



White Paper

Array Networks for Cloud & Virtual Environments

Cloud Agility at Scale

APV Series Application Delivery Controllers

AG Series Secure Access Gateways

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Introduction

Virtualization of networking, servers, storage and other network components in the data center has become standard practice – and with good reason. Decoupling compute workloads from the underlying infrastructure allows more efficient use of resources, reduces the overall datacenter footprint, reduces OpEx and CapEx, improves agility and extracts greater ROI for mission-critical applications and data stores.

Today, enterprises are taking virtualization one step further, folding optimization of application availability and performance, as well as secure application access, into their private and public cloud deployments. However, due to the compute-intensive nature of many application delivery functions, special attention must be paid to ensure that the requisite levels of performance and reliability are not sacrificed in the search for greater agility and efficiency.

This white paper will discuss various deployment models for application delivery controllers (ADCs) and secure access gateways (SSL VPNs) in public and private cloud environments, and examine how they may be leveraged to strike the optimal balance of performance and agility. In addition, the paper will explore ADC and SSL VPN multi-tenancy and orchestration – capabilities that are gaining increased importance within cloud and virtualization architectures.

Key Cloud & Virtualization Concepts

In its essence, virtualization is an abstraction that serves to decouple higher-level services and applications from the physical resources that support and deliver them. By allowing services and applications to migrate among servers, network administrators gain flexibility, adaptability, and portability of applications and services.

Virtualization is most commonly achieved using hypervisor technology which divides bare-metal servers into multiple virtual machines (VMs) which may then be used to host a wide variety of application workloads or networking functions. Importantly, VMs may be dynamically provisioned via a centralized management platform – spinning up additional resources as required, and/or reallocating and repurposing resources to support a multitude of business objectives. This agility and ability to squeeze maximum ROI from underlying infrastructure has made virtualization almost synonymous with public and private cloud deployments.

Public clouds are homogeneous fully shared environments run by third-party platforms such as Amazon Web Services (AWS) or Microsoft Azure. Networking services purchased on public cloud platforms are commonly referred to as infrastructure-as-a-service (IaaS). Services are available via an on-demand utility computing model, i.e. customers pay for the service by the hour, day, week, month or year.

Private clouds are similar in design, taking advantage of virtualization and automation; however, they are owned and operated by the enterprise and the "customers" of the private cloud tend to be internal departments. Like the public cloud, the ability to dynamically provision and repurpose resources

generates dramatic ROI for the organization. Private clouds may reside either in a 3rd party data center or in the enterprise's own data center.

Public & Private Cloud Deployment Models

Appliances such as Array's vAPV virtual application delivery controller and vxAG virtual secure access gateway are at the heart of the move towards virtualization of networking functions within public and private cloud deployment models. The more places virtual appliances such as these are available and the more platforms they support, the greater the ability to architect a solution that strikes the right balance of performance, agility and cost. Array application delivery controllers and secure access gateways support multiple deployment models, each of which offers specific benefits depending upon the end-goals of the enterprise.

