Next-Generation Network Management System

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Abstract

As a result of current research and the construction of the NGN, it is expected that carrier networks will shift significantly to be based in the future on IP/IMS. In order to provide profitable services on an open network, the network management system is required to provide advanced functions that are connect more directly to carrier's business management decisions. These include business management support and customer care services, as well as retaining the conventional requirements for efficient operations management functions.

This paper discusses the requirements for the network management system under the NGN and introduces some of the solutions provided by NEC.

Keywords

NMS, EMS, NGN, 3G, QoS, IMS, all-IP

1. Introduction

The R&D for the next generation network (NGN) is underway and the carrier networks are shifting significantly toward IP/IMS (IP Multimedia Subsystem) based networks. In the field of carrier businesses, it is becoming an important issue how to provide profitable services more efficiently and more quickly on the open network infrastructures.

The network management system for NGN should enable the carriers to run efficiently management operation cycles that are critical for competitive services, and also to contribute to improved profits by supporting appropriate business strategy decisions and arrangements for customer care.

2. Changes in Carrier Businesses and Management System

The business targets of carriers are changing from measured rate voice communications to multimedia service delivery via networks. In addition, due to the participation of new carriers that mainly including mobile carriers, competition in services and prices are becoming more intense than ever. The carrier business necessitates large-scale equipment investment for infrastructures, and investment decisions for new services and quality enhancement should be made more quickly in order to achieve improved competitiveness. On the other hand, although the migration of networks into IP networks is transforming network equipment into commodities, it is still necessary to maintain the quality of services and their reliability at the same level as with the legacy circuit switched networks.

In order to deal with the environmental changes as described above, it will be necessary to enhance the operation management system as shown in **Fig. 1** at the same time as fulfilling conventional requirements such as the improvement of operation and reducing the management systems construction costs.

(1) Real-time Business Strategy Support

This function provides traffic predictions and the analysis of

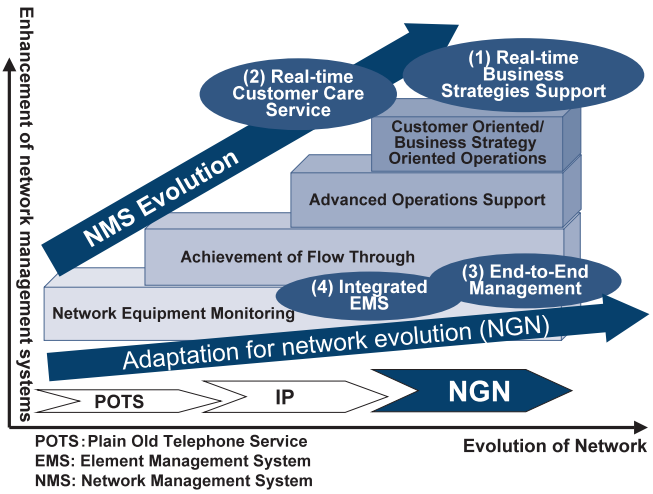

Fig. 1 Direction of operation management system.

subscribers presenting signs of unsubscription in order to support efficient investment decisions by carrier's business management.

(2) Real-time Customer Care Service

This function provides accurate fault information to customer in real-time by utilizing a system architecture that can cope efficiently with changes in operations.

(3) End-to-End Management

This function provides network quality management in the same level with legacy circuit switch network in order to support quick failure recovery.

(4) Integrated EMS

The integrated EMS (Element Management System) built on a unified platform reduces OPEX and CAPEX.

3. NEC's Network Operation Management Solution

This section describes some of NEC's solutions for the implementation of Network Operation Management Solutions for the NGN. **Fig. 2** shows an overall representation of the solutions.

3.1 Real-time Business Strategy Support System

It is not enough for the NMS to support network operations but it should also support the investment decisions by carrier's business management as well as the measures taken to promote customer satisfaction (CS). The Real-time Business Strategy Support System is capable of comprehensive, real-time various viewpoint analysis/evaluation of inquiries/complaints from the customers and equipment information in each service area, in addition to the information collected from the network. The introduction of this system will make the following operations possible.

(1) Support for Network Equipment Investment Decisions

This system applies multi-dimensional, predictive, and trend analyses of information on traffic, quality, equipment and customer complaints as shown in **Fig. 3**. This makes it possible to predict future traffic volume in a specific area, predict quality degradation, predict future increase of customer complaints and estimate the time frame for extending network equipment to resolve these problems. In addition, the system also predicts the traffic and quality improvement results before and after equipment extensions based on the results of similar equipment extensions performed in other areas.

