Implementation of IP-Centrex in Oki Electric Group of Companies

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The Oki Electric Group fully implemented the VoIP voice network (extension network) within the group in 2003. This system dramatically reduced costs by doing away with conventional toll switching equipment and converting connections between the switches of individual locations to IP communications. This was performed along with a review of domestic networks. Implementation of the IP-Centrex has been promoted since FY2004 to unify phone numbers within the Oki Electric Group in response to the diversification of terminals, fusing them with information systems and further reducing costs. Activities ranging from the implementation of VoIP to IP-Centrex are introduced in this paper.

Conversion from toll switching equipment to VoIP networks

The conversion of toll switching equipment networks to VoIP for voice connections within the Oki Electric Group started in August 1998 and was completed in 2003, when networks at all locations (domestic and overseas) were converted to IP networks (sharing with data systems) (**Figure 1**).

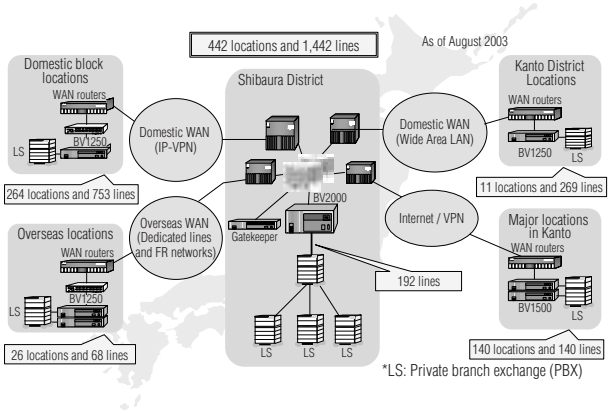

Fig. 1 VoIP network of Oki Electric Group

Networks for data systems and voice systems were centralized through the conversion of networks to VoIP systems, thereby dramatically reducing network expenses. However, since the operation of switching the equipment installed at individual locations continued as it was, a response to new functions, such as IP conversions and wireless conversions within those locations, was difficult to achieve. The “IP-Centrex Implementation Plan” was formulated and the implementation of the IP-Centrex has been promoted since FY2004 in order to further reduce operating costs.

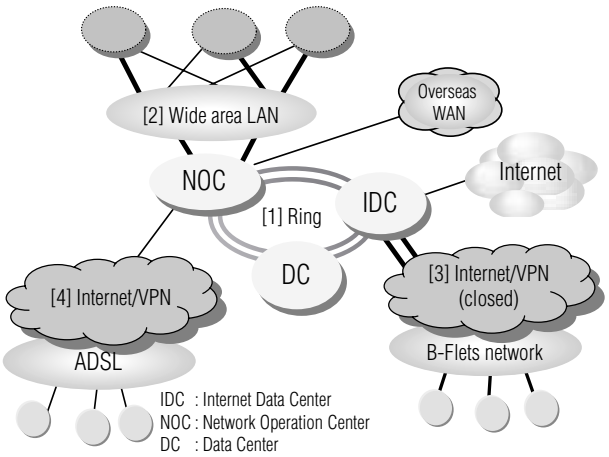

Fig. 2 IP networks of Oki Electric Group

Furthermore, clarification of the risks as well as a further reduction in costs have been promoted through the selection of four network categories suitable for particular situations; backbone networks ([1] Ring), large-scale location networks ([2] Wide area LAN), intermediate-scale networks ([3] Internet/VPN: Closed) and small-scale location networks ([4] Internet/VPN), as shown in **Figure 2.**

Network evaluation for IP-Centrex implementation

A network evaluation, intended to determine the effects on internal networks of the Oki Electric Group, as well as to secure voice quality, was conducted as advance preparation for the full-scale implementation of the IP-Centrex system. For this reason a model was set for each mode of connection for domestic IP networks and verifications were performed for each evaluation item including voice quality, bands used by data, voice and images, as well as responses, priority control and band control for each model.

(1) Wide area LAN model

Network loads are not a concern for wide area LAN models, since networks are redundantly configured and the main lines are used by data systems, the secondary by voice systems. Since both data systems and voice systems use the same line when network disorders occur, there are no practical problems as long as the band control on such occasions is adequately designed.

(2) Large and intermediate-scale internet/VPN models

Large and intermediate-scale locations of the

Internet/VPN models are 100Mbit/second connections with secured practical speeds of approximately 20Mbit/second that present no problems with regards to the load on the network. However, since both data systems and voice systems use the same line at all times and as the VPN equipment will be installed on the route, it is necessary to have a band control with a thorough consideration for such issues and control the priority.

(3) Small-scale internet/VPN models

Depending on the extent of application use at certain locations, there is a slight deterioration in the response capability with small-scale internet/VPN models. Although these models are not valid for band controls, as they are open internet/VPN models, we determined that coverage should be possible through operations at locations with a small number of users.

