The Development of CenterStage® NX3200, a Session Border Controller to Interconnect Next Generation Networks (NGNs)

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With the realization of ubiquitous services by the acceleration of the Next Generation Network (NGN), various services such as Triple Play (integrated audio, data, and video) and fixed mobile convergence (FMC) are being provided. In the future, it will become essential for these services to be provided not only within a single carrier, but also among various carriers. Therefore, session border controllers play an important role because they enable the interconnection between NGNs built under different environments. Providing a session border controller faces challenges, such as scalability, ensuring high reliability, absorbing inter-carrier differences, absorbing codec differences, and functional expandability. To solve these challenges, OKI has developed and manufactured NX3200 CenterStage®*1).

This review first gives an overview of the product, then describes how the product solves those challenges.

Product overview

As shown in **Fig. 1**, the CenterStage NX3200, a line of the CenterStage series that is the carrier-grade product line-up for NGN, is positioned as an equipment to interconnect NGNs. It has the basic configuration shown in **Fig. 2**. The NX3200 ensures interconnection among different carriers by accommodating a Session Initiation Protocol (SIP) signal, which is required for signaling for NGN, the Real-time Transport Protocol (RTP), and the RTP Control Protocol (RTCP). As for the product architecture, SIP signals and media are processed on separate blades so as not to affect each other's performance.

Scalability

Because session border controller is an equipment to interconnect carriers having several million to several tens of millions of subscribers, such an equipment as ensures several tens of thousands of simultaneous connections is needed. Also, it is necessary to transmit streaming type media such as audio and video in smaller units of packets at wire speed. To solve this challenge, the CenterStage NX3200 has deployed a SIP signal and a media signal on separate blades physically. In addition, because of a growing number of simultaneous connections, the blade for processing media (media interface blade) is so configured that more blades can be added. The media interface blade adopts a large-capacity network processor, thereby achieving an architecture that allows transmission at wire speed.

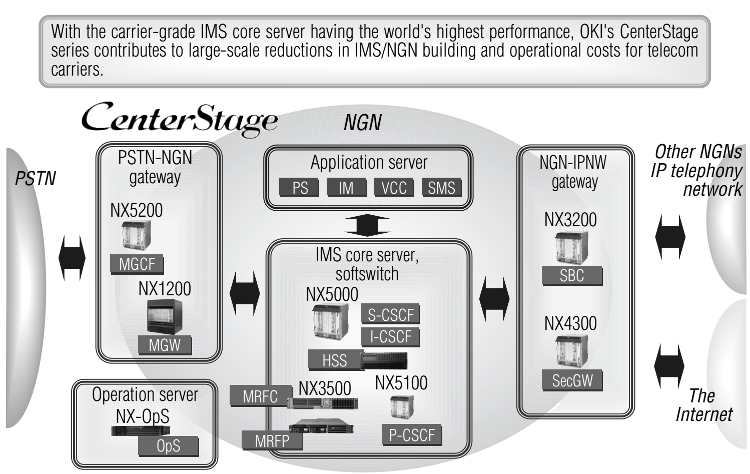

Fig. 1 CenterStage series overview

*1) CenterStage is a registered trademark of Oki Electric Industry Co., Ltd.

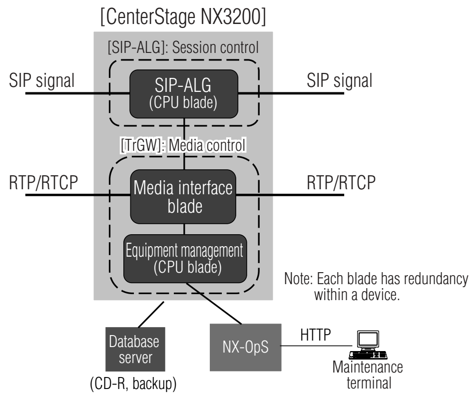

Fig. 2 Basic configuration of CenterStage NX3200

Ensuring high reliability

As a next-generation network infrastructure, NGN not only offers high-quality services, but also plays a role of a lifeline. Therefore, NGN needs to ensure the same high reliability as the conventional public switched telephone network has. Equally, an equipment to interconnect carriers is required to ensure reliability. The CenterStage NX3200 has adopted Advanced TCA (ATCA), an architecture that ensures carrier-grade reliability, as its platform. ATCA is a standard that is being developed based on the guidelines specified by the PCI Industrial Computer Manufacturers Group (PICMG); with ATCA, high reliability required for interconnection among carriers can be ensured. What is more, the NX3200 has a configuration where both SIP-ALG and the media interface blade have a 1+1 redundancy, and, in order to manage that redundancy, OKI has developed High Availability Middleware (HA-MW), which has been deployed on the Carrier-grade Linux (CGL). This HA-MW has the following functions besides redundancy management:

1. File management
   Updates files in operation and improves rollback maintainability, so that reliability can be increased.
2. Plug-in functionality
   Allows program modification without stopping services, so that the functions of HA-MW can be enhanced without stopping operation.
3. Failure monitoring
   Since the middleware itself has a function that collects information upon occurrence of a failure, failure handling is made easy.

