

White paper for Netscout

**Cable MSOs: why service assurance
is critical for delivering a superior
customer experience and
operationalizing the new strategic
initiatives**

September 2016

Anil Rao

1. Executive summary

Cable multiple-system operators (MSOs) are operating in a fast-changing business environment, facing competitive threats from non-traditional over-the-top (OTT) service providers in the video services market and innovative telecom companies in the residential broadband and business service segments.

The video services market has undergone significant transformation over the last 5 years. A diverse ecosystem of smart devices combined with a plethora of OTT and on-demand video service providers have significantly altered the competitive landscape and fundamentally changed customer expectations. Cable MSOs face an ongoing threat of ‘cord-cutting’ from customers who are shifting allegiance to alternative service providers. On the other hand, in the high-growth residential broadband and business services, cable MSOs are facing intense competition from fast-evolving technologies from fixed broadband and fixed wireless service providers. To increase competitiveness and profitability, cable MSOs are elevating focus in two areas: investing in new technologies to better compete with OTTs and other telcos and diversifying into new business lines.

Cable MSOs have enjoyed a near monopoly in the ‘in-home’ linear broadcast-based video services market, which means that customer experience has not necessarily been an area of strategic importance. This also means that the network has been highly optimized to deliver a linear video experience. However, with increased competition and new viewing screens, the challenge now is to not only compete with OTTs, but also deliver the same viewing experience using new devices and new distribution methods. Therefore, cable MSOs must have an overarching strategy for providing a superior customer experience in order for their business to succeed.

Cable MSOs are embarking on many new strategic initiatives such as cloud-based video platforms that provide greater control and flexibility for both customers and cable MSOs. Another example is the DOCSIS 3.1 technology, which enables cable MSOs to provide multi-gigabit broadband services. Aggressive roll-out and expansion of fiber increase reach and coverage, which better positions cable MSOs against traditional telecom companies. Cable MSOs are also augmenting their core business lines by diversifying into wireless access through carrier Wi-Fi. This enables operators to retain control of their customers in public places and opens up new business opportunities such as Wi-Fi wholesaling for other service providers (such as mobile virtual network operators – MVNOs).

The success of many of these initiatives will depend on the ability of the operators to differentiate based on customer experience. Analysys Mason research shows that customer service and network quality are the main factors that affect customer experience and influence the customer’s decision to stay or churn. A holistic service assurance strategy that focuses on proactively monitoring and enhancing end-to-end network performance and quality of service (QoS) can enable cable MSOs to improve customer experience, reduce churn and increase efficiency in operations and customer care.

This white paper examines three key strategic initiatives that cable MSOs are undertaking, and provides in-depth analysis of the nature of the network and service issues that cable MSOs must overcome to deliver a superior customer experience. The initiatives considered are related to the following areas:

- cloud-based video services using virtual set-top box (vSTB) technologies
- virtual CPE- (vCPE-) enabled business services (for example, bandwidth on demand)
- carrier-grade Wi-Fi access using public and community hotspots.

2. Cable MSOs are investing in new technology to enhance market position, but face intense competition

Video, residential broadband and business services are three significant revenue pillars for cable MSOs. Figure 2.1 shows the average revenue distribution per segment for US cable MSOs. The emerging business environment is having varying levels of impact on each of these segments.

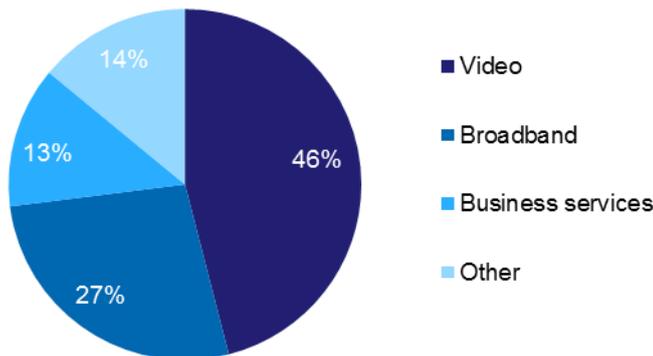


Figure 2.1: Average segment revenue of US cable MSOs [Source: Analysys Mason, 2016]

Video is facing intense competition from non-traditional service providers (such as Amazon Prime and Netflix); most companies are experiencing flat or declining video revenue. In the other segments, traditional operators (such as AT&T and Verizon) compete heavily with cable MSOs on coverage and price.

2.1 Cable MSOs are investing in new technology to counter the threat of ‘cord-cutting’

Figure 2.2 and Figure 2.3 demonstrate how large cable MSOs, such as Comcast and Time Warner in the US and Liberty Global companies in Europe, have experienced a decline in video subscribers in the last 3 years. There is growing evidence that this decline is partly attributed to the rise of non-traditional service providers such as Hulu and Netflix. Even though the impact is limited at the moment, the threat of large-scale substitution is real, and there is concern about the increasing ‘cord-cutting’ trend, with customers permanently shifting their allegiance to these non-traditional service providers that offer content anytime, anywhere, and on any device.

Figure 2.2: Video subscribers, US [Source: Analysys Mason, 2015]

