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The Day VMware ate Cisco

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With as much as we have all seen and heard for the past several years about the cloud, sometimes things happen that make you realize just how real the drastic changes facing the networking industry really are. And the purchase of Nicira by VMware this week is one of those moments. It should serve as a wake up call to everyone in the networking industry about how to prepare for the changes that are coming to your IT department.

It's no secret that 'the cloud' is growing in popularity and that private cloud architecture is rapidly becoming the dominant architectural style of on-premise infrastructure. While VMware has clearly won the battle for virtualizing enterprise workloads, the battle for cloud controllers such as VMware's vCloud director is intense right now. All of computing is undergoing a drastic shift as the cloud is evolving, and this has caused 'betamax' style wars to be fought across the industry. The computing industry has been through numerous epochal shifts in its history, and so we realize that as the cloud matures, there will eventually be consolidation and dominant architectural styles will emerge. Different vendors will eventually converge, each with their own slant, around these common styles. And for now, nearly all of the major vendors are making their play for dominance in the cloud, struggling to get their own architecture to become the standard of the new era.

The key battles that VMware is facing right now are not with Cisco, but rather with Microsoft, Citrix, OpenStack, CloudStack, Amazon, and even Google. At one point, enterprise private cloud infrastructure seemed like it may have evolved in a way that was more disconnected with cloud service providers; however, a lot of different technical and economic factors have helped to shape the current state of the cloud market. As the significance of computing in all aspects of business continues to grow, rapid application introduction has become increasingly critical at the business level, which is forcing infrastructure standards to morph at a rapid pace. And as XaaS and consumerization continue to explode, the ability for enterprise IT departments to offer infrastructure that is as streamlined, flexible, accessible and inexpensive as XaaS providers is critical ... at least for those that still want to have in-house infrastructure to manage.

The battle for private cloud now demands that VMware include a holistic, self-contained solution that provides everything cloud application developers demand. And as enterprise applications that were built for the client-server era are getting re-engineered and purpose built for cloud architecture, they are now emerging with fundamentally different infrastructure demands. Going back to the client-server era, applications were largely built around the ability to run on one big server, scale out methods were primitive and proprietary. The explosion of the internet led to massive improvements in distributed computing. As cloud-style application architectures have emerged, developers have taken advancements in distributed computing to a whole new level. The latest MapReduce applications do truly treat an entire cloud of infrastructure resources as though the cloud were a single system ... and accordingly many of the application-level interactions that used to happen inside of a single computer are now happening across the cloud fabric. And as a result, cloud application developers are far more network savvy than

those who have been focusing on enterprise infrastructure alone may be aware of.

For the average enterprise IT worker, the intricacies of advanced distributed computing have been largely hidden. For the past 10 years as enterprises have been focused on virtualizing enterprise applications that were built for the client-server era, web providers have been increasing the ranks of IT professionals that understand web-style programming & architecture up to huge numbers. All of these developers have to learn networking for development, and they have to debug their applications across network fabrics. The old concept where the network guy is needed to come in with their sniffer to help debug application problems is really a lot more relevant to legacy applications. In this new world, application developers are already using tcpdump and packet-level analysis tools to debug application streams across a network. Not only is the traditional network guy not needed, but often their skill set is still optimized for legacy applications that only sent more primitive communications across the network.

Much like one of the prevailing themes of the past ten years has been around efforts for enterprises to virtualize large percentages of their applications, today the momentum has changed to a very analogous effort ... to move virtualized applications into the highly optimized and automated cloud application lifecycle. In the early days of virtualization, there were a lot of inhibitors limiting virtualization to a small percentage of enterprise applications. With time hypervisor vendors added new features and applications evolved to the point we are at today where most applications can now be virtualized. So the momentum over the next few years will largely be around how many different applications can we stuff into one common private cloud.

One of the biggest challenges with this effort is that many different applications, most notably the newest and emerging cloud applications, have distinctly different network and topology requirements. And where it gets really challenging is the need for elasticity ... or for the need for applications to grow and shrink on demand ... and for distributed applications this means dynamic modification of network topologies. So how do you stuff a bunch of applications with disparate topology requirements into a single cloud with a single static topology? ... the same way that you put numerous applications and operating systems onto a single server ... by putting a virtualization layer that shields applications from the complexities of the physical infrastructure. The function of network topology itself is now becoming a network service, and true network virtualization will allow hypervisor environments to provide these virtualized network topologies and services.

If you have worked in the networking industry and have any exposure to VMware, it is pretty obvious that the type of virtualization common in the networking industry (VRF/VDC) isn't even in the same league as the type of virtualization that VMware has provided for servers. Ultimately it comes down to this: the requirement from cloud developers is to be able to define network services and behavior dynamically through software ... something the traditional network just can't do.

