SUSE

Technical Reference Documentation

Layered Stack Deployment of SUSE Rancher

Integrated with Hewlett Packard Enterprise (R)

SUSE | Hewlett Packard Enterprise

Layered Stack Deployment of SUSE Rancher: Integrated with Hewlett Packard Enterprise (R)

SUSE Linux Enterprise Micro 5.1, K3s 1.20.14, SUSE Rancher 2.5.12

The purpose of this document is to provide an overview and procedure of implementing SUSE (R) and partner offerings for SUSE Rancher, as a multi-cluster container management platform for organizations that deploy containerized workloads, orchestrated by Kubernetes. SUSE Rancher makes it easy to deploy, manage, and use Kubernetes everywhere, meet IT requirements, and empower DevOps teams.

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https://documentation.suse.com

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1 Introduction

On the digital transformation journey to a full cloud-native landscape, the use of microservices becomes the main approach with the dominant technology for such container orchestration being Kubernetes.[1] With its large community of developers and abundant features and capabilities, Kubernetes has become the de-facto standard and is included across most container-as-a-service platforms. With all of these technologies in place, both developer and operation teams can effectively deploy, manage and deliver functionality to their end users in a resilient and agile manner.

1.1 Motivation

Once on such a digital transformation journey, also relevant to focus on areas like:

Workload(s)

Determine how to manage and launch internally developed containerized, microservice workloads

Kubernetes

While any developer or organization may simply start with a single, Kubernetes-based deployment, it is very common for that number of cluster instances to rapidly grow. While each of these may have specific focus areas, it becomes imperative to figure out how to use, manage, maintain and replicate all of these instances over time.

This is where SUSE Rancher leads the industry, being able to manage access, usage, infrastructure and applications across clusters, that are Cloud Native Computing Foundation (CNCF[2]) conformant and certified[3], anywhere across edge, on-premise data centers, or cloud service providers. SUSE Rancher optimizes creating and managing Kubernetes clusters like:

- Lightweight edge-centric K3s (https://www.suse.com/products/k3s/)
- Rancher Kubernetes Engine (RKE (https://rancher.com/products/rke/))

1 https://kubernetes.io/

2 https://www.cncf.io/

3 https://www.cncf.io/certification/software-conformance

- Rancher Kubernetes Engine Government (RKE2 (https://www.suse.com/products/rancher/))
- and other Kubernetes clusters that are based upon CNCF certified Kubernetes distributions or installations

and deployed across various supported (https://rancher.com/support-maintenance-terms) infrastructure elements.

Compute Platform(s)

To optimize availability, performance, scalability and integrity, assess current system or hosting platforms
from Independent Hardware Vendors (IHV), such as Hewlett Packard Enterprise (https://www.hpe.com/us/en/home.html) ® as the platform for physical, bare metal, hypervisors and virtual machines

1.2 Scope

The scope of this document is to provide a layered *reference configuration* for SUSE Rancher. This can be done in a variety of solution layered stacks, to become a fundamental component of a managing multiple Kubernetes ecosystems.

1.3 Audience

This document is intended for IT decision makers, architects, system administrators and technicians who are implementing a flexible, software-defined Kubernetes management platform. One should still be familiar with the traditional IT infrastructure pillars — networking, computing and storage — along with the local use cases for sizing, scaling and limitations within each pillars' environments.

2 Business aspect

Agility is driving developers toward more cloud-native methodologies that focus on microservices architectures and streamlined workflows. Container technologies, like Kubernetes, embody this agile approach and help enable cloud-native transformation.

By unifying IT operations with Kubernetes, organizations realize key benefits like increased reliability, improved security and greater efficiencies with standardized automation. Therefore, Kubernetes infrastructure platforms are adopted by enterprises to deliver:

Cluster Operations

Improved Production and DevOps efficiencies with simplified cluster usage and robust operations

Security Policy & User Management

Consistent security policy enforcement plus advanced user management on any Kubernetes infrastructure

Access to Shared Tools & Services

A high level of reliability with easy, consistent access to a broad set of tools and services

2.1 Business problem

Many organizations are deploying Kubernetes clusters everywhere — in the cloud, on-premises, and at the edge — to unify IT operations. Such organizations can realize dramatic benefits, including:

- Consistently deliver a high level of reliability on any infrastructure
- Improve DevOps efficiency with standardized automation
- Ensure enforcement of security policies on any infrastructure

However, simply relying on upstream Kubernetes alone can introduce overhead and risk because Kubernetes clusters are typically deployed:

- Without central visibility
- Without consistent security policies
- And must be managed independently

Deploying a scalable kubernetes requires consideration of a large ecosystem, encompassing many software and infrastructure components and providers. Further, the ability to continually address the needs and concerns of:

Developers

For those who just focus on writing code to build their apps securely using a preferred workflow, providing a simple, push-button deployment mechanism of their containerized workloads where needed.

IT Operators

General infrastructure requirements still rely upon traditional IT pillars are for the stacked, underlying infrastructure. Ease of deployment, availability, scalability, resiliency, performance, security and integrity are still core concerns to be addressed for administrative control and observability.

Beyond just the core infrastructure software layers of managed Kubernetes clusters, organizations may be also be impacted by:

Compute Platform

Potential inconsistencies and impacts of multiple target system platforms for the distributed deployments of the cluster elements, across:

- physical, baremetal, hypervisors and virtual machines

2.2 Business value

By allowing operation teams to focus on infrastructure and developers to deploy code the way they want too, SUSE and the Rancher offerings helps bring products to market faster and accelerate an organization's digital transformation.

SUSE Rancher is a fundamental part of the complete software stack for teams adopting containers. It provides DevOps teams with integrated tools for running containerized workloads while also addressing the operational and security challenges of managing multiple Kubernetes clusters across any targeted infrastructure.

Developers

SUSE Rancher makes it easy to securely deploy containerized applications no matter where the Kubernetes infrastructure runs -– in the cloud, on-premises, or at the edge. Using Helm or the App Catalog to deploy and manage applications across any or all these environments, ensuring multi-cluster consistency with a single deployment process.

IT Operators

SUSE Rancher not only deploys and manages production-grade Kubernetes clusters from datacenter to cloud to the edge, it also unites them with centralized authentication, access control and observability. Further, it streamlines cluster deployment on bare metal or virtual machines and maintains them using defined security policies.

With this increased consistency of the managed Kubernetes infrastructure clusters, organizations benefit from an even higher level of the Cloud Native Computing model where each layer only relies upon the API and version of the adjacent layer, such as:

Compute Platform

Using the above software application and technology solutions with the server platforms offered by Hewlett Packard Enterprise (HPE (https://www.hpe.com/us/en/home.html)) provides many alternative for scale, cost-effectiveness and performance options that could align with local IT staff platform preferences:

- density-optimized - high performance and efficiency for big data and the most demanding workloads
- mission-critical - systems of intelligence to fuel your digital transformation in a world where time and data are the new currency and business continuity is expected
- composable - fully adaptable and ready for Hybrid-IT to future-proof your data center for today's workloads and tomorrow's disruptors
- IoT - realize the potential of the Internet of Things to provide compute at the network edge
- cloud - high-capacity, mass-compute open infrastructure with security and software to match
- and virtualized use cases.

3 Architectural overview

This section outlines the core elements of the SUSE Rancher solution, along with the suggested target platforms and components.

