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Next Generation Networks and Their Relation with Ad-hoc Networks

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***Abstract*—**The communication networks development and advancement during two last decades has been toward a single goal and that is gradual change from circuit-switched networks to packed switched ones. Today a lot of networks operates are trying to transform the public telephone networks to multipurpose packed switch. This new achievement is generally called "next generation networks". In fact, the next generation networks enable the operators to transfer every kind of services (sound, data and video) on a network. First, in this report the definition, characteristics and next generation networks services and then ad-hoc networks role in the next generation networks are studied.

***Keywords*—**NGNs services, Ad-hoc Networks, NGN.

I. Introduction

NGNS includes extensive meaning of the communication systems and services which are more flexible and the architecture of their transition networks is based on packet. It can be referee to three main meanings for NGNs:

NGNs has larger architecture which divide the networks operation into four separate layers:

Access, transport, control and intelligence and services, the large architecture benefit is the possibility of make changing in the layers that are separated from each other.

These four layers are related through open interfaces with each other that make the integration and 3rd party access top the networks operation possible.

NGN is a network with multi services and integrated and analog services can be implemented in it. The operators will enable to access to various services through every network.

Therefore, NGN opens the communications for providing new services and content and make 3rd party content and services development possible without any knowledge about the systems complexities [11].

The term "next generation services" is more applied to some changes that are made in the networks infrastructure.

Today, these changes have begun in the network infrastructure in the communications and IT industry. So, it is not a term which can be defined precisely, but it can be different among people, salesmen and various operations.

Of course, certain organizations and these institutes are trying to define it in a standard way and these attempts are also continued.

In the continuation, the NGN formal definition will be stated by ITU-t [1].

II. Next Generation Networks Definition

The definition which ITU-T institute has provided for the next generation networks (NGNs) is as follows: The networks that data transport is on the closed basis in there and are able to use the band width transport technologies based on QOS. In these networks, the operation related to the services is separated from the transport technology and they make possible infinite access to different services suppliers for the operators. Also, operator's movement and mobility are supported and then they can use the services constantly and during various occasions and places. Some other characteristics of NGN are:

- The separation of control operation (such as beginning conversation meeting, its interruption and handover) from applied programmes and services.
- The supporting of the extensive range of services, applied programmes and some mechanisms such as instant communications, circulation and multimedia services (picture transmission with high quality, video transmission and sound transmission).
- The interaction with previous networks through open interfaces.
- The identification methods which can be used for IP addresses in the routing networks based on IP.
- Analog and integrated services between fixed and mobile networks.
- Consistent with the other operations such as emergency communications and the security and secret in the network.

There are similar definitions in [10] and [11].

This project had defined by SG13 or research group No.13 in ITU-T institute as "NGN 2004 Project" in January 2002. In the research group13 meeting in November 2002, a

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preliminary description of project had prepared and it had decided to perform it. Since, the project is always updated. The NGN 2004 project role is the organization and coordination of ITU-T activities about Next Generation networks and its purpose is producing of primary collections of NGN recommendations until 2004[9].

III. NGN$_s$ Services

While the services which are presented now will also be in future, the customer's expectations are toward concentrated and multimedia services. The operators will communicate with the network through advanced terminals and will able to choose the qualified services and the ones that have bandwidth among the extensive range of services. In future, the network intelligence meaning wouldn't just include new methods such as the routing based on look-up in the data bases and routing tables, but also includes more extensive contents as multimedia meetings management, coordination among connections with different technologies, management and intelligent operations, advanced security, real operating factors scripts and applets which are installed by operator, services based on on-line directory and proxy factors.

The NGNs preliminary aim is to enable the operators to acquire the information content in every format and by each media, equipment, size and every place and time. Regarding to the mentioned matters, some kinds of services which are important in NGN environment have presented in figure 1.it is necessary to note that while there are some definitions for NGNs services but nobody yet knows about the applied programmes which suppose to implement these services.

Fig. 2 also shows NGN services range.

An architecture as IMS or IP Multimedia subsystem has also defined to transport the multimedia services in the NGNs through 3 GPP or 3rd generation Partnership Project which its scheme has shown in Fig. 3. In this architecture, physical layer includes the technologies that exist today and the technologies which will be comprehensive in the future and IMS architecture core is the middle layer that includes control services and middle wares to perform the applied programmes of the upper layer.

