Draft/Final Report

< Ozmart Retail Group on prem to Cloud Network Migration Design >

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* Introduction

This paper seeks to analyze a migration to the cloud project that was conducted by Ozmart Retail Group; a fast-growing retail company in Australia. The opportunity and necessity of becoming a cloud-oriented company appeared as Ozmart encountered such problems regularly dealing with the on-premises IT infrastructure: the growth of requirements for the company’s IT infrastructure; the growth of the costs needed to support it; and concerns about security. This step was undertaken in order to carry out organizational transformation in Ozmart’s IT department, flexibility, increase data protection and also to minimize the operational costs.

This project entailed developing the plan on how Ozmart could move all its existing IT systems such as its network, applications and data to the cloud. It was not just progression in technologies, but one of the crucial business strategy for the future development of Ozmart which would enable the company to sustain in the long run as we observe competition growing in near future. This migration used the most progressive cloud technology and service to develop a hybrid cloud environment that is secure and scalable to interconnect with the conventional systems of the enterprise.

In this case study we will learn about all processes of migration, steps, problems, suggested solutions, and essential business effects of the transition to the cloud. This case study represents a review of the approach and success of the Ozmart’s cloud migration project, and as such gives beneficial information and experience on how organizations can efficiently shift to cloud to add value.

This report specifically documents the Ozmart Retail Group Cloud Migration project, which was a blueprint of instituting the retail firm, Ozmart, into an Australian retailer with a visionary approach for the technological development of the organization’s IT setting, into a state of the art cloud platform. Ozmart’s transition to cloud computing is an absolute imperative due to over it has 1500+ employees in different locations where there is always the need to adopt more flexible working model, protect its data and cut on expenses.

The development of the architecture is focused on the adaptation of the hybrid cloud model to work with legacy systems of Ozmart. This design utilizes the advanced services from the AWS (Amazon Web Services), including availability, elasticity and security. Some of the layers are computing layer, storage layer, and networking layer, all designed to operate at their optimum best. Some of them are EC2 instances for general purpose computing, S3 as a storage service, RDS as a database service and VPCs as a service that helps create networks that are isolated.

Say approach is based on the proper methodology for constructing a network and adheres to various model security standards. Being network engineers, we have come up with an elaborate plan that outlines firewall settings, VPN settings, and network access controls and all traffic in and out of the network as well as data stored in the network is encrypted under industry standard encryption methods. Further, the migration strategy also facilitates the normalized migration of data and applications by employing AWS CloudFormation and utilizing AWS Lambda to perform application deployments and to monitor a system as well, and thereby minimizing human interference.

* System Overview

Ozmart Retail Group Cloud Migration project will involve creation of a solid hybrid cloud network solution which includes the integration into the on-site infrastructure owned by Ozmart. This system overview will give a technical detail of the scheme with reference to the structures that compose the project. It describes how different design prospects have been chosen and how different plans have been conducted and tested in order to achieve secure and efficient cloud environment which is appropriate for Ozmart’s functioning.

**1. Problem Definition**

Ozmart Retail Group is a medium B2B retail industry based in Australia that has experienced fast growth; however, its existing IT environment can become a major issue. There are some problems inherent to the growth of the company: for instance, more and more on-premises systems become unable to bear the growing load, their scalability is severely constrained, their maintaince constantly increases. further, the current structure does not have sufficient protection mechanisms and drastic approaches to recover the system with the same efficiency it loses if it were attacked by hackers or get into any disasters. They are as follows and end up hampering Ozmart’s capacities to provide staple services to consumers and achieve its development goals. The first issue this project will address is the migration of Ozmart current IT infrastructure from the on-premise data center and transitioning it to the cloud using AWS services to make it efficient, secure, and low cost.

Today there are several burning issues associated with on-premises IT infrastructure that have been impacting Ozmart Retail Group. Some of the problems that arise include performance bottlenecks due to increased workloads that the existing infrastructure cannot accommodate leading to slow system response time and thus low productivity. Further, there is still a problem of scalability of the IT systems and infrastructure thus constraining the operations of the fast-growing business. Due to the high maintenance costs, resources are stretched since the infrastructure is dilapidated and requires a lot of money to be put into for maintenance or upgrading thus affecting the bottom line.