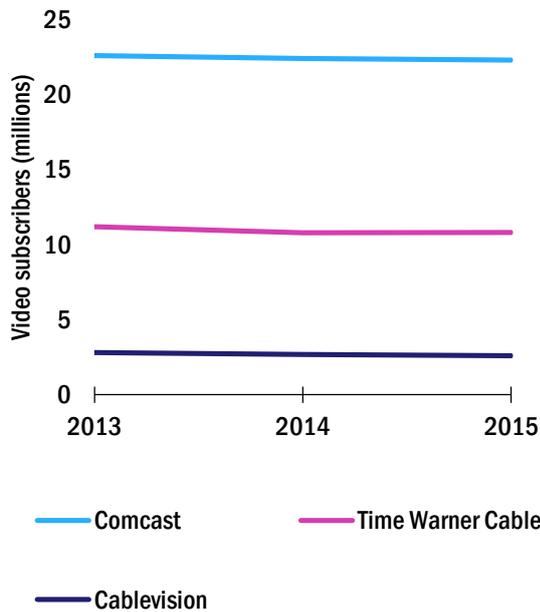
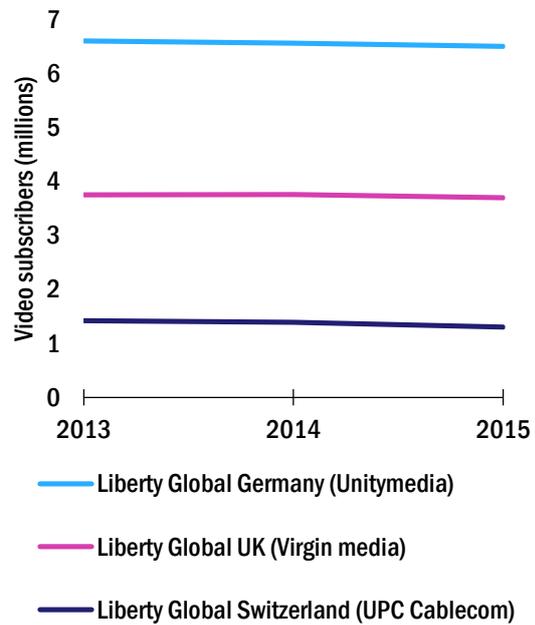


Figure 2.3: Video subscribers, Europe [Source: Analysys Mason, 2015]



Cable MSOs have experienced a significant business impact as a result of these developments, not least of which is a drop in customer satisfaction.¹ In the past, improving customer satisfaction was not a business objective because of the monopoly operators enjoyed in the video market and the relatively few options available to consumers. However, the changing business environment is forcing the operators to reverse this trend by focusing on improving customer experience.

The other area where cable MSOs are increasing their focus is in new technology investment and innovation. For example, in the last few years, Comcast has made heavy investments in next-generation access and video technologies such as DOCSIS 3.1, X1, and Cloud DVR platforms. Capital expenditure in the customer premises equipment segment increased by about 24% in 2 years, which is starting to bear results. After years of decline in video subscribers, Comcast added customers in 4Q 2015,² thanks to an increase of about 10% in new customers in the video services segment.

2.2 Cable MSOs face intense competition in the growth segments

Cable MSOs are aggressively pursuing the residential broadband and business services segments by deploying DOCSIS 3.1-enabled gigabit services and rolling out fiber on a large-scale basis.

Residential broadband services

The residential broadband services segment has been successful for cable MSOs, enabling some mitigation of the declining growth in video services. The imminent commercial availability of DOCSIS 3.1-based gigabit broadband services will further strengthen the position of cable MSOs. However, continuing technical advancements elsewhere in the telecom ecosystem, as well as new entrants like Google Fiber, will pose a credible threat to cable MSOs. Competition will intensify both from the traditional fixed service provider segment and from new emerging technologies, such as 5G, which could potentially provide a fixed—wireless

¹ Refer to American Customer Satisfaction Index (ACSI) Telecommunications and Information Report

² Refer to Comcast [4Q 2015 results](#)

substitute for multi-gigabit broadband services to homes. Cable MSOs are competing by providing multi-service bundles and expanding their carrier Wi-Fi offering to enhance their value proposition and increase customer stickiness. Operators are also using a combination of innovative approaches to blanket their markets with the carrier Wi-Fi service – for example, splitting the home Wi-Fi access points into public and private, as well as deploying public access points to blanket a region for “mobile” access.

Business services

In relation to business services, cable MSOs are building on the success in the small-and-midsize business (SMB) segment, and now attacking the high-value large enterprises segment. Competition will be intense in this domain, which has historically been a stronghold of the telecom companies. Compared with the SMB segment, the expectation on the network QoS and the demands on service level agreements (SLAs) will be very high in the large enterprises segment. The emergence of the network function virtualization (NFV) and software defined networking (SDN)-based virtual network architectures will enable cable MSOs to pursue this segment while strategically managing the network investment required to enter and expand their market presence. This is being done using virtualization and vCPE-based flexible services, but the increased network complexity will require new approaches to monitoring and assuring SLAs.

2.3 Increasing focus on the network QoS and customer experience will enable cable MSOs to compete better

It is clear that the shift in customer behavior, driven by the rise of alternative video service providers, new consumer technology, and competition in the residential broadband and business services segments, is bringing important changes to cable MSOs. To compete effectively in the emerging business environment, cable MSOs are taking a number of important strategic steps, and chief among these is aggressively embracing new technologies and new business models to deliver differentiated services. New technologies introduce new challenges and complexities, but cable MSOs need to focus on delivering the highest network reliability, delivering superior end-to-end network QoS and differentiating services based on customer experience to reduce churn and increase revenue.

3. Cable MSOs need proactive service assurance to underpin their customer experience strategy

3.1 Customer service and network quality are important factors influencing NPS

Net Promoter Score (NPS) is a measure of customers' willingness to recommend their service, and is widely used to evaluate customer experience across industries. Scored on a scale of 0 to 10, NPS indicates the overall customer satisfaction and is often used to compare operator performance. Different aspects of a service affect NPS. Based on a linear model developed by Analysys Mason, we were able to identify the relative importance of five different satisfaction scores (on a scale of 1 to 7) relating to customers' willingness to recommend their service provider, as indicated by the coefficients in Figure 3.1.

Customer service constitutes a prime determinant of overall customer satisfaction. Poor interpersonal interactions with a company's representative, when one is already calling to resolve an issue, can leave a poor impression on customers' experience, dragging down their opinion of the operator as a whole. At the outset, it may seem that the root cause of poor customer experience is customer care. However, this is often a myth. In reality, customer contact centers are a symptom of failures of other systems, not the cause of issues. Investing in better contact centers and appropriately skilling the customer care agents will only improve customer experience to a certain extent. However, understanding and tackling the root causes of the reasons why customers contact customer care may provide a better way to improve customer experience.



