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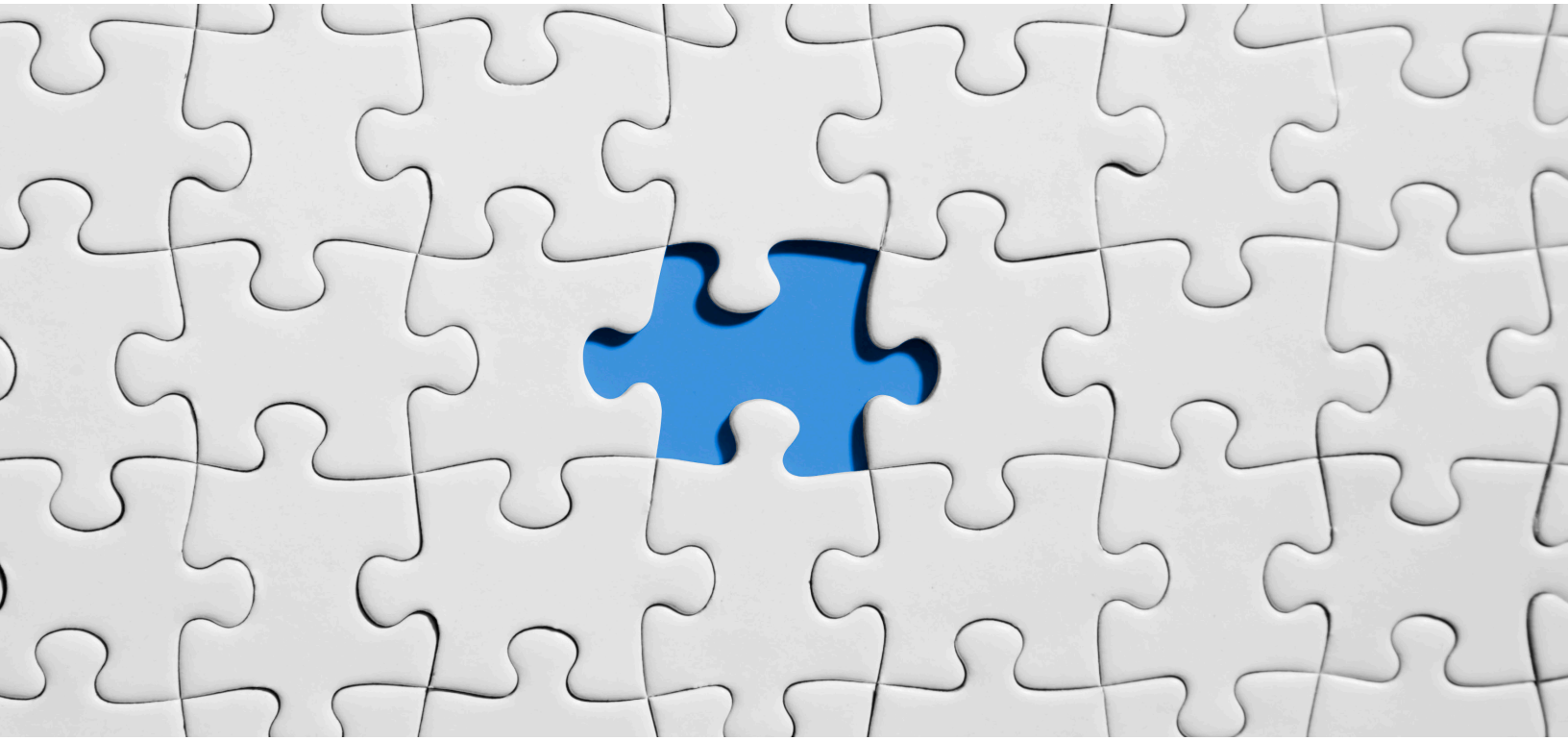
APPLICATION MODERNIZATION USING VMWARE TANZU



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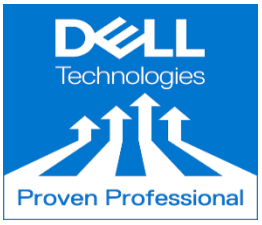

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1. Introduction

Applications are central to an organization's digital transformation efforts to generate new revenue streams by delivering personalized digital experiences to their customers. Enterprises are modernizing their applications to compete effectively and embrace the full potential of cloud environments.

