

The history of MML (Medical Markup Language) and its application for EHR (Dolphin Project) in Japan.

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ABSTRACT

Since the Ministry of Health, Labor, and Welfare (MHLW) issued its notice in April 1999 (approving the electronic storage of medical records), the introduction of electronic medical records at national universities, key regional hospitals, clinics, and other facilities has advanced. It should be noted that behind this trend and in line with the e-Japan concept there has been financial support from the MHLW and Ministry of Economy, Trade and Industry (METI).

We, in 2001 "Regionally Shared Electronic Medical Record System Research and Development Project (METI)," proposed project plan via the Miyazaki and Kumamoto regions, and the project was adopted for both regions. Thereupon, the joint development of a commonly accessible system began as the Dolphin Project. The Dolphin system was created to improve patient service, improve the quality of medical care, and achieve efficient medical care. A Data Center (iDolphin) was established to accumulate and manage clinical information in the regions and share clinical information safely and appropriately. The system has already been in operation for more 11 years. Even though a patient may have been examined at multiple hospitals, his medical record information will be integrated at the Center. This ensures medical care continuity and enables the patient to view his own medical records at home. Its usefulness in obtaining informed consent has been demonstrated as well. XML instances established in the MML standards (Medical Markup Language) are used for Electronic Medical Record System data exchange between the Data Center and each medical institution. The openness provided by XML makes it possible to connect diverse electronic medical records to the Center. As of the year 2007, four Data Centers has been established in Japan (Miyazaki, Kumamoto, Kyoto and Tokyo).

In order to provide a nation-wide information service, Super Dolphin Project started in 2005. The Super Dolphin Server has two important functions. The first one is super directory by which a patient can search his medical records over the plural data centers. The second one is data mapping function which can convert a type of XML instance to another one. Using this Super site, a nation-wide medical data exchange became possible.

1. History of Dolphin Project

The examination of a Japanese version of the medical information exchange convention MML (Medical Markup Language) began in 1995, and MML was released in 2000 as a standard that utilized XML [1]. Development continued after that time, and MML 2.3 [2] was released in 2003; then MML 3.0, which conformed to HL7 CDA rel.1, was released in 2004 [3]. In 1998 the original draft of the Dolphin Project was proposed by Yoshihara as a cooperative regional medical application that utilized this standard [4]. It had the following type of concept (Figure 1):

- 1) Establish Data Centers for storing medical information in regional units.
- 2) In this center, create accounts for each patient.

- 3) Using means such as the Internet, send data generated in the hospital to this account.

On such occasions, send standardized data in MML, HL7, etc.

- 4) Make it possible for the patients themselves to browse through this data (B2C: business to customer) and, with the patient's approval, for the data to be shared between hospitals (B2B: business to business).

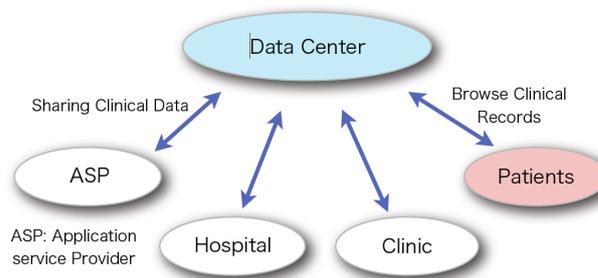


Figure 1 Model of Dolphin Project

Data Centers for accumulating information are established in each region. Corresponds to model centered on the RHIO (Regional Health Information Organization) in the U.S.

2. Background of Dolphin System development and utilization

In 2001 the system was developed with the cooperation of the prefectures of Miyazaki and Kumamoto as a research and development project of the Ministry of Economy, Trade and Industry [5]. Data Centers were established respectively in the city of Miyazaki (Haniwa Net) and city of Kumamoto (Higo Medo). Under the leadership of Miyazaki University Hospital and Kumamoto University Hospital, utilization of the system continues with the aim of providing cooperative medical care through which data is shared between medical institutions and data is disclosed to patients.