Absorbing inter-carrier differences

In most cases, carrier networks use a SIP signal with their own specifications added. Therefore, session border controllers are required to have a function that absorbs such differences. From the viewpoint of security, a function to conceal the topology of the network is also required. For example, once the IP address of the call server included within the Record-Route, which indicates the route information of SIP, has been transmitted or received between carriers, the topology inside the carriers will be revealed. This can be the target of DoS attacks. For this reason, session border controllers usually need to be equipped with a function that deletes topology information. This approach is called Topology Hiding (THIG).

When such a differential absorption function and THIG are implemented, flexible response must be taken for each interconnecting carrier.

In the CenterStage NX3200, differential absorption has been so designed that differences can be absorbed not by modifying the program but by configuration. This will allow functions to be provided quickly even if it comes to adding an interconnecting carrier. In addition, the NX3200 analyzes syntax within a Session Description Protocol (SDP) message and retains the status instead of using L5 NAT, the address conversion method using mere pattern matching. This will realize a precise absorption of network differences.

As for THIG, topology can be easily concealed in the CenterStage NX3200, because SIP-ALG operates as a Back-To-Back User Agent (B2BUA), where SIP-ALG itself can be seen as a user agent from both interfaces.

Absorbing codec differences

In a NGN network, codecs to be used during the transmission and reception of audio and video may differ depending on the terminal that the carrier accommodates, as shown in **Fig. 3**. Normally, in a unicast communication using a SIP signal, a codec that can be used by both terminals will be selected in the process of negotiations for signal processing, so communication can be made with no problem. However, a case may arise when one terminal can use only G.711, for example, which is the basis of IP phone, and the other, when it is a mobile terminal accommodated in a mobile network, can use only an audio codec specific to mobile networks, a codec such as Enhanced Variable Rate Codec (EVRC), for example. In this case, communication will be disabled because the problem cannot be solved by signal processing using the codecs. To avoid this, codec conversion needs to be performed between carrier networks so as to absorb codec differences. The CenterStage NX3200 absorbs codec differences on the media conversion blade developed exclusively for codec conversion, thereby supporting codec conversion on large-capacity channels between carriers. For the media conversion blade, OKI has developed a card dedicated to codec conversion, where a DSP is mounted on an AMC

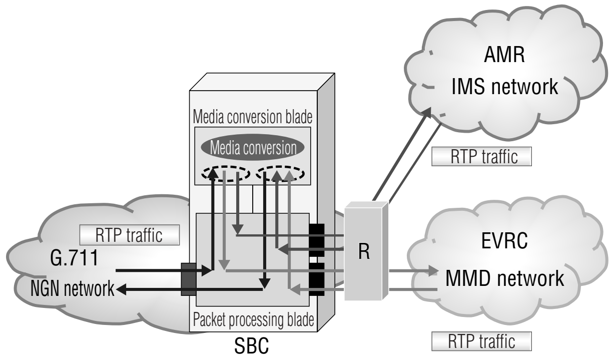

Fig. 3 Codec conversion function

card (Advanced Mezzanine Card (AMC) is an ATCA standard for mezzanine cards). The media conversion blade has superior expandability when increasing the number of channels: Up to three AMC cards can be mounted on one blade. Also, the media conversion blade allows converting not only audio codecs but video codecs at the same time. The following codecs are currently supported: (For audio codecs:) G.711, EVRC, adaptive multi-rate (AMR), G.726, G.722, AAC, EVRC-B, WB-AMR, and G.711.1; (For video codecs:) MPEG-4 and H.264.

Functional expandability -Countermeasures against IPv4 address exhaustion-

It is estimated that IPv4 global addresses will be exhausted in the years between late 2010 and 2011 because of failure in assignment of new addresses[1]. The Ministry of Internal Affairs and Communications reports[2] that action policies on the IPv4 address exhaustion issue include the following three: (1) Save on IP addresses by use of NAT/NAPT; (2) Make the utmost use of IP addresses by redistributing IP addresses already assigned; (3) Make use of new address resources through transitioning to IPv6. Of these, (1) and (2) are the items to be dealt with on the terminal equipment side. Product situation in these days finds that what is called a Large Scale NAT (LSN) equipment intended for telecom carriers has been being commercialized for the realization of (1). There, terminal addresses are changed from global to private ones and after that they are made global addresses by Network Address Port Translation (NAPT) using LSN, thereby saving on addresses. The CenterStage NX3200 is equipped with this private/global address translation and, what is more, it also has an IPv4/IPv6 address translation function, making (1) and (3) realized at the same time. Additionally, when realizing (1) and (3), the location for the CenterStage NX3200 to be installed will be the edge of the access network that accommodates the UNI connected to the terminal, not the original position for networks to be interconnected. For the signaling for accommodating a UNI, SIP-ALG is capable of interpreting it, which means that the NX3200 is equipped with the function of countermeasures against exhaustion.

