Master of Science in Internetworking

Capstone Project Report

On

The process of migrating web applications to the Microsoft Azure Cloud

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Under the supervision of
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Winter 2024

Acknowledgments

This report is an essential component of the Master of Science in Internetworking (MINT) program offered at the University of Alberta.

I want to express my sincere gratitude to my project supervisor, Professor Mike MacGregor, for his unwavering guidance, supervision, inspiration, and support throughout the last two semesters. His mentorship has provided me with invaluable opportunities such as participation in speaker series, Cisco Academy, Linux Academy, VMware Academy, and more. I would also like to express my heartfelt appreciation to the University of Alberta for providing us with essential skills for our careers in Canada. The opportunity for MINT students to interact with senior industry leaders one-on-one has been particularly valuable.

Over the past 18 months, I have been enrolled in the M.Sc. in Internetworking program where I had the privilege of learning from esteemed faculty members in the electrical engineering and computer science departments. Their expertise and the engaging courses offered not only improved my technical skills but also enhanced my interpersonal and leadership abilities. I am grateful to all my classmates and faculty members for their kind cooperation and support throughout my studies, and I extend my thanks to them.

I am grateful for the support of my family, including my wife, parents, and sister, whose encouragement has been instrumental in my journey.

At the age of forty, I am proud to have embarked on a new journey that involves immersing myself in academic pursuits and embracing a new culture and language.

Abstract

This report delineates the comprehensive migration process of a few web applications to the Microsoft Azure Cloud, a strategic initiative successfully executed. The migration, driven by the need for enhanced scalability, flexibility, availability, security, and cost-effectiveness, aimed to leverage Azure's dynamic infrastructure. Key elements of the process include the selection of Microsoft Azure services, meticulous pre-migration planning, seamless data migration, and the fine-tuning of application configurations.

The selected web application, WordPress Content Management System (CMS), was meticulously chosen for its robust features and widespread usage. Rigorous compatibility assessments were conducted, guiding the adoption of diverse migration strategies, embracing both Platform as a Service (PaaS) and Software as a Service (SaaS) models. The implementation strategies, such as Subdirectory-based[1] Multisite and Subdomains-based Multisite offer nuanced optimization possibilities. Subdomains contribute to organizational structure, which is ideal for complex content frameworks, while subdirectories cater to smaller websites with streamlined content needs. This dual[2] The approach ensures flexibility in performance enhancement, aligning with the specific requirements of the migrated web application.

Testing and optimization phases ensured data integrity, functionality, and overall performance on the Azure platform. Insights gained from Microsoft's use of WordPress on Azure were incorporated, contributing to the robustness of the migration.

This report offers an extensive description of the technical steps involved, the challenges encountered, and the lessons learned during the migration. It acts as a valuable reference for organizations considering a similar transition to Microsoft Azure, offering practical recommendations based on real-world experiences. The successful execution of this migration underscores the strategic advantages of adopting Azure for web application hosting.

[1] It is necessary to have a customized domain if you want to use the subdomain method, which is not included in the Microsoft Student Azure account (Azure, Multisite, 2023).
[2] Both can be done simultaneously when you are applying PaaS and VM, which have been developed.

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1. Introduction

1.1 Background Overview of Cloud Adoption Trends

In recent years, businesses have faced significant upheaval, adjusting to various macroeconomic, political, and societal hurdles. These obstacles persist, contributing to ongoing uncertainty in the business landscape, which includes worries about inflation, disruptions in the supply chain, and escalating energy costs (Azure, Trends, 2022).

Microsoft advocates that the most effective strategy for navigating this uncertainty is for organizations to achieve more with fewer resources. This entails reducing complexity and costs while enhancing agility, resilience, and innovation. It involves leveraging digital capabilities to expand what organizations can accomplish despite the current constraints (Azure, Trends, 2022).

Transitioning workloads to the cloud offers organizations greater flexibility in aligning IT investments with business requirements, all while capitalizing on the economies of scale provided by the cloud. By embracing modern infrastructure and cloud functionalities, organizations can liberate their IT teams to concentrate on the most impactful workloads and applications for their customers. (Azure, Trends, 2022).

To gain a comprehensive insight into the obstacles encountered by our clients and their strategies regarding cloud integration, Microsoft conducted a worldwide survey involving over 1200 IT decision-makers. (Azure, Trends, 2022).

1.1.1 The research revealed three primary trends in cloud adoption (Azure, Trends, 2022)

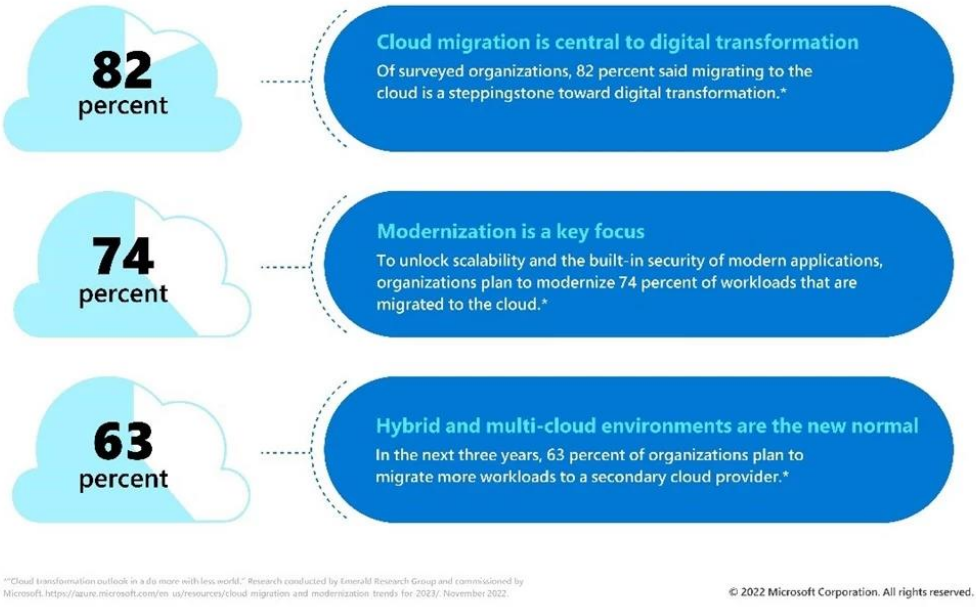


Figure 1 – 3 key cloud adoption trends (Azure, Trends, 2022)

1.1.2 Cloud adoption strategies continue to be a crucial component of organizational plans, particularly in times of uncertain business environments (Azure, Trends, 2022)

The survey highlights a growing emphasis on cloud adoption in IT transformation, with 62% of organizations having migration and modernization strategies. Key motivators include reducing business costs, future-proofing strategies, and driving revenue growth. Top benefits desired from cloud migrations include security, business continuity, disaster recovery, and scalability. Return on investment (ROI) considerations remain a priority, with cost optimization leading initiatives. The Flexera State of the Cloud 2022 report[1] This focuses on optimizing existing cloud use. Organizations are strategically planning cloud adoption across their entire IT infrastructure, with an expected increase from 27% to 47% in the next 18 months. Those with migration strategies are 58% more likely to be 'cloud-only' in the coming years. This holistic approach underscores the evolving landscape of cloud initiatives, encompassing both business-critical and non-critical workloads (Azure, Trends, 2022) (Flexera, 2023).

1.1.3 Modernization stands as a central pillar in the journey of digital transformation (Azure, Trends, 2022)

82% of surveyed organizations view cloud migration as a crucial step in digital transformation. Migration involves moving workloads to the cloud, while modernization entails optimizing existing applications for cloud-native technologies like Platform-as-a-Service (PaaS) or containers. The survey indicates that 74% of migrated workloads are suitable for modernization, presenting opportunities for accelerating product innovation cycles and enhancing personalized user experiences in the realm of digital transformation (Azure, Trends, 2022).

1.1.4 Hybrid, multi-cloud interoperability and integration are anticipated (Azure, Trends, 2022)

Organizations are increasingly adopting multi-cloud solutions, seeking cross-cloud management and interoperability. Surveyed customers express a desire for investment flexibility and best-of-breed cloud capabilities, with 71% planning to maintain a hybrid or multi-cloud strategy. Barriers to cloud adoption, such as cloud-to-cloud integration complexities and application refactoring, highlight the importance of dedicated migration and modernization support. Customers prioritize post-migration assistance, access to engineering resources, and technical skilling support from cloud vendors. These findings underscore the significance of cloud providers to tailor programs and investments to aid customers amid uncertainties (Azure, Trends, 2022).

[1] Please find the full PDF report attached at the end of this report. A link to the PDF is also available in the Appendix.

1.1.5 Importance of cloud migration for scalability, flexibility, availability, security, and cost-effectiveness.

Cloud migration is crucial for organizations seeking enhanced scalability, flexibility, availability, security, and cost-effectiveness in their IT infrastructure. Here's an explanation of the importance of each aspect:

- **Scalability:** Scalability denotes efficiently managing rising workloads or resource demands.
  - **Importance:** Cloud platforms offer on-demand resources, allowing organizations to scale up or down based on changing requirements. This ensures optimal performance during peak periods without overprovisioning resources during low-demand periods.
- **Flexibility:** Flexibility involves the ability to adapt and respond to changing business needs quickly.
  - **Importance:** Cloud environments provide agility, allowing organizations to deploy and manage applications swiftly. This flexibility enables rapid innovation, accelerates time-to-market, and facilitates seamless adjustments to evolving business requirements.
- **Availability:** Availability refers to ensuring that services and applications are accessible and operational when needed.
  - **Importance:** Cloud providers offer redundant and geographically dispersed data centers, minimizing downtime risks. This ensures high availability of applications and services, contributing to improved business continuity and user satisfaction.
- **Security:** Security involves protecting data, applications, and infrastructure from unauthorized access, security threats, and data breaches.
  - **Importance:** Cloud providers invest heavily in security measures, including encryption, identity management, and compliance certifications. Migrating to the cloud often enhances overall security posture, leveraging the expertise and advanced security features provided by cloud service providers.
- **Cost-Effectiveness:** Cost-effectiveness involves optimizing resource usage and minimizing expenses.
  - **Importance:** Cloud migration eliminates the need for significant upfront investments in hardware and infrastructure. Organizations can leverage a pay-as-you-go model, paying only for the resources they consume. This results in cost savings, improved financial predictability, and the ability to allocate budgets more efficiently.

In summary, cloud migration empowers organizations to adapt to changing demands, ensures consistent and reliable service availability, enhances overall security, and provides a cost-effective model for resource utilization. It is a strategic move that aligns IT infrastructure with business objectives and positions organizations for long-term success in the ever-evolving digital landscape.

1.2 Objectives

The primary objectives of migrating 4 WordPress websites from the Hostinger web host platform to Microsoft Azure are to enhance scalability, improve performance, strengthen security measures, optimize costs, implement Azure App services, establish business continuity and disaster recovery, and comply with best practices.

- **Enhanced Scalability:** The migration aims to leverage Azure's scalable infrastructure, allowing the WordPress websites to efficiently scale with growing demands. This objective ensures optimal performance during peak periods without overprovisioning resources during low-demand times.
- **Improved Performance and Load Times:** By utilizing Azure's advanced infrastructure and CDN services, the migration seeks to enhance the overall performance and reduce page load times for the WordPress websites. This objective prioritizes providing users with a faster and more responsive experience.
- **Strengthen Security Measures:** Strengthening the security posture during and after migration is a key goal. The objective is to utilize Azure's robust security features, including encryption and threat detection, to safeguard WordPress websites and sensitive data from potential cyber threats.
- **Cost Optimization:** The migration aims to optimize hosting and resource utilization costs by leveraging Azure's flexible pricing model and resource management tools. This objective ensures cost-effectiveness while maintaining or improving the performance of the WordPress websites.
- **Implementation of Azure Services:** Integrating specific Azure services such as Azure App Service and Azure Database for MySQL flexible server, Private DNS zone, and Virtual Network is a core objective. This step aims to optimize the hosting environment and enhance the overall capabilities of the WordPress websites on the Azure platform.
- **Business Continuity and Disaster Recovery:** The migration aims to implement strong business continuity as well as disaster recovery measures using Azure's backup and recovery solutions. This objective ensures data resilience and quick recovery in case of unforeseen incidents, minimizing potential downtime.
- **Compliance with Best Practices:** Adhering to industry best practices and Azure's guidelines is a key objective. This ensures optimal performance, security, and compliance with standards for web application hosting on the Azure platform.

Along with our objectives, there are also a few expected advantages of transitioning to Microsoft Azure Cloud, such as minimizing impact on end users, ensuring documentation and knowledge transfer, and executing seamless data migration.

- **Minimized Impact on End Users:** Minimizing disruption and downtime for end users is a critical objective. The migration plan includes phased execution or scheduling during low-traffic periods and keeps the source websites during the migration to reduce the impact on website visitors and ensure a seamless transition.
- **Documentation and Knowledge Transfer:** Comprehensive documentation creation and knowledge transfer to the business owner or internal IT team are outstanding merit. This ensures that the team is well-equipped to manage and maintain the Azure-hosted WordPress websites effectively in the long run.
- **Seamless Data Migration:** Ensuring a smooth and error-free migration of data from Hostinger to Azure is critical. This importance can be attained by planning and executing a well-structured data migration strategy to prevent data loss, maintain data integrity, and minimize downtime during the transition.

2. Literature Review

2.1 Cloud Computing Definition

Cloud computing involves providing computing powers over the internet, enabling users to access and utilize a wide range of resources and applications without relying on local infrastructure and hardware. These services typically include servers, storage, databases, networking, software, and other computing resources. With cloud computing, tenants can access all resources on-demand, scale them as required, and pay just for the resources they use, leading to increased flexibility, efficiency, and cost-effectiveness compared to traditional computing models (Azure, Cloud Computing, 2023).

2.2 Cloud Computing Different Types

Cloud computing offers various deployment options to meet diverse business needs: public cloud, private cloud, and hybrid cloud. Each deployment method caters to different requirements, and there's no one-size-fits-all solution. Organizations can choose the deployment model that aligns best with their specific goals and preferences (Azure, Different Clouds Types, 2023).

- **Public Cloud:** In a public cloud deployment, computing resources are hosted and managed by third-party providers, such as Microsoft Azure, Google Cloud Platform (GCP), or Amazon Web Services (AWS). These resources are accessible to multiple users over the internet on a pay-as-you-go basis. Public cloud deployments are known for their scalability, cost-effectiveness, and ease of access.

- **Private Cloud:** Private cloud deployments involve hosting computing resources within an organization's own infrastructure or dedicated servers. This approach offers greater control, security, and customization compared to public cloud options. Private clouds are suitable for organizations with strict regulatory requirements, sensitive data, or specific performance needs.

- **Hybrid Cloud:** Hybrid cloud deployments combine features from both private and public clouds, enabling organizations to capitalize on the advantages offered by each. In a hybrid cloud setup, certain workloads or data are hosted on-premises in a private cloud environment, while others are hosted in the public cloud. This hybrid approach offers flexibility, scalability, and seamless integration between on-premises and cloud-based resources.

Choosing the right deployment method depends on factors such as security requirements, data sensitivity, regulatory compliance, performance needs, and budget constraints. By evaluating these considerations, organizations can determine the most suitable cloud computing model to meet their unique business needs and objectives.

2.3 Types of Cloud Services, IaaS, PaaS, SaaS, Serverless models

The majority of cloud computing services can be categorized into four main types: infrastructure as a service (**IaaS**), Platform as a service (**PaaS**), software as a service (**SaaS**), and serverless. These categories are often referred to as the cloud computing "stack" as they form layers of services. Understanding these distinctions can streamline the achievement of your business objectives.

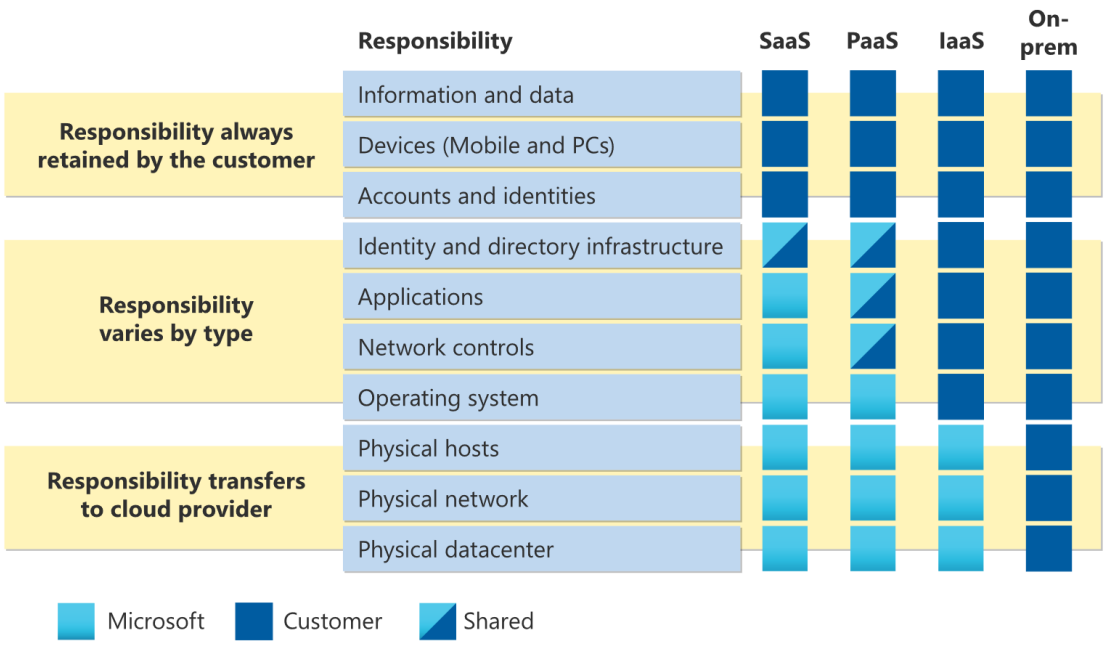


Figure 2: Division of responsibility[2] (Microsoft, 2023)

- **IaaS**

  Infrastructure-as-a-Service (IaaS) is a cloud computing power model that offers essential computing resources, including compute, network, and storage capabilities, to users over the internet. With IaaS, consumers can access these resources on-demand and pay only for what they use, eliminating the need for significant upfront investments in infrastructure. This flexible scalability allows users to adjust resources based on workload demands, minimizing wastage and optimizing cost-efficiency. Unlike PaaS or SaaS, IaaS provides users with a lower level of control over their cloud resources, offering greater flexibility and customization options.

  "IaaS emerged as a popular computing model in the early 2010s, and since that time, it has become the standard abstraction model for many types of workloads. However, with the advent of new technologies, such as containers and serverless, and the related rise of the microservices application pattern, IaaS remains foundational but is in a more crowded field than ever" (IBM, 2023).

[2] As you transition from an on-premises data center to the cloud, the allocation of responsibilities shifts between your organization and Microsoft. The diagram below illustrates how these responsibilities vary based on the deployment type of your stack.

- **PaaS**

  Platform-as-a-Service (PaaS) is a cloud computing power model that offers customers a comprehensive platform for developing, running, and managing applications without the complexities and costs associated with maintaining on-premises infrastructure. In the PaaS model, the provider hosts all necessary components, including hardware, software, and infrastructure, at their data center. Customers can choose from fixed fee or pay-as-you-go pricing models, allowing them to access resources based on their specific needs and usage. This approach enables organizations to build, test, deploy, and scale applications more efficiently and affordably than if they were to manage their own on-premises platform.

  Major cloud service providers like IBM Cloud, Google Cloud, Microsoft Azure, Amazon Web Services (AWS), and each offer their own Platform-as-a-Service (PaaS) solutions. Additionally, open-source projects such as Cloud Foundry and Apache Stratos, as well as commercially available options like Salesforce Heroku and Red Hat OpenShift, provide popular PaaS solutions. These cloud platforms offer a variety of features and capabilities to support application development, deployment, and management in the cloud environment, catering to diverse needs and preferences within the industry (IBM P. , 2023).

- **SaaS**

  Software-as-a-Service (SaaS) refers to application software hosted on the cloud and accessed over the internet via web browsers, mobile apps, or thin clients. In this model, the SaaS provider is responsible for operating, managing, and maintaining both the software and the underlying infrastructure. Customers simply create an account, pay a fee, and begin using the software without the need for complex setup or management. While the origins of SaaS can be traced back to the 1950s with mainframe-based applications, the modern SaaS era began in 1999 with the launch of Salesforce's cloud-hosted customer relationship management (CRM) system.

  Today, SaaS is the most prevalent public cloud computing power service and the dominant software delivery model. A wide range of software applications, from everyday tools like Slack and Dropbox to critical business systems like enterprise resource planning (ERP) and human resources platforms, are delivered via the SaaS model. This approach offers businesses numerous advantages, including rapid time-to-value, minimal management overhead, and predictable costs, making it appealing to organizations of all sizes, from startups to large enterprises.
  This popularity will continue to surge. “Industry analyst Gartner forecasts worldwide SaaS software revenues to exceed USD 145 billion by the end of 2022 (link resides outside IBM); another analyst, International Data Corporation (IDC), projects the worldwide market for SaaS will grow to USD 302.1 billion by 2025” (IBM S. , 2023)**.**

❖ **Serverless**

Serverless computing revolutionizes application development and execution by eliminating the need for developers to provision or manage servers and backend infrastructure. In this model, developers focus exclusively on writing application code and deploying it to containers managed by a cloud service provider. The provider handles all aspects of infrastructure provisioning and scaling, including routine maintenance tasks such as updates, patches, security management, and system monitoring. This approach allows developers to concentrate their efforts on writing high-quality code and business logic without worrying about the underlying infrastructure, resulting in faster development cycles and increased agility.

