Standardization Trends toward the Next Generation Network

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Abstract

At ITU-T, international standardization of the NGN (Next Generation Network) is underway by involving various standards organizations. The aim is to build managed IP networks that guarantee QoS (Quality of Service) and security through resource management and strict user authentication, and to replace the telephone networks, the traditional communication infrastructure. This paper introduces standardization trends, describes the concept of dependability that NEC proposes, and summarizes its activities at ITU for the realization of this concept.

Keywords

NGN, ITU-T, ETSI, *de jure* standard, *de facto* standard, dependability

1. Introduction

Attempts to replace the existing telephone networks with the NGN based on IP technology are very active at present. In Japan, NTT Corporation announced in its mid-term management strategy published in Nov. 2005[1] that it will start field trials of NGN from the latter half of FY2006. Similarly, KDDI Corporation is aiming at implementing its fixed telephone network as an all-IP network by the end of FY2007[2]. Also, carriers in countries other than Japan are announcing one after another that they intend to shift to the IP networks.

However, various problems related to interconnection and security issues have emerged in the process of migration to the IP network. These problems were analyzed by the Study Group on Next-Generation IP Infrastructure set up by the Japanese Ministry of Internal Affairs and Communications (MIC) and by the Next Generation IP Network Promotion Forum[3] that was established in Dec. 2005. The suggested solutions for them are currently under discussion.

Construction of the NGN and its associated problems solutions need various standardizations. The ITU (International Telecommunications Union) and ETSI (European Telecommunications Standards Institute) are presently standardizing the overall image of the NGN, including its architecture and functions. Other NGN-related standardizations are being established in the appropriate fields. In this paper, we will first summarize the related trends and then describes the standardization efforts that are being pursued by NEC.

2. Standardization of NGN at ITU-T/ETSI

The ITU-T (ITU Telecommunication standardization sector), which played a critical role in the standardization of telephone networks, has issued recommendations[4,5] that define the basic concept and characteristics of the NGN by positioning it at the core of the communications infrastructures of the next generation. The ITU-T also recommended in Jan. 2006 that an organization named the FG-NGN (Focus Group on NGN), which was founded in May 2004 should be reformed as the NGN-GSI (NGN Global Standards Initiative). In addition, the ETSI started the TISPAN (Telecommunications and Internet converged Services & Protocols for Advanced Networking) project in Sept. 2003 to compile European standards related to the NGN, and is presently developing activities in order to turn them into international standards through the ITU-T. Although the descriptions that follow in this paper adhere to the standards of the ITU, it should be noted that those of the ETSI are generally similar.

The ITU-T is a United Nations organization and its standards are regarded as representative *de jure* (official) standards. *De jure* standards feature a high transparency of the established process and the sharing of each single standard by all of the participants but, it also contains the disadvantage that a long time is taken before reaching a consensus due to the large number of participants. In this context, *de jure* standards do not qualify as the mainstream standardization process in the present rapidly progressing technological environment. However, since the NGN has an inherent social infrastructure, its overall image should be established by also taking emergency police calls and the tracing of malicious users into consideration. In

this context, the roles of the ITU-T and ETSI are very important. Actually, influential vendors in North America and Europe are recently developing supportive activities in this context.

The standardization process of the ITU begins with definitions of the purposes and requirements, then proceeds to definitions of the support functions blocks, and finally defines the protocols. Unlike the protocols, the definition of the provided services and function architectures are not always necessary for interconnection, but defining the "method of use" of a protocol enables awareness coordination and facilitates interconnections.

The NGN as targeted by the ITU-T is a managed IP network with high reliability and safety. The communications quality is guaranteed by applying strict user authentication and SIP protocol-based session controls on an IP network equipped with a resource management facility. Consequently the ubiquitous network society embellished with a variety of secure services will be constructed by using the NGN as a social infrastructure to replace the conventional telephone networks.

For the present, the following six types of services are listed as specifically NGN services.

(1) PSTN/ISDN Emulations
Backward compatibility service for enabling the use of existing telephone sets.

(2) PSTN/ISDN Simulation
VoIP service that interfaces with telephone sets using IP.

(3) Multimedia Services
Various messaging, streaming and presence services making use of IP network functions such as IM, SMS and MMS.

(4) Internet Access
Services for connecting to the existing Internet by using the NGN as a quality-controlled communication path.

(5) Other Services and Applications
VPN, data services such as file transfer, sensor networks, etc.

(6) Services with a Public Aspect
Services deserving of a social infrastructure, including emergency calls to police, etc., assistance for handicapped persons, legal tapping by police, selection of services and/or network providers with the help of number portability, protection of privacy, and tracing of malicious users.

Communications carriers, some of whom are third parties, can select and provide some of the above services. The current study places emphasis on VoIP and compatibility with traditional telephones but it is expected that the emphasis will shift to streaming and other issues in the future.

