

# **Cloud Migration Plan**

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# **Cloud Migration Plan**

Migrating the companies' aging infrastructure to cloud platforms will offer numerous benefits including but not limited to enhanced scalability, reliability, and cost-effectiveness. This report outlines the migration plan, capabilities, upgrades, and cost analysis for transitioning the company's many infrastructures into the future.

## **ERP/Database Servers**

### **Reasons for transition:**

- High maintenance and operational costs due to aging hardware.
- Limited scalability hinders business growth.
- Increased risk of hardware failure and data loss.
- Inefficient disaster recovery mechanisms.
- Cheaper maintenance costs due to outsourcing developers.

### **Current Infrastructure Analysis:**

- 8 mid-frame servers: 6 for production (clustered) and 2 for testing/development.
- Oracle Database in use.
- Server specifications per unit:
  - Quad Socket Quad Core Xeon processors.
  - 96 GB RAM.
  - 8x2TB drives in RAID 5 configuration (6TB usable storage).

### **Migration Plan:**

- **Database Migration:**
  - Utilize AWS Database Migration Service (DMS) to transition the Oracle database to Amazon RDS for Oracle.

- Conduct thorough testing in a replicated development environment to ensure data integrity.
- **Compute Migration:**
  - Deploy ERP workloads on Amazon EC2 using R5 instances, optimized for memory-intensive applications.
  - Implement AWS Elastic Load Balancing (ELB) to ensure high availability and failover capabilities.
- **Storage Migration:**
  - Replace RAID 5 local drives with Amazon EBS (gp3 for cost-efficiency or io2 for high IOPS) for primary storage.
  - Use Amazon S3 for archival data storage.
  - Set up AWS Backup for comprehensive disaster recovery and compliance.
- **Cluster Migration:**
  - Establish clusters using AWS Auto Scaling for production workloads to maintain elasticity and availability.
  - Create staging and testing environments using AWS CloudFormation templates for consistency.

#### **Upgrades and Capabilities:**

- Scalability: Elastic scalability to accommodate future business growth.
- Performance: High-performance EC2 instances and managed databases tailored for ERP workloads.
- Reliability: Multi-AZ deployments and robust backup solutions.
- Security: Built-in encryption (SSL/TLS, encryption at rest) and adherence to industry compliance standards.

## **Cost Analysis:**

- **Local Infrastructure Costs:**
  - Annual maintenance, hardware replacement, and energy consumption costs, licensing.
  - **Current Estimated Costs:**
    - With 8 servers, the total hardware investment is approximately \$150,096.
    - Oracle's licensing is based on the number of processors. The Enterprise Edition is priced at \$47,500 per processor license with Annual support typically being around 22% of the license cost, estimating the amount to \$57,950 per processor.
    - For 8 servers assuming 4 processors per server, the total licensing cost is \$1,520,000, with annual support fees totaling \$334,400.
    - Does not include highly variable maintenance, support, energy consumption, and data center costs.
- **AWS Costs:**

Matching current infrastructure capabilities.

  - **Compute:** R5 instances are priced at approximately \$2.016 per hour for r5.8xlarge instances, which offer 32 vCPUs and 256 GB RAM. Price estimation is \$1,500 per month in the US East region.
  - **Storage:** Amazon EBS gp3 volumes cost around \$0.08 per GB-month. Estimation for matching infrastructure with basic storage capabilities is around \$8,592 for 16TB.
  - **Database:** Amazon RDS for Oracle pricing varies based on instance needs.
    - A 2 Node db.m5d.8xlarge with 32 CPU, 128 GB Ram, multi zone enterprise instance is estimated to be \$9,403 per month not including licensing.
  - **Additional Services:** Costs for AWS Backup, data transfer, and other services.

## **Client Considerations**

Dell hardware will be utilized for client upgrades to support the new cloud infrastructure.

Benefits include standardization, reliability, cost effectiveness, and reduced maintenance costs.

### **Current Infrastructure Analysis:**

- **User Workstations:**
  - 20 locations, 100 desktops/workstations in each remote location.
  - 200 desktops/workstations at the corporate headquarters.
  - Field users connect via personal/home/portable devices.

### **Reason for transition:**

- Outdated desktops leading to reduced productivity.
- Lack of standardization across devices.
- Increased IT support burden due to varied device configurations.

### **Upgrade Plan:**

- **Corporate Workstations:**
  - Replace outdated desktops with Dell OptiPlex 7000 Series for standardized, high-performance computing.
  - Include Dell Ultrasharp monitors for enhanced user experience.
- **Remote and Field Users:**
  - Provide Dell Latitude laptops for field and remote workers requiring corporate access.
  - Deploy Dell Wyse thin clients for users primarily accessing virtualized resources via AWS Workspaces.
- **Virtual Desktop Infrastructure (VDI):**
  - Utilize AWS Workspaces for secure, scalable virtual desktops for remote and field users.
  - Standardize software images to ensure uniformity and reduce support needs.

### **Upgrades and Capabilities:**

- Enhanced Productivity: Faster machines and consistent user interfaces improve user satisfaction.
- Portability: Dell Latitude laptops support mobility for field users.
- Security: Centralized device management using Dell Optimizer and integration with AWS security policies.

### **Cost Analysis:**

- **Hardware Costs:**
  - Dell OptiPlex 7000 Series: Prices vary based on configuration. For instance, a model with Intel Core i7-12700, 16GB RAM, and 512GB SSD is priced at approximately \$1,249.
  - Dell Latitude Laptops: Pricing depends on specifications; bulk purchase discounts may apply.
- **Operational Savings:**
  - Reduced maintenance and support costs due to standardized hardware and software.
- **Hardware Estimation Cost:**
  - **Dell hardware:** \$3,000,000
  - **Peripherals:** \$1,584,000
  - **Estimated Total:** \$4,584,000

# Active Directory/DNS Servers

## Project Overview

In today's fast-paced digital world, businesses depend on reliable and flexible IT systems to keep operations running smoothly. Unfortunately, the company's current Active Directory (AD) and Domain Name System (DNS) setup, built on outdated hardware and software, is struggling to keep up with the demands of modern workloads. This aging infrastructure not only hampers performance but also creates vulnerabilities and limits the company's ability to grow and scale effectively.

Migrating to a cloud-based solution offers a clear path forward. It promises faster performance, greater reliability, the ability to scale, and less time spent on tedious maintenance. This migration plan takes a close look at three leading cloud providers—Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP)—to determine which platform offers the best combination of performance, cost efficiency, and seamless integration with the company's existing systems.

## Current Infrastructure

- **Active Directory/DNS Servers:**
  - 4 servers running on Windows Server 2008 R2.
  - **Specifications:**
    - Single Socket Quad-Core Xeon processors.
    - 32GB of RAM.
    - 2x2TB drives configured in RAID 1 (2TB usable storage).
  - **Functions:** The servers handle Active Directory (AD), DNS, and DHCP.

## Challenges with the Current Setup

The existing infrastructure faces several issues:

- **Slow Performance:** DNS queries are experiencing high latency (~75ms), which impacts overall system responsiveness.
- **Scalability Issues:** The hardware is not equipped to handle increased loads as the company grows, creating bottlenecks during peak times.
- **Outdated Technology:** Running on older software and hardware introduces security risks and limits compatibility with modern tools and systems.

## Cloud Platform Evaluation

### 1. Amazon Web Services (AWS)

- AWS Directory Service for Microsoft Active Directory offers Standard and Enterprise Editions:
  - Standard Edition: \$86.40 per month (720 hours x \$0.12/hour).
  - Enterprise Edition: \$288.00 per month (720 hours x \$0.40/hour)
- Amazon Route 53 DNS Service:
  - Pricing: \$0.50 per hosted zone + \$0.40 per million queries.

AWS Directory Differences between Standard and Enterprise:

#### Standard Edition

AWS Managed Microsoft AD (Standard Edition) is optimized to be a primary directory for small and midsize businesses with up to 5,000 employees. It provides you enough storage capacity to support up to 30,000\* directory objects, such as users, groups, and computers.

#### Enterprise Edition

AWS Managed Microsoft AD (Enterprise Edition) is designed to support enterprise organizations with up to 500,000\* directory objects.

