TECHNICAL WHITE PAPER

VMware Cloud Foundation and Pure Storage

Optimized storage for modern hybrid cloud environments.

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Introduction to VMware Cloud Foundation

VMware Cloud Foundation offers immense advantages to data center professionals, enabling you to simplify day 0 and day 1 activities, streamline management operations, and provide agility in deploying and decommissioning new environments within the VMware vSphere ecosystem. Administrators simply provide imaged ESXi hosts and a few DNS/IP address entries as the input and receive a fully functional vCenter domain backed by VMware NSX-T or NSX-V as the output. This domain is immediately ready for whatever use case or use cases are needed by the tenant organization. You can dynamically add or remove additional hosts as requirements change and simply layer other VMware products like Horizon or Pivotal Container Service (PKS) on top of the initial deployment through the common SDDC Manager control plane. Native deployment, integration, and connectivity are also provided with members of the VMware vRealize Suite, also via SDDC Manager.
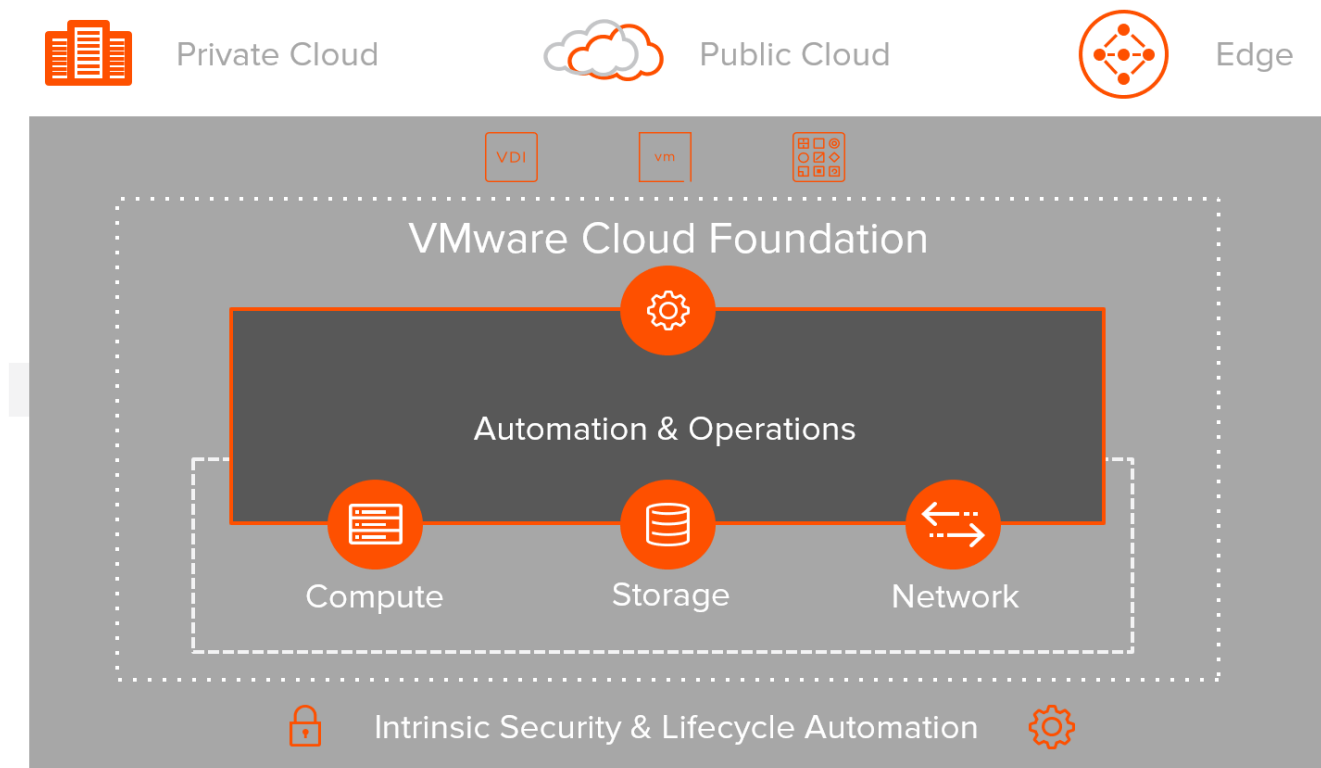

Figure 1. VMware Cloud Foundation architectural overview

Management and Workload Domains

The **Management Domain** supports the control plane for VMware Cloud Foundation. It consists of a minimum of four (or more) ESXi hosts enabled by VMware vSAN. This domain is where core VMware infrastructure components such as vCenter, NSX, NSX Edge Gateways, and SDDC Manager are deployed. SDDC Manager functions as the brain of the entire environment. Use it not only **to spin up or spin down** Workload Domains, but also to orchestrate and track all upgrades of existing infrastructure.

