Citizen-Centric e-Healthcare Management Based on Pervasive Authentication -New ICT Roadmap to Active Ageing -

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Abstract

The purpose of our study is to incorporate the authentication roaming technology with existing social infrastructures from the perspective of users instead of that of service providers. By conducting experiments in the Business to Consumer (B to C) environment, our research demonstrated and confirmed the effectiveness of the authentication roaming technology to realize a safe and convenient network society. This technology contributes to the construction of a citizen-centric, reassuring system especially for community medicine and healthcare by proposing a cooperation system for the medical information services based on the XML Web Services technology. Our aims to enable patients (including active aging) and residents to access a variety of essential information for maintaining good health and preventing diseases and enable them to make an educated decision regarding the treatment they may receive in case of illness..

1. Introduction

It is essential to reinforce citizens' health management and disease prevention as well as to reduce increasing public share of medical costs, as Japan is well on the way to an aging society. In order to achieve them, it is essential to improve the quality of the health services as unifying force (hubs) to utilize a variety of functions such as authentication, security, procedures, and procurements. As has been the pattern, individual medical institutions including clinics and hospitals had independently responded to the medical needs of citizens. Currently, there are various services available that utilize the Internet. Additionally, more and more services are newly created to meet users' diverse needs by incorporating existing services and social infrastructures. Nonetheless, many of the existing services are often provided with specifications unique to each service provider, making it difficult or even impossible to integrate them with existing social infrastructures. Therefore, it is essential to develop a scheme that incorporates different services and infrastructures without boundaries of specifications.

Traditionally, many services were provided by locally connecting computers. However, with the rapid and widespread diffusion of the Internet, the demand for integration remotely or globally has increased. Consequently, there emerges an increasing need for the development of technologies that incorporate different systems. However, implementing the same technology used for connecting computers locally into a system connecting computers globally is costly and time consuming.

The social infrastructure is a wide concept, and it includes so many various entities. Today, not only information and communications technologies (ICT) including broadband networks and mobile phones but also the logistics and sales systems are prevailed as social

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infrastructures. Nonetheless, there are still few models that transcend the difference of business types and industries, and connect them altogether to provide a new service.

2. Background of this Study

With the rapid aging of population, Japan has the world's highest longevity rate today. As a result, a reform of the conventional healthcare at hospitals is required. That is, building a cooperative structure with related organizations, institutions, and citizens is strongly required to establish a total lifetime healthcare not only for sick people but also for healthy people to swiftly respond and figure out the medical, healthcare, and welfare needs of all the citizens. Conventionally, medical care has functioned specifically to diagnose and treat illness. Nonetheless, today's scope of medical care is required to include health maintenance and promotion, prevention of disease and early detection, early diagnosis and treatment, and elderly care. Furthermore, people have become more conscious about not only *cure* but also *care* to live a healthy life. It has long been difficult for patients and citizens to access a variety of information including insurance, illness, and treatment that are essential to choose appropriate medical institutions and receive proper treatment. Especially in countryside areas far from urban cities, there are much less medical resources such as healthcare centers and medical institutions.

From the perspectives of total optimization for medical and healthcare needs of people, it is essential to take a citizen-centric, patient-oriented approach to determine the appropriateness of functions and locations of medical institutions from the viewpoint of residents（Ohashi,edi,2005）. In addition, it is highly important to create a cooperative network among not only medical institutions including hospitals and clinics but also among municipalities, corporations dealing with food, medicine/medical devices/care centre facilities, nutrition centers, and universities and research institutes to improve patients and residents' quality of life including health promotion, prevention of diseases, medical treatment, and rehabilitation (Hori & Ohashi,2006).

3. Comprehensive Foundation across Healthcare Organizations – Utilizing the XML Web Services

Healthcare organizations typically experience reduced solution acquisition and implementation costs, lower training costs, and fewer ongoing costs with implementations in weeks, instead of months, all yielding more immediate customer value. Building of a flexible foundation is necessary for providers to develop their ICT infrastructure beyond HL7. It is ideal when integrating applications within and across hospitals and clinics.

As healthcare providers look to integration and messaging as a way to simplify their infrastructure and reduce cost, they also seek greater flexibility to handle the demanding and changing healthcare field. They are also looking to new and innovative components that are easy to use and implement. By driving down implementation and maintenance costs, provider organizations can get the right information at the right place that helps them deliver high-quality and timely care.

Therefore, it is critical to create the foundation that connects healthcare providers to information providers and to their systems. With real-time application integration and efficient messaging across the organization, healthcare organizations can support real-time collaboration, manage knowledge more effectively, and deliver personalized information.

