Emerging Technology Analysis: Cloud-Based Solutions Change Video Delivery for CSPs and MSOs Globally

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To escape the commoditization of traditional services, communications service providers and cable multiple service operators are exploring cloud-based solutions. These offer customers a better video experience and reduce capital expenditure on newer roaming and timeshifting multiscreen services.

Key Findings

■ Activities for communications service providers (CSPs) will include addressing digitally enabled consumers and embracing network virtualization, in a "net-neutral world."

■ Hypervisor-based solutions with network function virtualization (NFV), combined with software-defined networking (SDN) and content delivery networks (CDNs) are emerging to provide real-time video services.

■ Software-defined, video-based solutions are in the early days of transforming core video operations and will coexist with edge routers, mobile packet core solutions, and newer cloud radio access networks (RANs).

■ CSPs and CDN providers are placing more focus on end-user quality of experience (QoE) for video due to the increased interest in on-demand services, and to reduce capital expenditure (capex).

Recommendations

CIOs, CTOs, network architect CSPs, and MSOs should:

■ Develop competencies in each element of the Nexus of Forces (cloud, social, big data and mobility), with newer software video technologies as they offer more digital services.


- Confirm the viability of video solutions by moving from legacy, siloed hardware platforms to software-based products with innovative and converged service features (for example, unified communications as a service [UCaaS] with video sharing).

- Embrace digital business transformation with software-defined video services by leveraging DevOPS models for network and IT operations to improve service agility.

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### Strategic Planning Assumption

By 2018, at least 25% of CSP/MSO-hosted and managed CDN services revenue for video delivery within mature markets will include software-defined video functionality built into video services, with over $10 billion forecast.
Analysis

The stakes are enormous for CTOs, CIOs, CSPs, and cable MSOs — especially for those that fail to innovate. CSPs that do not exhibit an urgency to transform will risk ceding their market positions to alternative service providers, such as system integrators (SIs), technology vendors and over-the-top (OTT) service providers. With net neutrality concepts lurking in many countries, these legacy CSPs may become bitpipe providers only.

For many CSPs, the proliferation of real-time Internet Protocol (IP) video applications from OTT providers has created a network environment that is costly for those remaining as bitpipes. Opportunities exist for CSPs to partner with OTT providers, creating innovative services with any screen, any device, at any time — perfecting the multimedia experience with policy-based control of the networks. While net-neutrality must be considered, differentiation is possible with HD transcoding, or mobile-edge computing/caching of content for an enhanced, preferred content experience, as well as charging for tiered services.

There are many business strategies that CSPs can use to redefine their services. One is to start their own paid video services in direct completion with OTT video services. The other is to disrupt the usual relationships by charging the content owners for various services, including those related to video delivery. In both cases, software-defined video (SDV) concepts can apply. CSPs like Bell Canada with CTV Television Network, and cable MSOs like Comcast with NBC, own the content with TV stations, but this is an expensive proposition.

CSPs can also partner with OTT providers and content owners to provide innovative services. The virtualization trials taking place within many CSP organizations (for example, Telefonica’s Unica project, Deutsche Telekom’s TeraStream project, and AT&T’s Domain 2.0 project) give CSP technology providers an opportunity to create rational and cost-effective solutions that capitalize on combining emerging virtualization based on NFV and SDN capabilities.

Combined virtualization provides the following benefits:

- Agility for new services that are tested, prototyped and deployed in days, instead of legacy hardware-based solutions deployed in years.
- Higher performance as legacy, application-specific integrated circuits and field-programmable gate arrays become software functions from leveraging general-purpose processors (graphics, processing units, and CPUs) on standards-based servers.
- Flexibility across fixed and mobile networks from platform-neutral solutions.
- Lower cost of ownership and flexible pay-as-you-grow business models with equipment vendors for upfront capex savings. Some equipment vendors have claimed 25% lower capex.

CSPs, MSOs and CDN providers are increasing the focus on end-user QoE for video, as well as interest for on-demand services.
Technology Description

Software-Defined Video Provides a New Way of Engaging Customers Using Innovative Services

Gartner's nexus and other new competencies are required by CSPs to stay ahead of their rivals, and for survival in the fiercely competitive telco market. Newer technologies and processes will enable the convergence and mutual reinforcement of IT and network trends. SDV has this potential for several reasons:

- It is cloud based.
- It relies on big data analytics to transcode, cache and deliver content for an enhanced experience.
- It is likely to have a mobile angle to support seamless session continuity across devices.
- It may have a social media angle when combined with DevOPs.

