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Managing a VMware Cloud

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Power your cloud
operating model

Automate and govern
your cloud

Operate and optimize
your cloud



Faithe Wempen
and the VMware Cloud
Management Team

VMware Limited Edition

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Every day, we work to solve our customers' toughest challenges through disruptive technologies like edge computing, artificial intelligence, blockchain, machine learning, Kubernetes and more—to define the digital foundation that will accelerate the next wave of innovation.

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Managing a VMware Cloud

VMware Special Edition

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**for
dummies®**
A Wiley Brand

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Introduction

All companies are tech companies.

It's a bit of a worn out phrase these days, but it's worn out because it's true. Your organization can't win without quality technology. No matter what your business is, you must deliver innovation to customers as quickly as possible. And that's enabled by efficient technology.

That's the reason over 90% of companies rely on the cloud. Why? Cloud technology is service-rich, scalable, elastic, and — if used correctly — can carry some significant performance and cost advantages over a traditional infrastructure stack.

Cloud doesn't come without its challenges, however. If you've been around the IT world for a while, you know that it's not as easy as swiping a credit card and getting started. What happens if every developer in your organization decided to procure their own cloud solution? You'd have chaos!

Unfortunately, chaos is more of a reality for a lot of organizations today than most executives would admit. Their administrators lack visibility and control across the different lines of business, silos, and shadow IT operating in the wild. Plus, there's a whole slew of legacy IT that needs to be managed and maintained in the meantime.

So how do you bring this all together in a unified, cohesive approach? *That's what we're going to address in this book.* We're glad you're here!

What is VMware Cloud?

VMware Cloud is an increasingly popular approach to bringing order to this chaos. It's an approach that enables organizations to choose where applications run, who owns and maintains the cloud infrastructure, and what degree of multi-cloud they're ready for.

VMware has strategic relationships with all major hyperscale clouds — AWS, Azure, Google Cloud, IBM Cloud, Oracle Cloud — and more than 120 other VMware Cloud Verified partners around the world. This gives organizations ultimate flexibility to deploy applications wherever they choose, on the cloud provider that best fits their needs, and all leveraging consistent VMware Cloud infrastructure and operations.

The main advantage of a VMware Cloud is pretty simple — literally. It provides an integrated, flexible solution that simplifies complex environments. If you're currently dealing with a *Frankenstack* (technically *Frankenstack's Monster*) of disparate tooling, hopefully you can see why a VMware Cloud approach would be advantageous. If you prefer to go all-in with one of the hyperscalers, another solution might work better for you — and that's okay too.

Odds are though, if you're reading this book, you have some level of interest in VMware Cloud. Perhaps you are a VMware Cloud customer, are seriously considering a VMware Cloud approach, or are just curious. No matter what your reason for picking up this book, it's designed to help you understand the value to be gained through unified cloud management for a VMware Cloud. We believe that management (automation and operations) is what makes a cloud a cloud, transforms your organizational practices (for the better), and throttles the return on your cloud investment.

About This Book

We've tried to pack *Managing a VMware Cloud For Dummies* as tightly with simple, digestible information as possible. Nothing is worse than a broken promise to simplify a complex topic. The beauty of cloud is that it can seem complex — but it doesn't have to be! Not with the right people, processes, and technology. Consider this book the fourth ingredient — the user manual for putting it all together.

Foolish Assumptions

In writing *Managing a VMware Cloud For Dummies*, we've had to make some assumptions about you:

- » You're an IT influencer, decision maker, or executive.
- » You're either using, considering, or researching a VMware Cloud approach.
- » You want to maximize the value of that cloud.
- » You want your infrastructure to operate at maximum performance and speed, at the minimum cost and risk.
- » You'd like to get a better handle on the concept of *management* — especially as pertains to a VMware Cloud.

Icons Used in This Book

We've included some handy callouts to make reading easier, so take note of these as you're following along.



REMEMBER

Discover key definitions and points.



TECHNICAL
STUFF

Check out the technical details.



TIP

Seek out the target for tips that can save you time.



WARNING

Watch out for these pitfalls on your cloud journey.

Where to Go from Here

The book is written as a reference guide, so you can either read it from cover to cover or jump straight to the topics you're most interested in.

Whichever direction you choose, you can't go wrong. Chapters are written to stand alone as easily as they flow linearly. Either way, you'll reach a better understanding of approaches and solutions to supercharge the ROI of your VMware Cloud.

To explore the topic further, check out Chapter 7, which lists some outside resources you might find useful. Or, you can visit via.vmware.com/EW0Q to get started right away.

- » Finding out what *cloud* means
- » Understanding why businesses are moving apps to the cloud
- » Taking a first look at VMware Cloud
- » Mapping out your migration journey
- » Establishing the right tools

Chapter 1

Introducing the VMware Cloud

Set.

Run.

Mine.

Nail.

Stand.

What do these words all have in common? Each one can mean a lot of different things.

Take *set* for example. It can mean putting something down, but it can also refer to providing context to a story, a collection of tennis games, or fixing a price or value on something. Without context, you'd be hard pressed to know why you should care about the word *set*.

Sometimes the word *cloud* can feel the same way. Even though this word has been around — in a computing sense, at least — for

little over a decade, today it's inescapable. Yet it's already garnered lots of different meanings, such that when people speak about the cloud, they have no shared understanding of what it means.

When you say that your new business is a cloud startup, does that mean it provides cloud computing infrastructure? Or is it cloud storage? Or maybe you simply mean you're a software company delivering your offering as a hosted subscription service? Perhaps you mean none of these things, and your system is simply a "born in the cloud" invention that runs exclusively on AWS.

Before we start talking about managing a VMware Cloud, we need to establish a few ground rules. Everybody has a different set of associations with the cloud, so let's be clear about what we mean up front, to avoid any confusion (or at least as much as possible).

Defining Cloud



REMEMBER

In this book, we use the term *cloud* to refer to the core infrastructure and management components packaged together by a provider as a consumable offering. If that makes sense to you — great. If not, keep reading the rest of this section for some additional context.

DEFINING IMPORTANT TERMS

Like the term *cloud* itself, many cloud-related terms can have different meanings depending on who is using them (and why). Here are a few important ones that we use in this book, and how we define them:

- **Private cloud:** Customer-managed cloud resources available only to a single tenant, situated on-premises.
- **Public cloud:** Third-party-maintained cloud resources generally available for consumption by anyone, hosted off-premises.
- **Hybrid cloud:** A solution that is able to bridge the private-to-public gap with workload portability.
- **Multi-cloud:** The ability to use multiple clouds based on business needs.

Cloud is more than just virtualization

Before virtualization, IT infrastructure consisted of dedicated physical stacks, with one application per server. Then we figured out how to abstract the compute resources away from the physical hardware, and we got *virtualization* — fitting many self-contained virtual compute machines on top of one physical server. Virtualization revolutionized the way companies managed servers.



REMEMBER

In some ways, cloud is an extension of virtualization. However, you need more than just virtualization to make a cloud. Modern cloud environments need software-defined infrastructure components, but they also need to host modern containerized applications. They need to be able to support serverless compute. They need a self-service interface. And they need to be operated by someone!

Cloud's four core ingredients

A good way to think about cloud for the purposes of this book is from the perspective of providers and consumers. Let's say you're a software developer, and you want to develop an application on Amazon Web Services (AWS), using AWS cloud services. In this case, AWS would be the cloud *provider*, and you would be the cloud *consumer*. AWS is providing the cloud resources; you are consuming them to create your application.



REMEMBER

What resources — or cloud services — are you actually consuming? Well, that depends on what you're wanting to do in the cloud. AWS has over 200 different cloud services available for you to use. To oversimplify, though, you can essentially group those 200 services into 4 different buckets:

- » Compute
- » Storage
- » Networking
- » Management

That's it! Those four things are the core ingredients of a cloud. If you were building your own cloud to operate yourself or provide services to your customers, at a minimum, you'd need those four things. The first three are infrastructure resources — abstracted away (virtualized) from their physical underpinnings — and

the fourth is how the provider and consumer *interact* with those resources.

Of course, this is a very simple way of looking at a cloud stack, and there's a lot going on under the hood, but these are the essential ingredients.

A key benefit of cloud consumption is the ability to use resources only as you need them, rather than having to own the resources yourself. But this is just a small piece of the puzzle (and really doesn't apply as much to organizations exclusively running a private cloud, where they *do* own the resources).

Why Move Business-Critical Software to the Cloud?

It's helpful to think about all companies today as being software companies. Even if software isn't the offering you package, bundle, and sell at the end of the day, you're relying on software somewhere along the way to gain a competitive advantage.

To bring this a little closer to home, think of the application your business develops or uses that would ruin your day if it went down. If you're a retail company, maybe it's your online shopping cart app or inventory system. If you're a car manufacturer, maybe it's the software going directly into the cars you sell. If you're a telecom giant, maybe it's the radio controller software that allows users to access 5G services.

These applications are what we call *business critical software*. Your business needs it working properly to survive. And more than just uptime, your business needs that software to be secure, fast, flexible, and so on.



REMEMBER

Most companies today have figured out that it takes a cloud to accomplish those goals. Why? Clouds offer many benefits for both software production *and* development that traditional legacy infrastructure simply can't match. Obviously, the rapid scalability of the cloud is huge. But so are:

- » **Self-service:** App teams, DevOps engineers, and site reliability engineers (SREs) being able to get the resources they need, when they need them.
- » **Resilience:** Seamless disaster recovery if the worst happens.
- » **Lifecycle management:** Consistently fresh, new cloud infrastructure instead of legacy hardware deprecation and procurement.

For years now, app developers have increasingly been influencing organizations' infrastructure investment. And given all the benefits of the cloud for software development, developers are increasingly turning to the cloud as their development environment of choice.



REMEMBER

Every organization in today's world needs a well-defined cloud strategy. In fact, an organization without a cloud strategy is in the minority — and odds are, it's probably falling behind. However, getting your cloud strategy right is crazy difficult. How do you know what approach is best for your organization? Plus, even if you find the right answer, how do you enforce that approach without teams (or individuals) going off and doing their own thing?

Most companies use several different clouds for different things — typically a combination of private and public. Lots of factors weigh into what cloud(s) a company uses, including organizational policy, legal compliance, performance needs, cost limitations, special arrangements, existing systems, and infrastructure. Some applications might need to be hosted on-premises in a private cloud; others might be a better fit for a public cloud. No two organizations have the exact same approach.

Introducing VMware Cloud

While you might know VMware as the innovative virtualization pioneer that developed vSphere, what you might *not* know is that more workloads are deployed on VMware today than on any other cloud provider on the planet.



The reason you might not know this is that VMware Cloud is a bit of a unique cloud offering. It's not just one cloud; there are four different types of VMware Clouds:

- » **Customer managed:** On-premises private cloud deployment of VMware technology: virtual compute (vSphere), virtual storage (vSAN), virtual networking (NSX), and virtual management (vRealize).
- » **Partner managed:** VMware Cloud Provider Program (VCP) partners offering hosted solutions to end consumers.
- » **VMware managed:** Any offering that starts with *VMware Cloud on . . .* (for example, VMware Cloud on AWS), hosted on the partner's cloud infrastructure and maintained by VMware.
- » **Hyperscaler managed:** Offerings similar to *VMware Cloud on . . .* systems but maintained by the hyperscaler partner (such as Azure VMware Solution or Google Cloud VMware Engine).

The beautiful thing about a VMware Cloud is that you can use one or multiple of these offerings without deviating from the industry standard tools and skillsets that your infrastructure teams are already using. You can keep everything in a local private cloud, you can leverage all the benefits of the public cloud, or you can do some combination of the two — with seamless portability between options.

For example, you might want to leave some apps on-prem, build others from scratch in a public cloud environment, and migrate still others from on-prem to the cloud. A VMware Cloud gives you the flexibility to accommodate all those approaches, without having to learn new skills or tools from one environment to the next.

