The role of softswitch in NGN network

ARIANIT MARAJ, SKENDER RUGOVA
Post and telecommunication of Kosova
Republic of Kosova, Dardania n.n.
Prishtina, 1000
arianit.maraj@ptkonline.com, skender.rugova@ptkonline.com , www.ptkonline.com

Abstract: - Nowadays service providers are focused in Next Generation Network, which is considered as a key on the future of telecommunication technologies. NGN network has a lot of advantageous compared with traditional telecommunication systems. This converged network allows the creation, deployment and management of all kinds of services. One of the main components of NGN network is softswitch which controls VOIP calls. Softswitch enables integration of different protocols inside NGN network. The main function of softswitch is to create network interfaces between signaling gateways and media gateways. In this paper we will describe in details the role of softswitch in NGN network, especially the role of softswitch in a simple call scenario in a concrete NGN network architecture which is implemented in Telecom of Kosova (TK).

Key-Words: - Next generation network, softswitch, network interfaces, protocols, call scenario, applications.

1 Introduction

NGN network is designed to offer various multimedia communications [4], which implies that NGN network guarantees high broadband capacities, multichannel transport with high data rates, low latencies, low packet loss and QoS [1]. NGN provides the capabilities (infrastructure, protocols, etc.) to converge voice services (traditionally provided by a circuit-switched network in Time Division Multiplex mode) and data services (traditionally provided by a packet-switched network) into one common network infrastructure: IP/MPLS-based packet network [2]. It represents new technology and services that all operators want to have at their disposal. NGN technology enables converged IP/MPLS network services [3], mostly focused on opportunities for service differentiation and service-oriented technology. The convergent services are based on packet switching rather than circuit switching technology. [4]. In this paper we will describe in details NGN network architecture, protocols, services but we will be focused in the main part of NGN network that is softswitch. Softswitch is considered as platform for packet switching in NGN network. It is designed to replace class 4 and 5 switches which are based on circuit switching technology. Also, here we will describe the the main functions of softswitch in NGN network in TK and the role of softswitch in a simple call scenario in NGN network in TK.

2 Next Generation Network

NGN is a safe technology for the future. Nowadays market demands always change. Customers require different services with high quality. In order to fulfill those requirements is developed NGN network with an advanced platform. Next Generation Networks as a platform is able to offer ubiquitous connectivity and intelligent interfaces [5] for human and machine communication as well as pervasive services access, bringing value to human life for its improvement and new experiences [6]. It is proved that NGN network offers more services compared to PSTN network. NGN network needs lower investments to achieve the same functions. By creating dedicated virtual communication environment, NGN is able to disappear distance barrier between two users, handover problems etc.

NGN is packet based network, so it is oriented in VoIP services. The main features of NGN network are: packet based transmission; broadband capabilities with end-to end QoS, fixed-mobile convergence as well as wide range of services. Two international organizations as the IETF and ITU propose two different NGN network models, each one having its own set of features and protocols.

According to IETF, NGN network topology model is based in Softswitch model which consists of:

- Media Gateways (MG): the role of media gateway is conversion of voice message from circuit format into packet format.
- Media Gateway Controllers (MGC): the main role of MGC is to manage different connections in a certain packet network. Also, has the feature for call control.

