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WWT and Intel® Ease Transition to vCMTS for Cable MSOs

Companies develop virtual Cable Modem Termination System (vCMTS) based on 3rd generation Intel® Xeon® Scalable processor technology and WWT advanced services

Virtualization of compute and networking systems has been proven in the data center and is increasingly being adopted by telecommunications service providers and cable Multiple System Operators (MSOs). For MSOs, the virtualization of the Cable Modem Termination System (vCMTS) is delivering significant network scaling and service agility improvements along with a dramatic reduction in power and rack space.

Adopting a vCMTS infrastructure improves an MSO's ability to meet demand for higher bandwidth from consumers, and to better compete against fiber and fixed wireless access providers. The vCMTS uses container-based microservices running on Intel architecture processor-based servers and replaces a legacy single-function CMTS appliance. The potential benefits of this new approach include increased network capacity, better signal quality, fewer hub sites and reduced power and cooling costs.

Network maintenance has the potential to be reduced significantly by moving to a vCMTS, which can enable new analytic tools for proactive problem identification and remediation. This real-time telemetry of system health data means faster response to network trouble spots when compared to polling methods used by legacy CMTSs that return network health information every 15 to 20 minutes.

The challenge is the perception that vCMTS radically changes the paradigm for MSOs. Adoption of these systems certainly brings with it new requirements for staff training, integration, technical support, and procurement. But the migration can be handled smoothly with the right technology and integration partners.

Industry technology shifts are helping to make the market for internet access more competitive, driving a need for every MSO to evolve their networks. Additionally, data demand continues to grow, making migration to a vCMTS a powerful option for the future of DOCSIS networks. World Wide Technology (WWT) and Intel have joined forces to provide a complete vCMTS reference implementation and the professional services to go along with the technology to help reduce technology risk so that MSOs can embrace this technology change.

vCMTS Reference Implementation

Intel has developed a vCMTS reference implementation to provide a blueprint for the hardware and software needed to build out a virtualized cable access network. This reference architecture is the foundation of a vCMTS implementation practice managed by WWT.

Table of Contents

The key element to the reference implementation is the data plane, which is optimized for high-performance packet processing on Intel® architecture CPU-based virtualized servers. The vCMTS Reference Data Plane is based on the DOCSIS 3.1 data plane specification and also incorporates open source Data Plane Development Kit (DPDK) software libraries for virtualized packet processing. The data plane reference defines both the packet processing performance and the power consumption of the application when run on an Intel® server.

The data plane reference supports multiple Kubernetes pods that each host MAC processing applications for multiple cable service groups. This results in a configurable number of subscribers per service group. A scheduler is part of the reference software that can be configured to characterize scheduling of upstream traffic for service groups. Control plane services are simulated through a JSON file containing subscriber cable modem information.

In addition to the data plane, the reference platform download package provides a traffic generator node based on the open source Pktgen software that can be used for testing. The software is deployed in pods that host traffic generation instances that are based on Pktgen and DPDK to simulate upstream and downstream traffic into corresponding vCMTS data plane instances.

The reference implementation has deployment flexibility running either on a cloud-native Kubernetes container operating system or on the Bare Metal Reference Architecture (BMRA) for containers. The BMRA is Intel® software that runs containerized vCMTS and Pktgen applications on bare metal servers with automated orchestration (deployment, scaling, and operational functions of the application containers) provided by Kubernetes.

Kubernetes-based data plane telemetry provides a comprehensive set of vCMTS data plane statistics and platform key performance indicators (KPI) via the open source collectd daemon. A Grafana dashboard is provided for visualization of these metrics via the Prometheus* event monitoring application. The reference platform also contains a power manager that reduces power consumption of CPU cores during quiet network periods.

vCMTS Uses Intel® Technology for Performance

The reference implementation is designed to be run on servers using 3rd Generation Intel® Xeon® Scalable processors. These CPUs deliver a balanced architecture with built-in AI acceleration and advanced security capabilities. More specifically, the vCMTS makes use of the features in network-optimized (N-SKU processors) such as the Intel® Xeon® Gold 6338N processor, that is designed to support high throughput network applications such as data planes. The reference implementation includes a Kubernetes plug in that allows automated management of the CPU cores for improved power management.

