

Milestone 2 : LowTech GMmBH Migration to Azure

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Abstract

1 Overview of the Problem

2 Objectives of the Migration

3 Migration Strategy

After reviewing the company landscape we have evaluated several options for the migration to a public/private cloud context depending on the application. For each one we detail the Cloud Context to deploy, which tools to use, and, if relevant, details on the service models of each product.

3.1 Finance: Legacy Application

As the finance department still needs to use this application for the next 3 years, we are only going to migrate to our own private cloud context. In this case, it is going to be deployed into a virtual machine with the ability to scale in terms of memory and CPU thanks to PoxMox. For backup purposes, we will create a file share specific to this application using Azure Files. We are also going to use Ansible playbooks to automate the configuration and installation of the application.

| Cloud Context | Products And Technologies | Service Models |
|---------------|---------------------------|----------------|
| Private Cloud | ProxMox, Ansible | N/A |
| Public Cloud | Azure Files | IaaS |

Table 1: Finance Legacy Application Deployment Strategy

3.2 Finance: SAP PPM, ERP, IAM and ERM

These applications will also be deployed in the new private cloud context. Since the finance department is the only one that needs access, this system will be somewhat isolated. We are going to configure networking access only for the finance department clients. Following the same patterns as for the Legacy application, we are also going to use Ansible to automate and make the installation and configuration repeatable.

| Cloud Context Products And Technologies Service Models | | |
|---------------------------------------------------------------|------------------|-----|
| Private Cloud | ProxMox, Ansible | N/A |

Table 2: Finance SAP PPM, ERP, IAM and ERM Deployment Strategy

3.3 Production: Reporting Management

This application will be newly developed, for this, we are going to deploy the backend using Azure App Service, the front end using Azure Static Web Apps, Azure Blob Storage to save reports, and Azure CosmosDB if a database is needed. To secure all newly developed applications we are going to use Microsoft Entra ID, and make them accessible only with the company VPN.

| Cloud Context Products And Technologies Service Models | | |
|---------------------------------------------------------------|----------------------|--------------|
| Public Cloud | Azure App Service | PaaS or CaaS |
| Public Cloud | Azure Static Web App | PaaS or CaaS |
| Public Cloud | Azure Blob Storage | IaaS |
| Public Cloud | Microsoft Entra ID | PaaS |
| Public Cloud | Azure Cosmos DB | PaaS |

Table 3: Production Reporting Management Deployment Strategy

3.4 Production + HR: Shift Management

This application will be newly developed. Following the standard for new applications, we will deploy the backend using Azure App Service, the front end using Azure Static Web Apps, and Azure Database For PostgreSQL if a database is needed. To secure all newly developed applications we are going to use Microsoft Entra ID, and make them accessible only with the company VPN.

| Cloud Context Products And Technologies | | Service Models |
|------------------------------------------------|-------------------------------|-----------------------|
| Public Cloud | Azure App Service | PaaS or CaaS |
| Public Cloud | Azure Static Web App | PaaS or CaaS |
| Public Cloud | Microsoft Entra ID | PaaS |
| Public Cloud | Azure Database For PostgreSQL | PaaS |

Table 4: Production, HR, Shift Management Deployment Strategy

3.5 Supply Management: SCM

This application is supplied by a third party. It will be installed in a linux virtual machine, using Azure Linux Virtual Machines + Azure Virtual Machine Scale Sets, to enable autoscaling. Same as all other internal applications, it will only be accessible through the company VPN.

| Cloud Context Products And Technologies | | Service Models |
|------------------------------------------------|-----------------------------------------------------------------|-----------------------|
| Public Cloud | Azure Linux Virtual Machines + Azure Virtual Machine Scale Sets | IaaS |

Table 5: Supply Management SCM Deployment Strategy

3.6 Quality Management: QM Software

This application is supplied by a third party. It will be installed in a windows virtual machine, using Azure Windows Virtual Machines + Azure Virtual Machine Scale Sets, to enable autoscaling. Same as all other internal applications, it will only be accessible through the company VPN.

| Cloud Context Products And Technologies | Service Models |
|-----------------------------------------|------------------------------------------------------------------------|
| Public Cloud | Azure Windows Virtual Machines + Azure Virtual Machine Scale Sets IaaS |

