

Affordable Cloud Solution

by

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ABSTRACT

Small to medium size businesses face very high upfront IT costs. Our Affordable Cloud Solution is a low cost solution that provides a range of features for a much lower cost than our competitors. The OwnCloud solution is open source software with plenty of features. The Affordable Cloud Solution includes a calendar, messaging, tasks, activity, and an email application. For an added level of security, an encryption application has been developed for OwnCloud. The Affordable Cloud Solution can only be accessed via HTTPS to secure data in transit. To make installation even easier for our clients, a BASH script is available to make the Affordable Cloud Solution quick and easy to stand up. Affordable Cloud Solution is a quick, easy, and reliable cloud solution for small to medium size businesses.

1 PROBLEM STATEMENT

1.1 Introduction

Our group wanted to integrate a cloud based solution for small to medium sized companies that do not have a very large budget for IT projects and equipment. With our Affordable Cloud Solution businesses will be able to create a cloud environment for users to share documents, email, and live-chat, create tasks, and manage calendars all while being in a secured environment.

1.2 Project Description

The goal of this project is to create a cloud environment using ownCloud as the base. This project will be broken up into multiple phases. Each phase will have its defined scope. The phases of the project will be determined after the approval of this project. The users will be able to use this service for the following reasons, (but are not limited to these reasons, the scope may change): access email, use tasks to track progress of assigned projects, use calendar events, check activity and of course upload and share many types of files where all of the user files will be encrypted using the encryption app. This project mainly focuses on deploying ownCloud as an internal cloud environment, but ownCloud can also be accessed from the internet.

1.3 Problem

This project will solve the problem for companies with a small IT budget looking to create a safe, easy, working environment for users to store documents, live chat, manage calendars and more. This is a cloud based solution that is quick and easy to install as well as manage.

1.4 User Profile

Table 1 below displays our User profile. The potential users for Affordable Cloud solution would be for system administrators of small to medium sized companies and of course their user base. The system administrators would need to be familiar with web applications, Linux servers,

networking, security, and using the OwnCloud integrated web applications. They should have experience using VMware, configuring and managing server operating systems, and the tools associated with each. The users would need to be somewhat computer and web application savvy to navigate through using the mail, calendar, task, and other applications. The interface on the user side is very simple, and any user in a company would be able to easily navigate its pages, apps tab, and use them effectively.

Application: ownCloud web user interface, ownCloud web admin interface, Ubuntu command-line, Client web browser.
Potential Users: - Small to medium sized business System Administrators - Small to Medium sized business users
Technical and Software Experience: - The System administrator for Affordable Cloud Solution should have high experience and knowledge with application integration, building virtual machines, using scripts, and general knowledge of application security, and troubleshooting these applications. - The Affordable Cloud solution users should have general knowledge of using a web browser for online cloud applications such as Google Drive, Box, Dropbox, etc.
Prior Technical Experience to use Affordable Cloud Solution: - System Administrators should be familiar with cloud solutions similar to Microsoft SharePoint, and in general using virtual machines and cloud storage. - Users should be familiar with general web browsing and cloud based applications.

User Experience and Use: • The System Administrators should be able to manage all data integrated within the application, keep services running, upgrade services as necessary, and manage all users within the application. • The System Administrators should be familiar with change control, update, and Disaster Recovery processes. • The users will be able to easily access and use all applications within the Affordable Cloud Solution such as mail, tasks, calendar, as well as document saving and sharing.
Frequency of Use: The actual project and demonstration will basically be a one-time use. However, the solution we are providing can be used by companies whenever there is a need for it. If everything works out, the affordable cloud solution will be used multiple times a day, by multiple end user groups and system administrators. This may include both running background scripts as well as actual user/administrator interactions.
Design Requirements: • Ease of access and the security of the data. • The interface is based on ownCloud's prebuilt UI. • Emails sent only internally.

Table 1 Use Case Table

Figure 1 Use Case Diagram: Below is the Use Case Diagram for the Affordable Cloud Solution. Our diagram outlines what each user can access, change, or control through the Affordable Cloud Solution. The diagram shows that the users will have access to multiple applications within the ownCloud environment. The diagram also shows how the client system administrators will be able to view logs, make changes to their ownCloud environment to tailor it to their company, as well as do some minor troubleshooting to fix issue(s) within the solution. Lastly, the Affordable Cloud Solution support team would do any major troubleshooting to resolve any issues that may arise and are not resolvable by client System Administrators. The Affordable Cloud Solution support team would also be there for support to install, fix, or troubleshoot any issues within the ownCloud solution.