Organizations face multiple challenges along their journey to modernize their applications. Examples include cloud migration (a time-consuming and expensive process), lack of expertise and experience to manage next-gen container workloads, lack of global-scale central management of the applications, insufficient developer experience, etc.

VMware has introduced the VMware Tanzu portfolio to address these challenges. Tanzu offers full-stack modernization, enabling you to transform your teams and your applications, while simplifying operations of your software across the multi-cloud infrastructure. This article discusses the importance of application modernization, the challenges and how VMware Tanzu effortlessly takes you through this transformation journey.

2. Evolution of application modernization

2.1 What is application modernization?

Application modernization is a process an organization performs to create new business value from existing, aging applications by updating them with modern features and capabilities. By migrating legacy applications, one can include the latest functionalities that better align with one's business needs. Organizations are looking for rapid innovations that enable new business models, optimize business processes, and respond to new regulations. Some of the modernization strategies involved include re-platforming, re-hosting, re-coding, re-factoring, re-architecting, re-building, or replacement and retirement of your legacy systems.

Mainframe to cloud Journey

The digital era started with mainframe infrastructure, an age-old legend that has been around since the dawn of computing. In the current cloud computing age, mainframe infrastructures are slowly phasing out. Reasons include the cloud's low cost of ownership, quick deployments, harmless upgrades and infinite portability, i.e. access to your data is only limited by your ability to access the internet.

2.2 Why are organizations modernizing?

- **Cost Avoidance**: Modern applications enable low operational expense (management and scalability) which reduce overall cost of modernization in long run.
- **Staff Productivity**: Modernized applications improve employee productivity due to lower application incidents, automation and new features and functionalities.
- **Customer Experience**: Improved customer experience through new services and processes with simple and more user-friendly interfaces.

- **Take advantage of innovations offered by cloud:** Organizations are trying to move workloads to the cloud and deploy applications on the cloud to take full advantage of capabilities introduced by cloud-like operations.
- **Manage the growing volume of software vulnerabilities:** While the number of legacy applications grows, the technical debt also grows which adds to management overhead and security threats. Modernization can avoid such vulnerabilities.

2.3 Container Adoption

With this rapidly evolving application ecosystem, the number one trend around application modernization is the concept of Containers.

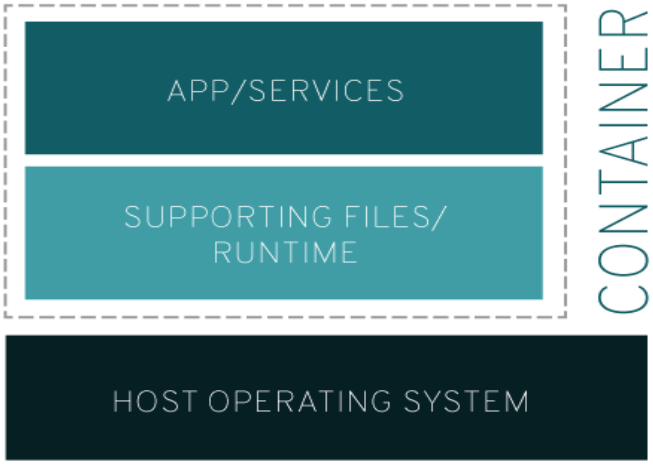

Figure 1 – High-level architecture of a container

Consider a container as a mini-virtual machine (VM) which is a self-contained, machine-agnostic unit that can be installed anywhere. The only difference is it does not possess all the components of a VM and is much smaller and exceptionally lightweight.

Containers take all of the tools, technologies, and code required to run an application to create a single, portable package. Since containers are isolated OS processes that can run anything, they enable flexibility and choice for businesses that may have previously been tied to a single operation.

With the agility and flexibility that a container exhibits comes an inherent problem of "need for orchestration" such as automated resource provisioning, control, automated deployments and updates, managed services, etc. Orchestration tackles these problems. This is where Kubernetes comes in.

2.3.1 Kubernetes

Kubernetes is a container orchestration tool that provides a platform for automating deployment, scaling and operations of containers across clusters. Below are some Kubernetes orchestration capabilities:

- Orchestrate containers across a multiple-host environment
- Resource provisioning such as memory, CPU or storage when required

- Control and automate application deployments and updates
- Scale containerized applications and their resources on demand
- Health-check and self-heal your apps with auto-placement, auto-restart, auto-replication, and autoscaling.
- Declaratively manage services, which guarantees the deployed applications are always running the way you intended them to run.

