

Reference Implementation - SUSE Rancher



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SUSE LLC

1800 South Novell Place

Provo, UT 84606

USA

<https://documentation.suse.com> 

Contents

Preface v

1 Introduction 1

- 1.1 Background 1
- 1.2 Motivation 1
- 1.3 Scope 2
- 1.4 Audience 2

2 Component model 3

- 2.1 Component overview 3
 - Software - SUSE Rancher 4 • Software - K3s 6 • Software - SUSE Linux Enterprise Micro 8 • Compute Platform Options 8

3 Deployment 10

- 3.1 Deployment overview 10
- 3.2 Hardware deployment configuration 10
- 3.3 Software deployment configuration 11
 - Operating System Deployment 11 • Kubernetes Deployment 12 • SUSE Rancher Deployment 14

4 Deployment considerations 15

5 Summary 16

6 References 17

A Appendix 18

- A.1 Appendix A: Bill of Materials 18

7	Legal Notice	20
8	GNU Free Documentation License	21



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Preface


The purpose of this documentation is to provide a reference implementation of deploying 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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1 Introduction


Kubernetes has become the container orchestration standard. Most cloud and virtualization vendors now offer it as standard infrastructure. SUSE Rancher users have the choice of creating Kubernetes clusters with Rancher Kubernetes Engine (RKE), lightweight edge-centric K3s, on premise or in cloud Kubernetes services, such as GKE, AKS, and EKS. SUSE Rancher users can also import and manage their existing Kubernetes clusters created using any Cloud Native Computing Foundation (CNCF (<https://www.cncf.io/>) ) certified (<https://www.cncf.io/certification/cka/>) ) Kubernetes distribution or installer.

1.1 Background

Even on the journey to a full Cloud Native Landscape, classic IT pillars are still valid considerations for the underlying infrastructure. General requirements include the need for a small, purpose-built operating system with a container runtime engine and a container orchestration platform to distribute workloads across a target, clustered instance. The dominant technology for container orchestration is [Kubernetes](https://kubernetes.io/) (<https://kubernetes.io/>) . With its large community of developers and a plethora of features and capabilities, Kubernetes has become the defacto standard and is included across most container-as-a-service platforms. With all of these attributes in place, both developer and operation teams can effectively deploy, manage and deliver functionality to their end users in a resilient and agile manner.




Note

As a further reference, the National Institute of Standards and Technology's (NIST) [Definition of Microservices, Application Containers and System Virtual Machines](https://csrc.nist.gov/publications/detail/sp/800-180/draft) (<https://csrc.nist.gov/publications/detail/sp/800-180/draft>)  describes the important characteristics of application containers.

1.2 Motivation

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 the 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 (CNCF (<https://www.cncf.io/certification/software-conformance/>) ) compliant, anywhere from edge, core, on-premise, or cloud.

1.3 Scope

The scope of this document is to provide a quick-start, reference implementation of SUSE Rancher. This can be done in a variety of solution stack, architectural scenarios as a fundamental component of an overall Kubernetes ecosystem.

1.4 Audience

This document is intended for IT decision makers, architects, system administrators and technicians who are implementing a flexible, software-defined Kubernetes management platform. You should 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 Component model

This section describes the various components being used to create the SUSE Rancher, which enables the management of multiple Kubernetes clusters, as shown in the following figure:

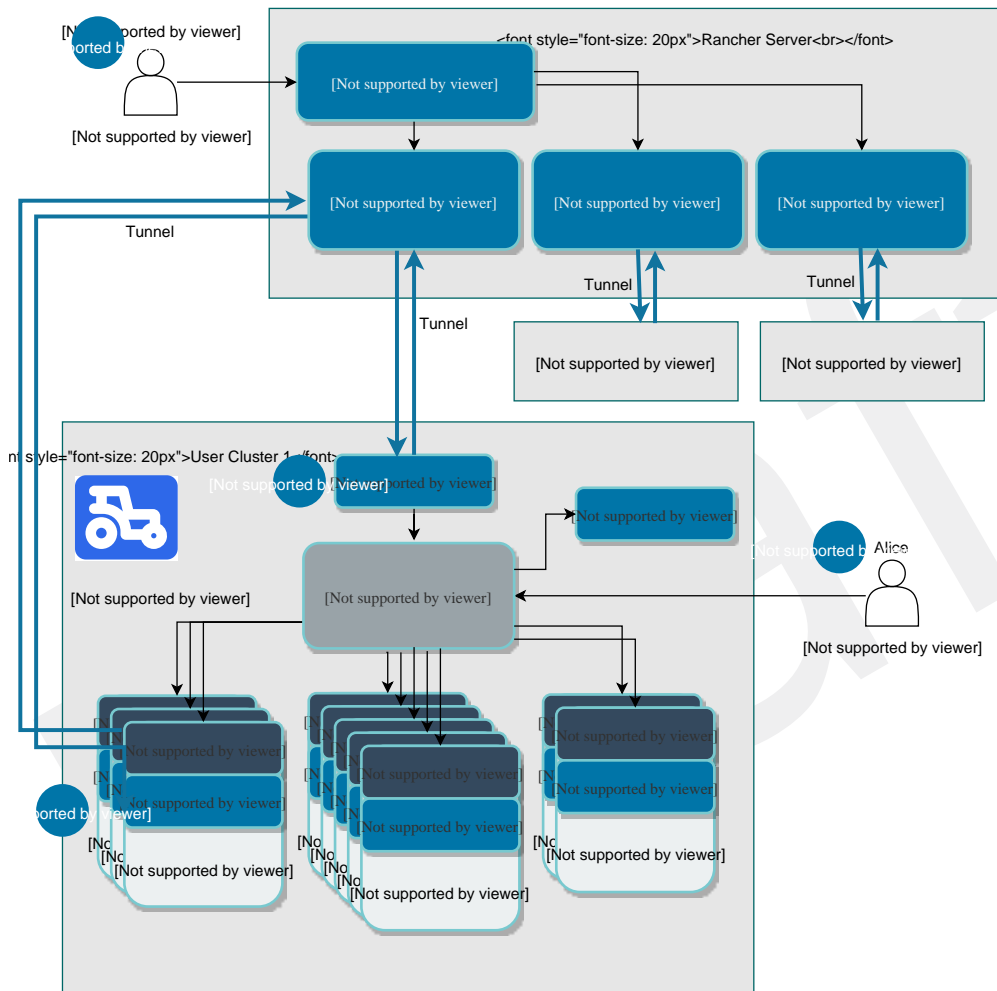



FIGURE 2.1: KUBERNETES CLUSTER MANAGEMENT BY SUSE RANCHER

2.1 Component overview

SUSE (<https://www.suse.com>) ®, the Open Open Source Company, works with an ecosystem of partners and communities to deliver enterprise-grade, open source software-defined infrastructure and application delivery solutions backed by superior service and support. The leading Linux operating system meets the most widely-adopted enterprise Kubernetes management platform. SUSE and Rancher are now one company!

Innovate Everywhere

Our goal is to give you the freedom to innovate everywhere — from the data center, to the cloud, to the edge and beyond. We are driven by the power of many: everything we do is empowered by the skills, creativity and vision of our employees, partners, customers and community.

By utilizing these software products from the SUSE portfolio:

- Multi-cluster Management Server - SUSE Rancher
- Kubernetes Platform - K3s
- Operating System - SUSE Linux Enterprise Micro

one can build the necessary infrastructure and services to administer and manage multiple Kubernetes clusters. Further details of these SUSE products are described in the following section.