This multiscreen vision with seamless roaming across networks (such as Long Term Evolution [LTE], and satellite, fixed and Wi-Fi communications) can also present a revenue opportunity for CSPs to provide differentiation for OTT content providers, as well as enhancing their own content.

CSPs can deploy real-time policy control and charging solutions for on-demand HD experiences (a "turbo" button, for example) to monetize a better user experience, even for OTT applications. While turbo experiences have yet to be proven successful, other options include targeted ad-insertion, or newer converged services, such as:

- UCaaS with video sharing (both broadcast video and personal video).
- Video gaming as a service, where people watch others game (via platforms like Twitch) with social network applications.
- Converged Web real-time communication experiences (Web chat, click-to-call) with video sharing (broadcast video and personal video).

However, this also adds complexity to the architecture, as it entails personal cloud solutions and public cloud content being relayed with controlled radio elements, as well as backhaul and network core elements. Policy-based control and session persistence also add to the complexity. With net-neutrality becoming more important, CSPs will need to think creatively and differentiate based on QoE.

This can be achieved by leveraging better transcoding and caching, and customizing closer to the edge, allowing all packets to be treated equally in the network, with some packets receiving added non-network resources, such as compute/caching resources to permit tiered services.

Innovative emerging services include:

- Wi-Fi/small cell solutions with local routing in newer cloud RAN offerings.
Video session control, with multiscreen capabilities within cloud-based solutions.

Converged small cell/Wi-Fi controllers and set-top box/home gateway solutions playing a significant role. These home gateway solutions are in turn being virtualized in the cloud.

For core services, CSPs should look to private or public cloud-based SDV offerings interworking with cloud-based Hotspot2.0 WLAN controllers, as well as gateways such as virtualized LTE Evolved Packet Core solutions, all running as virtual machines rather than dedicated appliances.

Virtual machines will require networking, distribution and load-balancing logic, and provide the concept of a service chain of functions on demand. These are easily imagined as video-specific tasks such as encoding, transcoding, splicing and clipping, among others, where they were once isolated and confined to data management and routing functions.

SDN is an increasingly popular approach for networking within data centers, but it is still emerging within the CSP domain. SDN provides key attributes, including:

- Separation of data and control planes, allowing for holistic control and management of disparate networks.
- Heterogeneity in underlying network equipment, allowing for best-of-breed vendor selection.
- Rapid reconfiguration of the (virtual) network, allowing for newer services like bandwidth calendaring and service orchestration for on-the-fly network functions.

Attempts at standardization exist (such as OpenFlow), but fragmentation is still occurring within the SDN space that includes variations where router vendors expose proprietary APIs to provide unique features. Inter-CSP SDN deployments will require interoperability testing with network equipment solution providers. This means that the standards will need to be extended.

Services that are more toward the edge, or CDNs with SDN potentially can support:

- CSP networks becoming delivery-neutral, with on-demand provisioning of bandwidth on the fly, which will be useful in federated CDNs across CSPs.
- CSPs differentiating with on-demand services and made available by using APIs with real-time charging and network virtualization for a "turbo experience," assuming net-neutrality.

CDNs with NFV can potentially support:

- Virtualization of video within CDNs, which allows CSPs to be neutral for server availability, physical location, content movement/replication and load distribution, which saves on capex and operating expenditure.
- Hypervisor-based CDNs, which allow operators to leverage off-the-shelf hardware and newer elasticity scaling (as needed) to other CDN providers via federation technology.
- Fixed CDN providers, with opportunities to partner mobile equipment vendors with broad video expertise (for example, Cisco, Ericsson, Akamai, Alcatel Lucent, and Citrix with ByteMobile, or hybrid offerings from F5 Networks, Elemental Technologies and others), to create solutions that
exploit common content (such as for TVs and mobile devices) and develop cost-effective peering points to the CDN cloud.

CSPs embarking on digital business transformation typically look to SIs and cloud-based service providers for expertise and support. However, to compete effectively with OTT providers, CSPs must develop competencies in the SDV arena. CSPs risk ceding ground to OTT providers and even SIs able to offer competing services, since they understand the requirements better. SIs like HP, Cisco and others are offering CDN solutions both as a platform and as a managed service.

For CSPs, the build versus buy or lease for CDN platforms is a difficult question, as significant financial and engineering commitments are needed for both, along with extensive peering agreements. However, if service differentiation for newer revenue and to minimize customer churn are required, then hybrid offerings can be considered. Many network operators choose to buy wholesale CDN services while building CDNs themselves (for example, Verizon with EdgeCast, also partnering with Akamai, and AppleTV with its own CDN).

