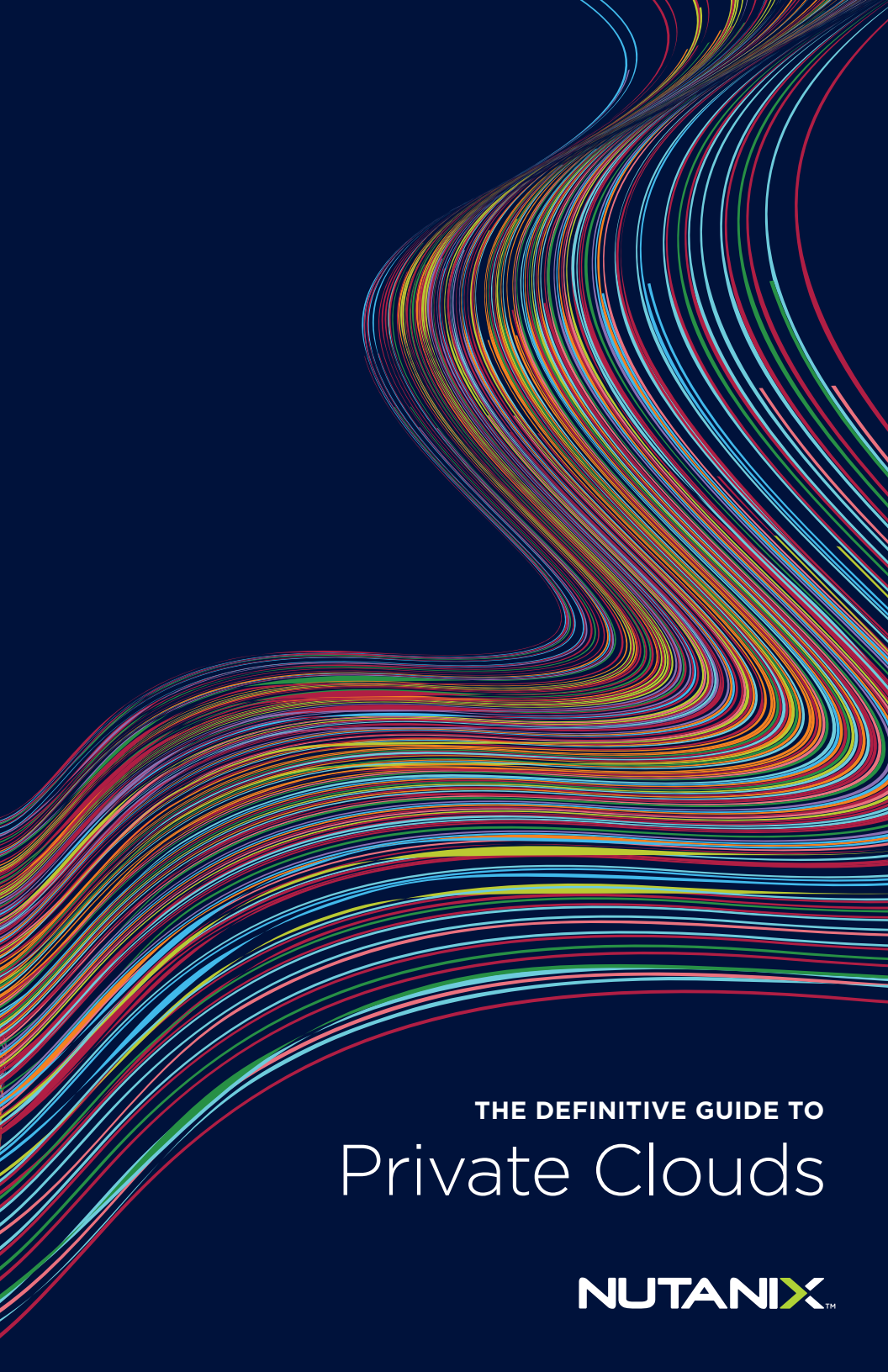
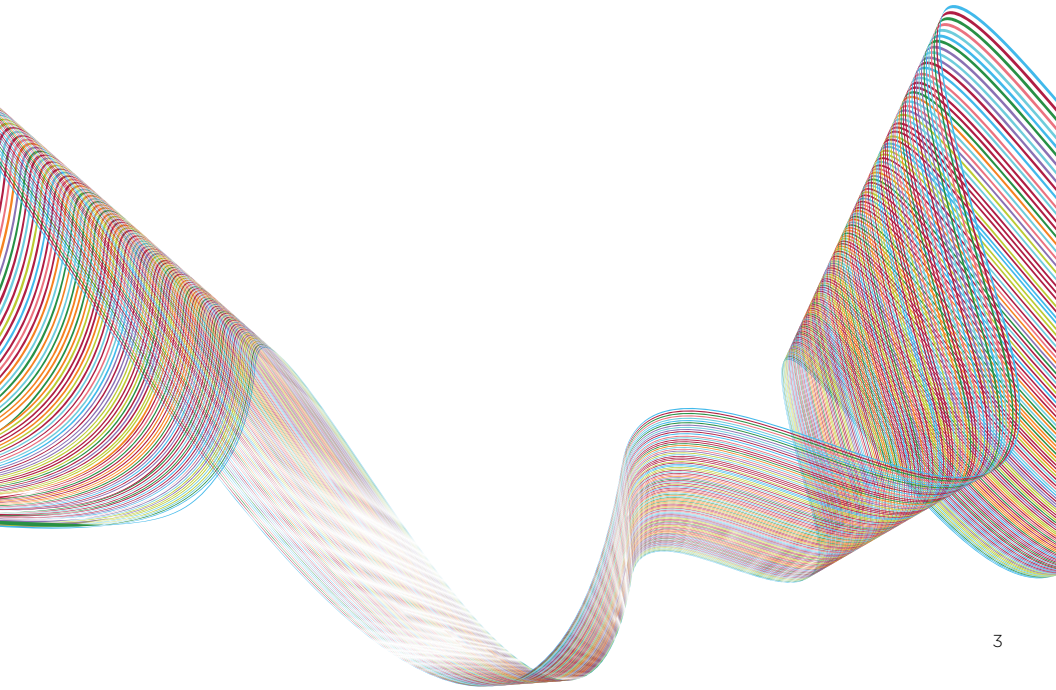
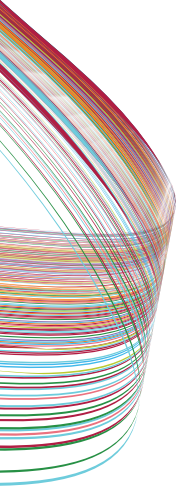


THE DEFINITIVE GUIDE TO

Private Clouds

NUTANIX™





Datacenter Evolution

AN ENTERPRISE PERSPECTIVE ON CLOUD

Cloud services are disrupting the status quo for enterprise IT. Many enterprises are in the midst of a digital transformation, seeking to engage with customers and satisfy their needs through digital technologies. Line of Business managers, application developers, and IT leaders tasked with achieving these goals are attracted by the public cloud, but when they bypass enterprise IT in favor of public cloud alone, it creates a host of security, data protection, and compliance concerns. What's needed is a platform that merges the agility, simplicity, and control of public cloud services with the reliability, DR, and predictable workloads of a private cloud and is capable of meeting all your IT needs from core datacenters to the edge of your network.

To deliver on the promise of digital transformation, you need a unified infrastructure that fuses public and private cloud with the latest technology trends such as distributed and edge computing. This gives you the flexibility to support new technologies and data driven analytics where you need them while avoiding the potential problems associated with "shadow IT" and enabling your IT team to deliver the services and user experience customers want. IT teams are looking at a combination of private cloud and public cloud services—what is commonly referred to as a hybrid cloud —to meet these needs.

