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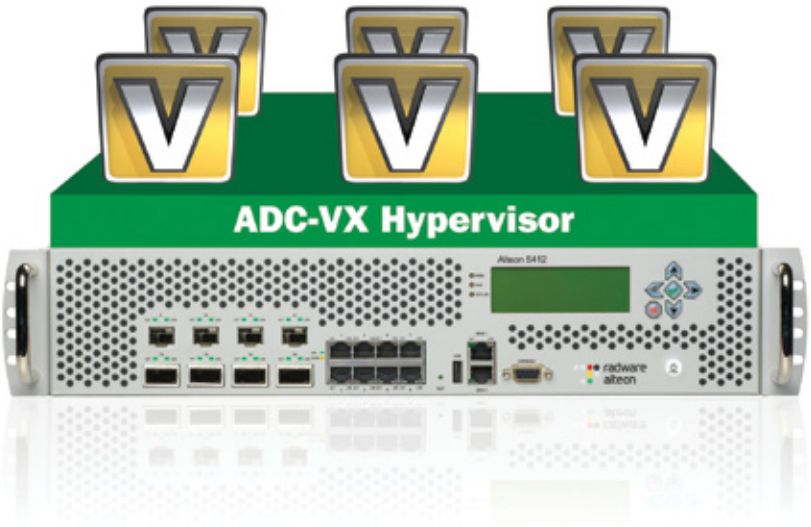
Smart Network. **Smart** Business.

Radware ADC-VX™ Solution

The Agility of Virtual; The Predictability of Physical



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General

Data centers are in the midst of a major transformation from sprawled, static architecture to consolidated, dynamic and virtualized. This transformation impacts all the components in the data center including servers, network devices, storage equipment as well as Application Delivery Controllers (ADC).

This paper focuses on the effects of the data center transformation on the ADC role and how Radware's innovative solution , ADC-VX™, meets the new ADC challenges in the virtualized data center.

Virtualization and consolidation trends in the data centers

Virtualization and consolidation are key market drivers and major IT initiatives. Data center virtualization can be found in most organization's networks - from SMBs through large enterprises up to the very large hosting companies, carriers data centers and service providers. While the scope of virtualization may differ between different size organizations, the business drivers for the virtual data center are the same —it is all about creating a consolidated, cost-effective, agile, highly available and performing data center.

In order to truly profit from the benefits derived from the virtual data center, a complete architecture redesign of all layers of the data center is needed. The first layer is virtualization and consolidation of the server and storage infrastructure. According to recent surveys, most organizations have deployed server virtualization but have not yet virtualized 100% of their environment, creating hybrid environments of dedicated and virtualized servers.

The second layer is the virtualization and consolidation of network and infrastructure hardware and the transition from a siloed architecture to a flatter, less tiered virtualized network design.

How virtualization and consolidation trends affect the ADC

Infrastructure virtualization and consolidation has a major impact on the ADC role, position and deployment models. In the virtualized data center, new services are deployed quickly and configuration changes addressed instantly, hence the ADC must provide the same level of instant provisioning and agility as all other virtual elements. Creating a virtualized Application Delivery infrastructure layer allows alignment of the Application Delivery services with the frequent changes in the virtualized data center, and also provides each application with an Application Delivery service matching its SLA and performance predictability needs.

While all components in the data center are consolidated to support the transition from a siloed and sprawled architecture to a consolidated, flatter one, ADC vendors must also provide a risk free path to ADC consolidation, so that the ADCs can be an integral part in the new forming data centers.

Radware's Virtual Application Delivery Infrastructure (VADI)

To address the data center transformation and latest trends, Radware is introducing its innovative Virtual Application Delivery Infrastructure (VADI) strategy. Radware VADI's goal is to enable the consolidation and virtualization of Application Delivery services as an integral part of the virtual data center architecture, its orchestration and provisioning systems.

