virtana

The Complete Cloud Migration Planner

MIGRATE

It's go time

If your organization is a typical large enterprise, you'll have hundreds to thousands of active applications—from the most straightforward internal file-sharing tool to your mission-critical internal and customer-facing workloads. And, the chances are that your organization is already in the cloud. Perhaps your business units leverage Google Office or Microsoft Office 365 for collaboration and productivity. Or your sales organization is built around a software-as-a-service (SaaS) offering such as Salesforce.com. Or your developers are using hosted platforms such as Confluence or Jira. Or some of your newest applications are delivered on Pivotal platform-as-a-service (PaaS) or using a cloud infrastructure-as-a-service (IaaS) infrastructure.

But now it's time for the heavy lifting. Your organization is no longer opportunistically adding cloud applications and infrastructure for new projects and services. You are in the midst of a serious digital transformation effort that will alter and renew your organizational model as well as your operations, services, and product delivery.

The average enterprise with 100,000 employees has between 1,500 and 3,000 applications, which means that migrating to the cloud is going to be a process that takes place over a long time frame—one that has to be staged, planned, and managed.

This raises many questions:

- How do you evaluate what you should keep on premises?

- What should you pick up and move to the cloud?

- When should you replace a service with a SaaS application?

- When should you rewrite completely to use cloud services?

- When should you extend a mission-critical application to use cloud resources?

- Is private cloud an element that makes sense for your applications and organization?

THIS PLANNER WILL HELP YOU ASK THE RIGHT QUESTIONS, AVOID COMMON PITFALLS, AND GUIDE YOU THROUGH THE PROCESS FROM PLANNING TO EXECUTION AND BEYOND.

How to use this guide

This guide is broken into four sections that align with the cloud migration journey:

1

Cloud Basics

Provides an introduction to terminology and concepts you need to understand as you embark on this journey.

2

Planning Your Migration

Offers guidance to help you do the up-front work to ensure your cloud migration is a success.

3

Key Steps in the Migration Process

Delivers insights about the migration itself.

4

After You Migrate

Covers key considerations to bear in mind after you complete the migration.

This e-book is meant to be a helpful resource and does not need to be read cover to cover. Feel free to dip in and out of chapters based on where you are in the process and what kind of help you're looking for.

Contents

Cloud Basics

A primer of cloud terms and concepts

Just as with any technology, the cloud comes with its own lingo. While this is not an exhaustive list, here is a guide to some of the most common concepts you need to understand.

CLOUD BURSTING

This refers to adding cloud resources to an application when load increases, most often as it relates to hybrid applications. In these instances, additional resources are added in the cloud. This avoids the need to pay constantly for the resources that you'll only need to handle a 99% load scenario; if your typical application loading is much lower than your maximum, this results in substantial savings. It's one of the first reasons that most mission-critical applications are extended to cloud resources.

HYBRID CLOUD

Refers primarily to implementations that include both data center/private cloud and public cloud components, primarily with IaaS, but also with additional cloud services.

INFRASTRUCTURE-AS-A-SERVICE (IaaS)

Cloud service providers (CSPs) offering "infrastructure" services typically start with traditional compute, network, and storage. Although they can be thought of as virtual data centers in a box, these services have rich sets of tailored offerings to support specific technologies and capabilities. Top-tier IaaS providers often offer SaaS and PaaS solutions as well. Sometimes referred to as "private cloud," some allow the deployment of cloud offerings locally (in the form of physical cloud infrastructure) in a customer's data center, hosted environment, or co-location provider's facility.

Cloud Basics

A primer of cloud terms and concepts

MULTI-CLOUD

An application environment that relies on more than one public cloud provider. While a multi-cloud deployment can refer to any implementation of multiple software as a service (SaaS) or platform as a service (PaaS) cloud offerings, today, it generally refers to a mix of public (IaaS) environments, such as Amazon Web Services and Microsoft Azure.

PLATFORM-AS-A-SERVICE (PaaS)

PaaS is sometimes now referred to as "serverless" computing. PaaS providers offer full environments for building applications for developers who don't require visibility into the underlying virtualization, compute, storage, and networking environments. Developers choose and knit together solutions from available components, and may also have the option to bring their own. Many current PaaS platforms are Kubernetes/container-based.

PUBLIC CLOUD SITES/ AVAILABILITY ZONES/REGIONS

Major public cloud providers often make their services available in multiple physical locations. Common drivers include application response time, options for disaster recovery, risk, and regulatory requirements. You'll see a variety of names, as cloud providers often use their own terminology for these capabilities.

Cloud Basics

A primer of cloud terms and concepts

RESERVATIONS

If you are aware of periodic changes in loading for an IaaS-deployed cloud application, you can save money by planning ahead and reserving resources in advance for a period of time.

SCALE-UP AND SCALE-OUT

Two primary models are used for adding more resources to a cloud or virtualized application in IaaS (and sometimes PaaS) environments. **Scale-up** refers to adding more resources to an existing instance (more CPUs to a VM, more networking bandwidth, etc.), while **scale-out** refers to adding more instances of the same size and type to add capacity. Think of scale-out as the same type of action you'd perform with a load-balancer for a traditional three-tier web application that will spin up more web servers to the front end when needed, but applied to any element of a cloud application's infrastructure.

SOFTWARE-AS-A-SERVICE (SaaS)

This term applies to cloud-delivered services offered as a "black box" to organizations over network connections. Offerings range from simple conferencing and file sharing to highly complex HR, enterprise resource planning (ERP), and sophisticated sales management systems. Organizations typically consume only the service and have little to no visibility into underlying infrastructure, deployment models, physical locations, or security stances, though there are, of course, exceptions to the rule.

Cloud Basics

A note on the cloud security shared responsibility model

		Infrastructure as a Service (IaaS)	Platform as a Service (PaaS)	Software as a Service (SaaS)
	Data	🔒	🔒	🔒
Customer Responsibility	Application	🔒	🔒	🔒
Provider Responsibility	Runtime	🔒	🔒	🔒
	Middleware	🔒	🔒	🔒
	O/S	🔒	🔒	🔒
	Virtualization	🔒	🔒	🔒
	Servers	🔒	🔒	🔒
	Storage	🔒	🔒	🔒
	Networking	🔒	🔒	🔒

In each of the three cloud deployment models (IaaS, PaaS, SaaS) there is less control by customers of the IT and physical security compared to the traditional on-premises model, but this doesn't mean that the cloud provider is responsible for all elements of security. It's a shared model where customers are responsible for some portion of the IT security stance, and the cloud provider is responsible for others. The following diagram provides a typical split of duties between the cloud provider and customer, but there are large variations.

If your organization has heavy regulatory and compliance requirements, financial data, critical intellectual property to protect, or just has high uptime requirements, you should familiarize yourself with the Cloud Security Alliance (CSA) guidelines before selecting cloud provider partners or making more extensive use of cloud services.

Cloud Basics

Cloud migration options

Cloud migration isn't a single process. Here are five common approaches for migrating existing on-premises applications to the cloud.

Lift and shift: Pick it up and move it to the cloud

Occasionally referred to as "rehosting," this is the easiest of the cloud migration scenarios to recognize. In this case, an existing application workload, often including multiple dependent workloads, is captured from a set of physical or virtual servers and redeployed within a cloud or multi-cloud environment. As the name implies, the application is picked up and moved over largely as is.

Extend: Modify to add some cloud capabilities

This option is frequently undertaken for mission-critical applications. In this approach, an existing application workload is "extended" to leverage cloud service resources, most often IaaS. The business benefit gained is the scalability and cost-efficiency of the application, as cloud resources support "burst" modes when the load increases precipitately on either a periodically predictable basis or as the result of an unexpected event. Costs can decrease when applications no longer need dedicated infrastructure to support a maximum load at all times, while scale is delivered through cloud infrastructure for higher loading events. Often the qualifying event for determining application suitability for extending to the cloud is the need for high-speed transaction processing at the lowest layers of the application stack to support the existing architecture. Keep in mind that this is a direct extension of the underlying application infrastructure, and doesn't imply replacement with newer cloud-native technologies such as serverless computing or containers and Kubernetes.

