



HYPER-CONVERGED INFRASTRUCTURE (HCI)

L8-L12



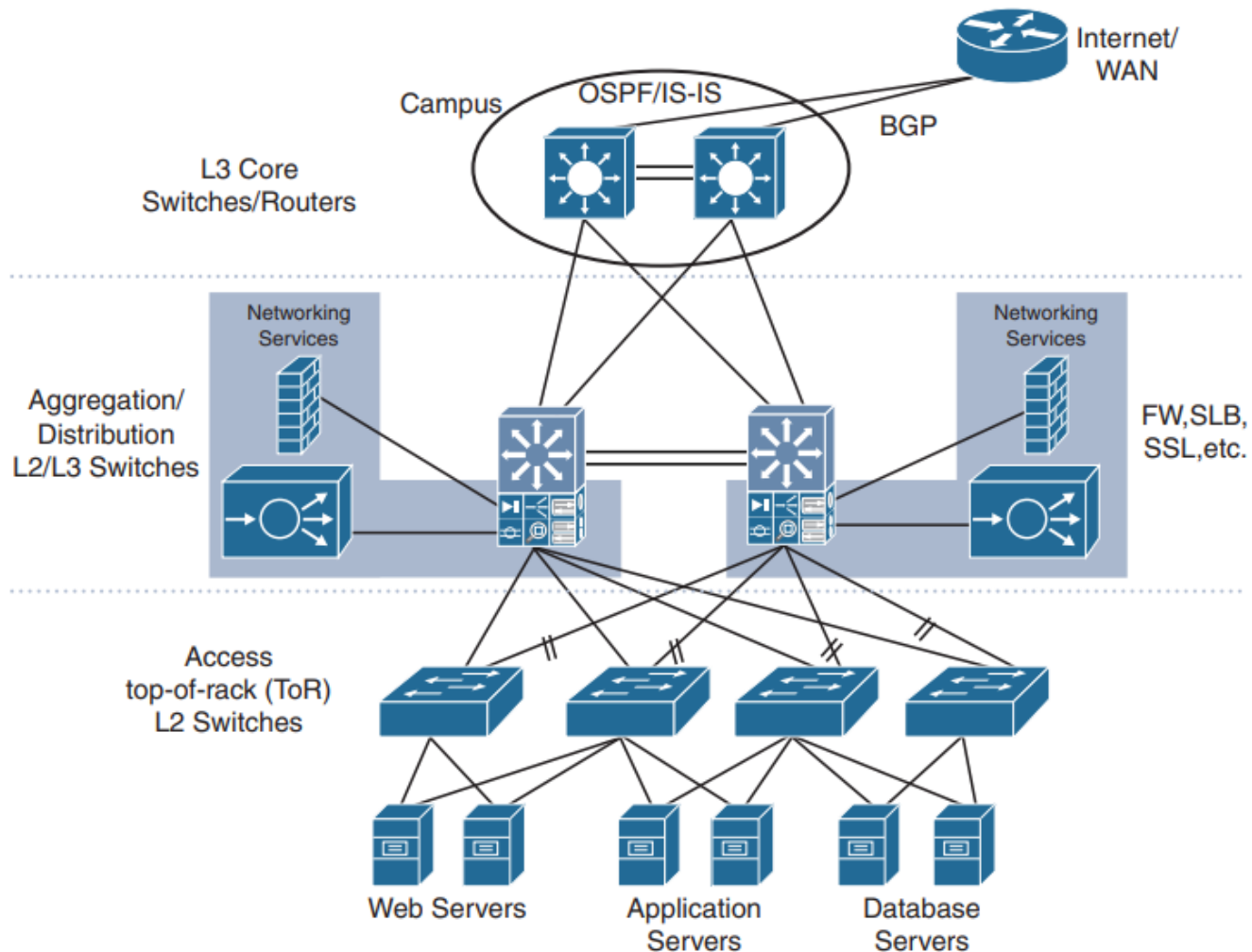
INTRODUCTION TO HYPER CONVERGED INFRASTRUCTURE(HCI)

- Increasing their demands on enterprise IT led to provide **more infrastructure with less cost and time.**
- These demands have resulted in the need for IT organizations to attempt to mimic **NASA's** much-heralded “**Faster, Better, Cheaper**” operational campaign.
- Unfortunately, most of today's data center architectures actively work against these goals, because with increasing complexity comes increased costs — and things have definitely become more complex.
- With virtualization, enterprise IT has moved from physical servers, where storage services could be configured on a per-server basis, **to shared storage systems.**

HCI (CONTD..)