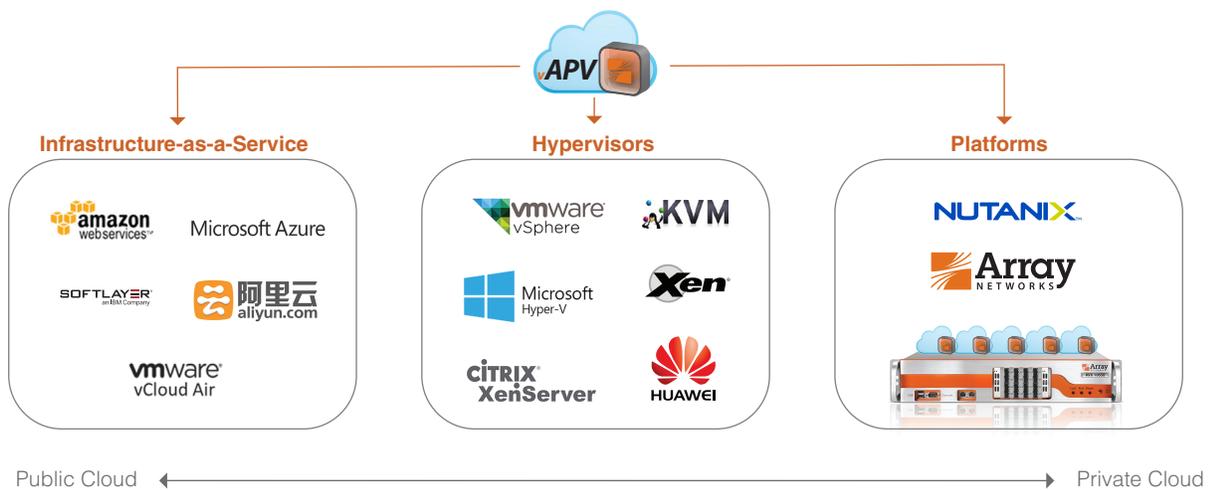


Figure 1: Multiple deployment models to fit requirements

Infrastructure-as-a-Service (IaaS): Array vAPV and vxAG are available on leading IaaS platforms including Amazon Web Services, Microsoft Azure and others. Primary benefits of the IaaS deployment model include the ability for businesses to "pay as they go" – purchasing capacity in direct proportion to demand for their products and services – and the ability to gain immediate access to a global delivery platform. By leasing Array application delivery and security solutions from a top-tier IaaS provider, enterprises gain a higher degree of advanced capability as compared to entry-level load balancing and SSL VPN services, and also gain access to features consistent with Array solutions deployed in their private data centers. Array application delivery solutions are made available from today's premier public cloud service providers either on a utility (pay-as-you-go) or BYOL (bring your own license) basis.

Hypervisors: As an essential component of virtualization technology, hypervisors span both public and private cloud deployment models. Whether enterprises have purchased virtualized servers that

they own and operate in a private data center, or are leasing virtualized servers from a cloud service provider, deploying in a virtual environment requires that app delivery solutions run on industry-standard hypervisors. The broader the support the better, as different cloud service providers and enterprises often run different virtual infrastructures. Array vAPV virtual application delivery controllers (load balancing) and vxAG virtual secure access gateways (SSL VPN) support a broad range of industry-standard hypervisors including VMware vSphere, Microsoft Hyper-V, KVM, Citrix XenServer, OpenXen, and Huawei FusionSphere, and support a range of purchase options that span subscription and perpetual licenses as well as a range of tiered capacity options.

Platforms: While IaaS and hypervisor deployment models shine in terms of agility, they can sometimes fall short when it comes to application workloads that require either a higher degree of performance and control, or a higher degree of permanence. In these cases, enterprises may be better served by deploying a dedicated platform such as Array's AVX Series virtualized appliance within a private cloud environment. The AVX Series allows for mixing and matching variable-size vAPV virtual application delivery controllers and vxAG virtual secure access gateways on purpose-built virtualized networking hardware. In addition to supporting pay-as-you-go purchase options, the AVX allocates dedicated CPU and SSL cores, along with dedicated memory and I/O ports for each virtual appliance to ensure performance is guaranteed. With Array AVX, enterprises gain the best of both worlds – the agility of cloud and virtualization and the performance of dedicated appliances. In addition to the AVX platform, Array vAPV and vxAG virtual appliances are also available on Nutanix Xtreme Computing Platforms – for enterprises building private clouds that bring servers, storage and networking functions together on hyperconverged infrastructure.

Selecting the Right Deployment Model

Public and private cloud deployment models that span a range of infrastructure-as-a-service, hypervisor and platform options are giving enterprises more choices than ever for supporting business-critical applications. As a result, it is essential to understand the pros and cons of each deployment model and how they align with application requirements and business objectives.