Cloud optimized: Application alterations to use cloud services

This cloud migration option is sometimes an "all in cloud" deployment and sometimes a "hybrid" deployment (mixing cloud and on-premises resources). It differs from the extend scenario by leveraging cloud resources beyond simple compute and storage. An existing application is rearchitected and partially rewritten to take advantage of additional cloud service resources such as artificial intelligence (AI) and machine learning (ML) capabilities, cloud-deployed containers/Kubernetes, and other offerings while retaining the application core as-is either on premises or in a public/private cloud deployment.

Cloud native: Complete replacement of an application

In this cloud migration approach, an application workload is replaced by a new cloud-native application. It is rewritten and redeployed to extensively leverage PaaS and serverless computing options. Kubernetes, containers, and PaaS environments, as well as the full gamut of available cloud services deliver the services of the legacy application that are optimized for cloud delivery and cost structures and are capable of supporting the business with extensive new capabilities.

Cloud Basics

Cloud migration options

Replace with SaaS

In many cases, once you've assessed an existing internal application, you may find that its functions are replaceable with a SaaS offering. This is an excellent option for applications that are not core to an organization's success. HR, billing, salesforce management, and other functions are required for organizational success but don't merit the same level of attention as applications that can make or break your organization's competitive stance and future.

There is one more option you should consider as you assess your applications, and that's not migrating an application at all. We'll touch on this in later sections of this guide.

Cloud Basics

Benefits of the cloud

1. Cost savings

OPEX VS. CAPEX: Organizations can transition from a capital-expense to an operating-expense model. There are pluses and minuses to each for tax and accounting purposes, but the use of pay-as-you-go models shifts many basic infrastructure and/or application costs to the cloud provider. There is considerable variation by the model used (SaaS, PaaS, or IaaS/hybrid deployments), but each reduces portions of the up-front costs of acquiring, architecting, and deploying new applications. This reduces the need for up-front capital equipment and software, which can result in net positive cash savings.

PAY ONLY FOR THE INFRASTRUCTURE YOU USE: With an internally deployed application, infrastructure and resources are often sized to be able to support the highest load level required. Often, these maximum loads only occur for short durations, for example, a Black-Friday scenario for a retailer, or the "Monday morning surge" for an internal email server. This can result in a large set of resources that are idle 99% of the time. Properly architected and deployed cloud or hybrid applications consume resources only as they are needed, resulting in substantial cost savings.

DECREASED DATA CENTER AND UTILITY COSTS: Rather than having to own the infrastructure to support every application needed across an enterprise, organizations can now concentrate on their mission-critical infrastructure that unique value or otherwise the business. Regulatory or performance requirements often drive needs for some portion of infrastructure to be placed in local data centers or hosting facilities. Even with these considerations, transitioning to the cloud results in decreased facility and utility costs as responsibility for major portions of infrastructure is shifted to the cloud services provider.

REDUCED MAINTENANCE AND MANAGEMENT COSTS WITH SAAS: Leveraging a SaaS application rather than deploying off-the-shelf software can result in savings by offloading the vast majority of maintenance and management tasks. Some SaaS applications also offer integration with your directory services or single sign-on environments, allowing them to be added automatically to employee onboarding, re-classification of roles, or terminations.

CONCENTRATE CRITICAL RESOURCES ON YOUR ESSENTIAL BUSINESS GOALS AND COMPETENCIES: Completely replacing an in-house application that isn't part of your organization's core business offering or value-add with a cloud-based service, usually SaaS, can not only save money but also free up internal technical resources to focus on more critical projects.

Cloud Basics

Benefits of the cloud

2. Enabling new business models

Cloud migration is a critical enabler of your digital transformation initiatives by enabling new business models. Examples are numerous and can be market- or product-specific, but here are a few examples:

- Manufacturers can gain direct access to their customers as opposed to third-party distribution systems, or directly link to their supply chain with live AI-based forecasting models.

- Government agencies can offer services online instead of through physical means or outdated green-screen-compatible models.

- Retailers can track and suggest content based on customer preferences through cloud-based AI and analytics resources.

- Companies can develop integrations between cloud services to enhance the capabilities of their mission-critical offerings. Examples include accounting, CRM, and AI/ML.

- Organizations can gain operational advantages by enabling more collaboration, better options for remote working, and enhanced application uptime, as well as new functional and business unit structures.

3. Improved customer experiences

For some organizations, the most significant transformational change is to improve the customer experience. Cloud migration supports digital transformation by enabling personalized customer experiences for every user—to speed service, improve information, and better serve individual interests of users.

4. Increased business flexibility

When applications were all concentrated in data centers, the requirement-to-deployment time frame for new applications or services could be quite long. Even requests for an existing application from a known vendor with limited dependencies required ordering hardware, negotiating and buying the underlying software licenses, implementing network and management tools, testing, and deploying—which could take months for initial implementation. Even expanding capacity could be a significant time sink requiring weeks to months. But SaaS applications can be immediately available, and new versions of in-house applications adapted, deployed, and scaled as required. Plus, applications developed in-house can expand capacity when needed from cloud-based resources. As a result, enhancements to existing applications, digital experiences, and offerings can be quickly implemented by extending them to embrace cloud resources, or new cloud-native replacement applications more quickly built and deployed.
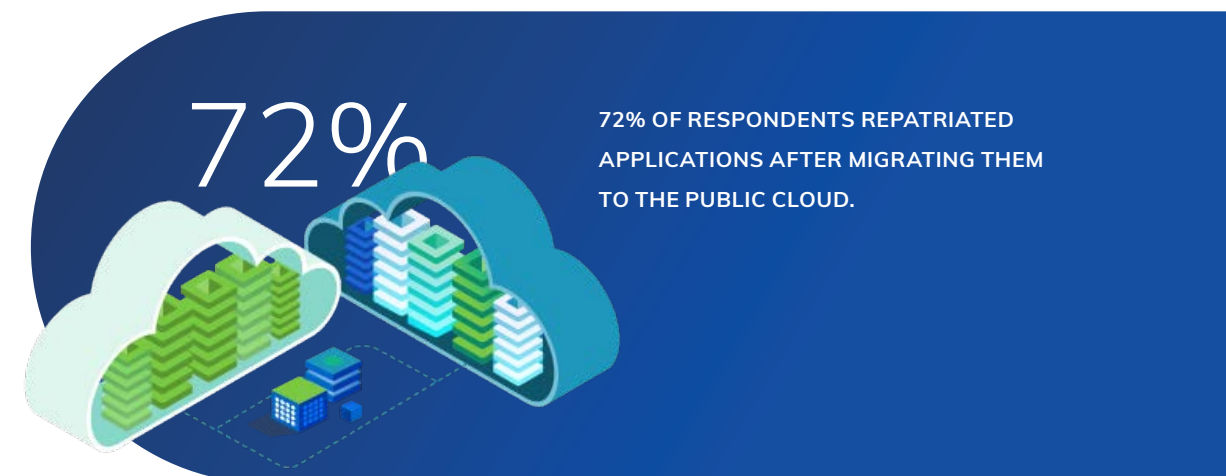
Cloud Basics

A note on repatriation

Cloud migration is, more often than not, perceived as a one-way street where organizations migrate applications and workloads from on-premises to a public cloud, or less often, from one public cloud to another. But a key finding in our recent State of Hybrid Cloud survey of 350 IT professionals with cloud decision influence/authority is that a whopping 72% of participating organizations stated that they've had to move applications back on-premises after migrating them to the public cloud. Such repatriation doesn't necessarily mean there's an issue, but cloud migrations require a lot of time and effort, neither of which most IT groups possess. When you have more than just a handful of cases doing this—and three-quarters of respondents is a significant number—it raises some eyebrows. It's important to distinguish between a strategic repatriation undertaken to support evolving business needs and a rollback to undo challenges that are caused by inadequate migration planning.

