Why Run Modern Apps on VMware Hyperconverged Infrastructure

Silverton Consulting, Inc. StorInt™ Briefing

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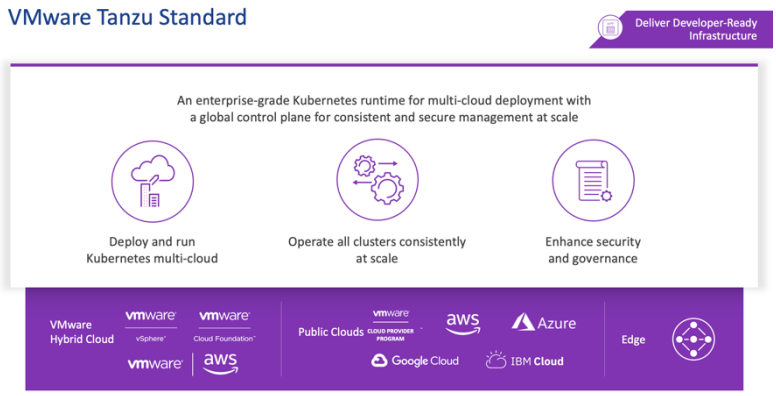
Introduction

Cloud native modern applications are taking over IT. They run anywhere, evolve overnight and scale rapidly. In contrast, enterprise applications run in one environment, rarely change and scale only with great difficulty.

The promise of the cloud, with its infinite processing, storage, and networking capacity, is extremely enticing to enterprise organizations. However, migrating enterprise applications to the cloud can be a massive undertaking. One alternative is to convert enterprise applications to modern applications which can run natively in the cloud.



However, there are other reasons to modernize applications such as, to add multi-cloud capabilities, to implement edge/IoT services and to start lights out, automated operations.

Fortunately, **VMware vSphere® with Tanzu**, together with **VMware vSAN™ hyperconverged infrastructure** (**HCI)** systems, can help enterprises migrate to modern applications. Tanzu and vSAN can enable organizations to run all the enterprise applications they need and start the transition to modern applications by executing both on the same infrastructure.

The advantages of modern applications

Modern applications consist of a multitude of containers that run microservices which interact with each other and work together to implement application functionality. An orchestration framework controls where and how these containers run. Over time, the Kubernetes® (K8s) framework has become the industry standard.

K8s, together with continuous integration/continuous delivery (CI/CD) tooling, stages the rollout and testing of new microservices and rolls releases back when needed. K8s containers run on pods or server nodes, and multiple pods combine to make a cluster. K8s namespaces can be used to carve up a single cluster into multiple virtual clusters.

Traditionally, containers ran stateless, meaning they did not need persistent data or state. However, enterprise applications use data and will require stateful containers to access Persistent Volumes (PVs) data. K8s uses Container Storage Interface (CSI) drivers to connect PVs to infrastructure storage.

K8s can use a declarative operations model, which contrasts with the traditional imperative (GUI/CLI) one widely deployed today. Declarative operations use scripts or files to identify modern app infrastructure needs. Using a declarative approach means operations and DevOps can take advantage of extreme automation to run modern apps on K8s

Another advantage of modern apps is that they can be built once and run anywhere. An organization can develop modern apps using Cloud Native Computing Foundation (CNCF)-compliant K8s services

running in AWS© EKS, Microsoft® AKS, GCP™ GKE™, vSphere with Tanzu, VMware Cloud Foundation™ or a host of other systems and then move those apps to another environment to execute in minutes.

Why Enterprise Organizations need to shift to modern applications now

While system infrastructure and other software change frequently, enterprise apps essentially stand still. Of course, it is possible to update enterprise apps so that they work with the latest system infrastructure update. However, these updates take substantial time and effort, and all they do is reset the clock until the next update is required. Deteriorating responsiveness, application disruption and customer frustration are common as a result.

Alternatively, IT can turn enterprise apps into containerized modern apps that run under K8s. Following this conversion, the apps will be able to do the following:

- Be deployed and updated automatically,
- Scale from single instances of microservices to hundreds of instances within minutes, and
- Be built one time and run-in hundreds of different locations/environments/clouds.