In 2003 the Tokyo Medical Association established a Data Center in the Tokyo metropolitan area (HOT Project). In 2006 a Data Center was established in Kyoto (Maiko Net). In 2007 the Kyoto University Hospital, in 2011 the Kyoto Prefectural University of Medicine became connected to the Maiko Net, and data disclosure and data link services started in October 2007. As of August 2011, the Maiko Net has approximately 6,000 user accounts (1500 for patients, 4500 for medical provider). Utilizing the Internet, users (patients, doctors, nurses, etc.) can browse through data by accessing their account from a personal computer or cell phone (Figure 2).



Figure 2 Browsing through medical charts by cell phone and personal computer

3. Dolphin System function composition and future plans

Figure 3 shows the (planned) functions that compose the Dolphin Project as of 2008. As shown in the figure, it is taken into consideration from three separate levels: an international level (global), national level, and regional level. Users exist at the regional level; and through mutual provision of data from medical institutions, patients can browse through more than just their personal data from one institution but data integrated from various institutions.

- The regional-level "iDol: iDolphin" accumulates the essence of medical data.
- "uDol: Ubiquitous Dolphin" can be accessed by cell phone, but has no data and only provides a directory service.
- The national-level "sDol: Super Dolphin" was already implemented in 2006. Spanning over multiple Data Centers, it ethically integrates user accounts that have multiple accounts, and enables single sign-on [6]. For instance, if a person has separate accounts in both Tokyo and Kyoto, the data from both centers will automatically be integrated and made available for searching when that person accesses either of the centers. This corresponds to the National Health Information Network (NHIN) that is currently being conceived in the United States.
- "gDol: Global Dolphin" (already implemented in China [7]) will be in charge of an international directory service. Already in China (Zhejiang Province, Zhejiang University) in 2007, an iDolphin whose localization in China was completed is being

test-operated. In the future, sDol will be installed and international connections will be possible with gDol.

- "Trans" (unimplemented) is a function that provides language translation when gDol is operating.
- "xMappin': Cross Mapping" (currently contained in sDol) is a function that utilizes data mapping to interconvert differences in XML standards sent from subordinate Regional Data Centers (iDol). Even in the Dolphin Project, the standard that is adopted (MML 2.3/3.0) may differ, depending on the time of Data Center establishment. In order to absorb these differences, this function is installed. In the future, utilization will be possible from multiple iDols independently from sDol, and efficiency and maintainability will thus be improved.

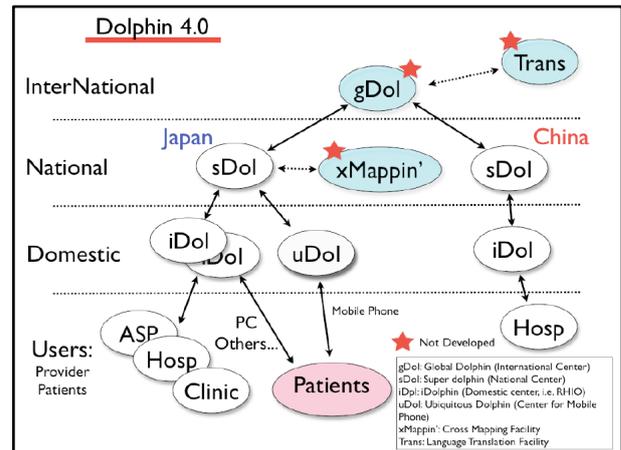


Figure 3 Dolphin System functions and their relationships (Dolphin 4.0)

As previously mentioned, the purpose for developing the electronic health record (EHR) with the Dolphin Project is to secure medical care transparency, safety, and accountability; further improve the quality of medical care; and utilize limited medical resources effectively. As the use of electronic medical charts grows in the future, we plan to continue making efforts so that this project becomes a part of the social infrastructure and functions effectively.

4. References

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