

Milestone 2 : LowTech GMmBH Migration to Azure

Wladimir Alexander Brborich Herrera (1437876)
wladimir.brborich-herrera@stud.fra-uas.de,
Vishwaben Pareshbhai Kakadiya (1471845)
vishwaben.kakadiya@stud.fra-uas.de,
Hellyben Bhaveshkumar Shah (1476905)
hellyben.shah@stud.fra-uas.de,
Heer Rakeshkumar Vankawala (1449039)
heer.vankawala@stud.fra-uas.de, and
Priyanka Dilipbhai Vadiwala (1481466)
priyanka.vadiwala@stud.fra-uas.de

Frankfurt University of Applied Sciences
(1971-2014: Fachhochschule Frankfurt am Main)
Nibelungenplatz 1
D-60318 Frankfurt am Main

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 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 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 PaaS
Private Cloud	ProxMox, Ansible N/A

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 N/A

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 applicaation 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 aplication 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 & Justfication 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.

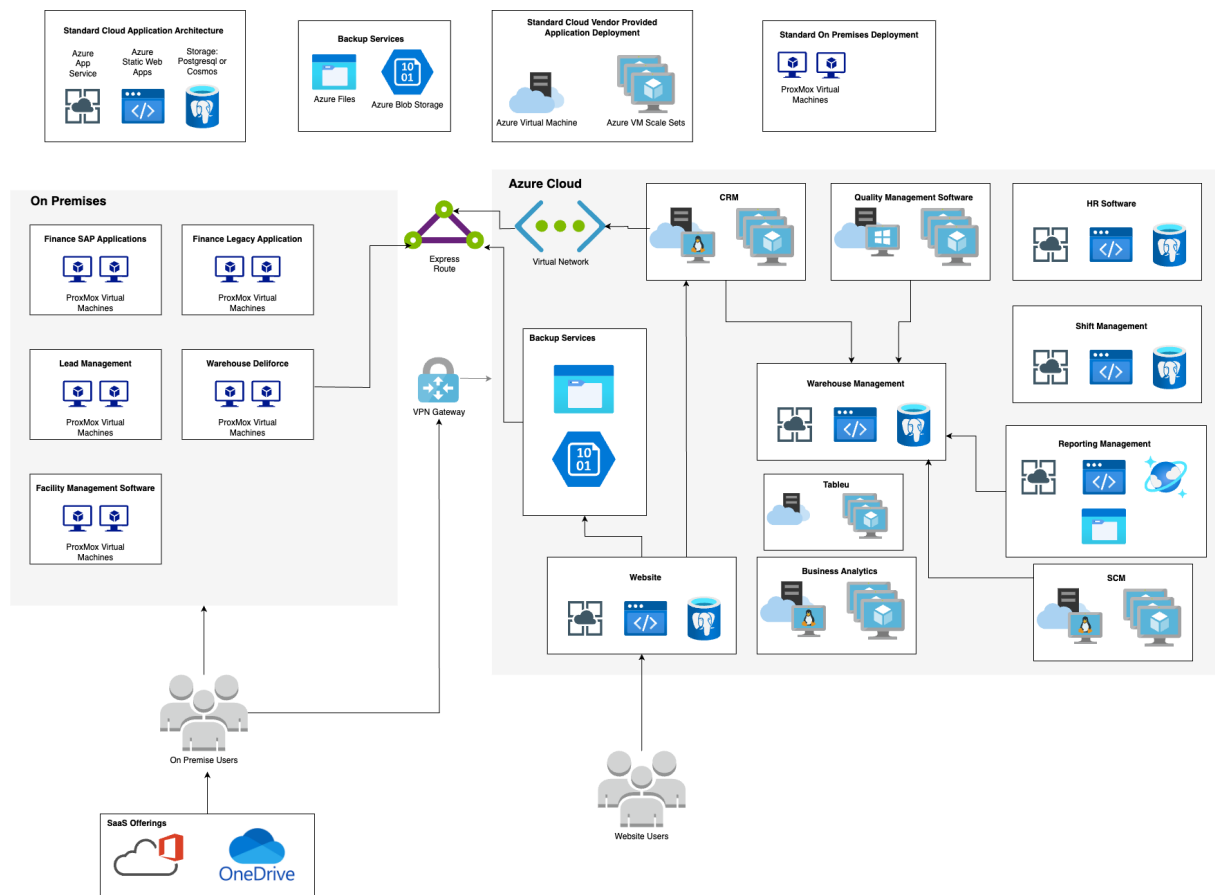


Figure 1: Hybrid Cloud Architecture (Azure and On Premises)

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 due to following reasons.
 - **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 libraries¹. 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 are mentioned below.

- **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.

- **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

- **CRM & SCM**
 - **Instance:** *Dls v6-series*
 - **Operating System:** *Ubuntu Linux*
 - **vCPUs:** *2*
 - **Operating System:** *4 GiB*

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

- **QM**
 - 1 more instance of VM same as above

Azure Database(PostgreSQL/Cosmos DB) : PaaS

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	Dls v6-series	~31 €	6	~186 €
Storage				
Database				

Table 17: Cost of operations in Microsoft Azure

6 Migration Roadmap

7 Standard For a Cloud Native Application

When developing a cloud native application Figure 2 shows the basic setup to integrate DevOps concepts into our workflow. The website is going to be development under this standard.

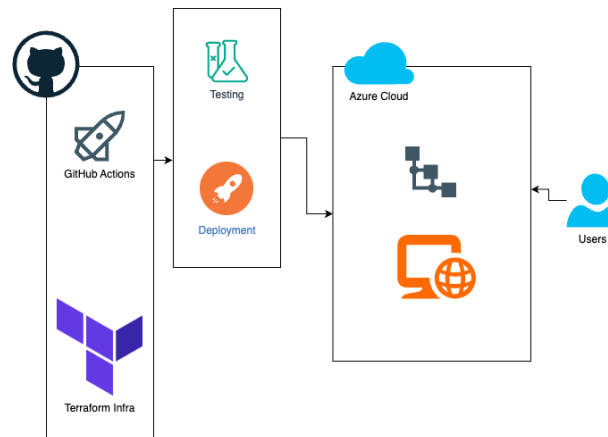


Figure 2: Standard Configuration To Deploy An Application

References

1. Microsoft, *High-density hosting on Azure App Service using per-app scaling*, 2024, <https://learn.microsoft.com/en-us/azure/app-service/manage-scale-per-app>.
2. Microsoft, *Reliability recommendations for Azure App Service*, 2024, <https://learn.microsoft.com/en-us/azure/reliability/reliability-app-service?pivots=premium>.
3. Microsoft, *App Service-Übersicht*, 2024, <https://learn.microsoft.com/de-de/azure/app-service/overview>.
4. Microsoft, *Azure App Service plan overview*, 2024, <https://learn.microsoft.com/en-us/azure/app-service/overview-hosting-plans>.
5. Microsoft, *Azure subscription and service limits, quotas, and constraints*, 2024, <https://learn.microsoft.com/en-us/azure/azure-resource-manager/management/azure-subscription-service-limits>.
6. Microsoft, *Configure Linux Python apps - Azure App Service*, 2024, <https://learn.microsoft.com/en-us/azure/app-service/configure-language-python>.