WHITE PAPER

The Infrastructure for Enterprise Innovation: Software-Defined, Cloud-Ready

Why SDI is the Path to a Modern, Agile Data Center

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Digital Everywhere, Data Everywhere—the New Normal

It is a long-standing truism that a business that can't continually improve its value proposition won't keep up. Case in point: Only 71 companies remain today [1] from the original 1955 Fortune 500 list. In today's world of constant innovation and technology enablement, enterprises need to not just keep up, but stay ahead.

Mobile consumers and employees, the rise of pervasive analytics, rapid innovation across industries—these changes can make business as usual obsolete in a matter of weeks. The ability to launch new initiatives rapidly and change directions just as quickly is now of premium importance. Enterprises must evolve to an infrastructure that supports this business innovation through agility, and efficiency not only to thrive but to stay viable.

For IT departments, real agility means much more than quick provisioning of servers. IT needs to:

- Enable self-service so that users can get what they need with minimal delay or IT intervention.
- Meet predefined service levels for critical applications.
- Let users pilot new capabilities. Scale the ones that pay off, and drop those that don't.

And this must all be delivered along with maximum return on the investment.

Behind the scenes, these demands require more automation; higher utilization of compute, networking, and storage resources; on-the-fly allocation; and built-in resilience and security.

To accomplish these goals, IT departments must enable their own self-service enterprise cloud. Software-defined infrastructure (SDI) represents an architecture for compute, networking, storage, and security. Applications and the physical hardware they run on are separated and entirely controlled by software to maximize agility, availability, and efficiency.

SDI is necessary in the evolution to a modern, agile data center. It is a journey whose early phases started more than a decade ago with compute virtualization, spawning a revolution in enterprise computing and delivering tremendous payoffs in efficiency and performance.

The SDI architecture is now actionable, allowing the enterprise to realize immediate efficiency and increasing agility. The investment in a modern data center infrastructure isn't a "nice to have" but rather a critical business imperative.

The Cost of Inaction

More than 60 percent of enterprises consider cloud computing a top infrastructure priority, according to

"Enterprises must evolve to an infrastructure that supports business innovation through agility."

an Intel-sponsored survey conducted by 451 Research*, with data security, service agility, and lower operational costs as key factors when evaluating cloud deployments. For the vast majority of enterprises, however, the transformational benefits of the cloud have not yet been realized.

Enterprises today are eager to capture new opportunities created by the digitization of business. The falling cost of compute in recent years has driven the creation of hundreds of innovative and data-rich applications and services. In fact, every dollar spent on server hardware today gives customers four times the performance it did in 2010 [2]. While those economics have spurred innovation, they have also introduced new layers of infrastructure complexity and silos, and slowed down IT's ability to serve as a responsive partner to their business counterparts.

While 72 percent of organizations have at least one application in the cloud [3], the bulk of enterprise software still runs on legacy platforms and on infrastructure that simply isn't designed to achieve the levels of manageability, agility, and self-serve convenience that users now demand. The vast majority of enterprise data centers today are complex environments—expensive to maintain and manage, lacking in flexibility, and unable to cope with growing business and service delivery goals. In the Deloitte* 2015 Global CIO Survey [4], CIOs reported that to take full advantage of digital and analytics trends, they would need to revamp their existing legacy and core infrastructure.

One typical scenario of an IT pain point in serving the needs of a dynamic enterprise: IT tries to anticipate the growth of each workload, then buys and implements hardware just ahead of that demand. This creates a constant balancing act: underestimating means that some applications outrun the available capacity; buying extra capacity in advance often means that expensive storage hardware sits unused or underutilized. The traditional infrastructure-centric model of enterprise IT is simply at odds with the needs of today's application-centric enterprises, which require dynamic resource provisioning.

The enterprise data center infrastructure must evolve and modernize, taking on more cloud-like attributes to support service agility—both for internal stakeholders, such as developers building new cloud-native applications, as well as external customers, who have grown to expect better experiences when interacting with business.

Software-Defined Infrastructure: The Path Forward for a Cloud-Ready, Agile Enterprise

Today, explosive growth in digital data has placed new demands not just on compute but also on traditional storage architectures and enterprise networks, creating bottlenecks for performance and service agility. To mitigate these challenges, enterprises need to advance along the cloud maturity curve, extending virtualization beyond compute to storage and network domains, and then moving to greater automation and orchestration levels for self-service provisioning and real-time SLAs.

Think of a real-time, compute-intensive analytics workload being processed within the data center. With a software-defined infrastructure, this workload can be moved automatically to run on servers nearest the data, while less intensive or time-sensitive work temporarily moves elsewhere. To the business, this means that insights are delivered faster, without requiring the purchase of more computing muscle.

