Scale At The Hybrid Edge With Minio Object Storage

Run MinIO on VMware Telco Cloud Platform™

AT A GLANCE

- High-performance object storage enables the widest range of use cases from ML/AI to analytics and video streaming.
- With VMware Tanzu, MinIO's Kubernetes native object storage suite is completely flexible - any edge, any cloud.
- Seamless storage expansion coupled with intelligent tiering establishes data on demand.
- API driven interfaces ensure operationally automation is simple, reliable, and available.
- Software-defined storage provides operational flexibility to CSPs - form factor, performance and maintainability are all accommodated with MinIO.
- Software-defined storage provides economic benefits - MinIO supports different media types (HDD, NVMe, Optane) and different silicon in different locations depending on workload and footprint requirements.

Introduction

To be successful at the edge, organizations must model the lessons learned in the cloud around performance, scalability, resilience, and security. The intelligent edge does not replace the cloud or data centers but extends them within the constraints of footprint, bandwidth, and serviceability.

To take advantage of the opportunity, edge solutions need to be completely interoperable with the cloud - because different workloads need to run in different places and applications need to be able to determine that context.

MinIO and VMware have partnered to drive innovation at the edge of VMware Tanzu™ with the Data Persistence platform. Using VMware's Telco Cloud Automation™, VMware and MinIO can deliver dense compute and AWS S3-compatible object storage in constrained edge environments. Now CSPs can dynamically allocate edge compute, storage, and bandwidth resources to connectivity and other edge functions as needed in the space-limited confines of deeply placed micro datacenters. Together, the companies enable storage that is easily accessible for 5G and enterprise applications that can run in virtual machines (VMs) or containers.

MinIO brings superior object storage solutions to the telco market with a high level of operational flexibility to deploy a consistent architecture from core to edge.

MinIO provides a wide range of features to securely store and manage data at scale. Per object encryption, end-to-end TLS, easy upgrades, and quick release cycles enable customers to secure their most critical data within MinIO. VMware vSAN Direct with flexible Erasure Coding from MinIO allows fine-grained capacity management while maximizing storage utilization and minimizing overhead. Applications can start small and grow as large as they like without unnecessary overhead and capital expenditure. In addition, erasure coding delivers greater resiliency, high availability, and usable space compared to replication.

With MinIO, object storage can be pushed to the absolute edge of the network and run with the same performance, resilience, security, and consistency as it would in the data center.

The solution is cost-optimized for both initial deployment and, more importantly, ongoing operational expenditures.

VMWARE TELCO CLOUD PLATFORM

The VMware Telco Cloud Platform enables CSPs to accelerate 5G rollouts from core to edge to the RAN for both containerized network functions (CNFs) and virtualized network functions (VNFs).

VMWARE TELCO CLOUD PLATFORM RAN

The VMware Telco Cloud Platform RAN is powered by field-proven virtualized compute coupled with VMware Telco Cloud Automation and VMware Tanzu for Telco RAN, a telco-grade Kubernetes distribution.

- Use the same common platform to virtualize the RAN now and migrate to O-RAN in the future.
- Run virtualized baseband functions, virtualized distributed units (VDUs), and virtualized central units (VCUs) following stringent RAN performance and latency requirements.
- Optimize the placement of DUs and CUs through programmable resource provisioning.
- Deploy and operate both RAN and non-RAN workloads on a horizontal platform.
- Transform the RAN into a 5G multi-services hub.
- Reduce time-to-deploy by automating the provisioning of RAN sites.
- Simplify the onboarding of vRAN functions with validated and standards-compliant packages.
- Automate lifecycle management of infrastructure, Kubernetes clusters, vRAN functions, and 5G services.
- Programmatically adjust the underpinning platform availability and resource configuration based on the requirements of vRAN functions at the time of instantiation.
- Automatically discover, register, and create Kubernetes clusters from a centralized location to manage thousands of distributed components with ease.

The Challenge

- As devices proliferate at the edge, traffic is surging, driven by machine-to-machine communication. The result is that more data is created outside of the data center/cloud in it. This seachange has considerable implications. Data needs to be immediately available, processed, moved, or deleted by an edge to cloud storage system that is cloud-native, elastic, performant, and resilient.
- CAPEX on 5G rollouts is massive. Choosing software that is hardware-independent but operates seamlessly at every point from core to edge - is paramount to retaining flexibility, managing costs, and ensuring operational viability.
- 5G demands edge performance at scale from GBs to PBs. This is quite difficult to deliver in a small footprint.

The Solution

MinIO and VMware enable CSPs to have the Data Persistence platform running on the VMware Telco Cloud Platform. It incorporates a Kubernetes-first approach to the deployment of compatible networks and storage in a lightweight footprint close to the end-user (application). Because data is stored/processed at the network's edge as opposed to a data center that could be five or six hops away, performance is enhanced - delivering new applications, use cases, and most importantly, revenue streams.

