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Hybrid Cloud Management

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Manage any cloud from anywhere

Deploy applications faster

Control utilization and costs across clouds

Scott D. Lowe

HPE 2nd Special Edition

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Hybrid Cloud Management For Dummies®, HPE 2nd Special Edition

Published by
John Wiley & Sons, Inc.
111 River St.
Hoboken, NJ 07030-5774
www.wiley.com
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ISBN 978-1-119-74625-6 (pbk); ISBN 978-1-119-74139-8 (ebk)

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

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Publisher's Acknowledgments

Some of the people who helped bring this book to market include the following:

Project Editor: Elizabeth Kuball

Associate Publisher: Katie Mohr

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Production Editor: Mohammed Zafar Ali

Special Help: Faithe Wempen

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Introduction

The hybrid cloud has become the de facto standard operating model for IT, and with that comes a lot of benefits — and a few drawbacks and risks as well. It's an exciting time to be in the IT industry, but it's also a bit scary at times. The rate of change continues to increase, and the demands from the business seem to get more intense as time goes on. There are major decision to be made, with significant consequences.

What are IT pros and decision makers to do?

About This Book

This book helps you understand the world of hybrid cloud: how to define it, how to manage it, and how its use affects an organization. Although much cloud management involves controlling costs, there's also a lot of opportunity to be found by considering the hybrid cloud environment in a more substantial way.

In this 48-page journey of discovery, you learn about the key items that you need to address as you undertake your cloud journey. This book explains how *cloud* encompasses both on-premises and public cloud provider environments and why it's important for a cloud management platform to support it all.

Foolish Assumptions

This book is for anyone in IT who may want to learn more about the cloud in general and hybrid cloud specifically. For this book, I assume that you're an IT professional, manager, or executive with at least a basic understanding of data center computing, virtualization, and cloud.

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Icons Used in This Book

Throughout this book, you find a number of icons intended to help you better understand and remember key concepts:

REMEMBER

The Remember icon marks important terms and concepts to take away from your reading.

TIP

Anything marked with the Tip icon points out ways to use the book's concepts in practical ways to improve your company's IT.

WARNING

The Warning icon spotlights information that can help you mitigate risks and avoid problems.

Beyond the Book

There's only so much I can cover here. To learn even more about hybrid cloud management when you're done, visit `www.hpe.com/greenlake` for more information.

Finally, even if you choose to ignore everything you read in this book, never forget this: If the users can't get their work done in a reasonable and cost-effective way, IT will be seen as a failure. It's up to forward-thinking technologists and leaders like you to figure out how to turn the IT function into a driver of the business.

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IN THIS CHAPTER

- Finding out what the term *cloud* actually means
- Seeing why people are heading for the cloud
- Discovering the key IT issues driving interest in all things cloud
- Identifying the challenges IT pros face in their hybrid cloud journeys

Chapter 1
Understanding Hybrid Cloud Management

In these modern times, the cloud is everywhere. Vendors from across the globe are creating new products and retrofitting old ones to support this computing paradigm. For customers, though, cloud can sometimes be a confusing morass as vendors and industry analysts, in an effort to educate and differentiate, sometimes take messaging detours that result in cloud confusion.

In this chapter, I dive into the murky waters that are the cloud and discover the buried treasure that will help you clarify *cloud* in all its forms.

Defining the Cloud

Let me start by defining what people mean when they toss around cloud-related terminology.

At the most basic, *cloud,* regardless of whether that cloud runs in an on-premises data center environment or is provided by the

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likes of Amazon or Microsoft, is a service that exhibits several characteristics:

- **Elasticity:** You don't always know exactly what resources a workload will require. A cloud environment allows you to automatically provision and deprovision resources as needed, a concept that is referred to as *elasticity.*
- **On-demand, self-service provisioning from a centralized catalog:** Having to call IT for every single technology task that a company wants to undertake is not only incredibly inefficient, but also incredibly expensive — and it ensures that projects will take three times longer to accomplish than planned.
- **A shared resource pool:** In a cloud environment, there are servers, storage, and networking devices, among other things, but users don't need to worry about discrete resource management. Instead, resources are aggregated into a single cohesive pool and allocated on demand.
- **Multi-tenancy:** Whether you're supporting multiple departments or building an environment that supports multiple companies, a cloud environment enables multiple tenants to enjoy secure data center resources.
- **Service catalog:** A service catalog is a preapproved set of services sanctioned by IT that users can leverage to deploy IT services for use by the business.
- **Utility cost model:** Buying all your data center resources upfront is no longer necessary with the cloud. A private cloud environment, like a public cloud one, enables a pay-as-you-go economic model that is a hit with CFOs everywhere.
- **Low-ops model:** IT can no longer afford the time to constantly touch data center resources. A low-touch, low-ops model is enabled by the cloud, which includes powerful automation and orchestration capabilities.

The cloud is IT, presented as a service to the user, delivered by virtualized resources that are independent of location. Various types of clouds are available for your use: public, private, and hybrid.

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CLOUD COMPUTING ORIGINS

The term *cloud computing* came into wide use around 2006 or 2007, but the origins of the term date back as far as 1996, when Compaq created a strategy document for its Internet Solutions Division. The document, entitled *Internet Solutions Division Strategy for Cloud Computing,* correctly predicted:

> . . . the emergence of the Internet is driving the migration of communication and collaboration applications into the Internet "cloud" (e.g., telephony, fax). This migration is resulting in increased infrastructure spending, as well as raising new challenges for CIOs to integrate the cloud into future enterprise-wide IT solutions.

Sounds like a familiar refrain, eh?

The public cloud

Amazon Web Services (AWS). Microsoft Azure. Google Cloud Platform. These companies have built data centers around the world and sell compute resources from those data centers to users around the world. The public cloud is the instantiation of "using someone else's computer" as businesses move workloads from behind their own firewalls to operate in this public world.

The public cloud has transformed IT. Instead of having to build local infrastructure, companies are turning to these public entities that are already built. Use of the public cloud enables immediate workload deployment and new ways to think about budgeting for IT through consumption/utility-based economic models that let you pay as you go.

The private cloud

As great as the public cloud is for some workloads, it's not a sure thing for every application you want to operate. Sometimes, there are concerns around security. Other times, you may discover that the public cloud's consumption model actually lays waste to your operating budget.

Private clouds are on-premises data centers that feature most or all of the features of public clouds.

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TRUE PRIVATE CLOUD VERSUS VIRTUAL MACHINE CLUSTERS

As much as you may want to make the claim, you may not actually be operating a private cloud. Many people make the mistake of equating *private cloud* with being *highly virtualized.* If you're highly virtualized, that's great, but that doesn't mean that you have a private cloud on your hands.

When you add services to your on-premises data center that imbue that environment with the defining characteristics of cloud outlined earlier in this chapter, *then* you have a private cloud.

Hybrid cloud

You likely know that most companies have yet to put 100 percent of their applications in the public cloud. Most companies moving into the public cloud today are making strategic decisions about which applications should go to the cloud and which should stay on premises.

