SERVICE-DEFINED INFRASTRUCTURE WILL SHAPE FUTURE CONVERGED SYSTEMS

MOVING TO THE HYBRID CLOUD REQUIRES INTELLIGENT AUTOMATION & UNIFIED MANAGEMENT FOR HETEROGENEOUS ENVIRONMENTS

EXECUTIVE SUMMARY

Many view a hybrid cloud deployment model as the path to the flexibility for both traditional and cloud-native workloads. On the private cloud side, converged systems have emerged as an approach for IT to improve efficiencies and lower overall costs. On the public cloud side, IT organizations value the ability to stand up infrastructure in minutes without worrying about the specific hardware required for each workload. Moving forward, IT organizations want the same quick time-to-market capability in their private clouds that they currently experience with the public cloud. In addition, IT wants to manage both their private and public cloud resources under a unified systems management plane.

Moor Insights & Strategy (MI&S) believes converged systems are on the verge of reaching a new inflection point, driven by the desire for infrastructure to be service-defined. **Service-defined infrastructure** means IT policies, service level agreements, and workload requirements (the "soul" of the system) can be converted and validated into templated code. With service-defined infrastructure, IT can dynamically provision (and re-provision) all resources to keep up with user requirements, provide support for continuous operations, and adhere to consistent end user service levels.

This paper explores the key tenets of service-defined infrastructure. In addition, we discuss Dell's approach to converged systems and how the company sees it aligning with the service-defined infrastructure requirements of the future.

CONVERGED SYSTEMS IMPROVE EFFICIENCIES

IT organizations face increasing pressure to deliver new products and services that provide competitive advantage for the business. This requires agility to deliver solutions quickly with flexible deployment models and infrastructure choices to meet the specific needs of each application and SLA. Many IT organizations see a hybrid cloud approach as a flexible solution to meet their evolving needs. The benefits of the cloud are clear: increased productivity, faster response to users, reduced operational costs, and the ability to adjust quickly as demands change.

As customers look to drive wide adoption of private clouds within their datacenters, many have turned to **converged systems**—pre-integrated configurations combining server, storage, and networking with unified systems management—to improve efficiency and get to market quickly. Converged systems are different from traditional hardware platforms in that they are designed to be deployed quickly using a modular building-block approach to scale up resources and workloads rapidly and lower costs.

Before the market recognized converged systems as an official category, large web scale companies were deploying workload-optimized solutions with compute, network, and storage building blocks in one rack. VCE brought this category to mainstream IT, and other industry leaders quickly followed with converged systems that included technology integrations from both single and multiple vendors. As an extension of converged systems, workload-optimized hyperconverged infrastructure appliances were created with price points and configurations for both mid-market and enterprise organizations.

Reference architectures were created as an alternative to converged systems to give IT more flexibility to create solutions for their specific needs. IT organizations with expertise in application optimization and sizing have used reference architectures effectively, but reference architectures may not be right for users with less knowledge about the intricacies of their workload bottlenecks or optimizations.

A New Inflection Point: Service-Defined Infrastructure

Customers today are demanding an advancement in converged systems infrastructure. They want more flexibility than a pre-wired monolithic system, but they still want to make sure they know how to optimize for their environment and achieve the benefits of the converged infrastructure. In addition, IT administrators' expectations have been permanently modified by the capabilities afforded by the public cloud—the ability to stand up infrastructure in minutes without worrying about the specific hardware required for each workload or how to update the hardware. Also, IT organizations want the ability to operate both their traditional IT and cloud-native workloads using one infrastructure and to turn on the capacity they want when they want it with the click of a button. These customer needs are driving converged systems toward a new inflection point.