Serverless computing has a significant advantage over traditional computing models including cost-effectiveness and efficiency. Developers only pay for the computing resources consumed during code execution, with billing based on actual execution time and resource usage. This pay-as-you-go pricing model ensures optimal resource utilization, as computing resources are provisioned dynamically as needed and scaled down to zero when not in use. Additionally, serverless architectures inherently support auto-scaling, allowing applications to seamlessly handle fluctuations in workload demand without manual intervention. Overall, serverless computing offers developers a streamlined and cost-efficient approach to building and deploying applications in the cloud. (IBM S. , 2023).

2.4 Microsoft Azure App Service Architecture

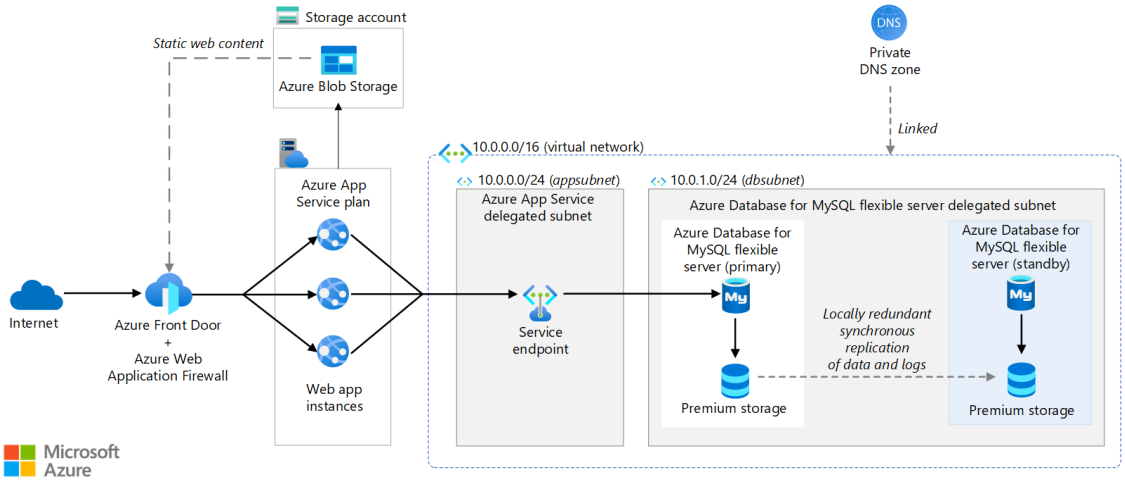


Figure 3: WordPress on Microsoft Azure App Service (Learn, 2023)

2.4.1 Dataflow

This scenario entails the implementation of a scalable WordPress deployment hosted on Azure App Service (Learn, 2023).

- Users interact with the front-end website via the Azure Front Door, benefiting from the added security measures provided by the Azure Web Application Firewall.
- Azure Front Door efficiently distributes incoming requests among the various App Service web apps hosting WordPress. Additionally, it retrieves any uncached data directly from the WordPress web apps.
- The WordPress application leverages a service endpoint to connect with a flexible server instance of Azure Database for MySQL. This connection facilitates the retrieval of dynamic information directly from the database, enabling seamless data access and functionality within the WordPress application.
- Locally redundant high availability is enabled for Azure Database for MySQL via a standby server in the same availability zone.
- All static content is hosted in Azure Blob Storage.

2.4.2 Potential Components[3]

The WordPress on App Service template is a managed solution for serving web applications like WordPress on App Service. In addition to App Service, the solution integrates various other Azure services outlined in this section (Learn, 2023).

- App Service offers a framework for the development, deployment, and scaling of web applications.
- Azure Front Door is a contemporary cloud content delivery network designed to efficiently deliver web content to users. Utilizing a distributed network of servers, it minimizes latency by caching content on edge servers strategically located near end users.
- Azure Content Delivery Network (CDN) optimizes the delivery of web content to users by strategically storing blobs at various locations. In this scenario, Content Delivery Network can serve as an alternative to Azure Front Door, providing efficient delivery of web content to users.
- Azure Virtual Network facilitates communication among deployed resources, the internet, and on-premises networks, offering isolation, segmentation, traffic filtering, and routing capabilities. It enables connections between different locations and establishes secure communication channels. In this scenario, the two networks are linked through virtual network peering, ensuring seamless connectivity and efficient data exchange between resources.

[3] Some of the core components are not available in Microsoft Azure Student Subscription.

- Azure DDoS Protection Azure DDoS Protection offers advanced features for mitigating Distributed Denial of Service (DDoS) attacks, enhancing the security of your network infrastructure. When coupled with best practices in application design, these features provide robust defense mechanisms against DDoS attacks. Enabling DDoS protection on perimeter virtual networks is recommended to safeguard your resources from potential threats and ensure uninterrupted service availability.
- Network security groups (NSGs) employ a set of security rules to regulate inbound and outbound network traffic, dictating access based on criteria such as source or destination IP address, ports, and protocols. In the context of this scenario, NSG rules are applied to subnets, controlling the flow of traffic between various components of the application. This enforcement helps fortify the network perimeter and ensures that only authorized communication occurs between different segments of the application architecture.
- Azure Key Vault serves as a secure repository for storing and managing high-risk information such as passwords, certificates, and cryptographic keys. It provides centralized control over access to these credentials, allowing organizations to securely store and manage their secrets. By leveraging Azure Key Vault, organizations can enhance their application security and ensure that sensitive information is approvingly blocked from unauthorized access or exposure.
- Azure Database for MySQL - flexible server is a fully managed relational database service built on the open-source MySQL database engine. This deployment option offers organizations granular control and flexibility over database management functions and configuration settings. With Azure Database for MySQL, organizations can store and manage their WordPress data securely and efficiently, leveraging the scalability as well as reliability of the Azure platform for their database needs.
- Blob Storage offers scalable and optimized object storage, making it an ideal solution for various cloud-native workloads, archival purposes, data lakes, high-performance computing, and machine learning applications. With Blob Storage, organizations can efficiently store and maintain large amounts of unstructured data, such as videos, images, documents, and logs, while benefiting from the scalability and cost-effectiveness of the Azure cloud platform. Whether it's storing data for long-term retention, powering analytics, and AI applications, or supporting high-performance computing tasks, Blob Storage provides a reliable and flexible storage solution for diverse use cases in the cloud.

2.4.3 Comparison of Azure offerings with AWS (Microsoft, AWS vs Azure, 2023)

The most recent complete set of comparisons can be found at the following address:

https://learn.microsoft.com/en-us/azure/architecture/aws-professional/services

3. Selection of WordPress Web Application, Azure App Service, and Migration Strategy:

3.1 WordPress Web Application Selection Criteria

I currently host several web applications on my Hostinger account (located in the US) and Dedicated Private Server (DPS) with Hetzner (located in Germany), a private cloud infrastructure I have maintained since 2015. These WordPress-powered applications benefit from the combined capabilities of Hetzner and Hostinger, ensuring redundancy, availability, and optimized performance tailored to the geographic location of service requests. Given their established infrastructure and reliability, these applications serve as suitable candidates for migration in the context of this project.

In addition, Selecting WordPress as the web application platform can be advantageous for various reasons, depending on my specific needs, requirements, and the Platform's capabilities. Here are some criteria to consider when evaluating WordPress:

- **Ease of Use:**

  Azure provides a user-friendly environment with intuitive interfaces and tools, complementing WordPress's user-friendly interface. The seamless integration between Azure app services and WordPress simplifies deployment and management tasks for both technical and non-technical users. It allows me to focus on the migration process completely.

- **Flexibility and Customization:**

  Azure's extensive range of services, including App Service, Azure Functions, and Azure Database for MySQL, enables seamless integration with WordPress. This allows for extensive customization and tailoring of WordPress websites to meet specific requirements, leveraging Azure's scalability and flexibility. WordPress CMS also offers a wide range of plugins, themes, and customization options that allow me to create highly tailored and visually appealing UI. Whether you're building a blog, e-commerce site, portfolio, or corporate website, WordPress provides the flexibility to customize design, functionality, and features to meet your specific needs.

- **Scalability and Versatility:**

  Azure's robust infrastructure seamlessly integrates with WordPress, enabling extensive scalability to accommodate websites of all sizes. Leveraging Azure's autoscaling capabilities optimizes resource utilization and ensures cost-effectiveness during peak usage periods. With proper optimization techniques, WordPress can effectively handle high traffic volumes and growing user bases without compromising performance or reliability.

- **Community Support:**

  Both Azure and WordPress benefit from extensive and active communities comprising developers, administrators, designers, and users. This ensures readily available support, guidance, and resources for migrating and managing WordPress on Azure, facilitating smooth transitions and ongoing support. Whether seeking assistance with Azure's integration or WordPress-specific challenges, the vibrant communities provide invaluable help, guidance, and solutions, ensuring seamless operation and optimization of WordPress websites on the Azure platform.

- **SEO-Friendly:**

  By leveraging Azure's integrated services like Azure CDN and Azure Search, WordPress users can enhance the Platform's built-in SEO features. Azure's advanced SEO tools and capabilities augment WordPress's existing functionality, thereby improving website visibility and rankings in search engine results. This synergy between Azure and WordPress maximizes the effectiveness of SEO efforts, driving organic traffic and engagement. With WordPress's inherent SEO-friendliness and Azure's additional enhancements, users benefit from a comprehensive suite of utilities to enhance their websites for better visibility on search engines, consequently leading to increased visibility and improved rankings in search results.

- **Security:**

  WordPress's commitment to security, manifested through regular updates and patches to address vulnerabilities, complements Azure's robust security features. While WordPress prioritizes security measures and offers various plugins and best practices to strengthen website security, Azure provides additional layers of protection. Azure's security features, such as network security groups, Azure Security Center, and Azure DDoS Protection, work in tandem with WordPress's security measures to provide comprehensive protection against cyber threats. This collaboration ensures the integrity and confidentiality of WordPress websites hosted on Azure, safeguarding them against potential security breaches and vulnerabilities. Together, the combined efforts of WordPress and Azure create a fortified security posture, enhancing the resilience of websites in the face of evolving cyber threats.

- **Cost-Effectiveness:**

  The pay-as-you-go pricing model offered by Azure complements WordPress's cost-effective nature, allowing users to tailor expenses to their usage. Azure's pricing flexibility and array of cost management tools facilitate efficient resource allocation and budget optimization, rendering it an economical choice for hosting WordPress websites. WordPress's open-source nature further enhances cost-effectiveness, as it is free to use, making it accessible to users with varying budgets. While additional expenses may arise for hosting, themes, plugins, and other services, WordPress offers affordable options to accommodate diverse financial constraints and requirements. Together, Azure and WordPress provide a

comprehensive and budget-friendly solution for website hosting, empowering users to manage costs effectively while leveraging robust infrastructure and features.

In summary, selecting WordPress as the web application platform provides a comprehensive solution, offering ease of use, flexibility, scalability, community support, SEO-friendliness, security features, and cost-effectiveness. With these criteria in mind, WordPress emerges as a viable choice for various projects and objectives. Furthermore, migrating WordPress to Azure facilitates seamless integration of these features, empowering users to deploy and manage high-performance websites tailored to their specific needs while leveraging the strengths of both platforms.

3.2 Justification for selecting WordPress as a Content Management System (CMS):

As we discussed in the 3.1 section, the justification for selecting WordPress as the web application lies in its multitude of advantageous features and capabilities that align with the needs and objectives of this project. Here are more reasons to justify choosing WordPress as a CMS:

- **Whatcms.org Analysis**
  The analysis of microsoft.com reveals a diverse array of content management systems (CMS) employed across its applications. WordPress and Adobe Experience Manager are the primary platforms, with WordPress managing 215 instances and Adobe overseeing 181. Other CMS platforms such as Kentico, Sitecore, Contentful, Next.js, Khoros, Gatsby, and Jekyll are also utilized across various instances of the website. Notably, 32 instances were not associated with any recognized CMS during the analysis, showcasing the versatility and complexity of Microsoft.com's content management infrastructure.

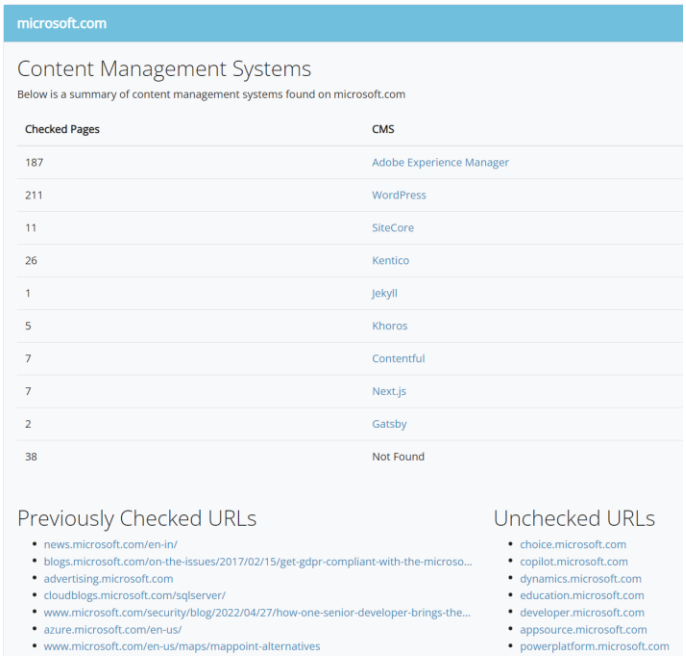


Figure 4 – Whatcms.org detection result (CMS, 2024)

❖ **Top CMS Platforms by Market Share**

In February 2023, WordPress dominates the CMS market share at 63.5%, followed by Shopify at 5.5%, Wix at 3.7%, and Squarespace at 3.0%. Joomla and Drupal hold 2.7% and 1.8%, respectively, while Adobe Systems and PrestaShop each have a share of 1.7% and 1.1%. Google Systems and Webflow stand at 1.2% and 0.9%, and Bitrix and OpenCart both have a market share of 1.1% and 0.8% correspondingly (W3TECHS, 2024).

	2023 1 Feb	2023 1 Mar	2023 1 Apr	2023 1 May	2023 1 Jun	2023 1 Jul	2023 1 Aug	2023 1 Sep	2023 1 Oct	2023 1 Nov	2023 1 Dec	2024 1 Jan	2024 1 Feb	2024 11 Feb
WordPress	63.5%	63.4%	63.3%	63.3%	63.2%	63.2%	63.1%	63.1%	63.0%	63.0%	62.7%	62.9%	62.8%	62.8%
Shopify	5.5%	5.5%	5.5%	5.6%	5.6%	5.7%	5.8%	5.8%	5.9%	5.9%	6.0%	6.0%	6.2%	6.2%
Wix	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.8%	3.8%	3.8%	3.8%
Squarespace	3.0%	3.1%	3.1%	3.1%	3.1%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Joomla	2.7%	2.7%	2.7%	2.7%	2.7%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.5%	2.5%	2.5%
Drupal	1.8%	1.8%	1.8%	1.8%	1.7%	1.7%	1.7%	1.7%	1.6%	1.6%	1.6%	1.6%	1.5%	1.5%
Adobe Systems	1.7%	1.7%	1.7%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.5%	1.5%	1.5%	1.5%	1.5%
PrestaShop	1.1%	1.1%	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%
Google Systems	1.2%	1.2%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%	1.0%
Webflow	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Bitrix	1.1%	1.1%	1.1%	1.1%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.9%	0.9%
OpenCart	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%

Figure 5 - Market share trends for content management systems (W3TECHS, 2024).

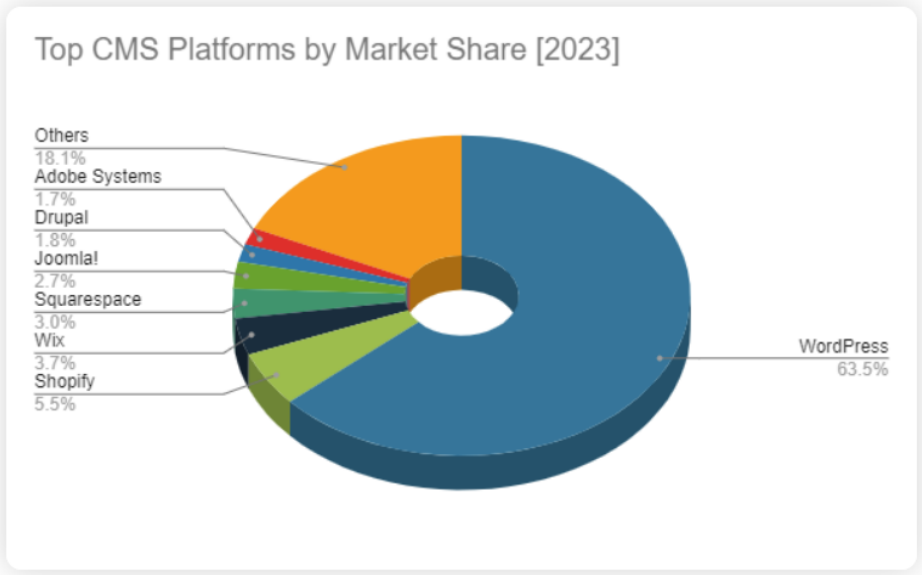


Figure 6 - Market share trends for content management systems (W3TECHS, 2024)

3.3 Why Azure App Service

Between Azure Container (IaaS/PaaS), Azure Virtual Machine (VM) (PaaS), and Azure App Service (PaaS), Azure App Service has been preferred. Azure App Service offers several advantages over Virtual Machines and Containers, including simplified management, faster deployment, scalability, cost-effectiveness, high availability, and managed security features. These benefits make Azure App Service an attractive choice for hosting and managing web applications, allowing me to focus on building great software without the hassle of managing infrastructure.

- **Simplified Management:**
  Azure App Service abstracts away the complexity of managing the major infrastructure, such as servers and operating systems. With App Service, I can focus solely on deploying and managing my web applications without worrying about server provisioning, configuration, or maintenance tasks required with Virtual Machines.

- **Faster Deployment:**
  Azure App Service allows for rapid deployment of web applications with built-in support for continuous integration and deployment (CI/CD) pipelines. Compared to setting up and configuring Virtual Machines, deploying applications on App Service is much faster and more streamlined, enabling quicker implementation.

- **Scalability:**
  App Service offers built-in scalability features that allow me to easily scale my web applications up or down based on demand. With only a few clicks or using API, I can adjust the number of instances or resources allocated to my application, ensuring optimal performance and cost-efficiency. Scaling Virtual Machines requires more manual intervention and management.

- **Cost-Effectiveness:**
  Azure App Service follows a pay-as-you-go pricing model, where I only pay for the resources I use. This pricing model can be more cost-effective compared to running and maintaining Virtual Machines, especially for smaller applications or those with fluctuating traffic patterns. Additionally, App Service offers various pricing tiers and options to suit distinct budgets and performance requirements.

- **High Availability:**
  Azure App Service provides built-in high availability and fault tolerance features to ensure my applications are always up and running. App Service automatically handles load balancing, failover, and recovery processes, minimizing downtime and ensuring a seamless user experience. Achieving similar levels of high availability with Virtual Machines would require additional configuration and management efforts.

- **Managed Security:**
  App Service includes managed security features to help protect my web applications from security threats and vulnerabilities. With features such as automatic patching, SSL/TLS encryption, and Web Application Firewall (WAF), App Service helps me maintain a secure environment for my applications without the need for manual intervention. Managing security on Virtual Machines typically requires more effort and expertise.

3.4 Migration Strategies:

3.4.1 Detailed explanation of chosen migration strategies:

Migrating a WordPress website to Azure App Services incorporates multiple steps and factors to guarantee a seamless shift. Below is a detailed explanation of the migration process, along with key considerations and best practices.

- **Assessment and Planning:**

  Before beginning the migration, it's essential to assess the current WordPress website's architecture, dependencies, and requirements. Identify any customizations, plugins, or themes used, as well as the version of WordPress and PHP. Determine the desired Azure App Service plan and region based on performance, availability, and compliance requirements.

- **Backup and Export:**

  Back up the WordPress website's files and database to guarantee the integrity and accessibility of data throughout the migration process. Use WordPress plugins or manual methods to export the site's content, including posts, pages, media, and settings.

- **Azure App Service Setup:**

  Create an Azure account if you don't have one already and navigate to the Azure portal. Create a new Azure App Service plan and web app, selecting the desired pricing tier, region, and resource group. Configure the web app's settings, including Application Settings, PHP version, SSL certificates, and custom domains.

- **Database Migration:**

  Since the WordPress website uses a MySQL database, you can migrate it to Azure Database for MySQL. Use the Azure Database Migration Service or manual methods to export the MySQL database and import it into Azure. Ensure compatibility with the selected Azure Database for MySQL version and adjust database settings as needed. In the case of using multisite, make sure that you will use a unique database name for every single website.

- **File Transfer:**

  Transfer the WordPress website's files, including themes, plugins, uploads, and customizations, to the Azure App Service. Use FTP or Azure Blob Storage for large files, ensuring proper permissions and directory structure. Use FTP/FTPS client to access to the website files installed on Azure App Service.

- **WordPress Configuration:**

  Update the WordPress configuration files (**wp-config.php**) to point to the new Azure Database for MySQL instance and configure other settings as necessary. Adjust file and folder permissions, including those required for WordPress updates and plugin installations.

- **DNS and Domain Configuration:**

  Update the DNS records and configure the Domain to point to the Azure App Service's custom domain. Set up SSL certificates for secure connections and ensure proper HTTPS redirection.

- **Testing and Validation:**

  Perform thorough testing of the migrated WordPress website on Azure, including functionality, performance, and user experience. Verify that all content, media, and settings are intact and accessible. Track the performance of the website and resolve any identified issues or discrepancies promptly. Make sure you have updated all the required service configurations successfully, such as Google Captcha, GTmetrix for WordPress, SEO plugin, Akismet Anti-spam, Contact Form 7, Google Analytics for WordPress, LiteSpeed Cache, PDF Embedder, and Jetpack.

