Information Utilizing Technologies for Value Creation —The Present Status and Future Perspectives of Commercialization and Product Implementation

By Kensaku TSUTSUI*

ABSTRACT People say that the Ubiquitous Society is becoming a reality and also that the general focus is moving from the preparation of infrastructures to a positive utilization of information. The positive utilization of information in the ubiquitous society requires technologies to support real-time processing of the kinds of information that have not been handled typically by previous information systems (e.g. multimedia information including audio and video, information on the location and status of people and objects, etc.) This paper overviews the present status of commercialization and product implementation of technologies in the fields of urgent issues from the viewpoint of the positive utilization of ubiquitous information, such as the Ubiquitous Application Platforms and the Next-Generation Contact Center.

KEYWORDS **Ubiquitous, Ubiquitous application platforms, Presence, Two-way communications, Voice recognition, Text mining, Contact center.**

1. INTRODUCTION

The ubiquitous network society, in which connection to networks is possible "anytime, anywhere, anyhow and by anyone," is becoming a reality. In the ubiquitous network society, networks are not only those places that can be connected from PCs in the household or office but also the places where various parts of machines are interconnected, so that anyone can utilize them easily and safely. The Information Communication White Paper (FY2004) of the Japanese Ministry of Internal Affairs and Communications estimates that the ubiquitous network-related market will grow to 59.3 trillion yen in 2007 and 87.6 trillion yen in 2010. It also expects that this trend will produce extensive ripple effects over the entire industry.

The broadband environments based on xDSL, CATV, FTTH, etc. are the basic infrastructures of the ubiquitous network society. Japan has implemented the world's lowest priced, most efficient infrastructures in this field, and the focus of national activities is said to be moving from preparation of infrastructures to the positive utilization of information. However, positive utilization of information in the ubiquitous society requires suitable technologies for real-time processing of the kind of information that has not been handled typically by previous information systems (multimedia information including audio and video, information on the location and status of people and objects, etc.) It is only after these technologies are put to practical use that the ubiquitous society will become a reality.

This paper overviews the present status of commercialization and product implementation of the technologies in the fields of urgent topics from the viewpoint of a positive utilization of ubiquitous information, such as the Ubiquitous Application Platforms and the Next-Generation Contact Center.

2. UBIQUITOUS APPLICATION PLATFORMS

2.1 Objectives

NEC has set four key domains for the ubiquitous-related solutions of business customers, and have been preparing and promoting various solutions as shown in **Fig. 1**. Ubiquitous-related solutions necessitate the connection of a large variety of terminals to diverse networks as well as their utilization in diverse environments. However, the construction platforms of traditional systems are not sufficiently compatible with these diversities and modification has been required for each system. To deal with this problem, we have systematized the conventional

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†As the products introduced in this paper are mainly sold for the domestic market, some figures feature explanations by the Japanese language.

technologies for the implementation of ubiquitous-related solutions and have arranged them into middleware named "Ubiquitous Application Platforms." This middleware allows solutions to be constructed for the customer in a short period and at low cost. At the same time, ensuring the reliability and scalability of the system and also making it capable of tracing new technical innovations quickly.

2.2 Provided Functions

The Ubiquitous Application Platforms are composed of eight functions shown in **Fig. 2**. Each function is not only usable independently but is also designed to be linkable and combinable with other functions.

The outline of each function is as described in the following.

(1) RFID Platform

A platform for the real-time collection of the movements of "humans, objects, money and information" represented by RFIDs (Radio Frequency Identification) and for the preparation of the collected data by processing it in a form that is easy to be handled by the applications.

(2) Two-Way Communication Platform

A platform for real-time joint work that crosses the barriers of time, place, terminal and network.

(3) Mobile Service Platform

A platform (development and execution environments) for easy linkage between the real-society services using mobile terminals and Internet services.

(4) Authentication and Security Platform

Shared platforms for the authentication and security matters required by ubiquitous applications, that facilitate linkages between applications.

(5) Terminal Adaptation Platform

A platform for making each single application capable of providing services to various terminals such as PCs, mobile terminals and PDAs.

(6) Location Information Platform

A platform such as mobile equipment, for the real-time collection of location information for humans and objects that provides collected data by processing it in a form that can be easily handled by the applications.

(7) Presence Platform

A platform for the collection and management of the status ("Presence") of humans and objects, and for the provision of the collected data by processing it in a form that is easily handled by the applications.