#### Comparison Table

	Standard Edition	Enterprise Edition
Storage capacity available for directory objects	1 GB	17 GB
Total directory objects	30,000*	500,000*

## AWS Pricing hourly:

Pricing (varies by region)	
Region:	
US East (Ohio)	▼
AWS Directory Service for Microsoft Active Directory (Standard Edition)	Total hourly price
Base price	
Includes two domain controllers for high availability. AWS bills you for each domain controller at an hourly rate of \$0.06 per hour.	\$0.12
Each additional domain controller	\$0.06
For directory sharing: price per additional account to which the directory is shared	\$0.018
AWS Directory Service for Microsoft Active Directory (Enterprise Edition)	Total hourly price
Base price	
Includes two domain controllers for high availability. AWS bills you for each domain controller at an hourly rate of \$0.20 per hour.	\$0.40
Each additional domain controller	\$0.20
For directory sharing: price per additional account to which the directory is shared	\$0.06

Price per GB of data transferred "out" of your domain controllers for multi-region replication:

## Route 53 Pricing:

### DNS Queries

The following query prices are prorated; for example, a public hosted zone with 100,000 standard queries per month would be charged \$0.04, and a public hosted zone with 100,000 latency-based routing queries per month would be charged \$0.06. Route 53 does not charge for queries on private hosted zones.

<b>Standard Queries</b>	◦ \$0.40 per million queries (first 1 billion queries per month) ◦ \$0.20 per million queries (over 1 billion queries per month)
<b>Latency-Based Routing Queries</b>	◦ \$0.60 per million queries (first 1 billion queries per month) ◦ \$0.30 per million queries (over 1 billion queries per month)
<b>Geolocation and Geoproximity Queries</b>	◦ \$0.70 per million queries (first 1 billion queries per month) ◦ \$0.35 per million queries (over 1 billion queries per month)
<b>IP-Based Routing Queries*</b>	◦ \$0.80 per million queries (first 1 billion queries per month) ◦ \$0.40 per million queries (over 1 billion queries per month)

\*No fees are charged for storage of up to 1,000 IP (CIDR) blocks, but you incur charges of \$0.0015 per month (prorated hourly) for each stored IP block above 1,000 blocks.

## 2. Microsoft Azure

- Azure Active Directory Domain Services offers three SKUs:
  - Standard: \$109.50 per month.
  - Enterprise: \$292 per month.
  - Premium: \$1,168 per month
- Azure DNS:
  - Pricing: \$0.50 per hosted zone + \$0.40 per million queries.

## Azure Active Directory Hourly:

Region:	Currency:	Display pricing by:	
East US	United States – Dollar (\$) USD	Hour	
<hr/>			
Microsoft Entra Domain Services usage is charged per hour, based on the SKU selected by the tenant owner. Note that a standard load balancer and IP will be deployed to run Microsoft Entra Domain Services. <a href="#">Learn more</a> about load balancer pricing.			
	Standard	Enterprise	Premium
Instances			
Managed domain <sup>1</sup>	\$0.15/hour/set	\$0.40/hour/set	\$1.60/hour/set
Features			
Replicas	✓	✓	✓
Extra sync options <sup>2</sup>	✓	✓	✓
Trusts	✓	✓	✓

<sup>1</sup>Each instance consists of 2 domain controllers for high availability, spread across 2 availability zones (if available in region).

<sup>2</sup>Includes Customised attributes and Cloud-only sync.

## Azure Active Directory Monthly:

Region:	Currency:	Display pricing by:	
East US	United States – Dollar (\$) USD	Month	
<hr/>			
Microsoft Entra Domain Services usage is charged per hour, based on the SKU selected by the tenant owner. Note that a standard load balancer and IP will be deployed to run Microsoft Entra Domain Services. <a href="#">Learn more</a> about load balancer pricing.			
	Standard	Enterprise	Premium
Instances			
Managed domain <sup>1</sup>	\$109.50/month/set	\$292/month/set	\$1,168/month/set
Features			
Replicas	✓	✓	✓
Extra sync options <sup>2</sup>	✓	✓	✓
Trusts	✓	✓	✓

<sup>1</sup>Each instance consists of 2 domain controllers for high availability, spread across 2 availability zones (if available in region).

<sup>2</sup>Includes Customised attributes and Cloud-only sync.

## Azure DNS:

DNS Private Resolver	
	Price
Azure DNS Private Resolver inbound endpoint	1 endpoint - <b>\$180</b> /month prorated to hours if discontinued earlier
Azure DNS Private Resolver outbound endpoint	1 endpoint - <b>\$180</b> /month prorated to hours if discontinued earlier

Azure DNS Private Resolver rulesets

	Price
1 ruleset	<b>\$2.50</b> /month prorated to hours if discontinued earlier

Azure DNS billing is based on the number of DNS zones hosted in Azure and the number of DNS queries received.

DNS	Public and Private Zones
First 25 hosted DNS zones	<b>\$0.50</b> per zone per month <sup>1</sup>
Additional hosted DNS zones (over 25)	<b>\$0.10</b> per zone per month <sup>1</sup>
First billion DNS queries/month	<b>\$0.40</b> per million <sup>2</sup>
Additional DNS queries (over 1 billion)/month	<b>\$0.20</b> per million <sup>2</sup>

<sup>1</sup>Per-zone charge is calculated daily; partial months are pro-rated.

<sup>2</sup>Queries are aggregated within an Azure subscription for billing purposes.

## 3. Google Cloud Platform (GCP)

- Google Cloud Managed Service for Microsoft Active Directory:
  - Pricing: \$288.00 per month (720 hours x \$0.40/hour).
- Google Cloud DNS:
  - Pricing: \$0.20 per managed zone + \$0.40 per million queries.

### Google Active Directory Pricing:

## Pricing overview

When you use Managed Service for Microsoft Active Directory, you are charged for the following:

Billable item	Price
Managed Active Domain	\$0.40 per hour per region

If you pay in a currency other than USD, the prices listed in your currency on [Cloud Platform SKUs](#) apply. You can filter the list by your currency and the [Managed AD](#) product.

## Google Monthly Example pricing:

### Domain deployed in a single region

In this example, your Managed Microsoft AD domain is deployed in `us-west-1`. When you deploy a Managed Microsoft AD domain in a region, two domain controllers are deployed to ensure high availability. Your VPC spans three regions: `us-west-1`, `us-east-1`, and `europe-north-1`. Although the authorized network has presence in three regions, only the number of regions where a Managed Microsoft AD domain is deployed factor into pricing calculations.

`$0.40 * 1 region * 24 hours * 30 days = $288.00`

### Domain deployed in multiple regions

In this example, you scale up your Managed Microsoft AD domain and deploy domain controllers in multiple regions. As before, your authorized network has presence in three regions: `us-west-1`, `us-east-1`, and `europe-north-1`. You retain the domain controllers in `us-west-1` and add domain controllers in `europe-north-1`.

`$0.40 * 2 regions * 24 hours * 30 days = $576.00`

## Cost Comparison

### Active Directory Services:

Provider	Service	Monthly Cost
AWS	Standard Edition	\$86.40
AWS	Enterprise Edition	\$288.00
Azure	Standard SKU	\$109.50
Azure	Enterprise SKU	\$292.00
GCP	Managed AD	\$288.00

### DNS Services:

Provider	Service	Monthly Cost
AWS	Route 53	\$0.50 per hosted zone + \$0.40 per million queries
Azure	Azure DNS	\$0.50 per hosted zone + \$0.40 per million queries
GCP	Cloud DNS	\$0.20 per managed zone + \$0.40 per million queries

## **Migration Plan**

### **Phase 1: Preparation**

#### **1. Assessment**

- 2.** The first step is to take stock of the current setup. This means documenting all the existing Active Directory (AD) and DNS configurations, including user accounts, DNS zones, and DHCP scopes. It's also important to identify any dependencies or integration points that might affect the migration.

#### **3. Backup**

To ensure nothing is lost during the migration, we'll perform a full backup of all AD and DNS data. This includes critical files like zone files and Group Policy Objects (GPOs).

#### **4. Testing Environment**

Before starting the migration, create a test environment on the chosen platform. This allows us to have correct configurations and make sure everything performs as expected without impacting live operations.

