451 Research

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Arista makes upgrade smarter – arcane network management tricks or the essence of SDN?

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Arista introduced significant additions to the tool kit it provides for 'in service' switch and network maintenance (what it calls Smart System Upgrade or SSU). The features take advantage of the programmability of Arista's EOS software, give EOS the ability to automate other systems, take advantage of existing network capabilities in EOS and, most of all, build on the carefully designed architecture of EOS itself.

At first blush, these are a set of features and functions that only a network admin would understand or value, but upon further examination, they perhaps tell an important story about what 'software defined networking' is really all about.

The 451 Take

SDN is always about making the network more programmable and automatable. Some equate this to having a centralized controller, but we think this seriously trivializes the complexity of network management, especially when it comes to the ongoing evolution of an operating network – adding nodes or reconfiguring, adding features, adjusting to changing load patterns and application use. The network can't be upgraded in isolation, but requires an elegant orchestration of the entire application system that is built on the network. Arista positions its EOS software as a key element of differentiation, arguing that it enables considerably shorter product release cycles and faster feature addition; SSU builds heavily on the EOS architecture and ease of feature insertion.

SSU is a set of features that presents a view of the breadth of what is involved in network operations, suggesting that significantly reconfiguring a working network is more like the proverbial rebuilding of an airplane in flight than it is a question of the controller architecture – perhaps one more example of the oversimplification of the SDN discussion. OpenFlow was touted as an elixir that cured all network ailments, but on balance, the general programmability of an Arista switch with its traditional autonomous network functionality seems more valuable for the solution of many real problems.

Context

Networks are often seen as 'brittle.' A working network configuration isn't changed casually, because the change process is complex and there are many possibilities for causing disruption. There are many issues that contribute to this, and the lack of standardized

network management interfaces and automation architectures is certainly one, adding credibility to the OpenFlow reasoning that a centralized controller could be key to improvement.

In an OpenFlow network, rather than having to independently upgrade the software in each device, only the controller software is involved. Intuitively, this sounds like a good approach, but misses the point that the network is part of a much more complex application system, and that most meaningful network changes require careful attention to the application's use of the network, not just the network proper. Otherwise, as the old saying goes, the operation is a success, but the patient dies.

The complexity of datacenter network operations has increased considerably over the last five years because what goes on inside is more complicated and more dynamic. Five years ago, the datacenter was simpler, and the applications in the datacenter were simpler and more static; as a result, upgrading the network was simpler too. Many of the applications ran on a specific server, and connected to the users and data storage using the network. If a network device needed to be upgraded, it was straightforward to understand which applications were affected.

In today's datacenter, there are more applications, and the applications are more complex (much more intra-application traffic), as well as more dynamic and subject to change. Often server virtualization is used, in which case, even the relationship between the application and a given server is gone. Today, a network change is likely to cause a broader disruption, and understanding the extent of the disruption is more complicated. To compound that further, with virtualization, datacenter operations have become more agile, placing pressure on network management to become more agile as well. The value of Arista's SSU features should be judged in the context of today's demands on datacenter network operations.

Products

Arista announced a set of new and upgraded features for the Arista EOS software, used in all its switch offerings that collectively support what Arista calls Smart System Upgrade (SSU). Arista places the features into a number of categories: (1) the APIs that Arista provides for programmatic (or automated) management of an Arista switch; (2) the ability to run automation scripts within EOS that can in turn program and automate external devices and applications; (3) 'infrastructure awareness' features that relate to a given switch's role in a network (e.g., leaf or spine); (4) 'intelligent network infrastructure maintenance' features that leverage network operating features including high availability; and (5) the basic design and implementation of EOS.

Arista provides programmatic interfaces (APIs collectively called eAPI) for all switch administrative commands. Historically, network administration has not been standardized and implemented through vendor-specific command line interface (CLI) text commands. CLI commands can be scripted for automation purposes, but it's a fragile interface because minor command changes are likely to break the script. Arista is unique in having modified its software development process so each CLI command automatically creates an equivalent API so that customer or partner automation can orchestrate Arista switches.

Conversely, Arista has upgraded EOS scripting capabilities, making it possible to create EOS-hosted scripts that drive external systems and applications. Compared to competitive switches, EOS management is straightforward to automate using EOS APIs. EOS can be a platform for orchestrating other systems, or a combination of the two can be used. Infrastructure awareness is a set of features that leverage the role a given switch is playing in a network, with the intent of temporarily reconfiguring the network to minimize dependence on that switch while it is upgraded.

Intelligent network maintenance is similar in the sense that these features leverage existing network capabilities to simplify and speed maintenance. For example, switches can be configured into high-availability pairs that share state, so that if one fails the other can immediately assume the load. In the case of network maintenance, one switch can declare a failure that assures the other is keeping the function going, it can quickly move to a new version of software or feature, and then come back online using the HA capability to rapidly restore the operating state.

Finally, Arista points with justification to how the basic design of EOS contributes to its ability to offer advanced SSU capabilities. The EOS design pedigree is strong. EOS was designed by Arista's head of engineering, Ken Duda, who has a PhD in computer science from Stanford studying under David Cheriton, Andy Bechtolsheim's longtime investment partner and Stanford CS professor – all of which is just to say that EOS was designed by people with a lot of understanding of operating-system design. Duda was one of the first employees at Granite Systems, Bechtolsheim and Cheriton's earlier venture that was purchased by Cisco and formed the Catalyst switch family. So Duda also knows a lot about writing software for network devices.

EOS is a unique blend of Linux architecture with what might be called an object-oriented 'kernel' part to the system. Most of the switch software is implemented as a set of Linux tasks or processes (about 90 currently). The tasks access inner switch state and share data with one another by using a fast, in-memory 'pub/sub' database mechanism. As a result of this design, the tasks are isolated from one another and from the switch packet-forwarding hardware, so the failure of one task is unlikely to cause other tasks (or the switch itself) to fail as a result. The same isolation mechanisms and robustness provide the basis for in-service feature upgrade, since every task can be updated independently and quickly without disruption to other tasks or to the packet-forwarding core.

Competition

Despite its growth and successes, Arista is still a small player compared to market leader Cisco. Arista has done an excellent job penetrating markets where some combination of hardware nuance (e.g., latency) and flexible software programmability could be combined to provide competitive products in a particular application or market sub-segment.

Arista has focused on cloud computing as a big category to position itself within, because that minimized the competitive disadvantage of not having all the Cisco features – compared, for example, to campus or WAN networking. In the cloud and datacenter, Arista's most direct competitor is often Cisco, and Arista's advantage often derives ultimately from the EOS architecture and intrinsic programmability.

SWOT analysis

Strengths	Weaknesses
Arista has emphasized the software aspects of its products from the beginning and has an industry-leading internal software architecture that it believes enables quicker software release cycles than its competitors, a great asset when bringing new software capabilities such as SSU to market.	Arista is still a small vendor and has strategically chosen to forego ASIC development to focus engineering spending on software.
Opportunities	**Threats**
The success of OpenFlow (or lack thereof) notwithstanding, network programmability and automation requirements have increased continuously over the last few years, highlighting the value of Arista's software architecture and flexibility.	As Arista continues to grow, it will have to compete with Cisco and others across a broader set of markets, an unenviable job for any company. If Arista goes public in 2014 as many expect, it will have to operate under the harsh light of quarterly financial scrutiny.