



IMPLEMENTATION OF SECURE PRIVATE CLOUD INFRASTRUCTURE

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Abstract: *Cloud computing has been rapidly and radically changing the dynamics of IT consumption. Private cloud solutions can reduce costs, help to efficiently utilize the resources, minimize security risks, and help meet many core IT goals and requirements. The fundamental resources like processing power, storage capacity and network can be efficiently used by leveraging the benefit of private cloud in an organization. For an organization, the data stored is extremely very large. Thus, it becomes very important to have the secured use of data. For this, most suitable option is a private cloud. The aim of this platform is to boost the efficiency in determining an organization's ability and security threats. As a result, the proposed private cloud system provides account login with a username and password for each client. Then after login, each client can access to a proposed private cloud system and using different services privately such as file sharing, word document, slideshows, photo sharing and display, online video playing, and there is a dedicated storage area for each user. This dedicated storage enable an user for storing documents on the cloud, retrieve or even edit them from any end device connecting to this private cloud inside organization through private Intranet. This paper highlights the process of design and realization of a private cloud environment in an organization and how it can be beneficial for seamless and secure data exchange within an establishment.*

Index Terms - Cloud computing, Sharing, Storage, Privacy, Encryption.

1. INTRODUCTION

The cloud is a term used to describe a global network of servers, each with a unique function. These servers are designed to either store and manage data, run applications, or deliver content or a service such as streaming videos, web mail, and office productivity software.

Generally, there are four different methods to deploy cloud resources. There is a public cloud that shares resources and offers services to the public over the Internet, a private cloud that isn't shared and offers services over a private internal network typically hosted on-premises, a hybrid cloud that shares services between public and private clouds depending on their purpose, and a community cloud that shares resources only between organizations, such as with government institutions.

The private cloud is defined as computing services offered over a private internal network and only to selected users instead of the public. These deliver a higher level of security and privacy through both company firewalls and internal hosting to ensure operations and sensitive data are not accessible to third-party providers.

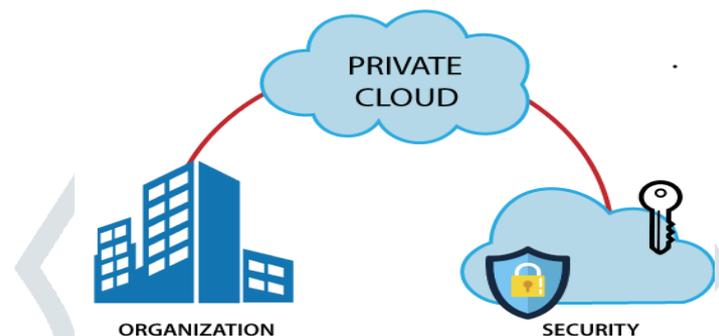


Figure 1. Private cloud

2. REQUIREMENTS FOR OUR PRIVATE CLOUD

The cloud provides highly secure storage for user's data, which can be accessed anytime. In addition, all data stored in the cloud is encrypted and secured so that it cannot be tampered with. An enhanced secure data transfer with non-removable media is achieved.

3. OUR PRIVATE CLOUD DESIGN

Private cloud is open source file syncing and sharing software for everyone. It provides a safe, secure, and compliant file synchronization and sharing solution on servers that are controlled. User can share one or more files and folders on the computer, and synchronize them with the private cloud server. Once files are placed in local shared directories, these files are immediately synchronized to the server and to other devices. Features of Private cloud:

1. Easier way to select a new app (application).
2. Contacts menu to reach colleagues easier.
3. Many other apps, like screen sharing in Video calls, push notifications, notifications of file changes even when shared to another server.
4. Document shared with timelines.

3.1 Our private cloud Web Interface

Private cloud can be accessed using any Web browser with proper authentication. By pointing it to the Private cloud server URL (e.g.cloud.example.com) and entering the username and password as depicted in Fig 2.

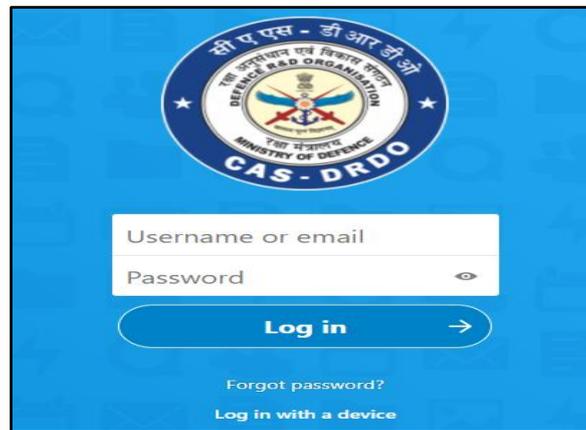


Figure 2. Private cloud login page.