Table 6: Quality Management QM Software Deployment Strategy

3.7 Warehouse: Warehouse Management

This application will be newly developed. Following the standard for new applications, we will deploy the backend using Azure App Service, the front end using Azure Static Web Apps, and Azure Database For PostgreSQL if a database is needed. To secure all newly developed applications we are going to use Microsoft Entra ID, and make them accessible only with the company VPN.

| Cloud Context Products And Technologies | Service Models |
|-----------------------------------------|------------------------------------|
| Public Cloud | Azure App Service |
| Public Cloud | Azure Static Web App |
| Public Cloud | Microsoft Entra ID |
| Public Cloud | Azure Database For PostgreSQL PaaS |

Table 7: Warehouse, Warehouse Management

3.8 Warehouse: Deliforce

This application will be installed on premise. As other on premise deployments we will automate it with Ansible. It will communicate with other internal applications using Azure Express Route, enabling us to transfer information between our private cloud and its public counterpart.

| Cloud Context Products And Technologies | Service Models |
|-----------------------------------------|---------------------|
| Public Cloud | Azure Express Route |
| Private Cloud | ProxMox, Ansible |

Table 8: Warehouse Deliforce Deployment Strategy

3.9 Sales + Operations + Customer Service: CRM

This application is supplied by a third party. It will be installed in a linux virtual machine, using Azure Linux Virtual Machines + Azure Virtual Machine Scale Sets, to enable autoscaling. As all other internal applications, it will only be accessible through the company VPN.

| Cloud Context Products And Technologies | Service Models |
|-----------------------------------------|----------------------------------------------------------------------|
| Public Cloud | Azure Linux Virtual Machines + Azure Virtual Machine Scale Sets IaaS |

Table 9: Quality Management QM Software Deployment Strategy

3.10 Sales: Lead Management

This application will be installed on premise. As other on premise deployments we will automate it with Ansible.

| Cloud Context Products And Technologies | Service Models |
|-----------------------------------------|------------------|
| Private Cloud | ProxMox, Ansible |

Table 10: Sales Lead Management Deployment Strategy

3.11 Sales: Business Analytics

This application is supplied by a third party. It will be installed in a linux virtual machine, using Azure Linux Virtual Machines + Azure Virtual Machine Scale Sets, to enable autoscaling. As all other internal

applications, it will only be accessible through the company VPN.

| Cloud Context Products And Technologies | | Service Models |
|------------------------------------------------|-----------------------------------------------------------------|-----------------------|
| Public Cloud | Azure Linux Virtual Machines + Azure Virtual Machine Scale Sets | IaaS |

Table 11: Sales Business Analytics Deployment Strategy

3.12 Sales: Tableau (Market Development)

This application is supplied by a third party. It will be installed in a custom virtual machine, using Azure Tableau Server. In this case we are not going to actively enable auto scaling, since we anticipate that the use case does not benefit from adding more instances. As other internal applications it will only be accessible through the company VPN.

| Cloud Context Products And Technologies | | Service Models |
|------------------------------------------------|----------------------|-----------------------|
| Public Cloud | Azure Tableau Server | IaaS |
| N/A | Tableau Desktop | N/A |

Table 12: Sales Tableau (Market Development) Deployment Strategy

3.13 HR: HR Software

This application will be newly developed following the standard for new applications. To secure all newly developed applications we are going to use Microsoft Entra ID, and make them accessible only with the company VPN.

| Cloud Context Products And Technologies | | Service Models |
|------------------------------------------------|-------------------------------|-----------------------|
| Public Cloud | Azure App Service | PaaS or CaaS |
| Public Cloud | Azure Static Web App | PaaS or CaaS |
| Public Cloud | Microsoft Entra ID | PaaS |
| Public Cloud | Azure Database For PostgreSQL | PaaS |

Table 13: HR Software Deployment Strategy

3.14 Facility Management: Facility Management Software

This is a proprietary application that will be deployed on premises following practices stated for all previous on premise deployments

| Cloud Context Products And Technologies | | Service Models |
|------------------------------------------------|------------------|-----------------------|
| Private Cloud | ProxMox, Ansible | N/A |

Table 14: Facility Management Software Deployment Strategy

3.15 Finance + HR + Sales + Legislation: Office Suite

In this case, several departments need access to the office suite. We are going to provide them with access to the Microsoft 365 selection of products. Each client will have the option to use the office suite in the cloud, or locally on their devices. We will also provide OneDrive access for easy document sharing and collaboration.

