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Human Factor Needs for Highly Available Hyper Converged Appliance for Containerized Platform

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ABSTRACT

In today's rapidly evolving digital landscape, businesses rely heavily on efficient and reliable hardware and software solutions to maintain competitiveness and meet the demands of an increasingly connected world. Hyper-Converged Infrastructure (HCI) has evolved as a cornerstone in modern data center architecture, offering an integrated solution for compute, storage, and networking. The deployment of a highly available hyper converged appliance for containerized platforms presents unique challenges and opportunities from a human factors' perspective. As customers embrace containerization for deploying and managing applications, it is essential to consider the human element in the design and implementation of such appliances. This paper investigates the implementation and integration considerations of Human factors concepts across various stages in commissioning an HCI appliance along with its operating and management software in a data center. We discuss how the design helps to improve usability, efficiency, productivity, error prevention, and adaptability in the installation, configuration, and operation processes. We also explore how managing a highly available hyper converged appliance that is pre-built from factory is recommended in comparison to building your own appliance how the overall design of hardware and software optimizes the user experience of getting a complex appliance into production use swiftly.

Keywords: Human systems integration, Systems engineering, Hyper-converged infrastructure system management open shift install

INTRODUCTION

Hyper-Converged Infrastructure (HCI) and Containerization has emerged as a potent force, promising streamlined operations and enhanced flexibility. However, as organizations navigate the integration of these technologies, they encounter intricate challenges, particularly in operationalizing hyper-converged appliances to harness the full potential of containerized environments.

Hyper Converged Infrastructure and Containers

Hyperconverged infrastructure (HCI) is a combination of servers and storage into a infrastructure platform with intelligent software to manage it.

HCI infrastructure typically includes a hypervisor, a software-defined storage component and software-defined networking. HCI converges the entire datacentre stack, including compute, storage, storage networking, virtualization, and containers. HCI solutions also include a management pane to enable you to easily administer HCI resources from a single interface.

A container is a standalone unit that can execute a piece of software, which is packaged up along with runtime, system tools, libraries, and settings. Kubernetes is a container orchestrator that usually runs on Linux operating systems. Additional components are needed to make the Kubernetes cluster able to respond adequately to enterprise needs such as data storage and networking. A HCI appliance purpose built for containers uses Kubernetes in place of a hypervisor.

Challenges in Operationalizing a Hyper Converged Appliance

Designing an HCI (Hyper-Converged Infrastructure) appliance following a traditional approach is a meticulous process that often spans several months and requires the expertise of various professionals.

From conceptualization to procurement to assembly and putting to production each step demands careful consideration to ensure seamless integration of hardware and software components ranging from ordering a complex mix of servers, switches, racks, PDU's and then finding a set of software that can be installed on this infrastructure for day-to-day use and management.

Once the design is finalized, acquiring the necessary equipment involves navigating complex supply chains and negotiating with multiple vendors. Manual configuration tasks such as initializing servers, setting up network connections, and configuring storage arrays demand painstaking attention to detail. Additionally, implementing monitoring appliances to ensure performance and reliability further extends the deployment timeline. Scaling the infrastructure by adding additional servers and disks introduces another layer of complexity, requiring careful planning and execution to maintain appliance integrity and performance.

Human Factors Need for Hyper Converged Appliance

To approach the human factors, need for hyper converged appliance we have identified the following key areas that needs to be included to address the customer experience.

- Usability: By presenting all the information in a clear and accessible manner, customers can more effectively interact with the hardware and software, reducing cognitive load and enhancing overall customer experience. Customers should be able to complete configuration tasks more quickly and with fewer interruptions, allowing them to complete the desired outcomes impacts the overall customer experience.
- Efficiency and Productivity: Efficiency and productivity increase as errors are minimized by identifying and resolving issues before configuration begins. This can reduce the need for troubleshooting and rework is reduced, leading to time savings and improved productivity impacts the overall customer experience.

- Error Prevention: Once a appliance is used in production its key identify and resolve issues before they escalate. By validating customer-provided data against expected norms, potential failures are bought to the attention of customer thereby minimizing the likelihood of appliance failures and disruptions. This approach reduces the overall risk of errors and contributes to a more stable software environment impacts the overall customer experience.
- Adaptability: The appliance is built in the factory in a standard way. However, it needs to able to support the different constraints that are there in end customer data centre without major changes during the deployment phase as well in continuous use. This appliance's ability to evolve and adapt to changes and ensures trouble free deployment and continuous use impacts the overall customer experience.
- Support: Having a single point of support for an appliance composed of hardware and software components sourced from multiple vendors is crucial for seamless troubleshooting and efficient resolution of issues. The lack of a streamlined process impacts the overall customer experience.

Human Factors Centric Hyper Converged Appliance Design

In-order to address the above key categories impacting customer experience an end-to-end methodology was developed. Listed below are some of the key design attributes that were factored apart from user experience.