We're in the era of hybrid cloud. The *hybrid cloud* is an integrated combination of public and private clouds, including consumption-based IT services delivered on premises. The terms *hybrid cloud* and *hybrid IT* are often used interchangeably to describe this conglomeration. Regardless of your preferred terminology, the management experience around supporting these types of environments needs to change in order to fully realize the value. I talk more about this throughout the rest of this book.

One of the benefits of hybrid cloud is that even if you need your IT to be on premises, you can still take advantage of the cloud elasticity and economics. Hybrid cloud leverages a consumption-based IT model for on-premises resources. In other words, consumption-based IT brings many cloud benefits to the local data center via an outcome-based pay-per-use model with transparent costing that aligns with business processes. Additional resources can be spun up quickly whenever they're needed, either on premises or at a co-location facility.

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REMEMBER

The migration to hybrid cloud shouldn't be seen as a destination or an end state. The journey — what you do and discover along the way — is where the real power originates. What you learn about maintaining an IT environment that is constantly evolving is that there are business benefits in continually meeting new needs while also maintaining an environment that supports legacy needs.

Understanding What's Driving People to the Cloud

What's driving people to the cloud? Today, perhaps a more accurate question would be to ask what's *not* driving people to the cloud.

REMEMBER

Before I jump into answering that question, let me be clear about one thing: "The cloud" in this context doesn't necessarily mean the likes of AWS, Microsoft Azure, or Google Cloud Platform. In this context, and to answer this question most fully, I'm talking about any environment — public, private, or hybrid — that exhibits cloud characteristics.

Organizations are seeking the kinds of benefits that can be realized by adopting cloud technologies for a number of reasons. At a high level, organizations are looking for easier, faster, and cheaper ways to leverage their technology investments and the services that technology can provide. The traditional approach, with a centralized IT division that acts as the gatekeeper, isn't as desirable as it used to be. The traditional "command and control" mind-set is now seen as outdated and inefficient.

TIP

There are two key drivers on which decision makers typically focus:

- **Cost:** Particularly for organizations adopting public cloud services, cost is a key factor because these services don't typically require the significant initial capital outlays often needed for traditional on-premises infrastructure purposes. For private cloud environments, though, there may still be capital costs, but product architectures have matured that

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enable a pay-as-you-go spending strategy as opposed to a buy-everything-I-need-for-the-next-five-years-right-now strategy.

- **Faster time to value:** There have been innumerable statistics over the years surrounding how many IT projects end up behind schedule or just failing completely because traditional environments can take forever to build. Cloud environments, with improved operations and dead-simple scalability capabilities, can turn this around and allow business units to achieve their goals far more quickly.

The goal: Get things done in a fast, economical way.

Considering the Hybrid Cloud Challenges

Today's chief information officers (CIOs) have to overcome numerous challenges. From new business demands to a rapidly shifting set of technology opportunities, there's never a dull moment.

One major challenge is *digital transformation*, a buzzword (or term) gone viral that has required many CIOs to think in ways they never have before. The entire goal of digital transformation is to allow a business to get and maintain competitive advantage, which can include being first to market with new services.

In addition, there's a shift in how applications themselves are being crafted. Today, rather than monolithic enterprise applications being developed with traditional waterfall development methodologies, we see whole new classes of apps being developed using microservices inside cloud-native containers.

WARNING

But some key issues hold back transformation and modernization efforts. It's a mad spiral that goes like this:

- **Slow IT velocity:** IT's need to support everything under the sun, including legacy and modern applications, forces IT to spend cycles on keeping the lights on rather than innovating. Business units get frustrated and go buy their own services, which results in sprawl.

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- **Sprawl:** Clouds, virtual machines (VMs), and containers grow in quantity as a result of *shadow IT* (IT services not managed or even known about by central IT) and rapid adoption of cloud to combat slowness, which results in silos.
- **Silos:** As a result of sprawl, individual business units may create their own resource pools and adopt their own services, which results in lack of visibility.
- **Lack of visibility:** Central IT can no longer get a holistic view of what IT resources are in use in the organization, which results in increased spending.
- **Increased spending:** With everyone spending on his or her own credit cards and potentially underlapping services, costs increase, which results in no funding.
- **No funding:** Without funding to support digital transformation efforts, business leaders realize that something has to change, which results in the need for IT as a service (ITaaS).
- **The need for enterprise IT to deliver ITaaS:** Regardless of where the workload resides, IT has to make serious changes in order to continue to adequately support the evolving needs of the business.

In the following sections, I go over some of the key challenges that can result from some of these issues.

Lack of interoperability and integration

As more and more tools and services get acquired, complexity increases while efficiency plummets. At some point, things need to work together, or you'll be in a situation in which everything just stays in silos forever. The need to integrate tools and services so that they work together is critical.

This is also giving rise to *hybrid cloud environments*, which, as the name implies, are environments that consist of services from multiple cloud providers, as well as on-premises private cloud environments and consumption-based IT services. The emerging variations of hybrid cloud environments are straining IT to its limits and require management tools that can help manage activities among these clouds.

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Nonexistent visibility

The unplanned increase in services and platforms results in a scenario in which overall visibility into performance metrics and spend becomes worse over time. Without visibility, the business can't gain a full understanding of what they're spending and what services they have unless they manually compile this information each month, a task that would be both onerous and not all that accurate, because workloads change over time. Today, more than ever, IT needs a centralized solution that can provide them with at-a-glance insight into what the business as a whole is running in real time.

IT responsiveness and the developer and business unit revolt

When people can't do their jobs due to a lack of proper tools, they go get those proper tools. Their acquisition methods aren't necessarily sanctioned by central IT, but they do it anyway. The same occurs when IT takes too long to provide developers with resources. Developers eventually take matters into their own hands. This rise in shadow IT can create serious cost and security challenges for organizations, but it has become an unfortunate necessary step as people find ways around the roadblocks that inhibit their work efforts.

The same is happening with individual business units. Ultimately, decision makers in individual business units go off and get their own resources, which may not align with company policy but allow them to be successful. As mentioned, there are risks in doing this, but with the only other option being to do nothing, business units are all too willing to take the risk.

Workload placement

Shadow IT may not seem like much of a problem, but when you consider it in the context of an organization's overall risk profile, it becomes a big one.

REMEMBER

Workload placement is critically important today. You need to understand where your data lives at all times so it doesn't end up in the wrong hands. The issue of what has become known as *data sovereignty* is a big one and requires that application owners know in what jurisdiction their data resides. In some cases, if data

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is placed in the wrong jurisdiction, there can be significant legal troubles ahead, thanks to strict regulatory compliance laws.

So, if you have business units doing an end run around a snail-like IT organization and putting workloads into random cloud environments, you could be open to a whole host of problems down the line.

The tools you operate to support your hybrid cloud environment may not always help you understand jurisdiction-level workload placements, but with a consolidated view of which providers hold all your workloads, you're well on your way to maintaining a sensible security posture for your company.

