The Ultimate Guide To
Cloud Migration

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AN INTRODUCTION TO CLOUD MIGRATION

The term "cloud migration" can mean different things to different people. For some, migrating workloads from on-premises infrastructures to the cloud is an opportunity to be grasped with both hands. For others, there may be a reluctance to change existing work practices; which, possibly coupled with a fear of the unknown, can be a handicap to taking advantage of what the cloud has to offer.

For people who fall into the second category, this guide to cloud migration has been prepared for you.

Some of the things you can find in this ultimate guide include:

- Why Migrate to the Cloud?

- The Three Factors Required to Migrate to the Cloud

- The Options for Migrating to the Cloud

- Choosing the Right Cloud Service Provider

- What You Need to Consider before Migrating

- What You Need to do During Migration
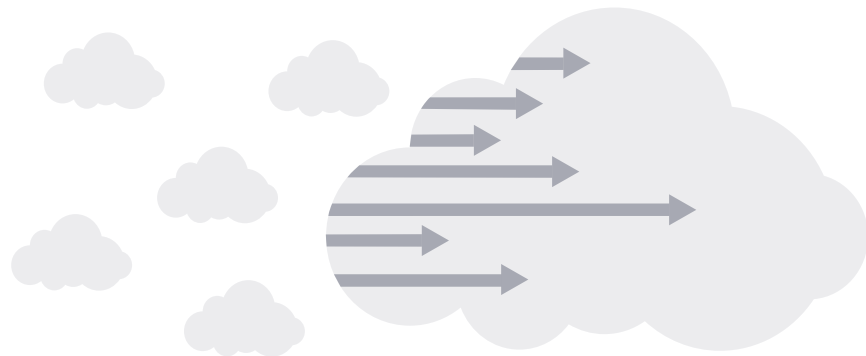
1 WHY MIGRATE TO THE CLOUD?

Practically every business has migrated to the cloud in some respect. For example, if your business uses a web-based email service rather than an on-premises mail server, the corporate email account operates in the cloud. The web-based email service makes it possible for employees to log into their accounts from any location using any device, and it's therefore both convenient and productive.

It's not only convenience and productivity that motivates businesses to migrate to the cloud. Many choose to migrate some or all of their operations to the cloud to address issues with "end-of-life" on-premises legacy systems, increasing data storage requirements, or regulatory compliance (i.e. disaster recovery).

Other reasons businesses migrating to the cloud include:

- Rapid scalability for workloads experiencing increased demand
- Reducing operational costs while increasing the effectiveness of IT
- Instant access to evolving cloud services in order to accelerate innovation
- To build a distributed development team that can access applications remotely
- Reduce the IT maintenance overhead and create a more secure IT environment

While there are multiple advantages of migrating to the cloud, it's not a win- win in every scenario. There are circumstances in which applications will have to be fully refactored to operate in the cloud, when the performance of shared resources (i.e. containers) can be affected by "noisy neighbors", and when a cloud migration fails to achieve its forecast benefits due to a lack of accurate planning.

It's important to consider that many senior IT executives' reluctance to migrate to the cloud comes from the wealth of historic experience they have working with hardware IT systems. Remember to have everyone on board when making a decision to migrate workloads to the cloud or else, no matter how diligently you prepare, reaching a successful migration will be challenging.

2 THE THREE FACTORS REQUIRED TO MIGRATE TO THE CLOUD

For any IT project to be a success, there have to be three factors in place: **the right people, the right processes, and the right technology.** The way to find out where your business stands in relation to these three factors is to stage migration trial runs. These "proof of concept" trial runs will help identify where changes need to be made to ensure you have the right people, right processes, and right technology.

There is no one-size-fits-all approach to proof of concept trial runs. How the trial runs are formatted will depend on the expected business benefit, predetermined success criteria, and the long-term objectives of the business. It may be necessary to conduct multiple proof of concept exercises to determine what works and what doesn't.

The results of the trial runs will help you develop a cloud migration strategy. This strategy is a roadmap to successfully migrating to the cloud and starts with identifying which workloads are candidates for migration. Then it's necessary to examine the downstream application and infrastructure dependencies of these workloads before calculating the total cost of ownership and modelling out the migration.