Radware's VADI provides maximal ADC agility while reducing physical to virtual risks, saving both capital and operational expenses of application delivery deployments. VADI transforms computing resources, ADC services and virtualization services into an integrated, agile and scalable Application Delivery Virtualization Infrastructure. It is designed to bridge across the underlying hardware resources and to cater to the various application needs in terms of SLA and performance predictability in order to overcome the inherent challenges of ADC consolidation while delivering maximal agility to the application delivery space.

In the virtual data center Application Delivery Controllers are transformed into virtual ADC instances (vADCs) running on top of specialized or general purpose computing resources. Each vADC provides a consistent and complete set of application delivery features and services regardless of the computing resources it utilizes.

In order to support the transformation of the data centers, three form factors of ADC Computing are required:

I. Dedicated ADC – a dedicated physical ADC device running a single vADC
II. Radware ADC-VX – the industry first ADC hypervisor that enables the use of multiple vADCs on top of a dedicated, specialized ADC hardware – Radware OnDemand Switch.
III. Radware Soft ADC - vADC on general server virtualization infrastructure, running as a virtual appliance

Organizations can utilize computing resources in any combination of these form factors to match their application SLA requirements, the number of vADC instances, the throughput capacity each instance is allocated with, their cost savings objectives, their footprint limitations and their application deployment model.

Of all the three available form factors, this paper focuses on ADC-VX.

Challenges of ADC consolidation and virtualization

Consolidation challenges

Like server consolidation, ADC consolidation achieves significant cost savings with fewer ADC hardware devices, power and space reduction, management efficiency and higher resources utilization. However, to successfully consolidate multiple ADC devices and to create a virtualized ADC running multiple virtual ADC instances (vADC), some significant challenges must be addressed with a unique and innovative solution.

Ensuring privacy per virtual ADC instance

In the traditional, non consolidated data center, each physical ADC device had its own dedicated hardware appliance and its own private environment – neighboring ADCs in the data center did not have any effect on the behavior of the other ADCs. However, in the consolidated device, the virtual ADC instances share the same hardware resources and the same environment; therefore the solution must ensure the same level of privacy as separated devices.

Isolate failures between virtual ADC instances

In the consolidated device, a failure of one of the virtual ADC instances must not create a domino effect that will fail additional neighboring instances; the solution must create an environment that segregates and isolates failures so it only affects the faulty instance.

Performance predictability

When several vADCs share the same CPU, memory and other physical resources, it becomes challenging to predict the performance of each one of the virtual instances. However, ADCs are in the business of performance guaranty and hence the solution must be able to reserve resources per vADC so that the performance is predictable and not affected by neighboring vADCs.

Capacity planning and resource allocation

Each vADC needs to be allocated with slices of physical resources so it can perform its tasks. However, the device administrator has to decide how much CPU, memory and other shared resources should be allocated to each vADC. Successfully doing this without automatic mechanism is complicated and prone to human errors. Therefore, the solution must provide an efficient and automatic tool to guarantee simple yet smart resource allocation among the vADCs.

Network virtualization to support existing topologies
All layers of the network must be completely virtualized and private so that each vADC appears as a separated network entity. Only with complete virtualization the consolidated solution is able to support so many different existing network topologies on one physical device.

Business agility challenges

As discussed earlier, the virtualized data center is a dynamic, ever-changing environment with frequent changes of virtual machines and network configurations. The ADC must be part of this dynamic eco-system by offering greater service agility and alignment of its services with the changes in the data center.

Instant provisioning of services
The ADC cannot be left behind and must offer a quick provisioning of new services just like all other virtual elements. To support instant provisioning, the solution must ensure simple and fast methods to create new virtual instances and fast deployment of these services.

Manageability
There are two major aspects to management of a consolidated device – ease of management and privacy per instance. First, the solution must guarantee complete separation of all management elements including configuration files, user database, logging and reporting. If the consolidated device is designed to serve multiple customers, its management layer must also provide the required privacy, or else one customer might corrupt the shared configuration file and will cause the entire device to fail.The second aspect of the solution should ease the complexity involved in managing of many virtual ADC instances from one central location.