Another critical requirement will be in optimizing the efficiency level of infrastructure. For several years as virtualization efforts have been maturing, enterprise VMware admins have been working to find the optimal mix of applications to maximize average resource utilization on a server. To date, this effort has focused on maximizing CPU, memory, and storage utilization, and the network has largely gotten a pass as Cisco has sought to raise barriers preventing VMware administrators from infiltrating their domain of control. However the latest generation of server CPU's have taken a renewed focus on input/output efficiency, and the current momentum is to scrutinize network utilization the same way that CPU/ram/storage utilization have. This is no simple proposition, and to make it even more challenging, private cloud platforms seek to do this in an automated fashion.

The main job of the private cloud controller is to examine the needs of applications and their changing demands in real time and optimize these across a pool of server, storage and networking resources with the goal of creating the maximum resource utilization to the highest possible levels without impeding application performance. For networking, this idea is a nightmare, it simply cannot function across the the industries antiquated approach to Quality of Service (QoS). And this is THE critical point driving SDN. For private clouds to achieve the key goals of their current growth trajectory, the cloud controller must tightly manage network access and each applications network requirements, this job simply cannot be part of a separately controlled 3rd party solution. And clearly the legacy approach to QoS cannot be extended to this level of demand.

Over the past 15 years we have seen the evolution of QoS starting as a model built at a time when application architectures barely resembled what they are today. The networking industry has approached modernizing QoS on an application by application basis, and even with the slow one-app-at-a-time approach, new network-sensitive applications like VoIP and FCoE have taken years to implement. Each of these also has had the benefit of frequently being the only prioritized traffic on a given link, and in the case of VoIP real contention for bandwidth was rare. And today despite years of effort, multivendor/heterogeneous FCoE fabrics still seem like a pipe dream. It is astoundingly clear that this approach will not work for the emerging demands of the cloud.

This is exactly why OpenFlow has been so appealing to cloud developers ... while traditional networking devices still have no real awareness of network conditions in their forwarding decisions, even the earliest OpenFlow applications written by grad students showed how powerful the OpenFlow paradigm is in its ability to forward not only based on real time network conditions, but also with real time awareness of application and server availability. This behavior is exactly what cloud-developers are looking for, hence their affection of SDN.

Because the traditional network has been abysmal at providing meaningful application services, interfaces or programmability to web application developers, for years application developers have been building patchwork at the application layer to compensate for the inability to communicate with the network. If any Cisco fans have read to this point this statement may upset them, but this was the exact theme of [David Ward's presentation](#) [1] at the first Open Networking Summit. This lead the path to Open vSwitch (OVS) emerging as a massive success in the cloud provider market. OVS has become radically popular with cloud providers so much that the OVS kernel is now part of mainline Linux. Because Open vSwitch resides in the hypervisor and is open source, it gave application developers a new way to try to get around many of the limitations of the non-developer-friendly traditional network. So for the past few years OVS has been enabling many of the world's largest networks to deliver elastic networking features through bypassing limitations of traditional infrastructure.

What will this mean for the networking industry?

Historically in enterprise, hypervisor networking hasn't been treated very seriously. When VMware first came on the scene, rapid provisioning and process optimization had so much business value that few decried the breakdown of the traditional network access layer. Cisco has been in a fight to control the access-layer and important value-added network services, so as customers have adopted VMware and the originally dumbed-down vSwitch, Cisco has been focusing on trying to get customers to adopt vn-tag or the nexus 1000v (N1k) to keep control of access layer services, and VMware has been slowly adding features to deliver advanced networking capabilities to compete with the N1k. However in my experience, the enterprise market overall has shown limited interest in advanced hypervisor networking thus far as only

recent advancements have shown this space to be a real threat. The hypervisor networking space got a massive boost with the announcement of the VXLAN protocol, a tunneling technology that will allow VMware to completely bypass many of the constraints of the physical network. While the Vxlan announcement was significant, it was not very clear how aggressively VMware would pursue the hypervisor networking space, but now looking at the advanced features of VMware's latest distributed switch, VXLAN, and now the billion dollar acquisition of Nicira, it seems clear this is key strategic territory for VMware.

Predictions

We can expect to see that hypervisor networking will emerge from its oft-overlooked status to become the new darling of data center networking. Data Center networking itself will also now be divided into separate markets, and notably the hypervisor network market will become increasingly distinct from the traditional networking market. The fabric that connects the innards of a private cloud is now becoming analogous to the motherboard of a computer, and will evolve with the hypervisor market creating increasingly divergent characteristics for fabrics within a computing cluster and the fabrics that connect different clusters of computing resources (aka grid or cloud containers) together.