According to IDC's CloudView Survey , 79.7% of large organizations have already adopted a hybrid cloud IT strategy. A combination of on-premises IT services and cloud-based services can deliver substantial business benefits and give your company a competitive edge over less nimble rivals. For many companies, rolling out a new service or application can still take weeks or even months as the request passes from the server team to the storage team to the networking team.

A private or hybrid cloud has substantial benefits for enterprise IT as well. The move from dedicated infrastructure and purpose-built hardware for each application to standardized infrastructure reduces your reliance on and need for expensive and hard to find IT specialists in favor of IT generalists. Some organizations see a substantial benefit from changing CapEx to OpEx, freeing up capital for other uses.

The initial idea of private cloud was to bring the capabilities of public cloud services on-premises. However, many enterprises encounter limitations with that approach. Many existing enterprise applications aren't well suited to run in the cloud. They often require data management and data protection capabilities that aren't needed by cloud-native applications.

Increasingly, IT teams recognize the benefits of an "Enterprise Cloud," a cloud designed specifically for enterprise needs and tailored to meet the needs of both existing enterprise applications and next-generation applications. An enterprise cloud combines the agility and simplicity of public cloud infrastructure with the predictable costs and control of on-premises infrastructure.

ENTERPRISE CLOUD: INTERFACE AND INFRASTRUCTURE

To get your enterprise cloud right, it's important to think about the architecture. There are two aspects to any cloud:

- The interface. How do end users see and access the cloud? How do administrators manage it?
- The infrastructure. What technology is a cloud built on?

To succeed, you have to get both the interface and the infrastructure right. If you get the interface wrong, end users will be tempted to go elsewhere.

Even IT administrators may be tempted by the public cloud when management interfaces are too complex, not flexible enough, or make dealing with new additions or upgrades nearly impossible. And even the best interface won't make up for a bad foundation. Your cloud infrastructure should:

- Scale quickly and easily
- Respond readily to business changes and directives
- Minimize or eliminate the effects of noisy neighbors
- Support your developers and DevOps efforts
- Accelerate the process of application deployment and management

Making Cloud Decisions

The question you need to ask yourself is not, "Will we use a cloud?" but rather, "What is our cloud strategy?" To develop that strategy, you have to ask some hard questions:

- How much of the cloud experience will you deliver to users?
- Where should different workloads run? On-premises? At a cloud service provider (CSP)? At a Software-as-a-Service (SaaS) provider? In a big public cloud such as Google Cloud Platform (GCP), Amazon Web Services (AWS), or Microsoft Azure? Users, of course, don't care where an application workload runs, they care about the service levels delivered—and the cost.
- What infrastructure will you use on-premises?
- Even if your users don't want or need the full cloud-like experience, how can your business benefit from a cloud strategy?

The Nutanix Enterprise Cloud Platform is designed to deliver both the interface and infrastructure to help you get your cloud strategy right and accelerate business transformation. Nutanix Enterprise Cloud delivers the simplicity, agility and fractional IT consumption benefits of public cloud, with the control and security needed in the enterprise datacenter.

Nutanix Enterprise Cloud OS software leverages the industry's most popular hyperconverged technology with comprehensive operations management and an automation and orchestration framework to deliver any application with one-click simplicity, and provides the foundation for a multicloud architecture.

This book will help you understand the Nutanix Enterprise Cloud Platform, including interface and infrastructure, and provide advice on how to figure out which applications belong on-premises and which belong in the cloud.

UNDERSTANDING DIFFERENT CLOUD TYPES

Public Cloud

An external company provides a cloud interface from which VMs can be provisioned. The interface abstracts the hardware and removes hardware planning from the equation. Usage is billed on a consumption basis and treated as an operating expense. Public cloud often takes the form of infrastructure as a service (IaaS).

Private Cloud

An organization's internal IT team provides a self-management and provisioning portal for end users. The services are similar to what the public cloud, but access is restricted. Private cloud services may be hosted and/or managed by an external cloud service provider with your IT team retaining some or all of the control over resources and networking.

Hybrid Cloud

A hybrid cloud combines elements of private and public cloud. Some of your workloads run on-premises, while others run in a public cloud (such as GCP, AWS, or Azure) or at a cloud service provider.

Multicloud

As cloud computing becomes ubiquitous for enterprises, workloads are increasingly being distributed across multiple private clouds, public clouds, remote and branch offices, field deployments and service providers. This is referred to as multicloud. With workloads distributed across public and private clouds, the risk of vendor lock-in may be reduced.

Enterprise Cloud

An enterprise cloud is designed specifically for enterprise needs and tailored to meet the requirements of both existing enterprise applications and next-generation applications. Correctly architected, an enterprise cloud transcends previous conceptions of the cloud, delivering the benefits of private, hybrid, and multicloud in a way that best fits with your business needs. The key is choosing a service provider that can deliver on enterprise cloud needs such as an X-Powered Service Provider.

Application Lifecycle Management and Cloud Orchestration

The Nutanix Enterprise Cloud Platform makes it simple to deliver a powerful, application-centric automation with Nutanix Calm™. Calm provides native application orchestration and lifecycle management, fully integrated with the Nutanix management interface: Nutanix Prism. (Nutanix Prism is described in detail in chapter 3.)

Calm decouples application management from the underlying infrastructure, enabling applications to be easily deployed into private or public cloud environments. With Calm, IT can empower end users and other teams, such as application developers or business analysts in a line of business to deploy and manage applications in a self-service manner, while retaining full control of the infrastructure.

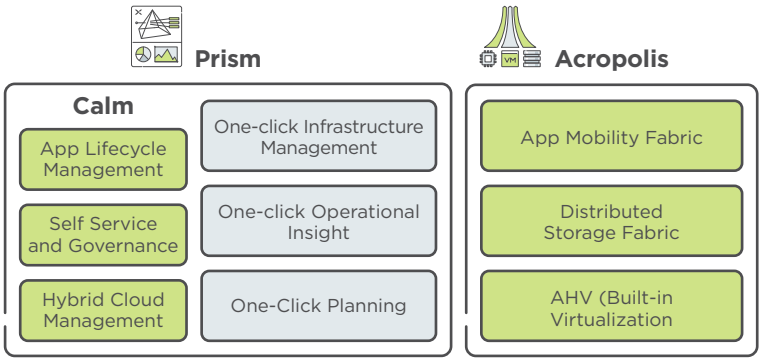


Figure 1. Nutanix Calm simplifies application provisioning

APPLICATION LIFECYCLE MANAGEMENT

By approaching applications as complete entities, not just virtual machines (VMs), Calm orchestrates how applications are created, consumed and governed. Calm delivers simple, repeatable and automated management of applications across a variety of environments, including private and public clouds.

Calm simplifies the set-up and management of custom enterprise applications by incorporating all elements of each application, including relevant VMs, configurations and related binaries, into an easy-to-use-blueprint, making the deployment and lifecycle management of common applications automated and repeatable.

A unified application language provides a single flexible construct to improve collaboration between teams and avoid errors between disciplines.

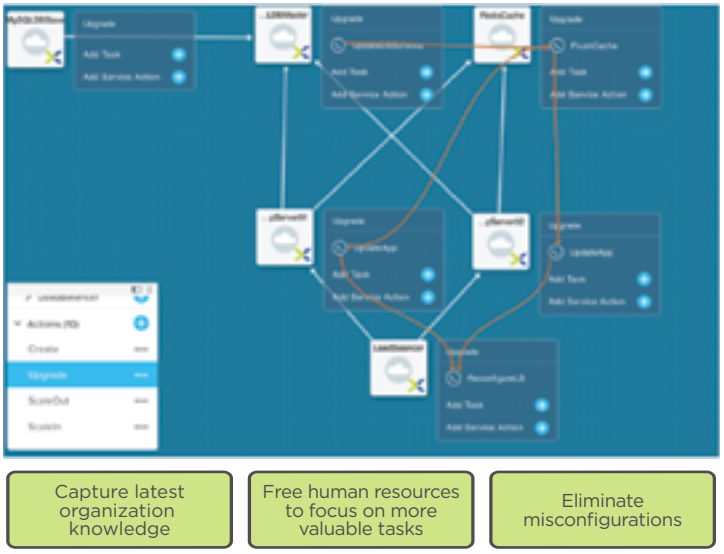


Figure 2. Calm blueprints incorporate all the elements needed to deploy and manage a custom application.