Now that we are familiar with how application modernization has evolved and the new age technologies enabling it, let's discuss some of the challenges expected in this process.

2.4 Challenges of modernization

- **Modernizing cost and duration –** It is obvious that there will be some cost and time involved in modernizing your legacy applications, the specific challenge being the difficulty in balancing your decisions between existing technical challenges and budget constraints.
- **Lack of Skills –** Breaking down legacy components and their interdependencies is not a straightforward task. Hence, there is a need to have the necessary workforce with strong knowledge and understanding of legacy applications.
- **Integration of On-Premises and Cloud Infrastructure –** Many organizations are migrating their legacy applications from on-prem to cloud. The biggest challenge here is that most of the legacy applications were developed and deployed with on-prem infrastructure. Migration to cloud would involve leaving behind existing hardware, software, servers, etc. Therefore, organizations need a migration strategy that involves seamless integration of on-prem and cloud infrastructure.
- **Aligning the Applications with the Current Business Needs** – As important as it is to modernize legacy applications, it is also important to check if the choices made will align with the organization's business need.

2.5 How do you make this transformation?

Addressing these challenges requires a technology that will lead the modernization journey on the aspects of "Build, Run and Manage". This is where VMware Tanzu comes into the picture. It offers full-stack modernization which enables you to transform your legacy applications, while simplifying operations of your software across multi-cloud infrastructure centrally, securely and at scale.

3. VMware Tanzu Overview

Organizations around the world are moving their applications to cloud-like or containerized architecture to modernize their applications as the legacy systems have reached their limits on innovation. Although they serve business SLAs like agility, reliability and performance these monolithic architectures are ripe for cloud modernizations around scaling, operations and ease of deployment. That said, simply lifting and shifting legacy applications onto containerized infrastructure with Kubernetes will not achieve the benefits of modernization. A new way of thinking is needed to realize the desired outcomes. Kubernetes has emerged as a ubiquitous infrastructure that can connect developers and IT operators and has become the de facto standard to deploy and operate containerized applications. However, the flexibility of Kubernetes can make it hard to deploy and use in large organizations. It needs a secured, opinionated experience before it can be widely adopted in production. The best platform that can do this is the VMware Tanzu portfolio.

VMware Tanzu is a family of products and services for building, running and managing modern apps on any cloud and continuously delivering value to customers. The portfolio simplifies multi-cloud operations running Kubernetes clusters and enriches the developer experience. It enables developer teams and operations teams to work together in innovative ways that deliver transformative business outcomes. It brings together the VMware technology and expertise to help customers build modern applications and run a common Kubernetes framework across clouds and manage their entire footprint from one point of control. The portfolio is spread across three major categories – Build, Run and Manage – each having a set of services and functionalities that provides a development framework, application runtime and modern infrastructure as shown below.

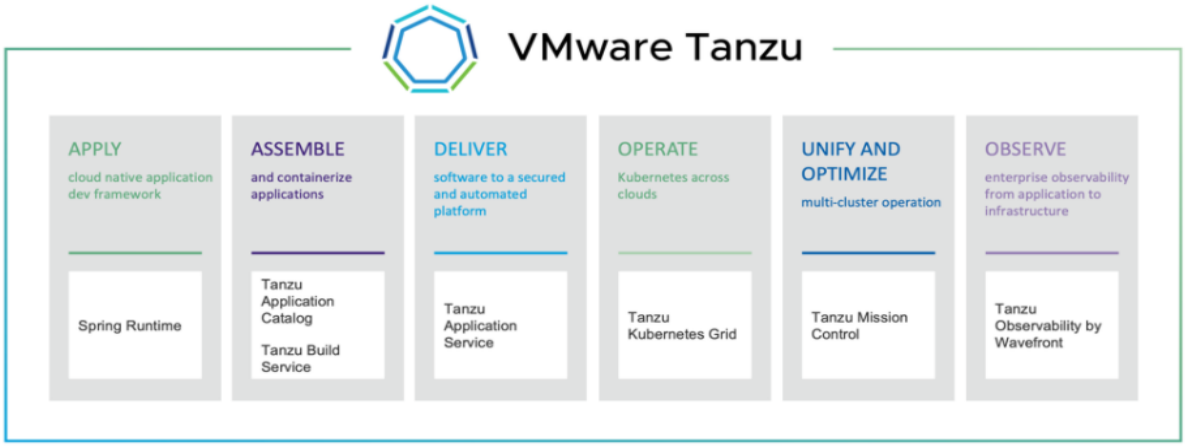

Figure 2 - Tanzu Portfolio

In essence, the portfolio is positioned such that it can offer services to customers simultaneously from application down to infrastructure up.

