01

Implementing Hybrid Cloud with Microsoft Azure ⌐

How GFT and Azure can help your organization implement a strategic hybrid model that is cost effective and offers sustainable benefits.

Microsoft
Partner

Gold Application Integration
Gold DevOps
Gold Data Analytics
Gold Application Development
Gold Cloud Platform

■■ Microsoft

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

White paper

Introduction

In a diverse world where technology is in constant flux, many organisations have computing solutions that straddle cloud and on premises. While both environments have an important role to play today and in the foreseeable future, a consistent approach is crucial.
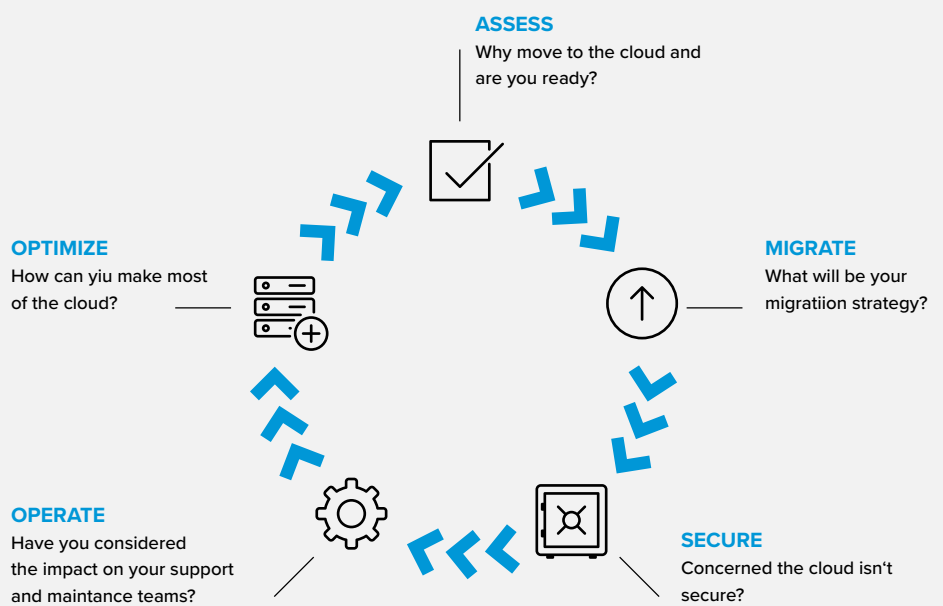
For many organisations, integrating these two to create a hybrid model is essential but there are many business and technical considerations.

This paper evaluates how Microsoft Azure can help any organisation implement a strategic hybrid model that is cost effective and offers sustainable benefits.

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

Why use a hybrid cloud?

Cloud computing gets a lot of attention, and for good reason: it is where much of IT is going. However, on-premises datacentres also have an important role to play, both today and in the future. For many organisations, integrating these to create a hybrid cloud is essential.

ASSESS
Why move to the cloud and
are you ready?

MIGRATE
What will be your
migratiion strategy?

SECURE
Concerned the cloud isn't
secure?

OPERATE
Have you considered
the impact on your support
and maintance teams?

OPTIMIZE
How can yiu make most
of the cloud?

Microsoft understands this reality. To help you to achieve it, they are offering a broad range of cloud and on-premises technologies that work together in a coherent way. Moreover, unlike many other vendors in the market, Microsoft provides the flexibility to let you choose the path that is right for your organisation. Microsoft is committed to providing a consistent hybrid cloud that supports every strategy. So, what exactly is a hybrid cloud? While getting everyone to agree on a definition is not easy, there are some obvious requirements. For example, you need a way to connect your on-premises datacentres with the cloud, a problem Microsoft solves with Azure Virtual Networks, Azure ExpressRoute. However, basic connectivity is not enough; a hybrid cloud must extend beyond this to provide complete set of consistent services. Microsoft believes that a true hybrid cloud must provide four components, each of which brings significant benefits.

These are:
- Common identity for on-premises and cloud applications. This improves productivity by giving users single sign-on to all of their applications.

- Integrated management and security across the hybrid cloud. This offers a cohesive way to monitor, manage, and help secure the environment, giving increased visibility and control.

- A consistent data platform for the datacentre and the cloud. This ensures data portability, combined with seamless access to on-premises and cloud data services for deep data insight.

- Unified development and DevOps across the cloud and on-premises datacentres. This lets the client move applications between the two environments as needed, and it improves developer productivity, as both places now have the same development environment.

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

White paper

Taken together, these four requirements provide consistent experiences for developers, data professionals, IT managers, and users. Figure 1 summarizes this, showing example Microsoft technologies for each.
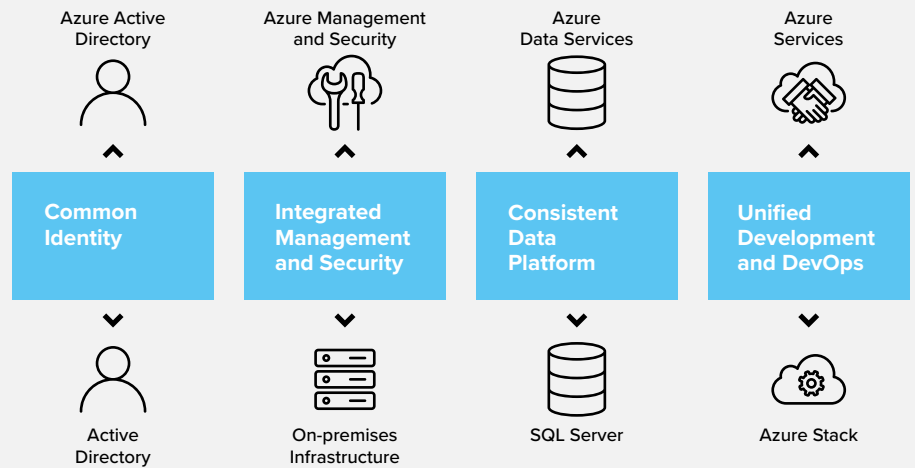
Azure Active Directory

Azure Management and Security

Azure Data Services

Azure Services

Common Identity

Integrated Management and Security

Consistent Data Platform

Unified Development and DevOps

Active Directory

On-premises Infrastructure

SQL Server

Azure Stack

Figure 1: A hybrid cloud must provide consistent solutions in four areas: identity; management and security; data platform; development and DevOps.

As the figure shows, Microsoft offers hybrid cloud technologies that address all four areas. **Examples of these include:**

- Azure Active Directory works with the on-premises Active Directory to provide common identity for users.

- Azure provides integrated management and security services for both cloud and on-premises infrastructure.

- Azure data services combine with SQL Server to create a consistent data platform.

