

Building a Scalable IT Infrastructure Using AWS Cloud.

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Summary

Modulo is a startup company that was preparing to begin operations during the project. Today, the company offers IT solutions to small businesses and non-profits. However, when the project began, Modulo lacked any existing systems, services, or IT infrastructure. Establishing a reliable IT infrastructure was essential for the company to serve clients, so this project was needed to create one.

The Modulo team chose a remote-first model for their company to allow employees to work from anywhere, and they implemented it using a public cloud provider to minimize upfront costs. Amazon Web Services (AWS) was chosen as the company's cloud platform provider. When setting up its cloud infrastructure, Modulo identified several top priorities:

1. Creating a website.
2. Providing employees with email addresses.
3. Implementing a cloud collaboration platform.
4. Provisioning virtual workstations.
5. Protecting against data loss.

Modulo's implementation plan comprised several key steps to create a comprehensive and secure IT infrastructure. The first step involved creating a website to communicate the company's offerings, pricing, and contact information to potential clients. The team developed the website in-house and hosted it on AWS Simple Storage Service (S3). AWS WorkMail was configured to provide email service. A virtual server was set up on AWS Elastic Compute Cloud (EC2), and Nextcloud was installed. An AWS S3 bucket was connected to the Nextcloud server as the pri-

mary storage medium, and the server was integrated with Microsoft Active Directory to manage access controls and file permissions. Next, DNS was configured in AWS Route 53 to make the website, email, and Nextcloud servers accessible to end-users via memorable web addresses. Then, AWS WorkSpaces was configured to provide a virtual workstation for each employee. Once all systems and services were operational, all EC2 instances were imaged, and all data was backed up to create the baseline recovery point. All backups and images were tested to ensure a smooth recovery process, and a routine backup plan was implemented to safeguard data on an ongoing basis. These IT components addressed Modulo's immediate business needs, provided room for future growth, and increased the chances of meeting the deadline to start operations.

Review of Other Work

Review of Work 1

The Accessible Web RAMP User Guide (*Accessible Web RAMP User Guide*, n.d.) explains how to use Accessible Web's RAMP tools to identify website accessibility issues and provide remediation recommendations. When the Modulo team was creating the company's public website, the RAMP tools helped ensure that the website adequately met Modulo's commitment to accessibility. This guide was referenced while testing the website to ensure it was ready for deployment in a production environment.

Review of Work 2

Modulo's team used the AWS WorkSpaces Administration Guide (*Get Started with WorkSpaces Advanced Setup - Amazon WorkSpaces*, n.d.) while implementing the company's virtual desktop infrastructure. The guide provides step-by-step instructions for setting up and managing AWS

WorkSpaces. The networking and directory services sections were particularly beneficial when integrating Microsoft Active Directory.

Review of Work 3

When setting up Modulo's email service, the team followed The Amazon WorkMail User Guide (*Getting Started with Amazon WorkMail - Amazon WorkMail*, n.d.). The guide contains technical instructions for using WorkMail as an organization's email provider. The team referenced it when setting up the company's WorkMail site and again when providing user email access by connecting Nextcloud's email client to the WorkMail site.

Review of Work 4

AWS WorkSpaces was chosen as the company's virtual desktop solution after considering the viability and cost-effectiveness of various protocols and Desktop-as-a-Service (Daas) providers detailed in the paper (Magaña et al., 2019). RDP, ICA, TeamViewer, VNC, and PCoIP protocols were tested, and several service providers, including TeamViewer, Citrix, and AWS WorkSpaces, were compared in the paper.

Several use cases were tested, including standard office work, web browsing, and video streaming. AWS WorkSpaces (based on PCoIP) used more bandwidth than competing services. However, it provided a "reasonable quality" for all tested use cases. The conclusions of this paper were a significant influence when Modulo selected AWS WorkSpaces to reduce the networking complexity required to build its intranet and to stick with a single vendor relationship for most of its infrastructure.

Review of Work 5

The Nextcloud Installation and Server Configuration manual (Nextcloud GmbH, n.d.) provides instructions for setting up a Nextcloud server. The manual outlines system requirements, deployment recommendations, detailed installation instructions, hardening and security guidance, and performance tuning advice. This manual was referenced countless times during nearly every step of the Nextcloud setup process, especially when following the official all-in-one installation method, which provided the most comprehensive set of features in the best-supported way.

