

Evaluation of 3D Electronic Medical Record for Medical Collaboration Cloud Model

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1. Introduction

Our project is researching medical record system for medical regional collaboration, home care support, radiographic image interpretation, health management support etc. We proposed 3D electronic medical record on Cloud Mode. In this paper, the performance of our pilot system is shown.

2. System Evaluation

We develop an experimental 3D medical record system on Cloud Mode [1]. In this paper, the performance of our system is measured and discussion for the application for actual hospital usage is shown.

2.1 Experiment System

(1) Virtual Clinic Model

In this experiment, we built a virtual medical collaboration cloud system, which included 4 local clinics and one shared Data Base. Fig.1 shows this system.

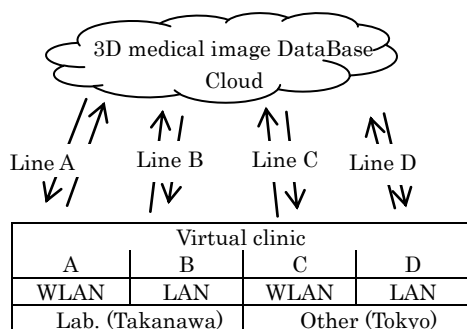


Fig.1 Virtual Clinic Model

3D medical image Data Bases exist on the cloud. Each virtual clinic is connected by different internet connection method (different media, wireless of LAN speed etc.)

(2) Experiment Data

We used 3D electric medical records developed in our project. These 3D electric medical records include an introduction letter, patient information, allergy and problem with 3D medical image data. We developed a function to pack all the information into one directory. Usually the size of an electric medical record is about 1MB and 18MB with 3D electric image.

(3) PC specification

We assume PCs in each hospital / clinics have the same specification. PCs used in this experiment are shown in Table.1.

Table.1 PC specification

OS	Windows7
bus	32 bit
CPU	Intel(R)Atom (TM) CPUZ540 1.86GH z
Memory	2GB

(4) Network connection

- ① Virtual clinic A is located in our lab (Takanawa Tokyo), connected with Wireless LAN of 130.0Mbps.
- ② Virtual clinic B is located in our lab, connected with wired LAN of 1Gbps.
- ③ Virtual clinic C is located in a different location in Tokyo, connected with Wireless LAN of 65.0 Mbps.
- ④ Virtual clinic D is located in the same location as virtual clinic C, connected with wired LAN of 100bps.

2.2 Evaluation method

From each PC in the virtual clinic A,B,C,D, we upload and download the same 3D electric medical record file with 3D image data, which is 18MB size. Fig.2 shows the experiment flow.

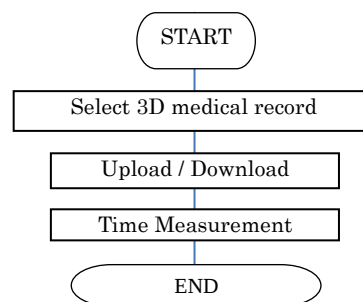


Fig. 2 Experiment Flow

After we opened Google Doc site, an excel file (3D electric medical record file with 3D image data) will be uploaded/downloaded. We measure the time for uploading / down loading time. The experiment is repeated for 10 times.

2.3 Results

(1) Upload

Upload results are shown in Fig.3.

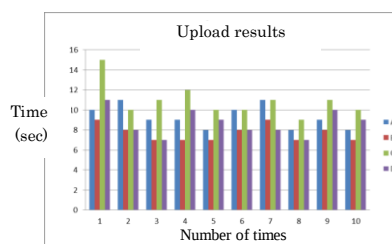


Fig.3 Upload Time

① Virtual clinic A

The maximum time is 11 seconds; the average time is 9.3 seconds.

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② Virtual clinic B

The maximum time is 9 seconds; the average time is 7.3 seconds. This is the fastest result in all the clinics.

③ Virtual clinic C

The maximum time is 15 seconds; the average time is 10.9 seconds. This is the slowest result.

④ Virtual clinic D

The maximum time is 11 seconds; the average time is 8.7 seconds.