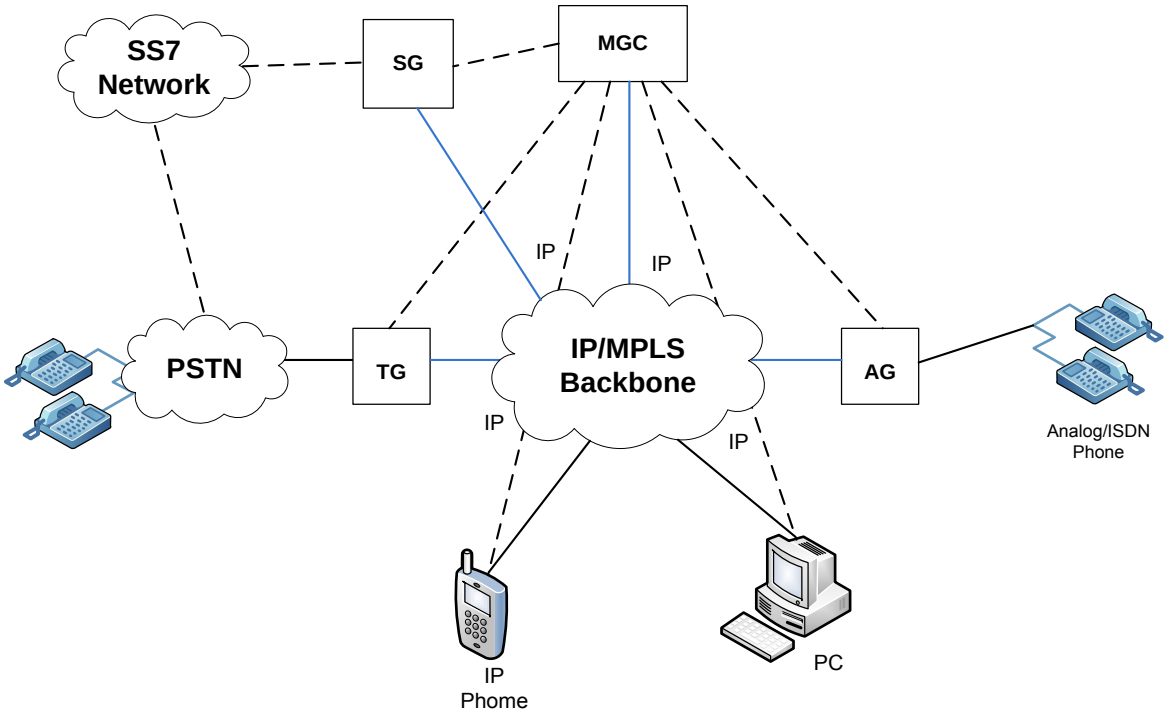

Figure 1: General NGN network architecture

- Signaling Gateway (SG): it is the interface between packet network and signaling network nº 7 (SS7) of the switched circuit network.

Whereas, the ITU defines the NGN network topology based on H323 standards. This ITU model includes:

- Gateway (GW): it is the interface between the IP network and switched circuit network.
- Terminal: may be any end-point of the network able to establish duplex communications in real time with any other H.323 terminal or any Gateway.
- Gatekeeper (GK): the Gatekeeper manages an H323 zone, thus providing address translation of terminals within one H323 zone.

NGN network is designed to become more than ISP (internet service provider). NGN network brings change in service network architecture and service network management [6].

3 Types of services that are carried over NGN network

In the Internet, data packets that belong to traffic flow are not guaranteed. Said in other words, the Internet is not suitable for real time applications, because network capacity is not guaranteed and delays are not limited. Thus, it is necessary to present an architecture that supports new services in the Internet and guarantees QoS for real time applications. NGN network is able to support those services.

Most important types of services that are carried over NGN are:

3.1. OAM Traffic

OAM traffic is again subdivided in categories depending on the type of equipment:

- NGN OAM: OAM for/from NGN specific servers: softswitch server, open service platform, core and edge routers etc
- Access gateway OAM: to/from AGW and their network management centers
- Network OAM: to/from routers, switches, firewalls and their network management

3.2. VOIP Traffic

VoIP traffic is a unique form of traffic in that it requires little bandwidth but very low latencies [5]. Call controlling protocols for VoIP traffic are: SIP, Megaco signaling and RTP voice traffic.

SIP & Megaco are signaling protocols that will be used to establish calls. Traffic will flow between terminal endpoints (AGW) and the NGN core equipments softswitch and open service platform (OSP).

RTP traffic carrying the call will flow directly between the interested terminal endpoints (AGW, IP/MPLS routers and media server).

3.3. Data Traffic

This traffic is pure Internet traffic between BRAS (broadband remote access server) and DSL accesses

in the AGW & ISAM. This traffic must not be able to interact with the VoIP world but should be carried across the IP backbone from the ADSL directly to the BRAS. The Internet security and standard practices related to ADSL based access must be taken into account.

