Hybrid Cloud Strategy

for dummies

A **Wiley** Brand

Consider key cloud strategies

Design for maximum flexibility

Plan with an iterative approach

Ed Tittel

**3rd Red Hat® and Intel®
Special Edition**

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Publisher's Acknowledgments

Introduction

Moving to the cloud and adopting new technologies such as generative artificial intelligence (GenAI) can bring numerous benefits, but your organization must also be prepared for the changes that come with it. This shift continues to grow ever more complex and multifaceted. Organizations often build their own private cloud infrastructures in-house, sign up for services from public cloud providers, and then create hybrid environments. Other vital choices follow close behind, including Software-as-a-Service (SaaS) in many shapes and forms.

Architects and engineers must deal with an array of connections, integrations, portability issues among clouds, resource options, orchestration, storage, and more. And it must all be managed, maintained, and made to work for improved profitability and productivity.

You can probably see why a carefully thought-out and detailed approach to hybrid cloud — a strategy, in other words — is so important.

About This Book

Jumping onto the cloud is easy. Getting it right is somewhat trickier. Getting it right for the long term is a big challenge. A good cloud strategy helps you and your organization work things out, makes sure that all the bits and pieces fit together well, and improves the odds of realizing your business goals.

In this book, you discover the world of hybrid cloud strategy: building, deploying, and running multiple clouds. This book dives into a discussion of the cloud and the strategies for its best deployment and use.

Icons Used in This Book

I occasionally use special icons to focus attention on important items. Here's what you find:

REMEMBER

This icon with the proverbial string around the finger reminds you about information that's worth recalling.

TIP

Expect to find something useful or helpful by way of suggestions, advice, or observations here.

WARNING

Warning icons are meant to get your attention to steer you clear of potholes, money pits, and other hazards. Soft clouds can deliver hard knocks!

TECHNICAL STUFF

This icon may be taken in one of two ways: Techies can zero in on the juicy and significant details that follow; others can happily skip ahead to the next paragraph.

Beyond the Book

This book helps you discover more about the cloud and strategies for its best deployment and use, but if you want resources beyond this book, additional reading that's chock-full of useful info can be found at the following links:

» `www.redhat.com/en/resources/modernize-application-delivery-ebook`: Download your copy of *Modernize application delivery with cloud services.*

» `www.redhat.com/en/resources/openshift-application-transformation-ebook`: Read through your free copy of *Innovate and transform with a modern application platform.*

» `www.redhat.com/en/technologies/linux-platforms/enterprise-linux/cloud`: Explore Red Hat Enterprise Linux in the cloud.

» `www.intel.com/cloudcomputing`: Get more from your cloud with Intel.

» `www.intel.com/content/www/us/en/cloud-computing/hybrid-cloud/overview.html`: Explore hybrid cloud solutions with Intel.

Chapter **1**

Looking at Key Cloud Strategy Considerations

Streamlining and strengthening an IT ecosystem's foundation is essential to realizing business objectives. There's no better way to do that than formulating an effective cloud strategy. Creating a cloud strategy involves pondering some key considerations, which you discover in this chapter.

TIP When building a strategy, complying with applicable policies or regulations around your data and processes is important during every step. Check each one!

Tying Your Project to Success

By tying your cloud project to clear desirable outcomes and benefits, you define your own yardstick for success. All your goals should have clear and specific key performance indicators (KPIs) and success criteria. That means making important decisions as you set those objectives. You must decide what represents success and how you'll measure its attainment. Is your desired outcome to accelerate software delivery through adoption of containers or is it to automate provisioning of servers and applications over the entire life cycle? It makes a big difference. Or is the true goal to

replace legacy infrastructure and modernize IT delivery, improve the customer experience, strengthen security against threats, or improve employee productivity? Whatever your goals, you need KPIs and success criteria to match (and measure) them.

Overcome hurdles

For cloud computing success, projects must address organizational challenges in implementing new systems. Failure to anticipate and handle these challenges poses dangers to project success. While benefits from adopting a new cloud abound, change disturbs the status quo. That's why securing management sponsorship and buy-in is key, starting at the top of the org chart. Set the expectation with management up front that cloud migration will be an iterative process, building on initial successes and adjusting as needed. Get all important stakeholders in your camp and you'll have less disappointment when further modification is needed.

REMEMBER

A proper staff training plan is a critical piece of adopting a hybrid cloud strategy. Many organizations underestimate their capabilities in adapting and fully adopting cloud technologies. This point is critical: Intentions are good, but complete adoption falls short due to assumptions that the internal teams are set up for success. Sometimes this notion occurs due to resourcing constraints, or changes, but it can also occur due to an inadequate training plan.

Identify major challenges

Start with easy apps and identify your implementation challenges. Learn about and consider various options to solve them. Can a public cloud handle your needs and concerns, or should you use a private cloud? Or do you need a hybrid cloud (mix of both)? Whatever you decide, be sure it matches your organization's goals for automation, management, scaling, and cost.

Think about things from users' perspectives. Ask yourself, "How does this cloud project serve them?" and "By opting to host my apps on public cloud providers, what are the risks of locking the company into those providers?" Also ask, "Does it make more sense to build cloud-ready applications so that they can run on or migrate into any cloud infrastructure to avoid vendor lock-in?" Emphasizing benefits helps gain buy-in from decision makers and makes a project an easier "sell."