| Cloud Context Products And Technologies Service Models | | |
|---------------------------------------------------------------|----------------------|------|
| Public Cloud | Microsoft Office 365 | SaaS |
| Public Cloud | OneDrive | SaaS |

Table 15: Office Suite Deployment Strategy

3.16 Webshop: Website CMS

This application will be newly developed following the standard for new applications. As a special consideration, this application is the only public facing application which needs to handle customer requests. Our standard for newly developed applications enable this critical piece of the business to easily scale and be secured with valid certificates with no extra configurations.

| Cloud Context Products And Technologies | | Service Models |
|------------------------------------------------|-------------------------------|-----------------------|
| Public Cloud | Azure App Service | PaaS or CaaS |
| Public Cloud | Azure Static Web App | PaaS or CaaS |
| Public Cloud | Azure Database For PostgreSQL | PaaS |

Table 16: Webshop Website Deployment Strategy

3.17 General Considerations

Importantly, for all newly developed applications we will:

- Set up a private GitHub repository
- Set up GitHub actions to enable continues integration and continuous deployments in Azure
- Set up an infrastructure folder to hold terraform files. These files will define the infrastructure and will allow for easy repeatability
- Use Microsoft Entra ID in case authentication with the organization is needed
- Use Docker to package the application with containers that will be deployed in Azure App Service in case of the backend, and Azure Static Web Apps in case of the frontend

For all applications that will be deployed on premises:

- Set up a private GitHub repository
- Create Ansible playbooks to make configuration and instalation in a VM repeatable
- In case the application needs to communicate with another application deployed in the public cloud we will use Azure Express Route to create a getaway.

For all applications that will be installed on the cloud and run in virtual machines:

- Set up a private GitHub repository
- Create terraform files to define the infrastructure i.e the VM size and OS
- Create Ansible playbooks to make configuration and instalation in a VM repeatable

4 Proposed Cloud Architecture & Justification of Used Service Models

By considering the requirements of LowTech GmbH, we offer Hyrid Cloud Architecture as mentioned earlier in section 3 and illustrated in the figure 1 below. According to the newly modified application landscape, each department's software components use suitable service model solutions (IaaS, PaaS, and SaaS) from public or private cloud service providers.

