BROADCOM PRESENTS

the GORILLA GUIDE® to...

# Operating and Optimizing VMware vSphere Foundation

## Optimize Data Centers Through Improved Operations Management, Supercharged Workload Performance, Elevated Security, and Accelerated Business Innovation

**ED TITTEL**

IN PARTNERSHIP WITH

vmware® by Broadcom

POWERED BY ActualTech MEDIA

**www.actualtechmedia.com**

## PUBLISHER'S ACKNOWLEDGEMENTS

**DIRECTOR OF CONTENT DELIVERY**

Wendy Hernandez

**GRAPHIC DESIGNER**

Robert Crossland

**HEAD OF SMARTSTUDIO**

Katie Mohr

**WITH SPECIAL CONTRIBUTIONS FROM BROADCOM**

Sehjung Hah,
PRODUCT MARKETING ENGINEER

Stephanie Karic,
PRODUCT MARKETING ENGINEER

Tom Nagelmeyer,
PRODUCT MARKETING ENGINEER

## ABOUT THE AUTHOR

Ed Tittel is a 30-plus year veteran of the IT industry who writes regularly about cloud computing, networking, security, and Windows topics. Perhaps best known as the creator of the Exam Cram series of certification prep books in the late 1990s, Ed writes and blogs regularly for GoCertify.com, ComputerWorld, and other sites. For more information, including a resume and list of publications, please visit EdTittel.com.

# ENTERING THE JUNGLE

# CALLOUTS USED IN THIS BOOK

### SCHOOL HOUSE

In this callout, you'll gain insight into topics that may be outside the main subject but are still important.

### FOOD FOR THOUGHT

This is a special place where you can learn a bit more about ancillary topics presented in the book.

### BRIGHT IDEA

When we have a great thought, we express them through a series of grunts in the Bright Idea section.

### DEEP DIVE

Takes you into the deep, dark depths of a particular topic.

### EXECUTIVE CORNER

Discusses items of strategic interest to business leaders.

### DEFINITION

Defines a word, phrase, or concept.

### GPS

We'll help you navigate your knowledge to the right place.

### KNOWLEDGE CHECK

Tests your knowledge of what you've read.

### WATCH OUT!

Make sure you read this so you don't make a critical error!

### PAY ATTENTION

We want to make sure you see this!

### TIP

A helpful piece of advice based on what you've read.

## INTRODUCTION

# Operating and Optimizing VMware vSphere Foundation

**In modern organizations, workloads are proliferating everywhere.** That includes the public cloud, at the edge, as well as in the data center. Unfortunately, these same organizations too often see their IT environments fracture across these environments, to become more isolated, disjointed, and complex. Getting past these barriers is essential.

To overcome these hurdles, and bring operations together, organizations need a modern solution that delivers all five of these critical capabilities:

- **Intelligent operations management to assist in optimizing and improving how existing resources get used.**
- **High performance infrastructure that simplifies and automates hardware lifecycle management.**
- **Hyperconverged Infrastructure (HCI) with storage to simplify deployments.**
- **Developer-friendly platforms to support DevOps services and Kubernetes clusters.**
- **Security and compliance coverage to protect data and adhere to regulations, mandates, and best practices.**

At the same time, organizations need provisioning and orchestration across all environments, so that on-premises acts like the cloud, and vice versa. This means on-premises levels of security and performance, with the flexibility and elasticity of the public cloud, and its support for an everything-as-a-service model and agile operations at any scale.

## REACH OUT TO YOUR PARTNER

**While everybody can deploy VMware vSphere Foundation and all the components,** it is always strategic to work with a valued partner to gain all the benefits available and to enable all the capabilities that an organization needs.

What if organizations could have their cake and eat it, too, based on a common, consistent cloud-native operating model? They can, using the VMware vSphere Foundation, aka VVF. In this Gorilla Guide, we explain how VVF works to optimize data center performance for organizations of all sizes. We'll survey the computing landscape, cover the basics of intelligent operations management, and dig deep into the facilities for adding capacity, planning infrastructure and

**To deploy a private cloud, VMware Cloud Foundation is the complete solution from Broadcom.** VMware vSphere Foundation is for an enterprise-grade Hyperconverged Infrastructure (HCI) platform that takes vSphere-only users to realize benefits with vSAN and better operations.

workloads, and reporting on TCO and chargebacks. From there, you'll find further coverage of VMs and Kubernetes clusters, storage, access to infrastructure resources, enhanced security, governance and compliance, and more. Buckle up: it's going to be an interesting ride!

**This Gorilla Guide covers VMware vSphere Foundation as an enterprise-grade Hyperconverged Infrastructure (HCI) platform.** The process to assist customers includes assessing their current state in deployment, evaluating their infrastructure maturity relative to their goals, identifying relevant use cases, and providing a detailed adoption plan that partners can implement. Additionally, it's essential to highlight the total cost of ownership (TCO) benefits associated with these options.

CHAPTER 1

# Today's Cloud Computing Landscape

**Workloads are increasing in numbers and size everywhere you look inside modern organizations' environments.** Thus, a 2023 Morgan Stanley study predicted that enterprises would run 497 million workloads in the cloud (301 million public, 196 million private) in 2024, increasing to 622 million by 2026 (398 million public, 224 million private).

At the same time, 69% of IT leaders report overspending their cloud budgets in 2023, while 61% of such leaders attribute proactive monitoring of cloud spend as the best way to stay within budget. Server forecasts indicate, however, that by 2027, enterprise containerized instances will grow by 450% with a CAGR of 41%. That's a lot of complexity to budget and pay for, as well as manage and secure.

### CLOUD MIGRATION GOES BOTH WAYS

**While everybody knows that it's easy to migrate workloads from the data center into a public cloud such as AWS, Azure,** Google and so forth, there are good reasons why companies sometimes move workloads from the cloud into a data center. As explained in a 2023 Study, Gartner Inc. identified four trends driving a new shape for cloud, data center and edge infrastructures. Reasons for reverse migration include correcting for overbuilt, unused, or redundant public cloud infrastructures; creating resilience instead of service level redundancy, modernizing infrastructure, and adding extra access paths for supply chains to avoid disruption. By no coincidence whatsoever, VVF supports all these things, in the name of delivering cloud-like experiences across the entire enterprise. These considerations also sit behind many of the challenges described in the next section.

## Facing Down Some Formidable Challenges

In particular, organizations face some formidable challenges in getting their cloud estates under control, while also enabling IT to support innovation and growth. These include the following:

- **Innovation:** the landscape keeps changing, as new tools and technologies emerge, particularly those built upon or based around artificial intelligence (AI).

- **Modernization**: enterprises incur technology debt as tools, platforms, and infrastructures age. A constant stream of analysis, selection, and investment is needed to rotate old, legacy technologies out, and new, more capable and powerful technologies in.
- **Cloud costs:** organizations must pay for licenses and use, typically on a pay-as-you-go basis. That said, over-provisioning and idle resources, unfavorable pricing, lack of visibility, data transfer costs, duplication across multiple clouds, inefficient workloads, and lack of governance around resource usage can all cause cost to break budgets.
- **Cyberthreats:** the increasing severity and frequency of cyberthreats, especially ransomware, poses serious challenges to organizations' abilities to conduct business. As complexity grows, so also do the difficulties of securing the digital estate.
- **Sustainability:** As the digital estate spreads out across data centers, private and public clouds, and so forth, the energy footprint and sustainability profile can grow burdensome. It's important to tailor or optimize that footprint to control consumption costs, but also to ease the burden on the environment.
- **Repatriation:** while momentum and recent history tend to favor the cloud over on-premises operations, organization may have valid reasons to repatriate some data and applications into their own hands. Those reasons include lower costs, internal policy, regulatory requirements, security and storage needs, and better control over data and applications.

# Transforming Current Infrastructures

These challenges also demand modern solutions to transform current infrastructures so they can support modern workloads, and get organizations prepared to handle what the future has in store. Among these you'll find:

- **Intelligent operations management.** AI and best practices driven approaches to management, informed by data and deep understanding of modern practices and processes, designed to deliver smooth, trouble-free IT services delivery.
- **High-performing infrastructure.** Optimized and well-equipped physical servers and virtual machines that provide high energy efficiency, low latency, and best-of-breed transaction processing, user interaction, and more.
- **Developer-friendly platforms and capabilities.** Reduce tool proliferation by not requiring other third-party management tools.
- **Secure, compliant operating environments.** Designed with security from the get-go, and provide policy and process controls to make sure organizations protect user data, meet privacy requirements, and comply with relevant mandates and regulations.