Jurisdiction is just one part of placement. You also need to understand how much it will cost to run a workload in a particular location, as well as how secure each target location is. Certain workloads may not need to be as secure as others, and improved security may come at a higher cost.

The right tools will provide you with actionable guidance to optimal placement of workloads.

Migration between clouds

As you add more workload options, your complexity increases when it comes to both placement and integration of workloads. But we're moving quickly to a hybrid cloud world, and such decisions need to be made.

There is a myth that needs busting, though: You can find articles that describe a scenario in which workloads will seamlessly and automatically migrate to whatever provider offers the lowest cost. That's simply not reality, at least not yet.

TIP

Even with high levels of automation, it's a heavy lift to migrate workloads between environments. Having visibility into costs isn't necessarily just so you can bounce workloads around to save money. It's so that you can plan and have expectations for how much things will cost. Perhaps, eventually, you may be able to find a compelling cost benefit to migration, but that migration is an expensive undertaking.

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Consider this: You may have a family member who is a coupon cutter. He spends every Sunday cutting out coupons and then spends the entire week driving from store to store to get the items from each location that has the lowest cost. But how much time and gas is he spending on this process? Is it worth traveling to multiple supermarkets to save a few dollars on canned peas when it likely costs more in gas and time to go between different stores? Or is it smarter to look at all the coupons in whole, determine which store provides the best overall value, and then do your shopping there?

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IN THIS CHAPTER

- Understanding the problems that plague some hybrid cloud solutions
- Identifying the capabilities you need to achieve hybrid cloud success

Chapter 2
Introducing the Hybrid Cloud Solution

Chapter 1 provides an overview of the challenges facing IT and a list of reasons that hybrid cloud environments, including hybrid cloud variations, are gaining steam in the enterprise IT world. As IT continues the march toward a hybrid world, new challenges are arising, which means that new management solutions are needed to help overcome them.

This chapter introduces a new class of IT management solutions that focus on the hybrid cloud. In this chapter, you also learn about some key steps that you should take as you journey down the hybrid path.

Seeing the Pitfalls in Current Hybrid Cloud Solutions

There is no shortage of solutions intended to help people manage the hybrid cloud world, but a number of these "solutions" suffer from key shortcomings that can impact their long-term usefulness.

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Many such solutions require an on-premises deployment and may only support an on-premises private cloud or a very small subset of public cloud providers. Requiring an on-premises deployment ultimately means that it'll take quite some time to get deployed. In contrast, a software as a service (SaaS)–based solution, such as HPE GreenLake Central, a unified management platform, can be up and running and providing value in mere minutes, and it can provide insights from your private cloud deployments, including those based on Azure Stack, bare-metal systems, container deployments, and virtual machines (VMs), as well as a number of public cloud providers.

REMEMBER

Supporting Amazon Web Services (AWS) is pretty much guaranteed, but not every enterprise is going to move to AWS and AWS alone. They may choose some other platform to meet their hybrid cloud desires. The management solution needs to support what the customer intends to do.

Selecting a Hybrid Cloud

Here are some key points to consider as you select your hybrid cloud.

Developing a hybrid cloud strategy

First and foremost, you need a strategy. A hybrid cloud environment can encompass, quite literally, everything that your company does on a day-to-day basis. It's really important. Your strategy should link to your company's strategic goals and align to your overall IT governance strategy.

Implementing software-defined everything

In an age in which IT continues to straddle the line between legacy and futuristic, the software-defined data center (SDDC) remains a relative newcomer to the design. In a hybrid cloud environment, everything is treated as software. That doesn't mean that there isn't underlying hardware that supports it all, but even this hardware is treated as what is called *programmable infrastructure.* Although that's a really cool name, it really means that all the hardware resources in the data center and at the various cloud

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service providers that are selected operate an environment that provides comprehensive application programming interfaces (APIs). APIs provide a high level of customization and automation that would not be possible otherwise.

Software-defined infrastructure has emerged as an eminently flexible architectural option that allows IT to automate mundane tasks and streamline infrastructure life-cycle management.

Connecting to all your clouds

Whether you have 2 clouds or 20, you need to be able to connect them all with your cloud management platform, as well as in other ways. Operating a series of cloud silos is not an efficient operating methodology (hence, the need to complete integration).

REMEMBER

Cloud, in this context, also includes your on-premises private cloud and consumption-based IT environments. You need a management platform that is capable of fully supporting your on-premises and edge endeavors, as well as supporting the one or more public cloud services you may choose to deploy.

Feeling the need, the need for speed

For a business, speed isn't about whether it's running flash storage or 100-Gigabit networks. It's about how quickly the business can get what it needs from IT so that it can continue to forge ahead.

REMEMBER

In modern IT and business, what does speed really mean? There are actually a number of characteristics that fit:

- **Same-day onboarding:** IT capability to rapidly provision resources means that users don't have to wait weeks to get access to them. When required, an IT customer should be able to get onboarded to the company's internal or contracted services (for example, a public cloud) the same day. It shouldn't take an inordinate amount of time to build new services.
- **Reduction of operational friction:** Developers should be able to streamline their workflows. They shouldn't be hindered by slow, outdated IT ops processes that hinder progress.

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- **Real-time decision-making:** It used to be okay to wait until next week to report on what happened this week. Not anymore. Your environment and your management platform should enable you to make informed decisions in real time by providing visibility into resource utilization, workloads, performance, health, cost, and other critical metrics.
- **Service catalogs updated in real time for self-service:** To further reduce friction, as IT makes changes to service catalogs, the changes should be pushed in real time for immediate use by users.

Controlling costs

As much as people may like to think that their businesses have a higher calling, if the financials don't work, neither does anything else. That's why it's so important to control costs, an activity that hasn't always been a simple one for IT.

REMEMBER

As you seek to adopt a swath of services from various cloud providers, the problem of understanding costs, let alone controlling them, becomes even more complex. With the right cloud management platform, you'll gain the ability to know exactly what's running where and how much it's costing you on an ongoing basis.

Most important, this type of platform must provide visibility across your entire hybrid estate to get comprehensive spending and utilization information. You should also have the ability to get a more granular view by project, individual, line of business, and so on, so that you can take appropriate, data-driven action on costs when it becomes necessary.

Although the platform may not enable you to constantly shift workloads in an automated way, it will provide you with cost data that you'll need in order to negotiate service costs with providers. With hard data, you can more easily find the right path for your company.

Plus, with this data, you can start to execute what-if scenarios that can make it possible for you to model the cost impact if you discover that a different provider or location (perhaps public cloud versus on premises) is better suited to meeting your needs. After all, although cost is important, it's only one factor. If a provider or location is no longer meeting your needs, you need to have all the information necessary to be able to migrate that workload elsewhere.