In this sense, VMware Cloud is a true hybrid cloud solution. What's the importance of having a true cloud solution? Well, like we mentioned before, it may make sense to keep some of your apps on prem, but you may want (or need) to move others to a public cloud. Or maybe you want to move everything out to the cloud but don't want to have to completely refactor your applications for the new cloud platform.

VMware Cloud is also a true multi-cloud solution, because you can run the same stack with management in your private cloud and across multiple hyperscalers.



REMEMBER

When we say *VMware Cloud* in this guide, we mean any incarnation of a VMware Cloud, whether hosted and managed on-prem or off-prem. Regardless of what your VMware Cloud looks like, you're going to need to manage it. In most cases, that management layer will act the same way. We'll spell it out when there are exceptions.

Why You Need Cloud Management

As you learned earlier in the chapter, management is one of the four core ingredients of a cloud. Why is that? Do you really need management, or is it just an optional “extra?”

Let's put it another way. Would you ever fly a plane without an instrument panel?

Planes are great for transporting lots of people very quickly. Everybody is using planes. If you're not flying a plane, you're getting left behind. Okay, fine, so you finally get a plane, and now it's time to fly. Let's see: Are the plane's electronic systems functioning? Is the landing gear working correctly? What's your altitude? What's your speed? What direction are you heading? Where's your destination?

It's kind of an absurd metaphor to use, but hopefully the take-away is clear. It would be ridiculous to fly a plane without being able to monitor any of that stuff!

Benefits to cloud providers

Let's say you're part of the infrastructure operations team. You can't do your job well if there's no instrument panel to let you know what's happening. And that's just basic monitoring. What happens when you have a problem? You need to fix it fast, right? Ditching the metaphor and going right back to your IT stack — infrastructure concerns are a big deal. Every minute spent troubleshooting is a minute that your business-critical application is down, or running slow, or hogging resources from other business-critical applications, or a billion other potential problems that mean nothing good for your business.

Speedy troubleshooting is important, but you know what's better than troubleshooting problems? Not having those problems in the first place! If you can proactively see trouble on the horizon far enough out to steer clear of it, you'll do it every time.

Ah, and costing. All this cloud stuff can get expensive really quickly. But it doesn't have to! An effective management solution can help you rein in bloat, waste, and other inefficiencies in no time.

Benefits to developers

Now put yourself in a developer's shoes for a minute — in other words, a cloud *consumer*. Your job is to develop and maintain the applications that make (or save) the business money. You'd like to do your job as quickly, efficiently, and safely as possible. To spin up an application, you must figure out what resources to request, submit a ticket, wait for approval from multiple different teams, get your resources, and independently ensure you're not overlapping requests with anyone else in the organization.

Since that process adds a lot of red tape to your job, slows you down, and generally annoys you, you decide to take a shortcut around all that bureaucracy. You swipe the company credit card on AWS, get your development environment, and go about your business with no IT oversight. The result? Your IT department is flying the plane without an instrument panel! This in turn leads to low visibility, mistrust, disunity, stifled communication, silos of independence, overprovisioned resources, sprawling costs, lack of control, and headaches for everyone.

That paints a pretty bleak picture, doesn't it? Kind of makes you wish your IT organization would function more like AWS and less like a stuffy bureaucracy, doesn't it? (Spoiler alert: It can!)

Now let's imagine instead another scenario:

- » You have access to a self-service catalog of templates for common workloads. When you request one of these deployments, you can get started in minutes instead of days or weeks.
- » You can see exactly where to deploy that workload to stay within the project budget.

- » You have automatic built-in version control and are automatically supplied with the right type and amount of resources for your project.
- » You don't have to remember to delete an environment when you're finished, because it's taken care of automatically. In fact, you don't really have to concern yourself with *any* of the peripheral overhead — you can just code.
- » The business gets improved utilization, better visibility, faster development, fewer errors, enhanced performance, better security and compliance, and an overall better experience for providers and consumers alike (let alone customers!).

Ahhhh . . . so much better. What's the difference? The difference is a cohesive *cloud management approach*.



REMEMBER

We say *approach* here instead of product or tool, because good cloud management is about more than a simple product offering. It's about radically transforming the way your teams work. It's about giving the right people the right tools within the right processes to efficiently provide and consume cloud resources. *People, process, technology*. We call this the *cloud operating model*. It means that your business outcomes are aligned with your technical outcomes. It adds the *how* and *who* to the *what* and *why* of your cloud strategy.

How does VMware Cloud with management help your organization enact this cloud operating model? Keep reading this book to find out.

Comparing the Three Categories of Cloud Migration

Every organization today is undergoing some degree of digital transformation. No two organizations' journeys look the same, of course, but there's one commonality: Every journey is driven by the application. What's best plan for applications that have been around for a while? What about applications that are being developed today? In the future?

Every organization has a different app mix, which is reflected in the different migration — or cloud adoption — approaches they take. There are three categories of cloud migration organizations tend to pursue:

- » **Limited (web/mobile) app migration:** Due to the increased efficiency of development and deployment, a lot of organizations will choose to at least move certain web and mobile applications to public cloud architecture.
- » **Partial app migration:** An organization may have applications that need to stay on-premises, for a variety of reasons — including cost, security, or compliance with industry policies. A partial migration approach would involve keeping these applications on-premises while moving others to the cloud.
- » **Full app migration:** Full migration involves outsourcing the entirety of an organization's data center hardware to an externally hosted cloud provider. Needless to say, this is the most complex of the three options and can take years and/or millions of dollars to accomplish.

Many organizations choose to prioritize some apps to migrate now, some to migrate later, and some to leave on premises.



REMEMBER

It's all about the application. IT infrastructure doesn't exist in a vacuum — it exists to meet the needs of the applications (which in turn exist to meet the needs of the business). Accordingly, cloud isn't an endpoint; it's a way of better supporting application needs to better serve the business.

Making Sure You Have the Right Resources

Since we haven't already exhausted our cache of metaphors, picture a NASCAR pit crew changing a tire. They do it *fast*! And not like ordinary fast — like *10 seconds* fast.

How can they manage such a seemingly impossible feat? The answer is simple: They have the skills; they have an efficient, well-established process; and they have the right tools for the job. Put you or me out there with no training, a banana, and a miter saw, and we're going to give up because the task of changing a tire is impossible.

In both cases, the task is the exact same, but the people, processes, and technology are completely different. *People, process, technology.* Hmm, where have you heard that before? That's right — it's the cloud operating model!

Without a well-defined cloud operating model, operating a cloud is impossible. You need the right people, the right processes, and the right tools to make it happen. If it sounds obvious, that's because it really is that straightforward.

Managing a cloud — especially a VMware cloud — doesn't have to be difficult at all! Establishing a set of cloud best practices, having the right staff to enact them, and arming them with a unified management solution — that's the trifecta.

Sound easier said than done? In the chapters to come, we break down the ins and outs of making it happen for your VMware Cloud.



TIP

For a spectacular dive into the ins and outs of implementing a cloud operating model in your organization, check out the book *Cloud Operating Model For Dummies* at <https://via.vmw.com/EYD1>.

- » Understanding the steps in a workload lifecycle
- » Getting to know the cloud management stakeholders
- » Weaving a narrative
- » Comparing the approaches

Chapter 2

Discovering the Value of Cloud Management

Remember from Chapter 1 that the cloud operating model way of thinking requires three ingredients: *people, process, and technology*.

Since you're smart enough to have picked up this book, we're going to assume you've hired nothing but great people in your organization. Terrific! We've already taken care of the first item. On to the other two.

This chapter addresses the specific technology that will maximize your ability to manage a VMware Cloud. Then it weaves the process in with a narrative in the "Telling a Teamwork Story" section at the end of this chapter.

Stepping Through a Workload Lifecycle

Workload is a term we throw around a lot. It simply means the resources required to run an application. In a cloud management sense, we often use the term *workload* because we're managing application resources.



REMEMBER

It's all about the application. The infrastructure exists to host the application. The infrastructure management solution exists to optimize the infrastructure that hosts the application. You get the point.

It helps to think about the role of cloud management in the context of a workload's lifecycle. Let's do this by assigning each lifecycle phase to a day. Each day is associated with a specific action with regard to how your team interacts with the cloud and will require adequate tooling to accomplish the task at maximal efficiency and minimal cost.

Day 0 (Plan/Setup)

On Day 0, you set up the cloud infrastructure and define cloud constructs. In other words, you make the resources available for your software engineers to develop, test, and deploy an application into production. You might think of this stage as making your cloud self-service for its end users.

This stage's tasks might include:

- » Separating development, test, and production zones from one other
- » Defining an application template
- » Configuring network and storage profiles
- » Automating a request process

Day 1 (Deploy)

At this point in the process, your developers begin to deploy applications with the infrastructure and self-service constructs you established on Day 0. This is where the self-service cloud takes flight.

Day 2 (Manage)

Now that you have a bunch of applications running on your cloud, your teams need to manage cloud performance, capacity, and costs. They need to troubleshoot issues and automate the remediation of those issues.

Day 2 most closely maps to what we think of as *operations management*. It involves the management and optimization of all three core cloud ingredients: compute, storage, and networking.

Day N (Run)

The letter *N* stands for a number here, as you might have guessed. Day *N* is just a concise way of saying that the Day 0–2 cycle repeats into the future.

At this stage, your organization uses the same tools and processes to continuously deploy and observe applications via an efficient, streamlined pipeline. Remediation and optimization processes are automated. Everything moves quickly, affordably, and securely.

Migrate

This one doesn't get a fancy *Day* title, but it's an unavoidable reality. At some point you will likely need to consider the implications of migrating at least one workload into the cloud — or, from one cloud to another.

Migration isn't to be taken lightly or attempted without careful planning and analysis. Some of the tasks involved include:

- » Discovering all the apps running in your environment
- » Mapping dependencies
- » Grouping resources
- » Executing a cost analysis
- » Deciding what to migrate and what to leave alone
- » Executing the migration

As with Days 0–*N*, you're going to need the right tools to execute a successful cloud migration.



TIP

When a migration occurs, the Day 0–*N* lifecycle starts all over again in the new cloud. And by the way, VMware Cloud makes a migration from on-prem VMware infrastructure to the cloud very easy.

How VMware vRealize Cloud Management supports the workload lifecycle

As you might have guessed, VMware's approach to cloud management considers and covers the needs of each step in the lifecycle using an integrative approach.

The core building blocks of the VMware vRealize Cloud Management solution for VMware Cloud are vRealize Operations, vRealize Log Insight, vRealize Automation, and vRealize Network Insight. These four building blocks share common language and constructs, talking to each other throughout the management timeline.

For example:

- » vRealize Automation is in charge of making your cloud self-service, but it works with vRealize Operations to deploy workloads to the right place. It then pulls performance and costing data from vRealize Operations back in, so infrastructure operators and developers can talk about the same issues with the same data.
- » vRealize Operations, Log Insight, and Network Insight work together to proactively prevent capacity or performance issues, and troubleshoot problems that do arise.
- » vRealize Network Insight works with vRealize Operations to plan and execute a migration based on all the required steps.

The great thing is that this all applies equivalently to *any* VMware Cloud, including VMware Cloud Foundation, VMware Cloud on AWS, VMware Cloud on Dell EMC, Azure VMware Solution, Google Cloud VMware Engine, and Oracle Cloud VMware Solution.

The next three chapters are going to get into a lot more juicy detail about how you put this into motion.

Who Benefits from Cloud Management?

There are three groups of people to consider when we talk about cloud management. First are the end users of the platform. They are the folks who are going to be interacting with the tools and solutions every day.

Then there are the individuals or teams who may not be hands-on with cloud management, but do have influence in the strategy, approach, and tools selected.

Finally, there are the people who are accountable for the performance of their organization's technology, and ultimately, business results.