3.1 Solution architecture

The figure below illustrates the high-level architecture of the SUSE Rancher installation that manages multiple downstream Kubernetes clusters:

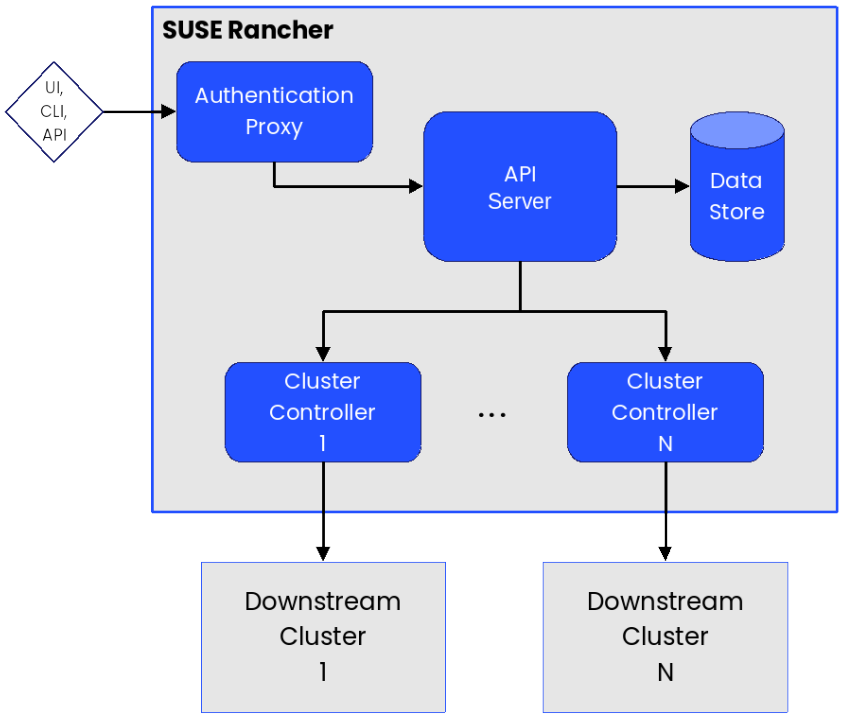

FIGURE 3.1: ARCHITECTURE OVERVIEW - SUSE RANCHER

Authentication Proxy

A user is authenticated via SUSE Rancher and then, if authorized, can access both the SUSE Rancher environment and the downstream clusters and workloads.

API Server

This provides the programmatic interface back-end for a user, using command line interactions with SUSE Rancher and the managed clusters.

Data Store

The purpose of this service is to capture the configuration and state of SUSE Rancher and the managed clusters to aid in backup and recovery processes.

Cluster Controller

Interacting with a cluster agent on the downstream cluster, the cluster controller allows the communication path for users and services to leverage for workloads and cluster management.

When set up, users can interact with SUSE Rancher through the Web-based user interface (UI), the command line interface (CLI), and programatically through the application programming interface (API). Depending upon the assigned roles, group membership and privileges, a user could:

- manage all clusters, users, roles, projects
- deploy new clusters, import other clusters, or remove existing ones
- manage workloads across respective or labeled clusters
- simply view clusters or workloads, or benefit from what is running

For the best performance and security, the recommended deployment is a dedicated Kubernetes cluster for the SUSE Rancher management server. Running user workloads on this cluster is not advised. After deploying SUSE Rancher, one can then create or import clusters for orchestrated workloads.

4 Component model

This section describes the various components being used to create a SUSE Rancher solution deployment, in the perspective of top to bottom ordering. When completed, the SUSE Rancher instance enables the management of multiple, downstream Kubernetes clusters.

4.1 Component overview

By using:

- Software
  - Multi-cluster Management Server - SUSE Rancher
  - Kubernetes Platform - K3s
  - Linux Operating System - SUSE Linux Enterprise Micro
- Compute Platform
  - Hewlett Packard Enterprise ProLiant
  - Hewlett Packard Enterprise Synergy

you can create the necessary infrastructure and services. Further details for these components are described in the following sections.

4.2 Software - SUSE Rancher

SUSE Rancher is a Kubernetes native multi-cluster container management platform. It addresses these challenges by delivering the following key functions, as shown in the following figure:

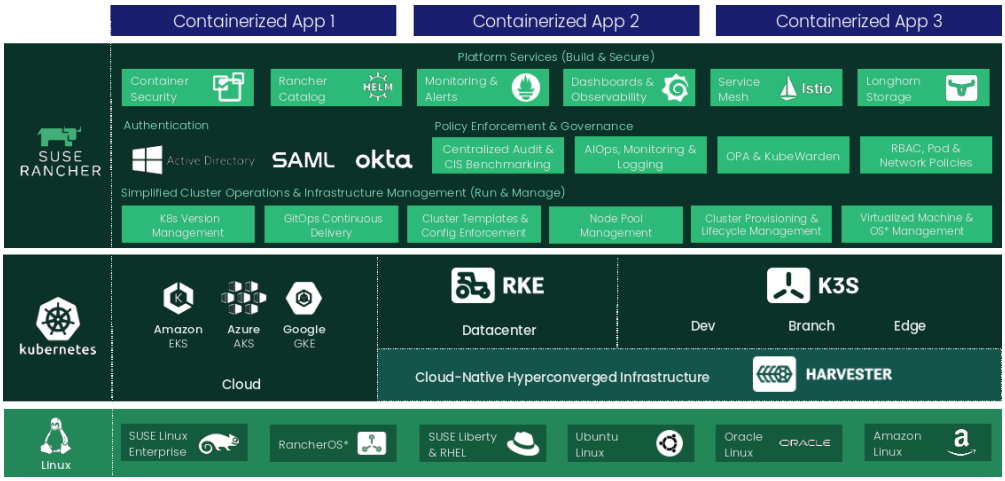

FIGURE 4.1: COMPONENT OVERVIEW - SUSE RANCHER

Certified Kubernetes Distributions

SUSE Rancher supports management of any CNCF certified Kubernetes distribution for:

- development, edge, branch workloads, SUSE offerings like K3s (https://www.suse.com/products/k3s/), a CNCF certified lightweight distribution of Kubernetes
- workload infrastructures, either on-premise or public-cloud based, SUSE offerings like Rancher Kubernetes Engine (RKE (https://rancher.com/products/rke/)) or Rancher Kubernetes Engine Government (RKE2 (https://www.suse.com/products/rancher/)), as CNCF certified Kubernetes distributions for both bare-metal and virtualized servers
- the public cloud, hosted Kubernetes services like
  - Amazon Elastic Kubernetes Service (EKS[1]),
  - Azure Kubernetes Service (AKS[2]) and
  - Google Kubernetes Engine (GKE[3]).

1 https://aws.amazon.com/eks

Simplified Cluster Operations and Infrastructure Management

SUSE Rancher provides simple, consistent cluster operations including provisioning and templates, configuration and lifecycle version management, along with visibility and diagnostics.

Security and Authentication

SUSE Rancher integrates and utilizes existing directory services, to automate processes and apply a consistent set of identity and access management (IAM) plus security policies for all the managed clusters, no matter where they are running.

Policy Enforcement and Governance

SUSE Rancher includes audit and security guideline enforcement, monitoring and logging functions, along with user, network and workload policies distributed across all managed clusters.

Platform Services

SUSE Rancher also provides a rich catalog of services for building, deploying and scaling containerized applications, including app packaging, logging, monitoring and service mesh.