Accordingly, development of user interface and framework that developers, business analysts, and administrators can all use to efficiently develop and apply rules and policies is vital for collaboration. Developers can create vocabularies and bind business logic to data; business analysts can change policies practically in real time; and administrators can deploy and manage policies, and monitor the results. The framework needs to be extremely flexible and extensible – its functionality has to be fully exposed through public interfaces, allowing users great latitude in implementation to meet their business requirements.

Furthermore, it is also important to construct massively scalable messaging and orchestration-based applications through scale-out architecture as well as to provide direct visibility into transactions to assure the correct and timely access to information for busyness analysts.

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4-1. The XML Web Services

Many organizations depend on large amount of information to effectively run their businesses, from tracking customer orders to gauging customer satisfaction. While collecting such information is critical, in many cases capturing necessary information results in inefficient business processes. Such practices vary from completely manual, paper-based systems to semi-automated steps involving standalone desktop applications, e-mail or redundant data entry practices dependent on human follow-through. In order to cope with this issue, the XML Web Services can be implemented to improve and centralize the process of gathering information using rich, dynamic electronic forms.

4-2. Problems with Previous Healthcare Systems

Most healthcare organizations have dozens if not hundreds of applications running in the enterprise. Information exists in silos across organization because these applications often do not "talk to" each other, and clinicians find it extremely frustrating when searching information they need. In addition, every application has a slightly different user interface and work-flow. This is especially troublesome for clinicians who travel from one hospital to another. Every hospital may have a different clinical information system that the clinician is expected to use. Therefore, it is very tiresome and too difficult for clinicians to learn how to use all these different systems with their unique user-interfaces and work flow interpretations.

Today, many key decision makers are often unable to make informed decisions because the information they need is trapped within documents or databases in another part of the organization. Technologies such as the Extensible Markup Language (XML) and Web services have been helpful in improving business processes from server to server, but to date they have not been connected directly to information workers at their desktops. This has meant that information workers have not had a way to interact with Web Services directly to access and use the enterprise information that they need.

4-3. Implementing the XML Web Services

Therefore, it is important to develop a user-friendly application that enables information workers at their desktops to use Web Services to access and use enterprise information in order to explore the full potential of the XML Web Services that streamlines the process of gathering information and makes it easier to reuse information throughout the organization.

Below is the image of a portal server (Figure 1). Each block of information is a Web Service coming out of what may be entirely different applications; yet they are all synchronized and each block will change as the user drills down through the information he or she needs that is specific to a particular patient or problem. Clinicians can enter XML data that are stored on a server or relayed to a legacy clinical information system, and any column on the form can automatically be added. While developing a user-friendly application, there are a few points to be kept in mind. First of all, the application has to allow high flexibility for users to customize existing forms or build a custom form from scratch or from an existing data source. Secondly, it should provide a familiar environment in which users can fill out forms while the XML is automatically created behind the scenes. It should enable users to work with structured documents without needing to know anything about XML. This also reduces the amount of training required to become productive with the tool. Thirdly, the application should be compatible with widely-used operation systems so that important information can be shared among collaborators.

4-4. Example of the XML Web Services Utilization

In order to meet the above mentioned criteria, we have developed a system and implemented the Web Services, XML messages, and MLLP ports for all communication between components in its lab order management (Figure 3).

The Web Services and the Patient List Web Part enable the physician to view lab order data in an InfoPath form by sending data in XML messages. The information shared between forms and databases is processed in BizTalk orchestrations. The BizTalk orchestrations act as the reference implementation's central engine for processing forms and routing lab orders and results to and from a lab information system. For demonstration purposes, the reference implementation includes a lab simulator in place of a hospital's actual lab information system.

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The figure below shows an overview of how data is communicated between components, enabling BizTalk to process the business logic of lab order management.

