intel®

Easily consumable infrastructure and services built on secure, scalable, high-performing Hybrid Cloud

vmware®

Today's global economy is driven by data. Businesses of all types and sizes continually find new ways to drive better decision making and profitability through large-scale analytics based on massive and ever-growing data sets. At the same time, the pace of change continues to accelerate, with greater agility taking on a major role as a driver of competitive advantage. That leaves IT organizations struggling to provide massive computing resources that can turn on a dime, even as their budgets continue to shrink.

> Intel and VMware have teamed together to provide a dynamic, fully automated solution that simplifies your evolutionary path to hybrid cloud. It's time to get started.

Hybrid cloud is an innovative approach to meeting the need to do more with less. Combining the benefits of on-premises infrastructure with those of public clouds, this model is gaining traction as a forward-looking model for businesses as they adapt their existing computing resources to emerging needs. Co-engineered solution stacks from VMware and Intel offer a path forward through this field of opportunity.

Hybrid Cloud Combines the Best of Public and Private Infrastructure

Traditional approaches to building out infrastructure require large, dedicated capital expenditures and long time horizons for planning, acquisition, and deployment. These constraints proved to be incompatible with the need to rapidly commission and decommission resources to support changing service requirements and to provide elastic capacity on demand.

Public cloud services helped address some of these challenges, with on-demand resources provided on a pay-per-use basis. Business customers were able to increase their agility in responding to new business needs, as well as expanding and contracting capacity as needed, without the CAPEX burdens of having to over-provision infrastructure. Still, public cloud is not a panacea; concerns remain in areas such as security, latency, uneven performance, data locality and unpredictable OPEX. And many sensitive or regulated workloads are simply not candidates for execution on public clouds.

Many enterprises operate private clouds to obtain the agility advantages of public cloud while also retaining the control enabled by on-premises data center resources. The limitations of this approach are also clear, however. Private-clouds are ultimately only as elastic as on-premises capacity allows; just as with traditional infrastructure, over-provisioning in advance is required to allow for workload peaks.

Hybrid clouds combine the benefits of both public and private cloud infrastructures, while overcoming many of the disadvantages, as illustrated in Figure 1. This approach involves running a private cloud on-premises that interconnects with one or more public cloud services to provide open-ended capacity on demand. Thus, companies get the low CAPEX and high elasticity of public cloud models, with the low OPEX and high security and performance of on-premises private clouds.

To define a native hybrid cloud environment, both the private and public clouds it encompasses environments should be built on a common foundation. This approach supports smooth workload transition across the private and public parts of the environment and ensures that a single toolset

and skillset apply to both. VMware Cloud Foundation helps enterprises achieve these goals, for high compatibility and a consistent, simplified operational experience for the end user.

Hybrid-Cloud Topology from VMware and Intel

To advance the state of hybrid cloud adoption by mainstream enterprises, Intel and VMware offer a highly optimized hybrid cloud platform that is the product of more than a decade of collaboration. Building blocks from the two companies are co-engineered for simple and cost-effective deployment that delivers a feature-rich topology with excellent performance, stability, and security. Hybrid clouds based on the joint VMware-Intel solution stack power IT transformation for the future-ready enterprise, as illustrated in Figure 2.

The Best of Both Worlds

Private Cloud:
High CAPEX
Limited OPEX
High Security & Performance
Limited Elasticity

Hybrid Cloud:
Limited CAPEX
Limited OPEX
High Security & Performance
High Elasticity

Public Cloud:
Limited CAPEX
High OPEX
High Security & Performance
High Elasticity

Figure 1. Combined advantages of public and private cloud models, based on the same underlying platform.