Review of Work 6

The Service Level Agreement (SLA) for AWS S3, as described in the (*Service Level Agreement – Amazon Simple Storage Service (S3) – AWS*, 2023), guarantees a monthly uptime of 99.9%, ensuring the reliability of the service. In case of any failure to meet this goal, Modulo is eligible for a service credit, the amount of which depends on the extent of the downtime. Modulo examined this article when choosing web hosting and storage solutions and again when formalizing the project's success metrics. It is also an essential reference document for ensuring that Modulo continues receiving the level of service it is paying for.

Review of Work 7

An article from the AWS documentation explains how to use Simple Storage Service (S3) to host a static website. (*Tutorial: Configuring a Static Website on Amazon S3 - Amazon Simple Storage Service*, n.d.) This guide was followed while deploying Modulo's public website and was also referenced when verifying that Modulo's website met the company's technical requirements.

Changes to the Project Environment

Original Environment: Modulo existed only on paper and had no physical or digital presence. The company was starting from scratch and had to implement numerous systems and services before serving its first client. Modulo's business needs had to be evaluated, and a comprehensive plan had to be created before technology purchasing decisions and implementation work could begin. The development team planned to be a remote-first organization with employees world-wide, requiring a website, collaborative cloud platform, and virtual workstation infrastructure. Despite the challenges of starting from scratch, without an existing IT infrastructure in place or legacy systems to consider, Modulo had a blank slate and greater flexibility to implement modern best practices from day one.

New Environment: The project team built a website that provided general information about the business, listed available services, and offered a contact form so clients could initiate dialogue with Modulo's sales team. Next, the company's email service was configured using AWS Work-Mail. Each employee was given an email address, and an email client was set up for each user so they could access their mailbox. Then, a scalable Nextcloud server was launched on AWS EC2 to facilitate collaborative teamwork through real-time document editing, file sharing, and video conferencing. Once these core services were set up, remotely-accessible virtual workstations were implemented using AWS WorkSpaces. Finally, a robust backup solution was configured to protect the company against data loss and unexpected downtime. Now that the project is complete, Modulo has a functional IT infrastructure and can serve its first clients.

Methodology

Waterfall Methodology was chosen to implement Modulo's IT infrastructure. This decision was based on the project's well-defined requirements and results. Waterfall is a linear project management approach that offers a sequential flow of stages. Each project progresses through the following stages:

Analysis → Design → Construction → Testing → Deployment and Maintenance.

Analysis: Project objectives, requirements, and constraints are identified.

Design: A plan to meet the project requirements is created.

Construction: The plan is executed, and the necessary infrastructure is built.

Testing: The project is tested to verify that the end product meets the project requirements.

Deployment and Maintenance: The project is deployed into a production environment, and ongoing maintenance ensures continued function.

Analysis: Potential solutions for Modulo's technology needs were determined by analyzing factors such as scalability, performance, security, cost-effectiveness, and regulatory compliance.

Implementing an internal network, workstations, a public website, and a collaborative cloud platform were identified as essential IT functions required for the business to commence operations.

Design: A design plan was agreed upon to ensure the successful implementation of the company's infrastructure. AWS was chosen as the core infrastructure provider due to its minimal upfront costs and employee familiarity with the platform. At the same time, they decided on Nextcloud as the company's cloud collaboration platform due to its vendor neutrality. Once the

core infrastructure was chosen, the plan prioritized other objectives based on dependence and business criticality. First, the team would register an AWS account. Creating a public website was identified as the next highest priority because it would be essential for onboarding new clients and ensuring cash flow. Business emails would then be set up to maintain a consistent and professional brand image when corresponding with clients. Nextcloud would then be implemented, after which a web domain would be registered and DNS configured for global accessibility. Finally, employee workstations would be provisioned for security, and regular data backups would be performed.