This last point deserves further expansion. Modern apps are increasingly being used to support customer multi-cloud requirements. What multi-cloud means to each customer varies but in essence, customers want the **option** to run their applications on any cloud.

Moreover, as customers start to make use of IoT, being able to rapidly deploy, run and manage modern applications across a multitude of edge environments is crucial to IoT success. All these capabilities can be facilitated by modernizing apps.

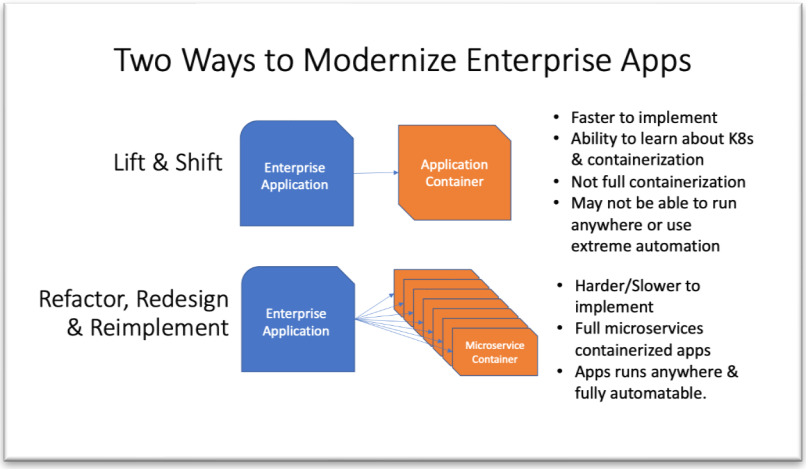
However, often the challenge with edge/IoT apps is the need for real time/near real time transaction latencies or high data bandwidth. Latency and bandwidth requirements will dictate infrastructure residing close to edge devices AND under ITs direct control. Modernized IoT applications can be easily deployed and moved to any local infrastructure needed to support edge device requirements.

In addition, as 5G communications ramp up around the world, providing broadband services, in a timely manner, will require functionality to reside in edge data centers. Like IoT above, 5G services need high bandwidth, and low latencies but they also demand scalability. For instance, it's hard to predict when a crowd will gather to record activities or use other advanced 5G services that surge bandwidth demand, beyond normal use. Modern apps are tailor made to support the service scalability required for 5G success.

Updating enterprise apps to run as containers, though challenging, is worthwhile in the long run -- particularly when considering that constant enterprise app updates are merely band-aid solutions that also require significant time and effort.

Enterprise application modernization

Two common approaches to converting enterprise applications to modern apps include a **lift and shift** containerization model and a **refactor, redesign and reimplement** containerization model.



The lift and shift model deposits current application functionality, mostly unchanged, into a container. This process is not as simple as it seems, as adjacent software may require containerization as well. However, lift and shift can be the quickest route to something resembling containerization, and it has the added benefit of giving development teams an opportunity to gain experience using K8s orchestration and tooling.

The refactor, redesign and reimplement model, on the other hand, involves a complete re-architecture of application functionality into microservices that are then implemented as containers. This model takes more time and effort but, in the end, achieves a fully containerized modern application.

Some organizations use lift and shift as a temporary expedient or as a solution for only a few apps. After a while, those organizations usually begin the process of refactoring, redesigning and reimplementing their applications.

Modern apps on VMware

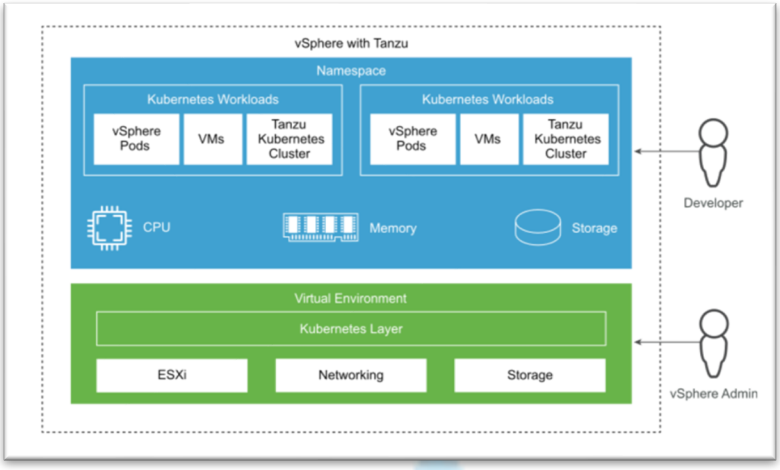
VMware has incorporated K8s functionality into vSphere and recently launched vSphere with Tanzu, a fully CNCF-compatible K8s service. It's the fastest and most efficient way to get started with Kubernetes workloads. The service comes standard with VMware Cloud Foundation and is also available as a vSphere add-on.