Who uses it?

The following is not an exhaustive list by any stretch, but it's fairly representative of the most common users.

VI/Sys Admin: This role often has to manage a lot more than just the virtual infrastructure, so it has a lot of names. In this book we use the titles *VI Admin* and *Sys Admin* interchangeably. No matter what they're called, these folks are responsible for setting up, maintaining, and managing a virtual environment of operating systems, network resources, servers, storage, desktops, applications, data, and so on. They also may need to understand how to integrate public cloud resources. Their key responsibilities revolve around infrastructure performance, capacity, cost and compliance. Although their charter is infrastructure-specific, they do need to understand the applications that reside on the infrastructure so they can provide the best service possible.

Cloud Admin: The role of cloud admin has emerged as cloud technologies have become popular. The cloud admin is responsible for defining, delivering, and supporting strategic plans for implementing cloud technologies. They form a bridge between traditional IT admins and developers, trying to balance control for the former with choice for the latter.

The cloud admin may administer the cloud environment; configure the service catalog and cloud templates; and align infrastructure resources for developers to use.

Network Admin: Network admins provide the application and infrastructure teams with networks that meet their business needs and security/compliance requirements. They need to be able to ensure networks are available, performant and secure. The ability to quickly troubleshoot network performance and connectivity issues is critical.

Developer: Developers are concerned with quickly deploying new workloads when needed. They don't necessarily care about infrastructure, so long as it meets the requirements for testing or running the app. They also need to know what it will cost and how it is performing.

Who plans and organizes it?

Cloud Architect: Cloud Architects are responsible for overseeing an organization's cloud strategy. This includes developing cloud adoption plans, application design, and overseeing management and monitoring. This is a role that bridges business and technical strategy and often has significant influence into the tools teams are using.

Who is accountable?

At the end of the day, these are the folks who need their organization's IT to enable business-critical objectives through increased agility, reduced cost, and minimized risk. They may not care exactly what's under the hood as long as IT is a value add, not just a cost center.

Director or VP of Infrastructure/Operations/Cloud Ops: This role can take on many titles and many organizational nuances, but the essential responsibility here is ensuring the organization's infrastructure and operations are fast, flexible, and safe enough to meet business needs. This individual is responsible for establishing and maintaining IT infrastructure strategy, ensuring the business meets its current SLAs efficiently while also planning for future demands. It's becoming increasingly important for this role to embrace the cloud operating model, which is product-centric, highly automated, lightly coordinated, and driven by autonomy and self-service.

CIO: The chief information officer is typically responsible for establishing and maintaining the enterprise vision, strategy, and programs to ensure that information assets and technologies are

up to date, meet the organization's needs, and are adequately protected. They direct the IT vision/mission, strategy, and budget to align with business strategy and outcomes.

CEO: IT drives business outcomes. Who's at the helm of the business? The chief executive officer. They are ultimately accountable for the results of the business, whether they are enabled or hindered by IT/cloud practices.

Telling a Teamwork Story

So far, we've been asking and answering a lot of questions about cloud and cloud management. What is it? What's the VMware approach? Who is it for?

Now let's bring it all together with a *day in the life* narrative. In other words, what does it look like when a real organization with real people puts the cloud operating model into practice? How do they manage their VMware Cloud to achieve cloud efficiency, scale and agility with purpose-built tools for management, automation, operations, networking and security?

Let's introduce our (fictional) customer, Massachusetts Omni Automated Devices, or MOAD, a robotics firm with an established business line in industrial automation solutions.

While the legacy business is doing well, MOAD needs to diversify into another market to increase growth. Last year, MOAD rebranded and launched a consumer division for home robotic solutions. Since they previously relied on relationship-based B2B sales motions, they need help transitioning and building this new business unit which is primarily based on web store consumer sales. MOAD is struggling with:

- » Quickly providing resources for developers to build and improve the web store
- » Meeting SLAs for app performance and availability
- » Understanding security and compliance risks
- » Optimizing capacity for their datacenter to stay efficient
- » Providing cost visibility for applications

MOAD brought in a VMware Cloud approach with vRealize Cloud Management to help them address these problems. Let's assume they've started with a private cloud approach for now, with VMware Cloud Foundation. Let's see how it's being managed by the key users.

Developer

Let's first meet one of MOAD's Developers, Rachel. Remember, she doesn't need to know what's under the hood of the cloud she's working with; she's concerned with application performance and cost, and pushing new code as fast as possible.

Rachel starts by accessing the vRealize Automation service catalog, where she finds cloud templates to help her deploy a copy of the web shopping cart app for working on a new feature.

She fills out a simple request form, which collects all the information needed to customize this deployment for Rachel's needs. This workload will be deployed to MOAD's private VMware Cloud, but Rachel could just as easily deploy to AWS or Azure with a simple choice on the request.

Rachel is given a daily price estimate for this deployment, sees that it is within budget, and submits the request.

Then, once the app is deployed, she can easily see the deployment topology, view performance and event details of each VM, and perform self-service Day 2 actions if necessary (so she doesn't have to bug IT). She can also see the ongoing price for running the application.

Rachel quickly got what she needed for the deployment, and now she has the visibility to make decisions about resource usage and performance. Let's switch now to MOAD's Cloud Admin to see how this self-service experience is administered.

Cloud Admin

Like Rachel, MOAD's Cloud Admin, Carlos, uses vRealize Automation. However, as an administrator, he has access to different services. He is responsible for configuring the service catalog, cloud templates, and backing cloud infrastructure resources for Rachel to use. Carlos knows that IT agility is critical for the company's growth goals, so he has automated as much of the deployment

process as possible for when users like Rachel want to spin up a new workload.

He has configured the organization's cloud accounts, defined resources, and assigned access rights for those resources. In this case, he has given Rachel access to the web shopping cart cloud template and made it easy for her to automatically push a new deployment to the private cloud. The system offers her specific VM configurations to simplify the deployment request, so she doesn't have to call him up and ask for resources with each deployment. Since this is a business-critical application, Carlos has applied infrastructure tags to ensure that it will be provisioned to a particular cloud zone, in a particular region, in a specific resource cluster.

And just like Rachel, Carlos has visibility into the deployment and the infrastructure supporting it, including monitoring information for assisting with troubleshooting issues.

VI/Sys Admin

Speaking of troubleshooting, let's check in with MOAD's Sys Admin, Lisa.

Lisa uses vRealize Operations as her primary tool for VMware Cloud monitoring and optimization, but also needs to understand app-level information so she can provide the best service possible. Although Lisa and Rachel care about different things, vRealize Operations and vRealize Automation are integrated, and understand the same constructs as one another. It's therefore easy for Lisa to talk to Rachel about a problem with the deployment.

Lisa has complete visibility into the infrastructure and application topology, which makes it quick and easy to identify problems that could cause performance or availability issues for the shopping cart. She can even correlate metrics with logs from vRealize Log Insight to get a full picture of causes and effects. Additionally, since this is a retail shopping cart processing customer credit card data, the underlying infrastructure needs to comply with PCI requirements. Fortunately, Lisa can easily see the compliance status of the VMware Cloud and quickly (even automatically) remediate if anything is out of compliance.

Finally, since she is responsible for the cost optimization of the infrastructure, Lisa reports the cost of Rachel's project via by something called a *showback* dashboard, which just means the project costs are being *shown back* to the line of business. She even has a dashboard specific to the shopping cart application encapsulating everything discussed above — performance, capacity, cost, compliance, and so on.

Network Admin

Now let's switch over to our Network Admin, Ray, who will show us how networking insight completes the picture.

Ray primarily uses vRealize Network Insight for visibility into the organization's networks. He can see all the applications on the network, including the production shopping cart app.

Ray gets information showing how everything in the environment connects. He can inspect the flows to find out if there are any critical issues. He can also see what's new on the network, helping identify any recent changes in behavior that could indicate problems or compromised systems.

Based on how the application has been using the network, vRealize Network Insight suggests a set of security recommendations to Ray. Like Lisa, he also has a PCI compliance module, and notices credit card or personal data may be going over non-encrypted network connections. Upon confirming his suspicions, he takes corrective action.

What about migration?

In this scenario, MOAD was only using a private cloud environment. What happens if they are looking at migrating workloads to a different cloud?

Ray would probably be responsible for mapping all the applications, planning the migration, and determining the impact of network performance. Lisa would likely assist with the planning, especially regarding cost and capacity implications for the organization. Rachel would have the choice to deploy to any of these multiple clouds, and Carlos would of course administer this whole multi-cloud landscape.

Evaluating Your Alternatives

There are lots of ways you can manage your VMware Cloud, each with its own pros and cons. Let's quickly take a look at your alternatives to vRealize.

Do it yourself

Capacity planning via spreadsheets. Homebrew automation scripts. Vendor-outsourced troubleshooting. This approach is super common and very tempting due to the low price tag. However, it has some big drawbacks. This is the most manual of all the methods, and can easily end up being the most *expensive*. It's slower, more reactive, and more error-prone than you probably want to be. And when you figure in the salaries of the people who have to do all that manual work, plus the costs of human error, being slow, and having less uptime, it stops looking like a good value.

Use only vCenter

vCenter is the centralized platform for vSphere environments and is fine for some very basic monitoring, but it doesn't include any of the following:

- » Trending info, analytics, AI
- » Storage and network monitoring
- » Automated performance optimization and analytics
- » Capacity management with granular cost optimization and planning for future workloads
- » Apps-to-infra troubleshooting with multi-cloud visibility
- » Infrastructure configuration and compliance
- » An automation framework
- » Self-service portal
- » Infrastructure pipelining
- » Policy and governance
- » Software configuration management
- » Infrastructure as code
- » Orchestration and extensibility

- » Infrastructure automation
- » Flow-based network analysis
- » Application discovery
- » Log management



WARNING

We love vCenter but it was never designed or intended as a comprehensive Day 0-N management solution.

Combine multiple tools

Cloud management is a *huge* concept. It encompasses a lot of things, including lifecycle management, operations management, cost management, automation, logging . . . the list goes on.

It's only natural that organizations look to separate tools for each of these things. Often, tools have been selected at different points in time, by different teams, to fit the needs of the moment. But one day you look down and see an unseemly pile of tools that you own (and are paying support for). Are all of them being used? Is there any overlap in use cases being covered? Do they integrate with one another? Do they collectively cover your whole infrastructure?

This tool pile can be chaotic, inefficient, and expensive.

Don't do anything

To be fully exhaustive with our options, we have to include this one. Yes, technically, you could choose to do nothing. Let the cloud manage itself. Are you your cloud's keeper? (Spoiler alert: You are.)

For obvious reasons, we wouldn't recommend this approach.

Use VMware vRealize Cloud Management

VMware vRealize Cloud Management was built for the VMware Cloud. It sounds obvious, but we have to say it. That means the roadmap and release schedule for each vRealize tool is crafted in conjunction with all the core VMware Cloud elements for compute,

storage, and networking. vRealize *knows* VMware Cloud infrastructure intimately, and therefore knows how to optimize it best.

However, VMware vRealize Cloud Management is not *limited* to the VMware Cloud. It has extensibility to multiple public clouds, third party technologies, hardware, apps . . . you name it.

Deploy to any cloud? Check.

Monitor on any cloud? Check.

Optimize across clouds? Check.

vRealize offers a single suite — with embedded lifecycle management — that helps you monitor and control factors including performance, capacity, cost, remediation, config, compliance, self-service, security operations, DevOps for infrastructure, and automated deployment. It works across clouds, from apps to infrastructure, spanning VM-based and modern container-based applications.

It's a single, highly integrated, end-to-end, extensible suite to manage (or let someone else manage, if you go SaaS).



TIP

The old adage of spending some money to make (or save) a lot holds here. Read Chapter 6 for customer-quantified ROI data.

