SUSE

SUSE AI requirements

WHAT?

Hardware, software and networking requirements for successful deployment and operation of SUSE AI.

WHY?

To ensure efficient operation of SUSE AI.

EFFORT

Less than 30 minutes of reading and a basic knowledge of hardware and RKE2 environment.

This page describes the software, hardware and networking requirements for the cluster nodes where you plan to install SUSE AI.

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1 Hardware requirements

For successful deployment and operation, SUSE AI has the same hardware prerequisites as RKE2 cluster.

1.1 Recommended hardware (basic functionality)

RAM

At least 32 GB of RAM per node. This is the minimum recommendation for the control plane node. Additional resources may be needed for the worker nodes based on workload.

CPU

A multi-core processor with the minimum of 4 cores. 8 cores or more may be necessary depending on the cluster scale and application demands.

Disk space

- 50 GB or more is recommended for control plane nodes.

- Additional space for data storage, such as application data or log files, are required depending on the deployment scale and the workloads running on the cluster.

- SSDs or high-speed storage is preferred for faster data access and efficient operation of containerized workloads.

Networking

- A reliable and stable network connection between all nodes in the cluster.

- Cluster nodes need to be able to communicate with each other and access external resources,such as container images or software updates.

- Ensure that all nodes have public IPs or are accessible via VPN or other private network if deploying across multiple data centers.

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1.2   Recommended hardware (for High Availability)

> ❗ **Important**
>
> While 32 GB of RAM is the minimum for basic functionality, a production-grade deployment with high availability, multi-node clusters or running resource-intensive applications like AI/ML workloads might require more.

RAM

64 GB or more per node is recommended for larger clusters or to run applications with high resource demands.

CPU

At least 8 cores, ideally 16 or more cores depending on the expected load.

Disk space

- For larger-scale clusters or persistent storage applications, 100 GB or more of disk space per node might be required.

- Using high-performance SSDs is recommended, especially for workloads with high I/O requirements such as databases or AI/ML model training.

Networking

Ensure a low-latency, high-throughput network for efficient communication between nodes, especially if deploying in multi-region or multi-cloud environments.

> 💡 **Tip**
>
> For more detailed and specific hardware recommendations, refer to the official RKE2 installation requirements documentation at https://docserv.suse.de:8085/cloudnative/rke2/latest/en/install/requirements.html ↗

2   GPU hardware

To run AI/ML workloads such as training machine learning models or running inference workloads, deploy cluster nodes with compatible NVIDIA GPUs to gain acceleration.

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2.1 Using the NVIDIA GPU Operator

Configuring and managing nodes with hardware resources can require multiple configurations for software components. These include drivers, container runtimes and libraries. To use NVIDIA GPUs in a Kubernetes cluster, you need to configure the NVIDIA GPU Operator. Because GPU is a special resource in the cluster, you need to install the following components to enable deployment of workloads for processing on the GPU.

- NVIDIA drivers (to enable CUDA)

- Kubernetes device plug-in

- Container runtime

- Other tools to provide capabilities such as monitoring or automatic node labelling.

To ensure that the NVIDIA GPU Operator is installed correctly, the Kubernetes cluster must meet the following prerequisites:

- All worker nodes must run the same operating system version to use the NVIDIA GPU Driver container.

- Nodes must be configured with a container engine such as Docker (CE/EE), containerd, or Podman.

- Nodes should be equipped with NVIDIA GPUs.

- Nodes should have NVIDIA drivers installed.

2.2 Supported GPUs

The NVIDIA GPU Operator is compatible with a range of NVIDIA GPUs. For a full list of supported GPUs, refer to NVIDIA GPU Operator Platform Support (https://docs.nvidia.com/datacenter/cloud-native/gpu-operator/latest/platform-support.html) ↗ .

3 Application-specific requirements

The SUSE AI stack consists of multiple applications. We recommend running each application on nodes that meet or exceed the corresponding hardware requirements.

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3.1 Milvus hardware and software requirements

This topic describes requirements for the Milvus application.

3.1.1 Hardware requirements

3.1.1.1 Minimum requirements

The following requirements are for basic Milvus deployment on a single node or a small scale.

RAM

A minimum of 32 GB of RAM.

CPU

At least 8 CPU cores.

Disk space

At least 100 GB of storage, preferably SSD.

Networking

A stable connection with 1 Gbps network bandwidth.

3.1.1.2 Recommended hardware for large-scale workloads

The following requirements are for multi-node Milvus clusters or heavy workloads, such as large vector databases.

RAM

A minimum of 64 GB of RAM per node.

CPU

8-16 CPU cores per node or more.

Disk space

500 GB or more of high-speed storage, ideally SSD or NVMe SSD.

Networking

10 Gbps Ethernet or faster for high-performance clusters.

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3.1.1.3 CPU instruction set requirements

The following CPU instruction sets are required for Milvus:

- SSE4.2

- AVX

- AVX2

- AVX-512

3.1.2 Software requirements

Running Milvus requires specific versions of the following software:

Kubernetes

>   SUSE supported versions of RKE2 that use Kubernetes 1.18 or higher.