VMware Cloud Foundation deployments all begin the same way: by building a Management Domain with vSAN via the CloudBuilder OVA, which takes a VMware Validated Design (VVD) as input. This methodology ensures consistency in the critical first phase of a greenfield deployment by requiring you to input a predefined set of values into a Microsoft Excel spreadsheet or json file. This minimizes the chance of a mistake and directs you to correct errors before deployment starts.

Workload Domains represent three or more ESXi hosts aggregated in one or more clusters under a single vCenter instance. They are deployed and then managed by VMware Cloud Foundation administrators within SDDC Manager. These units of compute, network, memory, and storage can be rapidly expanded and contracted, upgraded, and orchestrated via integrated connectivity to the vRealize Suite. Once deployed, you can assign Workload Domains to one or more groups of tenant organizations that can then deploy, manage, and use the VMs and applications required for their respective use case(s). A key differentiator between Management Domains and Workload Domains is that Workload Domains allow for other types of principal storage besides vSAN.

A brief description of the differences between principal storage and supplemental storage and how it relates to VMware Cloud Foundation is in order to set the table for the rest of this document. Fortunately, it is very easy to distinguish between the two storage types.

- **Principal storage** is any storage type that you can connect directly to your Workload Domain as a part of the setup process within SDDC Manager. Today, this includes vSAN, NFS, and VMFS on Fibre Channel (April, 2020).
- **Supplemental storage** simply means that you connect your storage system to a Workload (or Management) Domain after it has been deployed. Examples include iSCSI-based storage and vVols (Fibre Channel or iSCSI).

Pure Storage and VMware

You want your technology to be simple, to stay out of the way of getting things done. Pure Storage® [FlashArray™//X](#) accelerates, consolidates, and simplifies running core production applications. And now it does more.

Figure 2. Benefits of Pure Storage FlashArray

Pure focuses on continuous innovation. The third generation of the FlashArray//X family of products and services—now available—provides a truly modern data experience with new features, increased capacity, and performance improvements across the portfolio.

With latency as low as 250 µs, the all-NVMe architecture of FlashArray//X brings new levels of performance to mission-critical business applications: Think faster transactions and more immersive customer experiences. And with built-in Purity ActiveCluster™, more applications can now benefit from the always-on reliability of active-active metro clustering.

NVMe also enables unprecedented performance density at the level required for mixed-workload consolidation in your cloud. FlashArray//X currently supports ultra-dense 18.3TB DirectFlash™ modules, which you can adopt non-disruptively, with full performance. In addition, Purity's always-on QoS feature means you can consolidate radically diverse applications without fear. A shared design consolidates data silos; accelerates production, DevOps, and data analytics; and helps enterprises pivot to a data-focused architecture.

Pure Storage and VMware closely partner to provide a seamless multi-cloud experience for the ever-changing IT landscape and operational requirements that challenge modern day administrators. Featuring deep integration points across a wide variety of VMware products, Pure provides management simplicity, efficiency through automation, and deep analytics. You can immediately use the following integration points with VMware Cloud Foundation deployments:

- vSphere Web Client Plugin
- Virtual Volumes—vVols
- Pure Storage PowerShell Module
- vRealize Operations Management—vROPs
- vRealize Log Insight

- vRealize Automation—vRA
- vRealize Orchestrator—vRO
- Site Recovery Manager—SRM
- Pure Storage VM Analytics

Limitations of vSAN with VMware Cloud Foundation

One of the primary benefits of vSAN is the ability to aggregate compute, memory and storage for simplified management. However, aggregation also includes several challenges within the VMware Cloud Foundation framework, particularly at scale. Pure FlashArray is perfectly suited to resolve these shortcomings.

The first vSAN trade-off is fairly obvious but deserves mention: A vSAN node can only be assigned to a single Workload or Management Domain, which automatically limits its utility to that single domain instance. Meanwhile, you can connect a single Pure FlashArray to one or many Workload Domains, providing density and coverage for use cases of many different types, even potentially across multiple, federated VMware Cloud Foundation instances. Going further, you can set up two FlashArrays with ActiveCluster and provide both your Workload and Management Domains with transparent and automatic failover in the event of an outage.

The other important vSAN trade-off is limited flexibility in deploying data center resources. As VMware Cloud Foundation Workload Domains demand additional resources due to growth, new initiatives, or even as the hosts themselves are refreshed , it's very possible that only more compute, memory, *or* storage may be required rather than all three. However, because of the aggregated nature of vSAN, you are potentially stuck adding all of those resources. One or more might go unused, creating silos and wasting valuable data center resources.