- **Post-Migration Optimization[4]:**

  Optimize the WordPress website for Azure App Services, including caching, performance tuning, and security enhancements. Implement Azure-specific features and services, such as Azure CDN, Azure Search, and Azure Monitoring, to enhance the website's functionality and performance.

- **Deployment and Go-Live:**

  Once testing and optimization are complete, deploy the migrated WordPress website to production on Azure App Services. Monitor the website's performance, security, and availability, and address any issues promptly.

- **Ongoing Maintenance and Support:**

  Frequently update WordPress, themes, and plugins to ensure compatibility and security. Monitor the Azure App Service's performance and resource utilization and scale as needed to accommodate traffic fluctuations. Back up the website's files and database regularly to prevent data loss.

By adhering to these steps and considering the best practices, you are able to successfully migrate a WordPress website to Azure App Services, ensuring a seamless transition and optimal performance on the Azure platform. Of course, there are enriching communities that are able to answer your questions and assist you with developing potential issues. Some of these communities are:

[4] Some of the features are not included in Microsoft Azure's free student account.

I. https://learn.microsoft.com
II. https://azure.microsoft.com
III. https://github.com/Azure
IV. https://github.com/WordPress
V. https://wordpress.com

3.5 Implementation Strategies:

3.5.1 Why multisite?

Multisite architecture, particularly in the context of WordPress, presents an array of compelling advantages. These include centralized management, streamlined resource allocation, consistent branding, scalability, cost efficiency, heightened security, and SEO enhancements. The multifaceted nature of these benefits renders multisite architecture an attractive solution for organizations seeking to efficiently manage multiple websites or applications. Recognizing the prevalence of businesses requiring multilingual websites while offering diverse services, I have elected to implement a multisite architecture to demonstrate the practicality of addressing real-world demands.

Consequently, my strategic initiative entails the deployment of a multi-language website, serving content in both English and Persian languages, alongside a pair of specialized web platforms, each targeting distinct Web Application Services. One of these platforms is dedicated to meticulously introducing the brand, furnishing comprehensive insights into its overarching mission, core values, and diverse array of offerings. Concurrently, the second Platform is meticulously crafted to elucidate a specific service provided by the brand, meticulously showcasing its distinctive features, inherent advantages, and unique value proposition.

3.5.2 An idea for a website addressing scheme:

In light of a unified conceptual addressing scheme, the primary Domain is designated as "parsmartsl.azurewebsites.net," with each subdirectory representing distinct businesses or services offered by a single brand. Furthermore, subdirectories can also be utilized to accommodate content in different languages, thereby enhancing the Platform's accessibility and inclusivity.

Look at some ideas based on subdirectories:

- "parsmartsl.azurewebsites.net" - to introduce the brand
- "parsmartsl.azurewebsites.net\en" - to provide special information
- "parsmartsl.azurewebsites.net\psccts\en"or
- "parsmartsl.azurewebsites.net\psccts-en"- Service in English language
- "parsmartsl.azurewebsites.net\psccts\fa" or
- "parsmartsl.azurewebsites.net\psccts-fa"- Service in Farsi language

Based on subdomains ideas:

- "parsmartsl.azurewebsites.net" - to introduce the brand (main website):
- "en.parsmartsl.azurewebsites.net" - to provide special information
- "en.psccts.parsmartsl.azurewebsites.net" - specific service in the English language
- "fa.psccts.parsmartsl.azurewebsites.net" - specific service in the English language

4. Technical Steps in Details for Migration:

4.1 Pre-Migration Planning

- **Assessment of existing infrastructure**

  Looking into current infrastructure, we have two sources for the migration including a dedicated private server (DPS) as well as a Hostinger web host account. Both sources have been serving same web applications for few years.

4.1.1 Dedicated Private Server (DPS)

The DPS is located at the Hetzner Data Center in Germany. It has been powered by VMware hypervisor ESXi 6.5 and has maintained a few virtual machines, including a Linux Ubuntu 22.04 web server, a Mikrotik OS as Firewall, and VEEAM Backup & Replication. Please find the following information for your reference[5]:

4.1.1.1 Dedicated Private Server:

VMware Hypervisor ESXi 6.5

CPU i7-4770 @ 3.40GHz 8M Cache, up to 3.90 GHz, 4 Cores, 8 Threads

Total Computing Power (BCPU) 13.6 GHz

Memory: 32GB

Location: Germany

Internet 1 GB

Public IP

4.1.1.2 Virtual Machine: Firewall

Operating System: Mikrotik OS 6.47.9

CPU: 1vCPUs

Memory: 512 MB

Public IP

[5] Related screenshots have been added to Appendix section.

4.1.1.3 Virtual Machine: Web Host Server

Operating System: Linux Ubuntu 22.04

CPU: 4vCPUs

Memory: 6GB

Apache

Plesk Obsidian 18.x

NGINX

PHP 8.3.2

MYSQL

Public IP

Daily incremental backup and weekly Full backup

4.1.1.3.1 WordPress web applications served by Web Server:

The following WordPress are maintained by the Ubuntu web server:

- **www.parsmartsl.tk**
- **www.parsmartsl.tk/fa**
- **psccts.parsmartsl.tk**
- **parsmartcrypto.tk**
- **en.psccts.parsmartsl.tk**
- **www.parsmartsl.tk/en**

4.1.1.3.2 Plesk Domains and subdomains:

The following Domains are maintained by the Ubuntu web server:

- **www.parsmartsl.tk**
- **www.parsmartsl.tk/fa**
- **psccts.parsmartsl.tk**
- **parsmartcrypto.tk**
- **en.psccts.parsmartsl.tk**
- **esxi.parsmartsl.tk**
- **whostp.esxi.parsmartsl.tk**
- **www.parsmartsl.tk/en**

4.1.1.3.3 WordPress Instances Developed by Plesk Control panel:

The following WordPress Instances are powered by the Plesk Control Panel. You can find more information about WordPress Instances in Appendix 1 section.

- **https://www.parsmartsl.tk/**
- **https://www.parsmartsl.tk/en/**
- **https://www.parsmartsl.tk/fa/**
- **https://enpsccts.parsmartsl.tk/**
- **https://psccts.parsmartsl.tk/**

4.1.1.3.4 Disaster Recovery Strategy:

Plesk administrator has meticulously ensured that individual subscription data is segregated and backed up separately, a practice that is pivotal in preserving data integrity and expediting restoration processes. Additionally, the admin has judiciously implemented an auxiliary backup for the entire storage, a prudent measure that aligns with best practices for disaster recovery. This approach, which encompasses both local and external cloud storage, underscores the admin's commitment to maintaining a robust and secure backup infrastructure for their Plesk server. Additionally, a comprehensive and extensive disaster recovery solution is offered by VEEAM Backup & Replicator for backing up Hypervisor Datastore.

- **Individual Subscription Data Backup:**
  Plesk has been configured to back up each subscription's data into distinct files. This is helpful because it allows individual subscription owners to restore their data without affecting other subscriptions. All the backup procedures follow the incremental daily backup and weekly full backup.

- **Entire Storage Backup:**
  Plesk has also been set up to provide an additional backup for the entire web host's data storage. This is a good practice for disaster recovery purposes. In case of a catastrophic failure, having a complete backup of the entire web host server can help you restore everything more quickly.

- **Local Storage backup:**
  The server is backing up data into local storage. This is likely on the same server or a local network storage device. Local backups are usually faster to create and restore, but they might not be as secure as off-site backups.

- **Cloud Storage backup:**
  Plesk also backs up data to external Dropbox cloud storage. This is a good practice because it provides an additional layer of redundancy and security. If something happens to the local storage, you still have a copy of your data in the cloud.

Overall, this comprehensive backup strategy can be well thought out. It covers individual subscription data and entire server storage and utilizes both local and cloud storage for redundancy and security.

4.1.1.4 Virtual Machine: Veeam Backup & Replication

Operating System: Windows Server 2012 Standard Edition

CPU: 4vCPUs

Memory: 8GB

RAID 1: 400GB

Software: Veeam Backup & Replication

Daily incremental backup and weekly Full backup

Public IP

Additional Disaster Recovery Plan:

A supplementary virtual machine (VM) has been securely integrated with the hypervisor. This VM has been specifically allocated to a distinct VLAN to facilitate the secure and comprehensive backup of all six VMs hosted on the ESXi hypervisor. To ensure the utmost network efficiency, six separate backup jobs have been meticulously configured, with each job dedicated to the meticulous backup of an individual virtual machine. The initial job has been scheduled for a specific time, and subsequent jobs will be initiated sequentially once the previous job has been successfully completed. The backup data has been secured using a RAID 1 storage system, which adds an additional layer of security and availability in the event of a hard disk failure.

4.1.2 Hostinger data center located in the US:

Managed by Hostinger, there is another redundancy for all four web applications located in the US, which is a web application host account**.** Hostinger stands out for its affordability, with budget-friendly hosting plans that cater to those on a tight budget. Beginners will find the interface easy to use due to its simple and intuitive design. Moreover, some Hostinger plans include a free domain, which can lead to significant cost savings. Additionally, Hostinger offers free SSL certificates with its plans, ensuring secure connections for websites. Hostinger's daily backups and weekly full backups add an extra layer of information security, ensuring that your website's data is always safe and accessible. Lastly, Hostinger provides 24/7 customer support via live chat, which is instrumental in promptly resolving any issues that may arise. The simplicity of maintenance and overall ease of use of Hostinger's shared hosting plans are often preferred over the complexity and higher costs associated with managing a Dedicated Private Server (DPS).

Indeed, the comprehensive nature of the Managed Hosting service relieves clients of the burdens associated with managing a myriad of technical aspects such as Virtual Machines, high-performance hardware, VEEAM Backup solutions, Firewall configurations, Domain registration costs, SSL certificate expenses, network design intricacies, public and private IP address allocations, RAID storage configurations, and the ongoing maintenance of these components. This approach substantially streamlines the management and maintenance of infrastructure, offering a more efficient and user-friendly experience.

4.1.2.1 WordPress web applications:

The following WordPress websites are maintained by the Hostinger:

- **www.parsmartsl.com**
- **www.parsmartsl.com/fa**
- **www.parsmartsl.com/en**
- **psccts.parsmartsl.com**
- **en.psccts.parsmartsl.com**

Considering the current Microsoft Azure student account limitations along with the necessity of focusing on creating complete web application software with the minimum effort, maintenance and developing time, and costs, the Hostinger web host account has been selected for migration.

4.1.3 Identification of dependencies and potential challenges

When migrating a WordPress website to Azure App Service, several critical tasks ensure a smooth transition. Database migration involves transferring content, settings, and user data, while file transfer requires compressing and uploading root folders using FTP clients like FileZilla. Post-migration, DNS configuration updates, and application compatibility checks are necessary. Performance optimization and security configuration using Azure's features are vital, along with backup plans to prevent data loss. Cost management is crucial due to Azure's pay-as-you-go pricing, and updating plugins and APIs tied to specific domains ensures uninterrupted functionality, such as Google reCAPTCHA and Jetpack. Additionally, changing domains requires updating internal links, images, and URLs within the database to maintain website integrity and ensure proper redirection of traffic.

- **Database Migration:**

  WordPress relies heavily on its database for storing content, settings, and user data. Migrating the database from Hostinger to Azure App Service can be complex, especially if there are differences in the database versions or configurations between the two platforms.

- **File Transfer:**

  In addition to the database, the files associated with the WordPress website (e.g., themes, plugins, images) also need to be transferred to Azure App Service. This can be challenging if there are large amounts of data or the source is a multisite web application.

  To facilitate file transfer, I have compressed and downloaded the root folders of four web applications from their respective sources. These compressed files have been subsequently uploaded to the new Azure app service file. The process of compressing and downloading was executed on the source side while uploading, which can be performed using an FTP(s) client such as FileZilla on the destination side. For visual reference, please refer to the accompanying image.

- **DNS Configuration:**

  After migrating the website to Azure App Service, the DNS records need to be updated to point to the new hosting location. This can take time up to 48 hours to propagate and may result in temporary downtime for the website. This task can be executed at the domain registrar.

- **Application Compatibility:**

  Some WordPress plugins or themes may not be compatible with Azure App Service due to differences in the underlying infrastructure. This can lead to errors or issues with the website after migration.

- **Performance Optimization:**

  Azure App Service offers a diverse selection of performance optimization options, but it requires careful configuration to ensure optimal performance for the WordPress website.

- **Security Configuration:**

  Azure App Service provides built-in security features, such as DDoS protection, a web application firewall, etc. However, these security items need to be configured correctly to protect the WordPress website from potential security threats.

- **Backup and Disaster Recovery:**

  Before migrating the website, it is important to have a backup plan in place to ensure that data is not lost during the migration process. Additionally, a disaster recovery plan should be developed to handle any unpredicted issues that may arise during or after the migration. The default backup plan for Azure app service consists of a one-hour backup process.

- **Cost Management:**

  Azure App Service offers a pay-as-you-go pricing model, which can be cost-effective for small to medium-sized websites. However, it is important to monitor and manage costs to avoid unexpected expenses.

- **Changing Domain**

  Migrating a WordPress website may also include changing the domain name. This can involve updating all internal links, images, and URLs to reflect the new Domain inside the database. It is important to ensure that all redirects are properly configured to avoid losing traffic and search engine rankings.

  Updating the web application through the database is the fastest way to address links. However, there are always a few links that should be updated individually, and you can not find them in the MySQL database.

  Please find The SQL query I have executed to complete the database migration process:

```
UPDATE wp_options SET option_value = replace(option_value, 'parsmartsl.com', 'parsmartsl.azurewebsites.net')
WHERE option_name = 'home' OR option_name = 'siteurl';
UPDATE wp_posts SET guid = replace(guid, 'parsmartsl.com ', 'parsmartsl.azurewebsites.net');
UPDATE wp_posts SET post_content = replace(post_content, 'parsmartsl.com', 'parsmartsl.azurewebsites.net');
UPDATE wp_postmeta SET meta_value = replace(meta_value, 'parsmartsl.com', 'parsmartsl.azurewebsites.net');
```

Figure 34

- **Plugins**

  When undertaking a transition to a new domain, the careful consideration of third-party plugins and APIs becomes essential, particularly if they are intricately tied to specific domains for authentication or verification purposes. For instance, notable services such as Google reCAPTCHA, Jetpack, and Akismet anti-spam typically mandate the utilization of unique codes or API keys that are specifically

assigned to individual domains. Consequently, during the process of domain migration, it becomes imperative to update these aforementioned keys or codes to ensure the uninterrupted functionality of the APIs and plugins.

Overall, migrating a WordPress website from Hostinger to Microsoft Azure App Service can be a complex process that requires careful planning and execution. By considering these challenges and developing a detailed migration plan, businesses can ensure a smooth and successful transition to the Azure cloud.

4.2 Migration Steps:

Based on the comprehensive evaluation of the existing infrastructure, we have gained a comprehensive understanding of the requisite technology and pertinent information necessary to initiate the migration process. By meticulously adhering to the prescribed steps outlined below, we can guarantee a smooth and thorough deployment of the transmission to Microsoft Azure. The whole process can be split into the following steps:

4.2.1 Detailed steps for transmission to Microsoft Azure:

4.2.1.1 Preparation of the destination of migration:

Involves setting up the Azure environment, configuring necessary services, and ensuring compatibility with the migrated WordPress website.

- **Creating a Microsoft account:**
  The journey begins with the creation of a Microsoft account, a pivotal step for accessing the Azure portal. In this digital age, many individuals possess multiple Microsoft accounts tailored to their professional, academic, or personal needs. Leveraging an existing Microsoft account, one can seamlessly enter the Azure portal. Microsoft Azure, at present, extends a warm welcome with a $200 US credit for the first 30 days. Furthermore, Azure generously offers its most sought-after services for free during the initial 12 months. Beyond this period, Azure continues to provide over 55 services perpetually free of charge, a testament to their commitment to accessibility and innovation (Azure, 2024).

  The Azure student account offers a wealth of opportunities, providing students with a $100 US credit for the initial 12 months, along with a corresponding 12-month period of complimentary access to Azure services. This benefit is further enhanced by perpetual access to over 55 always-free services. To unlock this academic treasure trove, I took the initiative to verify my personal Microsoft account using my educational email address. This allowed me to seamlessly transition my Azure account into a student subscription, thereby enabling me to harness the myriad advantages associated with a student account (Azure, Student subscription, 2024).

  My Microsoft account: Benhzm82@*******.com has linked into my CCID.

- **Creating an Azure account:**
  By logging in with your Microsoft account and accepting the terms and conditions on the Microsoft Azure portal, you are able to create a free Azure account. Alternatively, you can make a new Azure account at the following address: **https://azure.microsoft.com/en-us/free/**

- **Creating a subscription in Portal.azure.com**

  In Azure, a subscription is essentially an agreement with Microsoft that allows you to access and use Azure services. It provides a way to manage access, billing, and resources within the Azure environment. Subscriptions come in various tiers and offer different levels of features, support, and pricing options. They can be tailored to suit individual needs, ranging from free or trial subscriptions to paid plans with specific benefits and limitations. Additionally, subscriptions can be managed and organized within Azure to facilitate efficient resource allocation, cost management, and collaboration among team members. Overall, subscriptions serve as the foundation for accessing and utilizing Azure services, providing users with the flexibility and control to deploy and manage their cloud resources effectively.

  Upon creating your Azure account, your first subscription is automatically generated. Initially, I began with a basic free Azure subscription after using my Microsoft account. Subsequently, upon linking my Azure account to my Student CCID, Microsoft upgraded me to the Azure for Student subscription.

- **Creating a Resource Group**

  In Azure, a resource group is a logical container that holds related Azure resources for a specific application or workload. It acts as a management unit to organize and manage resources collectively, providing benefits in terms of resource management, access control, billing, and monitoring. By grouping resources together within a resource group, users can efficiently manage and monitor the entire application lifecycle, including provisioning, updating, and deleting resources. Resource groups also enable users to apply common policies, tags, and permissions across all resources within the group, streamlining governance and compliance efforts. Overall, resource groups simplify the management and organization of Azure resources, facilitating better control, visibility, and efficiency in managing cloud workloads.

- **Creating an Azure App service:**

  Begin by accessing the Azure portal and utilizing the search bar to locate "WordPress on App Service."

  - Proceed by selecting "Create WordPress on App Service" from the search results.
  - Complete the necessary fields, including Subscription, Resource Group, Hosting Region, and Name. If opting for a paid plan, specify the Hosting Plan. Additionally, provide WordPress details such as admin email, username, and password.
  - Once the required information is filled in, click on "Review and create" to assess the current configurations.
  - Take a moment to confirm that all settings align with your requirements.
  - If satisfied, proceed by clicking on "Create" to initiate the deployment process.

- By following these steps, you can seamlessly deploy a WordPress instance on Azure App Service, tailored to your specifications.

❖ **Creating a NetworkWatcherRG:**

NetworkWatcherRG is a resource group in Microsoft Azure that is automatically created when you enable the Network Watcher service. Network Watcher is a networking monitoring and troubleshooting service provided by Azure that allows users to monitor, diagnose, and gain insights into their Azure network infrastructure.

The NetworkWatcherRG resource group contains the resources associated with the Network Watcher service, such as network security groups (NSGs), virtual network (VNet) resources, traffic analytics, and connection monitors. These resources are used to monitor network traffic, detect and diagnose connectivity issues, and optimize network performance within an Azure environment.

❖ **Azure Database for MySQL flexible server**

The Database for MySQL flexible server is a fully managed database service offered by Microsoft Azure for hosting MySQL databases. It provides users with a flexible and scalable MySQL database platform without the need for managing the underlying infrastructure. When you create an Azure App Service, Azure automatically creates a MySQL flexible server for the Azure App Service.

Key features of the Database for MySQL flexible server include:

- Fully Managed Service: Azure handles infrastructure management tasks such as provisioning, patching, backups, and high availability, allowing users to focus on managing their databases.
- Flexibility: Users have the flexibility to choose the compute and storage resources based on their workload requirements. They can scale resources up or down dynamically to accommodate changing needs.
- High Availability: The flexible server option ensures high availability by automatically replicating data across multiple nodes within the same data center, minimizing downtime and ensuring data durability.
- Security: The service includes built-in security features such as encryption at rest and in transit, network security groups (NSGs), and firewall rules to protect data and prevent unauthorized access.
- Compatibility: The database for the MySQL flexible server is compatible with existing MySQL applications, tools, and frameworks, allowing for easy migration of MySQL databases to Azure.

Overall, the database for MySQL's flexible server provides users with a reliable, scalable, and cost-effective solution for hosting MySQL databases in the Azure cloud environment, with simplified management and enhanced security features.

❖ **Private DNS zone**

Azure Private DNS Zone is a feature provided by Microsoft Azure that enables users to create and manage custom domain names in their Azure Virtual Network (VNet) without the need for external DNS servers. It allows for the resolution of domain names to IP addresses within the VNet boundary, ensuring secure and

efficient communication between resources within the same virtual network. When you create an Azure App Service, Azure automatically creates a Private DNS Zone for the Azure App Service.

- **App Service plan**
  When you create a Microsoft Azure App Service, an App Service plan is automatically provisioned. An App Service plan defines the resources and capabilities available to your web application, such as CPU, memory, storage, and scaling options. When you create an Azure App Service, Azure automatically assigns the Basic B1 pricing plan for the Azure student subscription.

- **App Service**
  Azure App Service in Microsoft Azure is a platform-as-a-service (PaaS) offering designed to simplify the process of building, deploying, and scaling web applications and APIs. It offers a fully managed environment for hosting various types of applications, including websites, web apps, mobile backends, and RESTful APIs. When setting up WordPress on Azure App Service, Azure automatically creates an App Service within the selected Resource Group. App Service supports multiple programming languages and frameworks, providing developers with flexibility and ease of use. It offers various deployment options, seamless integration with other Azure services, and built-in scalability and security features. Additionally, App Service ensures compliance with industry standards and regulatory requirements. Overall, Azure App Service is a versatile and dependable solution for hosting and managing web applications and APIs in the cloud.