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IN THIS CHAPTER

- Understanding the challenges facing IT and how to overcome them
- Discovering why developers are in revolt and why hybrid cloud is the answer
- Finding out why business executives see hybrid cloud as their answer for digital transformation

Chapter 3
Identifying the Primary Hybrid Cloud Users

In Chapters 1 and 2, I focus on the cloud itself and some of the business outcomes. In this chapter, it's time to turn your attention to the people who will have to use the hybrid cloud services deployed by your organization. I focus on three key groups in this chapter: IT people, developers, and executives.

IT People

You may not think of IT as a typical user of hybrid cloud services. In most organizations, though, these are the people who have the day-in, day-out responsibility for all of it, so ensuring that you meet their needs is quite important.

IT decision makers are responsible for services and solutions to support the near-term needs of their constituents and the business, while also devising long-term strategies regarding new technologies, evolving trends, and new business models. Today, these IT leaders are consulted at the board level regarding business transformation, and they play a leading role in digital transformation.

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To support the growing needs of the business, IT decision makers need tools that can automate the provisioning and management of on-premises and cloud resources. They're looking for solutions that can help the IT department shift from a command-and-control organization to playing the role of an internal service provider for rapid virtual machine (VM) and container vending. IT decision makers today are also embracing DevOps methodologies, cloud development self-service, and continuous development platforms and tools to accelerate the development process and bring new products to market faster than ever before.

Understanding their challenges

It's not an easy life. Chief information officers (CIOs) are struggling with improving productivity so they can reinvest time into more strategic initiatives. Legacy baggage is a real thing, and a huge part of IT budgets still goes to maintaining these types of systems.

REMEMBER

CIOs would prefer to get ahead of the curve and be proactive than be forced into a defensive, reactionary position, but it's not always possible with existing tools and resources.

Plus, CIOs are often used to a scenario in which they're in control. In the past, they maintained full operational control of all aspects of a technology environment. Now they're having to cede some of that control to others. No matter how forward-thinking a person, that isn't an easy task.

Imbuing IT with hybrid cloud capabilities

Today, CIOs are turning to hybrid cloud technologies as a way to address the key issues they face. With the capability to quickly turn up new services, cloud can help CIOs meet their goals very quickly. Of course, in many cases, their users are already there with shadow IT initiatives, but turning shadow IT into a sanctioned and managed set of services can help the company save money and improve security.

There are a number of ways that CIOs change the direction of their organizations to migrate IT thinking away from operations and toward applications:

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- **Turning a VM cluster into a private cloud:** A highly virtualized environment is not a private cloud, but with the addition of the right services atop that environment, CIOs can transform those environments into full-fledged private clouds that provide the company with all the benefits I mention in Chapter 1. This first step can get quick wins as the business becomes more agile.
- **Turning containers and bare metal into private clouds:** The same goes for container-based workloads and even bare-metal systems. In a highly virtualized world where things like hyperconvergence are talked about as a panacea, it's easy to forget that bare metal is still a thing, and it will remain relevant for a very long time.

  With the right tools, you can extend your private cloud goodness to your container environment and your bare-metal servers. This shouldn't be a would-be-nice feature — it should be baked right into the core product.

TIP

- **Connecting to any provider:** Your hybrid cloud management platform shouldn't dictate the provider you can use. The platform should enable the business, regardless of which provider you choose to use. One of the goals in IT today is avoiding cloud lock-in; you should be able to use any provider any time.
- **Intelligently scaling infrastructure:** Most companies aren't moving 100 percent to the public cloud. The vast majority will retain significant on-premises assets. A key characteristic of private clouds and consumption-based IT environments is the capability to easily and intelligently add resources as needed without incurring capital costs.
- **Transforming IT into a service provider:** One of the outcomes of the cloud renaissance is the ability to rethink how IT operates. One of the key goals for businesses today is to transform IT into an internal service provider and broker. IT won't necessarily run everything, but it'll help business units best decide where to run workloads.

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Developers

Developers are a key constituency in any organization that has them. Hybrid cloud environments have the potential to help this group of professionals move far more quickly to achieve their aims of accelerating the business.

Developers develop and maintain software applications. No mystery here. They may work within a formal IT department that services multiple business units or departments, or they may work within another business unit or department and provide IT services exclusively for that group.

Developers fall into one of two camps:

- They're well versed in scalability, availability, and performance of cloud-native apps.
- They're more traditional enterprise application developers, responsible for one or a few monolithic applications.

REMEMBER

The services that developers require will depend on which camp they fall into and the department they work in. If they're inside IT, it has often been easier for them to get their work done. If they reside outside IT, it hasn't always been ideal.

Understanding their challenges

We know developers care about speed in the context of how quickly they can get their creations to market and the quality of their applications. But as with anything, developers are keenly aware of the *time–cost–risk triad.* Simply put, the time–cost–risk triad means that you can only pick two of the three elements at a single time. For example, you can't have fast and cheap without risk. Something always has to be sacrificed.

Developers are generally unwilling to compromise on risk that would impact the quality of the app. That means that speed has to be the element that gives way because developers aren't typically as concerned about cost as the business is. Developers simply want to get their work done, and slow IT often gets in the way of that goal.

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Enabling developer autonomy within an IT-sanctioned environment

Developers can't afford to wait for IT to handle all operations for them. In fact, the DevOps movement was initiated to streamline operations related to development so that the developer could focus on ensuring fast time-to-market for their applications without having to sacrifice quality.

TIP

CIOs today need to provide developers with environments that meet the fast-moving needs of developers but that run within the reasonable confines of an agreed-upon hybrid cloud infrastructure environment. That environment needs to include streamlined development project workspaces, as well as complete self-service provisioning, tools, and access to a catalog of curated tools, templates, and resources.

Business Executives

IT and developers are important, but we can't forget about the people running the business side of things! Execs view IT either as a strategic partner in business success or as a frustrating and serious impediment that has to be overcome. The goal, of course, is to bring everyone into the first camp.

Tech-involved line of business (LOB) decision makers reside outside the IT function but are actively involved in planning, recommending, funding, or implementing technology to help digitally transform aspects of their companies. These people are tech savvy and understand how technology can best meet the needs of the business, and they need a hand in carrying out their vision.

Understanding their challenges

Business executives who are funding transformation initiatives are interested in *results.* Results may take the form of cost or time savings, or they may directly improve revenue generation. These people realize that the longer it takes to develop and deploy an app they're funding, the more they fall behind their goals or the competition. Neither is palatable.

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A significant problem today for business executives is that they don't have visibility into resource utilization and costs. They often get a bit of a surprise when the bill comes at the end of the month.

Providing execs with the insights they need

Your LOB users need platforms that help them to directly achieve their goals in ways that don't require constant IT intervention. They need to see systems that help them improve their individual service levels, as well as improve the overall health of the business.

REMEMBER

Various parts of the business have embraced shadow IT to meet their goals. However, shadow IT services leave businesses open to risk in a number of forms, including security, cost, and general chaos.