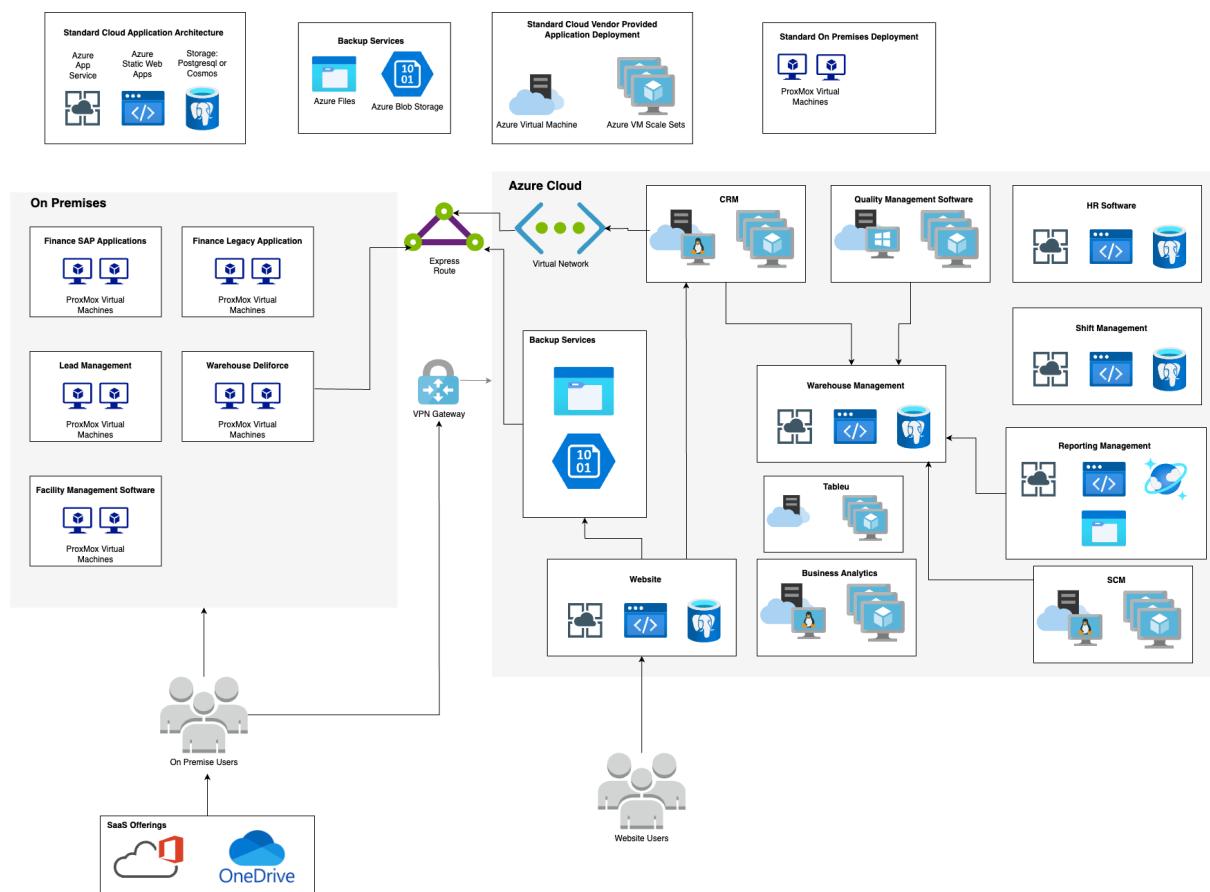


Figure 1: Hybrid Cloud Architecture (Azure and On Premises)

4.1 Public Cloud Service Provider : Microsoft Azure

Azure App Service: PaaS

Azure App Service is a comprehensive HTTP-based Platform-as-a-Service (PaaS) offering for developers, providing a fully managed environment for building, deploying, and scaling web applications under offered service plan.

All the newly developed Python3 applications (Reporting Management, Shift Management, Warehouse Management, HR Software and Webshop Website) will be deployed within the single azure app service plan to optimize cost and performance, provided the plan has sufficient resources to handle the load as multiple apps in the same app Service plan share the same VM instances.

- **Service Plan:** *Premium v3* - The premium service plan offers better compatibility with our application landscape and requirements compared to other tiers.
- Key features of this service
 - **Auto-scaling & Per-app scaling** - With automatic scaling enabled, Azure will monitor the load on your apps and distribute instances based on the metrics set up as such CPU usage. It also supports per-app scaling, allowing each app to scale independently based on its specific load.
 - **Availability & Zone Redundancy** - Azure SLA guarantees 99.95% availability but in case of availability zone failures it is advised to configure app service plan as zone redundant, which means that your resources are spread across multiple availability zones. (Note: To enable zone-redundancy at least 3 instances should be there in a app service plan).
 - **Security** - Supports authentication, IP address restriction and also offer virtual network integration.
 - **Load-balancing** - Distributes incoming traffic across multiple instances to maximize throughput, minimize response time, and avoid overloading any single resource.
 - **Multi-tenant** - Multiple clients can access the solution via their own individual domains.
- **Operating System:** *Linux* - As Linux is the only operating system option for running Python apps in App Service. Linux is generally recommended due to better performance and compatibility with Python libraries. Linux also offers a more native environment for Python development[?].
- **VM Instance:** *P2v3* - #Instances: 3
 - **Core:** 4
 - **RAM:** 16
 - **Storage:** 250 GB

Azure Static Web App: PaaS

Azure Static Web Apps is a Platform-as-a-Service (PaaS) offering that automatically builds and deploys modern web apps with a static front-end to Azure from a code repository and provides seamless backend connection options. Here, we will be deploy our React.js based front for all newly developed applications to static web apps connected with dedicated Web apps from App service plan explained above.

- **Service Plan:** *Standard* - #Apps: 5
 - **Included Bandwidth:** 100 GB *NOTE: We need 500 GB bandwidth*
 - **Storage:** 2 GB/app
- Key features of this service
 - **Global Distribution** - static assets are distributed around the world, makes serving files much faster as files are physically closer to end users.
 - **DevOps & CICD Pipeline** - Automated deployment from code repositories like GitHub or Azure DevOps based on code changes and allows CI/CD pipeline integration.
 - **Security** - Supports authentication and Custom Domains with SSL certificates which are automatically renewed.

Microsoft Entra ID : PaaS

Microsoft Entra ID is a cloud-based identity and access management service that enables your employees to access cloud resources. Microsoft Entra ID Free edition is included with Azure cloud services (here, App Service & Static Web Apps) which provides security standards with multi-factor authentication. It offers basic RBAC user and group management as well but advanced security is offered in paid plans only.