Conclusion

In this review, we have introduced the CenterStage NX3200, an inter-carrier session border controller that ensures high reliability and high scalability and, at the same time, a product developed and commercialized as an OKI's approach toward NGN. We have also introduced that the product, if used expansively, can be used for a countermeasure against IPv4 address exhaustion.

Interconnection between NGNs has only begun, and it is expected that this type of interconnecting equipment will increasingly be playing its part as carriers expand their NGN services. As described earlier, the equipment has superior expandability and enhanced underlying functions. We therefore consider that the equipment will meet future demands for interconnecting equipment. Also, even if a new use of the equipment, such as a countermeasure against IPv4 address exhaustion, arises, the equipment can respond with flexibility.

References

1) JPNIC: About IPv4 address exhaustion
http://www.nic.ad.jp/ja/ip/ipv4pool/

2) Ministry of Internal Affairs and Communications: Report by the survey and research committees on smooth transitioning to IPv6 on the Internet
http://www.soumu.go.jp/menu_news/s-news/2008/pdf/080411_3_bs1.pdf

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TIPS [Basic Terminology Descriptions]

NGN: Next Generation Network

A next-generation network operated by communications carriers based on IP technology. International standardization efforts are underway under the aegis of the ITU-T (International Telecommunication Union-Telecommunication Standardization Sector), and Japanese communications carriers are becoming more actively involved in efforts to build NGN. In addition to existing fixed and mobile communication service, NGN networks are capable of providing high-quality video distribution, videoconferencing, and high-reliability communications services for enterprises over a single IP network. In addition to enabling carriers to lower the costs associated with building and operating networks, NGN technology makes it easier for carriers to offer new services such as Triple Play (integrated audio, data, and video) and fixed mobile convergence (FMC). Additionally, an open application programming interface (API) makes it easy for third parties to offer original services that take advantage of NGN functionality.

SIP-ALG: Session Initiation Protocol Application Level Gateway

Carriers may use their own version of IP and SIP. When different IPs (IPv4 and IPv6, for example) are used, the IP address for the SIP message also must be changed. SIP-ALG is a function to absorb such differences.

AMR: Adaptive Multi-Rate

One of the audio codecs. It was standardized by the Third Generation Partnership Project (3GPP), a standards body for mobile networks, and has been adopted in W-CDMA.

EVRC: Enhanced Variable Rate Codec

One of the audio codecs. It was standardized by the Third Generation Partnership Project 2 (3GPP2), a standards body for mobile networks, and has been adopted in CDMA2000.

G.711

One of the audio codecs. Standardized by the ITU-T, G.711 is a basic codec widely used in telephone applications.

G.711.1

One of the audio codecs. It allows regenerating wideband speech and features scalability with G.711, a codec now widely used. G.711.1 was proposed by NTT, acting as the leader of its standardization, ETRI (Korea), France Telecom (France), Huawei (China), and VoiceAge (Canada) and was approved as ITU-T G.711.1 in 2008 as a global standard.

AMR-WB: Adaptive Multi-Rate Wideband

One of the audio codecs. It was standardized by the Third Generation Partnership Project (3GPP), a standards body for mobile networks, and is expected to be utilized in future wideband services.

EVRC: Enhanced Variable Rate Codec Rev.B

One of the audio codecs. It was standardized by the Third Generation Partnership Project 2 (3GPP2), a standards body for mobile networks, and is expected to be utilized in wideband networks.

MPEG-4: Motion Pictures Experts Group phase 4

One of the highly-efficient audio and video codecs. It was standardized by an ISO/IEC (International Organization for Standardization/International Electrotechnical Commission) joint working group (ISO/IEC/JTC1/SC29/WG11).

H.264

One of the highly-efficient audio and video codecs. It was recommended by the International Telecommunication Union (ITU). It was also recommended by the International Organization for Standardization (ISO) as part of motion picture compression standard MPEG-4 (MPEG-4 Part 10, Advanced Video Coding). For this reason, it is common to refer to the codec with names such as H.264/MPEG-4 AVC or H.264/AVC.