In the table below, we look at application delivery and security solutions in the context of public, private and hybrid cloud architectures.

Public Cloud: Purchasing networking functions such as load balancing and remote access as a cloud infrastructure service commonly makes sense for early stage businesses as well as providers of Web-based software services. The public cloud option eliminates the need for heavy investment in enterprise-owned and operated infrastructure, and allows resources to be purchased in direct proportion to demand for a new product or service. Performance and control will not match what is possible in an enterprise-owned and operated data center; however, application requirements and business objectives typically do not yet warrant the corresponding level of capital and operational expense. For larger, more established enterprises, the public cloud offerings are a great choice for developing, testing and sizing new application workloads. Once application requirements are defined, the business can more confidently invest in private cloud infrastructure to cost-effectively support services for the longer term.

Table 1: Pros and Cons of Various Deployment Models

	Public	Private	Hybrid
Deployment Model	<ul style="list-style-type: none"> • Utility or BYOL networking services (IaaS marketplace) • Enterprise-owned networking software on leased hypervisors 	<ul style="list-style-type: none"> • Purpose-built virtualized networking platforms • Virtual networking functions on virtualized servers 	<ul style="list-style-type: none"> • Enterprise-owned networking infrastructure supplemented by leased IaaS networking services
Pros	<ul style="list-style-type: none"> • Pay-as-you-go utility pricing • Reduced CapEx • Flexibility 	<ul style="list-style-type: none"> • Guaranteed performance • Customization and control 	<ul style="list-style-type: none"> • Instant global presence • Cost-effective burst capacity
Cons	<ul style="list-style-type: none"> • Higher long-term costs • Less customization and control • Hypervisor performance penalty 	<ul style="list-style-type: none"> • Initial and ongoing CapEx and OpEx • Potential resource underutilization 	<ul style="list-style-type: none"> • Cost and complexity of establishing functional cross-platform architecture
Business Alignment	<ul style="list-style-type: none"> • Early-stage business • Web-based services • Development, testing and sizing 	<ul style="list-style-type: none"> • Larger enterprise organizations • Established cloud businesses with a need to maintain SLAs 	<ul style="list-style-type: none"> • Enterprise with growing geographical presence • Seasonal or surge business demands

Private Cloud: Investments in private clouds or enterprise-owned and operated data centers are driven by two key considerations: performance and ROI. Public clouds are shared environments that most often operate on a "best effort" basis. For enterprises with business-critical applications or customer-facing services that must maintain SLAs, public clouds will not always align with business objectives. In a private cloud, enterprises are free to deploy purpose-built platforms such as Array's AVX Series Virtualized Appliances which deliver the agility of cloud and virtualization, but at the same time deliver guaranteed performance. From the perspective of cost, private clouds are more affordable for long-term deployments that are predictable in nature. Similar to leasing vs. purchasing a car or renting vs. purchasing a home, over the long term enterprise-owned infrastructure will deliver greater ROI. In addition to performance and long-term cost benefits, enterprises also gain a higher degree of control and greater latitude for customization within private cloud environments.

Hybrid Cloud: Hybrid clouds join together public and private clouds into a single seamless "virtual" data center that provides enterprises with the best aspects of both environments. The move to a hybrid cloud deployment can have its starting point in either a public or a private cloud. For instance,

an organization that is operating 100% in a public cloud may decide that it makes sense in terms of cost and control to own and operate some portion of their infrastructure in a private cloud. Or an organization that has historically owned and operated a private data center may decide that it makes sense to connect to a public cloud for the purpose of cost-effectively fielding burst or seasonal application traffic. Due to the hybrid cloud's ability to provide the best of both worlds, it is likely to gain ground as a deployment model in the years to come.