Virtual Machine Scale Sets: IaaS

Azure Virtual Machine Scale Sets are a compute resource that allows to deploy and manage a set of identical, auto-scaling virtual machines. We will be using it to manage our group of VMs. This service is offered free of cost along with the VM.

- Key features of this service
 - **Automatic scaling** - Can automatically increase or decrease the number of VM instances based on demand or a defined schedule.
 - **High availability** - Distributes VMs across fault domains and update domains to ensure application resilience.
 - **Load balancing** - Integrated with Azure Load Balancer for distributing traffic across VM instances.

Virtual Machine: IaaS

Total 5 instances VM mentioned below will be deployed under 1 Scale Set for CRM application used by Operations, Sales & Customer Service and SCM used by Supply Management.

- CRM & SCM - #Instances: 5
 - **Instance:** Dpsv6
 - **Operating System:** Ubuntu Linux
 - **vCPUs:** 2
 - **RAM:** 8 GiB
- QM - #Instances: 1
 - **Instance:** Dpsv6
 - **Operating System:** Windows
 - **vCPUs:** 2
 - **RAM:** 8 GiB
- Key features of this service
 - **New optimised architecture:** Outstanding performance for general-purpose workloads for day-to-day business operations.
 - **Balanced performance:** Equipped with faster processors provide a solid balance between CPU capabilities and memory size.

Azure Database(PostgreSQL/Cosmos DB) : PaaS

In the new adjusted application landscape no specific details of the database so we will assume size of database previous application landscape.

- Azure PostgreSQL
 - **Payroll:** 1 TB - used by HR Software and Shift Management
 - **Delivery:** 250 GB - used by Warehouse Management
 - **CRM:** 980 GB - used by Sales, Operation and Customer Service
 - **CMS:** 10 GB - used by Webshop Website

Chosen configuration for our solution is mentioned below.

- **Server:** D2ds v5 - Flexible
- **vCores:** 2
- **Memory:** 8 GiB
- **Storage:** Premium SSD v2 configuration - 2240 GB ~2085 GiBs
- **IOPS:** 3000 at no additional cost, Our estimated requirement is ~6000
- **Provisioned Throughput:** 125 MB/S
- **Backup Storage:** Geo-Redundant Storage (GRS) - 2240 GB ~2085 GiBs
- Key features of this service
 - **Flexibility:** Fully managed database service offering more control and flexibility over database management and configuration.

- **Balanced performance:** *Balanced compute and storage capacities with scalable I/O throughput, efficient cost-performance ratio*
- **High availability & Low latency:** *Allows users to collocate the database engine with the client tier for lower latency and choose high availability within a single availability zone or zone redundant (At extra cost)*
- **Redundancy:** *The storage maintains three locally redundant synchronous copies of the database files ensuring data durability.*
- **Backup:** *GRS replicates your data in a secondary region several hundred kilometers away from the primary source data location and provides greater durability of your data even in the event of a regional outage.*
- **Azure CosmosDB**
 - *Reporting Management - Details not mentioned*

Azure Storage : IaaS

- **Managed Disk** - *Needed to use with Azure VM for CRM, SCM and QM for both the VM Scale sets*
 - *Standard SSD*
 - **Storage:** *2048 GiB + 128 GiB*
 - **IOPS:** *500*
 - **Provisioned Throughput:** *100 MB/S*
 - **Backup:** *LRS (Locally redundant storage)*
- **Blob Storage: Hot** - *For storing reports in Reporting Management*
 - **Storage:** *512 GiB*
 - **Redundancy:** *LRS (Locally redundant storage)*
- **Azure Files** - *For Legacy Application storage*
 - **Service Plan:** *SSD - Provisioned v1*
 - **Storage:** *256 GiB*
 - **Redundancy:** *LRS (Locally redundant storage)*