The VMware vSphere Foundation (VVF) is purpose-built as an enterprise workload engine to optimize and operationalize your IT infrastructure. Throughout the rest of this guide, we'll explain how VVF delivers the goods to help you transform and modernize your IT infrastructure.

In the next chapter, we'll dig into this workload engine to explain how it works to boost operational efficiency, supercharge workload performance, elevate security, and, ultimately, accelerate innovation.

CHAPTER 2

# Introducing VMware vSphere Foundation (VVF)

**VMware vSphere Foundation (VVF) provides an enterprise workload engine that's designed to optimize data centers in organizations of all types and sizes.** As you can see in **FIGURE 1**, this architecture supports a variety of virtual client and infrastructures, including vSphere Kubernetes

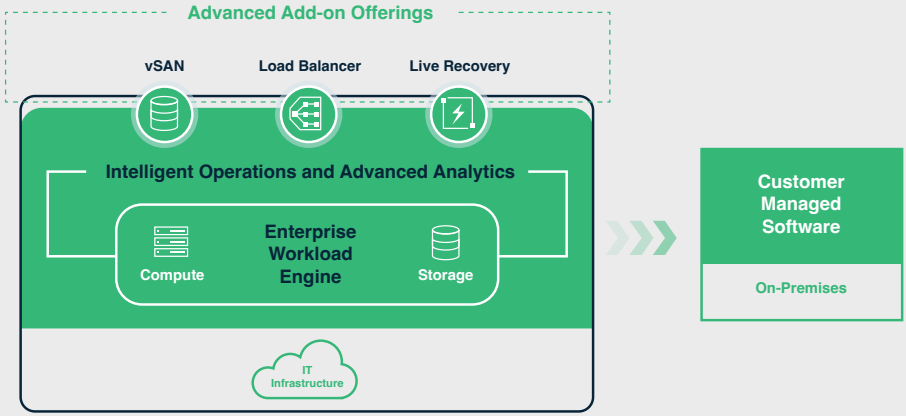


**FIGURE 1:** VMware vSphere Foundation (VVF) is an enterprise-grade workload engine that provides virtualized compute (vSphere) storage (vSAN) infrastructure with intelligent operations and advanced analytics on-premises. Additional add-ons are also available.

Service, vSphere Pods, and any number of virtual machines (VMs). Indeed, VVF provides a platform for running virtualized and containerized workloads within VMware virtual infrastructures.

VMware vSphere Foundation is the enterprise workload engine built to optimize the IT infrastructure for organizations of all sizes by enhancing operational efficiency, supercharging workload performance, and elevating security. It delivers intelligent operations management, purpose-built to enable the best performance, availability, and efficiency from your infrastructure, while providing comprehensive visibility and analytics in one place. Working from the bottom up, **FIGURE 1** shows that the VVF virtualized software leverages IT infrastructure. One layer up you'll find VVF's basic facilities: compute, storage, and its enterprise workload engine. VVF's intelligent operations and advanced analytics embrace these facilities, and also accommodate add-ons (e.g., additional storage, VMware Live Recovery, and more). Indeed, VVF—which includes vSphere—can use virtualization to transform individual data centers into aggregated computing infrastructures. These include CPU/computer, storage resources, and extend into properly instrumented customer managed software on-premises. In fact, VVF manages such infrastructures as one single, unified operating environment, and provides tools to administer data centers that participate therein.

Three core components sit at the heart of VVF—namely, ESX, vCenter Server and vSAN. ESX defines the virtualization platform on which virtual machines and appliances are created and run. vCenter Server providers services for managing multiple hosts connected via network and pool their combined resources. vSAN aggregates local and direct-attached storage devices into a single storage pool available to all hosts in a vSAN cluster. This eliminates needs for

external shared storage, and streamlines storage configuration and VM provisioning. Built-in policies ensure flexible data availability and protection.

VVF intelligent operations and advanced analytics let organizations deploy and operate compute and storage infrastructure. Also known as Workload Management, this opens permits running Kubernetes workloads natively at the hypervisor layer through the workload engine. Enabling this tool on a vSphere cluster allows Kubernetes workloads to run directly on ESX hosts, and to create Kubernetes clusters as dedicated resource pools. In the same vein, VVF Operations Management offers management capabilities tailored for heterogeneous data centers. It supports and manages infrastructures and applications that increase business agility while maintaining proper IT controls. Indeed, VVF Ops Management provides a comprehensive management stack.

## A Typical VVF Environment Is Multi-Faceted and Capable

Overall, VVF is built around an enterprise-grade workload engine designed to optimize IT infrastructures. It can run virtual machines and Kubernetes clusters, and deploy hyperconverged (software-defined) infrastructures together within a single global management framework. A typical configuration would include these VMware platforms:

- ESX
- vCenter
- vSphere Kubernetes Service
- VMware Cloud Foundation Operations (includes logging and diagnostics)

- vSAN (0.25 TiB per core)
- Plus, available add-ons (e.g., VMware Live Recovery, additional vSAN capacity, Tanzu Platform for additional Kubernetes capabilities, and more).

First and foremost, VVF delivers intelligent operations management, built around AI/ML to enable best performance, availability and efficiency from your organization's infrastructure. VVF also uses comprehensive analytics and provides visibility into the entire digital estate. This explains how VVF boosts operational efficiency to get the best from your infrastructure.

Likewise, VVF helps supercharge workload performance using real-time metrics and optimizations to meet their throughput and latency needs. VVF also helps to elevate security through its zero trust, secure-by-default methods and models purpose-built to safeguard data and ensure business continuity. Finally, VVF opens the door to innovation to improve existing workloads and open new greenfields through simple tools to discover, access, and deploy DevOps services that run workloads inside VMs and containers.

VVF also incorporates vSAN storage to create a hyperconverged infrastructure. But as storage needs grow, organizations may choose to add vSAN capacity to increase available storage pools. Various VMware add-ons can cover high-impact use cases such as load balancing, ransomware and disaster recovery.

Above all, VVF seeks to optimize your data center and improve operational efficiency and security to help you meet your business goals, improve IT, obtain better insights, and find more opportunities to improve infrastructure. With these principles to inform your understanding of VVF, the following chapters dig more deeply into specific capabilities that deliver the goods. In the next chapter, for example, you'll learn more about how VVF helps organizations improve IT operations by boosting efficiency and effectiveness.

CHAPTER 3

# How VMware vSphere Foundation (VVF) Boosts Operational Efficiency

**Through three major aspects and capabilities, VVF provides key visibility, insights, and toolsets to promote and bolster an organization's operational efficiency.** Here, operational efficiency is best understood as representing an organization's ability to conduct more business, more quickly, and more safely, with minimal impact from disruptions of all kinds.

In particular, VVF helps organization achieve operational efficiency using the following capabilities:

- Intelligent operations and advanced analytics
- Cost and capacity management
- Diagnostics troubleshooting
- Performance monitoring
- An enterprise-class Hyperconverged Infrastructure (HCI) powered by vSAN

Next, each of these topics will be covered in its own section.

# Intelligent Operations Management and Advanced Analytics

Intelligent operations management uses AI/ML based capabilities to understand and anticipate how IT works in your environment. When coupled with insight into your organization's business goals and priorities, this also helps transform operations into how things should work (or work better) within the constraints of governance, rules and regulations, and best practices. To those ends, advanced analytics provide metrics and trends to show how IT is doing and where it's going, as opposed to what your goals and priorities say about what it should be doing and where it would like to be going.

## ADVANCED ANALYTICS

**In the context of VMware vSphere Foundation (VVF), advanced analytics describe the use of sophisticated and complex data analysis upon all the data observed from system usage, resource consumption, performance data, and more.** Advanced analytics help organizations make faster and better data-driven decisions, including optimizing operations, proactive troubleshooting, and improved resource utilization and workload positioning. You'll learn more about predictive analytics, capacity planning, AI-driven troubleshooting, performance monitoring and cost optimization in chapters ahead.

These VVF capabilities deliver maximum visibility into how your applications and services operate, as well as the underlying and supporting infrastructure. That means operations can expect a better console experience, with improved, intelligent container and VM monitoring, as well as AI-driven proactive troubleshooting and streamlined, well-informed remediation and repair or correction.