It turns out that there's not just one thing driving disruptive (i.e., not strategic and purposeful) repatriation. Respondents cited various issues, including:

- Migration of applications that should have stayed on-premises (41%)

- Technical issues with provisioning for the public cloud (36%)

- Application performance degradation (29%)

- Wrong public cloud provider selection (21%)

- Unexpected costs (20%)

In fact, one-third of the respondents cited two or more reasons for the rollback, and 12% experienced three or more. This doesn't have to happen. Here's how you can avoid these costly and disruptive cloud migration mistakes.

72%

72% OF RESPONDENTS REPATRIATED APPLICATIONS AFTER MIGRATING THEM TO THE PUBLIC CLOUD.

Cloud Basics

A note on repatriation

How to avoid migrating applications that should stay on-premises

Not every workload should be migrated to a public cloud, which is why many organizations opt for a hybrid cloud approach, keeping some part of their estate on-premises. You need to consider various attributes of different workloads—e.g., data, back end, privacy and security requirements—and their inherent suitability for a public cloud environment (several examples are explored in more detail in the "Understanding what not to migrate" section that follows). You also need to have clear goals and priorities so you can make the best decision to support your business needs—and you must communicate those objectives and decisions with everyone involved in the cloud migration process. Finally, you should understand the detailed health, utilization, and performance characteristics of your workloads in the data center. This baseline provides critical information to help you make migrate-or-stay decisions.

How to avoid technical issues with public cloud provisioning

The technical challenges of public cloud provisioning are due in no small part to the sheer number of configuration options available. Added to that is the fact that most of the guidance available focuses primarily on CPU utilization. While important, it's not the only factor to consider. You must also take other computing dimensions—such as memory usage, IOPS, and network bandwidth—into account. Additionally, you may have certain conditions that need to be factored in, such as pre-paid reservation commitments or certain types of VMs you

want to avoid, to name just two examples. All of these puzzle pieces have to fit together and if they don't, you're going to run into problems. You can head this off at the pass with an automated recommendation engine that looks at all the critical dimensions of your workloads over time, within constraints that you set, to provide you with a manageable short list of configurations. From there, you can perform what-if analysis to find the optimal combination. When it comes time for provisioning, you'll have a no-surprises process.

How to avoid application performance degradation in the cloud

Any benefits you gain by moving applications to the cloud are outstripped if performance slows to an unacceptable level. To prevent this from happening, you first need to create a baseline of on-premises performance, and model representative workloads in your public cloud configurations—before any migration work begins. Baselines are critical because they provide a reference point for comparing workload utilization and performance in the cloud. You need to ensure your baselines reflect any seasonality to give you the most complete view of the health, utilization, and performance characteristics of your workloads in your on-premises infrastructure. Then after you've moved your applications to the target cloud, you must optimize them to keep it rightsized for performance and cost.

Cloud Basics

A note on repatriation

How to avoid selecting the wrong public cloud provider for your needs

Cloud providers are not all the same, and picking the wrong one could be an expensive and disruptive mistake. You may have specific requirements to help you narrow the list of potential providers, but how do you make an apples-to-apples comparison to ultimately select the provider who will deliver the best performance at the lowest cost? The key is the advice of an automated recommendation engine, as described previously, to build the list of comparable configurations for each provider, and then "play back" those workloads before making any commitments.

How to avoid unexpected public cloud costs

No one wants a nasty surprise in their end-of-month cloud bill, but it happens all the time. Whether due to an unplanned surge or an accumulation of workload shifts over time, you want to understand potentially costly changes before they bust your budget. To do this, you need visibility to see potential problems before they add up, along with ongoing cloud optimization capabilities to safely adjust resources to save on your bill without risking performance.

Cloud Basics

Cloud readiness checklist

Think you're ready to migrate to the cloud? If you can't answer all the following questions with a resounding "Yes," then you've still got some work.

Have you vetted your migration approach?

There's more than one path to get your applications to the cloud (see "Cloud migration options" above). Lift and shift, where you pick up your application as is and move it to the cloud, is just one approach. Others include extend (modify an existing application to add cloud capabilities), cloud optimized (use new front-end technology, such as Kubernetes/containers, to make greater use of cloud resources and environments), cloud native (completely rewrite an application to fully exploit cloud technologies and resources), and replace with SaaS (instead of migrating, swap it out for a SaaS option—not a migration, strictly speaking, but a viable option nonetheless). There's no objectively right or wrong approach. Each has its place, and it's important to understand the optimal approach based on the characteristics of your applications and organizational objectives.

Do you have a clear understanding of which workloads to migrate and which to keep in the data center?

There's one additional option when it comes to migrating applications or workloads—you don't. The fact is, not all workloads are well suited for the cloud. There could be any number of reasons not to migrate, including data sensitivity, massive or massively growing data volumes, high transaction-speed requirements, or mainframe back ends, to name just a few. If you haven't assessed your workloads

based on key considerations, you could make suboptimal decisions that will have a long-term impact on your effectiveness and ROI.

Do you have a clear handle on all the dependencies of your workloads?

Enterprise applications are complex, with many interdependencies among application, compute, networking, and storage resources. Missed dependencies can lead to broken applications, outages, and other headaches. Before you move, you need a full workload inventory that includes complete application dependency maps. This enables you to fully assess the impact of your cloud migration and gives you the information necessary to identify and reduce risk.

Have you evaluated your cloud provider service options in a meaningful way (other than price)?

Price points are tempting barometers. When it comes to the cloud, there are so many configuration options, each with their own nuances, it can be challenging to evaluate them. Price becomes a "tangible" factor to grab onto. Of course, cost is important, but it's not. You need to be able to assess your cloud options in terms of both cost and risk. Here's an example: Option A is cheaper by a couple hundred dollars and comes with a certain threshold that could create

Cloud Basics

Cloud readiness checklist

performance bottlenecks or downtime. Option B is more expensive, but you eliminate the risks that could potentially cost thousands and hurt your reputation. There's no one correct answer—it depends on your organization's individual goals and risk profile. But you need a way to evaluate that cost/risk trade-off.

Can you handle the large number of diverse workloads to be migrated?

You need to distill hundreds, or even thousands, of workloads into a small set of representative workloads. From there, you can analyze these "synthetic" workloads to characterize performance. This will help you create candidate cloud configurations and construct your move groups.

Do you know what configurations to use for your migrated workloads?

What worked on-premises isn't necessarily what will work best in the cloud. If you're planning to simply replicate your CPU, memory, network, and storage configurations, you could end up with suboptimal selections. You need to be able to rightsize each migrated workload to ensure you're setting yourself up to be fully cloud-optimized.

Can you confirm with confidence that your application(s) will perform as expected in the public cloud?

Once you have your synthetic workloads and candidate cloud configurations, you need to be able to model them. This "playback" enables you to verify performance, tune your configuration, and understand all related costs before financially committing to a particular configuration.

Do you understand the impact future changes could have on performance and cost?

You can't plan for unplanned changes—by definition—but you should understand where the stress points are in your infrastructure. Workload monitoring and analysis will tell you how much buffer you have before an SLA-killing breaking point. Plus, you'll have a better grasp on where tolerances and potential bottlenecks exist so you're better prepared when the unexpected does happen. If you need to make changes at that point, you'll also have clear data that demonstrates business impact, which can help expedite the process within your organization to quickly purchase and deploy additional resources.

Cloud Basics

Cloud readiness checklist

Do you know what you don't know?

According to LinkedIn, cloud computing was the #2 most in-demand hard skill globally in 2020. There's clearly an immense demand for organizations to bring cloud expertise on board. But given the ongoing shortage of tech talent, many of these positions may be going unfilled, leaving a big gap in institutional know-how. It's impossible to get all the critical answers you need if you don't even know which questions to ask. There simply is no substitute for been-there-done-that skills and experience. If you don't want to learn lessons the hard way, you'll want to work with a partner who can guide you every step of the way.

Cloud readiness checklist

☑ Have you vetted your migration approach?

☑ Do you have a clear understanding of which workloads to migrate and which to keep in the data center?