- Microsoft Azure services in the cloud combined with Microsoft Azure Stack on-premises provide unified development and DevOps.

What happens if you attempt to create a hybrid cloud without these four attributes? The short answer is pain: you will have needless differences throughout your environment. These differences bring complexity, which in turn makes the hybrid cloud harder to use, harder to manage, and harder to secure. Risks increase while user benefits shrink.

Creating a truly consistent hybrid cloud, with the advantages it brings, is a better approach. As this paper describes, Microsoft stands alone in offering these advantages.
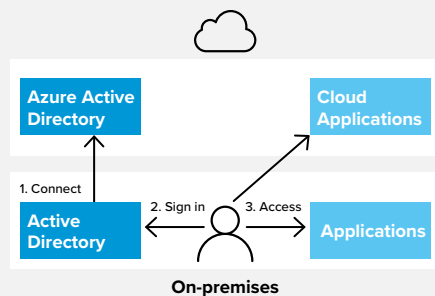
01.
Requirement: common identity
⅂

When users access applications, they should not need to worry about whether those applications are running on-premises or in the cloud. Providing consistent identity is fundamental to achieving this, which is why Microsoft created Azure Active Directory (Azure AD). Among other benefits, cloud service offers secure single sign-on and automated provisioning of new users.

01.1
Give your users single sign-on to applications anywhere

Everyone hates having to remember different passwords. In enterprises, the problem of providing single sign-on – the ability to log in once to access any application – was solved long ago. With the rise of Software as a Service (SaaS), however, this problem must be solved again. Rather than make users sign in separately to each application, they should be able to sign in just once, and then access both on-premises and cloud (that is, SaaS) applications.

Figure 2 shows how Azure AD makes this possible.

On-premises

To use Azure AD in a hybrid cloud, an organization first connects its on-premises Active Directory to Azure AD in the cloud. Users can then sign in as usual – Azure AD is invisible to them. Those users can now access both on-premises applications and cloud applications without signing in again. They enjoy single sign-on throughout their hybrid world.
Azure AD supports cloud applications from Microsoft, including Office 365 and Dynamics 365. It also supports many other SaaS offerings, including Google Apps, Salesforce CRM, Dropbox, Box, Slack, Service Now, Workday, and many more. Just as Active Directory allows single sign-on to on-premises applications from many different vendors, Azure AD provides this for cloud apps from many SaaS providers.

Figure 2: Azure Active Directory lets a user sign in once, then access both on-premises and cloud applications.

Using Azure AD for single sign-on also offers other benefits:

■ Because Azure AD provides a common account for many applications, there is less need to have multiple passwords that might be reused across different SaaS applications. This improves security, because a breach at one site is less likely to expose a password that has been reused for another application.

■ When a user leaves the organization, an administrator can terminate access to multiple applications (cloud or on-premises) by simply removing one ID from Azure AD. If there were separate sign-on to these applications, the administrator would need to find and remove each one.

Microsoft's broad support for hybrid identity is unique among major cloud platform providers. For example, AWS Identity and Access Management focuses on managing identity for AWS itself and for resources running on AWS. Unlike Azure AD, it does not provide a general solution for single sign-on that works across cloud applications from multiple vendors.

Hybrid SaaS applications

Applications that are available as both SaaS solutions and on-premises products represent another form of hybrid cloud computing. For example, Office 365 includes several components that function this way, including Exchange and SharePoint.
In a hybrid world, hybrid SaaS applications can be useful. For example, SharePoint Online and SharePoint Server offer a common administrative experience, as do Exchange Online and Exchange Server. These applications also provide other hybrid benefits, such as support in SharePoint for searching across SharePoint Online and SharePoint Server and the ability to use a common email domain across Exchange Online and Exchange Server.
Like other applications, hybrid SaaS solutions must deal with identity. With Office 365, the application is also using Azure AD, but users may be unaware of this. This offers benefits, such as assigning licenses to specific Office 365 applications based on AD groups, so that everyone in a particular group is granted access. Combining hybrid identity with hybrid SaaS applications is another way that a consistent hybrid cloud provides value for an organization.

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

White paper

01.2
Protect identities across on-premises and cloud environments
⌐

Using a common identity to access many applications has real benefits. It also makes protecting that identity more important than ever. Microsoft offers several ways to do this.

For example, Azure AD provides Multi-Factor Authentication (MFA). With this option, logging in to Azure AD requires more than just a simple password. Users also need a second factor, such as entering a code sent to their mobile phone. With MFA, even an attacker who steals a user's password cannot log in as that user. The attacker would also need access to the user's phone, or another factor being used for authentication. The result is better identity protection and lower risk.

Azure AD also supports conditional access policies. These let your administrators control access to specific applications using not just the user's identity, but also based on what device is being used, the location, the groups the user belongs to, and more. User identities define the perimeter of the hybrid cloud, cross-platform APIs to integrate identity management into on-premises or cloud applications, with support for all modern protocols, including SAML 2.0, WS-Fed, OAuth 2.0, and OpenID Connect.

02.
Requirement: integrated management and security
⌐

Using a hybrid cloud can broaden options for delivering IT services to the organization. However, hybrid clouds bring new hurdles for management and security. Challenges include:

- Monitoring combined on-premises infrastructure and cloud resources
- Effectively automating whenever possible, such as the response to alerts raised through monitoring
- Securing the larger surface area that a hybrid cloud brings
- Providing effective data backup and disaster recovery for both cloud and on-premises resources

Addressing these challenges requires a specialist approach to management and security that is designed for hybrid clouds. To provide this, Microsoft delivers management and security services from Azure, providing built-in capabilities throughout the operational lifecycle. Azure includes a cohesive set of tools for monitoring, configuring, and protecting the entire hybrid cloud. Figure 3 shows the big picture of Azure Management and Security (which is sometimes referred to as the Operations Management Suite).

Designed for a hybrid and heterogeneous world, Azure management and security services give increased control of Windows and Linux systems running in Azure or in an on-premises datacentre. Although not shown in the diagram, these Azure services can also extend to management of Windows and Linux systems running at hosting services or on other cloud platforms, such as AWS.

Four key services comprise the lifecycle approach to management from Azure: Insight and Analytics, Automation and Control, Protection and Recovery, and Security and Compliance. All of them are accessed through a single dashboard, an example of which is shown in Figure 4.