- » Understanding why self-service is important
- » Harnessing the power of a service catalog
- » Managing governance and policies
- » Working with cloud templates and the provisioning engine

Chapter 3

Making your VMware Cloud Self-Service

In the previous chapter, you learned that a cloud operating model enables you to deliver services to users via a self-service system. This chapter takes a deeper look into what *self-service* entails.

What Does Self-Service Entail?

To better understand self-service, let's break it down into its components.

Self is easy to conceptualize. It means the people who *need* the services can *get* the services — when and how they want them.

The *service* provided can be any number of things, including:

- » Infrastructure, such as virtual machines, storage volumes, load-balancers, Kubernetes clusters, and namespaces.

- » Applications, such as e-commerce, video calling, or messaging services.
- » Other cloud services, such as databases and serverless, or machine learning.

Some of those things may sound technical, but remember that they're all just different combinations or applications of the foundational elements you learned about in Chapter 1: compute, storage, and networking.

Put *self* and *service* together, and your end users can request and instantly consume these services via a web-based portal with a couple mouse clicks.



Instead of a web portal, you can also set up application programming interfaces (APIs) that enable end users to programmatically request resources but with scripts rather than a GUI.

Regardless of what specific delivery mechanism you employ, a self-service solution needs to enable end users to instantly consume the resources they need. Without this attribute, any infrastructure you're using can't really be described as a *cloud*.

A popular tool for facilitating the self-service process is known as a *catalog*. In addition to enabling customers to select services for themselves, the catalog should provide a consistent user experience regardless of destination platform. In this case, the platform is a VMware Cloud; however, we can't ignore the reality that most organizations are using multiple clouds (or will be at some point in the future).

Why is Self-Service Important?

Let's think through the typical challenges for requesting an IT service by looking at a specific example.

Remember MOAD's developer, Rachel, from Chapter 2? She might need to add a new feature for an existing application that is aligned to a new business initiative. However, this new feature requires Kubernetes infrastructure for testing before it can be taken all the way to production.



INFRASTRUCTURE AS CODE

Infrastructure as Code is a concept that was created to solve the problems that teams face managing infrastructure in the Cloud Age by applying principles more often used in software development.

Infrastructure as Code describes the desired infrastructure end state. A provider can then interpret this code format to provision, configure, and manage the infrastructure in a repeatable, reliable, and on-demand fashion. The code description can then be source controlled and managed as a developer would an application's source code.

How could Rachel and the Dev/SRE team get that infrastructure? Without a self-service consumption model, they might chase the lab administrator for a couple weeks, open multiple tickets, and fill out never-ending forms. Then when they finally see the light at the end of tunnel and gain access to the desired resources, these resources may end up being shared across multiple teams, which introduces an entirely new layer of challenges.

Self-service replaces the need to define complex bureaucratic processes to create and deliver infrastructure, applications, and solutions; especially when those services are powered by DevOps principles, including Infrastructure as Code (IaC).

Now let's explore the same situation, but this time from the rest of the team's perspective: MOAD's Sys Admin (Lisa), Cloud Admin (Carlos), and Network Admin (Ray).

Giving Rachel access to infrastructure and application services (which are often defined by multiple and disparate tools) can be a complex task, even on one cloud. Doing this for a hybrid cloud has the potential to multiply the complexity, tools, procedures, access control, and configuration data — plus the countless hours required to cover all those activities.

Think about the controls needed in place for allowing access to any given environments, such as:

- » Who is permitted to make network configuration changes?
- » How can these changes be easily tracked?
- » What are the container versions allowed in the Kubernetes clusters?

... and many other interdependent tasks that might be generated by a single user request.

Also, although we know Rachel would *never* do this, developers with fewer scruples are going to ask for the largest VMs, with the most GPUs, highest IOPS rates, dedicated hosts in the public cloud, and so on, even though they just need to execute a *Hello World* app. Heck, why not repeat this (unnecessarily) giant application across all their VMware Clouds?

That's a bit of an exaggeration to prove a point, but Cloud Admin Carlos is constantly worried about wastefully overprovisioned resources and controlling the associated expenses. In essence, he wants to better define guardrails for the optimal consumption of MOAD's VMware Cloud.

When you consider these major dilemmas, it's clear that Carlos needs a simpler way to provide Rachel with self-service access to infrastructure and application resources, abstracting and unifying the delivery of predefined services that run on different VMware cloud environments, while at the same time giving the Sys Admin (Lisa), the Network Admin (Ray), and himself policy-based management capabilities. (We call this *Cloud Governance*.)



TIP

An Enterprise Cloud Management Platform with truly Self-Service support needs these key capabilities:

- » **Self-Service.** A portal for end users that provides access to both infrastructure and application-level services.
- » **Governance.** Policy-based management that gives Cloud Ops teams control over a wide variety of policies, including who can access resources and on what clouds users can deploy specific resource configurations.

- » **Abstraction.** Support for integrating end-user services that have been designed using a broad range of definition tools including VMware Cloud Assembly, VMware Cloud Templates, Cloud Formation, Azure ARM, Kubernetes Helm Charts, Code Stream Pipelines, and so on.
- » **Multicloud Support.** The ability to deploy catalog services across VMware-based private and hybrid clouds and across native public clouds.



VMware vRealize Automation provides a single point where you can request and manage catalog items, aggregating content in native formats from multiple clouds and platforms into a common catalog with tag-based policies for easy consumption on VMware-based private or hybrid clouds and on cloud native mega clouds including AWS, Azure, and GCP.

Harnessing the Power of a Service Catalog

If you were in a time crunch and needed to prepare a giant meal, you wouldn't want to go to 17 different stores to collect all the ingredients, right? *Of course* you would prefer to get all the ingredients in one single place. And it would be even better if those ingredients were already cut and mixed together, taking into account the right quantities for maximum flavor.

This one-stop shop is exactly what Carlos needs for empowering Rachel with an effective self-service framework. We call this one-stop shop the *service catalog*.

The vRealize Automation service catalog consists of four components:

- » **Portal:** The interface for a Dev/SRE to consume cloud services with a single click.
- » **Library:** The curated collection of ready-to-consume cloud templates and services.
- » **Service Broker:** The means of availing third party services for a Dev/SRE.
- » **Policies:** The means by which a Cloud Admin can implement controls without inhibiting service consumption by the Dev/SRE.

A service catalog can free Rachel to focus on value-added work by consuming managed services from internal or third-party service providers.

On the other side of the coin, Carlos can focus on setting policies which will be continuously enforced to ensure access, performance, security, and cost constraints.

It's not only searching and requesting services that makes a service catalog great and efficient. It's also, and probably more meaningfully, what happens with those services *after* they are deployed.

Deploying Self-Service Resources

Continuing with our previous example, maybe the reason Rachel requests a cluster of e-commerce web servers from the service catalog is because she wants to test the performance improvements in her code that runs on top of those servers.

At some point, as part of the test, she may want to scale the server node sizes (more CPU, more memory, and so on). Or perhaps she will want to add more server nodes. If so, she will need to know what difference those changes make, right? Rachel will need to compare the server performance with the standard setup versus after she has applied those changes. She will watch for any alerts (such as high CPU utilization or network packet drops) when she changes a parameter or two. Does Rachel need to contact Carlos, Lisa, and Ray to get the KPI reports she needs and execute changes? Or can she get self-service access to those reports?

Of course, she should be able to easily get operations details about those clusters and networking devices and execute changes on her own. A service catalog *must* allow users to locate and manage any deployment they've made from the service catalog and then run Day 2 actions on those deployments.

With a functional service catalog, Rachel can use the deployment details to understand how the resources are deployed and what changes have been made, pricing information, the current health of the whole deployment, and whether capacity constraints are likely to inhibit performance in the future.



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WHAT ARE DAY 2 ACTIONS?

Day 2 actions are operations that you could apply on resources and deployments, from virtual machines to Kubernetes clusters, namespaces, or network services, for performance, capacity, or troubleshooting reasons.

The available actions depend on the resource type, whether the action is supported on a particular cloud account, and what the Cloud Admin has entitled the user to run.

Common examples are re-sizing a boot disk, scaling an existing deployment, powering on a VM, resetting Kubernetes namespace limits, deleting a whole deployment, or taking a VM Snapshot.



REMEMBER

To sum things up:

The deployments are the provisioned instances of catalog items, cloud templates, and onboarded resources.

You use the deployment details to understand how the resources are deployed and what changes have been made.

You can also see cost or pricing information, the current health of the deployment, and if you have any resources that need to be modified.

Monitoring the deployment not only ensures that the provisioned resources are performing as expected, but also helps determine when resource resizing is required for performance optimization.

With access to the deployment alerts, Rachel can directly perform remediation and optimization tasks, rather than needing to ask Lisa in IT to fix the infrastructure. This includes the all-too-common task of identifying oversized (underutilized) or under-sized (overutilized) machines in a given deployment and resizing those machines accordingly.

Crucially, Rachel can even track all the provisioning events in the history of this deployment, which will help enormously in troubleshooting issues.

Managing Governance and Policies

Remember, every cloud has a provider and a consumer.

So far, you have studied the service catalog *mostly* from Rachel's (consumer) perspective. To round out your understanding, let's dig further into what things look like from Carlos' (provider) perspective. After all, the Cloud Admin is the one who will need to navigate the complexity behind a single-click consumption experience.

Introducing a self-service approach to any VMware Cloud makes things a whole lot easier for everyone involved. However, it forces some adaptation to Cloud Operating Model processes. One of the most important considerations is how cloud providers like Carlos can guarantee an optimal utilization of VMware Cloud resources.

A developer (again, not our upstanding employee Rachel, but a different developer) might deploy multiple workloads and forget about them, leaving wasteful, unneeded workloads stranded in the cloud and consuming resources. In that scenario, Carlos needs to provide the controls, or *policies*, that govern how the cloud and resources are managed — not only for when resources are initially deployed, but for their entire life cycle.

The Cloud Admin needs to be able to set up policies and enforce them. *Policies* are sets of rules or parameters that are automatically applied to deployments, freeing the Cloud Admin for other tasks.

Each policy has a scope that determines how it is applied. For instance, you can assign a policy to the whole organization, to multiple projects within the organization, or to a single project.

There are different kind of policies. Let's examine a few of them:



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- » **Approval policies** enable you to exercise control over deployment and Day 2 action requests before they are run. A Cloud Admin could define approval policies so that you, or others that you designate, can review requests before resources are consumed or destroyed.
- » **Policy-based leases** reduce the need to intervene manually to reclaim resources. A Cloud Admin creates lease policies so that you can control the amount of time that a deployment is available to be active in the cloud.

» **Resource quota policies** enable you to limit the number of resources that are available to your Dev/SRE. A Cloud Admin defines resource quota policies for limiting the resources that each Dev/SRE, project, or organization can consume.

Working with Cloud Templates and the Provisioning Engine

So far, we have seemingly taken for granted the availability of infrastructure and application services within a vRealize Automation service catalog. But how do they get there? Cloud templates and the provisioning engine within vRealize Automation provide the answer to this question.

Cloud templates specify the infrastructure and application resources to be deployed across VMware Cloud. It includes the dependencies among them in a “low-code” fashion where code and the graphical interface coexist. In other words, users don’t need to know how to code, because they can drag-and-drop items onto a canvas and the code will update automatically.



TIP

Cloud templates should be easy to develop and construct. You should be able to drag and drop in a design canvas, or use your favorite text editor that is specialized for writing software, such as VIM, Notepad++, Microsoft Visual Studio Code, or Atom Editor.

A *provisioning engine* ingests these cloud templates, as well as other relevant information such as end user inputs and system variables, and evaluates all that information against the cloud environments and the policies that govern them.

Simply put: If you were to deploy a workload from a simple cloud template for a virtual machine with a couple of storage disks, here is what would happen:

- » The cloud template gets ingested by the provisioning engine.
- » The provisioning engine evaluates the required resources (which may include user input such as the number of CPUs, the quantities of the storage disks and associated sizes, and so on).

