Technical Report

NetApp AIPod Mini

Enterprise RAG Inferencing with NetApp and Intel

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In partnership with

Abstract

This paper presents a validated reference design of NetApp® AIPod for Enterprise RAG with technologies and combined capabilities of Intel® Xeon® 6 processors and NetApp data management solutions. The solution demonstrates a downstream ChatQnA application leveraging a large language model, providing accurate, contextually relevant responses to concurrent users. The responses are retrieved from an organization’s internal knowledge repository through an air-gapped RAG inferencing pipeline.

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Executive Summary

A growing number of organizations are leveraging retrieval-augmented generation (RAG) applications and large language models (LLMs) to interpret user prompts and generate responses to increase productivity and business value. These prompts and responses can include text, code, images, or even therapeutic protein structures retrieved from an organization's internal knowledge base, data lakes, code repositories, and document repositories. This paper covers the reference design of the NetApp® AIPod™ Mini solution, comprising NetApp AFF storage and compute servers with Intel® Xeon® 6 processors. It includes NetApp ONTAP® data management software combined with Intel® Advanced Matrix Extensions (Intel® AMX), and Intel® AI for Enterprise Retrieval-augmented Generation (RAG) software built on Open Platform for Enterprise AI (OPEA). The NetApp AIPod Mini for enterprise RAG enables organizations to augment a public LLM into a private generative AI (GenAI) inferencing solution. The solution demonstrates efficient and cost-effective RAG inferencing at enterprise scale, designed to enhance reliability and provide you with better control over your proprietary information.

Intel storage partner validation

Servers powered by Intel Xeon 6 processors are built to handle demanding AI inferencing workloads, using Intel AMX for maximum performance. To enable optimal storage performance and scalability, the solution has been successfully validated using NetApp ONTAP, enabling enterprises to meet the needs of RAG applications. This validation was conducted on servers featuring Intel Xeon 6 processors. Intel and NetApp have a strong partnership focused on delivering AI solutions that are optimized, scalable, and aligned with customer business requirements.

Advantages of running RAG systems with NetApp

RAG applications involve retrieval of knowledge from companies document repositories in various types such as PDF, text, CSV, Excel, or knowledge graphs. This data is normally stored in solutions such as an S3 object storage or NFS on-premises as the source for data. NetApp has been a leader in data management, data mobility, data governance, and data security technologies across the ecosystem of edge, data center, and cloud. NetApp ONTAP data management provides enterprise-grade storage to support various types of AI workloads, including batch and real-time inferencing, and offers some of the following benefits:

- **Velocity and scalability.** You can handle large datasets at high velocity for versioning with the ability to scale performance and capacity independently.
- **Data access.** Multiprotocol support allows client applications to read data using S3, NFS, and SMB file-sharing protocols. ONTAP S3 NAS buckets can facilitate data access in multimodal LLM inference scenarios.
- **Reliability and confidentiality.** ONTAP provides data protection, built-in NetApp Autonomous Ransomware Protection (ARP), and dynamic provisioning of storage, and it offers both software- and hardware-based encryption to enhance confidentiality and security. ONTAP is compliant with FIPS 140-2 for all SSL connections.

Target audience

This document is intended for AI decision makers, business leaders, data engineers, AI engineers and departmental executives who want to take advantage of an infrastructure built to deliver enterprise RAG and GenAI solutions. Prior knowledge of AI inferencing, LLMs, Kubernetes, Microservices, n-tier application architectures, APIs, networking and its components will help during the implementation phase.

Technology requirements

Hardware

Intel AI technologies

With Xeon 6 as a host CPU, accelerated systems benefit from high single-thread performance; higher memory bandwidth; improved reliability, availability, and serviceability (RAS); and more I/O lanes. Intel AMX accelerates inferencing for INT8 and BF16 and offers support for FP16-trained models, with up to 2,048 floating-point operations per cycle per core for INT8 and 1,024 floating-point operations per cycle per core for BF16/FP16. To deploy a RAG solution using Xeon 6 processors, a minimum RAM of 250GB and 500GB disk space is generally recommended. However, this is highly dependent on the LLM model size. For more information, refer to the Intel Xeon 6 processor product brief.

Figure 1) Compute server with Intel Xeon 6 processors.

NetApp AFF storage

The entry-level and mid-level NetApp AFF A-Series systems offer more powerful performance, density, and greater efficiency. NetApp AFF A20, AFF A30, and AFF A50 systems provide true unified storage that supports block, file, and object, based on a single OS that can seamlessly manage, protect, and mobilize data for RAG applications at the lowest cost across hybrid cloud**.**

Figure 2) NetApp AFF A-Series system.

