M−019

A Storage Platform with Easy Delivery of Computerized Information

Yasuhiro Ichikawa[†]   **Hideyuki Takada**[‡]

1. Introduction

There is a lot of information in office spaces and laboratory rooms. Such information is created by PC as documents and stored in files. However, in the end, when these documents are used, they are printed on paper in most cases. On the other hand, the document has recently begun to be managed by digital data, because various types of terminals have become common and the performance of terminals and storage devices has been improved. In addition, tables and bulletin boards will be replaced with digital devices such as a tabletop display and a large display with a touch panel. As a result, documents will be displayed on terminals as digital data, and people will need an environment which enables them to easily deliver the information in their sight to other terminals.

Today many people have various types of devices, because a lot of devices which have various types of functions are available. In addition, synchronized on-line file storage systems such as Dropbox (`https://www.dropbox.com/`) and SugerSync (`http://www.sugarsync.jp/`) have begun to be used as a way of information management for synchronizing files among multiple devices. As a result, users will become more conscious of carrying documents with such terminals, compared with the server-based file sharing system. Therefore people will need an environment which enables them to easily deliver the information at their hands on tablet terminals. User interface such as "Pick-and-Drop[1]" or "Toss-It[2]" realizes the easy delivery of the information among terminals, but this interface has to be combined with the storage system emerging recently.

This paper presents a platform which enables users to easily deliver the computerized information managed by the synchronized on-line file storage system among terminals.

2. Office Spaces with Computers

2.1 Computerization of Office Spaces and Information Management

Currently, a lot of papers are still used in office spaces. For example, printed documents are distributed at a meeting, printed flyers are posted on bulletin boards and document files are stored in racks. However, in the future, digital document will not be printed on paper. Tables and bulletin boards will be computerized and digital documents will be displayed on these digital devices.

Moreover, these digital documents are stored on the file storage system and referenced from every terminal easily. For example, a digital document is shown using a tablet device such as iPad at the meeting or displayed on a large display while an entity of digital document is stored on a file storage system.

Moreover, the way of information management is changing. Files have been shared by a traditional file sharing system. However, files are now shared by the on-line file storage system such as Dropbox and SugarSync, and if necessary, an in-house on-line storage system can be built using the ownCloud (`http://owncloud.org/`) .

2.2 Synchronized On-line File Storage System

Synchronized on-line file storage systems have the following features.

- Each user account is created and files are managed on a storage area which is assigned to each user account.

- Versions of documents on servers are managed automatically.

- Documents on servers are synchronized between local storage and on-line storage.

- Documents can be shared by a URL which is assigned to each file.

On a synchronized on-line file storage system, users have their own user account and storage area. This storage area stores files of the user. On the contrary, on a traditional file sharing system, all files are stored in a shared storage area. Separation of users is realized using the file permission.

2.3 Problems of Delivering Information

This section describes problems of delivering the information which is displayed on terminals. For example, research papers which are put on a table or advertising flyers which are posted on a bulletin board in a traditional office will be shown on terminals as digital data in a future office. These digital data will be managed by the shared or personal user account of the storage system. In this environment, there are two problems to deliver the information among terminals as follows.

- People have to know which directory stores the digital document under which user account.

- People have to manage versions of digital documents when they are copied or moved among users.

The next section describes the solution to these problems.

3. The Storage Platform Architecture
3.1 Platform Layers

To deliver information among terminals easily, two layers are composed on the synchronized on-line storage platform. Figure 1 shows the layer structure. In

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[†]Graduate School of Science and Engineering, Ritsumeikan University

[‡]School of Information Science and Engineering, Ritsumeikan University

the user interaction layer, the way of interaction for users to acquire the information is defined. The storage platform layer hides the difference of user accounts and file locations. The storage platform also manages the version of data.
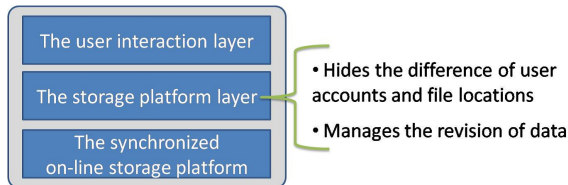

Figure 1: Layer structure

To hide the difference of user accounts, we use the file sharing function using a URL which is common in the synchronized on-line file storage system. Figure 2 shows the behavior of each layer when the user gets a file which is managed by the synchronized on-line file storage system. In Figure 2, there are two terminals: the tablet terminal used by the user and the shared terminal to display digital documents. Each of the numbers below corresponds to the number on the arrows in the figure.

1. The user interaction layer on the shared terminal identifies a file path of a document which is requested by a user.

2. This file path is given to the storage platform layer from the user interaction layer.

3. The storage platform layer sends the file path to the on-line file storage server and gets a URL of the file from on-line storage server.

4. The storage platform layer returns the URL to the user interaction layer.

5. This URL is transferred to the user interaction layer of the tablet terminal from the user interaction layer of the shared terminal.

6. This URL is given to the storage platform layer from the user interaction layer.

7. The storage platform layer sends the URL to the on-line storage server and gets the file.

In this way, the user of the tablet terminal can get a necessary file from the shared terminal.

3.2 Methods of Moving Information and Revision Management

To deliver information, we consider three methods of delivering information: referencing, replicating and moving. If a user gets a file using the reference method, a reference of file moves among terminals, but the file itself does not move. If a user gets a file using the replication method, the file is copied among terminals. In these methods, the revision of files is managed by each user account on the synchronized on-line file storage
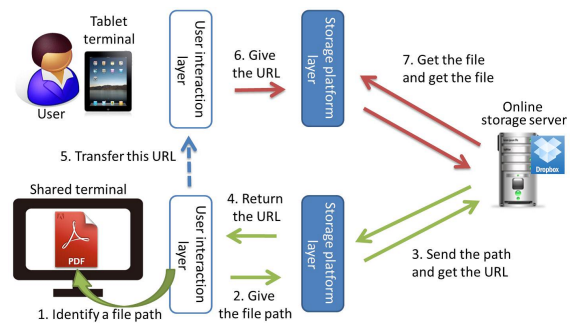

Figure 2: The behavior of the layers

system. On the other hand, if a user gets a file using the moving method, the file moves among terminals and the file is deleted on the terminal which sends the data. In this case, the synchronized on-line file storage system does not manage the destination terminal of file. Instead, the storage platform layer manages revisions of files.

3.3 Implementation Example of the User Interaction Layer

To realize an environment with easy delivery of computerized information using this platform, it is necessary to realize the user interface to transfer the URLs of files. We describe two examples of such interface.

- Interface using a QR code

- Gesture interface using a mobile terminal which has an acceleration sensor

In the QR code interface, the URL which is obtained from the on-line file storage is displayed as a QR code and a receiver terminal reads this QR code. In the gesture interface, the URL is notified among terminals with a trigger by the specific gesture of user.

4. Conclusion

This paper described a storage platform with easy delivery of the computerized information which is managed by a synchronized on-line storage system. This platform delivers data using the file sharing function by URLs. This paper also described three methods to move data and presented the revision management in each method. In the future, we will study an evaluation method to show how easy users can move the computerized information.

References

[1] Jun Rekimoto, Pick-and-Drop: A Direct Manipulation Technique for Multiple Computer Environments (in Japanese), WISS'97, 1988.

[2] Koji Yatani, Koiti Tamura, Masanori Sugimto, Hiromichi Hashizume, Information Transfer Techniques for Mobile Devices by Recognizing Usersf,Locations, Orientations and Gestures (in Japanese), Human Interface Society, Vol.6, No.4, pp.31-36, 2004.