ARISTA WHITE PAPER

Arista EOS CloudVision®: Cloud Automation for Everyone

INTRODUCTION

Architecting a fault tolerant and resilient network fabric is only one part of the challenge facing network managers and operations teams today. It is simply not good enough to build a scalable fault tolerant network. Typical data centers can range from tens, to hundreds if not thousands of networking devices.

Operational tasks alone at this scale have created an endless set of challenges faced by the implementation and operations teams. Often the cost of these challenges outweighs the benefits of introducing a new vendor or emerging technology.

To meet these challenges, network operations teams have glued together a basket full of reactive software tools in order to manage, monitor and alarm on a day-by-day, minute-by-minute basis. Such tools usually consist of either homegrown scripts or 3\textsuperscript{rd} party tools that have little or no integration with each other. The end result being every network issue ultimately requires human intervention in order to provision, manage or troubleshoot any infrastructure. This model adds to the complexity and exponentially increases the OpEx costs of running infrastructures of any size. Additionally it is counterproductive to the original business intent, which led to purchase of these tools in order to drive down OpEx costs.

The media is full of stories describing tremendous OpEx savings by the largest (private or public) cloud companies achieved by using automation techniques. Naturally other companies want to achieve the same significant savings in their environment also.
However, most of these customers are handcuffed in moving forward with automation solutions, as they simply:

- do not know which solutions to deploy, or
- how to go about doing it, or
- do not have the budget, or
- do not have the resources to engage down this journey.

What these customers need is a turnkey solution to enable them to embark on this journey, initially ‘holding their hand’ before allowing them to mature to more advanced levels of customized automation.

At the end of the day, businesses need to be able to simplify data center operations. The main reason they need to do this is to enable “business agility & flexibility” for workloads and workflows. This flexibility helps them drive their businesses at a more rapid pace.

The advantage that Arista brings to the data center is not only a reduction in CapEx costs with the artistry of its leading product portfolio, but also access to the benefits of a software driven cloud solution by leveraging its open and programmable Extensible Operating System, EOS, to drive down OpEx costs. Arista EOS CloudVision is an extension of EOS focused on giving customers a turnkey solution to cloud-like automation and visibility.

ARISTA’S APPROACH TO NETWORK AUTOMATION

Much of the network automation deployments to date have been built on two approaches, illustrated in the following figure:

**1. Do-It-Yourself Automation** - D.I.Y. solutions are typically deployed by Cloud Titans, such as, Amazon, Google, Microsoft, Facebook, etc. Often cloud titans have a 10x appetite for deploying infrastructure (server, database, network) compared to the largest enterprises. For them data center automation is...
necessary to their business model as a means to compete in the market place. Such large organizations also have different application profiles and their applications are designed to account for infrastructure failure. As a result, cloud titans often employ large software teams to write custom designed scripts to automate their infrastructure. Arista helps such customers by providing them open tools like EOS SDK and eAPI with unrestricted access to the kernel to deploy their own scripts to be able to fully customize their network.

2. **DevOps model** - This model is typically deployed by large Service Providers or larger Enterprise, as they embark on the automation journey. The approach includes prebuilt 3rd party automation frameworks currently being used by the compute teams, such as Puppet, Chef, Ansible, CFEngine etc. to consolidate provisioning tools and apply those frameworks to the network infrastructure to drive down OpEx costs. Such customers are large enough to have resource pools available in order to write custom scripts to achieve some of the automation gains in their environment. They are more invested in the automation approach with committed resources, budget and vision to achieve the OpEx reduction goals. Arista helps such customers by providing open tools like EOS SDK and eAPI with unrestricted access to the kernel to deploy their own scripts or 3rd party tools like Puppet, Chef, etc. to be able to fully customize their network.