SELF SERVICE AND GOVERNANCE

The Nutanix Marketplace enables complete self-service for your Nutanix Enterprise Cloud environment. Users can consume pre-integrated blueprints or custom blueprints that have been published to the marketplace. This gives application owners and developers the ability to request IT services and have them be instantly provisioned.

Role-based governance allows user operations to be limited based on assigned permissions. All activities and changes across the entire infrastructure stack are centrally logged for end-to-end traceability and debugging, aiding security teams with key compliance initiatives. Department and group-level chargeback and cost controls allow you to carefully monitor IT expenses across public and private clouds.

Calm includes budgeting tools that reduce IT negotiations to an easy-to-understand number, allowing you to control user behavior through service costs. For example, if you have a preferred database, you can encourage people to adopt that database by making it free, or less expensive than alternatives.

Figure 3. Calm provides detailed cost accounting on a team and application basis across clouds.

HYBRID CLOUD MANAGEMENT

Calm makes it easy to provision applications across hybrid cloud deployments. Both multi-tiered and distributed applications can be scaled across different cloud environments. Policy-based reporting shows the overall utilization and true cost of your public cloud consumption at a glance so that application provisioning decisions can be based on business needs and budget requirements.

Calm abstracts an application from the infrastructure it runs on, providing a single uniform deployment across different clouds. To change how an application is deployed, you just tell Calm what's different. For example, you can make changes to orchestration, custom actions, deployment steps, and so on, and the system will recommend the best cloud choice, giving you the ability to choose between clouds without risk of lock-in.

Nutanix Enterprise Cloud Delivers Better DevOps Outcomes

Nutanix Enterprise Cloud is the ideal platform for organizations moving to DevOps. By eliminating the fragmentation that comes with traditional IT infrastructure, Nutanix reduces infrastructure complexity, creating a platform that's highly resilient, easy to automate, and simple to monitor and troubleshoot. With Nutanix Enterprise Cloud Platform, every member of your team can understand and perform infrastructure tasks—no IT superstars required. The result is smoother operations and less friction, resulting in faster time to delivery and higher quality.

Notable among the many DevOps-friendly features are:

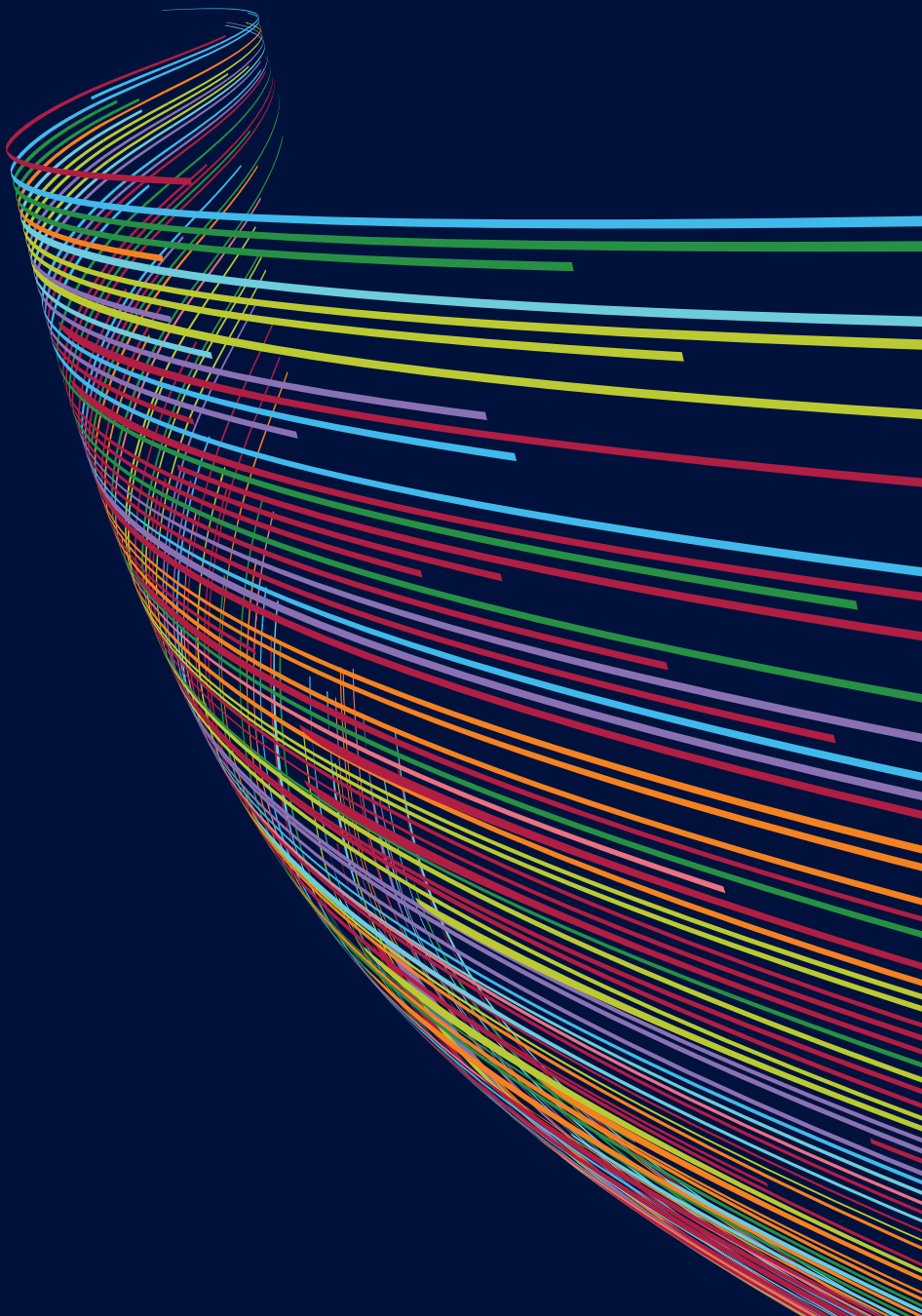
- Built-in self-service through Nutanix Calm, plus support for many other self-service platforms
- Self-healing architecture eliminates fire drills and reduces downtime
- Advanced data management with snapshots, replication and clones
- Data services with support for containers and file and block services
- Integrated virtualization with AHV plus multi-hypervisor support

In addition, Nutanix is addressing the three primary networking challenges that affect networks and network security in DevOps environments:

- Orchestrating the network to automatically adapt to dynamic application needs
- Securing the network from internal threats—without adding complexity
- Visualizing the network design and network health in an application-centric manner

Nutanix Calm completes the DevOps picture with native application orchestration and lifecycle management that manage everything in the application environment, not just the VMs. Calm's application-centric capabilities give DevOps teams:

- A single language for application modeling using application blueprints
- Unified management and governance across on-premises and cloud
- Democratized operations that eliminate IT personnel bottlenecks



Enterprise Cloud Infrastructure: Nutanix Enterprise Cloud Platform

It can be a struggle to implement a private cloud on top of traditional enterprise IT infrastructure with separate servers and storage connected by storage networks. Despite its familiarity, this type of infrastructure is difficult to scale, slow to respond to business needs, prone to noisy neighbor problems, and complicated to manage. These challenges are amplified in a cloud environment.