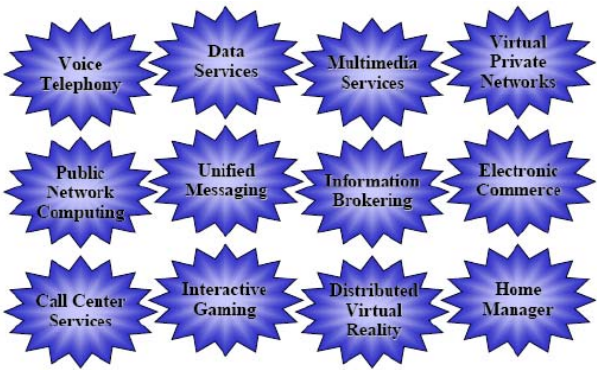

Fig. 1 Examples of NGNs services [11]

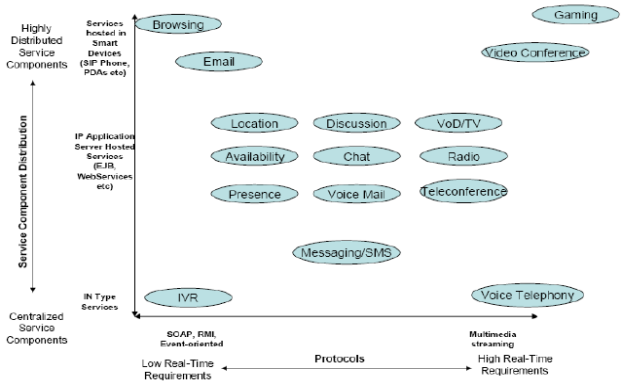

Fig. 2 NGNs services range [12]

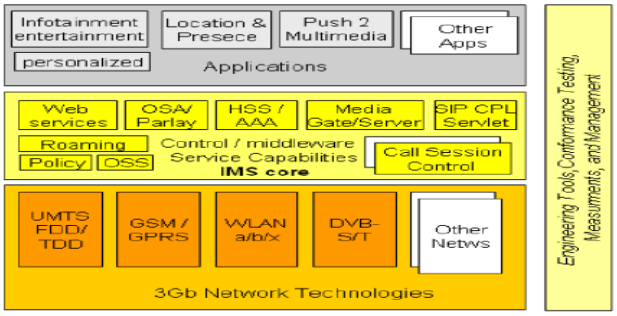

Fig. 3 IMS NGNs [2]

In [4], a general architecture is presented for NGNs which is seen in Fig. 4.

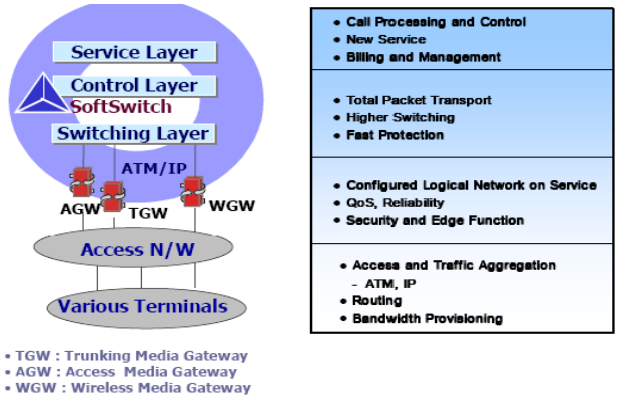

Fig. 4 General architecture of NGN levels

Coverage is one of the fundamental problems in sensor networks. The most common problem is the node scheduling problem: determine the minimum number of sensor nodes that need to perform active sensing in order to provide certain coverage (with desired reliability).

On the other hand, given a sensor network, we need to find out the quality of service that can be provided by this network, e.g., finding breach areas or best observed areas.

IV. Networks, Services and Ubiquitous Communication Unity

Regarding to services which NGNs must present, it can be mentioned to their main characteristics as following [14].

Ubiquitous or pervasive

- embedded
- nomadic
- adaptable
- powerful
- efficient
- intentional
- eternal

He meaning of the whole characteristics is nearly clear.

Here, we explain about ubiquitous meaning in more details.

The ubiquitous computations indicate gradual shift toward 3rd generation of communications. Mobile computations will have an important role in this shift. primary purpose of ubiquitous computations is the hidden of small tools and equipments allocated to an activity in human surroundings as their performance is continuous and common in human view and the operators don't generally have enough information about theme.

These tools should be portable and then they shouldn't occupy large volume and should be light. In addition, they should know about their environment and the operator who works with it. Wireless communications will be one of main participants of these computations.

In [13], there is an interesting example about communications world before and after the unity of networks and services (Access to communication networks is essential and important for people who have professions such as companies sale management).The mentioned characteristics of NGNs are clearly observed in this example. We don't pay attention to the example in this report. Its study is suggested to interested readers.

V. Ad-hoc Networks, Main Element of NGNs

With regard to the mentioned matters, it can be found wireless networks will present as a main part in NGNs because of providing communication permit by more flexible. From architecture point of view, the wireless networks are dividing into two groups: with infrastructure and without infrastructure.