Figure 3.1: Linear regression model³ for predicting the willingness of respondents to recommend their fixed broadband service based on their satisfaction with five aspects of their service⁴
[Source: Analysys Mason, 2016]

This brings us to the second most important factor influencing NPS – network quality and reliability. Operators that promise superior network reliability, including higher network performance and QoS, need to back up their claims with real improvements to the user experience if they wish to improve NPS by this route. Operators often find that the issues related to network performance and network QoS relate to one of the top reasons (among others such as billing enquiries) why customers contact customer care. The ability to leverage proactive tools and processes to significantly reduce the mean-time-to-repair (MTTR) and avoid service outages will be essential for improving this component of NPS.

³ Linear regression is a way to model the relationship between a dependent variable and one or more independent variables. This formula indicates the relative influence of different aspects of service on the likelihood of respondents to recommend their provider's service.

⁴ Question: "How would you score your satisfaction with the following aspects of your fixed broadband service?"; n = 5566.

3.2 Service assurance systems and associated business processes in the ‘support’ phase are crucial to enhance customer service and network quality and reliability

A typical customer–operator engagement lifecycle can be categorized into five stages: inquire, join, on-board, support, and renew (see Figure 3.2). Customers have various types of touchpoints with the operator across these stages, which trigger a multitude of operator business processes. The ‘support’ stage, along with the longest period of operator–customer interactions, has the highest influence on the decision of the customer to stay or churn. It includes business processes that pertain to the customer experience complaints received by customer care (or other channels), operational processes inside the network operations and service operations, home visits by the engineer to troubleshoot issues.



Figure 3.2: Estimated influence levels for each phase of the customer lifecycle
[Source: Analysys Mason, 2016]

By monitoring the network in real time for potential anomalies, manifesting in the form of poor network performance and degraded network QoS, operators can proactively identify potential issues and take corrective action to resolve them before they affect the service. Consequently, operators can pre-empt and, perhaps, avoid customer complaints relating to service quality being received by customer care. With this approach, operators can provide a superior customer experience and significantly uplift NPS. Furthermore, with proactive assurance, operators can cut operational costs with reduced calls to customer care and improved operational efficiency in network and service operations.

From the perspective of cable MSOs, new market offerings, such as gigabit broadband and multi-screen video, will be important capabilities for success. However, it will be increasingly difficult to compete purely based on these attributes because competitors will catch up and eventually offer similar services. In particular, the first-mover cable MSOs will have a significant advantage over others during this period, but may struggle to sustain the competitive advantage in the long term.

By implementing advanced service assurance software and processes, operators will be in a position to differentiate based on superior network reliability underpinned by higher end-to-end network QoS and enhanced customer experience, which will ultimately enable them to gain — and retain — customers, and increase revenue.

4. Cable MSOs are embarking on a number of growth initiatives that will require holistic service assurance

Cable MSOs are executing an ambitious strategy on multiple fronts in order to rejuvenate the slowing video services business, capitalize on the emerging opportunities in the business services, reduce customer churn and increase customer stickiness. For example, cable MSOs are looking to provide:

- original content through partnerships with content producers
- home security and automation services
- wholesale transport business for mobile backhaul
- cloud, IT-managed services and infrastructure outsourcing
- cloud-based video services using vSTB technologies
- virtual CPE-enabled network connectivity service (for example, bandwidth on demand) and value-added services (including firewall or WAN optimization)
- carrier-grade Wi-Fi access using public and community hotspots.

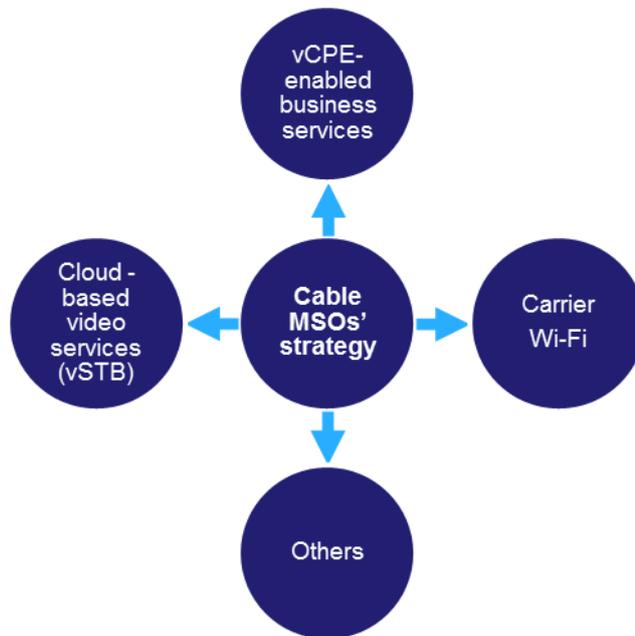


Figure 4.1: Cable MSOs' multi-pronged strategy
 [Source: Analysys Mason, 2016]

Each of these initiatives presents a variety of technical and operational challenges for cable MSOs. The rest of this white paper will provide a detailed analysis of how operators can address the service assurance challenges for three specific areas: cloud-based video, vCPE-based business services and carrier Wi-Fi. Figure 4.2 presents a brief description of these three strategic initiatives.

Figure 4.2: Cable MSOs' strategies [Source: Analysys Mason, 2016]

Strategy pillar	Description
Cloud-based video services using a virtual set-top box (vSTB)	A virtual set-top box (vSTB) enables cable MSOs and other video service providers to shift away particular IP functions such as processing, recording (cloud DVR), storage, video-on-demand (VoD) from on-premises STBs to the CSP's network. It allows simplification of STB terminals to basic connectivity functionalities and delivery of the service through virtual network functions (VNFs) running on carrier-grade COTS servers in the network.