PEOPLE

PROCESSES

TECHNOLOGY

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3 TOTAL COST OF OWNERSHIP IS NOT TOTAL COST OF MIGRATION

One area to be wary of when migrating workloads to the cloud is the distinction between the total cost of ownership and the total cost of migration. The total cost of ownership (TCO) represents the cost of renting services to run workloads in the cloud—you don't actually own anything. This is the figure you compare against the cost of running the same workloads on-premises.

The total cost of migration is how much it will cost the business to migrate workloads to the cloud. The TCO figure is part of that calculation; but, most businesses meet or better cost estimates of migrating to the cloud.

We'll address the primary causes of overspending on migration as we progress through the guide. Before getting into the details of migrating to the cloud, it's beneficial to understand the options you have when migrating to the cloud and list the best cloud service providers for supporting a move—or partial move—from an on-premises infrastructure to the cloud.

4 THE OPTIONS FOR MIGRATION TO THE CLOUD

Migrating to the cloud doesn't have to be all or nothing. Businesses can run some workloads in the cloud and keep others on-premises; or—as recommended above—migrate workloads little-by-little until what worked in theory can work in practice on a larger scale. What's more important is having a plan in place and a strategy to execute the plan.

The best place to start developing a plan is determining where you want to finish. Although the finishing point will likely change over time as your business progresses on its journey to cloud maturity, setting initial goals can help your migration team develop a strategy that gives you the best chance to reach success. Your initial goals should include your cloud vision—or what type of cloud environment you want the business to operate in.

There are four types of cloud environment—public cloud, virtual private cloud (not to be confused with on-premises infrastructures which are sometimes referred to as "private clouds"), multicloud, and hybrid cloud. All of the major cloud providers support each type of cloud environment, and each provider offers tools to help businesses migrate to the cloud environment of their choice.

PUBLIC CLOUD

VIRTUAL PRIVATE CLOUD

MULTICLOUD

HYBRID CLOUD

PUBLIC CLOUD

The public cloud consists of computing services offered by third-party service providers over the public Internet. The cloud service provider is responsible for the management, maintenance, and security of their data center, while the customer (business) is responsible for the security of applications and data deployed in the public cloud.

VIRTUAL PRIVATE CLOUD

A virtual private cloud is an isolated section of a cloud service provider's public cloud. Business using a virtual private cloud enjoy the same flexibility, scalability, and reliability of a public cloud, but with higher levels of security and privacy. The tradeoff for this cloud migration option is cost and a higher management overhead.

MULTICLOUD

A multicloud environment is one in which the business uses more than one public and/or virtual private clouds from a range of cloud service providers. The benefits of operating in a multicloud environment include access to a wider range of services, a higher level of redundancy, and the option to switch from provider to provider whenever it's financially beneficial.

HYBRID CLOUD

A hybrid cloud environment is one in which the business operates an on- premises infrastructure and at least one public or virtual private cloud with some degree of integration between the two. Most businesses fall into this type when they start on their cloud journeys—although sometimes by accident.

6 ONE OTHER SCENARIO TO BE AWARE OF

It's possible for a business to operate an on-premises infrastructure and in at least one public cloud without it being a hybrid cloud environment (because there is no integration between the two). In some cases this can be a planned and sanctioned scenario to provide a Line of Business with access to services that are unavailable via the on-premises infrastructure—but, in many cases, it's not.