**Technology Adoption**

To counter the bitpipe effect, CSPs are looking at ways to monetize the OTT experience with newer QoE, on-demand turbo buttons. Newer business models are occurring — and the federation of content in CDNs is allowing content owners to pay for content delivery optimization from caching content closer to consumers (minimizing buffering delays). Targeted insertion of advertisements, as well as newer converged services, like video gaming as a service (with collaboration), are new revenue opportunities.

Integrated fixed and mobile CDN offerings are likely to be used by multiple-access CSPs to differentiate themselves from OTT providers and single-access CSPs. Here, a seamless video session across networks and devices can be a differentiator. OTT players or single-access providers like cable MSOs are likely to have choppy or dropped sessions as people roam with tablets and smartphones across 4G networks and fixed Wi-Fi access networks.

**The Market Size**

From a services revenue perspective, what is at stake is approximately $40.6 billion of CSPs' projected adjacent market (nontraditional) revenue for 2017 (see "Market Trends: Adjacent Market Revenue Opportunities for CSPs in 2017" on video-related services).

The SDV market is estimated at approximately 25% of the overall forecast, as SDN and NFV become more prevalent in CSP and cable MSOs' services. By 2018, at least 25% (or over $10 billion) is forecast for the SDV total addressable market for CSP/MSO-hosted and managed CDN services revenue. Video delivery within mature markets will have SDV functionality built into CSP and MSOs' video service offerings.

In each of these areas, Akamai, Alcatel Lucent, Cisco, Citrix and Elemental have reasonably complete platform offerings provided as a service to CSPs and cable MSOs. Akamai is primarily a services provider, although it is entering into partnerships with platform vendors like Cisco and Juniper. Alcatel Lucent is a third-party SI, but also provides its own platforms for SDNs, NFVs and
CDNs. Cisco is an end-to-end solutions provider, while Citrix (with its ByteMobile acquisition) and Elemental are disruptive, as they are helping to move the industry forward more rapidly. Other startups include Inmobly and Vantrix, among others.

Factors Inhibiting Adoption

CSP Networking Equipment With SDV Is Still Being Developed

Attempts have been made at standardization (such as from OpenFlow for SDN and NFV) and standards exist from the European Telecommunications Standards Institute (ETSI), but the SDV space remains fragmented. The vendor landscape is converging, often with proprietary solutions that create complex SDV solutions.

The requirements for CSPs' SDV services and CDNs include:

- Supported video transcoding, caching, and transrating with traffic routing based on proximity, network health and resource load balancing.
- Integration with existing operations support systems (OSSs), DNSs and bandwidth management systems.
- Virtualization of the service to CSPs and ISPs.
- Supported innovative services, like targeted ad insertion and live-to-video on-demand applications, while maintaining resiliency and security.
- Supported service assurance, with revenue assurance, self-service portals and analytics with billing, across CSPs and ISPs.

Proprietary Hardware-Based Video Solutions From Attempts at Customized Products Are Still Available

Given the complexity of SDV solutions, it may be easier to leverage existing hardware-based video solutions, such as from Arris, Harmonic and others, offering a video-in-a-box product, as well as the combined functions of deep packet inspection, transcoding and caching from vendors like Allot Communications.

Figure 1 shows an example of a video-in-a-box product that provides a complete and proven end-to-end solution currently deployed in networks.
These solutions are valued for their incumbency, their reliability and their ability to scale in managed network environments. However, with the rapid change associated with the move to an agile service delivery model like DevOps, these legacy systems will need to adapt to provide hybrid SDV-based solutions supporting dynamic service orchestration with the resiliency of hardware-based solutions.

## Technology Impacts

### The Vendor Landscape Converges With the SDV Concept

Equipment vendors are emerging as new models or converging via acquisitions and partnerships to react to market conditions — examples include:

- Allot acquiring Oversi.
- Qwilt emerging as a transparent cache provider and partnering with AltioStar for cloud RAN caching.
- Elemental emerging as a software video infrastructure provider and partnering with Adobe, Akamai, Amazon Web Services, Cisco, Comcast and Ericsson.
- Saguna Networks being funded by Akamai and partnering with PeerApp for mobile-edge caching of content.
- Cisco and Juniper’s partnerships with Akamai.
- Ericsson’s Media Delivery Network (MDN) with Mediaroom and Azuki, and Fabrix’s acquisition and partnership with Elemental and Citrix Skytide.
- Alcatel Lucent with its Velocix acquisition, and Contextream’s partnership with Telefonica, leverages solutions from Elemental and HP (that partners with Vantrix and Imagine Communications) acquiring Digital Rapids’ RGB Networks via a recapitalization of Harris and partnership with Microsoft Azure.