Pure Storage provides undeniable advantages for VMware Cloud Foundation Workload Domain clusters at scale:

- Superior data reduction to minimize data center footprint
- All-NVMe performance allowing for VMs and applications to achieve results faster
- 99.9999% availability to ensure that your most critical workloads stay online where they belong

Using Pure Storage FlashArray with VMware Cloud Foundation

This section provides executive summaries of scenarios available today for using VMware Cloud Foundation with Pure Storage. Each section title includes a link for more detailed, step-by-step instructions.

Principal Storage: VMFS on Fibre Channel

As of the 3.9.0 release, VMware Cloud Foundation supports VMFS on Fibre Channel (FC) as a principal storage option for Workload Domain deployment. Figure 3 shows the selection screen within the Workload Domain Deployment Wizard.

Figure 3. Use the Workload Domain Wizard to select your type of storage.

Figure 4 shows the steps for a VMFS on FC Workload Domain deployment. What's important to note about this workload type is that it requires some pre-work to set up a VMFS on FC datastore on the Workload Domain hosts prior to deploying the Workload Domain itself within SDDC Manager.
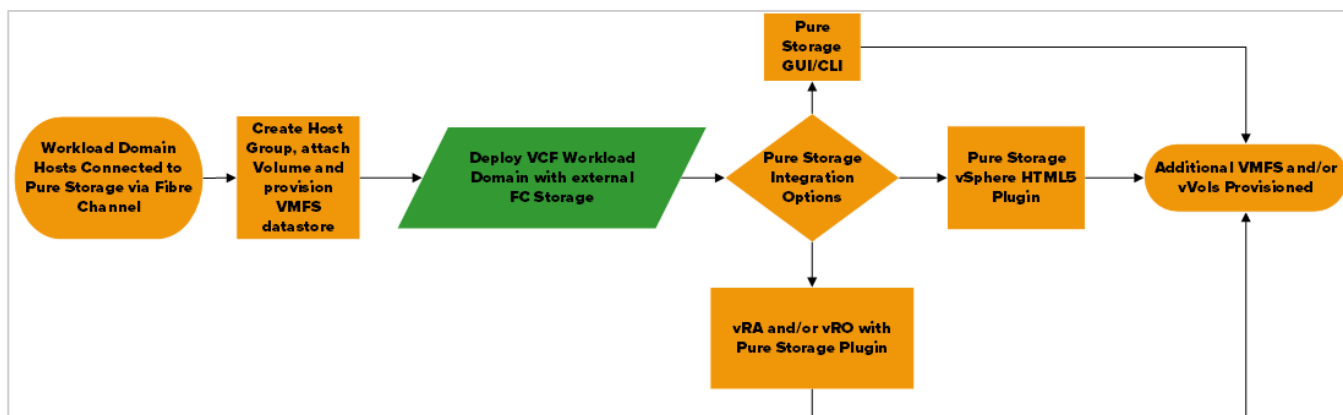

Figure 4. VMFS on Fibre Channel Workload Domain Deployment

You can accomplish the pre-work accomplished in a few ways, but the easiest is with the Pure PowerShell module with the Initalize-PfavCfWorkloadDomain cmdlet. This cmdlet:

- Takes in a comma-separated list of ESXi FQDNs/IPs, their credentials, a datastore name, a size, and a FlashArray connection
- Connects directly to each ESXi host directly, gets their FC WWNs, creates a host object on the FlashArray for each
- Creates a host group and adds each host
- Creates a new volume of the specified size
- Rescans one ESXi host and formats it with VMFS
- Rescans the remaining hosts
- Disconnects from the hosts
- Cleans up anything it did, if any step fails

Principal Storage: VMFS on Fibre Channel with Pure Storage ActiveCluster

The beauty of ActiveCluster is that it provides fully transparent failover and data resiliency between two arrays with only a couple of additional steps beyond setting up VMFS on FC (previous section) that are outlined in Figure 5.
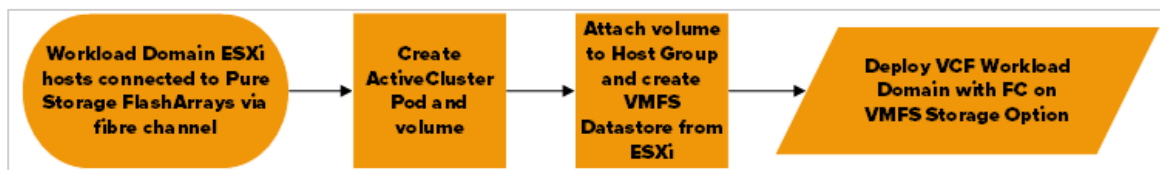

Figure 5. VMFS on Fibre Channel with ActiveCluster

In summary, the only thing you need to make ActiveCluster operational for VMFS on Fibre Channel is a second fibre-channel–based array with the proper replication network enabled. You can then move the VMware Cloud Foundation VMFS volume to be used into a pod that is stretched between the Workload Domain ESXi hosts.