2.3 Examples of Actual Applications

As an example of the application of Ubiquitous Application Platform, **Fig. 3** shows a solution for improving customer relations at a big store. In this case, the movements of customers visiting the store are detected by the RFIDs assigned to mobile phones

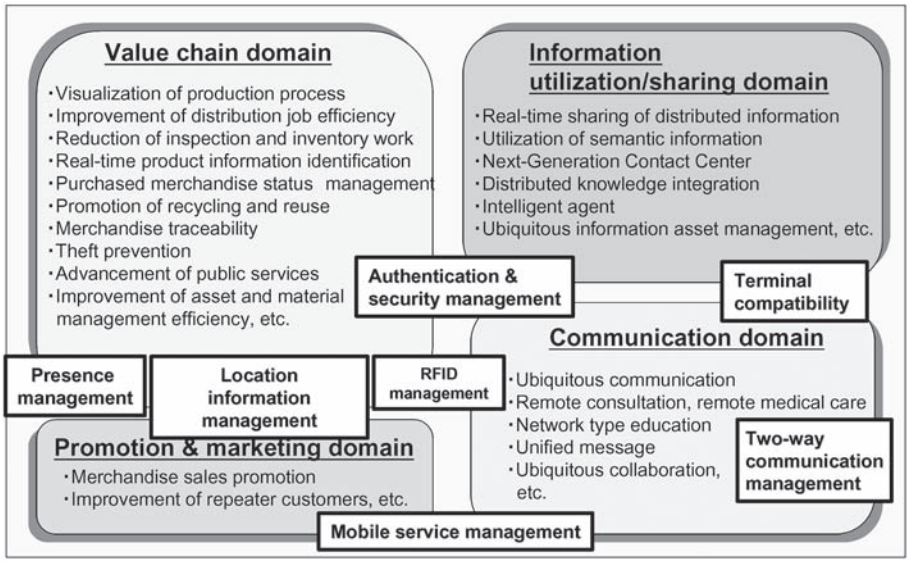

Fig. 1 Ubiquitous solutions.

located in the entrances or on the various floors of the store. This system allows the store clerks to identify the activities of individual customers and to provide a one-to-one service for them. In addition, value-added services such as coupons or free parking tickets can also be provided to the customers by distributing them via their mobile phones.

This solution is implemented by combining the following four functions of the Ubiquitous Application Platforms.

- RFID Platform
- Presence Platform
- Location Information Platform
- Mobile Service Platform

3. UTILIZATION OF PRESENCE

3.1 Efforts for Utilization

Presence refers to information expressing the real-time status of humans and objects. Some of the examples of Presence include:

① Status of a person: Desk attendance, location, action, feelings and emotions.
② Status of an object: Machine operating status and equipment availability status.

Efforts for the utilization of Presence are advanced in various fields including the CRM field as represented by the "Store Customer Relation Improvement Solution" shown in Fig. 3, as well as in the enterprise core system field of linked inventory and sales management and in the field for the productivity improvement of knowledge workers. Among these fields, the following description focuses on efforts for the most general utilization of Presence in office jobs.

Communications using phones, conferences and E-mails occupy a high share in office jobs routines. However, they are almost always accompanied by wastage, with which communications encounter difficulties due to lack of knowledge on the status of the other party. If the status (Presence) of the party to be

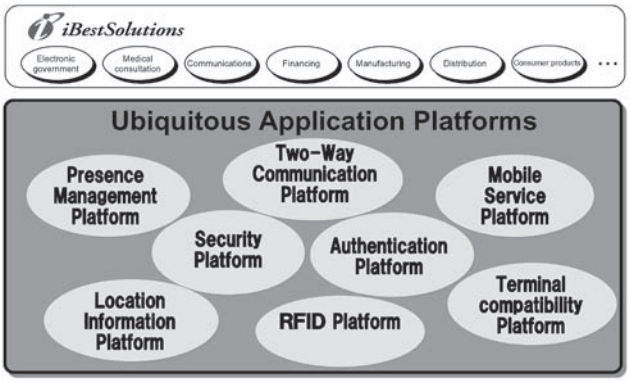

Fig. 2 Ubiquitous application platforms.