The unsanctioned use of public cloud services is known as "Shadow IT" and it's estimated to account for as much as 40% of some businesses' cloud bills. Furthermore, not only can the use of cloud services without appropriate governance allow costs to spiral out of control, there can also be consequences for performance and security. How to address Shadow IT is described later in this guide.
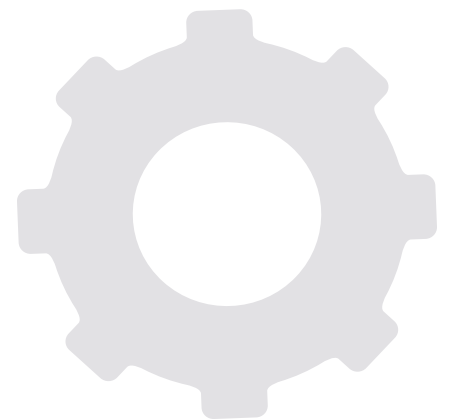
7 CHOOSING THE RIGHT CLOUD SERVICE PROVIDER

In addition to knowing what sort of cloud environment you want the business to operate in, it's also important to understand which cloud providers are the best fit for your particular workloads. Since each cloud service provider has particular strengths, many organizations choose a multicloud strategy in order to take advantage of each provider's unique attributes are suitable for specific workloads.

AMAZON WEB SERVICES

Amazon Web Services (AWS) owes its position of being the most popular cloud service provider to being first to market. AWS' huge growth has allowed it to reinvest in the services it offers and build an extensive, worldwide network of data centers. Consequently, AWS has been described as the most mature, enterprise-ready provider, with the deepest capabilities for governing a large number of users and resources.

MICROSOFT AZURE

The success of Microsoft Azure is attributable to Microsoft taking its on-premises software solutions and delivering them as cloud services. Azure has been growing quickly and enterprises have expanded beyond Microsoft's Software-as-a-Service (SaaS) solutions to also explore Microsoft Azure's Platform-as-a-service (PaaS) and Infrastructure-as-a- Service (IaaS) solutions. There are also discounts available for existing Microsoft customers.

GOOGLE CLOUD

Google Cloud has carved out a strong position for Big Data, machine learning, and analytics workloads as well as container technologies, automation,and networking. If you're considering deploying workloads that could benefit from these services, Google Cloud may be the right cloud service provider for your business.

VMWARE CLOUD

Although not strictly a cloud service provider, VMware is worth mentioning in this section if your company has a significant VMware data center footprint. In 2017 VMware partnered with AWS to create VMware Cloud on AWS (VMC on AWS)—a hybrid cloud solution that delivers the VMware Software-Defined Data Center (SDDC) software stack as a cloud service that can be deployed on on-premises vSphere infrastructure and on AWS bare metal EC2 instances.

For companies with a lot of vSphere based workloads, VMC on AWS offers a seamless way to migrate those workloads to either a private or public cloud without having to rewrite or re-factor applications. It also gives VMware IT shops a way to rapidly adopt hybrid and public cloud services while taking advantage of their investments in, and familiarity with, VMware technologies.

EMERGING CLOUD PROVIDERS

Among other cloud service providers, Alibaba has a strong presence in Asia Pacific and is looking to grow their presence globally. IBM was one of the first cloud service providers to identify the potential of multicloud and hybrid cloud environments and is still a strong brand in the enterprise with a very large professional services business to support cloud services and migrations. Oracle is a compelling choice for customers with significant investments in Oracle applications who want to run their Oracle software in the cloud.

The bottom line is that enterprises have a number of choices available to them and it's important to evaluate each cloud provider based on cost, capabilities, and suitability for different applications and workloads.

8 WHAT YOU NEED TO CONSIDER BEFORE MIGRATING

So far we've touched on many of the things organizations need to consider before migrating to the cloud and now it's time to get into the details on two areas that can often be the biggest contributors to overspend during the migration process: **application refactoring and poor migration planning**.

Poor migration planning can include the miscalculation of TCO, non-platform operational costs, and costs associated with external advice/support—all of which should be accurately forecasted and incorporated into migration budget planning ahead of time. While the values of these cost drivers will likely change during the migration process, it's best to set realistic expectations from the start—even if that means adding a buffer to certain budget line items.

9 THE DIFFERENT TYPES OF APPLICATION REFACTORING

Unless your business is running the exact same software stack in the public cloud as they are running on-premises, it's likely that you'll need to refactor existing applications to address compatibility issues between on-premises operating systems and cloud operating systems. Sometimes it's enough to replace a couple of on-premises components with cloud native ones. Other times a full rebuild is required.