Enterprises are discovering that they can achieve better cloud results using hyperconverged building blocks that provide compute capacity and storage capacity on each node—similar to the approach used by many of the large public clouds. The right hyperconverged infrastructure provides many of the cardinal virtues of cloud including self-healing, simplified capacity planning, easier automation, and reduced management overhead. Nutanix Enterprise Cloud ticks all of these boxes.

One OS, One Click

Nutanix Enterprise Cloud bridges efficiency and performance gaps. A single software fabric unifies your private and public clouds, and delivers one-click simplicity in managing multicloud deployments. Nutanix enables application mobility across clouds while remaining open to any hardware, hypervisor or cloud.

Nutanix accomplishes all this without compromising the value provided by private datacenters through a combination of:

- Full-stack infrastructure and platform services that deliver turnkey hybrid infrastructure for any app at any scale, anywhere
- One-click operations for cloud-like operational simplicity
- Pay-as-you-grow economics that allow you to buy and use just the IT resources you need, as you need them
- Integrated security and control that simplifies security validation
- Application mobility that eliminates infrastructure lock-in

When you have an enterprise cloud architecture, you've got a foundation with the agility and features you need to succeed. You are able to reap the benefits of cloud, taking the complexity out of your IT infrastructure and simplifying planning.

ARCHITECTURE

Hyperconverged infrastructure is the foundation of the Nutanix Enterprise Cloud. Scale-out clusters of high-performance servers (nodes) contain processors, memory, and local storage. Clusters can scale from three nodes to a very large number. In addition to standard virtual machines, each Nutanix node runs a special controller VM (CVM) that acts as a storage controller for the drives on that node, providing data services for VMs running locally, as well as other nodes as needed.

In hybrid clusters, each node contains a combination of flash SSDs and hard disk drives (HDDs) for performance and capacity. All-flash nodes and all-flash clusters are also available.

Each node in a Nutanix cluster has a standard hypervisor and runs virtual machines just like any other virtualized server. Nutanix AHV virtualization provides a next-generation, native hypervisor that integrates closely with the Nutanix architecture and is included with your Nutanix purchase at no additional cost. Nutanix also provides support for VMware, vSphere, Microsoft Hyper-V, and XenServer. By supporting a wider selection of popular hypervisors than competing platforms, Nutanix is better able to meet multi-hypervisor business requirements.

Acropolis Container Services is also available to provide full container support with persistent storage for those who are deploying container-based applications now or in the future.

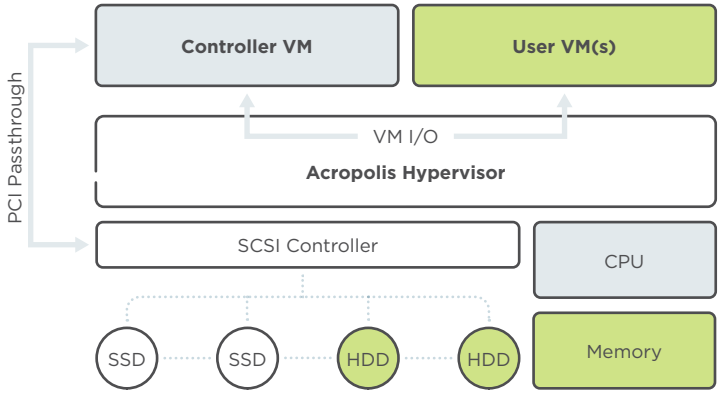


Figure 4. Nutanix node architecture

Nutanix: Full-Stack Infrastructure and Platform Services

Most private cloud solutions offer cloud management on top of traditional infrastructure. Unless that infrastructure has been built to scale out and has no single points of failure, the resulting environment won't deliver full cloud benefits.

With Nutanix Enterprise Cloud Platform, infrastructure is delivered as a set of software-defined services—including file, block, and container storage, as well as integrated data protection and availability to support application needs—built on top of flexible, scalable infrastructure. Nutanix combines compute, storage, servers, and virtualization in a hyperconverged platform available on a range of hardware—the Nutanix Enterprise Cloud OS software runs on servers from Dell, Lenovo, IBM, HPE, Cisco UCS, and others—in addition to hardware supplied by Nutanix. Because server virtualization is built in, virtualization is just a feature, not a separate solution to purchase and manage.

DISTRIBUTED STORAGE FABRIC

The Acropolis Distributed Storage Fabric (DSF) virtualizes all storage in a cluster into a unified pool. DSF uses the local SSDs and HDDs on each node to store virtual machines and data.

DSF provides a number of cloud-like features that minimize the management overhead of private cloud environments:

- Data locality. The data used by each virtual machine is kept preferentially on local storage on the node where the virtual machine is running, reducing noisy neighbor effects.
- Auto-tiering. Hot data is stored preferentially in flash, while cold data resides in the HDD tier. For optimal performance, data is automatically moved between tiers based on access patterns.
- Auto-tuning. Nutanix delivers excellent performance for both random and sequential I/O without the need for constant performance tuning—even when multiple and/or different workloads are running simultaneously.

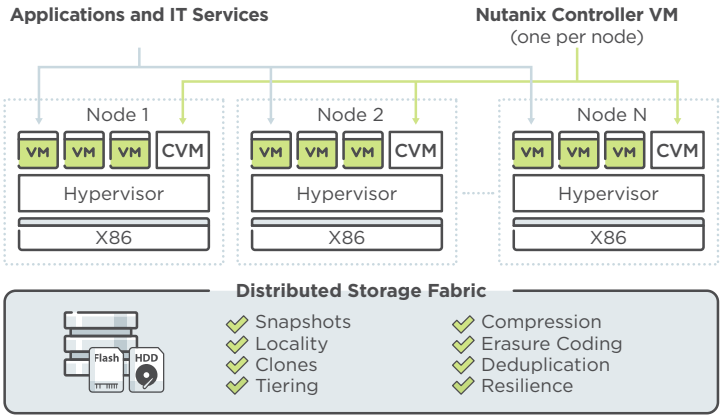


Figure 5. Acropolis Distributed Storage Fabric (DSF)

- Auto-leveling. Advanced algorithms ensure that data is balanced across nodes. Data from any virtual machine can utilize storage on other nodes when needed, eliminating the possibility of running out of storage on any single node and simplifying data management. If a particular node has more hot data than it has local SSD, available SSD capacity on other nodes is used.

- Auto-archiving. A Nutanix cluster can include capacity-only nodes to increase available storage. When these nodes are deployed, cold data preferentially finds its way to them. In effect, this provides auto-archiving of cold data. Whenever data becomes active again, it moves back to the node where it is needed without intervention.

- Replication factor. Nutanix Enterprise Cloud Platform relies on a replication factor (RF) for data protection and availability. Either two or three copies of all data are maintained on different nodes within a cluster. Nutanix's patented erasure coding algorithm, EC-X, can be used to reduce the storage overhead resulting from RF. Using EC-X can increase usable space in the cluster by up to 70%.

- Self-healing. Replication factor also enables a Nutanix cluster to be self-healing. When a disk or node fails, full data redundancy is quickly and automatically restored. In the case of host failure, VMs are restarted on other nodes. A larger Nutanix cluster can withstand the failure of an entire four-node enclosure (referred to as a block).

NUTANIX PRISM

Nutanix Enterprise Cloud incorporates management as an integral part of the solution. The Nutanix Prism management interface delivers consumer-grade simplicity for infrastructure management and makes it easy to keep infrastructure up and running.