Radware ADC-VX solution

Solution overview

ADC-VX is the industry's first ADC Hypervisor that runs multiple virtual ADC instances on a dedicated ADC hardware, Radware's OnDemand Switch platforms. ADC-VX is designed from the ground up to enable organizations to consolidate their ADC hardware devices without compromising resiliency or performance predictability of their ADC services – resulting in significant savings of hardware costs and operational expenses. Additionally, ADC-VX provides the agility and the simplicity that is required in the dynamic, ever-changing virtualized data center, driving faster deployment of new services and better alignment of ADC services with frequent configuration changes.

ADC-VX is a specialized hypervisor for ADC services built on unique architecture that virtualizes Radware's OnDemand Switch platform resources – including CPU, memory, network and acceleration resources. This specialized hypervisor runs fully functional virtual ADC instances that each one of the instances delivers ADC functionality just like a dedicated physical ADC device. Each virtual ADC instance contains a complete and separated environment of resources, configurations and management.

With Radware's ADC-VX it's easy to amend the operations of the virtual ADC instances to quickly align the ADC services with changing business needs.

Meeting the challenges of ADC consolidation and virtualization

ADC-VX is uniquely designed from the ground up to meet the challenges of ADC consolidation and virtualization. This section discusses the key capabilities of ADC-VX and how they meet the aforementioned challenges.

Ensuring privacy of the virtual ADC instances with complete isolation
ADC-VX architecture guarantees the full privacy of the all virtual ADC instances that run on top of it. Per vADC,

ADC-VX offers three layers of privacy:

1. **Private physical resources** – each vADC is allocated with a dedicated set of physical resources such as CPU and memory. Although these are slices of shared resources, ADC-VX guarantees that they cannot be consumed by neighboring vADCs, hence they can be referred to as private resources per vADC.
2. **Private management domain** – ADC-VX is designed to allow different customers to manage different vADCs without sharing any management entity to guarantee complete privacy of the management domain. All the standard management options of dedicated ADC are available plus RBAC per vADC. Additionally, each vADC has its own private and isolated configuration file, logging and reporting.
3. **Private network traffic** – from the moment a network traffic enters the ADC-VX system, it's immediately routed through a private path that is dedicated only for the traffic of a single vADC; the result is complete privacy of the traffic and assurance that network security threats will never affect neighboring vADCs.

Isolate failures between virtual ADC instances

ADC-VX introduces a fault isolation mechanism to ensure that any failure in one of the vADCs will not create a domino effect that will propagate to neighboring vADCs. Regardless of the causes to the failure, whether it's software issue or a failure in the one of the components of the system, the fault isolation guarantees that the failure will be segregated and isolated from other parts of the system. This unique mechanism results in:

- system with no single point of failure that might create the whole system to fail
- fault isolation that is similar to separated physical devices
- non-stop ADC that continues to operate even during local failure of a single vADC
- each vADC can be independently started, shut down or restarted without stopping the entire ADC-VX

Instance based redundancy

ADC-VX breaks the paradigm of a redundant pair of physical devices for high availability (HA), and introduces vADC instance-based redundancy. This allows you to increase the availability of your infrastructure and boost redundancy of your ADC deployment, ensuring reduced risk in the infrastructure and creation of a large array of redundant platforms. vADCs can reside on available computing resources and provide active or backup capabilities, and the peer vADC can reside on other computing resources and provide similar capabilities. This new approach to HA allows customers to design a redundancy scheme across a cluster of devices moving from the traditional approach of 1+1 devices to a new approach of n+n devices for redundancy – resulting in reduced risk of ADC consolidation projects.