The console is built from tiles, and each user can customise which tiles appear to suit specific needs. A user focused on security, for example, might choose to show the status of antimalware software on managed systems, the number of outstanding security issues, and a map showing where threats are coming from. A user who is responsible for backup might choose to display information about the
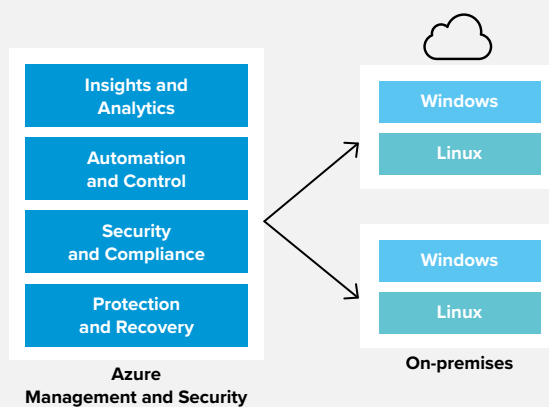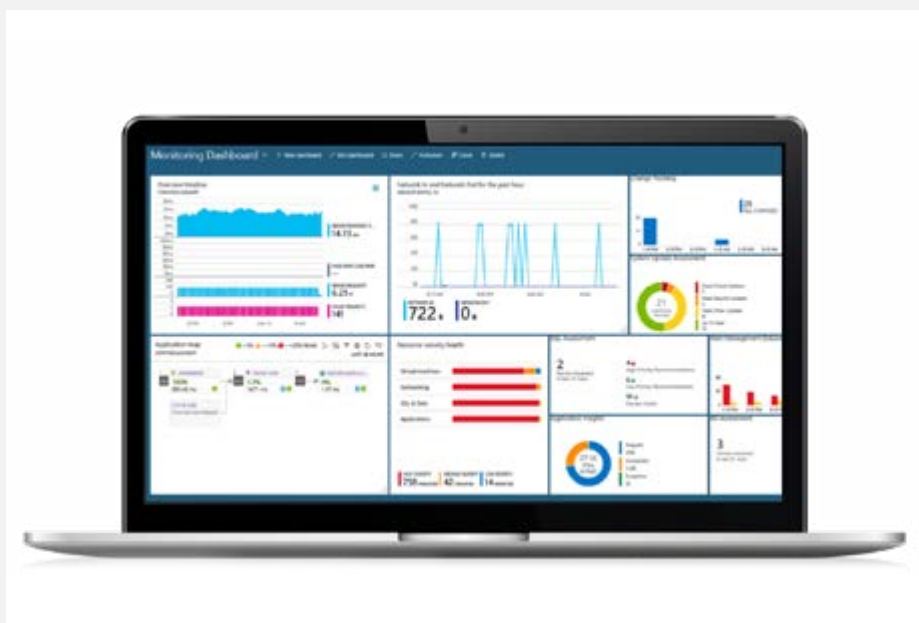

Figure 3: Azure provides integrated management and security services for a modern hybrid cloud.

Figure 4: The Monitoring Dashboard provides a broad and customizable view of a hybrid cloud environment.

latest backups for virtual machines, email, and other data. A user who is responsible for all of these areas — Azure management and security services are designed to be effective tools for generalists — might display some combination of these things. Whatever the requirement, this customizable interface gives all users access to the information and services most relevant to their own needs.

In addition, because Azure cloud services are designed for a hybrid world, the picture the dashboard presents can span both on-premises and cloud datacentres.

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

White paper

02.1
Get common insight and analytics across your hybrid cloud
⌐

One of the most important aspects of management is monitoring to keep track of what is happening in your world. Doing this effectively in a hybrid cloud is especially challenging, since you need the ability to reach into both on-premises and cloud datacentres. Azure addresses this with the Insight and Analytics service.

The Insight and Analytics service collects information, such as log and performance data, about all the systems it monitors. Using the dashboard, a user can then issue custom queries against this data or create queries that run regularly, and then generate an alert if there is an irregularity. Moreover, to support common situations, Insight and Analytics includes a group of solutions that provide predefined queries and logic for addressing a specific area. For example, the AD Assessment solutions displays the status of Active Directory, along with recommendations for improvement, while the SQL Assessment solutions provides similar information for SQL Server.

This Azure monitoring service can also connect directly to System Centre Operations Manager. Doing this lets Insight and Analytics receive information and alerts that Operations Manager gets from the systems it monitors. Connecting to Operations Manager provides easy access to useful information, and so it is a common way to get started with Insight and Analytics.

Insight and Analytics also provides other useful tools, including:

- Service Map, which can automatically discover distributed applications in your hybrid environment; show the dependencies among application components, such as databases and business logic, and help trouble shoot problems.

- Network Performance Monitor allows an administrator track network performance, including links between on-premises and cloud datacentres, the find and fix network problems.

To understand the value of this technology, consider a simple scenario, and suppose Insight and Analytics raises an alert about an application in your environment. An administrator might use Service Map to understand the structure of that application and then determine that the problem lies with the application's SQL Server database. The administrator can use the SQL Assessment solution provided by Insight and Analytics do take a closer look at that database. Perhaps the problem is that one of the database's tables has reached its maximum size, for instance. Once the administrator knows this, the table can be truncated and the application returned to normal operation.

The important point to note is that the process of finding and fixing an error is the same whether the problem database is running on-premises, at a hosting provider, or in the cloud. It is also the same for SQL Server and Azure SQL Database. Consistency is an integral feature of the Insight and Analytics service because it was designed specifically for a hybrid world.

Compare this with other cloud vendors. AWS, for example, provides CloudWatch for monitoring a cloud environment. Yet this technology provides little information about anything else because is not designed for a hybrid world. Service Map, by contrast, can automatically discover applications that span cloud and on-premises datacentres, and the monitoring capabilities of Insight and Analytics in Azure treat both environments equally. This Azure service is designed from the ground up to work with a hybrid cloud.

02.2
Provide management automation for your hybrid cloud
⌐

In general, it is a good idea to automate as much of systems management as possible. To do this from the cloud, Azure includes the Automation and Control offering. This service lets administrators create PowerShell scripts called runbooks to automate common processes.

For example, think about the scenario just described, where Insight and Analytics raises an alert based on detection of a problem with an application. One way to handle this is to rely on an administrator to find and fix the problem. This might be the only option the first time a problem surfaces. If it is likely to the administrator, can create a runbook that takes the same steps, such as truncating the database table, and then configure the runbook to execute whenever the alert appears. Doing this can make problem resolution faster, more reliable, and less expensive.

The Automation and Control offering also addresses many other scenarios. The administrator might create runbooks that reset user passwords or set up virtual machines for a development environment or schedule and deploy patches for Windows and Linux. To make this easier, Microsoft and others provide a gallery of predefined scripts that address many common scenarios. Besides runbooks, this Azure service offering also provides Desired State Configuration (DSC), which is the ability to specify how Windows or Linux server should be configured, then monitor and enforce that configuration.