Powered by advanced data analytics and heuristics, Prism streamlines common IT workflows, providing a single interface for managing your entire IT environment including servers, storage, data protection, security, and virtualization. Prism makes configuring, monitoring, and managing Nutanix solutions remarkably simple. One-click management reduces the administrative burden and the potential for operator error while eliminating the need for planned downtime. Prism One-click Planning includes sophisticated scenario-based modeling, based on X-Fit™ machine intelligence, so that you can foresee the impact that changes to the IT environment will have on application performance and availability.

ONE-CLICK MANAGEMENT

One-click software upgrades. A consistent pain point for any IT environment, especially a private cloud, is keeping system software and firmware up to date. IT administrators spend countless evening and weekend hours on upgrade tasks, not to mention the expensive professional services required with some platforms. Prism takes the pain and disruption out of upgrades, allowing them to be executed during normal business hours. Intelligent software does all the heavy lifting, eliminating the need for detailed upfront planning.

Nutanix operating software and hypervisor software on each node is updated using a rolling methodology that eliminates disruption to running jobs.

One-click remediation. In the event of alerts or failures, Prism suggests remediation actions that you can initiate to correct problems quickly. With one-click remediation, the mean time to repair and restore services is greatly reduced, significantly improving availability.

FULL REST APIS

Any task that can be performed via Prism can also be performed using REST APIs or a library of PowerShell cmdlets. As a result, you can easily incorporate Nutanix data management capabilities as cloud services.

AHV

When you use cloud services from a large public cloud such as AWS or Azure, you don't know or care what hypervisor is running. You only care that it works simply and reliably. That's what Nutanix AHV virtualization delivers. AHV is the preferred hypervisor choice for Nutanix Enterprise Cloud because of its low cost and native integration with Nutanix Prism.

Traditional hypervisors were designed for a world of monolithic non-VM-aware storage arrays and switch fabrics; they were built to accommodate thousands of combinations of servers, NICs, and drivers. They require multi-pathing policies and complex designs to mitigate issues such as storage congestion and application resource contention while still accommodating high availability and scalability. Acceptable performance often requires segregating workloads.

AHV virtualization was designed from the ground up to provide a much simpler and more scalable hypervisor and associated management platform by leveraging the software intelligence of the Nutanix Enterprise Cloud Platform. AHV liberates virtualization from the domain of specialists, making it easier for IT generalists to deploy and manage. AHV is based on the proven Linux KVM hypervisor to ensure support for all popular workloads and is hardened to meet the most stringent enterprise security requirements. It is fully supported by Nutanix, which means that you get full infrastructure and virtualization support from a single vendor with no hidden costs.

Nutanix: Zero-Click Operations

Nutanix provides a universal control plane spanning private and public cloud, eliminating management complexity. An intuitive interface and comprehensive REST APIs covers the entire stack: VM operations, virtualization, compute, storage, backup, applications and disaster recovery across a single site, multiple sites, and public cloud.

Machine intelligence and self-learning capabilities drive end-to-end automation—the platform becomes smarter with time. Management is built on the principle of consumer-grade design, minimizing time to productivity. Automatic infrastructure optimization and remediation take the place of many routine tasks with the end goal of eliminating the need for daily operator involvement.

Why NASDAQ Chose Nutanix Enterprise Cloud and AHV

The NASDAQ stock exchange runs a complex multi-hypervisor environment to meet its diverse needs. NASDAQ chose the Nutanix Enterprise Cloud Platform and AHV to meet the infrastructure needs of a rapidly growing Splunk environment. The team was already familiar with KVM, the open source hypervisor on which AHV is based, so they knew AHV was a technology they could trust. But AHV is 100% integrated with the Nutanix Enterprise Cloud Platform, so Nutanix Prism eliminates the well-known challenges of managing open-source KVM.

Since AHV is included with the Nutanix platform, it substantially lowers the total cost of ownership for the stock exchange, making its use a no-brainer as they move into a hybrid cloud paradigm where they are increasingly hypervisor agnostic.

NASDAQ has been extremely happy with the performance gains it has seen. All types of Splunk queries run at least 2x faster on Nutanix versus traditional systems, even with just three Nutanix nodes versus five physical nodes.

From an operational perspective, the team really likes the deployment agility. Nutanix scales quickly and easily to adapt to growing needs. The current cluster is being expanded.

Read the full NASDAQ case study for more information.

Jabil Choose Nutanix and Microsoft for Cloud Needs

Jabil is a global manufacturing services company that helps customers design, build, and take products to market affordably and efficiently. It has 90 facilities in 23 countries and more than 150,000 full-time employees.

The company deployed a Microsoft cloud running on Nutanix Enterprise Cloud Platform to deliver the IT infrastructure scalability needed to accommodate rapid business growth. The company's IT staff can now automate many more IT processes, deliver servers quickly, and increase capacity on demand.

"With 35 datacenters around the world, it got to the point where we couldn't scale our systems and manage them as efficiently as we wanted to," says IT Systems Architect at Jabil. "We wanted to consolidate our datacenter footprint and increase efficiency."

Jabil IT decided to build its cloud on the Microsoft platform—Windows Server, Hyper-V, Microsoft System Center, and Windows Azure Pack—all running on Nutanix Enterprise Cloud. "Nutanix had what we wanted: an infrastructure that would let us start small and scale out gradually. The Nutanix platform supported Hyper-V and contained integrated solid-state storage fed by intelligent tiering that would boost application performance. Once we saw how simple it would be to deploy and manage, the Nutanix platform was a no-brainer."

The choice of Azure Pack allows Jabil to easily scale beyond its own datacenters as needed, while Nutanix greatly simplifies the on-premises infrastructure lifecycle. "Once hardware reaches maturity, we don't have to do a big bulk decommissioning of servers; we just upgrade individual server nodes one at a time," the IT Systems Architect concluded. Read the full Jabil case study for more information.

Third-Party Self-Service Options

In addition to the native self-service capabilities provided by Nutanix Enterprise Cloud and Nutanix Calm, Nutanix also supports a number of other popular options.

- VMware vRealize Automation. vRealize Automation (formerly vCloud Automation Center) can be used to automate infrastructure tasks and provide self-service on Nutanix clusters running both VMware ESXi and Nutanix AHV. Nutanix has created a full reference architecture, including deployment profiles for proof-of-concept and small, medium, and large production deployments

- Windows Azure Pack. Microsoft and Nutanix have partnered to deliver a seamless hybrid cloud solution with Microsoft Windows Server 2012 R2 and Windows Server 2016, Microsoft Windows Azure Pack and the Nutanix Enterprise Cloud OS.

- OpenStack. Nutanix has created a set of fully tested and supported drivers to integrate with OpenStack services. The drivers provide integration with the core components of an Infrastructure-as-a-Service (IaaS) deployment, while supporting integration with your choice of advanced services and cloud management through your OpenStack controller.

No matter which of these you use today or might use in the future, you can integrate it with the capabilities of Calm. Calm can call or be called with APIs giving these tools added flexibility and new features.

Nutanix: Application Mobility

When applications are not bound by the constraints imposed by infrastructure, you are free to pick the best location for each application based on business needs.

Nutanix Enterprise Cloud breaks down the barriers to application mobility. IT teams decide where applications reside based on application needs and business requirements rather than infrastructure limitations. Effective mobility provides any-to-any freedom, requires no application changes, translates SLAs across environments, and preserves application state, configuration, and environmental requirements to minimize risk. Applications are free to move between Nutanix AHV and VMware ESXi environments and can be extended to X-Powered service provider and public clouds using Calm.

Integrating with Cloud Service Providers

The Nutanix Enterprise Cloud Platform also enables you to integrate with the rapidly growing number of Nutanix X-Powered Service Providers.

Nutanix X-Powered Service Providers bring the agility and scalability advantages of the Nutanix Enterprise Cloud Platform to cloud datacenters, increasing application service levels and reducing your risk.