A simplified, unified console delivers easier management for all components. It offers a global inventory, simplified diagnostics and unified license management. Admins also gain unified diagnostics through integrations via VMware Cloud Foundation Operations. You can see this console at work in **FIGURE 2**, which aggregates information from three distinct data centers.

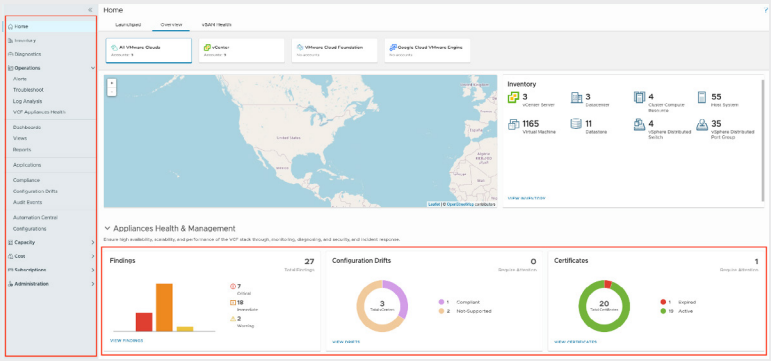


**FIGURE 2:** This VMware vSphere Foundation (VVF) with the VMware Cloud Foundation console provides one place in which to manage multiple deployments with rich visual insights for security, diagnostics, license management, and more. Highlighted are some of the dashboards and the menu choices.

VVF offers still more interesting benefits: it makes for easier configuration, management and deployment operations. Indeed, such operations are often simplified thanks to ready incorporation of automated tasks. By design, this console also offers a unified and consistent user experience across all components and activities. Overall , VVF customers will use vCenter which is already familiar to VMware users, but now VVF offers them the ability to enable intelligent operations management (VMware Cloud Foundation Operations) this helps to reduce costs, improve performance, and secure compliance of the infrastructure.

## Container and VM monitoring

Because containers and virtual machines are where workloads live and run, keeping track of same is essential to monitoring the health and efficiency of IT operations. One of VVF's major strengths, in fact, is in its ability to coordinate and handle VMs and Kubernetes containers simultaneously, across multiple clusters and sites, on-premises and in the cloud. Key services in this quest include:

- **vSphere Kubernetes Service:** Enables consumers to leverage consistent, compliant, and Kubernetes clusters with ease, ensuring standardization across containerized environments. This was formerly named Tanzu Kubernetes Grid service.
- **VM Service:** Allows consumers to independently create virtual machines without requiring direct access to the vSphere Client, streamlining virtual machine creation alongside Kubernetes workflows.
- **Supervisor services:** These include capabilities to support DevOps for workloads including configuration, orchestration, provisioning and so forth. Third-party independent software vendor (ISV) services such as connectors can be integrated here as well, with support for declarative APIs so DevOps can automate infrastructure operations.

Organizations can benefit from running VMs alongside Kubernetes containers for various reasons. These play into the following scenarios and situations:

- **Application modernization:** Organizations can modernize legacy applications if they containerize them while keeping VM-based applications running. This approach supports gradual transition without disrupting current operations.
- **Resource optimization:** Combining VMs and containers lets organizations optimize resource use, because both can share a single underlying infrastructure.
- **Development and test:** Developers can use containers for agile, rapid DevTest cycles, while production VMs provide stability and security for public and in-house applications and services.
- **Operational efficiency:** Because containers and VMs are managed together through a single console, this simplifies operations, lowers complexity and fosters more and better collaboration between DevOps and IT teams.
- **Disaster Recovery:** Through a VVF add-on, this facility improves disaster recovery capabilities and resolution metrics (RTO, RPO, and MTTR) because VMs and containers get recovered together in the same ways.

**FIGURE 3** shows a typical console from VVF that includes both a Kubernetes cluster and VMware VMs with both manageable through a single interface, where business applications can use both kinds of resources together.

AI-driven intelligence can also improve operational efficiency because ML can understand application boundaries and requirements thanks to auto-discovery and monitoring data. In similar fashion, intelligent alert clustering unifies repeated and related alerts in the VVF through an at-a-glance timeline view that supports easier identification and diagnosis of errors, events, and incidents.

Best of all, VMware offers management packs for monitoring through VMware Cloud Foundation Operations. Such management packs bring comprehensive monitoring and management capabilities into VVF on monitored systems, containers and VMs. This works by using existing protocols, APIs and remote access tools to collect data from EXS hosts, VMs, containers, and other components. Monitoring covers performance, health and capacity of virtualized environments including key resources (compute, memory, and storage utilization). These same protocols and APIs also integrate with vCenter Server to plug into the global console and unified views.

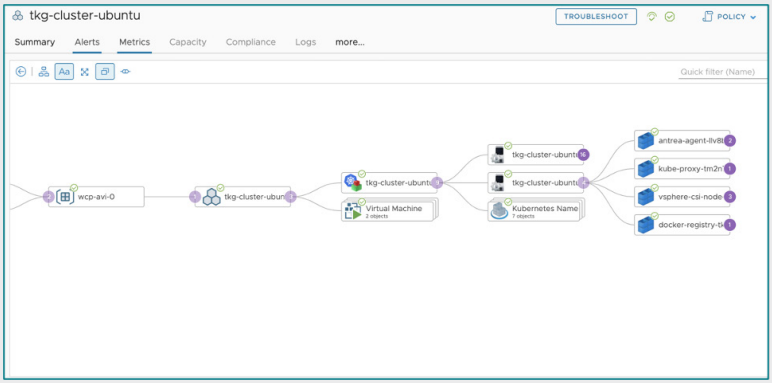


**FIGURE 3:** VMware vSphere Foundation (VVF) provides simultaneous visibility into Kubernetes containers and VMs—applications can use both.

# AI-Driven Proactive Troubleshooting, Streamlined Remediation

Indeed, AI-driven capabilities also support proactive, well-informed troubleshooting and response within VVF. This includes automated root-cause analysis, that uses intelligent automation to look for anomalies, errors, and so forth, perform event correlation, and use all that data (along with anonymized intelligence collected across the vSphere user base) to make remediation recommendations.

In fact, VVF provides an AI-driven troubleshooting workbench for administrators. This offers a single, unified workspace in which operators can find, diagnose and even fix problems and issues. Where automation can help with remediation or resolution, it is available to that workbench. Authorized users will find this environment well-suited to problem identification and resolution, because it highlights notifications and events as they occur and aggregate. It does likewise for relevant property changes and anomalous metrics as well. Indeed, the workbench ties into and correlates with available vSphere logs to improve last mile root cause analysis resolution. That's how it makes sure that proposed solutions actually match reported conditions and deliver desirable outcomes. This also helps prevent recurrence and minimize user impact.

VMware vSphere Foundation (VVF) with vSAN integration maximizes operational efficiency by integrating compute, storage, and management into a unified, software-defined hyperconverged infrastructure (HCI) solution. Using Storage Policy-Based Management (SPBM), vSAN automates storage configuration and policy enforcement at both the VM and container levels, reducing manual intervention and ensuring consistent performance. vSphere Lifecycle Manager (vLCM) simplifies updates and patching across the entire infrastructure, minimizing downtime and streamlining maintenance. vSAN's

scalable architecture enables on-demand resource expansion without added complexity. By leveraging commodity hardware and automating key storage functions, vSAN significantly reduces operational overhead, providing a simplified and efficient IT environment that supports modern workloads and enhances business agility.

By now, it should be clear that VVF brings considerable smarts to operations management, including a single consistent environment for managing containers and VMs. Users should expect a cloud-like experience when managing one or more data centers, with seamless integration. In the next chapter, you'll learn more about how VVF helps improve resource consumption and utilization, while also providing multiple means to contain and reduce associated costs.

CHAPTER 4

# How VMware vSphere Foundation (VVF) Maximizes Utilization and Minimizes Costs

**Hopefully, the benefits of maximizing utilization and minimizing costs are obvious.** Though it may belabor that expectation, these desiderata both produce the same results: doing more, and spending less. Maximizing utilization means ensuring that the organization does not pay for more resources than it needs, particularly those that may be underused or even entirely idle. It also means providing positive user experiences with just enough throughput, latency and response time to deliver the goods, but without laying on more capacity or capability than is really needed.