Strategy pillar	Description
	<p>A vSTB environment provides better control for operators (e.g. change the user interface dynamically if required), enabling them to offer video services at scale and significantly reduce the time to market for new services without the high costs of supplying new devices. Additionally, the vSTB can act as a platform upon which third-party media-streaming applications can be made available in addition to the service provider's own content, in the same fashion as certain OTT devices (e.g. Roku) offer today. Customers can install these applications on demand and start using them instantly to watch third-party content.</p> <p>This can be extremely appealing to customers as they now have to only deal with one service provider and maintain one billing relationship for all their video consumption needs – linear TV, VoD, and OTT video. Together with the increasingly popular video everywhere capability with multi-device support, the vSTB-based cloud video service enables cable MSOs to offer a strong value proposition to attract and retain video customers.</p> <p>In fact, the STB-based video capability can potentially strengthen the overall triple-play value proposition, enhancing customer stickiness and reducing churn.</p>
vCPE-based business services	<p>Enterprise services that use vCPE provide a competitive advantage for first-mover operators with early market share capture by differentiating themselves through agile, on-demand service delivery with customer self-provisioning capabilities. Using vCPE, operators can provide advanced SDN-enabled connectivity services such as self-service bandwidth on demand, dynamic VPN and bandwidth calendaring. Additionally, NFV-enabled value-add services (VNF-as-a-service), including WAN optimization, load balancing, application delivery controllers (ADC), firewall, and anti-DDoS services.</p> <p>Operators can achieve significant business benefits through:</p> <ul style="list-style-type: none"> • Self-service provisioning: new service orders or upgrades can be requested by customers over a secure self-service portal of pre-created services in the service catalogue, or by using a drag-and-drop service designer to create a new service with tested VNFs and SDN connectivity options. • NFV automated scaling and network management: NFV automation provides dynamic up/down-scaling, onboarding of VNFs, and auto-configuration of the network connection with SDN following customers' self-service requests. This enables rapid, remote delivery of VNFs to commercial-off-the-shelf (COTS) servers in customer premises, as well as on-demand connectivity services. The resulting benefits include eliminating the need for field engineers on site for on-net service additions or changes, and reducing network management (capacity, optimization, and provisioning) costs.
Carrier Wi-Fi	<p>Carrier Wi-Fi creates new service differentiation and revenue opportunities for operators that move quickly to build market penetration. Providing carrier-class public Wi-Fi helps cable MSOs with brand building and churn reduction. Hotspot branding reinforces the presence of the operator and provides a visible reminder to both customers and non-customers of the operator's availability and (ideally) widespread coverage. Ultimately, cable MSOs would like to monetize carrier Wi-Fi, either via location-based services, data analytics, ad-funded Wi-Fi services and roaming, and premium Wi-Fi.</p> <p>However, to achieve all of this, operators need to provide additional benefits such as carrier-class robustness, security and QoS. Together, these benefits have the potential to outclass inferior solutions provided by third parties and, in some cases, could even compete with 'free' alternatives. Furthermore, the user experience of carrier Wi-Fi networks should be seamless and transparent.</p>

5. Cloud-based video introduces latency issues that may affect customer experience

5.1 Isolated control plane may introduce potential latency issues

The most significant technological change in vSTB is the transfer of the main processing capabilities such as computing, graphics engine, storage, and user interface and control plane to a network cloud environment.

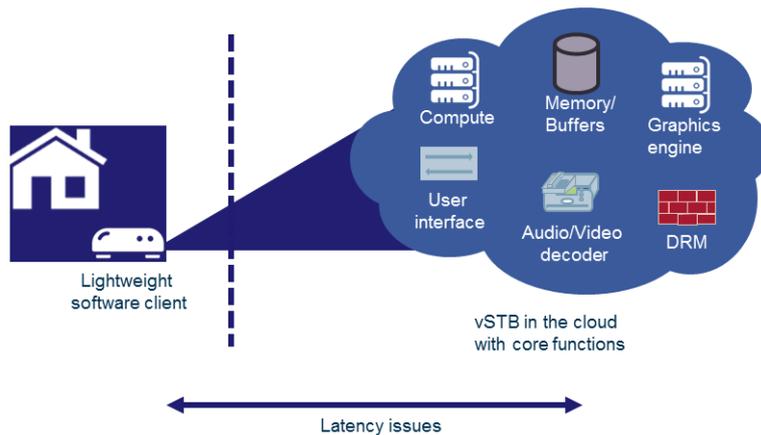


Figure 5.1: vSTB latency issues

[Source: Analysys Mason, 2016]

The isolation of the control plane and media processing functions significantly reduces the complexity of the STB, but introduces new requirements for information exchange between the on-premises physical terminal and the vSTB in the cloud. The on-premises physical terminal, with basic connectivity features and lightweight software client, acts as a gateway for receiving commands from a control interface such as a remote, and sends them to the vSTB. The vSTB processes the commands and executes a series of control functions to perform the desired action, which is then transmitted back to the physical terminal.

By moving greater functionality to the cloud, the service delivery process becomes more complex, requiring the coordination of multiple network elements each functioning independently and some serving multiple functions not necessarily related to the service the customer is using. Evidently, the control plane interactions between the physical terminal and the vSTB introduce potential latency issues during scenarios such as navigating a programming guide or changing a channel, resulting in poor customer experience. Cable MSOs that offer vSTB-based video services need a robust mechanism to monitor the different types of latencies and proactively take action.

5.2 Challenges in the media plane – measuring the end-to-end video QoS

Today's video networks consist of a multitude of delivery components and network legs such as video headend, CDNs, transport, STB and, increasingly, multiple screens in the household. Video quality (VQ) degradations can be caused by a variety of issues in any of these domains. Therefore, it is important to monitor the video quality at every demarcation point in the network, and isolate quality issues to trigger targeted troubleshooting processes.

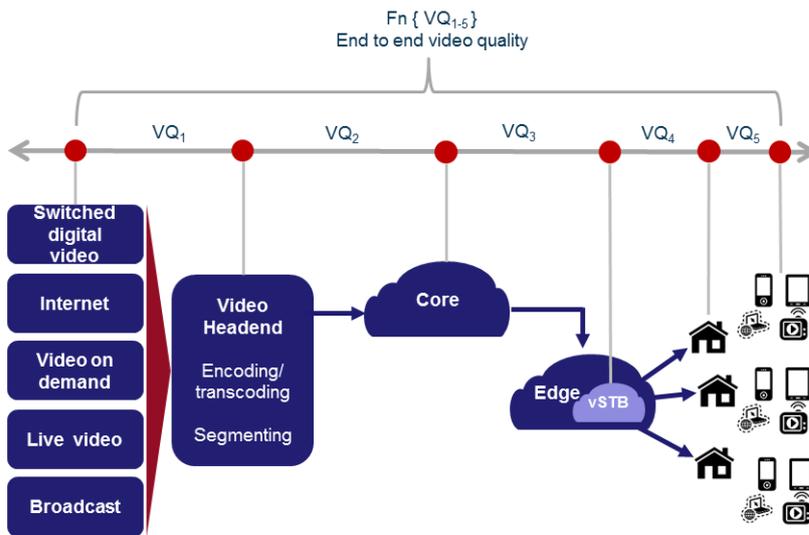


Figure 5.2: End-to-end video quality
 [Source: Analysys Mason, 2016]

