Optimize Fixed Wireless Access with Network Programmability

Converged Intelligence and Programmability for 5G FWA

The fixed wireless access solution from VMware empowers you to deliver reliable 5G connectivity to businesses and enterprise branches at the edge while optimizing the telecommunications network to meet service-level agreements and ensure quality of service through converged intelligence and network programmability.

The solution includes the following components:

- Network programmability for optimizing fixed wireless access over network APIs
- Automation and assurance for FWA with management and orchestration
- Simplification of the transition to Open RAN, 5G SA Core, and URLLC
- Cloud-native technology to rapidly deploy, scale, and manage 5G FWA capacity
- Intelligent, programmable SD-WAN for multiple access options, including satellite

In addition, applications from a vibrant ecosystem of partners can use AI/ML to further manage and optimize the network for fixed wireless access.

The expansion of 5G networks has advanced fixed wireless access (FWA) to a highly viable solution for delivering wireless connectivity to businesses in certain regions with quality increasingly comparable to fiber-optic broadband — especially when the radio access network can be optimized for reliability and performance by using cloud-native technology, automation, orchestration, network APIs, and applications — and mobile operators are quickly seizing the opportunity to not only expand their residential customer base but also provide connectivity to businesses and branch offices. Converged operators can use 5G fixed wireless access to complement wired access to improve service-level assurance for availability and, in some cases, boost performance to meet SLAs for the software-defined wide-area networks (SD-WAN) of enterprise sites. In addition, FWA connectivity can be supplemented with satellite coverage for continuity.

Even with 5G FWA, however, the networks of mobile carriers require optimization to meet capacity, reliability, and throughput demands in line with common expectations for FTTx-type services. To successfully deploy and monetize fixed wireless access, addressing the following concerns throughout a telecommunications network is paramount:

- Programming the network to minimize congestion, boost capacity, meet service-level agreements (SLAs), and ensure quality of service.
- Optimizing the 4G/5G radio access network to manage FWA service as well as the ever-shifting demands of mobile subscribers.
- Developing location and terrain awareness to properly plan, deploy, and operate a network with sites suitable for fixed wireless access.
- Optimizing the backhaul network and the core telecommunications to maintain quality of service.
- Using service assurance to maintain throughput and capacity SLAs and to deliver speed-price tiers of service.
- Accessing a partner ecosystem of FWA-specific solutions — including those using AI/ML — to optimize the radio access network to comply with SLAs and ensure quality of service (QoS).
- Analyzing spectrum, capacity, and other network capabilities to determine how many FWA customers can be served in a given coverage region and at what levels of quality.

vmware® by Broadcom

The Business of 5G FWA

Various analysts, surveys, and mobile operators herald fixed wireless access as a major driver for monetizing 5G infrastructure. Although FWA works with 4G/LTE networks, 5G provides FWA with speeds and reliability that approach or equal the quality of broadband, making it a viable yet cost-effective primary or secondary connectivity option for consumers, small businesses, edge facilities, and enterprise branch offices. 5G FWA can be combined with other access options -- including satellite -- to satisfy various connectivity use cases.

- With 5G FWA, mobile operators can quickly increase their broadband footprints and subscribers without costly investments like installing or upgrading cables.
- FWA requires spectrum coverage and capacity as well as load and usage management to maintain the quality of experience for subscribers and to offer price-speed tiers of service.
- 5G Standalone networks furnish both eMBB and Ultra-Reliable, Low-Latency Communications (URLLC), and URLLC to make FWA a highly viable solution for businesses.
- SD-WAN solutions can help businesses optimize connectivity to support primary or secondary access.
- SD-WAN solutions can include satellite, 4G/LTE fallback, wired broadband, and other connectivity options optimized with Dynamic Multipath Optimization (DMPO).

