



# vCMTS:

The next generation of  
cloud-native connectivity

Consumers are now digital first, and increasingly digitally native. Devices are connected, experiences are in ultra-high definition (UHD), and 4K streaming is a norm across households, with 8K adoption accelerating. Gamers and video streamers also expect high speeds and low latency for consistency that keeps people in the moment while playing, working, teleconferencing, or browsing online.

These demands are pushing broadband providers to upgrade their systems at scale. Upgrading to DOCSIS 4.0 (the current cable modem communication standard) enables 10G downstream and multi-gig upstream speeds, essential for keeping pace with consumer demand. Virtual cable modem termination systems (vCMTS) are emerging as the next step in delivering scalable, cost-effective broadband.

vCMTS, combined with a remote physical layer (PHY), uses cloud-native architecture to deliver scalability, flexibility, and cost-efficient operations. It supports advanced DOCSIS features like [full-duplex communication](#) and consumer-level services like augmented reality, virtual reality, and IoT-connected devices. As a digital-first system, cable operators can rapidly implement software upgrades – establishing a competitive edge against fiber providers without needing full network overbuilds. It also supports new revenue

opportunities through Network-as-a-Service (NaaS) offerings that expand API accessibility and accelerate product and service development in the cloud.

The vCMTS market is growing rapidly, driven by distributed access architectures (DAA), DOCSIS 4.0, and demand for cloud-native broadband solutions. [According to research firm Data Intelo](#), the global vCMTS for distributed access architecture market is projected to rise from \$1.82 billion in 2024 to \$5.38 billion by 2033.

But what is required to truly take advantage of this exciting new chapter in next-gen connectivity? Complementary systems like NaaS and open API frameworks create new revenue opportunities, while technologies like agentic AI, automation, and advanced cloud architecture can cut costs while improving operations.

#### **Cloud-native architecture: A cost-effective solution**

Traditional cable modem termination systems (CMTS) use dedicated hardware to deliver broadband services and were historically designed for low-bandwidth needs.

As demand for bandwidth grew, operators had to shrink service groups, add more fiber nodes, and expand CMTS ports – leading to higher costs. Scaling this way requires more hardware, facilities, fiber, and software licenses. Also,

fixed-function CMTS devices can't share unused resources or adapt easily, making them unsuitable for modern, flexible network strategies.

#### **vCMTS and Network-as-a-Service: Maintaining a competitive edge**

vCMTS is a virtualized, cloud-native platform that delivers broadband services over cable networks. vCMTS runs on commercial off-the-shelf hardware and uses containerized software, which reduces the need for proprietary CMTS. Cloud-native architecture supports provisioning and monitoring automation, which reduces manual operations and maintenance costs.

To integrate these capabilities as part of a NaaS offering, operators need standardized APIs that allow external systems to interact with network functions programmatically.

This is an exciting area for the future of connectivity. [CableLabs](#), which focuses on research and development for global broadband innovation, contributes to API development and testing to ensure that cable-specific technologies like DOCSIS and vCMTS are represented in the broader NaaS ecosystem. [Camara](#), a global alliance of telco operators, vendors, and hyperscalers, is also dedicated to expanding the industry's API infrastructure for 5G, while upholding data privacy and security standards.



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Adopting an API framework allows multi-system operators to evolve from connectivity providers into NaaS platforms. When combined with vCMTS, this yields incredible opportunities for expansion, improved customer experience, and greater efficiency.

- **Optimized vCMTS capabilities.**

APIs allow providers to build on and optimize existing vCMTS capabilities like bandwidth provisioning, bandwidth-on-demand upgrades for users or apps, telemetry, and elevated quality of service to external platforms and customers.

- **New revenue streams.** API development and connectivity create the potential for new products and network-aware services that go beyond broadband, while expanding 5G services like low-latency streaming and industrial automation. Providers can also monetize network features like identity, and personalized location-based services for customers.

- **Faster innovation.** APIs offer more flexibility, which can help providers expand their reach into new markets with increased exposure for developers and support for cross-operator app development on a global scale.

- **Network security.** Identity and authentication APIs provide secure access to services using telecom-grade identity verification.

- **Operational efficiency.** Easy-to-use API integrations, modular architecture, and unified frameworks improve agility and speed to market, while reducing manual work and simplifying vendor processes.

## Agentic AI and vCMTS testing

vCMTS demand advanced testing methods that can adapt to frequent changes and diverse configurations. Agentic AI offers a transformative approach, with the ability to automate, optimize, and continuously evolve testing capabilities for vCMTS platforms.

Agentic AI agents can perceive their operational environment by analyzing network states, logs, and performance metrics. Based on predefined goals such as maximizing test coverage or detecting faults, these agents can make informed decisions and execute actions like initiating tests or reconfiguring system parameters. This combination of capabilities enables autonomous and intelligent testing workflows that can evolve over time.

### Key applications for agentic AI in vCMTS testing

- **Autonomous test generation.**

Agentic AI can autonomously analyze vCMTS configurations, DOCSIS profiles, and traffic patterns to generate relevant test cases. These agents simulate realistic subscriber behaviors, provisioning flows, and interactions between cable modems and the CMTS, ensuring comprehensive coverage of potential scenarios.

