Casa Systems, Kyrio, and Intel show that virtualization decreases rack space and power and increases throughput—while cutting TCO

Today’s cable service providers face no shortage of opportunities and challenges as they compete in a rapidly changing marketplace distinguished by high-bandwidth growth and a race for faster speeds. At the same time, new markets for low-latency applications, such as augmented/virtual reality, 5G small-cell backhaul, and mission-critical IoT, loom on the horizon.

Virtualization and the disaggregation of network functions provide key tools to allow service providers to face their challenges and seize opportunities. Distributed access allows for an order of magnitude increase in capacity while freeing up space and reducing power. Virtualization delivers the flexibility to respond rapidly to new revenue opportunities along with the high potential for significant cost savings.

As more cable service providers balance opportunities and challenges, many are rethinking how they operate so that they can balance change and expenses. A solid total cost of ownership (TCO) analysis for the architecture changes and transition steps, as presented in this white paper, is needed.

Why move to virtualization

The evolution to the virtualization of network functions and the development of software-defined infrastructure in general represents a paradigm shift in the industry, with virtualization likely being new to many. It moves companies from fixed-function appliances with fixed capacity to virtual network functions (VNF) written in software and running on commercial off-the-shelf (COTS) servers and switches.

Bringing the power of virtualization to cable service operators
Among the most sought-after goals is a lower TCO of the network elements. That means bringing down the cost per bit over the network while giving service providers the enhanced flexibility they need to respond to market demands. It also means preserving, as much as possible, existing services and technology, thereby avoiding costly rip and replace scenarios.

By exchanging a hardware-based cadence for one driven by software, service providers can greatly accelerate the speed of innovation. Virtualization is also the best way to conserve space and power while growing the access network.

Some purpose-built infrastructure will always be needed, but it is becoming clear that important benefits can be achieved when progressively adding more network function virtualization (NFV) and software-defined networking (SDN)-based deployments over time. This evolution becomes an important tool for driving network scale and agility.

A Casa Systems, Kyrio, and Intel collaboration

In 2017, in the face of these escalating demands, a client approached Casa Systems with a question. As a cable service provider with millions of subscribers, the company wanted to know this: As we increase network throughput, what will the effect be on our hubs if we grow in a traditional way vs using a virtual solutions? In addition, what are the options and what is the TCO?

Casa Systems had already been exploring the potential cost impacts of going to a virtual solution. Now it decided to tap a long-standing partnership with fellow industry leaders Kyrio and Intel to explore the question further. The three companies had already worked on an earlier 2017 proof of concept (PoC) focused on virtualizing fixed and mobile core networks. Now the team decided to complete a detailed TCO analysis of the options based on a specific hub site in the large cable service provider’s network.

The launch of the TCO analysis

The aim of the TCO analysis was to explore the effects of migrating to a Node Plus Zero (N+0) architecture with a Virtual CCAP (vCCAP) core using general-purpose 86 servers.

The specific hub site chosen was large, but as can be seen by the distribution of rack space shown below, it was a typical CCAP installation. As a result, the TCO analysis and conclusions are applicable for a wide range of deployments and cable service providers.

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Casa Systems relied on Intel® Xeon® processors for the 2017 PoC system. A vCCAP solution was part of the PoC, and significant performance efficiencies were verified.

Virtualizing the CCAP system and implementing Remote PHY (R-PHY) results in an IP-enabled system that offers cable operators a host of important benefits. Cable operators increase their capacity in the field by augmenting their existing HFC nodes with DAA/R-PHY nodes and virtualizing their CCAP core. Moreover, cable service providers could remain within the same hub space, which represented a big win as that would negate the need for building out new infrastructure, acquiring new property, or expanding one’s existing footprint—often in costly urban settings.

Further minimizing TCO were the savings forecast for OpEx, including a notable reduction in electricity costs. Other benefits existed but were hard to quantify. For example, cable companies would now be able to offer differentiated services and fully orchestrate the provisioning of services across the network.

With the end goal of a N+0 network (i.e., no amplifiers between nodes and subscriber homes), two architectures were assessed—iCCAP and vCCAP. Because N+0 significantly increases total Service Groups, it quickly became apparent that vCCAP was the only solution that could be deployed in the same headend footprint.
The project and its results

**What was done**
The TCO analysis involved the evaluation of two N+0 deployment options:
1. iCCAP with N+0
2. vCCAP with N+0

In each case, the following elements were assessed:
- Physical hardware
- Rack space
- Power
- Cooling
- CapEx (adding power to the facility)
- OpEx

**What was achieved**

**TCO results**
Both of the deployment options below represent a 6:1 increase in Service Group count to 6,942 Service Groups due to the required increase in node count for N+0 deployments.

