

Milestone 2: LowTech GMmBH Migration to Azure

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Abstract This report presents a comprehensive cloud transformation strategy for LowTech GmbH, developed by consultants from Awesome Cloud AG. Building on previous technical analyses, it outlines a strategic migration plan for the expanded application landscape, incorporating diverse service models such as IaaS, PaaS, and SaaS. The strategy identifies suitable public, private, and hybrid cloud environments to optimize performance and security while detailing operational cost calculations for a selected public cloud service provider. Key considerations include SAP requirements, legacy system maintenance, and leveraging DevOps and Cloud Native approaches for applications like the Webshop. The report critically analyzes the proposed solutions, balancing benefits and challenges, and aligning them with LowTech GmbH's business objectives. This forward-looking strategy ensures scalability, flexibility, and resilience, positioning the company for sustainable growth and competitive advantage in the digital era.

1 Overview of the Problem

LowTech GmbH faces critical challenges with its outdated IT infrastructure, which lacks flexibility, scalability, and standardization. The diverse application landscape, including Finance, HR, Operations, Webshop, and Warehouse systems, requires tailored migration strategies. While some applications can be modernized and containerized, others must remain in their current state due to constraints like unavailable source code.

Resource limitations, including a finite budget and workforce, further complicate the transition, necessitating a phased approach to minimize downtime and ensure business continuity. The lack of full elasticity in the new setup, despite virtualization improvements, limits immediate adoption of cloud-native capabilities like serverless computing.

The transformation requires careful planning for data migration, fallback strategies, and post-migration optimization, ensuring LowTech GmbH achieves a scalable, modernized IT environment while balancing costs, risks, and operational demands.

2 Objectives of the Migration

The primary objective of the migration is to modernize LowTech GmbH's IT infrastructure to enhance scalability, flexibility, and operational efficiency. By transitioning to a cloud-based environment, the company aims to:

- **Improve Performance:** Migrate applications to optimized environments (public, private, or hybrid cloud) to ensure enhanced performance, reliability, and security.
- **Enable Standardization:** Standardize the software stack and deployment processes to simplify maintenance and updates.
- **Ensure Business Continuity:** Minimize downtime and disruptions during and after the migration through robust contingency and fallback strategies.
- **Optimize Costs:** Implement a cost-effective solution by carefully assessing resource allocation and operational expenses.
- **Facilitate Modernization:** Leverage containerization and virtualization to enable future adoption of cloud-native and advanced technologies.
- **Support Long-Term Growth:** Create a scalable infrastructure that adapts to evolving business and technological requirements.

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 will also 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 the Legacy application, we will also 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 with 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 with 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-premises. As with 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 with 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. We will use the provided Tableau cloud instances, since installing a virtual machine running a server will be extremely cost inefficient due to the base requirements.

Cloud Context Products And Technologies Service Models		
Public Cloud	Tableau Cloud	SaaS
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 that needs to handle customer requests. Our standard for newly developed applications enables this critical piece of the business to easily scale and be secured with valid certificates with no extra configurations.

3.17 General Considerations

Importantly, for all newly developed applications, we will:

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

- Set up a private GitHub repository
- Set up GitHub actions to enable continuous 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 of 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 installation 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 installation in a VM repeatable

4 Proposed Cloud Architecture & Justification of Used Service Models

By considering the requirements of LowTech GmbH, we offer Hybrid 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.

4.1 Public Cloud Service Provider: Microsoft Azure

Azure App Service: PaaS [1]

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 the 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.