Mean opinion score (MOS) is the most common way of gauging a human’s perception of the network QoS, and by definition is more subjective and open to interpretation. Standardized by the International Telecommunications Union (ITU), MOS scores range from 1 to 5 (‘bad’ to ‘excellent’). For voice, the MOS algorithms are captured in perceptual evaluation of speech quality (PESQ) and perceptual objective listening quality assessment (POLQA), and for video, it is perceptual evaluation of video quality (PEVQ).

Indeed, as multi-screen video consumption and the so-called ‘video everywhere’ become more widespread, operators must consider different VQ demands and perceptions when measuring, monitoring, and assuring end-to-end video quality.

5.3 Key assurance considerations for vSTB-based video services

The primary requirement that must be fulfilled by the assurance solution is to monitor and proactively flag the latencies that could crop up due to the isolated control plane. Figure 5.3 provides example scenarios that should be considered.

Figure 5.3: Latency considerations for vSTB [Source: Analysys Mason, 2016]

Latency type	Description
Latency of first response	Setup to Setup Response latency; may vary depending upon the control protocol
Latency of media	Time from first Setup message until first media received at the physical terminal
Latency of playback	Time from first Setup message until enough media received to begin playback
Latency of channel change	Time to switch channels from the program guide

One of the potential side effects of the latency issues would be the indeterminate control plane protocol behavior, causing retransmission problems between the physical terminal and the vSTB. In addition to monitoring the control plane latencies, it will also be necessary to correlate the control plane and the media plane to accurately identify the root cause of video quality issues, which could be down to the transport layer. Out-of-synch or dropped packets could result in temporary audio problems, video pixelation or freeze-frame, causing poor quality of video experience. A real-world example of the manifestation of this problem is described below:

- the customer is watching a video and decides to perform a control function such as ‘fast forward’ of the media he/she is watching

- the customer does not witness the intended behavior within the expected time window, perhaps due to a control plane latency
- in frustration, the customer reacts by performing the control function repeatedly
- in the meantime, the delayed packets have arrived, but the system must now execute the additional ‘fast forward’ control functions
- the video has now skipped over by a few frames causing further viewing displeasure that requires the customer to ‘rewind’ back.

By accurately pinpointing the network location and the root cause of such delays, service assurance solutions can quickly trigger troubleshooting workflows. Using real-time network performance feeds and applying predictive analytics algorithms, assurance solutions can caution the NOC/SOC about a potential quality-of-experience issue ahead of time. Therefore, it is enormously important to reduce the mean time to knowledge of a customer-affecting issue.

As the STB functions centralize in the network, operators will have better operational control in terms of troubleshooting issues. The vSTB software issues will be tackled without a site visit, significantly reducing the mean time to resolution, but this will need assurance functions either co-located with, or embedded in, the vSTB. This could also serve as a key demarcation point in the network to measure the video QoS, and possibly carries a high weighting when deriving the end-to-end QoS.

As part of the troubleshooting workflow, operations need to consider several factors before deciding on the next course of action. Figure 5.4 highlights some important considerations.

Figure 5.4: Operational troubleshooting considerations for vSTB [Source: Analysys Mason, 2016]

Troubleshooting consideration	Description
Troubleshoot or replace	Whether to triage and solve the issue or spin up a new vSTB (equivalent of replacing the physical STB)
Cost	What are the financial implications (cost of troubleshooting vs. replacing with new vSTB)
Time	Which option provides the best resolution time (how quickly the service can be brought online)
Customer experience	What is the impact on customer experience, size and scale of issue (how many customers are affected).

6. Enterprise vCPE-based services will need adaptive and automated assurance

First-mover operators with enterprise vCPE-enabled services are expected to benefit from significant take-up in revenue⁵ from up-sell/cross-sell of existing and new SDN-based services. Some examples of SDN-based services include dynamic VPN or WAN configuration, self-service bandwidth on demand (BoD), data center interconnect services and security as a service (including firewall, antivirus and D-Dos). With the operators' NFV-based services, enterprises can also deploy on-demand vCPE VNFs, such as WAN optimization, DPI, web acceleration, and caching.

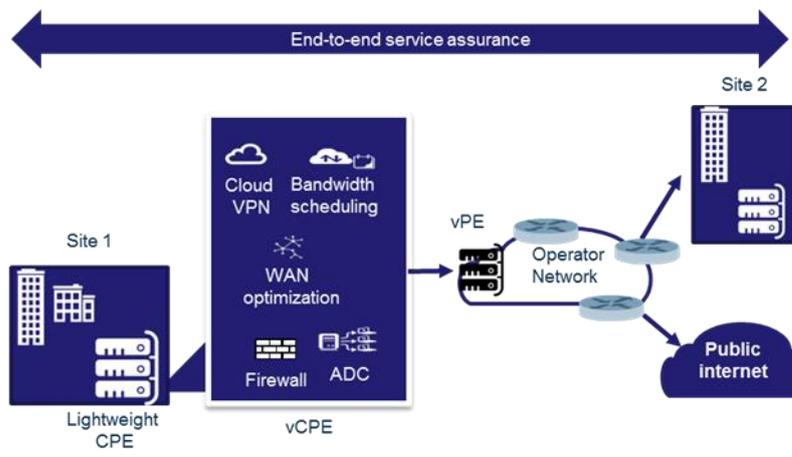


Figure 6.1: vCPE- and SDN-enabled network
[Source: Analysys Mason, 2016]

Cable MSOs that intend to target the lucrative vCPE-based enterprise services market will need to implement a service assurance solution that can address the unique challenges presented by the dynamic nature of NFV and SDN technologies (see Figure 6.1).