Another risk aspect is security risks, the current arrangement for security is relatively insecure and involves absolute risks to sensitive data. Adding to this is a problem of the absence of a decent disaster recovery plan thus exposes the system to a high possibility of data loss and extended downtime in the event of system failure. Another issue is operational inefficiency due to the current infrastructure which frequently develops faults and hampers operations and the delivery of services to the customers.

Some of the impacts include; Limited bandwidth and archaic infrastructure lead to the slow download/download speeds and connectivity hindering operations within the network. The IT staff also suffers from these outdated structures as they are bogged down with their support, at the expense of working on strategic activities. Besides, the current infrastructure does not cater well for work from home, a trend that has recently been adopted due to changes in the culture of work. Last but not least, most organizations experience inadequate data management practices and small storage space that result in creating data silos whereby data becomes dispersed and challenging to share and analyze. These challenges thus require the migration to a more more agile, secure and cloud based infrastructure for the growth and operational use of Ozmart.

**2. Approach**

The IT issues of Ozmart Retail Group were approached systematically in which cloud conversion and hybrid networks were developed. The project kick off with carried out assessment of the current on-premises environment to determine critical communication constraints and teamwork security exposures. Further, Cisco Packet Tracer was used to implement and test the network topologies, in order to make sure that a new hybrid architecture would allow on premise and cloud environments to interconnect seamlessly.

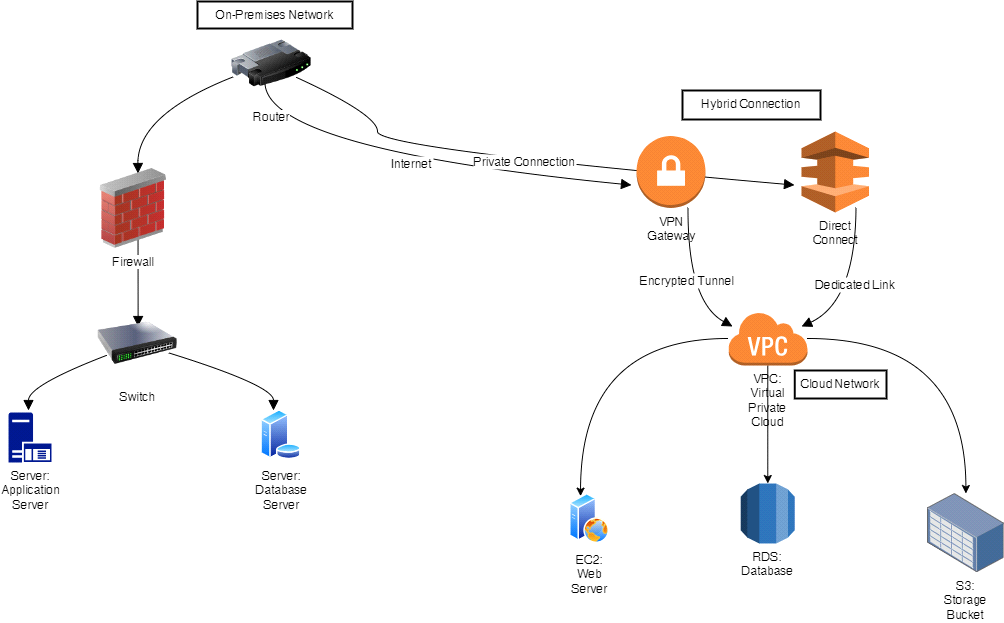
The migration plan included create a VPC on AWS for web servers, databases and storage services while keeping latency sensitive applications on premise. A model that represented a blend between private and public clouds was selected as a means to gain from the flexibility of the cloud while being cautious of the constraints of the programs hosted on the physical server. All the above were to interconnect through AWS Direct Connect and VPN, the gateways providing reliable, low latency, and direct connections.

Security considerations were taken throughout the process; the aspects included had firewall security, encryption of data and strong access control measures using the AWS IAM policies. These configurations were tested using Cisco Packet Tracer specially that the actual equipments were not available, the team was able to modify settings as required to achieve the main goal of having a secure and high performing hybrid network. Thus, this approach helped Ozmart to achieve the optimization of the company’s work time, to make it more scalable, as well as the company provided high data securities level.