Key Infrastructure Categories Ripe for SDI Transformation

For the vast majority of businesses

contemplating moving to SDI, compute virtualization is the most mature and pervasive element. Those that are already starting with a highly virtualized environment can progress to more mature states of cloud architecture to drive greater levels of automation and software-driven orchestration across their data centers.

Server-based, software-defined storage (SDS) for storage workloads, and software-defined networking (SDN) for enterprise networks, are the most immediate opportunities for enterprise IT organizations debating their next steps on the path to SDI.

"79 percent of enterprises plan to have software-defined networking (SDN) in live production in 2017."

– Infonetics Research

SDS is the rapidly maturing SDI subcategory where enterprises are most aggressively moving. Compute performance improves dramatically at the pace of Moore's Law, but storage hasn't kept up with that rate of innovation. Explosions in data volumes, data types, and application-specific access requirements make compelling business cases for an SDS architecture that can scale in both capacity and performance.

Take the example of Oregon State University* [5], a public educational institution that was early to adopt SDS, implementing a VMware*-based storage solution that increased storage performance in a cost-effective manner. The staff found great efficiencies in the recompose process, as full-system resets of the virtual desktop went from ten hours down to less than two hours. The university's students and faculty now enjoy uninterrupted service, even during peak load periods, and IT priorities have shifted from trying to manage around storage limitations to other critical (and more strategic) tasks.

SDN, another SDI subcategory, extends virtualization and software orchestration principles to the network. While communications service providers have been making the most aggressive moves to upgrade their legacy networks, mainstream enterprises are just starting to realize how much impact these technologies can have in their networks. According to a 2015 Infonetics* survey [6], 79 percent of enterprises are planning to have software-defined networking (SDN) in live production in the data center in 2017.

When George Washington University* recently deployed VMWare's SDN solution [7], NSX*, its time to deliver policy-based automated network solution services in conjunction with the virtual machines themselves shrunk from several days to several minutes. And NASDAQ* recently launched [8] an OpenStack* based SDN/network functions virtualization (NFV) Proof of Concept with Intel where it expects that the following deployment of NFV infrastructure will make it possible to dynamically provision network resources and improve time-to-market for new customer products and services.

Early Movers to SDI-Enabled Enterprise Clouds Discover Cost Savings, Greater Agility

While many enterprises are early in the SDI journey, and few have implemented the architecture comprehensively across all data center infrastructure subcategories and functions (compute, networking, storage), technology barriers are rapidly falling, and leading enterprises are building on-premises, SDI-enabled self-service private clouds to give their business the optimal levels of agility, flexibility, and efficiency.

Consider these use cases from industry leaders:

Walmart* Stores has built a large private cloud on OpenStack, where it runs more than 100,000 cores and several petabytes of storage for its e-commerce operations. This makes it possible to test and add e-commerce features to Walmart.com [9]. Walmart's cloud infrastructure now gives the company enough flexibility to build applications that respond to its ever-changing user needs.

DreamWorks Animation* uses a Red Hat* private-cloud implementation for rapid and secure collaboration on data- and compute-intensive animation work across its pool of artists. Cloud infrastructure gives the company a shared pool of resources for all of the movies in production at any given time [10], resulting in increased reliability and scalability.

PayPal* now routes almost 100 percent of its Web traffic through an OpenStack private cloud, bringing its business the required levels of agility without sacrificing availability [11]. Its former corporate parent, eBay*, has deployed OpenStack private clouds across its data centers, supporting workloads ranging from development use cases to external-facing business-critical applications [12].

And at Intel, we have been running a software-defined infrastructure for our internal IT operations to keep us agile, cost-competitive, and service-oriented. The shift to SDI has saved our company millions of dollars in capital investment while improving infrastructure operations efficiencies approximately 10 percent each year [13].

Deploying Enterprise Clouds: SDI Solultion Stacks Ready for Prime Time

The scale of industry leaders' cloud architecture implementations makes a compelling case for the "prime time" readiness of on-premises

cloud deployments in the enterprise. The underlying software-defined infrastructure supports the availablility, efficiency, and agility levels that businesses demand.

The cloud management layer of the SDI stack has matured dramatically of late. Prior to 2016, Enterprise IT organizations used OpenStack most often in proof-of-concept deployments. However, OpenStack has now achieved enterprise-ready functionality, and the industry is beginning to see robust adoption in cloud-native production environments. Leading enterprise software vendors in this space (Microsoft*, VMware) also continue to enhance their products, in support of automation and self-service cloud.

