

Project Final Report : A Prototype of the Cloud Environment

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1. Introduction

Recently the cloud computing paradigm has been receiving significant excitement and attention in the media. There exist an increasing number of large companies that are offering cloud computing infrastructure products and service. Cloud database concept is start from sequence that shares a file between two (or many) different servers. In the paper, we have researched fundamental technique, socket programming, database and security, and made a cloud server demo. For the demo program, we set three specific aims and all implementation is used by Java.

- Specific Aim 1 We will implement client/server model with TCP/IP socket programming.
- Specific Aim 2 We will develop convenient user interface.
- Specific Aim 3 We will implement server synchronization for cloud computing.

2. Backgrounds

2.1 Cloud Computing

Cloud Computing is a technology that uses the internet and central remote servers to maintain data and applications. It allows consumers and businesses to use applications without installation and make it possible to access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing data storage, processing and bandwidth. In cloud computing, there are three segments which are application, storage and connectivity. Each segment serves a different purpose and offers different products for businesses and individuals around the world. In June 2011, a study conducted by V1 found that 91% of senior IT professionals actually don't know what cloud computing is and two-thirds of senior finance professionals are clear by the concept, highlighting the young nature of the technology. In Sept 2011, an Aberdeen Group study found that disciplined companies achieved on average of 68% increase in their IT expense because of the cloud computing and the only 10% reduction in data center power costs.

2.2 Socket Programming

Sockets are network communication channels. The sockets described in this paper use the TCP network protocol. TCP provides a reliable byte stream between two hosts connected to a network. It handles all the issues about routing information across the network, and it automatically recovers if data is lost or corrupted along the way. What's more, TCP is the basis for other protocols like Telnet, FTP, and HTTP.

2.2.1 Client Socket

A client opens a socket by specifying the host address and port number for the server of the socket. The host address gives the network location (i.e., which computer) and the port selects a particular server from all the possible servers that may be running on that host. For example, HTTP servers typically use port 80, while FTP servers use port 20.

2.2.2 Server Socket

A server socket is a little more complex because it has to accept multiple clients. The way this works is that the socket creates a listening socket, and then new sockets are created when clients make connections to the server.

2.3 JFC/Swing

Swing is a GUI widget toolkit for Java. It is part of Oracle's Java Foundation Classes (JFC) – an API for providing a graphical user interface (GUI) for Java programs. Swing was developed to provide a more sophisticated set of GUI components than the earlier Abstract Window Toolkit (AWT). Swing provides a native look and feel that emulates the look and feel of several platforms, and also supports a pluggable look and feel that allows applications to have a look and feel unrelated to the underlying platform.