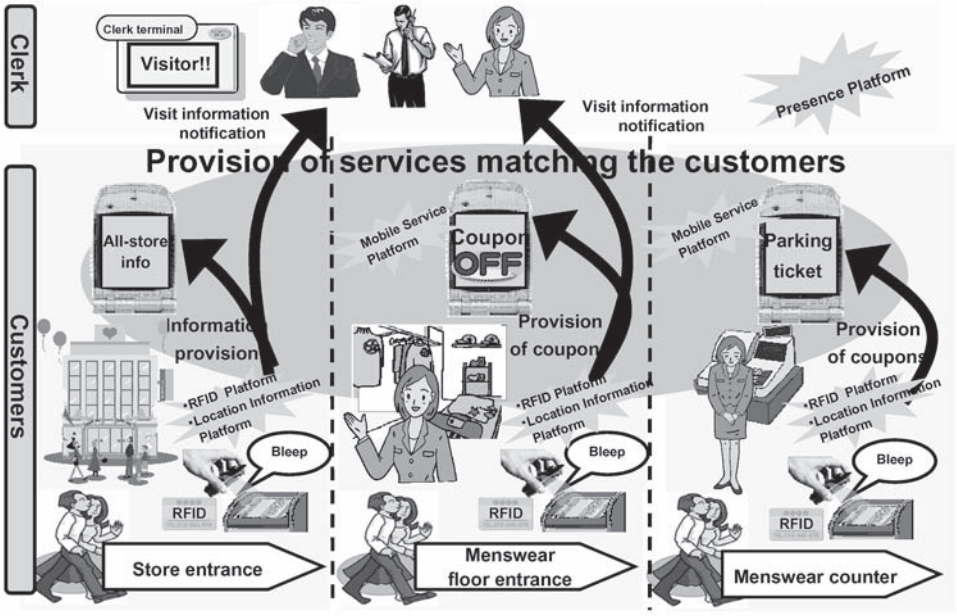

Fig. 3 Customer relation improvement solution.

communicated with can be identified, then communications would be much more efficient. And owing to this efficiency, a further improvement of the quickness of worker's decision making brings a good many effects for the entire organization.

To utilize presence as valuable information, it is important to utilize multiple pieces of presence information as integrated, processed secondary information as well as to accurately collect individual pieces of presence information (primary information). From the viewpoint of improvement of the efficiency of communications, the secondary information consists of "the means of contact that can be used to contact the party to be communicated," as well as the primary information, which is the status of that party (attending at desk, out for meeting, talking on the telephone, etc.) does not always have to be known. With the "Communications Portal" shown in **Fig. 4**, when one inquires the electronic phone directory to search for the party to be communicated, the extended Presence information, formed by integrating multiple pieces of Presence information on that person, is displayed together with the selection display of the currently available means of contact. For the primary Presence information, information is provided on the schedule management, desk attendance management, phone status and PC ON/OFF status and also an interface that allows the user to set one's own Presence information.

3.2 Presence Infrastructure

The kinds of information required as secondary information varies between applications. If the collection of Presence and its processing were packaged individually in applications utilizing Presence, the following problems would result:

- Increase in the application development costs.
- Inconsistence between applications because the definitions of presence integration and processing become variable between applications.

The Presence Infrastructure solves these problems by providing the Presence collection and processing functions commonly to multiple applications. **Figure 5** shows the configuration of the Presence Infrastructure.

The outline of each function of the Presence Infrastructure is as described in the following.

1) Presence Provider Linkage Function

Acquisition of individual Presence information through APIs of various Presence providers.

2) Application Linkage Function

Acquisition of the Presence information managed by applications through APIs of the schedule management of groupware, and feedback of the acquired information in the Presence of the Presence Infrastructure. Notification of changes in Presence according to the rules specified by applications.

3) Directory Linkage Function

Integrated user management of the users and applications managed by the Presence Infrastructure based on linkage with LDAP servers.

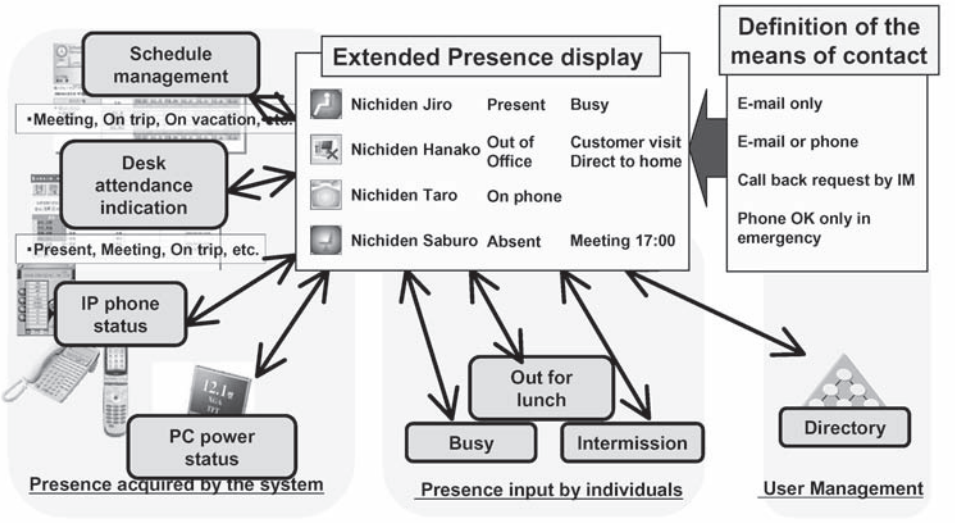

Fig. 4 Example of presence utilization in office.

4) Presence Conversion Function

Acquisition of the Presence information of each phone number from telephony type Presence servers, assignment of correspondence between it and each user, and provision of the results as the Presence information of individual users.

5) Extended Presence Definition Function

Provision of Presence storage locations for applications utilizing Presence in order to allow them their own Presence definitions.