- **Hyperconverged infrastructure (HCI) is a software-defined, unified system that combines all the elements of a traditional data center: storage, compute, networking and management.**
- **Why** are these two resources, storage and compute, at the core of hyperconverged infrastructure?
 - **Storage** has become an incredible challenge for many companies. It's one of— if not the — most expensive resources in the data center and often requires a highly skilled person or team to keep it running
 - **Combining storage with compute** is in many ways a return to the past, but this time many new technologies have been wrapped around it.
- Before virtualization and before SANs, many companies ran physical servers with directly attached storage systems

HCI (CONTD..)



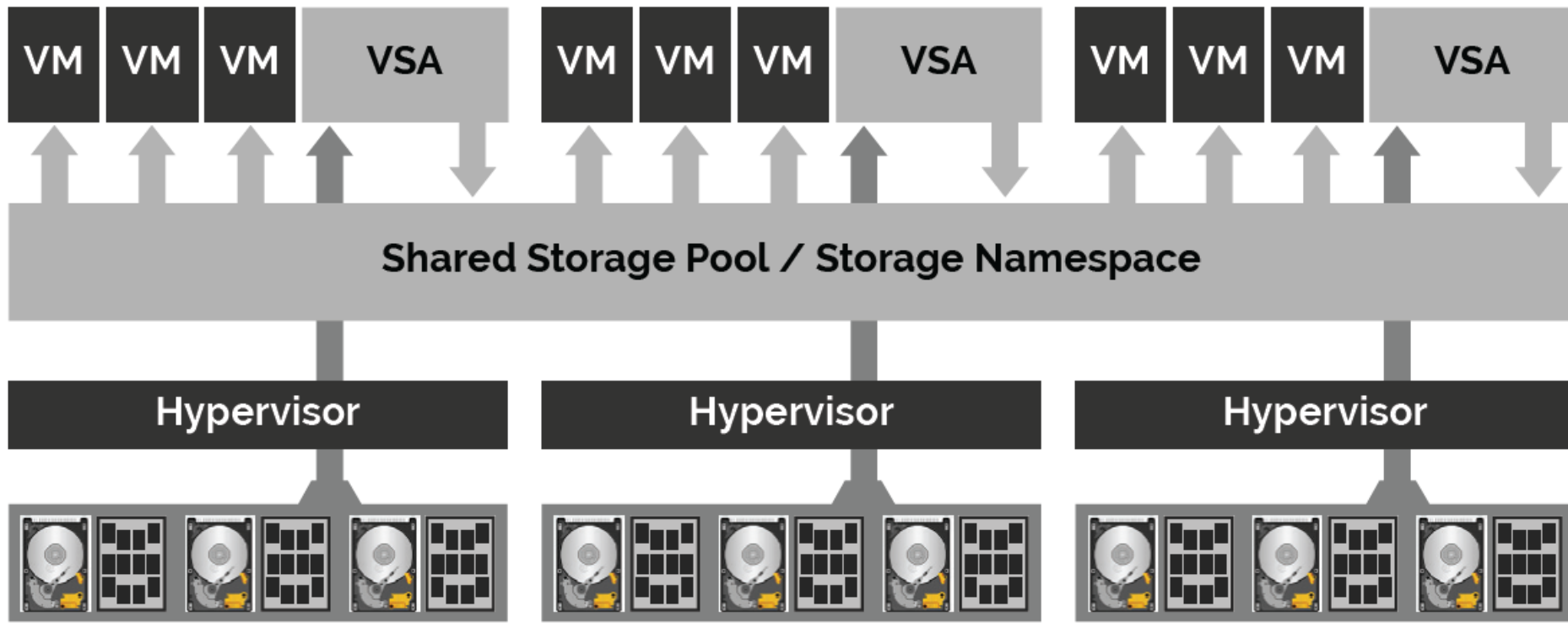
HCI (CONTD..)