☑ Do you have a clear handle on all the dependencies of your workloads?

☑ Have you evaluated your cloud provider service options in a meaningful way (other than price)?

☑ Can you handle the large number of diverse workloads to be migrated?

☑ Do you know what configurations to use for your migrated workloads?

☑ Can you confirm with confidence that your application(s) will perform as expected in the public cloud?

☑ Do you understand the impact future changes could have on performance and cost?

☑ Do you know what you don't know?

Planning Your Migration

Cloud migration is a complex process. The more up-front planning you put into it, the more likely you'll be able to avoid challenges and setbacks during execution.

This section provides guidance on how to set your migration up for success.

Planning Your Migration

Setting cloud migration goals and priorities

Identify the executive sponsor(s)

It's imperative to have a strong executive sponsor or set of sponsors. Trying to drive a cloud migration solely from IT operations, services, or development is a recipe for failure. Successful cloud migration initiatives need buy-in from key leaders who understand the priority and business context of the change. These leaders need to be aware of and support the resulting changes since digital transformation through cloud migration will result in substantial changes to roles, processes, and operations throughout the organization. Even if IT operations or development are the leading edge of the spear to get these changes underway, an executive sponsor needs to be seen as the principal focal point, and the owner for the desired business outcomes.

Identify specific, measurable goals

For most organizations, goals fall into a few simple categories: reduce costs, enable entry into a new market or use of a new business model, improve customer experience, or increase agility to adapt to market and business changes. Often, more than one of these can be on the list. For example, if cost savings is the critical measure, understand the organization's goals in terms of amount and scope. Similarly, if the goal is to radically enhance an existing application's capabilities, an explicit set of requirements is needed. It's also important to ensure you consider candidates for initial cloud migration in terms of how they meet the intersection of business priority, budget/resource availability, and suitability for transition.

Iterate

You'll need to reevaluate your goals once you've assessed your applications and what your organization is capable of, but a first pass should tell you what your executive sponsors and critical stakeholders have in mind. Do, however, set the expectation that you'll be revisiting this first pass again once you have a better idea of how to move forward.

Additionally, plan for adjustments after your first cloud migration deployments, so that you can incorporate what you've learned into the plan.

Planning Your Migration

Setting cloud migration goals and priorities

Goal-setting dos and don'ts

Again, you need to identify and quantify an explicit set of goals that includes details of what the business can expect as a result of the migration effort. At a minimum, identify the business drivers for your cloud migration, and if multiple applications are to be migrated, the priorities. Here's an example of a flawed goal set. Don't settle for one of these:

XYZ CORPORATION CLOUD MIGRATION GOALS

Transition 80% plus of of our current internal applications to the cloud to reduce cost and overhead while improving load times, increasing transaction speeds, as well as improving scalability, service levels and uptime

Enhance our existing partner-only financial assessment profiling application into "UltimateResource.com" to enter consumer and extended B2B markets

☑ Reduce cost

☑ Enable new business model

☑ Improve customer experience

☐ Drive business flexibility

What's missing from this initial plan? Not just measurable goals for "cost savings," but also some gauge of the scope of savings expected (was the executive sponsor thinking 2%? 20%? 80%?), and the priorities of what is most important for the organization. With this assessment, it isn't clear which is the

higher priority, implementing the offering that enables a new business model or delivering cost savings. Nor are there clear dates and time frames for delivery. Let's take another cut at this goal set:

XYZ CORPORATION CLOUD MIGRATION GOALS - TAKE 2

PRIORITY 1
Enhance our existing partner-only financial assessment profiling application into "UltimateResource.com" to enter consumer and extended B2B markets within 6 months

☑ Enable new business model

PRIORITY 2
Transition 80% plus of our other applications to the cloud to reduce application costs by 50% per year over 3 years (goal) while reducing CapEx

☑ Reduce cost

Also improve load times, increase transaction speeds, as well as improve scalability, service levels and uptime

☑ Improve customer experience

In this second assessment, there are measurable goals and priorities, as well as specific target dates and time frames. This goal set allows for planning, budgeting, and setting your cloud migration strategy as the next step.
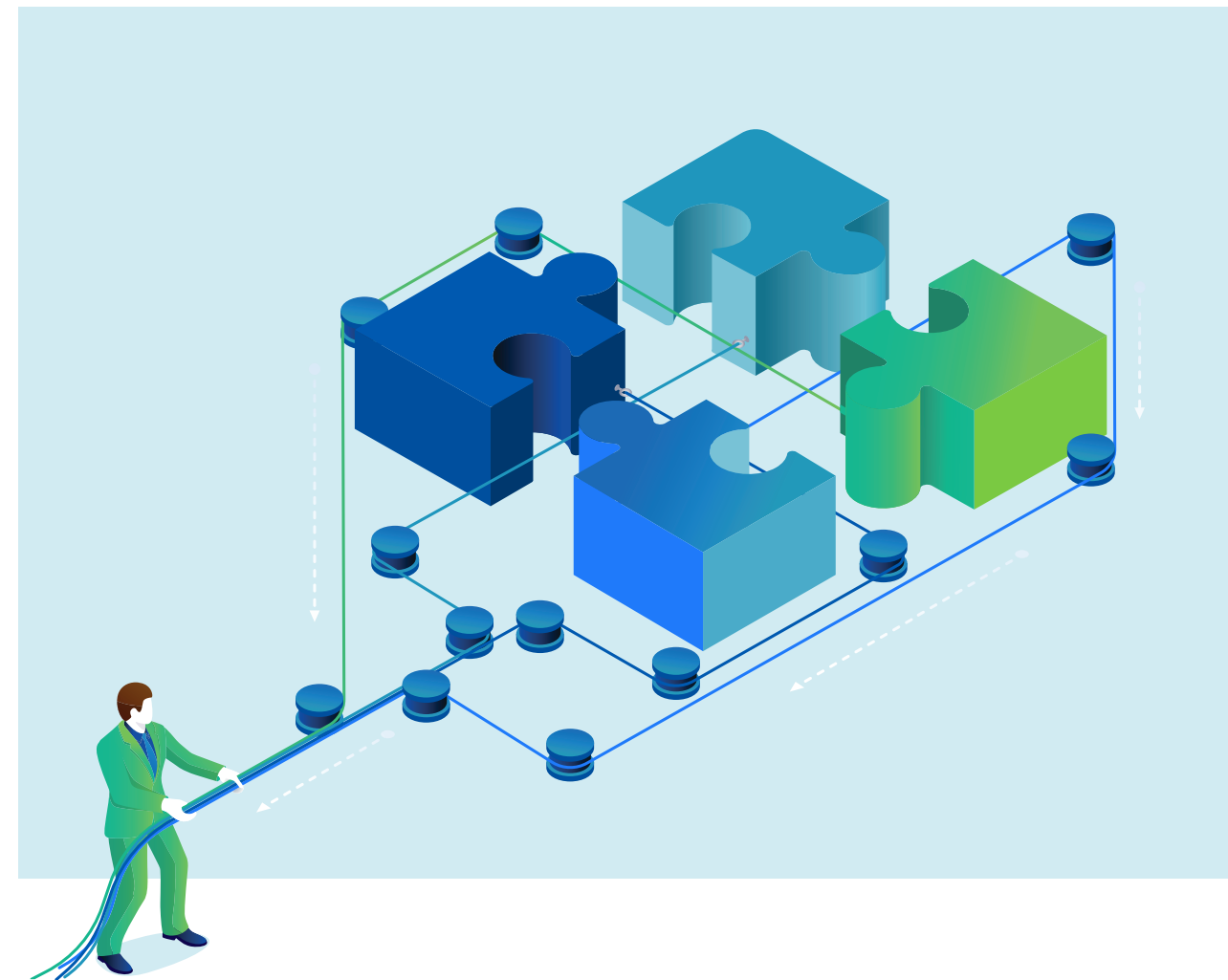
Planning Your Migration

Understanding your organization and team

You need a clear understanding of your team's skill set, training, and ability to learn and master new tasks to create a cloud migration process that will work for your organization. You'll need to understand:

- Whether the team will be able to take on the initial migration implementation and management, and then on-going management of the migrated applications, without significant changes.

