Horizontal Integration - Unlocking the Cloud Stack

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Any comments relating to the material contained in this document may be submitted to:

FusionLayer, Inc.

keilaranta 1, FI-02150 Espoo, Finland.

or by email to:

info@fusionlayer.com

Horizontal Integration — Unlocking the Cloud Stack

1. Brief Look at Software Defined Data Centers (SDDC)

Software Defined Data Centers (SDDC) provide unprecedented automation, flexibility and efficiency.

A year after its introduction by VMware, the Software Defined Data Center (SDDC) concept has become incredibly popular among industry pundits as the blueprint for the next generation of elastic data centers. As the name suggests, SDDC promises to free data centers from the tyranny of traditional computing and networking stacks in which hardware and devices have largely defined the infrastructure. It hands over the reign to an intelligent policy-driven software system controlling how applications and network services are being implemented and consumed. Ideally, SDDC would provide unprecedented automation, elasticity and efficiency; eventually transforming the way IT services are delivered.

In the wake of VMware's original launch, a number of other prominent IT vendors have raced to announce their own cloud stacks, making SDDC one of the most debated areas in technology today. At the same time however, most data centers continue to thread carefully in this space due to maturity concerns and SDDC's lacking integration with existing environments. Meanwhile, the analyst community is also debating whether SDDC should be based on proprietary stacks or multivendor environments leveraging best of breed solutions from multiple vendors.

This whitepaper outlines an architecture that can be used to experiment with SDN and SDDC without having to compromise the continuity of the traditional network environment. It also provides a blueprint for creating a multivendor SDDC stack by introducing a new layer that provides horizontal integration between various cloud orchestration systems, SDN controllers and traditional network environments

2. Coexistence of Traditional and Software-Defined Networks (SDN)

All of the current SDDC stacks are vertically integrated. That is, each stack has a cloud orchestration system on the top that feeds information to the SDN controller in the next layer. The controller in turn configures the physical pieces of the network equipment on the lowest layers of the stack. While such a top-down approach is suitable for greenfield environments, cloud stacks have not generally been designed to coexist with existing networks. Bearing in mind the Service Level Agreements (SLAB) most data centers have to work with, discontinuities such as this pose a real threat to service level.

The reality is that the two environments have to peacefully co-exist within the same data center, at least for a number of years. As depicted in Figure 1, the way to achieve this is through horizontal integration of the SDN-based environment and the existing network using a central IP address management (IPAM) system. Such a horizontal integration will not only make it extremely easy for data centers to start experimenting with SDN-based environments but will also ensure a smoother transition once they are ready for production rollouts.

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Horizontal integration between existing networks and the SDN-based environments requires:

- Allowing all address blocks and networks (IPv4, IPv6 or overlapping private networks) to be managed centrally in the same system regardless of whether they are legacy, SDN-based or cloud.

- Ensuring smooth migration of the existing network information from spreadsheets to a standardized IPAM solution that provides automated integration and management capabilities for existing shared network services such as DNS and/or DHCP.

- Supporting integration between the centralized management solution and the SDN controllers, so that the SDN-enabled networks (whether new or converted) can be easily selected and provisioned to the controller from the shared tool used for network management.

To verify the feasibility of its horizontal integration concept, FusionLayer, Inc. implemented a test environment consisting of OpenStack, Windows Server 2008 and FusionLayer's IPAM technology. The goal of this experiment was to manage existing Microsoft AD networks and new SDN-enabled environments through a unified management interface. As an outcome, FusionLayer now has a technology that can be used to manage both IPv4 and IPv6 prefixes and networks within a single system, and bind the managed networks to either Microsoft DHCP servers or to SDN network segments via integration with Quantum. The same system can also be used to provision IP address and names as part of cloud orchestration process, and propagate the names in real time to production DNS.

3. Connecting Cloud Orchestration, SDN and Traditional Networks in Multivendor Environment

The key to creating a multivendor SDDC stack using best of breed solutions for different layers is an IPAM system that supports API-based release parameter provisioning for cloud application deployment and orchestration systems. Besides facilitating the peaceful co-existence of traditional network with the SDN-based environments, the next generation IPAM system has four important roles:

1. Centralized IP address provisioning for workloads,
2. Seamless integration with SDN controllers,
3. Visibility into traditional networks and SDN environments and
4. Ability to use Fully Qualified Domain Names (FQDN).

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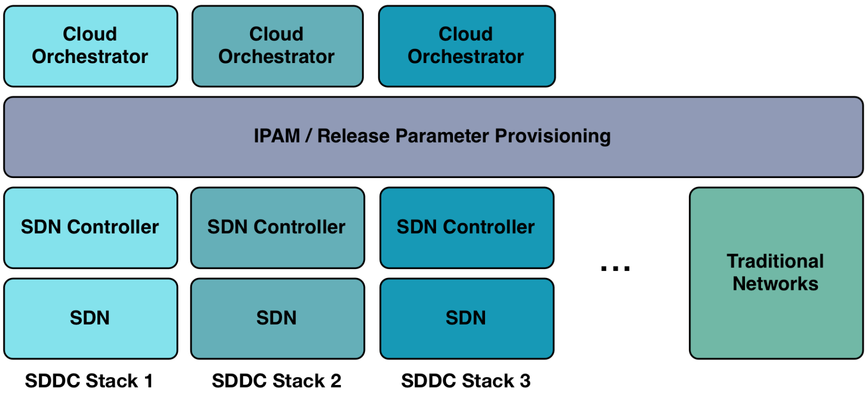