- There are other challenges that administrators of legacy data centers need to consider as well:
 - **Hardware sprawl.**
 - **Policy sprawl.**
 - **Scaling challenges.**
 - **Desire for less technical overhead.**

UNDERSTANDING HCI

- Hyperconverged infrastructure **distributes the storage resource** among the various **nodes that comprise a cluster**.
- Often built using commodity server chassis and hardware, hyperconverged infrastructure nodes and appliances are bound together via Ethernet and a powerful software
- The software layer often includes a **virtual storage appliance (VSA)** that runs on each cluster node.
- Each VSA then communicates with all of the other VSAs in the cluster over an Ethernet link, thus forming a distributed file system across which virtual machines are run

UNDERSTANDING HCI (CONTD..)



UNDERSTANDING HCI (CONTD..)

- The fact that these systems leverage commodity hardware is critical.
- The power behind hyperconverged infrastructure lies in its ability to **corral resources** – RAM, compute, and data storage – from hardware that doesn't all have to be custom-engineered.
- This is the basis for hyperconverged infrastructure's ability to **scale granularly and the beginnings of cost reduction processes.**

RESOURCES TO CONSOLIDATE

(CONTD..)

- The basic combination of storage and servers is a good start, but once one looks beyond the confines of this baseline definition, hyper-converged infrastructure begins to reveal its true power.
- The more hardware devices and software systems that can be collapsed(fallen down) into a hyper-converged solution, the easier it becomes to manage the solution and the less expensive it becomes to operate.

RESOURCES TO CONSOLIDATE

(CONTD..)

- Here are some data center elements that can be integrated in a hyperconverged infrastructure:
 - **Deduplication Appliances**
 - **SSD Caches/All-Flash Array**
 - **Backup Software**
 - **Data Replication**

RESOURCES TO CONSOLIDATE

(CONTD..)

Deduplication Appliances

- Deduplication technologies are common in today's data center. i.e. **eliminating duplicate copies of repeating data**
- **Dedicated appliances** are now available that handle complex and CPU-intensive deduplication tasks, ultimately reducing the amount of data that has to be housed on primary storage thus improving storage utilization
- Successful implementation of the technique can **improve storage utilization**.
- Deduplication works by creating a **data fingerprint** for each object that is written to the storage array.
- As new data is written to the array, if there are matching fingerprints, additional data copies beyond the first are **saved as tiny pointers**.

RESOURCES TO CONSOLIDATE

(CONTD..)

SSD Caches/All-Flash Array

- **To address storage performance issues**, companies sometimes deploy either **solid state disk (SSD)-based caching systems or full SSD/flash-based storage arrays**.
- However, both solutions have the potential to **increase complexity** as well as cost.
- When server-side PCI-e SSD cards are deployed, there also has to be a third-party software layer that allows them to act as a cache, if that is the desired.

Note: PCIe -- Peripheral Component Interconnect-express

RESOURCES TO CONSOLIDATE

(CONTD..)

Backup Software

- Data protection in the form of backup and recovery remains a critical task for IT and is one that's often not meeting organizational needs.
- **Recovery time objectives (RTO)** and **recovery point objectives (RPO)** are both shrinking metrics that IT needs to improve upon.
 - **RTO** is concerned with getting appliances and systems back up and running soon as possible within a predefined time frame.
 - **RPO** is about how much you afford to lose before it impacts business application.
- On the other hand RTO is the time frame within which applications and systems must be restored after an outage.

RESOURCES TO CONSOLIDATE

(CONTD..)