- Whether your team is ready to learn and make the leap to master new skills for assessment, strategy-setting, and deployment.

- Even if your team already has all the right skills and capabilities, whether resource loadings must be adjusted (with the right trade-offs) to undertake a significant new project or project set.

Once you have a clear understanding of your team's capabilities, available time, and tools, you'll be ready to make a call about whether outside resources are required. The next consideration is if the scope of work needed justifies new resources, it's time to engage a third party to bridge gaps, or some combination to achieve a successful result.

Planning Your Migration

Assessing your applications

Once you understand the different migration approaches and know your organization's goals and priorities, the next step is to assess the high-priority application workloads for migration and the best deployment model to target for those workloads. To do this, you need to have a clear view of what your application workloads are, their underlying infrastructure, dependencies, regulatory environment, availability, and service requirements. This assessment then enables you to identify the best disposition of the services these applications deliver.

Assessing workloads is a complex task. You don't need a complete assessment for all your priority workloads to complete your initial cloud migration strategy, but you do need to understand the basics. Here are the essential characteristics that you'll need to evaluate your priority applications for:

STRATEGIC VALUE OF THE APPLICATION

Is it an element of your key differentiation or go-to-market? Or is it an internal service function only? (Hint—Spend the resources on your key differentiation and customer experiences. When an application isn't one of these, focus on reducing cost or offloading delivery wherever possible.)

APPLICATION CUSTOMIZATION (IF SAAS MAY REPLACE COMMERCIAL SOFTWARE)

For applications delivering internally focused services, what customizations beyond generic off-the-shelf capabilities do you need? Heavy customization requirements can make even a generic function such as order fulfillment software difficult to replace with a SaaS offering.

REGULATORY AND PRIVACY REQUIREMENTS

Regulations such as GDPR in the European Union and the California Consumer Privacy Act (CCPA) often require specific information safeguards that can create challenges for applications that use these data sets via cloud-based services or delivery. Financial and healthcare organizations also have myriad requirements to meet, which can directly affect cloud migration.

PERFORMANCE REQUIREMENTS

For a mission-critical application, are there significant performance requirements for transactions and database access? It can be difficult to meet some of these without a complete application rewrite for a cloud environment. Instead, consider as your first step a hybrid deployment with key storage resources remaining in existing data centers or hosted sites. Storage performance and volume are a key part of this evaluation, and often the primary determiners here. Even for applications you plan to transition to SaaS delivery, performance requirements should be a part of the vendor evaluation process.

STAKEHOLDERS

Who are the critical stakeholders for the application? They will need to be involved in making decisions, trade-offs, and compromises required to complete the task.

Planning Your Migration

Assessing your applications

DEPENDENCIES

Discover and assess the details of your workloads' operations, resource usage, and internal or external services. Many organizations are surprised to discover the number of internal application and service dependencies for their applications. Make sure to audit this up front, or you may misjudge the scope of your migration efforts. In many cases, this discovery will identify clusters of services or applications that will need to be migrated together, also known as move groups.

SLAs AND KPIs

Understanding application SLAs and KPIs can help home in on the right migration strategy. Applications with strict, high-volume or high-speed requirements tend to be mission-critical and may be good candidates for hybrid deployments rather than all-in-cloud.

APPLICATION TRAFFIC AND VOLUME

If traffic is highly variable, with short peaks followed by extended periods of lighter loading, this is a good scenario for a hybrid extend or cloud optimized migration as it enables your organization to take advantage of cloud resources when needed while minimizing local data center or private cloud resource requirements.

WHEN CLOUD MIGRATION MEANS "PRIVATE CLOUD"

Applications with low variability but high transaction or data access volume are often best suited for migration to a private cloud (on-premises or in your hosted data center).

INFRASTRUCTURE CLOUD ZONES

Will you need to have implementations in multiple cloud zones to address regional requirements? Be sure to understand cloud vendor infrastructure zones, especially when thinking about user experience and disaster recovery.

INFRASTRUCTURE CLOUD COSTING AND SIZING

When using lift and shift, extend, or cloud optimized migration models, an assessment of your application infrastructure workload can be used to forecast your basic application needs and bursting requirements. Combine this with an analysis of cloud vendor offerings to identify the best match from their large catalogs of available instance types and services. It's best to optimize your workloads before capturing the data needed to make these selections.

Planning Your Migration

Assessing your applications

CLOUD VENDOR LOCK-IN

Migrating to cloud environments can result in vendor lock-in. If the cloud vendor's offering is heavily customized for your use (in the case of SaaS) or offers services or APIs only available on their platform, then the cost of the technical transition to another platform can be the same as a complete rewrite of the application. Data can be the stickiest piece. Once your organization has terabytes to petabytes of data within a cloud environment, just copying that data to another platform could be a years-long (and costly) effort. Although major cloud vendors will roll up a semitruck to your data center's back door to load your data in more quickly, don't expect them to help you move it out of their environment the same way.

To mitigate lock-in, consider a re-architecture of the application as part of the cloud migration that supports multi-cloud deployment. This enables vendor independence and has disaster recovery advantages, but it can limit the services that can be deployed within cloud platforms (and hence the advantage gained), and it also means that teams will have to master multiple cloud vendor tool environments.

Planning Your Migration

Understanding what **not** to migrate

Should you put everything in the cloud? The short answer is: no. A new application is no problem; you can usually develop it to be cloud-native, though there are still a few exceptions. But if you're like most companies, you have lots—hundreds or even thousands—of existing applications in your data center, and you don't have the luxury of starting over from scratch. While some of those existing applications are great candidates for migrating to the cloud, others are not. The good news is that the cloud isn't an all-or-nothing proposition. Some applications can be migrated wholesale. A few should just be kept as is. But for many, a hybrid approach—moving some but not all application components to the cloud—is appropriate. With hybrid deployment, you can benefit from the advantages of the cloud, including maintaining your uptime SLAs, while avoiding issues that could end up costing you more time, money, and effort than you bargained for. Here are five common examples where hybrid cloud will give you the best of both worlds.

Requires

The Hybrid Solution

1. **You need very high transaction speeds**
2. **You have massive data volumes**
3. **The back end is a mainframe**
4. **There are privacy and compliance concerns**
5. **Scaling isn`t budget-friendly**

Planning Your Migration

Understanding what not to migrate

1. You need very high transaction speeds in your back-end data layer.

THE CHALLENGE: Moving an entire application to the cloud can affect transaction speed, so if that speed is critical, you'll need to put in some extra effort. There are solutions available to put high-speed, enterprise-class storage into AWS and Azure, but that requires you to rearchitect and rewrite your application for all-in-cloud operation. If it's mission-critical, that's not a step that's taken lightly, or without large project expense and time.

THE HYBRID SOLUTION: In this case, you'll want to keep your data layer on premises, but move the other application layers to the cloud to get the scalability and cost advantages for those components. You may need to do a little rearchitecting, but it's nowhere near the heavy lift that would be required to support your data speed requirements in the cloud.

2. You have massive—or massively growing—data volumes.

THE CHALLENGE: When your data is measured in petabytes or exabytes, moving it from one place to another can take a very, very long time. That's why Amazon created an exabyte-scale data transfer service, called the AWS Snowmobile, where they physically bring a shipping container full of hard drives to your data center, plug in a fiber optic line to siphon off up to 100 petabytes, then truck it over to an Amazon data center where it's uploaded to S3 or Amazon Glacier. When there's that much data, no matter how you got it in, it's going to be difficult to move it. Plus, if you need to access that data frequently, you could end up with ballooning data costs that are difficult to manage and control.

THE HYBRID SOLUTION: Analysis-intensive applications that require significant compute power are better candidates to be fully moved into the cloud. But to protect your massive data sets from cloud "stickiness" and cost, consider keeping them on-premises. Even if you don't have immense volumes today, if you have data sets that grow very quickly, you could be setting yourself up for big headaches in the future. Keep massive data sets on-premises—and add scalability with cloud resources for analysis or front-end tasks.