Minimizing costs needs little justification—it's desirable to help the bottom line—but where VVF is concerned, may need additional explanation. The ways in which VVF help to reduce costs include the following:

- **Reduced hardware outlays:** VVF helps organizations consolidate workloads onto fewer servers. By reducing capital expenditures on hardware, VVF helps lower costs.

- **Reduced operating expenses:** Reducing server count has a knock-on effect: it also lowers costs for power, cooling and rack space. Likewise, fewer servers also incur lower maintenance charges (both scheduled and unscheduled).
- **Staff productivity:** Automation and orchestration streamlines management time and effort, reduces needs for manual intervention, and lowers overall labor costs, making IT and DevOps staff more productive.
- **Optimized resource usage:** VVF tools continuously assess capacity, and help automate cost savings by maximizing resource usage.

Here's a short list of key operation scenarios that play into the cost savings that VVF brings to the table:

- Assess capacity, address shortfalls as they occur
- Reclaim capacity to automate cost savings as peak usage reverts to lower levels
- Improve infrastructure and workload planning through analytics that predict and anticipate trends before they become problems
- Obtain improved TCO with showback and chargeback reporting so that stakeholders, IT, and executives all see who's using which resources and services, and to what effect
- Cost-efficient scalability and simplified management

Each of these topics is explored and explained in its own section in this chapter. Overall, managing capacity and costs efficiently means applying optimal consolidation, eliminating unused or unnecessary expenditures, and proactive planning. In the same vein, using smart management techniques lets organizations improve how they set up and run their overall infrastructures.

# Assess Capacity and Address Shortfalls

In VMware vSphere Foundation (VVF), capacity assessments serve to evaluate current and future resource needs within its virtualized environment. There are several steps that are key to this process. It begins with data collection, with resource usage metrics gathered for resources (CPU, memory, and storage) from ESX hosts, VMs, and containers. Over time, historical analysis shows how this is changing, to help identify trends and patterns. Predictive projections point analytics at the future, to forecast future resource requirements based on current usage and observed trends. Capacity planning uses all this information to develop a capacity plan, which spells out the resources needed to meet future demand, both to ensure optimal performance and avoid

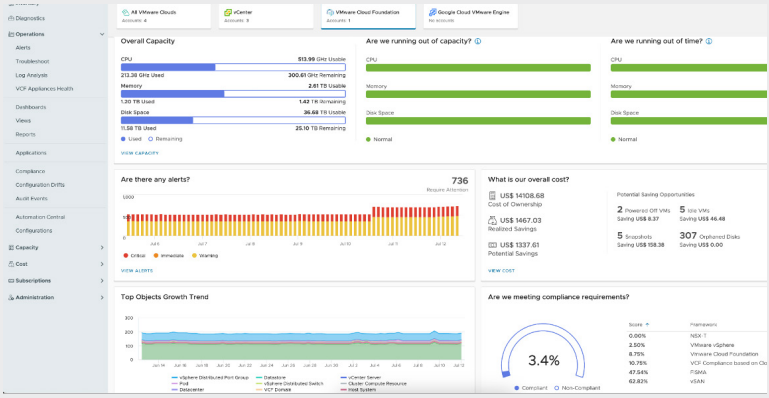


**FIGURE 4:** Among its various dashboards, VMware vSphere Foundation (VVF) shows capacity in the top third, and shows object growth trends in the bottom third (middle shows cost metrics and saving opportunities).

resource shortages. Reporting and visualization generate materials to present these finding, and make convincing recommendations to stakeholders and executives. You can see growth and capacity information in **FIGURE 4**, in a collection of overview dashboards.

In general, VVF assessments help organizations make well-guided decisions about infrastructure investments. This ensures that organizations will have the resources they need to support their workloads effectively and efficiently. By design, VVF's capacity assessment leverage AI-driven, real-time predictive analytics that make capacity visible across all environments under the purview of VMware Cloud Foundation Operations. Indeed, administrators can generate capacity projection using demand and allocation models to anticipate trends, handle business cycle ups and downs, and deal with rising and falling customer demand.

## Reclaim Capacity, Automate Cost Savings

Through its real-time monitoring capabilities, VCF Operations provides a critical capability for any efficient data center—namely, the ability to reclaim capacity and automate cost savings continuously. Indeed, efficient capacity and cost management depend on applying optimal consolidation, proactive planning and smart procurement to the ways in which an organization runs its infrastructure.

Otherwise, things like powered off or idle VMs, old VM snapshots, and orphaned virtual disks can incur costs without providing offsetting benefits. VCF Operations helps organizations identify and automate cleanup of such objects, thereby reclaiming capacity (and saving related costs: look back at 4, middle). It also reports savings both in dollar terms and in capacity units. In fact, capacity reclamation workflows can be fully automated to relieve staff to focus on value-added activities. Given the right capacity management approach,

organizations can reallocate infrastructure to new applications. They can also avoid purchasing additional hardware to meet unknown or worst-case demand. VCF Operations helps organizations plan better for the future, and avoid extra, just-in-case outlays.

### AUTOMATED COST SAVINGS ROCK!

**It can be difficult to appreciate automated cost savings in the abstract.** Though saving money is always a good idea, and makes great business sense, think about some implications. Better operations with VVF can identify and reclaims powered-off and idle VMs, orphaned disks, and obsolete snapshots. Automation means that every time it finds one of these things, it reallocates such resources to reduce capacity waste. Likewise, VVF continuously analyzes current resource usage to predict future needs, and plan for capacity upgrade and better resource allocations. Every time VVF finds and implements an opportunity to save money, your organization scores.

## Infrastructure and Workload Planning

Overall, efficient capacity and cost management helps maximize utilization of resources at the lowest cost levels. To that end, infrastructure and workload planning help organizations zero in on scenarios they can check out to see if resources should be added or removed to support current and future workloads at optimal cost.

VCF Operations helps organizations run "what-if" scenarios to plan for future capacity needs. These alternatives highlight cost implications, and point to potential savings. They allow organizations to choose among or combine multiple capacity plans to best meet emerging needs and situations. Proper planning means organizations avoid resource constraints: they can steer clear of under-provisioning that degrades performance, yet also prevent wasting capacity and associated CapEx.

Furthermore, VCF operations extends to the cloud, so that organizations can find the environment most suitable for applications to balance cost and performance. This supports a proactive stance toward cloud investment that reduces performance issues, and leads to more predictable cost and capacity outlays.

## TCO Reporting with Showback and Chargeback

There's nothing new or radical about tracking total cost of ownership (TCO) to tie usage and activity to related costs incurred. What new in VCF Operations is that is provides information to individual lines of business based on actual usage and expenses, in a format that's easy to follow and understand.

In fact, VCF Operations provides comprehensive visibility into the costs of the organization's infrastructure, and where those costs come from. TCO gets calculated based on specific cost drivers to help IT and stakeholders make informed decisions, while keeping costs under control. VCP Operations supports both showback and chargeback mechanisms, to allocate costs accurately (whether charged or not) to different departments or business units based on actual, observed resource consumption.

In addition, applications may be tracked to see which ones incur the highest costs to the infrastructure. This lets you identify potential issues or excesses, and work with departments or business units to evaluate and manage those costs. It provides excellent input into a process to notify offenders who may overspend or overutilize resources. Likewise, it enables clawback mechanisms to reduce resources extended to those who may not be using them (or not using all of them, as is often the case).

It's important to understand that VMware supports reporting prices as well as costs for VMs, and that price is the amount to be charged to VM owners for their use. Price may be based on cost or allocation, with additional amounts added, as circumstances dictate. Chargeback appears in a report that itemizes costs or prices conveyed to a user as an invoice or bill. Overall, VMware's full visibility into cloud costs helps organizations make better decisions and decrease waste. Users can see the cost of running apps in the cloud, and take opportunities for savings as they present. Indeed, this approach lets organizations run IT as a business—not a cost center—with the ability to bill and charge users driven by actual consumption.

## Cost-Efficient Scalability and Simplified Management

VMware vSphere Foundation (VVF), an HCI solution powered by vSAN, offers a cost-efficient storage solution that eliminates the need for traditional SAN/NAS hardware. By utilizing industry-standard x86 servers, VVF removes the expense associated with dedicated storage appliances and storage fabrics. This approach allows organizations to select from a variety of vendors, maximizing hardware flexibility. Unlike traditional storage solutions, which require separate management tools, vSAN integrates directly into VVF, streamlining operations and reducing complexity. Additionally, VVF supports

easy scaling by simply adding disks to existing servers, providing a highly flexible and cost-effective way to expand storage without the need for expensive hardware investments, while maintaining a streamlined and efficient IT infrastructure.

