

Figure 2: The challenge to provide users with a seamless experience across different networks

The horizontal, layered approach

The enhancement of the user experience is developing from IP-based network capability – in addition to the PSTN domain – toward the all-IP environment or, more specifically, IMS (IP Multimedia Subsystem) as the future framework architecture. The goal is to create a horizontal, layered approach for all telecommunications carriers – fixed, mobile and cable. **The key outcomes will result in a cost-effective management of a single identity, a single bill and a higher level of experience across different access technologies. Finally, the carrier will preserve its market share and increase its revenue in the long run.**

3 Why an IMS evolution?

The current challenge for carriers is to find the right balance between their business plans and the reality in the field. Carriers have to find out about the new revenue-generating applications and services and which are the right choices for network-infrastructure evolution.

The main revenue is still generated from legacy networks. They are basically single-purpose networks providing a "silo" solution, referred to as vertically integrated networks. The user who wants to access different services must go back and forth between these silos to get the complete set of services (Figure 3). Carriers have to establish a totally converged future network for fixed, wireless, and cable on common network architecture to offer a complete set of services with reduced running costs.

The IMS architecture is becoming widely accepted as an evolution path to control and develop new applications and services on a single layer. The key economic driver is to avoid the parallel development of the same common support services. What the new framework does is to draw together session control, multimedia delivery and service provisions into a horizontally integrated system. This allows carriers to introduce new, interesting "sticky" services in combination with the web environment (chat, presence, etc.) and existing Telco services (telephony, SMS/MMS, TV). The main goal is to enrich the user's communication experience without the need to know which communication platforms are being used (Skype, MSN, Gtalk, etc.).

IMS framework draws together session control, multimedia delivery and service provisions into horizontally integrated system.

The obvious benefits of the IMS evolution approach include:

- The capacity to provide services to all eligible subscribers, regardless of the access technology used,
- The capacity to enrich the user's communication experience by combining web services with multimedia telephony,
- The capacity to reduce an OPEX explosion.

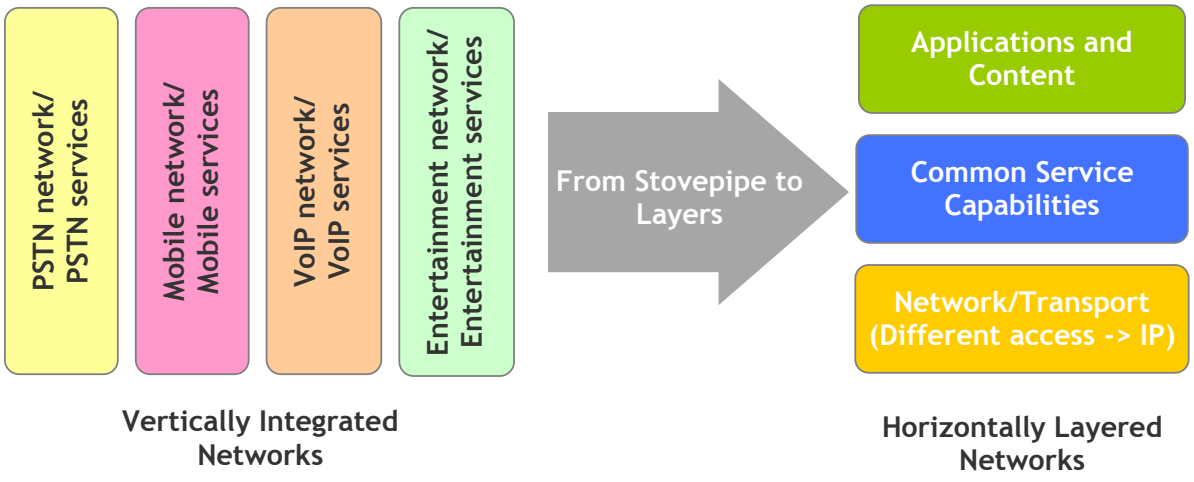

Figure 3: Traditional Silos of Services vs. Future Converged Services

3.1 The economic benefits of an evolution to IMS

Apart from resolving the technical challenges inherent in today's stovepipe architectures, IMS's biggest impact as the telecommunications industry moves toward convergent communications is the economic benefits. Many virtual service providers, including Google with Android, and Apple with iPhone, have started to offer targeted services. While all the traffic for these services is still being delivered on the underlying physical network of the carrier, the ARPU for this traffic is lower. Brand erosion is occurring as consumers do not differentiate between the real network provider and the brand owner, and all this impacts on the carrier's revenues.

