Next/New Generation Networks Services and Management

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Next/New Generation Networks Services and Management

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Abstract

New/Next Generation Networks aim to provide mutual trusted IP Based Networks for a multi access network and innovative services tailored to users needs. NGN architecture has been the purpose of several studies within organism of standardization like ITU-T and ETSI.

We present here a literature about NGN architecture (NGN) and Next/New Generation service (NGS) requirements: details about functionalities of NGN layers and IMS (IP Multimedia Subsystem) Architecture are in the scope of the paper. We also describe the service management aspects and its challenges while evolution towards NGS.

Key words *NGN, NGS, IMS, Service management.*

1 Introduction

NGN (Next Generation Network) is a concept that has been introduced to take account of the new situation and changes in telecommunications fields. It is characterised by a lot of aspects: Deregulation of markets, new demand from user for innovative services tied to his needs and to his location and explosion of digital traffic (increase of using Internet). NGN as defined by the ITU-T is a packet-based network able to provide services including Telecommunication Services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It offers unrestricted access by users to different service providers. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users [1].

It is to notice that the cornerstone of NGN architecture is the separation of services from transport allowing them to be offered separately and to evolve independently. [2] The conception of these services is a key challenge for the telecom market. Their usage is evolving toward integrated services, relying seamlessly on multiple access networks and bundling multiple service elements (e.g. voice/video connectivity, community tools, presence, conferencing, gaming, TV broadcasting…).

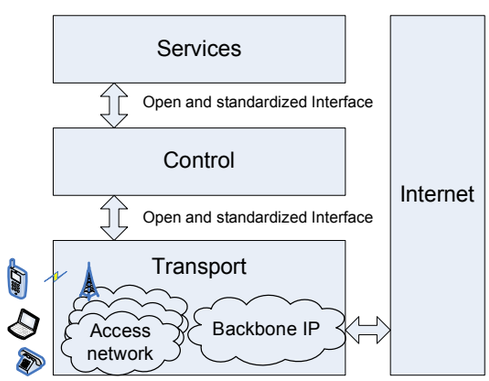

Figure 1 NGN decomposition Layer

The figure below illustrates:

◊ The multi access networks: xDSL, WiFi, UMTS, Cable. This also means diverse fixed and mobile terminals.

◊ Mutual transport layer for all access type and for numerous multimedia services

◊ The relation between NGN and Internet architecture: continuity between the two concepts

NGN introduce economical and technical aspects: economically it allows increasing productivity by creating new usage relating voice and data services (voice over IP, Instant messaging, Presence, Streaming and Advanced push to talk). In fact, NGN enable service provider to offer real time and non real time communication services, and allows them to provide nomadicity and mobility of both users and devices. NGN promises that communications services are always reachable every where using a terminal.

It also permits reducing costs for infrastructure maintenance, hence one type of transport network instead of specific one to each access network. Technically NGN make very flexible the network architecture in order to define and introduce easily new services.

Numerous research activities and studies are dealing with Next Generation Networks and Services to realize the predefined economic and technical aspects: the architecture of NGN and the new protocols and API, the service architecture in order to set up a clear and flexible way to define innovative services, the service interaction, the service management and network management to handle and integrate the new concept of NGN within new vision of OSS/BSS.

To ensure these studies several efforts are continually in practice within organisms like:

Internet Engineering Task Force (IETF), 3rd Generation Partnership Project (3GPP), International telecom Union (ITU) and (ETSI TISPAN)

Telecommunication and Internet converged Services and Protocols for Advanced Networking [4].

The paper is organized as follow: section 2 covers NGN architecture by describing its layer functionalities. Section 3 provides an overview for the Next/New generation services: definition and types Also the description of the IMS architecture as an NGN realization. Section 4 gives an overview of organisms working on the management of services and presents challenges that are facing the management for the Next Generation networks and services.

2 Next/New Generation Networks Architecture

NGN architecture is a set of functions per layer: the transport functions, the control functions and the service functions.

2.1 Transport functions

Transport layer functions within NGN Transport functions within NGN architecture are allowing access to networks and routing traffic of multimedia flows during a communications session.

