Modernize Radio Access Networks to Monetize 5G

VMware Telco Cloud Platform RAN

At a Glance

VMware® Telco Cloud Platform RAN™ is powered by field-proven compute and a telco-grade Kubernetes distribution. When combined with the VMware Service Management and Orchestration package, Telco Cloud Platform RAN paves a clear path to RAN modernization by enabling you to evolve from traditional RAN to a disaggregated RAN and, ultimately, open RAN.

Key Benefits and Capabilities

- Run virtualized baseband functions, virtualized distributed units (vDUs), and virtualized central units (vCUs) in accordance with stringent RAN performance and latency requirements
- Use the same common platform to disaggregate the RAN now and migrate to open RAN in the future
- Isolate vDUs and vCUs on virtual machines and the VMware hypervisor to establish strong security boundaries
- Automatically provision underpinning infrastructure resources at the time of vDU and vCU instantiation for RAN optimization
- Automate lifecycle management of infrastructure, Kubernetes clusters, vRAN functions, and 5G services
- Monitor and manage your RAN for high availability with automated closed-loop remediation

Disaggregate the RAN to Gain Flexibility and Efficiency

While communication service providers (CSPs) have been virtualizing, and in some cases containerizing, their core networks, the radio access network (RAN) is still often being built and operated with legacy purpose-built hardware equipment because of the stringent requirements associated with RAN. To lower the costs of deploying 5G, CSPs must disaggregate RAN functions so that different virtualized RAN (vRAN) functions can be instantiated on a horizontal platform and deployed at the locations that best serve their functional purposes.

Another key rationale for disaggregating the RAN is to use a consistent virtualization architecture and cloud-native principles in 5G networks, from the core to the RAN. This move becomes particularly important when CSPs construct logical end-to-end networks tailored to different 5G services. As a result, the ability to host a multitude of network functions regardless of location, to automate operations, and to assure the uptime of services across 5G networks are integral aspects of modernizing the RAN.

Paving a Path from Legacy to Open RAN

VMware Telco Cloud Platform RAN is powered by field-proven compute and a telco-grade Kubernetes distribution. When combined with the VMware Service Management and Orchestration package, the platform paves a clear RAN modernization path: You can move from your traditional RAN to vRAN now and start to move in the direction of open RAN.

Telco Cloud Platform RAN helps disaggregate RAN functions on a horizontal platform optimized for the RAN. The same platform becomes the foundation for moving to open RAN by giving you the flexibility to evolve toward the future without disrupting your operations or overhauling your network design. Furthermore, Telco Cloud Platform RAN simplifies operations with consistency across distributed RAN sites, regardless of the vRAN functions each site hosts. Simplified operations are achieved through centralized automation, which reduces OpEx.

Key Capabilities and Benefits of Telco Cloud Platform RAN

Telco Cloud Platform RAN is a cloud-native RAN solution designed specifically for running virtualized baseband functions or virtualized distributed units (vDUs) and virtualized central units (vCUs), meeting the stringent performance and latency requirements inherent to RAN.

Automation and Programmability to optimize the RAN

Telco Cloud Platform RAN and the VMware Service Management and Orchestration package deliver the automation and programmability needed for a 5G future and the rise of edge computing.

Programmable resource provisioning optimizes where to locate vDUs and vCUs. When you onboard a virtualized RAN function, you can programmatically adjust the underpinning platform availability and resource configuration based on the function's requirements.

To meet high-performance, low-latency requirements, vDUs can be placed at the far edge and near users.

vCUs, which might not need to meet the same high-performance, low-latency requirements as vDUs, can be automatically placed or dynamically moved to be closer to the core to maximize resource utilization.

These resource provisioning capabilities let you move vDU and vCU resources on demand to improve resource utilization or to add more resources when necessary.

If, for example, you need more resources for vDU automation, you can move vCU resources closer to the core.