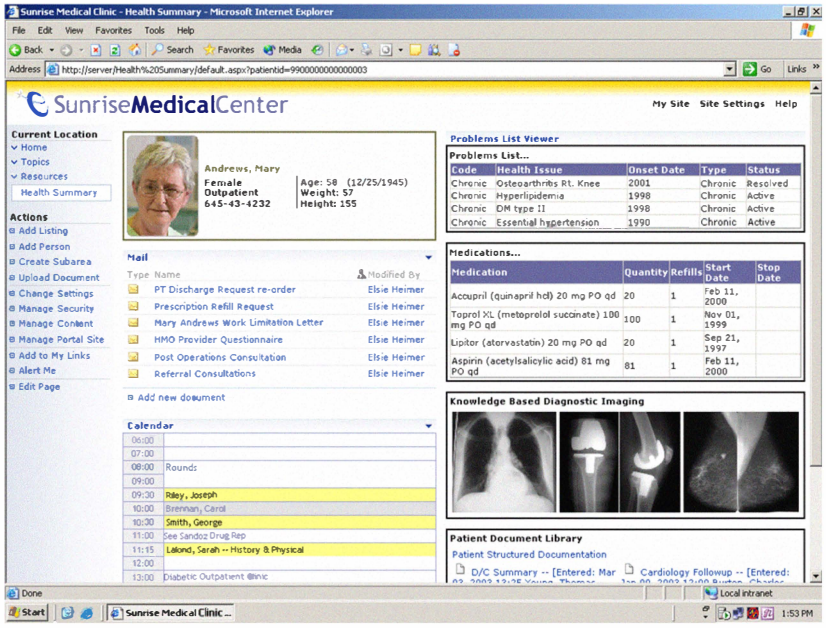

Figure 1. The image of a portal server

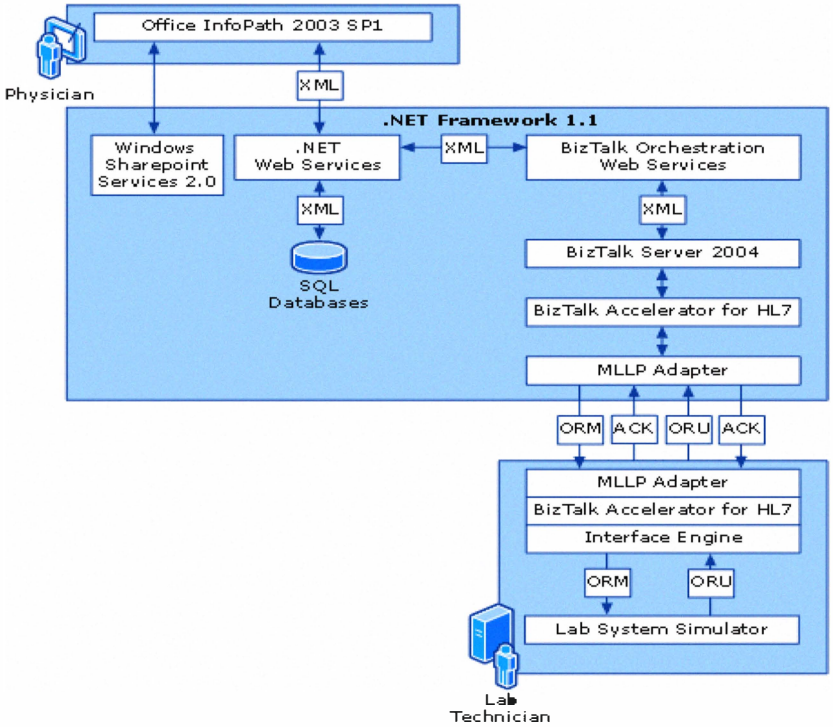

Figure 2 Web Services and Patient List Web Part

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5. Empirical Method and Results

We examined the possibility of collaboration among corporations, universities, and research institutions by building an information sharing environment prior to applying the XML Web Services into the data management system which utilizes the information stored within the iDC. Second, we examined the effectiveness of the data storage system and evaluated whether the external applications are capable of high-level utilization such as its proficiency of producing knowledge out of information, presenting data effectively, and storing know-how.(*Ohashi.edi*,2003b) The following criteria were examined by the demonstration experiment utilizing the collaborative work test bed.

1) The possibility of collaboratively creating digital visual image contents in the distributed environment. All the materials in the visual library were stored, managed, and safely backed-up in an integrated fashion without making duplications at organizations within in the distributed environment.
2) The potentialities of connecting different organizations through the iDC with high-speed network and of building a system with which users can exchange large amount of data on-line and on-time. Its effectiveness of arousing an academic curiosity for the further development of high-speed, large capacity data and information exchange and sharing.
3) The capability of the iDC and the proxy servers to operate interactive control functions even when clients and their servers are located in an IP unreachable area.
4) The efficiency of collaboratively developing educational materials, reducing the process dynamics before making it available to classes, and reducing the cost of security by examining the issues in operating with modified server applications to make them more suitable and useable within the iDC. The operationalization of the dynamic image archives.

5) The validity of the data structuralization, retrieval, extraction, supply, and utilization with XML in the knowledge management systems being developed in the platform.