Together with Insight and Analytics, Automation and Control has one overarching goal: to help proactively find and fix problems in your hybrid cloud before they affect your business.

02.3
Get a unified view of security and compliance ⌐

No aspect of systems management is more important than security. Which of your systems are being attacked right now? Where are the attacks coming from? What is the status of antimalware software on each of those systems? In a hybrid cloud, you must be able to answer all of these questions in a common way for systems in both on-premises datacentres and the cloud.

Azure Security and Compliance addresses these concerns. By providing a unified set of tools, it lets your administrators - even those who are not security specialists - prevent, detect and respond to threats across your hybrid cloud. Here are some examples of what this capability provides:

- Administrators can see the security state of their entire hybrid cloud in a single view. This view can include antimalware status, whether systems conform to defined baseline configurations, and more. In fact, the Security and Compliance service offering relies on the repository and query mechanism used by Insight and Analytics, bringing the same breadth and power to security management.

- This broad visibility can help administrators quickly detect and respond to security threats. For example, an administrator can determine that a virtual network is incorrectly configured, the click a

button in the dashboard to fix it, or that a database in Azure SQL database does not have encryption enabled, and the turn it on with a few more clicks. Security and Compliance even provides a prioritized list of security vulnerabilities like these, along with guidance on how to fix them.

- Because Azure Security and Compliance is continually updated by Microsoft, it learns about new threats as they appear. This helps administrators maintain an up-to-date security posture across the hybrid cloud. In addition, because these updates draw from Microsoft's own information about attacks on Azure, Xbox and other cloud services, this threat intelligence is based on a very large dataset. You get the benefit of Microsoft's broad experience, along with the ongoing updates possible in a cloud-based solution.

Once again, it is worth comparing what Azure provides with what most other cloud providers offer. Because these vendors are focused solely on the cloud, their solutions do not typically address the wider needs of a hybrid environment. Moreover, since the other major cloud providers tend to lack Microsoft's long experience as a provider of enterprise management software, they might not understand what is required to manage an on-premises computing environment as well as the cloud.

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

White paper

02.4
Use cloud-based services for on-premises backup and disaster recovery ⌐

Wherever it is stored, data needs to be backed up. Given the massive amount of low-cost storage available in a cloud platform like Azure, using a cloud service to do this makes sense. Similarly, many applications need disaster recovery (DR) to make sure they keep running in the face of unexpected failure. The cloud is ideally suited to provide this service.

To meet these needs, Microsoft provides two distinct services: Azure Backup and, for DR, Azure Site Recovery. As its name suggests, Azure Backup backs up data to Azure datacentres. This data might be from Windows or Linux virtual machines, Exchange, SharePoint, SQL Server, or Windows files. Whatever the source, Azure Backup lets you store copies of data on Azure, then restore that data as required.

In addition, you can restore just the data you need. Unlike tape backup, there is no need to fetch an entire tape from an offsite location. Azure Backup also lets you keep that data on geo-redundant storage to protect your backup in the unlikely event that an entire Azure datacentre is disabled. Azure Site Recovery is a cloud-based disaster recovery service designed to take advantage of the scalability and resilience of Azure. Figure 5 illustrates this service.

Azure Site Recovery can be used with Linux and Windows virtual machines running on VMware or Hyper-V, as well as physical servers. These can be running anywhere in the hybrid cloud, on-premises, at a hosting provider, or (for virtual machines) on Azure. Wherever they are, these systems send regular updates to Azure Site Recovery in the cloud. Should disaster strike, the service manages failover to Azure. This includes creating the necessary Azure virtual machines, initializing these with the most recent state stored in Azure Site Recovery, and configuring virtual networks. Intended to be used for even complex workloads, such as SAP, this service provides easy-to-use disaster recovery at relatively low cost. Backup and DR are commonly available offerings, so what makes these Azure services uniquely suited for a hybrid cloud?

The answer is that both Azure Backup and Azure Site Recovery are managed cloud services. Any cloud platform lets you run third-party software for backup and DR, and Azure does too. You are free to use CommVault, Veritas, or something else with Azure Blobs, for example. This big difference is Microsoft provides managed services for both, which removes the need to buy, install, and run backup and DR solutions in the cloud. This is significantly simpler than managing your own servers in the cloud, and it is an important example of the benefits of a hybrid cloud.
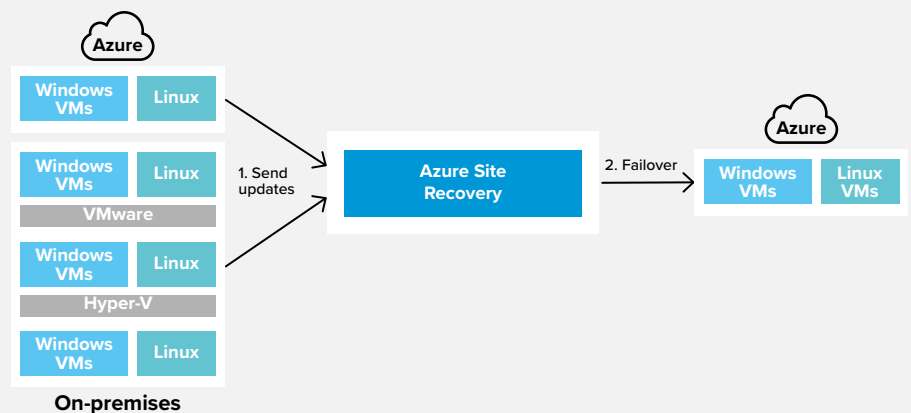

Figure 5: Azure Site Recovery provides disaster recovery for virtual machines and physical servers with failover to Azure.

Maintain hybrid or migrate entirely to the cloud?

Some organizations plan to remain hybrid indefinitely. Others view hybrid as a waystation on their journey to the cloud: they consider hybrid cloud as part of a migration strategy.
If you are in this second category, a consistent hybrid cloud can make migration significantly easier. For example, Azure Site Recovery can help with migration as well as disaster recovery because it can create new instances of on-premises applications on Azure. Rather than manually moving applications to the cloud, you can rely on Azure Site Recovery to do this and to help you cut over to the new cloud instances. The Microsoft hybrid cloud provides other tools as well, such as the migration wizard built into SQL Server Management Studio to help move on-premises SQL to help move on-premises SQL Server applications to Azure IaaS virtual machines.
Microsoft also helps lower the cost of migration by transferring on-premises licenses to Azure. You can use your existing Windows Server licenses with Software Assurance to enable up to 40 percent savings on Windows Server virtual machines in Azure by using the Azure Hybrid Use Benefit. Similarly, license mobility provides the flexibility to deploy existing SQL Server licenses with Software Assurance in the cloud without additional fees. These attributes can unlock significant savings as you look to extend into cloud or lift and shift to cloud. You can also rely on GFT Cloud Team, to provide both migration knowledge and tools.
Whatever options you choose, Microsoft's consistent approach to hybrid cloud can make migration to a full cloud environment simpler, faster, and less expensive.