6) Composite Presence Generation Function

Generation of composite Presence based on multiple Presence settings (rules defined in advance).

7) Application Interface (API)

Means of access from applications utilizing Presence to the Presence Infrastructure. The provided APIs will include the SOAP, Java and net interfaces.

NEC believes that the Presence Infrastructure will grow in importance more than ever as the positive utilization of the Presence information advances in various fields. It is therefore planning continual enhancement of the functions, expansion of the platforms and extension of the scalability.

4. TWO-WAY COMMUNICATION INFRASTRUCTURE

4.1 Communications in the Ubiquitous Society

The most general forms of communications in the ubiquitous society will be the multimedia communications combining voice, image and data. Expansion of network bandwidths and advancement of the performances of servers and terminals are now preparing infrastructures in which multimedia communications are available without introduction of special hardware or network. The Two-Way Communication Infrastructure utilizes these infrastructures to provide common foundations for applications that are compatible with various forms of communications.

4.2 Applications in Offices

One of the typical examples of applications of the Two-Way Communication Infrastructure is the conference system for offices. The "Communication Door (Conference Solution)" shown in **Fig. 6** is a Web conference system making use of the Two-Way Communication Infrastructure.

The Communication Door (Conference Solution) allows 20 persons to participate in a conference and 8 persons to speak at the same time. Offering various means of data sharing such as the whiteboard, image sharing, data sharing, application sharing and the possibility of using personal data (data on hand of each participant), it enables various forms of use to match the conferences held at various offices.

4.3 Application in Contact Centers

The target of applying two-way communication in Contact Centers lies in improving the customer satisfaction and upgrading the provided services by implementing those customer relations activities that used to rely on the telephone and E-mails, by means of

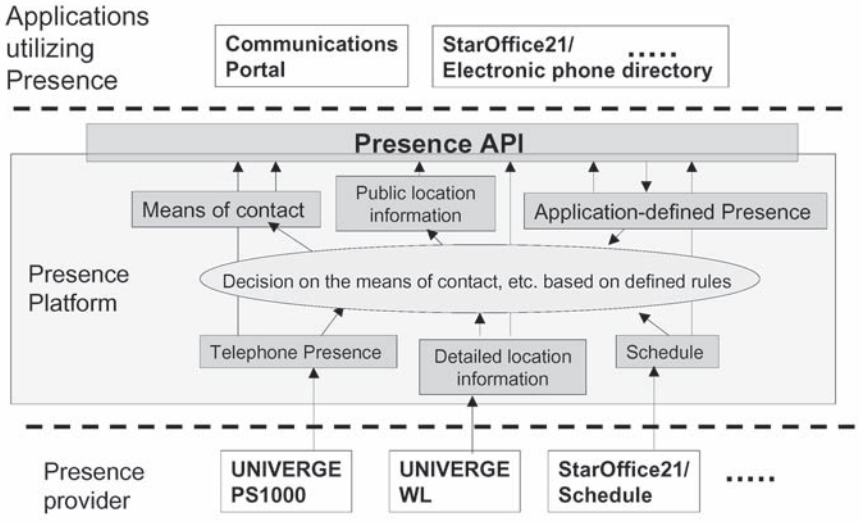

Fig. 5 Presence infrastructure.

multimedia (**Fig. 7**).

The "Communication Door (Contact Center Solution)" shown in **Fig. 8** shows a case in which the Two-Way Communication Infrastructure is applied to a Contact Center to enable multimedia interaction between customers and operators.

The Communication Door (Contact Center Solution) allows the customers and operators to communicate while listening to the voice of each other and viewing images. Using the means of data sharing such as the Web image sharing, form entry synchronization, whiteboard and text chatting, this system can be used mainly in information provision and consulting services using Web contents.

Other fields of application of the Two-Way Communication Platform include remote education,

