New Era in Technological Development: NGN

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***Abstract*—NGN is a shift from a "one network-one service" approach to a "one network-may services". Next generation networks are the migration to fully Internet Protocol enabled networks and services. Limitations of Internet era can be overcome by Next generation network protocols and their advanced features and technologies. Research and development on Next Generation Network (NGNs) have been carried out over the last few years. Due to the efficiency and flexibility of IP technology, most new network being established are also IP based. The advent of NGN's therefore heralds a shift from vertically to horizontally integrated networks, enabling unfettered, consistent and ubiquitous access for both users of these networks and competing service providers. In this article we discusses the major driving forces for network evolution, we outline the fundamental reasons why neither the control infrastructure of the PSTN nor that of the present-day Internet is adequate to support the legion of new services in next-generation networks and overview of its architecture and control and management and its evaluation from fixed and mobile network infrastructure. Its control and management architecture is different from internet and PSTN but NGN inherit heavily from both.**

Keywords*— *Automatic Transfer Mode, Multi protocol Label Switching (MPLS), IP Multimedia Subsystem (IMS),Session Initiation Protocol, Network Attachment Control Functions(NACF) ,Media gateway control(MGC)

I. INTRODUCTION

Since Internet was born, we have experienced its expansion regarding both the number of users and the number of different services available. As a consequence of this rapid expansion until today, service providers have more and more the needs to speed up the implementation of new network solutions in a effective and efficient way. These newest and innovative network solutions are generally referred to as Next Generation Networks (NGN).

The market for information and communications technology is currently undergoing a structural change. The classic telecommunication networks were planned and implemented for the transfer of specific data such as telephone calls or pure data packages. The recent growth

in competition, new requirements for the market and technological developments have fundamentally changed

the traditional attitudes of the telecommunications industry. The present industry is characterized by the rapid growth of broadband connections, the convergence processes of various network technologies and the emergence of a uniform IP standard for individual and mass communications.

The traditionally familiar market boundaries between fixed networks, mobile telephony and data networks are disappearing more and more quickly. This gives the customer the advantage that he can call on an extremely wide range of services, regardless of his access technology. This development requires a meta-infrastructure beyond the existing, subordinated networks – a core network for all the access networks called as Next Generation Network. The Internet Protocol is the most significant integration factor because it is available globally and, at least in principle, it can use almost all the services and applications in all the networks.

An NGN, the result of merging the internet with the telephone network, combines the best features of both. It provides:

- Adaptability for transmitting any type of traffic, which can be compared to the internet's adaptability as opposed to the inefficiency of a PSTN in transmitting data.
- Guaranteed quality of voice telephony services and critical data applications; in this case an NGN offers PSTN reliability as opposed to the best effort of the internet's capacity.
- Low transmission costs per content unit - the price is closer to the internet than to a PSTN, the total amount of data and voice traffic trebles every year.

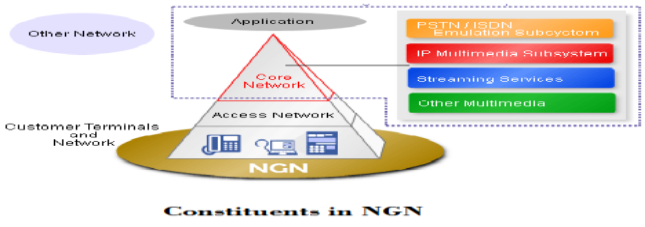

Fig:1

MAJOR DRIVING FORCES OF NGN

Heterogeneity of the Telecommunications Infrastructure

In the traditional network infrastructure, the introduction of new services and applications can be an arduous and expensive process. The process requires high staffing costs.

Many functionalities in the network have to be configured manually in order to implement new features. Moreover, the variety of networks and the heterogeneous subscriber end devices make the provision of infrastructure-independent services more difficult. As a result, the services can only be used via specific networks and appropriately adjusted end devices such as fixed network phones, cell phones, televisions, etc.

The growing number of services has led to an increase in the platforms needed to provide them, which in turn has increased the complexity of the overall infrastructure. The problems of interoperability between the various systems are becoming more serious, and this growing complexity is also placing greater demands on staff. Maintaining these platforms involves high annual operating costs for the network operators.