Data Replication

- **Data protection is about far more than just backup and recovery.** What happens if the primary data center is lost? This is where replicated data comes into play.
- **By making copies of data and replicating that data to remote sites,** companies can rest assured that critical data won't be lost.
- To enable these data replication services, companies implement a variety of other **data center services.**
- For example, to minimize replication impact on bandwidth, companies deploy **WAN acceleration** devices intended to reduce the volume of data traversing the Internet to a secondary site.
- **WAN acceleration** remediates network congestion and latency by implementing bandwidth preservation techniques such as **compression, caching, data deduplication, and image optimization.**

ARCHITECTING THE HYPER-CONVERGED DATA CENTER

- One of the primary goals of hyper-convergence is to **simplify infrastructure decisions** in the data center.
- Right hyper-converged infrastructure solution converges of computing and storage resources can be wrapped up into a single hyper-converged appliance.
- Also, include entire backup-and-recovery process, your deduplication and WAN acceleration appliances, and much more

ARCHITECTING THE HYPER-CONVERGED DATA CENTER

- Four decision has to be made while choosing the HCDC:
 - Server support
 - Storage support
 - Data protection services
 - The management layer support

ARCHITECTING THE HYPER-CONVERGED DATA CENTER:

DECISION 1: **SERVER SUPPORT**

- Not all hyper-converged solutions ship in the same kind of packaging.
- For example, there are **appliance-based hyper-converged** solutions from companies such as SimpliVity, Nutanix, Scale Computing, and Maxta.
- And then there are **software-only solutions** that you install yourself, which include Stratoscale and Maxta. Maxta is on both lists because they support both pre-configured appliances
- **With an appliance-based solution, you're buying the full package, and you just need to plug everything in and turn it on. These are really easy to get going since most things are already done for you.**
- However, with an appliance-based solution, you generally have to live with whatever constraints the vendor has placed on you.

ARCHITECTING THE HYPER-CONVERGED DATA CENTER:

DECISION 1: **SERVER SUPPORT**

- **You need to remain within their hardware specifications, and you don't always get to choose your server platform**, although many appliance-based solutions do support servers from multiple vendors
- If you'd rather **go your own way with regard to hardware**, you can choose a **software-based hyper-converged solution**.
- **Software-based solutions are really good for larger organizations** with sufficient staff to install and support the hyper-converged infrastructure.
- **Hardware-based solutions are often desired by companies that are looking for a more seamless deployment experience** or that do not have sufficient staff to handle these tasks.

ARCHITECTING THE HYPER-CONVERGED DATA CENTER:

DECISION 2: **STORAGE DECISION**

- One of the **main reasons people are dissatisfied** with their data centers is because **their storage solution has failed to keep pace** with the needs of the business.
- It's either too **slow** to support mission critical applications or it doesn't have data efficiency features
- Many storage devices are not well-designed when it comes to supporting virtualized workloads, either.
- Traditional SANs are challenged when attempting to support the wide array of I/O types that are inherent in heavily virtualized environments.
- At the same time, **storage has become more complex, often requiring specialized skill sets to keep things running.**

ARCHITECTING THE HYPER-CONVERGED DATA CENTER:

DECISION 2: **STORAGE DECISION**

- As companies grow and become more dependent on IT, they also start to have more reliance on data mobility services.
- For some systems, it's not easy to do the basics, which can include managing LUNs, RAID groups, aggregates and more
- **Legacy storage systems don't always do a great job** enabling data mobility and often **don't even support services like remote replication and cloning** or, if they do, it's a paid upgrade service.

Note:

LUN: logical unit number

RAID: redundant array of independent disks

SOFTWARE DEFINED STORAGE

- With **storage hardware fully abstracted into software**, it becomes possible to bring policy-based management and APIs to bear in ways that focus efforts on the management on the virtual machine rather than the LUN (logical unit number)
- **The virtual machine (VM) is really the administrative target of interest whereas a LUN is just a supporting element** that contributes to how the virtual machine functions. By moving administration up to the VM level, policies can be applied more evenly across the infrastructure.
- A **VSA (virtual storage appliance)** is a virtual machine that runs on a host computer. This virtual machine's purpose is to manage the storage that is local to that host.

SOFTWARE DEFINED STORAGE (CONTD..)

- The **VSAs on individual hosts work together to create a shared storage pool and global namespace**. This storage is then presented back to the virtual hosts and used to support virtual machines in the environment.
- Hyperconverged infrastructure companies such as SimpliVity, Nutanix, and Maxta all use VSAs to support the storage element of the solution.