3. The back end is a mainframe.

THE CHALLENGE: There's a reason that mainframes are still alive and well. They are the back end to a lot of well-structured and reliable mission-critical applications. They work, they're stable, and you can scale the back end—and that's probably not something you want to mess with. Which is not to say that you have to keep the entire application on-premises.

THE HYBRID SOLUTION: You can build new in-the-cloud front ends for the application—like a new web interface or mobile application—and link back to the mainframe environment. This approach enables you to easily extend the usefulness of that very predictable and secure back end, while enabling new uses for the services that it provides.

Planning Your Migration

Understanding what not to migrate

4. There are privacy and compliance concerns.

THE CHALLENGE: There's a growing body of regulations that require you to control access to your data. GDPR and CCPA are currently in force, and other U.S. states are proposing new strict privacy legislation. There are also industry-specific regulations, such as HIPAA in healthcare and PCI DSS for credit card processing. When data is the problems (and risks) of meeting these regulations are well understood, and compliance is fully under the enterprise's control—and easily demonstrated to auditors. For cloud environments, security is a shared responsibility between the cloud provider and customer, with each required to fully understand and meet their part of the security and compliance responsibilities. Regulatory compliance is possible under this model, but may be beyond the comfortable risk profile for some organizations, and require mastery of new technology controls and skills.

THE HYBRID SOLUTION: If your data is subject to stringent controls and you want to meet privacy stances and compliance requirements without having to worry about managing new exposure points in the shared security environment of the cloud, you may want to keep that back-end data on-premises. With this hybrid approach, you only need to control the encryption of the data rather than rework the entire set of security controls for the cloud environment.

5. You're looking to scale your mission-critical application without breaking the budget.

THE CHALLENGE: Demand continues to grow for the core applications that your organization depends on, resulting in a need for increased capacity. In traditional models, you'd add on-premises (or hosted) infrastructure to support the change and you'd size the additions to meet your 99.99% workload environments. This can be an expensive proposition, as your typical workloads may require only 25% to 50% of the maximum peak in demand you need to meet.

THE HYBRID SOLUTION: Move application components that can scale horizontally, such as web or application servers in a typical three-tier web application, to cloud environments, while keeping core components for data and transaction processing in their existing location on-premises. This gives your mission-critical application immediate "headroom" to scale using components that are only paid for when they are needed. The result is a more scalable application—without breaking the budget.

Planning Your Migration

Formalizing your initial strategy

Once you have a clear idea of the options available, a good understanding of your team's capabilities, documented the priorities and goals of the business, and assessed the best options for your high-priority workloads, it's time to create your initial plan with your stakeholders.

The objective is to use what you've learned to assess difficulty and scope of work to migrate these priority applications to the appropriate cloud-deployment models, and to negotiate the initial strategy and deliverables with business owners. The outcomes of that work should include a set of specific priorities, metrics, and first-round scheduling, including:

- Selection of applications for initial migration

- Profiles of the best cloud migration scenario for each application or application cluster, including critical considerations

- Initial project timelines and matrices of owners, tasks, and stakeholders based on the migration type

- First-pass recommendations for cloud vendors and services to be deployed

- Plans for supporting the migrated applications' operation once migrated

Planning Your Migration

The importance of taking a workload-centric approach

Is cloud migration a journey or a destination? That's a bit of a trick question. Let's take it in parts.

As a destination, there's no such thing as THE cloud. There are public clouds and private clouds. There's hybrid cloud and multi-cloud. There's IaaS and PaaS. In short, it can be complicated.

In terms of the journey, while cloud providers offer tools to help migrate on-premises workloads, they are often incomplete. That leaves you to create your own scripts and spreadsheets to manage the process. Plus, it's not a one-time event. In reality, the effort is repeated as more and more workloads are migrated.

You have to get both right, but that's just the start. You can't forget what happens after migration. This critical part of the story—the part where the cloud is meant to be doing its transformational thing—is too often glossed over. You've got to manage and optimize all those in-the-cloud resources and that's a whole new ballgame because the cloud, whichever version you're in, is a fundamentally different infrastructure from on premises. Your existing tools don't give you the specific visibility and capabilities you need. There are plenty of point solutions and cloud-provider tools you can add to your stack, but they don't replace your current tool set, which you still need because you'll keep some percentage of your workloads on premises for a variety of reasons. So now you've completely bifurcated your cloud and on-premises deployments—which is compounded if you use multiple public cloud providers. The resulting siloed tools, teams, and processes create complexity, eroding your agility and driving up costs. This is the exact opposite of what the cloud was supposed to deliver in the first place. The very infrastructure that was supposed to enable your transformation is now standing in its way.

It's not just the cloud itself—it's also what's IN the cloud (and not)

The cloud in its various forms gets all the attention, but really that's just your infrastructure. It's your workloads that are providing the direct business value. So, when all your processes and tools are focused on the cloud—in other words, when they're deployment-model-specific—they're missing the point.

Instead, you need to take a workload-centric approach to migrating and then managing and optimizing capacity, costs, and performance of your entire estate in a unified way regardless of location. In fact, in a recent report on tips for avoiding common mistakes, Gartner[1] advises companies to align their cloud strategy with their data center strategy, noting that "cloud strategy decisions are workload by workload." The only way you can make workload-by-workload strategy decisions, let alone ongoing optimization adjustments, is to understand both the details of your mission-critical workloads and the details of the environment they run in.

[1] Gartner, Top 10 Tips for Avoiding the Most Common Mistakes in Cloud Strategies, May 2020

Planning Your Migration

Cloud migration planning best practices cheat sheet

→ **Get clear, well defined and flexible business goals and priorities.** Make sure to quantify and understand what the business expects from your cloud migration effort and when it expects it.

→ **Identify what can and should be migrated—and what should not.** Understand the common cloud migration scenarios, and assess your application workloads to understand which cloud migration option is right for each application. This will also help you identify applications that should stay where they are, or not be replaced until they've reached a clear end-of-life.

→ **Consider rearchitecting, rewriting, or replacing applications.** You may need to create a new architecture by application or by service for applications that goes beyond lift and shift. Traditional architectures for a data center application have little in common with cloud-first applications. Containers, Kubernetes, big data, new platform environments, and specialized cloud services change the game. When extending your applications to the cloud with a hybrid model, or rewriting them to operate as standalone cloud applications, make sure to use a cloud-appropriate architecture.

→ **Meet compliance and regulatory requirements in the cloud shared responsibility model.** Make sure to understand and plan for the compliance, regulatory, and security needs in the shared responsibility model of your cloud service provider.

→ **Understand what your team can (and cannot) do.** This also includes understanding when you'll need to get outside help. Make sure to bring your team's skills up to date with what they'll need to develop or operate in the cloud. Plan for the right partners to bridge temporary gaps.

→ **Keep a handle on your cloud service costs as you migrate.** Without tools that span multiple cloud services and can help you to optimize cloud instance sizing and service use, it's easy for monthly cloud service costs to get out of hand.

→ **Set a measured, controlled, and predictable cadence for transition.** Mid-sized to larger enterprises have hundreds to thousands of applications. If your initiative is to transition these to cloud environments, you'll need to perform good up-front assessments of each application, and then set a measured, achievable pace for transition to cloud deployment environments and SaaS applications.

Planning Your Migration

Cloud migration planning best practices cheat sheet

→ **When lifting and shifting to the cloud, rightsize your application workloads before migration.** The quickest way to migrate an application to the cloud is to capture existing applications and dependent infrastructure services and move them to a cloud or hosted private cloud environment. If your assessments of applications and your organization have led you to this as a first step, be sure that you've optimized your application first.

→ **Deploy the right tools for monitoring and managing your new hybrid or all-in-cloud environment.** Your existing monitoring and management tools may not be suitable for supporting a hybrid or cloud-based application.

→ **Measure and quantify the results.** It doesn't matter what a wonderful job your team has done in migrating your applications to cloud environments if you don't have the evidence to say that the migration has made a difference. Capture costs, SLAs, uptime data, and user experience information before and after the transition to make it clear what a great job your team has delivered.