The transport functions as defined within ITU-T [3] are composed of transfer functions from various access networks (UTRAN, WLAN, xDSL) and from core network, of the functions to control these transfer functions (e.g. network attachment control or resource and admission control), of the transport user profile functions (e.g. to store the data linked to network attachment), and of the media handling functions (e.g. to play media messages).

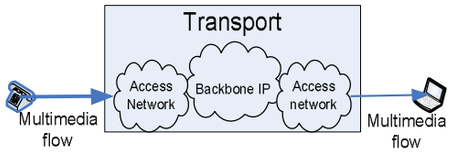

Figure 2 NGN Transport Layer

Transport functions ensure [3]:

- ◊ User to user connectivity.
- ◊ User to service platform connectivity.
- ◊ Service platform to service platform connectivity.

2.2 Control functions

Control functions deals with functions such as connectivity of terminals to the network, control of multimedia session and control of physical resources on the network (e.g. router).

Specifically, these functions handle the signalling for starting a session and supervise transport functions.

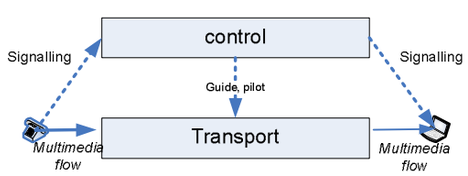

Figure 3 NGN control layer

2.3 Service functions

The service layer is a set of functions as defined in the ITU-T Recommendations Y.2011 [3]:
The service functions deal with registration authentication and authorization.
The user profile function represents the compilation of user date and other control data into a single profile function.
The application function supports open APIs to enable third-party service providers to apply NGN capabilities to create innovative and enhanced services for NGN users.

It is to notice that ITU-T and ETSI-TISPAN decompose NGN architecture into layers the service layer and the transport layer. Both contain control function respectively for services and for transport.

3 Next/New Generations Services

Communication services are moving from PSTN/GSM telephony and/or email to multiple communication services: chat, instant messaging, voice, video, presence, address book, TV broadcasting… If all these services are deployed in an uncoordinated way by a service provider, the user has to handle the interaction between the services (e.g. by entering the same personal preferences several times). In addition, advanced functionalities between these services (like routing voice calls according to the originating community and the availability state) are not possible in this case. The answer to improve the user experience is to build an environment of **integrated services** that enables the reuse of the user information between services, the ability for the user to integrate easily new services and the service continuity whatever is the access (copper line, radio) and the terminal (phone, PC). An example of integrated service is the seamless use of multiple communication modes (chat, instant messaging, voice, video), on multiple access and terminals, and providing the availability management in coherence with the user's communities.

Communication services can not be conceived anymore independently from this environment of integrated service, accessible seamlessly in a user-centric way. This environment should include at least the founding service elements like identity management, community management, availability management or context management. This service environment should be able to integrate third-party service elements. The service value will reside in the quality of the interactions between all the service elements. A kind of service control framework handling these interactions will thus be needed, for the interactions between the operator services and for intermediation with other service providers.

3.1 Next Generation Service Definition

The main question is how to define Next generation services, which are basically an advanced telecommunication services. Here is after a brief survey about the latest service meanings in telecommunications fields: Telemanagement Forum (TMF) defines services as following “Services are developed by a service provider for sale within products. The same service may be used as a

component in multiple products, packaged differently with different pricing".

They also define Telecommunication Services [5] as "a set of independent functions that are an integral part of one or more business processes. This functional set consists of the hardware and software components as well as the underlying communications medium. The Customer sees all of these components as an amalgamated. A service can be a service component of another service".

The TMF definition for Service is quite similar to the 3GPP definition for Service which is the following "it is a component of the portfolio of choices offered by service providers to a user, functionality offered to a user." 3GPP defines also a terminology for the term service, and defines other composed expression.

The former definition doesn't specifically define NG services but can be reused to extract an NG services definition.

Within ETSI-TISPAN (standardization of NGN and services) project NG Services are " sold as combinations of [4]:

- Services based on resources these can be Applications such a voice, Unified messaging or Transport : e.g. GPRS access
- Management services such as service repair, SLA monitoring....

