

TRANSFORM YOUR STORAGE FOR THE SOFTWARE DEFINED DATA CENTER

With EMC ViPR Controller

ABSTRACT

The following paper opens with the evolution of the Software-Defined Data Center and the challenges of heterogeneous storage silos in making the SDDC and hybrid cloud a reality. It continues by introducing EMC's Software-defined Storage Solutions and details how EMC® ViPR® Controller delivers storage automation and Storage-as-a-Service that is foundational to the SDDC and a hybrid cloud strategy.

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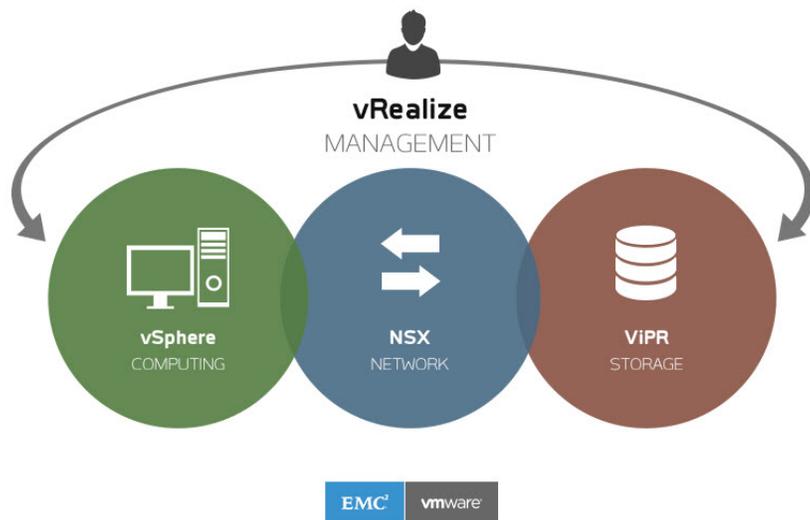
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EXECUTIVE SUMMARY

The past decade and a half has seen virtualization technology transform applications, servers and networks into software abstractions that enable data center and IT managers to build adaptive and agile data centers. The rise of the Software-Defined Data Center (SDDC) (Figure 1) promises to build on the progress of virtualization by completely abstracting every component of the data center from its underlying hardware so that IT can truly deliver resources as customizable, on-demand services. The SDDC is the foundation for a cloud strategy that offers choice of traditional or converged infrastructure, applications, operating systems, and public clouds. This is the transformative potential. However, the reality is that storage still acts as a headwind to a SDDC. Unlike applications, servers and networking, storage and its valuable data are still too often tied to proprietary hardware.

One major reason that storage has lagged behind server and network virtualization is its inherent heterogeneity. Storage hardware and operating systems vary much more than server, client or network platforms. Storage platforms are incredibly diverse; even different arrays from the same vendor will feature different operating systems, proprietary APIs and unique feature sets. Storage naturally evolved this way over decades as a response to new and different application workloads that require unique performance and protection characteristics. Every new business service required a new storage array - be it block, file or object-based - optimized for that purpose. Out of necessity, storage administrators have evolved into storage managers who spend most of their time managing arrays rather than optimizing storage for the business. If enterprises and service providers are going to break from this pattern and be part of the evolution to a SDDC and hybrid cloud they need to fundamentally transform storage and how it is delivered to consumers.

Figure 1. The Federation Software-Defined Data Center



EMC software-defined storage solutions, which include EMC® ViPR® Controller, Elastic Cloud Storage (ECS), ViPR SRM and ScaleIO, all bring a revolutionary approach to storage, automation, management and delivery. ViPR Controller is storage automation software that centralizes and transforms storage into a simple and extensible platform. It abstracts and pools multi-vendor, heterogeneous storage resources to deliver automated, policy-driven storage services on demand via a self-service catalog. ECS is a software-defined cloud storage platform designed and engineered specifically for Web, mobile and cloud applications that can leverage the economics and capabilities of scale-out, commodity infrastructure. ViPR SRM is storage management software that increases visibility and control of multivendor traditional and software-defined data centers with automated monitoring and reporting from hosts through the storage infrastructure. ViPR SRM allows storage teams to analyze capacity utilization, historical performance trends and relationship dependencies for better, faster decision making. It continuously validates compliance with design best practices and the EMC Support Matrix to ensure the environment is always configured to meet service levels. ScaleIO is a software-only server-based storage area network (SAN) that converges storage and compute resources to form a single-layer, enterprise-grade storage product. ScaleIO storage is elastic and delivers linearly scalable performance. Its scale-out server SAN architecture can grow from a few to thousands of Servers.