Tip

Learn more information about SUSE Rancher (https://www.suse.com/products/rancher/)

For a production implementation of SUSE Rancher, deploying upon a Kubernetes platform is required and the next sections describe the suggested component layering approach.

4.3 Software - K3s

K3s is packaged as a single binary, which is about 50 megabytes in size. Bundled in that single binary is everything needed to run Kubernetes anywhere, including low-powered IoT and Edge-based devices. The binary includes:

- the container runtime
- important host utilities such as iptables, socat and du

2 https://azure.microsoft.com/en-us/overview/kubernetes-on-azure/

3 https://cloud.google.com/kubernetes-engine

The only OS dependencies are the Linux kernel itself and a proper dev, proc and sysfs mounts (this is done automatically on all modern Linux distributions). K3s bundles the Kubernetes components:

- kube-apiserver,
- kube-controller-manager,
- kube-scheduler,
- kubelet and
- kube-proxy

into combined processes that are presented as a simple server and agent model, as represented in the following figure:

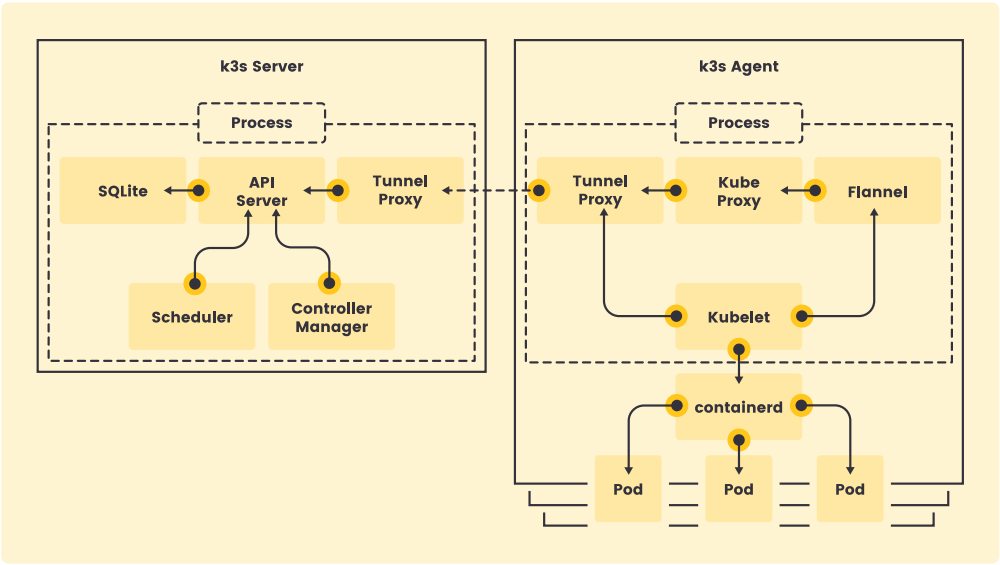

FIGURE 4.2: COMPONENT OVERVIEW - K3S

K3s can run as a complete cluster on a single node or can be expanded into a multi-node cluster. Besides the core Kubernetes components, these are also included:

- containerd,
- Flannel,
- CoreDNS,
- ingress controller and
- a simple host port-based service load balancer.

All of these components are optional and can be swapped out for your implementation of choice. With these included components, you get a fully functional and CNCF-conformant cluster so you can start running apps right away. K3s is now a CNCF Sandbox project, being the first Kubernetes distribution ever to be adopted into sandbox.

Tip

Learn more information about K3s (https://www.suse.com/products/k3s/)

4.4 Software - SUSE Linux Enterprise Micro

SUSE Linux Enterprise Micro combines the assurance of enterprise-grade security and compliance with the immutability and portability of a modern, lightweight operating system. The top 4 features are:

Immutable OS

Immutable design ensures the OS is not altered during runtime and runs reliably every single time. Security signed and verified transactional updates are easy to rollback if things go wrong.

Security and Compliance

Fully open source and built using open standards, SUSE Linux Enterprise Micro leverages SUSE Linux Enterprise common code base, to provide FIPS 140-2, DISA SRG/STIG, integration with CIS and Common Criteria certified configurations. Includes fully supported security framework (SELinux) with policies.

Architectural Flexibility

Both Arm and x86-64 architectures are supported so you can deploy edge applications with confidence across multiple architectures.

Kubernetes-ready

You can easily combine SUSE Linux Enterprise Micro with the latest cloud-native technologies including SUSE Rancher, Rancher Kubernetes Engine, Longhorn persistent block storage, and K3s, the world's most popular Kubernetes distribution for use in low resource, distributed edge locations.

As a result, you get an ultra-reliable infrastructure platform that is also simple to use and comes out-of-the-box with best-in-class compliance. Furthermore, SUSE's flexible subscription model ensures enterprise assurance for any edge, embedded or IoT deployment without vendor lock-in. A free, evaluation copy can be downloaded (https://www.suse.com/download/sle-micro/) or if the organization already has subscriptions, both install media and updates can be obtained from SUSE Customer Center (https://scc.suse.com).

4.5 Compute Platform

Leveraging the enterprise grade functionality of the operating system mentioned in the previous section, many compute platforms can be the foundation of the deployment:

- Virtual machines on supported hypervisors or hosted on cloud service providers
- Physical, baremetal or single-board computers, either on-premises or hosted by cloud service providers

Note

To complete self-testing of hardware with SUSE YES Certified Process (https://www.suse.com/partners/ihv/yes/yes-certified-process), you can download and install the respective SUSE operating system support-pack version of SUSE Linux Enterprise Server and the YES test suite. Then run the tests per the instructions in the test kit, fixing any problems encountered and when corrected, re-run all tests to obtain clean test results. Submit the test results into the SUSE Bulletin System (SBS) for audit, review and validation.

Tip

Certified systems and hypervisors can be verified via SUSE YES Certified Bulletins (https://www.suse.com/yessearch/) and then can be leveraged as supported nodes for this deployment, as long as the certification refers to the respective version of the underlying SUSE operating system required.

Even with the broad certification and support model across the range of available HPE platform models, the following table summarizes which might be a best-practice selection for the various deployment types and focus areas:

TABLE 4.1: HEWLETT PACKARD ENTERPRISE PLATFORM MATRIX FOR DEPLOYMENT TYPES

System Platform	Baremetal	Hypervisor	Virtual Machine
ProLiant	DL360,DL380	DL360,DL380	(hosting)
Synergy	SY480	SY480	(hosting)

As listed in the previous table, multiple server product-line and model options abound in the HPE server portfolio (https://www.hpe.com/uk/en/servers.html), as detailed in the following sections.

