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Software Engineering Focus

Final Deliverable

Project Title: NextAzure

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Abstract

This document presents the information necessary to gain a good understanding of the NextAzure project, an application that allows Azure users to interact with the portal from NextCloud. Users are able to sign into Azure from NextCloud and view their Subscriptions, Resource Groups, Virtual Machines, App Services, Database Servers, Databases, and Storage Accounts.

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INTRODUCTION

NextAzure is an application developed for NextCloud that allows users to interact with the Microsoft Azure portal from the NextCloud website. Using Microsoft Azure's REST API, NextAzure can get information about users' services and applications from the Azure portal, send information about users' desired actions back to the Azure portal, and even allow users to create or delete their services and applications on the Azure portal.

Purpose of New System

Much of NextCloud's audience are tech-enthusiasts, so it is likely that many of them are users of Microsoft Azure services. While there are many apps on the NextCloud app store, ranging from video calling apps to cookbook apps, there are none that allow users to interact with the Azure portal. NextAzure gives users the ability to do so.

USER STORIES

The following section provides the detailed user stories that were implemented in this iteration of the NextAzure project. These user stories served as the basis for the implementation of the project's features. This section also shows the user stories that are to be considered for future development.

Implemented User Stories

1. As a user, I would like to sign into the Microsoft Azure portal from NextCloud.
2. As a user, I would like to be redirected back to NextCloud once I have finished signing into the Microsoft Azure portal.
3. As a user, I would like to view a list of my Microsoft Azure subscriptions from NextCloud.
4. As a user I would like to view a list of my Microsoft Azure virtual machines from NextCloud.
5. As a user, I would like information from my Microsoft Azure portal to be presented in a table format from NextCloud.
6. As a user, I would like to view a list of my Microsoft Azure database servers from NextCloud.
7. As a user, I would like to view a list of my Microsoft Azure databases within each database server from NextCloud.
8. As a user, I would like to view a list of my Microsoft Azure storage accounts from NextCloud.

9. As a user, I would like to view the status of my Microsoft Azure virtual machines from NextCloud.
10. As a user, I would like to start my Microsoft Azure virtual machines from NextCloud.
11. As a user, I would like to stop my Microsoft Azure virtual machines from NextCloud.
12. As a user, I would like to restart my Microsoft Azure virtual machines from NextCloud.
13. As a user, I would like to view a list of my Microsoft Azure app services from NextCloud.
14. As a user, I would like to view the status of my Microsoft Azure app services from NextCloud.
15. As a user, I would like to start my Microsoft Azure app services from NextCloud.
16. As a user, I would like to stop my Microsoft Azure app services from NextCloud.
17. As a user, I would like to restart my Microsoft Azure app services from NextCloud.
18. As a user, I would like to view a list of my Microsoft Azure resource groups from NextCloud.
19. As a user, I would like to create a new Microsoft Azure resource group from NextCloud.
20. As a user, I would like to delete a Microsoft Azure storage account from NextCloud.

Pending User Stories

1. As a user, I would like to pause my Microsoft Azure databases from NextCloud.
2. As a user, I would like to resume my Microsoft Azure databases from NextCloud.
3. As a user, I would like to create a new Microsoft Azure storage account from NextCloud.

PROJECT PLAN

This section describes the planning that went into the realization of this project. This project incorporated the agile development techniques and as such required the sprints to be planned. These sprint plannings are detailed in the section. This section also describes the components, both software and hardware, chosen for this project.

Hardware and Software Resources

The following is a list of all hardware and software resources that were used in this project:

- NextCloud
- Azure REST API
- Azure Entra ID
- Ubuntu 20.04.6
- Docker
- Visual Studio Code
- Postman
- GitHub

Sprint Plan

Sprint 1

Project: *Nextcloud App: Enhancing the Security of Microsoft Azure Applications*

Attendees: *Athena Scarlett, Lucas Villoch*

Start time: 9:00 PM

End time: 9:32 PM

After discussion, the team's velocity was estimated to be 6 tasks.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- Know how to use NextCloud
- Set up environment
- Gain basic knowledge of API
- Update Cybersecurity
- Download Nextcloud Mobile
- Download Nextcloud Talk

The team members indicated their willingness to work on the following user stories.