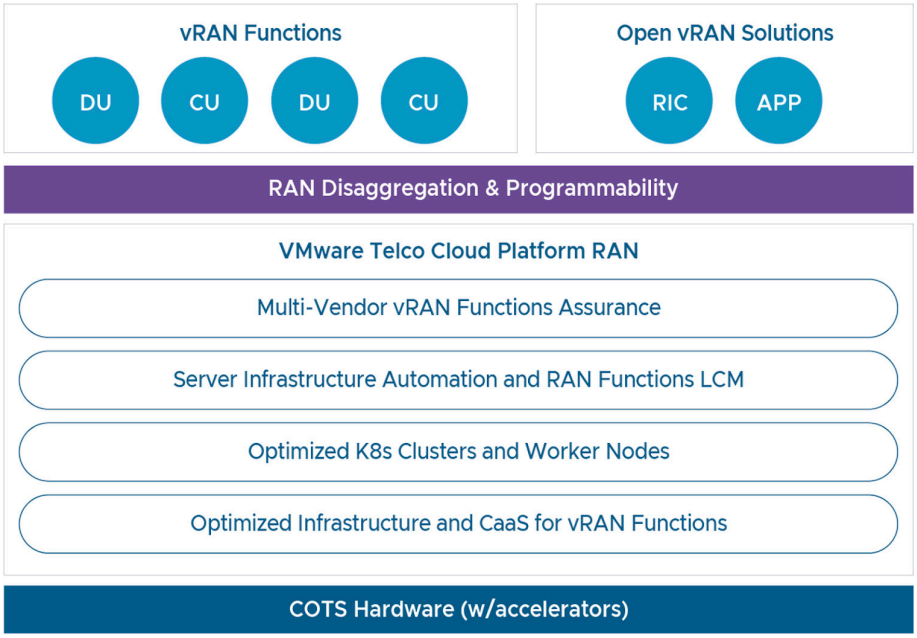

FIGURE 1: When coupled with the VMware Service Management and Orchestration package, the RAN solution from VMware combines flexible horizontal infrastructure with multi-layer automation and multi-vendor service assurance.

RAN-Optimized Platform

Telco Cloud Platform RAN enables you to deploy multi-vendor vDUs and vCUs on a common horizontal platform at RAN sites best suited to perform their functional purposes. The platform provides RAN-specific performance enhancements, such as the following:

- Real-time optimization of the VMware hypervisor to meet the Precision Time Protocol (PTP) accuracy and latency requirements of virtualized baseband functions, including vDUs and vCUs.
- Real-time optimization of Photon OS and the Kubernetes worker node by supporting various plugins, such as BIOS CNF, CPU manager, NUMA topology manager, Calico, Multus, Macvlan, DPDK modules, and SR-IOV.
- Exposure of virtual hyperthreading to vDUs and vCUs enables a single physical processor to function as two logical processors so that the physical processor can run two independent applications at the same time, improving the performance of vDUs and vCUs.
- Optimization of Photon OS improves the scheduling latency of vDUs and vCUs by removing the virtualization overhead.
- Exposure of underpinning server host capabilities such as hardware acceleration to the vRAN functions sitting atop the hypervisor layer, enabling you to transform your traditional RAN to a disaggregated vRAN or open RAN.
- Intel FlexRAN optimization for enhanced dimensioning to ensure the maximum compute resources are available to RAN functions.

Dynamic Infrastructure Policies

The telco automation capabilities from VMware dynamically configures infrastructure resources to meet the requirements of the vRAN functions being deployed, ensuring the right node customization at instantiation time regardless of the type of vRAN functions or the RAN vendor.

Dynamic Infrastructure Policies, for example, let you manage the lifecycle of vRAN functions by using GitOps, which in turn speeds up the onboarding, deployment, and scaling of vRAN functions.

The automated customization of the following items lets you fulfill heterogeneous RAN vendor requirements with speed, consistency, and efficiency:

- Real-time Linux kernel versions
- Network adapters
- Precision Time Protocol configuration
- NUMA alignment
- Kernel arguments like Huge Pages
- Custom Linux package installations
- Configuration for the tuned daemon

The result prevents the overprovisioning of hardware resources and significantly shortens the times for pre-deployment configuration and validation.