Key Steps in the Migration Process

As you get ready to migrate your workloads into the public cloud, there are a lot of steps that have to happen to ensure a smooth process that delivers on your objectives.

This section offers guidance on some of the critical activities you need to undertake to avoid unnecessary disruptions and cost.

Key Steps in the Migration Process

Performing a baseline assessment

What happens in the data center doesn't stay in the data center

Long gone are the days of siloed applications. Data and services are shared, often extensively, creating a complex web of interdependencies. What you have in the data center, including compute, networking, and storage elements—and how they are all interconnected—is critical information you need to understand before you can even begin to think about migrating anything into the cloud. The digital transformation philosophy of "move fast and break things" does not apply to migrating your mission-critical applications to the cloud. Simply "not breaking" is a low bar, however, and not enough to justify the effort and expense of migration. Once in the cloud, your workloads need to perform to expectations. That's where baselines come in.

A BASELINE ASSESSMENT PROVIDES DETAILED INFORMATION ABOUT THE HEALTH, UTILIZATION, AND PERFORMANCE CHARACTERISTICS OF YOUR WORKLOADS IN YOUR ON-PREMISES INFRASTRUCTURE.

The role of baselines in cloud migrations

A baseline assessment provides you with detailed information about the health, utilization, and performance characteristics of your on-premises infrastructure. This is critical for two reasons.

First, it identifies any potential issues that need to be addressed prior to migration. You certainly don't want any sins in your data center to be replicated in the cloud, but you also don't want to move forward with faulty assumptions. For example, if you have ongoing performance issues such as CPU contention or memory pressure due to oversubscribed hosts or virtual machines, you might presume that these performance-affecting conditions will go away once the workload is running in a scalable cloud. And they could, but you could also see a big cost jump as a result. Wouldn't you want to identify that and adjust your plan accordingly—before you incur the surprise expense?

Second, the baseline provides you with a reference point for comparing utilization and performance in the cloud. It should reflect any seasonality in the targeted workloads to ensure your post-migration deployment delivers on performance and other KPIs to support the enterprise's objectives.

The bottom line: A baseline gives you the information you need to understand how the workloads will operate in the cloud so you can make more informed decisions about your cloud configurations, and so you can actually quantify what "better" means for your transformation initiative.

Key Steps in the Migration Process

Creating move groups

You've heard that old Chinese proverb that says a journey of a thousand miles begins with a single step. It's sound advice … except if the journey you're talking about is the one from the data center to the cloud. With cloud deployment at the center of virtually any digital transformation effort, the journey itself can have a profound impact on the successful outcomes you seek at the destination. So, you have to get it right. But what does that actually mean? How do you configure your cloud instance appropriately to ensure you don't inadvertently sabotage your budget and performance targets?

This journey has multiple destinations—and a lot of baggage

For companies that plan for a 100% cloud deployment, the journey can be fairly straightforward if they're simply starting fresh with cloud-native applications. But according to IDC, that's a small minority, only 2% of companies. The vast majority—84%—will go for a hybrid approach with some portion of their IT environment (infrastructure, applications, data analytics, etc.) in the cloud and some on premises. Therein lies the challenge.

Migrating a self-contained application from on premises to the cloud would be a relatively simple proposition, except that's a rare beast nowadays. We've spent the past 20-some-odd years decoupling application functionality and detaching infrastructure layers into smaller and smaller components and services. This approach has delivered many benefits, including increased

flexibility, agility, speed to deployment, etc. If that sounds familiar, it should because these are also the reasons why companies are moving to the cloud— to turbocharge those benefits. Today, the typical enterprise has hundreds—or even thousands—of applications, infrastructure components, and service sets that are all interconnected in a complex web of dependencies.

It's not hard to spot the challenge: How do you keep stuff from breaking when you migrate some of it to the cloud? Even if you're in the small cohort that's going the all-cloud route, you still probably have to migrate some parts of your existing infrastructure. In all cases, you're not doing one massive move but accomplishing it in phases. Either way, you have to deal with this challenge.

The value of move groups

You need to understand your baselines at high fidelity and map out all the dependencies between related applications, infrastructure, and services sets. This can be a massive undertaking, making advanced analytics a must-have. But that's just the first step; the key is in figuring out what to migrate when. To do that, you also need an intelligent, prioritized plan for how you're going to address those dependencies to ensure a smooth migration. This requires advanced conversation analysis so you can construct your move groups that are targeted to move together.

Key Steps in the Migration Process

Understanding the behavior of your targeted applications and workloads in the cloud

Once you understand what's in your data center, you're in a better position to model what will happen when your targeted workloads are operating in the cloud—to validate performance and estimate costs. It starts with a cloud mapping exercise to evaluate candidate configurations and their associated costs. You want to do this with high-fidelity data to ensure the selection is rightsized for your workloads. Then you want to simulate those workloads in the targeted cloud service provider to validate, not just your configuration selections, but even your strategic approach. For example, based on the simulation, you may realize that lift and shift may not actually be appropriate for certain workloads. Uncovering that reality at this point—rather than after the workloads have been migrated—can save you significant time, money, and headaches. Determining the optimal candidate cloud configurations for your move groups will result in better performance and reduced risk both during and after your migration.
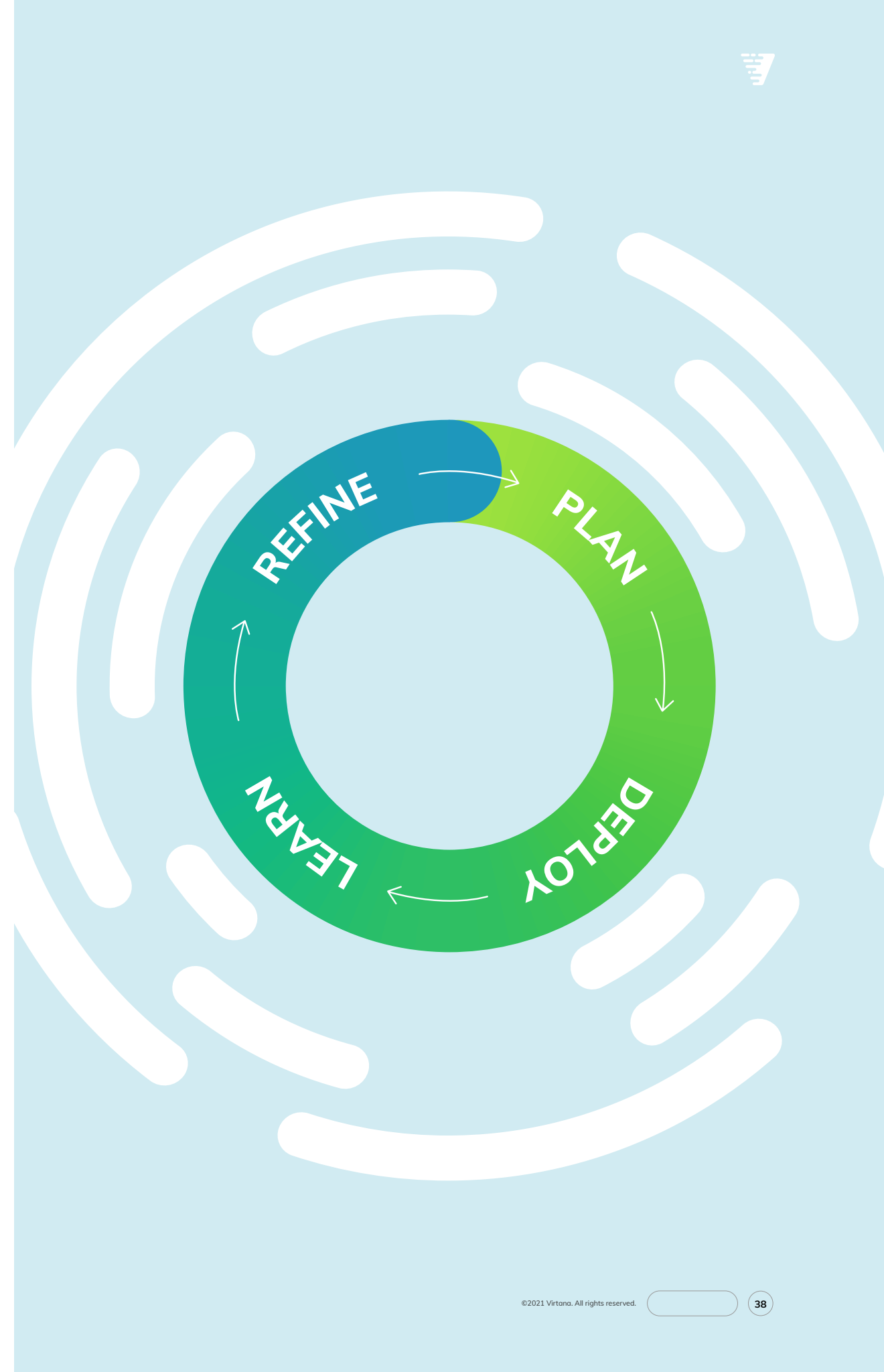
After You Migrate