- Athena Scarlett
 - Know how to use NextCloud
 - Set up environment
 - Gain basic knowledge of API
 - Update Cybersecurity
 - Download Nextcloud Mobile
 - Download Nextcloud Talk
- Lucas Villoch
 - Know how to use NextCloud
 - Set up environment
 - Gain basic knowledge of API
 - Update Cybersecurity
 - Download Nextcloud Mobile
 - Download Nextcloud Talk

Sprint 2

Project: Nextcloud App: Enhancing the Security of Microsoft Azure Applications

Attendees: Athena Scarlett, Lucas Villoch, Bradley Consuegra

Start time: 4:00 PM

End time: 4:33 PM

After discussion, the team's velocity was estimated to be 10 tasks.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

1. Learn Azure REST API
2. Develop design document (diagram and use cases) for Event App
3. Describe features/requirements
4. Create user stories
5. Create object diagrams
6. Create class diagrams
7. Create scenario diagrams
8. Create sequence diagrams
9. Create database diagram
10. Create use cases

The team members indicated their willingness to work on the following user stories.

- Athena Scarlett
 - Learn Azure REST API
 - Develop design document (diagram and use cases) for Event App
 - Create user stories
 - Create use cases
- Lucas Villoch
 - Learn Azure REST API
 - Develop design document (diagram and use cases) for Event App
 - Create sequence diagrams
 - Create class diagrams
- Bradley Consuegra
 - Learn Azure REST API
 - Develop design document (diagram and use cases) for Event App
 - Create database diagram
 - Create scenario diagrams

Sprint 3

Project: Nextcloud App: Enhancing the Security of Microsoft Azure Applications

Attendees: Athena Scarlett, Lucas Villoch, Bradley Consuegra

Start time: 4:14 PM

End time: 4:23 PM

After discussion, the team's velocity was estimated to be 2 tasks.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

1. Populate azure account info on nextcloud app by end of sprint
 - Set up REST API on personal machine
 - Apply REST API code to Nextcloud app

The team members indicated their willingness to work on the following user stories.

- Athena Scarlett
 - Populate azure account info on nextcloud app by end of sprint
 - Set up REST API on personal machine
 - Apply REST API code to Nextcloud app
- Lucas Villoch
 - Populate azure account info on nextcloud app by end of sprint
 - Set up REST API on personal machine
 - Apply REST API code to Nextcloud app
- Bradley Consuegra
 - Populate azure account info on nextcloud app by end of sprint
 - Set up REST API on personal machine
 - Apply REST API code to Nextcloud app

Sprint 4

Project: Nextcloud App: Enhancing the Security of Microsoft Azure Applications

Attendees: Athena Scarlett, Lucas Villoch, Bradley Consuegra

Start time: 4:17 PM

End time: 4:23 PM

After discussion, the team's velocity was estimated to be 3 tasks.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

1. Populate azure account info on nextcloud app by end of sprint
 - Change Nextcloud CSP to allow Microsoft login
 - Focus on different API functions on Nextcloud, 1 per developer
 - Save Microsoft account data to Nextcloud

The team members indicated their willingness to work on the following user stories.

- Athena Scarlett
 - Change Nextcloud CSP to allow Microsoft login
 - Focus on different API functions on Nextcloud, 1 per developer
 - Save Microsoft account data to Nextcloud
- Lucas Villoch
 - Populate azure account info on nextcloud app by end of sprint
 - Change Nextcloud CSP to allow Microsoft login
 - Focus on different API functions on Nextcloud, 1 per developer
 - Save Microsoft account data to Nextcloud
- Bradley Consuegra
 - Change Nextcloud CSP to allow Microsoft login
 - Focus on different API functions on Nextcloud, 1 per developer
 - Save Microsoft account data to Nextcloud

Sprint 5

Project: Nextcloud App: Enhancing the Security of Microsoft Azure Applications

Attendees: *Athena Scarlett, Lucas Villoch, Bradley Consuegra*

Start time: *4:09 PM*

End time: *4:14 PM*

After discussion, the team's velocity was estimated to be 5 tasks.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

1. Create Nextcloud page to display API info
2. Have multiple API calls run on the app
 - VMs
 - Databases
 - Account Storage
 - Subscriptions

The team members indicated their willingness to work on the following user stories.