(2) CS Improvement Support

This system categorizes and evaluates network quality and

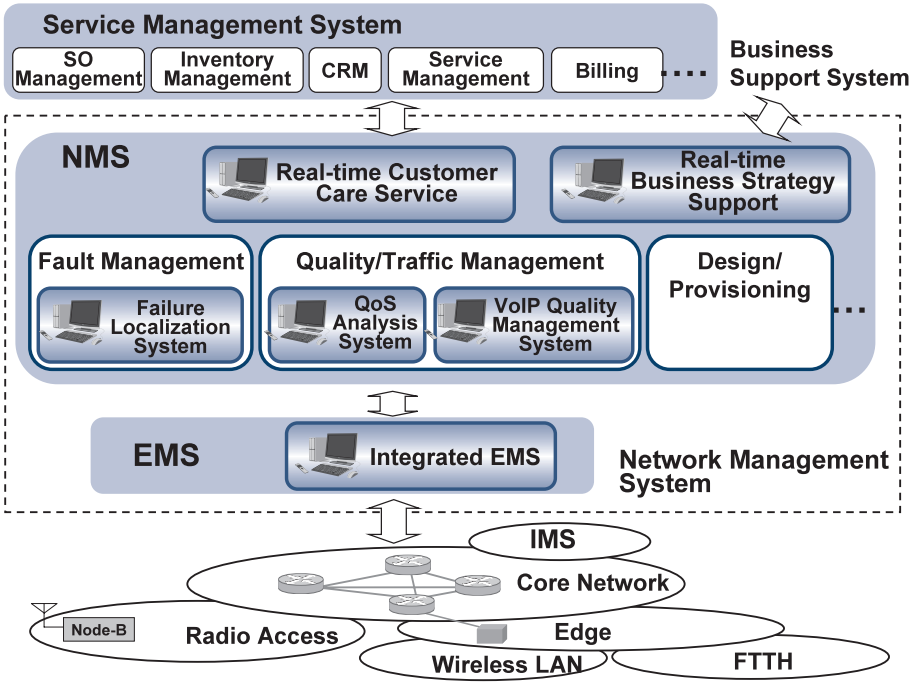

Fig. 2 NEC's Network Operation Management Solutions.

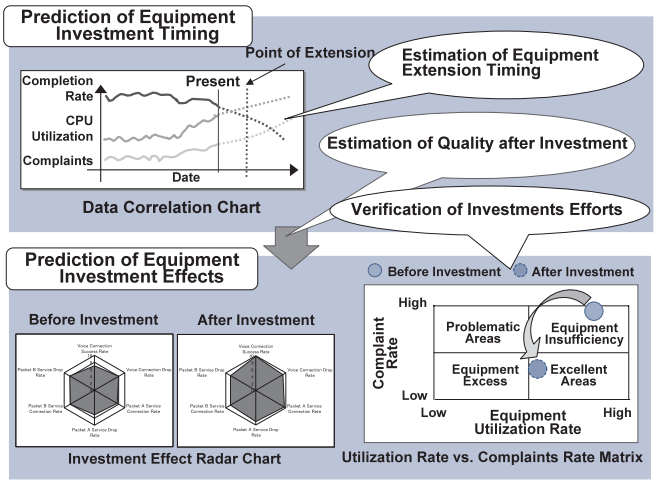

Fig. 3 Network Equipment Investment Decisions Support.

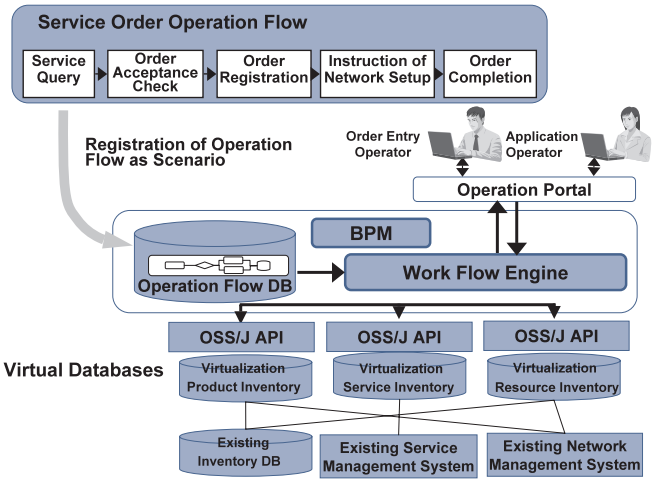

Fig. 4 Real-time Customer Care System.