Especially, the capability of prompting the collaborative work while protecting the data privacy by allowing users to switch the collaborative workplaces according to their object where access is controlled by each organization so that only permitted group members have the authority to share data.

One-stop services is the original goal for promoting the Health Care System. As a means to realize one-stop services that integrates variety of services, portal has been reviewed and implemented from the beginning of the stage by government and with collaboration between public and private sectors. Implementing Web Services into the interface between servers and clients, and implementing not on the portal (server) but on clients (users) would bring about a new way to realize one-stop services (Figure 1)(Web Services Initiative,2005). There are two main advantages of citizen-centric one-stop services:1)No need of the portal systems that could be a major burden to construct 2)No need for portal to posses personal information.

Building of a portal system is very difficult. From the point of authentication and organizing interfaces, it is difficult to develop a portal after each service has been developed. Additionally, it is also difficult to build a portal before any service will be developed because it means to design a gigantic system from scratch.

In terms of the personal information necessary for one-stop services, though temporally, portal needs to acquire and possess all the information. On the other hand, the citizen-centric model would enable users to submit bare minimum of personal information from their PCs to receive individual service. On the other hand, the weak point is that it is required for users to equip themselves with a program that realizes one-stop services; hence it is not suited for the systems that are less used by general public. In general, portal model is suited for simple services that are less often used by general public. It is appropriate for the G2C services while citizen-centric model is suited for complicated services that are often used by specific users. Therefore, it is appropriate for the G2B services and in G services inside government offices.

Results for The Demonstration Experiment

The demonstration experiment proved that real-time discussion with sharing data and resources among the geographically-dispersed teams was possible. Furthermore, we confirmed that it is possible to collaboratively edit and process image data between remote locations using high-speed network and From the experiment, the following benefits of applying

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the XML Web Services were proved: 1) flexible cooperation and collaboration through sharing the ICT resources, 2) flexibility in data exchange, 3) automatic execution of modules, 4) applicability to existing internet-based technologies (vendor independent), 5) effective utilization of existing programs, and 6) low cost for implementation(Ohashi edi.2003,2004)

