"cocoBox": A Social File Cloud System for Collaboration

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Abstract— **File cloud provides file storages on the Internet and manages them for people to access and manipulate their contents like documents, pictures, and movies anywhere and anytime. There are various smart devices such as tablets, smart phones, and smart pads, which can utilize file cloud services. In this paper, we introduce a social file cloud system as one of tools for collaboration between people in the workplace. We extend basic file cloud service by adding social factors such as tags, score, and comments to a file into a social file cloud service, that is, "cocoBox", which means a file box for communication and collaboration. CocoBox provides the basic functionalities of file cloud service such as file upload and file download. In addition, we focus on social factors of files to help collaboration among people who share same files. Whoever shares a specific file with others can add tags, give score, and add/remove his/her opinion on that file. Therefore, cocoBox enhances communication and collaboration among people with these social factors.**

Keywords-file cloud; REST; service component; score; tag; comment; collaboration

I. INTRODUCTION

Cloud computing is defined as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [1]". There are several service models for cloud computing such as SaaS (Software as a Service), PaaS (Platform as a Service), and IaaS (Infrastructure as a Service).

File cloud provides file storages on the Internet and manages them for people to access and manipulate their files anywhere and anytime. Recently, we have various kinds of mobile devices such as laptops, mobile pads, and smart phones to use file cloud services. File cloud services enable us to access same files on any devices and share various contents like pictures, movie, and music to other people. As the examples of file cloud, dropbox [3], Amazon S3 [4], and iCloud [5] are popular. These services provide file storage service with user friendly interfaces on desktops, web browsers, and mobile internet devices and enable file sharing among people.

We extend file cloud service by adding social features such as tags, score, and comments to ordinary content repository into a social file cloud service. Based on the Java Content Repository (JCR) 170 [6], we develop "cocoBox", which means a file box for communication and collaboration.

CocoBox provides the basic functionalities of file cloud service such as file sharing, uploading and downloading. But, in addition to it, cocoBox has social features for collaboration between people who share the same files. Whoever shares a specific file with others can add tags, give score, and add/remove his/her opinion on that file. These social factors of the file give people additional information of it; therefore, these social values can help to promote the collaboration among colleagues who share common files.

This paper is organized as follows. In Section 2, we overlook recent popular file cloud services such as iCloud, S3, dropbox. Section 3 shows the architecture, data models of cocoBox including social features. In addition, REST APIs of cocoBox and cocoBox applications implemented by using the APIs are introduced. Finally, we summarize and describe further works of this study in Section 4.

II. RELATED WORK

With the bombing growth of number of smart phone users and mobile internet devices, the need to share contents such as pictures, movies, and music with other people also grows. It is required to provide file cloud services for users to access their files on various devices. A lot of file cloud services are developed and provided. In this section, we outlook on worldwide popular file cloud services, e.g., iCloud, Amazon S3, dropbox.

A. iCloud

iCloud is a cloud storage and cloud computing service from Apple Inc. announced on June 6, 2011 at the Apple Worldwide Developers Conference (WWDC). The service allows users to store data such as music files on remote computer servers for download to multiple devices such as iOS-based devices, and personal computers running Mac OS X or Microsoft Windows. It also replaces Apple's MobileMe service, acting as a data syncing center for email, contacts, calendars, bookmarks, notes, to-do lists, and other data. As of 2012, the service has over 100 million users [2].

iCloud stores music, photos, documents, and more and wirelessly pushes them to devices. iCloud is said to makes it quick and effortless to access just about everything on the devices people use every day. iCloud automatically and securely stores content so it's always available to iPhone, iPad, iPod touch, Mac, or PC and gives people access to their music, movies, apps, latest photos, and more from whichever device people happen to be using. It also keeps

email, contacts, and calendars up to date across all devices without explicit syncing and management.

B. Dropbox

Dropbox is a web-based file hosting service operated by Dropbox, Inc. that uses networked storage to enable users to store and share files and folders with others across the Internet using file synchronization [2].