Consensus among industry analysts is that today, roughly a third of application delivery deployments encompass network service or cloud elements, as well as premise-based application delivery controllers (ADCs) and WAN optimization controllers (WOCs). However, the rate of adoption will depend largely on the complexity of joining the two environments. The simpler that cloud providers and vendors make things, the more enterprises will embrace hybrid deployment models.

Virtualization & Multi-Tenancy

Because virtualization is used to enable multi-tenancy – multiple customers, users or application workloads sharing the same hardware – many people consider the two terms to be synonymous. While similar, virtualization and multi-tenancy are not one and the same. Using Array's dedicated, virtual and virtualized appliances as an example, this section will demonstrate how multi-tenancy may be enabled in multiple ways and may be layered to provide additional levels of flexibility.

Dedicated Appliances: Array's dedicated APV Series application delivery controllers can support up to 256 virtual IPs (VIPs), which effectively partition an appliance to support multi-tenancy. While not a fully independent ADC instance, a VIP can be used to support different customers and applications and define server load balancing groups, for example, to load balance user requests across a specific subset of servers, or for global server load balancing across geographically dispersed servers. Similarly, Array's dedicated AG Series secure access gateways support up to 256 virtual portals, which allow different communities of interest (customers, departments, partners, etc.) to securely access network resources based on rules or policy definitions.

Virtual Appliances: In contrast to VIPs and virtual portals, Array's vAPV virtual application delivery controllers and vxAG virtual secure access gateways are fully independent ADC and SSL VPN instances. Array virtual appliances run on servers that have been virtualized using industry-standard hypervisors such as VMware vSphere and Microsoft Hyper-V. The number of vAPV and vxAG instances supported on a virtualized server (degree of multi-tenancy) is variable, and is dictated by both system resources as well as the number of users and volume of traffic per instance. Like dedicated appliances, Array virtual appliances also support multiple virtual IPs and virtual portals – giving enterprises and service providers the ability to support deployments with nested multi-tenant capabilities.



Table 2: Multiple Ways to Implement Multi-Tenancy

APV/AG Dedicated Appliances	vAPV/vxAG Virtual Appliances	AVX Virtualized Appliances
Multiple Virtual IPs & Virtual Portals	Multiple Array Virtual Appliances on General-Purpose Virtualized Servers	Multiple Array Virtual Appliances on Dedicated Array Virtualized Hardware
	Multiple Virtual IPs & Virtual Portals	Multiple Virtual IPs & Virtual Portals

Virtualized Appliances: Rather than deploying vAPV and vxAG virtual appliances on “best effort” general-purpose servers, AVX Series virtualized appliances allow Array virtual appliances to run on purpose-built networking hardware. Unlike commodity servers supporting virtual appliances, the AVX assigns dedicated CPU, SSL, memory and I/O resources for every virtual appliance and reserves system resources for hypervisor management to eliminate virtual machine contention. In addition to enabling guaranteed performance in shared environments, AVX appliances may be partitioned into up to 32 instances and support mix-and-match configurations with pay-as-you-grow pricing. Virtual appliances running on the AVX support multiple virtual IPs and virtual portals and retain the ability to support nested multi-tenancy capabilities.

Just as enterprises must weigh the pros and cons of public and private cloud options, they must also weigh the pros and cons of various multi-tenant options to select a deployment model that best suits their requirements. In general, dedicated appliances and purpose-built virtualized appliances are better suited for high-volume, compute-intensive environments where both multi-tenancy and guaranteed performance are required. Where portability, flexibility and a uniform server infrastructure are key priorities, virtual appliances running on general-purpose servers may be the more desirable solution for enabling multi-tenancy.

Cloud Orchestration & Automation

Last but not least, an increasingly important consideration for enterprise and cloud data center operators is the ability to fully utilize available resources and to provision resources and services on demand via a cloud management platform (CMP). As a consequence, cloud orchestration and automation are rapidly becoming the most important capabilities in cloud architectures.