Hardware procurement and deployment is also easier and more flexible than ever before, with converged infrastructure solutions offering new choices and simplicity of deployment to enterprises ready to move to a cloud architecture within their data centers.

Converged infrastructure solutions available from many industry-leading, trusted vendors include integrated computing, storage, and network infrastructure in a single box or frame, with management software already installed. This gives enterprise IT the option of buying "units of infrastructure" instead of individual hardware components requiring integration with each other. The solutions are precertified and preconfigured to offer a single-vendor support model, and ease the path to deployment of SDI.

According to IDC* research, the hyper-converged systems market grew by more than 160 percent in 2014 [11]. Some enterprises wanting more flexibility may eschew converged solutions for a "do it ourselves" approach, selecting SDI solution components from the portfolios of various hardware and software vendors.

Regardless of which approach an enterprise chooses, hardware and software companies are providing a steady advance at all levels of the SDI and cloud stack. For IT, that adds up to an increasing array of choices for enterprise cloud deployments.

Intel's Role in Accelerating Enterprise Clouds

Intel silicon innovation is a critical factor in cloud architecture innovation and deployment. Our broad portfolio of workload-optimized products supports the efficient execution and, often, acceleration of key enterprise workloads. And the capabilities of those silicon products are then better exposed and enhanced by our software investments, enabling SDI solutions to be deployed and scaled more rapidly. As today's data center workloads grow more diverse, so do requirements around throughput, latency, memory capacity, resiliency, and scalability. All must be addressed in order to maintain optimal levels of service delivery for end users.

As silicon is at the heart of these advancements, Intel is driving a range of initiatives—both technology- and ecosystem-focused—to advance solution maturity and ease of deployment of enterprise clouds on SDI. The economics, efficiencies, and performance of Intel® Architecture—augmented by a rich suite of technologies such as Intel® Virtualization Technology, Intel® Cloud Integrity Technology, and open-source platform telemetry like Snap—are at the foundation of the most robust, enterprise-ready SDI solution stacks available today.

Beyond its core technology innovation, Intel is also working actively to enable complete solutions. It is driving open standards and contributions to open source, including participation in the development of OpenStack, OpenDaylight*, Cloud Native Computing Foundation*, Open Container Initiative* and other industry-wide collaborative efforts.

These initiatives are helping make enterprise cloud implementations simpler, easier to manage, interoperable, and more reliable. Additionally, Intel® Builders programs are developing reference architectures and solution blueprints, showing optimal infrastructure configurations to support various business applications. These resources, as well as best-match efforts across solution providers—all facilitated through Builders programs—are helping accelerate adoption and easier deployments of SDI solutions.

Modernizing Your Enterprise Data Center—an Urgent Imperative, Now Actionable

The early years of cloud innovation have forever reset expectations around what it means to be a dynamic and responsive enterprise. This transformation is coming to life in enterprises that modernize their data centers with a software-defined infrastructure; IT is reducing costs while delighting their lines of business with new capabilities and faster deployment of new services.

Technology and ecosystems are coming together in ways that are enabling enterprises to take immediate steps toward a cloud-ready future. True agility in the enterprise is possible, and leading companies are taking notice.

If your competitor is realizing true agility and responsiveness, adopting new business models, and creating new customer experiences—can you afford not to?

To learn more, visit
www.intel.com/cloud

[1] Digital Darwinism: What Killed Borders, Blockbuster and Polaroid and How to Survive, Brian Solis Blog.

[2] Results projected by Intel based on comparison SPECint_rate 2010 and 2016 performance results and historical prices for XeonX5680, (6C, 3.33 GHz, 130W) and Xeon E5-2699 v4 (22C, 2.2 GHz, 145W).

[3] Cloud Computing Survey 2015, IDG Enterprise.

[4] 2015 Global CIO Survey, Deloitte University Press.

[5] VMware Case Study, Oregon State University.

[6] "Vendor Market Share Up for Grabs as N. American Businesses Prepare to Turn Up SDN in the Data Center," Infonetics Research.

[7] "Standardizing IT Services and Delivering Faster with VMware NSX," VMware.

[8] "Developing and Deploying NFV Solutions Efficiently: Nasdaq Transforms Its Network Infrastructure," Intel.

[9] "Why we chose OpenStack for Walmart Global eCommerce," Walmart Labs.

[10] "DreamWorks Animation Utilizes the Red Hat Portfolio to Build a Private Cloud," Red Hat.

[11] "PayPal's Front-End Cloud Powered by OpenStack," Sri Shivananda, vice president of global platform and infrastructure at PayPal.

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[13] "How Software-Defined Infrastructure is Evolving at Intel," Intel.

[14] "Hyperconverged Systems Market Grew 162% in 2014 – IDC," IDC.

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