- The Development framework offers the Java-based Spring framework and .net core which is widely used across the developer communities.
- Application Runtime is offered by Tanzu application service (TAS), Tanzu Kubernetes Grid (TKG) and vSphere on Kubernetes.
- All these development clusters can be managed by Tanzu Mission Control that applies Kubernetes to bring developers and operators closer together then apply for access, back-up, security and more to individual clusters or groups of clusters

This next section takes a closer look at each component that is part of the Tanzu portfolio and how it will help organizations in their application modernization journey.

4. VMware Tanzu Portfolio

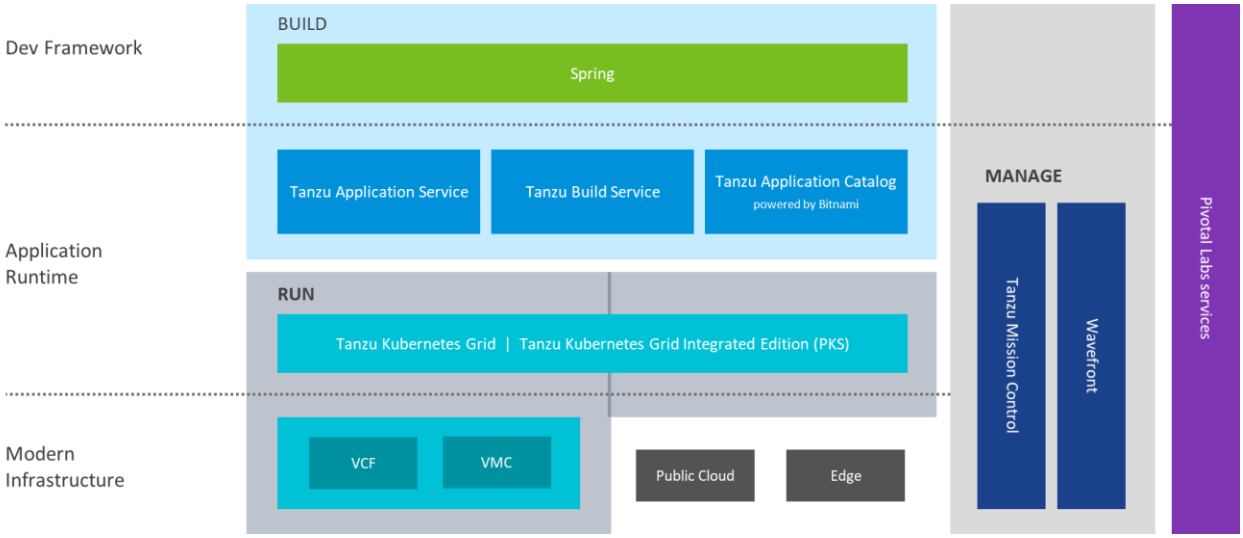

Figure 3 - Tanzu Portfolio Breakup

4.1 Build

VMware Tanzu Portfolio offers three different products that provide a production ready open-source catalog, a service that offers secure, consistent container builds and a service that automates the application life cycle. Here is how these products come together to simplify the development stage of an application.

4.1.1 Tanzu Application Catalog

This is a catalog that contains hundreds of open-source containers based on the public Bitnami catalog that developers can choose from. This Tanzu application catalog enables you to select the pieces that your organization requires and further customize those applications based on your requirement. You can then further deploy that catalog in your private repository in a secured and validated fashion. That way, your developers can grab those open source containers and build applications and run rather than building from scratch or grabbing them from an insecure environment.

4.1.2 Tanzu Build Service

Once you create an application code, you would want to containerize it. Tanzu Build Service offers cloud-native build packs that turn the application source code into container images. Here, the images refer to the source of the application, build time environment and registry destination. This Build Service basically executes reproducible builds that align with modern container standards, and additionally keeps images up to date thereby orchestrating the entire image lifecycle. Tanzu Build Service helps you develop and automate containerized software workflows securely and at scale while reducing operational overhead.