By default, our Private cloud web interface opens to the Files page. We can add, remove, and share files, and make changes based on the access privileges set by the server administrator.



Figure 3. User Interface

Figure 3 shows the Private cloud user interface which contains the following fields and functions:

Apps Selection Menu (1) It is located in the upper left corner, we'll find all the apps which are available on the instance of Private cloud.

Apps Information field (2) It is located in the left sidebar, this provides filters and tasks associated with the selected app. For example, when we are using the files app we have a special set of filters for quickly finding the files, such as files that have been shared with us, and files that we have shared with others.

Application View (3) The main central field in the Private cloud user interface. This field displays the contents or user features of the selected app.

Navigation Bar (4) It is located over the main viewing window (the Application View), this bar allows us to migrate to higher levels of the folder hierarchy up to the root level (home).

New button (5) It is located in the navigation bar, the new button enables us to create new files, new folders, or upload files.

Search field (6) The magnifier in the upper right hand corner is used to search for files.

Contacts Menu (7) It gives an overview about the contacts and users on the server. Depending on the given details and available apps, we can directly start a video call with them or send emails.

Gallery button (8) This looks like four little squares, and takes us directly to the image gallery.

Settings menu (9) By opening the profile picture, the settings dropdown menu pops up.

3.2. Files & Synchronization

a) Accessing the files

The files can be accessed with the web interface and create, preview, edit, delete, share, and re-share files.

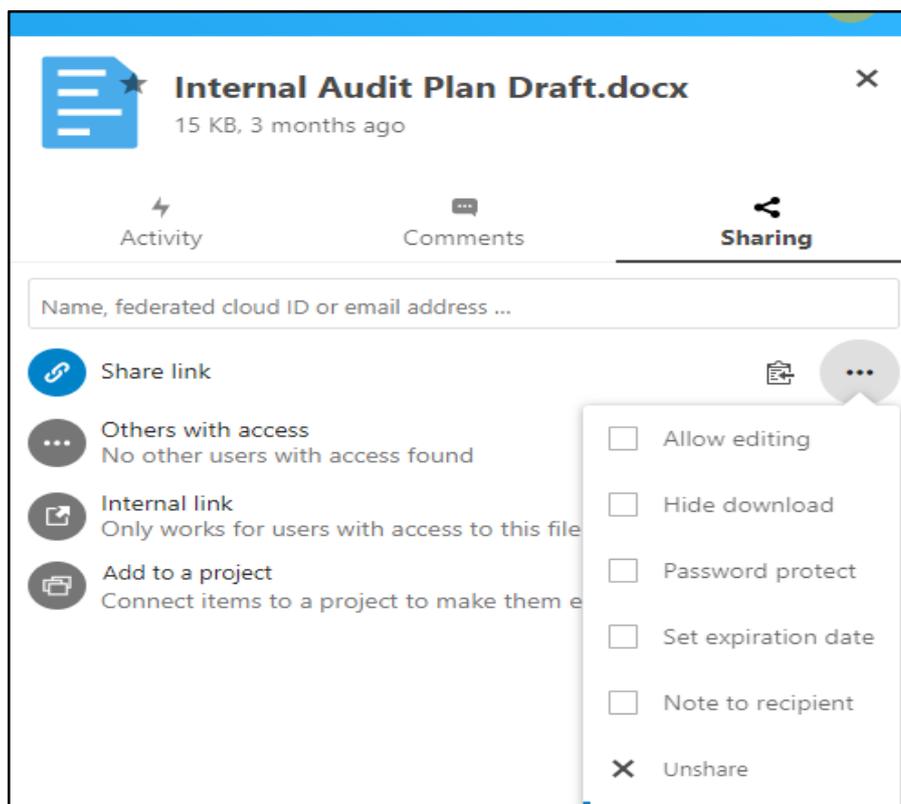


Figure 4. File sharing options.

Activity: This tab shows the history of a file as when it was created, shared and deleted.

Comments: In the details view we can add and read comments on any file or folder.