### **Phase 2: Migration**

#### **1. Deploy Managed AD Service**

The next step is to create a managed domain on the selected cloud platform using the appropriate SKU. Domain controllers will be deployed automatically to ensure high availability and redundancy.

#### **2. Migrate AD**

Using synchronization tools, we'll replicate all on-premises AD data to the cloud. This includes user accounts, GPOs, and security settings. Once replicated, double-check that everything transferred correctly.

### **3. Migrate DNS**

Existing DNS zone files will be exported from the current system and imported into the cloud-based DNS service. Configure the necessary records to make sure everything resolves properly.

### **4. Configure DHCP**

Either setup DHCP services in the cloud or configure virtual network DHCP options to replace the existing setup.

### **5. Testing**

Once the migration steps are completed, thorough testing is needed. Validate that AD replication and DNS resolution are working perfectly. A subset of users and devices will be tested to ensure authentication and access are seamless.

## **Phase 3: Cutover**

### **1. Gradual Rollout**

To limit risk, start by redirecting a small group of users and systems to the new cloud environment. This phased approach helps identify and resolve any issues early on.

### **2. Full Transition**

Once the gradual rollout is successful, all user and system traffic will be redirected to the cloud-based environment.

### **3. Decommission On-Premises Servers**

With everything running in the cloud, the old on-premises servers will be retired. Data should be securely wiped, and the hardware should be disposed of, according to best practices.

## **Phase 4: Post-Migration**

### **1. Monitoring**

Continuous monitoring will make sure that the new environment performs as expected. Use tools to track AD and DNS performance and set up alerts for potential issues.

### **2. Optimization**

Over time, review and tweak resource usage to make sure the system is running efficiently.

### **3. Documentation and Training**

Finally, update all system documentation to reflect the new setup. IT staff will be trained on managing the cloud environment, making sure they're fully equipped to handle day-to-day operations and troubleshoot if needed.

## **Best Choice for Price-to-Performance**

After comparing the top cloud platforms, Microsoft Azure stands out as the best option for migrating the client's Active Directory (AD) and DNS infrastructure. Its enterprise-grade features, easy integration with existing Microsoft tools, and great pricing make it a clear winner over AWS and GCP, as well as the current on-premises setup.

## **Comparison to Current Infrastructure**

### **1. Performance Enhancements**

- a. **Current Setup:** Struggles with limited scalability, outdated hardware, and slower DNS query speeds (~75ms).
- b. **Azure:** Delivers high availability with automated deployment of two domain controllers, improved DNS latency (~50ms globally), and state-of-the-art security protocols.

### **2. Cost Efficiency**

- a. **Current Setup:** Comes with recurring expenses for hardware maintenance, power consumption, and staffing.

- b. **Azure:** Offers a predictable cost structure, starting at \$109.50 per month for AD services and \$0.50 per hosted DNS zone, eliminating physical hardware and maintenance costs.

### 3. Scalability

- a. **Current Setup:** Hardware limitations make scaling difficult during busy periods or as the business grows.
- b. **Azure:** Provides seamless scaling for both AD and DNS, enabling the infrastructure to grow with the organization without large upfront investments.

### 4. Ease of Migration

- a. **Current Setup:** Upgrading to new hardware would require significant time and financial resources.
- b. **Azure:** Streamlines migration with tools like Azure AD Connect and Azure DNS utilities, ensuring a smooth and efficient transition.

## Summary and Recommendation

Migrating to Microsoft Azure is the best choice for modernizing the company's Active Directory (AD) and DNS infrastructure. With its great price-to-performance balance, advanced features, and seamless compatibility with Microsoft services, Azure ticks all boxes for the organization's immediate needs while setting the stage for future growth.

Choosing Azure means the company will benefit from:

- **Streamlined Operations:** Less time and effort spent on maintenance, with predictable monthly costs that eliminate surprise expenses.
- **Improved User Experience:** Faster logins and quick, reliable DNS queries that ensure smooth day-to-day operations.
- **Uninterrupted Business Continuity:** High availability, failover systems, and modern security standards that keep the organization running no matter what.

This migration isn't just about upgrading technology, it's about giving the company an opportunity to work smarter and adapt faster. By moving to Azure, the organization can grow exponentially, knowing that its IT infrastructure is future-proof, scalable, and equipped to handle challenges as they come.

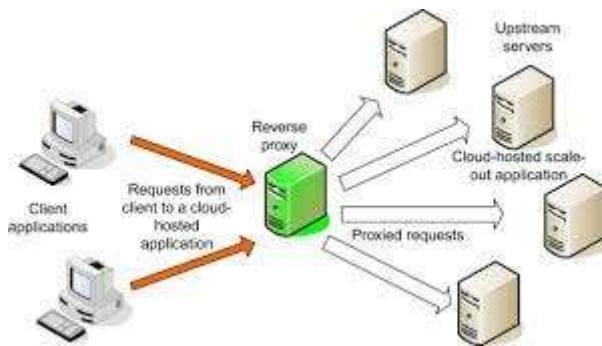
Azure's Standard SKU and DNS services provide the perfect mix of affordability and performance, making this a decision that's both practical and forward-thinking.

# Web Servers

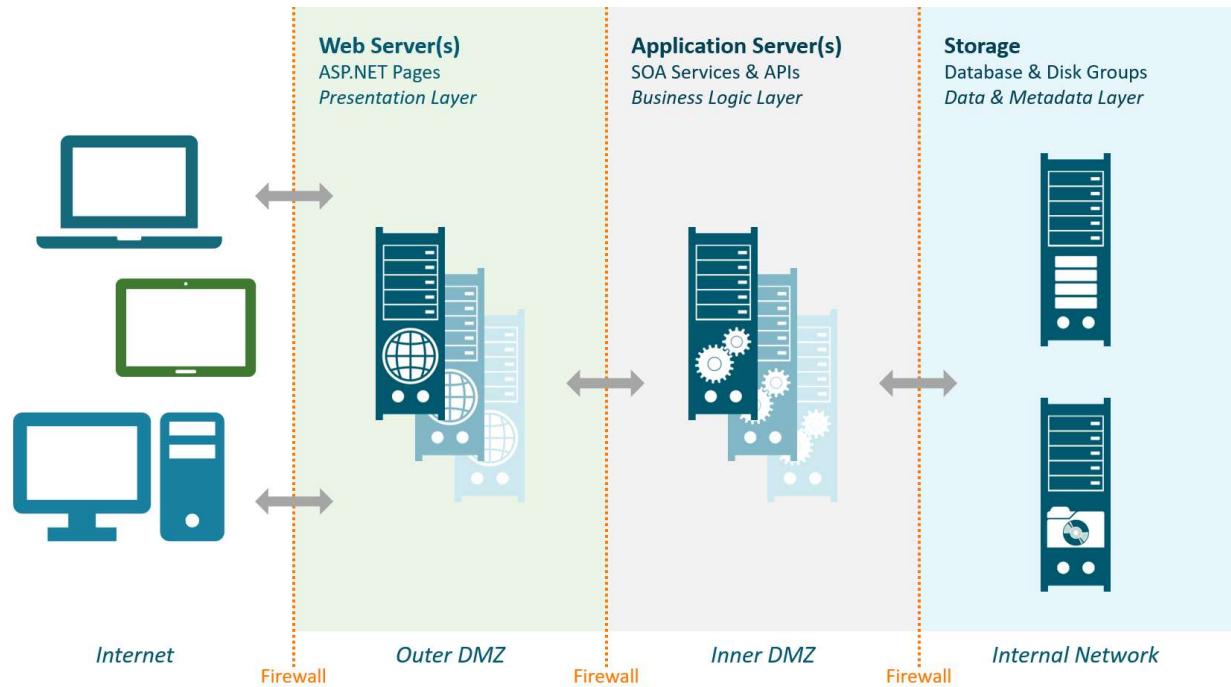
## Current Infrastructure Overview

The company's web servers are divided into two classes:

1. **External Web Servers:** Handle primary corporate websites and public-facing departmental sites.



2. **Internal Web Servers:** Manage employee internet resources, such as time reporting, HR requests, and IT ticketing.



### **Specifications (Per Server):**

- Processor: Single socket quad-core Xeon class processor.
- RAM: 8 GB.
- Storage: 2x2TB drives (one for OS, one for application data/storage).