When you complete your big cloud migration project, by all means celebrate, but don't party too hard. The job's not done.

This section provides guidance for what to do after your initial migration effort.

After You Migrate

Refining your strategy

It is said that no battle plan survives contact with the enemy. Once your organization has worked through your initial deployments, you'll have learned things about your own infrastructure, applications, and organizational dependencies, as well as about your cloud environment's capabilities and offerings, that you weren't aware of at the start of the process. These are all important inputs for building out a full plan that meets your organization's longer-term goals for digital transformation through cloud migration. Use what you've learned and keep moving forward.

REFINE

PLAN

DEPLOY

LEARN

After You Migrate

Becoming a "migration factory"

Digital transformation is never finished. Technology will progress. Customer expectations will evolve. The competition will advance. Your business must grow. This means that the transition to hybrid and multi-cloud is not a one-time event—it's an ongoing process. The process itself will continue to evolve as business drivers, requirements, constraints, and other factors shift with subsequent transitions.

Migration is a process, not an event

Consider the heavy lift of your initial cloud migration. How often would you like to repeat that experience? Even if you consider that additional projects won't be as wide-ranging in scope—and that you've now gained valuable cloud experience—future transitions will still be complex and time-consuming, and their success is vital to the business.

Even before the cloud, when we were living in an on-premises world, things were constantly evolving and moving. That pace of change is not only accelerating, but it's happening over a wider landscape. From on premises to public cloud, from one public cloud to another, and even from the public cloud back to on premises, workloads won't stay put—nor do they need to. But these transitions can't disrupt your infrastructure or your business functions; they've got to become simply part of the way you operate in a hybrid and multi-cloud environment. This means that the migration itself must become an efficient, smooth procedure, and it means that ongoing optimization is more important than ever.

Broaden your view of optimization

When we think of cloud optimization, we're typically referring to the process of adjusting to achieve optimal performance for the least cost, and this needs to be continually balanced. This rightsizing has to be done up front, as part of the initial migration, and on an ongoing basis. But that shouldn't happen in a vacuum, because workload utilization and other characteristics aren't the only things subject to change. This requires you to build unified visibility and tracking to manage ongoing transitions—between cloud providers, zones, and physical locations—into your standard IT operations.

Virtana Is With You Every Step Of The Way

No matter where you are in your cloud migration journey, Virtana can help.

With Virtana Platform, you can #KnowBeforeYouGo to the public cloud with a single AI-powered observability platform to migrate, control cost, optimize performance, monitor, and drive uptime for your infrastructure across data centers, private and public clouds. **Request a demo today.**
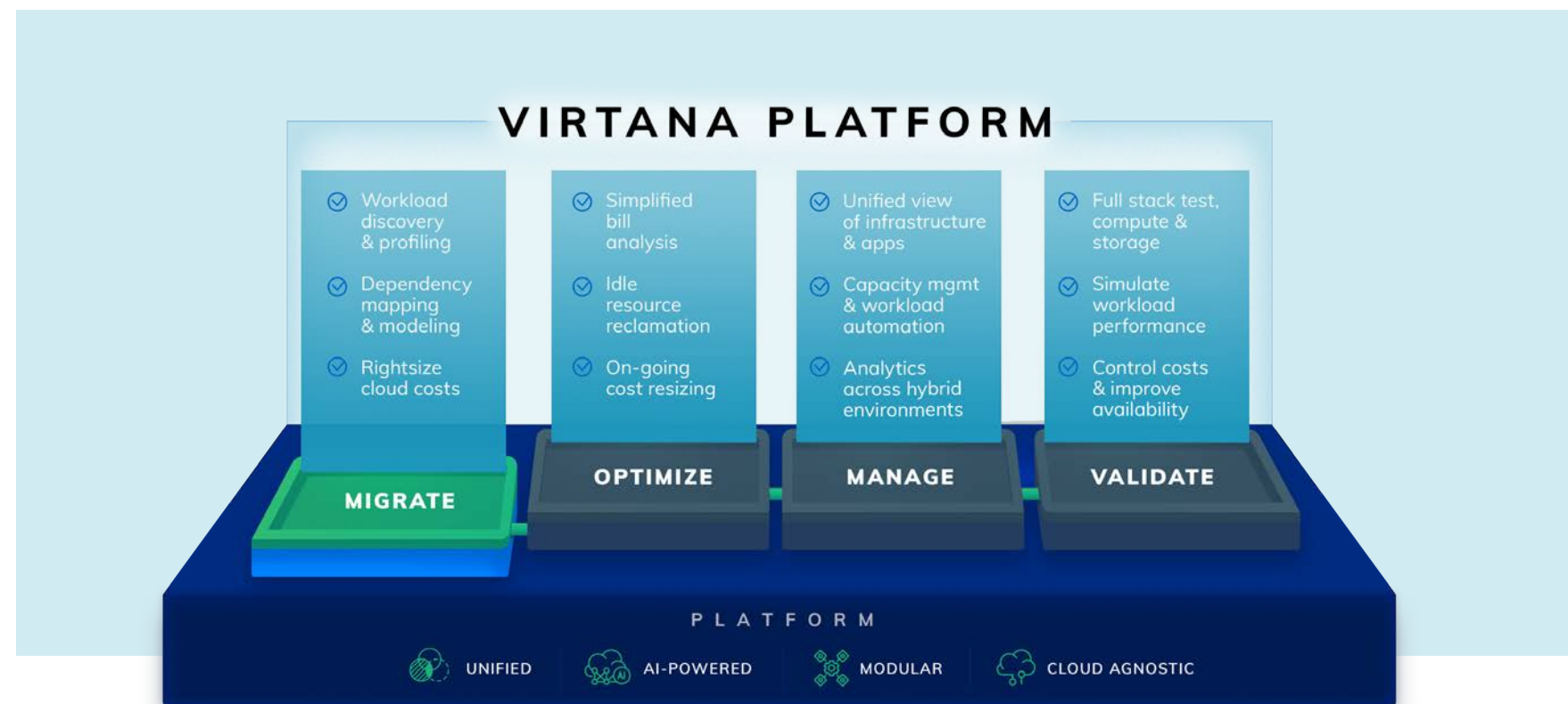
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About Virtana

Virtana delivers the industry's first unified observability platform for migrating, optimizing, and managing application workloads across public, private, hybrid, and multi-cloud environments. Using artificial intelligence for IT operations (AIOps) technologies, including machine learning and advanced data analytics, the cloud-agnostic Virtana Platform solves the most difficult challenges facing enterprises as they seek to leverage public clouds. The SaaS platform enables a "know before you go" approach by providing intelligent observability into which workloads to migrate. It also ensures that unexpected costs and performance degradation are avoided once workloads are operating in the cloud. With the Virtana Platform, enterprises can confidently speed cloud adoption and reduce cloud operating costs by simplifying management of their IT environments.

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