- Athena Scarlett
 - Create Nextcloud page to display API info
 - Have multiple API calls run on the app
 - VMs
 - Databases
 - Account Storage
 - Subscriptions
- Lucas Villoch
 - Create Nextcloud page to display API info
 - Have multiple API calls run on the app
 - VMs
 - Databases
 - Account Storage
 - Subscriptions
- Bradley Consuegra
 - Create Nextcloud page to display API info
 - Have multiple API calls run on the app

- VMs
- Databases
- Account Storage
- Subscriptions

Sprint 6

Project: Nextcloud App: Enhancing the Security of Microsoft Azure Applications

Attendees: Athena Scarlett, Lucas Villoch, Bradley Consuegra

Start time: 5:27 PM

End time: 5:29 PM

After discussion, the team's velocity was estimated to be 5 tasks.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

1. Create Nextcloud page to display API info
2. Have multiple API calls run on the app
 - Databases
 - Account Storage

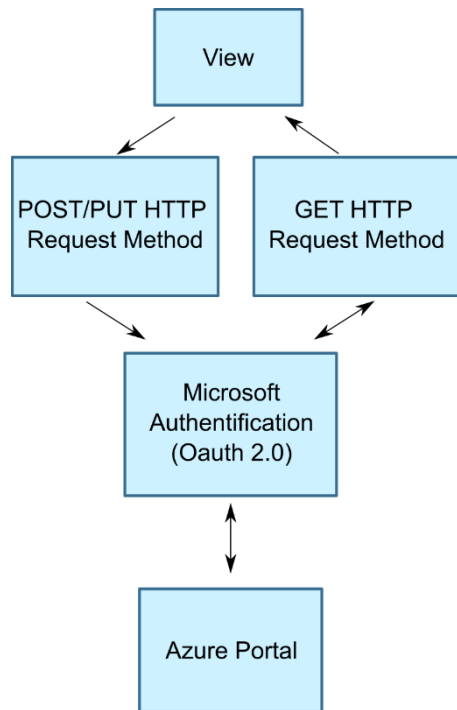
The team members indicated their willingness to work on the following user stories.

- Athena Scarlett
- Lucas Villoch
 - Create Nextcloud page to display API info
 - Have multiple API calls run on the app
 - Databases
 - Account Storage
- Bradley Consuegra
 - Create Nextcloud page to display API info
 - Have multiple API calls run on the app
 - Databases
 - Account Storage

SYSTEM DESIGN

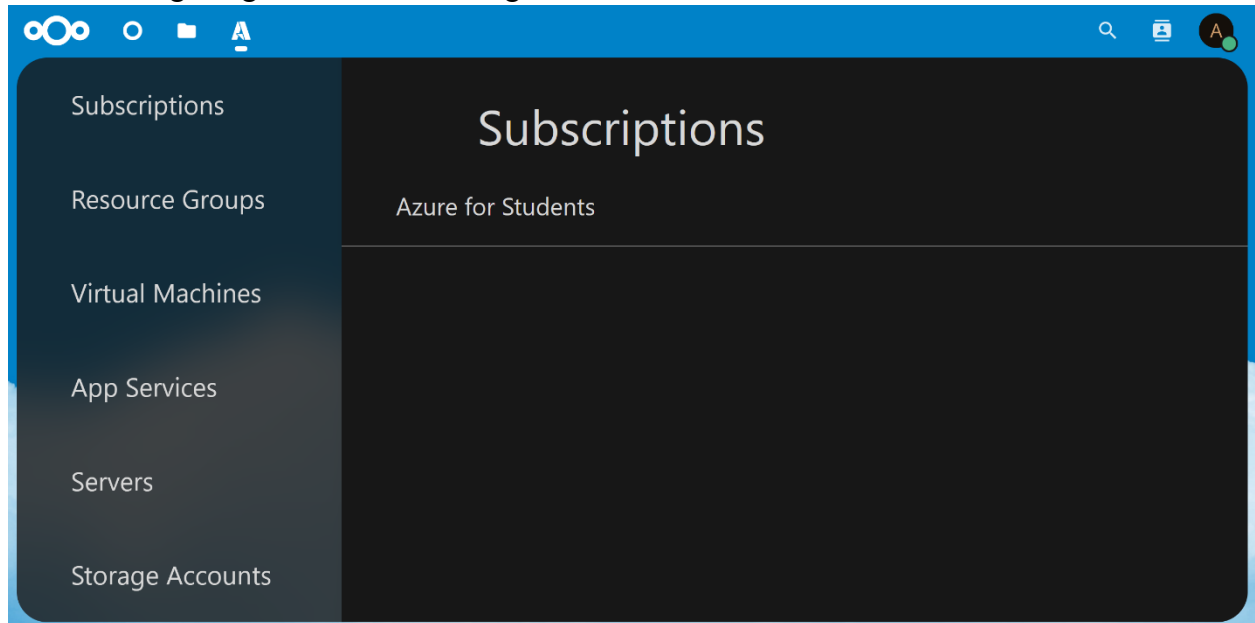
This section contains information on the design decisions that went into this project. The architecture patterns are outlined and explained. The entire system is shown in a package diagram and the subsystems are explained. Finally, the design patterns used in the project are discussed.