GROWING COMPETITION FROM OTHER SECTORS

Apart from the fixed-network and cell phone operators, companies from other sectors will also establish themselves in future on the convergent market. Portal suppliers with strong brand names and powerful financial backing – including Google, MSN, eBay and Yahoo – are planning to penetrate the voice and infrastructure business. They will also be joined by cable network operators and companies that provide media content, such

as Microsoft. This convergence is therefore producing virtually inevitable conflicts and incompatibilities. Technologies and market forces are colliding with each other. The market participants are crowding each other out and defending their positions strongly. In the course of this convergence, the value of the network business will gradually decrease and the service range will make a much larger contribution to end-customer sales. Traditional network operators will have to rethink their business model and also position themselves much more strongly on the upper levels of the value-added chain.

FALLING CALL SALES

The increasing competition due to the liberalization of the markets and the arrival of market participants from other sectors are causing great concern to the operators of former state monopolies. The classic telephone business, known as a Public Switched Telephone Network (PSTN), is particularly unsatisfactory. The golden age of the high-margin business with revenue in the billions based on classical phone calls is clearly over. Figure shows the estimated development of the global number of telephone minutes since 1990 end some predictions for market trends till 2015. In spite of the current fall in fixed-network minutes, a strong growth in the total of telephone minutes is to be expected. Experts see particularly strong potential in the use of the Internet Protocol for phone calls. This so-called Voice over IP (VoIP) is possible with all IP-based networks.

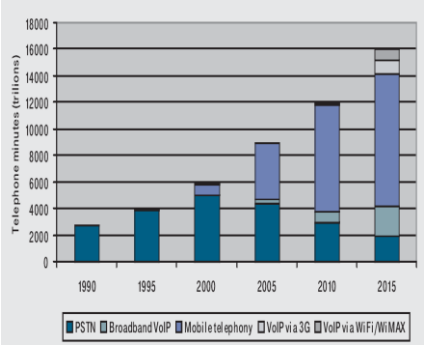

Fig:2

II. ARCHITECTURE

Access Layer(Gateway layer):

It is responsible for direct subscriber function.NGN can support all kind of existing access as well as upcoming access and is capable of processing traffic originated from PSTN, XDSL, Wimax or any other system and depending upon the type of access.Protocol conversion or media conversion may be required at the NGN gateways.

NGN gateways:-

i) Media gateway:- It terminates media, coming from PSTN/PLMN . Here, it is responsible for packetization of media under the instruction of control layer. It performs the task of packetizing voice and providing connections from switched circuits(TDM)to packetized circuits (IP, Frame relay or ATM).It is responsible for media conversion, resource allocation and resource management and event notifications and reports events to Media Gateway Controller within its zone.

ii) Access Gateway:- Allows the connection of subscriber lines to the packet network and Provides subscriber access to NGN network and services

iii) Signalling gateway:- It works as a bridge to PSTN and converts between SS7 address and IP address.

Softswitch/MGC – referred to as the Call Agent or Media Gateway Controller (MGC). It provides the "service delivery control" within the network and in charge of Call Control and handling of Media Gateways control (Access and/or Trunking).It connects to Intelligent Network /applications servers to offer the same services as those available to TDM subscribers

Transport Layer

Transport Layer of NGN is based on IP and forms the core of network. It consists of routers,which are responsible for carrying traffic originated by access layer.It's use is to transfer between nodes of network. It is consisting from one or from multiple high-speed backbone packet switched networks.

It is possible to serve to a flows of different character with different requirements on quality of transfer (delay, data

loss,...). On interface in direction to access networks and to networks of another operators are mediation gateways (MGW) situated, which are adapting and routing data flows between these networks and unified transport network. It's function is coding, decoding and packetization.