03.
Requirement: consistent data platform
⌐

What is the best approach for working with data in a hybrid cloud? There is no single answer to suit all organizations. However, one thing is universally clear: you will have important information in both the cloud and on-premises. Given this, it makes sense to have a common approach to working with data in both places.

To facilitate this, the Microsoft hybrid cloud provides a consistent data platform. This consistency lets an organization use the same tools and the skills throughout its environment. Moreover, because organizations use data in various ways, the Microsoft platform works with both operational data, such as orders in an online shopping application, and analytical data, such as aggregated information used for data analysis

The challenges this helps you address include:
- Using a common database across an on-premises datacentre and the public cloud.
- Using data services in the cloud to complement on-premises database.
- Providing consistent services on-premises and in the cloud for data warehousing, data analysis, and data visualization.

03.1
Take advantage of common database on-premises and in the cloud
⌐

Microsoft SQL Server is a mature offering that supports mission-critical workloads in datacentres around the world. In a hybrid cloud environment, this technology can be used in a number of helpful ways.

One option is to run SQL Server in an Azure IaaS virtual machine. For example, you might do this as part of moving an entire application to the cloud to lower your costs, or to create a development environment for applications that are deployed on-premises. Whatever the reason, you can use the same database technology throughout to your hybrid cloud. This makes it easier to move data and applications as needed to respond to changing business requirements.

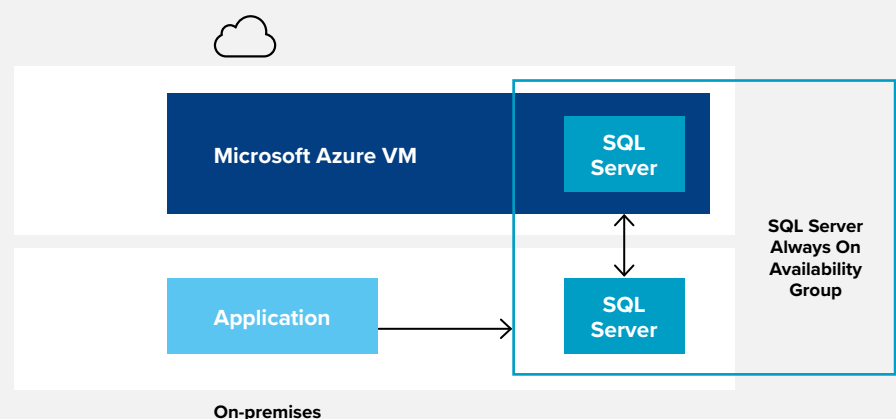Another possibility is to take advantage of the cloud to provide business continuity

Figure 6: With SQL Server AlwaysOn, a secondary server can run in an Azure virtual machine, using the cloud to provide business continuity for an on-premises database.

with SQL Server AlwaysOn Availability Groups. Figure 6 shows how this looks. As the figure shows, an availability group has two, or more, instances of SQL Server running on two different systems. The AlwaysOn technology automatically replicates changes to data across both systems. If the primary fails, the secondary can automatically take over, letting applications that use this database continue running. This kind of replication is essential for mission-critical workloads, and AlwaysOn supports scenarios with a low recovery time objective (RTO).

Running the secondary server in the cloud can save money and time. This secondary can also be made readable to help scale access to data. For example, a readable secondary could be located in an Azure datacentre that is closer to salespeople using a mobile business intelligence app.

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

White paper

03.2
Save money by moving your on-premises data to the cloud
⌐

Running a database in a cloud virtual machine is useful. However, a hybrid data platform should also provide cloud database services that complement on-premises databases. The Microsoft hybrid cloud does this in several ways.

SQL Server, for example, provides built-in support for backups to Azure Blobs. This support is simple to use – setting up scheduled backup requires just a few clicks – and it lets you take advantage of the low-cost storage provided by Blobs. It can also provide geo-replication of backup data, making sure this data is stored in two different Azure datacenters. Given the ever-growing amount of data that organizations need to store, having easy access to this bottomless cloud storage is useful.

Using Azure SQL Database, a PaaS data service, brings more possibilities. Because Azure SQL Database is based on SQL Server, in fact, the two share the same core database engine, applications can access data in the same way with both technologies. Azure SQL Database can also be combined with SQL Server in useful ways.

For example, the SQL Server Stretch Database feature lets an application access what looks like a single table in a SQL Server database. In fact, however, some or all rows of that table might be stored in Azure SQL Database. This technology automatically moves data that is not accessed for a defined period to the cloud, as Figure 7 illustrates.

2. Transparently access cloud data as needed

Azure SQL Database

1. Read

Application

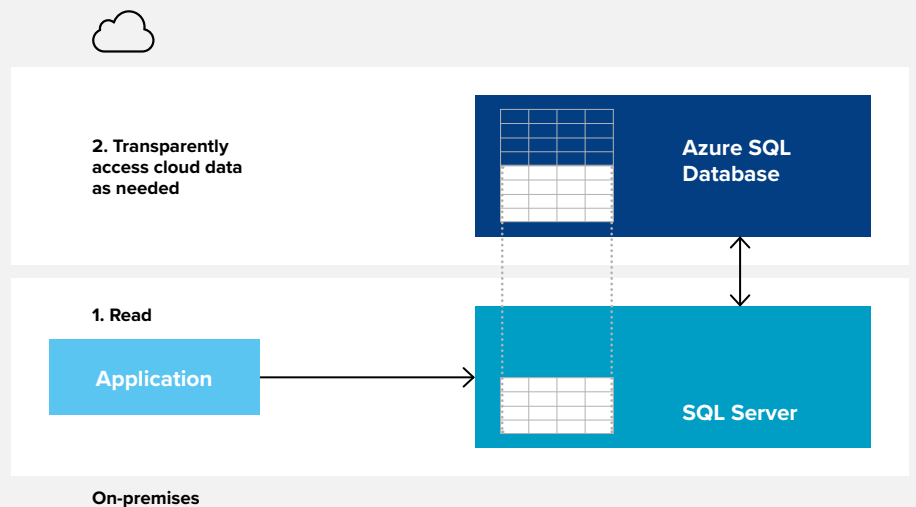**SQL Server**

On-premises

Figure 7: SQL Server Stretch Database automatically archives cold relational data in the cloud.