To meet this requirement, Array has developed a very robust set of APIs and integrations with leading cloud management platforms, and has also developed the ability to integrate with homegrown cloud management platforms via either XML-RPC or Array’s highly-extensible eCloud™ RESTful API.

A summary of Array integrations with leading CMPs includes:

OpenStack – Array has developed a plug-in for the eCloud API that integrates with the OpenStack Neutron load balancing-as-a-service (LBaaS) API, and allows management of multiple dedicated, virtual or virtualized Array appliances.

VMware & Microsoft – Similarly, Array offers plug-ins for orchestration systems such as vRealize Orchestrator (vRO), and supports Microsoft System Center Configuration Manager as well.

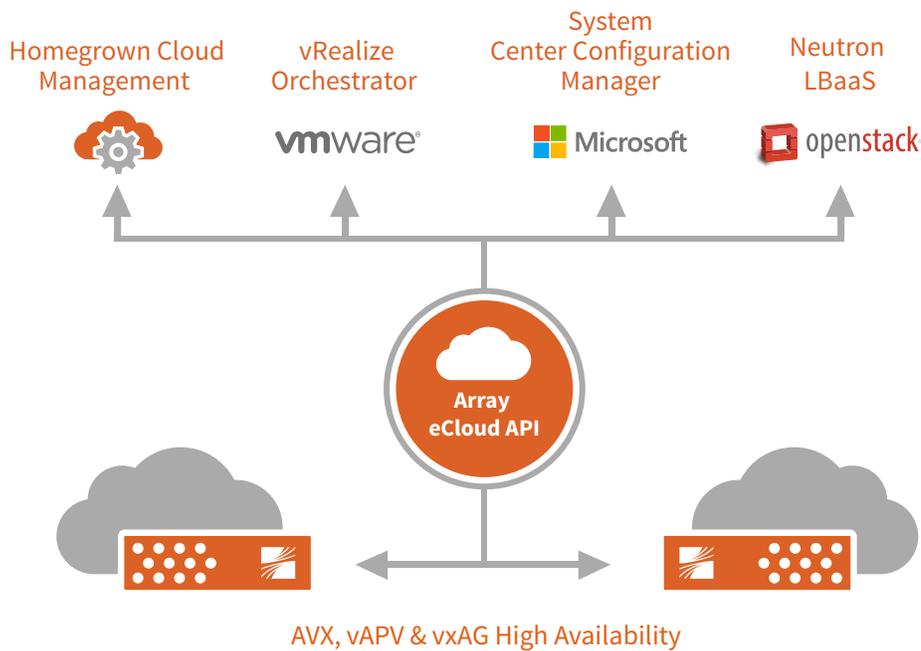


Figure 2: Multiple management and orchestration integration options

Conclusion

As enterprises increasingly adopt cloud and virtualization technologies, many will decide to deploy application delivery and security functions within public and private cloud environments. Keys to success for these deployments will be a thorough understanding of the capabilities and limitations of these new architectures. Equally important will be the selection of solutions capable of supporting any deployment model and operating in any environment. Array's dedicated, virtual and virtualized application delivery controllers (ADCs) and secure access gateways (SSL VPNs) meet and exceed these requirements, giving enterprises the ability to strike the right balance of agility and performance and successfully deploy applications and services across public, private and hybrid cloud environments.

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About Array Networks

Array Networks is a global leader in application delivery networking with over 5000 worldwide customer deployments. Powered by award-winning SpeedCore® software, Array application delivery, WAN optimization and secure access solutions are recognized by leading enterprise, service provider and public sector organizations for unmatched performance and total value of ownership. Array is headquartered in Silicon Valley, is backed by over 250 employees worldwide and is a profitable company with strong investors, management and revenue growth. Poised to capitalize on explosive growth in the areas of mobile and cloud computing, analysts and thought leaders including Deloitte, IDC and Frost & Sullivan have recognized Array Networks for its technical innovation, operational excellence and market opportunity.



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