**1. High-Level Network Architecture**

The overall system is an integration of on-site and cloud solution such type of solution provide the flexibility and scalability to its IT system. The architecture is organized within cloud computing advantages to preserve the essential on-premises activities, as adopted in previous studies improving performance and security as well as costs.

**Diagram 1: High-Level Network Architecture**



*Above hybrid cloud includes a component of the private cloud and or on-premises systems that can interconnect seamlessly with the cloud.*

This high-level architecture consists of the following key components:

* **On-Premises Data Center:** This comprises of the existing physical servers, network devices and storage systems that are still in use in supporting key local operations. The data centre is connected to the cloud environment through a VPN link so as to allow easy data interchange between the two.
* **AWS Cloud Infrastructure:** The cloud resources are deployed on Amazon Web Services (AWS) which includes the EC2 to provide computational power, S3 to provide storage, RDS to provide managed databases and VPC for network virtualization and security. The cloud infrastructure is dynamic in nature which is very much suitable for the changing requirements of the business.
* **Secure Connectivity:** VPN and Direct Connect are employed to create secure and dependable connection between the on premise data center and AWS cloud. This make sure that data can be transferred from one environment to the other in a more secure manner without compromising for data integrity and privacy.

**2. Detailed System Components**

The cloud migration project is to develop and integrate a number of system elements to form a hybrid cloud solution. These components include:

**a. Compute Resources**

The compute layer is the most basic element of the cloud design since it offers elastic virtual machines to host applications and services.

* **Amazon EC2 Instances:** Amazon EC2 instances are utilized in mirroring on-premises servers in the cloud with the ability of scaling up or down the compute capacity. For the same, different instance types are chosen depending on the workload that needs to be handled for best performance, and low costs.
* **Auto Scaling Groups:** For this purpose, Auto Scaling Groups are used which control the number of EC2 instances by adding or removing instances as per the load. This makes it easier for Ozmart to do the following; control its resource usage, this will enable it to offer its services at optimum capacity during the peak hours and at the same time it will not be incurring high costs during the off-peak hours.

**b. Storage and Data Management**

The use of strong storage systems is used in order to address issues of data or information accessibility, data reliability and data protection.

* **Amazon S3:** Object Storage Services like Amazon Simple Storage Service (S3) is used for storing objects, files, backup or any log files. It is used to ensure appropriate data integrity and minimize the storage cost by making use of versioning & lifecycle management features of S3.
* **Amazon RDS:** Elasticache is used for managed caching solutions and Redis is used for data store solutions while Relational Database Service (RDS) is used for managed database solutions, which supports different database engines such as MySQL, PostgreSQL, Oracle, and others. Amazon Web Services through RDS makes it easier for organization to manage their databases through features such as automated backups, patching and scaling since it is a highly available and durable service for critical business data.
* **Amazon EFS:** Prestorage performance tuning is unlikely to succeed because disk error rates vary, and the access rates depend on more than the number of requests tagged for optimized performance, such as Elastic File System (EFS) for file storage that needs to be accessed by multiple instances. EFS is available at a very high level of performance with the capability of handling concurrent connections from multiple amazon EC2 instances that is good for shared data and application files.

**c. Networking and Security**

Another factor that should not be overlooked with the hybrid cloud is the need to create a secure network configuration that will allow the networks to be set up efficiently for effective connectivity to the cloud while at the same time have protection for the cloud data that can be accessed.

* **Virtual Private Cloud (VPC):** A VPC is defined to setup an isolated network in AWS with option turning on the networking features such as IP addressing, routing, and subnetning. Several subnets are developed within the VPC for the purpose of logical division of application layers (for example, for web-servers – one subnet, for databases – another).
* **Network Access Control Lists (ACLs) and Security Groups:** These features are to regulate the traffic, both ingoing and outgoing to the cloud resources. The ACLs help in filtering traffic for the subnets while security groups help to act as firewalls for the EC2 instances to allow only desired traffic.
* **VPN Gateway and Direct Connect:** A VPN Gateway is used because it enables secure connection of the on-premises data center to AWS cloud over the internet. AWS Direct Connect is also established to deliver an instance of a dedicated network connection to allow a more stable and faster connection between environments.