Helm

>   The recommended version is 3.5.0 or later.

3.1.3 Additional considerations

Disk and storage

- **Storage type:** SSDs or NVMe SSDs are highly recommended for fast read/write access to large datasets and high-performance vector retrieval.

- **Metadata and data storage:** For large-scale deployments, ensure that metadata and vector data is stored on fast disks (SSD or NVMe).

Network

>   For high-performance clusters, especially for large-scale deployments, ensure high-bandwidth network connectivity between nodes.

3.1.4 For more information

For more detailed and specific hardware recommendations, please refer to the official Milvus (https://milvus.io/docs/prerequisite-helm.md) ↗ and pre-requisite docker (https://milvus.io/docs/v2.1.x/prerequisite-docker.md) ↗ documentation.

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3.2 Ollama hardware and software requirements

The version of Ollama provided with SUSE AI is optimized for NVIDIA GPU hardware. This section guides you through the steps for configuring Ollama on an NVIDIA-enabled system, including necessary configurations for both the hardware and software.

💡 Tip: General recommendations

- **Run Ollama on NVIDIA GPU nodes.** Since Ollama is GPU-optimized, utilizing the power of NVIDIA GPUs is essential for maximum performance. This ensures that the application runs efficiently and makes full use of the hardware capabilities.

- **Assign applications to specific nodes.** SUSE AI provides a mechanism to assign applications such as Ollama to specific nodes. For more details on how to assign applications to nodes, refer to

3.2.1 Hardware requirements

NVIDIA GPU

- The recommended GPU models include Tesla, A100, V100, RTX 30 series, or other compatible NVIDIA GPUs.

- Ensure that the CUDA Compute Capability of your GPU is compatible with the required version of Ollama.

RAM

At least 16 GB of RAM is recommended. However, higher amounts (32 GB or more) may be necessary for larger models or workloads.

Disk space

At least 50 GB of free disk space is recommended for storing the container images and any data files processed by Ollama.

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3.2.2 Software requirements

NVIDIA Docker (nvidia-docker)

- You must install `nvidia-docker` (the NVIDIA Container Toolkit) to allow Docker containers to use the GPU. Refer to https://docserv.suse.de:8085/suse-ai/1.0/html/ NVIDIA-Operator-installation/index.html ↗ for more details.

CUDA Toolkit

You must install the CUDA version supported by your GPU model. For most recent GPUs, CUDA 11.0 or later is required. Refer to CUDA Toolkit installation guide (https://developer.nvidia.com/cuda-toolkit) ↗ for more details.

NVIDIA driver

Install the NVIDIA driver compatible with your GPU model. Its version must be compatible with the installed CUDA toolkit.

> ### Tip
> You can check your GP driver version by running the `nvidia-smi` command.

3.3 Open WebUI hardware and software requirements

While Open WebUI has no specific hardware dependencies beyond those of the underlying platform, consider the following guidelines for optimal performance.

- Because Open WebUI shares most dependencies with Milvus and Ollama, follow the hardware requirements mentioned in Milvus requirements (https://docserv.suse.de:8085/suse-ai/1.0/html/AI-requirements/index.html#ai-requirements-milvus) ↗ and Ollama requirements (https://docserv.suse.de:8085/suse-ai/1.0/html/AI-requirements/index.html#ai-requirements-ollama) ↗

- Stable network connection is essential, particularly if Open WebUI is integrated with other services or databases. Ensure sufficient bandwidth for Web traffic and API calls.

- For interacting with the Open WebUI interface, use standard Web browsers such as Google Chrome, Mozilla Firefox or Microsoft Edge.

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3.4 Apache Pulsar software requirements

Installation of Apache Pulsar and its dependencies may require updating the SELinux policy as follows:

1. Create a new file with the `.te` extension, for example, `pulsar.te`, with the following content:

```
module pulsar 1.0;

require {
    type unconfined_service_t;
    class process execstack;
}

#============= unconfined_service_t ==============

# this AVC can be allowed using the boolean 'selinuxuser_execstack'
allow unconfined_service_t self:process execstack;
```

2. Use the **checkmodule** and **semodule_package** commands to compile and package the `pulsar.te` file into a loadable module.

```
> checkmodule -M -m -o pulsar.mod pulsar.te
semodule_package -o pulsar.pp -m pulsar.mod
```

3. Load the `pulsar.pp` module to apply the policy.

```
> sudo semodule -i pulsar.pp
```

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Glossary

AI

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are designed to learn and solve problems like humans. AI enables computers to understand language, making decisions, and improving from experience.

GenAI

Generative AI (GenAI) is a type of artificial intelligence that can create new content such as text, images or music.

NLG

Natural Language Generation (NLG) is a process of automatically generating human-like text from structured data or other forms of input. NLG systems are designed to convert raw data into coherent and meaningful language easily understood by humans.

NLU

Natural Language Understanding (NLU) is a process the AI uses to analyze and understand the meaning of the input query.

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