- » The provisioning engine takes into account any permissions or entitlements (for example, maybe the user isn't allowed to add more than one storage volume), system information (like workload placement policies), and other settings.
- » The provisioning engine creates the required resources in the appropriate location as restricted by the policies, to the benefit of the developer and the cloud admin alike.

Why vRealize for Automating Your VMware Cloud?

A lot of what you've learned so far in this chapter applies to *any* cloud you want to work with. vRealize Automation can deploy to the cloud of your choosing. So what makes its value for the VMware Cloud so unique?

VMware Cloud was designed to handle both VM- and Kubernetes-based workloads. No matter how modernized your array of enterprise applications is, a VMware Cloud has VM and container orchestration built right into the platform.

Likewise, vRealize Automation can provision both VM-based and Kubernetes-based workloads. The origin and the destination are specifically engineered to work together and share common constructs! vRealize Automation can also extend self-service infrastructure automation to Kubernetes infrastructure, enabling Kubernetes cluster management, self-service, and app deployment in a mixed VM- and Kubernetes-based infrastructure environment through a central management plane with a unified governance and consumption model.



REMEMBER

The integrative synergies of both these things working together are what make vRealize a great solution for managing a VMware Cloud. Together, they can help your organization accelerate its deployment of modern apps and ensure the management of Kubernetes-enabled infrastructure, enabling streamlined development, agile operations, and accelerated innovation for cloud-native modern apps.

Holistically, nothing can automate the VMware Cloud like vRealize can. Custom extensibility workflows, advanced workload operations, customizable catalog forms, and out-of-the-box integrations with common ecosystem tools are just a few of the proof points.

- » Knowing why day-to-day operations matter
- » Optimizing performance, troubleshooting and cost
- » Achieving efficient capacity
- » Controlling configuration and compliance

Chapter 4

Operating Your VMware Cloud

By now, your organization has chosen a cloud and provided an efficient way for your consumers to self-provision their workloads on it. Congratulations! You've made it to the end of the book. After all, the cloud is just someone else's computers, so all your problems automatically become theirs. Right? No! Of course not. This chapter outlines the basics of keeping your cloud systems performing well and optimally tuned for maximum efficiency, cost savings, and compliance.

What Are You Responsible For?

No matter what type of cloud you select, your IT crew is still responsible for the uptime and performance of the applications and services provided to the organization (and most likely its customers). What *does* change, however, is the scope of that responsibility. The cloud is after all, just a platform. Let's review the examples mentioned in Chapter 1 and consider your responsibilities for each.

- » **Self-Managed Cloud:** If you choose a customer or self-managed cloud, you are responsible for the entire stack. That starts with the server, storage, and network hardware. Next comes the virtualization layer (also known as the

hypervisor), followed by the guest operating system, and then finally the application. Phew! That's a lot of layers. Plus, if you own the data center then there's the facility, power, cooling, and a myriad of other things to oversee.

- » **Managed Cloud:** With managed clouds, whether VMware, hyperscaler, or partner-managed, you have a narrower scope of responsibility. In exchange for a subscription fee, you can offload the facility, hardware, and hypervisor responsibilities to a third party. However, you're still responsible for the configuration, performance, patching, and uptime of the guest operating system and the application. Additionally, you need to manage the capacity of the platform from your cloud provider to avoid performance issues or surprise charges.
- » **Public Cloud:** Public clouds are a lot like managed clouds in that you're still responsible for the configuration, performance, patching of the guest operating system and the application, assuming you run everything on virtual machines. However, it's up to the cloud provider to manage the capacity of the platform to ensure that all customers are receiving the level of performance they are paying for. Nearly all public cloud providers also offer application services where they will host your database, function, or application for you. In this case, you can abstract away everything below the application layer and just be responsible for the database, application, or function itself.



REMEMBER

There are many choices when it comes to cloud and what level of responsibility you're willing to take. There's no shorthand rule as to which is the best option. Staffing, facilities, customer and regulatory requirements, licensing and support, and more must all be factored into your decision. And remember, nobody said you can only choose one. Many companies leverage multiple cloud options to suit their needs.

Why Day-to-Day Operations Matter

Let's return to our friends at MOAD. They recently deployed a new Customer Resource Management (CRM) system on a public cloud. Things are going great! The CRM is lightning fast, and their business is growing rapidly. In the past month, MOAD has

hired 15 more sales and customer service representatives. However, MOAD's CRM is now running much slower, so MOAD opens a support ticket with their cloud provider. It must be the provider's fault! After all, their CRM had been running great until recently. Days go by and eventually the ticket is closed after the provider confirms nothing is wrong with their infrastructure. However, they suggest that MOAD look at their monitoring portal to troubleshoot further. After more time passes, MOAD discovers the 15 new power users are pushing the CRM to the limits. They realize that the application is out of memory and that they can resolve the issue simply by resizing their VM.

Did you happen to catch the problem with MOAD's approach? Without the proper monitoring in place, MOAD quickly jumped to the conclusion that the service provider was the cause of the issue. This resulted in their CRM being barely usable for days while they waited for their provider to troubleshoot things on their end, only for the issue to wind up back in MOAD's court. To make matters worse, MOAD now has a backlog of orders to process and unhappy customers calling in with their complaints.

A few months later, MOAD's CRM developer releases a brand-new version of their software. Sales is all over this because of some new features that will make their jobs much easier, and IT is under pressure to get the software upgraded. Unfortunately, they're unaware that this new version of software requires more resources (something they would know had they read the release notes). Fortunately, they learned from their prior fiasco and now have the proper monitoring in place to quickly catch their mistake and grant more resources to the VM before it encounters any performance issues.



WARNING

Ignorance isn't bliss and can cost your organization dearly. Ensuring you have the proper management tools in place will help avoid time lost chasing after those red herrings.



TIP

The only thing we can count on, apart from cessation and tariffs, is that things will change over time. MOAD's once high-performing CRM fell victim to organizational changes outside of IT's control. Other such changes could be newly discovered security vulnerabilities, changes in regulations (General Data Protection Regulation (GDPR) for example), changes in the market demand, and user behavior. All of these have some impact on IT services. When and how quickly you react depends on how well you're managing your day-to-day operations.

Optimizing Performance

Performance optimization is a very broad topic, but in simple terms, the end goal is to provide the highest-performing services for both the organization and its customers. *Services* in this context refers to the front-end applications, file or print servers, and web pages that are directly used by IT consumers.

If you're reading this and thinking *that's an obvious statement!* then you fully understand the main objective of IT in any organization. It really is as simple as that. What's not so simple is *how* you deliver these high-performing services.

Let's take a look at the total process of performance optimization, starting with the application and working our way toward the infrastructure.

Understanding the needs of your applications

Make a list of the organization's most important applications. These are the applications that would have the most negative impact to the company's day to day operations should something happen to them. Start with the first item on your list and then repeat these steps for the rest.

With this application in mind, can you or your team map out all its dependencies? Is this a standalone application or is it reliant on other services such as databases, file services, web services, or load balancers? Having this information is critical because issues in any of these supporting services can manifest themselves as a problem with the application. Only after you have the complete picture of the application and its dependencies can you understand its performance.



TIP

Don't beat yourself up if you don't know; there are tools that can help map these dependencies for you. For example, vRealize Network Insight can build a dependency map just by looking at network traffic and understanding what other systems your application is talking to.

The next step is to understand how all these pieces perform under normal circumstances to collect a good baseline. This means collecting data about the application, its dependent services, and the virtual machine it's presumably running in. Many customers overlook this step because tools like vRealize Operations provide a historical view that enables them to compare performance metrics before and after an issue occurs. However, it's still important to understand what your baseline data should be, as this provides a good indication of how well or how poorly the application is running. It's generally a bad practice to rely on your users to tell you when things are running poorly. Additionally, having a good baseline will provide a target to reach should the performance be degraded.



TIP

A disaster recovery runbook is a fantastic place to keep track of this information. Not only will it be useful in your day-to-day but will prove to be invaluable in returning to regular business following a disaster.

You now have a dependency map and good baseline data for your applications, dependent services, and virtual machines. If you're running completely within the public cloud, you can stop here. If you're running on a private or hybrid VMware Cloud, then read on.

Understanding your infrastructure's capacity

One of the biggest and most common infrastructure performance inhibitors is *overutilization* — in other words, when the infrastructure resources are pushed to the limits of what they can handle. This is generally caused by one of two factors:

- » **Budget concerns.** Infrastructure can be expensive. Some decision-makers think they don't have budget to buy more hosts to support their project, or want to milk every penny from their hardware.
- » **Lack of awareness.** Companies often don't have the proper monitoring tools in place to properly manage their infrastructure so they don't realize they're overutilizing.

The former is perfectly understandable, and the latter is easily preventable.

Maintaining proper utilization requires a strong understanding of your infrastructure. First, you need to know what your hardware is capable of. What is the maximum performance of your storage, your network, and your compute hardware capable of? This information is available from your hardware vendor or in your service level agreement if you're leveraging a cloud provider.

Next, you must figure out how to measure your current infrastructure utilization. You could use the many different tools that each manufacturer provides, or a centralized tool like vRealize Operations that can make all this information available in one place. In either case you must be able to gauge your current utilization compared to the maximum that your hardware can deliver.



REMEMBER

It's also important to determine how much risk you're willing to accept. Do you want to utilize 100% of your capacity and maximize your hardware spend? This approach puts you at great risk of performance degradation, as there are no more resources to feed any sudden demands for more resources. A better approach is to maintain some headroom for these demand spikes. Whether that's 15%, 20%, or more depends on how critical the applications that are running on that hardware are. Capacity management also plays a big role here, and we'll discuss that more in just a bit.

Tuning your alerts

Alerting is the next big piece of the puzzle. Now that you know what your resource limits are, you need to know when they are exceeded. A monitoring tool with alerting capabilities is a must-have for any organization. How your team gets that information is up to you and whatever tool you chose to use. vRealize Operations, for example, can interface with a broad range of notification methods such as email, Slack, or opening an incident in your ticketing system. Getting the data to your team in a way that works with their workflows is crucial to avoiding performance issues.

Simplifying Troubleshooting

Even with the best monitoring and alerting tools out there, things will inevitably manage to slip through the cracks. Changes in the environment, hardware breaking down, or a bad software patch can ruin anyone's day. A former co-worker always used to say that IT is like juggling hand grenades — one is bound to go off sooner or later.



REMEMBER

To avoid as many problems as possible, you need to be monitoring everything from the application layer all the way down to the compute layer, including the network, storage network, server chassis, and storage arrays. Some customers even take things to the next level and measure the user experience using Application Performance Monitoring (APM) tools, which can measure things like how fast the application is serving data to the user. Many customers also measure environmental metrics such as the temperatures inside their data centers and how much power is being drawn. The more quality data you can collect, the better.



WARNING

When you don't have visibility into the entire IT stack, troubleshooting is often a matter of wandering around, poking at different things, and hoping you stumble onto the root cause. Either because you don't have any monitoring in place, or because the monitoring tools you're using don't provide enough historical information to see what happened at the time of the incident, you're mostly flying blind. You can end up spending a lot of time theorizing what *might* have occurred, but your troubleshooting journey often ends without any conclusive explanation.

You can avoid this unhappy situation by periodically reviewing what is being suitably monitored and what isn't. Here are a few things to look for:

- » **Quality data:** There are quite a few approaches you can take to collect information from an application or a device. The available options depend on what technology the manufacturer or developer has implemented, and some may implement them better than others. Just make sure the collected data accurately represents what is being monitored. For example, suppose you're monitoring a storage

array, but the only data you're collecting is how much capacity is used and how much is remaining. While this data is certainly useful, you're missing out on a huge swath of performance data, such as how quickly the array can store and retrieve data.