When choosing cloud technologies, it's not always either private or public. You can create a hybrid cloud approach and combine private and public clouds together.

Plan workloads

Think about the time and work it will take to bring your idea to life. That means learning about the runtime environment to better understand your IT landscape and its current limits. Find out which of your applications can be moved to the cloud — possibly through some refactoring — and which ones can't. Through analysis, and perhaps even a pilot project, determine how best to support current and planned workloads.

Migrate easy (that is, application web tier) applications and then work into the harder stuff (like databases or message bus hosting). Keep compliance in mind, as well.

Brace for impact

Your new project impacts your operations (Ops) team's work-flows, automation, and management policies. Bring them into your process early and often. If you focus on operational knowledge and skills, you help align your organization with new or re-engineered processes. The more Ops is prepared, the smoother your transition becomes. This makes inclusive awareness and documentation vital because they capture changes during the transformation process and keep folks informed.

Assembling Strategy Ingredients

An open, hybrid, business-oriented cloud lets organizations focus on digital transformation, and it shortens time-to-market windows. To do this right, identify common private cloud use cases and then create architectures that fit their needs and requirements. For example, an IT organization may need a cloud strategy focused on security and compliance requirements, as well as regulatory or financial considerations. It may also want to transition to a hybrid environment in which applications run across multiple clouds. The use case would be the point from which it picks appropriate architectures. In the same vein, a telco organization needs to understand its service offerings and

integration and interoperability requirements to help client organizations make the most of what they offer.

REMEMBER Get all key questions answered before starting a cloud architecture. Don't zoom ahead with a lot of issues open.

Putting Cloud in Perspective

To put the cloud in perspective for strategy purposes, check out this definition: *Hybrid cloud* describes a mixture of public and private cloud resources. Such a mix offers the potential for portability among clouds but requires connection and integration points. Hybrid clouds normally employ elements such as containers, container orchestration, common operating systems, runtime environments, flexible storage, and universal developer frameworks and tools. Hybrid clouds designed for portability make it easier to orchestrate cloud workloads via unified management.

Why cloud native? *Cloud native* means that applications and services are completely at home in the cloud, providing greater scalability and availability of applications. A cloud-native infrastructure makes these features feasible and provides self service and on-demand provisioning for cloud-based resources. It also helps automate the application life cycle from development and into production. Although cloud native is the preferred approach, existing applications and workloads can also be migrated to the cloud, where replatforming or refactoring isn't feasible.

REMEMBER Red Hat OpenShift provides a common container, orchestration, operating system, and storage environment regardless of the infrastructure where it's running. It also provides the scalability and availability needed for cloud native applications, so by adopting OpenShift, you can be well on your way to a hybrid cloud.

Chapter **2**

Architecting to Maximize Flexibility

Cloud computing's growth curve is steepening. Essential cloud computing usage trends include containerization, serverless architectures, the extension of the edge into cloud operating models, and artificial intelligence (AI). As the world gets more connected, users want everything to be software–defined. The growth of the edge and cloud services should ramp up the cloud even further. Increasing popularity and reliance on the cloud means that any good cloud strategy must be flexible to meet new (and possibly unforeseen) demands.

Planning for Max Flexibility

If you want to plan for maximum cloud flexibility, you need to ponder a variety of different considerations:

» **Portability and manageability:** The biggest enabler for flexibility comes from adopting an open and extensible architecture, which also helps avoid vendor lock-in and proprietary implementations.

» **Regulatory requirements:** The private versus public decision often comes from the data itself, where regulatory concerns may specify that data can't leave a certain country or be subject to certain audit requirements. Such data may best reside in a private cloud under tight control, while other parts of an application (such as stateless web servers) not subject to restrictions could reside in a public cloud.

» **IT security:** Security is an overriding concern and focus for investment and build-out in enterprise infrastructure with a special focus on securing the cloud.

2024 Global Tech Trends: A Red Hat report states that security and cloud are top of mind for IT professionals. Get more details at `www.redhat.com/en/resources/2024-global-tech-trends-overview`.

» **Geo-redundancy:** Applications that need strong resilience and high availability can benefit from a hybrid cloud model. This allows you to divide services and endpoints between multiple private and public clouds. In this scenario, if a private cloud fails, you can elect to recover the service in a public cloud. Similarly, a hybrid cloud reduces risks of data loss or inaccessibility.

» **Consistency:** Having a consistent cloud environment across hardware and software makes it easier to automate, secure, and manage. Building multiple different cloud environments requires you to duplicate efforts for each environment or, worse, maintain a separate team of resources for each cloud. As your cloud personnel move, leave, or change, logistics become costly and unwieldy.

» **Preparing for the future:** This technology shift won't be the last that your company faces. Part of architecting your clouds for flexibility is recognizing that future technologies need to be incorporated. Recognizing this and adopting open technologies and standards helps you make that eventual next transition.

» **Confidential computing:** Traditional computing models focus heavily on securing data at rest (stored data) and in transit (data being transmitted over networks), but they often fall short in providing comprehensive protection while data is being processed. Confidential computing fills this gap by ensuring that data remains encrypted and confidential even while it's being processed by applications, operating systems, and virtual machines.