**d. Migration and Optimization**

The migration from the on-premises environment to the cloud is carefully planned and executed to ensure minimal disruption and optimal performance.

* **Lift and Shift Strategy:** Some of the applications are still moved to the cloud using the ‘straight move’ method which means that minor changes are made. This approach can be recommended for the applications that don’t need cloud-native characteristics, but at the same time, provides the opportunity to perform a swift migration process.
* **Replatforming and Refactoring:** Other applications are migrated or redesigned to leverage the native services and features of cloud services. This entails the process of fine tuning the applications for the cloud platform with an aim of enhancing their performance as well as achieving better scalability at lesser costs.
* **Continuous Integration and Continuous Deployment (CI/CD):** There is an integration of CI/CD where there is high automation in the deployment of the application, hence enhancing the delivery of updates as well as new features. AWS CodePipeline and AWS CodeDeploy are used for the actual process of configuration since it is more efficient and less error prone when done mechanically.

**3. System Testing and Validation**

Several tests are performed throughout the migration process in order to confirm the proper functionality, efficiency, and soundness of the cloud environment.

* **Functional Testing:** Can check out that all applications as well as services are running well after the migration process is done. This entails the assessment of the functionality of an application, durability of data as well as compatibility and connectivity of the system.
* **Performance Testing**: Complements the performance rating achieved by the cloud infrastructure under varying test loads. In addition, it helps the organization establish order which assists in the detection of issues that hamper performance and improvement of the system.
* **Security Testing:** Evaluates the physical security and logical controls present, such as firewalls, access control and encryption in cloud environment. It means that regular security audit and vulnerability assessments are performed to assess risks factors and prevent possible threats.
* **Disaster Recovery Testing:** Role plays through practice of disaster scenarios as a disaster recovery plan that measures organisational preparedness. This helps the system to be self-healing and be able to quickly recuperate in the event of a failure to enable the business to carry on as usual.

Using the innovative technologies of cloud solutions the company provides a stable and efficient cloud network design and security for the Ozmart Retail Group Cloud Migration project.

* Delivered Technical Artefacts

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **File** | **Description** | **PDF?** |
| Wireless Design | group08-wireless-design.docx | Detailed design of the WiFi network | Yes |
| Risk Assessment Report | group08-risk-assessment-report.docx | Reports the process, assumptions and conclusions of the risk assessment | Yes |
| Risk Assessment Table | group08-risk-assessment-table.xlsx | Details of the risks and security controls identified from the risk assessment | Yes |
| AWS Setup Instructions | group08-AWS-setup-instructionds.docx | Instructions for deploying the webserver in Azure | Yes |
| Website Performance Test Script | Group08-test-script.java | Java code used for testing the performance of the website | No |
|  |  |  |  |
|  |  |  |  |

