Standardization Efforts in IP Interconnect Specifications

Seiichi Sakaya, Kenjiro Arai, and Shunsuke Kanegae

Abstract

As the use of VoIP (voice-over-Internet protocol) telephone services continues to spread, it is becoming increasingly desirable to migrate the connections between communications carriers to IP technology (IP interconnection) rather than connecting them through the existing public switched telephone networks. We describe here the domestic and international trends in standardization of IP interconnection interfaces as well as the NTT initiatives in this area.

Keywords: IP interconnection, VoIP, standardization

1. Introduction

As Internet protocol (IP)-based communication services have spread on the Internet, the migration to providing voice-over-IP (VoIP) and other telephony services on IP networks has been rapidly advancing. For example, the Next Generation Network (NGN) is the basis for provision of telephony services such as *Hikari Denwa*; the FOMA mobile network is migrating telephone services to an IP-based circuit-switched core network [1]; and VoLTE (Voice-over-LTE (Long Term Evolution)) services were started in June 2014.

To enable users served by different carriers to talk with each other, the networks of each communications carrier need to be interconnected. With conventional VoIP services, each VoIP provider's network was generally connected to the existing public switched telephone network (PSTN), and connections between VoIP carriers were implemented through the PSTN.

However, as these IP-based telephone services have spread, and the possibility of migrating existing telephone networks from PSTN to IP-based technology has become a reality, it is becoming more desirable to migrate the interconnections between carriers to IP-based technology as well, rather than maintaining connections through the PSTN (**Fig. 1**).

2. VoIP standardization trends

Currently, the session initiation protocol (SIP) is used as a protocol for VoIP session control (connecting and disconnecting with the other party). The basic specifications for SIP are standardized in RFC (Request for Comments) 3261 developed by the Internet Engineering Task Force (IETF), an organization that develops technical standards for the Internet. In addition to the basic specifications of RFC 3261, many extensions to the basic SIP have also been developed. An RFC guide created by IETF that is related to SIP (RFC 5411: A Hitchhiker's Guide to the Session Initiation Protocol (SIP)), indicates that there were over 100 related RFCs as of 2009. For VoIP services, communications carriers need to select the technical specifications for the services they need to implement from among numerous RFCs, and then they need to decide various rules (standards) needed to operate the VoIP service such as the service architecture, security, and charging structure.

Accordingly, the standards and international specifications required by communications carriers to provide their services were deliberated and developed by standardization organizations including the International Telecommunication Union-Telecommunication Standardization Sector (ITU-T) and the 3rd Generation Partnership Project (3GPP), which was organized to promote standardization of 3rd generation and later mobile communications. Then, based on

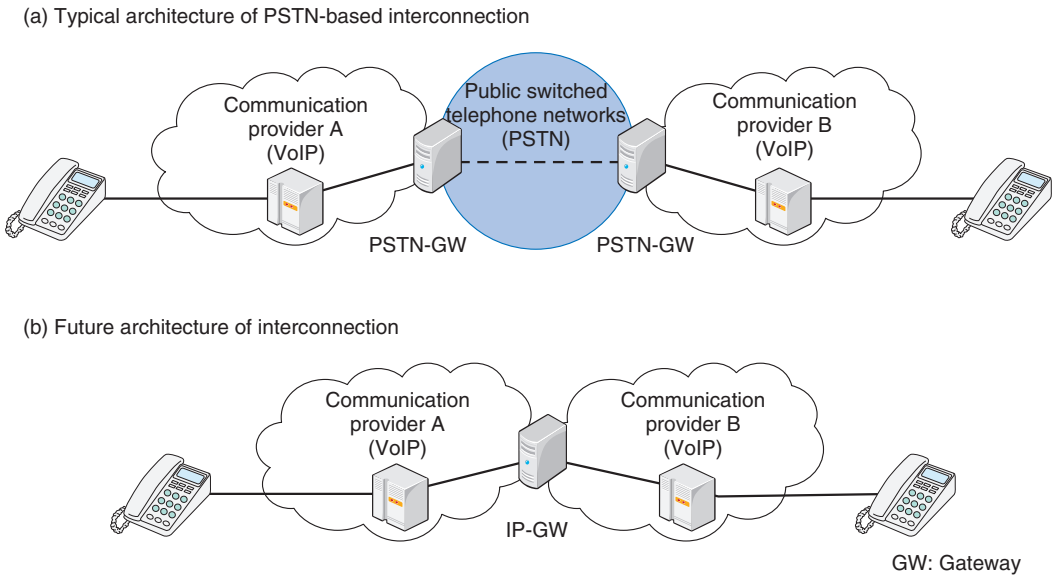

Fig. 1. Architecture of interconnection for VoIP services.