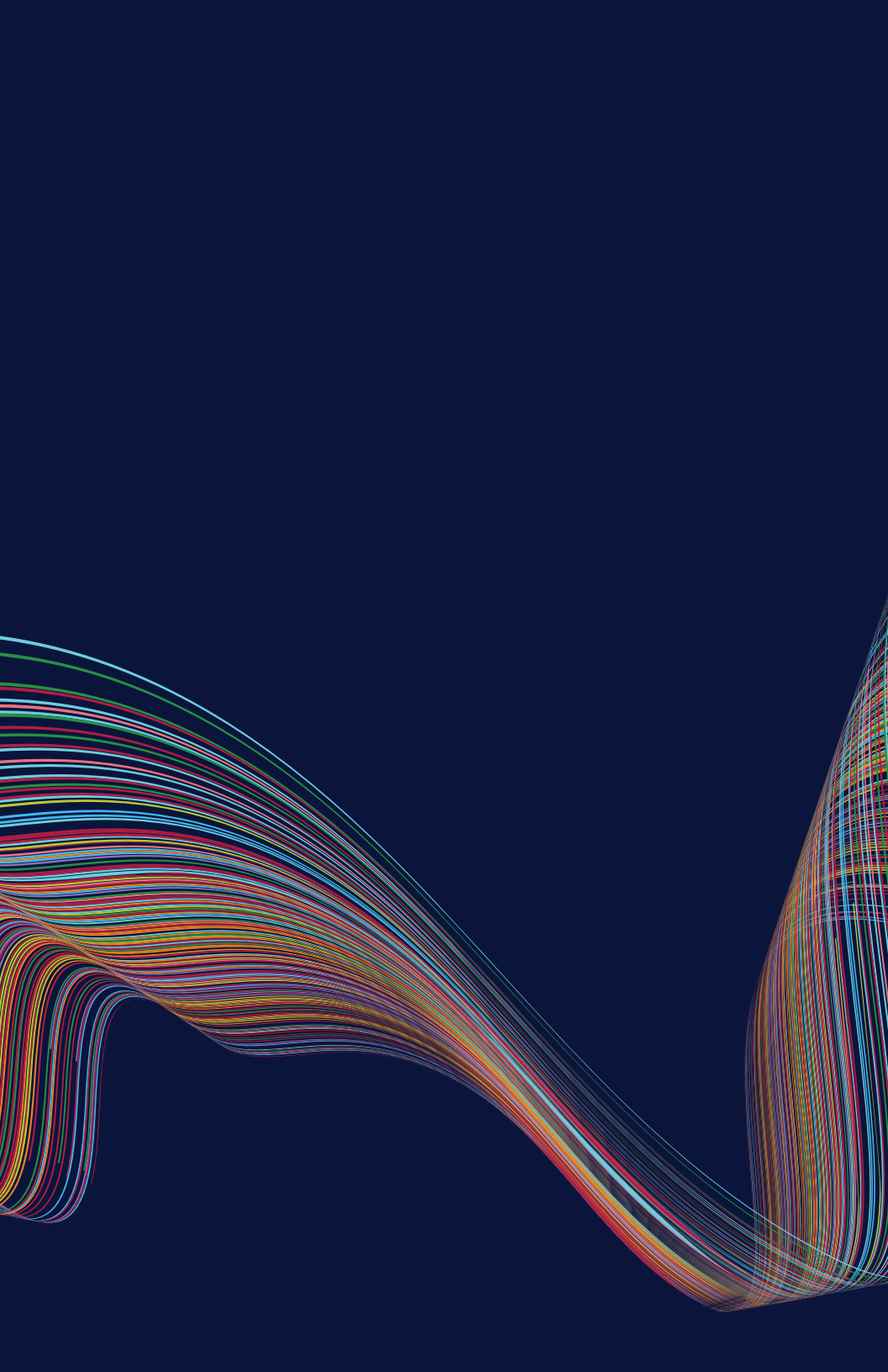
By choosing a Nutanix X-Powered Service Provider, you can make sure that your applications run smoothly while delivering greater value for users. You can respond faster to new requirements and react rapidly to business changes. New employee onboarding becomes effortless, and acquisitions can be handled without the worry of extended time tables.

Grow your footprint—even 2x or 3x—without the long lead times that would usually be required with traditional cloud service providers. Nutanix scales out quickly, allowing Nutanix X-Powered Service Providers to react to your growing business needs faster than their competition.

Nutanix X-Powered infrastructure eliminates the need for planned downtime, delivering two major benefits:

- Your business doesn't have to be designed around your service provider's maintenance schedule.
- X-Powered Service Providers are first to receive the latest features and performance enhancements, improving your application performance and availability over time.

Nutanix X-Powered Service Providers offer a cloud experience with features unavailable from other providers. A variety of services is available to accommodate everything from high-security environments to healthcare IT.



Cloud Economics

Nutanix hears from a lot of potential customers who want to adopt a cloud-first strategy to save money. However, our experience has been that there are many situations where the cloud is not a money saver. When you factor in all the costs—including getting the performance you need, data protection costs, and other variables—it can be twice as much to run predictable workloads in the cloud.

So why are so many enterprises going to the cloud? In a word, agility. When end users are frustrated by enterprise IT, they turn to the cloud to get the resources they need quickly because the benefit outweighs the cost. In this chapter, we discuss how to determine which apps to run on-premises and which apps to run in the cloud to maximize the benefits of both.

HOW DO YOU TAKE THE BEST ADVANTAGE OF PUBLIC CLOUD AND CLOUD SERVICE PROVIDERS?

When you ask Nutanix for advice on this question, we advise you to take a strategic look at what you want to accomplish before considering individual applications.

Create a cloud decision matrix that includes all the factors that need to go into your decision to move an application from your datacenter to a cloud service provider. This includes assessing likely costs and whether an application is ready for the cloud:

- Can the application be containerized?
- Can the application consume and release resources as needed or is it persistent?
- What's the I/O pattern? Steady or fluctuating? High or low?
- Does the application scale vertically or horizontally?
- Does the application consume more and more resources over time in a way that you can't control or limit?
- Does the application depend on an ecosystem of other applications?

- Does the application have stringent compliance requirements?
- What is the impact to your business if the application is up but unreachable?

These factors tend to be interrelated. High I/O requirements or the need to run as part of an ecosystem will affect the cost of running an application in the cloud.

Once you have the right cloud decision matrix for your organization, you can evaluate individual applications against it. Some applications will rank as prime candidates; some applications will clearly not be well-suited to move to the cloud and will probably never be moved; others may require a little work to make them cloud ready.

TWO CLASSES OF APPLICATIONS THAT BELONG IN THE PUBLIC CLOUD

As a rule, very few existing enterprise applications were engineered to be well-suited to the public cloud. It may be years before legacy applications evolve to be public cloud ready—if they ever do. If you move an application that isn't ready to the public cloud, you'll likely find you're burning money and not meeting your business needs.

The applications that do belong in the cloud fall into two categories:

- Highly elastic applications
- New applications where you don't yet understand the demand

Applications that have a low ecosystem requirement and are very elastic—have highly variable resource requirements—are often perfect for the public cloud. They can get all the resources they need when they need them and release them when they don't. Hosting a highly elastic application on-premises might mean having to provision a large amount of expensive infrastructure to accommodate occasional activity spikes.