* Contributions

**Contributions Table for Ozmart Retail Group Cloud Migration Project**

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Name** | **Percent Contribution** | **Summary of Contributions** | **Technical Lead on Artefacts** |
| **Navdeep Saini** | **25%** | Navdeep Saini was working as Network Architect who was predesigned the cloud and on-prem network architecture of the Network and Network Data Center locations. He directed the creation of the VPC, subnets and the IP addressing to provide a good network to work on and at the same time providing the security that was needed for the network. He also coordinated the link and data flow integration of traditional systems with the cloud environment. Navdeep contributed in defining the network management architecture which consisted of the monitoring and alerting mechanisms for the health and performance of the network. | Network design, Wireless Network design, Traditional network management, Network management and monitoring. |
| **Simarpreet Kaur** | **25%** | Simarpreet Kaur was the Security Specialist and she was responsible in controlling the security of the cloud and on-premises part of the network. She set up firewall settings, VPN settings, and SSL protocols besides formulating general security measures. In terms of security, Simarpreet was in charge of the idea behind the security which encompassed the data security during migration and its running. She also did a risk assessment which involved the identification of risks and risks exposures as well as the formulation of an appropriate risk management plan to deal with the risks appropriately. | The following job titles related to information security are identifiable within the current position: Security Architecture Design, Risk Analysis. |
| **Mohmed Amaan Patel** | **25%** | Mr. Mohmed Amaan Patel provided the Cloud Solutions Architect service for connecting the cloud elements on AWS. He had to configure all necessary items like EC2 instances, S3 storages, and load balancers with complete consideration of all aspects of scalability and security. Mohmed also made settings in auto-scaling groups and CloudWatch for maintaining the dynamic capability of cloud for the varied workloads. As one of his task, he had to refresh the cloud service selection criteria and overseeing web server installation to optimize web server performance and costs . | CSM, Bandwidth and Connection Strategy, Implementation of Cloud Based Components |
| **Anupa Bodhimaluwa** | **25%** | Anupa who was the Data and Application Migration Specialist was responsible for planning and managing data and application migration plans. He created a detailed data migration strategy for transition so that it can gather and transfer data safely. Anupa carried out a study of existing applications and provided a plan on how to migrate the existing applications to the cloud while carrying out the cloud migration process without affecting operations. He also oversaw the application inventory as well as dealt with the process of application optimization for cloud deployment. Further, Anupa assessed the security arrangements for protecting data at the time of migration and was responsible to meet up policies under the particular data protection laws. | Migration of data planning, migration of application planning |

**Contribution Breakdown**

**Navdeep Saini (25%):** Navdeep was also position as a Network Architect because it was responsible for the overall design of the network to be appropriate for Ozmart’s cloud migration. He was responsible for leading several significant artefacts such as, designing the network, installing WiFi network, handling the legacy network, managing and controlling networks and monitoring the networks, which gives him a central role in the technical part of the project.

**Simarpreet Kaur (25%):** Being a real Security Specialist, Simarpreet had aimed at maintaining the network’s security and its file protection. The security architecture and the risk assessment artefacts have been created under her supervision, which provided for extensive coverage of cloud and on-premise environments.

**Mohmed Amaan Patel (25%):** Mohmed being responsible for being the Cloud Solutions Architect was instrumental in the deployment and configuration of the AWS platform. He was charged with the responsibility of choosing cloud services, deciding on the bandwidth and connectivity as well as deployment of cloud elements. He made certain that Ozmart cloud environment is flexible and would have good levels of security.

**Anupa Bodhimaluwa (25%):** It was critical to have a successful transition to the cloud, where Anupa’s role as the Data and Application Migration Specialist. He worked on the data migration plan and application migration plan among other deliverables, and she ensured he wanted the least disruption in the whole process, and she wanted to ensure data was well protected during the whole process. His work contributed to preserving the Ozmart’s application quality and their stability when transferred to the cloud.

This is the contributions table showing each of the team member’s position and responsibility, which are related to the actual contribution to the Ozmart Retail Group Cloud Migration project. There was active participation from each of the members resulting in a detailed and safe migration to AWS.

* Next Steps

For the convenience of Ozmart Retail Group and the project of cloud migration more steps are suggested as follows. First of all, bring into operation and assess the effectiveness of security measures that we have developed but did not manage to integrate in full, including intrusion detection systems and improved DDoS protection through AWS Shield Advanced. Further, it is also important to establish AWS CloudTrail as well as Amazon CloudWatch for effective security and monitoring.

We also propose to transfer other LO applications and databases as well to fully harness AWS’s horizontal scalability and cost competitiveness. This could include remodeling some of these applications to fully take advantage of the AWS cloud platform and employing a newer and better architecture for these applications and enhancing the integration with other cloud services.

There could also be room for diversification with hybrid cloud arrangements by Azure or Google Cloud for instance, and would bring in redundancy and less vendor dependency improving generality. Moreover, disaster recovery supported with AWS Backup and cross region replication would mean that business operations are not impacted by outages.

Lastly, it is noted that continued education of IT personnel with regards to managing the cloud and its security measures will be crucial in the continuous running of an efficient and secure cloud. The steps above when followed will assist Ozmart to achieve maximum benefit out of the cloud structure without compromising on the performance of the company’s IT systems and their security.