2.1.1 Software - SUSE Rancher

Many organizations are deploying Kubernetes clusters everywhere – on-premises, in the cloud 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, relying on upstream Kubernetes alone can introduce overhead and risk because Kubernetes clusters are typically deployed:

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

SUSE Rancher is a complete cluster and container management platform built on Kubernetes itself. It addresses these challenges by delivering the following key functions, as shown in the following figure:

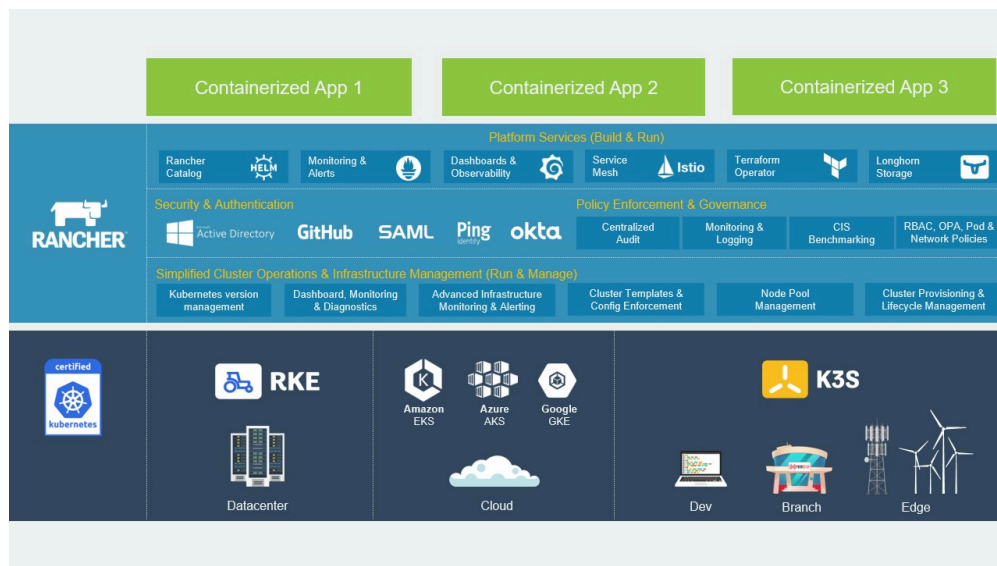


FIGURE 2.2: OVERVIEW OF SUSE RANCHER

Certified Kubernetes Distributions

SUSE Rancher supports any certified Kubernetes distribution. For on-premises workloads, we offer the Rancher Kubernetes Engine (RKE). For the public cloud, we support all the major distributions, including Amazon Elastic Kubernetes Service (EKS), Microsoft Azure Kubernetes Service (AKS), and Google Kubernetes Engine (GKE). For edge, branch and desktop workloads we offer K3s, a certified lightweight distribution of Kubernetes.

Simplified Cluster Operations

SUSE Rancher provides simple, consistent cluster operations including provisioning, version management, visibility and diagnostics, monitoring and alerting, and centralized audit.

Security, Policy and User Management

SUSE Rancher lets you automate processes and applies a consistent set of user access and security policies for all your clusters, no matter where they're running.

Shared Tools & Services

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

As SUSE Rancher relies upon being deployed on a Kubernetes platform, the next section describes such a suggested component layer.

2.1.2 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
- any important host utilities like
 - iptables, socat and du.

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:

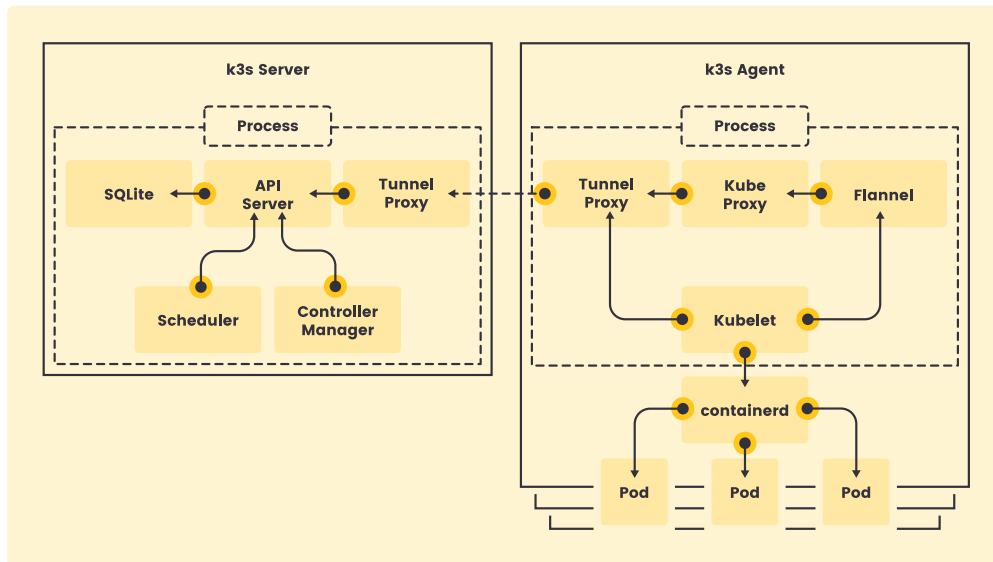



FIGURE 2.3: OVERVIEW OF K3S

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, we also run

- 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.

Learn more information about K3s at <https://k3s.io> 

Given that K3s relies upon being deployed on a Linux operating system, the next section describes that target component layer.

2.1.3 Software - SUSE Linux Enterprise Micro

SUSE Linux Enterprise Micro is built from ground up for edge applications. It leverages the enterprise-hardened technology components of SUSE Linux Enterprise and merges that with what developers want from a modern, immutable OS platform. 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 \(https://www.suse.com/download/sle-micro/\)](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 \(https://scc.suse.com/login\)](https://scc.suse.com/login) .

With the flexibility of SUSE Linux Enterprise Micro, multiple compute platform variants can be considered, as outlined in the next section.


2.1.4 Compute Platform Options

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-premise or hosted by cloud service providers



Tip

Any SUSE YES (<https://www.suse.com/yessearch/>)  certified platform can be used for the nodes of this deployment, as long as the certification refers to the major version of the underlying SUSE operating system required by its release.



Note

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

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3 Deployment

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3.1 Deployment overview


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3.2 Hardware deployment configuration

Leveraging the enterprise grade of the following software components being deployed, many hardware platforms are enabled and can readily be used.



Tip

Any [SUSE YES \(https://www.suse.com/yessearch/\)](https://www.suse.com/yessearch/)  certified platform can be used for the nodes of this deployment, as long as the certification refers to the major version of the underlying SUSE operating system required by its release.

Further, by reviewing the minimum requirements for each of the software layers, in conjunction with the target solution deployment context, the processor, memory, disk and networking aspects can be determined.

3.3 Software deployment configuration

SUSE (<https://www.suse.com>)⁷®, the Open Open Source Company, works with an ecosystem of partners and communities to deliver enterprise-grade, open source software-defined infrastructure and application delivery solutions backed by superior service and support. The leading Linux operating system meets the most widely-adopted enterprise Kubernetes management platform. SUSE and Rancher are now one company!

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Our goal is to give you the freedom to innovate everywhere — from the data center, to the cloud, to the edge and beyond. We are driven by the power of many: everything we do is empowered by the skills, creativity and vision of our employees, partners, customers and community.

By utilizing three products from the SUSE portfolio:

- Operating System - SUSE Linux Enterprise Micro
- Kubernetes - K3s
- Multi-cluster Management - SUSE Rancher

one can build the necessary infrastructure and service to administer and manage multiple Kubernetes clusters. These layered components are described in the following sections.