There are several economic drivers for change, which include the carrier's most sensitive problems:

- **The high cost of developing new applications and services** for carriers who are trying to remain competitive. New, common functions have to be developed, such as subscriber management, billing, reporting, user interface and presence management. The development of replicated common service capabilities for each and every offering is a time-consuming, expensive process and new services take longer to get to the revenue-generating end-user.

  Each time a carrier decides to introduce a new service, for example Prepaid, there is a choice between an expensive application development on traditional proprietary service platforms and the offer from VAS platform suppliers. The existing VAS platforms are mostly not appropriate for supporting multiple services and are deployed as stand-alone. This leads to a lack of convergence between the services as well as higher maintenance costs.

- **The lack of interoperability** among carriers who offer the same new services in conjunction with subscribers on another carrier's network. One example is the Click-to-Dial service. The service is mostly only available to subscribers of the specific carrier's packet-switched network and for subscribers from another carrier on a circuit-switched network. Subscribers from different networks cannot use the service, because of the lack of interoperability. This hampers the uptake of this valuable application in the same way that text messaging did not take off until service providers used gateways to allow subscribers from one network to message with subscribers from another network.

  To establish broader service acceptance by customers solving interoperability issues is the key.

- **Taking advantage of converged networks**. Fixed voice access, fixed broadband access and mobile packet networks are still isolated from each other and are typically provided by different service providers. The subscriber usually has to choose one carrier for fixed connectivity and different one for mobile connectivity, but cannot use the same applications on mobile and fixed terminals. IMS allows the subscriber to gain network access and use the same applications, regardless of the media. In this way mobile or fixed carriers transform into converged carriers that have many possibilities to offer their applications to subscribers in different networks.

Migrating toward economic benefits

The current trend is oriented toward gaining revenue from next-generation services (high-revenue-producing premium services), which include IMS's ability to integrate voice, data and content services. The flexible IMS platform enables carriers to build their own services and mix-and-match applications for a custom suite. End-users using premium services will increase ARPU and minutes of usage or "megabytes of usage" in the IMS world of data. For carriers who move toward an all-IP IMS-standardized network, the cost savings from reduced OPEX and CAPEX will come in a variety of forms:

- **Build once, use many times** - The first objective of carriers today is to roll out new services as quickly as possible, both to keep subscribers interested and to increase revenue. The implementation of IMS-based technology provides shared, standardized protocols and a decomposed architecture. The lower cost is associated with reduced time and expense to develop new applications and services. IMS solves this problem with fast and efficient service creation and delivery by using standards-based functions that are reused rather than replicated each time a new application or service is developed.

- **Less expensive HW platforms** – With NGN and future IMS, carriers have the capacity to scale their growth with the use of commercial hardware platforms (i.e., Unix box or blade servers) and not with purpose-built platforms for things such as switching centers for mobile and fixed networks.

- **Less expensive SW development** – Carriers will not pay for specially designed proprietary service-control platforms, but will purchase and deploy less expensive platform-independent Java programming software.

- **Less expensive support** – Maintaining today's complex networks requires sophisticated management and support tools. To support complex networks, specialized knowledge is required. This can be costly and time consuming. Common protocols of the IMS network and the consequent simplification of the management on service provisioning and even on self-provisioning will reduce the knowledge base necessary for network support. It will also reduce the administrative support for separate networks.

- **Lower maintenance costs (fast ROI)** – Newer equipment and systems, in comparison with older equipment, even after initial purchase costs, have a short-term payback period (ROI) due to significantly lower maintenance costs. Older equipment is prevalent in today's network and represents hefty maintenance costs (a large power consumption relative to the number of subscribers, the repair costs of installed equipment), despite being paid for and depreciated. A lot of software is also obsolete and not supported any more, which creates additional maintenance costs.

  To lower maintenance costs an emulation of PSTN services in a "softswitch" is mandatory.

  An Eastern European carrier, for example, is on the way to an IMS evolution with the implementation of a PSTN emulation service for users on a traditional POTS. With an investment made in 2009, the lifecycle OPEX reduction will be, on average, 44 percent per

year, compared to the existing legacy equipment. This mainly includes the reduction of labor costs, maintenance costs and the cost of power consumption. It finally puts the IMS approach on a favorable curve, as seen in Figure 4.

