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Why Azure?

In addition to being featured in the [Gartner Cloud Quadrant](#) as a cloud leader for several years, Microsoft Azure has helped several large enterprises, such as [Adobe](#) and [GE Healthcare](#), move to the cloud, increasing their productivity and encouraging innovation. Whether you are choosing to move to Azure to lower TCO, for resiliency, or for scalability, one of the biggest advantages of the Azure platform is the dominance of Microsoft in the enterprise software space and its huge partner ecosystem.

Migration to the public cloud should be considered a strategic move, which includes reviewing and planning each of the steps in advance of migration so your organization enjoys a smooth transition. You have to consider all the different subsystems, including storage, compute, and network, as well as different IT management aspects (for example, security, availability, and cost). This approach allows you to adequately prepare your team members in advance for the migration and what it means for them and their workloads.

This paper provides enterprise IT leaders and professionals with key considerations in planning a migration, offering practical tips and tools they need to take the next steps.

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The Assessment Phase

Before you start brainstorming about how to move to the cloud, it is essential that you determine which workloads will most benefit from a move to the cloud. This approach means using tools such as the [Migration Assessment Tools](#) and [ASR Deployment Planner](#) to gain operational insights and create an itemized checklist to help you on your cloud journey. These tools also provide a detailed view of your current environment and an analysis about what workloads, if moved to the cloud, would scale better, reduce TCO, and provide better ROI.

It is essential to form a migration team that can own the migration project from start to finish. Remember, moving to the cloud is an essential change that can cause disruptions in the forms of refactored applications, modified DevOps processes, and redesigned infrastructure. The migration team needs to make sure that the stakeholders involved in this process are aware of the forthcoming changes and are well equipped to adapt, maintain, and upsell these cloud-based services.

A good starting point is the extensive documentation provided by Microsoft in the form of [blogs](#), [white papers](#), and [Channel 9 videos](#). If you need a helping hand or want to employ a consultant to conserve time and resources, there are plenty of [Microsoft Azure migration partners](#).

The Migration Plan: 5 Key Considerations

Now that you have a fairly good assessment of your current environment, it is time to formulate a plan for migration. Here are the factors that you need to consider.

1 CHOOSE YOUR METHOD

According to an [analysis by Gartner](#), you should consider the following five main methods optimal for application migration to the public cloud:

Infrastructure as a Service (IaaS)	Platform as a Service (PaaS)
<p>1. Rehost (lift and shift): Redeploy on an IaaS without making changes.</p>	<p>3. Refactor: Inject your code and run your application on top of the cloud.</p>
<p>2. Revise (rearchitect): Modify or extend existing code to fit the new cloud environment.</p>	<p>4. Rebuild: Discard code for an existing application and rearchitect the application on top of the cloud.</p>
<p>5. The fifth is the most simple to understand: replace.</p>	



Choosing the right method depends on your company's area of focus and strategy. Are you a mobile, web, or software developer-oriented company? If so, you might be better off choosing Azure PaaS offerings such as [Azure App Services](#), which provide serverless architecture capabilities. This way, R&D teams can concentrate on innovation, as opposed to maintenance.

However, if you want fast migration to Azure, you need to consider the lift and shift method and use the infrastructure components of Azure. In this case, IaaS is the way to go. Often, enterprises choose a mix of both.

2 CHOOSE YOUR HYBRID CLOUD SUPPORT

Microsoft provides out-of-the-box support of hybrid cloud for enterprises. With products such as [Windows Azure Stack](#), for example, Microsoft has enabled enterprises to deploy a true hybrid cloud.

Windows Azure Stack brings Azure Resource Manager, blob storage, and fault domains (among other features) to your on-premises data center, transforming it to a true, scalable private cloud solution.

This approach enables a smooth transition to the public cloud when and if needed without substantial refactoring. Microsoft's intent in the hybrid space is also evident in its latest server operating system, Windows Server 2016, which ships with several cloud provider features such as [Storage Spaces Direct](#), containerization, and software-defined networking solutions. Taking this approach a step further are tools such as [ExpressRoute](#) and [Azure AD](#), which provide a dedicated network to Azure and integrated directory management, respectively.