To implement an IT entity that has embraced a hybrid cloud methodology based on distributing access to services, good governance is key. Business leadership must be involved in IT strategy to keep that chaos at bay and to ensure that IT always keeps its eye on the ball.

The platform that the business selects to support its hybrid cloud efforts needs to help the business optimize costs. I carefully chose the word *optimize* here. Constantly chasing the cheapest option is a fool's errand that has negative results. A true hybrid cloud platform will help the business ensure that its spend is accurate and sustainable.

The hybrid cloud platform should provide an understanding of the utilization of each project across the various business units. Through the use of a well-designed dashboard and other interfaces, the tool will provide insights and the capability to drill down to further analyze areas of potential interest.

Finally, you know that your business won't stand still. To that end, the platform will allow you to create what-if analyses as you seek to extend your application portfolio or shift workloads between clouds.

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IN THIS CHAPTER

- Finding out why "as a service" is critical to digital transformation efforts
- Understanding the difference between "virtualized" and "private cloud"
- Learning about the low-ops lifestyle

Chapter 4
Delivering Everything as a Service

We live in an on-demand world. Entire industries are being upended as people eschew driving to the mall in favor of setting up recurring orders on Amazon and having goods delivered right to their doors. As companies such as Amazon move even closer to same-day delivery by drone, people's expectations for what's possible only increase. After all, if Amazon can show up at your doorstep with a new electric toothbrush just hours after you ordered it, why does it still take enterprise IT four weeks to create a virtual machine (VM) for a new mission-critical application?

In this chapter, I explore the ins and outs of the "as-as-service" movement and reveal the key achievements you need to unlock to maximize your efforts' potential for success.

Making Sense of the as-a-Service Movement

With a traditional private cloud, you build everything yourself and install every application yourself. With the public cloud, you don't build anything, nor do you have to deploy applications. These

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are the two opposite ends of the spectrum. There is also a set of middle-ground services, which have a number of characteristics in common with the pure public and private cloud offerings.

Anytime, anywhere, any device management

No one wants to be inhibited by location, time of day, or device choice anymore. If you're sitting on the beach at 2 a.m. and feel like spending a bit of quality time creating a development environment from your iPhone, why should anything hold you back from that goal? After all, we don't accept such limitations from other tools.

Managing hybrid IT from anywhere using a software as a service (SaaS) portal and delivering a consistent cloud experience across the hybrid estate should be as easy as opening an app on your iPhone.

Presenting all resources as ready-to-deploy services

If you have resources in your environment, they should be ready to go at a moment's notice. This includes resources from on-premises environments, as well as those from public cloud providers. In an on-demand world, there's no such thing as "offline resources."

Making the Jump from Virtual Machine Farm to Private Cloud

Being highly virtualized doesn't necessarily mean that you have a private cloud. All too often, people are quick to pull out the *private cloud* term to describe an environment that may be anything but. This does a disservice to the business because this description implies that the environment has certain capabilities that are critically important in digital transformation efforts.

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In this section, I explain the defining characteristics that transform VM farms into private clouds.

Multi-tenancy

REMEMBER

Multi-tenancy is the ability to support separate customers or departments inside their own silos. It's a cornerstone feature of cloud environments, whether that cloud is public or private.

Perhaps you're thinking that, as a single company, your organization doesn't really need an environment that provides multi-tenancy capability. Think outside the box on that, though. Multiple tenants doesn't just mean multiple companies. You may want to have the ability to cordon off the finance group's work from the rest of the company or provide different kinds of service for different departments.

Self-service portal

If you require your users to run everything via the IT help desk or operations instead of allowing them to manage their own services, you don't have a cloud environment. A self-service portal that works from anywhere and from any device is a necessity.

Service catalog

You probably don't want business users to have to specifically design resource configurations for new workloads. Although business users are far more tech savvy than users were in the past, they shouldn't be expected to figure out how many vCPUs and RAM a new LAMP installation on Ubuntu requires, for example. This is an area in which IT can and should retain some level of control and oversight.

IT can create for the entire business a series of standard, easily consumable configurations that anyone can deploy. For example, you may have a catalog item that deploys a three-tier architecture by creating three different VMs for the user, or a catalog item that deploys a single web server. By implementing a service catalog, you take the complexity right out of the equation, making it dead simple for non-IT business users to accomplish their goals.

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Implementing Low-Ops Life-Cycle Management

You've probably been inundated with collateral about so-called DevOps, which is a cultural philosophy and set of tools that requires far more collaboration between developers and IT operations to streamline application development and support activities.

There are other "ops" mentalities out there, too, that are really important to understand. They often focus on the IT side of the equation, but they have the potential for positive outcomes for all the constituencies — IT decision makers, developers, and business leaders (see Chapter 3).

REMEMBER

One of these other ops mentalities is *low ops,* which, as the name implies, in a low-touch operating methodology. If you consider *IT ops* to be the traditional operating model, you see that it's bloated, heavyweight, and high touch — all things that are anathema to the new world order.

Low ops is a methodology that operates atop a highly automated and orchestrated infrastructure environment. Those catalog items that I cover in the previous section don't build themselves. An IT expert needs to build the constructs that make it all work. Cloud management platforms don't have the innate knowledge about your business to understand exactly what resource configuration your specific database servers require, for example.

After these constructs are built, they can be consumed by the business or even by IT itself. This low-ops model is intended to shield everyday users from the complexity that often plagues IT.

It's fair to say that making things easy is really hard. To get to easy, you need common tools across the organization that anyone can use and that provide comprehensive support for all your on-premises infrastructure, as well as any public cloud providers that you choose to work with.

This paradigm is what makes your environment "as a service."

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Enabling on-demand provisioning of hybrid resources

The key part of this heading is *hybrid resources.* In a digitally transformed organization, you're generally using some combination of a private cloud environment and one or more public cloud environments.

TIP

Any management platform you select to manage your operations should support any environment you need to procure. Plus, the platform needs to support *real-time* provisioning. Regardless of where a workload resides, users shouldn't have to wait for an IT staff person to get involved (see the nearby sidebar).

Dynamically scaling pooled resources

Dynamic resource scaling in the public cloud is typically not an issue at all. For all intents and purposes, cloud providers provide "unlimited" scale. Of course, there's a cap somewhere, be it hitting the limits in a single region or hitting your company's credit card limit. But for most needs, you can scale to your heart's content.

Things are a bit different in your private cloud on-premises data center environment, though. No matter how agile your infrastructure, there will come a point at which you need to add more physical resources.

EXCEPTION-BASED IT MANAGEMENT

One of the guiding principles in all of this is that general IT management needs to become *exception-based.* As it stands right now, for many IT organizations, an IT staffer needs to get involved in every operation. In an ideal world, there would be a level of underlying automation and orchestration that negates this need. Instead, an IT staff person would only need to get directly involved when something unusual is desired. Otherwise, business users will have the ability to request services that happen automatically.