4.5.1 Hewlett Packard Enterprise iLO

The Hewlett Packard Enterprise iLO (https://www.hpe.com/us/en/servers/integrated-lights-out-ilo.html) [iLO] arms you with the tools to manage your servers efficiently, resolve issues quickly, and keep your business running – from anywhere in the world, allowing you to manage your entire server environment with ease. Upgrade the basic iLO license for additional functionality, such as graphical remote console, multi-user collaboration, video record/playback, remote management, and much more. The latest iLO innovations include:

- Security and performance
- Support for Simple Certificate Enrollment Protocol [SCEP]
- Enablement for 802.1x protocol to securely onboard servers into a network
- Redfish API Conformance

4.5.2 HPE ProLiant DL Rack Servers

The HPE ProLiant DL (https://www.hpe.com/us/en/servers/proliant-dl-servers.html) family of servers are the most flexible, reliable, and performance-optimized HPE ProLiant rack servers—ever. HPE continues to provide industry-leading compute innovations. The new HPE ProLiant rack portfolio, with flexible choices and versatile design, along with improved energy efficiencies, ultimately lowers your TCO. Integrated with a simplified, but comprehensive management suite and industry-leading support, the HPE ProLiant rack portfolio delivers a more reliable, fast, and secure infrastructure solution, helps increase IT staff productivity, and accelerates service delivery. In addition, the rack portfolio is performance-optimized for multiapplication workloads to significantly increase the speed of IT operations and enable IT to respond to business needs of any size, faster.

Specific models that offer relevant choices for Enterprise Kubernetes are:

HPE ProLiant DL380 (https://www.hpe.com/us/en/product-catalog/servers/proliant-servers/pip.hpe-proliant-dl380-gen10-server.1010026818.html)

The industry-leading HPE DL380 2P/2U server with world-class performance and supreme versatility for multi-workload compute server delivers the latest in security, performance and expandability, backed by a comprehensive warranty. Standardize on the industry's most trusted compute platform. The HPE DL380 server is securely designed to reduce costs and complexity, featuring:

- the First, Second, Third Generation Intel Xeon Processor Scalable Family with up to a 60% performance gain1 and 27% increase in cores2
- the HPE 2933 MT/s DDR4 SmartMemory supporting 3.0 TB
- support of 12 Gb/s SAS, and up to 20 NVMe drive plus a broad range of compute options
- HPE Persistent Memory offers unprecedented levels of performance for databases and analytic workloads to run everything from the most basic to mission-critical applications and deploy with confidence.

HPE ProLiant DL360 (https://www.hpe.com/us/en/product-catalog/servers/proliant-servers/pip.hpe-proliant-dl360-gen10-server.1010007891.html)

Adaptable for diverse workloads and environments, the compact 1U HPE DL360 server delivers security, agility and flexibility without compromise. It supports:

- the Intel Xeon Scalable processor with up to a 60% performance gain1 and 27% increase in cores2
- along with 2933 MT/s HPE DDR4 SmartMemory supporting up to 3.0 TB2 with an increase in performance of up to 82%3
- the added performance that HPE Persistent Memory6, HPE NVDIMMs7 and 10 NVMe bring, the HPE DL360 means business. Deploy, update, monitor and maintain with ease
- automating essential server life cycle management tasks with HPE OneView and HPE Integrated Lights Out to deploy this 2P secure platform for diverse workloads in space constrained environments.

Note

HPE Servers Support & OS Certification Matrices (https://techlibrary.hpe.com/us/en/enterprise/servers/supportmatrix/suse_linux.aspx) outlines the minimum version of SLE required for installation, yet later service pack releases may also be used and supported.

4.5.3 HPE Synergy Servers

HPE Synergy (https://www.hpe.com/us/en/integrated-systems/synergy.html), the first Composable Infrastructure, empowers IT to create and deliver new value easily and continuously. This single infrastructure reduces operational complexity for traditional workloads and increases operational velocity for the new breed of applications and services. Through a single interface, HPE Synergy composes compute, storage and fabric pools into any configuration for any application.

It also enables a broad range of workloads — from bare metal, to virtual machines, to containers, to operational models like hybrid cloud and DevOps. HPE Synergy enables IT to rapidly react to new business demands with the following components:

- HPE Synergy 12000 Frames are uniquely architected as Composable Infrastructure (CI) to match the powerful 'infrastructure-as-code' capabilities of the HPE intelligent software architecture. Flexible access to compute, storage, and fabric resources allows for use and re-purposing. Linking multiple HPE Synergy Frames efficiently scales the infrastructure with a dedicated single view of the entire management network.
    - Creating multiple composable domains in the infrastructure can efficiently deliver available resources to the business. HPE Synergy Frames reduce complexity by using intelligent auto-discovery to find all available resources to accelerate workload deployments. This drives IT efficiency as the business grows and delivers balanced performance across resources to increase solution effectiveness.
- With HPE Synergy SY480 (https://www.hpe.com/us/en/integrated-systems/synergy.html) Compute Module, one gains operational efficiency and control, and can deploy IT resources quickly for any workload through a single interface. HPE Synergy is a powerful software-defined solution. HPE Synergy Composable Compute resources create pools of flexible compute capacity that can be configured almost instantly to rapidly provision infrastructure for a broad range of applications. The HPE Synergy SY480 Compute Module delivers an efficient and flexible two-socket workhorse to support most demanding workloads. Powered by:
    - Intel Xeon Scalable Family of processors
    - up to 4.5 TB DDR4, more storage capacity and controllers
    - a variety of GPU options within a composable architecture HPE Synergy SY480 Compute Module is the ideal platform for general-purpose enterprise workload performance now and in the future.

Note

HPE Servers Support & OS Certification Matrices (https://techlibrary.hpe.com/us/en/enterprise/servers/supportmatrix/suse_linux.aspx) outlines the minimum version of SLE required for installation, yet later service pack releases may also be used and supported.

Note

A sample bill of materials, in the *Chapter 9, Appendix*, cites the necessary quantities of all components, along with a reference to the minimum resource requirements needed by the software components.

5 Deployment

This section describes the process steps for the deployment of the SUSE Rancher solution. It describes the process steps to deploy each of the component layers starting as a base functional *proof-of-concept*, having considerations on migration toward *production*, providing *scaling* guidance that is needed to create the solution.

5.1 Deployment overview

The deployment stack is represented in the following figure:

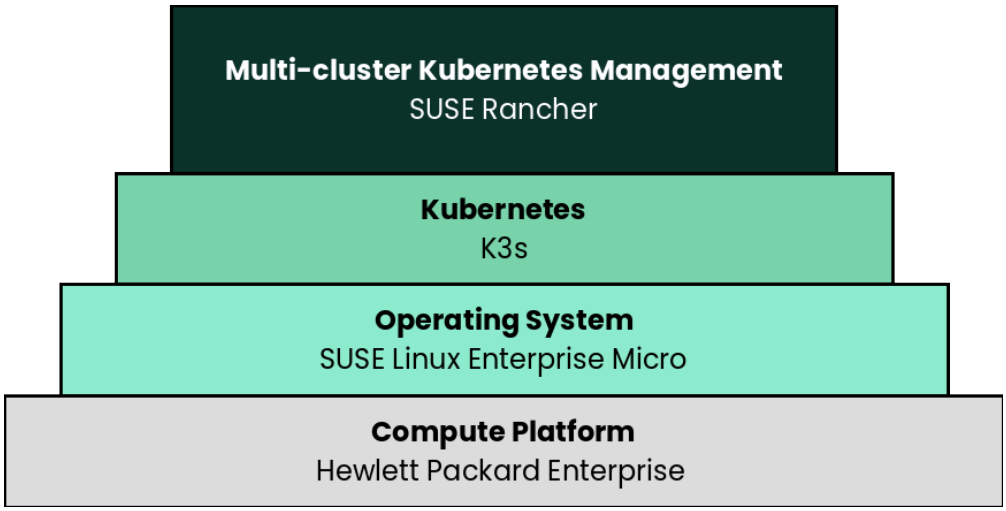

FIGURE 5.1: DEPLOYMENT STACK - SUSE RANCHER

and details are covered for each layer in the following sections.