3. Methods

3.1 Program Architecture

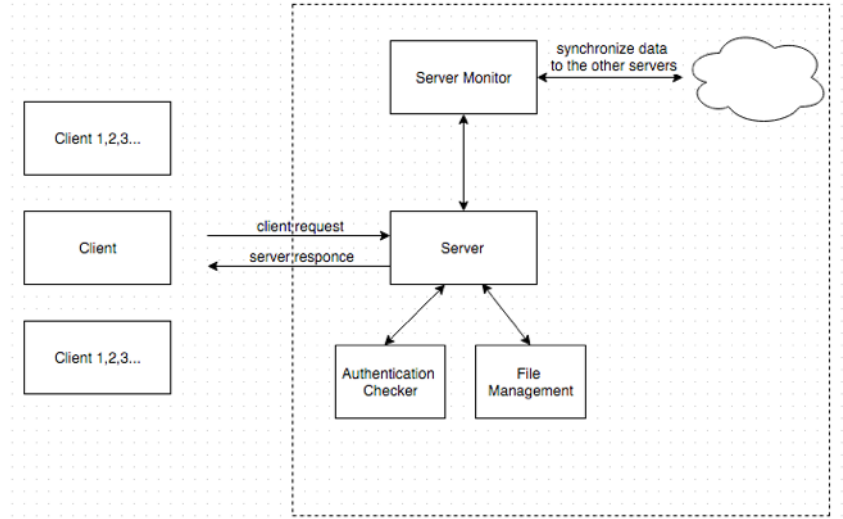


Figure 1: Cloud Architecture

3.2 Protocol (HTTP like protocol)

In this project, we will generate HTTP like protocol. Several types of requests will be considered in this project, for example, GET, POST, PUT and DELETE. The GET method is used to get a file or get the name list of a directory. The POST method is used to check authentication or close the connect. The PUT method is used to upload a file. The DELETE method is used to delete a file on cloud. Meanwhile, user cloud define any type of property in the request. The Status code is the same as HTTP protocol, we will use 200, 401, 404 and so on.

```
/* Login */
Auth auth = Auth.getInstance();
Connection cnn = new Connection();
auth.setAccount(username.getText(),String.valueOf(password.getPassword()));
cnn.setRequestProperty("Auth",auth.toString());
cnn.setRequestMethod(Connection.LOGIN,"POST");
request(cnn);

/* Get the path tree */
Connection cnn = new Connection();
```

```

cnn.setRequestMethod(Connection.GET_PATH,"GET");
cnn.setRequestProperty("Path","");
cnn.setRequestProperty("Auth",Auth.getInstance().toString());
request(cnn);

/* Upload a file */
Connection cnn = new Connection();
cnn.setRequestMethod(Connection.UPLOAD_FILE,"PUT");
cnn.setRequestProperty("Auth",Auth.getInstance().toString());
cnn.setRequestProperty("Content",textArea.getText());
cnn.setRequestProperty("Path",currentPath);
request(cnn);

/* Delete a file */
Connection cnn = new Connection();
cnn.setRequestMethod(Connection.DELETE_PATH,"DELETE");
cnn.setRequestProperty("Auth",Auth.getInstance().toString());
cnn.setRequestProperty("Path",currentPath);
request(cnn);

/* Lock a file */
Connection cnn = new Connection();
cnn.setRequestMethod(Connection.LOCK,"POST");
cnn.setRequestProperty("EditMode","");
cnn.setRequestProperty("Path",currentPath);
cnn.setRequestProperty("Auth",Auth.getInstance().toString());
request(cnn);

```

3.3 Client Side

For the client side, we will develop a socket library based on Java socket programming. This library will define the client side protocol, which is designed to communicate with the cloud server, and support applications for multiple devices such as the desktop and the mobile phone. Meanwhile, it will also implement the basic functions of cloud client, for instance, login to the account, show the file list of directory and basic file operations.

3.4 Server Side

For the server side, first of all, we will design socket communication with the client side. This implementation will handle all the requests of client side, including login, list the directory, and transfer files and so on. We will define a server side protocol which will manage different types of requests, and also it will include the error detecting. Next, we will design socket communication between multiple

server sides, in this project, we will assume there are only two servers. We will implement the synchronization of server side by defining a server side protocol. At last, we will consider about the security policy of server side.

3.5 Database Implementation

MySQL provides connectivity for client applications developed in the Java programming language with MySQL Connector/J, a driver that implements the Java Database Connectivity (JDBC) API. We can handle the database part with the connector

3.5.1 Salt Cryptography

Salt is random data that is used as an additional input to a one-way function that “hashes” a password or passphrase. The primary function of salts is to defend against dictionary attacks versus a list of password hashes and against pre-computed rainbow table attacks. A new salt is randomly generated for each password. In a typical setting, the salt and the password are concatenated and processed with a cryptographic hash function, and the resulting output (but not the original password) is stored with the salt in a database. Hashing allows for later authentication while protecting the plaintext password in the event that the authentication data store is compromised.

In the client side, we use the username as a salt combined with password and using SHA_256 to hash this combined string and get H1. Then, client side will pass both username and H1 to the server side. Next, in the server side, we will find the user in database and get another salt which is used in server side and the H2 which was computed when the user account is initialized. At the end, we will hash h1 with the new salt and get string H2_, and the user will be validated if H2_ is the same as H2.

3.5.2 Models for Hierarchical Data

In order to store the file path tree, we are using closure table which is a simple and elegant way of storing and querying hierarchical data.