Share: The file or folder can be shared with a group or other users. We can also see with whom we have shared already, and revoke shares by clicking the trash icon. The share feature has many options as Edit, Create, Change, Delete, Settings etc.

b) Previewing files

We can display uncompressed text files, open document files, videos, and image files in the cloud embedded viewer by selecting the file name. If the cloud cannot display a file, it starts a download process and downloads the file to the computer. Each file consists of the functions as the details, rename, move, delete and download.

c) Sharing status icons

Any folder that has been shared is marked with the shared overlay icon. Public link shares are marked with a chain link and unshared folders are blank.

d) Creating or uploading files and directories

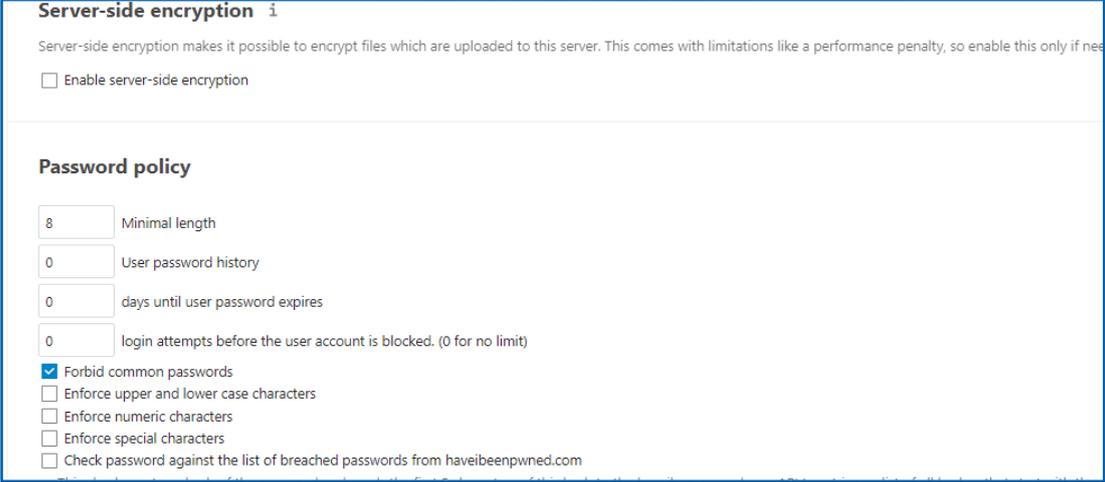
We can upload or create new files or folders directly in the cloud folder by clicking on the new button in the files app. The new button provides to upload files from the computer into the cloud, the text file creates a new text file and adds the file to the current folder. The left sidebar on the files page contains several filters for quickly sorting and managing the files such as favorites, shared with us, shared with others, shared by link and pending shares.

3.3 Managing deleted files

When we delete a file in our Private cloud, it is not immediately deleted permanently. Instead, it is moved into the trash bin. We can only manually delete it, or when the deleted files app deletes it to make room for new files. Deleted files are not counted against the storage quota. To ensure that users do not run over their storage quotas, the deleted files app allocates a maximum of 50% of their currently available free space to deleted files. By default, deleted files stay in the trash bin for 30 days. Additionally, our Private cloud calculates the maximum available space every time a new file is added.

3.4 Encrypting the files on the server

Our private cloud includes a server side encryption app, and when the cloud administrator enables it, all of the cloud data files are automatically encrypted on the server. Encryption is server-wide, so when it is enabled we cannot choose to keep the files unencrypted. Its main purpose is to encrypt files on remote storage services that are connected to the cloud server. This is an easy and seamless way to protect the files on remote storage. These files can be shared through the cloud in the usual way.



The screenshot shows two sections of a settings page. The first section, titled 'Server-side encryption', has a sub-header 'Server-side encryption' and a descriptive sentence: 'Server-side encryption makes it possible to encrypt files which are uploaded to this server. This comes with limitations like a performance penalty, so enable this only if needed.' Below this is a checkbox labeled 'Enable server-side encryption' which is currently unchecked. The second section, titled 'Password policy', contains several input fields and checkboxes. The 'Minimal length' field is set to 8, 'User password history' is 0, 'days until user password expires' is 0, and 'login attempts before the user account is blocked. (0 for no limit)' is 0. There are five checkboxes: 'Forbid common passwords' (checked), 'Enforce upper and lower case characters' (unchecked), 'Enforce numeric characters' (unchecked), 'Enforce special characters' (unchecked), and 'Check password against the list of breached passwords from haveibeenpwned.com' (unchecked).

Figure 5. Encryption and password policy.