VMware Cloud Foundation*

Cloud Management

Compute

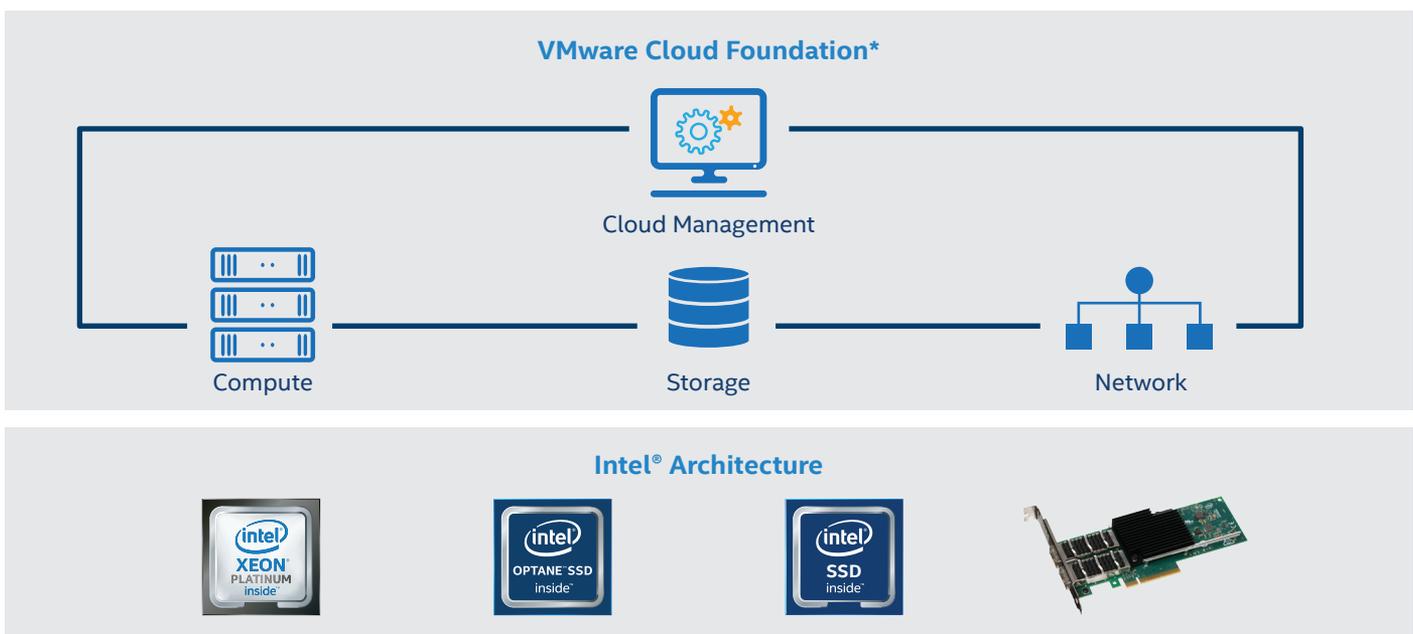Storage

Network

Intel® Architecture

Figure 2. VMware and Intel integrated solution stack for hybrid cloud.

The comprehensive platform includes complementary hardware and software technologies for compute, storage, networking, security, and cloud management, in addition to automation tools for both administrators and end users. The bottom tier of the figure includes Intel architecture-based physical building blocks for processing, storage, and networking: Intel® Xeon® processors, Intel® Optane™ SSDs, Intel® 3D NAND SSDs, and Intel® Ethernet Adapters.

The second tier is comprised of VMware Cloud Foundation*, VMware's hybrid cloud platform, which builds on VMware's two decades of innovation virtualizing workloads on Intel architecture to provide a comprehensive software environment to power hybrid clouds. This platform provides the virtualization mechanisms that decouple processing, storage, and networking from the underlying hardware, while defining them in software. It also includes VMware SDDC Manager*, which automates administrative activities that include deployment, configuration, and provisioning, based on user policy. Other capabilities include tools for admins to choose the timing and scope for the application of patches and upgrades to the environment.

VMware Cloud Foundation* Streamlines Hybrid Cloud Initiatives

Until now, complexity has been a key impediment to the mainstream adoption of private and hybrid clouds. Organizations faced requirements for large commitments in time and expense, as well as the need for scarce technical expertise to select, install, configure, and operate the needed hardware and software. Even successful deployment of a roll-your-own hybrid cloud creates its own challenges for ongoing administration.

VMware Cloud Foundation breaks through that high cost and complexity, providing a better path to hybrid-cloud infrastructure:

- **Dramatically simplifies hybrid-cloud implementation** with a pre-integrated set of components that eliminates guesswork and reinventing the wheel

- **Provides powerful, intuitive administration** with automated lifecycle management based on user policy and compatible with existing processes

- **Offers flexibility and stability** with rich optimization of compute, storage, and networking based on Intel® architecture, using both VMs and containers

The environment is a managed, hyper-converged, and highly secure software infrastructure for running enterprise workloads on any combination of private and public cloud resources.

Co-Engineered Hybrid-Cloud Building Blocks

Every generation of VMware and Intel technologies begins the optimization process in the early engineering stages of both companies' products, and their ongoing joint roadmap will continue to compound those advantages. That optimization encompasses the full enterprise stack, including compute, storage, and networking, as well as automated tools for administration and self-service IT.

Customers can access ecosystem solutions for their specific requirements through Intel® Builders Programs, which deliver reference architectures, whitepapers, solution blueprints, and solution briefs designed to help accelerate infrastructure deployments.

Software-Defined Compute

The complementary technologies behind software-defined compute for hybrid cloud environments are VMware vSphere* and the Intel Xeon Scalable processor. Together, they provide performance gains that are enabled in both hardware and software.

The foundation of vSphere is a bare-metal hypervisor, which runs directly on the server hardware without the overhead of an intervening host OS. It provides management functionality through vCenter* Server and the vSphere web-based administration client. It also includes Platform Services Controller, a service that handles functions such as single sign-on, licensing, and certificate management.

The Intel Xeon Scalable processor is based on a redesigned core microarchitecture and low-latency cache hierarchy. Integrated Intel® Ethernet reduces power consumption and transfer latency, for enhanced data center efficiency.

The combination of vSphere and Intel Xeon Scalable processors delivers a range of enterprise benefits, including the following:

- **Drive cutting-edge performance and scalability** through co-engineering synergies, dynamic scalable capacity, and lower server counts in the data center.

- **Accelerate transformation** to modernized data centers, enabled by hyper-converged infrastructure, greater agility and flexibility, and rock-solid dependability.