Fig. 1 shows an outline of the functions architecture of the NGN. This function architecture is more or less composed of the end user functions that correspond to terminals and customer networks, the transport stratum used in the transfer of user data including voice and mail, the service stratum includ-

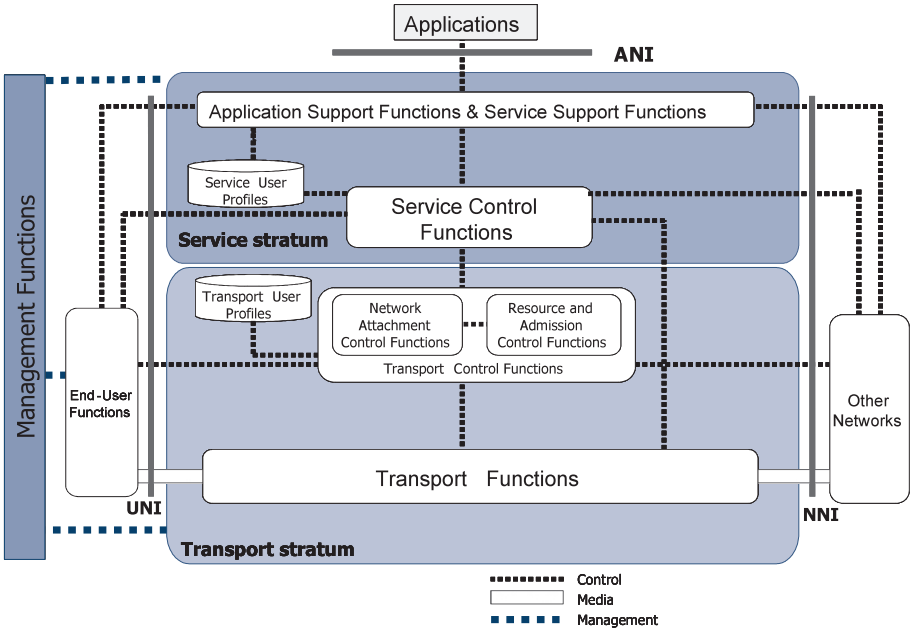

Fig. 1 Outline of ITU-T NGN architecture (Source: Draft Recommendations).

ing the SIP server for controlling the transport stratum, their management functions, the applications provided by third parties, and other networks (PSTN/ISDN, NGN, Internet, etc.). Each of these functions is further composed of various functions blocks and is connected through open interfaces. The division as described above will encourage the carriers that provide only a part of the functions of a network and thus enable a diversification of services.

3. Standardization of NGN by Other Organizations

The ITU makes it a rule to use the existing standards whenever possible. These standards include the *de facto* standards compiled by any of the organizations in the industry as well as the *de jure* standards established by the ETSI, etc. Some of the standardization organizations engaged in the NGN are described in the following sections.

3.1 3GPP (3rd Generation Partnership Project)

This project standardizes the IMS (IP Multimedia Subsystem) that uses the SIP protocol to provide a session control function. The original SIP protocol developed by the IETP does not define the timings for starting and ending the billing nor does it have a gateway function for connection to an existing network such as the ISDN. The 3GPP defines additionally the functions that had been lacking for the telephone business and standardized them into the IMS.

Although the research into the IMS was initially begun aiming at the implementation of the 3G cellular phone, the ITU-T and ETSI decided to use it as the NGN service control function. The latest IMS release of version 7 has been extended by taking the wired networks into consideration. This is the result of the mutual exchange of documents between the 3GPP and the ITU and ETSI and the participation of their managers in the meetings of the other organizations.

3.2 IETF (Internet Engineering Task Force)

Since the NGN utilizes IP technology, it adopts many of the results of the IETF, which is the organization for defining the Internet protocols. Particularly important among these is the SIP protocol that deals with the session control.

After the problems associated with the extension of the SIP functions for the preparation of the IMS have almost been overcome, the functional extension of the PSTN/ISDN emulations are currently being actively pursued and the work is being advanced in close collaboration with ETSI TISPAN. Also, SIP/VoIP is currently under discussion among carriers and the SIP connection between carriers and the ENUM Infrastructure is being actively studied.

3.3 SDP-Related Organizations (OSA/Parlay, JAIN)

In order to enable delivery of a variety of services via the NGN, it is important to offer an environment in which third parties can easily build services. In this context APIs that enable the use of functions including the IMS are necessary as a common foundation for the services of the next-generation telecom networks. Many standards organizations are developing activities using the generic name of SDP (Service Delivery Platform).

The Parlay Group is a nonprofit organization founded in 1998 by BT, MS, IBM, Ericsson, etc. It defines the APIs for implementing the OSA (Open Service Access) of the 3GPP and ETSI TISPAN jointly with them and in collaboration with the OM (Open Mobile Alliance). Their current focus is placed on the ESDI standardization of the API specifications for improving the affinity with web services.

JAIN is the technology for building communications software using Java. Parlay APIs and the SIP protocol-based APIs are currently offered by Sun Microsystems, etc.