In this chapter, you've learned how VCF Operations help organizations manage capacity and address shortfalls, including the ability to automate cost savings by reclaiming unused capacity in real time. You've also explored how VCF operations supports proactive, efficient infrastructure and workload planning to put future capacity on target as well as cost attribution to help organizations and their departments or business units balance outlays against ROI. In the next chapter, the focus turns toward how VCF Operations fosters new opportunities and improved business capabilities, to boost productivity and the bottom line.

CHAPTER 5

# How VMware vSphere Foundation (VVF) Helps Accelerate Innovation

**Essentially, VVF helps accelerate business innovation by extending key capabilities to their data centers, and tying them to the rest of their digital estate.** Such benefits should be familiar to those already familiar with vSphere and vCenter, as they provide a unified platform to simplify management, monitoring and optimization of VM-based workloads and containerized applications.

The following list enumerates some vital capabilities in VVF to help organizations innovate more quickly and effectively:

- **Unified management:** VVF simplifies and consolidates operations and reduces complexity. IT teams can focus on innovating instead of learning, maintaining and managing multiple, disjoint systems.
- **Workload Modernization:** Organizations can modernize existing workloads, especially through containerization, and meet more customer demand. This enables faster pivots to accommodate new and changing markets.
- **Enhanced Performance:** VVF delivers high performance and reliability for modern workloads—such as AI/ML applications—by leveraging advanced features (e.g., GPU support).

- **Predictive Ops Management:** VVF puts predictive analytics and intelligent operations management to work to optimize resource utilization and prevent disruptions. This helps ensure efficient and smooth operations.
- **Global visibility:** VVF offers holistic visibility and analytics across the entire infrastructure. This enables data-driven decisions to prioritize and optimize workloads, and identify areas for improvement or enhancement.

As you can see, VVF offers specific capabilities designed to foster innovation, and give business stakeholders and IT more and better ways to improve their ROI on technology investments. These include enhanced productivity, faster time to market, more fluid responses to changes in consumption and demand.

## WHAT'S ALL THE FUSS ABOUT INNOVATION?

**Innovation has roots in the Latin innovare, which means "to renew" or "to make new."** In the realm of business modernization (especially of the AI-driven variety) innovation is seen as an opportunity for people and systems to do new things, and exploit new opportunities, rather than spending time doing the same-old, same-old ad infinitum. The idea in VVF is that task visibility, predictive analytics, automated cost savings and capacity planning by deleting unneeded VMs, plus AI-driven troubleshooting and performance monitoring, free up staff time and resources. What can they do with that saved or reclaimed time and resources? Why, innovate, of course—that's a way to find something new to increase productivity, generate revenue, improve customer experiences, and more.

# VVF Runs VMs and Kubernetes Clusters from a Single Platform

By running VMs and Kubernetes containers on a single platform, VVF bring benefits to boost efficiency and increase flexibility (as well as fostering innovation, as in the preceding section). Such benefits encompass the following features and capabilities:

- A single platform brings both simplified operations and consistent policies. Managing VMs and containers through a single interface reduces complexity and streamlines operations (no need for multiple tools and platforms, either). A single platform also means the same security, governance, and compliance policies apply to VMs and containers alike.
- Resource optimization comes when organizations can dynamically allocate resources between VMs and containers based on actual usage and demand. Cost savings from the single platform occur when workloads get consolidated onto fewer physical services, and from making better use of existing infrastructure.
- Flexibility and scalability come naturally when the platform can scale up or down easily to meet changing workflow demands. Also, the VVF architecture supports a broad range of applications from enterprise apps to modern cloud-native apps on the same platform.
- Enhanced performance occurs when organizations leverage advanced features such as GPU support to boost performance for both VMs and containers. The VVF architecture and add-ons can also ensure high availability and disaster recovery for VMs and containers alike.

- Collaboration improves because VVF empowers DevOps through its common platform for VMs and containers. In turn, this enables faster development and deployment cycles, using container containers for rapid iteration for development, and VMs for stable, production-grade deployments.
- Consistent tooling and automation come from a single common set of tools for monitoring, logging and automation for both VMs and containers. A single API makes it easy to automate routine tasks (e.g., provisioning, scaling, updating) for both containers and VMs, while improving efficiency and reducing operator errors.

All in all, because VVF integrates VMs and containers on a single platform it delivers a comprehensive, flexible environment to support diverse workloads, enhance operational efficiency, and bring improved agility and faster development cycles to developers and DevOps.

# Access to Infrastructure Resources

VVF's operations management layer includes numerous services and toolsets. As you saw in Figure 1 these include the vSphere Kubernetes Service, the vSphere VM service (Workload Engine), along with a range of supervisory services. Let's examine these in a little more detail, in the upcoming sub-sections. But first, examine Figure 5, which shows the ability to add VM data into VVF dashboards from monitored vCenter resources and objects for ancestors and descendants in the overall hierarchy.

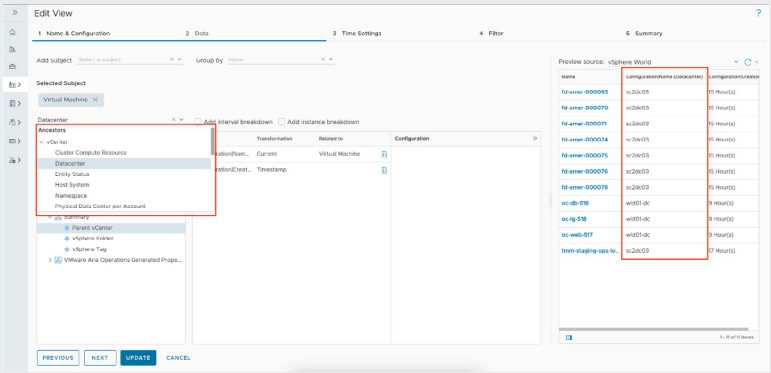


**FIGURE 5:** Adding ancestors and descendants properties and metrics provides customizable dashboards that displays key information for VMs and containers.

## VM REGISTRY SERVICE

The Registry Service allows developers to store, manage and secure Docker and OCI container images through Harbor as a Supervisor Service.

## VSPHERE VM SERVICE

The VM service allows developers to create virtual machines independently from Kubernetes without requiring access to vSphere Client.

## VSPHERE KUBERNETES SERVICE (VKS)

The vSphere Kubernetes Service allows developers to manage consistent, compliant and conformant Kubernetes clusters via ClusterClass API.

## CONTAINER REGISTRY SERVICE

A common synonym for VM registry service, when containers are included in that mix. See "VM Registry Service" section above.

## ACCELERATE INNOVATION WITH AN HCI SOLUTION POWERED BY VSAN

VMware vSphere Foundation (VVF) delivers an enterprise HCI solution, enabling organizations to accelerate innovation by providing developers with a unified platform for building, deploying, and managing modern applications. vSphere offers scalable compute, vSAN delivers high-performance, software-defined storage, and vSphere Kubernetes Service simplifies Kubernetes management for containerized applications. This integration allows developers to focus on innovation with persistent storage, high availability, and scalability, while IT maintains control over the infrastructure. By streamlining CI/CD pipelines and automating Kubernetes cluster management, VVF accelerates development cycles, reduces time-to-market, and ensures secure, efficient, and scalable infrastructure for both traditional and cloud-native applications.

In this chapter you've learned more about how VMware vSphere Foundation helps improve operation efficiency, and opens doors to innovation and creativity to improve existing business and cultivate new opportunities. You've also learned how VVF provides different types of access to infrastructure resources for developers, DevOps, and Kubernetes admins and users. In the next chapter, the focus gets more serious as we examine how VVF helps organizations elevate and strengthen security.

CHAPTER 6

# How VMware vSphere Foundation Elevates Security

**The overwhelming importance of security comes from all corners: practical, financial, legal, ethical, and more.** Fortunately, all key principles of infrastructure security are covered when VMware Cloud Foundation Operations is enabled—namely:

- **Confidentiality:** monitors unauthorized access to systems and data, and monitors and manages all other access
- **Integrity:** monitors unauthorized modification or deletion
- **Availability:** data and systems are ready for access and use whenever authorized parties need them

In cybersecurity circles, this is known as the confidentiality, integrity, and availability (CIA) triad or tripod. It's considered to be the foundation for modern cybersecurity. VMware does everything it can to hold up all three legs, and to make its products safe and secure. This is as true for VVF as it is for other items in the VMware product portfolio.