4.1.3 Tanzu Application Service

Once the containerized applications are ready, you need to run them on a secure platform optimized to support these modern applications, which offers APIs, turn-key microservices and simplicity of push-button deployment, termed "**cf push**" experience. This cf push performs various tasks on behalf of the IT teams such as:

- Uploads your code to the system
- Detects and installs required runtime and middleware
- Containerizes your app, packaged with dependencies
- Sets up a route or URL
- Creates SSL termination
- Creates a load balancing entry
- Starts your app in a healthy state, with the desired number of instances
- Binds specified backing services
- Creates health monitoring and logging subsystems

This application lifecycle automation and simplicity is what Tanzu Application Service offers.

4.2 Run

VMware Tanzu Portfolio provides a compatible and consistent infrastructure to deploy and run your applications smoothly.

4.2.1 Tanzu Kubernetes Grid

Once we have all the services necessary for application development, we need to ensure that the modern applications built thrive on the required modern infrastructure. Tanzu Kubernetes Grid (TKG) provides organizations with a consistent, upstream-compatible, regional Kubernetes base that is ready for end-user workloads and ecosystem integrations TKG can be deployed and run on any environment datacenters (SDDC) and public cloud environments, including vSphere, Microsoft Azure, and Amazon EC2.

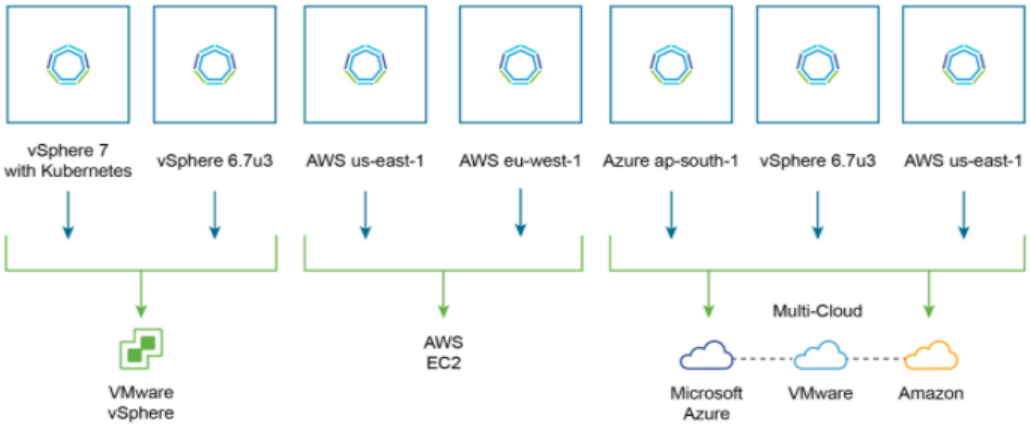

Figure 4 - Tanzu Kubernetes Grid deployment on various environments

4.2.2 Tanzu Kubernetes Grid Architecture

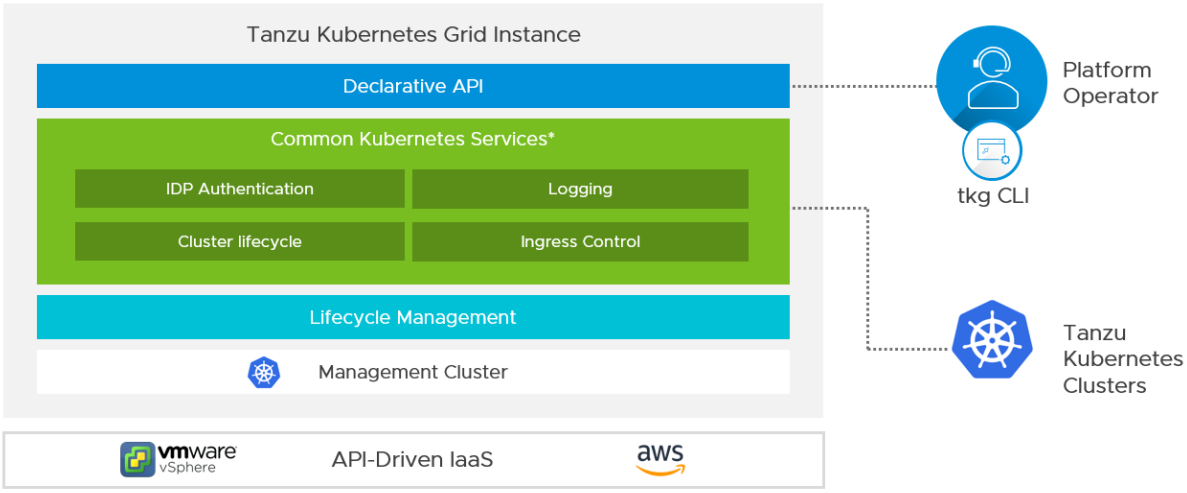

Figure 5 - Tanzu Kubernetes Grid Architecture

Components

I. A **Management cluster** is the first element deployed when creating a TKG instance which performs the role of the primary management and operational center for the TKG instance.
II. Next, deploy **conformant Kubernetes clusters (CNFC)** and manage their lifecycle. These clusters handle application workloads, that can be managed through the management cluster.
III. The cluster deployment configuration is defined by the **Tanzu Kubernetes Cluster Plan** which provides a set of configurable values that describe settings such as the number of control plane machines, worker machines, VM types, etc., needed for its deployment.
IV. Authentication and authorization of Tanzu Kubernetes clusters, logging, and ingress control are all managed by **Shared and In-cluster services**.

All of the above components come together to form a full deployment of Tanzu Kubernetes Grid called the **Tanzu Kubernetes Grid instance**.

4.2.3 Benefits of Tanzu Kubernetes Grid

- Tanzu Kubernetes Grid offers consistent Kubernetes clusters that are built on trusted upstream and community projects and delivers a Kubernetes platform that is engineered and supported by VMware so that you do not have to build your Kubernetes environment by yourself.
- It also has a special native awareness of the multi-cluster paradigm, not just for clusters, but also for the services that your clusters share.
- Along with the Kubernetes binaries that are tested, signed, and supported by VMware, it also provides services such as networking, authentication, ingress control, and logging that a production Kubernetes environment requires.