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REMEMBER

The environment that you choose for your private cloud has to scale easily, transparently, and dynamically. Choosing a managed private cloud solution ensures that capacity is actively monitored and made available, either via an onsite buffer or by delivering new capacity ahead of demand.

Completing the Economic Circle: Enabling Showback and Chargeback

One of the key tenets of the cloud movement is understanding infrastructure costs. As you work within a digitally transformed enterprise, it becomes even more important to understand how to apply those costs to individual business units.

Being able to charge certain IT costs to line of business (LOB) departments has always been important, but it has often been difficult. It is sometimes tough to determine, for example, how much of a particular resource's total cost of ownership should be allocated to a particular business unit.

The cloud — and even virtualization to a point — have helped organizations better understand how expenses break down in the IT environment. Today, business leaders have come to expect this exact capability for all resources enabled by the enterprise's hybrid cloud.

REMEMBER

There are two primary ways that IT organizations help business units understand their portion of costs in the IT environment:

- **Chargeback:** In a chargeback world, IT costs are distributed to LOB budgets, often with an overhead figure attached that includes the costs of hardware, software, and personnel for a particular resource. There's a journal entry in the general ledger made to show that the department has been charged a certain amount.
- **Showback:** This is similar to chargeback, but instead of costs being allocated to a LOB budget, those costs are simply shown to the LOB; the full expense stays inside the IT budget. This method is useful for times when CIOs need business leaders to understand what things cost, even when there is no process in place to support chargebacks.

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IN THIS CHAPTER

- Understanding why traditional service desk systems lead to poor outcomes
- Discovering how self-service programs improve collaboration
- Finding out why collaboration is key to a successful catalog rollout
- Seeing why private clouds and public clouds need to get along

Chapter 5
Enabling Developers by Enabling Fast Application Deployment

Developers are a vital resource in any organization, because they develop many of the tools that become foundational parts of the business. Unfortunately, developers haven't always received the support they need from IT, leading them to go it alone. As a result, developers often get blamed when shadow IT emerges in an organization. In reality, though, they were just trying to do their jobs.

REMEMBER

Collaborative DevOps methodologies are gaining in popularity, enabling cross-functional teams to work collaboratively. As a result, organizations can save time and get their apps deployed faster.

In this chapter, I explain what's necessary to get developers the tools and services they need in order to be successful.

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Eliminating the Queue and Service Ticket Wait

I truly believe that most IT departments have good intentions and that they don't try to actively hinder the rest of the business. They've been charged with supporting incredibly complex environments and services, given very little money to carry out this job, and admonished that the environment must never go down.

Many IT departments prioritize their workload by using help desk and ticketing systems. Such systems require users to submit a request for help or services. Those requests are then categorized, prioritized, and acted upon via whatever mechanism the company has in place.

WARNING

Many people outside IT view such systems as black holes. Requests go in and they can take a very long time to come out. In many cases, the volume of requests is so large that it's incredibly difficult to communicate status, so people are left in the dark.

With an infrastructure based on sound principles, good levels of automation, and a self-service system, this queue-and-hope process can be eliminated as people begin to carry out their own operations in an IT-sanctioned environment.

I'm a big believer in exception-based IT, and the service desk/ticketing system is included in that definition. I'd much rather have users, including developers, need to contact the service desk or open a ticket only when they need something unusual. Or, as someone I used to work for used to say, "Figure out how to make the routine things routine."

Enabling Collaboration via Self-Service

The problem, though, is that some level of centralized control is necessary. Businesses can't afford to let people do whatever that want to an infrastructure environment. The ensuing chaos would be worthy of a Michael Bay film, but it wouldn't be as fun to watch.

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Two reasons governance is so important are security and availability. Data assets are too critical to risk falling into the wrong hands. You can't have 50 people deciding individually what's an acceptable activity for certain kinds of data. You need to make sure that all services that are built adhere to service-level agreements (SLAs) based on the kinds of workloads.

Self-service systems that are built collaboratively between IT and developers can accomplish these goals. IT can continue to carry out its enterprise-wide charge of ensuring security and availability while also making operations available to developers via a self-service portal.

Accessing Tools, Templates, and Services via Service Catalogs

The self-service portal is just the first step in ensuring that developers can easily and quickly get what they need while staying within the boundaries IT has established. The next step is to define what developers can do inside the self-service portal. This is where IT, in collaboration with developers, sets up and maintains a catalog of approved apps, tools, and services that developers can deploy and manage on their own.

TIP

The service catalog is a critical component of any plan intended to help developers streamline their work to increase development speed, and it's a component that IT can't develop in a vacuum. IT must work closely with developers to identify the tools and services developers need on a regular basis. IT must then turn them into products that developers can deploy with the click of a mouse from the self-service portal.

Standing Up Private Clouds and Connecting to Public Clouds in Minutes

Let's get back to shadow IT for a minute. Shadow IT services, by definition, don't get IT department support. This leaves users, including developers, going it alone and figuring out how to navigate services to get what they need.

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This "going rogue" behavior leads to significant risk and significant expense. Instead of just focusing on their code, developers are forced to spend time figuring out how to create their software stack in the public cloud. Why the public cloud? Simply put, it's the easiest way forward for non-IT personnel. If these people had instead submitted a purchase order for a bunch of data center equipment, it's likely that IT would have been made aware of this request and intervened. The easiest way to go around IT is to use the public cloud.

REMEMBER

Developers are brilliant people, but they're not generally infrastructure and security gurus, nor should they have to be. With a hybrid cloud environment ready to go, your developers can reduce the need for specialized cloud stack skills and focus on the jobs they have. By making use of the self-service tools you've developed in collaboration with developers, they can compose hybrid cloud environments and apps on demand, and involve IT only when something unusual happens.

The tools you make available will allow developers to choose an environment that makes sense and will enable all the private cloud services you have in your data center to connect with authorized public cloud services, but with a management layer — such as HPE GreenLake Central — that ensures that they're aware of the costs that will be incurred.

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IN THIS CHAPTER

- Remembering that cross-cloud support is a critical need
- Controlling costs
- Finding out about workload placement for today and for the future

Chapter 6
Controlling Utilization and Spend across Clouds

In this chapter, I jump into some of the nitty-gritty business details that are so important to understand. I cover the specific business outcomes that most organizations want as they improve IT operations and adopt a hybrid cloud posture.

Supporting Cross-Cloud Resource Pools

Hybrid cloud is the future of IT and business. Everything you do with IT, starting now, should work torward providing and supporting a pool of cross-cloud resources composed of your on-premises infrastructure and the public cloud providers you've chosen to partner with.

Entire industries help people make sense of resource utilization levels in their on-premises environments. However, not all the solutions that purport to do this actually do it well, because they often can't include certain aspects of the infrastructure. For example, finding a tool that can monitor utilization across your virtualized environment is pretty easy, but that solution may not tell you anything about your physical server or storage assets that aren't tied to your virtual environment.