Any serious look at the 21st century security landscape is full of scary statistics and nearly unimaginable costs. How unimaginable? Cybersecurity Ventures estimates global cybercrime costs at $10.5 trillion annually by 2025, thanks to humungous numbers of increasingly severe and expensive cyberattacks, with ransomware at the top of the "bad actors" list. No wonder security is such a high priority for enterprises of all kinds, in all market sectors.

## LISTEN UP! WHY RANSOMWARE IS AN EXISTENTIAL THREAT

Ransomware picks up all the files in the systems it infects. Then, it encrypts them so that owners and users can't access files or systems unless and until they pay a ransom (or undo ransomware effects through some other means). Ransomware attacks all three legs of the tripod. By depriving authorized users of access to systems and data, it makes them unavailable. And by exfiltrating all data (and sometimes even selling same to third parties) it destroys confidentiality at the same time it calls the integrity of anything returned from ransom into question. Because ransomware attacks stop business until they can be undone, they threaten their very existence. CNET reported that 1 in 5 small companies that fall prey to ransomware close their doors. In 2022, Veeam reported that nearly 1 in 4 (24%) companies that paid a ransom could not recover their data anyway. No doubt about it: ransomware is dire!

# In VMware vSphere Foundation (VVF), Every Feature Includes Security

A sizable laundry list of named VVF security features is worth pondering. Each of them maps onto at least one leg of the CIA tripod. Built from the ground up with security in mind, and expressly designed to protect your data, your systems and your business, VVF sits at the core of a collection of security features intended to boost security, harden systems, avert damage and loss and improve peace of mind.

Here's an abbreviated list of VVF security features, with a brief explanation for each one:

- **Secure Boot with Trusted Platform Module (TPM):** Ensures that each host boots securely and verifies the integrity of the boot process.
- **Host Lockdown Mode:** Restricts access to the host, preventing unauthorized changes.
- **vSphere Authentication Proxy:** Provides secure authentication for ESX hosts.
- **vSphere Native Key Provider:** Manages encryption keys for virtual machine encryption.
- **VMware Tools and VMware Hardware Version:** Ensures compatibility and security for virtual machines.
- **vSphere Trust Authority:** Provides a trusted environment for sensitive workloads.
- **Data-at-Rest Encryption:** Encrypts data stored on virtual machines to protect sensitive information.
- **Data-In-Transit Encryption:** Encrypts data as it moves between hosts and virtual machines.

- **Identity Federation:** Integrates with identity providers for secure access management.

For readers really interested in the nuts and bolts of vSphere security, check out the "hardening guide" available online. **FIGURE 6** shows a VVF visualization for policy-guided risk configurations that shows where conservative, aggressive and peak-focused policies fall within an overall risk envelope, taken from that Guide.

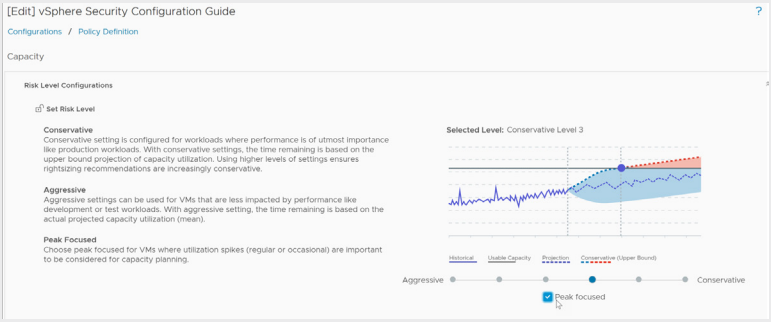


**FIGURE 6:** Using Risk Level Settings to visualize security risks, based on object risk propensities and utilization spikes, to establish recommended risk level settings.

# Let VMware vSphere Foundation (VVF) Put Governance and Compliance to Work

Through VMware Cloud Foundation Operations, policy management helps to ensure control, reduce risk, and ensure compliance with rules, regulations, and requirements. Controls, data protection, and best practices ensure that organizations get right and stay right. VVF offers the following capabilities in the arenas of governance and compliance:

- **Regulatory and hardening guideline compliance:** Allows organizations to establish current compliance posture, then remediate their out-of-compliance issues. This ensures that regulatory obligations are met, infractions reported as required, and an always-improving compliance posture.
- **Sustainability:** Given increasing emphasis on environmental, social, and governance (ESG) factors in modern business, sustainability is a growing focus. VVF helps organizations understand their sustainability posture, then take steps to meet existing ESG requirements, adapt to change, and accommodate new additions. This includes the ability to map and reduce the organization's carbon footprint, and identify processes to help meet green goals. Sustainability is a top VMware value and concern and reflects its efforts to decarbonize digital infrastructure, the supply chain, and customer operations. Best of all support for infrastructure reporting and best practices review provides an inventory from which to identify possible problem areas based on versioning. This helps reduce outages, and lower the possibility of disruptions or failures.
- Overall, VVF governance and compliance facilities help organizations lower administrative overhead. They can be sure they're meeting their compliance requirements across the board, and conserving energy to meet green goals.

# VMware vSphere Foundation (VVF) Supports Identity Single Sign-on Access and Licensing Controls

Through operations policy management, VVF helps ensure control and reduce all kinds of risk, including access violations, unwanted disclosure or breach, and even license misuses. In particular, VVF supports:

- Multiple identity federation providers, so vCenter identity federates with third-party providers that include Okta, ADFS, Entra ID and Ping Federate.
- Single sign-on delivers a better end-user experience with SSO across all VVF components.
- Unified licensing provides accurate license tracking, with a single view to track and manage all licenses consistently and coherently.

Each VVF component has its own authentication source, with no shared authentication context across services. By enabling SSO, all VVF components can use the vCenter-hosted VMware identity broker (which may be federated with the named third-party providers as well). This delivers a better experience for users who can access any and all authorized VVF components. It also works well for admins, who need sign in only once and then can also access all authorized components. **FIGURE 7** shows how VVF SSO integrates with various well-known identity providers (e.g. MS Active Directory Federated Services, Okta, Entra ID, and so forth).

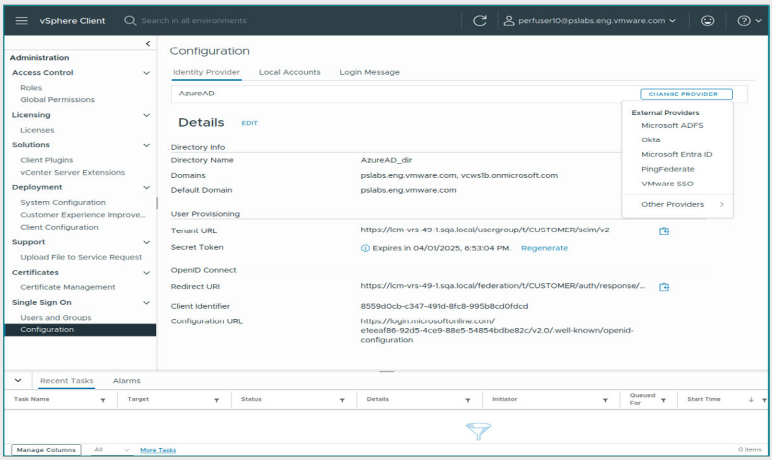


**FIGURE 7:** Choosing an identity provide that VVF SSO can use to manage global sign-on data and activity.

Unified licensing and entitlement management create a single console through which to view and manage license keys across deployments. Its reporting includes point-in-time and historical view of license consumption. This provides more accurate license tracking, better support for audits and entitlement planning, with reduced administrative effort and overhead.

In this chapter, you've seen how seriously VVF takes security, and all the many tools and techniques it offers to secure your data, your systems, and your business. The prevailing idea is to proactively avoid threats and exposures. In the next chapter, we leave security aside for the moment (though it's never far from consciousness) and examine how VVF helps supercharge workload performance to help you get the best bang for your technology investments.