- Citrix acquiring ByteMobile and Skytide to create solutions that exploit common content (for example, for TVs and tablets) and developing cost-effective peering points to the CDN cloud.

- CDN solutions, from vendors like Akamai, Cisco, EdgeCast and Elemental, could provide CSPs and partnering content providers with solutions to support higher QoE.

**SDN, NFV and CDN Convergence**

Companies like Cisco, Ericsson and Alcatel Lucent are announcing SDV offerings and combining NFV/SDN-based routers with CDN functions to support:

- Distributed control planes. SDN decouples the control plane from the data plane to maintain the autonomy of network elements and increase reliability, scalability and security.

- NFV-architected software. Allows for elastic services to be service chained like Elemental, Vantrix, Imagine Communications, and other CDN partners.

**DevOps Models for IT and Network Operations Convergence Realize the Full Benefits of Network Virtualization**

For many CSPs, the end goal for DevOps is service automation. This is where cost efficiencies and improvements to the customer experience are mostly found with innovative services. Network virtualization and SDV have an impact by marketing support for the newer converged IT and network teams, as well retooling and process re-engineering.

The earlier legacy waterfall delivery models of linear life cycles created services by connecting silos of “boxes” that were systems tested for years before being deployed. DevOps models now offer more of a design for recoverability paradigm that provides service agility in the cloud, where if features fail, they are likely to be detected quickly and decommissioned without affecting the rest of the network, and if successful are supported with Web-scale IT.

The key differentiator will be service orchestration of newer services on the fly by chaining network functions in the cloud, as needed, with multivendor functions and newer functions from startups, which is difficult with existing hardware-based platforms.

**Action for the Next Six Months**

Cable MSO and CSP CIO/CTO teams should be focusing on including SDV in their data center strategies. For those without a data center, or with data centers used for other purposes, consider partnering with OTT or CDN providers supporting SDV, which has a unique business model able to be sold using a pay-as-you-grow approach. For CSPs and cable MSOs, this can reduce customer
churn for newer services (with capex savings), while providing newer revenue streams. Network platform providers gain extra revenue streams with new revenue-sharing business models.

**Action for the Next Eighteen Months**

The midterm strategy for Cable MSO and CSP CIO/CTO teams is to develop SDV-based converged services. Here, competencies should be developed in each element of the nexus, with newer software video technologies in mind, as CSPs transition to offer more digital services.

Newer agile service delivery processes like DevOPs should be leveraged with innovative and converged service offerings in mind (such as UCaaS with video sharing). Joint solutions with innovative startups, along with traditional network platform providers, should be considered in field trials with partners or internal organizations, to develop the latest services and create an innovative ecosystem of partners.

**References**

"Hype Cycle for the Telecommunications Industry, 2011"
"Magic Quadrant for Cloud Infrastructure as a Service"
"Cool Vendors in Communications Service Provider Infrastructure, 2015"

**Gartner Recommended Reading**

Some documents may not be available as part of your current Gartner subscription.

"Emerging Technology Analysis: OpenFlow"
"Forecast: Carrier Network Infrastructure, Worldwide, 2009-2016, 1Q12 Update"
"Emerging Technology Analysis: Diameter Signaling Routing Provides CSPs With Opportunities for 4G"
"Emerging Technology Analysis: OpenFlow and Software-Defined Networking for CSPs"

**Evidence The Industry Trend for SDV Convergence**

In October 2014, Akamai and Juniper announced a strategic alliance to bring mobile cloud acceleration solutions to market. This has led to other mergers and partnerships, for example:

- Allot acquiring Oversi.
- Qwilt emerging as a transparent cache provider and partnering with Altiostar for cloud RAN caching.
- Elemental emerging as a software video infrastructure provider and partnering with Adobe, Akamai, Amazon Web Services, Cisco, Comcast and Ericsson.
- Saguna Networks being funded by Akamai and partnering with PeerApp for mobile-edge caching of content.
- Cisco and Juniper’s partnerships with Akamai.
- Alcatel Lucent with its Velocix acquisition.
- Citrix acquiring ByteMobile and Skytide.
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