Study of the Implementation of NGN in Ecuador

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Abstract*— the Next Generation Network concept is a model of network and service provisioning which objective is to provide horizontal services (converged services) to the user efficiently. The Next Generation Network concept is key to the Modern Telecommunication Operator because of it represents an efficient network architecture that allow the Operator to efficiently manage their network and services. While the architecture of Next Generation Network has been deeply study theoretically, and in many countries, it has been deployed in some sense, in this paper we present an analysis of deployment of Next Generation Network in Ecuador. The interest of this study is to show the grade of practical deployment of this concept in countries like Ecuador, where the economic power of Telecommunication Operators could limit that deployment. We conclude this analysis with possible evolution of this analysis and some conclusion and recommendations.

Keywords*— NGN, QoS, CAPEX, OPEX, Analysis.

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***Abstract*— the Next Generation Network concept is a model of network and service provisioning which objective is to provide horizontal services (converged services) to the user efficiently. The Next Generation Network concept is key to the Modern Telecommunication Operator because of it represents an efficient network architecture that allow the Operator to efficiently manage their network and services. While the architecture of Next Generation Network has been deeply study theoretically, and in many countries, it has been deployed in some sense, in this paper we present an analysis of deployment of Next Generation Network in Ecuador. The interest of this study is to show the grade of practical deployment of this concept in countries like Ecuador, where the economic power of Telecommunication Operators could limit that deployment. We conclude this analysis with possible evolution of this analysis and some conclusion and recommendations.**

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I. Introduction

Since first Telecommunication Network appeared in 1830 to our times, a lot of development and new technologies have been deployed with the objective to improve the Quality of the Service (QoS) and satisfaction of the user. The most recent and complete model for defining the Telecommunication network and service provisioning is named Next Generation Network (NGN) [XX]. This reference model has been standardized by the International Telecommunication Union (ITU) and European Telecommunications Standards Institute (ETSI), but also is related to Internet and its regulation organisms. This standardization organism normally emit document in which they made recommendations for the implementation of NGN. For example, in [https://www.itu.int/ITU-D/tech/NGN/CaseStudies/NGN_CaseStudy_IND_PHIL_SLKA_V2.pdf] is presented a case study of implementation of NGN in Asia-Pacific countries (India, Philippines and Sri Lanka) in the year 2012. They analyze the grade of implementation of NGN in those countries and the best practices to deploy efficiently the NGN. The importance of this study is that it can be used to show the QoS of service in that Telecommunication networks [2][7].

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The importance of Information and Communication Technology (ICT) in Information Society is such that European Union (EU) has developed the H2020 Strategy for Broadband services [https://ec.europa.eu/digital-single-market/en/broadband-strategy-policy] with the aim to set EU in the top of developed countries. This show the importance to develop a correct action deploying NGN in all the countries around the world. Also, recently, United State of America (USA) and Great Britain [https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/418567/UK_Next_Generation_Network_Infrastructure_Deployment_Plan_March_15.pdf] has developed plans to adapt their Telecommunication networks to NGN in the next years. This show the importance to count with high powered NGN infrastructure in the country to develop a correct Economy in the country in the hyperconnected world [https://www.weforum.org/projects/hyperconnected-world/].

Up to our knowledge these kinds of studies have not been developed in Ecuador recently. For this reason, we in year XX started the study of implementation of NGN in Ecuador. We wanted to show the grade of deployment of NGN in Ecuador to show the state of the country to avoid the new Economy in the World based on ICT (hiperconnectivity). To do this, we review the utilization of QoS in the networks of Ecuadorian Telecommunication operators. The aim of this analysis is to conclude some recommendations for the next future [2].

The structure of this paper is the following: in Section Two we first introduce the basics of NGN. In Section Three we present the variables we analyzed in our study. In Section four we briefly present possible evolution of the NGN in Ecuador in the next years and finally we sum up some conclusions and future work.

II. Evolution of Telecommunication Networks: Next Generation Network

First Telecommunication Operators in XX Century provided only Telephony service dedicating a specialized network. With the advent of digital and mobile Telephony

networks, there was the necessity to interconnect all these kinds of networks. At the beginning of 1990 years, appeared a strategy of interconnection called Signaling System Number 7 (SS7) that jointly with gateways in the edges of the different interconnected networks conformed the new Telephony network. This telephony network combined analog, digital and mobile telephony networks. The high complexity of SS7 only allowed providing vertical services. That is, the different telephony services and networks did not share their infrastructures. They only were interconnected by gateways and the SS7 protocols and services [1][4].