The hypervisor network will become the domain of application and VMware administrators to address slowness caused by operational silos such that a general purpose team will handle the administration of private clouds and each of the technologies that make up a private cloud including the intra-container fabric.

Why This is bad for Cisco

There are some obvious but also many not-so-obvious reasons why this is bad for Cisco. The most obvious is for Cisco's Nexus 1000v, which is now going to be facing some very serious competition from VMware. Ultimately though, Cisco isn't competing at the level of VMware here, they do not have a bid to compete for cloud controller. So the enterprise hypervisor networking space will become part of the battle between VMware, Microsoft, Citrix and smaller players like Eucalyptus, Ubuntu and Piston.

The cloud battle has cut into some very strategic territory for Cisco. With the cloud seeking to have all-inclusive support for all application performance-related features, it now means that the traditional access-layer and associated network services are being incorporated into cloud management platforms, severely limiting the ability for Cisco to provide value-added services to maintain their margin levels and strong brand loyalty.

This need for all-inclusive support means that the only critical features that VMware won't move to cover will be those significant to the infrastructure itself and not the application or workload. This limits the value proposition of UCS significantly, damaging some key strategic cornerstones such as VN-tag and the infamous Palo. And VMware's move to provide self-contained private clouds is built to work over vendor-agnostic infrastructure. And not just any infrastructure, but specifically the new style of cloud optimized hardware used in CloudFoundry and other leading IaaS/PaaS providers which really doesn't resemble UCS architectural style at all. With the strong precedent to support hybrid and community clouds, the architectural style that public cloud providers are using is having a significant impact on how enterprises will ultimately deploy their private clouds. While enterprises have unique requirements and will not deploy identical infrastructure, the style that will become dominant will be an enterprise-adapted version of cloud provider infrastructure, not something fundamentally different like UCS. I don't mean to simply attack UCS here, it has some great features, but ultimately the industry will converge around common architectural styles, and UCS increasingly appears to be a niche architecture.

As hypervisor networking grows and VMware administrators start to become confident in their ability to manage their own virtual networks, physical networking solutions will emerge that are built to have plug-n-play type compatibility to support and strengthen hypervisor networks. This will change the administrative domain that is controlling the cloud fabric to virtualization administrators and application developers and architects. And it is fair to assume that VMware, Microsoft and Citrix will eventually certify different vendors networking hardware further challenging Cisco's dominance.

While having to sell to a very different audience in customer environments and support entirely new features in a new and different marketplace are challenges, the biggest challenge for Cisco will be their competition with VMware. Cisco has a tendency to constrain their features to push customers toward purchasing more of their products. So as private clouds continue to approach Cisco's strategic ground and limit the value propositions of Cisco's data center ambitions, I find it unlikely that Cisco will take this lying down. My bet is they will move rapidly to develop advanced features limited to their N1k and UCS customers. I anticipate hearing about how VMware and other private cloud deployments will work much better for those that buy the N1k and UCS, pushing those that want to stick to VMware's roadmap elsewhere. Cisco has already kept crucial features out of their physical networking portfolio to help push their other platforms, and I think unless they drop their competing lines, this type of behavior is expected and natural. And frankly there is nothing wrong with it, but it will open the door for Cisco's competitors to strengthen VMware's native toolset without holding out premium features for UCS and N1k customers. So I am not simply trying to attack Cisco and not their competitors, it just seems clear that Cisco is in a more vulnerable position here. And if Cisco loses key ground in the data center, it will make them more susceptible to attacks from their competitors across the board. I really don't see them keeping the same level of brand loyalty if other switch vendors gain the opportunity to shine in the data center, it will demonstrate clearly that Cisco isn't the only company that can make a switch.

While the pace of change across all of technology has been maddening, this acquisition really signifies the cementing of the way that a lot of architecture will evolve in the cloud era, and the vision of the future of networking is now increasingly clear. The private cloud has unique needs and the networking components of each cloud container will become the domain of the private cloud management platform, separate from the rest of the network, and will emerge as a new and distinctly different networking marketplace and ecosystem where an entirely different group of players will control the industry. This move adds substantively to the SDN movement and is among the most powerful evidence to date that SDN will be the way of the future.

I should note that I am a Dell employee, but this is my personal blog and my personal opinions and does not necessarily reflect Dell's positions.

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Links:

[1] <http://www.youtube.com/watch?v=6qMgurC0juo>