3.3.1 Operating System Deployment

SUSE Linux Enterprise Micro is built from ground up for edge applications. It leverages the enterprise-hardened technology components of SUSE Linux Enterprise and merges that with what developers want from a modern, immutable OS platform. 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 \(https://www.suse.com/download/sle-micro/\)](https://www.suse.com/download/sle-micro/)⁷ or if the organization already has subscriptions, both install media and updates can be obtained from [SUSE Customer Center \(https://sc-c.suse.com/login\)](https://sc-c.suse.com/login)⁷.

To accomodate many options of underlying physical or virtualization hosts, this operating system supports a vast breadth of platforms and component resources. Further, it provides the core functionality for the next layer of Kubernetes-based infrastructure software.

The installation process is described and can be performed, per the product documentation, by following:

- the {pn_SLE-Micro_InstallationDocURL}[Installation Quick Start] for
 - manual installation
 - raw image deployment
- or {pn_SLE-Micro_AutoYaSTDocURL}[AutoYaST Guide] for unattended installations

TIP

An additional consideration is, for the first node deployed, to create an additional IP address on the host network interface card. This can be used for the SUSE Rancher access, which may also become managed by a load-balancer if a multi-node cluster becomes the base.

3.3.2 Kubernetes Deployment

This design leverage the {k8sName} Kubernetes distribution. {k8sName} is a highly available, CNCF certified Kubernetes distribution capable of deploying any Kubernetes production workload. {k8sName} is packaged as a single binary with minimal software dependencies. This significantly reduces the expertise and effort required install, run, and maintain a production ready Kubernetes cluster.

For this deployment, a single server installed with the {osName} immutable operating system will support a single instance of {k8sName}. For maximum flexibility, {k8sName} will be deployed in a manner that would allow expanding the single-node cluster into a highly available, three-node Kubernetes cluster. This will be only slightly more complex than the one-line, 45 second (`curl -sL https://get.k3s.io | sh -`) minimal installation method of {k8sName}.

While it is highly recommended that Kubernetes workloads (in this case the SUSE Rancher) be isolated from the Kubernetes control-plane and data-plane; this design will maintain all functions, including the {porfolioName} Server, on the server node. In this specialized case, the SUSE

Rancher workload is a known quantity and no other workloads will be run on this Kubernetes cluster. For this reason the SUSE Rancher cluster is more closely aligned with appliance model best practices.

The primary steps for deploying this single node {k8sName} cluster are: 1. (Optional) Provide the server with one extra IP address that will be used as the primary address for accessing the {k8sName} cluster API server. This will allow the cluster to grown beyond a single server node. It is not neccessary if there will be an external load balancer used to access the cluster, or if the cluster will never be grown beyond a single server node. 2. Download the appropriate version of the {k8sName} binary from: <https://github.com/rancher/k3s/releases/latest> 3. Download the installation script from: <https://get.k3s.io> 4. Install {k8sName} with embedded etcd enabled

STEP 2: DOWNLOAD THE APPROPRIATE VERSION OF THE {K8SNAME} BINARY:

- Set this variable with the desired version of {k8sName}
 - At the time of writing, the most current, supported version of {k8sName} for SUSE Rancher is 1.20.4. Verify the supported versions at: <https://rancher.com/support-maintenance-terms/>

```
{k8sName}_VERSION=""
```

```
wget https://github.com/k3s-io/k3s/releases/download/v${k8sName}_VERSION%2Bk3s1/k3s
sudo mv k3s /usr/local/bin/
sudo chmod 755 /usr/local/bin/k3s
```

Step 3: Download the installation script:

```
curl -sfL https://get.k3s.io > install.sh
```

```
chmod 755 install.sh
```

Step 4: Install {k8sName} with embedded etcd enabled:

```
INSTALL_K3S_SKIP_DOWNLOAD=true INSTALL_K3S_EXEC='server --cluster-init --write-
```

```
kubeconfig-mode=644' ./install.sh
```

- Verify the installation has completed: kubectl get pods -A -w

*

- Use Ctrl + c to exit the watch loop after all pods are running

3.3.3 SUSE Rancher Deployment

SUSE Rancher is a complete solution for managing Kubernetes clusters and Kubernetes applications. It addresses the operational and security challenges of managing multiple Kubernetes clusters and applications across any infrastructure. SUSE Rancher streamlines Kubernetes cluster management on bare metal servers, private clouds, and vSphere environments; from the datacenter to the edge. SUSE Rancher unites all of your Kubernetes clusters with global security policies, centralized authentication, access control and observability.