This straightjacket and very inflexible model of interconnection led to another model called Next Generation Network (NGN) to offer multiple converged services using a shared network characterized by several essential elements:

- A network with a unique and common Kernel for all access types and communication services.
- The network architecture was divided into three levels: transport, control and Quality of Service (QoS) guaranteed services and adapted to the user requirements.
- Usage of packet switching (native Internet Protocol (IP) transport).
- Open and standardized interfaces between each level and particularly for control and services to allow third parties to develop and create separate owner services network [2].

The model of service provision in NGN is a horizontal model, that is, the different service providers can implement their own services and the Telecommunication Operator can adapt it to its NGN using only one Kernel infrastructure and a variety of Access networks available in the market.

Thus, NGN is a model of implementation of services on a common Kernel network (normally owned by the Telecommunication Operator) that can deliver any service to the user. Services that can be deployed in any Access Network like Wireless Fidelity (Wi-Fi), xDigital Subscriber Line (xDSL), Fiber to the x (FTTx), Hybrid Fiber Cable (HFC.

To provide high bit rates, this kernel must be implemented using typically IPv6 over Multi-Protocol Label Switch (MPLS) over Wavelength Division Multiplexing (WDM). The usage of these technologies allows the Telecommunication Operator to provided efficient QoS mechanisms for providing efficiently the service to a user. Moreover, it allows the Telecommunication Operator to provide efficient mechanisms for controlling the service billing controlling the Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) [3].

The above implementation of the NGN concept in the Telecommunication Operator incur in economic costs that not all the operator can assume. For this reason, we have analyzed, in Ecuador, the grade of implementation of NGN in the Ecuadorian operators [4].

III. Development of Analysis

We have analyzed the developed QoS in the end to end processes in the Telecommunication operators. We did this for different services. Our objective with this methodology was to verify the grade of implementation of QoS in the NGNs currently deployed [3].

We interviewed to seven Telecommunication operators. We used several parameters in the polls to correctly show the state of implementation of NGN. Those parameters are:

- QoS Analysis and results.
- Analysis and results of the architecture of NGN deployed.
- CAPEX Analysis.
- OPEX Analysis.

A. QoS Analysis and Results.

In Table I, it is presented the question of the poll intended to discover the QoS of the NGN of the Telecommunication operators.

TABLE I
USE OF QOS FOR NGN TELECOMMUNICATION OPERATORS

QoS	%	Operators say if	Total Consulted Operators
Know about what is Quality of Service (QoS)	100,00%	7	7
Use some technique of Quality of Service (QoS)	100,00%	7	7
Handles some form of priority to the packet transmission	100,00%	7	7
SLA established with priority users	85,71%	6	7
Having implemented Quality of Service (QoS)	100,00%	7	7

We were interested in the knowledge of QoS of the Telecommunication operators about of QoS. It is important to remark that all the operators had technical knowledge of QoS. All the operators used technique of QoS in the NGN. Also, all of them managed priority for giving priority services of relevant users. Only one of them did not use Service Level Agreement (SLA) and all of them have implemented QoS in their networks [1][3].

In Figure 1, it is shown a graphical result in more detail with respect to Table I.

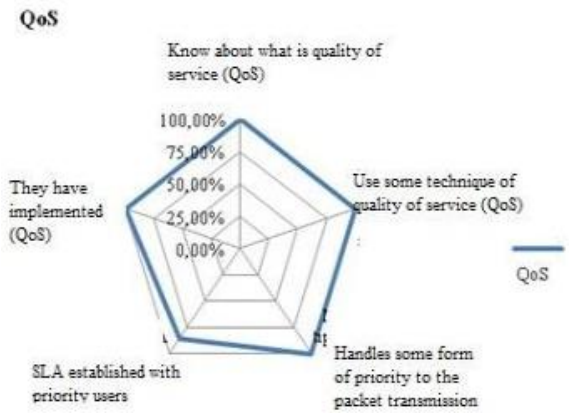

Fig 1. QoS Graphical Results.

Briefly, regarding the results show in Figure 1, we highlight:

- The 100% of the Telecommunication operator know the concept QoS. This makes sense because of we interviewed technicians which had a university grade of knowledge.
- The 100% of the Telecommunication operators used some technique of QoS. We could not be verified which kind of technique they used.
- We could be verified that the 100% of Telecommunication operators implement some priority techniques in the routers of their networks. They also use packet switching networks and benefits privilege users giving them priority services.
- The 85.71% of the Telecommunication operator use SLA. This is very interesting because the user can claim for QoS in the service provision. We cannot access to the claims of the users to verify the SLA because they were efficient and provide the grade of QoS demanded by the users.
- The 100% of the Telecommunication operators used QoS.