3.2 Next Generation Services types

Traditionally, Telecommunication services are divided into types of services: bearer services, teleservices and supplementary services. According to [7], "a bearer service is a type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces" while "a teleservice is a type of service that provides the complete capability, including terminal equipment functions, for communication between users". Examples of basic teleservice are telephony, facsimile, or data transmission.

In ITU-T terminology, a "*supplementary service* modifies or supplements a *basic teleservice*". The notion of *user centric service* that is independent from any user equipment and that provides usage continuity between service elements is not definable with these concepts. The orientation of the Next Generation Services is the user centric services which support ambient awareness, personalization and adaptability [7].

An example of user centric service is an instant communication service that provides the seamless use of multiple communication modes (chat, instant messaging, voice, and video) with an availability management based on the user's communities.

3.3 IP Multimedia Subsystem services

The fundamental basis of Next generation services is the IMS (IP Multimedia Subsystem) architecture standardized by 3GPP [4]. The IMS offers operators the possibility to build an open IP based service infrastructure that will enable an easy deployment of new rich multimedia communication services mixing telecom and data services. IMS architecture is based on the protocol SIP [8, 9] standardized by IETF for session's control.

IMS as defined by 3GPP is suitable for mobile networks. Within TISPAN project, IMS has been standardized for NGN and so for a multi access networks.

The conception of IMS services is a key challenge for the telecom market. IMS services are fundamentally tailored to user preferences, are relying seamlessly on multiple access networks and are bundling multiple service features (e.g. voice/video connectivity, community tools, presence, conferencing, gaming, TV broadcasting…). The targeted IMS services are user centric services. User centric services are described in the literature also as I-centric services [6], supporting ambient awareness, personalization and adaptability. They enable the dynamic reuse of the user's information between multiple service functionalities and that are not dependent on a specific network connection (e.g. an ADSL connection or a GPRS connection). An example of user centric service is an instant communication service that provides the seamless use of multiple communication modes (chat, instant messaging, voice, and video) with an availability management based on the user's communities.

The figure below shows the basic architecture of IMS: IMS is settled down in order to encounter limitations of Intelligent Networks. It is designed on layers: signaling layer, control layer and application layer.

There are many application servers: Application server or AS provides value added to a subscriber. They influence and impact the SIP sessions on behalf of the services supported by the operator's network.

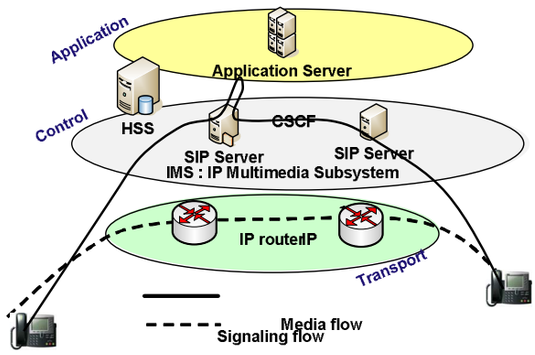

Figure 4. Functional view of IMS layers

4 Next Generation concepts and organisms for management

Service management has been a very hot topic in the research community for the last couple of years. Service Management is concerned with end-to-end service delivery quality and management. Particularly, it consists of ensuring proper activation, billing and monitoring of the service and the environment it executes under to ensure proper operation.

Being a complex area of research, no common definition of service itself, service management and service/service management framework is accepted as standards yet.

Service management is an iteration of management functions that goes handle the service from its creation to its delivery to the customer and its maintenance. Management functions can be service design/assign, service configuration, service provisioning, service performance, service quality monitoring & impact analysis, service problem

resolution, service assurance management and service introduction. No standardized common functions are defined however similar are settled down from several telecom organizations.

Existing management functions deal with networking services more than applicative services which are emerging with the new demand of customer.

4.1 Organisms involved in the service management

Several organizations and research group are dealing with service management and propose methodologies and approaches to improve it:

The ITU-TMN (International Telecommunications Union)-(Telecom Management Network), provides an architecture [10], made of OS (Operations Systems) and NEs (Network Elements), and the interfaces between them (Q, within one Operator Domain and X, between different Operators). It provides also a methodology to define those interfaces and other architectural tools such as LLA (Logical Layered Architecture) that help to further refine and define the Management Architecture of a given management area. It is to notice that they essentially focus on the NMS and EMS rather than Service Management System or Business Management System.