Prior to Tanzu, a K8s cluster could be run standalone within a single VM, but this solution required operational expertise and wasn't scalable. VMware vSphere with Tanzu, part of the vSphere 7.0 release, allows K8s clusters to be created across VMware ESXi hosts.

Converting enterprise apps to modern apps on VMware are an easy path to modernization because of:

- **Ease of management** – admins are already familiar with vSphere management and Tanzu, operations has been embedded into vSphere. This means current operators can support IoT/edge instances, data centers and public cloud environments running modern apps.
- **Ease of running both enterprise and modern apps –** with Tanzu, IT can run both their enterprise apps and modern apps on the exact same infrastructure**.**
- **Ease of migration** – modern apps on Tanzu can be easily migrated to multiple edge, data center and cloud infrastructures with no change.

Further, VMware now offers Tanzu Mission Control, a cloud based, K8s as a service solution that allows IT to provision, deploy, and manage K8s clusters running in vSphere, VMware Cloud Foundation, Amazon AWS, Microsoft Azure, Google Cloud Platform, VMware Cloud on AWS and Azure VMware Solution.



As discussed earlier, Tanzu management has been incorporated into vSphere operations and adds new entities to vSphere:

- **vSphere pods**, a single VM that is equivalent to a K8s pod and that runs one or more containers,
- **Supervisor cluster**, a vSphere cluster enabled for Tanzu processing,
- **Tanzu Kubernetes Cluster**, a K8s cluster running across vSphere pod VMs,
- **vSphere namespaces**, equivalent to K8s namespaces that allows a single Tanzu Kubernetes Cluster to be carved into multiple virtual clusters, and
- **Tanzu Kubernetes Grid Services**, which are used to provision and deploy Tanzu Kubernetes Clusters across a Supervisor cluster.

VMware vSphere with Tanzu supports all the processing, networking and storage services required to run K8s modernized stateful applications. VMware provides a CSI driver for K8s to link container storage requests to vSphere storage using the Cloud Native Storage (CNS) control plane. Together, VMware CSI driver and CNS control plane provide the glue and APIs required by modern apps to access vSphere storage for PVs. VMware vSphere with Tanzu uses first-class VMDK disks for PVs. These disks persist beyond the life of a container running across a Tanzu Kubernetes Cluster.

However, to fully support stateful container scaling, one needs to use software-defined storage. To that end, VMware offers vSAN, the premier software-defined storage for VMware, and can supply all the data services required by any modern application running on prem or in the cloud.

VMware vSAN is native to vSphere and runs on Dell EMC VxRail, a jointly engineered, turnkey appliance as well as over 500+ vSAN ReadyNodes, available from every major server OEM. vSAN also comes standard with VMware Cloud Foundation, VMware's full-stack HCI solution.

VMware vSphere Pods support three types of storage: ephemeral, PV (data storage) and container image (repository) VMDKs. Ephemeral and container image storage are supplied by the Supervisor Cluster.