TECHNICAL
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>> **Secure communication:** Encryption is widely used to secure communication channels, such as email, messaging apps, and web browsing. Transport Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL), encrypt data exchanged between clients and servers over the Internet, preventing eavesdropping and data interception.

As you review this list, consider your own goals and priorities, and adjust accordingly. You need to be flexible (pun intended) when it comes to maximizing flexibility.

REMEMBER

Conversations around cloud flexibility often default to the hybrid option. Creating the right mix between on-premises and public and private clouds requires creating a road map and begins with understanding overall goals for cloud computing. Bring in all your business stakeholders (key decision makers from business units that benefit from cloud computing) and start laying out ideas.

Getting from Idea to Production

After your road map is laid out, the next steps involve discovery and gap analysis. Making choices must begin with a careful analysis of your organizational constraints and the options ahead. In turn, this comes from thorough discovery and analysis of current processes and outcomes. Along the way, observe (and later on, manage) how the options you choose (or experiment with) affect interactions between operational and development teams along with other stakeholders in the organization.

Selection is also closely tied to proof of concept (POC) stages because a POC usually provides the best way to inspect and experiment with service choices that follow from an initial evaluation. A POC provides an opportunity to evaluate technologies and outcomes as they apply to specific business requirements. At the same time, you gain insight into possible or useful integrations.

The next step is architecture design. Thoughtful technology and organization design is important because it impacts the future direction for IT for a long time to come. It's never easy to go back and rework things if the design isn't right. Work closely with the organization's stakeholders and vendor partners to assess your workloads and applications.

WARNING

Architecture design is an exercise where redos are expensive and can limit or end careers. In your design, ponder (and choose) architectures that are open and flexible enough to accommodate as-yet-unknown business requirements, new and emerging technologies, and open-ended development environments and tools.

TIP

The best way to future-proof an IT infrastructure is to design flexibility and openness from the get-go. A recent example in 2024 is the development of Red Hat Validated Patterns powered by Intel. These pre-built solutions combine Red Hat's technologies (such as OpenShift) with technologies to support performance and lower operational costs. Patterns help to solve business challenges. They provide a reference architecture that can be used to accelerate deployment and reduce the complexity of the project. Make this task a priority.

Circling Back to Cloud Strategy

As you make choices — particularly, those that involve choosing specific platforms, tools, or technologies — you can't help but notice their impacts on your organization, processes, policies, and business goals. Not all proofs of concept succeed. Often, such failures require circling back to and adjusting strategy to reflect an improved and more realistic understanding of what's really needed. Don't be afraid to make adjustments as you go.

In fact, many experts argue that developing a proper cloud strategy unavoidably includes at least a little bit of a "two steps forward, and one step back" motion. That's because you have to move forward to select possible options and implement POC experiments, while recognizing that not all such concepts actually prove themselves in practice.

TIP

Understanding and evaluating the underlying capabilities of cloud instances is critical in terms of performance, cost, security, and governance policies. Not all cloud instances are created equal! Choose cloud instances that have the compute needed for your workload. Many cloud providers default to a generic instance that hampers the performance of your application. Compute, memory, and storage optimized instances ensure that you get the environment that's right for your applications. Make sure the instances you choose have the right accelerators for critical workloads like AI. Intel's Advanced Matrix Extensions (AMX) is an example.

Chapter **3**
Enabling Agile IT in the Cloud

Flexibility is key to any workable cloud strategy. It allows different technologies to run across various cloud architectures. For example, do you want to run storage services on-premises and in the public cloud for backup? Or across clouds? You can do that. Better yet, technologies such as containers open the door to truly portable workloads because they work the same wherever they run.

Automation makes deploying and managing cloud infrastructure and applications more streamlined and less complex and helps staff meet business objectives within organizational and regulatory constraints. In this chapter, you look at how the cloud and automation go together and how managing infrastructure like you manage code builds in added flexibility and capability.

Living in the Cloud Age

Back in the day, getting a new server up and running was time intensive. An administrator had to work with a vendor to buy a physical server, configure it, connect it to the network, image it, install applications, and test it. If something went wrong, it was time to start over. Weeks or months could pass before a server

went live. Then, consider the time involved when many servers across different environments are affected.

No more! In the Cloud Age, admins and users can provision a workload on demand. This takes mere minutes (not days, weeks, or months) by selecting parameters on a friendly user interface or via an API call. This enormous reduction in delivery time has caused the number of servers across enterprises to skyrocket. Today, the real challenge is to find a flexible, robust solution to manage all of them.

Understanding IaC

The answer to managing large numbers of on-demand servers is *Infrastructure as Code* (IaC). By using IaC, operators can provision and manage IT systems programmatically with a template defined in software code. If you're thinking this sounds a lot like application development, you're right.

The crux of IaC is a definition file, from which the entire infrastructure — networks, storage, virtual machines, and so on — is built. Such a playbook specifies not only infrastructure elements but also how they should be configured, and sets the stage for consistency. With a definitive file and automation such as Ansible, cloud infrastructure can be programmatically provisioned in response to demand and usage changes or user requests.