3.4. Supplementary services

Supplementary services that offers NGN network are: Call Forwarding services, Fixed announcements, presentation Services, Call screening, outgoing call barring, 3 party conference, Explicit call transfer, Call hold, Call waiting, PBX Line hunting

3.5. Intelligent services

Some Intelligent services that offer NGN are: Prepaid Card service, free phone, Premium Rate, Televoting.

3.6. NGN SIP traffic

SIP technology is the key for NGN deployment. SIP is the IP based signaling used for the call handling of VoIP calls. Some of the equipment also uses the MEGACO signaling (gateways) but this other IP based signaling protocol will travel on roughly the same paths and within the same LANs as the SIP signaling. As it is a signaling protocol, SIP will flow between a terminal endpoint and the NGN core elements. Terminal endpoints are the Trunking Gateway, the announcement server and all AGW nodes. NGN core elements are the softswitch, media gateway controller (MGC), and open service platform..

3.7. NGN RTP traffic

RTP is the IP based protocol used to carry voice in NGN/VoIP networks. RTP traffic is sustained, composed of short UDP packets, heavy volume, requires high priority handling and small inter-packet delays in order not to impact the voice quality. RTP traffic always flows between 2 endpoint terminals; it never goes to the NGN core elements as these only handle signaling (SIP/MEGACO) flows.

4 Protocols used in NGN network

NGN is considered as converged network aggregating different functionalities of existing network with common IP/MPLS backbone [7]. NGN network offers interoperability using multiple protocols. The main feature of NGN architecture is separation of service, transport and control layers, which are interconnected by open interfaces and use standards protocols as below: [8]

- MEGACO is protocol which is sponsored from IETF and ITU. It is used inside one MGC (media gateway controller) for controlling media gateways (MG-s). This protocol allows the MGC to tell to the MG-s when to send and receive information towards/from different addresses. This protocol also is useful for sending all information to the MGC from MG-s regarding with detected events such is: on –hook, off hook etc. The equivalent protocol of MEGACO according to ITU is H248.
- SIP-Session Initiation protocol: is protocol that resides into application layer and is signaling protocol. SIP plays a very important role for session creation for audio/videoconferences, interactive games and for call orientation towards IP network. SIP is IETF standard which supports traditional telephony services within IP domain such are: routing, identification, call establishment and other services.
- H323 protocol: this protocol is for multimedia conferences, including here: voice, video and data in packet switched networks. H323 standard can be applied in networks that which offers different services: IP telephony, networks for offering voice and data, video and data etc. The main components of H323 protocol are: terminals, Multipoint Control Units (MCUs), Gateways, Gatekeeper, Border Elements / Peer Elements.
- Real time protocol: this protocol offers end-to-end voice transmission in real time. Whereas H323 is used for data transmission in IP based networks, the RTP protocol is used for data transmission in User Datagram Protocol (UDP). RTP together with UDP offers functionality to the transport protocol. The RTP protocol identifies the type of load, enumerates sequences, measures time etc.
- Real Time Control protocol (RTCP): is a copy of RTP which offers control services. The main function of RTCP is identification of transport level for one RTP source.

5 Softswitch architecture

One of the main equipment that offers voice application in NGN network is Softswitch. The main role of Softswitch is to provide call control functions for VoIP calls. Softswitch enables integration of different protocols within NGN network. Call details for billing are generated in Softswitch also. Another important function is interface creation with existing telephony networks PSTN (Public Switched Telephone Network) through Signaling gateway and Media gateway.

Softswitch is considered as amount of distributed elements through IP/MPLS network. In the figure below (see Figure 2) is client-server softswitch architecture.