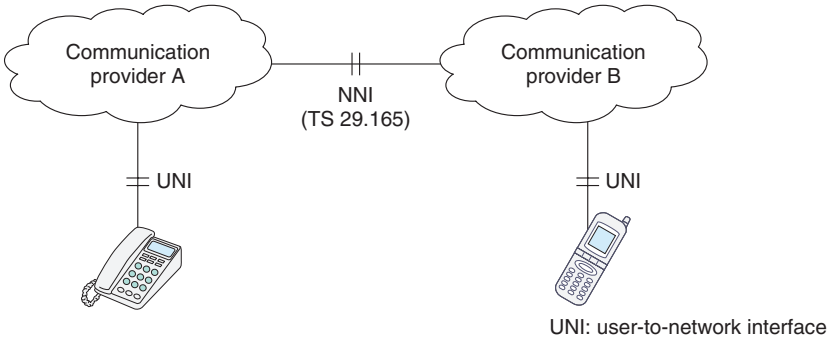

Fig. 2. Interconnection model in 3GPP Technical Specification (TS) 29.165.

these international specifications, domestic standards specific to each country (e.g., related to telephone number formats, additional services, and emergency services) are developed by regional standardization organizations in the respective countries. In Japan, the signaling specifications for VoIP services applied within Japan are standardized by the Telecommunication Technology Committee (TTC).

3. NTT initiatives for international standardization of IP interconnection

Our group is working on some initiatives for standardizing the interface between communications carriers, which is called the network-to-network interface (NNI), to enable future IP interconnection between carriers (**Fig. 2**).

The NNI specification for VoIP within Japan is JT-Q3401, which was created by the TTC in 2007. This consists of the specifications contained in ITU-T Q.3401—an NGN NNI recommendation—and the signaling specifications of TR-90.25 applied within Japan [2].

In international standardization, the 3GPP created a new NNI specification between the IP multimedia subsystem (IMS) networks in 2008, which is known as Technical Specification (TS) 29.165 (Inter-IMS Network-to-Network Interface). This 3GPP

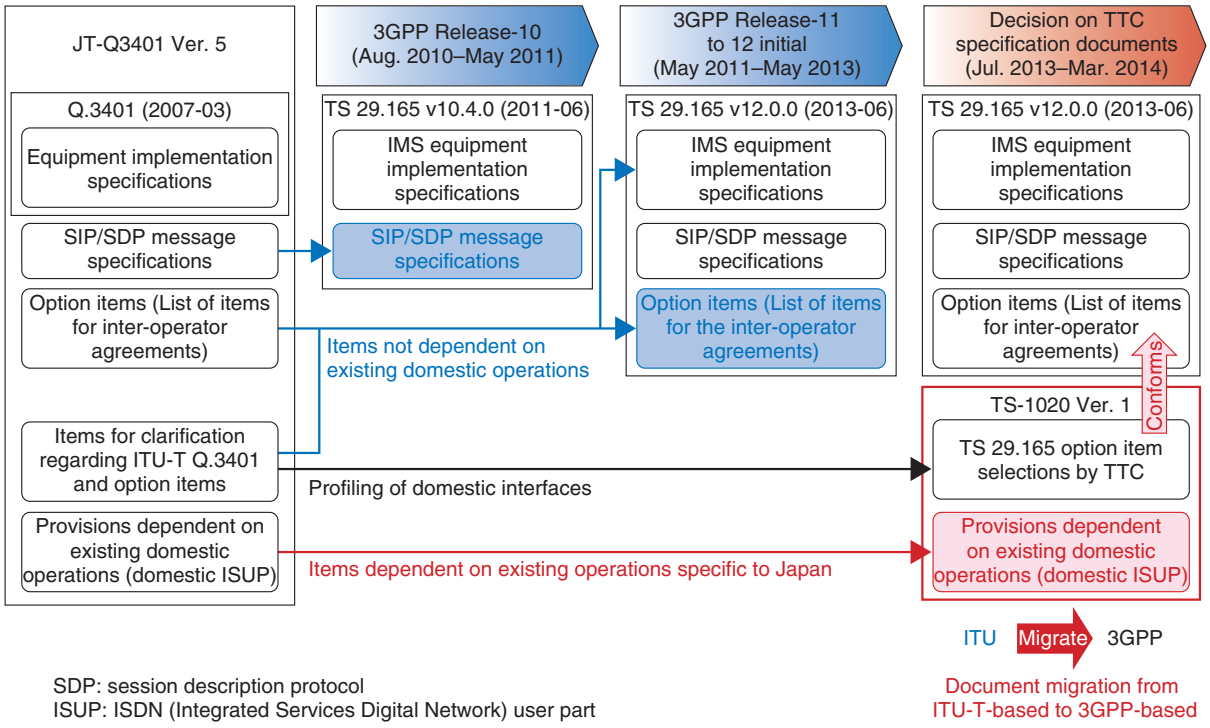

Fig. 3. Document composition for JT-Q3401, TS 29.165, and TS-1020.