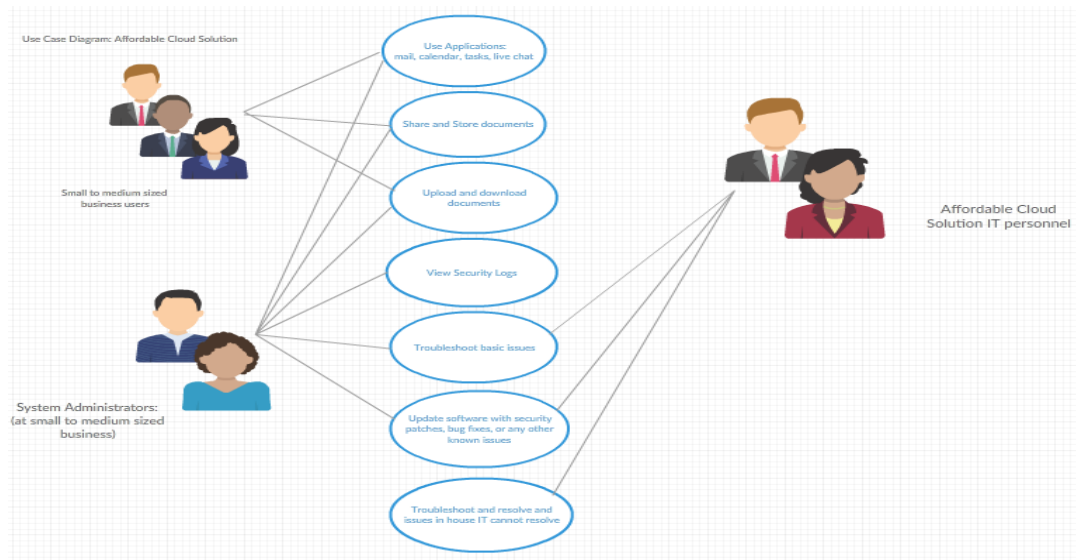


Figure 1 Use Case Diagram

2 PROJECT MANAGEMENT

2.1 Objectives and Deliverables

Table 2 displays the technical deliverables for our solution across semesters. This first table outlines our semester one technical deliverables which we were perfectly on pace for and had very little problem finishing our goal for this semester. It outlines from August 22nd until November 28th.

Affordable Network Solutions		Technical Deliverables
Semester 1	Week 1 August 22	Find students and form group members.
	Week 2 8/29	Discuss project ideas with team members and finalize idea by 9/4.
	Week 3 9/5	Meet with track advisor to discuss by 9/9 to get project approved.
	Week 4 9/12	Begin working on project documents and finalizing technical requirements for project.
	Week 5 9/19	Request Sandbox access.
	Week 6 9/26	Create a test environment in Sandbox for the project requirements
	Week 7 10/3	Research ownCloud installation and Technical requirements.
	Week 8 10/10	Deploy ownCloud and its dependencies in the test environment
	Week 9 10/17	Integrate tasks application with ownCloud in the test environment.
	Week 10 10/24	Integrate activity application with ownCloud in the test environment.
	Week 11 10/31	Integrate Email application with ownCloud in the test environment.
	Week 12 11/7	Integrate live chatting application with ownCloud in the test environment.

	Week 13 11/14	Integrate encryption application with ownCloud in the test environment.
	Week 14 11/21	Research and fix bugs found during the installation and deployment process as necessary.
	Week 15 11/28	- Document deployment and installation instructions for ease of redeployment next semester. - Finalize technical documents and prepare to deploy in the production environment.

Table 2 Semester 1 Objectives and Deliverables

Table 3 below displays our semester two technical deliverables that we plan to accomplish from the dates of December to April and have our project completely finished for the technical expo. We have a solid plan laid out to give us plenty of time to implement, test, and finalize our solution before the technical expo.