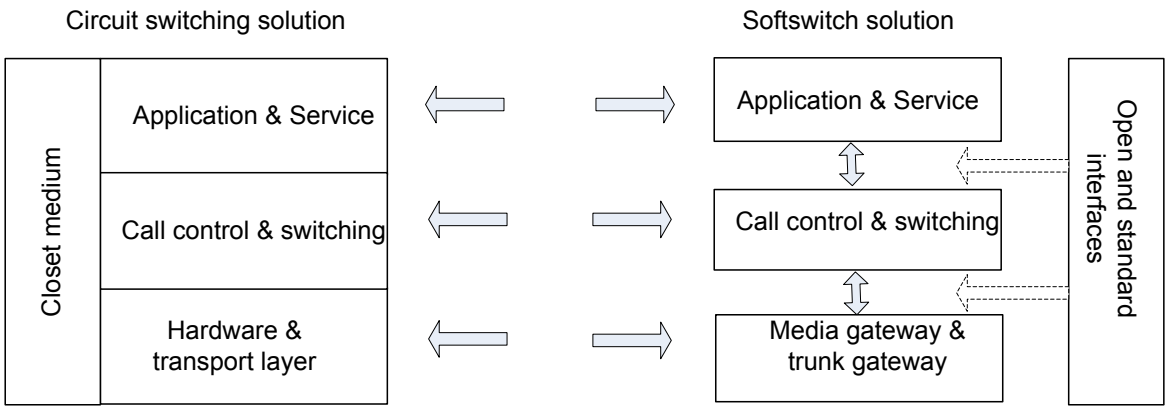

Figure 2. Client-server softswitch architecture

The main advantages of Softswitch against traditional switches are: new services, flexibility in operation and maintenance, easy integration of different components and networks, low cost etc. This technology enables connection between internet, wireless networks, cabling networks and traditional telephony network, which results in one convergent network.

Also this softswitch model opens opportunity for third order developers. Lower layer is considered to be the transport layer, which physically transports voice and data. This enables client-server softswitch architecture, known as "opposite" of main architecture in class 4 and 5.

Figure 3 illustrates the distributed architecture of Softswitch [9]. This model separates packet switched hardware from call control, service logic and creation of new services. This distribution enables high hardware flexibility. The lower layer is considered to be the transport layer, which physically transports voice and data services.

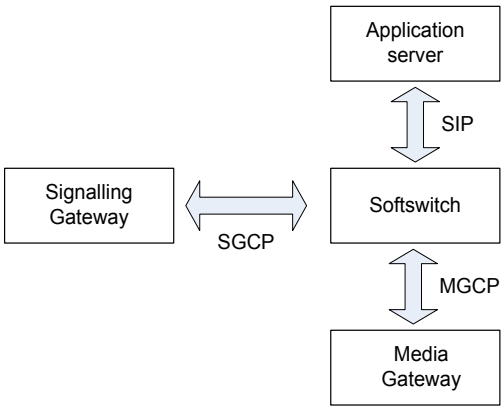

Figure 3. Components of Softswitch architecture

In NGN network VOIP control subsystem consists of Softswitch platform- fulfills users' requirements for voice and broadband multimedia services. In its efforts to keep the leading position in Kosova's competitive telecommunication market, TK (Telecom of Kosova) has implemented its technological development strategy and has finished migration to full IP/MPLS NGN network. Softswitch platform in NGN network in TK consists of four essential functions:

- Offers call control services and supports SIP, MEGACO/H.248 protocols (Call and Session Controller-CSC)
- Supports advanced interconnections with PSTN network (Media Gateway Controller-MGC)
- Keeps note in detail for user location (Subscription
- Location Server-SLS)
- Controls AGW (Residential Gateway Controller-RGC)

Software models for softswitch in NGN network in TK are structured in 3 main layers: protocol interfaces, call/session controller and management layer. Softswithes are simpler in that they do not require a small army of engineers to operate them. They are smaller in that they take as little as one-thirteenth of the real estate required of a circuit switch of similar scale. And finally, as the example of IP PBXs demonstrate, they are becoming increasingly more convenient to use. Softswitch technologies enable the telecommunications market to open the switching aspect to competition. Softswitch also enables a service provider to bypass the central office and Class 4 and 5 switches. Softswitch is cheaper both in purchase price and operating expenses than the circuit switches.