Tools and Resources

- > [Windows Azure Stack](#)
- > [Storage Spaces Direct](#)
- > [ExpressRoute](#)
- > [Azure AD](#)



3 MOVE YOUR COMPUTE RESOURCES

Compute resources planning is a complex topic. It is pertinent to have a solid compute migration plan, taking into consideration factors such as workload throughput, machine role, uptime guarantee, and budgetary constraints.

It is also important to make sure that every variable is worked into the equation so that the final result equates to lower TCO, improved measurable performance, and a game plan to further optimize monthly costs. The good news is that you have quantifiable parameters from the assessment phase that can be utilized while working on [Azure VM sizing](#).

Microsoft Azure runs on Microsoft's proprietary Hyper-V platform, so executing conventional lift and shift procedures from an on-premises

Hyper-V environment becomes as simple as transferring a VHD to the on-cloud blob storage. Having said that, tools such as [Microsoft Virtual Machine Converter](#) and [Azure Site Recovery](#) (ASR) have made sure that workloads from platforms such as VMware and AWS or non-virtualized physical servers can also be easily moved to Azure VM Infrastructure.

Finally, it's necessary to stress the importance of utilizing analytic and automation tools to make sure that you have operational insight into your workload and can control the ongoing monthly costs simple by automating shutting down of VMs during off-peak hours. The Azure Management Portal, Powershell, and Azure CLI make this level of automation possible to streamline spending.

Tools and Resources

- > [Microsoft Virtual Machine Converter](#)
- > [ASR](#)



4 CONTROL YOUR STORAGE

Storage costs would grow linearly or exponentially no matter what model you choose (IaaS, PaaS, or a mixture of both). Choosing the right [storage account](#) based on performance and replication options is key, as well as being on the lookout for additional charges such as those related to storage transactions (read/write operations). Also, the type of data you consume determines the storage services you use. The right storage service can significantly increase your throughput based on the workload.

Example:

Company XYZ wants to host a VM in Azure with terminal services, user applications, and file share data. Some of the applications such as analytics and relational DBs demand guaranteed high IOPS and therefore need to be hosted on premium storage such as SSD.

A sample configuration for this scenario could be:

1. Create two storage accounts: a premium account with [LRS redundancy](#) and a standard account with GRS redundancy.
2. Create a Windows Server 2016 Data Center DS2 Standard VM. This configuration would obviously depend on the number of users and your workload, with file shares residing on [Azure File Storage](#) in a standard storage account.

Another practical way to keep your storage costs under control is to move your cold storage data to [Azure Cool Blob Storage](#), which is considerably cheaper than its counterparts. Cool Blob storage service is suitable for data archiving, because it is an infrequently accessed dataset.

Big factors to consider in regard to storage are [IOPS and throughput](#). Make certain you understand the IOPS nuances for different types of storage and test this approach with tools such as [IOMeter](#) and SQLIO to simulate workloads on the Azure platform. It is equally important that you assess your current storage performance with tools like [NetApp OnCommand Insight](#).



Pro Tips

For some virtual machine tiers, you can use storage spaces to combine the IOPS from several disks. Also, you get [temporary SSD storage](#) when creating a VM, which can be utilized for things such as Pagefile or SQL TempDB. One way to tackle storage in Azure is to use the concept of [managed disks](#), which overcomes a lot of limitations inherent in storage accounts.



As needs for storage and associated costs increase, it might be a good option to utilize your on-premises storage resources to reduce the cost. A hybrid storage cloud solution is one that combines your on-premises storage infrastructure with a cloud-based one, such as Azure, both to improve storage economies and to provide out-of-the-box solutions to common challenges, such as DR and replication. These solutions can utilize your on-premises storage (NAS or SAN, for instance) and connect them to the Azure cloud storage, forming an extended workplace.

With Azure's [StorSimple](#) solution, for instance, you get to build on your prior expertise of on-premises storage solutions, but with a unified management console for both on-premises and cloud storage workloads. Another option to maintain compatibility with enterprise-grade products is to use [NetApp® Cloud Volumes ONTAP](#), which not only provides the familiar ONTAP features on [NetApp FAS](#) products, but also automates data movement in the cloud and provides a central console for operational insights and resource cost monitoring.