4.3 Manage

VMware Tanzu Portfolio also provides products to optimize multi-cluster operation and enterprise observability from application to infrastructure. This section explores the different products that enable management of the infrastructure.

4.3.1 Tanzu Mission Control

VMware Tanzu Mission Control is a centralized management platform for consistently operating and securing Kubernetes infrastructure and modern applications running on multiple clouds and operated by multiple teams. It's one of the offerings offered by VMware cloud services which emphasizes increased security and governance ensuring consistent management and operations. This comprehensive API-driven cluster management platform allows teams to manage all Kubernetes clusters from a single point of control, regardless of where they are hosted. Some of the cluster management capabilities include:

- **Cluster Lifecycle Management** – Customers can connect to their own cloud provider account to create new clusters, resize and upgrade them, and delete clusters that are no longer needed.
- **Cluster Observability and Diagnostics –** A single console that gives details about health, resource use and cluster details namespaces, nodes, and workloads directly from the Tanzu Mission Control console.
- **Cluster Inspections –** To ensure consistency over the fleet of clusters preconfigured inspections can be run in clusters powered by Sonobuoy, a Kubernetes diagnostic tool.
- **Data Protection –** Back up and restore data resources in clusters powered by open-source platform Velero.
- **Access Control –** Federated Identity management to apply granular role-based access control to adhere to security requirements.
- **Policy Management** – Eliminates the need for manual management of the Kubernetes resources for applications by letting users create policies to consistently management their clusters, namespaces, and workloads.

4.3.2 Tanzu Service Mesh

Tanzu Service Mesh, built on VMware NSX, provides consistent control and security for microservices, end-users and data across all clouds and clusters in the most demanding multi-cluster and multi-cloud environments. It extends mesh capabilities such as discovery, connectivity, control, security and observability to users and data and enables implementation of consistent application-layer traffic management and security policies across all clusters and clouds. This can be integrated by Tanzu Mission Control, VMware Enterprise PKS, or VMware Tanzu Kubernetes Grid.

4.3.3 Tanzu Observability

Tanzu Observability offers enterprise-grade observability and analytics at a massive scale with granular controls, enabling customers to render monitoring as a service to all their DevOps teams, including developers and Site reliability engineers across the organization. This is powered by **Wavefront** – a high-performance streaming analytics platform that supports 3D observability (metrics, histograms, traces/spans) that allows users to collect data from any services and sources across their entire application

stack. This can be integrated with Spring Boot, Kubernetes and Tanzu mission control making it a complete package for integrated development and advanced analytics platform.