III. COMPARISON BETWEEN NGN AND TRADITIONAL TECHNOLOGIES

	PSTN / IN	Internet Protocol	NGN
Multimedia service	No	Yes	Yes
QoS – Enabled	Yes (Voice)	No	Yes
Network Intelligence	Yes	No	Yes
Intelligent CPE	No	Yes	Yes
Underlying Transport Network	TDM	Packet	Packet
Service Architecture	Semi-Distinct	Ad-hoc	Distinct
Integrated Control & Management	No	Yes	Yes
Service Reliability	High	Low	High
Service Creation	Complex	Ad-hoc	Systematic
Ease of Use of Services	Medium	High	High
Evolvability / Modularity	Low	Medium	High
Time to Market of Services	Long	Short	Short
Architecture Openness	Low	High	High

Fig:3

The potential obstacles to NGN deployment QoS

Service quality will always come first when users think of alternative services. IP is a connectionless packet switching network protocol which was designed for network flexibility but lacks QoS guarantee. In contrast the connection-oriented (whatever physical or virtual circuit) network protocols are better at quality control because of the dedicated communication route. Thus, the connectionless protocols are usually working in conjunction with connection oriented protocols in packet switching networks to achieve higher QoS.

The IP suite cannot meet the QoS requirements, it is why usually the VoIP voice is considered low quality compared to PSTN voice within the current network infrastructure. On the other hand, one of the key improvements expected from an NGN network is the enhanced QoS. Thus, extra mechanisms are definitely needed within the NGN architecture: a virtual circuit switching protocol Multi Protocol Label Switching (MPLS) and its subsequent development Generalized-MPLS (GMPLS, developed for 37 optical networks) are introduced to mitigate the QoS problem by its traffic engineering mechanisms. Through traffic engineering, the packets labeled with higher priority such as VoIP traffic can be transmitted over some faster pathways to achieve higher QoS without extra requirements on existing network bandwidths. However, it is noted that within the NGN infrastructure the achievement of acceptable QoS relies on the combination of various QoS-integrated mechanisms from the edge to the core. Despite the great efforts made during the NGN development, the industry still has doubts on the quality of voice services provided by an all-IP packet-switching network, whether the current widespread VoIP or future NGN voice services. Thus, along with other reasons, QoS issues may prevent the fast deployment of the NGN.

SECURITY CONCERNS

As a unified network based on IP technology to integrate and replace the existing PSTN/ISDN and the Internet, besides the strengths, the weaknesses from the current Internet are also inherited by NGN; security issues may not be so important as quality issues especially in NGN optical backbone networks, but for end users it still could be another critical concern. Within the existing network infrastructure, traditional voice networks are well protected by being physically separate from computer networks; usually it is difficult for computer criminals to intrude into local PSTN networks from the Internet unless they can physically access lines, switches or terminals. However, the convergence between PSTN and the Internet provides facilities for cyber crimes as there will be no more differences between voice networks and computer networks in the future. In pace with an initial transition from PSTN/ISDN to the Internet, VoIP, which has been deployed for years as a cheaper alternative to PSIN in particular in long distance communications, the cyber crimes involving VoIP networks are raising. Thus, it is not surprising to see a number of enhanced and complex security mechanisms adopted and integrated in NGN, such as the concept of Security Domain, NGN IMS Authentication, and IPSec. At present it is difficult to judge how secure an NGN is until it goes to practice, but it is certain that security will be a big challenge for NGN implementation in the future.

EMERGENCY CALL HANDLING

Special attention is focused on the emergency call handling within the NGN infrastructure. Historically, at a very early stage of VoIP, the emergency call service was neglected by service providers, as VoIP was considered as

the complement only to PSTN at that time, but later when VoIP was widely deployed, many governments regulated the emergency call service as mandatory in VoIP services.

IV. CONCLUSIONS

As we draw our conclusion, demands of users and market need are the main factors which introduce Next Generation Networks. This paper represents an overview of NGN and how we can differentiate NGN from pre-NGN networks based on its architecture and working. We can see NGN provides completely ip packet based, multimedia open service network and guaranteed QOS. Standardization and research activities on NGN and its management have been taking place quite actively in the past several years but much more work is needed before NGN can be fully realized. Although there are so many challenges in deployment however, we require NGN to fulfill today's generation's demands and requirement of advanced networking as it provides:

- Mobility of a cellular networks round the globe
- Concept richness of internet and packet based data transmission
- Bandwidth of optical networks
- Security of private networks
- Flexibility of Ethernet
- Video delivery of cable and television

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