Construction: During this stage, the Modulo development team completed the tasks identified in the previous stage. A root AWS account was created, and the company's public website was coded based on planning phase requirements. Once completed, the website was deployed using AWS S3. Meanwhile, AWS Workmail was configured to provide employee and department email accounts. Afterward, the company's Nextcloud server was set up using an AWS EC2 instance and an S3 bucket for file storage. Nextcloud Enterprise and Hub app bundles were installed to provide collaborative features and directory plugins for integrating Microsoft Active Directory. Once installed, the domain modulo-technologies.com was registered, and DNS records were configured in AWS Route 53. When the servers are publicly accessible, an internal Microsoft Active Directory EC2 instance was created for centralized authentication and virtual workstations for each employee were created using AWS Workspaces. The workstations and Nextcloud server were connected to Active Directory using virtual networking to establish a simple intranet. Finally, baseline backup images were created, a Recovery Point Objective and Recovery Time Objective were determined, and regular backups were scheduled accordingly.

Testing: After completing the construction phase, the team conducted extensive testing to ensure the implemented systems' quality, functionality, and fulfillment of the business needs. The website was tested for functionality, accessibility, security, and compatibility with various browsers. Test emails were sent and received to ensure Workmail functioned as expected. Nextcloud's performance under load was tested to ensure it could handle large files and many simultaneous users. DNS configuration were verified by connecting to each server using its registered domain name, and the critical functions of each user's workstation, such as user authentication and application performance, were tested to ensure an acceptable user experience. Finally, the system backup images were tested by creating EC2 instances that ran parallel to the production environment, and traffic was redirected to those backup instances.

Deployment & Maintenance: Each system and service was deployed into a production environment during the project's deployment and maintenance phase. Ongoing maintenance will ensure the continued functionality of each component by regularly monitoring performance metrics and collecting user feedback to identify issues and areas for improvement. Frequent updates will be performed using a testing environment before production deployment to keep all systems stable and secure.

Project Goals and Objectives

F1. Goals, Objectives, and Deliverables Table

Goal	Supporting Objectives	Deliverables enabling the project objectives
Set up the necessary IT infrastructure for the business to commence operations.	a. Created a public website.	a.i. Registered an AWS root account for the company.
		a.ii. Wrote HTML, CSS, and JS for the website Home Page.
		a.iv. Wrote HTML, CSS, and JS for the website Contact Page.
		a.iv. Wrote HTML, CSS, and JS for the website Contact Page
		a.v. Configured AWS S3 static site hosting.
		a.vi. Registered a TLS certificate for the website.
	b. Set up business email.	b.i. Set up AWS Workmail for the company.
		b.ii. Created a shared "Sales" email address for initial customer contact.
		b.iii. Created individual email accounts for each Modulo employee.
	c. Configured a Nextcloud instance.	c.i. Configured an AWS EC2 instance and installed Nextcloud.
		c.ii. Used Let's Encrypt to create and register a TLS certificate for the Nextcloud server.
		c.iii. Created an AWS S3 bucket and configured Nextcloud to use this bucket for Pay As You Go unlimited storage capacity.
		c.iv. Linked Nextcloud instance with the company's MS Active Directory server to manage users and file permissions.
		c.v. Set up Nextcloud Talk for each employee and created a "Guest" account for potential clients.
Set up the necessary IT infrastructure for the business to commence operations.	d. Configured DNS.	d.i. Used AWS Route 53 to rent necessary domains.
		d.ii. Configured nextcloud.modulo-tech.com to point to the company's Nextcloud instance.
		d.iii. Configured www.modulo-tech.com to point to the company's public website.
		d.iv. Configured DNS MX record to point to the company's mail server.
	e. Created employee workstations.	e.i. Configured Microsoft Active Directory to create users and groups representing each department and employee.
		e.ii. Configured AWS Workspaces to provision a virtual desktop for each employee.
		e.iii. Configured virtual networking to connect

		all employee workstations and internal servers on a private virtual network.
	f. Created and tested backups.	f.i. Created baseline backup images of EC2 instance(s).
		f.ii. After a full baseline backup was performed, S3 backup intervals were adjusted to comply with Modulo's recovery point objective and recovery time objective.
		f.iii. Used backup images to create parallel instances on EC2 to verify that restoration to a fully functional baseline did not encounter errors.
		f.iv. Ensured S3 was configured for object versioning and replication across regions to protect against accidental data loss and unexpected downtime.