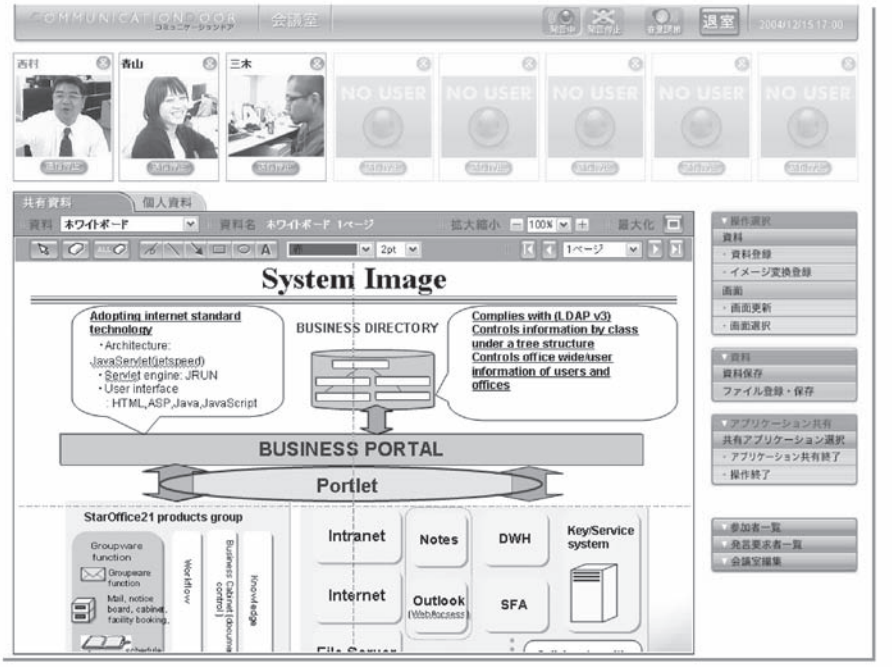

Fig. 6 Communication Door (Conference solution).

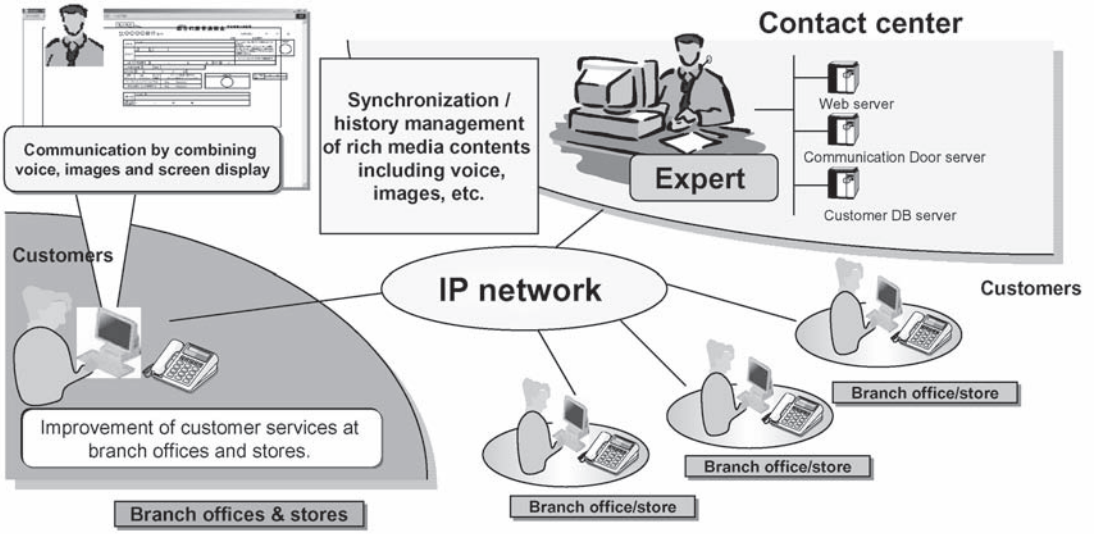

Fig. 7 Utilization of two-way communication at the contact center.

seminar-type multi-attendance conferences, remote presentations, medical consultations and counseling services by local government officials.

4.4 Distributed Collaboration

The horizontally distributed collaboration system based on the peer-to-peer (P2P) type communication model represents one of the future development orientations of two-way communication. The P2P type communication model features higher freedom in dynamic addition/deletion of members than the server concentrated model, and is suitable for project activities in which members participate relatively freely from several firms or organizations or, even within a single organization, for joint work by ad hoc participation of members. However, this feature on the other hand requires full consideration of security.

Figure 9 shows the configuration of a secure P2P type collaboration system. In this example, the Dynamic Community Management manages the members and the members participating in the community are allowed P2P type information sharing. The Virtual Network Management is used to ensure the security of the communication paths by configuring a VPN dynamically between the terminals of the members. The Content Protection Management that is linked with the DRM technology protects the shared information against being referenced by non-members.

The distributed collaborations introduced here are planned to be commercialized as the next-generation information sharing platform of StarOffice21.

5. NEXT-GENERATION CONTACT CENTER

5.1 Utilization of Ubiquitous Information at the Next-Generation Contact Center

With the integration of voice and data networks as a result of the introduction of VoIP (Voice over IP),

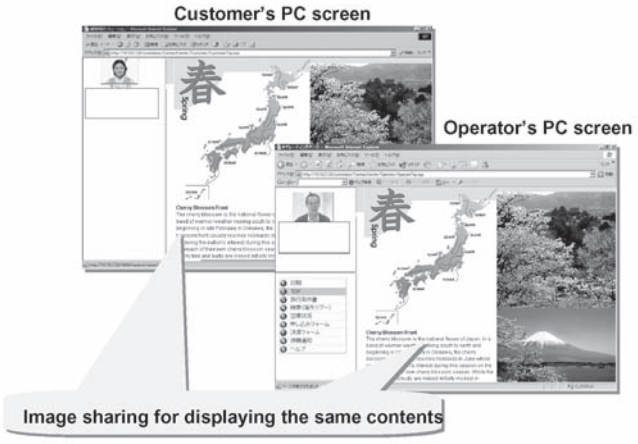

Fig. 8 Communication Door (Contact center solution).