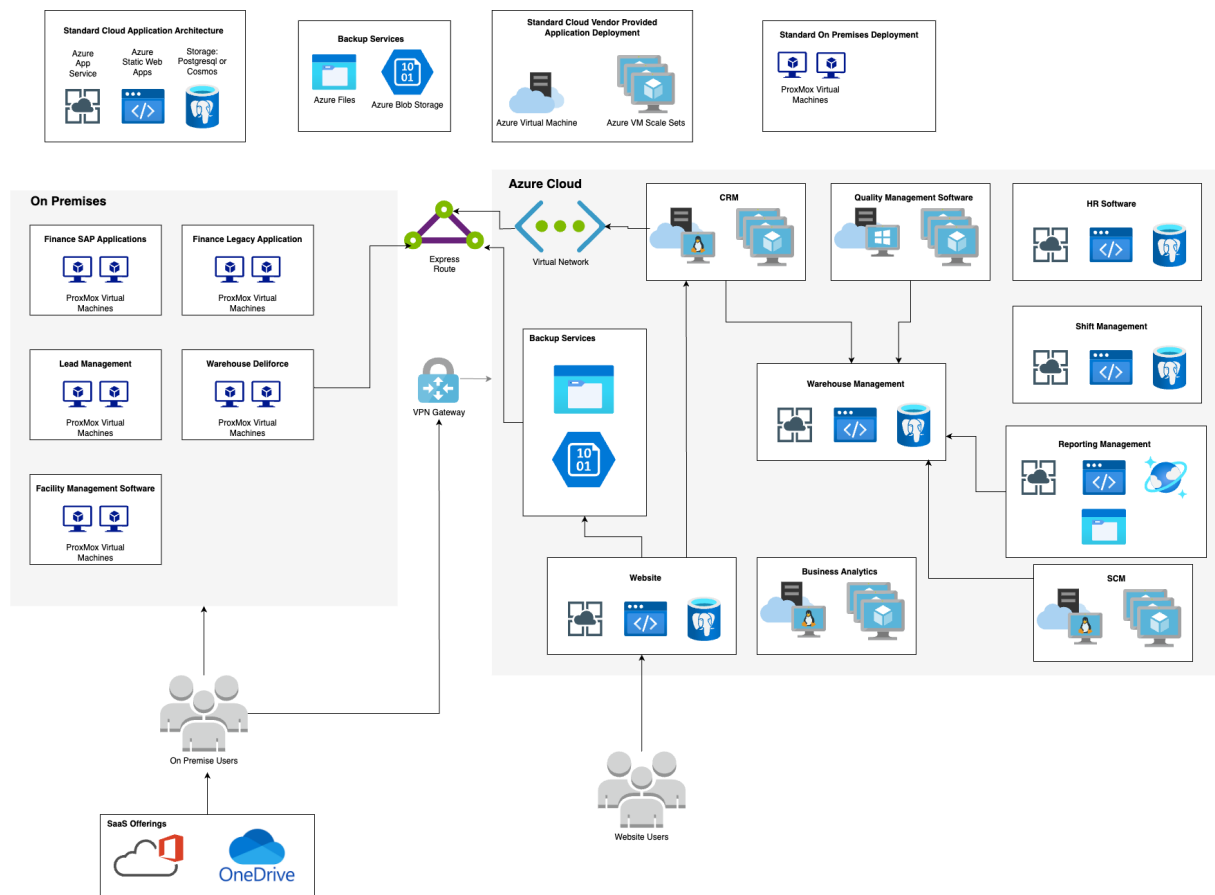


Figure 1: Hybrid Cloud Architecture (Azure and On-Premises)

- **Availability & Zone Redundancy** - Azure SLA guarantees 99.95% availability but in case of availability zone failures it is advised to configure the 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 an app service plan).
- **Security** - Supports authentication, and IP address restriction and also offers 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 domains.
- **Operating System:** *Linux* - 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[4].
- **VM Instance:** *P2v3* - #Instances: 3
 - **Core:** 4
 - **RAM:** 16
 - **Storage:** 250 GB

Azure Static Web App: PaaS [5]

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 deploy our React.js based front for all newly developed applications to static web apps connected with dedicated Web apps from the 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, making serving files much faster as files are physically closer to end users.
 - **DevOps & CI/CD 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 [7]

Azure Virtual Machine Scale Sets are a computing resource that allows the deployment and management of 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 updates domains to ensure application resilience.
 - **Load balancing** - Integrated with Azure Load Balancer for distributing traffic across VM instances.