6 Role of softswitch in a simple call scenario in NGN network in TK

In order to see the call setup scenario in NGN network and a role of softswitch in this call scenario, it is presented one system with all corresponding components that enables this process.

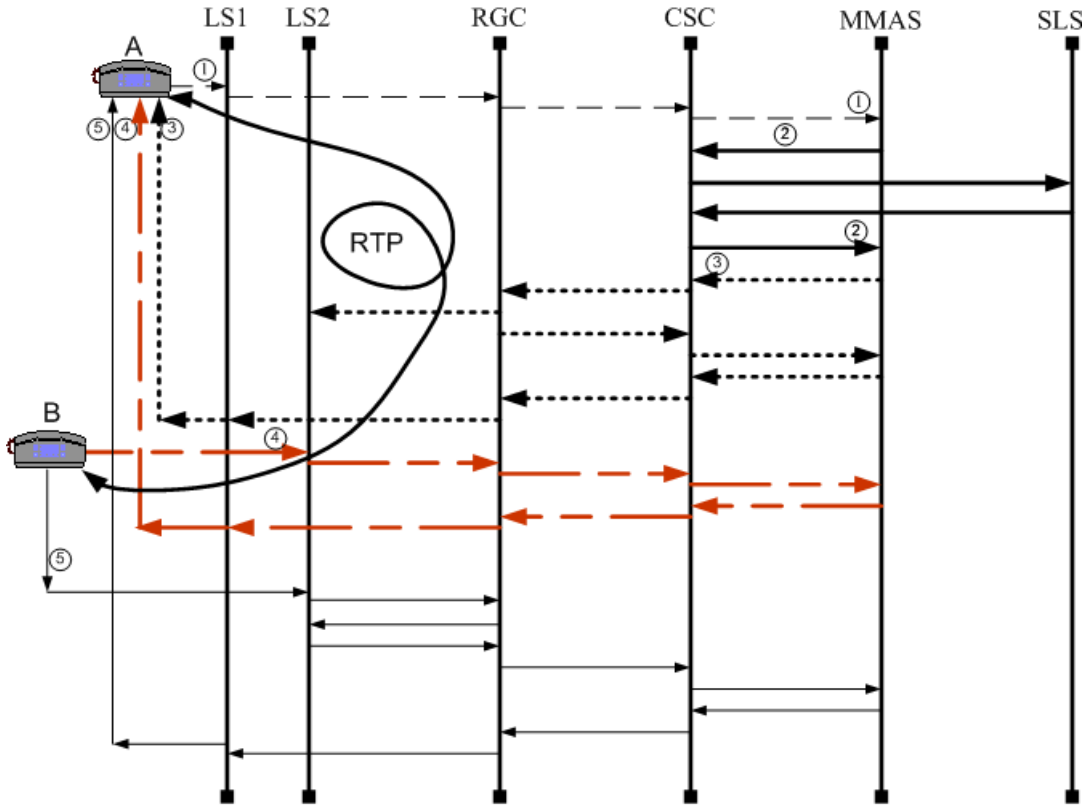

Figure 4: Call scenario in NGN network

This call scenario process includes 5 steps as shown below (figure 2) [4]:

1. User A goes off-hook and dials the destination number. In this case a MEGACO message is sent from Access gateway to the RGC (residential gateway controller) that contains an off-hook event and dialed number. RGC sends a SIP message to the CSC server; this SIP message contains information on the originating point and number of the destination user (E.164). CSC (call and session controller) proxies the INVITE message toward MMAS, where MMAS checks and applies originating side supplementary services if required (e.g. OCB-Outgoing Call Barring)
2. MMAS proceeds by sending an INVITE message toward CSC of the originating side (CSC_A). CSC forwards message to SLS to identify location of destination user. SLS looks up in its database and finds the CSC that hosts the user and sends status message 302 Temporary Moved (contains the ID of the CSC) showing the location of USER B (in our case CSC_A). CSC forwards INVITE message to MMAS to process supplementary services on the terminating user.
3. MMAS sends INVITE message to CSC. CSC_A figures it owns of the user and forwards the INVITE towards RGC_A. RGC_A finds user in its local database and then sends Megaco messages to the AGW of the destination user to set-up RTP context and applies ringing tones. In this case phone user B starts to ring. RGC_A sends status message 180 RING back to the CSC_A. CSC_A sends the status message back to the MMAS who originated the Invite. Now we have intensive communications between CSC and MMAS generating invite messages for originating side. Thereafter, CSC proxies' status message to RGC who originated the Invite. RGC_A tells AGW User A to apply ring-back tones (Megaco message), User A hears the ring-back tone. SDP (Session Distribution Protocol) for user A and B is known at both endpoints. Now full RTP path will only be set when user B answers the call.
4. User B answers, RGC_A receives an off-hook event from AGW. RGC_A sends status message 200 OK toward CSC_A. CSC_A proxies the reply back to MMAS (terminating side), MMAS terminating side, forwards it toward origin. After reciprocal communication between CSC_A and MMAS and generation of Invite messages, CSC proxies status

message to RGC who originated the Invite. RGC informs AGW to complete the RTP path. The RTP path is then completed over the IP network from LS user A to LS user B. Now user A chats with User B.

5. After User B hangs-up, on-hook event is sent to RGC. RGC_A tells LS to remove RTP context for user B. RGC_A sends BYE message toward CSC_A to terminate the call. Now we have a intensive communications between CSC_A and MMAS through call set-up but in opposite direction. Then the CSC proxies BYE message to RGC who originated the Invite. RGC tells LS to remove RTP context and apply tone. Call is terminated

As we can see the five steps described above the role of softswitch is fundamental for call setup scenario.

7 Conclusion

Softswitch as the key component of NGN network and is designed to replace traditional hardware telephone switches by serving as gateways between telephone networks. Many concepts deployed in PSTN have been translated into softswitched networks, including signaling, voice codec's and transport. Softswitch is disruptive to legacy networks and equipment vendors (makers of PBXs and Class 4 and 5 switches) in those elements of softswitch are cheaper, simpler, smaller and more convenient to use than their predecessors in the network. They are cheaper in purchase price, real estate and so on. In this paper we have explained the NGN network architecture, protocols used in NGN network, services that supports etc. The main purpose of this paper is to explain the role of softswitch in NGN network. Here we took an example of a simple call scenario in NGN network in TK and we have seen the role of softswitch in call scenario in NGN network.

References

[1] Liliam Goloniewski "Telecommunications essentials: the complete global source for communications fundamentals, data networking and the internet, and next generation networks" (book), Chapter 10, pg 283-327, copyright 2003 by Pearson Education, Inc.

[2] Next-Generation Networks Focus Group" Converging NGN Technical Framework – Principles and Issues, Draft3 For Tia Tcngnfg Consideration June 13, 2005

[3] B.Shatri, A.Abdullahu, S.Rugova, Arianit Maraj 'VPN creation in IP/MPLS Network in Kosova"- ICN 2008, The Seventh International Conference on Networking-IEEE, April 13-18, 2008 - Cancun, Mexico

[4] S. Rugova, A. Maraj, "Analysis of Call scenario in NGN network, Proceedings of the 8th WSEAS International Conference on ELECTRONICS, HARDWARE, WIRELESS and OPTICAL COMMUNICATIONS (EHAC '09), ISSN: 1790-5117, ISBN: 978-960-474-053-6

[5] Johan Zuidweg 'Next generation intelligent network" © 2002 artech house, inc.

[6] Dr Jingming Li Salina, Pascal Salina, Next Generation Networks-Perspectives and Potentials, Copyright © 2007 John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.

[7] NGN- Interconnection- S. K. Gupta, Advisor (CN&IT) Telecom Regulatory Authority of India

[8] NGN protocols-Technology white paper

[9] Franklin D.Ohrtman, Jr, "Softswitch - Architecture for VoIP"[BOOK-copyright 2003 by McGraw-Hill Companies, Inc. All rights reserved. ISBN 0-07-140977-7