Architectural Patterns



User Interface

The following images are the final designs for NextAzure's user interface.



The top screenshot shows the Azure portal's 'Virtual Machines' page. The left sidebar contains navigation links: Subscriptions, Resource Groups, Virtual Machines, App Services, Servers, and Storage Accounts. The main content area has a title 'Virtual Machines' and a table with columns 'Name' and 'Status'. The table lists two VMs: 'Ubuntu-VM-1' (VM deallocated) and 'Debian-VM-1' (VM running). Action buttons 'Start VM', 'Stop VM', and 'Restart VM' are visible next to the VM names.

Name	Status
Ubuntu-VM-1	VM deallocated
Debian-VM-1	VM running

The bottom screenshot shows the Azure portal's 'Resource Groups' page. The left sidebar is the same. The main content area has a title 'Resource Groups'. A modal dialog titled 'Create New Resource Group' is open, showing fields for 'Resource Group Name' (with a placeholder 'Enter Resource Group Name') and 'Resource Group Location' (with a dropdown menu 'Please Select a Location'). A 'Submit' button is at the bottom of the modal. A 'Create New Resource Group' button is also visible at the bottom of the main content area.

SYSTEM VALIDATION

Team collaboration and version control were maintained via GitHub. New contributions to the project were first tested on the team members' local machine before a pull request was created in the project's repository. Once the pull requests were reviewed and approved by each team member, they were merged with the main branch of the app repository. If a pull request wasn't approved, feedback was given to the team member who created the pull request, and the team member would rework the contribution with the feedback in mind.

GLOSSARY

- API: Acronym for Application Program Interface. APIs allow programs to communicate and share information among each other.
- NextCloud: A suite of open-source software used primarily for file storage and file hosting services. NextCloud allows for the development and hosting of independent apps onto the NextCloud platform.
- Microsoft Azure: A cloud computing platform that allows for the development and management of applications and computer services.
- Microsoft Azure portal: A website that is the main hub for accessing Microsoft Azure's services and feature.
- Azure REST API: An API that allows other programs to communicate with the Microsoft Azure portal.

APPENDIX

Appendix A - Sprint Review Reports

Sprint 1

***Project:** Nextcloud App: Enhancing the Security of Microsoft Azure Applications*

***Attendees:** Athena Scarlett, Lucas Villoch, Bradley Consuegra*

***Start time:** PM*

***End time:** PM*

After discussion, the team's velocity was estimated to be 6 tasks.

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners:

- Know how to use NextCloud
- Set up environment
- Gain basic knowledge of API
- Update Cybersecurity
- Download Nextcloud Mobile
- Download Nextcloud Talk

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- No stories were rejected

Sprint 2

***Project:** Nextcloud App: Enhancing the Security of Microsoft Azure Applications*

***Attendees:** Athena Scarlett, Lucas Villoch, Bradley Consuegra*

***Start time:** 8:07 PM*

***End time:** 8:08 PM*

After discussion, the team's velocity was estimated to be 5 tasks.