As SUSE Rancher server is a native Kubernetes application, it will run on the single-node {k8s-Name} cluster. In instances where a load balancer is used to support the {k8sName} cluster, deploying two additional {k8sName} cluster nodes will automatically make SUSE Rancher highly available. SUSE Rancher uses the {k8sName} etcd key/value store to persist its data, which offers several advantages. Additional, highly available, storage isn't needed to make SUSE Rancher highly available. In addition, backing up the {k8sName} etcd store protects the cluster as well as the installation of SUSE Rancher.

4 Deployment considerations

FixMe - Elaborate further on best practices and day2 considerations for the deployments.

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5 Summary

Using components and offerings from SUSE and the Rancher portfolio streamlines your 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 your 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 management and the infrastructure components.

Modernize

Bring applications and data into modern computing

- With SUSE Rancher, the digital transformation to containerized applications can benefit from the ability both to manage many target clusters, for each of the respective user bases and to facilitate 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.

6 References

WHITEPAPERS

- How to Build an Enterprise Kubernetes Strategy - <https://info.rancher.com/how-to-build-enterprise-kubernetes-strategy>

BOOKS

- Kubernetes Management - <https://info.rancher.com/kubernetes-management-for-dummies-rancher-and-suse-0-0>

TRAINING

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

WEBSITES

- SUSE - <https://www.suse.com>
- SUSE Customer Center (SCC) - <https://scc.suse.com/login>
- Products
 - SUSE Rancher - <https://rancher.com/products/rancher/> (documentation (<https://rancher.com/docs/rancher/v2.x/en/>))
 - Rancher Kubernetes Engine (RKE) - <https://rancher.com/products/rke/> (documentation (<https://rancher.com/docs/rke/latest/en/>))
 - K3s - <https://rancher.com/products/k3s/> (documentation (<https://rancher.com/docs/k3s/latest/en/>))
 - SUSE Linux Enterprise Micro (SLE Micro) - <https://www.suse.com/products/micro/> (documentation (<https://documentation.suse.com/sle-micro/5.0/>))

A Appendix

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A.1 Appendix A: Bill of Materials

Role	Qty	SKU	Component	Notes
System	1-3	n/a	<ul style="list-style-type: none">• Virtual Machine,• Single Board Computer (SBC) or• Industry Standard Server	<p>Configuration</p> <ul style="list-style-type: none">• see requirements (https://rancher.com/docs/rancher/v2.x/en/installation/requirements/#cpu-and-mem-

Role	Qty	SKU	Component	Notes
				ory-for-rancher-before-v2-4-0) 7
Operating System	1-3	874-007864	SUSE Linux Enterprise Micro, <ul style="list-style-type: none"> • x86_64, • 1-16 Cores, • Priority Subscription, • 1 Year 	Configuration: <ul style="list-style-type: none"> • 1x per node (up to 16 cores, stackable)
Kubernetes	1	R-0001-PS1	SUSE Rancher Management Server, <ul style="list-style-type: none"> • x86-64, • 1 Instance, • Priority Subscription, • 1 Year 	Configuration: <ul style="list-style-type: none"> • includes up to 3 nodes of K3s • includes up to 3 nodes of Rancher Kubernetes Engine • includes up to 3 nodes of Rancher Kubernetes Engine Governance



Note

For the software components, other duration of support terms are also available.

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