Virtual Machine: IaaS

A total of 5 instances of VMs 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 provides a solid balance between CPU capabilities and memory size.*

Azure Database(PostgreSQL/Cosmos DB) : PaaS [6]

In the newly adjusted application landscape no specific details of the database so we will assume the size of the database's 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*

The 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)*

4.2 Cloud SaaS Services

Tableau Cloud: SaaS

Tableau Cloud is a fully-hosted SaaS solution that enables organizations to access and analyze data through a web browser eliminating the need for dedicated IT resources, reducing costs, and simplifying maintenance.

- Tableau Cloud uses a user-based licensing model that offers various options such as Creator, Explorer, or Viewer. We will choose *Creator* as it will give the highest level of access to the users for using Tableau Desktop, Tableau Prep Builder, Tableau Pulse, and One Creator license of Tableau Cloud.

Microsoft 365 & OneDrive: SaaS

Departments such as Finance, HR, Sales, and Legislation will need Microsoft 365 Office suites products and Onedrive for access for easy document sharing and collaboration. Microsoft 365 Business Standard suits the LowTech GmbH requirements.

Note: Licensing costs of SaaS solutions are not included in the total cost calculations as suggested.

4.3 Cloud Migration Drawbacks

- **Strategic Migration Complexity:** Transitioning to Azure presents significant challenges in terms of setup and migration complexity. This process demands comprehensive planning and a well-defined migration strategy, careful identification of applications and workloads suitable for migration, addressing potential compatibility issues with legacy systems, and mitigating risks of operational disruptions and budget overruns.
- **Technology Dependency Risks:** Adopting Azure services extensively can lead to vendor lock-in, a situation where an organization becomes overly dependent on a single cloud provider. This dependency may result in reduced flexibility in switching to alternative providers, potential difficulties in data portability and application migration, vulnerability to provider-specific changes in pricing or services, and limited control over the technology stack and innovation options.
- **Technical Expertise Requirements:** Managing an Azure infrastructure necessitates specialized skills and knowledge, which can be challenging for organizations with limited IT resources. Key considerations include the need for personnel with Azure-specific expertise, potential difficulties in recruiting or training staff with required cloud skills, and the ongoing requirement to keep up with rapidly evolving technologies and best practices.

These challenges underscore the importance of thorough preparation, strategic planning, and investment in skilled personnel when considering Azure adoption and migration.

5 Cost of operations in Microsoft Azure (Excluding Software Licensing) [3]

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 - Managed Disk	SSD Standard	~147 € + 9 €	1 (2048 GiB + 128 GiB)	~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 €
Total Cost:	-	-		1480 €

Table 17: Cost of operations in Microsoft Azure

6 Cloud Migration Roadmap

For the migration we have determined 4 different workstreams:

1. New Application Development
2. COTS Applications Cloud Installation
3. On-Premises Deployments
4. SaaS Sourcing and Configuration

New Application Development In this case, the majority of the effort is in the development process, we are estimating at least 12 months of development time. An advantage of the new application standard is that we are shipping continuously. This means that from the first line of code, the application is deployed to the cloud and accessible. We plan for several teams to work on different applications concurrently.

COTS Applications Cloud Installation For Cloud Installations we are focusing on creating the infrastructure as code files, and the subsequent deployments to Azure. This application will be usable as soon as the installation is completed. Given that all other dependencies are accessible.

6.1 On Premises Deployments

Similar to the cloud deployments, we are focusing on creating Ansible playbooks and the relevant Proxmox configurations. These applications will be usable once the deployment is completed.

6.2 SaaS Sourcing and Configuration

In this case, we are interested in enrolling for the software, configuring access policies, and potentially negotiating enterprise licenses with the providers. This is the shortest phase and users will be able to use the applications once licenses and credentials are available.