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners:

- Have NextCloud environment running

- Reviewing Developer's manual for environment and app set up
- Create an "Azure" App on Nextcloud
- Sign in using Azure credentials
- API returns number of virtual machines in the environment

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- No stories were rejected

Sprint 3

Project: Nextcloud App: Enhancing the Security of Microsoft Azure Applications

Attendees: Athena Scarlett, Lucas Villoch, Bradley Consuegra

Start time: 8:07 PM

End time: 8:08 PM

After discussion, the team's velocity was estimated to be 2 tasks.

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners:

- Populate azure account info on nextcloud app by end of sprint
 - Set up REST API on personal machine
 - Apply REST API code to Nextcloud app

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- No stories were rejected

Sprint 4

Project: Nextcloud App: Enhancing the Security of Microsoft Azure Applications

Attendees: Athena Scarlett, Lucas Villoch, Bradley Consuegra

Start time: 2:37 PM

End time: 2:39 PM

After discussion, the team's velocity was estimated to be 2 tasks.

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners:

- Populate azure account info on nextcloud app by end of sprint
 - Change Nextcloud CSP to allow Microsoft login
 - Focus on different API functions on Nextcloud, 1 per developer
 - Save Microsoft account data to Nextcloud

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- No stories were rejected

Sprint 5

Project: Nextcloud App: Enhancing the Security of Microsoft Azure Applications

Attendees: Athena Scarlett, Lucas Villoch, Bradley Consuegra

Start time: 2:37 PM

End time: 2:39 PM

After discussion, the team's velocity was estimated to be 2 tasks.

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners:

- Create Nextcloud page to display API info
- Have multiple API calls run on the app
 - VMs
 - Databases
 - Account Storage
 - Subscriptions

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- No stories were rejected

Sprint 6

Project: Nextcloud App: Enhancing the Security of Microsoft Azure Applications

Attendees: Athena Scarlett, Lucas Villoch, Bradley Consuegra

Start time: 10:37 PM

End time: 10:39 PM

After discussion, the team's velocity was estimated to be 2 tasks.

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners:

- Create Nextcloud page to display API info
- Have multiple API calls run on the app
 - Databases
 - Account Storage

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- No stories were rejected

Appendix B – NextAzure Installation Manual

NOTES

NextAzure currently works only for Microsoft users that are not affiliated with an organization and that are invited by NextAzure admins.

The installation instructions are for the Windows operating system and much of the instructions are taken from the development environment installation tutorial provided by NextCloud, [which can be found here](#). If you would like, you may follow the instructions on the NextCloud website before returning to Step 8 in this manual to complete the installation of NextAzure.

Step 1: Prerequisites

To begin installing the NextCloud development environment, you will need:

- A recent Windows build of version 20262 or newer
- Windows 11 64-bit Home or Pro version 21H2 or higher, or Enterprise or Education version 21H2 or higher OR Windows 10 64-bit Home or Pro 21H1 (build 19043) or higher, or Enterprise or Education 20H2 (build 19042) or higher.
- 8GB system RAM or more
- SSD system-storage with at least 40GB free space
- 4-core
- 8-threads CPU
- Administrator access to the computer you will be using
- An internet browser. Firefox is heavily recommended for NextAzure

Step 2: Installing WSL 2

1. Open the Windows Command Prompt in administrator mode by right-clicking and selecting 'Run as Administrator.'
2. Enter the following command: `wsl --install -d Ubuntu-20.04`
3. Follow the installation procedure.
 - a. If you get the error WSL 2 requires an update to its kernel component. For information, please visit <https://aka.ms/wsl2kernel> , visit the link, download the kernel, and install the kernel.

Step 3: Setting up Ubuntu

1. Open 'Ubuntu' through the windows start menu
2. You will be asked to create a User Name and Password for your Linux distribution.
 - a. This User Name and Password is specific to each separate Linux distribution that you install and has no bearing on your Windows user name.
 - b. Please note that whilst entering the Password, nothing will appear on screen. This is called blind typing. You won't see what you are typing, this is completely normal.