Because of QoS analysis, we conclude that the grade of implementation of QoS in the Telecommunication NGN is satisfactory. But we could not verify some actions that could guide us to a more reliable result.

B. Analysis and results of the architecture of NGN deployed.

This section shows the surveys carried out by the different operators about the next generation networks NGN. (See Table II).

TABLE II
NGN IMPLEMENTATION

NGN	%	Operators say if	Total Consulted Operators
People aware of what the NGN is	100,00%	7	7
Currently using converged networks	100,00%	7	7
NGN Networks used	100,00%	7	7
Having implemented QoS in NGN Networks	100,00%	7	7
Offering more than one service	100,00%	7	7
Having over a Network System	100,00%	7	7
Integrating services with different networks (fixed networks, mobile networks)	71,43%	5	7
Provide the same service through 2 different networks	100,00%	7	7
Having the presence of an intelligent network	81,71%	6	7

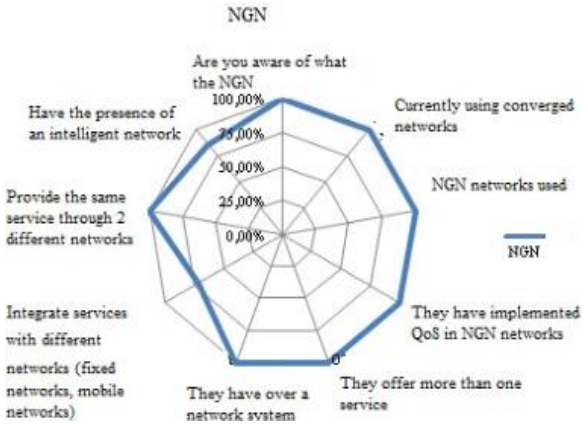

Fig 2. NGN Graphical Results.

The graph shows the following results:

- The 100% of the operators are aware of what the NGN networks are.
- The 100% of the operators using converged networks today.
- 100% of the carriers used NGN.
- The 100% of the carriers have implemented in NGN QoS.
- The 100% of the operators offer more than one service.

- The 100% of the carriers have more than one network system.
- The 71.43% of the operators integrate services with different networks (fixed networks, mobile networks).
- The 100% of the operators provide the same service through two different networks.
- The 85.71% of the operators have the presence of an intelligent network

C. CAPEX Analysis.

Due to the importance of what is relevant to the capital expenditure and the investment that operators must make to reach the goal of convergent networks, it is important to carry out the study of a CAPEX survey [4][5]. (See Table III and Figure 3).

TABLE III
CAPEX SURVEY TO OPERATORS

CAPEX	%	Operators say if	Total Consulted Operators
Investment in equipment and technologies	100,00%	7	7
Investment in equipment each year	100,00%	7	7
Believing that the investment is essential for growth	100,00%	7	7
Consider the use of NGN increase investment	85,71%	6	7

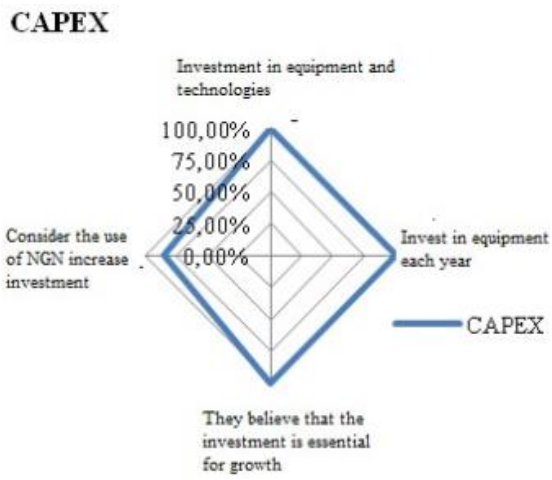

Fig 3. CAPEX Graphical Results.

CAPEX analysis indicates the following results:

- The 100% of operators believe that investing in equipment and technology is necessary for the development of the same.
- The 100% of the operators invested annually in NGN equipment to enter.
- The 100% of the operators considered that investment is essential for the growth of your networks.
- The 85.71% consider that the use of NGN will increase investment and only 14.29% think not.