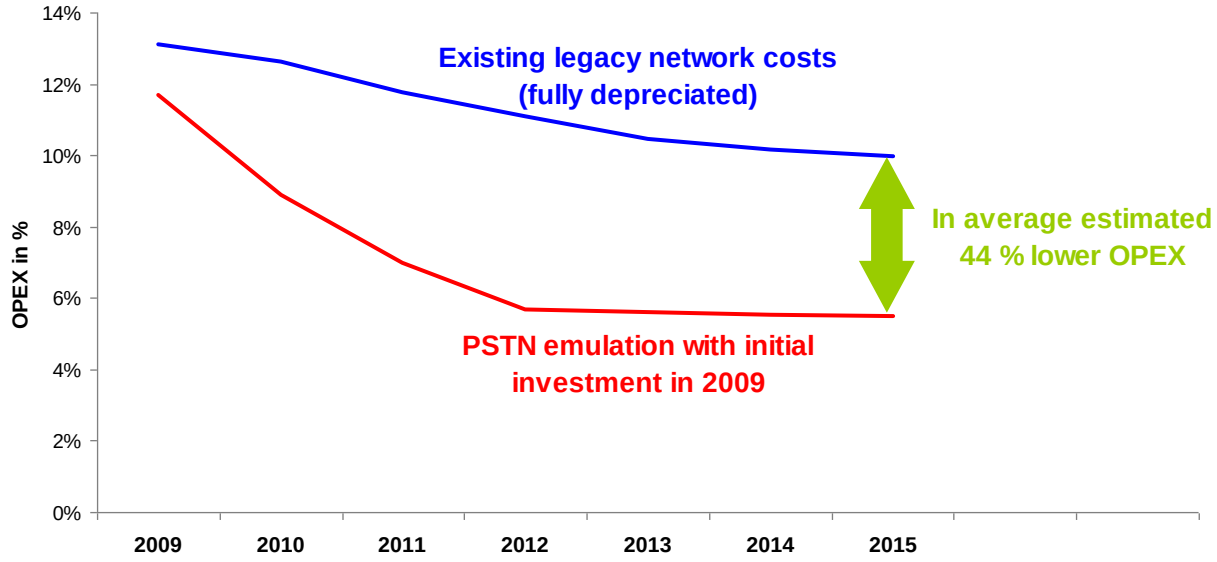

Figure 4: Estimated legacy vs. IMS network lifecycle OPEX savings (Source: Eastern European carrier)

- **Lower risk profile** – Minimal deployment time, effort and expense is needed to introduce new applications. This results in a shorter payback period and a minimal risk when launching new applications.

- **Less churn and easier to attract new subscribers** – Subscriber loyalty is important when the carrier delivers lifestyle voice and data services. Accepting the evolution to IMS is a step forward in overcoming interoperability issues. The subscriber has access to new applications and services with no delay. With the C2D service, for example, subscribers on one network will have the ability to immediately add a "buddy list" of C2D subscribers from another carrier's network.

- **Preserved roaming revenue** – WiFi-enabled Smartphone's, Mobile-USB sticks and Soft-Clients on laptops are a risk for carriers in terms of losing the roaming revenue to VoIP providers. Mobile carriers can preempt this movement and offer voice-call continuity through different radio access networks. With integrated billing and security, like in a cellular network, the subscribers are able to continue to access services from their mobile phones. The user who is able to access known services anywhere and at anytime intensifies the usage of services. As a result, the carrier gets an increased ARPU per user.

4 How the carrier's network evolves

It is generally thought that IMS is an "all or nothing" architecture and that the return on investment for moving to the IMS architecture is just not high enough to justify the changeover. **This is not true!** The move to IMS is the evolutionary path for the call-server architecture and should not be looked at as a wholesale replacement of an existing network.

The move to IMS is best made in small steps. This means adding IP capability in the form of a call server alongside the existing mobile switching center or adding VoIP and multimedia alongside existing fixed-voice circuits. It represents a revolutionary step from TDM to IP-based telephony.

The first revolutionary step should follow a gradual evolution step toward an all-IP network with the introduction of interactive multimedia services on a variety of access networks. This means that new, additional revenue streams are generated from existing ones and the introduction of new services on different access networks – legacy and broadband. The orchestration of the services is done with the Service Delivery Platform (SDP), with the included Service Capability Interaction Manager (SCIM). It represents an investment in the common service platform and important ground for the carrier to grow further.