6.1 A dynamic virtual network will need adaptive service assurance

Assurance in today's static networks tends to be an afterthought, coming into focus only at the last stage in the investment cycle, before handover to operations. This approach is not fit for purpose in a vCPE-based network or any other NFV/SDN-enabled virtual network where instantiation and on-boarding of new VNFs may alter service chains and traffic flow patterns in real time. Assurance systems must adapt and, if required, scale in line with the changing network, to monitor the new VNFs and the modified service chain.

Without the capability to adapt to the dynamically changing network conditions, operators cannot monitor and assure the contracted SLAs, which may result in financial penalties and poor customer experience. In addition, many large enterprises are often willing to pay a fee for detailed reports on bandwidth usage and network performance, which cannot be fulfilled if the assurance systems are not up to date with the network changes. Consequently, this will result in potential lost revenue to the operator and, in the worst case scenario, cause the customer to churn to a competitor.

⁵ Refer to [vCPE services business case: potentially billions of dollars payback for fixed CSPs](#)

6.2 Service assurance will underpin network automation, a vital pre-requisite for the success of vCPE-enabled services

To achieve potential new revenue benefits, operators need to implement highly automated order-to-cash and trouble-to-resolve business processes with dynamic up/downscaling and auto-configuration of the network with SDN and VNFs. This will not only allow operators to control costs, but will also enable them to provide flexible personalized services on demand to improve customers' network QoS and SLA metrics.

Evolved service assurance systems will enable automation of the key business processes. For example, small footprint software-based virtual probes (vProbes) can be used to enable a variety of use cases. In the order-to-cash journey, for instance, vProbes can trigger a suite of automated tests to validate a newly created service chain resulting from the introduction of a VNF before making it live.

On the other hand, actionable insights generated from service assurance can trigger automated actions via orchestration to support network augmentation and optimization use cases.

- bandwidth on demand: when additional bandwidth is requested, performance insights from the virtual provider edge (vPE) router can provide a view on whether the available capacity is sufficient to meet the requested additional bandwidth, and automatically trigger the routines to scale up the vPE to meet the demand if required.
- preempt network congestion: insights derived from assurance on potential network congestion points can trigger the SDN controller to alter the packet-forwarding path to alleviate or pre-empt the issue.
- a combination of these actions may also be necessary to prevent SLA breaches.

Furthermore, in the likely scenario that the vCPE services are being delivered over a hybrid network consisting of both physical and virtual network components, operators will need a hybrid assurance solution that is capable of monitoring both physical and virtual network resources, and provide a truly end-to-end view of the hybrid network.

6.3 Application-aware holistic service assurance

Enterprises are increasingly demanding networks that provide the best application performance. This requires operators to gain a highly granular understanding of the application traffic at a session and transaction level, and analyze how it is affecting network performance. By combining application performance intelligence with network performance, operators can generate insights, which could be used to trigger optimization routines or instantiate WAN optimization VNFs into the service chain to optimize application performance.

While this type of correlation between network and application performance cannot be performed for all applications running in the enterprise network, it may be possible to do this for those applications hosted by the operator for the enterprise client. In effect, operators providing both network connectivity and hosted applications can constantly optimize the network to ensure the best application performance.

The ability to assure true end-to-end performance encompassing the network and the application provides a significant market differentiation for operators, and enables them to pursue new business opportunities in application hosting.

7. Carrier Wi-Fi presents a multitude of assurance challenges

The success of cable MSOs' Wi-Fi business strategy greatly depends on the ability to offer and assure services over a 'carrier-grade Wi-Fi' network that allows customers to have a hassle-free Wi-Fi user experience. Carrier-grade Wi-Fi, also known as carrier Wi-Fi, enables operators to gain full control of the Wi-Fi access, as well as the end-to-end quality of experience of customers.

Wi-Fi technology is rapidly evolving and shedding the image of an unreliable and unstable access method. Wi-Fi is now an important wireless access method for many telecom service providers and a key part of cable MSOs' long-term strategy. The latest technologies, such as Hotspot 2.0, are enabling operators to forge roaming partnerships to provide a seamless service experience to customers.

While these are favorable developments that strengthen the case for wider Wi-Fi adoption, they are also rapidly raising the bar of customer expectations; especially, when cable MSOs start comparing the carrier Wi-Fi service with mobile radio access reliability. To meet such high expectations, cable MSOs and other service providers must tackle a multitude of assurance challenges. Figure 7.1 provides an illustration of a cable MSO's Wi-Fi architecture.

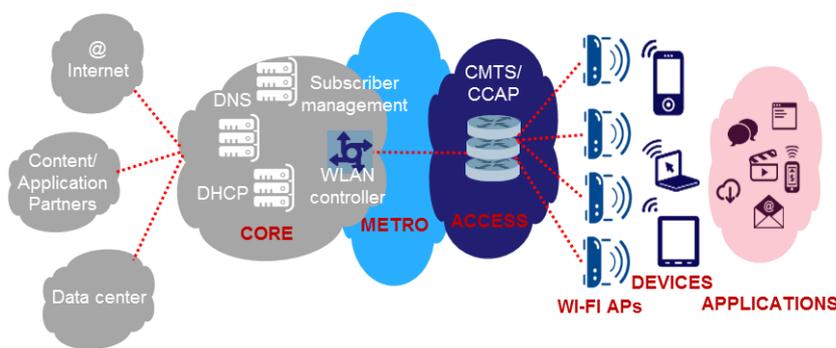


Figure 7.1: Cable MSO's Wi-Fi reference architecture [Source: Analysys Mason, 2016]

7.1 Identifying connection and authentication errors

Connection failures occur due to various reasons, chief among these is an unreliable Wi-Fi network that is not robust or carrier grade. Consequently, customers face frustration and poor experience while attempting to connect to Wi-Fi in public places such as airports or shopping malls. For the customer, this is the most important touchpoint with the operator, and sets the tone of expectations for future interactions.

Operators have a small window of opportunity during the connect stage to attach customers onto their network, and failing to do so will drive customers to a competing service provider. To avoid churn, it is therefore vital that operators provide a seamless connect and authentication experience. Service assurance systems can play an important role in proactively monitoring connection and authentication errors and enabling operators to take immediate remedial action.