A customizable template paired with automated instantiation of vRAN functions and Dynamic Infrastructure Policies radically reduces the time to deploy new RAN sites.

Each vRAN function is isolated with multiple layers to protect functions from unauthorized access. The multi-layer isolation includes the guest OS having its own process protections and permission models; the VM runtime isolating the guest VM; and the separation between the guest and the rest of the hypervisor. The management of the virtualization plane is separated from other systems to safeguard vRAN functions.

Cloud-Smart Automation

Paired with the VMware Service Management and Orchestration package, Telco Cloud Platform RAN is capable of automatically provisioning thousands of platform instances across distributed RAN sites. Furthermore, by understanding the requirements, such as latency and bandwidth, of each vRAN function intended to be instantiated, the platform programmatically configures the underpinning resources for better utilization.

This intelligence enables you to dynamically adjust where the functions should be deployed with cloud-smart lifecycle management, simplifying Day 0, Day 1, and Day 2 operations while providing telco-grade resiliency and service availability.

The platform provides RAN-specific automation, such as the following:

- Reduce the time-to-deploy RAN sites by automating their provisioning with bare-metal orchestration and standardized templates describing the required appliances and configurations.
- Simplify the onboarding of vRAN functions with validated and standards-compliant packages optimized for the platform.
- Programmatically adjust the underpinning platform availability and resource configuration, based on the requirements of vRAN functions at the time of instantiation through Dynamic Infrastructure Policies, supported by the automation and orchestration capabilities from VMware.
- Simplify the method to synchronize timing and clocking among vRAN functions with an automation framework that delivers O-RAN-compliant PTP status notifications.
- Automatically discover, register, and create Kubernetes clusters from a centralized location to manage thousands of distributed components across clouds with ease.
- Auto-scale and adapt Kubernetes clusters to meet fluctuations in demand for cloud resources in support of vRAN functions.
- When combined with the automation and orchestration capabilities from the VMware Service Management and Orchestration package, Telco Cloud Platform RAN provides APIs to act as a single point of integration to your DevOps tools and continuous integration and continuous deployment (CI/CD) pipeline.