3. **Turnkey solution (NEW)** - There are no real open tools which exist in the marketplace today to guide customers down the path in taking the first steps to network automation. Arista’s CloudVision is a new tool that provides a turnkey solution, whereby the portal specifically allows customers to be able to provision, manage and gain more visibility into an infrastructure without inhibiting customers to be able to take on more complex automation scripts in the future. This software is designed to help customers of all sizes, in particular the SMB, mid and large sized enterprise across every vertical, which are looking to achieve the same OpEx reductions or potentially having to justify their infrastructure being outsourced to the cloud. As mentioned before other enterprises have the need and desire to embark on an automation journey, but do not have the time, skillset, or resources to do so. They do now by deploying CloudVision.
CloudVision builds on one of Arista’s core strengths - the Extensible Operating System’s (EOS) innovative state database model, called “SysDB”. SysDB acts as a broker between the many processes that make up EOS, enabling the scale, feature velocity and robustness EOS is known. SysDB holds the entire state for that switch e.g., configuration, topology, protocol state, monitoring counters details, etc.

ARISTA EOS: CLOUDVISION

Most provisioning and monitoring tools are reactive and manage each box individually, i.e. box-by-box solution. There is no holistic view of the whole network to visualize as a complete view.

CloudVision changes that operational model by taking a drastically different approach. It is built on the following three characteristics:

1. **EOS ‘Network Wide Service’** - by taking per switch state, aggregating it to provide consolidated network wide state of network.

2. **Turnkey Automation Solution** - By providing the use of a portal to provide turnkey workflows for automation and visibility

3. **Single Touch Point** - Enable cloud mobility, by providing an open and single point touch point for any 3rd party controllers and orchestration services.

The rest of the whitepaper will now focus on the various use cases where CloudVision can be deployed.

EOS CLOUDVISION: NETWORK-WIDE CORE SERVICE

Why is a network-wide consolidated view key? Why do we need yet another model to manage the network. Simply put, as an industry, we can manage the network like it has been for last 25+ years for the next 25 years: box-by-box, provisioned individually, managed separately, no automation, with no correlation to the health of the infrastructure with no real OpEx savings. However, history has proven that...
that model does not work. So why has this not been done before? Network operating software architecture has not allowed that to happen. With EOS now as a distributed architecture, CloudVision is able to aggregate and consolidate the network state to provide a network wide view which provides the operator full proactive visibility of what is going on in the network at all times.

When a switch is managed, there are typically 3 things that can be changed on it - configuration, image or a script. Today, most customers may have tools to combine 1 or at best 2 of these items within the same tool. However, to be fully automated, what is needed is a tool that consolidates these management tasks into one simplified tool.

Today most networks have multiple devices from the same networking vendor which they have deployed over time, all running different code versions. Traditional inventory management tools are used to monitor platform versions and code versions. However, these tools are not able to provide a service dashboard that actually shows if there are any critical proactive software bugs, manage life cycle code upgrades, and not able to provide security reports. CloudVision solves that problem by providing a dashboard of code deployment with real time alerts of known security & bug patches that need to be patched.

When monitoring tools are deployed, they typically are purchased and deployed in pairs i.e. Active/Backup model or Active/Active model (rarely seen in traditional enterprise management tools). The challenge is that typically the tool would be placed in one region and, if the customer has global presence, devices from other regions are being managed by a separate tool. There is no synchronization across any of these devices. If an upgrade in software is required, it is a major change and typically the whole monitoring tool has to be decommissioned before upgrade.
CloudVision changes that monolithic way of deploying management software by leveraging a fully distributed in-memory and historical archived hadoop database, which allows it to be deployed in ‘n’ data centers and state is synchronized automatically globally. This allows the operations team to have one global central view that can be managed from any device, and any device can be brought out of service to be serviced or upgraded without impacting the rest of the cluster.

**EOS CLOUDVISION: PROVISIONING USE CASES**

Even today with the advent of so much automation, network devices are still being configured manually and images deployed using sneaker-net.