Performance predictability

A unique **resource guarantee** mechanism ensures that each vADC is allocated with dedicated resources for its operation that cannot be consumed by neighboring vADCs. This way, every vADC can utilize only those resources for which it was specifically allocated, resulting in guaranteed performance and SLA for each instance. This approach completely eliminates the risks of resource starvation even under the most challenging scenarios. For example, a flash crowd event on one of the vADCs will not affect the performance of other instances. If a vADC is at 100% CPU utilization, no neighboring vADC will be affected, as each vADC is allocated with one or more Virtualized Switch Processor, (VSP) to which the time slide available is controlled at the CPU level. The resource guarantee mechanism results in:

- **predictable performance of every vADC** - as neighboring vADCs do not affect the resources of other vADCs
- **SLA assurance of every vADC** - of the entire device, and the application response time
- **serve multiple customers or applications from one consolidated device** - while allocating dedicated vADC per customer, to assure the customer's performance and ADC requirements

Capacity planning and resource abstraction

To ease the allocation of the shared resources among the multiple vADCs, ADC-VX introduces resource abstraction mechanism through the concept of capacity units. Capacity unit is a fixed resources package, which provides memory, CPU power, table real-estate and all the elements that constitute an ADC. Each capacity unit can be translated into throughput values, where each capacity unit can process up to 700 Mbps of traffic. Capacity units can be added and removed from vADCs based on the needs of the application (more processing power, more throughput capacity, or both). Such operations can be done in real time and do not affect the entire system or neighboring vADCs.

As each capacity unit represents a certain value of throughput, ADC-VX administrators can eliminate complicated resources calculations, shorten their learning curves and continue to define each vADC by its throughput requirement, just like dedicated physical ADC devices.

Network virtualization to support existing topologies

Each vADC has a private dedicated network infrastructure including ARP table, VLANs, routing table, static and dynamic routing protocols and more that enable the vADC to appear in the network as an independent network entity. With such flexible design, ADC-VX meets every possible network topology to accommodate the needs of all vADCs while they serve separated and private networks. The separated and private network virtualization layer ensures that network security risks and threats will never affect neighboring vADCs.

ADC-VX supports **overlapping IP** between neighboring vADCs to increase the allowed network topologies and the flexibility of network designs.

Enabling Business Agility

Instant provisioning, decommissioning and resource reallocation of vADCs drive business agility by significantly shortening the deployment time of new applications and services in the virtualized data center. Radware's ADC-VX makes it easy to reallocate resources and distribute them across vADCs, adjusting their performance and functionality to meet changing business needs.

Radware's OnDemand strategy is integrated in ADC-VX in four dimensions:

1. OnDemand throughput of the entire device running ADC-VX up to 20Gbps
2. OnDemand throughput of each vADC in granularity of 100Mbps
3. OnDemand increase in the number of vADCs running on top of ADV-VX
4. OnDemand advanced services including global server load balancing, advanced denial of service, link optimizer and intelligent traffic management. Each vADC can run any of the advanced services

The OnDemand approach reduces capacity planning risks and drives business agility by easily alignment of the ADC-VX capabilities with the changing business needs. See more on OnDemand benefits below.

Instant provisioning of services

ADC-VX provides instant provisioning of new vADCs within a couple of minutes. To provision a new vADC, the ADC-VX administrator is only required to define the required throughput and from that point the entire process of allocating sufficient resources is completely automated by ADC-VX. Once the vADC has been created, ADC services can be added and that's it – the vADC is up and running.

ADC-VX instant provisioning supports rapid deployment of new services in the virtualized data center, enhances business agility and enables alignment of ADC services with the changing in the data center.

P2V migration of traditional ADC to virtual ADC

ADC-VX introduces a simple, automatic, wizard-driven tool to convert traditional physical ADC devices into virtual ADC instances. This easy to use wizard minimizes human errors and shortens the time required for conversion, resulting in reduced physical to virtual (P2V) migration risks and reduced OPEX associated with the consolidation project, as it takes less time to consolidate.