### **Deployment:**

- Total Servers: 5 (4 for production, 1 for testing).
  - 3 IIS servers (Windows-based).
  - 2 Linux servers.
- Network Considerations:
  - 20 remote offices connected via site-to-site VPN.
  - All servers and services are centrally managed at the corporate headquarters datacenter.
- Client Considerations:
  - 100 desktops/workstations per remote location.
  - 200 desktops/workstations at headquarters.
  - Field users rely on home or portable devices to connect to corporate resources.

### **Challenges**

1. Outdated Hardware:
  - a. Single socket quad-core processors and 8 GB RAM limit performance.
  - b. Insufficient to handle increasing traffic and future application demands.
2. End-of-Life Software:
  - a. IIS servers running on Windows Server 2008 R2 pose security risks.
3. Testing Limitations:

- a. Only one testing server for both internal and external web services reduce testing efficiency.

#### 4. Scalability Constraints:

- a. The current infrastructure is not designed for dynamic scalability.

### Proposed Solutions

#### Option 1: On-Premises Upgrade

Upgrading the on-premises infrastructure ensures full control over sensitive data and avoids recurring cloud costs.

- **Recommended Server:** Dell PowerEdge R650.
  - **Processor:** Dual Intel Xeon Silver 4310 (12 cores, 2.10 GHz).
  - **Memory:** 32 GB DDR4 RAM (upgradeable for future needs).
  - **Storage:**
    - 2x1.92TB SSDs in RAID 1 for OS.
    - 2x4TB SSDs in RAID 1 for application data.
  - **Operating System:**
    - Upgrade IIS servers to Windows Server 2019 or later.
    - Update Linux servers to Ubuntu LTS or CentOS Stream.
- Estimated Costs:
  - Server cost per unit: \$5,300.
  - Total for 5 servers: \$26,500.
- Benefits:
  - Full control over internal resources.
  - Enhanced security for sensitive intranet data.

- One-time hardware costs with no recurring fees.
- Drawbacks:
  - Requires skilled IT staff for ongoing maintenance.
  - Limited ability to scale dynamically for future traffic.

## Option 2: Cloud Migration

Migrating web servers to a cloud provider offers flexibility, scalability, and reduced maintenance overhead.

- **Cloud Provider: Microsoft Azure**
  - **External Websites:**
    - Hosted on **Azure App Service (P1V3)** to manage dynamic traffic demands.
  - **Internal Intranet:**
    - Deployed on a **Virtual Machine (B4ms)** for higher processing capacity.
- **Storage Solution:**
  - Azure Managed Disks (Standard SSD, 2TB) for all web server data.



- **Estimated Costs:**
  - Azure App Service (P1V3): \$227.04/month per external site (\$908.16/month for 4 sites).
  - Azure VM (B4ms): \$84.16/month for internal intranet.
  - Total: ~\$993/month or ~\$11,916/year.
- **Benefits:**
  - Automatic scaling for external websites during peak traffic.
  - Reduced maintenance with cloud-managed services.
  - Improved global accessibility for public-facing sites.
- **Drawbacks:**

- Recurring costs exceed on-premises solutions over time.
- Hosting internal intranet data on the cloud could raise security concerns.

## **Recommendation**

A **hybrid approach** is recommended:

1. **Internal Web Servers:** Retain on-premises infrastructure for intranet hosting to maintain control over sensitive data, using upgraded Dell PowerEdge R650 servers.
2. **External Web Servers:** Migrate to Microsoft Azure App Service for scalability and global accessibility.

This approach ensures a balance between security, performance, and cost-efficiency, preparing the company's web infrastructure for current and future demands.

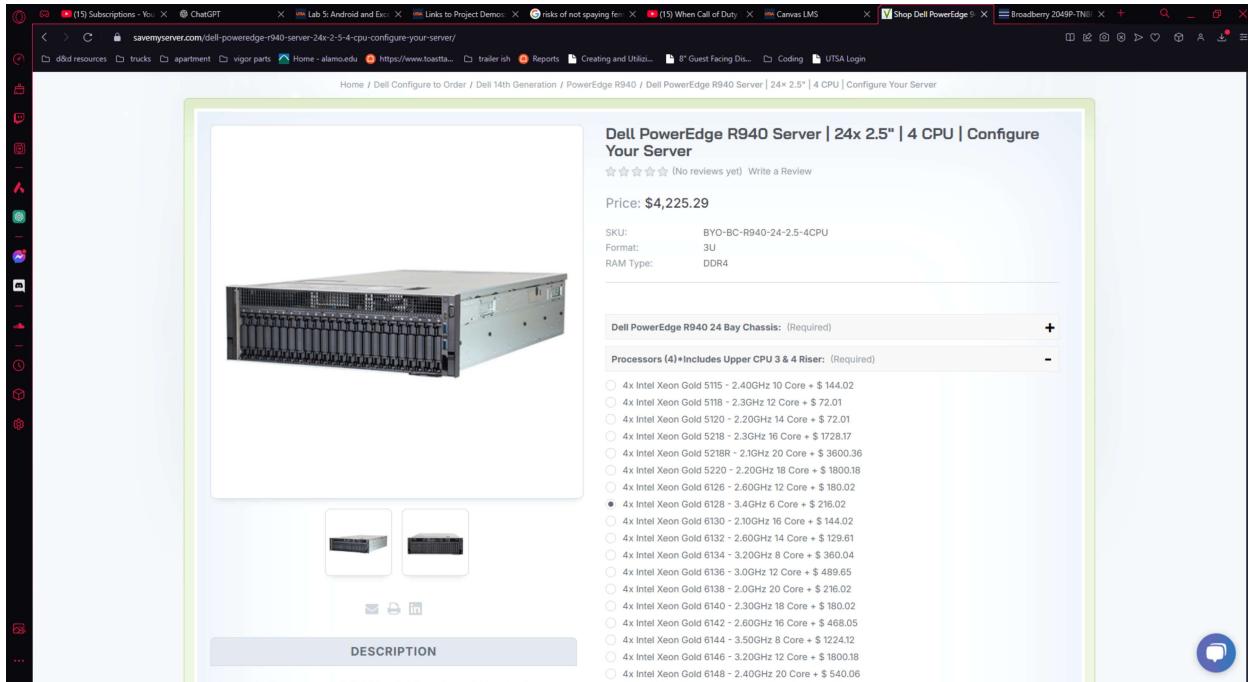
## **Email Servers**

For the on-premises option, which is what the company currently has. The requirements for each server are a motherboard with quad socket for four quad core Xeon class processors, 96Gb of RAM, and 16 drives of minimum 3Terabytes in Raid 5 configuration (at least 45 total Terabytes of storage). This system is expected to run on Windows 2008 R2 with a total of 4 servers handling email for the entire company.

