FEATURE

The programmable WAN: Applications are boss and networks bend

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Ezine

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Software-defined networking (SDN) is making the WAN the new black. That's because the avant-garde in networking is a virtual infrastructure that can be provisioned on demand and in response to the needs of rapidly moving virtual machines (VMs) and applications. SDN is beginning to make this possible in the new programmable WAN.

The goal of the programmable WAN is to use an SDN controller essentially as a network hypervisor to automate the provisioning of virtualized WAN tunnels or network segments in support of VM migration, fluid applications and varying data flows.

In most forms of SDN, the control plane is separated from the data plane and the intelligence and decision making is placed into a centralized controller. In the WAN, that controller sees the network end-to-end, and from the packet layer to the optical transport layer, explained Ashish Shah, director of product strategy and product line management at Vello Systems, an SDN upstart that provides the infrastructure for open, programmable networks.

Applications play a central role in WAN provisioning

Using this visibility and knowledge, the controller can insinuate network abstractions across the WAN along with network services to support specific applications or VMs in each tunnel. Programmable WAN with SDN meets this challenge by integrating the application with the WAN network using RESTful APIs. The controller uses input from individual applications to dynamically adjust policy for these virtual networks -- and potentially for the physical network beneath.

Engineers at Internet2, a global 100 Gigabit SDN network that connects a coalition of large research and education organizations, are working toward a programmable WAN with SDN that enables users to write applications that see and influence compute, storage, virtualization and intensive data movement in an integrated fashion.

"We'd like to put control of the network inside the application, so that an application's developer can make choices about where it processes data, where it stores data and how it accesses data," said Rob Vietzke, Internet2 vice president of network services. This is not possible in today's static networks. In an SDN-enabled network, applications will be able to optimize their environment and make smart choices about how to best use (cloud) resources, for example.

This kind of application-aware networking and policy setting can enable enterprises to offer more granular and reliable service level agreements (SLAs).

"We are working on an EMC solution where our application runs on our SDN controller and talks directly to the storage application. This enables the controller to extract policies

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directly from the application. We abstract the underlying infrastructure in the language of the application," said Vello's Shah.

"For customers who do not want the applications to tie directly into the network, we will abstract the network as a pool of resources [with joint policy]. The policy layer will translate the application requirements into the network SLAs."

Programmable WAN enables simple scalability

Application awareness and network flexibility are at the heart of the programmable WAN. The two together mean the ability to scale IT infrastructure using network automation and orchestration -- moving away from physical infrastructure rigidity.

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"Programmable WAN allows you to scale up services when your [need] is growing, based on the events happening inside [the network and applications] and then scale back down when the demand diminishes," said Karthikeyan Subramaniam, chief software architect at SDN and network virtualization provider ADARA Networks.

This kind of flexibility can ease bandwidth spending problems. Enterprises often end up paying for bandwidth they don't completely use because it's not optimized. On the flip side, they can wind up allocating insufficient bandwidth for applications or transactions because bandwidth is too costly, explained Mitch Auster, senior director of market development at optical networking specialist Ciena.

A programmable WAN with SDN allows machine-to-machine APIs to respond to autonomous capacity requests so that when an application or cloud orchestration decides it needs more bandwidth, SDN can immediately increase that bandwidth, Auster said.

"Programmable WAN using SDN solves challenges by turning the bandwidth up or down on demand based on application prioritizations for transactions that are latency sensitive, so migrations can complete satisfactorily," he said.

Internet2 has worked with Ciena, Brocade and Juniper, to build an OpenFlow Ethernet distributed exchange, in production for over a year now, that enables this kind of flexibility.

Ciena brings WAN programmability inside Internet2's optical transport network backbone, which stretches from Hanover, Maryland to Chicago where Internet2's infrastructure meets with the Canadian Research and Education Network, reaching up to that organization's Ottawa facilities. Specifically, Ciena's work with Internet2 moves programmable WAN down the stack from Ethernet switching to the core optical transport layer, giving the research labs in Ottawa an active programmable WAN test bed.

"These labs in Ottawa are among the last great North American pure research facilities," said Vietzke. A next generation network that supports such research better than today's small packet Ethernet or small packet IP requires direct access to program the optical layer and tune it to the needs of these science applications, he said.

Challenges remain for the programmable WAN

Programmable WANs that use SDN have hurdles of their own to scale. The first may be for IT pros to transition into thinking about networks as a shared infrastructure or set of virtual resources.

Vietzke pointed to the evolution of server and storage virtualization and how IT professionals learned quickly to treat the compute and the storage area network as a shared pool of flexible resources.

"That same virtualization trend has to track into the networking WAN space," said Vietzke. "That's how the cloud works. It is shared infrastructure that drives down the cost per unit while still offering dedicated capabilities. The network must go through that same transition."

Creating a standardized northbound API above the SDN controller is another challenge. While many SDN controllers use a RESTful API, this does not determine which data the system should pass through the API or how to communicate the parameters of a network request.

The type of application determines the kind of data the API should pass along. The method for communicating the data parameters requires standardization.

"Without a standard, agreed-upon way to communicate these parameters, all vendors might use a RESTful API, but one might use 'BANDWIDTH=1000' to mean a one gigabit per second connection, while another might use 'BW=1'," said Auster.

A standard northbound interface (NBI) -- or a small set of NBIs, each optimized for a broad category of service types -- along with standard data constructs/models/semantics, would make the programmable WAN using SDN more vendor neutral. The business application specifically would be portable across multiple vendors' SDN controllers, Auster explains.

Finally, the programmable WAN must evolve to enable engineers to better gauge network performance and use that information for troubleshooting, Auster said.

SDN innovators will work to enable probes that can extract very detailed information about specific flows, rather than collecting a modest amount of data from every flow, Auster explained. "Troubleshooting will become much more surgical," Auster said.

About the author:
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