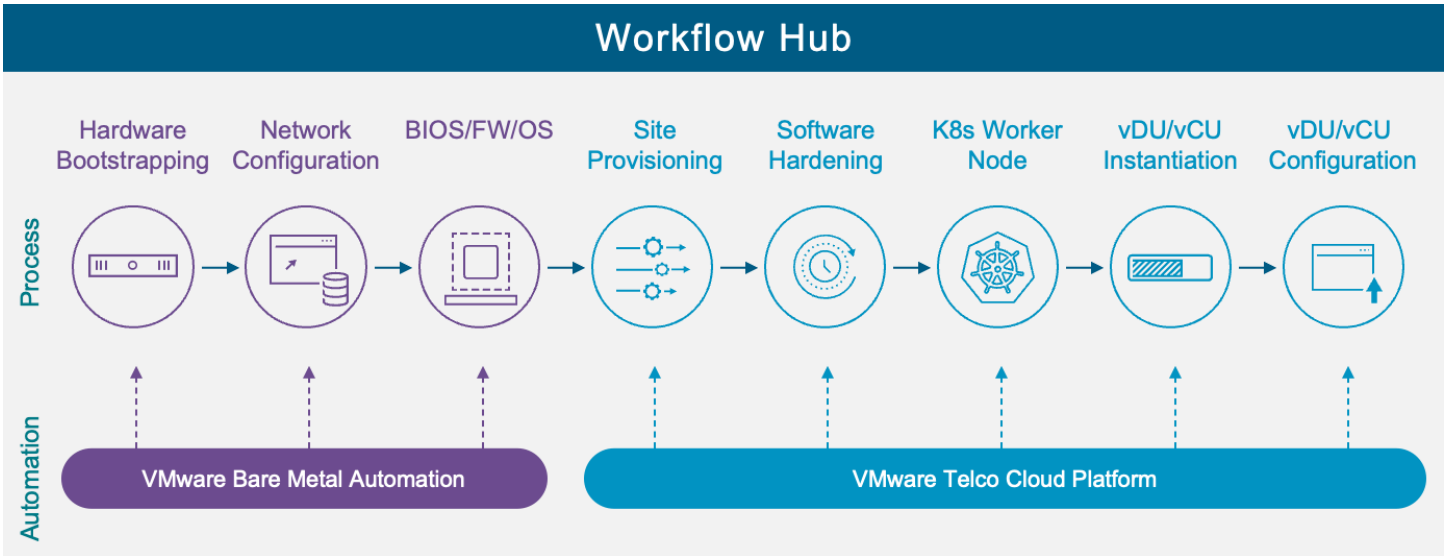

FIGURE 2: Workflow Hub bootstraps hardware, configures network elements, provisions cell sites, and instantiates vDUs and vCUs so that you can rapidly roll out a customized and optimized radio access network.

Speeding Up RAN Site Rollouts with Workflow Hub

Workflow Hub represents the next evolution of centralized operations and operating expense reduction. Workflow Hub is an umbrella orchestrator that unifies not only the existing telecom automation from VMware, but also extends to other VMware telco cloud solutions like VMware Bare Metal Automation and service assurance as well as third-party testing tools.

Workflow Hub enables you to easily define automated, repeatable workflows to minimize manual errors, save time, and reduce operating expenses.

By using pre-built templates as building blocks in a simple drag-and-drop GUI, Workflow Hub lets you quickly stitch together processes that address various use cases. Here are some examples of what you can do with Workflow Hub:

- Construct an executable and repeatable workflow that uses automation to provision a cell site, including vDUs and vCUs, in a few hours.
- Create a pipeline that application teams can use to bring up a Kubernetes cluster for network function version testing, obtain the results, and terminate the environment.
- Link deployment steps that take place outside Telco Cloud Platform RAN, such as setting up an external network, with the deployment of a network function.
- Automatically link several steps to manage the different components of your software-defined data center, such as provisioning a bare-metal server or performing lifecycle management for a VIM.
- Save a predefined workflow as code so that an operations team can execute and repeat it later after customizing it to fit its environment.

Workflow Hub is part of the Service Management and Orchestration package.

Reference Architecture

Telco Cloud Platform RAN can be deployed across radio access networks to meet target design and scalability objectives. The VMware Telco Cloud Platform RAN reference architecture provides guidance for designing and creating an infrastructure and automation solution. The reference architecture describes the high-level RAN design principles and considerations to implement the environment. It also provides example scenarios to help understand the solution's capabilities.

Comprehensive RAN assurance

The RAN assurance capabilities from VMware provides a multi-vendor, multi-layer solution that monitors, analyzes, and pro-actively manages multi-vendor physical and virtual environments in a single platform.

Key Capabilities and Benefits

- Simplify NOC and SOC operations with a centralized, cross-domain view.
- Gain rapid insights with integrated fault and performance management, service management, root-cause analysis, and impact assessment.
- Reduce costs and complexity through automation and optimization for assurance across layers and distributed RAN sites.
- Use closed-loop automation and rapid remediation to reduce OpEx and optimize resources and workloads to meet changes in demand.
- Increase operational efficiency by using AI-based analytics for rapid problem isolation, automatic suppression of extraneous alarms, and automated rule updates.

Comprehensive Service Assurance

Telco service assurance capabilities from VMware provides high availability, performance, closed-loop automation, and issue remediation, allowing you to monitor an entire network of RAN sites, including physical, virtual, and containerized network functions as well as cloud infrastructure.

The service assurance capabilities can be used with its telco automation capabilities to provide visibility and collect fault and performance indicators of registered clouds and instantiated software. This information coupled with automated Day 1 and Day 2 operations like healing and scaling enables closed-loop action for issue remediation.

