We are on the verge of a significant transformation in the modern data center, driven by the need for greater business agility and the ability to manage complexity at scale. This alternative vision for infrastructure, referred to as the software-defined data center, uses standard, commodity, scale-out hardware building blocks to create pools of compute, network and storage resources. These resources are abstracted and delivered as tiers of services that can be configured, managed and controlled entirely through software.

Companies like Google and Facebook that have had to deal with the challenges of massive scale and the need for rapid reconfiguration of resources have already been deploying infrastructure based on these principles, using white-label hardware and in-house technical expertise. As the challenges of scalability, agility and cost become more widespread, more companies are starting to adopt similar architectures.

Compute infrastructure was the first to shift from monolithic mainframe systems running a handful of applications to x86-based commodity hardware and scale-out virtualized resources that are centrally managed and controlled by an integrated control plane. More recently, companies like Arista, Nicira and Big Switch are introducing similar disruption to the networking world. With compute and networking firmly on the “software-defined” path, the focus is shifting to storage. There is now a flurry of marketing and engineering activity to capitalize on the momentum to disrupt legacy storage architectures.

As with any new technology trend, we are seeing a mix of hype and real innovation in software-defined storage. As storage architects begin to look at this new trend, it’s important to separate fact from fad.

**Characteristics of Software-Defined Storage**

Software-defined storage is characterized by several key architectural elements and capabilities that differentiate it from traditional infrastructure.

1. **Commodity Hardware**
   All the intelligence in software-defined storage (SDS) is in the software layer. SDS systems use commodity, off-the-shelf hardware for both physical storage as well as the interconnecting fabric – the storage network.

2. **Scale-Out Architecture**
   Hardware in a software-defined storage system needs to enable rather than hinder fluid, flexible and elastic configuration of storage resources through software. The best way to achieve this fluidity is by using a building-block approach to storage that allows architects to dynamically add and remove resources, in contrast to legacy storage with rigid controller designs.
3. Resource Pooling
The available storage resources are pooled into a unified logical entity that can be managed centrally. The control plane provides fine-grained visibility and control to all available resources in the system.

4. Abstraction
Physical storage resources are virtualized and presented to the control plane, which can then configure and deliver them as tiered storage services.

5. Automation
The storage layer provides extensive automation that enables it to deliver one-click, policy-based provisioning of storage. Administrators and users request storage resources in terms of application needs – capacity, performance and reliability – rather than storage configurations such as RAID levels or physical location of drives. The system automatically configures and delivers storage as needed on the fly. It also monitors and reconfigures storage as required to continue to meet SLAs.

6. Programmability
In addition to in-built automation, the storage system offers fine-grained visibility and control of underlying resources via rich APIs that allows administrators and third-party applications to integrate the control plane across storage, network and compute layers to deliver workflow automation. The real power of software-defined storage lies in the ability to integrate it with other layers of the infrastructure to build end-to-end application-focused automation.

Common Fallacies of Software-Defined Storage
As the battle heats up among enterprise storage companies to clarify what software-defined storage really is, vendors will try to muddy the waters in an effort to shoehorn existing technology into the new concept of SDS. Following are some common fallacies that customers need to be wary of.

“You can’t be software-defined storage unless you sell storage as just software”
Some storage vendors that sell software-only solutions have tried to argue that “software-only” is the same as “software-defined.” There is a big difference between storage software and software-defined storage – the former is a technology delivery model, while the latter is an architecture for how storage is deployed, provisioned and managed. All storage systems require hardware, whether the installation of software happens in the field or before the product is shipped.

“Storage virtualization is software-defined storage”
A common misunderstanding that is propagated by traditional storage virtualization vendors is that software-defined storage is just a new name for storage virtualization. Storage virtualization, the ability to abstract physical storage from the control plane, is a necessary but not sufficient capability for SDS. In addition to abstracting physical resources, SDS systems need to offer extensive policy-based automation for resource provisioning and management as well as the ability to programmatically control storage via REST APIs.

For instance, in a SDS system, administrators and end users do not need to specify technical storage configurations such as the RAID level, drive types, RAID set size for a volume, or cache size for a pool. Rather, they would ask for a volume with a certain performance and availability profile, which the system then automatically translates into the required storage specifications and creates an appropriate volume. The system also dynamically monitors the performance of the volume to ensure SLA conformance and automatically tunes the system as needed, for instance by adding more cache to a pool or migrating a volume to a different storage device.

“A software-defined storage system must run the storage controller in a virtual environment”
Some storage vendors are experimenting with or actively running their storage controllers in virtual machines. This trend developed independently from software-defined storage, and offers interesting possibilities such as virtual controller redundancy and the ability to dynamically convert a server with disks into a virtual storage appliance. But running the storage controller in a VM is by no means a requirement for software-defined storage.
storage—it’s simply a delivery method for software. As an example, administrators may be able to provision a bare-metal server with disks into a storage appliance using technologies such as PXE booting.

“You can build SDS with legacy Fibre Channel SAN”

Most industry experts believe that the complexity and multi-vendor nature of Fibre Channel storage systems are incompatible with the elastic, commodity nature of SDS. The practical difficulty of engineering and testing low-level automation across five or six vendors, including the complex point-to-point configurations of Fibre Channel, make this an unlikely scenario.

Conclusion

As with any major industry shift, there will be plenty of debate about the definition of software-defined storage. However, we have the benefit of examples at the compute and networking layers to frame the discussion, and it’s clear that the data center is entering a period of accelerating change. Few of the major vendors in the $30 billion storage market have succeeded in modernizing their technology to participate in this new data center architecture, so one outcome is clear: a lot of market share is going to be changing hands.

Software-Defined Storage from Coraid

Coraid EtherCloud is a software-defined storage platform that enables data center architects and operators to deliver storage infrastructure that is agile, flexible and simple to use, while maintaining control over every aspect of storage deployment, provisioning and management.

EtherCloud offers a powerful set of REST APIs that enables administrators to programmatically control storage management. The REST interface reduces the time taken to provision storage by allowing administrators to automate complex workflows, build self-service provisioning portals, and offer a broad range of cloud-computing services. EtherCloud also offers a web-based graphical user interface (GUI) that uses the API and allows administrators to conveniently manage their storage from anywhere.

Using EtherCloud, administrators can create highly customized cloud storage services that deliver storage resources with desired performance and reliability characteristics. Since storage provisioning and management are automated down to a single click, application owners without storage expertise can get required resources directly via self-service provisioning portals. EtherCloud also offers multi-tenant access control with LDAP/AD-based authentication that allows storage administrators to allocate resources to specific groups and delegate management of those resources to tenant administrators.

Administrators can use an advanced policy engine that EtherCloud offers to set granular control policies that limit what resources various users and groups can use. For example, a policy can be created that allows the use of high-end, flash-based, high-performance storage when a specific application is used in a production environment, but uses slower, less-expensive storage when that same application is used in a development environment.

About Coraid

Coraid redefines storage with its breakthrough line of EtherDrive and EtherCloud solutions. Coraid delivers scale-out performance, Ethernet simplicity, and an elastic storage architecture to handle massive data growth. Designed from the ground up for big data, virtualization, and cloud architectures, Coraid’s platform has been deployed by thousands of companies worldwide, including enterprises, government agencies, and private cloud-building organizations. For more information, visit www.coraid.com.