While there are clear benefits of both iCCAP and vCCAP over the current architecture, only the vCCAP scenario fits into the current headend footprint.

iCCAP with N+0 would require 4,331 RU vs. 3,334 RU available in the existing headend, whereas vCCAP requires only 2,782 RU. vCCAP proves to be more power efficient as well, requiring 629 KWh vs. iCCAP which requires 967 KWh for the same Service Group count.

**Virtualization benefits highlighted by the PoC**

Today, cable service providers use a variety of equipment to meet demand and combine services. That equipment consumes a great deal of space, power, and resources. What's more, until all services, including video, are converted to IP and integrated using CCAP, neither distributed access nor virtualization with Casa Systems' virtual Axyom™ Software Platform can be employed. Moving to CCAP is a prerequisite.

**TCO**

This case study clearly shows that vCCAP can bring significant OpEx savings—proving to be higher density and lower power vs. an iCCAP approach. This is especially critical in N+0 deployments where the number of Service Groups that need to be served out of a given headend footprint could increase by a factor of 6:1 or even higher. Moving to iCCAP is a prerequisite.
Flexibility

TCO is just the beginning. Service providers can also expect a great deal more functionality and capability than they currently enjoy as well as greater performance. It is easier to scale with servers than it is with customized hardware platforms. Because generic servers can run different kinds of functions, service providers stand to achieve greater flexibility in managing their infrastructure. Install or uninstall and add or remove capacity as needed. In addition, these changes can be scripted or scheduled and run in a more automated fashion.

Finally, as noted earlier, current tools and methodologies are fast becoming insufficient, given evolving consumer demand and the digital transformation those demands make necessary. The future is virtualization and NFV. By exploring the virtualization strategies used in the joint PoC, cable operators can better equip themselves with the flexibility they will need in the years to come.

Revenue

In addition to the TCO benefits, a DAA with virtualization enables a network with lower latency. That means service providers will be able to offer new, differentiated services ranging from VR to autonomous driving—and gain new sources of revenue. The journey does not end with vCCAP. Virtualization provides the baseline for the introduction of new advanced capabilities, such as a 5G core and network slicing, further adding to the new revenue opportunities.

A starting point: Moving services to IP

Many cable service providers, despite being new to the idea of virtualization, realize that traditional methods are no longer sufficient to meet the requirements of a rapidly changing industry. But making the switch too quickly is not a viable option either. Instead, as the TCO analysis demonstrates, companies can continue to offer ever greater levels of bandwidth by first introducing R-PHY while at the same time starting to explore and test new virtualized CCAP functions.

A critical early step in such a plan is moving all services to IP. That means that video, voice, and data all need to be natively transformed to IP and converged onto a single port. Getting there requires a CCAP solution, such as Casa Systems’ C100G, in which all services are converged. The aim is to create an IP stream linked to a layer 2 network or converged interconnect network (CIN). Casa Systems has solutions, such as the Casa Systems Video Gateway, to help ease the migration to all IP services.

The move to IP is not without its challenges. For example, service providers must contend with difficulties surrounding the transition of video. This includes broadcast video, video on demand, and switch digital video. These systems are complicated to convert because they tend to be proprietary. The PoC-leveraged technology helps overcome these obstacles, saving time and costs during the migration.

The path to virtualization

If virtualization is both a new paradigm for many cable service providers and the strategy of the future, how do you begin? Here is our suggested path:

1: Assess what you have and your growth, followed by a forecast.
2: Adopt integrated CCAP with your existing nodes.
3: Begin to perform node segmentation or fiber-deep initiatives.
4: Contact a Casa Systems sales representative to learn about all of your DAA and vCCAP options.
Simplifying the way forward

The call for network transformation is here as the world rapidly virtualizes. Cable service providers will need fast, agile services; access to massively increased bandwidth capacity; and different levels of service for different types of customers and use cases. Virtualization provides companies a viable path forward to meet those demands and grow their bottom line.

Casa Systems, Kyrio, and Intel launched a PoC intended to demonstrate the benefits of graduating from fixed-function appliances with fixed capacity to NFV. The results speak for themselves. The project achieved notable reductions in rack space and power and increased throughput. It is clearer than ever that cable service providers must consider vCCAP and DAA as important tools as they pursue continued growth and greater service flexibility.

Learn more about the PoC by consulting the following resources:
Webinar: brighttalk.com/webcast/12229/289379

Further explore each of the partner companies at the addresses below:
casa-systems.com  |  intel.com  |  kyrio.com