Affordable Network Solutions		Technical Deliverables
Semester 2	Week 1 01-09	- Create a production environment with all new servers and client. - Look into utilizing Docker containers to deploy base ownCloud installation if possible.
	Week 2 01-16	Install & configure base Operating System for the 2 server VMs and a client machine. Server VMs will be Ubuntu base OS and the client VM will have Windows 10 as the base OS.
	Week 3 01-23	Continue with installation and configuration.
	Week 4 01-30	Integrate Calendar app with ownCloud.
	Week 5 02-06	Integrate tasks app with ownCloud.
	Week 6 02-13	Integrate activity app with ownCloud.
	Week 7 02-20	Integrate Email app with ownCloud.
	Week 8 02-27	Integrate install DNS server with ownCloud.

	Week 9 03-06	- Integrate encryption app with ownCloud. Select and store the encryption keys in a secure place for troubleshooting in the future. NOTE: Once the encryption is deployed the server will NEVER be able to go back to its unencrypted state.
	Week 10 03-13	- Come up with a security policy for ownCloud deployment and usage. - Make ownCloud accessible strictly via HTTPS for the security of the data in transit.
	Week 11 03-20	Theme ownCloud with our company's theme requirements.
	Week 12 03-27	- Create script for ownCloud installation using Bash scripting language. - Finish ownCloud deployment script.
	Week 13 04-03	
	Week 14 04-10	** Potentially** - Configure firewall to allow internet traffic for ownCloud. - Configure internet facing DNS serves to carry a DNS entry for ownCloud server access - Throughout the semester, work towards a solution that can be marketed to real world businesses where we would be a hypothetical cloud solution provider.
	Week 15 04-17	

Table 3 Semester 2 Objectives and Deliverables

2.2 Budget

Table 4 below shows our real-world budget of \$19,990 for our solution. The subtotal is only an estimate of what the cost would be. This project will not be sold, but is only created as an educational experience.

Item	Quantity	Price Per Unit	Line Item Total
Hardware			
PowerEdge R730	1	\$2,490.00	\$2,490.00
Software			
Linux Ubuntu Server	1	\$0.00	\$0.00
Labor			
ACS Employee Hours	40	\$70.00	\$2,800.00
Subtotal			\$5,290.00

Table 4 Projected Budget

2.3 Project Schedule

Figure 2 below is our Project Timeline Gantt Chart that shows only the technical deliverables that we plan to accomplish through the 2016-2017 school year.



Figure 2 Project Timeline Gantt Chart

3 TECHNICAL ELEMENTS

3.1 Network

Our Test/PROD networks will be in the UC's sandbox as we continue to develop our cloud solution. As a business we will recommend our customers use a virtual appliance (preferably a VMware ESXI Hypervisor) to host our ownCloud solution as it would be much easier to maintain and recover if there is a disaster situation. It would also be easier to test and troubleshoot problems in their network, if such is to arise.

3.2 Firewall

Our current scope of the project is limited to users accessing the server from within the organization, and does not support clients accessing the ownCloud server from the internet. However, as the project progresses, the team may decide to pursue this solution alongside the internal aspects. If the team goes forward with the internet access aspect, we will need a firewall rule in place which allows ownCloud traffic to pass through and we will also need to have the internet facing DNS servers carry a DNS record for the ownCloud server.

3.3 Software

Our project team will be utilizing an open-source cloud solution called ownCloud as the base of our project. We will then take the base version and improve it in various aspects, including adding new functionalities through applications such as Calendar, Tasks, Internal Chat, and Activity notifications. Our version will also be customized in its appearance compared to the default ownCloud layout. The team will be using BASH scripting to simplify the ownCloud installation process. We as a team may also decide to pursue Docker container solution if possible where the ownCloud instance will be deployed through a Docker container.

3.4 Backup and DRS

Our solution will have a backup and DRS solution in place. The scope of this project includes that we run manual backups at this point. However, later on if we have enough resources we may try to script this as well for ease of backup. Since the current process will require manual backups, we will document these steps and instructions for repeatability.

4 INTERFACE AND TESTING

4.1 Network Architecture and Design

Figure 3 below is our network infrastructure diagram. This outlines how our solution is laid out from a network standpoint. The ownCloud solution would be connected to an ESXI server which hosts all the applications. That is connected to the internet through a secure firewall. From there the Affordable Cloud solution is connected to a company's network through their firewall then connects to their switches and routers. It can connect internally to wired and wireless devices.