The service assurance and telco automation capabilities together deliver end-to-end root-cause analysis and the application of custom resolution workflows.

Open and automated service assurance simplify and accelerate your RAN deployment while monitoring the performance of vRAN functions running on thousands of distributed RAN sites.

Automated Root Cause and Service-Impact Analysis

The root cause and service impact analysis, part of a broader telco service assurance capabilities, rapidly resolve problems by correlating symptoms from the following layers of the infrastructure stack and pinpointing the problem's root cause:

- Physical and virtual
- Containers as a service and Kubernetes clusters
- vRAN functions
- Services and applications

Automated Closed-Loop Remediation

Business impact analysis results then drive closed-loop remediation through integration with resource, service and lifecycle management orchestrators that are based on SOL API standards, such as telco automation capabilities from VMware.

The remediation policy framework of the service assurance capabilities from VMware automates the processes and procedures for common NOC faults that can be handled without human involvement.

- Define policies to allow automatic remediation actions when infrastructure faults occur that affect service.
- Take different automated remediation actions based on a problem's duration.

RAN-Focused Ecosystem

Telco Cloud Platform RAN is hardened through strenuous testing and integration work with key RAN vendors to maximize performance and improve resource

Advanced Automation and Assurance in Add-On Packages

Telco Cloud Platform RAN provides a lean product for radio access networks while allowing you to access powerful CaaS automation capabilities, including Dynamic Infrastructure Policies.

As such, the product includes the CaaS LCM Enabler and the CaaS Dynamic Infrastructure Policies Integrator, both of which are necessary to optionally integrate with third-party management and orchestration systems.

The comprehensive automation capabilities discussed in this data sheet become available to work with Telco Cloud Platform RAN when you add on the VMware Service Management and Orchestration package, which also includes the non-real-time Radio Intelligent Controller from VMware.

utilization. VMware and its RAN partners together test, tune, manage, and scale vRAN functions and their interfaces against the industry's packaging standards so that the performance of vRAN functions is validated and optimized to be telco-grade. In addition, the vRAN functions are continuously validated through upgrades and updates for optimal stability while the update procedures of the vRAN functions are streamlined.

Optional Add-On Components

Telco Cloud Platform RAN includes two optional add-on components: VMware Bare Metal Automation and VMware Service Management and Orchestration.

VMware Bare Metal Automation

VMware Bare Metal Automation is an optional add-on component that performs initial zero-touch provisioning of physical servers to speed up the deployment of RAN sites. VMware Bare Metal Automation functions as a bare-metal provisioning tool to the point of the VMware hypervisor installation—bootstrapping the server and installing the software and firmware that the automation and orchestration capabilities of VMware requires to start its CaaS automation processes.

VMware Service Management and Orchestration

The VMware Service Management and Orchestration framework automates the deployment, management, and optimization of radio access networks at scale This optional add-on includes the VMware Service Management and Orchestration (SMO) package consisting of automation and assurance services as well the non-real-time RAN Intelligent Controller from VMware. By encompassing automation and orchestration, assurance and observability, and analytics and optimization, the solution speeds up the deployment of a multi-vendor RAN, increases flexibility, and lets you tailor customer experiences in a dynamic, multi-cloud environment.

5G Evolution Starts with RAN Modernization

With VMware, operational consistency is end-to-end, from the core to the RAN. To realize the value of 5G services, existing disjointed islands of network domains and technologies must function harmoniously across 5G networks. Telco Cloud Platform RAN is powered by a field-proven virtualized compute solution and telco-grade containers as a service (CaaS) for rapid site scaling.

Learn More

For more information about Telco Cloud Platform RAN, call 1-877-VMWARE (outside North America, dial +1-650-427-5000) or visit https://www.vmware.com/telco

vmware® by Broadcom

Item No: bc-vmw-telco-cloud-platform-ran-datasheet 10/24