Together, VMware and MinIO deliver both an IT service environment and cloud computing platform to support CSPs and application providers from the core to the edge and at every point in between. This includes RESTful APIs, S3 compatibility, API-driven automation, and the ability to perform across a variety of hardware configurations.

Architecture on how VMware and MinIO work together

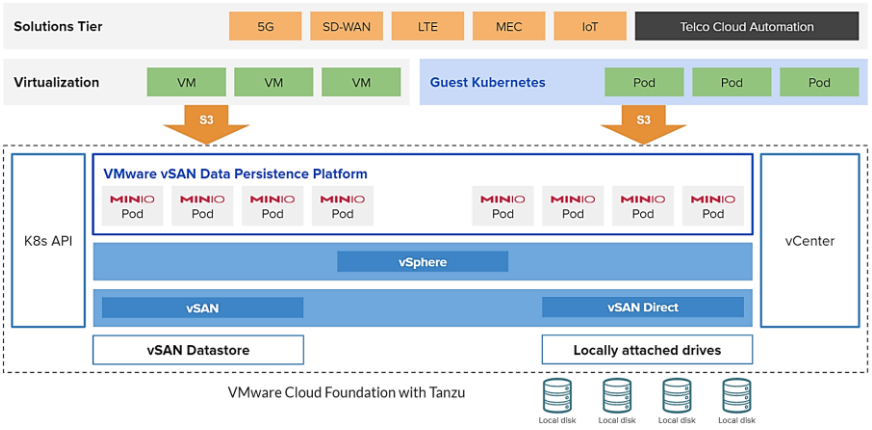

FIGURE 1: VMware Telco Cloud Platform and MinIO

From the Edge to the Datacenter

The solution is capable of meeting storage needs across the entire spectrum of Telco requirements regardless of location and data volume. In this infographic, the size of each block represents the relative size of the storage expected to be required at each location. Data volume starts small at the bleeding edge, where only real-time data is stored temporarily. As real-time data is merged with historical data and enriched with other sources to facilitate insightful analysis, storage requirements grow.

MINO OBJECT STORAGE PLATFORM

MinIO compatible with VMware vSphere® can create a scalable, high-performance, enterprise-grade object store with a few clicks via vCenter - at the edge, regional cloud, or core data-center.

- Through tight integration, capacity planning, hardware maintenance, software upgrade, heal monitoring, and performance management can now be done within a unified experience that is integrated with existing operational models.
- MinIO embraces the cloud-native way of breaking monolithic enterprise applications into scalable, stateless microservices, and lambda functions. This makes applications easy to build, update, and continuously deploy.
- MinIO surfaces a wide range of granular hardware and software metrics through the Prometheus endpoint, including health information, such as disk or node failure, free storage capacity, and per-disk storage capacity. This means telcos and application providers have complete visibility into the health of their data infrastructure. Additionally, MinIO can be configured to generate a log for every operation on the cluster, outputting log data to a configured HTTP/HTTPS webhook endpoint.
- MinIO is a high-performance object store, enabling VMware vSAN's wide range of certified hardware solutions to be optimized for different types of application needs. These could be geared towards low time to the first byte, large object counts, or high aggregate throughput needs.
- MinIO is designed from the ground up to live in a containerized world. This allows for an object store experience in Kubernetes without compromise. VMware vSphere's integrated Kubernetes experience is further

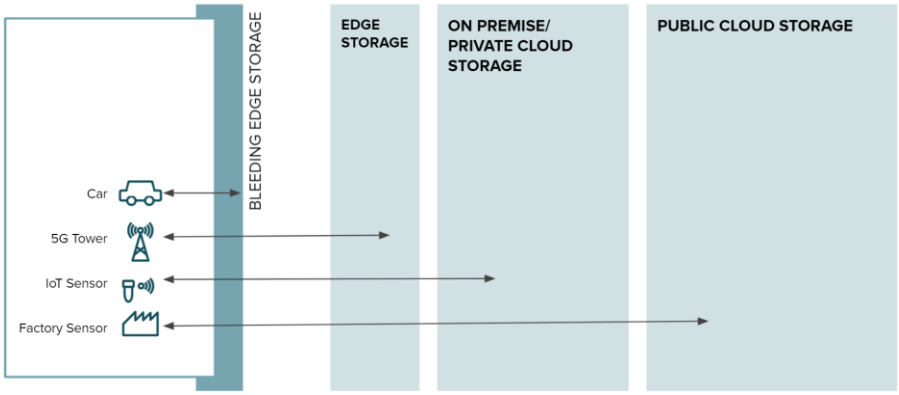

FIGURE 2: MinIO Object Storage Platform

Key Use Cases

AI and ML

MinIO's ability to deliver performance at scale makes it the ideal object store for ML and AI data pipelines where training and inference read/writes occur. This has resulted in MinIO becoming the standard storage platform for autonomous vehicle deployments as well as industrial IoT applications.