Best IaC Practices

As IaC makes its way into more cloud environments, ensure that your team follows best practices as a standard for execution. The following best practices apply to every IaC environment:

» **Use definition files as documentation.** Definition files are the essence of IaC — your blueprints for whatever type of resource you're creating — and they serve as documentation. In short, your code becomes your doc.

» **Your documentation is built into your code.** Because everything that describes infrastructure is in code, it's vital that code be crystal clear and self-explanatory.

» **Version everything.** Use a version control system, such as Git (see the nearby sidebar for details), to track changes,

conduct peer reviews, and provide good governance. Versioning is especially handy for audits and compliance.

>> **Validate templates before putting them to use.** Validating a template before creating or updating resources lets you identify syntax errors, misconfigurations, and dependency problems.

>> **Perform continuous testing.** This invokes the big picture to validate templates. Constantly test systems and processes to correct mistakes quickly and to ensure that changes don't create instability or unexpected performance issues.

>> **Make small, incremental changes.** Making a small change allows you to quickly see the effect and roll it back if needed with minimal effort. Batching small changes into one larger effort may seem faster but is more difficult to troubleshoot.

>> **Keep services available.** If a service, or server, fails, another should be ready to take over. The goal is to deliver uninterrupted services per service-level agreements (SLAs).

THE GITOPS VISION

GitOps is a way to develop IaC that uses Git repositories as a sole source of truth. Submitted code triggers a standard pipeline for continuous integration/continuous development (CI/CD) in DevOps fashion. This ensures that well-documented, policy-driven requirements for security, IaC itself, or boundaries in the application framework are met or exceeded. All code changes get tracked in such an environment. This makes updates easy to move through the life cycle and provides version control should rollbacks prove necessary.

GitOps delivers the following benefits:

- Standardized workflow for infrastructure management
- Increased security through baking in application and infrastructure requirements
- Improved reliability with Git-supplied visibility and version control
- Consistency across public clouds and on-prem environments

Tools may be combined to build a usable GitOps framework, such as Git repositories, Kubernetes, and CI/CD and configuration management tools. Red Hat Validated Patterns powered by Intel is based on the GitOps architecture.

The Six-Phase Iterative Approach to Cloud Infrastructure

IaC provides real payoffs from using the cloud. If you're ready to incorporate IaC into your IT organization, follow a structured approach to planning and design for rollout. To flesh out and implement your cloud strategy using IaC principles and practices, follow this checklist:

» **Discover.** Nail down and sort out short-term and long-term requirements with IT and business partners. This process includes identifying challenges, articulating business objectives, and determining workloads to move to the cloud.

» **Design and build.** Make sure the design fits your specific business strategies and use cases for the delivery of a Minimally Viable Product (MVP) that can scale as your company grows.

» **Test/validate.** Validate your technical design and test service features, assess their life cycle (for example, how they're updated/upgraded), see how they work, and assess organization fit and impact.

» **Plan migration.** Set a strategy for how best to migrate your selected applications. Standardize and establish automation mechanisms and operational processes.

» **Operationalize.** Tune your cloud infrastructure to meet your performance needs and add/integrate the operational tools you need to detect and respond to failures at lightning speed. The question isn't whether your infrastructure or application will fail; it's all about when and how fast you detect and recover from faults. The real goal is for no failure to be visible or noticeable to your end-users.

» **Iterate.** Revisit your initial MVP design for further improvements. Design changes to accommodate new business needs. Don't try to "boil the ocean" in your first attempt. Define increments and sprints with clear achievable outcomes that are time bound.

This process helps you look at all possible technologies and solutions and come up with a solid action plan. It creates the road map for seeing your cloud project through from beginning to end.

Chapter **4**

Adapting to a Hybrid World

The assertion that deploying a hybrid cloud makes good sense to more organizations is hard to argue because going hybrid enables cloud-based and on-premises resources and assets to work better together.

TECHNICAL STUFF

In fact, 2024 *Global Tech Trends: A Red Hat report* found that 50 percent of self-managed applications run in a hybrid cloud environment overall, while only 10 percent run in a public cloud overall. The remaining percentage that doesn't run in a hybrid or public cloud runs in an on-premises environment only. Get the full report at `www.redhat.com/en/resources/2024-global-tech-trends-overview`.

Using Hybrid Infrastructures

Many modern organizations already use hybrid IT infra-structures. Given that a hybrid cloud is an IT architecture that provides some degree of workload portability, orchestration,

and management across two or more environments, you may find it in these scenarios:

- » A mix of private and public clouds
- » Two or more private clouds
- » Two or more public clouds

Today, defining hybrid cloud computing by what it *does* makes more sense rather than by what kind of or how many clouds it uses. In fact, modern hybrid clouds should

- » Facilitate moving workloads between environments.
- » Run a single, unified management tool (and interface).
- » Orchestrate processes using common automation resources.

The infrastructure that supports a hybrid cloud works the same in stand-alone private and public clouds. Therefore, it includes

- » Networks, such as local area networks (LANs), wide area networks (WANs), virtual private networks (VPNs), and/or application programming interfaces (APIs), that connect multiple computers
- » Virtualization and containers that provide application portability
- » Data services that abstract data resources that may then be pooled together into data lakes
- » Management software that allocates resources into environments where applications and services run

Individual clouds become hybrid when application or service environments interconnect seamlessly. Interconnectivity is what makes hybrid clouds work.