Figure 1: *The proposed architecture with the IPAM / release parameter provisioning system acting as the management umbrella connecting multi-vendor SDN controllers, cloud orchestrators and traditional networks.*

3.1 Centralized IP address Provisioning for Workloads

Unlike the DHCP protocol that requires Layer 2 connectivity in order to provision IP leases, an API-based IPAM/ release parameter provisioning engine supports integration with any cloud orchestration and application deployment solutions. This second generation IPAM automates the allocation of release parameters such as IP addresses, names and other network parameters required by workloads. This allows workloads to be dynamically configured before being released to the hypervisor. The benefit of an API-based release parameter provisioning is especially apparent in multitenant environments where overlapping private networks are the norm and a dedicated DHCCP service is required for each tenant.

An API-based methodology also reduces the IP assignment loads. This is due to the fact that it eliminates lease renewal requests and only requires activation when a given workload is commissioned, decommissioned or moved from one data center to another. Assuming an 8-hour lease time and a lifecycle of a month for a workload, the API-based methodology would decrease IP addressing events by 99% compared to using DHCP. This provides a huge boost in terms of scalability.

3.2 Seamless Integration with SDN Controllers

While most SDN controllers come with templates and/or pods that can be used to standardize and automate the network configuration process, they lack centralized management tools that could be used to manage a multitude of network blocks, many of which exist outside the realm of the SDN-enabled part of the address space. Without a centralized IPAM solution that brings all networks under the same management umbrella, the risk of overlaps and configuration errors increase considerably.

This problem is easily solved by a second-generation IPAM solution that not only allows all networks to be managed from one location, but also supports dynamic integration with one or more SDN controllers. Thanks to this hybrid approach, existing networks may continue to be run as they are; while free network blocks can be easily located and activated with a single click. The selected network block is then pushed to the SDN controller for immediate and fully automated service activation.

3.3 Visibility into Traditional and SDN Networks

Traditional IPAM solutions have been designed to integrate with DNS and DHCP network services. This continues to be the norm with traditional network environments. The fact is though that using technologies like Virtual Private Cloud (VPC), many enterprise networks and data centers are being extended to span across a multitude of private and public cloud environments. Since all connected network segments are typically a part of the same enterprise Wide Area Network (WAN), the ability to centrally view and manage the private network space has never been as important as it is today.

Compared to commonly used cloud IP provisioning systems, this holistic approach allows data centers and enterprises to migrate all their networks into the same centralized management solution, regardless of whether they are deployed using traditional network infrastructure or SDN controllers. This horizontal integration between traditional and software-defined networks introduces a new level of control that is of utmost importance when a new network paradigm such as SDN is introduced to the data center environment.

3.4 Ability to Use Fully Qualified Domain Names

Most cloud environments continue to be based on the use of IP addresses without Fully Qualified Domain Names (FQDN). This is because of the limitations of traditional IP commissioning systems most of which do not auto-generate names, let alone provision those into appropriate zones in DNS. Furthermore, relying only on IP addresses poses a more significant problem when workloads migrate from one data center to another and require a new IP address, or when large changes are effected in the computing environment. Under these conditions, the benefit of actively using FQDN and DNS is that whenever a given host changes its IP address, the change can be reflected in its DNS record, eliminating the need to reconfigure IP addresses in all other devices that have been connected to the host.

In order to make FQDN a reality in elastic computing environments, the IPAM solution should support default zones that are configured for each network; automated generation of hostnames based on policy-based naming patterns; and automated provisioning of generated names into the appropriate master zones managed either locally or at a remote primary DNS service. Thanks to this end-to-end automation, each workload and device is able to obtain an automatically assigned FQDN that is provisioned in real-time to production DNS, with no manual intervention.

4. Conclusion

The growing popularity of SDDC has given rise to an increased competition amongst vendors offering vertically integrated cloud stacks. Meanwhile, customers concerned about the implications of being locked down into a single vendor solution are wondering how SDN and SDDC fits in with their existing environments. The key to a successful migration path lies in introducing a new management and provisioning layer to the SDDC stack that enables horizontal integration between various orchestration systems, multi-vendor SDN controllers and traditional network environments. This new layer comprises a second-generation IPAM solution placing API-based release parameter provisioning and management of the entire IP address space under the same umbrella. In addition to enabling SDN experiments, the proposed architecture also ensures a smooth transition from traditional networking into SDN once the user is ready for production rollouts.

About FusionLayer, Inc.

FusionLayer, Inc. simplifies cloud application deployment for enterprises and managed service providers who need to automate the IP commissioning process. The company's patented technology easily integrates with existing infrastructure allowing IT departments to manage IP resources in real-time. Nine out of 10 of the world's largest service providers and half of the Fortune 500 rely on FusionLayer to improve the manageability of their network.