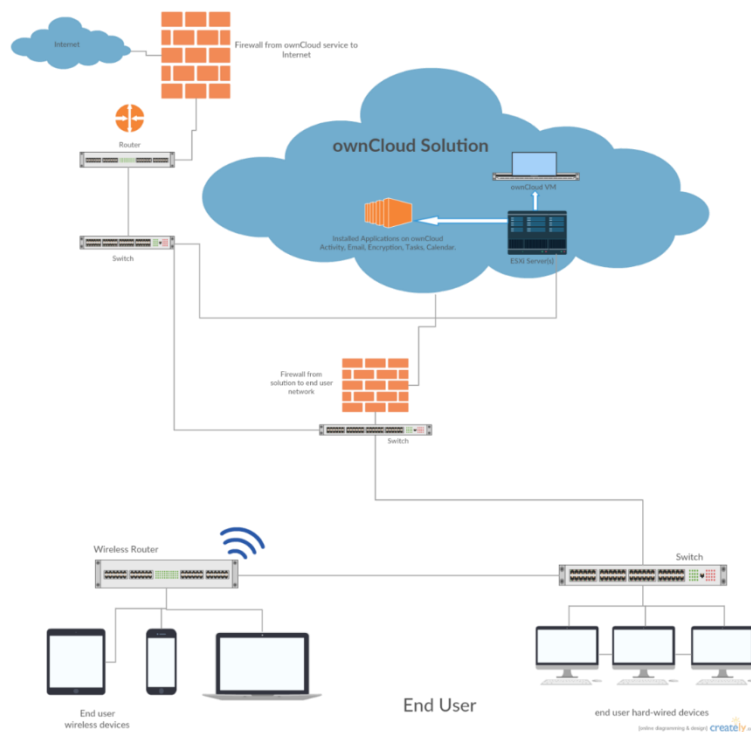


Figure 3 Network Infrastructure Diagram

4.2 Test Environment

Our Test environment is being hosted on UC's Sandbox environment. The client is a Windows

8.1 desktop client. The test server is running on Linux Ubuntu Server OS 64-bit.

4.2.1 Test Report and Development

Overview

This will cover the main points of our testing methodology for the Affordable Cloud Solution.

This should be used as a guideline for testing this solution.

- Project Managers
- Team members
- Lead System Administrators
- Managers
- Q&A Personnel

Scope

The scope of this testing is to test the functionality of the Affordable Cloud Solution on Google Chrome Browser. The test will be organized based on requirements of the solution.

Objective

The Objective of testing is to verify that the applications and functions of the solution is working as designed. These tests are designed to test the individual components of the solution. System Administrator or administrators will run the test for the system and functions they installed in their test environment.

Logging Test

Any bugs reported during testing will be documented and given a level of severity that was determined by the Business Analyst. A new round of testing will begin after the bugs are identified and fixed.

System Testing

Affordable Cloud solution will be completed in phases. This will help make the testing process smoother and more efficient. The testing will go into two phases. The first phase will consist of the server connections and the second phase will consist of testing the applications that are running on our solution.

Testing Procedures

The following are the steps necessary for completing a complete and accurate test.

- Create all necessary testing scenarios and test cases
- Prepare a document of the steps to use to conduct the testing and the expected results
- Specify the bugs in the correct report

Below are the tests that will be performed:

Phase 1

- Connection Test – This test will ensure that the connection to all servers are at acceptable levels.
- User Access Test – This test will ensure that security levels and user provisioning are working as intended.

Phase 2

- Stability Test – Test will focus Affordable Cloud Solutions application working on Google chrome desktop browser and mobile browser.
- User Interface Test – This test will focus on the user interface and how it functions for the user.
- Functionality Test – This test will focus on the features that are implemented on each application in the solution

Pass/Fail

All functions of the application must meet the defined requirements in order to receive a passing grade. If any aspect of the application fails then the application will receive a failing grade and the tester will document the feature that failed and the issue they were running into.

Time Line

In **Table 5** and **Table 6** below is outlined our testing timeline and the frequency of tests.

Project Team Member	Timeline	Testing Intervals
System Administrator	10/1/2016-04/01/2017	Weekly
Project Lead/Manager	10/1/2016-04/01/2017	Weekly

Table 5 Schedule of Testing Phase 1

Project Team Member	Timeline	Testing Intervals
System Administrator	10/1/2016-04/01/2017	Weekly
Project Lead/Manager	10/1/2016-04/01/2017	Weekly

Table 6 Schedule of Testing Phase 2

Risks

The following will impact the test cycle:

- Network Availability
- Delay in bug fixes

4.2.2 System and Logging Test Report

This testing report covers the System Test and Logs for phase 1 and phase 2. Comments are only left if the test had failed.