- **Virtual network**
  In Azure App Services, a Virtual Network (VNet) is a networking construct that allows you to securely connect your App Service to other Azure resources or on-premises networks. It provides isolation and control over inbound and outbound traffic to and from your App Service, enhancing security and compliance. By configuring a VNet for your App Service, you can define network access controls, route traffic, and connect to other resources such as Azure Virtual Machines, databases, or storage accounts within the same network boundary. This enables you to extend your on-premises network into Azure or create complex networking topologies to meet specific business requirements. Additionally, integrating DDoS protection, Azure Firewall, and Microsoft Defender for Cloud into your Virtual Network enhances security by mitigating potential threats and unauthorized access. Peering allows for seamless connectivity between VNets, facilitating communication between different Azure regions or subscriptions. Private Endpoint enables secure access to Azure services over a private connection, enhancing data privacy and compliance. Overall, leveraging a Virtual Network in Azure App Services, along with these additional security features, ensures a robust and secure networking environment for your applications.

- **Installing a simple WordPress on the App services**
  Simply by going to the default domain assign to the Azure App Services we can start the installation of the first WordPress. In this case the default domain is "parsmartsl.azurewebsites.net".

4.2.1.2 Preparation of the source of migration:

Entails backing up all WordPress files and exporting the database from the existing Hostinger environment, ensuring that all essential data is securely transferred to Azure.

- **Backing up data on the source side**
  Backing up a WordPress database and files is essential to ensure the integrity and safety of your data throughout the transition from the migration of WordPress websites from Hostinger to Microsoft Azure. I have Begun by exporting all WordPress databases from Hostinger's phpMyAdmin tool and saved the SQL files locally. These files contain crucial site content, settings, and user information. Additionally, download all WordPress websites' files, including themes, plugins, uploads, and the wp-config.php file, via FTP or the hosting control panel. This comprehensive file backup ensures that all elements of the WordPress websites are preserved for the migration process.

4.2.1.3 Migration Core Process:

Involves transferring the backed-up data to Azure including MYSQL database and WordPress root files, configuring wp-config.php, DNS settings, Updating the old domain address with new Domain within the MYSQL database, and conducting thorough testing to ensure the successful deployment and functionality of the WordPress website on the Azure platform.

- **Importing the MYSQL Database:**
  To import the MySQL database into Azure Database for MySQL flexible server, I simply navigate to the Azure WordPress address and append "\phpmyadmin" to the URL. Then, using the username and password created during the setup provided by Microsoft Azure, which can be found in the "Credentials" section, I logged in to the MySQL database. Once logged in, I imported the database previously backed up in section 4.2.1.2.

- **Transferring WordPress root files:**
  FileZilla was utilized to transfer the folders and files, requiring only the FTPS address, username, and password. These credentials and the FTPS address can be accessed from the Development Center within the App Service section of the Azure Portal. Once connected, the backup files saved on the desktop were selected and transferred into the wwwroot directory of the sites They were then decompressed to access all the files directly by Azure WordPress instance.

- **Considerations for database migration**
  After successfully importing the database into the Azure MySQL Database flexible server, the next step is to update the source domain with the destination domain. This process was discussed in detail earlier in the Changing Domain section 4.1.3.

- **WP-Config.php modifications**
  After importing the WordPress database and files into the new host, several modifications need to be made to the wp-config.php file to ensure proper functionality. These modifications include updating database connection details such as the database name, username, password, and host to match the settings of the new MySQL database. Additionally, any security keys and salts generated by WordPress should be replaced with new ones for enhanced security. It's also important to check and update the table prefix if it differs from the default "wp_". Furthermore, if SSL is enabled, the "define('FORCE_SSL_ADMIN', true);" line should be added to enforce SSL for administration pages. Lastly, any custom configurations or settings specific to the previous host should be reviewed and adjusted as necessary to reflect the new hosting environment.

- **Simply test the new WordPress website:**
  Since the previous steps were successfully completed, I was able to open WordPress by browsing the new domain https://parsmartsl.azurewebsites.net.

4.3 Application Configuration

4.3.1 Configuration steps for WordPress on Azure:

Azure App Service offers a wide range of features and capabilities beyond the scope of this report, including advanced functionalities such as Access Control (IAM), Tags, Microsoft Defender for Cloud, Events, Log Stream, Development Center, Environment Variables, Authentication, Identity, Backups, Certificates, and more. These features enable users to enhance security, streamline development and deployment processes, manage resources efficiently, and ensure compliance with organizational policies and industry standards. Access Control (IAM) allows users to control access to resources and manage permissions, while Tags help organize and categorize resources for easier management and cost tracking. Microsoft Defender for Cloud provides advanced threat protection and security insights, while Events and Log Stream offer real-time monitoring and troubleshooting capabilities. Development Center facilitates application development and deployment workflows, while Environment Variables enable configuration management across different environments. Authentication and Identity features enhance security and user management, while Backup and Certificate functionalities ensure data protection and compliance. Overall, Azure App Service empowers users with a comprehensive set of tools and functionalities to build, deploy, and manage web applications with confidence and efficiency.

4.3.2 Integration with Azure services for enhanced functionality:

Integration with Azure services enhances the functionality of WordPress deployments by providing additional features and capabilities. Some common integrations include:

- Azure CDN Integration: Users can integrate Azure Content Delivery Network (CDN) with WordPress to deliver static content, such as images, videos, and CSS files, to users worldwide with low latency and high availability.
- Azure Search Integration: By integrating Azure Search with WordPress, users can implement advanced search functionality, enabling visitors to search for content across the website more efficiently.
- Azure Storage Integration: WordPress websites can leverage Azure Storage to store media files, backups, and other static content. This integration helps offload storage and enhances scalability and reliability.
- Azure Active Directory (AAD) Integration: For WordPress websites requiring authentication and authorization features, integrating with Azure Active Directory enables single sign-on (SSO) and centralized user management, improving security and user experience.

Overall, application configuration and integration with Azure services play a crucial role in optimizing WordPress deployments on Azure, enabling users to build secure, scalable, and feature-rich websites.

5. Testing and Optimization

After migrating a WordPress website to Microsoft Azure App Service, thorough testing is essential to ensure that the transition is successful. This involves verifying the functionality, content, responsiveness, performance, browser compatibility, security, user acceptance, and load-handling capabilities of the migrated website. By conducting comprehensive testing, website developers can identify and address any issues or discrepancies, ensuring a seamless transition to the new hosting environment. One part of the testing aspect is optimization.

5.1 Testing Strategies

One critical aspect of testing after migrating a WordPress website to Microsoft Azure App Service is functionality testing. This involves thoroughly checking all website features, such as navigation menus, forms, search functionality, and user authentication, to ensure they are working correctly. Each page and interactive element should be tested to confirm that they function as expected, providing users with a seamless browsing experience. For testing links, media, forms, pictures, and any files, I used the Broken link checker WordPress plugin. I also used the “semrush.com” website to check all the broken links.

5.2 Optimization Strategies

Another important aspect of testing is performance evaluation. It is essential to assess the website's performance by analyzing page load times, server response times, and overall site speed. Performance monitoring tools such as “gtmetrix.com” can help identify any bottlenecks or areas for optimization, ensuring that the website performs well under various conditions and can handle peak loads without crashing or slowing down.

In summary, testing and optimization are essential after migrating a WordPress website to Microsoft Azure App Service to ensure a successful transition. By verifying functionality, content accuracy, responsiveness, performance, security, and load-handling capabilities, website developers can identify and address any issues or discrepancies, ensuring a seamless transition to the new hosting environment and delivering an optimal user experience.

6. Conclusion:

6.1 Key findings and insights from the migration process

In conclusion, migrating a WordPress website from Hostinger to Microsoft Azure App Service offers numerous benefits and considerations. Cloud migration provides scalability, flexibility, availability, security, and cost-effectiveness, all of which align with modern business needs. Leveraging Azure's comprehensive services, such as App Service, Azure Functions, and Azure Database for MySQL, ensures seamless integration and customization tailored to specific requirements. WordPress, with its user-friendly interface and extensive customization options, complements Azure's capabilities, enabling users to create visually appealing and scalable websites.

Throughout the migration process, challenges such as database migration, file transfer, DNS configuration, application compatibility, performance optimization, security configuration, backup, disaster recovery, and cost management must be addressed diligently. However, by following best practices and conducting thorough testing and optimization, website owners can ensure a smooth transition and deliver an optimal user experience post-migration. Azure's robust infrastructure, community support, security features, and cost-effective pricing model further enhance the value proposition for hosting WordPress websites. Ultimately, migrating to Microsoft Azure App Service presents an opportunity for businesses to leverage cutting-edge technology, streamline operations, and drive growth in the digital landscape.

7. Recommendations:

7.1 Recommendations for organizations considering a similar migration

If you are considering a similar migration, I recommend following these steps for a seamless and successful migration:

- **Comprehensive Planning:**
  Prior to migration, organizations should conduct a thorough assessment of their existing infrastructure, application dependencies, and business requirements. This planning phase should involve identifying key stakeholders, defining migration objectives, and developing a detailed migration strategy and timeline.

- **Choose the Right Azure Services:**
  Select Azure services that best align with your organization's needs and objectives. Consider factors such as scalability, performance, security, and cost-effectiveness when choosing Azure services to host your web application. Leverage Azure's extensive portfolio of services, including App Service, Azure Functions, Azure Database for MySQL, Azure CDN, and Azure Security Center, to optimize your web application's performance and reliability.

- **Implement Best Practices:**
  Adhere to industry best practices and Azure's recommended guidelines for cloud migration and application deployment. This includes following security best practices, optimizing performance, implementing disaster recovery and backup strategies, and monitoring and managing costs effectively.

- **Conduct Thorough Testing:**
  Prior to finalizing the migration, thoroughly test the migrated web application to ensure functionality, performance, and security. Conduct functional testing to verify that all features and functionalities work as expected, performance testing to assess the application's responsiveness and scalability, and security testing to identify and address any vulnerabilities or security risks.

- **Continuous Improvement and Optimization:**
  Migration to Azure is not a one-time event but an ongoing process. Continuously monitor and optimize your Azure resources to improve performance, reliability, and cost-effectiveness. Utilize Azure's monitoring and analytics tools to gain insights into your application's performance and identify areas for improvement. Implement automation and DevOps practices to streamline deployment, management, and maintenance processes.

- **Embrace Scalability:**
  Leverage Azure's scalability features to accommodate future growth and fluctuations in demand. Design your web application architecture with scalability in mind, utilizing features such as auto-scaling, load balancing, and Azure CDN to ensure that your application can handle increases in traffic and user load without compromising performance or reliability.

- **Invest in Training and Skill Development:**
  Ensure that your IT team has the necessary skills and expertise to effectively manage and optimize your Azure environment. Invest in training and skill development programs to empower your team with the knowledge and capabilities required to leverage Azure's features and services effectively.

- **Stay Updated with Azure Innovations:**
  Azure is constantly evolving with new features, services, and updates. Stay updated with the latest Azure innovations and advancements to leverage new capabilities and enhance your web application's functionality, performance, and security.

By following these recommendations, organizations can successfully migrate their web applications to Microsoft Azure Cloud as a Web Application Service and position themselves for future growth and success in the cloud.

7.2 Suggestions for continuous improvement and future scalability.

Here are some suggestions for continuous improvement and future scalability:

- **Monitor Performance:**
  Continuously monitor the performance of your web application on Azure to identify any bottlenecks or areas for improvement. Utilize Azure's monitoring and analytics tools to gain insights into resource utilization, response times, and user experience.

- **Optimize Resource Usage:**
  Regularly review and optimize the usage of Azure resources to ensure cost-effectiveness and efficient resource allocation. Utilize features such as auto-scaling and resource tagging to optimize resource usage based on demand and workload.

- **Implement DevOps Practices:**
  Adopt DevOps practices to streamline deployment, management, and maintenance processes. Implement continuous integration and continuous deployment (CI/CD) pipelines to automate the deployment of application updates and enhancements.

- **Enhance Security:**
  Stay updated with the latest security threats and vulnerabilities and implement appropriate security measures to protect your web application and data. Utilize Azure Security Center and other security tools to monitor for threats, detect vulnerabilities, and enforce security policies.

- **Embrace Cloud-Native Technologies:**
  Explore and adopt cloud-native technologies and architectures to further enhance the scalability, reliability, and performance of your web application. Consider leveraging serverless computing, microservices, and containers to build and deploy resilient and scalable applications on Azure.

- **Stay Updated with Azure Innovations:**
  Stay informed about the latest Azure innovations and updates to leverage new features and capabilities that can enhance your web application's functionality and performance. Regularly attend Azure events, webinars, and training sessions to stay updated with the latest developments.

By implementing these suggestions, you can ensure continuous improvement and future scalability of your web application on Microsoft Azure.

8. References

1. How to enable Multisite WordPress on Azure App Service?, Microsoft Azure, 2023.

   https://github.com/Azure/wordpress-linux-appservice/blob/main/WordPress/wordpress_multisite_installation.md

2. Three key cloud adoption trends in migrating and modernizing workloads, Microsoft Azure, 2022.

   https://azure.microsoft.com/en-us/blog/3-key-cloud-adoption-trends-in-migrating-and-modernizing-workloads/

3. 2023 State of the Cloud Report, Flexera, 2023.

   https://info.flexera.com/CM-REPORT-State-of-the-Cloud

4. What is cloud computing?, Microsoft Azure, 2023.

   https://azure.microsoft.com/en-ca/resources/cloud-computing-dictionary/what-is-cloud-computing/

5. What is IaaS?, IBM, 2023.

   https://www.ibm.com/topics/iaas

6. What is PaaS?, IBM, 2023.

   https://www.ibm.com/topics/paas

7. What is SaaS?, IBM, 2023.

   https://www.ibm.com/topics/saas

8. What is serverless computing?, IBM, 2023

   https://www.ibm.com/topics/serverless

9. Pss™ - Pars Smart Solution, parsmartsl.com, 2024

   https://parsmartsl.azurewebsites.net

10. How to set up subdirectory Multisite in WordPress on Azure App Service, Microsoft, 2023

    https://techcommunity.microsoft.com/t5/apps-on-azure-blog/how-to-set-up-subdirectory-multisite-in-wordpress-on-azure-app/ba-p/3791071

11. Azure Free Account, Microsoft, 2024

    https://azure.microsoft.com/en-us/free

12. Azure Student Account, Microsoft, 2024

    https://azure.microsoft.com/en-ca/free/students

13. Azure, Different Clouds Types, Microsoft, 2023

https://azure.microsoft.com/en-ca/resources/cloud-computing-dictionary/what-are-private-public-hybrid-clouds/

14. Whatcms.org, What CMS Microsoft is using, 2024

https://whatcms.org/?s=www.microsoft.com%2Fen-us%2F

15. Microsoft Learn, WordPress on App Service, Microsoft, 2023

https://learn.microsoft.com/en-us/azure/architecture/example-scenario/infrastructure/wordpress-app-service?wt.mc_id=searchAPI_azureportal_inproduct_rmskilling&sessionId=8b77a72f4c8a4d4890e0060a9362e15c

16. Microsoft Learn, Microsoft Azure vs AWS, Microsoft, 2023

https://learn.microsoft.com/en-us/azure/architecture/aws-professional/services

17. Microsoft Learn, Shared Responsibility, Microsoft, 2023

https://learn.microsoft.com/en-us/azure/security/fundamentals/shared-responsibility

18. W3TECHS, Market share trends for CMS, W3TECHS, 2024

https://w3techs.com/technologies/history_overview/content_management

9. Appendices:

This supplementary material, which includes screenshots, definitions, and other relevant data, will greatly enhance the comprehensiveness and clarity of the document. These extra details will serve to enrich the reader's understanding and provide valuable context to support the major findings and arguments presented in the report.

9.1 The websites that have been considered:

In this dedicated section of the Appendix, you can discover a comprehensive list for all the links and web addresses that were referenced and consulted throughout the report.

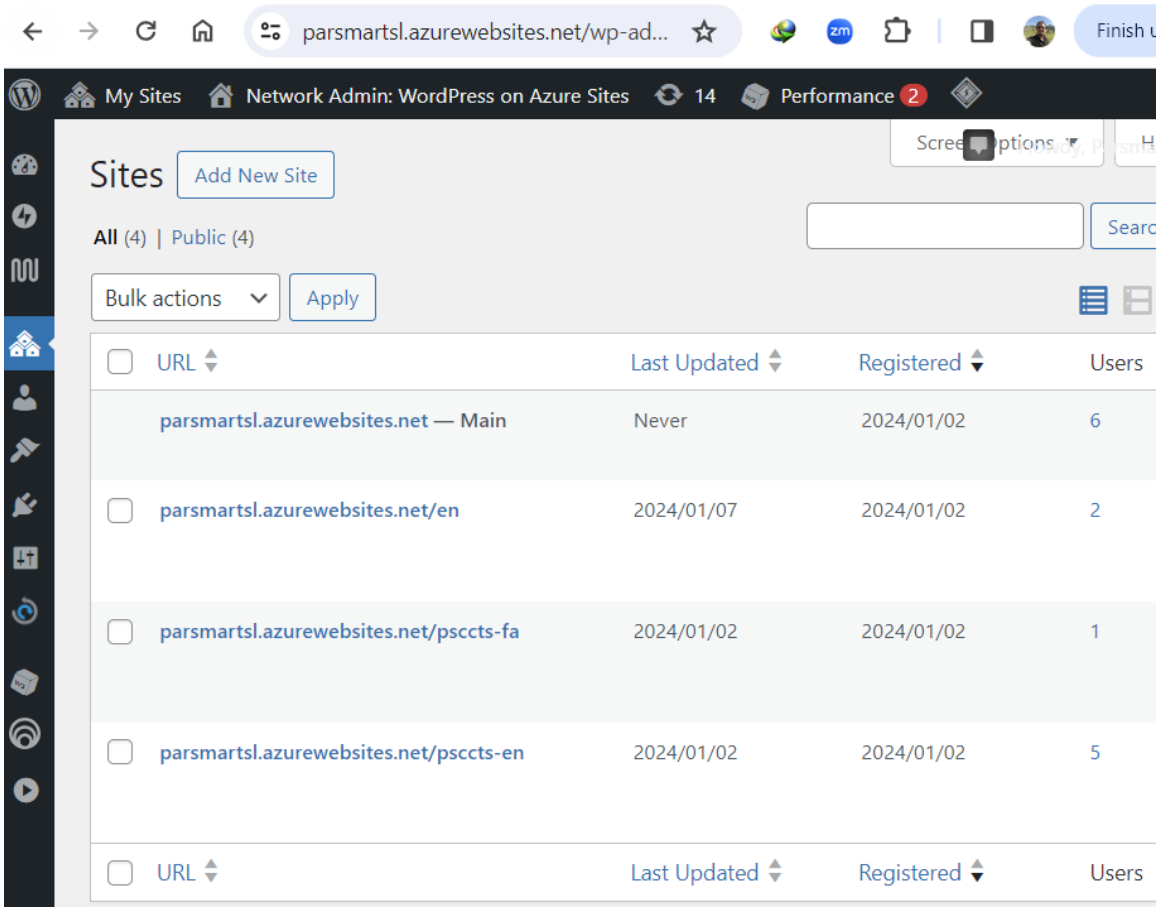
- **All available source websites**
  - https://www.parsmartsl.com/
  - https://www.parsmartsl.com/en/
  - https://enpsccts.parsmartsl.com/
  - https://psccts.parsmartsl.com/
  - https://www.parsmartsl.tk/
  - https://www.parsmartsl.tk/en/
  - https://enpsccts.parsmartsl.tk/
  - https://psccts.parsmartsl.tk/
  -
- **Migrated websites to Microsoft Azure Cloud:**
  - https://www.parsmartsl.com/
  - https://www.parsmartsl.com/en/
  - https://enpsccts.parsmartsl.com/
  - https://psccts.parsmartsl.com/
- **Subdirectory-based multisite theme:**
  - https://parsmartsl.azurewebsites.net/
  - https://parsmartsl.azurewebsites.net/en/
  - https://parsmartsl.azurewebsites.net/psccts-en/
  - https://parsmartsl.azurewebsites.net/psccts-fa/

- **Subdomain-based multisite theme:**
  - https://en.parsmartsl.azurewebsites.net/
  - https://en.psccts.parsmartsl.azurewebsites.net/
  - https://fa.psccts.parsmartsl.azurewebsites.net/

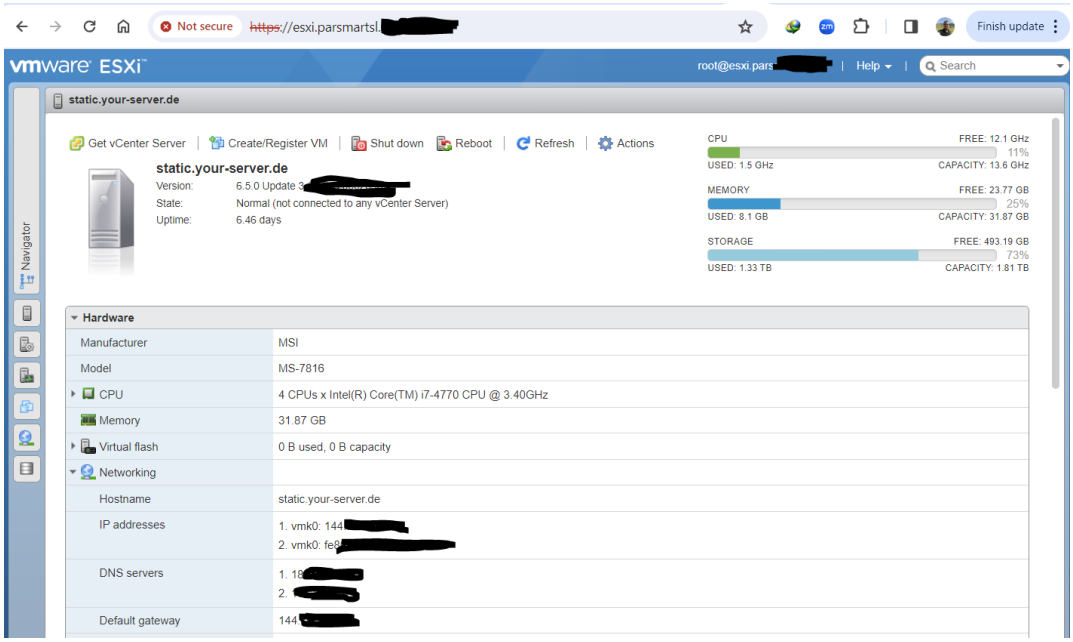
9.2 Related Screenshots:

In this section of the appendix, you will find a comprehensive collection of all the screenshots that were referenced and utilized in the reports. These screenshots serve as visual aids to complement the textual content, providing clarity, illustration, and evidence for the points discussed throughout the document.