This white paper details the architecture of ViPR Controller and how enterprises and service providers can reduce costs, provide choice and deliver a path to the cloud.

THE EVOLUTION OF THE SOFTWARE-DEFINED DATA CENTER AND THE CHALLENGE OF MANAGING ENTERPRISE STORAGE

The Rise of the Empowered End User and Customer

The relationship between the consumers and providers of IT has been turned on its head. With the advent of public cloud “as-a-service” offerings, circumventing IT no longer requires an engineering degree, a high-end Windows or Linux server and expensive software. All it takes is an Internet connection and a credit card. The ease with which developers and end users can find readily available technology alternatives means they can hold enterprise IT departments and traditional IT service providers to a much higher standard for service and delivery. Fair or not, IT departments and service providers find it increasingly difficult to dictate technology choices to their internal and external customers; they have to compete for it.

The Storage Evolution: How We got Here

Storage as it is deployed today often impedes the progress of building an agile data center, increases operational costs, and consumes operational resources that could be directed towards development of next generation Web, mobile, cloud and Big Data applications. Every data center workload is moving inexorably to a consumption-based, private, public or hybrid cloud service model. Storage must adapt and align with new data center operations and cloud stacks so that it too can be consumed ‘as-a-service’.

IT organizations have historically deployed different storage arrays optimized for specific application workloads, data types, access protocols, performance and protection requirements. These applications take advantage of unique services embedded in these storage arrays. Consider, for example, a global financial trading application where:

- New trades must be transacted in real-time
- Historical trades must remain easily accessible for end of month, end of quarter, and end of year processing
- Yearly historical records must be archived for seven years for compliance but will never require real-time access
- All of the above must be protected against disaster enabling rapid application restart in an alternate site

The sheer nature of these different data classifications force different price/performance trade-offs on storage. The next generation of cloud applications will require storage with very different performance and reliability characteristics which will push IT to deploy even more types of storage with the proper price/performance trade-offs.

Storage administrators are adept at intricately aligning the right storage array to the right data and the right application. But the resulting management complexity and operational rigidity fundamentally prevents IT from fully incorporating storage as a seamless component of the SDDC and cloud operation stacks.

Storage at the Tipping Point

If enterprises and service providers could centrally manage these varied workloads and offer the same user experience as public cloud providers, they would transform a perceived weakness into a sustainable competitive advantage. Getting to that advantage, however, has a host of immediate challenges including:

- Storage environments must be designed for the Software-Defined Data Center and cloud. The design premise of a traditional storage environment assumes the data path between applications, server, and storage is known, does not change frequently, exhibits a predictable traffic pattern, and is mainly confined within the boundaries of a data center. None of that holds true for a highly-virtualized data center or cloud. Traditional storage silos tightly tied to applications and servers are at odds with virtual data centers, dynamic applications and workloads.
- Storage must operate at the proper level of abstraction. Virtual machines (VMs), virtual applications (vApps) and virtual storage volumes operate at the logical level while storage arrays still operate at the physical level (LUNs or file shares). Operating at the physical level requires intervention from storage administrators who must create LUNs and file shares and manage their lifecycle. Because of this, IT can't easily integrate storage into data center and cloud operations stacks nor can they give end users a simple, flexible self-service capability to consume storage on demand.
- There is too much existing data to just ‘start over.’ Any solution to this problem, however innovative and transformative, must encompass existing data. If not, organizations will just end up with yet another storage silo. Storage must be viewed holistically.
- Storage complexity increases costs and management burden. The diversity of storage arrays necessary to satisfy business data requirements leads to multiple management control points. Each file, block and object-based storage array has its own

management interface and its own provisioning and management processes. Multi-data center environments exacerbate the management headaches. Administrators have poor visibility into storage usage, available capacity, performance and system health. That lack of visibility and self-service capabilities means storage administrators spend an inordinate amount of time identifying available storage capacity and manually provisioning storage. This inefficient use of valuable staff time results in an IT department that can't deliver storage quickly or cost-effectively, inconveniences users, as well as virtualization and automation investments that fail to reach their potential.