V2V migration

Radware V2V technology is game-changing in virtual ADC mobility, allowing migration of virtual ADC instances across different ADC computing resources including specialized hardware platforms and general purpose servers. With this unique technology, vADCs can move between computing resources in the data center with all the relevant information including configuration, computing resources capacity reserved and network information. V2V allows effortless migration from pre-production to production environment and migration of vADCs across virtualized ADC resource pool (several physical units of ADC-VX) for optimized capacity management.

vADC templates

vADC templates provide an innovative approach to provision vADCs from a pre-configured image; the template contains all the required information for the vADC including virtual hardware resources, software and configuration settings. With vADC templates the deployment time of new ADC services and applications is significantly shortened, tedious tasks are reduced and user errors are eliminated. With the usage of vADC templates, staff spends significantly less time to provision and configure vADCs, resulting in increased efficiency, reduced OPEX and manageability costs.

Manageability

The ADC-VX administrator is called the Global Administrator and is responsible for the management of the physical appliance as well as the vADC resources and infrastructure configuration. The Global Administrator is not involved in determining the SLB functionality of the vADCs. The Global Administrator is responsible for provisioning vADCs and resources, monitoring their use to preemptively identify application and service needs. The Global Administrator benefits from a centralized management system and dashboard that provide real-time view of the virtual instances' health and resource utilization, resulting in a scalable solution that is simple to operate and manage.

In addition to the Global Administrator, each vADC is managed by a local manager that is responsible for all the vADC functionality including SLB, configurations and network management just like a dedicated ADC device. The management domain of each vADC is completely private and isolated and includes separated configuration files per vADC, separated user database, separated alerts as well as logs and statistics. Each vADC can be assigned with roles based on role based access control (RBAC) system to restrict system access to authorized users and to maximize security.

Business benefits

Significant cost savings and ROI

By enabling seamless ADC consolidation and virtualization, Radware ADC-VX enables reduction in the number of physical ADC units required in the data center and therefore delivers the following cost savings:

Capital expenditures reduction

- **product cost**– by enabling ADC consolidation and increasing the utilization of the ADC solution, less physical ADC units are required to be deployed in the data center. In addition, Radware's on demand scalability enables cost-effective provisioning of new vADC instances and additional throughput capacity to address business growth requirements with no hardware replacements

- **switch ports cost** – as consolidated ADC instances can share the same network connections and ports, fewer network switch ports and less cabling are required to connect fewer physical ADC units
- **disaster recovery cost** – enables consolidation of ADCs also in the secondary data center to support disaster recovery plans and SLA

Operational expenditures reduction

- **data center power and cooling cost** – delivers dramatic savings on power and cooling costs thanks to fewer physical devices and the resulting reduced energy consumption. In addition, it also enables avoidance of costly data center upgrades and expansions needed to meet the growing power and cooling requirements
- **data center space cost** – since fewer ADC devices are deployed, less data center rack space is required by the solution – resulting in real estate savings
- **Service cost**–reduced spending on hardware support contracts thanks to ADC CAPEX reduction. In addition, the same service cost can be invested more cost-effectively, for instance, to purchase higher support levels
- **network administration cost** – increase network operations efficiency by reducing human errors via reduced ADC provisioning, decommissioning and shortening migration tasks from days or weeks to minutes
- **business administration cost** – allows companies to reduce business administration overhead costs such as frequent hardware purchases, and associated approval and procurement processes

Try now our online ROI Calculator

Check out how Radware's ADC-VX can help you achieve immediate cost savings

Increase efficiency in the data center

Radware's ADC-VX brings increased flexibility and agility to the virtualized data center by providing full virtualization of the application delivery services, while meeting application SLA requirements, providing predictable performance and reducing risks associated with physical-to-virtualization migrations. With ADC-VX, for the first time, ADC services are fully virtualized and offer the same level of agility as all other virtual elements in the virtualized data center.

Summary

Enterprises, carriers, cloud computing and hosting providers operating virtual data centers face numerous challenges in transforming their ADC devices into an integrated, scalable virtualized application delivery environment. Radware's ADC-VX and Radware VADI architecture successfully address these challenges and provides a risk free path the full ADC consolidation and virtualization.

References

Radware's Virtual Application Delivery Infrastructure White Paper
ADC-VX ROI Savings White Paper
Online ROI Calculator
ADC-VX Brochure