Interconnectivity and interoperability in a hybrid cloud explain how workloads move around and how management gets unified across multiple clouds. Hybrid clouds allow organizations to place workloads in the "right" cloud, depending on service-level agreements (SLAs), security, compliance requirements, and so on.

REMEMBER

Red Hat OpenShift provides consistent networking, virtualization, container orchestration, data services, and management whether running in a private cloud or a public cloud. By deploying Open-Shift across two cloud environments, you're well on your way to

having a robust hybrid cloud environment. Alongside the consistency of OpenShift, you can also find Intel Xeon server instances in the cloud and with each of the major original equipment manufacturers (OEMs) to have feature consistency across the board for easier portability.

Choosing Hybrid-Happy Platforms

A handful of basic principles describe two general ways to build a hybrid cloud environment. One is traditional; the other is more modern (and represents the best way to achieve future-proof, flexible business outcomes). Traditional methods mean interconnecting private and public cloud environments using massive, complex middleware.

WARNING

Using such connections to tie clouds together takes time and effort. That's why modern hybrid clouds focus instead on portability for apps that run inside them. Focusing on apps means building them as collections of small, independent, loosely coupled services. With the same operating system and consistent hardware in every IT environment, and managing everything on a unified platform, apps run everywhere with equal ease and facility. They can also move easily as well.

TIP

Think of a hybrid cloud as resulting from running an open source Linux OS, such as Red Hat Enterprise Linux, everywhere, building and deploying cloud-native apps, and managing environments and apps using an orchestration tool like Red Hat OpenShift. Consider the underlying technology in supporting public or private clouds, too. Intel Xeon Scalable processors incorporate leading performance, latency, scalability, and manageability for multi- and hybrid cloud environments. Having the right technologies and AI capabilities is paramount in driving digital transformation with an IT infrastructure that can meet your needs today and for tomorrow.

Using the same operating system (OS) abstracts hardware requirements, just as using an application platform abstracts app requirements. This creates an interconnected, consistent computing environment where apps can move from one place to another quickly and easily. Better yet, you don't need to worry about functionality breaking when apps get updates or move from one cloud to another.

Similarly, Intel Virtualization Technology, or Intel VT, enhanced with each generation of processors, provides the foundation for seamless movement of apps or workloads across different clouds as well as different generations of hardware.

Embracing Kubernetes

Kubernetes is an open source container-orchestration platform designed to automate how containerized applications are deployed, how they scale up and down, and how they're managed. Kubernetes works across a wide range of infrastructure environments. Most cloud services offer Kubernetes-based platforms as a service — usually as Platform-as-a-Service (PaaS) or Infrastructure-as-a-Service (IaaS) environments. This lets Kubernetes function as the platform on which container-based applications can be deployed, scale, and be managed.

REMEMBER

Kubernetes is a de facto orchestration platform for modern hybrid cloud environments. If you build an application to run in a container, Kubernetes can orchestrate it in any cloud or datacenter environment. The Kubernetes platform makes it easy to provide consistency across different cloud platforms because applications and their data reside within containers that come prepackaged with all inputs and outputs, capabilities, and connections needed, regardless of the runtime environment (which may be private or public cloud-based, on-premises or off).

REMEMBER

Because Kubernetes and containers depend on Linux, it's best to use the same Linux distribution all over. That includes using the same Linux distribution within the Kubernetes node hosts and the containers themselves.

Getting Past Plain Vanilla

TIP

Maximizing Kubernetes is more than simply grabbing code and putting it to work. Some Kubernetes implementations include additional features that confer amazing value. Look for, or insist on, certain features from your toolset to create a flexible and future-proof hybrid cloud environment. Ditto for containerized applications in that environment. The features include

» **Application services:** Applications in Kubernetes can use generic services that work across all containers in a cluster. A good Kubernetes implementation offers a large library of predefined and well-known services and also makes it easy for developers to build their own services so they can easily leverage common efforts and create reusable building blocks.

» **Data services:** Kubernetes Container Storage Interface (CSI) provides persistent data volumes. These services work with enterprise backup solutions to support Kubernetes apps. They use APIs that provide application-consistent backup images, complete with metadata to describe cluster resources and persistent data volume contents.

» **DevOps tooling:** Kubernetes is about running apps in containers. Modern app development adheres to a combination of development and operations philosophies known as DevOps. Key to this approach is for continuous integration and continuous deployment (CI/CD). In practice, this means your Kubernetes environment should integrate easily and seamlessly with your development and deployment tools, and support CI/CD.

» **ISV marketplace support:** Enterprises can be comfortable buying tools and technologies for Kubernetes application development, deployment, and management if prospective purchases are certified for Kubernetes. Red Hat operates an open marketplace specifically for such software from independent software vendors (ISVs) to simplify buying and deploying container-based software across clouds. Find it at `marketplace.redhat.com`.

» **Cloud services integration:** Red Hat OpenShift works with the major cloud platforms, including Amazon Web Services (AWS), Microsoft Azure, IBM, and Google. Cloud interoperability and access are essential in any modern hybrid cloud infrastructure and provide the foundations for workload migration, easy deployment and management, and more.