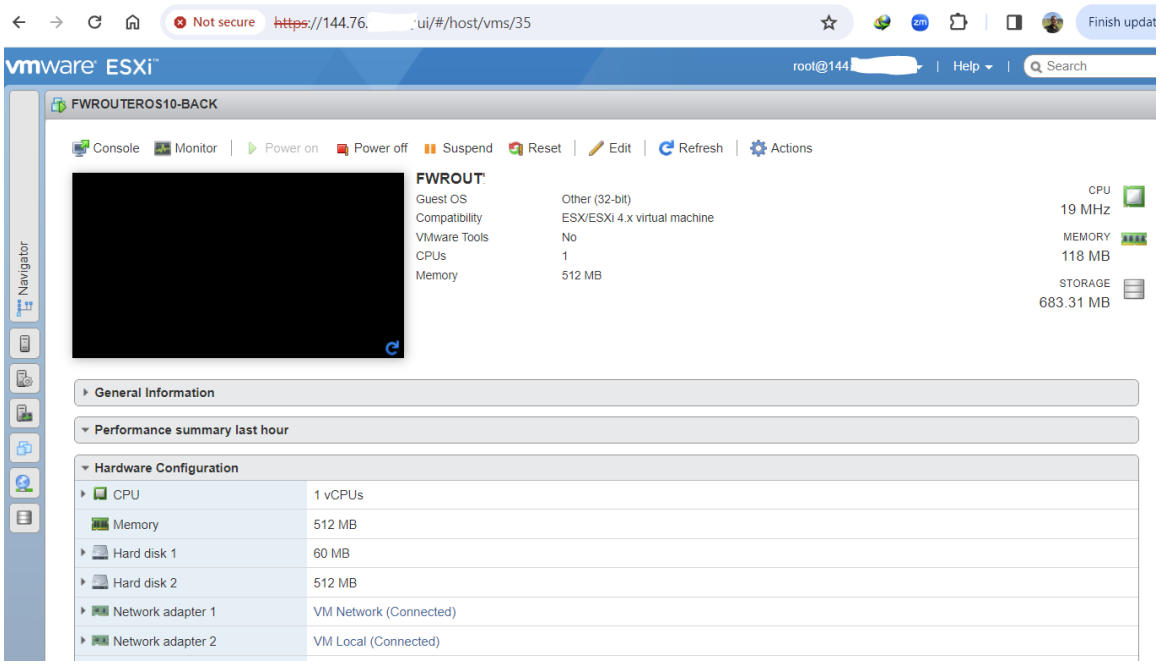
- **Multisite WordPress on Microsoft Azure App Service (Pss™, 2024)**

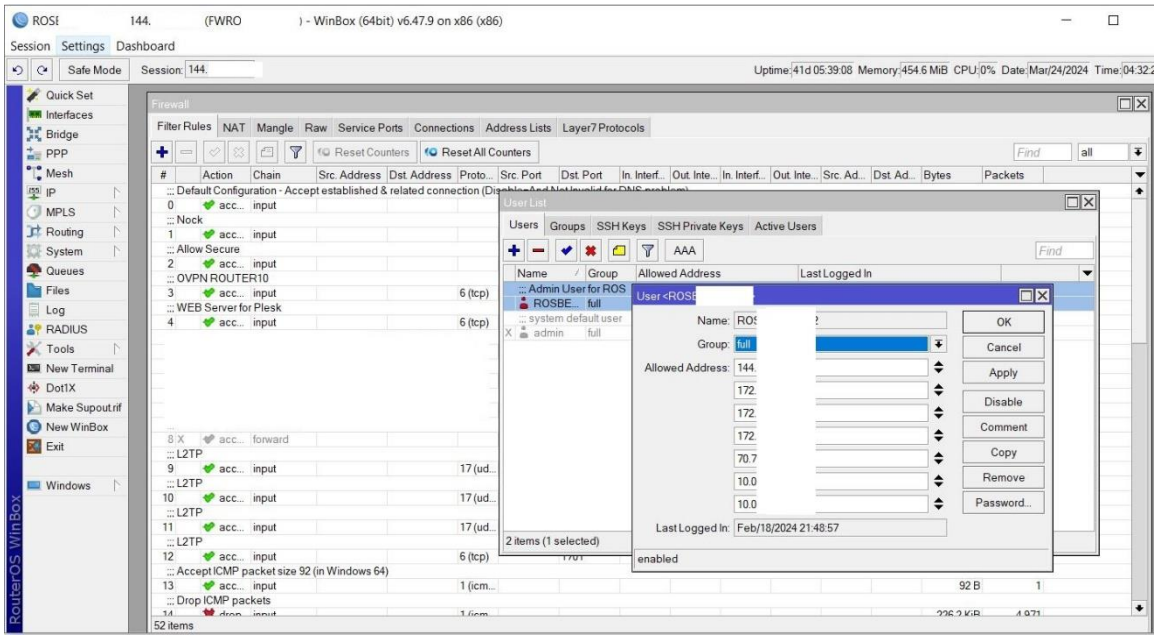


❖ Dedicated Private Server:

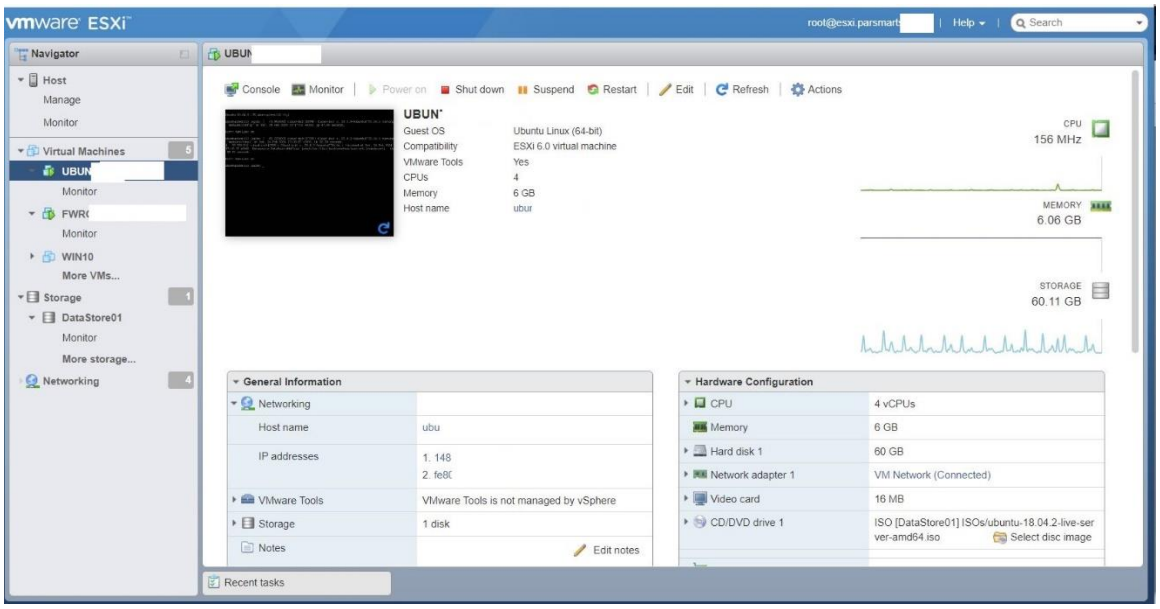


❖ Virtual Machine: Firewall

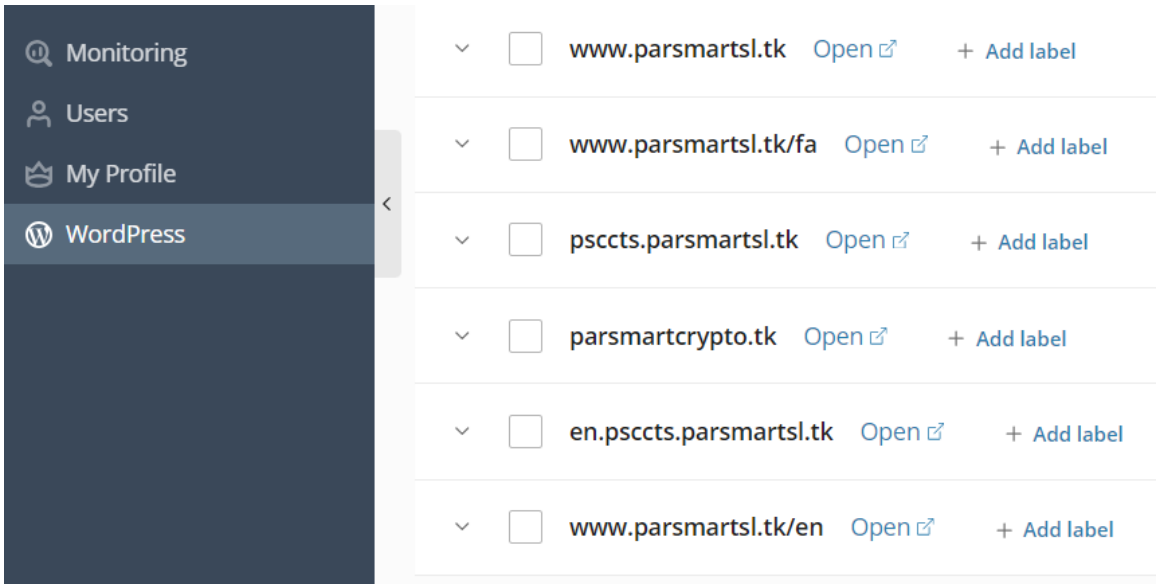




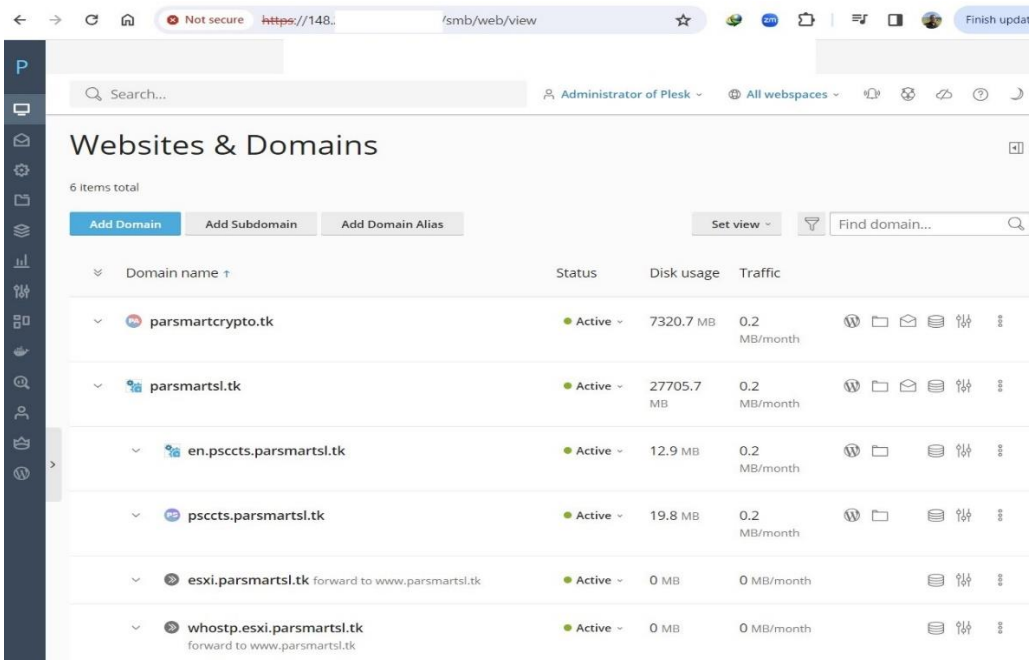
❖ Virtual Machine: Web Host Server



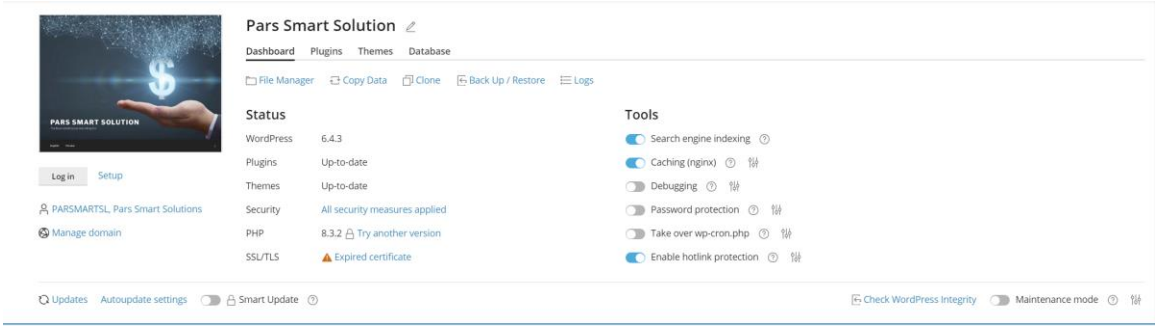
❖ **WordPress web applications:**

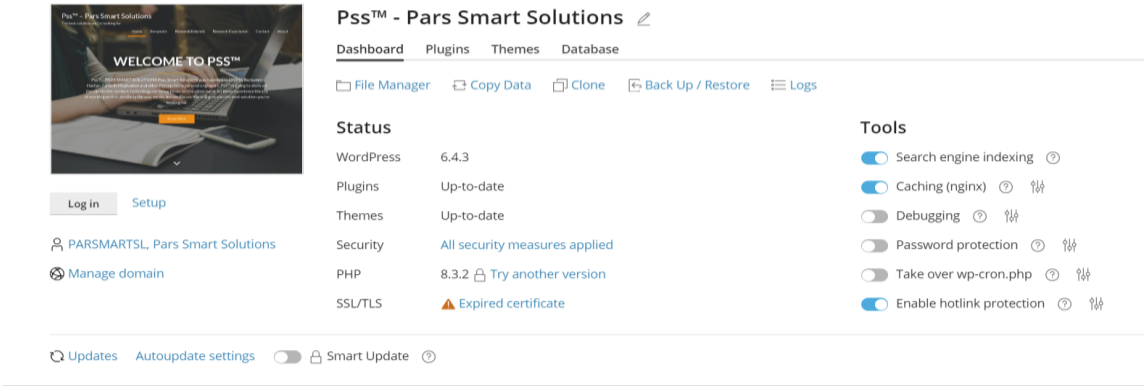


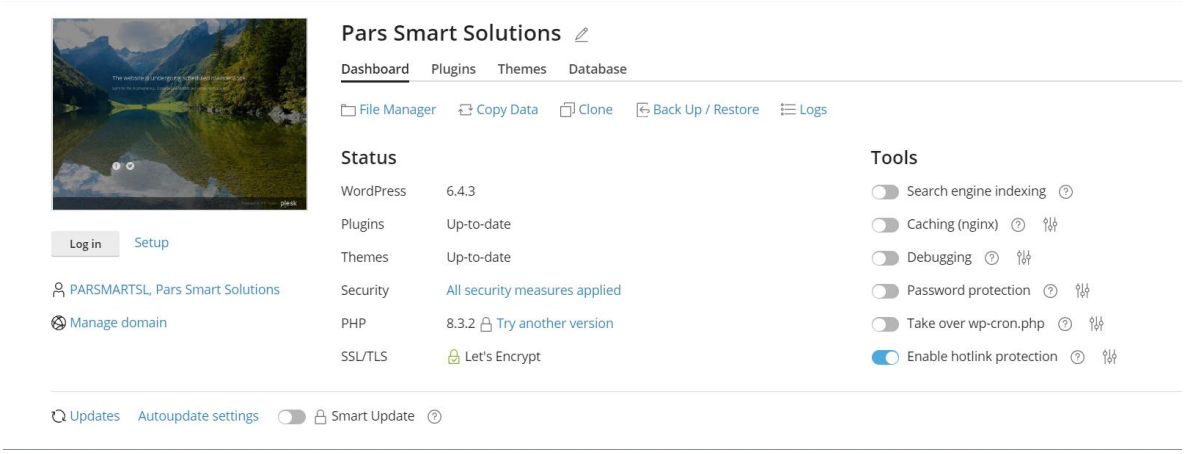
❖ **Plesk Domains and subdomains:**

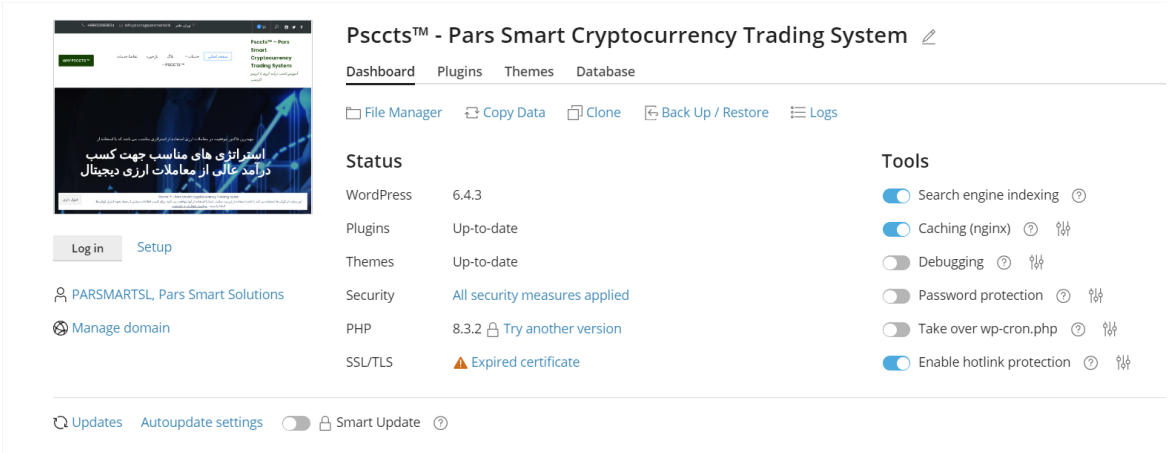


❖ **WordPress Instances Developed by Plesk Control panel on DPS:**

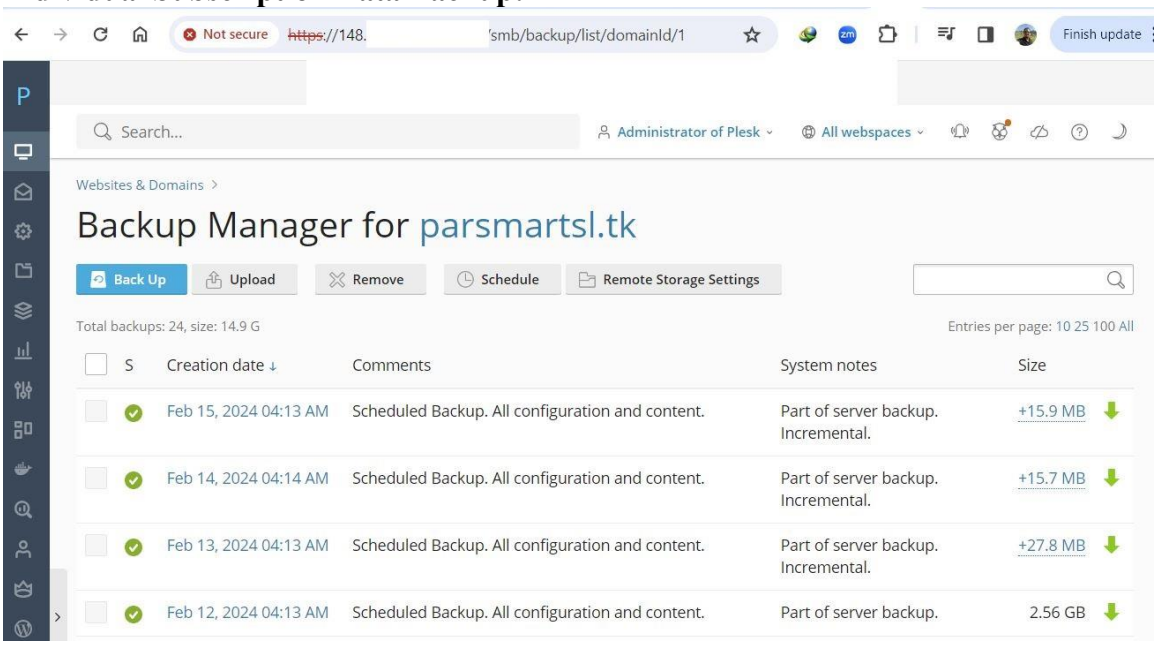




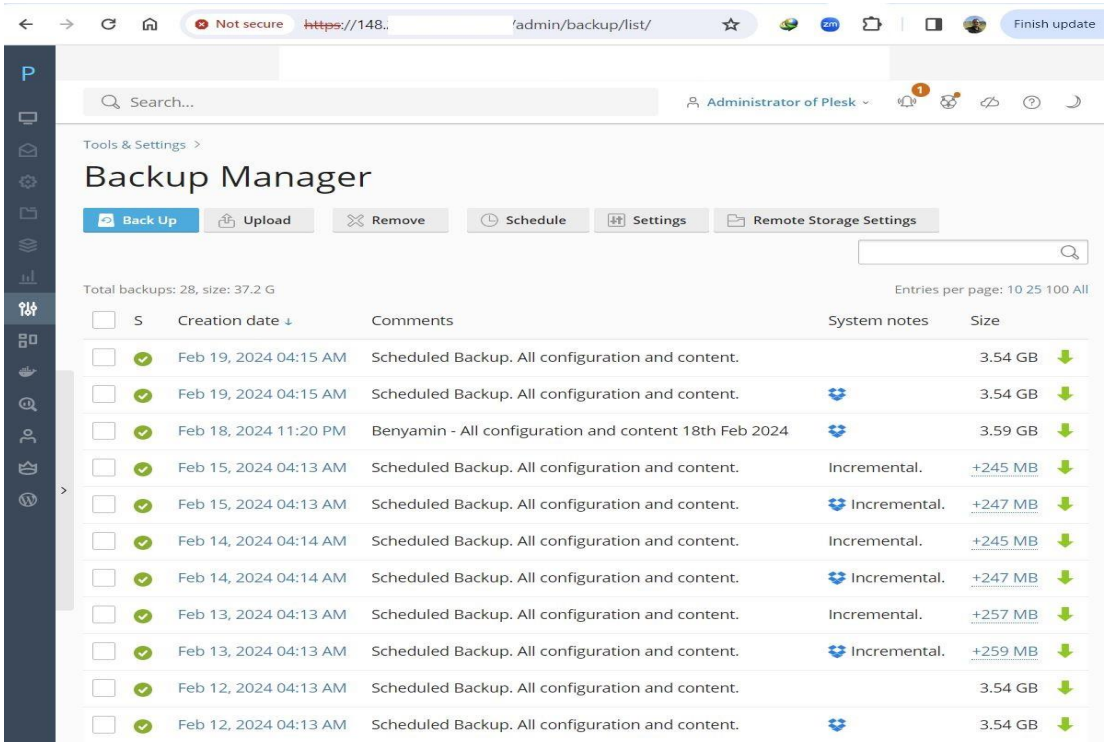




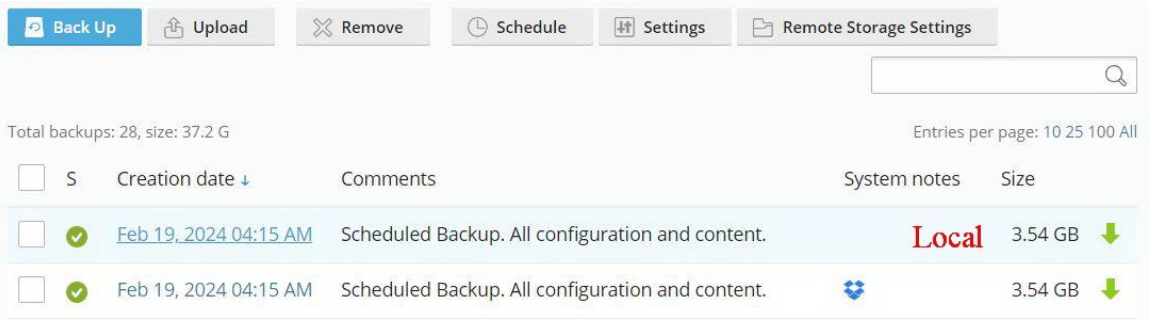
❖ Individual Subscription Data Backup:



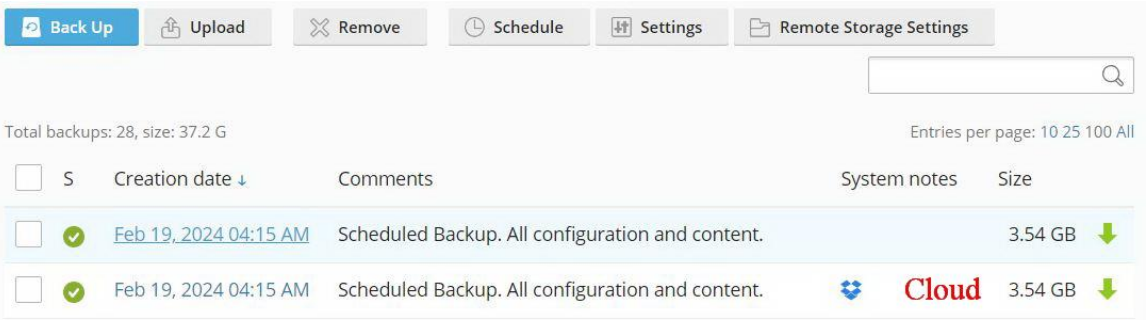
❖ **Entire Storage Backup:**



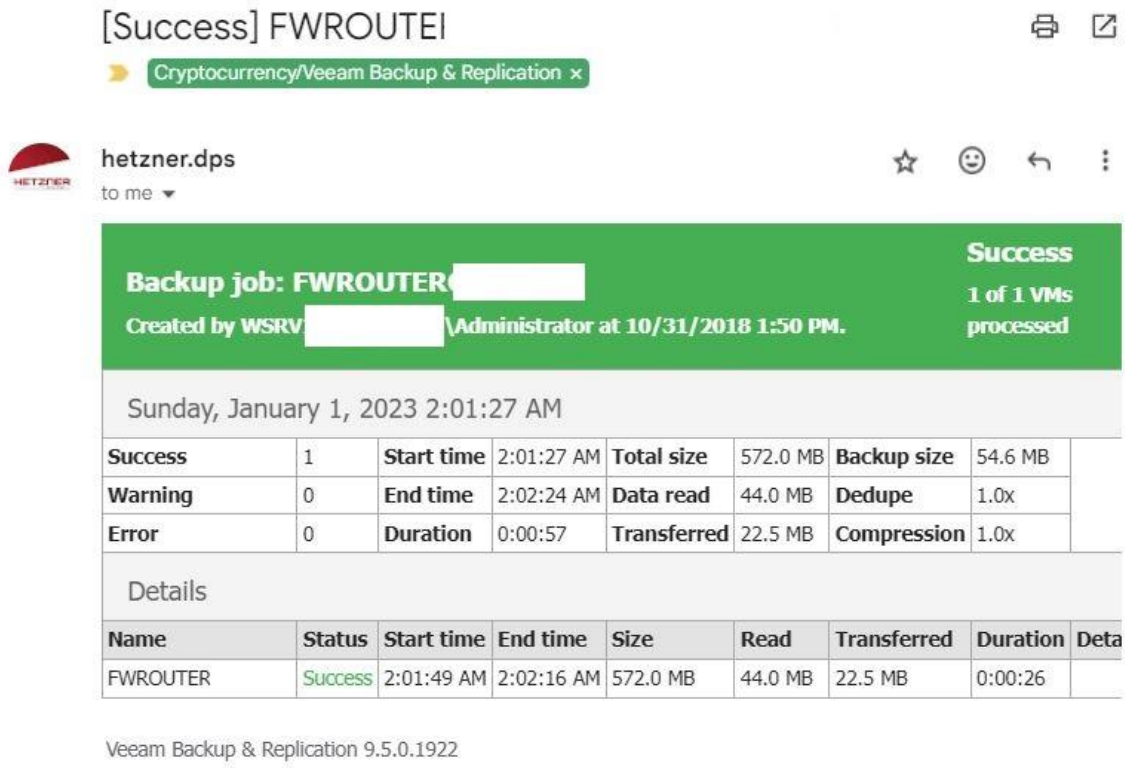
❖ **Local Storage backup:**

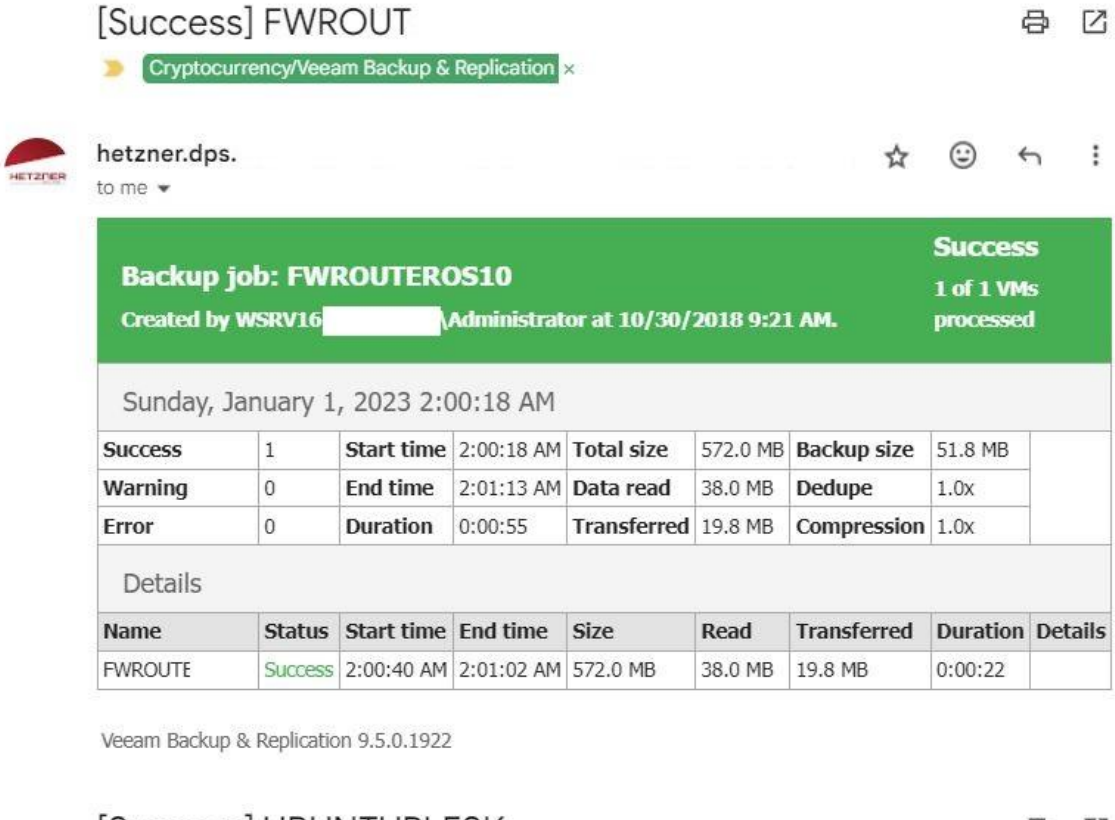


❖ **Cloud Storage backup:**



❖ **Virtual Machine: Veeam Backup & Replication,**





[Success] FWROUT

Cryptocurrency/Veeam Backup & Replication ×

hetzner.dps.

to me

Backup job: FWROUTEROS10 — **Success**

Created by WSRV16 \Administrator at 10/30/2018 9:21 AM. — **1 of 1 VMs processed**

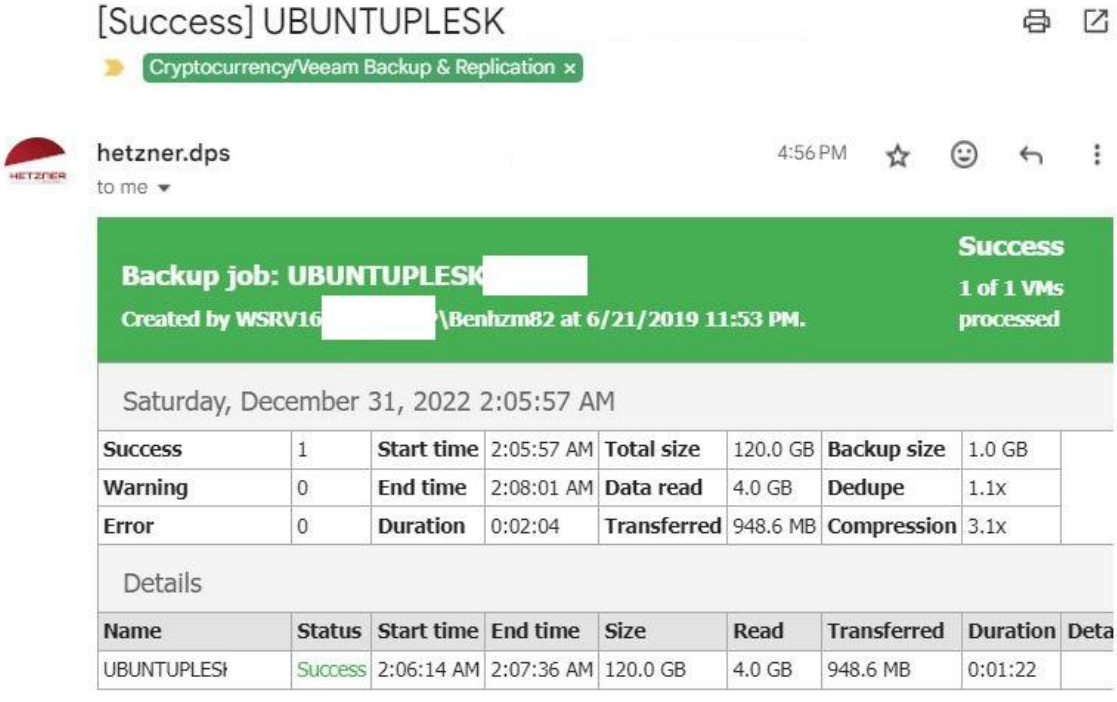
Sunday, January 1, 2023 2:00:18 AM

Success	1	**Start time**	2:00:18 AM	**Total size**	572.0 MB	**Backup size**	51.8 MB
Warning	0	**End time**	2:01:13 AM	**Data read**	38.0 MB	**Dedupe**	1.0x
Error	0	**Duration**	0:00:55	**Transferred**	19.8 MB	**Compression**	1.0x

Details

Name	Status	Start time	End time	Size	Read	Transferred	Duration	Details
FWROUTE	Success	2:00:40 AM	2:01:02 AM	572.0 MB	38.0 MB	19.8 MB	0:00:22	

Veeam Backup & Replication 9.5.0.1922



[Success] UBUNTUPLESK

Cryptocurrency/Veeam Backup & Replication ×

hetzner.dps 4:56 PM

to me

Backup job: UBUNTUPLESK — **Success**

Created by WSRV16 \Benhzm82 at 6/21/2019 11:53 PM. — **1 of 1 VMs processed**

Saturday, December 31, 2022 2:05:57 AM

Success	1	**Start time**	2:05:57 AM	**Total size**	120.0 GB	**Backup size**	1.0 GB
Warning	0	**End time**	2:08:01 AM	**Data read**	4.0 GB	**Dedupe**	1.1x
Error	0	**Duration**	0:02:04	**Transferred**	948.6 MB	**Compression**	3.1x

Details

Name	Status	Start time	End time	Size	Read	Transferred	Duration	Deta
UBUNTUPLESI	Success	2:06:14 AM	2:07:36 AM	120.0 GB	4.0 GB	948.6 MB	0:01:22	

Veeam Backup & Replication 9.5.0.1922

hetzner.dps 4:53 PM

to me

Backup job: WINSRV

Created by WSRV16-\Administrator at 10/30/2018 9:21 AM.

Success
1 of 1 VMs processed

Sunday, January 1, 2023 2:04:08 AM

Success	1	**Start time**	2:04:08 AM	**Total size**	60.0 GB	**Backup size**	30.6 MB
Warning	0	**End time**	2:05:25 AM	**Data read**	0.0 B	**Dedupe**	1.0x
Error	0	**Duration**	0:01:17	**Transferred**	14.2 KB	**Compression**	1.0x

Details

Name	Status	Start time	End time	Size	Read	Transferred	Duration	Details
WINSRV	Success	2:04:25 AM	2:05:18 AM	60.0 GB	0.0 B	14.2 KB	0:00:53	

Veeam Backup & Replication 9.5.0.1922

[Success] W16SEX64

Cryptocurrency/Veeam Backup & Replication ×

hetzner.dps , 4:51 PM

to me

Backup job: W16SEX

Created by WSRV16-\Administrator at 10/30/2018 9:21 AM.

Success
1 of 1 VMs processed

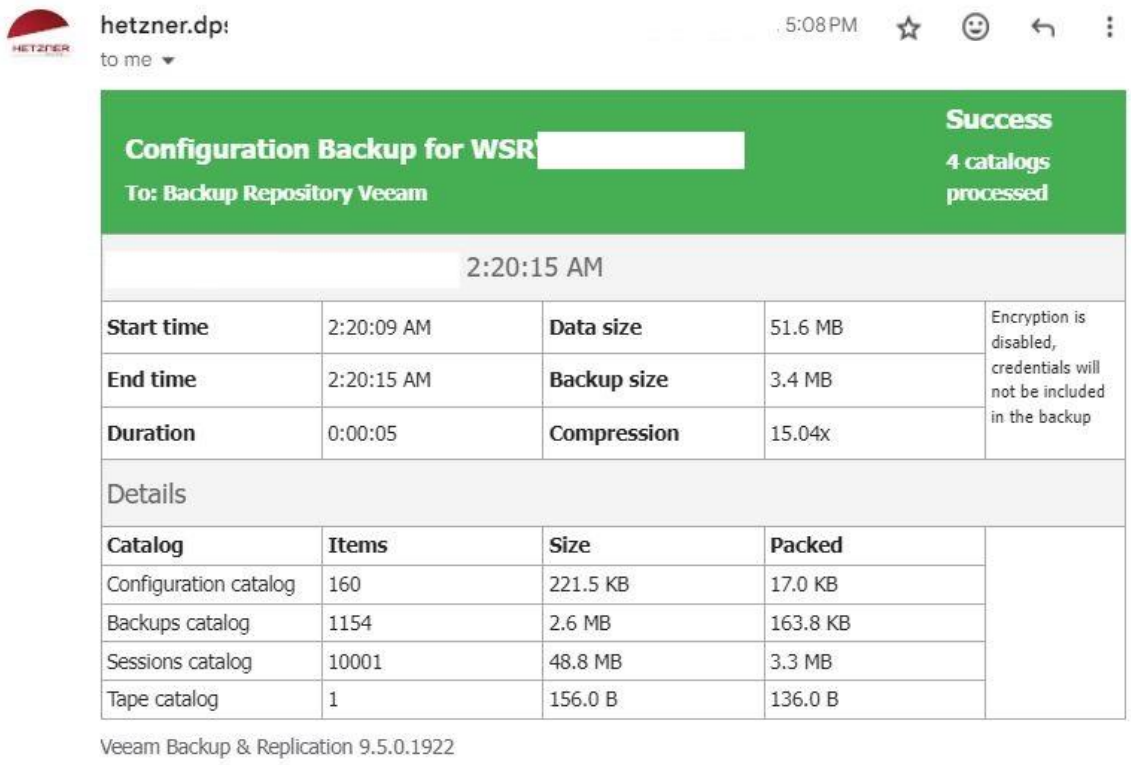
Sunday, January 1, 2023 2:02:36 AM

Success	1	**Start time**	2:02:36 AM	**Total size**	60.0 GB	**Backup size**	30.6 MB
Warning	0	**End time**	2:03:59 AM	**Data read**	0.0 B	**Dedupe**	1.0x
Error	0	**Duration**	0:01:23	**Transferred**	22.9 KB	**Compression**	1.0x

Details

Name	Status	Start time	End time	Size	Read	Transferred	Duration	Details
PLESK	Success	2:02:53 AM	2:03:50 AM	60.0 GB	0.0 B	22.9 KB	0:00:57	

Veeam Backup & Replication 9.5.0.1922



hetzner.dp[redacted] 5:08 PM

to me

Configuration Backup for WSR[redacted] — **Success**

To: Backup Repository Veeam — **4 catalogs processed**

[redacted] 2:20:15 AM

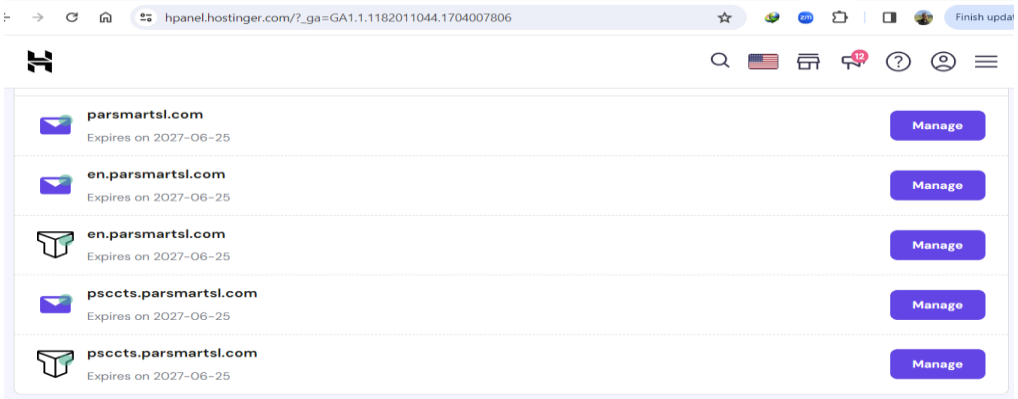
Start time	2:20:09 AM	**Data size**	51.6 MB	Encryption is disabled, credentials will not be included in the backup
End time	2:20:15 AM	**Backup size**	3.4 MB	
Duration	0:00:05	**Compression**	15.04x	

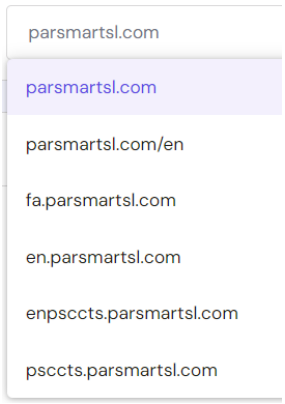
Details

Catalog	Items	Size	Packed
Configuration catalog	160	221.5 KB	17.0 KB
Backups catalog	1154	2.6 MB	163.8 KB
Sessions catalog	10001	48.8 MB	3.3 MB
Tape catalog	1	156.0 B	136.0 B