To help meet these evolving customer demands, industry leaders see an opportunity to revolutionize the makeup of converged systems and how they are ordered, delivered, managed, and maintained. MI&S calls the inflection point that will drive the future of converged systems **service-defined infrastructure**. Service-defined infrastructure

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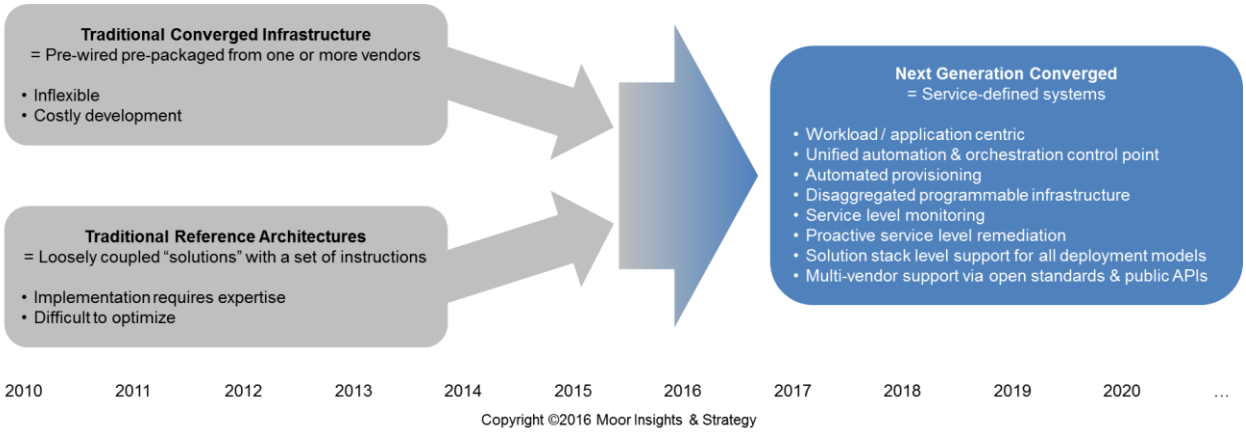
FIGURE 1: SHIFT FROM CONVERGED SYSTEMS TO SERVICE-DEFINED INFRASTRUCTURE



KEY REQUIREMENTS FOR SERVICE-DEFINED INFRASTRUCTURE

The future state of service-defined infrastructure will dramatically simplify and increase the speed, reliability, and efficiency of hybrid cloud deployments. Service-defined infrastructure must include **all** of the following components:

- **Workload / application centric**: A key element of a service-defined infrastructure is an architecture with intelligence about workload needs over time. This means the infrastructure can deploy the workload where it belongs using the right amount of resources and can manage and maintain the workload over time. This includes keeping up with the ongoing performance / efficiency requirements for the workload as well as the SLA requirements for each user and application.
- **Unified automation & orchestration control point**: The foundation for a service-defined infrastructure is a unified systems management plane that controls network, storage, and compute resources and integrates with public cloud resources. The control point must support all assets and services across the organization and support new technologies as they emerge.

- **Automated provisioning**: IT administrators must have accurate, up-to-date information about available resources and workload requirements via a standardized set of configuration templates. A library of templates should be available as a starting point, and IT must be able to create, manage, and update templates efficiently in a unified way. The management control plane should assign what compute, storage, and networking resources are needed without human intervention. Over time, the system continuously learns and evolves to make better decisions without the need for a system administrator.
- **Disaggregated programmable infrastructure**: Underlying infrastructure (compute, storage, networking fabric) must be a pooled set of resources that can be allocated and reallocated on demand. As service-defined infrastructure matures, resources will become increasingly disaggregated and programmable, so each can be allocated and managed as individual resources. The control point must be able to create and maintain shared resources to optimize utilization and maintain flexibility as demands change.
- **Service level monitoring**: Service-defined infrastructure requires robust support for Day 1+ continuous operations, including a unified view of system health and resource utilization as well as non-disruptive, automated system updates.
- **Proactive service level remediation**: Built-in intelligence must drive automated remediation to keep services healthy and ensure efficient resource use. This includes automatically adding more storage when running low, adding a load balancer to accommodate traffic spikes, and scaling down unused resources.
- **Solution-stack-level support for all deployment models**: Service-defined infrastructure requires management capabilities beyond just hardware; it must include hypervisor, cloud operating system, and application level management as well. In addition, the end goal for service-defined infrastructure must encompass automated management of all infrastructure models under one umbrella including traditional IT, private cloud (on premise physical and virtual) infrastructure, and public cloud resources. In this model, IT organizations must be able to rely on a single vendor for service and support regardless of the underlying infrastructure.
- **Multi-vendor support via open standards & public APIs**: Service-defined infrastructure should be based on open, extensible architecture using industry standard APIs and systems management. Service-defined infrastructure enables heterogeneous environments inclusive of a wide range of hardware, cloud operating systems, services, and applications. Support for heterogeneous architecture is critical; it enables seamless workload portability, efficient use of all infrastructure resources, and automated migration on demand. Services must be automated outside of the systems management user interface using public APIs.