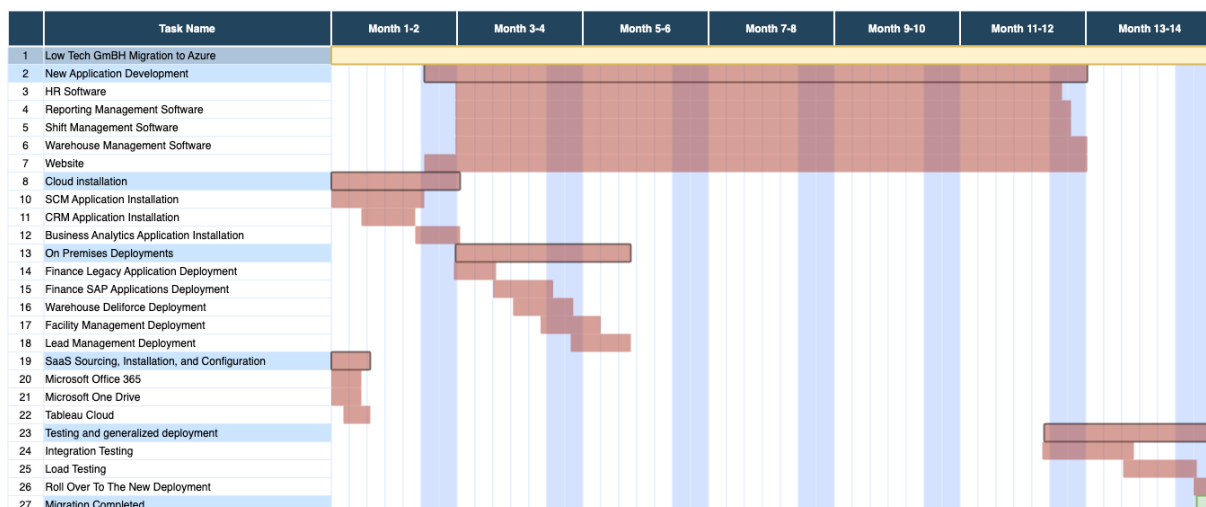


Figure 2: Visualised Cloud Migration Roadmap

7 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 developed under this standard.

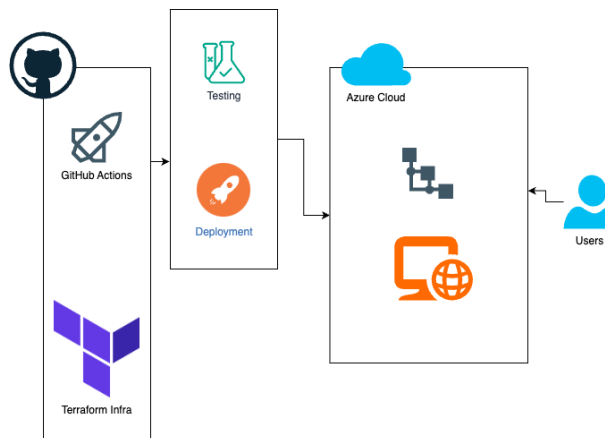


Figure 3: Standard Configuration To Deploy An Application

8 Analysis and Assessment

After considering the estimated cost of the infrastructure without software licenses, the choice seems expensive. This is not ideal since cloud providers often have many hidden costs, such as data transfer or internet connections, that are difficult to factor in without having the infrastructure running. Nevertheless, we are getting a lot of flexibility and development speed. Given that we will spend some time and effort developing new applications for the business, we believe it is worth the investment in the cloud just for the benefit of developer productivity. Since we are able to leverage only teams of software developers to also handle the infrastructure. Additionally, we are saving a lot on infrastructure, maintenance, and energy costs. Finally, the architecture also allows us back to move to an on-premises model if there is a need. In our assessment, the webshop and warehouse are the applications that benefit the most by

being on the cloud. In the future, there are two directions that the project can take: Optimizing the cloud infrastructure costs, by iterating and tailoring our development process to Azure, or downsizing the cloud deployment to only contain critical customer-facing applications.

Contribution

Topic	Contributor
1. Overview of the Problem 2. Objectives of the Migration	Priyanka Vadiwala
3. Migration Strategy 7. Standard For a Cloud Native Application	Wladymir Brborich-Herrera
4. Proposed Cloud Architecture & Critical Analysis of Used Service Models 5. Cost of operations in Microsoft Azure	Hellyben Shah Heer Vankawala
6. Cloud Migration Roadmap	Vishwaben Kakadiya

Table 18: Contribution Table

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