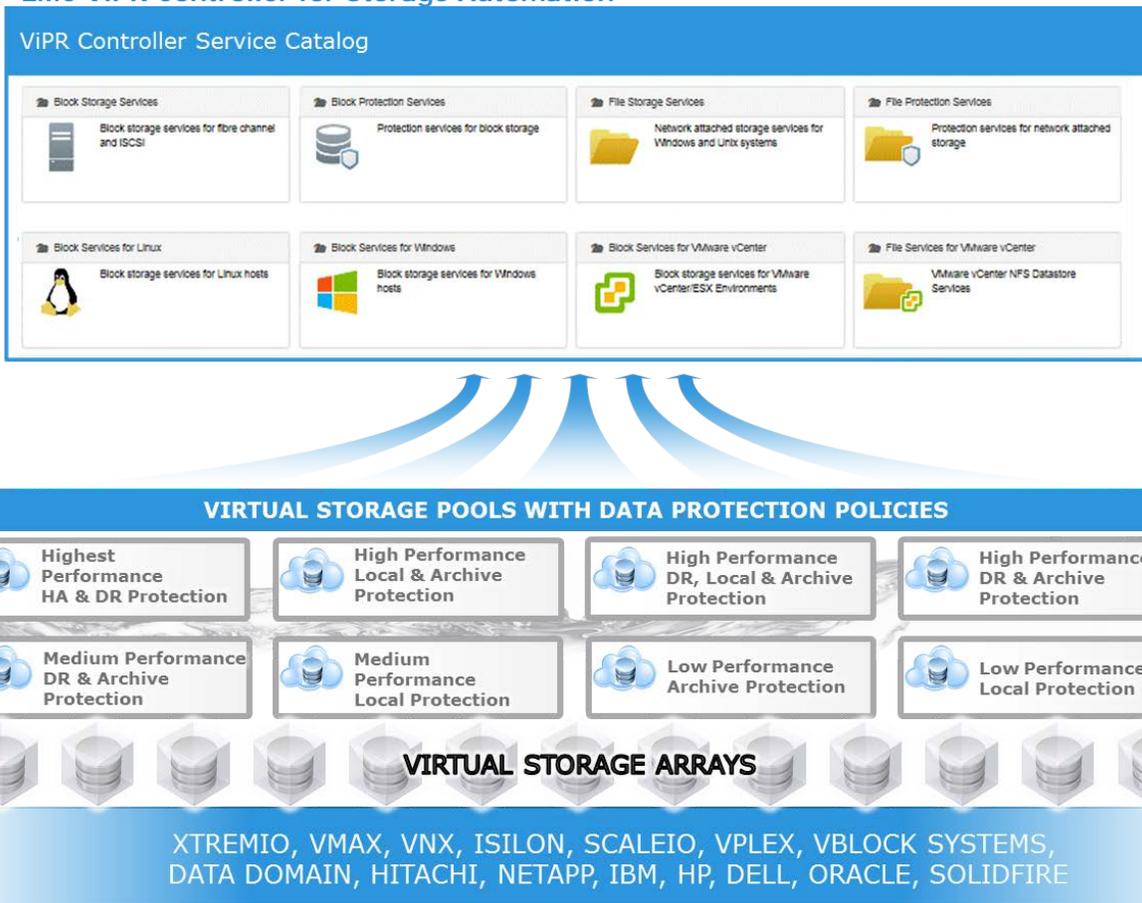
- Manual provisioning impedes application development and service delivery. Time to market is crucial, which has become the driving factor in the increasing adoption of converged infrastructures. Enterprises and service providers need the ability to rapidly onboard new applications and services and engage an ecosystem of application developers that create and launch new services. Closed, proprietary storage platforms and the lack of open APIs force developers to write more code to access storage. Plus, developers often have to wait for IT to provision storage, network and compute resources. The ability to quickly provision storage and host clusters for new applications is one of the most important factors in the success of the SDDC and giving enterprises and service providers the ability to deliver a private/hybrid cloud that can compete with public cloud alternatives.

TRANSFORM STORAGE: EMC VI PR CONTROLLER

Storage Automation Software

EMC ViPR Controller is a lightweight, software-only solution that transforms your existing storage environment into a simple and extensible platform that can deliver fully automated storage services. ViPR Controller abstracts multi-vendor storage from physical block and file arrays into a pool of virtual shared storage resources as well as abstracts the storage control path from the underlying hardware arrays so that access and management of multi-vendor storage infrastructures can be centrally executed in software (Figure 2).