Note

The following section's content is ordered and described from the bottom layer up to the top.

5.2 Compute Platform

The base, starting configuration can reside all within a single Hewlett Packard Enterprise Synergy Frame. Based upon the relatively small resource requirements for a SUSE Rancher deployment, a viable approach is to deploy as a virtual machine (VM) on the target nodes, on top of an existing hypervisor, like KVM. For a physical host, there are tools that can be used during the setup of the server, see below.

Preparation(s)

The HPE Integrated Lights Out (https://www.hpe.com/us/en/servers/integrated-lights-out-ilo.html) [iLO] is designed for secure local and remote server management and helps IT administrators deploy, update and monitor HPE servers anywhere, anytime.

1. Upgrade your basic iLO license for additional functionality, such as graphical remote console and virtual media access to allow the remote usage of software image files (ISO files), which can be used for installing operating systems or updating servers.

    - (Optional) - iLO Federation (https://www.hpe.com/us/en/servers/integrated-lights-out-ilo.html) enables you to manage multiple servers from one system using the iLO web interface.

2. For nodes situated in an HPE Synergy enclosure, like HPE Synergy SY480 used in the deployment:

    - Setup the necessary items in the Hewlett Packard Enterprise OneView (https://www.hpe.com/us/en/integrated-systems/software.html) interface, including:

        - Settings → Addresses and Identifiers (Subnets and Address Ranges)
        - Networks → Create (associate subnets and designate bandwidths)
        - Network Sets → Create (aggregate all the necessary Networks)
        - Logical Interconnects → Edit (include the respective Network Sets)
        - Logical Interconnect Groups → Edit (include the respective Network Sets)
        - Server Profile Templates → Create (or use existing hypervisor templates)
        - OS Deployment mode → could be configured to boot from PXE, local storage, shared storage

- Firmware (upgrade to the latest and strive for consistency across node types)
- Manage Connections (assign the Network Set to be bonded across NICs)
- Local Storage (create the internal RAID1 set and request additional drives for the respective roles)
- Manage Boot/BIOS/iLO Settings
- Server Profile → Create (assign the role template to the target model)

- Add Servers and Assign Server Roles
  - Use the Discover function from Hewlett Packard Enterprise OneView to see all of the available nodes that can be assigned to to their respective roles:
  - Then drag and drop the nodes into the roles and ensure there is no missing configuration information, by reviewing and editing each node's server details
  - Manage Settings - setup DNS/NTP, designate Disk Models/NIC Mappings/Interface Model/Networks
  - Manage Subnet and Netmask - edit Management Network information, ensuring a match exists to those setup in Hewlett Packard Enterprise OneView

Deployment Process

On the respective compute module node, determine if a hypervisor is already available for the solution's virtual machines.

1. If this will be the first use of this node, an option is to deploy a KVM hypervisor, based upon SUSE Linux Enterprise Server by following the Virtualization Guide (https://documentation.suse.com/sles/15-SP3/single-html/SLES-virtualization/#book-virt).

- Given the simplicity of the deployment, the operating system and hypervisor can be installed with the SUSE Linux Enterprise Server ISO media and the Hewlett Packard Enterprise Integrated Lights Out virtual media and virtual console methodology.

2. Then for the solution VM, use the hypervisor user interface to allocate the necessary CPU, memory, disk and networking as noted in the link:SUSE Rancher hardware requirements (https://documentation.suse.com/cloudnative/rancher-manager/latest/en/installation-and-upgrade/requirements/requirements.html).

Deployment Consideration(s)

To further optimize deployment factors, leverage the following practices:

- *Automation*
  - For HPE Synergy servers, you can simplify multiple compute module setups and configurations, leveraging the Hewlett Packard Enterprise OneView SDK for Terraform Provider (https://github.com/HewlettPackard/terraform-provider-oneview).
  - For nodes running KVM, you can leverage either virt-install (https://documentation.suse.com/sles/15-SP3/single-html/SLES-virtualization/#book-virt) or Terraform Libvirt Provider (https://registry.terraform.io/providers/dmacvicar/libvirt/latest/docs) to quickly and efficiently automate the deployment of multiple virtual machines.
- *Availability*
  - While the initial deployment only requires a single VM, as noted in later deployment sections, having multiple VMs provides resiliency to accomplish high availability. To reduce single points of failure, it would be beneficial to have the multi-VM deployments spread across multiple hypervisor nodes. So consid-

eration of consistent hypervisor and compute module configurations, with the needed resources for the VMs will yield a robust, reliable production implementation.

5.3 SUSE Linux Enterprise Micro

As the base software layer, use an enterprise-grade Linux operating system. For example, SUSE Linux Enterprise Micro.

Preparation(s)

To meet the solution stack prerequisites and requirements, SUSE operating system offerings, like SUSE Linux Enterprise Micro (https://www.suse.com/products/micro/) can be used.

1. Ensure these services are in place and configured for this node to use:

    - Domain Name Service (DNS) - an external network-accessible service to map IP Addresses to host names
    - Network Time Protocol (NTP) - an external network-accessible service to obtain and synchronize system times to aid in time stamp consistency
    - Software Update Service - access to a network-based repository for software update packages. This can be accessed directly from each node via registration to
        - the general, internet-based SUSE Customer Center (https://scc.suse.com) (SCC) or
        - an organization's SUSE Manager (https://www.suse.com/products/suse-manager/) infrastructure or
        - a local server running an instance of Repository Mirroring Tool (https://documentation.suse.com/sles/15-SP3/single-html/SLES-rmt/#book-rmt) (RMT)

Note

During the node's installation, it can be pointed to the respective update service. This can also be accomplished post-installation with the command line tool named SUSEConnect (https://www.suse.com/support/kb/doc/?id=000018564).

Deployment Process

On the compute platform node, install the noted SUSE operating system, by following these steps:

1. Download the SUSE Linux Enterprise Micro (https://www.suse.com/download/sle-micro/) product (either for the ISO or Virtual Machine image)
    - Identify the appropriate, supported version of SUSE Linux Enterprise Micro by reviewing the support matrix for SUSE Rancher (https://www.suse.com/suse-rancher/support-matrix/all-supported-versions/) versions Web page.
2. The installation process is described and can be performed with default values by following steps from the product documentation, see Installation Quick Start (https://documentation.suse.com/sle-micro/5.5/single-html/SLE-Micro-deployment/#book-deployment-slemicro)

Tip

Adjust both the password and the local network addressing setup to comply with local environment guidelines and requirements.

Deployment Consideration(s)

To further optimize deployment factors, leverage the following practices:

- *Automation*
    - To reduce user intervention, unattended deployments of SUSE Linux Enterprise Micro can be automated

- for ISO-based installations, by referring to the AutoYaST Guide (https://documentation.suse.com/sle-micro/5.5/single-html/SLE-Micro-autoyast/#book-autoyast)
- for raw-image based installation, by configuring the Ignition and Combustion tooling as described in the Installation Quick Start (https://documentation.suse.com/sle-micro/5.5/single-html/SLE-Micro-deployment/#book-deployment-slemicro)

5.4 K3s

Preparation(s)

1. Identify the appropriate, desired version of the K3s binary (for example vX.YY.ZZ +k3s1) by reviewing
   - the "Installing SUSE Rancher on K3s" associated with the respective SUSE Rancher (https://www.suse.com/suse-rancher/support-matrix/all-supported-versions/) version, or
   - the "Releases" on the Download (https://github.com/k3s-io/k3s/) Web page.
2. For the underlying operating system firewall service, either
   - enable and configure the necessary inbound ports (https://documentation.suse.com/cloudnative/k3s/latest/en/reference/resource-profiling.html) or
   - stop and completely disable the firewall service.