- » **Collection cycles:** Most monitoring solutions collect data at regular time intervals, usually in terms of seconds or minutes. This is fine for most troubleshooting scenarios; decreasing to sub-second collection intervals is generally not needed. In fact, polling data too frequently can be taxing on the monitoring solution as well as the device or application being monitored.
- » **High quality historical data:** Since troubleshooting is a reactive process that analyzes what happened in the past, a proper solution must be able to retain high-quality historical data. Most solutions will roll up or average older data as a method of saving storage. Look for a monitoring solution that retains the full data for an ample amount of time, as troubleshooting might take you days, weeks, or months into the past.



TIP

Monitoring isn't just about collecting metrics. Most applications and infrastructure have some level of logs available. Often, logs can provide the evidence needed to determine a root cause. Collecting logs in a central log analytics solution such as vRealize Log Insight can drastically reduce time spent on troubleshooting. Being able to simultaneously search across multiple log sources can be a real game changer.



TIP

Troubleshooting doesn't have to be a fully manual process anymore. Advanced monitoring solutions like vRealize Operations can monitor the full stack and sift through far more data points faster than any human. In a few clicks, only the most relevant information is presented automatically. This includes things like changes made to the environment and metrics that show significant changes or are behaving outside their normal range. Integration with vRealize Log Insight will also allow you to view logs alongside metrics for a complete picture.

In an ideal world, you would have a centralized solution that can monitor everything in the environment as well as integrate with other cloud management tools. The more centralized your monitoring becomes, the easier it is to correlate data and

leverage technologies such as machine learning to identify areas of interest. Leveraging too many disparate tools can become overwhelming and confusing as well and lead to more manual work accumulating data in spreadsheets or in notebooks.

Achieving Efficient Capacity

Managing the capacity of your clouds is a bit of a balancing act. On one hand you want to make sure you have plenty of resources available for your applications. On the other hand, you want to get the most out of every dollar you spend on cloud. Here are some things to consider.

To allocate or demand?

There are two ways to look at capacity with private and hybrid-clouds. The first is *allocation-based* capacity. This approach looks at the configuration of your virtual machines to determine how much capacity is consumed. If a VM is configured with 2vCPUs and 16GB of memory, then that's 2vCPUs and 16GB of memory less capacity that's available. This is the default approach that many customers choose as they begin their cloud journeys because it's easy to understand. However, as these customers cloud strategies mature, they start to realize this isn't the most efficient way to manage capacity. Allocation-based capacity management assumes that a VM will use 100% of its allocated resources. In the real world, nobody is provisioning a VM with the hopes that it will consume every resource completely. Headroom is factored in to meet the changing demands of the application and to run other processes such as backup jobs and antivirus scans. As a result, with allocation-based capacity you're potentially leaving a lot of unused resources on the table.

That's not to say there's no place for allocation-based capacity management. In the case of mission-critical applications, allocation-based capacity makes sense. That's because you're essentially guaranteeing resources to that VM or application. Most customers dedicate a group of hosts known as a *cluster* to such applications, accepting that there'll be unused resources.

For the non-mission-critical applications there's *demand-based* capacity management. This approach looks at the actual resource utilization for each VM to determine how much capacity is consumed. This approach enables you to pack more workloads on to your hardware and essentially get more for your dollar. There are of course some risks involved in taking this approach, but that's why you set thresholds for how many resources you want to leave free just in case.

Demand-based capacity management requires more scrutiny due to ever-changing resource demands, and it can be difficult to monitor manually. Tools like vRealize Operations can make it much simpler by analyzing the data as it's collected and calculating the current capacity utilization. Furthermore, it can tell you how many VMs you can deploy before you run out of capacity and even project when you'll run out.

Taking out the trash

Over time your environment will start to accumulate garbage. Snapshots will be taken and forgotten. VMs will be overprovisioned, or provisioned for a short project and then abandoned. Because *maybe it'll be useful again someday, and besides we don't want to have to open another ticket to have IT create a new one for us*. Or so goes the thinking.



TIP

Identifying and reclaiming wasted resources is another great way to maximize capacity. It's good for your bottom line because you're not wasting costly storage to hold on to garbage that you don't need. Plus, it's good for the environment. Reclaiming resources improves your consolidation, which means fewer servers consuming energy and producing heat. That's pretty cool (pun intended)! Self-service tools like vRealize Automation also have built in governance, so you can set a time limit for those test VMs; after a certain number of days, they're automatically deleted.

Alleviating the pressure

One last tip to achieving efficient capacity is to watch out for hot spots. One of the great things about cloud infrastructure is that you can move workloads without having to take services offline. This means if you have a cluster that's running out of capacity, you could simply move workloads to another cluster that has room to spare and avoid paying for additional hardware. Solutions

such as vRealize Operations can also enable you to set policies to avoid moving workloads to undesired hardware. For example, if there are regulatory or licensing requirements that prohibit a VM from running outside of a cluster or specific hosts.

Managing Cost

While the cloud may seem vastly infinite, your budget is not. Thankfully there are solutions to help stretch your hard-fought money.

Of course, proper capacity management plays a large role in managing your costs, and tools like vRealize Operations can help you measure your capacity savings in financial terms. But what are some other ways to manage your cloud costs better?



TIP

Tools like CloudHealth by VMware can help reduce costs on public clouds. By analyzing your public cloud services and bills, CloudHealth can highlight ways for you to save money. This includes things like rightsizing VMs and storage volumes to make sure you're not paying for wasted resources. It also takes the complexity out of things like reserved instances and savings plans to get a better discount on your services.

Similarly, vRealize Operations can provide cost management for your VMware Cloud(s). You can either leverage out-of-the-box cost drivers based on industry standards or provide your own. You can see your total cost of ownership all the way down to the individual VMs. That's very useful for planning upcoming projects and understanding their cost implications. You can even share cost data with vRealize Automation so users can see what the daily cost of their provisioned services will be.

Understanding your costs is just the tip of the iceberg. With this information, you can operate like a public cloud provider and charge your consumers for their resource usage. Not only can you mark up expenses, but you can also charge fees for things like backups, replication, or enhanced service level agreements. Now, you've got more budget for things like innovation and pizza parties.

Even if you're not ready to operate your cloud like a provider, you can at least show your consumers what their services cost the organization. Doing so can change their behavior. By realizing how much that mega VM is going to cost the organization, they may instead opt for a more reasonable configuration. You'll also gain leverage in cases where you're requesting to reclaim resources. It's easier for consumers to accept a loss of resources when they understand how much their gluttonous consumption of IT was costing the business.

Monitoring Configuration and Compliance

Now that you have a foothold on capacity, cost, performance, and troubleshooting, the next step is to talk about policies. Specifically, any policy held by your organization or regulatory standards committee with regards to maintaining a compliant and secure infrastructure.

Depending on where your organization operates, what industries it's involved in, what services it provides, and where its customers are, you may be bound to regulatory standards. One example is the General Data Protection Regulation (GDPR), which regulates how customer data is handled for customers inside the European Union. Similarly, healthcare providers within the US are bound to HIPAA to protect patient data. If your organization accepts payment via credit card, it may also be bound to PCI. Such standards protect your organization's consumers from things like breaches or sheer negligence. It's up to the organization to maintain compliance lest it face penalties for a breach or audit failure.

Knowing the policies and how to apply them is one thing. Configuring your environment and maintaining that configuration state is an entirely different element. Thankfully, there are tools and services that can help.



WARNING

Your organization should already be performing regular security and compliance audits and the tools and processes described in this book are no substitute for these essential exercises. Instead, these tools can compare your environment to pre-defined or custom benchmark standards to highlight deficiencies, and to help maintain a consistent and compliant configuration. Automation is a must for enforcing these policies, especially at scale.

For VMware Clouds, vRealize Operations can provide a good overview of your compliance posture. It can analyze the configuration of your hosts and virtual machines and compare that to benchmark compliance standards plus VMware's own hardening guidelines. If your organization has its own configuration policies or standards, vRealize Operations can compare your VMware infrastructure configuration to these as well. vRealize Operations provides actionable configuration changes you must make to comply with these benchmarks.

You can also use vRealize Operations to track your progress as your team makes changes. You can configure alerts to notify your team of misconfigurations. Plus, through its integration with vRealize Orchestrator, vRealize Operations can make these changes automatically as soon as they're discovered. This is also great for resetting temporary changes made for troubleshooting, for example.



WARNING

Although you don't have to manage physical infrastructure with Public Clouds, there are still many ways to shoot yourself in the foot when it comes to security and compliance. For example, rapid development cycles and lack of knowledge may cause engineering to take shortcuts that inadvertently put the organization at risk. This is where CloudHealth Secure State can help. Secure State will evaluate your public cloud topology and look for misconfigurations and vulnerabilities that can lead to security holes or non-compliance. It can also track these issues to connected services and bring visibility to the wider impact of non-compliance. Using automated actions, it can resolve these issues immediately and reduce the risk to your organization.



TIP

Operating system and application policies can be enforced by change configuration management tools like vRealize Automation Salt Stack Config. This enables you to take a desired configuration, be it security or application configurations, and apply it to your virtual machines on private or public clouds. You can even use it to ensure specific software is installed, like antivirus, or to deliver patches to existing software. If someone tampers with any of these configuration or software items, Salt Stack Config will revert everything back to your desired state.

- » Understanding why migration planning is important
- » Discovering application discovery
- » Mapping application dependencies
- » Forming migration waves
- » Monitoring migration

Chapter 5

Migrating To and Between VMware Clouds

Up until now, we've talked about the different types of VMware Clouds, and how to use VMware vRealize Cloud Management to build, operate, and create a self-service cloud experience.

But how do you get *into* that VMware Cloud or migrate workloads from one VMware Cloud to another? In this chapter, we dive deep into migration planning — what to take into account, how to gather the data, and how to get a seamless experience from the planning stage to running the migration.



REMEMBER

Planning is the most important step when moving traditional workloads into the VMware Cloud.

Why Should I Plan?

Migrating applications can be a scary process, fraught with dangers both real and imagined. Things often break during migrations, and the fear is that, like Humpty Dumpty, they can't be put together again. But it doesn't have to be that way, not if you plan

the migration right. In fact, planning is the most important step in the migration process.

In a migration, you're effectively picking up the application from its trusted, reliable infrastructure (on which you know how it performs) and placing it on a new infrastructure. How can you guarantee that the new infrastructure is able to handle the application?

Migration is a very collaborative process. The entire IT team must be involved, from the Developer (Rachel makes sure the app is functional after migration) to the Cloud Admin (Carlos is responsible for the migration) to the VI Admin (Lisa needs to make sure the destination is ready for the app), all the way to the Network Admin (Ray makes sure the app is reachable after migration). With this many people involved, making a solid plan is key.

In this chapter, we take the viewpoint of our (fictional) customer MOAD again and walk through a migration scenario.



REMEMBER

Remember from Chapter 1 that there are different types of migration: limited application migration, partial application migration, and a full application migration. These types can be handled differently. You can translate them into full data center migrations, a per-network migration, or a per-application migration. This chapter focuses on a per-application migration scenario, but the exact same data could be used for a per-network or a full data center migration.

Understanding the Application Discovery Process

When you're going to migrate applications to the cloud, it's important to understand what moving parts are involved, and how they'll react to the migration changes. Having a thorough knowledge of your application's topology and dependencies is a key factor in successfully migrating an application to the cloud. That's especially true in hybrid cloud scenarios where an application stretches between the on-premises data center and a public cloud — whether that be temporary or permanent.

To that end, understanding the application that you're about to migrate from a networking perspective is imperative. With

vRealize Network Insight, answering some of the hard questions around application topology and application dependencies is a lot easier.

In the bi-directional complexity of external services (or users) accessing an application, important factors include network-ing routes/topology, external resources the application needs to function (and where those run), and the bandwidth requirements of each of these relationships.