F2. Goals, Objectives, and Deliverables Descriptions

Goal: The IT infrastructure necessary to meet Modulo's communication, collaboration, and data management requirements needed to be configured and fully functional by June 15, 2024. Despite minor problems, the project successfully met Modulo's IT needs before the deadline.

Objective a: A public website is essential for any business looking to establish credibility, compete effectively, and reach potential clients. Modulo's website was created to streamline the sales process and improve the overall customer experience by providing service offerings, pricing, and contact details in one central location. First, an AWS root account was registered to manage and provision Modulo's IT infrastructure, including its public website. Next, a home page, an about page, and a contact page were designed and coded. Then, each webpage's HTML, CSS, and JS files were uploaded to AWS Simple Storage Service (S3), and S3 static hosting was configured to serve the webpages to visitors' web browsers. Afterward, a TLS certificate for Modulo's website was registered to encrypt the data sent between the website and users' devices. Encrypting

web traffic is an important security measure that protects sensitive customer information and is essential for establishing trustworthiness with visitors.

Objective b: Email provides a standard way for employees, clients, and partners to communicate and was the second highest priority service during the project. AWS Workmail is the managed email service implemented to allow Modulo to manage email for all its employees and departments without navigating the challenges of self-hosting email. A shared "Sales" email address was created so the sales department employees could handle customer inquiries more efficiently and professionally. Email accounts were also created for each employee to maintain a consistent brand image when communicating with external clients and partners.

Objective c: Modulo's employees also needed an IT solution to provide file storage, file collaboration, team communication, and calendar coordination. An AWS EC2 instance was provisioned, Nextcloud was installed, and a TLS certificate was registered for the server. The security certificate will encrypt all data transferred to and from the company's Nextcloud instance. This critical security measure will significantly reduce the risk of compromised sensitive data. An AWS S3 bucket was connected to the Nextcloud server as its primary storage medium. The S3 bucket stores files much more cost-effectively than attaching additional storage directly to the EC2 instance and automates the management of file versioning. Microsoft Active Directory was then connected to the Nextcloud server to allow the company to manage user access and group policies centrally, thus eliminating the redundant effort required to administer group policies separately for each service and improving security by reducing the likelihood of a misconfiguration.

Finally, Nextcloud Talk, Modulo's video conferencing solution, was installed for all employees so they could collaborate remotely.

Objective d: DNS (Domain Name System) is necessary for translating Modulo's human-friendly domain name (www.Modulo-Tech.com) into an IP address that visitors' computers use to access the company's website. The necessary domains were rented through the AWS Route 53 domain registrar, and DNS A and AAAA records were created for the company's website and Nextcloud server, thus enabling users to access the company's website and cloud collaboration platform with easy-to-remember web addresses. A DNS MX record was configured to direct email traffic to the company's email server IP address.

Objective e: Providing a dedicated workstation for each employee was imperative for security. If the company had not provided workstations, each employee would have needed to perform their work duties on their personal devices. Allowing personal devices to connect to the company's network or store sensitive customer data was an unacceptable security risk. For those reasons, AWS Workspaces was used to provide a secure virtual desktop for each employee.

First, users and groups were created in Microsoft Active Directory to centrally manage access to resources, applications, and data within employees' virtual desktop environments. Once Active Directory was implemented, a workstation was created for each employee using AWS Workspaces. Employee workstations and the company's servers were connected using a virtual private network to provide an additional layer of security that decreases the chance of sensitive data being captured during transit.

Objective f: Once Modulo's systems and services were operational, baseline backup images of the EC2 instances were created. Backups are essential for safeguarding the company's data from accidental loss or corruption because they minimize the negative impact on productivity when data loss occurs. Regular backup recovery tests are equally crucial for identifying faults in the backup system and allowing them to be corrected safely.

The implemented backup plan balanced critical data protection with financial cost and system performance. An RPO was determined based on how much data Modulo could afford to lose during an incident, and an RTO was determined based on how much downtime was acceptable. Together, the RPO and RTO determined the frequency of backups and imaging.