Supplemental Storage: iSCSI

Using Pure Storage with iSCSI is fully supported for use in Workload Domains, although the deployment procedure (Figure 6) follows a slightly different path than VMFS on FC. Customers can use the NFS Workload type by making an NFS share available via something like a Pure FlashBlade™ or a Linux VM with NFS configured. An important requirement is that the NFS share must be routable to the SDDC Manager management network VLAN.

You can also use the vSAN Workload type with Pure Storage iSCSI (or any other protocol, for that matter). Because that often requires additional local disk hardware and licensing costs, the bulk of Pure customers use the NFS storage type to better utilize vSAN-ready nodes elsewhere in the business.
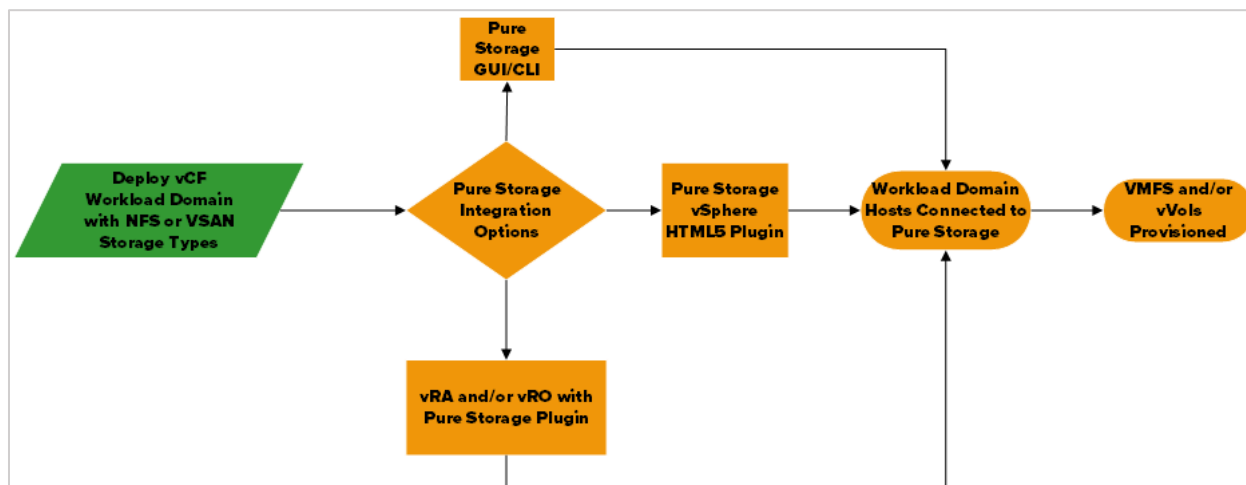

Figure 6. Deploying Workload Domain with NFS or VSAN

Supplemental Storage: vVols

Implementing vVols as Supplemental Storage within VMware Cloud Foundation is no different from the same operation in traditional vCenter deployments. Pure has multiple ways to simplify this deployment from either the GUI or command line. Once the Pure Storage vSphere Plugin is installed, for example, the basic setup for implementing vVols with it goes:

```
       Register Array → Register VASA Provider → Create vVols Datastore.
```

Once you completed these three steps, all the benefits of vVols (as well as VMFS after the array is registered to vCenter) are unlocked and available. This includes importing Protection Groups from the Pure Storage FlashArray, individual disk recovery/import to a different VM, VM undelete, and using SPBM for policy-driven VM and application placement based upon considerations like the VM tier or level of protection required.

In short, vVols enables you to use FlashArray in the manner in which it was intended, by unlocking granular operations at the VM and application level and offloading storage-based operations to the storage array, freeing valuable vCenter resources for other needs.

Conclusion

Throughout this document, we have showcased how straightforward it is to use VMware Cloud Foundation with Pure Storage for your on-premises operations. Dexterity and the capability to rapidly respond to asks from the business are the yardstick by which IT departments are measured against more and more. We feel strongly that the combination of these two best-of-breed products provides the framework customers need to shine in this business reality.

Additional Resources

- Check out the VMware Platform Guide for more information on all things Pure Storage and VMware.
- Access the latest VMware Cloud Foundation and Pure Storage content.
- Learn more about Pure Storage FlashArray//X.

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