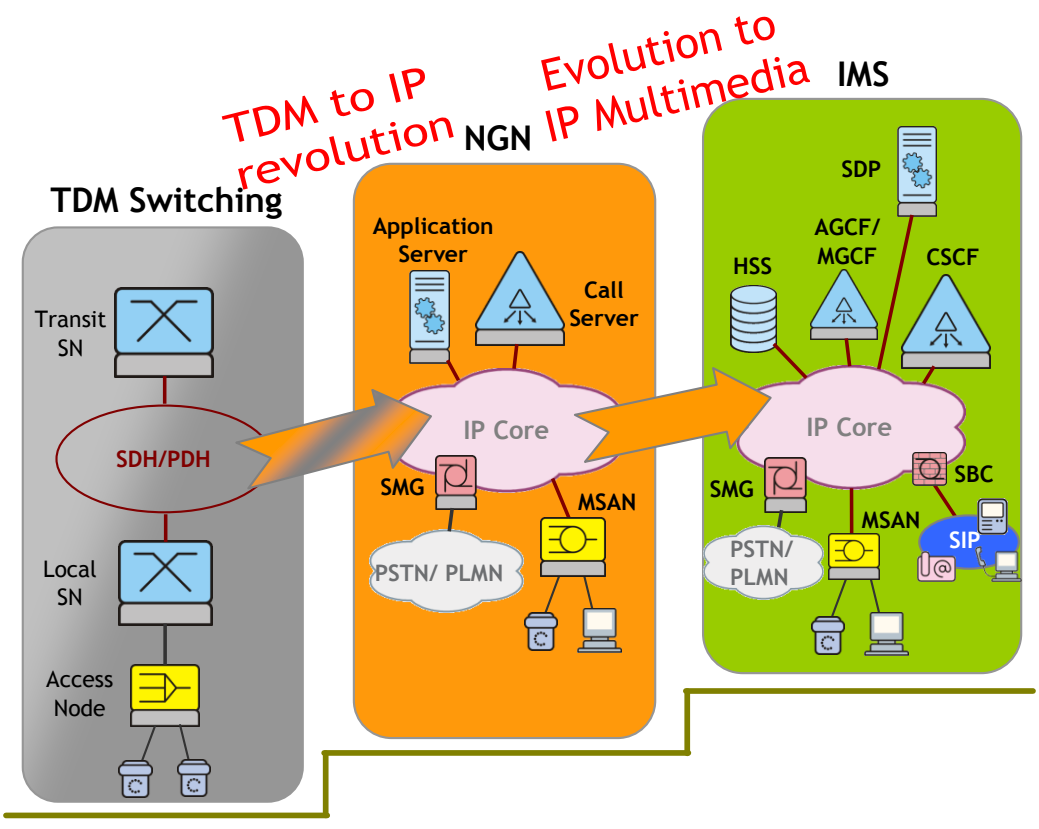

Figure 5: Evolution path toward IMS

The move to IMS is the evolutionary path for the call-server architecture.

As an NGN represents a common platform for fixed legacy and broadband access, the IMS further upgrades an abstraction for any type of data (VoIP, internet, multimedia). This means that regardless of the type of media – wired or wireless – the user accesses the same

familiar services. To introduce this access abstraction, the evolution of the NGN Call Server to a core IMS is necessary. A simple software upgrade of the CS (Call Server) into the CSCF represents a final step to handle all the necessary circuit-switched-to-IP conversion as a SIP server and a media controller.

The consolidation of the service delivery and the evolution toward a pure IMS network is justified independently in the following sections.

4.1 Consolidation of service delivery

A closer examination of a current carrier's application architecture reveals a costly IN-based Service Control Point (SCP) system for providing classical services like Number Portability, Free phone, Premium-rate, Voting services, etc. The corresponding services are still fully applicable in PSTN/PLMN networks and are also interesting for an NGN or IMS network. Along the existing application systems, carriers introduce new out-of-the-box services like Web Communication Assistant, Click-to-Dial, Personalized phone books, Call logs, Self-provisioning for IP subscribers on the SI3000 AS platform. Additional specialized services, like business services, video streaming, presence and instant messaging (IM) established on partner application servers, complete the service offer.

The main problem lies in a conglomerate of application servers that are serving their customers in the stovepipe manner (a single-purpose network). Users in the PSTN/PLMN get services from the IN infrastructure and IP subscribers get services from new application servers. The bottom line is that neither user gets a complete set of services or even a combination of applications as new services (mash-ups).