Deployment Process

Perform the following steps to install the first K3s server on one of the nodes to be used for the Kubernetes control plane

1. Set the following variable with the noted version of K3s, as found during the preparation steps.

```
K3s_VERSION=""
```

2. Install the version of K3s with embedded etcd enabled:

```
curl -sfL https://get.k3s.io | \
 INSTALL_K3S_VERSION=${K3s_VERSION} \
 INSTALL_K3S_SKIP_SELINUX_RPM=true \
 INSTALL_K3S_EXEC='server --cluster-init --write-kubeconfig-mode=644' \
 sh -s -
```

Tip

To address *Availability* and possible *scaling* to a multiple node cluster, etcd is enabled instead of using the default SQLite datastore.

- Monitor the progress of the installation: `watch -c "kubectl get deployments -A"`
  - The K3s deployment is complete when elements of all the deployments (coredns, local-path-provisioner, metrics-server, and traefik) show at least "1" as "AVAILABLE"
  - Use Ctrl + c to exit the watch loop after all deployment pods are running

Deployment Consideration(s)

To further optimize deployment factors, leverage the following practices:

- *Availability*
  - A full high-availability K3s cluster is recommended for production workloads. The etcd key/value store (aka database) requires an odd number of servers (aka master nodes) be allocated to the K3s cluster. In this case, two additional control-plane servers should be added; for a total of three.
    1. Deploy the same operating system on the new compute platform nodes, then log in to the new nodes as root or as a user with sudo privileges.
    2. Execute the following sets of commands on each of the remaining control-plane nodes:
       - Set the following additional variables, as appropriate for this cluster

```
# Private IP preferred, if available
FIRST_SERVER_IP=""

# From /var/lib/rancher/k3s/server/node-token file on the first
 server
NODE_TOKEN=""

# Match the first of the first server
K3s_VERSION=""
```

- Install K3s

```
curl -sfL https://get.k3s.io | \
 INSTALL_K3S_VERSION=${K3s_VERSION} \
 INSTALL_K3S_SKIP_SELINUX_RPM=true \
 K3S_URL=https://${FIRST_SERVER_IP}:6443 \
 K3S_TOKEN=${NODE_TOKEN} \
 K3S_KUBECONFIG_MODE="644" INSTALL_K3S_EXEC='server' \
 sh -
```

- Monitor the progress of the installation: `watch -c "kubectl get deployments -A"`

  - The K3s deployment is complete when elements of all the deployments (coredns, local-path-provisioner, metrics-server, and traefik) show at least "1" as "AVAILABLE"

  - Use Ctrl + c to exit the watch loop after all deployment pods are running
    By default, the K3s server nodes are available to run non-control-plane workloads. In this case, the K3s default behavior is perfect for the SUSE Rancher server cluster as it does not require additional agent (aka worker) nodes to maintain a highly available SUSE Rancher server application.

Note

This can be changed to the normal Kubernetes default by adding a taint to each server node. See the official Kubernetes documentation for more information on how to do that.

- (Optional) In cases where agent nodes are desired, execute the following sets of commands, using the same "*K3s_VERSION*", "*FIRST_SERVER_IP*", and "*NODE_TOKEN*" variable settings as above, on each of the agent nodes to add it to the K3s cluster:

```
curl -sfL https://get.k3s.io | \
 INSTALL_K3S_VERSION=${K3s_VERSION} \
 INSTALL_K3S_SKIP_SELINUX_RPM=true \
 K3S_URL=https://${FIRST_SERVER_IP}:6443 \
 K3S_TOKEN=${NODE_TOKEN} \
 K3S_KUBECONFIG_MODE="644" \
 sh -
```

5.5 SUSE Rancher

Preparation(s)

1. For the respective node's firewall service, either
   - enable and configure the necessary inbound ports (https://documentation.suse.com/cloudnative/rancher-manager/latest/en/installation-and-upgrade/requirements/requirements.html#_port_requirements) or
   - stop and completely disable the firewall service.
2. Determine the desired SSL configuration (https://documentation.suse.com/cloudnative/rancher-manager/latest/en/installation-and-upgrade/install-kubernetes/install-kubernetes.html) for TLS termination

- Rancher-generated TLS certificate NOTE: This is the easiest way of installing SUSE Rancher with self-signed certificates.
- Let's Encrypt
- Bring your own certificate

3. Obtain a Helm (https://helm.sh/docs/intro/install/) binary matching the respective Kubernetes version for this SUSE Rancher implementation.

Note

Enable the respective kubeconfig setting for kubectl , K3s - /etc/rancher/k3s/k3s.yml, to be leveraged by helm command.

Deployment Process

While logged in to the node, as root or with sudo privileges, install SUSE Rancher:

1. Install cert-manager
   - Set the following variable with the desired version of cert-manager

```
CERT_MANAGER_VERSION=""
```

Note

At this time, the most current, supported version of cert-manager is v1.5.1

   - Create the cert-manager CRDs and apply the Helm Chart resource manifest

```
kubectl apply -f https://github.com/cert-manager/cert-manager/releases/
download/${CERT_MANAGER_VERSION}/cert-manager.crds.yaml

# Add the Jetstack Helm repository
helm repo add jetstack https://charts.jetstack.io

# Update your local Helm chart repository cache
helm repo update

# Install the cert-manager Helm chart
helm install cert-manager jetstack/cert-manager \
```

```
  --namespace cert-manager \
  --create-namespace \
  --version ${CERT_MANAGER_VERSION}
```

- Check the progress of the installation, looking for all pods to be in running status:

```
kubectl get pods --namespace cert-manager
```

2. Add the SUSE Rancher helm chart repository:

```
helm repo add rancher-stable https://releases.rancher.com/server-charts/stable
```

3. Create a namespace for SUSE Rancher

```
kubectl create namespace cattle-system
```

4. Prepare to use the Helm Chart for SUSE Rancher:

- Set the following variable to the host name of the SUSE Rancher server instance

```
HOSTNAME=""
```

Note

This host name should be resolvable to an IP address of the K3s host, or a load balancer/proxy server that supports this installation of SUSE Rancher.

- Set the following variable to the number of deployed K3s nodes planned to host the SUSE Rancher service

```
REPLICAS=""
```

- Set the following variable to the desired version of SUSE Rancher server instance

```
RANCHER_VERSION=""
```

- Install the SUSE Rancher Helm Chart

```
helm install rancher rancher-stable/rancher \
  --namespace cattle-system \
```

```
  --set hostname=${HOSTNAME} \
  --set replicas=${REPLICAS} \
  --version=${RANCHER_VERSION}
```

- Monitor the progress of the installation:

```
kubectl -n cattle-system rollout status deploy/rancher
```

5. (Optional) Create an SSH tunnel to access SUSE Rancher:

Note

This optional step is useful in cases where NAT routers and/or firewalls prevent the client Web browser from reaching the exposed SUSE Rancher server IP address and/or port. This step requires that a Linux host is accessible through SSH from the client system and that the Linux host can reach the exposed SUSE Rancher service. The SUSE Rancher host name should be resolvable to the appropriate IP address by the local workstation.