Full rebuilds represent the greatest opportunity to take advantage of the elasticity and scalability of the cloud by breaking an application down into microservices that can then be containerized. However, full refactoring is time-consuming and therefore expensive. If you want to avoid the expense of a full rebuild, you may want to consider one of these other options.

LIFT AND SHIFT
This approach allows you to keep the application mostly as is and make the necessary adjustments for the application to run in the cloud. This is a fast and inexpensive process provided your chosen cloud service provider supports a cloud operating system similar to your on-premises operating system and provides a migration tool that can assist with the process.

PARTIAL REFACTOR
Some components of the application can remain as is, but other parts may need to be fully rebuilt in order to operate properly in the cloud. Again, the choice of cloud service provider is important because it may be possible to leave the existing application as is, and build additional supporting services from the cloud provider on top of it.

TRANSITION TO SAAS OR PAAS
If the workload you're migrating is a commodity application (e.g., email, CRM), or has commodity components (e.g., a relational database), you can incorporate a SaaS or PaaS into the mix—subject to the cloud service provider supporting the SaaS or PaaS service you want to use. This will help accelerate migration plans as well as reduce the management overhead.

10 WHY YOU SHOULD CREATE A CLOUD BUSINESS OFFICE

Earlier we mentioned that for any IT project to be a success, there has to be the right people, the right processes, and the right technology. Refactoring applications to be compatible with the cloud platforms they will be deployed on takes care of the technology, but what about the people and processes? This is where a Cloud Business Office takes center stage.

A Cloud Business Office is a team tasked with the responsibility of developing a framework for the business's cloud operations. While one of the team's most important roles is governing the IT infrastructure, it's not recommended to pack the entire team with developers, system administrators, network engineers, IT operations, and database administrators.

Instead, it's better to include personnel from departments outside of IT, such as procurement, finance, business operations, and security. This not only gets everyone "on board" with the project and ensures IT is aligned with the overall business objectives, it also helps prevent Shadow IT by giving different Lines of Business an opportunity to put their case forward for specific—sanctioned— services and capabilities.

Having a team comprised of representatives from different departments also helps identify training requirements—which can mitigate non-platform operation costs. However, one of the most important benefits of having a diverse set of talent in the Cloud Business Office is that the team will be able to devise cloud governance policies that make sense to all users and that are more likely to be adhered to.

Cloud
Business
Office

11 WHAT SHOULD CLOUD GOVERNANCE POLICES CONSIST OF?

While it's important to have rules about how resources in an on-premises infrastructure are used, it's critical to establish cloud governance policies when you migrate to the cloud due to the self-provisioning nature of cloud computing. Issues with cost, performance, and security can materialize quickly if there are no rules in place to govern actions in your environment or tools in place to monitor cloud activity.

In most cases there are six different categories of cloud governance policy that should be applied to each user within the business. In certain circumstances there can be additional, "localized" policies for specific departments. The Cloud Business Office should be responsible for defining these policies as well as establish the processes for overriding or adjusting policies when required.

**The six categories of cloud governance policies are:**

- Financial Management
- Cost Optimization
- Performance Management
- Operational Governance
- Configuration Management
- Security & Incident Management

It's not feasible for a business to work under two sets of IT governance policies—one for on-premises and one for the cloud. So, whatever policies are developed will have to take both environments into account. This is a further reason why it's beneficial to have representatives from different departments on the Cloud Business Office team—even if those departments are not first in line for migration to the cloud.

WHAT YOU NEED TO DO DURING MIGRATION

When tackling a migration project, one of the most challenging aspects is deciding where to start. The best approach is to begin migrating workloads with the fewest dependencies as this allows you to ramp up slowly, and build expertise and confidence along the way, before tackling more complex workloads. The downside is that the order of migration may not suit every department within your business.
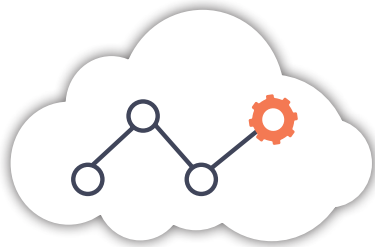
Therefore, an alternative approach is to start with workloads that have the most over-provisioned resources. Industry research suggests that as many as 30% of on-premises servers, both physical and virtual servers, are zombies and show no signs of useful compute activity for six months or more. On top of that, more than 35% of on-premises servers show activity less than 5% of the time.