(4) Wireless LAN implementation models

With regards to voice calls over wireless LAN on the premises of locations it is necessary to conduct advance surveys, such as the investigation of external environments (extrinsic waves), conditions of radio wave leaks to exteriors, radio interference between wireless applications, as well as adjustments to the number of connections that can be established simultaneously or the verification of handovers. Even if the designing and building of systems are conducted based on such surveys, the radio wave environment will change due to changes in the external environment, changes with the layout of the office, etc., therefore, periodical tuning will also be necessary.

(5) Mobile environment utilization models

Since security barriers are high for voice calls in a mobile environment, a thorough study must be conducted and adequate countermeasures need to be considered beforehand. Permission to use services in the mobile environment is granted only to specific employees at Oki Electric Group.

Selection of terminals for implementing IP-Centrex

The majority of terminal devices connected to conventional switching equipment were multi-function telephone sets (including analog phone sets) and personal handyphone systems (PHS). In contrast the IP-Centrex system makes it possible to use new terminals, such as IP phones, software phones, WiFi phones and FOMA phones. The types of terminals that can be connected and the usable functions are listed in **Table 1**.

Table 1 Usable terminal functions

	FOMA		WiFi	PHS (IP base stations)	e-Sound IP phone	Software phone (PCs)
	FOMA (mobile phones)	Wireless LAN (extension lines)				
Web access	○	○	△*1	△*1	×	○
Videophone	○	×	×	×	×	○
Presence referencing	×	○	△*1	△*1	×	○
Screen sharing	×	×	×	×	×	○
Instant messaging	×	○	×	×	×	○
Voice calls	○	○	○	○	○	○
Roaming	×	○	○	○	△	○

*1: Available using devices that support browsers.

Modeling of the selection criteria for implementation was performed in consideration for the fact that the functions that can be used differ from terminal to terminal as shown in **Table 2**, as well as the selection of terminals used vary depending on the business operation modes of individual employees. A trial was then conducted.

Table 2 Models of terminals implemented

Type of terminal	Reason for selection of terminal	Main implementing corporate organizations
Software phones	An improvement in operational efficiency and a reduction in costs arising from business travel are sought through effective use of application functions of software phones.	Back offices (excluding manufacturing lines)
FOMA phones	An improvement in operational efficiency and a reduction in communication costs are sought using mobile phones that are essential for business operations due to frequent business engagements outside the office and because they can also be used as phones for extension lines while moving around within the company.	Sales, SE and design organizations
WiFi phones	An improvement in operational efficiency is sought by making it possible to contact persons in locations where conventional phone lines have been abolished or transitioned to IP phones, as well as while moving around within the company.	Design and management organizations
PHS	Existing wiring is effectively utilized to gain the effects of the IP-Centrex, such as mobile environments, at locations where it is difficult to set up LAN environments.	Manufacturing plant organizations
IP phones (e-Sound phones)	Implemented as phones for receiving incoming calls from external lines, representative phones for individual corporate organizations, as well as phones for receiving calls at branch offices.	Fixed line phones of individual corporate organizations

Location implementation model with IP-Centrex

An evaluation was conducted during the trial implementation and models for the full-scale implementation of the network as well as the terminals, which do not rely on any network modes, were formulated for individual locations (**Figure 3**).

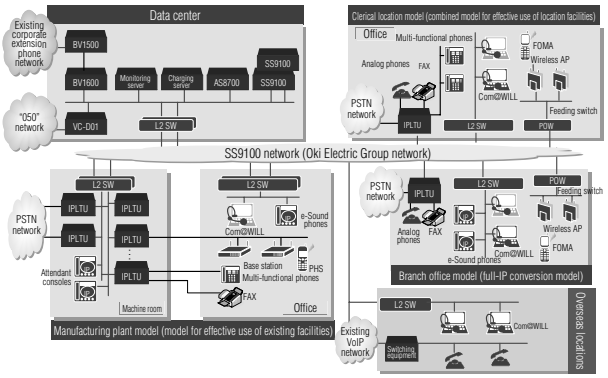

Fig. 3 Location implementation models

(1) Manufacturing plant model

This model is for large areas that will be subject to coverage, with consideration for mobility needs and accommodation for the use of numerous simple phones and a premise of making effective use of existing facilities to avoid spending more than the necessary costs in order to set up LAN environment due to the conversion to IP-Centrex. Terminals are primarily PHS.

(2) Branch office model

This model is for full-scale IP conversions covering areas that are not large, which cater to the needs of personnel with a relatively high frequency of external engagements, such as sales professionals and for which costs involved in setting up the internal LAN again will not be very high. Terminals are primarily FOMA phones.