Figure 2. EMC ViPR Controller hosts for Storage Automation



Principally, a storage device features a control path and data path. In simplistic terms, the control path sets and manages the policies for the storage device and the data path performs the actual reads, writes and services. ViPR Controller is unlike previous

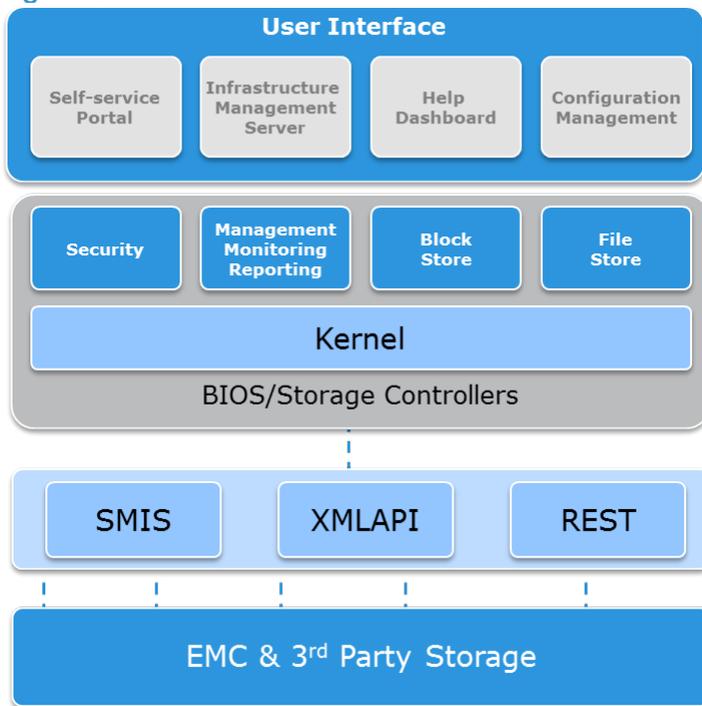
attempts at storage virtualization in that it decouples the control path from the data path. By abstracting the control path, storage management operates at the virtual layer, which gives customers the ability to partition their storage pool into various virtual storage arrays and manage them uniquely by policy. This is analogous to partitioning a server into a number of virtual machines. However, ViPR Controller does not sit in the data path for storage. This decoupling of the control and data paths enables all data provisioning and data management tasks to be centralized, allowing applications to access storage as they always have and continue to use the unique services embedded in the storage arrays.

ViPR Controller features block and file control services that provide all the functionality of physical block and file storage arrays as virtual services. Block and file control services allow users to manage block volumes, NFS file systems or CIFS shares, and advanced protection services such as snapshots, cloning, replication and high availability. These block and file control services offer full storage functionality as if the user were accessing a physical array. In contrast, block storage volumes typically provided for use by virtual compute instances in public clouds can forfeit many advanced array features in favor of using commodity disks for lower cost and operational simplicity. ViPR Controller, however, does not require that sacrifice, delivering operational simplicity and maintaining all the advanced features of the arrays such as mirrors, clones, snapshots, and multi-site high-availability, and replication.

ViPR Controller Architecture

ViPR Controller makes a multi-vendor, heterogeneous storage environment look like one, big shared storage platform. It uses software adapters that connect to the underlying arrays, similarly to how device drivers enable universal device compatibility with a PC. This creates an extensible “plug and play” storage environment that can automatically connect to, discover and map arrays, hosts and SAN fabrics (Figure 3).

Figure 3. ViPR Controller Architecture



ViPR Controller guides an administrator through the process of discovering the storage infrastructure. Once a storage administrator adds arrays, they are automatically discovered, including all their corresponding storage pools and ports. Once the Fibre Channel switches are added, they are automatically discovered and mapped to the Fibre Channel networks. This discovery, virtualization and mapping is for EMC and non-EMC arrays as well as EMC and third party data protection including:

- EMC XtremIO, EMC VMAX, EMC VNX, EMC VNXe3200, EMC Isilon, EMC VPLEX, EMC ScaleIO, EMC Data Domain, VCE Vblock Systems
- Dell, Hitachi Data Systems (HDS), HP, IBM, NetApp, Oracle and SolidFire
- Data Protection Technologies: Hitachi snaps, IBM snaps, RecoverPoint®, SRDF®, VPLEX®

ViPR Controller hides the complexity of all the underlying storage arrays and exposes their core functionality as services while retaining the unique attributes of the arrays. Storage administrators then create Virtual Storage Pools in ViPR Controller that represent sets of capabilities required by unique application workloads. For example, a transactional workload would be best served by a Virtual Storage Pool that features the characteristics of high-performance block storage such as EMC XtremIO. A file and content sharing application would work just fine on a NAS appliance that more economically provides the requisite level of data protection and availability. In either case, a user subscribes to a Virtual Storage Pool that meets their workload's demands. The user does not need to know or care about the underlying hardware and software that is providing the service to their application.