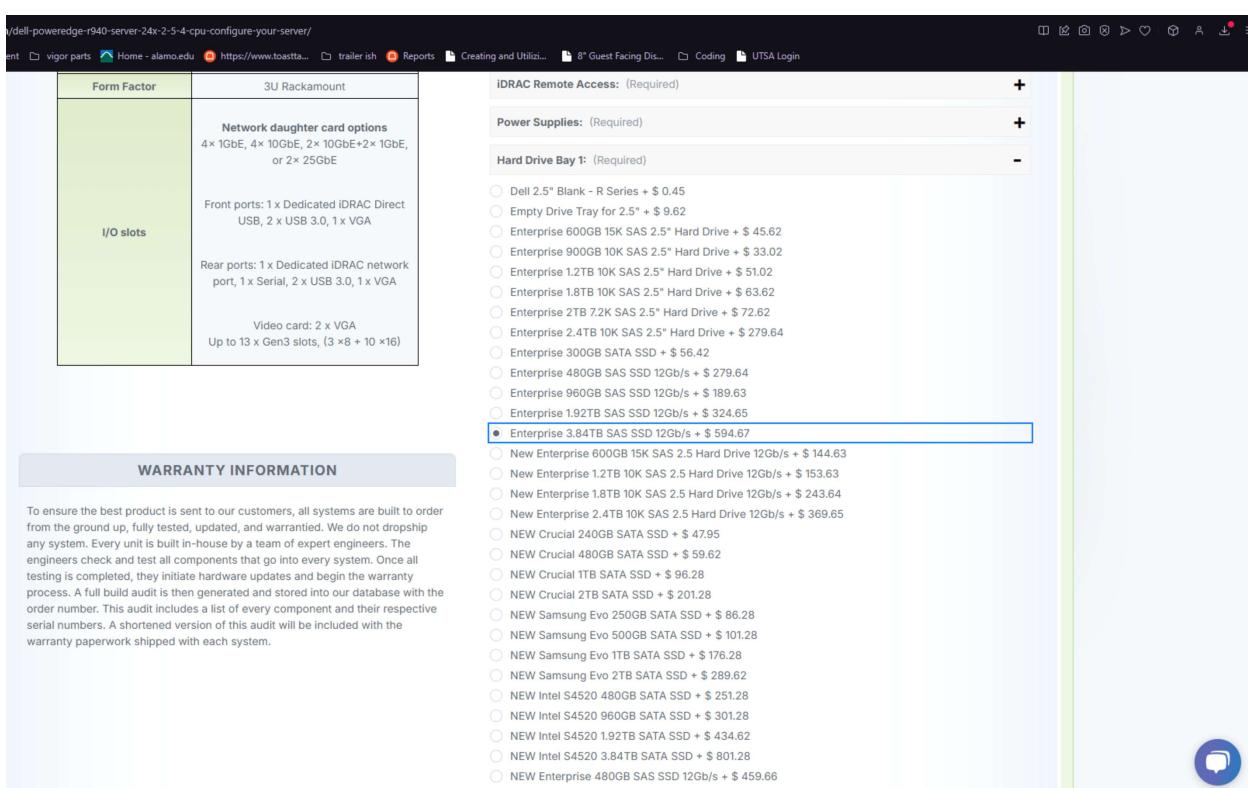
While some of the Hardware is now outdated, I was able to find hardware like the company's request to build an estimate for on-premises costs. The server I built is a Dell PowerEdge R940 and features 4 Intel Xeon Gold 6128 processors. 4 core processors were unavailable in a 4-socket setup, so I had to settle for 6 cores. Along with that is 96 Gb of 2400MHz Ram in 6 16GB sticks. This setup also has an H330 Raid controller capable of Raid 5 configuration and 16 Enterprise 3.84 Terabyte SAS SSD Hard drives that run at 12 Gb/second. While these servers only contain 16 hard drives each chassis has space

for up to 24 hard drives. As of 2020 Windows 2008 R2 is no longer supported so these servers feature a

Windows S 2019 16-core license. Without the Hard drives each server costs \$4225.29.



The screenshot shows the Dell PowerEdge R940 Server configuration page. At the top, it displays the server's name, price (\$4,225.29), and key specifications: SKU: BYO-BC-R940-24-2.5-4CPU, Format: 3U, RAM Type: DDR4. Below this, there are dropdown menus for selecting components. The 'Dell PowerEdge R940 24 Bay Chassis' dropdown is set to 'Required'. The 'Processors (4)\*Includes Upper CPU 3 & 4 Riser' dropdown is also set to 'Required' and contains a long list of Intel Xeon Gold processor options. A large blue box highlights the 'Enterprise 3.84TB SAS SSD 12Gb/s + \$ 594.67' option under the 'Hard Drive Bay 1' dropdown. At the bottom, the 'WARRANTY INFORMATION' section is visible, containing a detailed paragraph about warranty policies and audit results.



The screenshot continues from the previous one, showing the 'I/O slots' section which details network options (4x 1GbE, 4x 10GbE, 2x 10GbE+2x 1GbE, or 2x 25GbE) and port configurations. The 'WARRANTY INFORMATION' section at the bottom provides a summary of the warranty process, mentioning the audit of components and serial numbers, and the inclusion of warranty paperwork.

At \$594.67 a hard drive, purchasing the minimum 16 drives per server would cost \$9514.72 in hard drives alone. That brings the total with server hardware and drives to \$13740.01 per server. With 4 servers needed that brings the total server hardware costs to \$54,960.04. The benefit of this option is that it is an extension of the current system in place. From a companywide perspective no changes need to be made. Another benefit is that unlike the cloud service options, there is only the upfront cost of purchasing the hardware. On the negative side of this choice, while this is a flat cost versus other cloud options, this doesn't consider maintenance, labor, and on premises utility costs to maintain and develop these servers.

For the cloud options requirements are split for the needs of 2 groups. For the upper management and Executives accounts need to have at least 100 GB of storage capacity with consideration for 25% growth per year. There are 150 of these accounts. The secondary email service is for all non-management employees and requires 10Gb of storage and plans for 40% growth per year. There are 4000 active accounts on the secondary server.

One option to consider fulfilling this need is Microsoft's 365 service. This option offers Microsoft Outlook as well as a suite of business focused applications. It also includes a custom business domain and access to Microsoft teams for online group meetings. Each user account is given 1 Terabyte of cloud storage as well as a 50 Gb email mailbox. All these features will cost \$6 per user per month with discounts offered for companies over 300 users

While the 50 Gb storage capacity does not meet the requirements for the upper management accounts, it does meet the requirements of the secondary accounts. The secondary users only require 10Gb per user and with the estimated growth to only 21.97Gb after year 3. With a 50 Gb mailbox the company will be future proofed for quite a few years.

The issue with employing a cloud survive versus hosting servers on premises is that subscribing to an outside company will cost the company a monthly fee. At the current rate of \$6 a user per month,

for the 4000 users of the secondary email server it would cost the company \$24,000 a month to maintain email services.

Microsoft 365 Business Basic	Microsoft 365 Business Standard	Microsoft 365 Business Premium	Microsoft 365 Apps for business
<p><b>\$6.00</b> user/month (Annual subscription—auto renews)<sup>1</sup></p> <p><a href="#">Buy now</a></p> <p><a href="#">Try free for one month &gt;</a></p> <p><a href="#">See trial terms<sup>2</sup></a></p> <p>Apps and services to kick-start your business, including:</p> <ul style="list-style-type: none"> <li>✓ Identity, access, and user management for up to 300 employees</li> <li>✓ Custom business email (<a href="mailto:you@yourbusiness.com">you@yourbusiness.com</a>)</li> <li>✓ Web and mobile versions of Word, Excel, PowerPoint, and Outlook</li> <li>✓ Chat, call, and video conference with Microsoft Teams</li> <li>✓ 1 TB of cloud storage per employee</li> <li>✓ 10+ additional apps for your business needs (Microsoft Bookings, Planner, Forms, and others)</li> <li>✓ Automatic spam and malware filtering</li> <li>✓ Anytime phone and web support</li> <li>✓ Microsoft 365 Copilot, available as an add-on<sup>3</sup></li> </ul> <p>Secure cloud services:</p>  <p>Teams    OneDrive    SharePoint    Exchange</p>	<p><b>\$12.50</b> user/month (Annual subscription—auto renews)<sup>1</sup></p> <p><a href="#">Buy now</a></p> <p><a href="#">Try free for one month &gt;</a></p> <p><a href="#">See trial terms<sup>2</sup></a></p> <p>Everything in Business Basic, plus:</p> <ul style="list-style-type: none"> <li>✓ Desktop versions of Word, Excel, PowerPoint, and Outlook</li> <li>✓ Webinars with attendee registration and reporting</li> <li>✓ Collaborative workspaces to co-create using Microsoft Loop</li> <li>✓ Video editing and design tools with Microsoft Clipchamp</li> <li>✓ Microsoft 365 Copilot, available as an add-on<sup>3</sup></li> </ul> <p>Desktop, web, and mobile apps and secure cloud services:</p>  <p>W    X    P    O</p>	<p><b>\$22.00</b> user/month (Annual subscription—auto renews)<sup>1</sup></p> <p><a href="#">Buy now</a></p> <p><a href="#">Try free for one month &gt;</a></p> <p><a href="#">See trial terms<sup>2</sup></a></p> <p>Everything in Business Standard, plus:</p> <ul style="list-style-type: none"> <li>✓ Advanced identity and access management</li> <li>✓ Enhanced cyberthreat protection against viruses and phishing attacks</li> <li>✓ Enterprise-grade device and endpoint protection</li> <li>✓ Discover, classify, and protect sensitive information</li> <li>✓ Microsoft 365 Copilot, available as an add-on<sup>3</sup></li> </ul> <p>Desktop, web, and mobile apps and secure cloud services:</p>  <p>W    X    P    O</p>	<p><b>\$8.25</b> user/month (Annual subscription—auto renews)<sup>1</sup></p> <p><a href="#">Buy now</a></p> <p><a href="#">Try free for one month &gt;</a></p> <p><a href="#">See trial terms<sup>2</sup></a></p> <ul style="list-style-type: none"> <li>✓ Desktop versions of Word, Excel, PowerPoint, and Outlook</li> <li>✓ 1 TB of cloud storage per user</li> <li>✓ Anytime phone and web support</li> <li>✓ Microsoft 365 Copilot, available as an add-on<sup>3</sup></li> </ul> <p>Desktop, web, and mobile apps and secure cloud services:</p>  <p>W    X    P    O</p>

