Developing a Decentralized File Sharing System with a User Friendly GUI Building on the Hive2Hive Library

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24 February 2015

1 Introduction

The process of file sharing is an important and widely used component of computing. The exchanging of data between computer users promotes and simplifies development, with a multitude of uses and applications, from the distribution of work information between colleagues to sharing of movies and music. Many different file sharing protocols exist, with varying styles of user interface and levels of security.

2 Aim

The aim of this project is to develop a decentralized peer-to-peer (P2P) file sharing application that has an intuitive and user friendly interface. The system will build on the open source Hive2Hive library, which is written for distributed P2P based sharing and synchronization. The decentralized, P2P infrastructure will eliminate the substantial amount of server storage space typically needed for centralized or client-server infrastructure (Aboulhosn et al., 2005)

3 P2P Networking

P2P is a set of protocols, an IT architecture as well as a design philosophy with an emphasis on decentralization (Schoder and Fischbach, 2003). Each node on the network installs a single package which incorporates both client- and server- type code, so that each peer is able to issue queries and serve requests (Vu et al., 2009).

The system will build on the open source P2P library Hive2Hive, which is built on the high performance Distributed Hash Table (DHT) TomP2P. These Java libraries handle the configuration and connections of a P2P overlay network. TomP2P handles multiple values for a key and is responsible for managing multiple concurrent connections. Hive2hive is highly scalable and uses data encryption and user access control to ensure security. It is open source, highly extendable and platform independent as it runs on a JVM. These libraries will provide the foundation of the file sharing system.

The P2P overlay network infrastructure lends to efficiency through the self-organizing, highly scalable load balancing (Lua et al., 2005).

4   Security

It is important to note that as with all network communication, P2P networking lends itself to malicious use and attacks. As the intended user base consists of novice users, there are security implications involved in such a system. The system's user interface (UI) will aim to ensure that the user knows of the potential risks of sharing directories and downloading files from unknown sources (Bailes and Templeton, 2004).

It is arguable that no system is ever truly and wholly secure, and this is a safe lens through which to view communicative systems. While measures are developed to increase security, so are measures developed to bypass or compromise those measures. Our P2P file sharing system will aim for a moderate level of security via authentication and informative hints, tips and warning messages placed throughout the UI. A virus scan plug-in will be incorporated in order to protect users against known malicious files.

4.1   Authentication

A user's identity comprises of their user name on the system and their IP address. Their user name is chosen upon first initialization of the program. Both the uploader and downloader of a file will be able to confirm the identity of the other party (Kurose and Ross, 2013). Methods of banning malicious and abusive users, such as IP or MAC adress blacklisting by a moderator will be investigated.

4.2   Security Options

A user will have a range of custom security settings that they can adjust. An option to implement a white- or a blacklist will be present as well as an option to approve or deny download requests.

4.3   Hive2Hive Integrated Security

Hive2Hive provides the integrated functionality to encrypt and authenticate data and messages. A P2P system is much more difficult to keep secure than a typical client server system. Although reputation systems are implemented in P2P systems in order to prevent abuse, these are easily subverted in Sybil attacks via the forging of identities (Douceur, 2002).

5   User Interface

5.1   User Friendliness

The intended user base for this system is network users with basic computer literacy with the need to exchange data with other users in an overlay network. The details of networking and P2P distribution

protocols will be hidden from the user, who will only need to be presented with the user friendly graphical interface. The intended use of the system is, for example, the distribution of work files as well as installation files and other data between users in a work environment, such as the Rhodes University Department of Computer Science. Another example is the recreational distribution of multimedia between users.

Thus, the user friendliness of the system will depend on its effectiveness at distributing data, the intuitiveness of the graphical design, and the ease of learning and remembering to use it (Rogers et al., 2011).

5.2 Evaluating User Friendliness

User friendliness is most suitably evaluated by investigating users' actual experience with the system. We will provide a sample set of test users with a prototype of the system, and construct a questionnaire to study their experience and evaluation of it. There will be questions asking the user to describe the usability of the system and the intuitiveness of the UI in comparison to other file sharing applications and protocols such as DropBox, BitTorrent, DC++, FTP and Windows Homegroup. Further development will take place taking into consideration the results of the initial round of evaluation, after which another round of user testing and surveying will take place.

5.3 Safety Orientated UI

The UI of the system will be designed so as to promote usage that is as safe and informed as possible for a novice computer network user. A skippable tutorial will be displayed upon first usage of the program. There will be a security options menu where the user can customize the functionality of the program to their preference. Warnings will be displayed whenever a user downloads a potentially harmful, for example, .exe file. The user will have the option to disable these warnings. A text display box at the bottom of the main program window will show which files are currently being up-/downloaded.

6 Expansion of key words

1. Decentralized: The system is not dependent on a single server, and the work and processes are allocated between peers on the network.

2. File sharing system: Peers are able to search for and download files that others on the network have shared, as well as share files of their own via a repository.

3. User friendly GUI: An elegant and clear design which aims to be intuitive and easy to use.

4. Hive2Hive: An open source library for distributed p2p based synchronization and sharing.

5. TomP2P: An advanced, high performance DHT.

6. Overlay Network: A virtual network formed by participating nodes. Nodes are connected via logical links through paths which lie on top of physical links.

7. Whitelist: A user can specify a list of IPs/users that are allowed to browse/download their files.

8. Blacklist: A user can specify a list of IPs/users that are *not* allowed to browse/download their files.

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