fault information according to the criteria of time, area, equipment and services. Then, the system applies multi-dimensional analyses by considering the relevance of customer complaints/inquiries, and estimates the number of subscribers who might unsubscribe the service in the future. This feature allows carrier's business management to apply the appropriate CS countermeasures against churning in good time.

3.2 Real-time Customer Care Service System

Intensification of competition between carriers has made it a matter of urgency to improve operations efficiencies and to pursue CS improvements by speeding up the operations (reducing the lead time to provide services).

Improvements in operation efficiencies require a review of the operation flow using BPM (Business Process Management) techniques and a reconsideration of the information flow. **Fig. 4** shows a real-time customer care service system aimed at improving operations efficiency.

After reviewing operation flow using BPM techniques, each operation flow is created as a scenario that is managed in an operation flow database. The information flow can be improved by unifying and virtualization of large amount of network service information by using the virtual database technology. This virtualization does not necessitate the removal of the existing information management system. The existing information management system is connected to the virtual database by using an adapter. The work flow is connected to the virtual database by the API under study in the OSS/J (OSS through Java Initiative), which is a standardization organization for interfaces between operation management systems.

The Introduction of this system will make it possible to unify the operation flows that are variable between branch offices or between services, promote the automatic distribution and linkage of the data that is held in different operation systems and reduce the overall lead time required when starting a new service. The resulting automatic distribution and linkage of the quality data collected from the network and the service in the customer management system will also enable accurate information provision to customers as well as an increase in the speed of the operations for customer inquiry.

3.3 End-to-End Management

In the NGN, the traffic of various services including voice, video and data services flow in a single IP network. Consequently, detection of network failure (including silent failure), identification of services affected by a failure, detection of quality degradation and estimation of root cause of failure become important issues for the efficient operation of the network. To allow the NMS to guarantee high-quality NGN services and support a quick failure recovery, an End-to-End QoS (Quality of Service) management that is achieved by the solutions as shown in **Fig. 5** solves the issues described above.

(1) QoS Analysis System

This system uses a passive measurement method to measure the quality of communications per session. It samples IP packets in order to analyze TCP behavior or the UDP/RPT (Real-time Transfer Protocol) quality. The collected quality data is stored and analyzed in the server to identify the network quality and to detect network failure in order to isolate service failure.

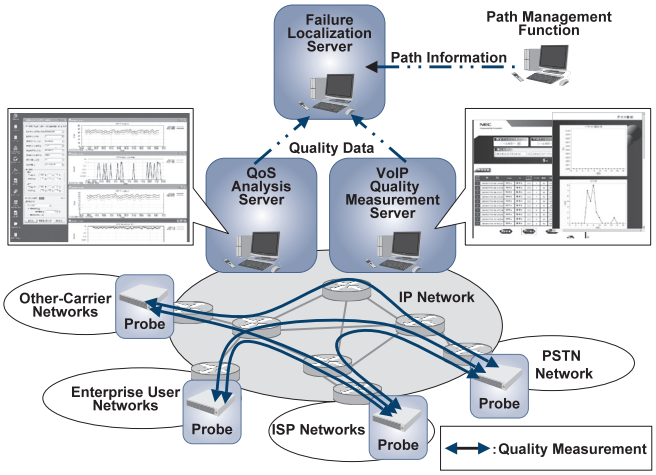

Fig. 5 End-to-End QoS Management System.

(2) VoIP Quality Measurement System

This system uses an active measurement method which exchanges pseudo RTP calls between probes in order measure the voice quality (R Factor, etc.) of the VoIP services based on the e-model as defined in ITU-T-G.107. These measurements are performed periodically and the collected quality data is stored in the server to enable management of the voice quality status of the network.

(3) Fault Localization System

This system estimates the root cause of a silent failure in real time and with higher accuracy than previous method, based on quality information obtained from the QoS Analysis System a VoIP Quality Measurement System and the path information obtained from the path management function of the NMS[1]. This will reduce the work required for failure localization that has hitherto necessitated a large number of man-hours.