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TIP

You need a holistic view of your resource world, one that encompasses your physical on-premises environment, your virtualized environment, and the environments of any cloud providers you work with. Only then can you make informed decisions about which workloads should run where and when it's time to scale your on-premises infrastructure.

Imagine what you can learn about your IT spend and your overall organization if you can get a dashboard view that provides you with at-a-glance statistics that span your on-premises hybrid cloud, private cloud, and public cloud environments — and in real time versus at the end of a billing cycle.

Gaining Visibility into and Controlling Cloud Costs

Figuring out how much things cost is really hard. It would seem to be an easy exercise. You just tally up the invoices and then go home for the night. But then you get into the details and realize that there's far more to it than that.

A hybrid cloud management platform will provide you with the costs that you're incurring to operate your workloads, whether they're on premises or in the public cloud. Your hybrid cloud environment will also enable you to get closer to a complete pay-per-use model, although you may not get all the way there. On-premises environments will always have at least some "growth overhead," so don't worry if you can't get to a 100 percent consumption-based model.

REMEMBER

Both your infrastructure and your management tools will play a role here. You need an infrastructure environment that scales in a way that makes sense, and you need a management platform that has sufficient visibility into that infrastructure to help you make good decisions about it.

What does this really look like? In general, it means that you can scale *out* your resources in some way. Older scaling models often required you to scale *up,* which placed constraints on how

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far an architecture could grow without having to make additional investments to continue growth.

There are all kinds of ways to scale out today, from hyperconverged infrastructure solutions to entire data center solutions such as HPE's Synergy composable infrastructure platform.

Optimizing Application Placement

Not all environments are created equal. You need to make sure that you can choose the right environment for your workloads in real time. It's not just about cost. Your focus needs to be on having the right mix of environment characteristics, including things that may be more important than cost, such as resiliency, data sovereignty, and general provider capabilities.

If you're looking at just the economics, you'll eventually be disappointed in some other way. It's really easy to find *cheap,* but it's more difficult to find *effective* in terms of all the needs you're trying to meet.

Today is just that: today. Tomorrow is another day and will carry with it new challenges. Your workloads will evolve and change over time. They'll grow, they'll shrink, they'll become more expensive, and they'll become less expensive. This goes for new workloads, too. You may not have a complete picture of what a new workload will look like, and as your planning evolves, your tools should evolve along with it.

REMEMBER

In a flexible consumption, hybrid cloud world, the possibilities are endless. Tools that can provide you with the capability to model outcomes based on configurable capacity and cost parameters are the panacea — now IT usage and spend is transformed into meaningful business intelligence. Although not all tools do this yet, HPE Consumption Analytics, included with the HPE GreenLake service, provides end-to-end detailed reports, views, and analytics to help you manage your consumption and maximize your investments across your public and on-premises environments.

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IN THIS CHAPTER

- Looking at what HPE GreenLake Central has to offer your organization
- Understanding how HPE GreenLake Central serves IT professionals, developers, and managers

Chapter 7
Introducing HPE GreenLake Central

Every business is now a technology-driven business, and IT professionals are under great pressure to help their business leaders and developers realize the benefits of digital transformation. What's an IT decision maker to do? There is so much opportunity with the right structure and tools, but getting there feels like a lot of heavy lifting.

Not all IT organizations have embraced the cloud environment. Some of them hold back due to budget constraints or a risk-averse corporate culture. Others have very legitimate reasons to keep certain functions in-house, such as security, compliance, or performance. That shouldn't matter, though. The IT organization must operate and maintain an enterprise-wide IT infrastructure in whatever form or deployment style is best for the organization. That could be public cloud, private cloud, hybrid cloud, or any combination of those.

That's where HPE GreenLake Central comes in to help empower IT with hybrid cloud management. Its flexibility ensures that no matter what structure an organization needs, it can be effectively managed. In this chapter, I explain how HPE GreenLake Central can help an organization manage a complex hybrid IT infrastructure.

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Introducing HPE GreenLake Central

IT has to navigate the complexity of the hybrid cloud and multi-service provider world without creating more operational overhead. They need to provide some autonomy and flexibility to developers while maintaining a loose grip to ensure no one breaks anything or puts the company at risk. And they need to improve service delivery for the business while keeping spending in check. HPE GreenLake Central delivers on these requirements, allowing IT to lead and drive the business with technology.

With HPE GreenLake Central's software platform, you can unify insights and operations across data centers, multi-clouds, and colocation facilities. Customers enjoy a simplified point-and-click experience across their applications and data, enabling them to more effectively run, manage, and optimize their entire hybrid estate.

Using HPE GreenLake Central's intuitive self-service platform, business leaders and developers are freed from the traditional wait times for services. They can use the platform themselves to deploy and manage services such as virtual machines (VMs) and containers. The dashboard provides easy access to insights about cost, capacity, and compliance, and simplifies management across their hybrid cloud environment.

REMEMBER

HPE GreenLake Central is chock-full of features that solve the problems and challenges discussed throughout this book. Here are some of the ways it puts IT in the driver's seat:

- Offering a public cloud-like experience on premises and enabling the self-service independence that developers and business leaders want
- Enabling users to gain role-based access to the services and key performance indicators (KPIs) they need to perform their jobs better
- Providing a centralized dashboard to manage their hybrid environment
- Empowering IT to be proactive, not reactive
- Enabling IT to optimize costs, which can be reinvested in digital transformation initiatives

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In the following sections, I explain what HPE GreenLake Central has to offer in several different areas.

Offering IT and Others a Service Portal

IT has a variety of roles and responsibilities in a business. Among other things, they must

- Ensure IT resources are available, secure, and performing well
- Manage, control, and report on costs
- Plan for future capacity needs

HPE GreenLake Central simplifies these tasks by centralizing key tools and capabilities in a central dashboard. IT operations staff can use it to gain a comprehensive view into usage and costs across the hybrid environment, including HPE GreenLake and public cloud services. It also reports the operational status of VMs and containers running in the HPE GreenLake private cloud, with easy access to the dashboard to deploy and manage those services.

Centralized management makes the CIO's job much easier, too. CIOs can offload the burden of managing the infrastructure and become a true service broker and partner who focuses on government regulations, security, compliance, and cost optimization, instead of running day-to-day IT. CIOs can monitor and take action on a range of KPIs, including security, capacity, cost, compliance, and resource utilization.

REMEMBER

The platform isn't just a resource for IT people. Non-IT staff such as developers can use it to deploy virtual machines, containers, and more. Business executives can also use HPE GreenLake Central to get visibility on cost with analytics, as well as showback information.

With security as a cornerstone, HPE GreenLake Central provides IT with role-based self-service access for all types of workers. It enables you to enact your IT policies and governance framework by ensuring that only those who have authority are able to act — and even then only within the confines that *you* construct.