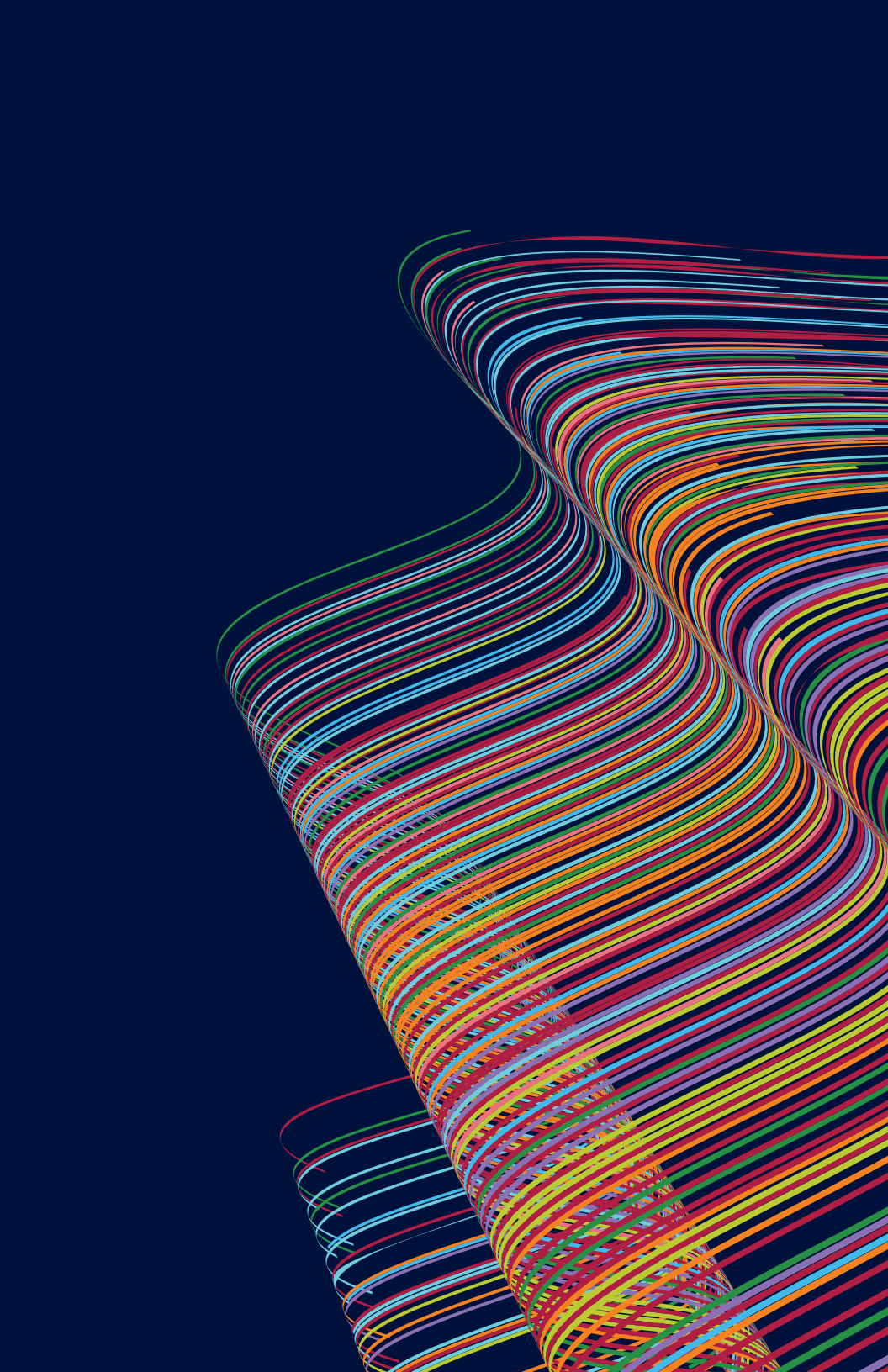
When you deploy a new application, it can be hard to predict what the demand or the resource requirements are upfront. It often makes sense to put these applications in the cloud initially so they can get the resources they need, and then move them on-premises once those needs are understood, especially if resource demands turn out to be predictable.

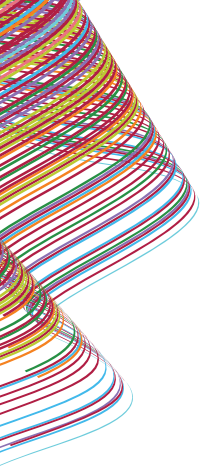
Many companies are initiating large numbers of development projects to create new applications and services as part of their digital transformation efforts. Only a handful of such projects are likely to succeed and deliver a high return on the initial investment. By developing and deploying those applications in the cloud, you can minimize upfront capital outlays. Applications that succeed may eventually become good candidates to move on-premises; applications that don't do well can simply fade away.

ECONOMICS OF THE NUTANIX ENTERPRISE CLOUD

Because the Nutanix Enterprise Cloud is built with the same web-scale architecture as the public cloud, it offers many of the same advantages—including agility. It's easier to move applications to and from enterprise cloud than it is with traditional infrastructure. Because the infrastructure scales easily, capacity and growth are less of a worry. Nutanix Prism can show you your runway and predict exactly when you'll need to order additional systems. It even recommends the hardware you should choose. As Figure 3 illustrates, Calm and Prism can also show you how much money you are spending in the public cloud and simplify your on-premises versus cloud decision-making process.

Because Nutanix powered solutions runs on-premises, you have lower fixed costs for running enterprise applications with predictable resource demands. You're not metered on whether a VM is up or down. And, because it provides the agility that your business may have been lacking before, it eliminates the pressure to move everything to the cloud, allowing you to make smarter decisions about what to run where. By making it possible to see exactly what your costs are on-premises versus in the cloud, Calm and Prism take the guesswork out of the on-premises versus cloud decision.





Cloud Security

Recent high-profile security breaches have elevated the importance of security in IT infrastructure decisions. Rather than rushing to retrofit security capabilities to existing products, Nutanix recognized security as a core requirement from the beginning.

Nutanix Enterprise Cloud OS is security hardened by default. It utilizes the principle of least privilege and delivers a true defense-in-depth model. Its custom security baseline exceeds the requirements of the U.S. Department of Defense.

Nutanix combines features such as two-factor authentication and data-at-rest encryption with a security development lifecycle. This is integrated into product development to help meet the most stringent security requirements. Nutanix systems are certified across a broad set of evaluation programs to ensure compliance with the strictest standards, and Nutanix is forging partnerships with leaders in the security industry to help you achieve your security goals.

Nutanix: Integrated Security and Control

Maintaining security with traditional infrastructure comprised of products from multiple vendors can be time-consuming and prone to error. Nutanix Enterprise Cloud OS utilizes a security-first design in which security specifications and testing are built into every step of product development. The result is a security-hardened infrastructure stack that delivers comprehensive end-to-end security with automated security validation and self-healing.

UNIFORM SECURITY POLICIES ACROSS CLOUDS

With Nutanix Calm, you can establish security policies for every application and ensure that those policies are applied uniformly both on-premises and in the cloud. This ensures policies are applied consistently and eliminates hours of tedious manual security configuration and verification tasks. The result is better security with far less effort.

Thanks to the hybrid-cloud management capabilities of Calm, you can guarantee that your applications always have the right profiles attached, export the logs for inspection or collection, and audit exactly who did what when to understand why something fell out of policy.

ENCRYPTION

Data-at-rest encryption is delivered through self-encrypting drives (SED) that are factory-installed in Nutanix hardware and software based encryption. This provides strong data protection by encrypting user and application data for FIPS 140-2 Level 2 compliance.

These security mechanisms enable compliance with data-at-rest encryption requirements set forth in HIPAA, PCI DSS, and SOX standards.