In this context, an *application* is defined as one or multiple work-loads working together to deliver a service. These workloads could be VMs, physical servers, or even Kubernetes services.

MOAD's Network Admin, Ray, will use vRealize Network Insight's capability to discovery applications to get a handle on the applica-tions running inside the MOAD on-premises network.



REMEMBER

Why the network? Because it's the absolute source of truth. CMDB's have to be kept up to date. The developer documentation might be incomplete (sorry, Rachel!), but the network shows you exactly what's talking to what.



TECHNICAL
STUFF

Here are the different methods to discover applications. You can use a single or a combination of them.

- » **VM Tags.** vSphere, AWS, Azure, any tags.
- » **VM Names.** Use a regular expression to match application and tier names from the VM name.
- » **Security Groups or Tags.** Match the application and tier names from the security naming convention.
- » **ServiceNow CMDB.** If your CMDB is up to date, pull the applications from it.
- » **Flow-Based.** Looks at the traffic in the network and forms application and tier boundaries based off actual behavior. (Hint: Use this one!)

Ray uses the latter method as his default because that looks directly at the traffic flows in the network and uses a machine learning algorithm to determine what workloads form applica-tions. No upfront configuration or meta-data is needed. Appli-cation Discovery suggests a list of applications that can be saved to vRealize Network Insights database. After the applications are

saved, you can use them for dependency mapping, monitoring, and troubleshooting.

You know what's totally awesome? When Ray runs Application Discovery in vRealize Network Insight and saves applications, that application context gets transferred into vRealize Operations. That way, Ray and Lisa can both understand the application landscape.

Mapping Application Dependencies

Now that Ray has gotten a handle on the applications running inside the on-premises environment, he can get to work and map out the dependencies between these applications using vRealize Network Insight. Using the same network traffic data, Ray can see the connections between different applications and the details around those connections.

To be more precise, he can see which network ports are being used, how much traffic is going between the applications, how much internet and end-user traffic is there.

Ray also uses the geographical information attached to traffic flows to determine where in the world the most end-users are located for internet-facing applications. Placing the application as close as possible to the bulk of your end-users will improve the performance for them.



TECHNICAL
STUFF

These metrics are very important when it comes to migration planning, and vRealize Network Insight shows them out of the box:

- » Inter- and intra-application
- » Internet egress/ingress and geography
- » Traffic patterns (bursts of traffic, or flat averages)
- » End-user traffic, or dependencies on other (physical, on-premises) workloads
- » Bytes-, packets-, connections-per second, latency, and security posture of all data

These are the most important metrics, vRealize Network Insight offers endless metrics via its search engine.

Going through these metrics and application dependencies will give Ray a good understanding of the traffic patterns in MOAD's network. Based on bandwidth, packets, and latency, he's able to define the network requirements in the VMware Cloud and make informed network design decisions around them. These are the main design questions to ask:

- » How much bandwidth do you need between the remaining on-prem applications and end-users and the VMware Cloud? The answer will dictate the size of the Directed Connect, Express Route, VPN, or other method of connecting to the cloud.
- » How many SDDCs do you need to handle the network load? While they are high, there are limits to what each SDDC can handle. Going over the limit will negatively affect performance.
- » How much egress bandwidth will you need when a VMware Cloud hosts these applications? In the public cloud there's a cost attached to sending data out, and vRealize Network Insight can help predict that cost.
- » What are the current security policies? You need to migrate these policies as well. vRealize Network Insight can recommend security policies, which can be directly imported into VMware Cloud.

Ray can get the answers to these questions and more with vRealize Network Insight.

Forming Migration Waves

So far, we've been talking about a per-application analysis. A typical data center has hundreds, maybe thousands of applications. *Migration waves* are groups of applications that are migrated in bulk and at the same time — or at least in the same maintenance window.

How do you form these migration waves? Depending on what type of migration you're doing (full data center or per-application), there's a process for selecting which applications to migrate.

The full data center migration is the easiest. You group the apps by which network they are in first, and then group by the amount of bandwidth going to apps outside of their network. The reason for focusing on the network is simple: You want to minimize the network extensions towards the VMware Cloud.



VMware HCX enables you to extend a network to anywhere. The same IP subnet is routable on each location, making it possible to migrate live workloads, and not having to change their IP addresses. More about this later.

The per-application migration might be a little tougher, depending how spread out the apps are between different networks. If a lot of networks are involved, Ray will need to make sure to design the VMware HCX network extensions diligently. (Learn more about network extensions at <https://tinyurl.com/amu5vcxp>.)

Create migration wave applications

Once Ray has figured out the right migration waves, he creates new applications in vRealize Network Insight that include all the applications in those migration waves. He nests the selected applications into another application (like Russian dolls) to further validate the migration waves.

Here's an example:

- » **Migration Wave 1.** Contains applications: CRM, Call Center, File Server.
- » **Migration Wave 2.** Contains applications: Exchange, VDI, Streaming Media.

Ray does this because of the application context. When the migration waves are defined as applications themselves, you can validate the network requirements for the entire group. This enables you to double-check whether the network design still holds up when these applications land on the VMware Cloud.

Another benefit is that the migration wave applications will synchronize to vRealize Operations.

We've looked at the network requirements, but not yet at the compute and storage requirements. That's where vRealize Operations comes in.

Compute and storage requirements

When Ray finishes mapping out the network requirements, Carlos and Lisa can get together to map out the compute and storage requirements. They'll have it easy, as Ray has done most of the work with vRealize Network Insight, which has synchronized to vRealize Operations.

Migration planning is also a native feature in vRealize Operations, so Lisa can easily create what-if scenarios for any of the VMware Clouds. She can create scenarios for each migration wave, with the right VMware Cloud type and Application Profile selected, configure some slack space, and run the report.

The resulting report tells Lisa and Carlos exactly how many hosts they'll need in their VMware Cloud, how much capacity is needed, and even how much it will cost to run the workloads in the migration wave.



TIP

You can also take existing SDDCs into account when doing this exercise. vRealize Operations keeps close track of the utilization of each VMware Cloud SDDC and knows exactly how much capacity is still available.

With these reports, Lisa and Carlos can make sure the destination compute and storage resources are up to snuff for the incoming workloads.

MOAD now has a migration plan with the workloads grouped into migration waves, and the team has made sure the VMware Cloud design isn't going to give them any surprises. The migration should go off without a hitch!

Running the migration

The actual migration is where VMware HCX really shines. HCX is VMware's Application Mobility platform. It provides a ton of migration features for either cold or hot migrations. The layer-2 network extensions and advanced traffic engineering take care of the network. There's even WAN optimization to speed up the migrations. It's extremely cool. Check out www.vmware.com/products/hcx to find out more about HCX.

HCX uses Mobility Groups, which is a similar concept to the applications within vRealize Network Insight and vRealize Operations. A *mobility group* is a group of VMs that are migrated together. Sound familiar? Yes! That's exactly what we built with the migration wave applications.

That's the second reason for creating those applications. There's a Fling available at via.vmware.com/EW05 that retrieves the applications and workloads inside it, to synchronize them to HCX. You don't have to manually copy and paste the migration wave information into HCX.

Carlos, the one running the migration, runs this Fling for every migration wave. They show up in HCX right away, and he's able to kick off the migration for the entire migration wave in one click.

Monitoring the Migration

Now that the migration is underway, it's crucial to get monitoring right. MOAD has scheduled multiple migration windows: some on weekends and some on weekday nights (depending on the size of the migration wave). During the migration period, network extensions will move from the on-premises data center to the VMware Cloud. During the migration windows, someone must monitor the HCX management components, the underlying infrastructure, and the applications for any issues because of the massive data move. Let's have a look at the most important metrics to look at in several key areas.



REMEMBER

Network:

- » Monitor outgoing traffic (bandwidth, packets, loss, and latency) usage between on-premises and the destination VMware Cloud. Be careful not to choke the connections.
- » Monitor traffic going over the network extensions. There are limits to how much traffic can go over those.

Management and Infrastructure:

- » Determine whether the VMware HCX components are healthy, from the network extension appliances to the interconnect appliances that replicate the workloads to the destination.
- » Make sure that both the source and destination clouds are handling the stress of the migration. You need a holistic monitoring setup to make sure all layers (including storage, compute, network, virtualization) are healthy and keeping up under the migration load.

Application:

- » Application monitoring should already in place, but always double check whether monitoring on the application level is configured. A successful ping doesn't mean your website works.
- » Use the monitoring status to get accurate before-and-after pictures of the application health.



REMEMBER

In all of MOAD's scheduled migration windows, the entire team utilizes vRealize Network Insight and vRealize Operations to cover all bases that we talked about.

- » Finding the ROI
- » Hearing what the experts say
- » Getting started

Chapter 6

Powering Your Cloud Operating Model

At the end of the day, your efforts need to deliver a quantifiable return on investment for your business. In fact, all three cloud operating model ingredients need to have a justifiable ROI:

- » The **people** on your team have to deliver value to the business that justifies their salaries.
- » The **process** your team uses has to be quantifiably better than the old process — measured in speed, efficiency, cost, risk, and so on.
- » The **technology** your team uses has to pay for itself.

Like we've said before, we're going to assume you have the right people, and so far this book has taught you a lot about the process ins and outs. Let's take a look at the final piece: technology.

Delivering the ROI

If you're the proud owner of a stable of management tools, it would be prudent to understand both what they're *costing* your business and what quantifiable value they're *providing* your business. It sounds obvious, but proving ROI can be a tricky thing. Some types of value are easy to quantify; other categories are less so.

It makes sense that the only cloud management technology built *specifically* for the VMware Cloud would give you the highest ROI on managing your VMware Cloud.



REMEMBER

vRealize Cloud Management can pay for itself. The payback is found in a variety of places.

Capacity optimization and hardware cost savings

By designating exactly how workloads should be distributed using vRealize, users can ensure they are utilizing their infrastructure capacity optimal efficiency. They can easily identify and reclaim waste in the environment, and they can even automate the process of doing so. That means less hardware and less procurement is required.

"We were able to recover enough resources that had been wasted to get through two years with no capital expenditures." Technical manager, a major travel company.

"(vRealize) enabled us to identify all our hardware and categorize what we don't use, haven't seen, or were not aware of. We saved \$1.5M in that consolidation and reallocation activity." Principal technical architect, a global automotive company.

Accelerated delivery

Automating the most time-intensive and dependency-heavy parts of the deployment process with vRealize enables organizations to cut workload deployment time from days or weeks to *minutes*. Not only that, but the control and governance that automation introduces make these deployments more consistently successful.

“Culture has shifted with automation because people think about servers differently. They don’t think in terms of days anymore; now, they just click a couple buttons and it’s ready in 30 minutes.” IT director and enterprise architect, healthcare services.

“In one use case for a large marketplace, a typical release cycle took about 80 hours and was brought down to 3 hours.” CTO, midsize Fin-Tech organization.

“We increased our deployment success rate to the high nineties from around 80% with our old processes.” Manager and senior systems architect, healthcare technology.

Reduction in issues and MTTR

When you can see everything in your environment, you can avoid a lot of issues. Think back to the plane cockpit example from Chapter 1 — you can’t fly a plane (operate a cloud) without visibility into the status and performance of its many intertwined systems. vRealize gives you that visibility into your VMware Cloud, helping you avoid costly issues (it’s expensive when stuff breaks).

When issues do arise, vRealize enables you to fix them as quickly as possible. Spending your days keeping the lights on and troubleshooting is just a waste of everyone’s time, and time is money when you need to get innovation to market ASAP.

“In my time in IT, I’ve never seen anything this dramatic. The improvements were so big. We suddenly got so much information.” Infrastructure manager, telecommunications.