- Appliance-centric Design: Designed from the ground up as an integrated appliance.
- Highly available architecture: To avoid single point failure the appliance is setup with redundant switches and adapters.
- Built as an Appliance: Every appliance is built with the same predictable quality and reliability.
- Unified Administration: A simplified, unified administration experience throughout the life of your appliance.
- Guided Software Installation: Provides contextual options based on configuration context including integrating seamlessly with other appliances for scalable infrastructure.
- Simplified storage configuration and deployment: Provides ser-friendly interfaces and wizard-guided configuration, ensuring smooth software defined storage installation.
- Integrated Support: One place to call for all server, network, data services, and container platform needs.
- Orchestrated Updates: A simplified experience for updating the appliance management software, firmware for servers and switches.
- Hardware scaling: Consistent management interfaces facilitate capacity expansion to add additional servers and disks to increase capacity. without disrupting workloads through labelling, strategic rack unit positions.
- Documentation and Training: Comprehensive documentation and training materials support administrators in deploying and managing

the appliance effectively, boosting confidence and proficiency at all skill levels.

We now describe in details how human factors were considered and a factory built HCI appliance was developed and provided.

- Order Placement: The process begins with the customer placing an order thru online system where they have options to select the number of servers, the RAM and CPU, the number of disks etc. This information once validated by the technical sales team are then passed on to the factory. The online system ensures that only valid configurations can ordered,
- Factory Assembly: Upon receiving the order, the factory assembles the hardware according to the specified configuration, including connecting cables, wiring up the rack, and labelling cables. Servers are positioned for easy identification before thorough installation testing to ensure functionality. In-order to facilitate large number appliance assembly the factory is provided with their own manufacturing software which is use initialize the appliance after assembly and perform testing.
- Deployment at Customer Premises: The deployment of customer premises is divided in multiple stages for each of the stage owners with roles and responsibility are identified. Each of the owner is provided documentation with step-by-step procedures, diagrams, and a previously collated configuration details before the appliance deployment starts. The strategic placement of KVM in the bottom center contribute to user-friendly setup procedures along with stacking the servers from bottom to top.
  - Stage 1: Upon receipt, the authorized engineer connects switches to pre-identified ports on the data center switch for seamless integration. As the design treats the entire hardware as a integrated unit, this step allows for efficient d hookup to data center network, validating networking requirements, which can then be leveraged to complete installation remotely.
  - Stage 2: In this stage a guided wizard installs the container runtime platform, the appliance management software and does all day 0 configuration to have a working appliance.
  - Post-Instal: In this stage all the additional software areas installed, and further customization is performed to meet the customer requirements.
- Day2 operations: The consistent management interfaces facilitate seamless management of both hardware and software in an integrated way. Administrators an easily perform tasks like capacity expansion, monitoring to track performance metrics and swiftly address any emerging issues to maintain optimal system health. and allowing users to user to run their applications,
  - Capacity Expansion: The implementation of labelling and coloring of cables, pre-determined rack unit positions allow easy capacity

expansion off the HCI appliance to add more disks, servers and additional appliances without disrupting existing workloads, ensuring continuous service availability.
- Monitoring and Alerting: The management software has built in capabilities to monitor potential and raise support tickets across hardware and software with single point of contact vendor. This allows to prevent issues before they escalate. Clear, actionable error messages and automated recovery procedures are also provided minimize disruptions and maintain appliance availability,

EVALUATION AND RESULTS

Overall, deploying an HCI appliance is a comprehensive endeavour that demands significant time in the range of months along with people with expertise, and coordination across various domains. Assembling the appliance on a rack requires the coordination of subject matter experts in networking, server administration, and storage management, who meticulously connect components and configure settings.

Our evaluation has identified that using a pre-built HCI system that has factored in a human centric design drastically reduces deployment time from months to mere hours. With all components pre-integrated and pre-configured, there's no need for extensive assembly or manual configuration, saving valuable time and resources. Additionally, the pre-built system comes with streamlined setup procedures and intuitive user interfaces and streamlined support further accelerating the deployment process and enabling customers to realize the benefits of HCI technology more rapidly minimizing the expertise required for deployment.

We also have found that day 2 operations also become much easier with an integrated hardware and software management capabilities along with a single point of support.

CONCLUSION

In deploying a highly available hyper converged appliance for containerized platforms, addressing human factor needs has ensure the success and usability of the appliance. We have found that using a pre-built system with customer-friendly configuration and management interfaces, clear documentation and training materials, proactive monitoring and alerting mechanisms, and customer-centric error handling and recovery procedures are essential components for adoption of an HCI appliance by customers. By prioritizing these factors, customers will be able empower their administrators to effectively deploy, manage, and maintain highly available containerized platforms, ultimately driving business agility and innovation.

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