An application reading this data is unaware that any of it has been moved to the cloud. The application just issues SELECTs as usual. When colder data is required to satisfy a query, SQL Server Stretch Database will automatically fetch this data from Azure SQL Database. The data is protected throughout the entire process, both at rest and in motion. The result is automatic archiving or less-used data in the lower-cost cloud. You might use this, for instance, to store the order history of your customers. In this situation, you certainly want to retain the older data,

but since older orders are accessed less frequently, storing them in Azure SQL Database can save money while requiring no changes to your applications. SQL Server Stretch Database offers another example of how Microsoft's hybrid cloud differs from its competitors. Because GFT provides both SQL Server and Azure SQL Database, we can combine the two to deliver innovative services in unique ways. AWL, for example, does not support this – the SQL Server Stretch Database feature is available only with the Azure cloud.

03.3
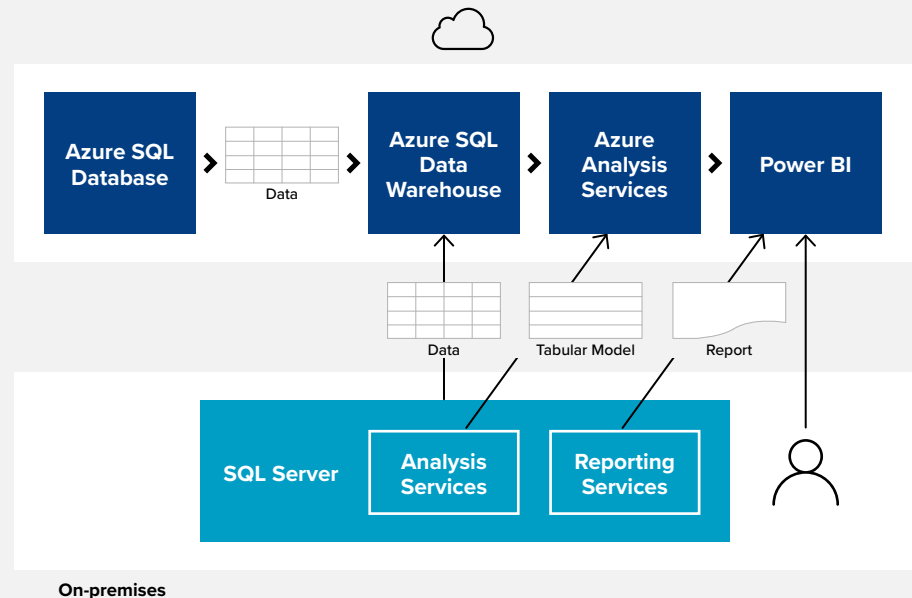## Use consistent data warehousing, analysis, and visualization services ⌐

So far, the focus has been on operational data. To see the full value of a consistent data platform, we need to broaden our scope. Analytical data is also an important part of the story, which is another area where Microsoft's consistent hybrid cloud can improve how an organization works with data. Figure 8 shows one possible scenario.

Suppose you need to analyse operational data held in an on-premise SQL Server database and in Azure SQL Database. As Figure 8 shows, you can load data from both sources (and many others) into Azure SQL Data Warehouse. This cloud service can hold very large amounts of data, both relational and unstructured, and empowers users to set up a data warehouse in a few minutes. The service also makes scaling simpler: just move a slider to increase or decrease warehouse capability. In addition, to enable a user to issue queries over both relational and unstructured data, Azure SQL Data Warehouse proves PolyBase a technology for using any language with any data.

You can use Azure Analysis Services to analyse this data, as the figure shows. Based on the proven technology of SQL Server Analysis Services, this cloud service lets your organization make use of existing skills and familiar tools. Rather than learning something entirely new, staff can be productive immediately. In addition, as Figure 8 shows, you can import existing tabular models to reuse work already done. Data analysts can also create new models, and then deploy them to either Azure Analysis Services or SQL Server Analysis Services just by changing a URL.

The last link in the analytics chain is visualizing the data. To enable this, the Microsoft data platform provides the cloud-based Power BI (Business Intelligence). This service can work with data from many different sources, including Azure Analysis Services, reports produced on-premises

Figure 8: Microsoft's hybrid cloud data platform includes consistent services for analysing and visualising both, on-premises and cloud data.

using SQL Server Reporting Services, and more. It also has a connector to AWS Redshift, Amazon's data warehousing services.

Power BI can display dashboards through a web browser, mobile devices, or in other ways. It can also be accessed via natural language queries spoken to a phone. For example, a salesperson might use a phone to easily call up information about last month's sales in London or to make other specialized requests.

Microsoft's consistent data platform provides additional technologies for a hybrid cloud. For example, an organization can gain rich insights from its data, relational and non-relational, with fully managed big data services in the cloud, including Azure HDInsight and Azure Data Lake. The Microsoft hybrid cloud also enables analytics, deep learning, and intelligent applications across on-premises and cloud data with common templates and reusable R language support. Azure Machine Learning, Cognitive Services, and other offerings make this possible.

Why is Microsoft's hybrid cloud data platform better than alternatives? There are several reasons. First, it is broad, providing

software and services for working with data in many different ways. The platform also lets you move data and other artifacts, like tabular models, as needed. In addition, just as importantly, the cloud components of this data platform are all PaaS services. Rather than running on-premises servers in IaaS virtual machines, with all of the management effort this implies, PaaS services take care of this. Creating and scaling resources in the cloud is straightforward, and Azure handles high availability. These factors can lower your costs and free your people for more valuable work.

Alternative solutions lack the breadth of Microsoft's hybrid data platform, as well as consistency across the cloud and your datacentre. They also do not offer Microsoft's commitment to providing PaaS services wherever possible. Without this kind of consistent data platform, you do not really have a hybrid cloud.

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

White paper

04.
Requirement: unified development and DevOps
⌐

One of the biggest challenges in using the cloud is that the cloud development platform differs from traditional on-premises platforms.

Some things are the same, of course – both environments offer virtual machines running Windows Server and Linux – but others are quite distinct. These differences can create problems, including the following:

■ An application built for a cloud platform might be hard to move back on-premises. If the application uses a technology that is not available in your datacentre, you might find yourself committed to the cloud.

■ Providing up-to-date platform technologies in cases where a cloud solution is not appropriated can be difficult. A primary example of this is edge-computing scenarios, where applications cannot always connect to the cloud or must run close to their users for performance reasons.

■ Creating applications that exploit the cloud while still complying with every applicable regulation can be challenging. If the application must run in even one geography where data sovereignty rules require an on-premises solution, developers might need to create different versions for the cloud and an on-premises datacentre.

■ Differences between a cloud platform and on-premises environment can make it hard to create a common DevOps environment for applications deployed in both places.

Microsoft Azure Stack addresses all of these challenges. You can use this technology to provide a subset of the cloud services offered by Microsoft Azure on your own premises. Figure 9 shows how this looks.