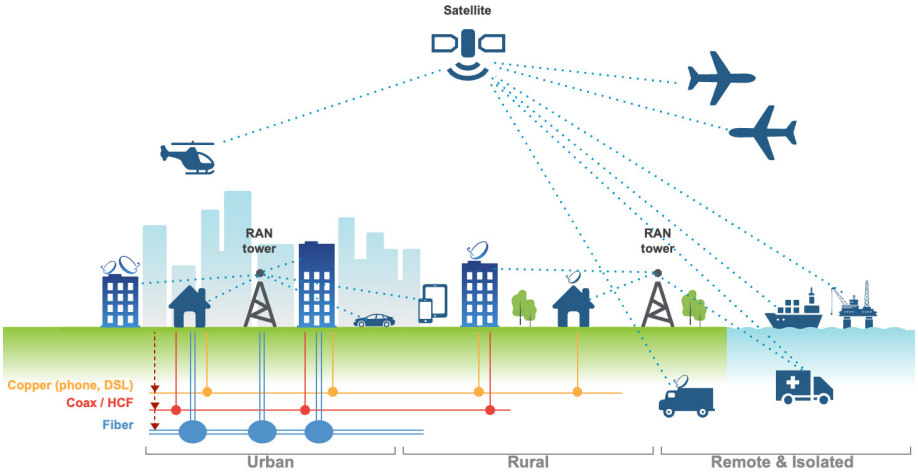

Figure 1: Converged intelligence for fixed wireless access.

In delivering high-performance, low-latency FWA service to enterprise branches and small businesses with edge locations, the FWA customer premises equipment, or CPE, should have robust SD-WAN capabilities to mitigate interference, maximize performance, prioritize traffic, manage access, and protect security. The following SD-WAN capabilities can help ensure that the throughput and capacity of an FWA solution delivers performance comparable to a fixed broadband connection:

- Fix such possible issues as packet drops, delays, and jitter.
- Map users and applications to quality-of-service tiers at the SD-WAN layer.
- Identify business critical applications and prioritize their traffic.
- Receive telemetry and network policy information from a telecom operator to help optimize connectivity for the SD-WAN devices.
- Remotely program and centrally administer operator-managed CPEs from an element within the telecom network to maximize the performance of fixed wireless access.
- Supplement FWA with satellite connectivity for business continuity.

Converged Intelligence for Full-Stack Programmability

A solution that can fulfill these requirements enables mobile network operators to monetize their 5G infrastructure and sets them on path to lowering capital expenditures by delivering FWA to a range of business and edge sites as an alternative to wired broadband and, in some areas managed by converged operators, as a superior replacement for older, slower cables.

The converged architecture from VMware by Broadcom lets mobile operators and converged operators deliver a reliable, high-performance FWA solution to businesses, edge sites, and enterprises. The solution's programmability and automation help overcome two critical barriers to expanding fixed wireless access: service-level agreements (SLAs) and quality of service (QoS).

The powerful cloud-native capabilities of the VMware Telco Cloud -- including automation and orchestration -- empower mobile operators to rapidly transition