The baseline EC2 backup images were used to test the backup process by creating new EC2 instances that ran parallel to Modulo's production environment. Each time such a backup test is performed, the backup intervals are reviewed to verify that Modulo's backup practices align with its data protection requirements. Finally, object versioning and data replication across multiple regions were enabled for the Nextcloud S3 bucket to protect against accidental data loss and unexpected downtime by allowing employees to save and track changes to their files over time and revert to previous versions if necessary. This feature is especially useful in Modulo's collaborative environment, where multiple people work on the same files and projects. Enabling replication across multiple regions also reduced the risk of data loss due to outages in a single AWS region.

Project Timeline

Milestone or deliverable	Anticipated Duration	Actual Duration	Projected Start Date	Actual Start Date	Expected End Date	Actual End Date
Register AWS root account.	3 hours	1 hour	1-Apr-24	1-Apr-24	1-Apr-24	1-Apr-24
Code website.	80 hours	68 hours	1-Apr-24	1-Apr-24	12-Apr-24	11-Apr-24
Configure AWS S3 static site hosting.	3 hours	2 hours	15-Apr-24	12-Apr-24	15-Apr-24	12-Apr-24
Register TLS certificate for website.	1 hour	1 hour	15-Apr-24	12-Apr-24	15-Apr-24	12-Apr-24
Set up AWS Workmail for company email.	20 hours	23 hours	16-Apr-24	15-Apr-24	18-Apr-24	18-Apr-24
Install and Configure Nextcloud.	30 hours	40 hours	22-Apr-24	22-Apr-24	25-Apr-24	26-Apr-24
Register Domains and Configure DNS.	1 hour	1 hour	26-Apr-24	29-Apr-24	26-Apr-24	29-Apr-24
Configure Microsoft Active Directory.	72 hours	64 hours	29-Apr-24	30-Apr-24	9-May-24	8-May-24
Create virtual workstations.	12 hours	8 hours	13-May-24	9-May-24	15-May-24	9-May-24
Network all workstations and internal servers.	48 hours	46 hours	16-May-24	10-May-24	24-May-24	20-May-24
Create EC2 backup images.	3 hours	4 hours	27-May-24	21-May-24	27-May-24	21-May-24
Configure S3 backups according to RPO/RTO	12 hours	8 hours	28-May-24	22-May-25	30-May-24	22-May-24
Test backups and recovery images.	6 hours	8 hours	31-May-24	23-May-24	31-May-24	23-May-24
Unallocated buffer time.	40 hours	88 hours	3-Jun-24	24-May-24	7-Jun-24	7-Jun-24

Unforeseen delays were anticipated when planning for this project. Extra time was allocated for each task, and an additional week of buffer time was added at the end of the project. This contributed significantly to the successful completion of the project one week ahead of schedule. Additional time was saved due to employee familiarity with the AWS platform.

Despite finishing well ahead of schedule, there were some delays along the way. During initial stress testing of the Nextcloud server, the average CPU load exceeded the acceptable limit of 0.8. At that point, the server became less responsive, and usability significantly deteriorated. The issue was resolved by provisioning a more powerful EC2 instance and reinstalling Nextcloud. However, the whole process took 10 hours longer than expected.

Unanticipated Requirements

Modulo's original Nextcloud server was subjected to stress testing to ensure its capacity to serve many users simultaneously and to identify potential bottlenecks. This test simulated ten user sessions, including a 10GB file upload, a user uploading one hundred 1KB files, a 5GB folder sync, a complete server data backup, and two Nextcloud Talk video conferences involving three participants each. When evaluating the server's performance, the 15-minute CPU load average exceeded 0.8, and the server became less responsive. The resulting sluggish performance and lengthy response times were unacceptable, so the decision was made to provision an EC2 instance with more CPU cores. As a result, the entire process, including the instance upgrade and Nextcloud installation, took approximately 10 hours longer than initially anticipated. When the

test was rerun, the upgrade enabled the Nextcloud server to handle the stress test without exceeding a 0.8 15-minute CPU load average or exhibiting any noticeable performance issues.