7.2 Identifying interference issues

2.4GHz and 5GHz are free-to-use spectrum bands, and consequently many different networks can co-exist and use these frequencies, causing interference issues for the user. Operators typically use advanced network

planning solutions to optimally design a Wi-Fi network that does not cause interference. However, changing indoor and outdoor conditions, for example, caused by new construction activities, may cause interference.

Operators need to make modifications to the original network layout to resolve interference issues, but need the right tools to constantly monitor for network interference. Service assurance systems can provide the monitoring capability to identify new and developing interference hotspots, and supply key intelligence on Wi-Fi planning and recommendations to network optimization engineers on where is best to locate the access points.

7.3 Monitoring important service-enabling components to isolate problems

By isolating issues to a specific part of the network, operators can efficiently allocate operations resources for troubleshooting and problem resolution, and minimize truck rolls. This can be achieved by gathering and analyzing telemetry data from various parts of the network and correlating the diverse performance indicators to identify service issues.

For cable MSOs' customers, poor service experience such as login time delays or delays in webpage loading are often caused by issues with the service-enabler components in the core network, such as DHCP, DNS, and AAA servers. These cross-service components may often be responsible for delivering multiple services such as Wi-Fi, video, and business services. It is therefore vital that cable MSOs deploy robust assurance systems for monitoring these components.

Operators cannot influence the infrastructure or application performance outside the perimeter of their own network. In cases where they have a content delivery partnership with an OTT service provider, operators may seek performance KPIs from the partner's domain to develop an end-to-end view of the performance, but this would largely depend on the willingness of the partner to disclose this information.

7.4 Assuring Voice over Wi-Fi (VoWiFi)

Operators have little control over the user experience of calls via unmanaged and third-party Wi-Fi networks, so cannot assure the QoS. However, this runs contrary to many operators' emphasis on quality and coverage, especially with the fully managed carrier Wi-Fi that the operators are rolling out. Consequently, the operators must ensure the QoS of VoWiFi both at the user plane and control plane.

While this is not going to be as straightforward as assuring QoS of traditional voice services, operators can use approaches such as traffic prioritization techniques in the Wi-Fi access, IP, and voice core networks to prioritize VoWiFi traffic. Real-time, traffic-based assurance solutions can help operators monitor the VoWiFi traffic in real time to identify degraded audio quality and one-way audio problems. In addition, any audio quality degradations can be correlated back to specific network elements so operations can take corrective action to resolve the issue. VoWiFi also introduces new network elements such as the IP multimedia sub-system (IMS), which will need to be monitored from a control plane perspective.

Implementing a large-scale IMS platform also opens up new business opportunities such as outsourcing the spare capacity and hosting VoWiFi calls for other operators, and IMS interconnect and peering. This creates new service assurance challenges such as monitoring a multi-tenant IMS platform and checking peering points for problem isolation.

Another new business opportunity that is emerging for cable MSOs is the wholesaling of the Wi-Fi access to other service providers such as MVNOs. In mature markets, LTE-based MVNOs offering VoLTE may need to use third-party Wi-Fi networks to supplement coverage, which represents the wholesale Wi-Fi opportunity for

cable MSOs. As part of such agreements, cable MSOs will need to assure the services carried over the Wi-Fi network. One such scenario is when MVNO customers initiate a VoWiFi call in the Wi-Fi domain and enter the home operator's LTE domain – this would require a seamless VoWiFi–VoLTE call handover. As part of the MVNO agreements, cable MSOs may need to assure the VoWiFi services and monitor complex VoWiFi–VoLTE call handover scenarios.

8. Vendor solution overview – Netscout

As cable MSOs introduce the product and service portfolios to include VoD, WiFi, home automation and security, the rapidly expansion needs to be managed with the confidence that the user experience of these new IP services is maintained regardless of the type of service or the transport and delivery infrastructure. Like mobile operators have been doing for years, cable MSOs need to assure the continuity and efficiency of operations and services.

Netscout has been providing the largest network operators in the world, visibility and insight into the performance of their network and services. The patented Adaptive Service Intelligence (ASI) technology processes traffic flow data, “at the source”, and in real-time. This ability to collect and process real-time traffic flow data to build and maintain key performance indicators (KPIs) at the source, distribute and store the data while maintaining coherency and context, has proven extremely useful for operators. By leveraging packet flow data, Netscout’s solution is able to provide visibility into how the various network elements are working together in the service delivery chain, allowing operators to quickly identify where issues are occurring.

Netscout’s ASI technology drives the company’s service assurance, security, and business intelligence platforms providing deep insight and data reliability for operations, engineering, planning, and marketing teams. The ASI technology allows operators to achieve their business goals by helping to see and manage the complexity of today’s IP networks. In addition, ASI is designed to scale for large traffic loads allowing operators flexibility and agility as they innovate tomorrow’s networks and services.

Netscout’s distributed architecture allows for real-time computation of metadata at critical points across the network providing not only hop-by-hop metrics, but end-to-end metrics as well. Understanding that operators are evolving their networks with technologies that support agility and flexibility, Netscout offers technology in an appliance form, as software on common off-the-shelf (COTS) hardware, as well as pure software for virtual network environments, ensuring visibility across all domains. By delivering performance alerts and KPIs throughout the service delivery chain, the monitoring infrastructure gives operators the flexibility to deploy the solution in a future-proof manner, enabling operators to use the same alerts and KPIs for future closed-loop automation for on-demand services.

Netscout also automates the mundane but important tasks of constantly checking the status of the network and service performance. The advanced analytics and proactive monitoring functions quickly learn the behavioral tendencies of the network or service, establish performance baselines and generate proactive alerts when deviations occur. When problems arise, the service triage capabilities can quickly identify the source of the problem reducing the mean-time-to-knowledge (MTTK). This allows operations teams to focus their efforts on solving the problem rather than spending time trying to discover the source of the problem.