## Why Single Sign-on (SSO) Matters in VVF


Single Sign-on is important in VVF because it simplifies access and boost security. Indeed, SSO provides VVF with:

- **Simplified Authentication:** Users log in once, but gain access to all available and authorized vSphere components and services without needing to login to each one separately. This delivers a simpler login process and a better user experience.
- **Enhanced Security:** With centralized authentication, SSO reduces risk of "password fatigue" and potential use (and re-use) of weak passwords. SSO also delivers a single point of control for managing user access and permissions.
- **Improved Administrative Efficiency:** Admins can manage user access and permissions more effectively: they need only configure SSO once for multiple services (instead of on a per-service basis). This lowers admin overhead, and makes it easier to maintain consistent security policies across the board.

CHAPTER 7

# VMware vSphere Foundation (VVF) Supercharges Workload Performance

**Through its unified console, its powerful workload and cost management capabilities, and its global visibility into VVF components and infrastructure, VVF can supercharge workload performance.** This comes in large part because VVF is always watching what's going on, monitoring performance and resource consumption, and using intelligence to deliver continuous and ongoing performance optimization.

VMware vSphere Foundation (VVF), an HCI solution with vSAN, is designed to deliver high-performance, scalable infrastructure for modern workloads. At the core of this performance is vSAN Express Storage Architecture (ESA), a next-generation storage architecture built to maximize storage efficiency and eliminate traditional bottlenecks. vSAN ESA leverages an optimized data path, single-tier architecture (where every device contributes to capacity), and advanced compression to improve storage utilization while maintaining ultra-low latency and high throughput. With VVF organizations gain a storage solution that optimizes resource utilization, accelerates workloads, and delivers the scalability needed to support evolving business demands.

A great many factors play into modern data center and cloud performance. In this chapter, you'll find a list of capabilities that VVF offers to help tweak, tune, and optimize performance. Each of these capabilities is discussed in brief. Overall, though, VVF takes advantage of a holistic view and understanding of workloads, resource consumption, costs, and performance to deliver great user experiences for applications and services, and great admin experiences in setting up, managing, securing, and maintaining supporting infrastructures.

VVF offers better operations for storage management for vSAN, with a host of tools to help admins manage, govern and control storage. Performance- and management-related aspects for vSAN available in VVF include:

- **vSAN what-if capacity planning:** allows admins to set up and compare, or even combine, vSAN configurations to maximize performance, or achieve optimal price-performance trade-offs.
- **vSAN Compliance:** checks to ensure that vSAN deployments meet hardware, software and licensing requirements, including hardware and cluster requirements, software compatibility, for vMotion and vSAN, and licensing coverage.
- **Troubleshooting Workbench:** As discussed in Chapter 3, this VVF workbench provides a workspace inside which admins can identify, diagnose and remediate problems.
- **vSAN aware workload planning (WLP):** helps optimize placement of virtual machines and workloads depending on performance and capacity of the underlying. Infrastructure. This means automatic placement by metrics, automated capacity and data management, and policy-based management to governs how and where VMs get placed.

- **Stretch cluster visualization:** graphic tools that represents stretched cluster configurations use for multi-site scenarios such as high availability or disaster recovery.
- **vSAN cost model:** a subscription licensing model that scales with the amount of storage capacity and compute resources used. The model incorporates per core licensing for ESX hosts, per TiB licensing for storage capacity in a vSAN cluster, and solution license for all components of VVF, including vSAN. Such a license provides .25 TiB storage capacity as part of that cost—additional storage can be purchased as an add-on.

# Continuous Performance Optimization

Because of its global, holistic view of workloads, resource allocations and usage, performance metrics, and intent as driven by policy and explicit configuration, VVF can continuously optimize and manage performance across its infrastructure.

Behind the scenes several key VVF components provide the wherewithal that makes continuous performance optimization possible and workable. Comprehensive real-time monitoring means that underlying data for current and historical performance is available to drive performance assessments and adjustments. This data also feeds into predictive analytics that use AI and machine learning to analyze performance data and predict future requirements.

Next, automated workload balancing programmatically adjusts workloads based on performance metrics, to ensure optimal resource utilization. Placement and positioning for workloads also comes from ongoing observation and adjustments to keep the current situation

as close to policy and performance goals as possible. Because these processes are automated, they can maintain resource utilization, user experience metrics, SLAs and so forth at appropriate levels.

## CONTINUOUS OPTIMIZATION NEVER STOPS

In VVF, continuous performance optimization encompasses three critical capabilities:

- Performance data analysis comes from a comprehensive collection of performance data from all endpoints in VMs, containers, and on physical hardware. Preconfigured OOTB dashboards (that work right "out of the box"), alerts and reports continuously show health and status, and ensure organizations can meet or exceed SLAs using advanced AI-driven monitoring and management techniques.
- Intent-based workload placement is driven by business and operational requirements through VVF. Among other things, this leads to automated resolution of content-based performance issues. This approach also ensures optimal workload placement and balancing across clusters and sites, to reduce risks and costs by hitting cluster utilization targets.
- For Kubernetes clusters, autoscaling lets VVF scale down underutilized nodes, then scale nodes back up as demand rises. This ensures a working balance between cluster activity, usage, and resource consumption.

Proactive troubleshooting also plays into continuous performance optimization. This approach detects anomalies and potential issues before they impact performance. This permits immediate remediation, so that users need never notice anything amiss. Automated tools often respond to incidents before human operates see related reports.

This also helps keep VVF humming along and delivering to meet its performance targets.

Capacity management provides insights into current and future capacity needs. This not only helps optimize capacity and resource consumption right now and in the near term, but it also feeds into future planning to make sure that resources are always available when they're needed. In Chapter 4, you learned about VVF cost management capabilities. In the context of continuous performance optimization, cost management ensures that unused resources are minimal and automates cost-saving techniques. This frees up resources for real demand, without tying them up in idle or abandoned objects. **FIGURE 8** shows the VVF cost management overview for a datacenter, with recommendations for savings and optimizations, plus capacity growth trends.

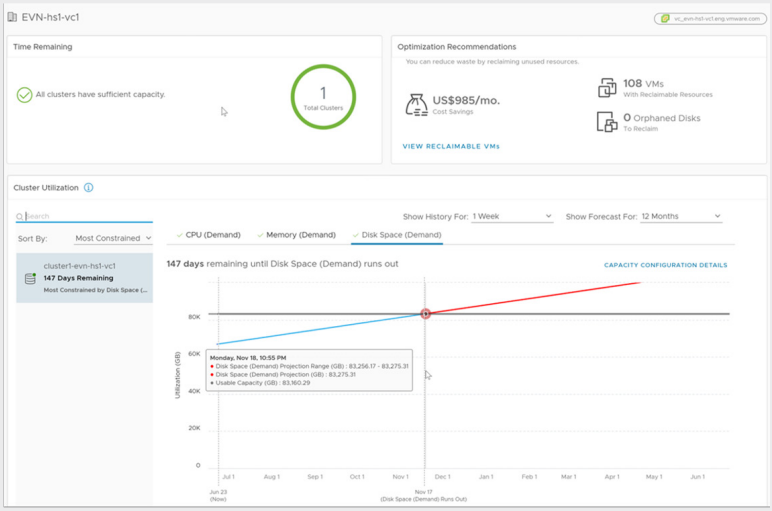


**FIGURE 8:** Capacity planning and cost saving operations dashboard from VVF with trends and recommendations.

# Benefits from Continuous Performance Optimization

Because VVF can do the work necessary to keep resource usage and performance optimized, the most obvious benefit it provides is performance that's as good as it can manage, with all the information and insights at its disposal. Indeed, a Forrester Total Economic Impact study (commissioned by VMware) reported that VVF can boost operational efficiency by up to 77% as compared to an unimproved data center operation.

The same Forrester study also reported that VVF's predictive and proactive operations management can reduce down time by up to 93%. That means fewer disruptions and faster recovery from issues as and when they occur. More importantly, it means that data centers and other digital assets keep working and doing what they're supposed to do for longer periods. This pays added dividends beyond productivity, through improved reliability and enhanced reputation.

Likewise, that study also showed that VVF helped reduce the time to resolve issues by 20%, which lets IT teams address problems more quickly and efficiently. It also gives them more time to work on value-added efforts such as more and better automation, improved or enhanced systems and services, and outright innovation.

By optimizing resource usage, VVF helps organizations avoid hurry-up hardware purchases. Spending less, especially on hardware with its follow-on costs for power, cooling, maintenance and staff for upkeep, is a sure-fire way to improve the overall bottom line.