This placed next to on-premises servers, while again maintenance and utility costs aren't factored in, would mean that it would only take a little over 2 months for the cost of the Microsoft 365 plan to surpass the cost of just the 4 on premises email servers

Another option for a cloud server is Google's Gmail. Subscription with Gmail also includes a custom email domain as well as access to Google's cloud-based business apps. Like Microsoft Teams, Gmail also offers support for up to 150 participant video meetings. Each account includes 2 terabytes of pooled storage across all apps and security controls for the entire domain. Gmail also has a soft limit of 300 users, but they offer their service at \$12 a user per month with a minimum one year commitment.

While Gmail's pooled 2 terabyte storage could allow for the possibility of a user filling up their storage with non-email data, neither the primary or secondary users require anywhere near that much storage to operate, even calculating for year to year growth. With that in mind at \$12 a user per month, accounts for the primary accounts would total to \$1800 a month and \$21,600 for the year. The

secondary accounts would total \$48,000 a month and \$576,000 a year. This would make the total cost of all accounts \$69,600 a month and \$835,200 a year. Like Microsoft 365, the cost to use the service for 1 month already out prices the cost of purchasing on premises servers.

Business Starter	Business Standard	Business Plus	Enterprise
<b>\$6 USD</b> per user / month, 1 year commitment	<b>\$12 USD</b> per user / month, 1 year commitment	<b>\$18 USD</b> per user / month, 1 year commitment	Contact sales for pricing
<a href="#">Start a trial</a> <ul style="list-style-type: none"> <li>✓ 30 GB pooled storage per user*</li> <li>✓ Secure custom business email, you@your-company.com</li> <li>✓ Gemini app - AI assistant with enterprise-grade security and privacy</li> <li>✓ 100 participant video meetings</li> <li>✓ Security and management controls</li> <li>✓ Standard Support</li> </ul>	<a href="#">Start a trial</a> <ul style="list-style-type: none"> <li>✓ 2 TB pooled storage per user*</li> <li>✓ Secure custom business email, you@your-company.com</li> <li>✓ Gemini app - AI assistant with enterprise-grade security and privacy</li> <li>✓ 150 participant video meetings + recording, noise cancellation</li> <li>✓ Appointment booking pages</li> <li>✓ Email layouts and mail merge</li> <li>✓ Security and management controls</li> <li>✓ Standard Support**</li> </ul>	<a href="#">Start a trial</a> <ul style="list-style-type: none"> <li>✓ 5 TB pooled storage per user*</li> <li>✓ Secure custom business email, you@your-company.com + eDiscovery, retention</li> <li>✓ Gemini app - AI assistant with enterprise-grade security and privacy</li> <li>✓ 500 participant video meetings + recording, attendance tracking, noise cancellation</li> <li>✓ Appointment booking pages</li> <li>✓ Email layouts and mail merge</li> <li>✓ Enhanced security and management controls, including Vault and advanced endpoint management</li> <li>✓ Standard Support**</li> </ul>	<a href="#">Contact sales</a> <ul style="list-style-type: none"> <li>✓ 5 TB pooled storage per user, with the ability to request more*</li> <li>✓ Secure custom business email, you@your-company.com + eDiscovery, retention, S/MIME encryption</li> <li>✓ Gemini app - AI assistant with enterprise-grade security and privacy</li> <li>✓ 1000 participant video meetings + recording, attendance tracking, noise cancellation, in-domain live streaming</li> <li>✓ Appointment booking pages</li> <li>✓ Email layouts and mail merge</li> <li>✓ Advanced security, management, and compliance controls, including Vault, DLP, data regions, and enterprise endpoint management</li> <li>✓ Enhanced Support**</li> </ul>

At least for email services, it seems like outsourcing to 3<sup>rd</sup> party services will always be the more expensive option. Since the focus of the email servers seems to be storage, I recommend staying with the on-premises servers. The costs saved hosting on premises outweigh the cost of maintaining and even upgrading servers on site.

## Application Servers

### Introduction:

The company currently utilizes 50 application servers in which 40% of the servers (**20 servers**) are used for local storage to retain data used by the end user, while the other 60% of the servers (**30 servers**) are used as middleware. These servers are connected to either the ERP or Database Servers. Our goal with migrating to a cloud solution is to provide high availability of their service, easy access

anywhere in the world, state of the art date security (which is needed from a 2008 server), allow for fluid scalability based on their current/future needs, and a more flexible cost of operation for our client.

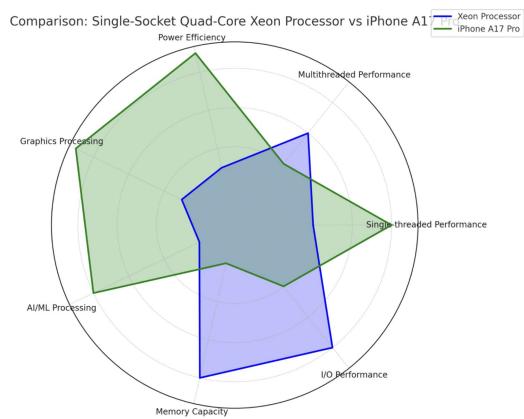
### Overlook of The Current Application Servers:

To begin with, Windows 2008R2 reached its end-of-life support on **January 14, 2020**. This means that there are no longer any free security updates on prem, no more non security updates, no more free support options, and no more online technical content updates.

Product	End of Extended Support
Windows Server 2008 R2 Datacenter	1/14/2020
Windows Server 2008 R2 Enterprise	1/14/2020
Windows Server 2008 R2 for Itanium-Based Systems	1/14/2020
Windows Server 2008 R2 Standard	1/14/2020

Another issue with the current servers is the extremely low available ram per server, 8 GB of ram was great back in the day, but nowadays and wanting to future proof this migration, we should highly consider upgrading the ram to **at least 16 GB** for the middleware application servers.

Furthermore, the single socket quad core Xeon class processors currently utilized are also very much **outdated**. To put this into perspective, your modern day smartphone more than likely has better performance and efficiency than the current processor.

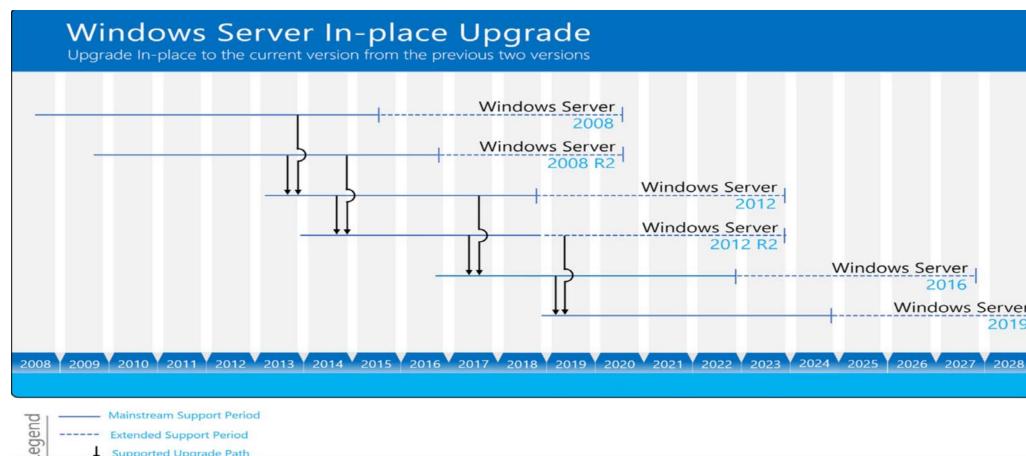


*The A17 Pro chip is used in the iPhone 15 Pro.*

On another note, the storage capacity of the servers is honestly not bad at all, 2TB both OS and 2TB for Application Data/Storage should be good for the migration and a few years to come. This can save the client a little bit of money by not having to immediately look for an increase in storage capacity and should allow us to be more flexible with lower-tiered server options.