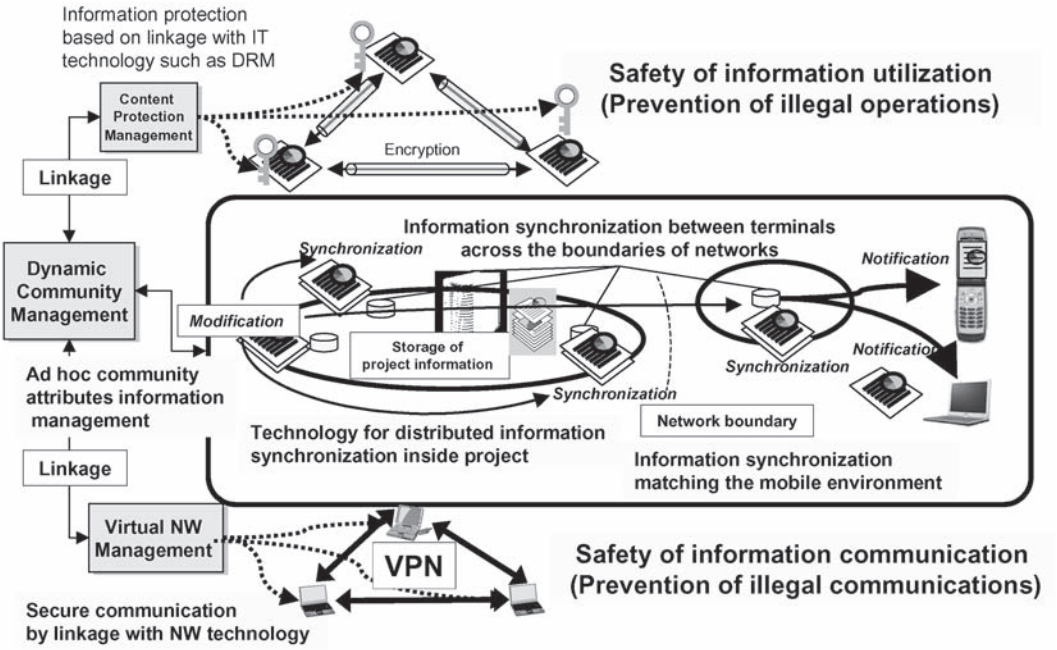

Fig. 9 Distributed collaboration.

the reconstruction of contact centers has now become a new trend. Although the traditional contact centers were thought to be necessary for customer services, they were labor-intensive and the mainstream of their management concept was to reduce the costs as much as possible while maintaining the level of service. Nevertheless, the notion that the contact centers where the raw opinions of customers can be collected are one of the most important sources of information for businesses and that the analyses and utilization of the information collected there will help enhance their competitiveness is a generalization. Therefore, expectations of a technology for the analysis and utilization of the information collected at the contact centers is becoming stronger than ever.

NEC proposes the "Next-Generation Contact Center," the objective of which is to enhance customer relations by introducing multi-channel operations and Web collaborations. The aim is also to promote the advanced utilization of the customer/market information collected at contact centers as management information based on information analyses. A further aim is to reduce the cost of operations by adopting the IP technology (**Fig. 10**).

This section summarizes the latest technology employed in the Next-Generation Contact Center.

5.2 Voice Recognition

Voice recognition technology has been put to practical use only at the level of word recognition, as may be seen in the IVR (Interactive Voice Response), but recent study is advancing the technology of recognizing spoken languages directly and to a practical level. As shown in **Fig. 11**, the Next-Generation Contact Center will incorporate voice recognition technology positively, in order to utilize it and achieve more strategic management information extraction as well as reducing the cost of operations.

The outline of each voice recognition technology system utilized at the contact center is as described in the following.

1) Interactive Voice Response

This system has already been introduced in many contact centers.

2) Operator's FAQ Inquiry Support

This system recognizes a keyword spoken by the operator, inquires the FAQ database with that keyword and displays the answer quickly.

3) Operator's Reception Report Creation Support

This system recognizes and records the words spoken by the operator to help the operator reduce the time taken to write the reception report.