Optimization means that whatever's being optimized—performance in this case (but with various inevitable benefits elsewhere)—is as good as it can get. In practice, that means workloads run on the most suitable resources, to best satisfy modern applications' requirements for latency

and throughput. But that produces better customer experiences, allows productivity to improve, and encourages more and better uses of existing applications (and more reasons to build or acquire new ones).

In a word, continuous optimization simply means that things just keep getting better all the time. What more could an organization, or its staff or customers, want?

In this chapter, you've learned that VVF provides continuous performance optimization. This comes thanks to constant monitoring and collection of performance data, subject to AI-driven analytics that can adjust to rapidly-changing conditions in real time. You've also learned that the benefits of such optimization are many, not least of which are better performance, happier users, reduced costs, and future-forward flexibility. Indeed: it's all good news! In the next and final chapter, we conclude our journey down this trail, and point to a plethora of additional information and resources for those who may still find themselves wanting more.

CHAPTER 8

# Summing Up VMware vSphere Foundation

**As you've seen and learned, VMware vSphere Foundation is the enterprise workload engine built to optimize the data center in organizations of all kinds and sizes.** It boosts operational efficiency, supercharges workforce performance, elevates security and resilience, and accelerates innovation for the whole business.

VVF delivers intelligent operations management that is custom-built to enable optimal performance, deliver high availability, and work efficiently and sustainably across your entire infrastructure. Best of all, VVF offers comprehensive visibility, analytics and controls, all in one place.

VVF is easy to upgrade to a Hyperconverged Infrastructure (HCI) through the included VMware vSAN. Other Add-ons are readily available, including specific use cases for ransomware and disaster recovery as well as additional vSAN storage capacity. In addition, the VMware partner ecosystem also offers additional add-ons, tools, applications and services, and much more for those seeking to boost their VVF potential.

# Case in Point: Wistron Embraces vSAN

Wistron is a global leader in information and communications technology (ICT) based in Taipei, Taiwan. It focuses on ICT products, including customized product development and services such as laptop and desktop PCs, servers and storage devices, and more. The company integrates hardware devices (such as PCs or smart devices) with cloud data systems via software services. It handles entire technology industry supply chains and innovation platforms for market sectors such as education, corporate services, medical care, and more. The company employs over 80,000 people and operates in Asia, North America, and Europe.

When Wistron found itself ready to retire its aging IT infrastructure in 2018, including servers and SAN storage, it decided to adopt a next-generation IT infrastructure. Indeed, its goal was to build a software-defined data center. After doing due diligence, the company decided to introduce VMware SDS HCI architecture to replace its three-tier architecture (devices, middle-ware, servers, and services) using vSAN.

After a five-month period for procurement and onboarding of systems and servers, Wistron began testing. It officially launched its next generation in July, starting with a quality assurance system (QAS) implemented as an 8-node testing cluster. Later on, Wistron activated a 4-node production cluster to deliver office automation related websites and applications.

After the introduction of vSAN HCI, Wistron observed improvements to its IT infrastructure. It's able to deploy an x86 Storage Server to get things ready in a single go, replacing its earlier, complex procedures to install servers and SAN storage devices independently and separately. The company reported a 25% savings on the time required to stand such systems up, and make them ready for use in test or

production. In addition, the company also reported "unprecedented flexibility and rapid scalability for the IT infrastructure." It also said that "investment cost was significantly reduced." You can read the entire Wistron Case Study for all the remaining details.

## Another Case in Point: CID GmbH

Based in Hessen, Germany, CID GmbH (a stock-holding company) specializes in computer system design and related services, as well as other scientific and technical services. As an industry-leading organization, the company seeks to identify and adopt cutting-edge technologies to stay ahead, and meet evolving customer needs.

Recently, CID implemented VMware's vSAN Express Storage Architecture (ESA), embedded within the vSphere hypervisor, and completely compatible with VVF. The company wanted to take advantage of ESA's integrated HCI for virtualized environments to make them more readily accessible and usable for CID's development teams.

What prompted this implementation? CID found itself up against the limitations of a traditional three-tier storage architecture (web, application, and database). Its expanding collection of virtual machines coupled with increasing use of containerized workloads meant CID started to suffer from storage issues—specifically: latency, slow application response times, and problems with backup efficiency and turnaround times.

High input/output demands from AI, SQL, and Apache Kafka workloads started to swamp its existing storage, and caused performance bottlenecks. CID was also facing challenges getting its traditional storage to scale to keep pace with growth. Working with VMware and partner Evoila, CID started to explore VMware vSAN ESA. Known for its efficient use of fast NVMe storage, and its streamlined architecture, it offered hope that the bottlenecks could be eliminated.

CID's Senior Infrastructure Administrator, Marcus Viel, said that the company was "struggling with ghost problems—issues that seemed to have no clear cause but were affecting our system performance." Using VMware vSAN ESA offered a way out. Indeed, Viel reports further that CID was "impressed by how vSAN ESA fully leveraged NVMe storage, removing caching layers and ensuring non-blocking infrastructure." Further he stated that "It was clear from the start that this technology could meet our needs."

Overall, vSAN ESA proved a game-changer for CID. Its simplified storage provisioning and ease of scaling let CID obliterate the storage-related issues the company had been experiencing. In turn, this let it concentrate more fully on providing its clients with top-notch technology solutions. In implementing vSAN ESA, CID also witnessed major improvements in technical performance and operational efficiency. The previously complex job of provisioning storage is now as simple and straightforward as deploying a VM, allowing CID's IT team time to focus on strategic initiatives.

Overall, benefits of the vSAN implementation included:

- **5x boost in transaction capacity:** jumped from 300K to 1.5M IOPS, for better application performance and efficiency.
- **Faster backups:** 1TB backup times dropped to under one minute.
- **Longer infrastructure lifecycle:** Enabled a 5-year cycle with scaling on demand that minimized storage review needs.
- **Cost saving:** CID experienced a 30% drop in costs for storage planning and infrastructure maintenance.

Going forward, CID GmbH expects that vSAN ESA will provide it with sufficient flexibility, scalability, and performance to meet its own and customer needs for the foreseeable future. You can read the entire CID Case Study for all the remaining details.

To learn more about VVF, please consult any or all these top-notch resources:

- VMware vSphere Foundation
- VMware Cloud Foundation Operations
- VMware vSphere
- VMware vSAN
- VMware vSphere Foundation Solution Brief
- Overview Video of VMware Cloud Foundation Operations
- Comparison between VMware Cloud Foundation and VMware vSphere Foundation
- Comparison between VMware vSphere Enterprise Plus and VMware vSphere Foundation

Dear reader, you've reached the end of the trail for this Gorilla Guide® To... Operating and Optimizing VMware vSphere Foundation. We hope you've enjoyed learning how VMware vSphere Foundation (VVF) can help organizations modernize and transform their existing IT infrastructures, while taking advantage of the improved performance and reliability and reduced costs that such a powerful platform can deliver. To learn more, please visit the resources linked in the previous section or elsewhere throughout this book. Enjoy!

# ABOUT BROADCOM


Broadcom Inc., a Delaware corporation headquartered in Palo Alto, California, is a global infrastructure technology leader built on more than 60 years of innovation, collaboration and engineering excellence.

With roots based in the rich technical heritage of AT&T/Bell Labs, Lucent and Hewlett-Packard/Agilent, Broadcom focuses on technologies that connect our world. Through the combination of industry leaders Broadcom, LSI, Broadcom Corporation, Brocade, CA Technologies, Symantec's enterprise security business and VMware, the company has the size, scope and engineering talent to lead the industry into the future.

Broadcom is focused on technology leadership and category-leading semiconductor and infrastructure software solutions. The company is a global leader in numerous product segments serving the world's most successful companies.

Broadcom combines global scale, engineering depth, broad product portfolio diversity, superior execution and operational focus to deliver category-leading semiconductor and infrastructure software solutions so its customers can build and grow successful businesses in a constantly changing environment.

# ABOUT ACTUALTECH MEDIA


ActualTech Media, a Future B2B company, is a B2B tech marketing company that connects enterprise IT vendors with IT buyers through innovative lead generation programs and compelling custom content services.

ActualTech Media's team speaks to the enterprise IT audience because we've been the enterprise IT audience.

Our leadership team is stacked with former CIOs, IT managers, architects, subject matter experts and marketing professionals that help our clients spend less time explaining what their technology does and more time creating strategies that drive results.

If you're an IT marketer and you'd like your own custom Gorilla Guide® title for your company, please visit actualtechmedia.com.