- **Self-healing test pipelines.** In environments where UI or API changes and network topology shifts are common, agentic AI can detect when a test fails due to such changes. It can then automatically adjust the test logic to accommodate the new conditions.

- **Real-time anomaly detection.**

Agents can continuously monitor telemetry data, including upstream

and downstream signal-to-noise ratios, and latency metrics. By applying predictive models, they can identify potential failures before they impact service quality. Upon detecting anomalies, agents can initiate diagnostic procedures or rerun targeted tests to isolate and address the issue.

- **Dynamic resource orchestration.**

In virtualized testing environments, agentic AI can dynamically allocate and scale resources such as virtual cable modems and traffic generators based on the scope of testing or current network load. Additionally, agents can reconfigure vCMTS parameters to explore edge cases and ensure robustness.

- **Continuous integration and continuous deployment (CI/CD).** Agentic AI can be seamlessly integrated into CI/CD workflows using tools like [Jenkins](#) or [GitHub Actions](#). Within these workflows, agents can automatically execute regression tests following each code commit, validate new firmware or configuration templates, and generate detailed reports that include root cause analysis.

- **Knowledge retention and continuous learning.** AI agents can continuously refine testing strategies by analyzing historical test results, failure patterns, and network behaviors. This enables a form of adaptive testing that evolves in tandem with the vCMTS platform, improving efficiency and effectiveness over time.



# Capgemini: Your partner in vCMTS system integration, testing, scalability and validations

Capgemini works with telecoms to simplify and scale network transformation. Our end-to-end testing strategy combines virtualization, DOCSIS 4.0 readiness, telemetry modernization, automation, agentic AI capabilities, and operational integration to ensure functional integrity, performance stability, and seamless customer experience at scale.

Our testing approach adheres to strict release checkpoints to ensure performance, reliability, and security throughout every step of the process, with weekly dashboards and readiness scorecards governing trial-to-production transitions.

## vCMTS testing

- **Functional:** Validate MAC/PHY features, OFDMA/OFDM profiles, QoS/QoE mechanisms
- **Non-functional:** Soak tests, failover resiliency, scalability under load
- **Performance:** Throughput, latency, jitter, packet loss under realistic traffic
- **Interoperability:** Integration with R-PHY/RPD vendors, timing protocols, L2TPv3, GCP
- **Upgrade scenarios:** Hitless ISSU, rollback, backward compatibility
- **Speed tier validation:** Test next-gen and legacy profiles for fairness and congestion handling
- **Operational readiness:** Validate provisioning, activation, assurance, and API contracts
- **Voice and video:** SIP/IMS, E911 compliance, QoS tagging, ABR stability, DRM compliance
- **Security:** IPv6 readiness, lawful intercept compliance

## Customer premises equipment (CPE) testing

- **Certification:** Validate DOCSIS versions, Wi-Fi 6/7, SKU matrix
- **Provisioning and management:** DHCP, TFTP, SNMPv3 security, MIB coverage
- **Firmware upgrades:** Canary deployments, rollback, success metrics
- **Performance:** Gateway speed, telemetry accuracy, concurrency handling
- **Advanced features:** IoT onboarding, multicast, BYOD, zero-trust security
- **Resiliency:** LTE/5G failover, brownout handling, session preservation

## Telemetry testing strategy

- **Streaming telemetry:** Test gNMI/GPB protocols and transport over Kafka/AMQP, ensuring back-pressure handling and schema compatibility
- **API operations:** Validate RBAC, audit trails, rate limiting, and error handling for secure, consistent automation
- **Scheduled polling:** Optimize SNMP/NETCONF intervals for legacy KPIs without overloading systems
- **Service assurance:** Test event correlation, deduplication, and root cause mapping to improve MTTA and MTTR
- **Trap management:** Validate SNMP traps for CPE, R-PHY, and vCMTS, ensuring normalization and flood protection
- **Data integrity:** Confirm accurate eCM IP mapping and stale record remediation

## Operational and field testing

- **Design validation:** Test R-PHY architecture, spine-leaf fabrics, and QoS models under real-world conditions
- **Resiliency:** Validate N+1/2N redundancy, blue/green deployments, and observability SLOs
- **Operational readiness:** Confirm monitoring, ticketing, and ITSM integrations; simulate outage workflows and escalation models
- **Governance:** Test CPE lifecycle management, rule enforcement, and audit compliance

**Are you ready to tap into the benefits of vCMTS, NaaS, and cloud-native architecture at scale?** Our approach enables operators to streamline operations and accelerate transformation, making it easier to meet evolving demands with agility and confidence.

Get in touch with our experts to learn more about how we can make next generation vCMTS a reality for your organization.

## Contact

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## About Capgemini

Capgemini is an AI-powered global business and technology transformation partner, delivering tangible business value. We imagine the future of organizations and make it real with AI, technology and people. With our strong heritage of nearly 60 years, we are a responsible and diverse group of 420,000 team members in more than 50 countries. We deliver end-to-end services and solutions with our deep industry expertise and strong partner ecosystem, leveraging our capabilities across strategy, technology, design, engineering and business operations. The Group reported 2024 global revenues of €22.1 billion.

**Make it real.**  
[www.capgemini.com](http://www.capgemini.com)