### **Server Upgrades & Cloud Migration Options:**

To begin with, let us address our very outdated Windows 2008R2, we can perform an in-place upgrade to Windows 2019. To start, we need to check for driver and firmware updates on our current setup and create a backup for our server as we transition into a newer version. After all this has been checked, we can now upgrade Windows 2012R2, and after that upgrade is completed, we can then again upgrade to the more recent Windows 2019. Now that we are finally on a modern release, we now have access to improved security, which will help protect the client from cyber-attacks. Furthermore, with this more modern infrastructure, we will have better performance, improved application compatibility/flexibility, and long-term support from Microsoft since Windows 2019 will be supported until 2029.



Now, let's explore the cloud server options available to us for hosting our new infrastructure. We will be comparing AWS and Azure to determine which platform provides the best bang for our buck.

in terms of performance, cost effectiveness, and future scalability. This comparison will help us make an informed decision about the ideal server configuration to host our applications and ensure smooth operations moving forward.

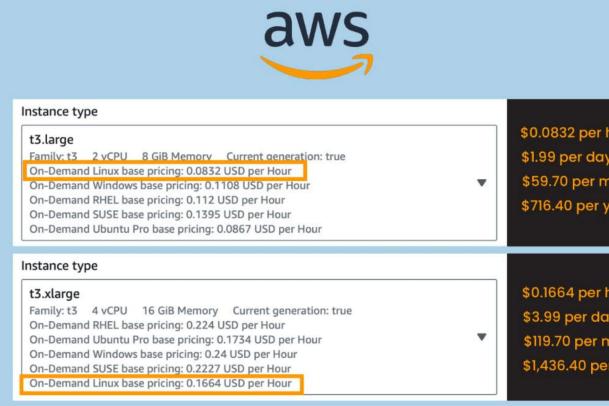
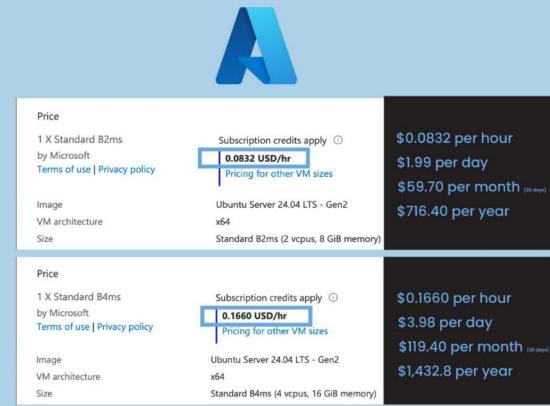
For AWS we can either select **t3.large** (2 vCPUs, 8 GB RAM) this configuration closely mirrors our current on prem server setup in terms of computing power and memory, making it an easy transition from our existing infrastructure. However, we can select **t3.xlarge** (4 vCPUs, 16 GB RAM) this option would provide a significant increase in computing capacity, allowing us to future proof for more demanding applications and increased traffic volume. It would also provide enhanced scalability, helping us prepare for future growth and demanding operational requirements.

Instance type	
<b>t3.large</b> Family: t3 2 vCPU 8 GiB Memory Current generation: true On-Demand Linux base pricing: 0.0832 USD per Hour On-Demand Windows base pricing: 0.1108 USD per Hour On-Demand RHEL base pricing: 0.112 USD per Hour On-Demand SUSE base pricing: 0.1395 USD per Hour On-Demand Ubuntu Pro base pricing: 0.0867 USD per Hour	\$0.0832 per hour \$1.99 per day \$59.70 per month (30 days) \$716.40 per year
<b>t3.xlarge</b> Family: t3 4 vCPU 16 GiB Memory Current generation: true On-Demand RHEL base pricing: 0.224 USD per Hour On-Demand Ubuntu Pro base pricing: 0.1734 USD per Hour On-Demand Windows base pricing: 0.24 USD per Hour On-Demand SUSE base pricing: 0.2227 USD per Hour On-Demand Linux base pricing: 0.1664 USD per Hour	\$0.1664 per hour \$3.99 per day \$119.70 per month (30 days) \$1,436.40 per year

For Azure, we can either select **B2ms** (2 vCPUs, 8 GB RAM), which closely matches our current on prem server setup in terms of computing power and memory, providing a smooth transition to the cloud. Alternatively, we can go with **B4ms** (4 vCPUs, 16 GB RAM), which would offer a notable boost in processing power and memory. This option would better support more resource intensive applications and increased traffic volumes, giving us the capacity to handle more complex workloads without running

into performance bottlenecks. It would also provide enhanced scalability, helping us prepare for future growth and demanding operational requirements.

<b>Price</b>		
1 X Standard B2ms by Microsoft <a href="#">Terms of use</a>   <a href="#">Privacy policy</a>	Subscription credits apply ⓘ <b>0.0832 USD/hr</b> <a href="#">Pricing for other VM sizes</a>	<b>\$0.0832 per hour</b> <b>\$1.99 per day</b> <b>\$59.70 per month</b> (30 days) <b>\$716.40 per year</b>
<b>Image</b>	Ubuntu Server 24.04 LTS - Gen2	
<b>VM architecture</b>	x64	
<b>Size</b>	Standard B2ms (2 vcpus, 8 GiB memory)	
<b>Price</b>		
1 X Standard B4ms by Microsoft <a href="#">Terms of use</a>   <a href="#">Privacy policy</a>	Subscription credits apply ⓘ <b>0.1660 USD/hr</b> <a href="#">Pricing for other VM sizes</a>	<b>\$0.1660 per hour</b> <b>\$3.98 per day</b> <b>\$119.40 per month</b> (30 days) <b>\$1,432.8 per year</b>
<b>Image</b>	Ubuntu Server 24.04 LTS - Gen2	
<b>VM architecture</b>	x64	
<b>Size</b>	Standard B4ms (4 vcpus, 16 GiB memory)	

Now that we've established that both AWS and Azure offer competitive and comparable pricing for virtual machines, the next step is to assess the storage options available on both platforms that will best support our current workload. The storage services on these cloud providers will need to align with the needs of the application you're running, ensuring data reliability, scalability, and cost effectiveness.



#### Unit conversions

Storage amount per volume: 2 TB x 1024 GB in a TB = 2048 GB

#### Pricing calculations

3,000 iops / 2,048 GB = 1.46 IOPS to GB ratio (gp3)

125 MBps / 3,000 iops = 0.04 IOPS to Throughput ratio

1 volumes x 730 instance hours = 730.00 total instance hours

730.00 instance hours / 730 hours in a month = 1.00 instance months

2,048 GB x 1.00 instance months x 0.08 USD = 163.84 USD (EBS Storage Cost)

**EBS Storage Cost: 163.84 USD**

3,000 iops - 3000 GP3 iops free = 0.00 billable gp3 iops

**EBS IOPS Cost: 0.00 USD**

125 MBps - 125 GP3 MBps free = 0.00 billable MBps

**EBS Snapshot Cost: 0 USD**

**Amazon Elastic Block Storage (EBS) total cost (monthly): 163.84 USD**

**\$163.84 per month**

For AWS, we can use Amazon Elastic Block Store (EBS), which provides us with high performance storage designed for use with Amazon EC2 instances. EBS is particularly suited for applications that require persistent storage, such as databases and file systems. The gp3 volume type is ideal for general purpose workloads, as it offers a balance of performance and cost.

Each gp3 EBS volume includes 125 MB/s of throughput, which should be sufficient for most standard applications. The price for 2TB of storage using gp3 is approximately **\$163.84 per month**. This cost includes the base storage and throughput, additional costs for snapshot backups or increased redundancy would add to the monthly price. Nevertheless, this pricing offers a solid, reliable option for handling typical enterprise workloads, with the flexibility to scale as needed.