The networks with infrastructure or cell networks include fixed and mobile terminal points. The stations are fixed base and have connected to wire connections and perform as a gateway between mobile terminal points and system connections. These networks include all of general present ones:

- traditional cell systems
- Local wireless networks
- cell networks
- WLAN, GSM, UMTS,…

A network without infrastructure or Ad-Hoc mobile network only contains mobile nodes and it has no fixed station or wire connection which is applied to data transaction and network management. Each mobile node doesn't just act as a host, but it acts like a router. The nodes are themselves responsible for packets forwarding to other present mobile nodes in the network. Since network creation with infrastructure causes limitation in normal cell and mobile networks, so non-infrastructure networks can be a good idea for the wireless communications continuation. Ad Hoc networks eliminate mobile networks limitation because of their needless to the infrastructure. In general, the reason of using AD Hoc networks is as following:

- capability of easy development
- capability of rapid development
- independency of infrastructure
- certain and rapid deployment
- robustness
- Flexibility
- Inherent support for movement

As it is observed the mentioned characteristics for Ad-hoc networks consider several cases of NGNs features. However, one of the main and challenging cases in Ad-hoc networks (which is also an important feature in next generation networks) is the video transport support and QOS supply. There are a lot of resources in this field, e.g, it has done complete study about it in [5]. Of course, it should note that Ad-hoc networks are part of next generation networks which various operators will use them certainly. Figure 5 shows an exponential of Ad-hoc networks in the next generation networks.

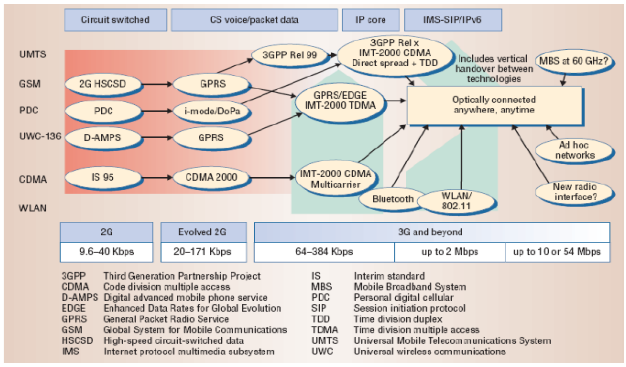

Fig. 5 Adhoc networks among NGNs[7]

VI. Doing Projects and Researches

A. France Telecom Company

This company's "Business every where " services enables the customers to connect their considered programmes and enterprise services through a remote software interface.

Using this service, the customers can connect VPN through DSL. Wifi, GPRS or telephone. New service also provides 3G network access by the operators in France in 2005.

B. Motorola Company

Motorola with cooperation of Apple Company have provided I Tunes for its telephones. I Tunes can synchronize itself by PCs and music stores and play digital music's through a IPod interface. These telephones will enter to the market in the first middle of 2005. This product is part of Motorola greater project called "Seamless mobility 2.0" which promotes the application of digital data every where and time by customers.

C. Computer Systems Laboratory in Stanford University

Mobile Net project that professor Horowitz is doing it in this university aims to design economical mobile distributed network that establishes stable by varied bandwidth, Low-cost and various wireless communication among different wireless networks.

D. Oxygen Project in MIT University

Briefly, this project aims to provide accessibility to the fixed and wireless networks every where and time (and with the mentioned characteristics in chapter 4).

VII. Conclusion

In this survey, we first gave an overview of wireless sensor networks, their application areas, characteristics and distinct requirements. We then covered two topics in sensor networks: coverage and routing. The first problem in coverage is the node scheduling problem. We presented and compared two node scheduling protocols: PEAS, a probing-based density control protocol [39], and the coverage-preserving node scheduling protocol [33], which focuses on calculating the sponsoring sensing area by neighboring nodes. We then discussed the question of the quality of service that can be provided by a particular sensor network, which is quantified by calculating maximal breach path and maximal support path. Next, we classified the routing protocols for sensor networks into four categories: data-centric protocols, hierarchical protocols, location-based protocols, and QoS-aware protocols. Due to the data-centric nature of sensor networks, most routing protocols belong to the first category. Among these protocols, some are source-initiated, some are destination-initiated, some focus on energy efficiency, and some emphasize robustness. Hierarchical protocols are a special family of routing protocols.

The idea is to organize sensor nodes into clusters and use cluster-heads as routers to aggregate and transmit data to base station. There are groups of routing protocols that require location information. By using location information, they can find a relatively optimal path without flooding. We also presented several QoS-aware protocols, which address energy efficiency and real-time requirements.

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