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Continuous Compliance, an additional service, provides ongoing monitoring, status, and remediation advice integrated into HPE GreenLake Central. HPE's experts work closely with compliance officers and regulatory agencies to tailor frameworks according to your specific needs and requirements, helping you select from more than 1,500 controls to ensure compliance across a wide range of areas, such as the Payment Card Industry Data Security Standard (PCI DSS), the Health Insurance Portability and Accountability Act (HIPAA), the General Data Protection Regulation (GDPR), and more. You can easily identify and address risks and failures, and comprehensive reports significantly reduce auditing times.

Offering Developers a Private Cloud

Developers need accessible in-house IT resources to do their jobs, and left to their own devices, they'll find a way to get them. This often means they turn to the public cloud, which isn't a perfect solution because it incurs unnecessary costs and can put the business at risk without the proper governance.

HPE GreenLake cloud services give developers simplicity, flexibility, and speed, enabling them to be self-sufficient. With HPE GreenLake Central, they can provision VMs and containers themselves, when and where they want them, while remaining securely in the confines of an IT-sanctioned environment.

Building and deploying applications becomes a frictionless process. And developers get easy access to tools and templates to quickly spin up images running with certified versions of the operating system (OS), patch levels, and security profiles to save time and reduce risk.

With rapid self-service capabilities and real-time access to new services, developers can work anytime from anywhere and from any device. No longer do developers need to be experts in cloud structures. Instead, they can focus on building applications and not infrastructure.

Offering Executives Business Insights

The ability to gain quick access to big-picture information is especially critical to line of business (LOB) users. CFOs, for example, need visibility into total usage and spend across the entire

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hybrid estate with easy ways to drill down by service, by cloud, by technology, and more.

HPE GreenLake Central's simple, clean insights portal helps organizations gain clear analytics regarding how much they're spending. They can also link into the full consumption analytics app to build custom reports, drill down into rules-based insights, get detailed capacity forecasting, or even set budgets for usage and spend.

Deploying and Connecting Clouds

The goal is to make it easy to manage your hybrid estate via one centralized platform. With HPE GreenLake Central, organizations gain self-service access to the resources they need on premises, with the ability to quickly spin them up in just a few clicks. And they get the scalability and pay-per-use economics of the public cloud, delivering a true cloud experience within their own environment.

HPE GreenLake Central also enables organizations to unify operations across multiple private and public clouds, providing full cost and usage transparency across the hybrid estate. You get access to a marketplace of HPE GreenLake services, such as VMs, containers, compliance controls, and even managed public cloud services, with many providing the option to try before you buy. And as HPE GreenLake services are added to your environment, they can all be brought into HPE GreenLake Central to centralize and simplify your hybrid cloud management.

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Chapter 8
Top Ten Requirements for Hybrid Cloud Management

As you consider the hybrid cloud management options at your disposal, there are ten key considerations you should keep in mind:

- **Speed via a software as a service (SaaS) solution:** In this book, I talk about the need for adopting a SaaS mentality for all your data center infrastructure. This mentality meshes nicely with the public cloud. The result will be an environment that is agile, flexible, and cost-effective.
- **True hybrid cloud across public and private:** Your management platform needs to enable a real hybrid cloud solution that spans your on-premises data center environment, as well as one or more public cloud provider environments that you've decided to deploy.

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- **Capability to support more than one public cloud, as well as multiple accounts within a public cloud:** We're in an era of *multi-cloud,* the hybrid cloud variant in which enterprises deploy multiple private clouds, each used for different workloads. A hybrid cloud management solution should be able to support any and all public clouds that you choose to deploy. Your platform should also enable you to establish multiple connections to a public cloud provider so that you can establish multiple accounts at each one.
- **The capability to manage any cloud from anywhere:** Whether you're on your desktop at work, on your tablet at lunch, or on your iPhone at a pizza place with your kids, you should be able to access your management platform.
- **Benefits for everyone:** Whether you need to support your IT operators, developers, compliance officers, or line of business (LOB) executives, your management platform should have the flexibility and capability to do so. There should be features tailored to each persona. For example, your developers should have easy access to the resources they need to deploy apps faster via virtual machines (VMs), containers, or bare metal. Your IT people should be able to view usage, costs, and capacity across on-premises and public clouds. Your compliance officers should have the opportunity to automate compliance controls to ensure the business is protected and can automate audit preparations. The LOB owners need to keep tabs on the services they use to manage their businesses.
- **A self-service, sanctioned IT environment:** How about deploying a bit of self-service without having to worry about shadow IT getting in the way? Centralized sanctioned IT services in a single self-service portal can dramatically improve your security posture and help you to better manage costs, complexity, and efficiency.
- **Insights into cost and utilization:** How much are you spending for each of your workloads in your current environment? Chances are, you don't know, and it would probably take an act of Congress to figure it all out. With a unified hybrid cloud management tool, you can get cost and utilization statistics for all your workloads, broken down by actual workload, by provider, and by on premises versus off premises. Never again will you have to answer, "Huh, that's a good question," when someone asks how much you're spending to run a workload.

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- **Economics of how to purchase and consume IT:** Being able to adopt a pay-per-use funding methodology is really important these days when you're locked into competitive battle with businesses around the globe. Having to buy a bunch of stuff years ahead of when you need it is no longer palatable. The public cloud has forever upended the expectations that CFOs have around how IT should be paid for. Your hybrid cloud management platform should be an enabler in this fundamental shift for how to pay for IT, both in the public cloud and on premises.
- **VMs, bare metal, and containers:** Not all workloads are created equal. Some run right on servers. Some run inside VMs. Some run in distributed container environments. The hybrid cloud management platform you deploy needs to be able to support all these constructs. And for VMs and containers, you need to be able to manage them both in your private cloud and in any connected public cloud environments.
- **Low-ops private cloud:** It's time to streamline your IT operations so that you can better focus on the ongoing needs of your business. Enabling a low-ops IT operating environment is your ticket to simplicity and reduced costs, along with less focus on infrastructure and more focus on business outcomes.

HPE GreenLake Central provides all these features and more to help you support your hybrid cloud needs.

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Self-service	Pay-per-use	Scale up and down	Managed for you

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1. **Get the cloud experience everywhere:** Bring the point-and-click, self-service, and on-demand cloud experience, resource elasticity, and pay-per-use model to your on-premises IT.

2. **Unify your hybrid experience:** Integrate the experience across your hybrid environment - private and multiple clouds - transforming IT operations to cloud operations.

3. **Gain superior control and insights:** Enhance governance, control, and visibility with comprehensive compliance capabilities, along with cost insights and analytics to help optimize costs.

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Enabling the brave new world of hybrid cloud management

Around the world, organizations are looking for ways to leverage the benefits of hybrid cloud, but they're facing challenges around cost, compliance, and complexity. No more! HPE helps companies tackle even the most complex hybrid cloud environment, enabling companies to shift resources and focus from mundane management to transformation efforts and time-to-value.

Inside...

- Overcome hybrid cloud management challenges
- Bring sanity to ITOps and DevOps alike—across clouds
- Gain economic insights across clouds
- Offer self-service for a self-service world

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ISBN: 978-1-119-74625-6
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