To resolve the above problem, Arista was one of the first in the networking industry to come out with Zero Touch Provisioning (ZTP). ZTP allows the customer to be able to take a switch out of the box, rack it, stack it and automatically provision it with an automatically generated configuration, golden image, or script without any human intervention at all.

However, there was no turnkey way to orchestrate the ZTP process using a network wide view. CloudVision’s ‘Network Provisioning’ portal process allows the end user to create a logical network design diagram view to ensure devices are being provisioned with a data center leaf/spine topology view or any other network topology view, which represents the final deployment design.

When network switches are managed, typically a configuration, image and script are used to provision and manage change controls for that switch. The ‘Network Provisioning’ portal allows a customer to be able to perform all three actions at same time in a network wide view.
ZTP solutions were first born out of the need for automating the initial deployment of a switch in the infrastructure i.e. on Day 1 process. To truly obtain OpEx cost reductions of managing the asset during the life cycle of its deployment in the data center, CloudVision is expanding the scope of ‘Zero Touch’ by using a single process called ‘Network Provisioning’ for the provisioning of every change management process. Now customers have the freedom to use a turnkey portal based ZTP solution to provision the device initially and throughout its useful lifespan.

**EOS CLOUDVISION: CHANGE MANAGEMENT USE CASES**

Typically enterprise customers perform change controls outside production hours and request a change control window. When the change control window starts, the engineer performing the change will perform pre-change control procedures e.g. capturing switch interface status, vlan status, ip routing status, multicast status, ACLs, QoS configuration etc. using a number of show commands. These scripts may be run on a single device or a larger set of devices depending on the size of the change. Once the change has been completed, the engineer will most probably run exactly the same scripts again. The reason these scripts are run is to ensure that the delta performed during the change is per expectation. The only way to ensure this delta is accurate is if the engineer were to manually compare the pre & post change status. If the change impacts a large number of devices, it is not manually possible to ensure 100% accuracy and there is a reliance on sample-based confirmation, which substantially increases the risk of the change. Typically depending on the device or the complexity of the change, verifying the change manually can take an hour per device.

To be able to eliminate this seriously manual process and to be able to substantially increase the accuracy of the change control, CloudVision presents change control status via a new ‘Snapshot Mode’. This unique approach leverages the underlying database principles of Sysdb. By capturing various fields or states of the database before and after the change and by being able to report them per device or by a set of devices (referred to as ‘Config Containers’) drastically reduces the time of performing the change control.

CloudVision now takes the change control to the next level, by introducing pre-integrated Smart System Upgrade (SSU).
SSU allows the customer to take the whole or selected parts of the network out of service easily without impacting application traffic, thereby reducing OpEx again.

Typically, if a change control has not gone smoothly, the engineer(s) performing the change have to roll-back their change - i.e. configuration, image or script. They have to do it methodically and step-by-step and device-by-device.

For the first time, a network-wide rollback is available. It is very easy to for the user to simply revert to a previous state of the network.

**EOS CLOUVDVISION: WORKFLOW VISIBILITY USE CASES**

In a cloud network spine leaf design, it is key to be able to track workflows. Without visibility, the network operators are driving blind to determine outage causes or capacity planning. CloudVision has taken a number of innovative steps to ensure visibility in a spine leaf architecture troubleshooting to reduce MTTR of a network is reduced drastically with the following features.

As demand on a network increases with the onset of server virtualization, consolidation, IP storage, hadoop, there will be times of congestion on the network. When there is congestion on the network, Arista switches have a feature called ‘LANZ’ (Latency ANalyZer) which can highlight proactively when there was congestion and the impact of the latency. However, this is by box and not holistic for the network.

CloudVision helps the network operator to manage the health and congestion network wide and to report any hot spots there may be on a specific port or link. This allows the operator to quickly move workloads and workflows to less demanding resources on the network.