SECURITY DEVELOPMENT LIFECYCLE

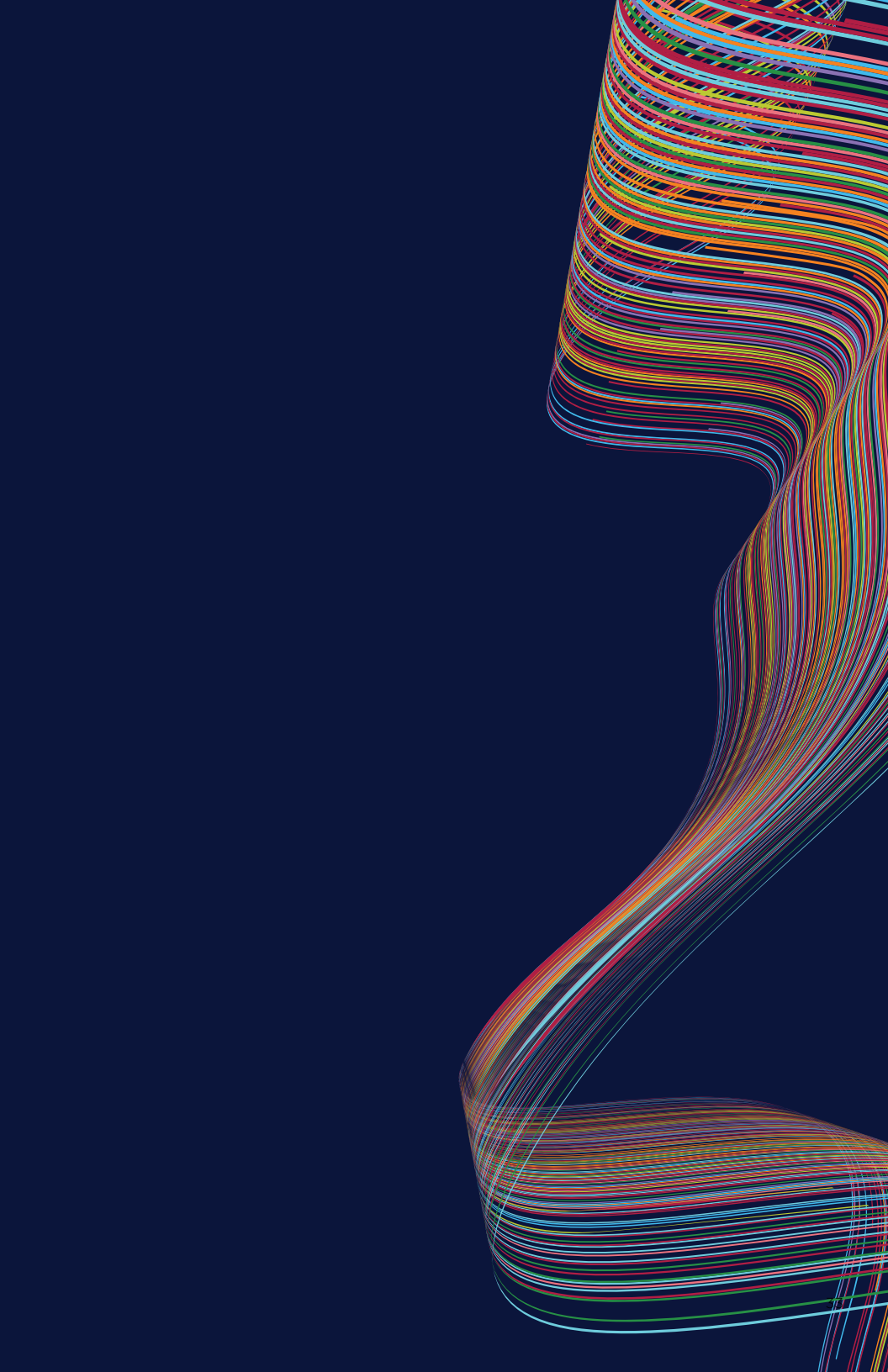
Nutanix uses a unique, well-defined Security Development Lifecycle (SecDL) to incorporate security into every step of the software development process, from design and development to testing and hardening. Embedding security awareness into the software lifecycle ensures that all software releases are secure, without slowing down the overall development process.

Threat modeling is used to assess and mitigate customer risk from code changes. SecDL testing is fully automated during development, and all security-related code modifications are timed during minor releases to minimize risk. The Nutanix Security Technical Implementation Guide (STIG) is written in the eXtensible Configuration Checklist Description Format (XCCDF), allowing it to be read by various automated assessment tools, such as Host Based Security System (HBSS). This provides detailed information on how to assess a Nutanix system to determine compliance with the STIG requirement, cutting down the accreditation time from 9-12months to a matter of minutes.

SECURITY AUTOMATION

Acropolis uses mature and well-adopted open source technology to self-heal any deviation from the security baseline configuration of the operating system and AHV.

Most systems are only fully secure at the time of deployment and immediately after audit. With Nutanix, you can make sure that your systems always adhere to your security baseline. Deviations caused by incorrect or unauthorized changes can be automatically corrected to maintain compliance.



Your Journey to the Cloud

Enterprises making the journey from traditional IT methods to the cloud must first decide whether they'll pursue a private or public cloud strategy or a hybrid strategy combining elements of both. As noted earlier, most enterprises are opting for a hybrid cloud. Enterprises increasingly recognize the value of an enterprise cloud that allows them to support both existing enterprise applications and new, cloud-native applications either on-premises or in the cloud.

On-premises infrastructure is usually the most economical option for predictable enterprise workloads and development needs, while the cloud supports elastic workloads, next-generation applications, and accommodates unforeseen resource needs.

When organizations consider which applications and workloads to run in the public cloud, they often look at the following opportunities first:

- Development and Test. Development work can often be supported economically in the cloud. This is especially true for new projects that might not succeed.
- Disaster Recovery and Data Protection. By eliminating the need for a secondary datacenter with resources dedicated for disaster recovery, DR in the cloud can be very cost-effective.
- Software-as-a-Service. Increasingly, enterprises choose a variety of applications to provide non-critical services. SaaS services can often eliminate much of the infrastructure and administrative overhead, allowing your IT team to focus on services that differentiate your business.

This is not to say that your organization should move these workloads to the cloud, just that most organization see them as potentially low hanging fruit. You should evaluate your needs as described in Chapter 5 before making any decisions.

CREATE YOUR ENTERPRISE CLOUD

When it comes to creating a cloud to meet your enterprise needs, you have two choices: build or buy. If you decide to outsource your cloud, be sure and weigh all the pros and cons and do a careful analysis of the full costs.

If you are building your own cloud, you need to consider your architectural options carefully. Conventional architecture with separately sourced servers, storage, and storage networks may be familiar to your IT team, but it can have significant management overhead and scaling can be difficult. In the end, it may not deliver the agility your business needs.

Many enterprises are discovering that hyperconverged infrastructure—built on the same principles as the big public clouds—provides much greater agility, dramatically simplifies management, and scales more easily. All these factors also make it more suitable for cloud management and self-service software.

The Nutanix Enterprise Cloud may be the ideal IT infrastructure for your cloud needs. Nutanix accelerates your organization's journey to the cloud, turning your datacenter into a flexible and scalable asset. The 100% software-defined, hyperconverged Nutanix solution brings the benefits of web-scale technologies to enterprise clouds at any scale so you can:

- Deploy secure cloud infrastructure in hours with validated turnkey designs
- Reduce administrative overhead with VM-centric operations and centralized management
- Start small and seamlessly scale your cloud to hundreds of nodes
- Use Nutanix Calm for application lifecycle management, cloud orchestration, and self-service
- Easily integrate with other popular cloud and orchestration stacks you may already be using

Nutanix makes infrastructure invisible, elevating IT to focus on the applications and services that power their business. The Nutanix enterprise cloud platform leverages web-scale engineering and consumer-grade design to natively converge compute, virtualization and storage into a resilient, software-defined solution with rich machine intelligence. The result is predictable performance, cloud-like infrastructure consumption, robust security, and seamless application mobility for a broad range of enterprise applications. Learn more at www.nutanix.com or follow us on Twitter@nutanix.

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