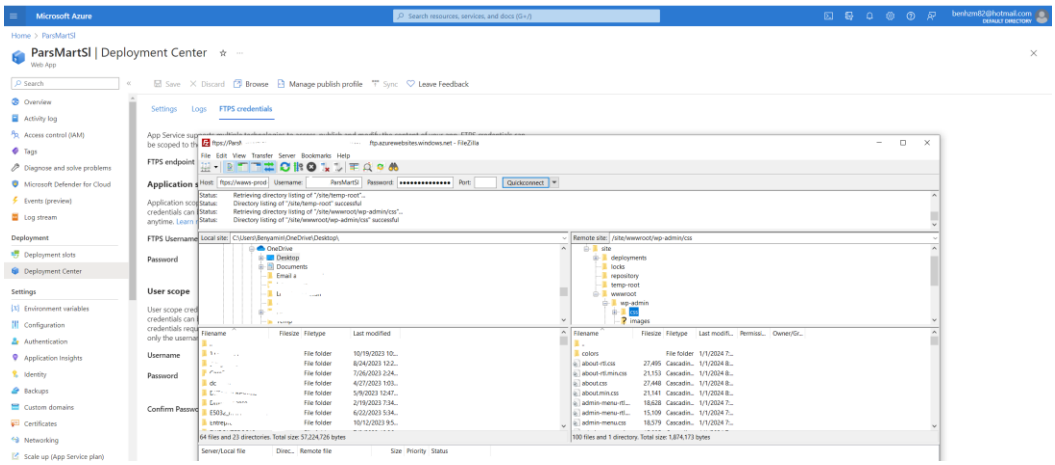
Veeam Backup & Replication 9.5.0.1922

- **Hostinger data center located in US:**

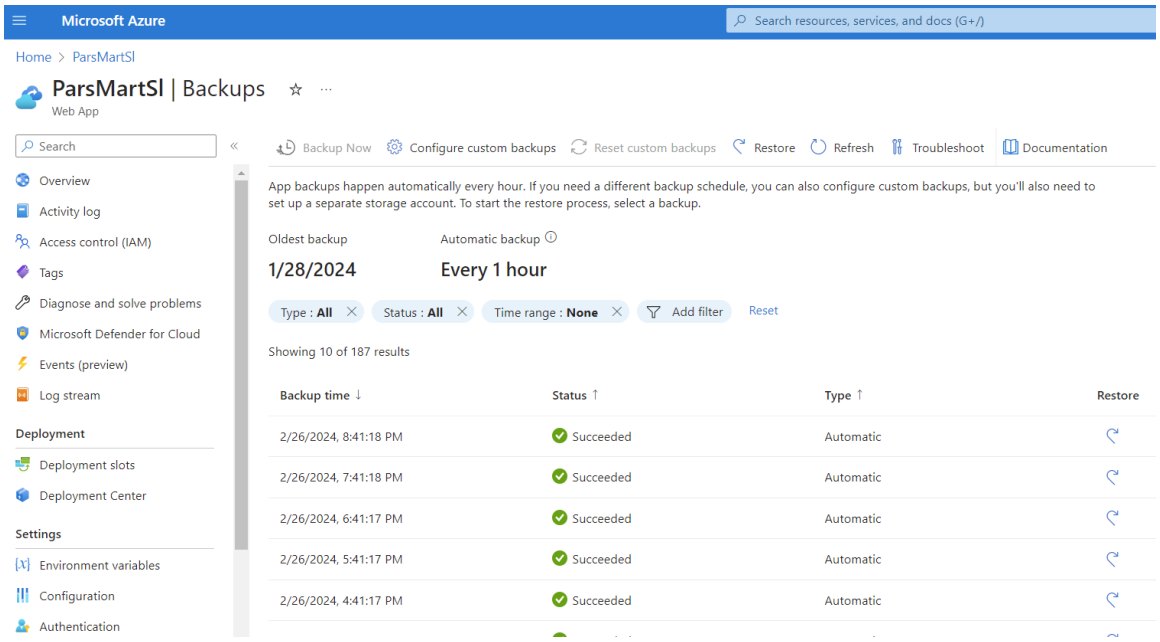




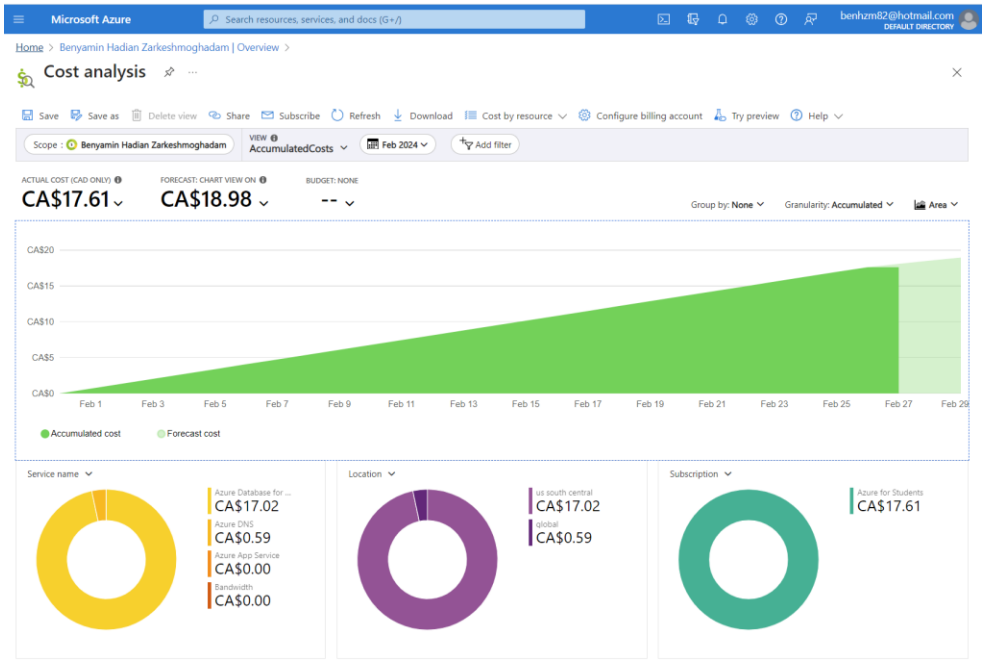
❖ **File Transfer:**



❖ Microsoft Azure Backup and Disaster Recovery:



❖ Cost Management:



❖ **Free Services for 12 months:**

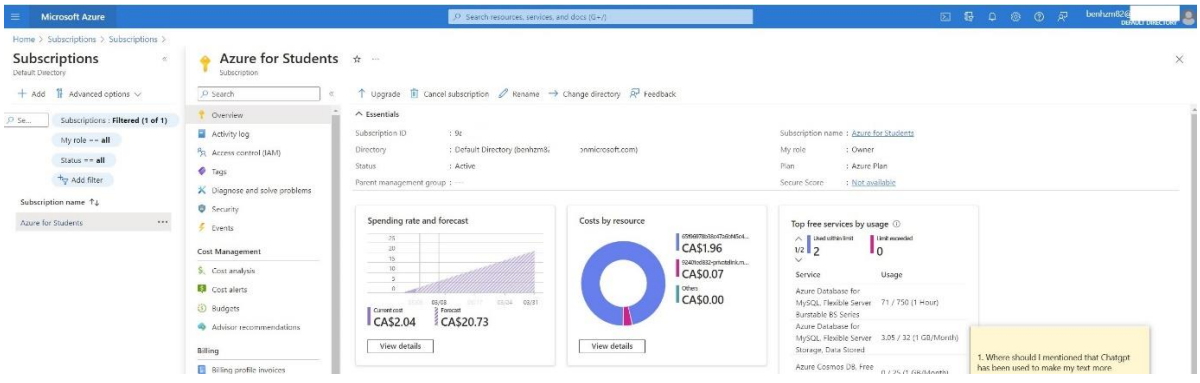
Free services for 12 months

Expires on Tuesday, November 5, 2024

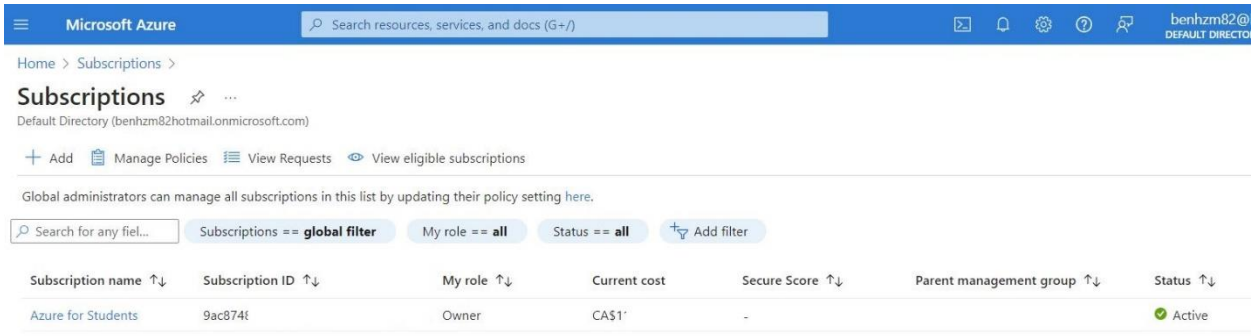
This month's usage

Meter	Usage/Limit			Status
Azure Database for MySQL, Flexible Server Burstabl...		9%	71 / 750 (1 Hour)	Unlikely to exceed
Azure Database for MySQL, Flexible Server Storage,...		9%	3.05 / 32 (1 GB/Month)	Unlikely to exceed
Azure Cosmos DB, Free Data Stored		0%	0 / 25 (1 GB/Month)	Not in use
Azure Cosmos DB, Free 100 RU/s		0%	0 / 2,976 (1/Hour)	Not in use
Storage, Files, LRS Data Stored		0%	0 / 100 (1 GB/Month)	Not in use
Storage, Premium Page Blob, P6 Disks		0%	0 / 2.2 (1/Month)	Not in use
Storage, Standard HDD Managed Disks, LRS Snaps...		0%	0 / 1 (1 GB/Month)	Not in use
Storage, Standard HDD Managed Disks, Disk Opera...		0%	0 / 200 (10K)	Not in use
Storage, Tiered Block Blob, Hot LRS Data Stored		0%	0 / 5 (1 GB/Month)	Not in use
Virtual Machines, BS Series, B1s		0%	0 / 750 (1 Hour)	Not in use
Virtual Machines, BS Series Windows, B1s		0%	0 / 750 (1 Hour)	Not in use
Networking, Data Transfer Out (GB)		0%	0 / 15 (1 GB)	Not in use
SQL Database, Single Standard, S0 DTUs		0%	0 / 31 (1/Day)	Not in use
Storage, Files, Read Operations		0%	0 / 4 (10K)	Not in use
Storage, Files, LRS Write Operations		0%	0 / 1 (10K)	Not in use
Storage, Files, Protocol Operations		0%	0 / 4 (10K)	Not in use
Storage, Files, List Operations		0%	0 / 1 (10K)	Not in use
Storage, Tiered Block Blob, Hot Read Operations		0%	0 / 2 (10K)	Not in use
Storage, Tiered Block Blob, Hot LRS Write Operations		0%	0 / 1 (10K)	Not in use
Networking, Public IP Addresses, IP Address Hours		0%	0 / 1,500 (1 Hour)	Not in use
Virtual Machines Licenses, Red Hat Enterprise Linux,...		0%	0 / 750 (1 Hour)	Not in use
Storage, Tiered Block Blob, LRS List and Create Con...		0%	0 / 2 (10K)	Not in use
Cognitive Services, Custom Vision, S0 Transactions		0%	0 / 10 (1K)	Not in use
Cognitive Services, Custom Vision, S0 Training		0%	0 / 1 (1 Hour)	Not in use
Cognitive Services, Custom Vision, S0 Image Storage		0%	0 / 10 (1K)	Not in use
Cognitive Services, Computer Vision, S1 Transactions		0%	0 / 5 (1K)	Not in use

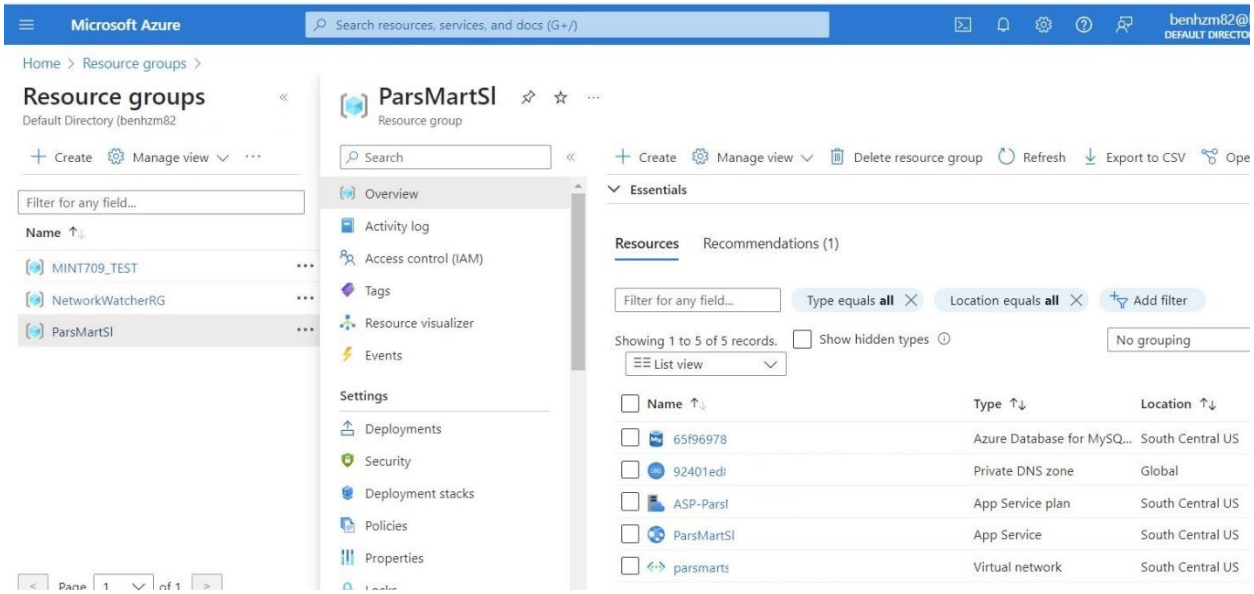
❖ **My Student Azure account: Benhzm82@***.com**