Recovery key password

If the cloud administrator has enabled the recovery key feature, we can choose to use this feature for the account. “Password recovery” feature enables the administrator to recover the files even if we lose the cloud password. If the recovery key is not enabled, then there is no way to restore the files if we lose the login password. Only the data in the files is encrypted, and not the filenames or folder structures.

3.5 Storage Quota

The cloud admin has the option to set a storage quota on users. At the top of the personal page we can see what the quota is, and how much we have used.

You are using 7.2 MB of 5 GB (0.14 %)

Figure 6. Storage Quota

3.6 Projects

The users can associate files, chats and other items with each other in projects. A new project can be created by linking two items together. With the Add to a project option, we can select the type of item we want to link with the current file/folder.

3.7 Transfer Ownership

The users can transfer the ownership of files and folders to other users. We can pick a new owner by typing their name into the search field next to the new owner with the transfer option. The target user receives a notification whether to accept or reject the incoming transfer.

4. ADDITIONAL FEATURES OF OUR PRIVATE CLOUD

4.1 The Gallery application

The Gallery app supports many image formats, sorting, zoom, and scrolling. It also supports advanced customizations via a simple text file. The gallery app automatically finds all images in the Private cloud folders, and overlays the thumbnails with the folder names.

This has the following features:

- A download button at the top center,
- A forward and back buttons at the right and left sides,
- An automatic slideshow button at the bottom right, and a close button at the top right.

4.2 The Contacts application

Our private cloud contacts app is similar to other mobile contact applications, but with more functionality. We can add contacts, edit or remove contacts, upload a contact picture. To add contacts into the address book, we can use one of the following methods:

- Import contacts using a Virtual Contact File (VCF/Vcard) file
- Add contacts manually

4.3 The Calendar application

The cloud calendar app works similar to other calendar applications. If we want to transfer the calendar and their respective events to the cloud instance, importing is the best way to do so or we can create a new calendar. By supporting the interoperable standard (RFC 5545) we made our private cloud calendar compatible with Google calendar. We can also create, edit, and delete an event of a particular day. We can set up reminders to be notified before an event occurs.

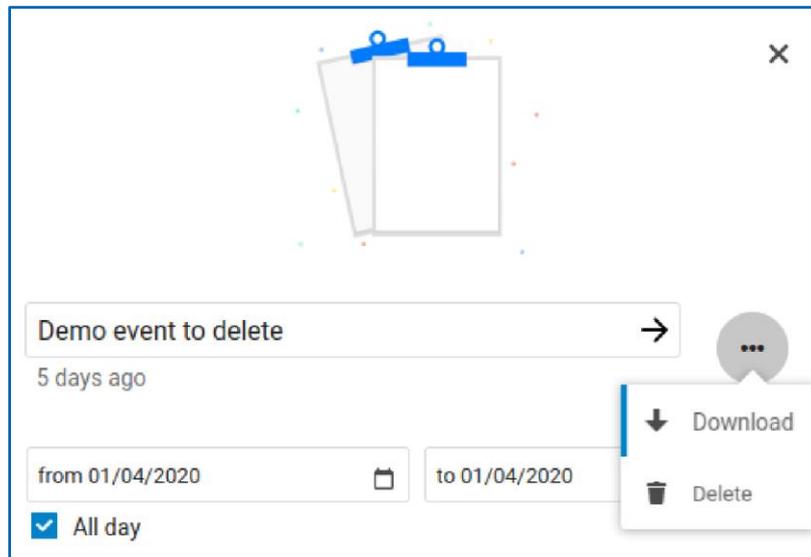


Figure 7. Event creation in calendar

4.4 Manage Connected Browsers and Devices

The personal settings page allows us to have an overview on the connected browsers and devices. In the list of connected browsers, it shows which browsers are connected to the account recently. We can use the trash icon to disconnect any of the browsers in the list.