During the project's construction stage, there was talk of expanding the project scope to include the implementation of Salesforce as a Customer Relationship Management (CRM) solution. A reliable CRM system could significantly improve Modulo's ability to manage a growing customer base and streamline its sales and marketing efforts. However, given the company's small size at that stage in its development, the team collectively agreed to prioritize servicing a few reliable customers before adding a new system and additional complexity to its IT stack. It was decided to revisit implementing a CRM solution as a separate project when the company is prepared to take on additional clients.

Some scope creep occurred when setting up virtual workstations for employees. This stage of the project was progressing smoothly and ahead of schedule when the employee implementing the virtual workstations got sidetracked ensuring that each workstation used the same company desktop wallpaper and then he revisited the theming and branding for the website, Nextcloud instance, and email signatures to ensure they were all consistent. Although this effort did not delay the overall project due to the availability of ample buffer time, it diverted attention and resources from higher-priority tasks that could have been addressed instead. While maintaining consistency in branding is important, it is crucial to ensure that multi-hour efforts fall within the project's intended scope. This experience served as a valuable reminder for the team to maintain a clear project focus and communicate effectively to mitigate the risks associated with scope creep.

Conclusions

This project set up the IT infrastructure necessary for Modulo, a managed service provider, to begin serving its first clients. Before this project, the company only existed on paper. The project succeeded in delivering the following outcomes:

1. The project team created a simple public website that implements industry best practices, using AWS cloud infrastructure to ensure global availability and maximum uptime, TLS encryption for protecting site visitors, and an accessibility audit to accommodate visitors using assistive technology. The two metrics for success were 99% monthly up-time according to AWS Cloud Watch and 0 critical or serious Web Content Accessibility Guidelines (WCAG) violations identified using Accessible Web's RAMP tool. Both metrics were satisfied before the company's go-live date. In the future, the website will continue to help Modulo attract potential clients and build trust in its brand.
2. An email system with accounts for each Modulo employee and shared mailboxes for departments and teams was created. The email system delivered 99.5% of the test emails that were part of the systems test, thus clearing the 99.0% delivery rate required for project success. Immediately following the project, Modulo's email system enabled and facilitated important communication between employees and clients while presenting a consistent and professional brand image. However, it also created a vector for malicious phishing attacks to be carried out against the company. Although a simple email system was sufficient to meet this project's requirements, it will be a high priority for the company to implement more robust email security measures and formal phishing awareness training.

3. A Nextcloud instance was created to meet the company's need for a cloud collaboration platform. The metric chosen to judge the acceptability of the server's performance was that the 15-minute CPU load average should never exceed 0.8. The server exceeded this limit during the first Nextcloud stress test, and the user interface was unacceptably unresponsive. A more powerful Nextcloud server was set up, the second stress test did not exceed the 0.8 threshold, and this project objective was successfully completed. As the company takes on additional clients and hires more employees the demands on the server will eventually necessitate a server upgrade. At that point, the company may choose to provision a more powerful EC2 instance, or it may be a better option to implement a more complex setup involving auto-scaling and load balancing.
4. Virtual workstations were created for each company employee. This greatly improved security by providing an alternative to storing sensitive company data on employees' personal devices. Once Modulo has had more time to establish its business with enough clients to ensure stable revenue, the company will provide laptops to each employee. Providing a standard laptop will eliminate many possible issues with the configuration of employee's personal devices, improve security, and will likely reduce the technical support workload on the IT team.
5. A robust backup system was put in place in which full system images of all servers are taken regularly, all working files are versioned, and differential data backups are carried out according to the RPO and RTO necessary for the company. For this system to be acceptable for production usage, 100% of data needed to be recoverable during backup test-

ing. All servers, workstations, and Nextcloud files were successfully recovered when testing was performed, so the system met the criteria for success. Over time, Modulo will probably outgrow the backup system implemented during the project. The team is already considering creating regular immutable data snapshots, writing them to (Linear Tape-Open) LTO cassettes, and storing those cassettes with an insured tape vaulting provider as a future improvement opportunity. Continued investment into Modulo's backup systems will ensure the company can focus on its core business by expanding its service offerings, scaling its operations, and attracting new clients.

Each outcome was assessed to ensure it adequately met the company's requirements.