- Create an SSH tunnel through the Linux host to the IP address of the SUSE Rancher server on the NodePort, as noted in Step 3:

```
ssh -N -D 8080 user@Linux-host
```

- On the local workstation Web browser, change the SOCKS Host settings to "127.0.0.1" and port "8080".

Note

This will route all traffic from this Web browser through the remote Linux host. Be sure to close the tunnel and revert the SOCKS Host settings when you are done.

6. Connect to the SUSE Rancher Web UI:

- On a client system, use a Web browser to connect to the SUSE Rancher service, via HTTPs.
- Provide a new Admin password.

Important

On the second configuration page, ensure the "Rancher Server URL" is set to the host name specified when installing the SUSE Rancher Helm Chart and the port is 443.

Deployment Consideration(s)

To further optimize deployment factors, leverage the following practices

- *Availability*
  - In instances where a load balancer is used to access a K3s cluster, deploying two additional K3s cluster nodes, for a total of three, will automatically make SUSE Rancher highly available.
- *Security*
  - The basic deployment steps described above are for deploying SUSE Rancher with automatically generated, self-signed security certificates. Other options are to have SUSE Rancher create public certificates via Let's Encrypt associated with a publicly resolvable host name for the SUSE Rancher server, or to provide preconfigured, private certificates.
- *Integrity*
  - This deployment of SUSE Rancher uses the K3s etcd key/value store to persist its data and configuration, which offers several advantages. With a multi-node cluster and this resiliency through replication, having to provide highly-available storage is not needed. In addition, backing up the K3s etcd store protects the cluster and the installation of SUSE Rancher and permits restoration of a given state.

After this successful deployment of the SUSE Rancher solution, review the product documentation (https://documentation.suse.com/cloudnative/rancher-manager/) for details on how downstream Kubernetes clusters can be:

- deployed (refer to sub-section "Setting up Kubernetes Clusters in Rancher") or
- imported (refer to sub-section "Importing Existing Clusters"), then

- managed (refer to sub-section "Cluster Administration") and
- accessed (refer to sub-section "Cluster Access") to address orchestration of workload, maintaining security and many more functions are readily available.

6 Summary

Using components and offerings from SUSE (https://www.suse.com) and the Rancher portfolio plus Hewlett Packard Enterprise ProLiant Rack Servers (https://www.hpe.com/us/en/servers/proliant-dl-servers.html) plus Hewlett Packard Enterprise Synergy Servers (https://www.hpe.com/us/en/integrated-systems/synergy.html) streamline the ability to quickly and effectively engage in a digital transformation, taking advantage of cloud-native resources and disciplines. Using such technology approaches lets you deploy and leverage transformations of infrastructure into a durable, reliable enterprise-grade environment.

Simplify

Simplify and optimize your existing IT environments

- Using SUSE Rancher enables you to simplify Kubernetes cluster deployment and management of the infrastructure components.

Modernize

Bring applications and data into modern computing

- With SUSE Rancher, the digital transformation to containerized applications can be extended, in a distributed computing context, to benefit from the ability both to manage many target clusters, for each of the respective user bases, and to simplify the actual workload deployments.

Accelerate

Accelerate business transformation through the power of open source software

- Given the open source nature of SUSE Rancher and the underlying software components, you can simplify management and make significant IT savings as you scale orchestrated microservice deployments anywhere you need to and for whatever use cases are needed, in an agile and innovative way.

7 References

WHITE PAPERS

- A Buyer's Guide to Enterprise Kubernetes Management Platforms - https://more.suse.com/FY22_Buyers_Guide_to_Enterprise_Container_Management_Buyers-Guide-to-Kubernetes-Management-Platforms.html
- How to Build an Enterprise Kubernetes Strategy - https://more.suse.com/FY22-global-web-How-to-Build-Enterprise-K8s-Strategy.html

BOOKS

- Kubernetes Management - https://more.suse.com/rs/937-DCH-261/images/002022021-DummiesGuide.pdf

TRAINING

- SUSE - https://training.suse.com/
  - Rancher - https://rancher.com/training/

WEB SITES

- SUSE - https://www.suse.com
  - SUSE Customer Center (SCC) - https://scc.suse.com
  - Products
    - SUSE Rancher - https://www.suse.com/products/rancher/ (documentation (https://documentation.suse.com/cloudnative/rancher-manager/))
    - Rancher Kubernetes Engine (RKE) - https://rancher.com/products/rke/ (documentation (https://rancher.com/docs/rke/latest/en/))
    - K3s - https://www.suse.com/products/k3s/ (documentation (https://documentation.suse.com/cloudnative/k3s/))
    - SUSE Linux Enterprise Micro (SLEMicro) - https://www.suse.com/products/micro/ (documentation (https://documentation.suse.com/sle-micro/5.5/))
    - SUSE Linux Enterprise Server (SLES) - https://www.suse.com/products/server/ (documentation (https://documentation.suse.com/sles/15-SP3/))

        - SUSE Manager - https://www.suse.com/products/suse-manager/ (documentation (https://documentation.suse.com/suma/4.3/))
        - SUSE Repository Mirroring Tool (RMT) - https://www.suse.com/products/server/ (documentation (https://documentation.suse.com/sles/15-SP3/single-html/SLES-rmt/#book-rmt))
    - Projects
        - Rancher Kubernetes Engine Government (RKE2) - https://github.com/rancher/rke2 (documentation (https://docs.rke2.io/))
- Hewlett Packard Enterprise - https://www.hpe.com/us/en/home.html
    - ProLiant - https://www.hpe.com/us/en/servers/proliant-dl-servers.html
    - Synergy - https://www.hpe.com/us/en/integrated-systems/synergy.html

8 Glossary

- Document Scope

  Reference Configuration

  A guide with the basic steps to deploy the layered stack of components from both the SUSE and partner portfolios. This is considered a fundamental basis to demonstrate a specific, tested configuration of components.

  Reference Architectures[1]

  A guide with the general steps to deploy and validate the structured solution components from both the SUSE and partner portfolios. This provides a shareable template of consistency for consumers to leverage for similar production ready solutions, including design considerations, implementation suggestions and best practices.

  Best Practice

  Information that can overlap both the SUSE and partner space. It can either be provided as a stand-alone guide that provides reliable technical information not covered in other product documentation, based on real-life installation and implementation experiences from subject matter experts or complementary, embedded sections within any of the above documentation types describing considerations and possible steps forward.

- Factor(s)

  Automation[2]

  Infrastructure automation enables speed through faster execution when configuring the infrastructure and aims at providing visibility to help other teams across the enterprise work quickly and more efficiently. Automation removes the risk associated with human error, like manual misconfiguration; removing this can decrease downtime and increase reliability. These outcomes and attributes help the enterprise move toward implementing a culture of DevOps, the combined working of development and operations.

---

1 link: Reference Architecture (https://en.wikipedia.org/wiki/Reference_architecture)

2 link: Infrastructure-as-Code (https://en.wikipedia.org/wiki/Infrastructure_as_code)

Availability[3]

The probability that an item operates satisfactorily, without failure or downtime, under stated conditions as a function of its reliability, redundancy and maintainability attributes. Some major objectives to achieve a desired service level objectives are:

- Preventing or reducing the likelihood and frequency of failures via design decisions within the allowed cost of ownership
- Correcting or coping with possible component failures via resiliency, automated failover and disaster-recovery processes
- Estimating and analyzing current conditions to prevent unexpected failures via predictive maintenance

Integrity[4]

Integrity is the maintenance of, and the insurance of the accuracy and consistency of a specific element over its entire lifecycle. Both physical and logical aspects must be managed to ensure stability, performance, re-usability and maintainability.