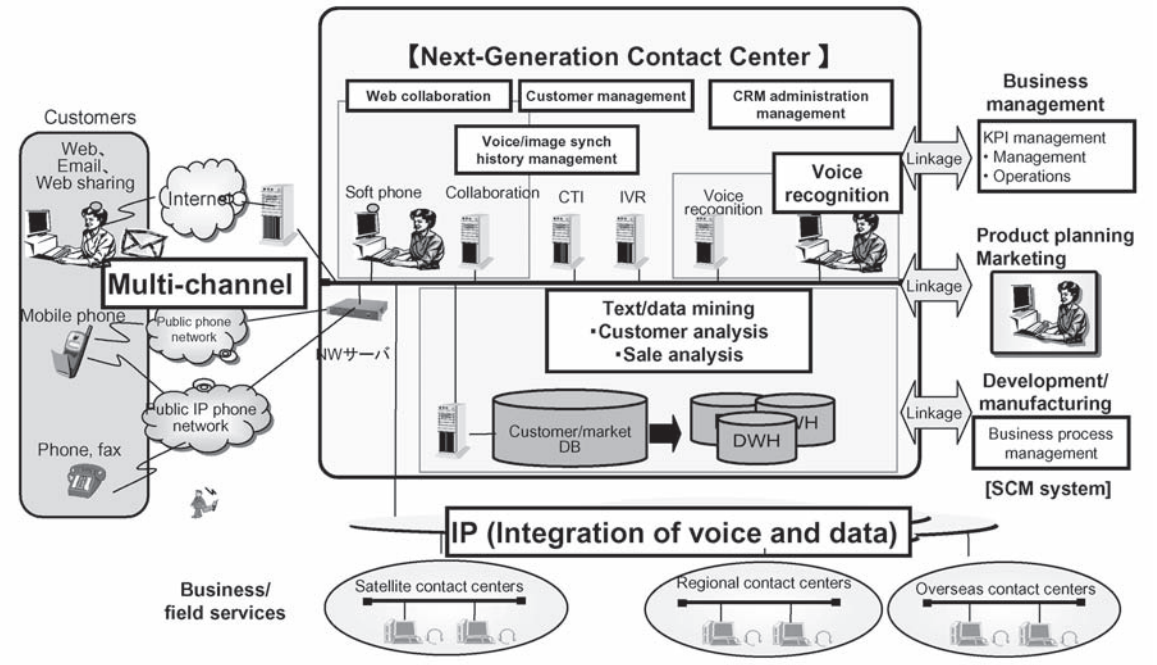

Fig. 10 Next-generation Contact Center.

4) Specific Word Detection

When the operator speaks one of the pre-registered words, such as a word that should not be spoken in front of a customer, this system informs the supervisor in real time.

5) Operator's Reception Monitoring

This system recognizes and documents all of the words of reception spoken by the operator to a customer. This improves the efficiency of monitoring because the operator's words can be confirmed on the documented text.

6) FAQ Self-Navigation

This system provides interactive navigation of the FAQ information based on the voice recognition and voice synthesis technologies.

NEC plans to commercialize the voice recognition technology products for the Next-Generation Contact Center one after another from FY2005.

5.3 Text Mining

Records of receptions of customers contain raw opinions of the customers. The text mining technology is expected to enable extraction of the information useful for management, including product planning and marketing, from the records. When the records of receptions (conversations) between operators and customers are textually documented, using the voice recognition technology, it will become possible to analyze customer opinions at firsthand and also to detect the kinds of events that businesses should handle urgently, such as new complaints. To be more accurate, **Fig. 12** shows an image of the application of the text mining technology in a New-Generation Contact Center.

(1) Extraction of Signs and Indications

The text data containing the raw opinions of customers collected at the contact center is analyzed to extract the "signs" indicating changes in the environments inside and outside the business or to provide the potential of solving problems and improving CS (Customer Service). The results of the analysis can then be fed back to the management and to persons in charge of various corporate departments. The typical analysis techniques that can be used in such operations include:

- Characteristic word analysis: Automatic extraction of characteristic words appearing in the text.
- Class analysis: Classification of text data based on classification dictionaries.
- Topic extraction: Detection, grouping and classification of the topics of conversations, their modifier and predicate words, aiming at facilitating the identification of "what is spoken on which topic."
- Time domain analysis: Display of the analysis results in time series and their comparison along the time axis. This makes it possible to identify the current trends and changes based on the