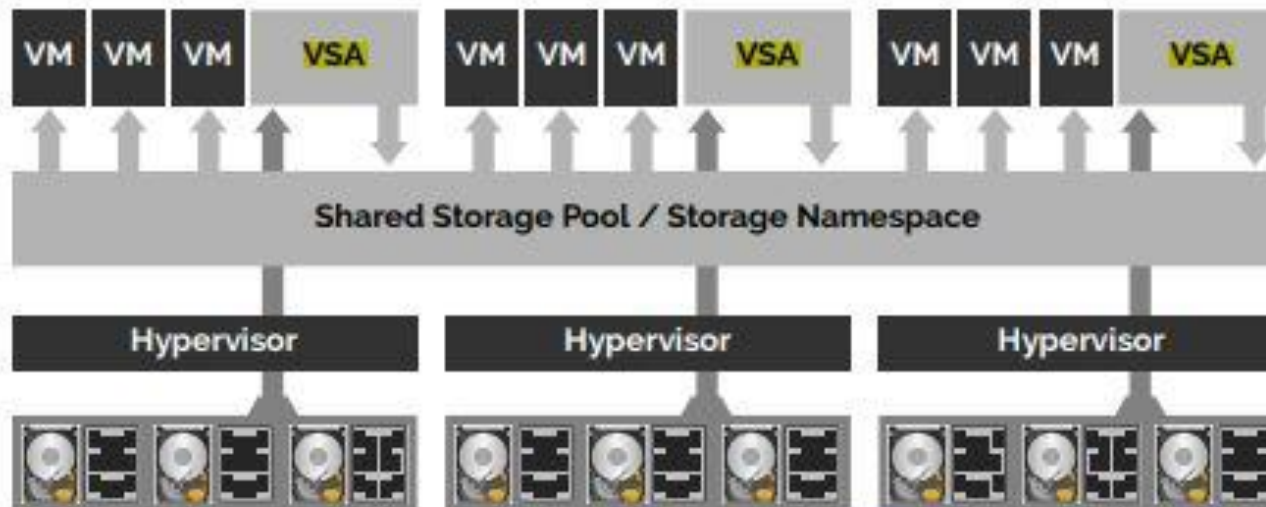


Figure 2-1: This is the general architecture that includes a VSA

ARCHITECTING THE HYPER-CONVERGED DATA CENTER:

DECISION 3: **DATA PROTECTION SERVICES**

- **Data protection** shouldn't be considered an afterthought in your data center.
- It should be considered a **core service that is central** to how IT operates.
- Recovery Time Objectives (RTOs) and Recovery Point Objectives (RPOs) should be **a key discussion point** as you're considering hyper-converged infrastructure solutions.
- Not all hyper-converged products come with the same levels of data protection.

ARCHITECTING THE HYPER-CONVERGED DATA CENTER:

DECISION 4: **THE MANAGEMENT LAYER**

- To simplify management in the data center, admins need as few interfaces possible.
- Here are the most common options that you need to be aware of when considering a hyper-converged virtual infrastructure:
- **Virtualization layer management**
- **Orchestration and Automation Layer Management**
 - VMware's vRealize Automation (vRA), Cisco's Unified Computing System Director (or UCSD), OpenStack — Rapidly growing in popularity, OpenStack
- **Vendor supplied management**
- **REST APIs**

HYPERCONVERGENCE & THE PUBLIC CLOUD

- Public cloud systems are comprised of **multi-tenant environments** operated by a service provider with the hardware and software located in the provider's data center.
- In these environments, **the customer may not always even be aware in which provider data enter the services reside, nor does the customer have to be aware.**
- The beauty of these systems is that workloads can move around as necessary to maintain service-level agreements.
- For the public cloud, there are a number of pros and cons to consider.

HYPERCONVERGENCE & THE PUBLIC CLOUD (CONTD..)

- **Public Cloud Advantages**

- Enable immediate implementation.
- Carry low to no initial deployment costs.
- Provide a consumption-based utility cost model.
- Provide more cost effective scale than would be feasible in a private data center.

HYPERCONVERGENCE & THE PUBLIC CLOUD (CONTD..)