vmware by Broadcom

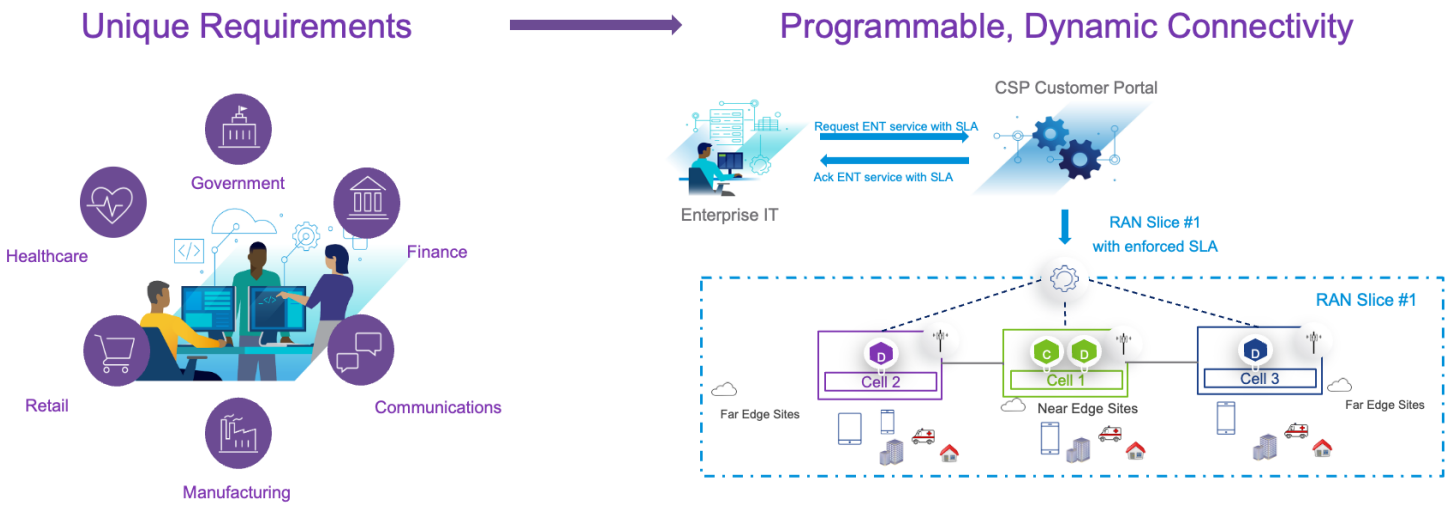

Figure 2: The VMware full-stack solution with converged intelligence for automation and optimization of fixed wireless access.

from 5G Non-Standalone (5G NSA) to 5G Standalone networks, which rely solely on a cloud-native 5G core and radio architecture. Whereas 5G NSA supplies only Enhanced Mobile Broadband (eMBB), 5G Standalone networks furnish both eMBB and Ultra-Reliable, Low-Latency Communications (URLLC) -- and it is URLLC that makes fixed wireless access a highly viable solution for businesses and branch offices.

VMware VeloCloud SD-WAN enables operators to supply businesses with multi-access connectivity that combines 5G FWA, 4G/LTE, satellite, and wired connectivity into a converged model that can be programmed and optimized across layers by using AI/ML and network APIs.

Components and Capabilities

The architecture includes the following key components and capabilities:

COMPONENT	CAPABILITIES
Converged intelligence network elements	Exposing open APIs and running applications for interoperability, analytics, optimization, programmability, and AI/ML
Automation, Assurance, and Orchestration	Planning and design, automation, observability, assurance, analytics, optimization, lifecycle management, data management, common services
Telco Cloud Platform	Hosting virtual network functions, cloud-native network functions, and 5G services from various vendors on a horizontal platform; centrally managing resources and workloads to maximize utilization and minimize operating costs; speeding up the transition to 5G Standalone to deliver ultra-reliable, low-latency communications
VeloCloud SD-WAN	Site connectivity options (5G and LTE fixed wireless access plus satellite, broadband, and MPLS) with programmable intelligence, security, traffic prioritization, problem detection and remediation

Service Management and Orchestration at a Glance

The SMO framework from VMware lets you plan, deploy, orchestrate, and observe a multi-vendor, multi-cloud RAN with end-to-end automation, assurance, and optimization.

- Support legacy RAN and Open RAN on a common, vendor-neutral platform.
- Design and deploy infrastructure, cloud resources, VNFs, and CNFs.
- Rapidly integrate network functions and apps from multiple vendors.
- Get end-to-end visibility into all the layers of your network.
- Tap closed-loop automation and assurance to optimize a multi-layer network ranging from bare-metal servers and network slices to fixed wireless access.
- Simplify the management of VNFs, CNFs, and apps with automated LCM and end-to-end observability.
- Optimize your network with AI/ML in order to manage capacity and performance for fixed wireless access in different regions.

Video: Power Up Next-Gen Services

Watch a video overview of how automation from VMware orchestrates next-gen network services and edge computing across multiple domains and clouds.