(2) Download

Download results are shown in Fig.4.

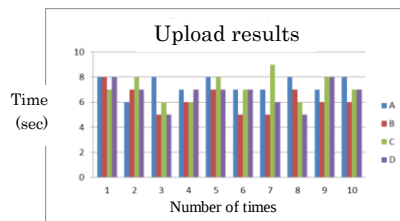


Fig.4 Download Time

① Virtual clinic A

The maximum time is 8 seconds; the average time is 7.4 seconds.

② Virtual clinic B

The maximum time is 8 seconds; the average time is 6.2 seconds. This is the fastest result in all the clinics.

③ Virtual clinic C

The maximum time is 9 seconds; the average time is 7.2 seconds. This is the slowest in all the clinics.

④ Virtual clinic D

The maximum time is 8 seconds; the average time is 6.7 seconds.

3. Discussion

(1) Upload

The upload time is 15 seconds for maximum and about 8 seconds for average. The average upload time for each virtual clinic are shown in Fig.5.

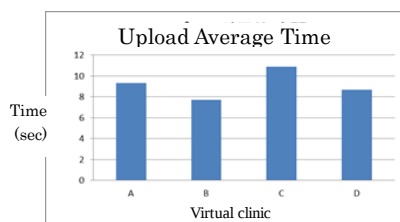


Fig.5 Upload Average Time

The difference of average time for each virtual clinic A,B,C,D is under 2.2 seconds and not so large. This may be because the actual effective transfer speed is around 18Mbps and the speed of Wireless LAN or Wired LAN is not dominant for this experiment system.

(2) Download

The download time is 9 seconds for maximum and about 6 seconds for average. The average download time for each virtual clinic are shown in Fig.6.

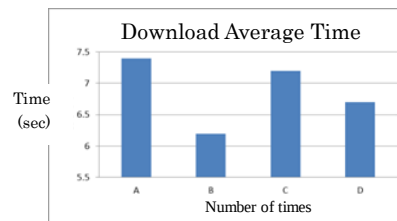


Fig.6 Download Average Time

The difference of average time for each virtual clinic A,B,C,D is under 1.2 seconds.

(3) Discussion for Cloud Model

We discuss the validity of Cloud Model from the number of patient arriving to the clinic and the result time of upload / download time of the electronic medical record.

A hospital is defined as a medical institution for more than 20 beds in Japanese health care law. When the number of beds is under 100, that hospital is defined as a small size hospital. In this system, the target hospital is considered as small size hospital.

The number of small size hospitals are 3,726. The average total number of outpatient are 335,036 [2].

The number of outpatient for each hospital is as follows.

$$335,036 / 3,726 = 89 \text{ (person / hospital)}$$

We assume the open time for the hospital is from 9:00 to 18:00. The time between 18:00 and 9:00, that is 15 hours, can be assigned for uploading time. From our experiment, the maximum time for uploading is 15 seconds. We can estimate the total time for uploading all the electronic medical record is as follows.

$$89 \text{ (person)} \times 15 \text{ (s)} = 1,424 \text{ (s)}$$

Within 38 minutes, all the data can be uploaded.

The size of uploading is as follows.

$$89 \text{ (person)} \times 18 \text{ (MB)} = 1,602 \text{ (MB)}$$

From these data, upload time and upload size is small enough for purpose.

The download time is under 9 seconds. This result is short enough for emergency case.

4. Summary

We develop an experiment 3D medical electronic medical record system on Cloud Model, using Google Documents. The upload / download time results shows the performance of Cloud Model is good enough for actual use.

We propose through our system to share the electronic medical records. The sharing the electronic medical records make it easy for doctors to check the patient record before they arrive to the patient for the case of big disaster like last year's east Japan earth quake. Security issue is one of the future studies.

References

- [1] Taiki Adati et al., "Implementation of 3D Electronic Medical Record for Medical collaboration cloud model", FIT2012
- [2] <http://www.mhlw.go.jp/toukei/saikin/hw/iryosd/07/kekka03.html>