To work out which workloads are ideal candidates for migration look at historical performance data across CPU, memory, network, and disk for servers, and across throughput, capacity, and IO for storage. As long as you rightsize the workloads before migrating them to the cloud, this approach will see the greatest price and performance improvements once migrated.

There are plenty of tools that can help you identify the ideal candidate for migration. One such tool is the VAST cloud management platform which—via its migration assessment capabilities—enables you to efficiently assess and model workloads for migration, and then manage and optimize resources for cost, usage, performance, and security once they're running in the cloud.

MONITOR, RINSE, REPEAT

With a well-executed plan, backed by a realistic cloud migration strategy and supported by a trained team working within effective governance policies, your initial deployments may go according to plan without any major roadblocks. Don't get too comfortable though, one successful cloud deployment doesn't equate to cloud maturity.

Assuming your first deployments in the cloud were small and simple, more complex workloads are likely still to come. You should continue monitoring the cost, performance, and security of every resource in your cloud environment—identifying where improvements can be made and reconfiguring resources as necessary. How resources are monitored can also make a difference to the final outcome of the project.

Although cloud service providers supply monitoring tools, many have their limitations. Some struggle to provide total visibility into the user's cloud environment; and, if you're deploying resources in more than one public cloud, it means extracting metrics from more than one provider-supplied monitoring tool in order to assess how resources are being utilized and how they're communicating with each other.

VAST offers a solution to these issues by providing total visibility across multiple and/or hybrid clouds simultaneously. The platform unites all data to provide a holistic view of cloud resources, which can then be broken down to create unique business groups (i.e. by workload, departments, COGS, etc.) that reflect different sets of data for analysis and evaluation.
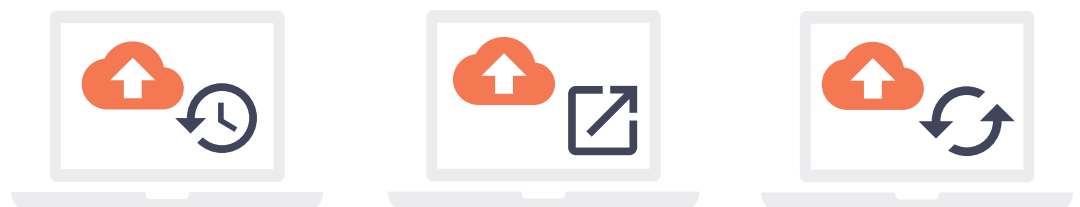
10 CLOUD MIGRATION BEST PRACTICES

Migrating to the cloud can involve juggling a lot of balls simultaneously, and the process isn't necessarily linear depending on the business's motives for migrating workloads to the cloud and whether the migration is seen as an opportunity. Concerns can be resolved with the right people, right processes, and right technology; but, for businesses just starting on their cloud journeys, knowing what's right can be difficult. Here's a summary of what's been discussed:

1

IDENTIFY THE OBJECTIVES OF MIGRATING TO THE CLOUD AND SEE WHAT OTHER OPPORTUNITIES EXIST.
Although the initial objective may be (for example) to increase capacity for specific workloads to meet increasing demand, there may be other candidates for migration that benefit from reduced cost, increased performance, or enhanced security.

2

CREATE A FULLY SUPPORTED AND SOLELY RESPONSIBLE CLOUD BUSINESS OFFICE.
The initial steps on your business's journey to the cloud have to be focused— derailment from outside parties, including C-Suite executives, should be avoided. Again, it's important to include representatives from throughout the business to prevent Shadow IT and to ensure your migration plan is aligned to overall business objectives.

3

IDENTIFY ON-PREMISES WORKLOADS SUITABLE FOR MIGRATION.
This can involve identifying which vendors' architectures are most compatible with your current on-premises architecture, or deciding upon a multicloud or hybrid cloud environment to match applications to services and limited the necessity for refactoring.