Dropbox is a free service that lets users bring photos, docs, and videos anywhere. This means that any file users save to Dropbox will automatically save to their computers, phones and the Dropbox website [3].

C. Amazon S3

Amazon S3 is storage for the Internet. It is designed to make web-scale computing easier for developers [2]. Amazon S3 provides a simple web services interface that can be used to store and retrieve any amount of data, at any time, from anywhere on the web. It gives any developer access to the same highly scalable, reliable, secure, fast, inexpensive infrastructure that Amazon uses to run its own global network of web sites. The service aims to maximize benefits of scale and to pass those benefits on to developers.

III. COCOBOX: A SOCIAL FILE CLOUD

Other file cloud services do not focus on social features, which can help people express their opinion on the sharing files or rank them. In this section, we describe the architecture of cocoBox and social features, which cocoBox provides to promote collaboration while sharing files.

A. System Architecture

"cocoBox" means a file box for communication and collaboration. In the previous section, most popular used services don't have social features which help people to collaborate, that is, to communicate their opinions on the files and evaluate them.

Figure 1 shows the overall architecture of cocoBox system. CocoBox is implemented based on the JCR (java content repository) 170 as a repository. The cocoBox server manipulates requests of users which are called from web browser on user's desktop or mobile internet device like a smart phone. Since cocoBox is focusing on collaboration between people, the main target domain would be small or middle – size enterprise. Within a closed group such as divisions, teams and departments, people share files and contents with their colleagues. To support this closed group collaboration, cocoBox interacts with a directory server which manages organization chart and member information using LDAP protocol.
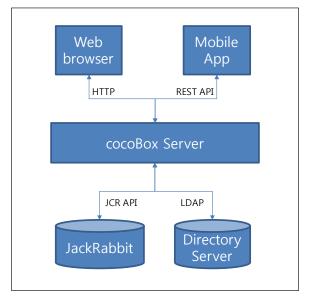

Figure 1. System Architecture of cocoBox

CocoBox also provides service components in the format of REST and enables application developers make their own applications easily. We developed a mobile application for cocoBox by using these components.
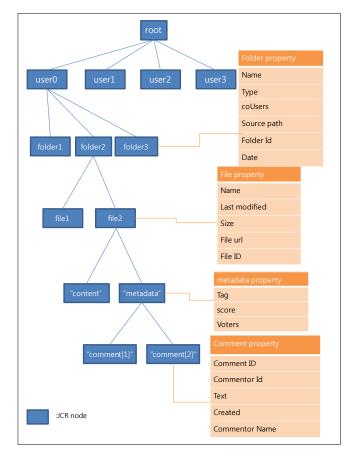

Figure 2. Data model of cocoBox

The data model of cocoBox is shaped into a tree structure as shown in Figure 2. This model supports a parent-child relationship between folders and files. Each file and folder is a node, which has properties respectively.

- Folder node
  This represents a folder, and includes basic folder properties and sharing information, and has subfolders and file nodes as its child. The folder node can have one of three types: sharing folder, shared folder, and personal folder type. If the folder is sharing folder, this means that its owner is the user, and it has coUsers properties ,which mean co-workers who share this folder together. If the folder is shared folder type, it has no children and it has source path property which is original owner's folder path. Otherwise, the folder is a personal folder, which nobody can share
- File node
  File node has contents of the file and metadata as it children and has general information as its properties.
- Metadata node
  Metadata and its children represent the social features of cocoBox. Metadata include tags, score, comments and related information.
- Comment node
  Comment node represents a comment and it has content of comment and commentator information. Only the writer of the comment can remove that comment.

To summarize, the social features in the cocoBox system are follows;

- Score
  The quality of document would be estimated using this score. People can score each file on a scale of 0 to5.
- Tag
  This tag information could be used as keywords. Since social data are in the data tree, people can search files which have the specific tag.
- Comment
  People can add their opinion about this file in the short sentence, share their thinking, and even discuss it.