Category	Test Case	Steps for Testing	Expected Outcome	Pass/Fail	Comments
Security	Admin Log In	1. Enter Admin credentials 2. Press 'Enter'	Admin should be taken to the Linux command line under the root directory.	Pass(1/30/2017)	When login is successful, leading to a different IP address then what's setup. Currently reviewing issue and working with team to resolve issue.
Security	Admin Log Off	1. Enter Admin credentials 2. Press 'Enter' Key 3. Enter 'Logout' Command 4. Press 'Enter'	Admin should be able to login with username and password and enter in the 'logout' command to go to the sign in page.	Fail(10/23/16) Pass(10/30/2016)	
Security	User Login	1. Enter User credentials 2. Click Sign In	User should be able to enter in credentials to the owncloud login and access the dashboard.	Pass(1/30/2017)	
Security	User Log Off	1. Enter User credentials 2. Click Sign In 3. Click Log off	User should only be able to log out of owncloud dashboard by clicking on log off button and not hitting the back button.	Pass(1/30/2017)	
Feature	Tasks	1. Sign in as User 2. Click on Tasks. 3. Click on Task List 4. Click on "... " to create new task.	User is able select Tasks App, create a list, enter in new tasks under that list, and check the box to complete a task.	Pass(1/30/2017)	
		1. Sign in as User 2. Click Calendar date to create a new event. 3. Set date and time. 4. Click on Update.	User should be able to select Calendar App. The user should be able to create an event from selecting a date and time. User should also be able to assign it to a calendar they created.	Pass(1/30/2017)	
Feature	Calendar	1. Sign in with Email credentials 2. Select send mail. 3. Type in email address to other user on network.	User should be able to login to ownCloud webmail app and taken to the email dashboard. User should be able to send email to another email address on the network. User should not be able to send email address to an external email address. User should be able to receive an email.	Pass(1/30/2017)	
		1. Sign in as User 2. Click on All Activities. 3. Click on Activities by You	User should be able to access Activity app. Customer should be able to view activities created by user and other users.	Pass(1/30/2017)	
Feature	Activity	1. Sign in as User 2. Select File and drag to upload and let process complete.	User should be able to create a new file. User should be able to create new folder and move files into that folder. User should also be able to delete files.	Pass(1/30/2017)	
		1. Type in url in address bar of google chrome browser.	User should be able to type in url to google chrome address and connect to owncloud login page.	Pass(1/30/2017)	
Connection	DNS				
Installation Script	Launch	Pending	Pending	Pending	Feature still in development.
Back up script	Data Back Up	Pending	Pending	Pending	Feature still in development.

Figure 4 Test Results

4.3 Security

Security is a high priority of this solution. This site can only be accessed from the intranet. A different login from the Active-Directory credentials is currently used for this solution.

Companies will have the option to link the Active-Directory to the solution and set permissions policies on their end. Traffic from the user to the server is encrypted using the secure communication protocol TLS, and data stored is encrypted on the server.

4.4 Layout Interface

4.4.1 User Interface

When the users first login they will see the files app splash screen for ownCloud. Then they will see the dropdown arrow next to the Applications' heading to switch between applications. Each application will have its own screen with its own features and functions.

4.4.2 System Administrator Interface

The system administrator interface will show all of the apps downloaded on the ownCloud server. The system administrator is to go into each individual application and change the configuration and settings of the applications.

5 CONCLUSION

The ownCloud environment has been fully implemented into the production environment with all applications fully functional. Installation and back up scripts have been created for easier and faster installations to meet business needs. The Affordable Cloud solution has achieved all requirements that were established by the team and is a complete product ready for a pilot customer.

Work Cited

OwnCloud | Secure File Access and File Sharing." OwnCloud. Accessed November 07, 2016. <https://owncloud.com/>.

SerenityNetworks. "How to Install OwnCloud on Ubuntu 14.04 LTS – Your Own Open Source Dropbox." SerenityNetworks. 2016. Accessed November 07, 2016. <http://serenity-networks.com/how-to-install-owncloud-on-ubuntu-14-04-lts-open-source-dropbox/>.