Once all systems had passed their respective tests, the project was considered successful and formally moved into its deployment and maintenance phase.

Project Deliverables

Appendix A: The screenshot shows that the Nextcloud server is reachable, securely connected, and properly configured. The address bar at the top of the browser reads "https://nextcloud.modulo-tech.com", indicating that DNS was configured correctly and the Nextcloud server is accessible from the appropriate domain. The padlock icon to the left of the URL indicates the TLS certificate was configured correctly and traffic to the Nextcloud server is being encrypted.

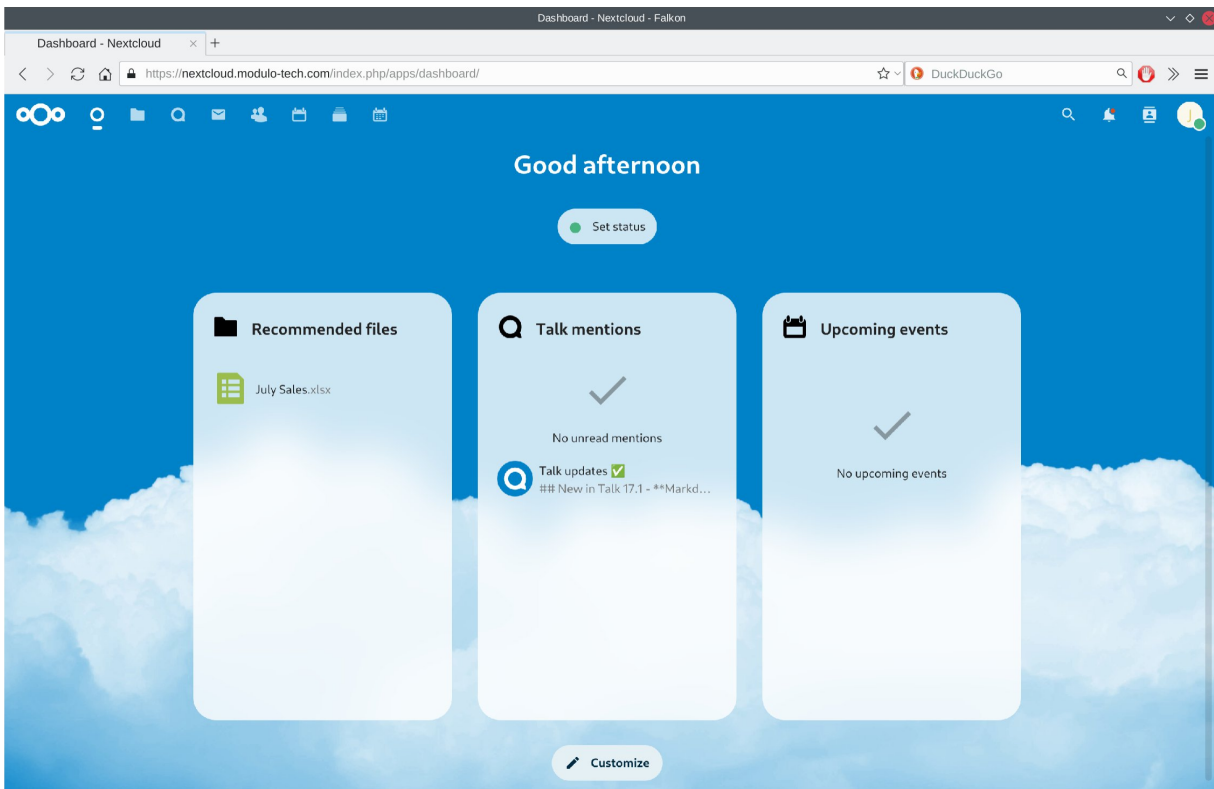
Appendix B: The screenshot shows a simple website homepage created for Modulo that was publicly reachable and securely connected. The address bar at the top of the browser reads "https://www.modulo-tech.com", indicating that DNS was configured correctly and the website is accessible from the appropriate domain. The padlock icon to the left of the URL indicates the TLS certificate was configured correctly and traffic to the Nextcloud server is being encrypted.

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Appendix A

Screenshot of Nextcloud Instance



Appendix B

Screenshot of Website Homepage