- **Public Cloud Disadvantages**

- Potentially unpredictable ongoing usage charges
- Concerns around data location; many do not want data stored in US-based data centers due to concerns around the NSA and PATRIOT Act
- Charges across every aspect of the environment, from data storage to data transfer and more
- No control over underlying infrastructure
- Care needs to be taken to avoid lock-in

HYPERCONVERGENCE & THE PUBLIC CLOUD (CONTD..)

The faces of the public cloud

Software-as-a-Service (SaaS)

- From a customer perspective, software-as-a-service (SaaS) is the simplest kind of cloud service to consume as it is basically an application all wrapped up and ready to go.
- Common SaaS applications include Salesforce and Office 365.
- **With SaaS applications, the provider controls everything and provides to the customer an application layer interface that only controls very specific configuration items.**

HYPERCONVERGENCE & THE PUBLIC CLOUD (CONTD..)

The faces of the public cloud

Platform-as-a-Service (PaaS)

- Sometimes, you don't need or want a complete application.
- In many cases, you just need a place to install your own applications but you don't want to have to worry at all about the underlying infrastructure or virtualization layers. This is where platform-as-a-service (PaaS) comes into play.
- **PaaS provides you with infrastructure and an application development platform that gives you the ability to automate and deploy applications including your own databases, tools, and services. As a customer, you simply manage the application and data layers.**

HYPERCONVERGENCE & THE PUBLIC CLOUD (CONTD..)

The faces of the public cloud

Infrastructure-as-a-Service (IaaS)

- In other cases, you need a bit more control, but you still may not want to have to directly manage the virtualization, storage, and networking layers.
- However, you need the ability to deploy your own operating systems inside vendor-provided virtual machines. Plus, you want to have the ability to manage operating systems, security, databases, and applications.
- For some, **infrastructure-as-a-service (IaaS) makes the most sense since the provider offers the network, storage, compute resources, and virtualization technology while you manage everything else.**

HYPERCONVERGENCE & THE PRIVATE CLOUD

- A private cloud environment generally resides in a **single tenant environment** that is built out in an on-premises data center, but it can sometimes consist of a single tenant environment in a public data center.
- Private cloud environments are characterized by heavy virtualization which fully abstracts the applications from underlying hardware components.
- Virtualization is absolutely key to these kinds of environments. Some companies go so far as to offer internal service level agreements to internal clients in a cloud-like manner.

HYPERCONVERGENCE & THE PRIVATE CLOUD (CONTD..)

Moving to more of a self-service model has two primary benefits:

- Users get their needs serviced faster
- IT is forced to build or deploy automation tools to enable self-service functionality, thereby streamlining the administrative experience

HYPERCONVERGENCE & THE PRIVATE CLOUD (CONTD..)

•Private Cloud Advantages

- Provides an opportunity to shift workloads between servers to best manage spikes in utilization in a more automated fashion.
- Enables ability to deploy new workloads on a common infrastructure. Again, this comes courtesy of the virtualization layer.
- Provides full control of the entire environment, from hardware to storage to software in a way that enables operational efficiency.
- Allows customers to customize the environment since they own everything.
- Provides additional levels of security and compliance due to the single tenant nature of the infrastructure.
- Private cloud-type environments are often the default due to security concerns.

HYPERCONVERGENCE & THE PRIVATE CLOUD (CONTD..)

- **Private Cloud Disadvantages**

- Requiring customers to build, buy, and manage hardware.
This is often something that many companies want to reduce or eliminate.
- Not always resulting in operational efficiency gains.
- Not really providing what is considered a cloud computing economic model.
- You still have to buy and maintain everything.
- Potentially carrying very high acquisition costs.

HYPERCONVERGENCE & THE HYBRID CLOUD (CONTD..)

- Increasingly, people are choosing both cloud options – public and private – to meet their needs.
- In a hybrid cloud scenario, the company builds its own on-premises private cloud infrastructure to meet local applications needs and also leverages public cloud where reasonable and possible.

THE INTERSECTION OF CLOUD AND HYPERCONVERGED INFRASTRUCTURE (CONTD..)

- Depending on the hyperconverged infrastructure solution you're considering, there are varying degrees of association between the hyperconverged infrastructure product and both public and private clouds
- Virtualization is absolutely key to these kinds of environments. Some companies go so far as to offer internal service level agreements to internal clients in a cloud-like manner.