» **Hardware optimization:** Intel has partnered with Red Hat on OpenShift as the market leader. Together they work to ensure OpenShift features and performance are optimized on Intel Xeon processors.

Making Much of Management

In a dynamic and distributed environment, with containers and clusters in multiple clouds, management and monitoring gain extra importance and value. A single view of core capabilities is key. Centralized management translates into

» Control over your private cloud, hybrid cloud, and public cloud instances and resources, including AWS, Microsoft Azure, Google Cloud, IBM Cloud, and others

» Management of key technologies used in the cloud and on-premises, including virtualization (VMware, OpenStack, and more) and varied operating systems (Linux, Windows, and more)

» End-to-end cluster management, using Infrastructure as Code (IaC) best practices and design principles to deliver reliable consistent management at-scale, cover clusters across multiple datacenters and public cloud services, illuminate health across all clusters and pods, and provide troubleshooting insight across all clusters

» Baked-in security, down to the hardware layer with Intel Security Technologies, that lets developer and operations teams work from the same playbook and account for compliance and regulatory requirements through the entire life cycle

REMEMBER A strong management solution offers policy-based governance, risk, and compliance controls.

» Centralized life-cycle management for containerized apps that allows for intelligent placement rules, uses channel and subscription definitions for deployment, provides usable views of service endpoints and pods, and facilitates moving workloads across clusters — even across public clouds

» Better results as integrated dashboards and tooling bring everybody together to get the work done consistently

REMEMBER A strong management solution helps break down departmental boundaries and encourages collaboration and cooperation across the organization.

Chapter **5**

Cloud Strategy for Telecommunication Service Providers

Many service providers are keen to alter the perception that they're only providing connectivity pipes. Have you ever heard the phrase "from pipe to platform?" It's often used in the transformation from telco companies to technology companies, and in this context, it means a platform that service providers can use to build and deliver compelling services and applications to generate new revenue streams. The right platform is also vital for service providers to optimize their cost base, using its extensive automation features and capabilities for more effi‑ cient deployment and operation of complex networks at scale.

Another aspect is risk mitigation, and, again, the platform plays an important role. A unified application platform that spans a network from the core datacenter to the edge of the network, and also to multiple public clouds, gives service providers a consistent experience regardless of environment, and empowers them to maintain high levels of flexibility and options to meet their own and mandated security and compliance requirements.

For telecommunications service providers, business transformation isn't just an idle dream. It's a make-or-break proposition as they evolve from traditional telecommunications companies (telco) to technology companies (techco). Service providers that can't lead the way into modern, progressive technologies may fall by the wayside.

Today, IT and applications live in clouds, so if a telco cloud infrastructure isn't moving toward cloud-native capabilities and won't or can't support hybrid multi-clouds easily or well, it loses the ability to compete against more advanced network providers.

Telco to techco describes how service providers fundamentally change the way they do business by adopting innovative ways to offer products and services built on new digital tools and technology. For success, though, organizational culture change must coincide because this transformation requires new ways of thinking and doing to improve or replace what came before.

For service providers, their services and platforms form the foundation on top of which this transformation rests. That means hybrid clouds, mobile apps, generative artificial intelligence (GenAI), and everything-as-a-service require new kinds of storage, analytics, networking functions, management, intelligent automation, and AI for IT Operations (AIOps).

Many CEOs of telecommunications providers are looking to accelerate the transition of their companies. But they must execute on a holistic business and operational strategy so the strategy doesn't fall prey to short-term budget limitations or fail to deliver on over-ambitious, poorly conceived implementation plans. Instead, service providers must carefully weigh the operational and business benefits for each element they build into their plans.

Finding Opportunity in a Paradigm Shift

When the rules change enough that you find yourself asking, "Are we still playing the same game?" that's a paradigm shift. Digital transformation — especially for service providers — represents a clear paradigm shift because it literally changes everything. Early adopters of new tools, methodologies, and technologies can capture more of the opportunities created. At a minimum, telco to techco transformation involves

» **Network cloudification:** Cloudification of the network technologies (routing, filtering, prioritizing, orchestrating, and organizing network traffic and structures) as well as operational methodologies used as the building blocks for increasing operational agility and efficiency

REMEMBER

Cloudification has accelerated adoption as it meets telecommunications standards. *Carrier-grade* designates systems and equipment that support the levels of capability, reliability, stability, quality, and availability required by service providers to provide the infrastructures that everybody relies on and that customers can bundle with their own services.

» **Cloud-native applications and services:** Depend on using open source, standardized containers and Kubernetes, and associated infrastructures, development tools, environments, and cloud-native operational methodologies

TIP

Service providers should seek out a cloud-native platform that provides the same operational experience across a multi-cloud environment.

» **Intelligent automation:** Covers the use of programming, scripting, and AI to capture commands and configurations and the use of management and control software to orchestrate its use

Automation is key to efficiently managing complex networks at scale and speed because it responds to events, requests for service, and incidents without human intervention or error. Automation, once proven and tested, is accurate, works at machine (not human) speeds, and can be repeated easily. Further, using Validated Patterns with Multicloud GitOps is an efficient way to automate application development and deployment.