Reduction in unplanned downtime

The worst issues are the ones that cause (unplanned) downtime in your business-critical applications. Every minute those applications are down, your business is potentially losing millions of dollars. You can almost see the money flying out of the building. Shuddering yet? You know what apps we’re talking about — or, you should — and you need to maximize their uptime. With vRealize helping you to dynamically optimize for infrastructure capacity, performance, and remediation time, those apps stay online when you need them the most — and your business charges onward with happy customers.

“(vRealize) has helped decrease downtime by 80%.” System analyst, engineering organization with 10,000+employees.

Operational efficiency

When your employees can see more things, solve issues faster, automate the “junk work,” and spend more of their time innovating, the business wins. After all, if your Sys Admin wanted to be a firefighter, she probably wouldn’t be working in IT with you.

vRealize can suppress a lot of fires before they happen, automatically extinguish others that pop up, automate time-intensive tasks, and generally free your IT team to be the best, most efficient version of itself.

“The amount of time it took us to write the automation was returned in hours saved in under a month for almost every task.” IT director and enterprise architect, healthcare services.

“With more proactive infrastructure management, we’ve been able to reduce issues by 10% to 15%, time to issue resolution by 20% to 30%, and overall operational workload by 35% to 40%. Managing our virtual and physical environments has become more effective and smoother.” Senior IT infrastructure analyst, South American education company.

Compliance enforcement

A more compliant environment reduces a lot of risk for your organization. It takes human error out of the equation and brings your deployment and operations into a consistent framework. This means your organization is more secure, and you’re less stressed. vRealize helps customers ensure the compliance posture of their VMware Cloud, decreasing the need for manual auditing.

“Instead of manual work to protect the environment, [with vRealize], the environment protects itself.” Manager, senior systems architect, healthcare technology.

“We had hundreds of non-compliant servers, and users dragged their feet getting off unsupported [platforms] because it was so difficult to get a new server. Automation improved compliance; servers are deployed quickly, so it’s much easier for users to stay compliant. All new builds are automatically put into the right patch group and audited, so nothing slips through the cracks. We’ve reduced risk and tightened our security posture while maintaining consistency across builds.” IT director and enterprise architect, major healthcare provider.

SURVEYING THE INDUSTRY EXPERTS

When you're selecting a strategic vendor to help you manage your IT stack and/or cloud infrastructure, *trust* is just as important as ROI or time-to-value. You need a partner on your journey that will not just *be around* for a long time, but also *empower* you to pursue whatever technological direction is best to accomplish your unique goals. With VMware Cloud, you can run your workloads on self-managed on-prem infrastructure, or cloud provider managed infrastructure, or some mix of the two — with a consistent operational framework.

This is also why vRealize makes good sense for operationalizing your VMware Cloud. The gamut of analyst recognition paints a clear picture:

- #1 in Market Share: IDC IT Automation and Configuration Management
- #1 in Market Share: IDC Worldwide Cloud System and Service Management
- #1 Position: OMDIA Universe – Selecting a Hybrid and Multicloud Management Solution
- LEADER: Forrester Hybrid Cloud Management Wave
- LEADER: Forrester Infrastructure Automation Wave
- LEADER: Forrester Cloud Cost Management and Optimization Wave

CASE STUDY: PROVIDENT MÉXICO

Provident México is the leading company in the personal home loans market in Mexico. Their goal is to make a difference every day by providing fast loans in an inclusive, transparent, and responsible way.

Recently, Provident sought to boost business growth by migrating several of its central applications to VMware Cloud on AWS.

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Seeking to maximize the value of their cloud investment, Provident turned to vRealize Cloud Management. Provident's goals with this solution were to:

- **Modernize legacy systems** and understand the complete IT environment, including application and networking dependencies.
- **Support a hybrid cloud environment** by continuously monitoring the capacity and performance of infrastructure and applications on-premises and in the cloud.
- **Understand the costs** and efficiency of their cloud environment.
- **"Future-ready" the business** by partnering with an industry-leading solution that would grow with Provident Mexico.

With vRealize Cloud Management, Provident saved time, capacity, and money. They improved their agility while decreasing risk at the same time. Although it was an intimidating step to migrate critical workloads to the cloud — especially in financial services — Provident knew it was "both necessary and practical to achieve IT and business goals."

Here are some of the specific ways Provident Mexico benefitted from vRealize Cloud Management for their VMware Cloud:

- Saved 2 years on their cloud migration project.
- Reclaimed 30% of their infrastructure capacity.
- Improved management efficiency.
- Lowered risk with app discovery and visibility.

Getting Started

If vRealize Cloud Management sounds like it might be a good fit for your organization to use with its VMware Cloud, you might start by thinking about the specific benefits you hope to get and making a plan to bring those benefits to fruition.

First, identify the top things you want to accomplish with the VMware Cloud for your organization, and how they might come together when you have vRealize Cloud Management's capabilities at your fingertips. For example, are you most interested in greater automation, cohesive operations, or the ability to plan out your migration?

Then pick out one "quick win" to pursue right away. What would be a big, (relatively) easy rock to move that would show instant value to your organization?

Maybe you're still early in the research process and you don't even know what a good "quick win" would be right now. Try exploring some vRealize customer reviews on IT Central Station (via.vmw.com/EW0a) or Gartner Peer Insights (via.vmw.com/EW0d; via.vmw.com/EW0e) — two great resources that will give you an unfiltered, unbiased look at real wins that customers have achieved for their businesses.

For more great resources to help you get started, turn to Chapter 7.

- » Exploring the Pathfinder library of resources
- » Reviewing VCF Solution Briefs
- » Getting hands-on experience

Chapter 7

(More than) Ten VMware Cloud Management Resources

While we provided some broad guidance on places to get started in Chapter 6, we want to end with our favorite specific resources for taking the next step. That next step could be learning one small new thing today, or it could be deciding to overhaul your entire organization's approach to cloud. Hey, you've got to start somewhere, right?

Pathfinder

VMware Pathfinder is a curated library of choose-your-own-adventure style content where you can easily learn, evaluate, and validate VMware solutions for your organization.

Here are what we consider the most relevant paths for evaluating management for your VMware Cloud. If this book hasn't answered your burning questions about managing a VMware Cloud, hopefully these resources will.

Managing a Private Cloud with vRealize Suite and VMware Cloud Foundation (via.vmw.com/EW0h): See how customers accelerate the speed of their IT responsiveness to changing business needs with infrastructure automation, consistent operations, and governance.

Managing a Hybrid Cloud with vRealize Cloud Management and VMware Cloud on AWS (via.vmw.com/EW0i): Discover the way to consistent hybrid cloud management using the same tools, processes, and skill sets to operate your apps, infrastructure, and platform services across clouds.

Modernizing IT with vRealize Cloud Management (via.vmw.com/EW0j): Learn how to modernize your infrastructure and operate it like a public cloud to get the most efficiency, offer just-in-time services for customers, and quickly resolve issues, so you can be more agile.

Accelerating Cloud Evolution with vRealize Cloud Management (via.vmw.com/EW0k): Learn how to accelerate hybrid and public cloud adoption by enabling consistent operations across clouds.

Assuring Developer Productivity with vRealize Cloud Management (via.vmw.com/EW0m): Find out how to operationalize self-service Kubernetes and VM workloads.

Overview of vRealize Operations (via.vmw.com/EW0n): Run production operations hands-off and hassle-free with self-driving operations, from apps to infrastructure and across private, hybrid, and multi clouds. VMware vRealize Operations, powered by AI and predictive analytics/ML, delivers continuous performance, capacity and cost optimization, proactive planning, intelligent remediation, and integrated compliance.

Overview of vRealize Log Insight (via.vmw.com/EW0p) / **Cloud** (via.vmw.com/EW0q): Achieve scalable log management with intuitive, actionable dashboards, sophisticated analytics, and broad third-party extensibility. Obtain deep operational visibility and faster troubleshooting across physical, virtual, and cloud environments.



TIP

Every vRealize offering has an on-premises counterpart and a SaaS (Software as a Service) counterpart. For example, there's *vRealize Operations* and *vRealize Operations Cloud*; *vRealize Automation* and *vRealize Automation Cloud*; and so on. *vRealize Log Insight*

Cloud is one of VMware's SaaS offerings that has been intertwined with VMware Cloud on AWS from the beginning — in fact, every VMware Cloud on AWS customer has access to VMware Cloud audit logs in vRealize Log Insight for free!

You can find out more about the specific vRealize offerings in VMware's cloud management portfolio today on the vRealize Cloud Management webpage (via.vmw.com/EW01).



TIP

Overview of vRealize Network Insight (via.vmw.com/EW0r): Build an optimized, highly available and secure network across clouds with visibility and analytics across virtual and physical infrastructure.

VCF Solution Briefs

Use these compact overviews to deepen your understanding of how vRealize Operations and Automation specifically deliver the cloud in VMware Cloud Foundation:

vRealize Operations (via.vmw.com/EW0s): Read how self-driving operations deliver the ROI on full-stack cloud infrastructure by helping organizations optimize performance, capacity, cost, planning, troubleshooting, and compliance.

vRealize Automation (via.vmw.com/EW0t): Discover how self-service private cloud with VMware Cloud Foundation enables IT organizations to transform their on-premises data center infrastructure into a modern private cloud with self-service consumption and delivery capabilities.

That's ten resources, but wait! We still have a few more things to tell you about, so here are some bonus suggestions.

Events and User Groups

There are lots of ways to interact with the VMware community at large. Every Fall, *VMworld* acts as a central hub for big announcements, expert sessions, roundtables, demo booths, and so on. If you like drinking from a fire hose, VMworld is the place to be. You can find information about this year's VMworld conference at vmware.com/vmworld.

You might also consider joining a VMware User Group (vmug.com), VMware's online community, where fellow users network, share, and learn from one another while getting specialized access to cutting edge information from VMware experts.

Hands-On Product Experience

For those of you tactile learners out there, sometimes the best way to learn about this stuff is just to dive right in and start tinkering. There are a couple ways to do this.

Hands-on Labs (via.vmw.com/EW0u): A set of online simulations that allow you to walk through a guided demo for a real-world situation. Pick a lab module to get a guided simulation of any vRealize product or solution as applied to a specific scenario. Some sample titles:

- » Operationalizing Your Cloud With vRealize Cloud Management
- » Getting Started With vRealize (Operations, Automation, Log Insight, Network Insight)
- » A Cloud Management Journey From Monolith to Modern Apps With the vRealize Suite

Eval License (via.vmw.com/EW0v): You can try out any of the vRealize offerings — completely free — for 60 days with a complimentary eval license. The vRealize Cloud Management website (via.vmw.com/EW01) can show you exactly where to go to try an evaluation license of any tools in the portfolio.

Sample Exchange: If you're already using vRealize, you might want to check out some of the custom content that vRealize users (and the product teams!) have put together. Content includes custom dashboards, workflows, metrics, views, alerts, scripts, and searches.

- » vRealize Operations (via.vmw.com/EW0w)
- » vRealize Log Insight (via.vmw.com/EW0x)
- » vRealize Network Insight (Scripts) (via.vmw.com/EW0y)
- » vRealize Network Insight (Searches) (via.vmw.com/EW0z)

Discover a powerful, integrated, and flexible cloud solution

Cloud technology has proven to be a game-changer for businesses the world over. But how do you know which approach is best for your organization? In *Managing a VMware Cloud For Dummies*, discover how VMware Cloud gives you a unified framework for any of these approaches – whether private, public, or hybrid – and how you can get the best from your VMware Cloud for maximum ROI. Dive in to discover how vRealize Cloud Management optimizes the VMware Cloud of your choosing, equipping your organization for maximum performance and speed – at minimum cost and risk.

Inside...

- Plan and monitor your cloud migration
- Ruthlessly automate services and deployments
- Govern for security, consistency, and compliance
- Optimize for performance, capacity, and cost
- Simplify troubleshooting
- Monitor configuration and compliance

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