WEB/MOBILE CLOUD-NATIVE APPLICATION DEVELOPMENT

Object storage is the storage class of the cloud. As a result, it is the default storage type for the tens of thousands of internally developed applications (consumer and enterprise) where performance and scale are important. Cloud-native from inception, MinIO offers RESTful APIs and is designed for containerization and orchestration - making it the object store of choice for modern developers.

ANALYTICS

The default architecture for modern analytics platforms is to use an S3 endpoint for your data. MinIO is the leader for object storage analytics given its footprint (<100MB) and its performance (183GB/s reads and 171GB/s writes). As a result, analytics applications can execute at the edge and with better performance and lower latency.

How it works

MinIO is already natively compatible with VMware Tanzu through the Data Persistence platform. VMware's Telco Cloud Automation acts as the interface between the solution tier and the Resource Orchestration Tier. This means that using Telco Cloud Automation, Telco-grade VMware Tanzu Kubernetes clusters with multi-tenant object storage can be provisioned with only a handful of clicks by any administrator or fully automated using Telco Cloud Automation API.

MinIO's object storage compatibility with the VMware vSAN Data Persistence platform is feature and API compatible with AWS and can run in any public cloud as well as the private cloud. This enables enterprises to deliver against their hybrid-cloud goals and establish operational consistency across

enhanced with MinIO's Kubernetes native experience.

clouds. Through these integrations, enterprises can run high-performance, secure, sustained workloads where they make the most sense, resulting in superior cost and security.

Through the VMware vSAN Data Persistence platform integration, customers can now bring big data applications like Apache Spark and Apache Presto, analytic engines like Splunk and Teradata, and AI/ML data pipelines with TensorFlow onto VMware's infrastructure with true multi-tenancy within a single vSphere installation. Each tenant lives in its namespace, and the admin can carve out resources, set quotas, and assign them to each tenant. By unifying key workloads under the VMware suite, enterprises enhance manageability and lower costs.

MinIO object storage is compatible with VMware Tanzu Kubernetes Grid.

Main offering from Solution/Technology Partner

MinIO is leading in multi-cloud object storage with a rich suite of enterprise features designed for public, private, and edge environments. It is compatible with VMware Tanzu Kubernetes Grid and is available as part of the VMware Telco Cloud Automation.

A pioneer in the area of high-performance, Kubernetes-native object storage, MinIO holds the object storage world's fastest benchmarks for HDD, NVMe, Spark, and Presto. Open source, software-defined, and Amazon S3 compatible, MinIO's object storage suite delivers ML/AI, analytics, backup, application, and archival workloads from a single platform.

The VMware-MinIO compatibility provides high-performance, scalability, multi-tenancy, security, active-active replication, object locking, versioning, tiering, and monitoring to meet the storage challenges of CSPs.

Solution Benefits

The 5G/MEC/ORAN movement is a function of several elements - orders of magnitude, more POPs, dramatically smaller equipment, greater network complexity, and a demand for lower latency applications. The net result drives demand for software-defined, Kubernetes-native approaches to storage and computes at the edge.

VMware and MinIO deliver against these requirements with a lightweight and performant solution, featuring VMware Tanzu's Data Persistence platform and MinIO object storage. Managed by the Telco Cloud Automation tier, Telcos, application providers, and enterprises have granular control over an expansive array of enterprise features to establish the entire range of edge workloads.

What makes this integration so powerful is that it is not simply combining best of breed - MinIO and VMware invested deeply in its compatibility analysis, and it is widely run in the data center today. The addition of the Telco Cloud Automation tier adds industry-specific capabilities and leverages the lightweight yet powerful functionality of MinIO to deliver against the demanding requirements of the edge.

Benefits of the VMware-MinIO compatibility include:

Software-Defined for Maximum Flexibility

MinIO completes VMware's software-defined data center strategy by extending that vision to storage. Portable across a variety of CPU architectures and server platforms, MinIO for VMware Tanzu is ready-made to automate the data center, compressing IT deployment cycles from months to hours.

Secure and Compliant

MinIO's Object Lock feature is designed to meet securities industry standards and requirements for preserving records in a non-rewritable, non-erasable format, enabling a wide range of critical applications to be built around MinIO.

Summary

With such compatibility between MinIO and VMware Telco Cloud Platform, CSPs and edge-focused enterprises can easily develop a consistent, performant, and scalable object storage architecture that performs the same - from the edge to the cloud.

For more information on the VMware Telco Cloud Platform, please visit *telco.vmware.com* or contact your VMware representative.

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