9. Conclusions

Cable MSOs are embarking on a variety of strategic initiatives as they move beyond their traditional, in-home domain and enhance their competitive position against alternative video service providers and traditional telecom companies. Innovations such as vSTB and vCPE are enabling the operators to offer services using cloud-based infrastructure. Carrier Wi-Fi marks a foray into wireless access, which opens up new revenue opportunities such as Wi-Fi wholesaling.

For the long-term success of these initiatives, cable MSOs need to differentiate based on superior customer experience to increase customer stickiness and reduce churn. Customer experience can be affected by a variety of factors, but cable MSOs need to focus particularly on high-impact factors such as network quality and reliability. Cable MSOs may also need to consider improving the business processes in the ‘support’ phase of the customer experience lifecycle, which is the longest engagement period between the operator and customer.

Service assurance systems can play a vital role in delivering first-class customer experience, and in operationalizing these strategic initiatives. New network technologies introduce a variety of network and service issues, giving rise to a new set of operational challenges. Cable MSOs need new tools and capabilities to effectively monitor and triage such issues to prevent degradation of network and service quality, and ultimately, customer experience. Within this context, fit-for-purpose service assurance systems and processes can significantly boost cable MSOs’ operational capabilities and better prepare them to execute the new strategic initiatives. Service assurance can enable cable MSOs to address the unique nature of issues that may arise by transferring the video control plane to the cloud or providing business services using a vCPE-based NFV environment, or offering public Wi-Fi access. In addition, service assurance can provide continuous understanding of the impact of new services and technologies on the network from the moment they are turned on and the first customer comes on-board until they achieve scale, move through their lifecycle, and are decommissioned.

The specialized capabilities of service assurance directly empowers network and service operations to proactively monitor the infrastructure and network performance, allowing operators to resolve issues before they affect the service. Proactive assurance also allows operators to deliver a much more reliable service, resulting in increased customer satisfaction, fewer calls to the contact center and, ultimately, increased operational efficiency and reduced operational costs.

About the author



Anil Rao (Senior Analyst) is a member of Analysys Mason’s Telecoms Software research team, and is the lead analyst for the Service Assurance program, focusing on producing market share, forecast and research collateral for the program. He has published research on assurance requirement for NFV/SDN, IP probes, real-time network analytics and the importance of service assurance in reducing churn and improving customer experience. Anil holds a BEng in Computer Science from the University of Mysore and an MBA from Lancaster University Management School, UK.

Analysys Mason does not endorse any of the vendor’s products or services discussed in this whitepaper.

Published by Analysys Mason Limited • Bush House • North West Wing • Aldwych • London • WC2B 4PJ • UK
Tel: +44 (0)20 7395 9000 • Email: research@analysismason.com • www.analysismason.com/research

Registered in England No. 5177472

© Analysys Mason Limited 2016

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, mechanical, photocopying, recording or otherwise – without the prior written permission of the publisher.

Figures and projections contained in this report are based on publicly available information only and are produced by the Research Division of Analysys Mason Limited independently of any client-specific work within Analysys Mason Limited. The opinions expressed are those of the stated authors only.

Analysys Mason Limited recognises that many terms appearing in this report are proprietary; all such trademarks are acknowledged and every effort has been made to indicate them by the normal UK publishing practice of capitalisation. However, the presence of a term, in whatever form, does not affect its legal status as a trademark.

Analysys Mason Limited maintains that all reasonable care and skill have been used in the compilation of this publication. However, Analysys Mason Limited shall not be under any liability for loss or damage (including consequential loss) whatsoever or howsoever arising as a result of the use of this publication by the customer, his servants, agents or any third party.

About Analysys Mason

Analysys Mason is a trusted advisor on telecom, technology and media. We work with our clients, including communications service providers (CSPs), regulators and end users to:

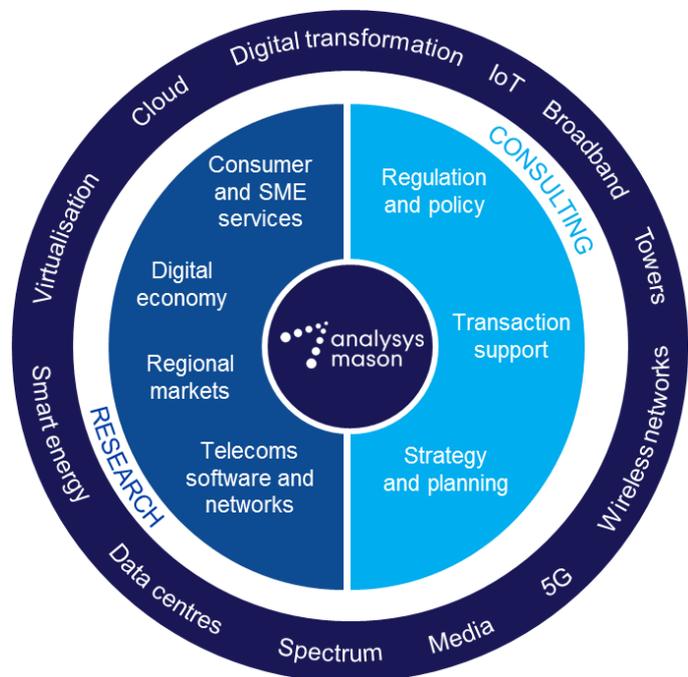
- design winning strategies that deliver measurable results
- make informed decisions based on market intelligence and analytical rigor
- develop innovative propositions to gain competitive advantage.

We have more than 220 staff in 12 offices and are respected worldwide for our exceptional quality of work, independence and flexibility in responding to client needs. For over 30 years, we have been helping clients in more than 100 countries to maximize their opportunities.

Consulting

- Our focus is exclusively on TMT.
- We support multi-billion dollar investments, advise clients on regulatory matters, provide spectrum valuation and auction support, and advise on operational performance, business planning and strategy.
- We have developed rigorous methodologies that deliver tangible results for clients around the world.

For more information, please visit www.analysismason.com/consulting.



Research

- We analyze, track and forecast the different services accessed by consumers and enterprises, as well as the software, infrastructure and technology delivering those services.
- Research clients benefit from regular and timely intelligence in addition to direct access to our team of expert analysts.
- Our dedicated Custom Research team undertakes specialized and customized projects for clients.

For more information, please visit www.analysismason.com/research.