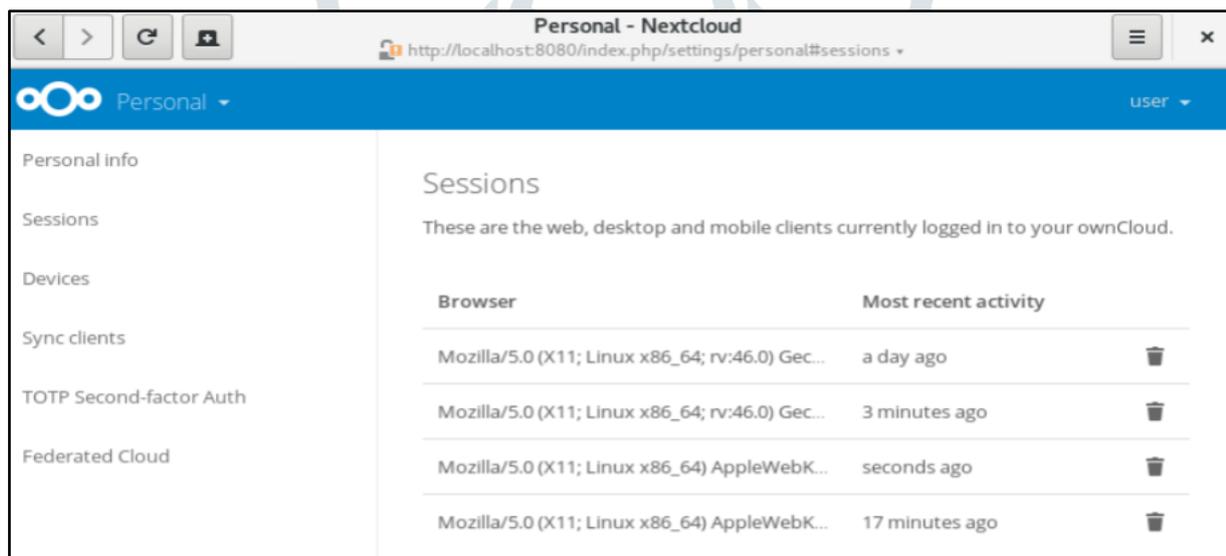


Figure 8. Session Management

5. OUTCOME

The current usage of this cloud platform in our organization is plotted as shown in figure below which shows active users and shares in our private cloud.



Figure 9. Graphical representation of number of users per time.

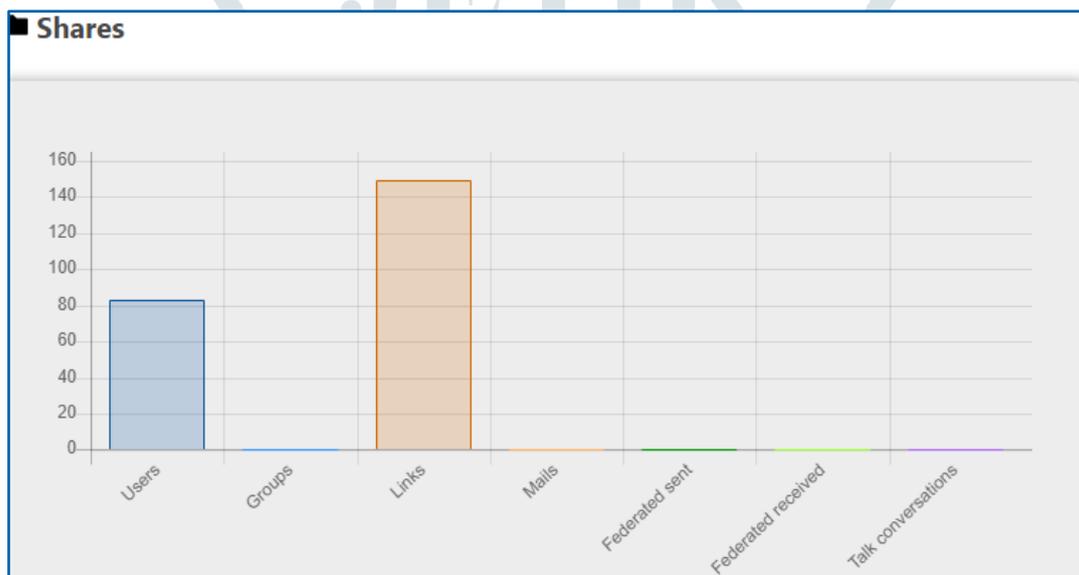


Figure 10. Graphical representation of shares done in our private cloud.

6. CONCLUSION

This paper has highlighted a simple way to create our own private cloud and its uses. We believe that due to the complexity of the cloud, it will be difficult to achieve end-to-end security. Therefore, by opting for a private cloud we achieved it.

7. FUTURE SCOPE

The following features can be incorporated in the updated version of cloud. The Federated cloud option can be added which allows to mount file shares from remote cloud servers and manage them just like a local share. Fully homomorphic encryption allows straightforward computations on encrypted information, and allows computing sum and product for the encrypted data without decryption. A mail notification to the users for the recent activity, changes made to the document can also be added in the cloud. Private cloud groupware is a

bundle of apps, which consists of a mail-client and a calendar and contacts server with the respective web interfaces.

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