Rather than provisioning space on a specific array, ViPR Controller gives storage administrators the ability to expose a unique and customizable combination of hardware and software resources as consumable services.

The ViPR Controller Value: Simple, Extensible, Open

ViPR Controller simplifies and automates repetitive storage provisioning, data protection and management tasks by virtue of an abstracted, central control path. This extensible platform enables an organization to develop new services and adapters to support additional arrays. The open, API-accessible platform facilitates integration with cloud stacks such as VMware vRealize Automation, OpenStack orchestration tools or Microsoft Hyper-V.

Simple: Reduce Costs and Deliver True Storage-as-a-Service with Automation and Centralized Management

The abstracted, central control plane simplifies the operation of a diverse storage infrastructure. ViPR Controller centralizes and automates the provisioning, reclamation and data protection of storage resources from centralized virtual pools to improve utilization and reduce costs. Administrators can add, provision, manage, and share storage from a single software control point, saving up to 73% (Source: Principle Technologies whitepaper "Reducing Operating Expense with EMC ViPR Controller and ViPR SRM") in administrative costs annually. On average, ViPR Controller reduces provisioning times by 63% (Source: Principle Technologies whitepaper "Realizing Software-Defined Storage with EMC ViPR"). This frees administrators from repetitive, manual tasks that may cause human errors and lengthen management review cycles.

ViPR Controller can not only empower IT to simplify management, but also simplify delivery and consumption. Rather than provisioning storage for users manually and via scripts, storage administrators can deliver policy-based storage resources via a self-service catalog – on demand. Users can easily subscribe in 5 simple steps to storage resources that meet their workload needs. This empowers users and reduces reliance on IT. This helps storage administrators minimize user-IT interactions, automate the process of identifying available storage capacity, and better map an application workload's requirements to the right combination of software and hardware storage resources.

Extensible – Increase Flexibility and Eliminate Lock-in with Multi-vendor Support

ViPR Controller supports EMC and third party storage. It also extends automated management to any block storage array that supports an OpenStack Cinder Driver. As a result, IT Organizations can manage a variety of EMC and non-EMC storage platforms, allowing them to choose the infrastructure that best meets their specific business needs.

ViPR Controller makes storage an API-accessible resource within the SDDC and an easily consumed resource within an enterprise hybrid cloud. The Representational State Transfer (REST) API provides for integration with higher level management automation solutions, including those from VMware, OpenStack and Microsoft Hyper-V.

ViPR Controller provides specific VMware integration with interfaces into VMware vStorage API for Storage Awareness (VASA), vRealize Orchestrator and vRealize Operations to:

- Simplify storage provisioning for IT-as-a-Service initiatives
- Provide a single controller point for cloud administrators to offer STaaS
- Correlate storage anomalies and metrics in-context with the virtual infrastructure for end-to-end analytics

This integration also gives a vCenter administrator end-to-end visibility from the virtual machine to physical storage, allowing supported storage to be managed and provisioned via VMware, which can reduce VM provisioning costs up to 63% (Source: Principle Technologies whitepaper "Reducing Operating Expense with EMC ViPR Controller and ViPR SRM").

Open – 100% Open Development

ViPR Controller development is driven by the open source community. This type of development model encourages community collaboration for expanding the breadth and depth of features and functionality including support for non-EMC storage arrays and data protection technologies. It also strengthens ViPR Controller as a single, vendor-neutral control point for software-defined storage automation.

CONCLUSION

The rise of public cloud computing has prompted executive leadership, line-of-business (LOB) managers, and developers to ask much more of their IT leadership, their service providers and, consequently, storage administrators. The continuing growth in traditional enterprise application workloads coupled with the explosive growth in Web, mobile and cloud applications demands a simple, automated way to align data center and storage resources to the myriad ways in which content is stored, protected and accessed.

The era of data silos is over. True software-defined storage is here. EMC ViPR Controller abstracts storage from physical arrays into pools of virtual shared storage resources that are foundational to the SDDC and enterprise hybrid cloud. Even complex, heterogeneous, multi-vendor environments can be made simple to manage, extensible, and open to innovation and value-adding services.