Efficient End-To-End QoS Management is achieved by integrating the products above and the fault management of the NMS. In the future, more advanced QoS management will be constructed by covering not only voice but also video and data services.

3.4 Integrated EMS

The migration to IP/NGN using the IMS is also occurring with the EMS that manages the NEs (Network Elements), and the construction of a more effective operations management system is required.

At NEC, we perform integrated management of our NEs using an EMS built on a unified platform to deal with acceleration of all-IP migration. **Fig. 6** shows an integrated EMS for a mobile network. In this example, operation and maintenance function of the overall network, billing mediation (billing MD) function and service order gateway (SO-GW) function solve the following issues.

(1) OPEX Reduction

The sub-network manager of the NEC network domain composed of NEC's radio access NEs, core NEs and IMS provides an integrated network management for the unification

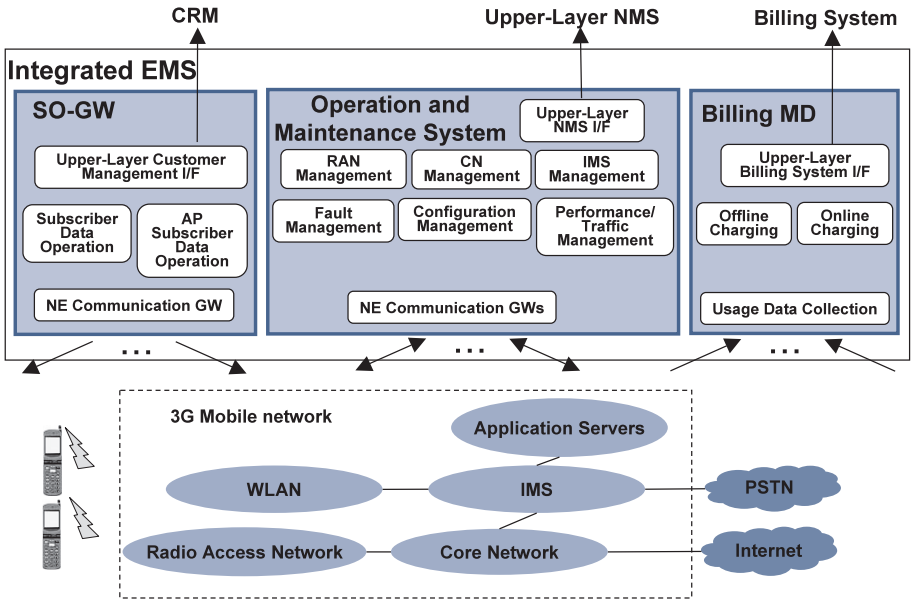

Fig. 6 Integrated EMS.

of operations policy and the improvement of operations efficiency.

(2) CAPEX Reduction

The number of EMS servers can be reduced by introducing the integrated management. The integrated EMS is implemented on a unified platform using the Linux blade server so that the investments and maintenance costs of EMS can be reduced. In addition, the integrated EMS also features a scalability that enable small start operations such as the start of a new service with IMS as well as the integrated management of large-scale networks from radio access to core networks.

(3) System Integration Cost Reduction

Usually, the NMS (Network Management System) collects and controls the management information through the upper-layer interface from the EMS. As a result, conventional NMSs used to necessitate high SI costs due to the need for multiple developments and tests for ensuring the compatibility with interfaces of the various EMSs

When an integrated EMS is used, it can provide a single interface to the NMS so that the system integration costs for NMS can be reduced.

(4) Time to Market

The network is subjected to rapid technological innovations and NEs are upgraded frequently to comply with new services. The integrated EMS provides an integrated operations management function that complies with new services in all of the radio access networks, core networks and IMSs, so that the loss of opportunities can be prevented by the 'Time to Market'.

In the future the end-to-end management products described above will also be applied to the integrated EMS in order to enhance the QoS management in the NEC network domain.

4. Conclusion

We will continue to develop the operation management system with the aim of increasing profit by providing service management functions that reduce customer awareness of the IP network, thus providing a customer care environment that reduce reliance on carriers or networks. Our operation management system will offer useful information for the carrier's business management and streamline the service delivery in addition to improving the efficiency of network operation.

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*Linux is a trademark or registered trademark of Mr. Linus Torvalds in the USA and other countries.

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