3.4 OCAF (Open Communications Architecture Forum)

The OCAF is a focus group established inside the ITU-T in May 2004 by IBM, Nortel, FT, etc. It aims at enabling the construction of the NGN by using catalogued products. At present, the CGOE (Carrier Grade Open Environment) reference models and specific components are being described for the standardization of communications software components by assuming the use of Linux.

3.5 Others

The standardization activities described above are only part of the standardization attempts related to the NGN. The NGN research at the ITU-T concentrates on the field of network control technology and does not consider transmission technology, but the possibility of NGN is in fact greatly dependent on the ease of transmission network control.

In addition, the NGN creates a managed IP network that can become a platform for various services, but it is required that services other than the VoIP services are used on the NGN so that the managed IP network is disseminated widely. For this purpose, the standardization attempts should be advanced by

considering new network usages such as streaming, RFID applications and sensor networking.

4. Toward the Standardization of NGN

The trends of standardization described in the above sections represent simply a part of the technological developments and, when developing a technology, it is important to clarify its final target. In consideration of the fact that the NGN was proposed in order to deal conveniently with Internet problems but that it lacks the "security and safety" that is essential for an effective social infrastructure, we at NEC believe that the final target must be its dependability.

Dependability means the reliability that any system becoming a social infrastructure should be equipped with. With communications networks, improvements in the reliability of individual functions and countermeasures against malicious users have been studied in various ways. Improvements in the reliability of individual nodes using fault tolerant technologies and route switching in case of failures are some of the examples that should also be advanced in the future. However, reliability as a social infrastructure does not rest exclusively in freedom from failure. Since it is impossible to eliminate system failures and malicious users completely, dependability should "be capable of immediately identifying the circumstances of a failure, fault or crime, starting recovery and preventing social alarms or catastrophes by predicting similar situations in the future while targeting a position that is completely free from such troubles"[6]. Such countermeasures should include a prevention/guarantee technology (preparation technology) and a recovery/treatment technology (technology for supplementing preparations) as shown in **Fig. 2**. Furthermore, the feeling of safety that the system will be economically, socially and culturally acceptable and that it will be available on a permanent basis is also important, in addition to featuring the qualities of predictability and recoverability as described above.

Research into requirements and function architectures are important for achieving the dependability of the NGN. These studies have almost been completed by clarifying the requirements, which for example include the provision of high reliability for the address resolution mechanism and a systems configuration that does not permit a single fault location (a point at which a fault would cause the entire system to crash). Therefore, we at NEC are focusing our efforts in the field of security.

The NGN security study at the ITU-T is presently compiling two recommendations on NGN security and NGN authentication as the most important issues. The NGN security recommendation will describe a threat analysis system that enumerates the information damaged by attacks and failures and estimates the risks, the framework for determining the study coverage, the architecture specifying the required function blocks and the relationships between them as well as the security requirements and the mechanisms for their realization. It is aiming thus at drawing an overall image of the security mechanisms that must be incorporated in the NGN.

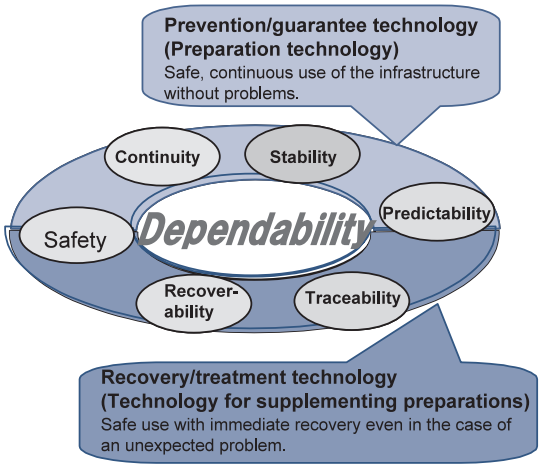

Fig. 2 Dependability required for social infrastructures.

The NGN authentication recommendations will classify the authentication into seven kinds including the user authentication at the UNI, mutual authentication of networks at the NNI and user authentications by services and applications, and describe the outline, requirements, specific examples of actual calls and the mechanisms for their realization.These recommendations are being prepared with considerable haste by setting the agreed target as Oct. 2006, and we are also participating in the work by assuming the editorial role in drafting the NGN security recommendations.

5. Conclusion

The ITU-T FG-NGN reached agreement on the main documents for the NGN Release 1, including those on the scope of standardization, requirements, architecture, security requirements and the migration scenario in Nov. 2005. The official completion date for the recommendations is scheduled for July 2006. The ETSI TISPAN already completed more than 50 recommendations for standardizations in Dec. 2005.

However, with regard to the final target of the NGN, which is to provide an IP network as a social infrastructure equipped with equivalent or superior safety standards and ease of use to the existing telephone networks, these achievements are still only the first step. At NEC, we will continue our efforts toward standardizations by developing technologies that will enable the construction of dependable infrastructures.

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