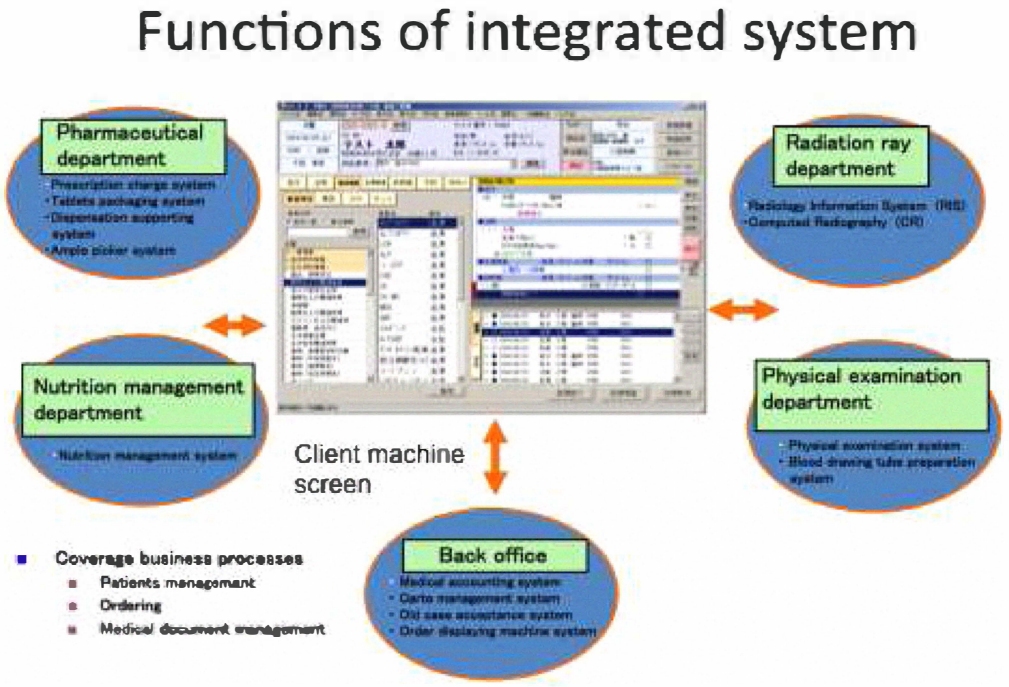

Figure 3 Function of Integrated System

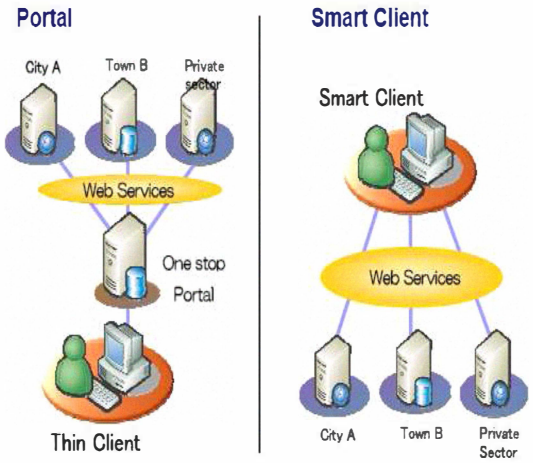

Figure 4: One-Stop Services on Smart Client
Source: Web Services Application Guideline (English Ver.),Feb.,2005

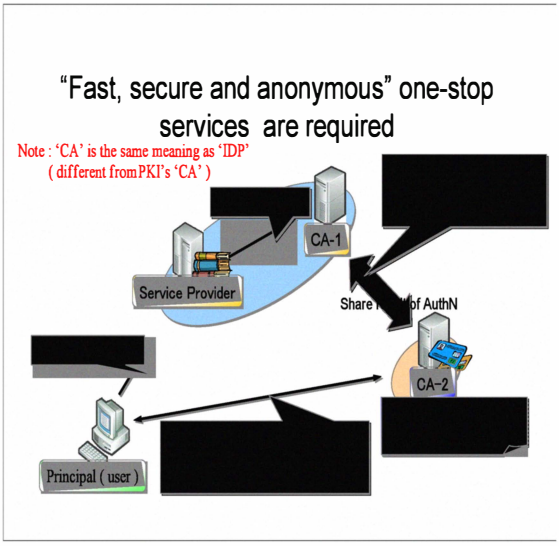

Figure5: "Fast, secure and anonymous one-stop" services are required([34] Takeda,Y. et al,2006)

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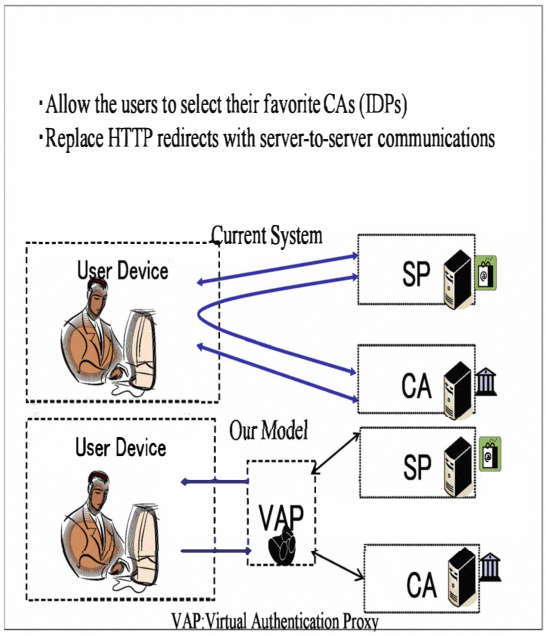

Figure 6: Allow the users to select their favourite CA's(IDPs)

6. Conclusions

As expressed in the survey of the metropolis of Tokyo, many people recognize the need of improving the quality and efficiency of health maintenance management. In order to improve the quality of the healthcare management system and contribute to community healthcare, it is necessary to share information among residents, patients, hospitals, clinics, medical institutes and pharmacies, nursing care, welfare centers and other related organizations. In the Ubiquitous Society, more accurate and prompt healthcare management and quality medical services are expected by utilizing advanced ICT. The system will be needed: effectively make appropriate counseling and educational information more accessible for the people so as to prevent them from suffering mental and/or physical health problems that may affect their work and life. XML Web Services enables many people to contact and stay in close touch with physicians and outside mental health professionals at any moment when necessary through network. Therefore, utilization of XML Web Services would generate innovative ways for the people to maintain and improve their mental and physical health. We believe that our proposal to apply the XML Web Services would make a substantial contribution to the healthcare and medical field to realize the patient-oriented services in the Ubiquitous Society.

Our study proved the effectiveness of the Authentication Roaming Technology to combine different social infrastructures to create a new service. Though there are still issues to cope with outside of the realm of technology including accountability of each participants and the level of the service, we expect this service to be soon available in the real world.

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