Field	Type	Null	Key	Default
id	int(11)	NO	PRI	NULL
username	varchar(255)	YES		NULL
h2	varchar(255)	YES		NULL
salt	varchar(255)	YES		NULL
firstname	varchar(255)	YES		NULL
lastname	varchar(255)	YES		NULL
email	varchar(255)	YES		NULL
createtime	timestamp	NO		CURRENT_TIMESTAMP

Figure 2: User Table

Field	Type	Null	Key	Default
id	int(11)	NO	PRI	NULL
name	varchar(255)	NO		NULL
parent	int(11)	NO		NULL
path	varchar(255)	NO		NULL
type	int(11)	NO		0

Figure 3: Path Table

Field	Type	Null	Key	Default
ancestor	int(11)	NO	PRI	NULL
descendant	int(11)	NO	PRI	NULL
depth	int(11)	NO		0

Figure 4: Path Closure Table

4. Results & Conclusion

The source code could be found in <https://github.com/wq2a/cloud>.

4.1 Login Panel

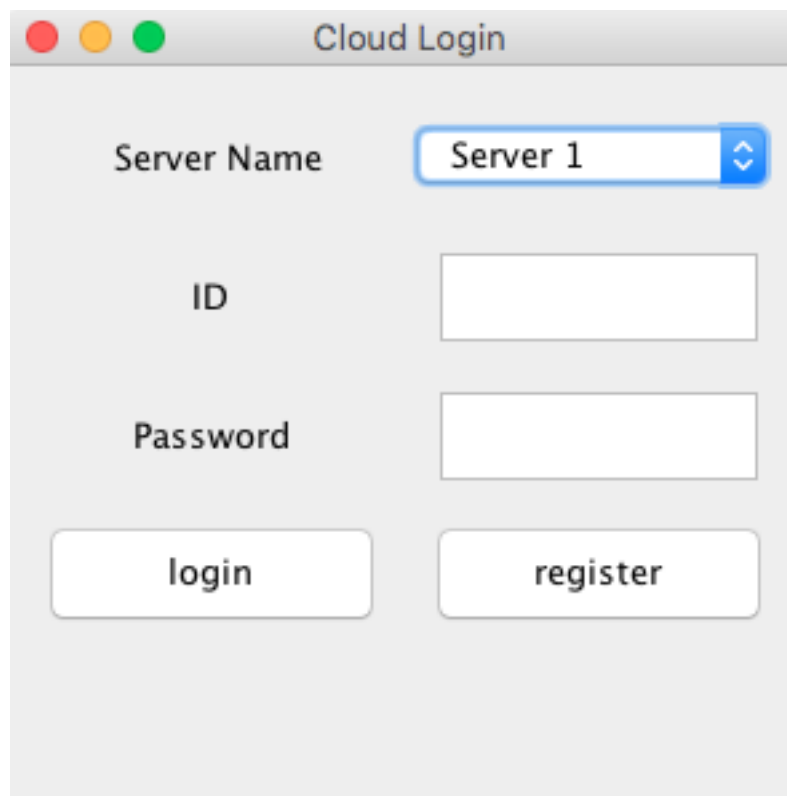
When users try to login the server, Client socket send a message including Id and Password to chosen server (See Fig.5).

4.2 Register Panel

Resister panel (See Fig.6) provides the function that creating new account. The panel rejects a message when Password and Confirm Password contents are different, and server response whether create a new one or duplicate.