Region: East US Type: Managed Disks Tier: Standard SSD Redundancy: LRS

Disk size: E40: 2,048 GiB, 500 Provisioned IOPS, 100 Provisioned MB/s, \$153.600/r

Number of Disks: 1 x \$153.60 = \$153.60

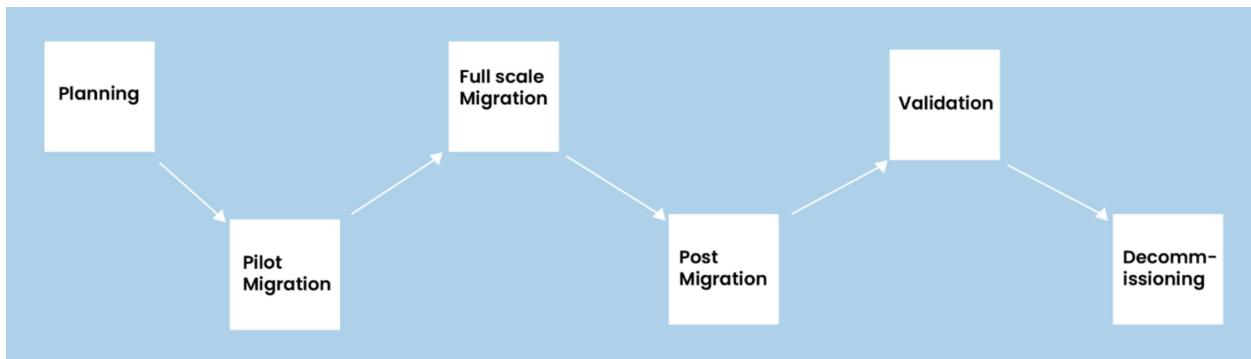
Storage transactions: 100 = \$0.20

Upfront cost: \$0.00 Monthly cost: \$153.80

**\$153.80 per month**

On the Azure side, we turn to Azure Managed Disks, they offer a range of disk types to choose from based on the performance needs of your workload, and for this case, we'll use Standard SSD Managed Disks. These disks provide a good balance between cost and performance, suitable for most enterprise applications. The Standard SSD Managed Disks in Azure offer us 100 MB/s of throughput, which is slightly less than the throughput provided by AWS's EBS solution. The cost for 2TB of storage using Standard SSD in Azure is **\$153.80 per month**. While this is slightly less than AWS's pricing, it does offer less throughput, adding another variable into our decision making. As with AWS, additional charges for features like IOPS, snapshots, or data redundancy may apply.

### Detailed Migration Steps:



We have decided to migrate the servers to Azure, this will require a well-planned approach to minimize downtime and ensure no data is lost throughout the process. This migration will be carried out in several phases: planning, pilot migration, full scale migration, post migration validation, and finally the decommissioning of our on prem servers.

The **planning phase** will begin by assessing all 50 application servers. This includes documenting server configurations, application dependencies, storage requirements, and network settings. Based on this analysis, Azure resources will be provisioned to match the company's needs. For local storage servers we will deploy B2ms instances (2 vCPUs, 8 GB RAM), which closely mirror the current setup. On the other hand, middleware servers will be upgraded to B4ms instances (4 vCPUs, 16 GB RAM) to improve scalability and future proof the infrastructure. Finally, data backups of all the servers will be created to prevent data loss during migration.

In the **pilot migration phase**, we will test the migration process on a small subset of non-critical servers. Using the Azure Migrate tool we will transfer data and applications to Azure, ensuring they perform as expected in the new environment. This testing will help identify any potential issues, before the full migration begins. The pilot phase provides an opportunity to fine tune the process and address any challenges in a controlled manner.

The **full-scale migration** will proceed in stages, starting with the 20 local storage servers, followed by the 30 middleware servers. Azure Managed Disks with Standard SSD storage will be utilized to provide a balance of cost and performance. During this phase, Azure Load Balancer will be configured to manage traffic efficiently between middleware servers. Data transfer will be conducted securely using Azure ExpressRoute or a VPN connection to maintain uninterrupted access to critical applications during the migration.

In the **post migration phase**, Azure Monitor will be employed to track server performance, ensuring that the infrastructure operates efficiently. Once all systems have been thoroughly **validated**,

the on-prem servers will be securely **decommissioned**, ensuring no residual data remains on outdated hardware.

This migration plan not only transitions the company to a modern cloud-based infrastructure but also provides enhanced scalability, improved performance, and robust security, aligning with our client's current and future business needs.

### **Expected Benefits and Cost Analysis:**

The annual cost of migrating and operating the company's 50 application servers on Azure can be broken down into two sections: virtual machine instances and storage.

For the local storage servers, we will deploy 20 B2ms instances (2 vCPUs, 8 GB RAM), with each instance costing \$716.40 per year. The total cost for these servers amounts to \$14,328 annually. For the middleware servers, we will utilize 30 B4ms instances (4 vCPUs, 16 GB RAM), with each instance costing \$1,432.80 per year, leading to a total cost of **\$42,984** annually for this portion of the infrastructure.

Storage costs are calculated based on 2TB of Azure Managed Disk Standard SSD storage per server. With 50 servers requiring storage, and each 2TB allocation costing \$1,845.60 per year, the total annual storage cost will be **\$92,280**.

Adding these sections together, the total annual operating cost for our new cloud infrastructure will be **\$149,592**. This calculation excludes additional services, such as networking or backups, which may add further expenses depending on the specific needs of the company.

### **Conclusion:**

Migrating from outdated Windows 2008R2 servers to Azure cloud infrastructure offers significant benefits, including improved security, performance, and scalability. The upgrade to Windows

2019 ensures better security and long-term support, while moving to Azure enhances flexibility and future proofs the system. The proposed Azure solution with B2ms and B4ms instances offers an efficient and cost-effective way to address current challenges and support future growth.

With a well-planned migration strategy, minimal downtime, and robust monitoring, the company will enjoy a modern, secure, and scalable infrastructure. This transition will improve operations, reduce costs, and position the company for long term success

**References and links:**

R5.8xlarge instance:

<https://instances.vantage.sh/aws/ec2/r5.8xlarge>

AWS cost estimator:

<https://calculator.aws/#/addService>

Workstation:

<https://www.amazon.com/Dell-OptiPlex-7000-i7-12700-Ethernet/dp/B0BZSJM6W5>

Current Infrastructure:

<https://www.asacomputers.com/Quad-Socket-4U-Rackmount-Server.html>

<https://redresscompliance.com/six-oracle-database-licensing-models-and-costs-2023/>

Google Cloud:

<https://cloud.google.com/managed-microsoft-ad/pricing>

AWS DNS:

<https://aws.amazon.com/directoryservice/pricing/>

AWS Route53:

<https://aws.amazon.com/route53/pricing/>

Microsoft Azure:

<https://azure.microsoft.com/en-gb/pricing/details/microsoft-entra-ds/>

Outdated Hardware and Software:

"Microsoft Windows Server 2008 R2 reached end-of-life on January 14, 2020, ceasing security updates and support."

Source: <https://learn.microsoft.com>

#### Proposed Hardware - Dell PowerEdge R650 Specifications:

"The Dell PowerEdge R650 offers dual Intel Xeon processors, scalable RAM configurations, and high-speed SSD support, making it suitable for modern workloads."

Source: <https://www.dell.com>

#### Cloud Migration - Microsoft Azure Services:

"Microsoft Azure App Service provides a scalable and secure platform for hosting web applications, while Azure Virtual Machines allow for flexibility in resource allocation."

Source: <https://azure.microsoft.com>

#### Cost Analysis - Azure App Service and Virtual Machines:

"Pricing for Azure App Service starts at \$227.04 per month for the P1V3 plan, with additional costs for Azure Managed Disks based on performance requirements."

Source: <https://azure.microsoft.com/en-us/pricing/calculator/>

#### Benefits of a Hybrid Approach:

"Hybrid cloud strategies combine the scalability of cloud services with the control of on-premises infrastructure, ensuring data security and operational efficiency."

Source: <https://www.gartner.com>