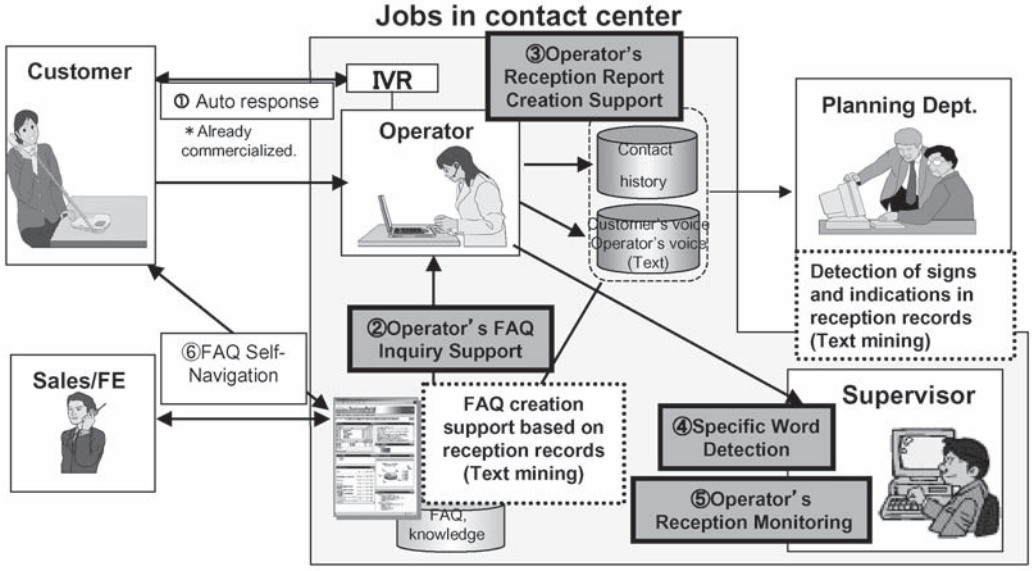

Fig. 11 Utilization of voice recognition.

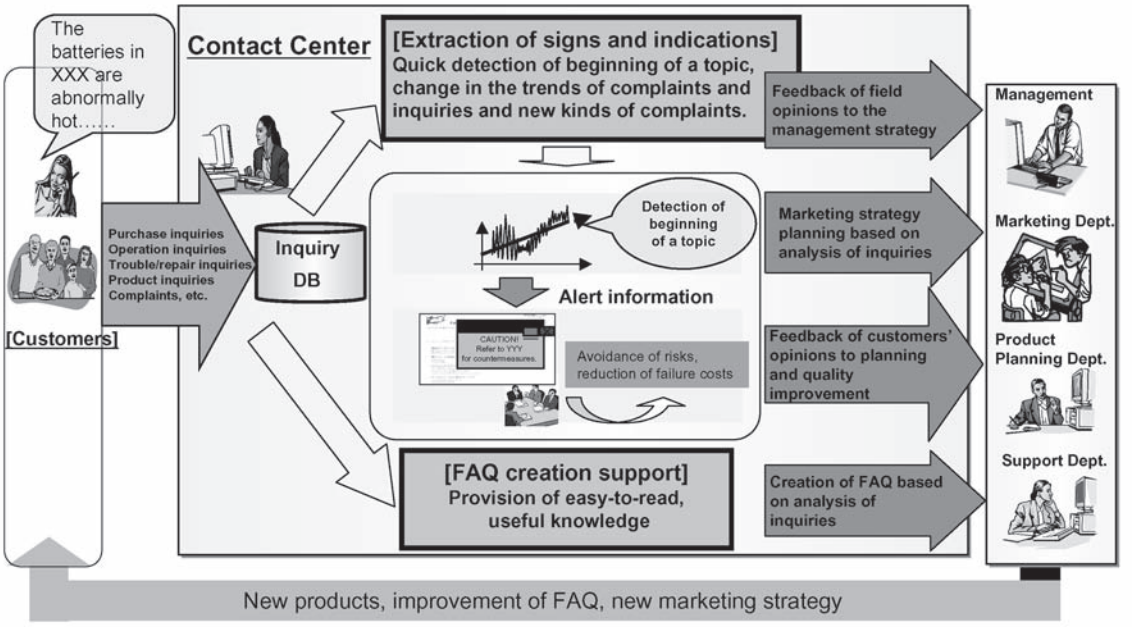

Fig. 12 Utilization of text mining.

appearance of new words and changes in "hot" words.

(2) FAQ Creation Support

Candidates of FAQ topics and the FAQ configuration plan can be extracted from the large amount of inquiry information including the documented reception records.

The text mining technology products for the Next-Generation Contact Center are planned to be commercialized as products called "TopicScope" and "ACTIVECR/FAQ navigation" from FY2005.

6. CONCLUSION

The technology for the positive utilization of information described in this paper, such as Ubiquitous Application Platforms (including the Presence Platform and Two-Way Communication Platform), voice recognition and text mining is still only at the first stage of commercialization, further efforts are required for R&D and the implementation of more products in the future. At present, NEC is making development investments for establishing the ubiquitous information technology as described in this paper, based on a close collaboration between the R&D and production departments. In addition, NEC will also enhance inter-departmental activities to promote the realization of the ubiquitous network society to come. This will be achieved by involving the marketing, sales and SI departments in the collaboration system through the collection of advanced user examples, the positive participation in standardization activities and the preparation of business promotion systems.

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