Security[5]

Security is about ensuring freedom from or resilience against potential harm, including protection from destructive or hostile forces. To minimize risks, one mus manage governance to avoid tampering, maintain access controls to prevent unauthorized usage and integrate layers of defense, reporting and recovery tactics.

- Deployment Flavor(s)

Proof-of-Concept[6]

A partial or nearly complete prototype constructed to demonstrate functionality and feasibility for verifying specific aspects or concepts under consideration. This is often a starting point when evaluating a new, transitional technology. Sometimes it starts as a Minimum Viable Product (MVP[7]) that has just enough features to satisfy an

3 link: Availability (https://en.wikipedia.org/wiki/Availability)

4 link: Data Integrity (https://en.wikipedia.org/wiki/Data_integrity)

5 link: Security (https://en.wikipedia.org/wiki/Security)

6 link: Proof of Concept (https://en.wikipedia.org/wiki/Proof_of_concept)

7 link: Minimum Viable Product (https://en.wikipedia.org/wiki/Minimum_viable_product)

initial set of requests. After such insights and feedback are obtained and potentially addressed, redeployments may be used to iteratively branch into other realms or to incorporate other known working functionality.

Production

A deployed environment that target customers or users can interact with and rely upon to meet their needs, plus be operationally sustainable in terms of resource usage and economic constraints.

Scaling

The flexibility of a system environment to either vertically scale-up, horizontally scale-out or conversely scale-down by adding or subtracting resources as needed. Attributes like capacity and performance are often the primary requirements to address, while still maintaining functional consistency and reliability.

9 Appendix

The following sections provide a bill of materials listing for the respective component layer(s) of the described deployment.

9.1 Compute platform bill of materials

Sample set of computing platform models, components and resources.

Role	Qty	SKU	Component	Notes
Example 1	1-3	867959-B21 ABA	Hewlett Packard Enterprise ProLiant DL360 Gen10 8SFF CTO server	• items below listed per node
	2	P02592-L21	• Intel Xeon-Gold 5218 (2.3GHz/16-core/125W) Processor Kit	
	12	P00918-B21	• Single Rank x8 DDR4-2933 CAS-21-21-21 Registered Smart Memory Ki	
	2	P18434-B21	• 960GB SATA 6G Mixed Use SFF (2.5in) SC 3yr Wty Multi Vendor SSD	
	1	P01366-B21	• 96W Smart Storage Lithium-ion Battery with 145mm Cable Kit	
	1	804326-B21	• Smart Array E208i-a SR Gen10 (8 Internal Lanes/	

Role	Qty	SKU	Component	Notes
			No Cache) 12G SAS Modular Controller	
	1	879482-B21	• InfiniBand FDR/ Ethernet 40/50Gb 2-port 547FLR-QSFP Adapter	
	1	BD505A	• iLO Advanced 1-server License with 3yr Support on iLO Licensed Features	
Example 2	1-3	868703-B21 ABA	Hewlett Packard Enterprise ProLiant DL380 Gen10 8SFF CTO server	• items below listed per node
	2	P02510-L21	• Intel Xeon-Gold 6242 (2.8GHz/16-core/150W) FIO Processor Ki	
	12	P00922-B21	• 16GB (1x16GB) Dual Rank x8 DDR4-2933	

Role	Qty	SKU	Component	Notes
			CAS-21-21-21 Registered Smart Memory Kit	
	2	P18434-B21	• 960GB SATA 6G Mixed Use SFF (2.5in) SC 3yr Wty Multi Vendor SSD	
	1	P01366-B21	• 96W Smart Storage Lithium-ion Battery with 145mm Cable Kit	
	1	804326-B21	• Smart Array E208i-a SR Gen10 (8 Internal Lanes/	

Role	Qty	SKU	Component	Notes
			No Cache) 12G SAS Modular Controller	
	1	879482-B21	• InfiniBand FDR/ Ethernet 40/50Gb 2-port 547FLR-QSFP Adapter	
	1	BD505A	• iLO Advanced 1-server License with 3yr Support on iLO Licensed Features	
Example 3 Chassis	1	797740-B21	Enclosure : Hewlett Packard Enterprise Synergy 12000 Configurer-to-order Frame with 1x Frame Linke Module, 10x Fans	• items below listed per enclosure
	1	804938-B21	• Frame Rack Rail Kit	
	1	804942-B21	• Frame Link Module	
	2	804353-B21	• Composer	
	2	779218-B21	• Network : 20Gb Interconnect Link Module	
	2	794502-B23	• Hewlett Packard Enterprise Virtual Connect SE 40Gb F8 Module for Synergy	
	2	755985-B21	• Storage : 12G SAS Connectivity Module for Synergy	
Example 3 Node	1-3	871940-B21	• Compute Module : Hewlett Packard Enterprise Synergy SY480 Gen10	• items below listed per node

Role	Qty	SKU	Component	Notes
			CAS-19-19-19 Registered Smart Memory Kit	
	1	804424-B21	• Smart Array P204i-c SR Gen10 (4 Internal Lanes/1GB Cache) 12G SAS Modular Controller	
	2	875478-B21	• 1.92TB SATA 6G Mixed Use SFF (2.5in) SC 3yr WTY Digitally Signed Firmware SSD	

9.2 Software bill of materials

Sample set of software, support and services.

Role	Qty	SKU	Component	Notes
Operating System	1-3	874-007864	SUSE Linux Enterprise Micro, • x86_64, • Priority Subscription, • 1 Year	Configuration: • per node (up to 16 cores, stackable)
Kubernetes Management	1	R-0001-PS1	SUSE Rancher, • x86-64, • Priority Subscription, • 1 Year	Configuration: • per deployed instance
Rancher Management	2	R-0004-PS1	Rancher 10 Nodes • x86-64 or aarch64, • Priority Subscription, • 1 Year,	Configuration: • requires priority server subscription
Consulting and Training	1	R-0001-QSO	Rancher Quick Start, • Go Live Services	

Note

For the software components, other support term durations are also available.

9.3 Documentation configuration / attributes

This document was built using the following AsciiDoc (https://github.com/asciidoc/asciidoc) and DocBook Authoring and Publishing Suite (DAPS (https://github.com/openSUSE/daps)) attributes:

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Appendix=1 ArchOv=1 Automation=1 Availability=1 BP=1 BPBV=1 CompMod=1 DepConsiderations=1
 Deployment=1 FCTR=1 FLVR=1 GFDL=1 Glossary=1 HWComp=1 HWDepCfg=1 IHV-HPE-ProLiant=1
 IHV-HPE-Synergy=1 IHV-HPE=1 Integrity=1 LN=1 PoC=1 Production=1 RA=1 RC=1 References=1
 Requirements=1 SWComp=1 SWDepCfg=1 Scaling=1 Security=1 docdate=2022-04-06 env-daps=1
 focusRancher=1 iIHV=1 iK3s=1 iRKE1=1 iRKE2=1 iRMT=1 iRancher=1 iSLEMicro=1 iSLES=1
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