5 Cost of operations in Microsoft Azure (Excluding Software Licensing)

| Azure Cloud Service | Plan Details | Cost/Month | Quantity | Total Cost/Month |
|----------------------------|-----------------------|-----------------------|--------------|----------------------|
| App Service | 3 years savings plan | ~136 € | 3 | ~408 € |
| Static Web Apps | Standard | ~8.5 € + (0.191 €/GB) | 5 + (500 GB) | 43 € + 95 € = ~138 € |
| Virtual Machine | Dpsv6 | ~27 € | 6 | ~162 € |
| Database - Server | D2ds v5 - Flexible | ~59 € | 1 | ~59 € |
| Database - Storage | SSD Premium v2 | ~0.13 €/GiB | 2085 | ~274 € |
| Database - Additional IOPS | Additional | ~0.02 € | 3000 | ~75 € |
| Database - Backup Storage | GRS - additional cost | ~0.099 € | 1000 | ~99 € |
| Storage | SSD Standard | ~147 € + 9 € | 1 | ~156 € |
| Blob Storage | Hot | ~0.0189 €/GB | 512 | ~10 € |
| Azure Express Route | 50 Mbit/s | ~52 € | 1 | ~52 € |
| Azure Files | SSD - Provisioned v1 | ~47 € | 1 (256 GB) | ~47 € |

Table 17: Cost of operations in Microsoft Azure

As per the table above total approximate monthly cost for Azure cloud services is

Cloud Migration Roadmap

| Application | Service Models & Infrastructure | Security & Automation | Timeline |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------|
| Finance + HR + Sales + Legislation: Office Suite | Microsoft Office 365 (SaaS), OneDrive (SaaS) | - | Phase 1 (Month 1) |
| Webshop: Website CMS | Azure App Service (PaaS), Azure Static Web Apps (PaaS), Azure Database for PostgreSQL (PaaS) | Terraform, GitHub Actions | Phase 1 (Month 1-2) |
| HR: Shift Management | Azure App Service (PaaS or CaaS), Azure Static Web Apps (PaaS or CaaS), Azure Database for PostgreSQL (PaaS) | Microsoft Entra ID (PaaS) + VPN, Terraform, GitHub Actions | Phase 1 (Month 1-2) |
| Finance Legacy Application | Azure App Service (PaaS), Azure Static Web Apps (PaaS), Azure Database for PostgreSQL (PaaS) | Microsoft Entra ID (PaaS), Terraform, GitHub Actions | Phase 1 (Month 1-2) |
| Azure Database for PostgreSQL (PaaS) | D2ds v5 servers, premium SSD, geo-redundant storage | Terraform for configuration | Phase 1 (Month 1-2) |
| Azure CosmosDB (PaaS) | Used for Reporting Management (specifics pending) | CI/CD with GitHub Actions | Phase 1 (Month 1-2) |
| Warehouse: Warehouse Management | Azure App Service (PaaS), Azure Static Web Apps (PaaS), Azure Database for PostgreSQL (PaaS) | Microsoft Entra ID (PaaS) + VPN, Terraform, GitHub Actions | Phase 1 (Month 1-2) |
| On-premises Deployments | Ansible automation, Azure Express Route integration | VPN, Ansible automation | Ongoing (Month 1-12) |
| Azure App Service (PaaS) | Python3 applications, Premium v3, Linux OS, P2v3 VM instances (3 instances) | CI/CD with GitHub Actions | Ongoing (Month 1-12) |
| Azure Static Web Apps (PaaS) | React.js frontend, Standard service plan (500 GB bandwidth required) | CI/CD with GitHub Actions | Ongoing (Month 1-12) |
| Microsoft Entra ID (PaaS) | Identity and access management for secure access | Integrated with all services for secure access | Ongoing (Month 1-12) |
| Supply Management: SCM | Azure Linux VMs + VMSS (IaaS), Autoscaling | VPN, Ansible automation | Phase 2 (Month 2-4) |
| Quality Management: QM Software | Azure Windows VMs + VMSS (IaaS), Autoscaling | VPN, Ansible automation | Phase 2 (Month 2-4) |
| Warehouse: Deliforce | On-premise with Ansible automation, Express Route integration for hybrid cloud | - | Phase 2 (Month 3-5) |
| Sales: Lead Management | On-premise with Ansible automation | - | Phase 2 (Month 3-5) |
| Sales + Operations + Customer Service: CRM | Azure Linux VMs + VMSS (IaaS), Autoscaling | VPN, Ansible automation | Phase 3 (Month 4-6) |
| Sales: Business Analytics | Azure Linux VMs + VMSS (IaaS), Autoscaling | VPN, Ansible automation | Phase 3 (Month 4-6) |
| Sales: Tableau (Market Development) | Azure Tableau Server (IaaS), No autoscaling | VPN, Ansible automation | Phase 3 (Month 4-6) |

| Application | Service Models & Infrastructure | Security & Automation | AU | Timeline |
|---------------------------------------------------|---------------------------------------------|-----------------------|----|---------------------|
| Facility Management: Facility Management Software | On-premise with ProxMox, Ansible automation | - | - | Phase 4 (Month 5-7) |