Most organizations are moving to a virtual world and typically have virtualized their compute environments using hypervisor-based solutions up to 80% to 90%. However, if there is a production issue, it is very difficult to correlate the virtualized world to the compute and network world. Arista has had a feature called ‘VMTracer’ in command line for a number of years that provides this correlation quickly within
CloudVision will be providing this feature with a network wide view, so that in the portal it will be very easy to search and find any virtual machine, and see it’s state thereby reducing the operating challenges and making it easier to run a tightly integrated overlay and underlay network.

Arista has now consolidated its Tap Aggregation Manager into a consolidated view within the CloudVision portal, thus giving the customer a common starting point to be able to operate their tap aggregation network.

**EOS CLOUVISION: WORKLOAD MOBILITY USE CASES**

There are various ways to implement VXLAN control plane functionality using multicast or BGP. However these approaches are not plug-n-play solutions and are not open to integrate with SDN Controllers.

CloudVision provides a simplified approach to deploy VXLAN overlays for mobility within the data center. Using open standards-based APIs like OVSDB or JSON, CloudVision is the platform for integration with Arista’s ecosystem of orchestration, overlay controller, and service delivery partners.

Visibility is key within a network monitoring tool set for quick identification of issues. Traditional network monitoring tools do not provide visibility into overlay VXLAN tunnels.

CloudVision bridges this gap in monitoring tools and provides a topological view of the overlay network.
that helps with troubleshooting and monitoring the environment.

CloudVision increases the visibility of the overlay network by stitching the virtual hosts and tunnel to the physical network ports and then providing a centralized view within the portal.

This allows the network designers and operators to make changes in the network with a higher degree of confidence.

Most VXLAN control protocols are run on the network switches themselves. If there is an outage, there will be huge convergence on the overlay network also where all the devices will have to relearn the state of the virtual environment.

CloudVision can be deployed in a clustered high availability mode with 3 servers in active/active state. In the event of a cluster outage, there is no convergence in the network, and the overlay network is uninterrupted, thereby maintaining a high availability at all times.

**EOS CLOUDVISION: PARTNER USE CASES**

Most SDN controllers are focused on the overlay network itself and are not tightly coupled with the underlay network.

CloudVision provides that openness to serve as a central integration point to all 3rd party controllers, such as VMware NSX, Microsoft, Nuage, etc. CloudVision also provides a more scalable solution as it does not require the controller to talk to every single network device. Instead the SDN controller simply talks to CloudVision’s central integration point, which will then communicate the overlay information to the rest of the VTEPs.
In addition to supporting tight OpenStack integration, CloudVision is fully open to supporting any customized controller that the customer may want to deploy. This provides the customer the choice of not being locked into any single overlay vendor.

CloudVision is the platform for integration with other best of breed solutions, including OpenStack integration (Rackspace, RedHat, etc), overlay controller integration (VMware NSX, Microsoft, Nuage, BYOC, etc), flexible compute integration (HP, Dell, etc), application services (L4-7) integration (Palo Alto Networks, F5, A10, etc), workflow tool integration (ServiceNow, etc), telemetry tool integration (Splunk, Corvil, etc), optical transport integration (Infinera), or storage partner integration. In addition, CloudVision can integrate with customer specific controller solutions.

This provides the flexibility to be able to integrate and write scripts to integrate their environment with any 3rd party vendor to manage the network.

**NEXT STEPS**

The next steps within any organization are to start by embarking down the automation journey. As such this section helps guide how to embark on this path and allows you to progress to very advanced levels of automation should you choose to do so.

Automation within your data center is not a specific destination but more of a journey, with newer ideas being generated as improvements are made. The best recommendation on approach is to:

a. Create a list of use cases that need to be tackled within the organization. Use the above whitepaper as tool to generate ideas on which use cases need to be tackled to compile the initial list.

b. The next step is to prioritize the list of use cases that are relevant for your organization. Use the 80:20 rule to prioritize the list, by identifying the 20% of use cases that will provide the largest benefit.

c. If automation has never been deployed before within your organization, the recommendation is to start with the easiest use case first even if it brings only small value. Once confidence is built
within the organization that automation is truly delivering a success story, more complex use case scenarios can be tackled subsequently.