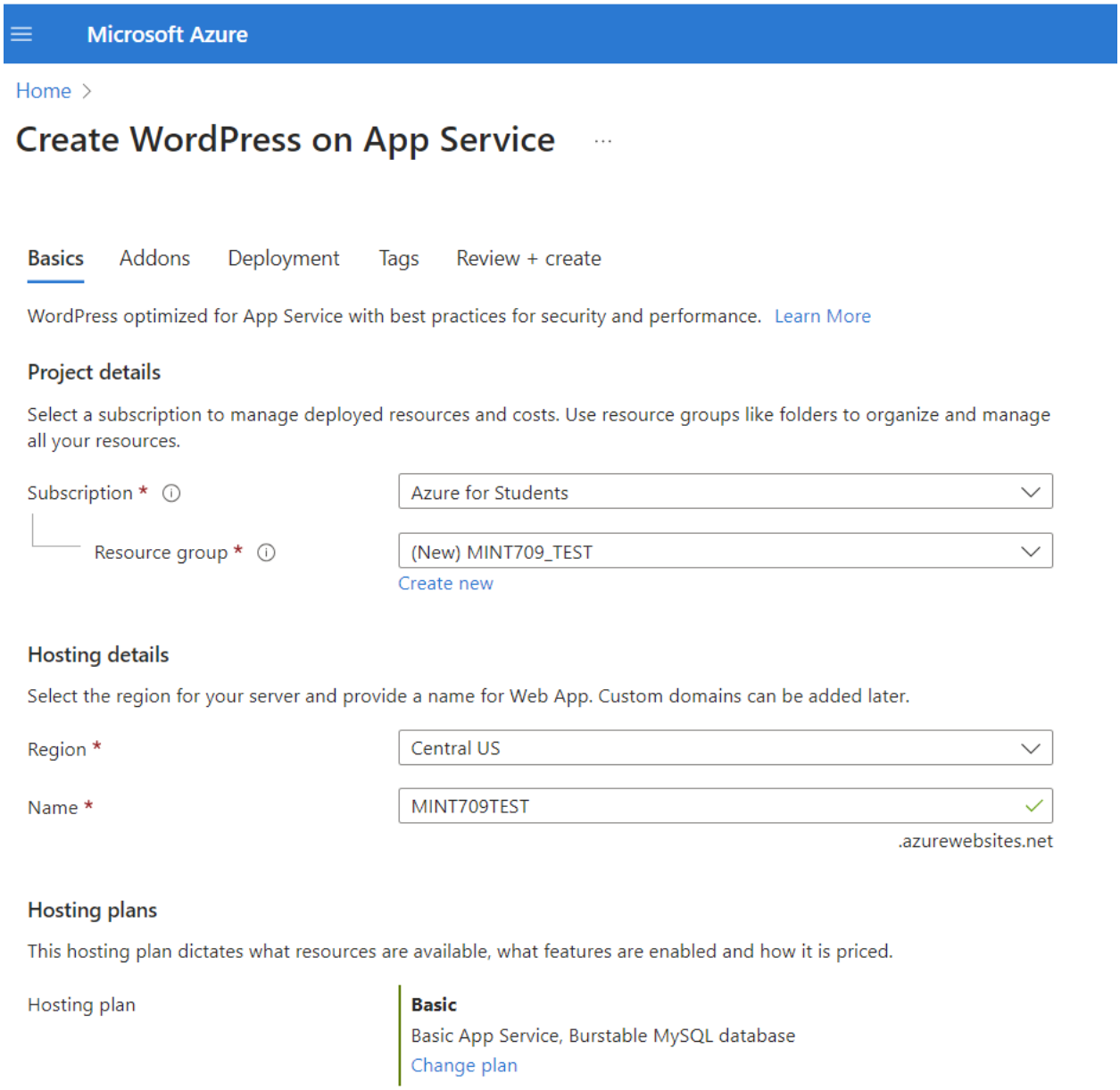
❖ Azure Subscription



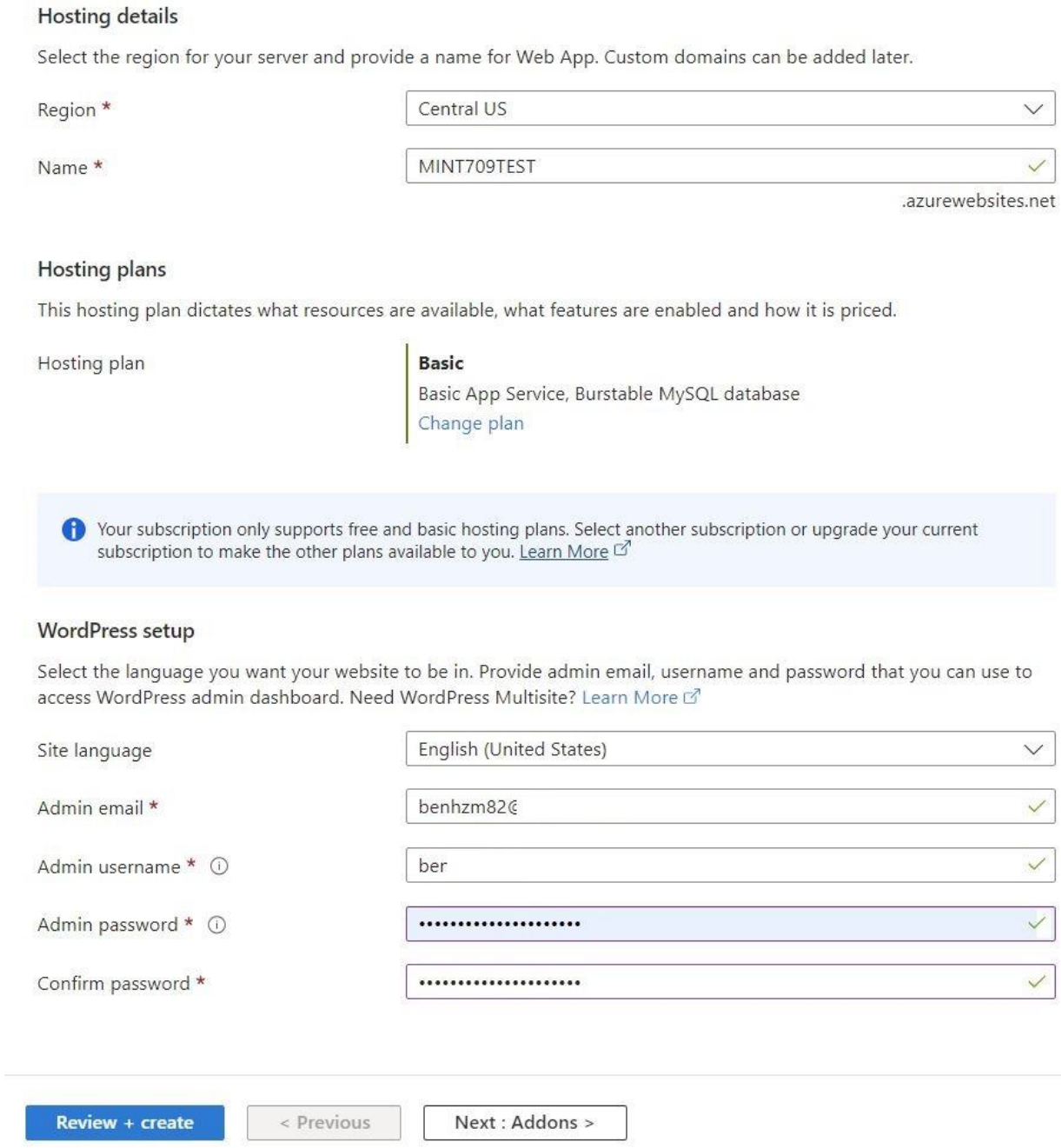
❖ Creating a Resource Group



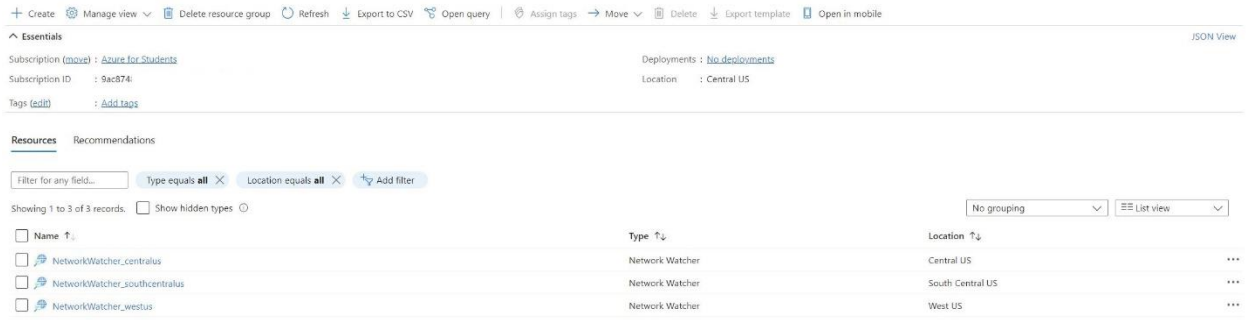
❖ **Create WordPress on App Service**



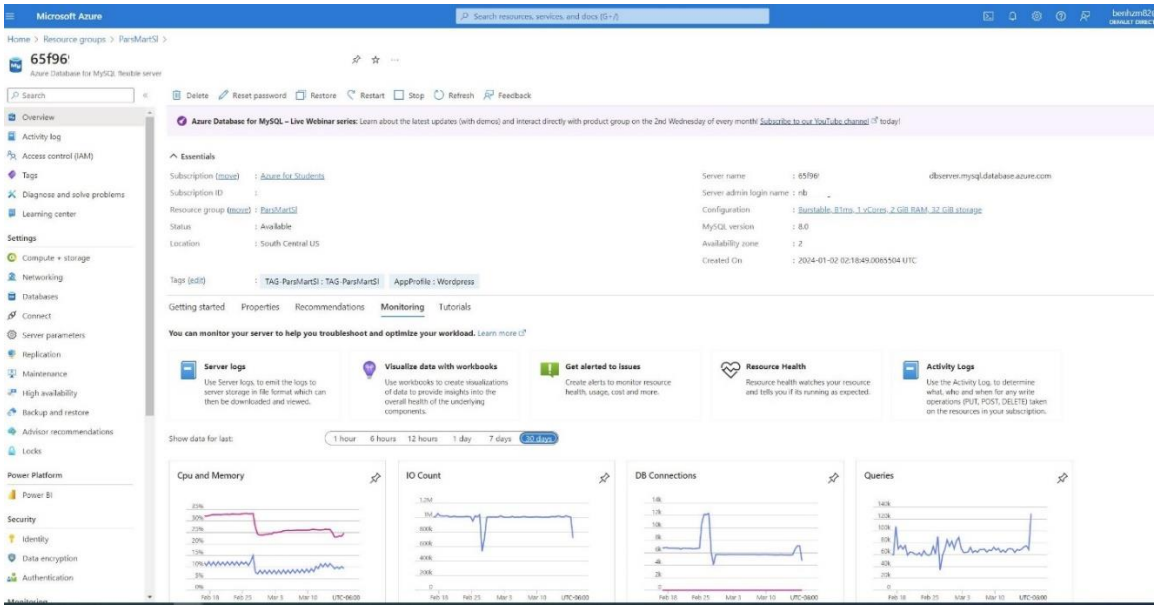
❖ **Create WordPress on App Service – Review + create**



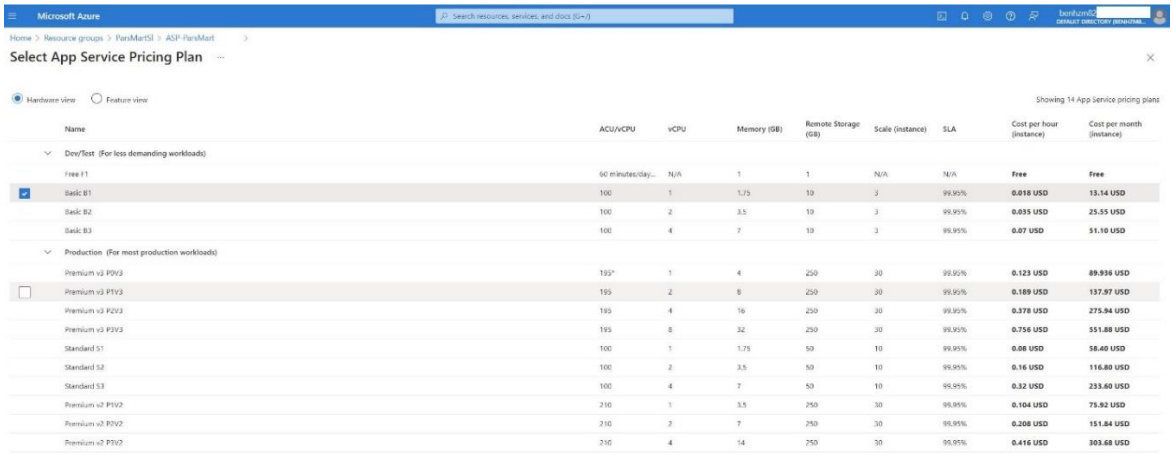
❖ **Azure NetworkWatcherRG**



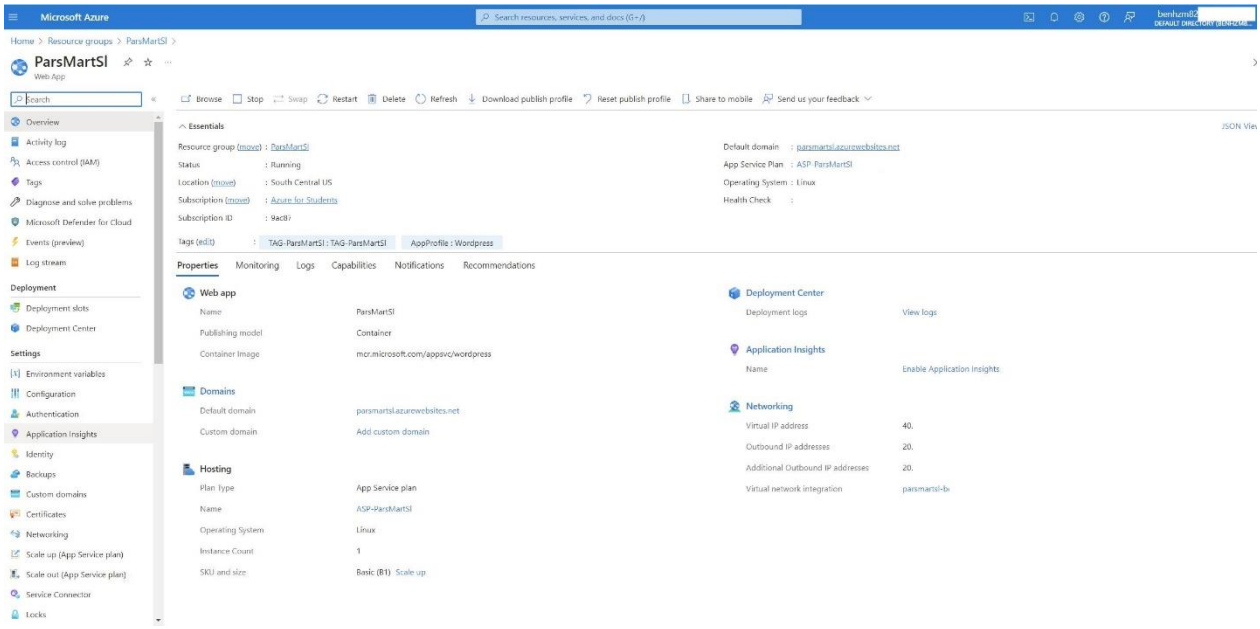
❖ **Azure Database for MySQL flexible server**



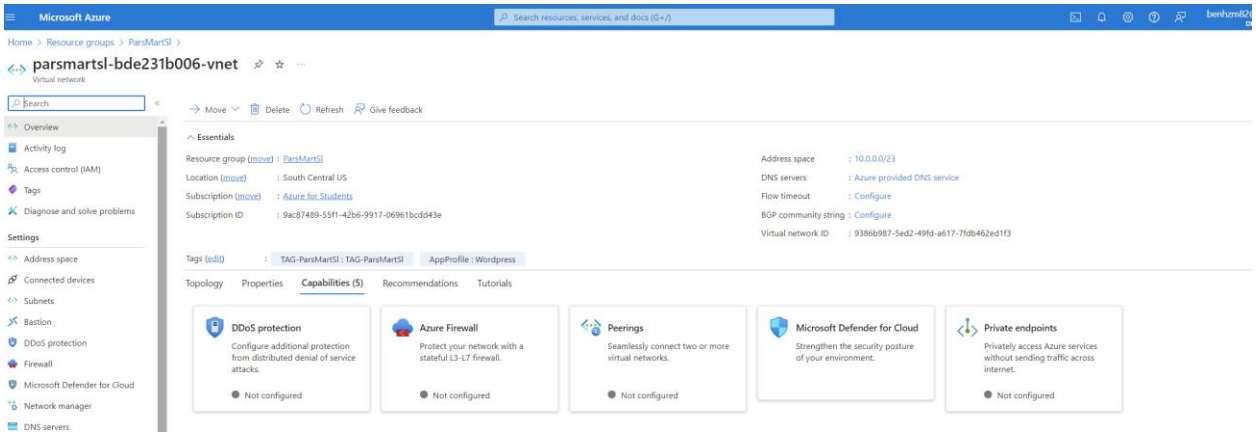
❖ **App Service plan**



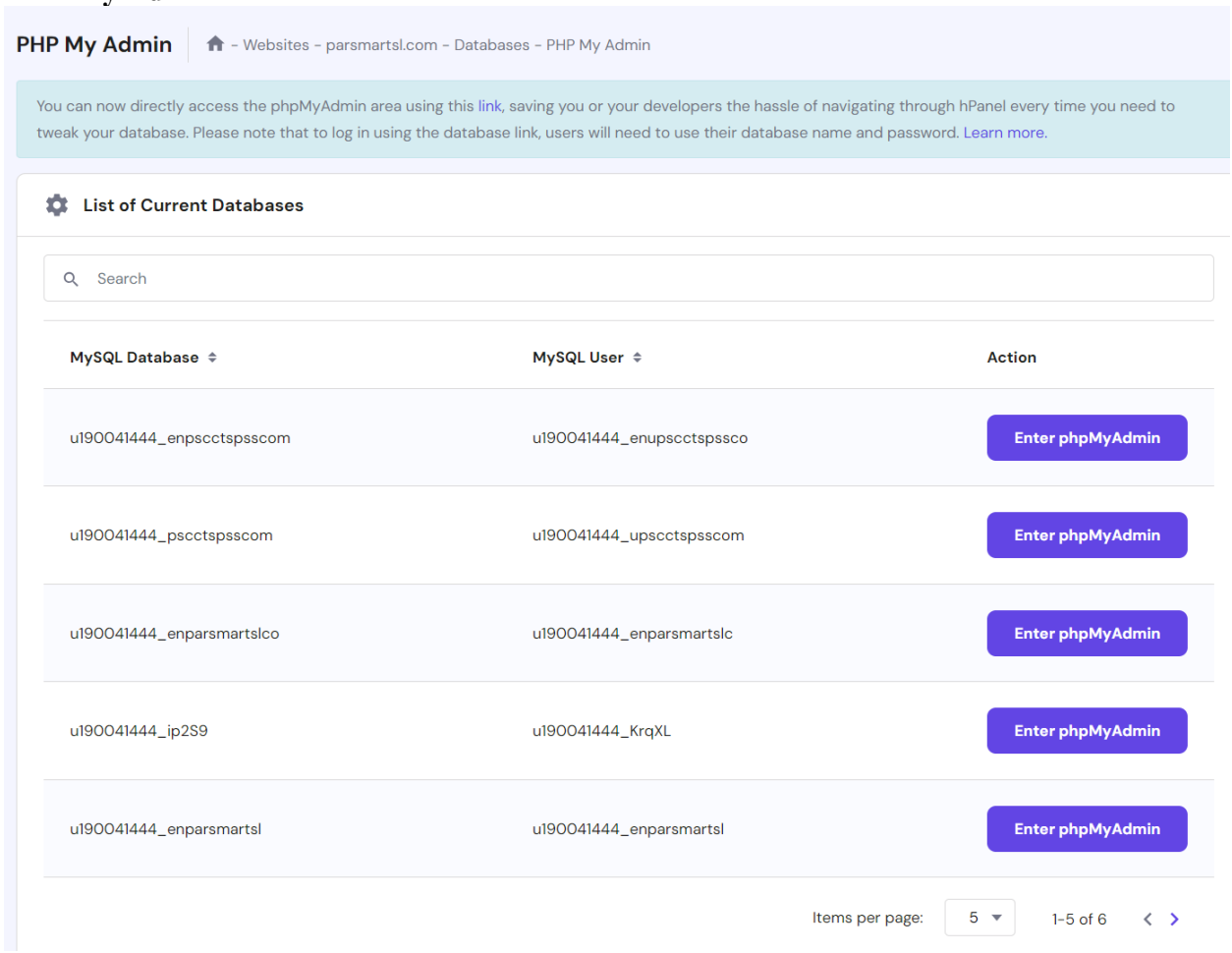
❖ App Service



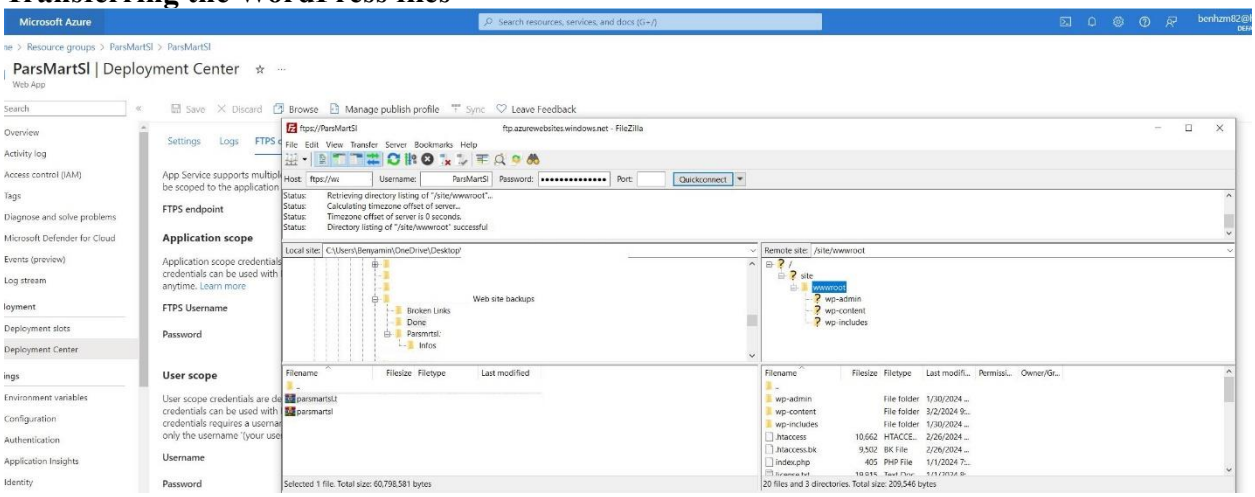
❖ Virtual network



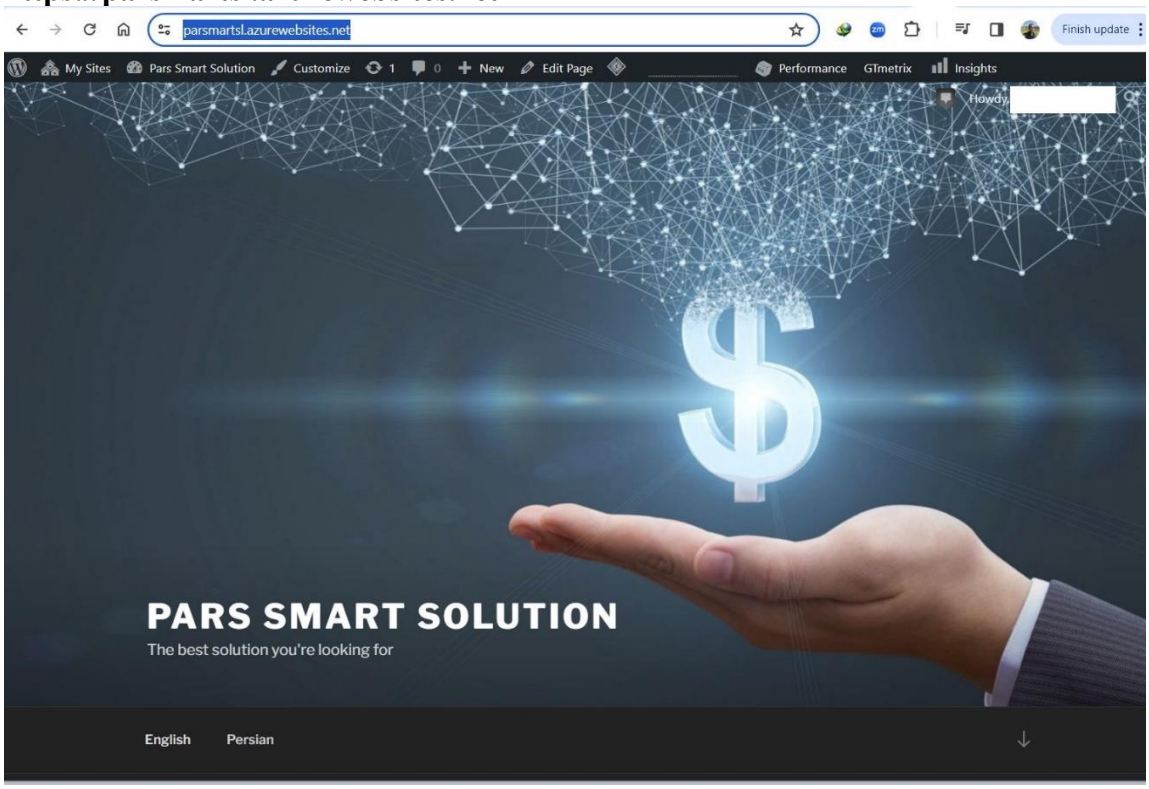
❖ PHP My Admin



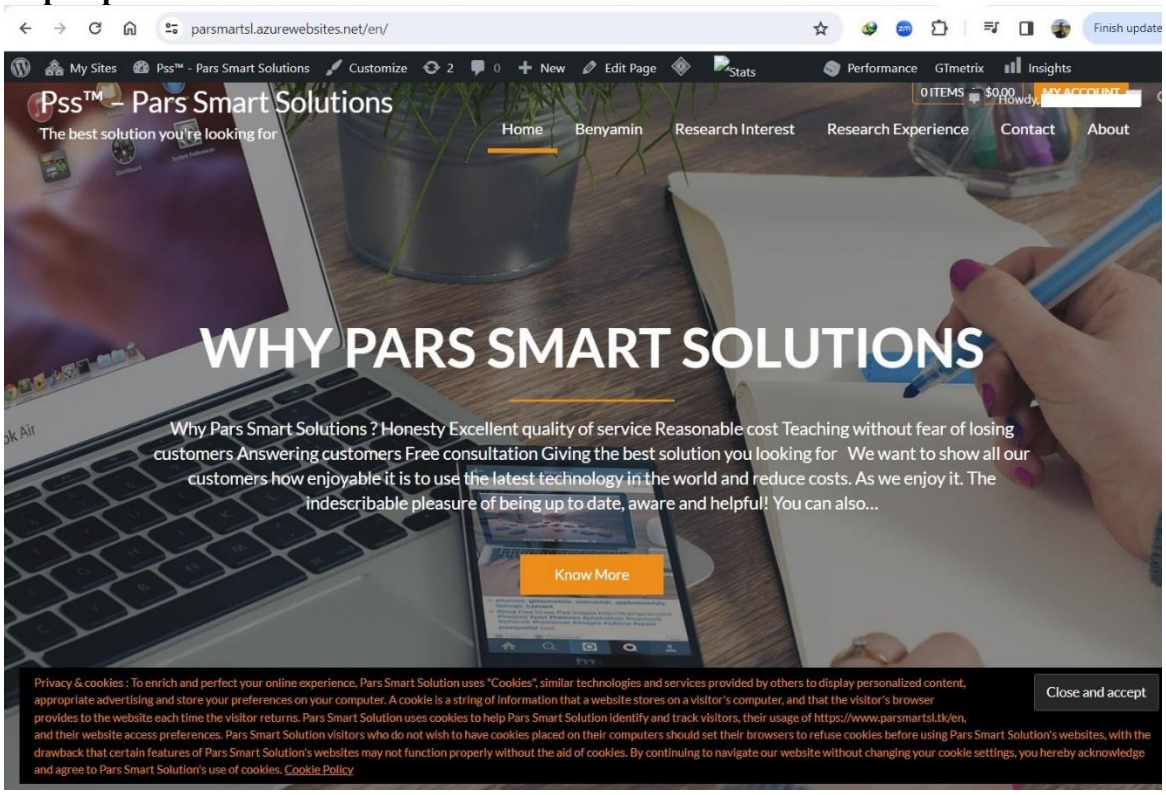
❖ Transferring the WordPress files



❖ **https://parsmartsl.azurewebsites.net**



❖ **https://parsmartsl.azurewebsites.net/en**



❖ **Https://parsmartsl.azurewebsites.net/psccts-en/**

❖ **Https://parsmartsl.azurewebsites.net/psccts-fa/**