API-based integrations with third-party configuration management tools, DevOps tool chains, and widely used infrastructure management platforms allow IT organizations to automate operational processes and design workflows with the same tools and frameworks they already use.

As converged systems enter this new phase over the next several years, heterogeneous infrastructure and application environments will be managed under one umbrella. MI&S expects leading vendors to battle for the infrastructure automation control point, and we expect to see consolidation as this market matures. Successful vendors will develop strategies that incorporate **all** of the above capabilities.

How Service-Defined Infrastructure Differs from Today's Composable Infrastructure

A number of enterprise hardware vendors are bringing to market a new category of solutions called composable infrastructure. The first generation of composable infrastructure solutions has some of the foundational attributes that are required for service-defined infrastructure but not yet all of the capabilities described above. Table 1 outlines the differences between today's composable infrastructure solutions and the long-term requirements for a service-defined infrastructure.

Table 1: Service-Defined vs. Composable Infrastructure

Service-Defined Infrastructure Requirements	First Generation Composable Infrastructure Capabilities
Workload / application centric	Limited
Unified automation & orchestration control point	Yes, but very limited for multi-vendor hardware
Automated provisioning	Limited templates available today, must be manually invoked
Disaggregated programmable infrastructure	Some components are disaggregated (storage), others are not yet capable of disaggregation (memory)
Service level monitoring	Yes
Proactive service level remediation	No
Solution stack level support for all deployment models	No
Multi-vendor support via open standards & public APIs	Very limited

DELL'S APPROACH TO CONVERGED SYSTEMS

Dell has doubled its efforts over the last 18 months to address the converged systems space and has shifted its strategy to align with where the company sees the market going. This shift in strategy was driven by a belief that converged systems should not be built using monolithic single-vendor solution stacks. In addition, Dell's shift in business is designed to help the company realize a flexible approach to converged solutions to market. As IT organizations transition to service-defined infrastructure, the traditional lines of converged systems types will begin to blend. To help align with where the market is going, Dell has categorized its converged systems portfolio into two buckets: Dell Engineered Systems and Dell Validated Systems.

As Dell moves toward service-defined infrastructure, the company is focused on an enablement model that will become increasingly heterogeneous to include solutions with a broad ecosystem of hardware, hypervisor, and applications partners. Dell believes robust infrastructure automation capability is central to delivering the service-defined converged systems of the future. Dell's vision is greater than just delivering automated hardware. It includes service-defined delivery and optimization for both traditional and cloud-native workloads. Dell's automation engine consists of two primary elements: Dell System Builder and Dell Active System Manager (ASM). Future MI&S papers will cover Dell's automation approach via System Builder and ASM and overall converged systems strategy in more detail.

CALL TO ACTION

IT organizations who see converged systems as a viable choice for their internal IT infrastructure should recognize that this market is undergoing a period of significant change. These organizations should consider what **service-defined infrastructure** could look like in future datacenters and how these capabilities may benefit their environments. When evaluating the long-term roadmaps of converged system vendors, it is important to understand how their products and ecosystem enablement strategies align with the key tenets of service-defined infrastructure. Dell is embarking on a long-term journey to deliver service-defined infrastructure to its customers. The pending acquisition of EMC enhances Dell's converged systems strategy with a portfolio strategy that spans from mid-market to large enterprise. IT organizations evaluating converged systems roadmaps should include Dell on their shortlist of vendors for consideration.

IMPORTANT INFORMATION ABOUT THIS PAPER

AUTHOR

Gina Longoria, Senior Analyst at Moor Insights & Strategy

REVIEWER / PUBLISHER

Patrick Moorhead, President & Principal Analyst at Moor Insights & Strategy

EDITOR / DESIGN

Scott McCutcheon, Director of Research at Moor Insights & Strategy

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