SDP & third-party service creation

As a solution to this problem, the IMS architecture foresees the Service Delivery Platform (SDP) with open application interfaces (like SOAP and REST enablers for Web 2.0 principles). This allows third-party service creation, execution and service orchestrating processes. Carriers who are not prepared to invest into the whole IMS solution right away have the possibility to enter into the value-added-services (VAS) market in an incremental way, with a "lite" version of the SDP platform or with the so-called SI3000 Open Services Application Platform (OSAP).

Strategy is to provide third parties with interfaces that enable access to common enablers and telecom functions in carrier's network.

SI3000 OSAP is the evolution of Iskratel's core products (SI3000 AS, SI3000 MN, SI3000 CS and SI3000 SMG) that support open Web 2.0 interfaces toward web community, service-provisioning applications, call log collector, service bus and the SIP servlet application server.

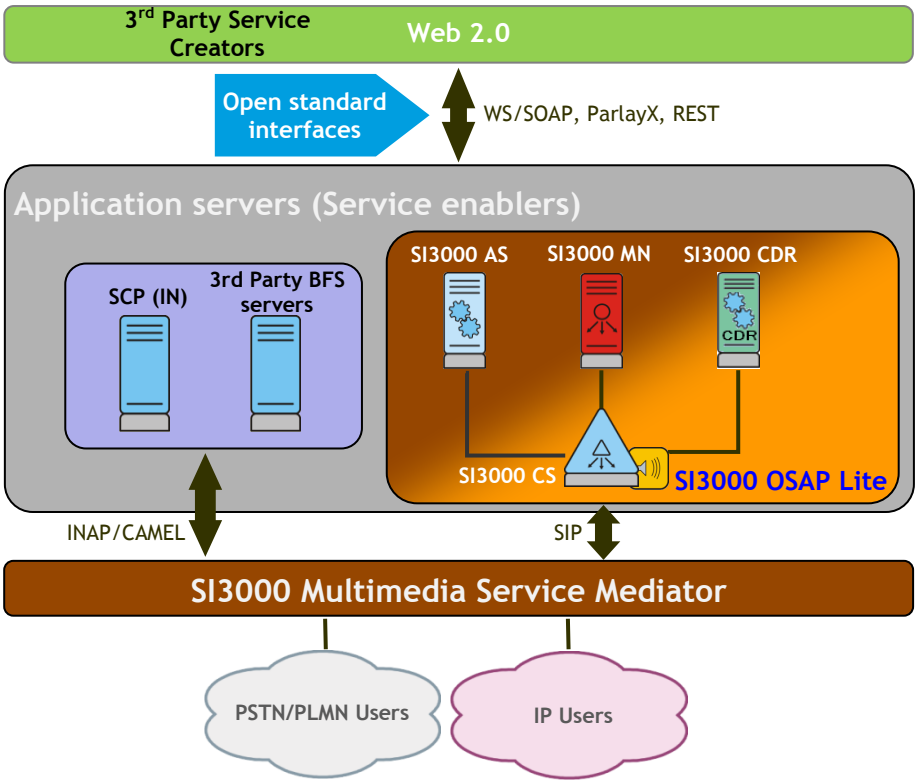

Figure 6: SDP platform based on SI3000 OSAP Lite and SI3000 MSM

For **third-party service creators** the application and management network elements are exposed through a single-entry point (Web 2.0 server). This approach offers the carrier the possibility to allow third-party creators to combine telephony with video and social networking without awareness of the underlying network specifics. To expand the services offering the carrier is able to simply upgrade to a "Full" version of the SDP platform. This means that the Web 2.0 server also offers extra integration with the service provider's BFS (Business Feature Server) as well as with end-user applications (e.g., a self-provisioning portal, integration with Facebook, Presence and Instant Messaging etc). A service bus with a special tool BPEL (Business Process Execution Language) enables the orchestration of services on the BFS and SCP (IN) servers toward third-party service creators.

Universal Access

The question of universal access to the application level is addressed with the **SI3000 Multimedia Service Mediator (SI3000 MSM)**. It provides the corresponding interfaces to the PSTN/PLMN/NGN/IMS networks (SIP, SS7) as well as the interfaces to different application servers (SIP, INAP, CAP). When the IMS core gains importance (serving a significant quantity of IMS users) the previously installed SI3000 MSM evolves with a software upgrade to the SI3000 SCIM. This IMS functionality will support the service orchestration and mediation capabilities between different SIP-based application servers and IN services environments. The product edition presents service providers with an effective way to begin rolling out their future IMS network, even before their legacy platforms have reached the end of their productive lives. Furthermore, the existing services on the legacy platform are rediscovered and used in a new web-based environment as user-friendly service enablers.