The TeleManagement Forum is a consortium that provides solutions to improve the management and operation of information and communications services. TeleManagement groups computing and network equipment suppliers, software solution suppliers and customers of communications services. Ex: Microsoft Corporation Alcatel, Ericson, France Telecom…TMF are developing a new approach for the development of a new version of OSS/BSS, the methodology is named Next Generation Operations System and Software (NGOSS). It defines Service Management "as being a set of processes that manages services to meet customer's requirements whether the customer has explicit knowledge of these services, including and delivery objectives, or not. It has authority to make decisions about delivery [11].

TMF defines CATALYST Showcase as a program to enable service providers, system integrators, and hardware/software vendors to work together to solve common, critical industry challenges. Catalyst projects are collaborative implementation projects that encourage and support the development of useable, commercial off the shelf (COTS) products needed to provide a sound business solution. Catalyst projects are multi-company, multi-national teams advancing collaborative implementations that encourage and support the development of useable, commercial off-the-shelf (COTS) products needed to provide sound business solutions to an industry problem.

Catalyst projects are sponsored by service providers who define the OSS/BSS problems and customer requirements. They are also NGOSS compliant, use existing COTS products and develop interoperable software/hardware products for their solutions [12].

While ITU-TMN and TMF are defining methodology and approaches to deal with service and network management, 3GPP and ETSI-TISPAN are adapting these standards and approaches to set up management architecture for mobile phones (GSM, UMTS, UMTS with IMS) and for ADSL.

The 3rd Generation Partnership Project (3GPP) is a collaboration agreement that brings together a number of telecommunications standards bodies which are known as organizational partner. The current Organizational Partners are **ARIB, CCSA, ETSI, ATIS, TTA, and TTC** [13].

The original scope of 3GPP was to produce Technical Specifications and Technical Reports for a 3rd Generation Mobile System based on evolved GSM core networks and the radio access technologies that they support. The scope was subsequently amended to include the maintenance and development of the Global System for Mobile communication (GSM) Technical Specifications and Technical Reports including evolved radio access technologies (e.g. General Packet Radio Service (GPRS) and Enhanced Data rates for GSM Evolution (EDGE))[13].

Besides being a partner in the 3GPP, ETSI pilot a TISPAN project. TISPAN is responsible for all aspects of standardization for present and future converged networks including the NGN) and including, service aspects, architectural aspects, protocol aspects, QoS support, security related matters, nomadicity and mobility aspects within fixed networks, using existing and emerging technologies. This work is in line with, and driven by, the business needs and commercial objectives of the ETSI membership.

TISPAN is focusing in several areas concerning the NGN:

- service Aspects
- network architecture and functional requirements
- protocols and profiles definition
- numbering, naming addressing and routing
- Quality service, resource control, and network performance
- Conformance and operability testing
- Security aspects
- Telecommunications management

4.2 Challenges for Service management

The main challenges that are facing networks and services are:

- Management systems supporting service management operations are increasingly complex and heterogeneous.
- Management systems are built in a stovepipe fashion hence integration of new services is quite difficult, takes long time and needs important investments
- No corresponding information models for service management are defined to implement the unified service planning and provisioning :

Management systems are bases and do not have any information model and are implemented based on different data model.

- Interfaces that relates information system (OSS/BSS) to the service platforms and the networks are missing or if they exist they are very complex and redundant
- Within NGN several parties will be involved to deliver the service but the lack and absence of a standard management interface across platforms is making the situation difficult. Hence services provided by several operators/Service Provider are facing several risk and QoS.

- Rapidly increase of services due to the exponential customer demand. And the requirements of the user to have services tailored to his needs and context.
- Emergence of new technologies that does not usually interfere with legacy systems.

5 Conclusion

This paper is a literature about Next Generation Networks, Next Generation services and the adequate set of management system for that.
Understanding the requirement of this evolution towards Next Generation Networks will enable to define in a proper way the NG services and especially the management that goes with it. In fact this literature will be the fundamental basis for our research:
The future work will be the set up of common service architecture for NG services and its management; this architecture should be enabler to integrate new services in an easy and proper way.

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