Tools and Resources

- > [Azure storage main page](#)
- > [StorSimple](#)
- > [IOMeter](#)
- > [NetApp Cloud Volumes ONTAP](#)

5 PROTECT YOUR CLOUD

Two of the biggest challenges to overcome while adopting public cloud are security and data sovereignty. Because you no longer have complete control over the infrastructure, it is imperative to put a solid strategy to encrypt the at-rest data. Use of Bitlocker Drive Encryption in Windows or DM-Crypt in Linux along with [Azure Key Vault](#) can be an excellent starting point in devising this strategy. Another important technology that helps encrypt data at rest is [Azure Storage Service Encryption \(SSE\)](#), which encrypts the data as it is stored in Resource Manager Storage Accounts. Look for third-party vendors on the [Azure marketplace](#), which can help you close gaps. As in the storage case, this approach not only provides a cost-effective way

of utilizing some otherwise expensive appliances, but also protects your on-premises investments through offerings such as BYOL.

Moving your infrastructure to the cloud does not mean you lose control over your networking resources. Determine how to utilize [route tables](#) and [User Defined Routes](#) to enforce forced tunneling or use the built-in [network security groups](#) and [Azure WAF](#) to govern and filter traffic flow. Make use of Azure [virtual network gateway](#) to plan and test capabilities, such as site-to-site VPN and Vnet-to-Vnet VPNs, and determine access performance through these tunnels. When evaluating the overall security of your Azure Resources, it is a good practice to



use the [Azure Security Center](#) which provides an unified console that helps you verify if the appropriate security controls are in place and take remedial actions wherever necessary.

An important aspect of Azure availability is its [38 regions](#) (34 Generally Available and four

coming soon) around the globe (see Figure 1 below). Review and understand how regions use geo-replication to maintain availability and support Azure with its guaranteed [99.9% uptime](#). It is important to note that not all services are available in all regions.



Figure 1 - Azure worldwide cloud regions

Make sure that this approach aligns with your company's RTOs and RPOs. Depending on your environment and availability requirements, you might want to invest in learning and leveraging the following tools, which are key capabilities to consider for your DR and backup needs:

- [Availability sets](#), which use fault and update domains to make sure of uptime during unplanned and planned maintenance
- [Guest clustering](#) uses Storage Spaces Direct, providing high-availability and load-balancing features for the workloads inside a VM
- ASR and [Azure backup](#), two essential components of OMS, which help make sure that you have an SLA-backed DR strategy and all your data is backed up regularly in redundant storage locations
- Finally, a good [guide](#) about resilience created by Azure that might come in handy

Tools and Resources

- [Azure Key Vault](#)
- [Route Tables](#)
- [Virtual Network Gateway](#)
- [Azure regions](#)
- [Availability Sets](#)
- [Guest clustering](#)
- [Azure Backup](#)



Next Step: Deploy and Manage

After spending considerable time on assessment, planning, and testing out your new environment, you are finally ready to move your workload to Azure. Now you need to think about migrating huge amounts of data to the Azure data centers. Tools such as [Azure Storage Explorer](#) and [AzCopy](#) can help move data to and from the blob-based Azure storage. Objects such as files and VHD can be easily migrated using these native tools.

What if your data is too big to migrate through these conventional tools? Consider using [import/export](#), with which you can ship hard drives with the on-premises data to Azure data centers. In the case of hybrid deployments, use of exclusive networks such as ExpressRoute can significantly

reduce transfer time. [Azure Site Recovery](#), already mentioned, is also a good feature to help you move VM-based and physical server workloads to the cloud. And don't forget to make use of the [SQL Database Migration Tool](#) to move SQL databases from on the premises to the cloud. A tool that can help you in this process is [Data Migration Assistant \(DMA\)](#), which detects compatibility issues and allows you to move data to an Azure SQL database. Existing NetApp users can leverage the familiar [SnapMirror® technology](#) to migrate data from on the premises to the Azure cloud. Similarly, the [Azure Website Migration Assistant](#) tool can help in automated assessment and migration of websites running on IIS.



Remember

Always have a contingency plan and make sure Azure workloads are running according to your plan before you decommission your on-premises infrastructure. Run drill-downs to verify your backup and disaster recovery solutions are also performing as expected.