» **AI and machine learning (ML):** Represent the use of computers to analyze enormous collections of data that modern digital devices, systems, and services generate

ML, in particular, is able to teach itself new and interesting ways to understand data, some of which may be counterintuitive or too complex for humans to handle unaided. Predictive AI forecasts outcomes, and now generative AI creates new content. They're what lets online shopping sites suggest purchases based on observed shopping behavior, supports fraud detection for financial services providers, and helps software developers write code and find and fix

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potential issues before they turn into real problems. AI and ML excel at building baselines and finding anomalies in large and growing data sets. AI thrives on speed, so new chipset and processors from Intel have built-in AI accelerators to enable faster and more responsive ML. For more info, check out `www.redhat.com/en/topics/ai`.

Paradigm shift opportunities go mostly to organizations that quickly recognize the value brought by major changes and use new technologies to make it easy for clients or customers to benefit. Service providers are uniquely positioned to benefit from providing services and infrastructures that support their customers' effective use of hybrid multi-cloud and the cloud-native applications that run there.

REMEMBER

Ensuring consistent and performant 5G communication requires all parts of your solution to be optimized to work together. Intel and Red Hat have partnered to give their clients the best possible 5G experience.

Interconnecting the World

A modern hybrid multi-cloud environment creates a veritable ecosystem within which service providers — and their legions of customers and partners — can thrive amidst the trials of everyone's digital transformation. This ecosystem depends on a key set of foundational ingredients that, in turn, depend on

>> Running a production-ready, open source Linux OS everywhere

>> Virtualizing or containerizing network and IT functions

>> Providing a consistent way to build, deploy, and operate cloud-native apps

>> Managing hybrid and multi-cloud environments with the Kubernetes orchestration and open source application platform capabilities found in Red Hat OpenShift

Red Hat OpenShift is a leading modern application platform that provides a trusted, comprehensive, and consistent experience, fostering organizational and IT growth and innovation through its security-first, scalable application development and delivery capabilities.

Building blocks for modern telco networks

As the entire telco industry moves toward 5G adoption and deployment, new technology helps deliver more capabilities to customers faster, improve their experiences, and accelerate digital transformation. This involves rethinking the entire carrier-grade environment and switching away from proprietary hardware and software to open, standards-based services and software-defined systems to accelerate and amplify new 5G capabilities and more.

The distributed architecture of 5G also permits service providers to offer services at the network edge, a priority for customers who want to improve data access and application responsiveness. Examples include access to complex medical imaging and diagnostic services in an ambulance or AI-driven operation of an autonomous vehicle in real traffic.

Service providers can use hybrid multi-cloud to extend datacenter resources while maintaining control over increasing presence and capability at the edge. Multi-access edge computing is key to enabling 5G and its new service opportunities. Service providers benefit from localized compute resources and data acquired and processed at the network edge. Indeed, open source and the hybrid cloud have established themselves as the key building blocks for modern telco agile networks, enhancing customer experiences, even when their needs change.

COUNTING GENERATIONS

In the world of wireless, connections are often labeled by using numbered generations, represented by the letter G. The first generation, or 1G networks, emerged in the late 1970s, providing a maximum speed of just over 2 kilobytes per second. The second generation (2G) arrived in the early 1990s, with speed increasing to around 200 kilobytes per second. The third generation (3G) made an appearance in the mid-2000s, rocketing speeds to 40 megabits per second (Mbps). In 2010, fourth generation (4G) was a game changer in terms of performance, offering speeds of up to 100 Mbps, and is still the dominant

mobile technology to date. Fifth generation (5G) offers data rates of hundreds of Mbps up to 1 gigabit per second (Gbps). With its first large-scale deployments in April 2019, 5G also supports massive scaling, better transmission efficiency and coverage, and lower latency.

With each new generation, speeds have increased as has the number, type, and complexity of digital streams supported. 5G, in fact, appears poised to challenge wired and cable connections from the edge of the infrastructure to homes and offices.

The open transformation journey

Service providers today are not only continuing but also accelerating their ongoing transformations. And now, platforms that can run any application provide the necessary flexibility and innovation at scale. This lets service providers quickly and efficiently create new enterprise business opportunities.

Open community collaboration accelerates innovation. Using an open, flexible environment permits service providers to add or change vendors as their business needs, cost considerations, and customer demands evolve, using the best solutions to offer top-notch customer experiences. By taking advantage of open technologies, service providers can meet customers' needs, whatever they're doing, wherever they're located, on whatever devices they're using, and whatever content they're consuming. Rapid innovation helps service providers compete more successfully in today's dynamic markets.

Modernizing OSS/BSS

Internal telco operations use operations support systems and business support systems, often abbreviated as OSS/BSS. The former addresses how service providers configure, provision, maintain, and troubleshoot network services, while the latter addresses how service providers track service orders, manage customer relationships, handle billing, and manage cross-carrier transactions. These are the nuts-and-bolts internal systems on which service providers depend, but like all other aspects of modern business, they too must change as a part of digital transformation.

OSS/BSS gain many of the same benefits that other applications and services enjoy when switched to a cloud-native architecture and hybrid multi-cloud ecosystem. The new capability, flexibility, and efficiency they bring help modernize OSS/BSS. The ecosystem supports a broad range of solutions, including databases, data stores, AI/ML analytics, and more, designed to enable a modern OSS/BSS environment. In turn, this makes service providers more agile, more flexible, and more able to innovate with new services, bundles, partnerships, and customer offerings.