4.3 Main Panel

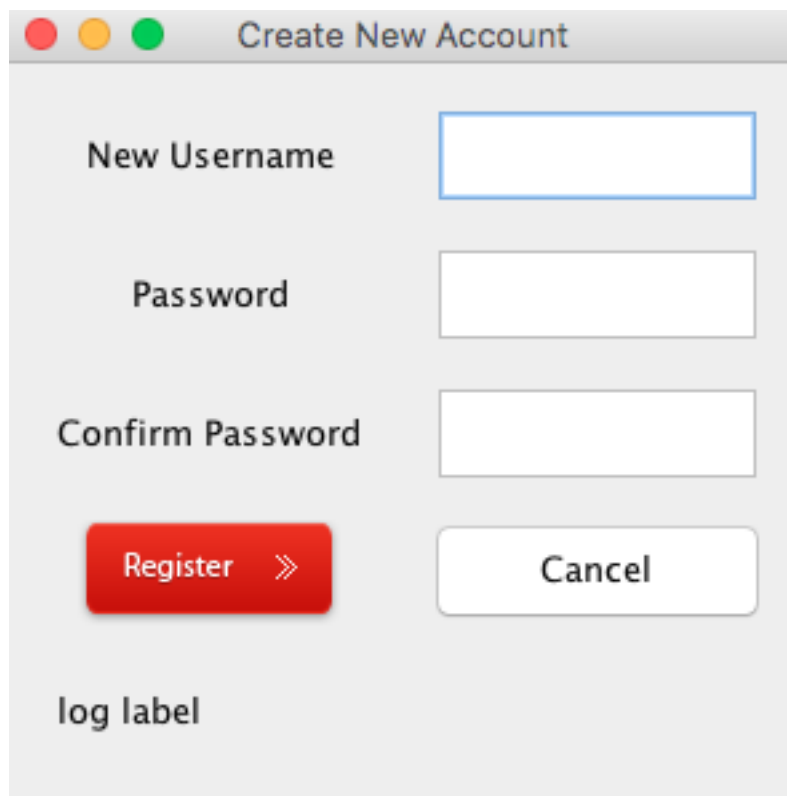
Main panel (See Fig.7) consists of two sub-panels. Left panel provide file tree, so that users can explore the folder and file. Right panel provide file contents, and also users can edit the contents.



A screenshot of a macOS-style window titled "Cloud Login". The window has a light gray background and a title bar with three colored buttons (red, yellow, green) on the left. The main content area contains the following elements:

- Server Name:** A label followed by a dropdown menu showing "Server 1" with a blue border and a small blue arrow icon on the right.
- ID:** A label followed by an empty rectangular text input field.
- Password:** A label followed by an empty rectangular text input field.
- login:** A rounded rectangular button with the text "login" in bold.
- register:** A rounded rectangular button with the text "register" in bold.

Figure 5: Cloud Login



A macOS-style dialog box titled "Create New Account". It features three standard window control buttons (red, yellow, green) in the top-left corner. The dialog contains three text input fields: "New Username" (with a blue border), "Password", and "Confirm Password". Below these fields are two buttons: a red "Register" button with a double-right arrow icon, and a white "Cancel" button with a gray border. At the bottom left, there is a "log label" text element.

Create New Account

New Username

Password

Confirm Password

Register »

Cancel

log label

Figure 6: Cloud Register

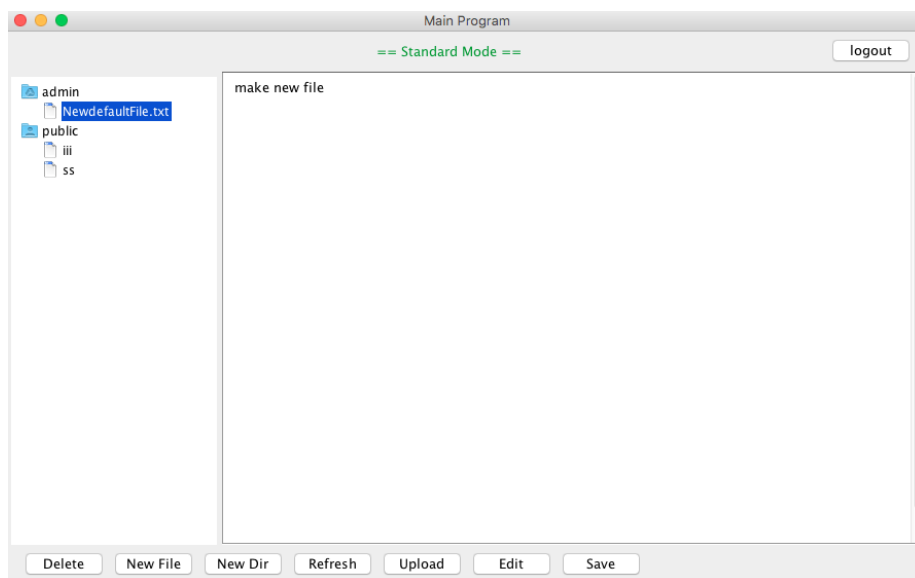


Figure 7: Cloud Main