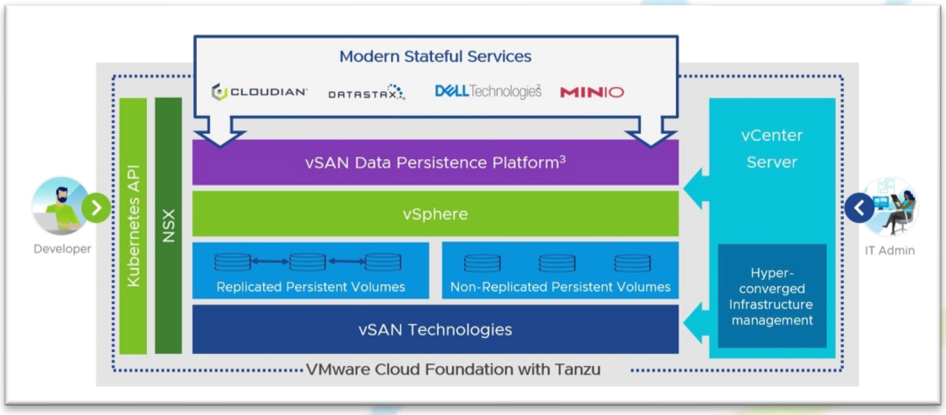
VMware vSAN offers K8s PV storage services that include the following:

- **vSAN ReadWriteMany (RWX) file storage service** for containers, provides file storage under vSAN and supports SMB2.1, SMB3, NFSv3 and NFSv4 through the vSAN Distributed File System (DFS) layer. These services create a scalable, resilient file service for container access.
- **vSAN ReadWriteOnce (ROX) storage service** for containers, provides ROX storage for containers using vSAN services.

PVs can make use of vSAN storage policy attributes such as failure to tolerate, IOPS limits and Flash Read Cache Reservation to supply storage policy-based management for modern app data.

With VMware Cloud Foundation, vSAN offers one additional storage service not available in vSphere with Tanzu alone: the vSAN Data Persistence Platform (DPp), which supplies object storage for both enterprise apps and modern apps. Object storage is increasingly used because the volume of data processed by AI, genomics and analytics applications has grown significantly.

VMware uses Cloudian HyperStore®, DataStax, Dell® ObjectScale and **MINIO**® Object Storage software partners as part of DPp to offer object storage on top of vSAN. VMware vSAN DPp offers two modes of operation:



- **vSAN Shared Nothing Architecture**, which uses standard vSAN services to support the underlying storage for DPp data.
- **vSAN Direct**, which uses a fast path storage interface to support higher performing storage that depends on dedicated, storage-intensive vSAN clusters (see HCI Mesh below).

With either approach, vSAN DPp provides all the object storage services required by any application to store and process enormous amounts of data.

VMware vSAN offers many other services to support modern apps. For instance, VMware vSAN offers two different types of scalability:

- **HCI Mesh** allows vSphere nodes to access vSAN storage in remote clusters. HCI Mesh also supports scaling of compute separately from storage as well as storage-intensive vSphere clusters.
- **HCI Clusters** allows servers with both compute and storage running vSAN software to scale both storage and compute together by simply adding more nodes to a cluster. Users can also expand cluster storage by adding drives to existing nodes.

VMware vSAN DFS can utilize Microsoft Active Directory (AD) services that allow for AD authentication of SMB file access or Kerberos authentication of NFSv4 file access to secure access to vSAN file data.

In addition, VMware can back up and recover Tanzu Kubernetes Cluster resources using Project Velero, a VMware open-source plugin that provides APIs for automated backup and on-demand restore of Tanzu Kubernetes Cluster metadata and container PV data.

Summary

Modern apps are the future. Containers running on K8s have become the de facto standard for the exponentially increasing number of scalable search, social media and anything as a service (XaaS) applications.

Enterprise applications were developed to run on specific infrastructure and were designed to support a limited number of users. Moreover, they require extensive, ongoing operations support. These enterprise applications can run as long as the infrastructure continues to exist but updating them is a labor-intensive task.

VMware vSAN deployment options, including Dell EMC VxRail and VMware vSAN ReadyNodes, can be tailored to run any workload and scaled for modern app execution. The combination of vSphere with Tanzu and vSAN can supply all the hardware, software and storage needed to enable easy migration of enterprise applications to modern applications.

Finally, organizations with enterprise apps that want to modernize can use vSphere with Tanzu and vSAN storage to bridge the transition to modern apps. With CNCF-compliant K8s services running under vSphere and software-defined storage in vSAN, enterprise IT has exactly what it needs to take advantage of everything the modern apps world has to offer.

Silverton Consulting, Inc., is a U.S.-based Storage, Strategy & Systems consulting firm offering products and services to the data storage community.