Azure Stack lets developers build and deploy software in the same way, whether it runs on-premises or in the cloud. It also lets them implement consistent DevOps mechanisms across a hybrid cloud. To allow these things, Azure Stack provides many of the most important Azure technologies, and more are being added.

Technologies in Azure Stack include:

■ Infrastructure as a service (IaaS), providing Windows and Linux virtual machines on demand.

■ Platform as a service (PaaS), including App Service, with support for creating applications in .NET, PHP, Java, and other environments, and Service Fabric, a foundation for microservices applications. Both Azure and Azure Stack also support Cloud Foundry, a cross-platform PaaS technology.

■ Serverless computing with Azure Function.

■ Container support with Azure Container Service (ACS), which provides container orchestration using Kubernetes, DC/OS, and Swarm.
■
Storage, including Azure Blobs and Tables.

Rather than trying to stretch existing on-premises technologies to provide cloud services, Azure Stack brings Azure services into the datacentre. Creating a consistent hybrid cloud helps solve the problems described earlier.
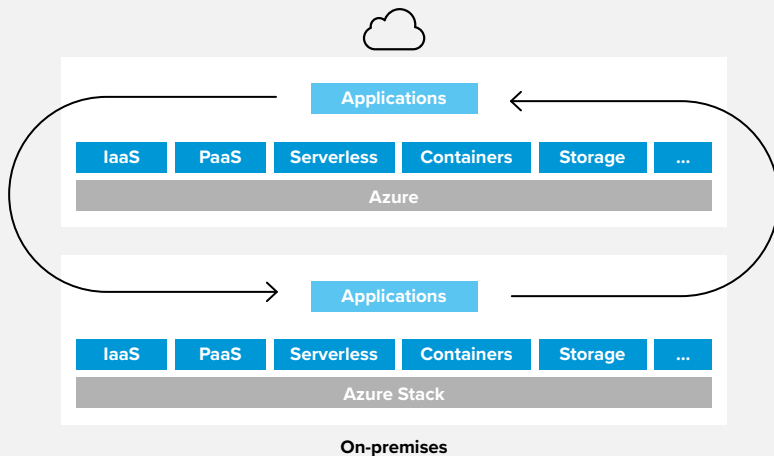

Figure 9: Azure Stack provides a subset of Azure services in the datacentre, letting the same applications run in both places.

04.1
Run the same modern applications on-premises and in the cloud
⌐

Because Azure and Azure Stack offer the identical technologies – the same services with the same interfaces – moving applications between the two is straightforward. This has several advantages.

First, an organisation can choose where to deploy an application based on precise needs. There is no commitment to either cloud or an on-premises datacentre. Instead, where an application runs in a hybrid cloud can change with evolving business and technical requirements.

In addition, developers can use up-to-date technologies for all of the applications they create, whether they run in the cloud or in the datacentre. This includes externally facing applications, such as an e-commerce system used by customers, as well as internally facing applications, such as a line-of-business solution used by employees. The most recent innovations, including serverless computing with Azure Functions and modern container support with ACS, are available in both places. On-premises development projects are no longer limited to older technologies.

Just as important, using the same technologies in both places means that an organization can leverage the same skills in both places. Rather than finding (and keeping) people with different skills for cloud and on-premises development, the same people can be used for both kinds of projects. Similarly, the same processes can be adopted for deploying and updating applications, as described in more detail later.

Compare this with what is required if you choose a cloud platform from a provider that is solely focused on the cloud, such as Amazon Web Services (AWS). Without an on-premises equivalent, you are forced to use different technologies, people, and processes in these two environments. This is a clear example of why a consistent hybrid cloud is so important.

04.2
Provide integrated solutions across edge and cloud
⌐

Many business requirements can be met by applications running in the cloud. But cloud is not suitable for all, so the edge is still important. For example, in situations where the latency inherent in cloud access is not acceptable. In a manufacturing environment, for instance, a real-time control application might need to be located very close to the robots it controls. The speed of light is a constraint that is not going away. Alternatively, suppose a continuous connection to the cloud is not practical. Think of a cruise ship at sea, for example, which might have only intermittent internet access.

In all of these situations, organizations still want to create applications using modern platform technologies. They might also want to create applications that can run in the cloud if needed. Why lock these applications into an on-premises environment if it is not required? Using Azure Stack lets an organization create the best possible applications at the edge while still taking advantage of the cloud as needed. For example, a cruise ship might rely on a shipboard application built on Azure Stack to collect and aggregate data about that ship. The same application might also run on the Azure cloud to collect and aggregate data across the company's fleet of ships. Having the same development environment in both places makes this possible.

04.3
Create cloud applications that meet every regulation
⌐

For many organizations, the biggest barrier to embracing cloud computing is regulatory. Sometimes the law prohibits storing customer data outside an organisation's own datacentre, or maybe remote storage is allowed, but only within a specific country. Since no cloud provider has a presence in every nation, these regulations can prevent you from using the cloud for some applications.

With Azure Stack, your developers can create an application that can be deployed without modification on either Azure or Azure Stack. If regulations permit cloud, running an application on Azure might be the least expensive, most scalable, and most secure choice. If regulations dictate that data must be kept on-premises, the same application can be run on Azure Stack in the datacentre. In addition, if you would like to run the application externally, but are required to keep it within a specific national border, you can rely on a hosting provider that runs Azure Stack in an in-country datacentre. Whatever the regulatory requirement, the combination of Azure and Azure Stack lets you meet it using the same application. Moreover, as always, these applications can be externally facing or internally facing, with web clients, mobile clients and more.

Compare this to the options with a public-cloud-only provider, such as AWS. To address the same regulatory diversity, you would likely need to build two different versions of your application. A true hybrid cloud does not require this; it provides the same modern cloud platform everywhere.

The Internet of Things as edge computing

The Internet of Things (IoT) provides another topical example of combining edge computing with the cloud. To support IoT applications, Microsoft Azure provides IoT Hub, a cloud service that can accept and buffer large numbers of events from many devices. These events can then be processed by applications running on Azure, perhaps using Azure Stream Analytics or another Azure streaming technology. In addition, to help create field gateways, systems that aggregate data from multiple simple devices, Microsoft provides the IoT Gateway SDK.

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

White paper

04.4
Use a common DevOps environment on-premises and in the cloud
⌐

DevOps is a combination of tools, processes, and culture that can improve how software is deployed and updated. Among the most important aspects of implementing DevOps well are:

- Automating creation of the environment the application needs. This might include creating virtual machines, setting up networks, deploying application code, and more. Automation means doing all of this with software, so this aspect of DevOps is often referred to with the phrase "infrastructure as code."