5. Why organizations should choose VMware Tanzu for their application modernization goals

- Accelerate their development process.
- Develop strong product practices with high code quality.
- Future-proof technology to drive cloud adoption.
- Gain value from existing Agile practices.
- Improve resiliency of the systems.
- Leverage microservices and API integration for cloud-native apps.
- Ease operations and management with preconfigured patches.
- Shorten the path to production.

6. How Tanzu can help achieve application modernization

The general definition of a modern app is that it is resilient, distributed, and leverages cloud-native principles like microservices API and is designed to be updated tens or hundreds of times a day to drive innovations for customers. If they are running their application on infrastructure platforms such as software-defined data centers, vSphere, VMware cloud foundation, Tanzu can help by working towards enabling them to use modern constructs such as Kubernetes spanning multiple cloud vendors or the hybrid cloud.

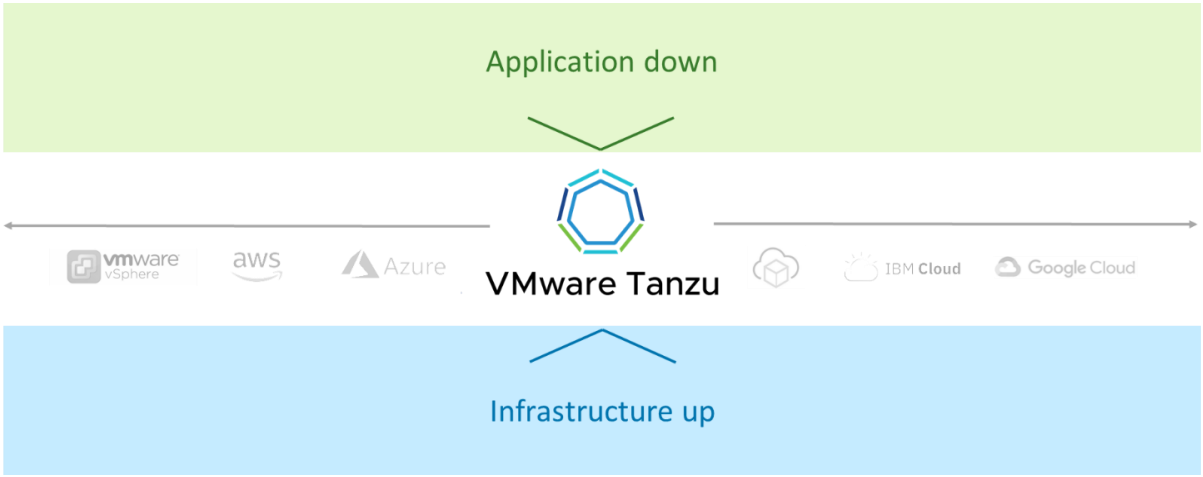

Figure 6 - Application modernization approach

Organizations today cannot achieve high potential digital modernization if they run a modern application on legacy infrastructure or run legacy applications on modern platforms. The approach to modernization should focus on both directions, i.e. infrastructure up and application down rather than focusing on one. VMware Tanzu offers the most flexible portfolio of modern apps, products and services that enables customers to achieve future-proof digital modernization focusing on:

1. **Modern software supply chain:** VMware Tanzu portfolio helps build a modern software supply chain to speed developer velocity to compress the path to production. This enables organizations to develop more applications faster for their customers with a distinguished set of Tanzu Frameworks and validated open-source technology.

2. **Ubiquitous Kubernetes:** A common abstraction of Kubernetes that can be run across private and public clouds, offering consistent operations and support of all applications hosted with increased visibility over an entire fleet of Kubernetes clusters.

3. **Managing the growing ecosystem:** The set of products offered under the manage pillar of Tanzu portfolio helps customers manage many clusters across many teams and enables them to run many small Kubernetes clusters either hosted on-prem, public cloud, edge, and other managed services environments. All these deployments can be controlled in a single pane of glass with Tanzu Mission Control (TMC).

7. Conclusion

The entire Tanzu Portfolio reviewed in this article – along with VMware services – enables organizations to build new applications, adapt existing applications on modern platforms and simplify their operations. We discussed how VMware Tanzu enables businesses to release code into production faster and more frequently, increasing developer productivity, reducing downtime, lowering cost and improving customer experience. For an organization to succeed in the digital era, they may adopt a variety of platforms depending on their industry verticals and their type of customers. However, when all of them are distilled, they will likely move to cloud-native, containerized platforms for their application needs. Consequently, moving to VMware Tanzu will be a one-stop-shop for all their DevSecOps requirements.

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