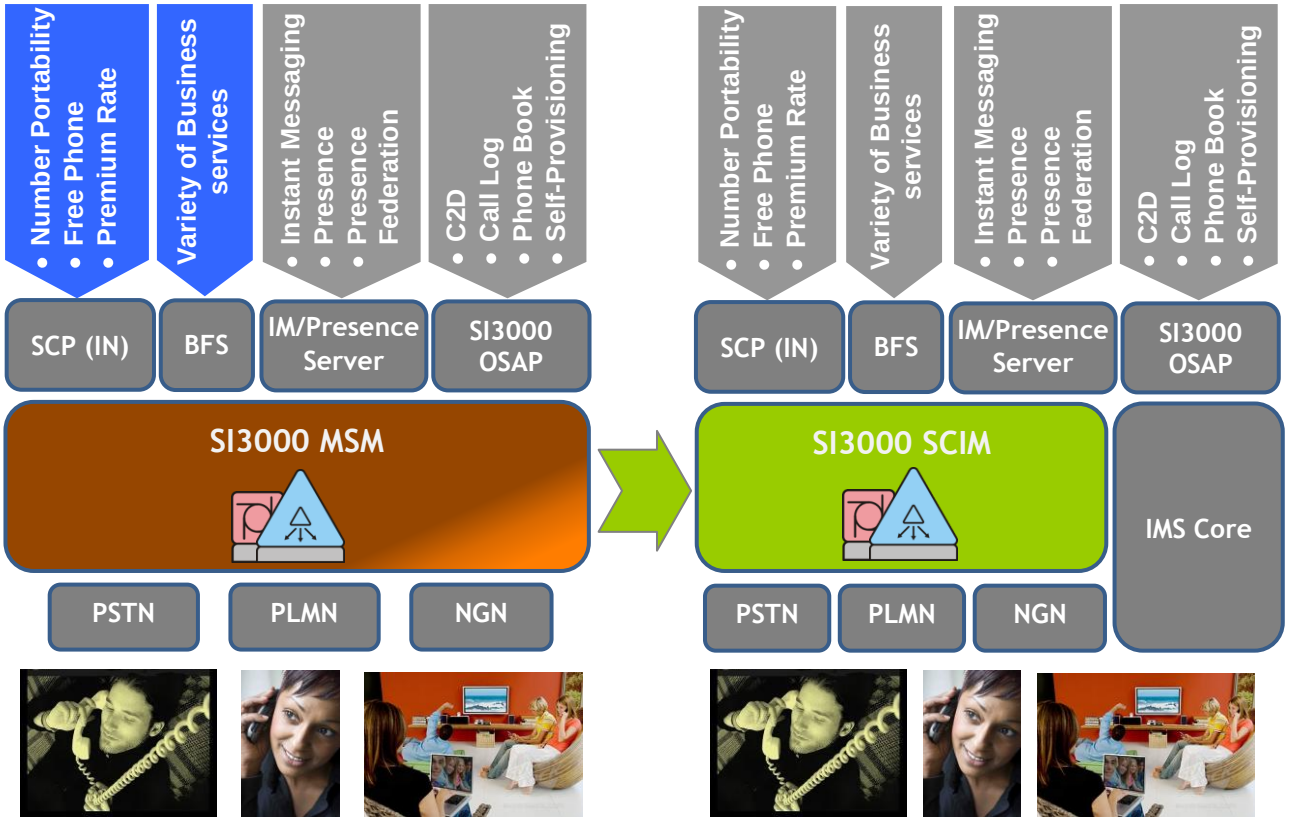

Figure 7: Evolution scenario from SI3000 MSM to SI3000 SCIM

SI3000 OSAP and SI3000 MSM provide the following benefits for the carrier:

- Create a flexible architecture free of endpoint constraints with fast service delivery on the market.
- Save operating costs by simplifying subscriber management and providing service assurance through integrated policy-enforcement capabilities.
- Explore different business models such as using third-party services created through open interfaces and integrated tools (Web mash-up with voice and video telephony).
- Monetizing existing IN infrastructure brings a set of services offer regardless of the subscriber endpoint access (IP or PSTN/PLMN user).