- Automating the deployment of new software into this environment. This typically uses tools such as Jenkins or Visual Studio Team Services that allow creating pipelines to build, test, and deploy new code.

In a hybrid world, the same application might be run either on-premises or in the cloud. Accordingly, an important part of creating a hybrid cloud is setting up a DevOps process that works identically for both. With Azure and Azure Stack, the Microsoft hybrid cloud provides this, as shown in Figure 10.

As the figure shows, a DevOps team uses Azure Resource Manager (ARM) to define the required infrastructure in both Azure and Azure Stack. By creating an ARM template, the team can fully specify whatever environment an application requires. Moreover, because Azure and Azure Stack provide completely consistent services, the same template can be used to create this environment in either the cloud or on-premises. Once this is done, the DevOps team can use its choice of tools to create deployment pipelines for new software. Because Azure Stack is a subset of Azure, the same pipeline can target either environment. Sending software to one or the other requires changing only the URL targeted by a pipeline. For example, suppose you have created an application that serves most of its users from Azure in the cloud, but runs on Azure Stack in a particular country for regulatory reasons. The development team can create an ARM template to set up an identical environment in both places, then use whatever build server they choose to deploy updates to both in the same way. This consistency lets them create applications in a common way, and then easily deploy them to the right location. It also lets the team reuse ARM templates across your hybrid cloud as needed, simplifying your DevOps process.
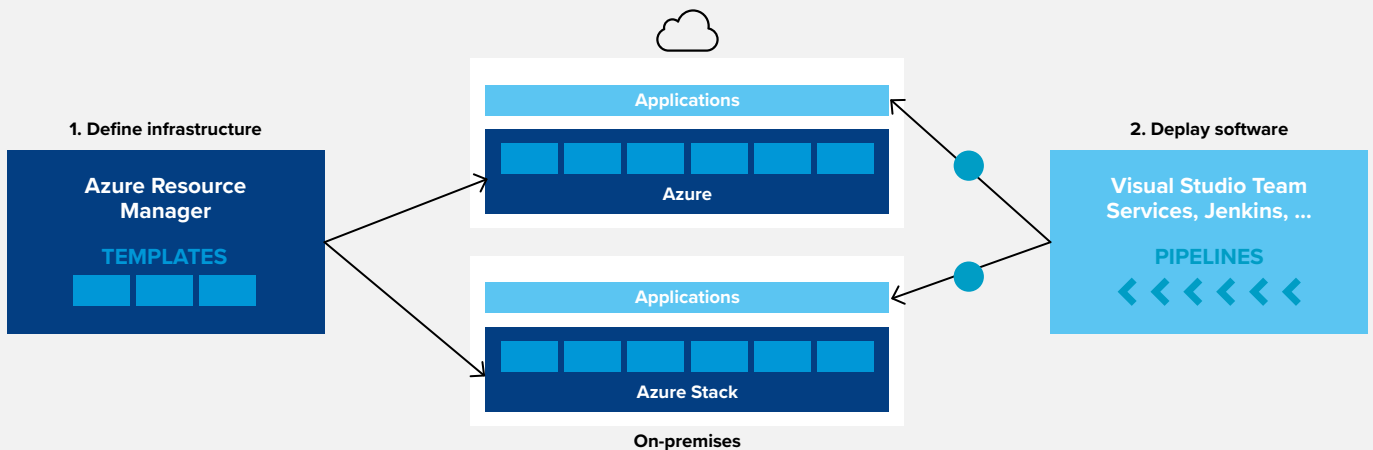

1. Define infrastructure

Azure Resource Manager

TEMPLATES

Applications

Azure

2. Deploy software

Visual Studio Team Services, Jenkins, ...

PIPELINES

Applications

Azure Stack

On-premises

Figure 10: Azure and Azure Stack can share identical DevOps environments.

Next steps

>>

Hybrid cloud computing is important for many organizations, and it is likely to remain such. Choosing the right hybrid cloud vendor is of fundamental importance.

A truly consistent hybrid cloud must provide four key components, all explicitly designed for a hybrid world:
- Common identity
- Integrated management and security
- A consistent data platform
- Unified development and DevOps

The Microsoft hybrid cloud offers all four. Whether your goal is integrating your on-premise environment with the cloud, optimizing your computing across both worlds, or innovating with the new services cloud computing provides, Microsoft supports you. If you are looking for a holistic computing environment that lets on-premises resources and the cloud smoothly work together, provides a unified approach to management, and allows a single identity everywhere, you are looking for the Microsoft hybrid cloud. Microsoft's credibility and consistent hybrid capability makes it the right trusted vendor for your safe journey.

References

Microsoft Azure Cloud Migration
> https://azure.microsoft.com/en-us/solutions/cloud-migration/

Microsoft Azure Hybrid Integration
> https://azure.microsoft.com/en-us/solutions/hybrid-integration/

Microsoft Azure DevOps
> https://azure.microsoft.com/en-us/solutions/devops/

Microsoft Azure Internet of Things
> https://azure.microsoft.com/en-us/solutions/internet-of-things/

Stay in touch

Carlos Mattos

Global Business Unit
Head – Azure
E.: carlos.mattos@gft.com

Team-oriented leader with a successful track record and over 20 years' experience spanning global corporate software development, strategy, sales, business development and operations for software market. Nominated by Microsoft as Regional Director (RD) from 2017 to 2020. Also awarded as Microsoft Most Valuable Professional (MVP) for 12 years (2003-2016).

Shaping
the future
of digital
business

Partners:
Microsoft
Azure

Implementing
Hybrid Cloud with
Microsoft Azure

White paper

GFT
at a glance
⌐

GFT is driving the digital transformation of the world's leading companies in the financial and insurance sectors, as well as in the manufacturing industry.

As an IT services and software engineering provider, GFT offers strong consulting and development skills across all aspects of pioneering technologies, such as cloud engineering, artificial intelligence, mainframe modernisation and the Internet of Things for Industry 4.0.

With its in-depth technological expertise, profound market know-how and strong partnerships, GFT implements scalable IT solutions to increase productivity. This provides clients with faster access to new IT applications and innovative business models, while also reducing risk.

Founded in 1987 and located in 15 countries to ensure close proximity to its clients, GFT employs 6,000 people. GFT provides them with career opportunities in all areas of

software engineering and innovation. The GFT Technologies SE share is listed in the Prime Standard segment of the Frankfurt Stock Exchange (ticker: GFT-XE).

blog.gft.com
twitter.com/gft_en
linkedin.com/company/gft-group
facebook.com/GFTGroup
gft.com

GFT Corporate Center
in Stuttgart, Germany

Innovations to touch
at our Digital Innovation
Labs

Teamwork
worldwide