Following is a table to help embark on this automation journey:

a. Prioritize your category which needs to be automated first by giving it a ranking from 1-6
b. Within each category prioritize each use case by giving it a priority 1-10
c. Estimate the Opex Savings (in currency) that can be potentially achieved
d. Work with your Arista account team to review the use case sheet and how best to embark on the CloudVision deployment

<table>
<thead>
<tr>
<th>CloudVision Use Case</th>
<th>Priority (1-10)</th>
<th>Opex Savings ($)</th>
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<tbody>
<tr>
<td>Network Provisioning</td>
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<tr>
<td>Automate new switch provisioning using ZTP</td>
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<td>Create switch configuration templates for leaf or spine</td>
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<tr>
<td>Create custom scripts to be managed on switches</td>
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<td>Maintain golden images post code certification</td>
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<tr>
<td>Manage &amp; Provision switch configuration, image, scripts centrally</td>
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<td>Change Management</td>
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<td>Snapshot Mode</td>
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<td>Smart System Upgrade</td>
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<td>Roll-back</td>
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<td>Workflow Visibility</td>
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<td>Network wide congestion notification</td>
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<td>Network wide virtualization visibility</td>
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<td>Centralized Tap Aggregation tool</td>
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<th><strong>Workload Mobility</strong></th>
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<tr>
<td>VXLAN plug-n-play deployment</td>
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<td>VXLAN topology view</td>
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<td>VXLAN virtualized host view</td>
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<td>VXLAN infrastructure HA deployment</td>
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<th><strong>Partner Integration</strong></th>
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<tr>
<td>Openstack Integration (Rackspace, RedHat, etc)</td>
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<tr>
<td>Overlay Controller Integration (VMWare NSX, Microsoft, Nuage, Bring Your Own Controller ‘BYOC’, etc)</td>
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<tr>
<td>Flexible Compute Integration (HP, Dell, etc)</td>
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<tr>
<td>Application Services Integration (Palo Alto, F5, A10, etc)</td>
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<tr>
<td>Workflow Tool Integration (ServiceNow)</td>
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<tr>
<td>Telemetry Tool Integration (Splunk, Corvil, etc)</td>
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<tr>
<td>Optical Transport Integration (Infinera, etc)</td>
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<th><strong>CloudVision Core Services</strong></th>
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<tr>
<td>Network wide view</td>
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<tr>
<td>Consolidation of various network monitoring tools e.g. change management tools, scripting tools, code deployment tools</td>
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</table>
Consolidated reporting within a single tool for compliance, security, alerting and management reasons

Deployment of monitoring tool within global data centers

TOTAL ESTIMATED OPEX SAVINGS

No matter which stage the organization is within the automation life cycle, CloudVision can help tackle simple or advanced use cases. If additional use cases are required, please share use case scenarios with Arista account team who would be more than happy to incorporate ideas in subsequent releases.

**SUMMARY**

Shifting spend from IT Operations to innovation and meeting business needs more quickly are the key goals for every CIO. The only way to obtain the substantial OpEx cost reductions required to remain competitive is to automate their network environments.

Traditionally, approaches have been shackled in working with closed or limited network operating systems. This seriously restricts the ability of an organization to be agile and flexible as the requirements of the data centers change quickly. This also provides the first opportunity companies have had the flexibility to be able to manage a network infrastructure network wide any of the following methods: CLI, API, scripts, or a portal.

Arista EOS CloudVision is built on an innovative network-wide database architecture and is a truly open, next generation solution for cloud-like operations. With a focus on easy provisioning, configuration, image management, troubleshooting, visibility, security and 3rd party integration, CloudVision provides the platform to allow an organization to start leveraging its network automation in ways it was never able to do before, and drastically reduces OpEx costs to run the infrastructure.