With these social factors of files, file sharers can rank their files and express their opinion about sharing files. Therefore people can discuss on the shared documents and even share their knowledge.

B. cocoBox service components

We provide cocoBox service components in the form of REST API. Not only core functionalities to manipulate file storage, but also additional functionalities to manage social metadata of the file are provided. Using these APIs, people can develop their file cloud applications easily which use cocoBox. These components provide simple interfaces to create/delete/share folders, upload/download files, and add/remove social metadata of files such as comments, tags, score, as shown in the Table 1.

TABLE I. COCOBOX SERVICE COMPONENTS

REST API	Function	HTTP method
http://{serveRoot}/cbox/login	login	POST
http://{serveRoot}/cbox/logout	logout	POST
http://{serveRoot}/cbox/{userId}/userInfo	get user info	GET
http://{serveRoot}/cbox/{userId}/folderInfo	get folder info	GET
http://{serveRoot}/cbox/{userId}/moverFile	move file	POST
http://{serveRoot}/cbox/{userId}	delete file	DELETE
http://{serveRoot}/cbox/{userId}/filename	change filename	POST
http://{serveRoot}/cbox/{userId}/file	upload file	POST
http://{serveRoot}/cbox/{userId}/file	get file	GET
http://{serveRoot}/cbox/{userId}/folder	create folder	POST
http://{serveRoot}/cbox/{userId}/folder	delete folder	DELETE
http://{serveRoot}/cbox/{userId}/file/meta	get meta info	GET
http://{serveRoot}/cbox/{userId}/tag	modify meta info	POST
http://{serveRoot}/cbox/{userId}/score		POST
http://{serveRoot}/cbox/{userId}/comment		POST
http://{serveRoot}/cbox/{userId}/comment		DELETE
http://{serveRoot}/cbox/{userId}/fileUrl	get file URL	GET
http://{serveRoot}/cbox/{userId}/search	search file	GET
http://{serveRoot}/cbox/{userId}/history	get history	GET
http://{serveRoot}/cbox/{userId}/folderInfo	share folder	POST
http://{serveRoot}/cbox/{userId}/folder/addUsers	invite users	POST

As an example, we implemented a cocoBox mobile application using these service components.

C. cocoBox applications

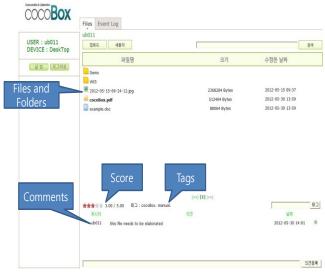We can use cocoBox services through web browser and mobile internet devices.

Figure 3. cocoBox web application

Figure 3 shows the cocoBox web user interface. When you select a file, the social data such as tag, average score, and comments are displayed in the page and you can add or modify them.

Figure 4 shows the home display of mobile cocoBox app. This application was developed using the cocoBox service components shown in Table 1and runs on smart mobile devices the Oss of which are Android 2.2.

Figure 4. cocoBox mobile application

Figure 5 shows the social data of the mobile cocoBox app. People can handle social data of a file using this interface. By providing these social data in file cloud service, people can discuss their sharing contents and express their thought or preference about it. We expect these social data of file cloud could help the collaboration and even communicating their knowledge with other people.

Figure 5. Social data on the cocoBox app: score, tags, comments on the file

IV. CONCLUSION AND FUTURE WORK

We introduce a social file cloud system, cocoBox. We extend this file cloud service by adding social features such as tags, score, and comments to ordinary content repository into a social file cloud service. The social features of cocoBox are tags, comments, score on the file. We expect these features can help collaboration and communication between people who share contents and have same interest. For further study, we continue to find more social features of file cloud such as e-mail notification of file changes and to develop desktop client which synchronizes files with cocoBox server. We expect improved cocoBox will help people to collaborate in the work environment.

ACKNOWLEDGMENTS

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