The following sections illustrate how these components form a comprehensive solution to rapidly deploy, manage, and optimize reliable fixed wireless access for businesses and enterprise locations at the edge with converged full-stack intelligence and programmability.

Network Programmability for Optimizing FWA

The converged intelligence network elements from VMware let a mobile operator programmatically manage the RAN and enable third-party application developers to tap into network data, analyze it, and use it to optimize the RAN for fixed wireless access. An application can, for example, analyze available coverage to identify the number of customers that can be served and the quality of service that can be provided, and that information can be rapidly acted on by using AI/ML and network APIs.

These applications introduce new use cases — automation, optimization, service customization, and AI/ML — that help tailor fixed wireless access to the cell sites and locations where it is deployed. RAN applications can radically improve the viability of offering FWA to businesses, including in regions with existing wired access:

- Program the network and steer traffic to minimize congestion and boost capacity.
- Optimize the 4G/5G radio access network to manage FWA services.
- Tap a partner ecosystem of FWA solutions — including those using AI/ML — to optimize the RAN, comply with SLAs, and ensure QoS.
- Improve spectrum utilization by using applications from various partners.
- Analyze coverage to determine capacity available for FWA customers.

VMware has, for instance, worked with Vodafone to demonstrate bidirectional network programmability. To enable near-real time and predictive packet delivery solutions while making sure efficient utilization ofnetwork resources, it is necessary to adopt a Network-Aware-Service Delivery approach. This requires granular metrics to be exchanged between the Application endpoints and the network entities. Application endpoints include the server side and user device side software functions. Network entities include measurement and control functions or platforms of a cellular network.

Automating and Assuring Fixed Wireless Access

The automation and assurance capabilities of VMware Telco Cloud Platform let mobile operators manage RAN applications as well as other RAN components and services from a centralized management plane. The platform becomes, in effect, a vendor-neutral foundational management layer for rapidly automating the deployment, management, and assurance for RAN applications from various partners — which helps make the kind of multi-vendor ecosystem needed to provision FWA with QoS and SLAs an operational reality.

Rapidly Moving toward Open RAN to Expand FWA

Disaggregation lets mobile operators rapidly deploy, efficiently manage, and effectively manipulate a heterogeneous radio access network at scale through the flexibility of virtualization and the agility of cloud-native technology.

- Disaggregated RAN functions can be instantiated on a horizontal platform and deployed at the locations that best serve their functional purposes.
- Cloud-native network functions (CNFs) can be managed efficiently at scale and readily manipulated to turn business objectives into productive outcomes.

The use of a horizontally consistent architecture that supports cloud-native principles fosters the construction of logical end-to-end networks tailored to different 5G services, including fixed wireless access.

Such a horizontal platform clears the path to RAN modernization by enabling mobile operators to move from traditional purpose-built RAN hardware stacks to virtualized RAN now and start to move in the direction of open RAN when they are ready — without disrupting operations or overhauling the network's design. Open RAN further disaggregates the RAN so it can be operated and managed with efficiency and cost-effectiveness. Principles like modularity, automation, and replicability become the operational norm.

VMware Telco Cloud Platform RAN delivers a horizontal platform optimized for running virtualized baseband functions or virtualized distributed units (vDUs) and virtualized central units (vCUs) from various vendors while meeting the stringent performance and latency requirements of radio access networks. The platform combines the flexibility of virtualization with the power of cloud-native capabilities to drive operational efficiency and business agility.

Simplifying the Transition to 5G SA Core and URLLC

VMware Telco Cloud Platform, which is widely deployed and used by more than 150 CSPs globally across their RAN and core networks, is optimized to design, deploy, and simplify telecommunications-specific networks and workloads. The platform includes virtual and containerized infrastructure along with network function management to fulfill the requirements of mobile operators for deploying, managing, and optimizing cloud-native and virtualized network functions in core telecommunications.