To accelerate the look aside crypto function, the reference implementation makes use of the Intel® QuickAssist Technology (Intel® QAT). Intel QAT accelerates data encryption and compression for a wide range of applications. The reference implementation includes a Kubernetes plug in for assigning single root input/output virtualization (SR-IOV) interfaces for Intel QAT devices and network adapters.

For network connections, the reference implementation specifies Intel® 800 Series Ethernet Network Adapters, which are designed for 25GbE or 100 GbE connections. The reference implementation makes use of the Dynamic Device Personalization (DDP) pipeline programmability feature along with flow director and RSS features to optimize the steering of upstream and downstream traffic to the receive software threads.

WWT Delivers vCMTS Implementation Services

Founded in 1990, WWT is based in St. Louis, with distribution centers located across the globe, more than 7,800 employees and $14.5 billion in 2022 revenues. WWT is a long time Intel® Network Builder ecosystem member and has worked collaboratively with Intel to offer deep expertise on vCMTS systems from specification to deployment to operation.

In addition to its help with defining the technology requirements, WWT brings a full suite of professional services for preparing, planning, deploying, integrating, operating and optimizing a vCMTS network.

Figure 1. Lobby view of the WWT Advanced Technology Center.

The process starts in the WWT Advanced Technology Center (ATC) a 24/7 virtually available collaborative technology showcase that includes four data centers with more than 350 racks of equipment. Customer or partner teams can work on-site or virtually with access to demos, workshops, labs, proofs of concepts, advisory services, and training. The ATC offers access to scalable lab resources that allow interaction with customer and partner environments and allows for collaboration on architectural solutions.

WWT has installed a complete vCMTS in the ATC for testing and training. The ATC provides a collaborative environment and dedicated computing resources for thorough and customized hardware and software integration. Customers that want to configure and thoroughly test their systems, or train their employees, can take advantage of dedicated rack space and engineering staff.

Global Supply Chain Expertise

Once the solution is specified in the ATC, WWT leverages its global supply chain to offer professional deployment services, including:

Solution definition, validation, and testing - In this phase, WWT experts provide business and technology advice to develop a business model to promote the business success of the vCMTS. As part of this planning, the end-to-end functionality, interoperability, and performance of the system are all fine-tuned. In addition, software vendors are selected and onboarded.

- Design, scoping and planning - In this phase, the WWT team conducts site surveys and reviews site planning and provides transition planning. If wireless technology is involved, the team will conduct radio frequency planning.

- Staging, solution build and shipping – Armed with the planning documents, the solution is staged, integrated, configured, and tested. WWT's centralized integration facilities allow solutions to be kitted per site or delivered as fully integrated and tested rack builds to field sites on time to meet in-service commitments. This increases deployment speed, de-risks critical projects, and reduces field engineering costs.

- Deployment, migration, and optimization – With the systems on the ground, WWT can provide commissioning, deployment, and acceptance testing.

- Ongoing support and training – With the network operational, WWT support personnel monitor for trouble spots ensuring quality of service metrics. Over time, WWT can help with lifecycle management, license management and employee training.

WWT has an extensive track record of building, integrating, testing, and delivering DOCSIS core networks and accelerating their customer's time to market with these service-critical solutions.

Conclusion

Adopting a vCMTS infrastructure is a pivotal transition for cable MSOs, providing a technology that can drive network service growth and reduce capital and operational costs. But the transition goes beyond technology to include procurement, supply chain expertise, employee training, and post-sales support. WWT and Intel have developed a reference implementation with a technology roadmap and complete set of integration services that can deliver the success of the transition for all size cable MSOs. From concept through deployment and ongoing technical support, the Intel and WWT solution delivers the benefits of vCMTS while helping to dramatically reduce the risk.

Learn More

WWT Home Page

WWT ATC

vCMTS Migration Is Imminent and Doesn't Need to Be Complex

WWT and Intel Introduce a New vCMTS Data Plane Reference Architecture in the ATC

DOCSIS Data Plane Performance on Intel's Ice-Lake Microarchitecture

Virtualized Cable Access with Cisco Cloud Native Broadband Router (cnBR)

Intel® vCMTS Reference Data Plane

Intel® 800 Series Ethernet Adapters

Intel® Xeon® Scalable processor

Intel® Network Builders

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