HCI VS. CLOUD

- An HCI platform is an integrated platform that virtualizes compute, storage and network resources and combines them with a software-defined management system to provide a unified platform for hosting virtualized workloads. The platform is made up of multiple server and storage nodes, along with the necessary networking components, to form a single cluster that IT can easily deploy, maintain and scale.

CONT..

- A cloud computing infrastructure, whether private or public, is made up of physical compute, storage and network resources that are integrated into a single architecture. An abstraction layer pools the physical resources and delivers them as services, which applications and users can easily configure and deploy, either through an API or user interface. However, setting up the infrastructure can be a complex and time-consuming task.

CONT..

- Virtualization lies at the heart of both cloud computing and HCI, but virtualization alone isn't enough to define either one. A cloud environment is directly concerned with the user experience, using advanced automation and orchestration to compose the underlying infrastructure. Hyper-convergence has more to do with simplifying IT, following a rigid node-based architecture that greatly simplifies administration but decreases flexibility. Although some HCI platforms have incorporated cloud-like capabilities, they still remain two different approaches to IT infrastructure.

CONT..

- PERFORMANCE
- SCALABILITY
- RELIABILITY
- WORKLOADS
- STORAGE
- DATA PROTECTION
- MANAGEMENT
- COSTS

REF: [HTTPS://WWW.TECHTARGET.COM/SEARCHDATACENTER/TIP/HCI-VS-CLOUD-THE-MAIN-DIFFERENCES](https://www.techtarget.com/searchdatacenter/tip/hci-vs-cloud-the-main-differences)

CASE STUDY

**Batlivala & Karani Securities migrates from traditional IT to
Hyper-Converged Infrastructure with Galaxy as
Implementation Partner**

CASE STUDY (CONTD..)

- Batlivala & Karani [B & K] Securities India Pvt. Ltd. is a leading financial research and advisory firm in India.
- Established in 1875, B & K Securities leverages their research strengths, keen business insights and years of experience to offer unbiased and in-depth financial advice to institutional and corporate customers.
- Their scope of services includes providing Equity Advisory & Research services, Mutual Fund Analysis & Distribution, Strategic Consulting, Insurance Advisory & Broking, and Investment Banking.
- Since 2017, they've embarked on a digital journey by migrating traditional IT to hyper converged infrastructure.
- Mukesh Mehta says **“Traditional Infrastructures take potentially months of planning prior to an install, and can take weeks to even months whereas Hyper-Converged solutions can be sized to current needs, reducing planning time, installs typically take days or even hours.”**

CASE STUDY (CONTD..)