4.2 Evolution toward a pure IMS network

Before the appearance of the relevant service architecture, a stand-alone step of the revolutionary replacement of the classical TDM switch for “softswitch” in the control plane, not all the parts of the control plane network took this step. The existing TDM system was preserved to serve the remaining PSTN subscribers. Many carriers stuck with numerous different platforms spread across the delivery field and the OPEX explosion continued.

Subscriber management and billing at a single point (HSS) and control of all (PSTN, PLMN and VoIP) the subscriber sessions at another single SIP-based call-control point (“Call Server”) is the key to consolidating the OPEX explosion. This consolidation means a step-by-step adoption of an IMS framework over several years.

Turnaround of the OPEX expansion with a single SIP-based call control for legacy-based subscriber equipment.

The first step is to exploit the existing infrastructure of the Call Server. It primarily serves the VoIP subscribers on broadband access, with the emulation of services for PSTN subscribers. This approach gradually transitions the existing PSTN subscribers to a single control point. This evolutionary approach best enables the carrier to save the present and future investments in the network infrastructure.

A simple reimplementation of telephony services, which in most cases are still the main vehicle for the carrier revenue, is not a sufficient reason for the introduction of IMS. It is also not economically viable to implement IMS, because of a single new service. In this case the revenue will hardly cover the investment costs and the carrier must have a long-term IMS introduction strategy in accordance with its future business strategy. The long-term IMS introduction strategy generally means a fast and cost-efficient introduction set of new services as well as the full migration of the existing services to the new infrastructure. As an example of a new service, Voice Call Continuity (VCC) represents the key aspect of the IMS user experience. It enables undisturbed voice calls for dynamic users that move between the IMS network, accessible via WiFi access points, and the existing 2G/3G (PLMN) mobile networks.