(3) Clerical location model

This model is for sales, design and management organizations that make efficient use of existing facilities, while full-scale IP conversions may take place on some floors, combining both the manufacturing plant model and the branch office model. For this reason, primary terminals vary among work sites and floors.

(4) Overseas locations model

It was decided to continue using existing switching equipment at overseas locations since connection modes of telecommunication carriers in other countries are inconsistent and because initiating and receiving external line calls must be performed locally. For this reason, software phones were to be used at overseas locations to utilize the extension line network of the Oki Electric Group. Currently it is possible to use software phones in Japanese, English and Chinese.

Application interlocking with IP-Centrex

An improvement in efficiency, as well as the optimization of corporate activities through the phased fusion of information and communications, are being promoted in connection with the implementation of IP-Centrex. We are currently putting into practice the interlocking of a backbone system with the newly developed purchasing management system (**Figure 4**).

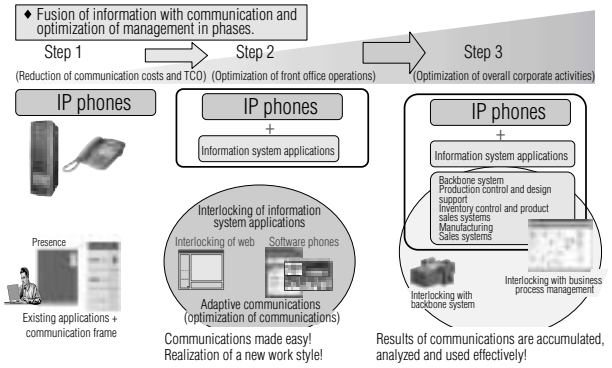

Fig. 4 Procedure of fusing information and communications

An example of interlocking with information system applications that have already been realized is shown in **Figure 5.**

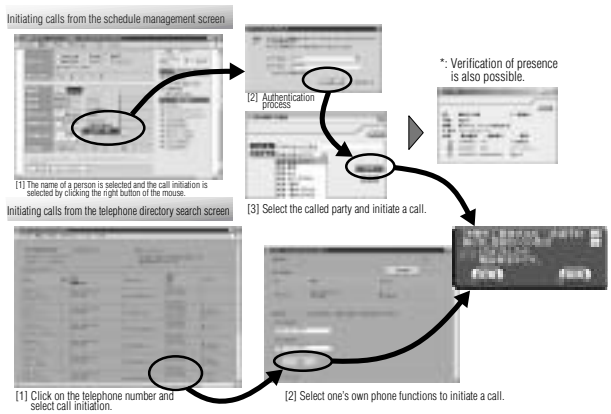

Fig. 5 Interlock of information system applications

(1) Initiating calls from telephone directory search

In the past an individual information search screen (company names, corporate organization names, e-mail addresses and telephone numbers) of the Oki Electric Group offered an e-mail transmission function that was triggered by clicking on the listed e-mail address. With the interlocking IP-Centrex it is now also possible to initiate telephone calls. The selection of a telephone number for the calling party, as well as the called party, is possible with this call initiation.

(2) Initiating calls from schedule management screen

Initiating calls by clicking on the name of the called party using the right button of the mouse is possible, without changing the schedule management software.

Operational services with IP-Centrex

A one-stop operating organization was established by centralizing operational maintenance tasks that have so far been conducted by individual corporate organizations, in connection with the implementation of IP-Centrex. This organization is providing all relevant services, in a unified collaboration of business units at Oki Electric, as well as subsidiary and affiliated companies (**Figure 6**).

Individual services provided by the operational management organization are shown below:

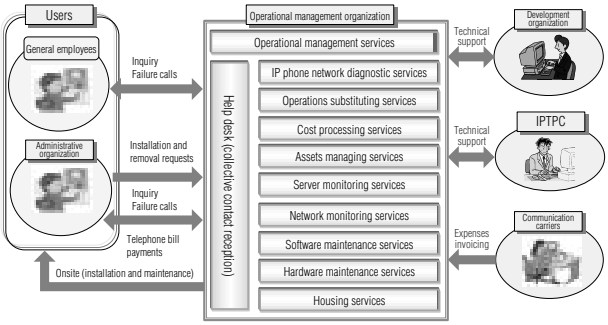

Fig. 6 IP-Centrex operational services

(1) Operational management services

Stable operations are achieved by managing the overall operations of IP-Centrex and by collecting individual services. Responsibility for the entire system is assumed, while coordinating with development and SE organizations, as well as preparing operational performance reports and proposing improvements.

(2) Help desk services

The help desk handles all inquiries, failure calls, as well as installation and removal requests from all users including general employees, part-time workers, temporary staff and administrative organizations in charge of managing business locations. Except for inquiries relating to directions of use, all calls are escalated to individual organizations providing specific services.