- **Automate security across the stack** delivered by complementary hardware and software features, an adaptable security approach, and a consistent posture across the enterprise.

Software-Defined Storage

Enterprises can replace proprietary SANs and the need for specialized expertise with lower-cost, object-based storage based on vSAN, which pools local flash-based storage from multiple hosts into a unified, managed data store. Virtual disks are then provisioned as needed for VMs throughout the environment from that shared resource. This approach also enables a "pay as you grow" approach, adding storage as needed to scale performance with capacity.

Capabilities can be tailored to the needs of the environment through any combination of Intel Optane SSDs and Intel 3D NAND SSDs, tuning the balance between cost, performance, and capacity. Intel Optane SSDs deliver extremely high performance and low latency for the VMware vSAN caching tier. Intel 3D NAND SSDs deliver data integrity, performance consistency, and drive reliability with attractive price/performance characteristics for read-intensive workloads in the VMware vSAN data tier.

Together, vSAN and the Intel SSD Data Center Family provide the basis for software-defined storage that delivers the following benefits:

- **Enhance scalability, performance, and reliability** with high optimization of vSAN on a broad choice of pre-validated and certified Intel® architecture-based servers from leading OEMs.
- **Eliminate storage silos** to enhance the value of enterprise data for conventional and cloud-native applications, using existing server choices and tools.
- **Simplify infrastructure and reduce OPEX** using standards-based hardware, two-click provisioning, and management within vSphere.

Software-Defined Networking

The combination of VMware NSX* and Intel Ethernet Adapters enables software-defined networking, abstracting network resources and applying them on demand.

NSX streamlines network operations with software-based central management across network services, including virtual network functions (VNFs) defined by NSX such as switching, routing, firewalls, load balancing, and VPNs. Virtual networks are spun up on demand, moving workloads around freely. Policy-driven micro-segmentation groups network resources into logical subdomains, increasing East-West data-center security granularity on a per-workload basis. Third-party security services, such as automated IPS and VM anti-malware, can be added to provide additional protection against threats originating from both inside and outside the network.

Intel Ethernet provides reliable, high performance network-packet processing for VNFs and VM workloads. Network virtualization overlays provide a software-driven switching layer that allows seamless migration of virtual servers across the network without physical switch reconfiguration. Intelligent offloads increase network throughput while reducing CPU utilization, both increasing network performance and increasing efficiency.

Software-defined networking based on these building blocks offers the following benefits to enterprises as they implement hybrid cloud models:

- **Enhance agility** with abstracted networks that enable networking and security services to be provisioned almost instantaneously, in lockstep with VM provisioning.
- **Optimize network performance and scalability** with minimized physical network resource requirements and dynamic scale-out of capacity, security services, and analytics.
- **Automate security** by isolating sensitive East-West traffic using micro-segmentation, unifying security posture with centralized policy, and taking advantage of combined, complementary hardware and software measures.

Management and Automation Tools

VMware SDDC Manager for Robust, Automated Administration

Enterprises use SDDC Manager to automate the entire hybrid cloud lifecycle by means of user policy, including deployment, configuration, and provisioning. The platform also monitors logical and physical resources by means of the SDDC Manager dashboard, shown in Figure 3.

SDDC Manager abstracts compute, storage, and networking resources into logical pools called workload domains, which administrators can provision and scale with the assignment of specific availability and performance requirements. Workflows consisting of a defined series of tasks executed by SDDC Manager control processes within the hybrid cloud environment. Simplified patching and upgrades give administrators granular control over the timing and scope of updates. SDDC Manager is also used to deploy additional components such as VMware vRealize* Suite or virtual desktop infrastructure (VDI).

Figure 3. Automation of hybrid-cloud administration with SDDC Manager.

VMware vRealize Suite

VMware vRealize suite is a comprehensive management platform for IT services across private, public, and hybrid clouds. With vRealize Suite, organizations can maintain consistent service delivery and service lifecycle management across heterogenous environments that combine both traditional and container-based applications. It is comprised of the following components:

- **VMware vRealize Automation*** automates delivery of personalized infrastructure, applications, and custom IT services.

- **VMware vRealize Operations*** delivers intelligent operations from applications to infrastructure to help organizations plan, manage, and scale their SDDCs.

- **VMware vRealize Log Insight*** enables real time log management and log analysis.

- **VMware vRealize Business*** for Cloud automates costing, usage metering, and service pricing of virtualized infrastructure.

Conclusion

Hybrid cloud topologies give enterprises the means to tailor resources to the needs of individual workloads, combining the security and performance advantages of on-premises infrastructure with the CAPEX and elasticity benefits of public cloud services. Building blocks from VMware and Intel are integrated and highly optimized to create an engine for transformation based on hybrid cloud. As part of a strategy for decoupling IT from physical constraints, this approach unleashes the potential of the next-generation data center.

Learn More

- Learn about the Intel-VMware alliance

- See the Intel® Builders website for programs that drive the future of the data center.

- Learn more about VMware Cloud Foundation and vSphere Integrated Containers.

- Learn more about the Intel® Xeon® Scalable processors, the Intel® SSD Data Center Family, and Intel® Ethernet Adapters

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