Table 18: Migration Strategy for Applications by Phase

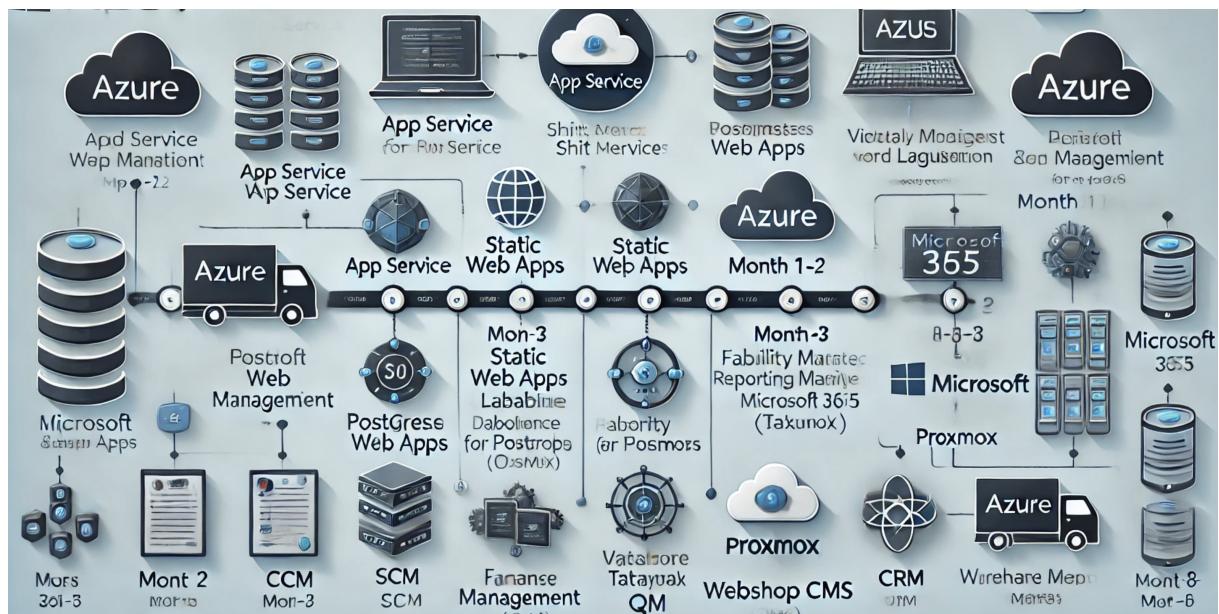


Figure 2: Visualised Cloud Migration Roadmap

6 Standard For a Cloud Native Application

When developing a cloud native application Figure 3 shows the basic setup to integrate DevOps concepts into our workflow. The website is going to be development under this standard.

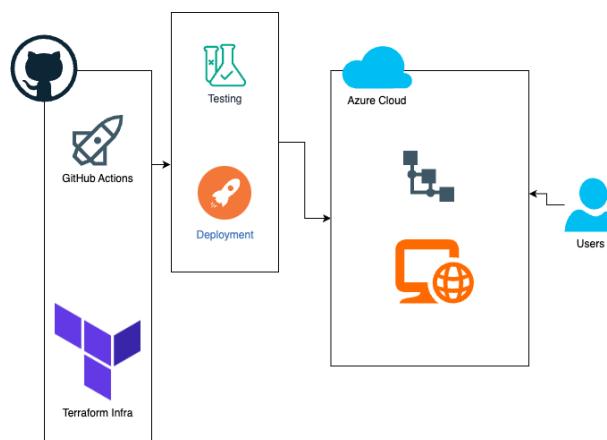


Figure 3: Standard Configuration To Deploy An Application

| Topic | Contributor |
|-------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 1. Overview of the Problem 2. Objectives of the Migration | Add your name Add your name |
| 3. Migration Strategy 7. Standard For a Cloud Native Application | Wladimir Brborich-Herrera |
| 4. Proposed Cloud Architecture & Justification of Used Service Models 5. Cost of operations in Microsoft Azure | Hellyben Shah |

Table 19: Contribution Table

Contribution

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