• The Challenges: -

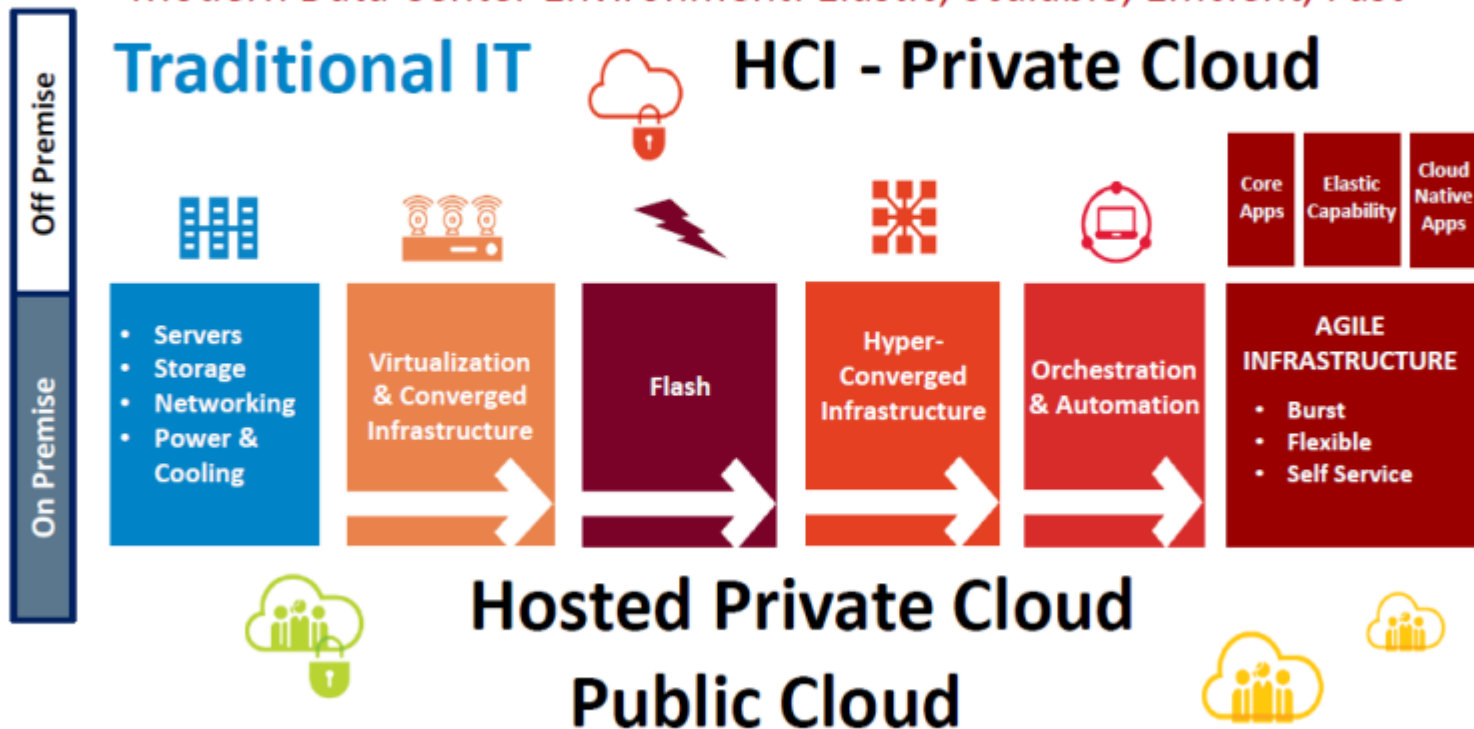
- Prior to virtual DC Infrastructure migration, B & K Securities **had over 30 servers** in their office [both Windows and Linux-based], with mixed bag of virtualized & stand-alone Servers.
- Thus, **Warranty and end-of-life** issues across components, product, as well as software used to be a major issue.
- Further, **individual downtime & dependencies, scalability and handling issues with multiple consoles** like admin/management modules (username/password & respective policies) turned out to be a hurdle in their smooth operations.
- On the other hand, Mukesh Mehta wanted to bring down the **TCO (i.e. IT opex) costs linked** to more space and electrical power consumption, as well as **air-conditioned cooling requirements needed for so many physical servers**.
- In addition, there were other **operational costs linked to periodic maintenance**, and additional resources needed to manage servers in different environments – Windows and Linux

CASE STUDY (CONTD..)

Journey to Integrated Infrastructure



Modern Data Center Environment: Elastic, Scalable, Efficient, Fast



CASE STUDY (CONTD..)

• **The Solution: -**

- Hyper-convergence solutions leverage Intel x86-based servers to natively integrate compute, storage, virtualization and management into a single turnkey platform.
- This replaces silos of servers, storage and virtualization, along with the need for having separate management tools and processes.
- A 100% software-defined storage solution runs on a hypervisor that aggregates the storage and compute performance between nodes and servers, thereby merging these discrete tiers into a single tier.
- As workload requirements grow, organizations simply add another node to an existing hyper-converged deployment to aggregate the additional resources into the cluster.
- A single vendor provides the hardware and software, eliminating all the complexity that comes with procuring and provisioning these components.

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CASE STUDY (CONTD..)

• The Solution: -

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 - Overall management and day-to-day operations are greatly simplified with only one system to manage.
 - It's easy to see how businesses can attain enormous cost savings by eliminating expensive storage, overprovisioning, hypervisor licensing costs and the need for specialized skill sets to manage all the complexity.
 - The end result of this shift is accelerated deployment, improved performance, and cloud-like consumption and management, all at a fraction of the cost of legacy system architectures.



NEXT CLASS....