Now that you have migrated your workloads to the Azure platform, it is time to evaluate how well the new infrastructure is running. This evaluation is where the power of [Microsoft's OMS](#) really shines. Its [Log Analytics](#), which gathers insights from your environment and proactively alerts or takes corrective action; [Automation](#), which includes runbooks to automate manual processes and deployment of configuration through PowerShell DSC; and [Site Recovery](#) all help provide a complete management and assessment solution. [Azure Advisor](#), a free tool from Microsoft provides recommendations to

optimize the availability, performance, security and cost of your Azure resources aligning them with the best practices of Azure.

In addition, several management solutions use one or more OMS products to give you better assessment capabilities such as [AD Assessment](#) and [Network Performance Monitor](#). Remember that proactive monitoring and reaction to unplanned incidents, either through human intervention or through automation, can go a long way to maintaining integrity of your cloud environment.



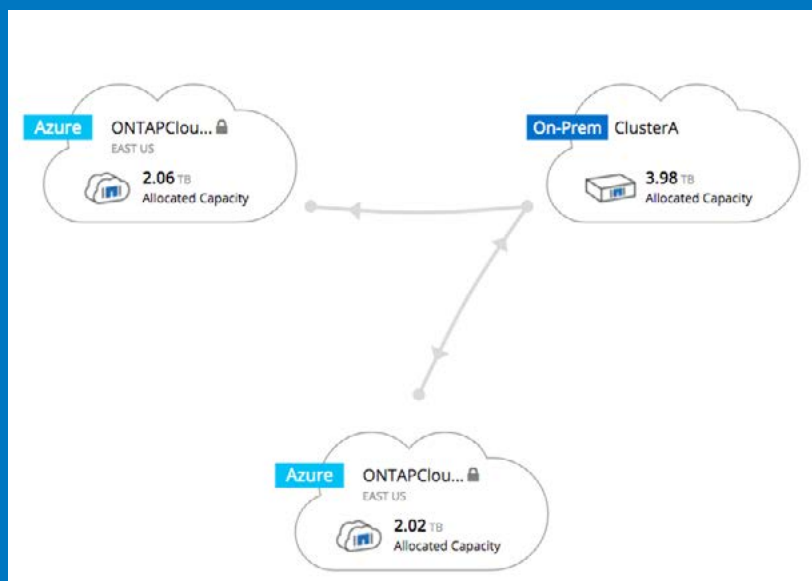
Final Notes

One interesting concept to mention in the context of migration is [data gravity](#), an idea conceived by David McCrory. Generally speaking, data, just like a planet, has gravity that holds down, or rather determines, the amount of services and applications that use it to function; in return, they are bound to it. As the data grows, so does the complexity of the environment.

McCrory's law states that the closer an application is to the data, the better the throughput and lower the latency. When you migrate to Azure (or to any other cloud, for that matter), it's imperative to consider this theory in the assessment phase and beyond and to always be aware of the difficulty level of your own migration process.

About NetApp Cloud Volumes ONTAP

For the last 25 years, NetApp has grown to be a worldwide leader in storage and data management. The company has a large partnership network, and if you've made the decision to migrate to Azure, you can do so quickly and in a cost-effective way with [Cloud Volumes ONTAP](#).



Cloud Volumes ONTAP, the leading enterprise storage operating system, is deployed using [OnCommand® Cloud Manager](#) to deliver secure, proven NFS, CIFS, and iSCSI data management for Azure storage. A software-only storage service running NetApp ONTAP software, Cloud Volumes ONTAP combines data control with enterprise-class storage features such as data deduplication and compression to minimize your cloud block storage footprint. You can take Snapshot® copies of your data without requiring additional storage or affecting your application's performance. Plus, Cloud Volumes ONTAP can tie your Azure cloud storage to your data center using the leading NetApp replication protocol, SnapMirror technology.



[OnCommand Cloud Manager](#) handles deployment and management of Cloud Volumes ONTAP, giving you a simple point-and-click environment to manage your storage and ease control of your data.

For more information about NetApp Cloud Volumes ONTAP for Microsoft Azure, [Click Here](#)



Refer to the [Interoperability Matrix Tool \(IMT\)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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