Helping Telcos Achieve Sustainability Goals

Being a sustainable service provider is becoming an important business objective in order to improve reputation, gain a competitive advantage, increase operational efficiency, and spur innovation. Sustainability is also being mandated by government as an important step to address the challenge of climate change.

Service providers are already improving sustainability by adopting strategies and best practices that aim to reduce their environmental impact, like moving workloads to the cloud — especially to clouds powered by renewable energy sources.

Winning Service Providers Serve Customer Success

Service providers can plan on future benefits from a hybrid multi-cloud adoption and deployment. A hybrid cloud ecosystem makes it easier and faster to migrate workloads among public and private clouds. Service providers can readily shift from private infrastructures to public clouds across multiple providers, if desired, and support cloudbursting when needed.

Cloudbursting refers to responding to increased demand for an application or service by placing additional workloads for it into one or more additional clouds (usually public). It supports scaling up and scaling out.

TIP

Service providers must understand the impact of their IT modernization journeys on customer experiences. Successful modernization strategies rely on innovative technology, new approaches, and cross-industry collaboration. To succeed in your modernization journey and to better serve your customers, keep these tips in mind:

» **Build a cloud-native application platform.** 5G networks, edge environments, and AI/ML all require a modern platform based on cloud and container technologies. With this architecture, you can

- Improve application and service security, scalability, and portability.

- Develop and deploy differentiated applications more quickly and cost-effectively.

- Prepare your business for future change, adaptation, and automation.

» **Automate everything.** When you're stuck in manual processes, delivering timely, resilient services while effectively managing security risks and compliance mandates across multivendor networks is difficult. IT and network automation help teams accelerate operations and collaborate more effectively to support modernization initiatives.

» **Collaborate through partner ecosystems.** Modern cloud, network, business, and customer experience solutions rely on vendor and service provider collaboration. A partner-based approach to transformation can

- Provide complete, interoperable solutions based on certified and validated components

- Increase choice of technologies, network functions, and services.

- Provide greater network and operations scalability and flexibility.

Partnership is critical for 5G and edge solutions because no one vendor can provide a complete solution.

Chapter **6**

Ten Reasons to Develop a Cloud Strategy

Each *For Dummies* book ends with a Part of Tens chapter. This one gives you reasons to develop a cloud strategy:

» **Get a road map.** A cloud strategy provides a road map for becoming cloud native. You understand your goals and objectives, what you can migrate to the cloud, which challenges you face, and how to overcome them.

» **Increase your cloud flexibility.** A cloud strategy also helps you ramp up cloud services appropriately to meet both existing and new (and possibly unforeseen) demands.

» **Go open source.** An architecture based on open source software is the cornerstone of a cloud strategy. Adopting an open and extensible architecture adds flexibility and portability (and avoids vendor lock-in).

» **Meet compliance requirements.** A well-developed cloud strategy helps ensure that you're meeting regulatory and internal compliance requirements. It also designs in policies, tests, and checks to compare and synchronize what's required and what's built.

>> **Follow a proven approach.** A cloud strategy provides a checklist to ensure nothing is overlooked. The checklist covers discovery, design and build, testing and proof of concept, and migration.

>> **Reach your goals more quickly.** Making cloud decisions involves many technical and business choices, input from operational and development teams, and proofs of concept. A solid strategy ties it all together and keeps choices on track toward achieving business outcomes.

>> **Increase agility with automation.** Infrastructure as Code (IaC) lets you provision and manage servers automatically by using a defined template. There's no need to touch a physical box. IaC is the essence of agility. Check out Chapter 3 for more information about IaC.

>> **Embrace a complete app platform.** Support your application development and deployment endeavors, accommodating a variety of environments, applications, and skill levels. An application platform, such as Red Hat OpenShift, empowers customers to innovate and increase the speed and efficiency of operations and developers, all while maintaining security and boosting application performance.

Red Hat OpenShift provides customers with a trusted, comprehensive, and consistent hybrid cloud application platform for the development, deployment, modernization, and management of existing and new cloud-native applications.

>> **Unified IT management is in play.** Single-pane-of-glass management increases efficiency, makes complex environments easier to manage, and builds in reliability and scalability.

>> **Get better visibility.** Unified IT management results in highly accurate data. Plan better, spend more wisely, and lower overall IT costs. From GitOps to global management, a cloud strategy illuminates the entire IT life cycle and drives continuous improvement.

Put together your hybrid cloud strategy

Cloud computing has become a mainstay in the world of IT. Trends such as containerization and serverless architectures, and the extension of the cloud to the edge, are essential cloud computing trends. As the world gets more connected, users want everything to be software-defined. Increasing popularity and reliance on the cloud means any good cloud strategy must be flexible to meet new or unforeseen demands. With this book, you see how to put together your cloud strategy and plan for the future.

Inside…

- Key architecture design considerations
- Infrastructure as Code best practices
- Hybrid cloud platforms and technologies
- Cloud strategy for telco
- Ten reasons to develop a cloud strategy

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