4

ORGANIZE TRAINING TO ENSURE THE RIGHT SKILL SETS ARE IN PLACE.
Once a vendor has been selected, take advantage of their online training programs to develop the skill sets required to support the migration project. Don't forget to include training on the tools that will be used to orchestrate deployments and monitor them.

5 **OUTLINE AND SHARE A CLEAR CLOUD GOVERNANCE MODEL.**
There is no harm in developing cloud governance policies before the proof of concept stage—even though they may be amended after the trial runs. Applying cloud governance policies to on-premises activities will prepare users in advance for the rules they will have to follow once workloads are in the cloud.

6 **DEVELOP A TIMEFRAME FOR PROOF OF CONCEPT TRIAL RUNS.**
Preparing, executing, and evaluating proof of concept trial runs can be time-consuming and push up non-platform operational costs and costs associated with external advice/support if they don't go to plan. Developing a timeframe that anticipates potential delays can help meet migration budgets.

7 **ADJUST THE CLOUD MIGRATION STRATEGY AS NECESSARY.**
Part of the Cloud Business Office's role is to develop a cloud migration strategy—but the strategy needs to be flexible to allow for changes to be made as issues develop and solutions are scoped. Just as the cloud is always evolving, so should your business's cloud migration strategy.

8 **RIGHTSIZE ON-PREMISES WORKLOADS BEFORE DEPLOYING THEM IN THE CLOUD.**
Rightsizing on-premises workloads before deploying them in the cloud not only saves having to rightsize them retrospectively, but also means your business is minimizing its cloud bill from Day 1. By using VAST's migration assessment, you can accurately map out your new cloud footprint in advance.

9 **RECALCULATE TCO AND MODEL OUT THE MIGRATION.**
Usually one of the first exercises performed by the Cloud Business Office is to determine the Total Cost of Ownership; but most businesses miscalculate TCO or, more likely, fail to take into account changes they have made to their cloud migration strategies during test phases.

10 **MONITOR EVERYTHING.**
If there are discrepancies between estimated cost and performance, and actual cost and performance, work out how these discrepancies have occurred before moving forward. Clear communication between the Cloud Business Office and the C-Suite will be crucial during the final stages of migration.

HOW TO MANAGE YOUR CLOUD ENVIRONMENT AFTER MIGRATION

Unless your cloud migration strategy involves a transition to be 100% in the cloud, your business will be operating in a hybrid cloud environment with some degree of integration between cloud-based resources and on-premises resources. This has the advantages of increasing agility, accelerating innovation, and reducing costs, but also brings along a fair amount of challenges.

Few cloud-native management tools (i.e. those supplied by cloud service providers) have the capabilities to provide total visibility across both your cloud environment and on-premises infrastructure. This can create problems with regards to monitoring utilization and costs, for example when businesses need to know which departments are consuming cloud resources in order to identify the cause of unexpected cost increases.

Without accurate information, businesses also lack the data for making informed decisions about whether to deploy more resources in the cloud or transition workloads back onto on-premises infrastructure. Consequently, you might be unable to tell whether the objectives of migrating to the cloud are being met.

USING **VAST View**™
TO STAY IN CONTROL

We've discussed how VAST's migration assessment can help businesses model workloads suitable for migration and accurately map out a new cloud footprint, as well as provide total visibility across multiple and/or hybrid clouds simultaneously.

With **VAST View™**, businesses can also easily identify optimization opportunities. As an example, VAST can make recommendations for purchasing, modifying, or exchanging committed use discounts (i.e. AWS Reserved Instances) and manage the discount programs throughout their life cycles.

Using the platform's policy-driven automation capabilities, businesses can enforce cloud governance policies by configuring VAST with the policies' parameters. VAST will flag violations or take remediation actions—such as terminating resources or revoking user access—based on how the platform has been configured.

VAST provides accountability and gives key departments more predictability and insight into near-future cloud costs. The platform not only helps businesses stay in control of their hybrid and multicloudenvironments but also allows them to plan for the future with confidence.

Learn more by visiting **www.vastITservices.com**

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