The platform is designed and engineered to address the requirements of telecommunications companies and their networks within the context of not only existing telecom industry standards, such as ETSI and 3GPP, but also emerging telecom standards, such as those of the O-RAN Alliance. As such, the platform enables you to rapidly deploy and centrally manage telecommunications sites and services to address use cases like network slicing, edge computing, emerging connectivity services, and fixed wireless access.

- Deploy a horizontal platform optimized for telecom workloads and for supporting diverse network functions.

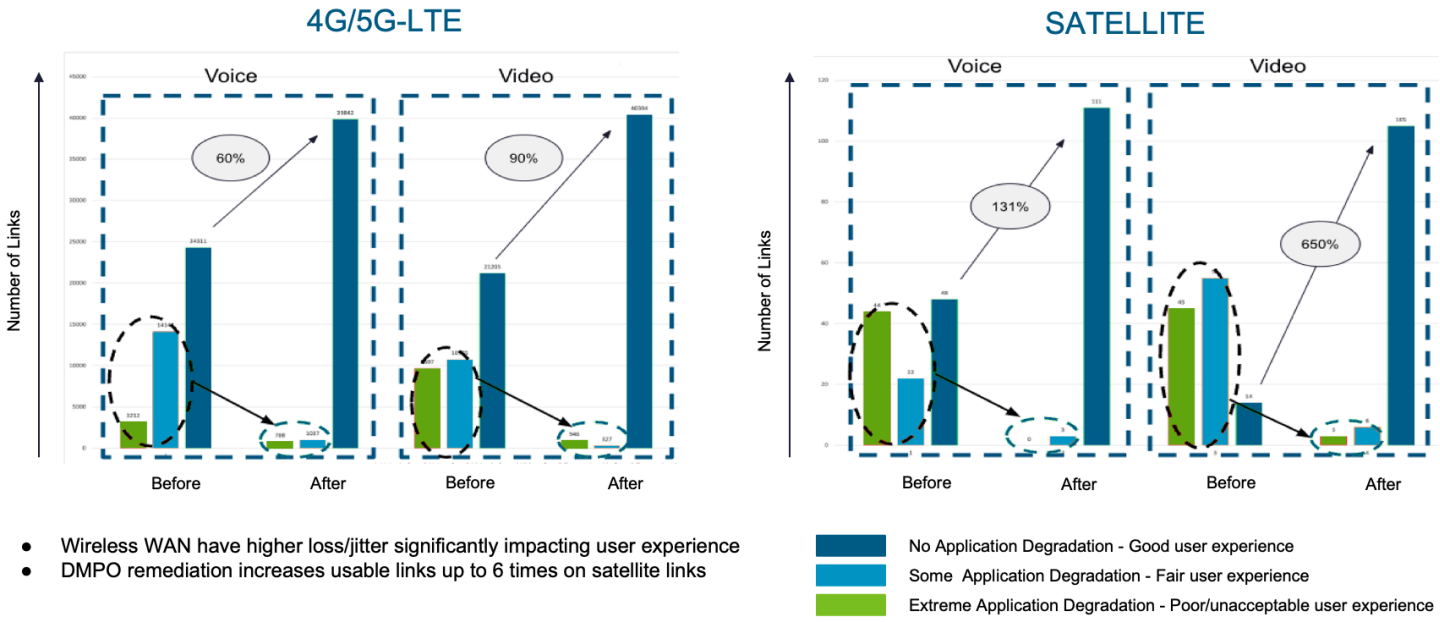

Figure 3: Placeholder for diagram on SD-WAN solution focused on providing reliable fixed wireless access with high levels of quality of experience.

- Gain the agility and automation to respond to changing market conditions.
- Use automation to rapidly deploy 5G cell sites in locations suitable for fixed wireless access.
- Dynamically manage resources to maximize utilization and minimize costs.
- Use service assurance to maintain throughput and capacity service-level agreements (SLAs).