(3) IP phone network diagnostic services

These services are provided to periodically diagnose the network utilization status as well as the wireless LAN utilization status after initial implementation. These services differ from ordinary network diagnostics in that they feature a diagnosis on voice quality, as well as an analysis on the usage of IP phones.

(4) Operations substituting services

The collection of clerical operations in general, such as layout changes, installations and the removal of terminals, arrangements for various installation works, cost processing, as well as assets management, are all performed by the system on behalf of individual administrative organizations that used to carry them out.

(5) Cost processing services

Invoices from individual communication carriers are paid in bulk and billing services, which involve charge management for individual terminals, as well as invoicing charges to individual corporate organizations, are conducted.

(6) Assets managing services

Ledgers listing individual assets (servers, network equipment, terminals, IP addresses, telephone numbers, external lines, DID, DIL, trunks, etc.) are prepared and basic information regarding the usage of individual services is provided.

(7) Server monitoring services

IP-Centrex is configured by a diverse group of servers. The status of these servers is monitored around the clock, 365 days a year. The main monitoring items include a suspension of services, failure messages and CPU usage rates, a mechanism of which is shown in **Figure 7**. When an abnormality occurs, the corporate organization of the escalated request identifies the issue as a hardware or software problem and performs onsite maintenance.

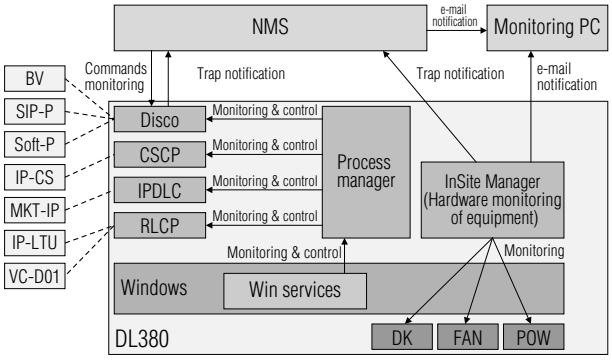

Fig. 7 IP-Centrex monitoring architecture

(8) Network monitoring services

Individual network equipment used by IP-Centrex is monitored around the clock, 365 days a year. Services equivalent with those of the server monitoring are provided for the network equipment.

(9) Software maintenance services

Versions for various software used by IP-Centrex, as well as software used by the server group, are periodically upgraded. Furthermore, strategies to fill security holes of these software, as well as steps to prevent viruses are also performed.

(10) Hardware maintenance services

Onsite maintenance services for hardware, such as the server group or network equipment, are conducted around the clock, 365 days a year.

(11)Housing services

Server group network equipment is installed in a solid data center to facilitate stable operations.

Cost reductions through conversion to IP-Centrex

A reduction in operating costs, as well as communication costs (fixed line and mobile phones) for the entire group, is being promoted through conversion to IP-Centrex.

(1) Reduction of operating costs

An overall reduction of man-hours is sought by centralizing tasks relating to the operation and maintenance of switching equipment previously conducted at each individual location. Furthermore, due to network conversions to IP and wireless, there has been a dramatic reduction in telephone installation work, which occurs with layout changes and organizational changes, thereby making it possible to compress installation costs.

(2) Reduction of communication costs

A review regarding the number of subscribed external phone lines at individual locations is being driven by the centralized initiation of calls to external points. Furthermore, communication costs relating to mobile phones and overseas calls are being reduced through conversion to the “050” networks (**Figure 8**).

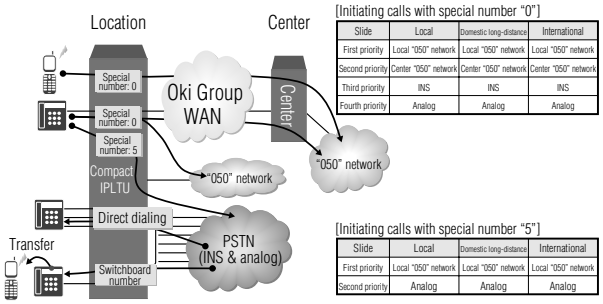

Fig. 8 Order of priority for initiating calls to and receiving calls from external lines

Conclusion

Activities relating to the implementation of IP-Centrex at Oki Electric Group have been introduced. The concepts and advanced technologies applied to these case examples can be applied to various business enterprises. We hope that this paper will serve our customers as a showcase for model cases.

Issues for the future include activities relating to the enhancement of interlocking with business applications of backbone systems, as well as work relating to imaging systems. Furthermore, since telephone functions and terminals of IP systems will continue to evolve in the future, it is important to work on model cases by conducting practical activities in the latest environments at all times.

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