specification has become the standard for implementing mobile networks. We expect that TS 29.165 will also be the basis for future domestic NNI specifications for IP interconnection, in which the interconnection between fixed and mobile networks needs to be addressed. However, the initial TS 29.165 was inadequate for use in Japan in some technical areas, so there was a need to reflect the signaling requirements to fulfill Japanese requirements in the international standard.

As such, our group began a differential analysis of the specifications in JT-Q3401 and TS 29.165. Then, we began work in fiscal year (FY) 2010 on incorporating all stipulations included in JT-Q3401 but not in TS 29.165, and that are not Japan-specific, into TS 29.165 in order to eliminate any differences. Then, in the three years leading to FY2013, we served as rapporteur in leading two work items containing over 300 contributions, and we were able to maximize the consistency between JT-Q3401 and TS 29.165.

4. NTT initiatives for standardization of IP interconnection within Japan

Telephony services on both mobile and fixed networks in Japan have been converted to IP; hence, there was increasing need to study the NNI specifications that will be the basis for IP interconnection between mobile and fixed networks. In FY2010, the Mobile/Fixed Network IP Interconnection Ad Hoc Study Group was established at TTC, by combining the signaling Working Group (WG), which primarily creates call control specifications, and three special mobile WGs (3GPP WG, 3GPP2 WG, and the mobile network management WG).

This ad hoc group shared information related to IP interconnection in areas of standardization and the activities of industry organizations, discussed the need for TTC standards of IP interconnection specifications, and clarified the scope of studies to be done. With the progress made in international standardization of NNI specifications, the TS-1020 NNI specification was published in FY2013, which conforms to TS 29.165 and includes the Japan-specific supplementary specification and clarifications. TS 29.165 was selected as the base document because it provides a framework equivalent to that in JT-Q3401 due to our activities at 3GPP. Considering future extensions to domestic specifications, it is appropriate to use the specification of 3GPP, where active

discussions on IMS specifications are still taking place.

5. Overview of NNI technical specifications in Japan

TS-1020, created by TTC in 2013, specifies the basic NNI signaling requirements for IP interconnection between different communications carriers. Protocols and supported procedures conform to TS 29.165, and differences that cover circumstances in Japan are described in TS-1020. The following are examples of such items (**Fig. 3**).

- Supplementary specifications regarding telephone number formats and signaling requirements (e.g., interworking with existing circuit-switched networks).
- TTC selection of the option items specified as optional for application over the NNI in 3GPP.
- Supplementary information for maintenance and operating conditions and examples of call flow and message coding, which are useful in practical operation.

6. Future prospects

TS 29.165, which is the basis for TS-1020, is still being studied and updated at 3GPP. 3GPP studies progress in units called Releases, and when the study for TS-1020 began, the final version of TS 29.165 Release-12 was not yet completed, so the initial version was used as a reference. Therefore, the TTC specification was also created as a provisional technical specification. 3GPP TS 29.165 Release-12 is scheduled to be finalized in December 2014, so the TTC specification is also scheduled to advance to the next step after that, which is establishing it as a standard.

Also, as standardization advances at TTC, we plan to cover requests from operators covering issues such as the roaming interface (the NNI between the home network and visited networks), which is being requested by mobile operators, the signaling requirements for emergency services, which are required when inheriting the existing circuit-switched networks, and the signaling requirements related to number portability.

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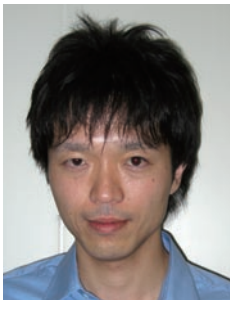

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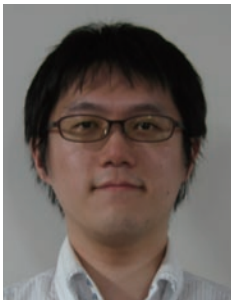

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