Step 4: Setting Up Docker

1. Go to <https://www.docker.com/products/docker-desktop/> Click on the download link for Windows users. This will download a .exe file.
2. When the download is finished, open the .exe file. Follow the installation procedure.
3. When the installation procedure is finished, you might get a prompt to restart your computer. If you get this prompt, restart your computer.
4. Once installed, start Docker Desktop from the Windows Start menu, then select the Docker icon from the hidden icons menu of your taskbar. Right-click the icon to display the Docker commands menu and select "Settings".
5. Read and accept the terms of service when prompted.
6. Ensure that "Use the WSL 2 based engine" is checked in **Settings > General**
7. Ensure that the Ubuntu distributions are selected in Settings > Resources > WSL Integration.
8. To confirm that Docker has been installed, open a WSL distribution (e.g. Ubuntu) and display the version and build number by entering: `docker --version`
9. Inside ubuntu some docker commands can only be run by members of the docker group. Add your user to the group so you can run docker commands easily (Replace user_name with your login): `sudo usermod -aG docker user_name`
10. Confirm that the following command works: `docker ps`
 - a. The output should be: `CONTAINER ID IMAGE COMMAND CREATED STATUS PORT NAMES`
 - b. If the command `docker ps` does not work, you might be able to fix this by toggling the WSL integration in docker desktop off and on.

Step 5: Installing nvm and node in Ubuntu

1. Open Ubuntu and make sure it is up to date by running: `sudo apt update && sudo apt upgrade`
2. Install curl by running: `sudo apt install curl`

3. Install nvm by running: `curl -o- https://raw.githubusercontent.com/nvm-sh/nvm/master/install.sh | bash`
4. Check if nvm is working and see which versions of node are installed by running: `nvm ls`
 - a. There should be no versions of node
5. Install node 16 by running: `nvm install 16`
6. Check if node and npm are installed:
 - a. `node --version`
 - b. `npm --version`

Step 6: Editing your host file

1. Run a text editor program such as Notepad as an administrator
2. In Notepad, click **File> Open**
3. Navigate to `C:\Windows\System32\drivers\etc`
4. In the lower-right corner, just above the **Open** button, click the drop-down menu to change the file type to **All Files**.
5. Select “hosts” and click **Open**.
6. Add the following entry to the bottom of the host file and save the file:
 - a. `127.0.0.1 nextcloud.local`

Step 7: Install git and nextcloud-docker-dev

1. Install the git version control system by running: `sudo apt install git`
2. Clone the nextcloud-docker-dev development environment for Nextcloud and follow the simple master setup to download and install Nextcloud by running the following commands:
 - a. `git clone https://github.com/juliushaertl/nextcloud-docker-dev.git`
 - b. `cd nextcloud-docker-dev`
 - c. `./bootstrap.sh`
 - d. `sudo sh -c "echo '127.0.0.1 nextcloud.local' >> /etc/hosts"`

Step 8: Installing NextAzure

1. Navigate to NextCloud’s apps folder by running: `cd workspace/server/apps`
2. Clone the NextAzure repository by running: `git clone https://github.com/BrdfrdC/azure-nextcloud`
3. Ensure that you have the require npm packages by running the following commands:
 - a. `npm i webpack`
 - b. `npm i jwt-decode`
4. Run the following command to ensure the compiled source script is up to date:
 - a. `npm run dev`

Step 9: Updating Certificates

1. Navigate back to the NextCloud root folder by running: `cd ~/nextcloud-docker-dev`
2. Update NextCloud's certificates by running the following commands:
 - a. `sudo apt install libnss3-tools`
 - b. `./scripts/update-certs`

Step 10: Running NextAzure

1. Start NextCloud by running: `docker-compose up nextcloud-proxy`
2. Open your browser of choice and navigate to <https://nextcloud.local>
 - a. If prompted to sign in: use "admin" as the username and password
3. Click on the profile avatar on the top right and navigate to **Apps**
4. Find "Azure" within the list of apps and enable it