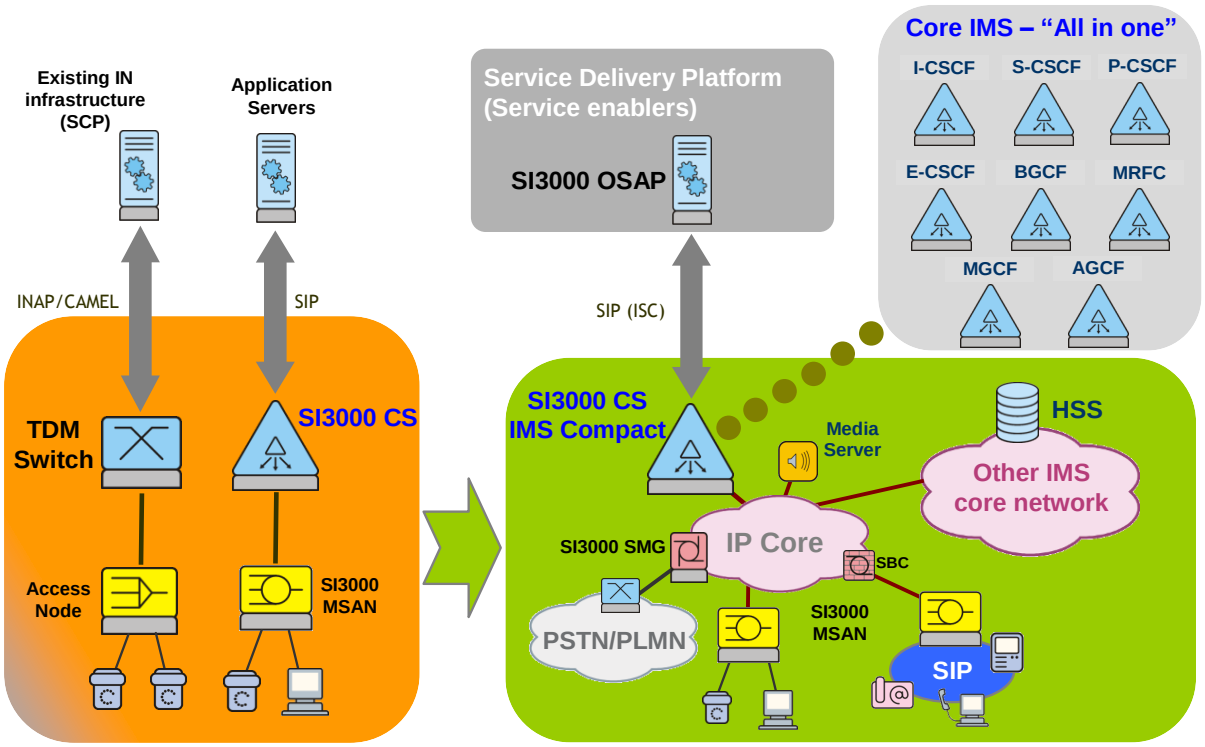

Figure 8: Evolution from the SI3000 CS to a pure SI3000 CS IMS Compact

The second step along the PSTN emulation is that a carrier is ready to upgrade the Call Server to the core IMS elements. With a software upgrade different core IMS functionalities (CSCF, MGCF and BGCF) are combined into a single network element: the SI3000 CS IMS Compact. The benefits for the carrier are in a complete SIP-based session and media control for voice, video and data traffic. To consolidate the subscriber management and billing to a single point a standard DIAMETER interface is used to connect the central database - HSS (Home Subscriber Server) – with the SI3000 CS IMS Compact. The gradual transfer of the existing services to the new IMS platform means that the number of users will increase. This potentially means that the individual functions are either separated into dedicated network elements or combined into a single network element (add as you grow).

In the last stage, when the complete IMS multiservice architecture is introduced, the carrier decides that due to OPEX savings the old TDM network is switched off. The remaining TDM access network is connected to the core network through AGCF functionality.

Benefits of a gradual IMS core introduction:

- Turnaround of the OPEX expansion in a short time frame, when the SIP-based call control is used for legacy-based subscriber equipment.
- Common service capability to control PSTN and IP-based services over multimedia SIP protocol enables the cost-efficient introduction of new services.
- Better control over the investment costs is done with the ability to scale the SI3000 CS IMS Compact incrementally, and from a modest starting point.
- Distribution of the investment costs over a longer period of time and a gradual adjustment to the required organizational changes inside the company.

5 Conclusion

IMS implementation should be viewed as a strategy of migration rather than the replacement of an entire network. The migration of PSTN toward NGN/IMS is needed to provide the same look and feel of existing services with a new technology, while providing new services. The common service control for existing and new services is the key element for future-looking carriers. Carriers choose which services to implement, and as a consequence the migration to IMS is gradual and deliberate with a focus first on the elements that make the most technological and fiscal sense.

As a result, IMS creates definite economic rewards, such as:

- An additional revenue stream to compensate for a drop in ARPU,
- Cost savings from turning around the expansion of OPEX and CAPEX,
- A lower risk profile for deploying new applications,
- Less churn and attracting new customers,
- Preserved roaming revenue.

In essence, IMS can be viewed as a roadmap for carriers to guide them through an evolution to fully converged communications. For example, web-based services will be adopted as standard usage – a process that is already underway.

6 Abbreviations

AGCF	Analogue Gateway Control Function
ARPU	Average Revenue Per User
AS	Application Server
BGCF	Breakout Gateway Control Function
BFS	Business Feature Server
CAP	Common Alerting Protocol
CAPEX	Capital Expenses
CS	Call Server
CSCF	Call Server Control Function
DVB-T/H	Digital Video Broadcasting – Terrestrial/Handheld
DMB-H	Digital Multimedia Broadcasting - Handheld
GSM	Global System Mobile
HSPA	High Speed Packet Access
HSS	Home Subscriber Server
I-CSCF	Interrogating Call Server Control Function
IMS	IP Multimedia Sub-system
IM-SSF	IP Multimedia – Service Switching Function
IP	Internet Protocol
IPTV	IP Television
INAP	Intelligent Network Application Part
IM	Instant Messaging
ISDN	Integrated Service Digital Network
LTE	Long Term Evolution
MBMS	Multimedia Broadcast Multicast Service
MGCF	Media Gateway Control Function
MN	Management
MRFC	Media Resource Function Controller
NGN	Next Generation Network
OPEX	Operational Expenses
OTT	Over the Top Players
P-CSCF	Proxy-CSCF
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
S-CSCF	Serving Call Server Control Function
SBC	Session Border Controller
SCIM	Service Capability Interaction Manager
SCP	Service Control Point
SIP	Session Initiation Protocol
SMG	Signaling and Media Gateway
SMS	Short Messages Service
SS7	Signaling System No. 7
TDM	Time Division Multiplexing
UMTS	Universal Mobile Telecommunication System
VoIP	Voice over IP

WLAN	Wireless Local Area Network