The platform can integrate with service assurance capabilities, including automated closed-loop remediation, fault management, performance management, service management, root-cause analysis, and service-impact analysis. With the platform's actionable insights in near real time and end-to-end visibility of physical, virtual, and service layers, network operations centers (NOCs) and service operations centers (SOCs) can manage many telecommunications networks as one to rapidly resolve network issues.

Intelligent, Programmable SD-WAN for FWA

VMware VeloCloud SD-WAN controls the wide-area network links — including 5G and 4G/LTE FWA, satellite, wired broadband, and MPLS — between a business site and one or more telecommunications networks to create a powerful programmable, intelligent overlay. It protects connectivity, prioritizes traffic, detects problems, and fixes issues. It can act on telemetry and policy information received from a converged intelligence element in a telecommunications network to optimize connectivity.

Multiple Primary and Secondary Site Access Options

The VMware VeloCloud LTE and 5G Edges portfolio is tailor-made for wireless access. 5G connectivity can be configured as always-on for fixed wireless access. When a 5G FWA link is used as a secondary connection, the flexible uplink configuration can save cellular data by using the 5G link only when the primary link is down. It reverts to the primary link when it is back online.

eSIM Support, Pre-Activated SIMs, and ZTE

The Edge 710-5G includes dual physical SIM support for 5G/LTE, along with SIM failover support, and backward compatibility with 3G and 4G technologies. The eSIM is integrated with the hardware, ready for activation. Pre-activated SIMs with select carriers are available for immediate use, and zero-touch provisioning eases the process to ship a VeloCloud Edge to a site with connectivity activated.

Managing Bandwidth with Dynamic Multipath Optimization

Accessing real-time applications requires a solid WAN connection, and the VeloCloud SD-WAN solution enhances the performance of business-critical applications by prioritizing them and addressing issues common in FWA such as packet drops, delays, and jitter. To optimize bandwidth usage, VeloCloud SD-WAN identifies non-business-critical applications and either de-prioritizes or blocks them, conserving valuable bandwidth. Its Dynamic Multipath Optimization (DMPO) technology identifies and classifies more than 4,000 applications into business policies to control FWA usage and manage bandwidth.

Multi-Access Connectivity with Satellite

VeloCloud SD-WAN supports satellite connectivity to enable mobile operators and converged operators to supply businesses with multi-access connectivity that combines 5G FWA, 4G/LTE, satellite, and wired connectivity into a converged model that can be programmed and optimized across layers by using AI/ML and network APIs. A telecom operator could, for instance, utilize a network API gateway to send telemetry and network policy information to the SD-WAN device for the purpose of optimization.

Indeed, SD-WAN becomes a key technology for integrating fixed wireless access alongside other access technologies in enterprise networks -- and operators can combine FWA with, for example, low-earth orbit (LEO) satellite connectivity to deliver multi-access options with cost-effective service and pricing tiers that match the use cases and requirements of business customers.

The VMware converged intelligence network elements, cloud-native technology, programmability capabilities, and network API enablers as well as applications from the ecosystem of VMware partners can ensure that multi-access connectivity is delivered, managed, and optimized to meet service-level agreements and quality-of-experience requirements.

Conclusion

5G has advanced FWA to a highly viable solution for delivering wireless connectivity with quality comparable to wired broadband — especially when a mobile operator or converged operator can optimize its radio access networks for reliability and performance by using the components of the FWA solution from VMware:

- Network programmability and applications for optimizing fixed wireless access
- Automation and assurance for deploying and managing FWA
- Telco Cloud Platform for simplifying the transition to 5G SA Core and URLLC as well as easing the transition to open RAN
- Intelligent, programmable SD-WAN for primary or secondary fixed wireless access and support for satellite connectivity

By combining these components into a full-stack solution, VMware enables you to deliver fixed wireless access to businesses and enterprises at the edge with converged stack intelligence for programmability, automation, and optimization.

Learn MORE

For more information about the the VMware Telco Cloud, 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-fwa 9/24