D. OPEX Analysis.

An important issue in the implementation of telecommunication systems is the operation that allows an operator to be efficient, therefore it has conducted a survey and analysis of the respective OPEX [4][5]. (See Table IV).

TABLE IV
OPEX SURVEY TO OPERATORS

OPEX	%	Operators say if	Total Consulted Operators
The operating costs of them networks allow surpluses for investment	85,71%	6	7
Consider that the process of connectivity to provide customer service is part of the operating cost	85,71%	6	7
Using increases operating cost NGN	28,57%	2	7
It has been possible to demonstrate a measurable benefit economically from the use of NGN Technologies.	100,00%	7	7

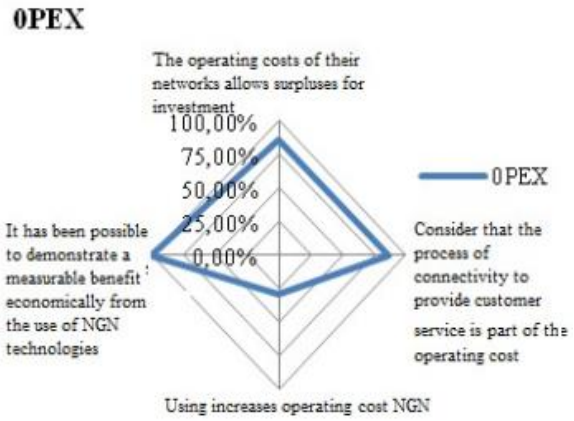

Fig 4. OPEX Graphical Results.

OPEX analysis indicates the following results:

- The 85.71% of operators believe that the operating cost of their networks allows them to have a surplus for investment.
- The 85.71% of the operators considered that the process of connectivity to provide customer service is part of the operating cost.
- The 28.57% of the operators consider the use of NGN increases operating cost.
- The 100% of the operators had a quantifiable economic benefit due to the use of NGN technologies. (See Figure 4).

IV. NGN Evolution 2013 – 2016

Considering the services currently offered by telecommunications operators in the country, as internet broadband using LTE, MPLS, providing access home with optical fiber FTTH, GPON, increased bandwidth, increased speeds transmission, offering the triple play of voice, video and data, VoIP services to both corporate and residential, we can infer that the degree of penetration in different cities of the country has been increasing for the use of services in next generation networks [4][6][7].

V. Conclusions

After completing the investigation about the implementation of NGN networks in Ecuador we can reach the following conclusions:

- QoS is essential to ensure the priority in the information services offered, be voice, video, data.
- Each operator defines a model for customer QoS depending on the level of service and quality parameters agreed with him
- Today most computers located on the network and provide telecommunications services, have some form of QoS implementation, but not used to their full capacity.
- NGN networks will facilitate the convergence of services of telecommunications operators.
- All operators are targeting the implementation of NGN networks.
- NGN will give the end user a different experience of life regarding their view telecommunications as through a mobile device can access all telecommunications services anywhere you are, anytime and anywhere with a single network access.
- The CAPEX of a company is important for the development and growth of the same, both in technology and in coverage.
- The operators analyze the evolution of demand in the market and have dynamic business objectives allowing them to allocate resources where demand is growing.
- The OPEX of a company is intended to maintain efficiency in the infrastructure and operation of networks in such a way that generates surpluses that are reinvested.
- The need for users to have all services at your fingertips, forcing operators to drive technologies to the existing demand.
- Offering services through new generation networks have increased in the country due to the introduction of new generation equipment in the core of their networks.
- In the future, all telecommunications services will be offered by operators through the same technological infrastructure.

References

[1] B. Duran, J. Sommerville, M. Buchmann and R. Fuller, Administering Cisco QoS For IP Networks, Syngress Publishing, 2001.

[2] J. Ding, Advances in Network Management, Taylor & Francis Group, 2010.

[3] CiscoSystems, End to End QoS. Network Design Quality of Services in LANs, WANs and VPNs., 2005.

[4] J. Salina and P. Salina, Next Generation Networks. Perspectives and Potentials, 2007.

[5] W. Stallings, Data and Computer Communications, Prentice Hall, 2000.

[6] J. Bates, C. Gallon, M. Bocci, S. Walker and T. Taylor, Converged Multimedia Networks, John Wilewy & Sons Ltd, 2006.

[7] M. Poikselka and G. Mayer, IMS. IP Multimedia Concept and Services,, John Wiley & Sons Ltd, 2009.