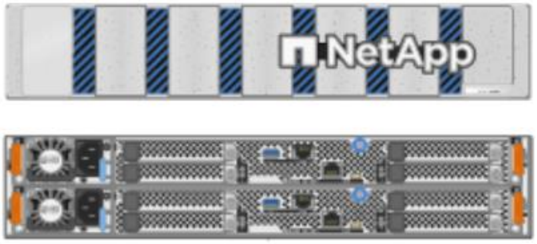


Table 1) Hardware requirements.

Hardware	Quantity	Comment
Server with Intel Xeon 6 processors	2	RAG inferencing nodes—with dual socket Intel Xeon 6900-series or Intel Xeon 6700-series processors and 250GB to 3TB RAM with DDR5(6400MHz) or MRDIMM (8800MHz). 2U server.
Control plane server with Intel processor	1	Kubernetes control plane/1U server.
Choice of 100Gb Ethernet switch	1	Data center switch.
NetApp AFF A20 (Or AFF A30; AFF A50)	1	Maximum storage capacity: 9.3PB. **Note:** Networking: 10/25/100 GbE ports.

For the validation of this reference design, servers with Intel Xeon 6 processors from Supermicro (222HA-TN-OTO-37) and a 100GbE switch from Arista (7280R3A) were used.

Software

Open Platform for Enterprise AI

The Open Platform for Enterprise AI (OPEA) is an open-source initiative led by Intel in collaboration with ecosystem partners. It provides a modular platform of composable building blocks designed to accelerate the development of cutting-edge generative AI systems, with a strong focus on RAG.

OPEA includes a comprehensive framework featuring LLMs, datastores, prompt engines, RAG architectural blueprints, and a four-step evaluation method that assesses generative AI systems based on performance, features, trustworthiness, and enterprise readiness.

At its core, OPEA comprises two key components:

- **GenAIComps:** a service-based toolkit made up of microservice components
- **GenAIExamples:** ready-to-deploy solutions like ChatQnA that demonstrate practical use cases

For more details, see the OPEA Project Documentation.

Intel AI for Enterprise inference powered by OPEA

OPEA for Intel® AI for Enterprise RAG simplifies transforming your enterprise data into actionable insights. Powered by Intel Xeon processors, it integrates components from industry partners to offer a streamlined approach to deploying enterprise solutions. It scales seamlessly with proven orchestration frameworks, providing the flexibility and choice your enterprise needs.

Building on the foundation of OPEA, Intel AI for Enterprise RAG extends this base with key features that enhance scalability, security, and user experience. These features include service mesh capabilities for seamless integration with modern service-based architectures, production-ready validation for pipeline reliability, and a feature-rich UI for RAG as a service, enabling easy management and monitoring of workflows. Additionally, Intel and partner support provide access to a broad ecosystem of solutions, combined with integrated Identity and Access Management (IAM) with UI and applications for secure and compliant operations. Programmable guardrails provide fine-grained control over pipeline behavior, enabling customized security and compliance settings.

NetApp ONTAP

NetApp ONTAP is the foundational technology that underpins NetApp's critical data storage solutions. ONTAP includes various data management and data protection features, such as automatic ransomware protection against cyberattacks, built-in data transport features, and storage efficiency capabilities. These benefits apply to a range of architectures, from on-premises to hybrid multicloud in NAS, SAN, object, and software-defined storage for LLM deployments. You can use an ONTAP S3 object storage server in an ONTAP cluster for deploying RAG applications, taking advantage of the storage efficiencies and security of ONTAP, provided through authorized users and client applications. For more information, refer to Learn about ONTAP S3 configuration.

NetApp Trident

NetApp Trident™ software is an open-source and fully supported storage orchestrator for containers and Kubernetes distributions, including Red Hat OpenShift. Trident works with the entire NetApp storage portfolio, including the NetApp ONTAP and it also supports NFS and iSCSI connections. For more information, refer to NetApp Trident on Git.

Table 2) Software requirements.

Software	Version	Comment
OPEA for Intel AI for Enterprise RAG	1.1.2	Enterprise RAG platform based on OPEA microservices
Container Storage Interface (CSI driver)	NetApp Trident 25.02	Enables dynamic provisioning, NetApp Snapshot™ copies, and volumes.
Ubuntu	22.04.5	OS on two-node cluster
Container orchestration	Kubernetes 1.31.4	Environment to run RAG framework
ONTAP	ONTAP 9.16.1P4	Storage OS on AFF A20. It features Vscan and ARP.

Solution deployment

Software stack

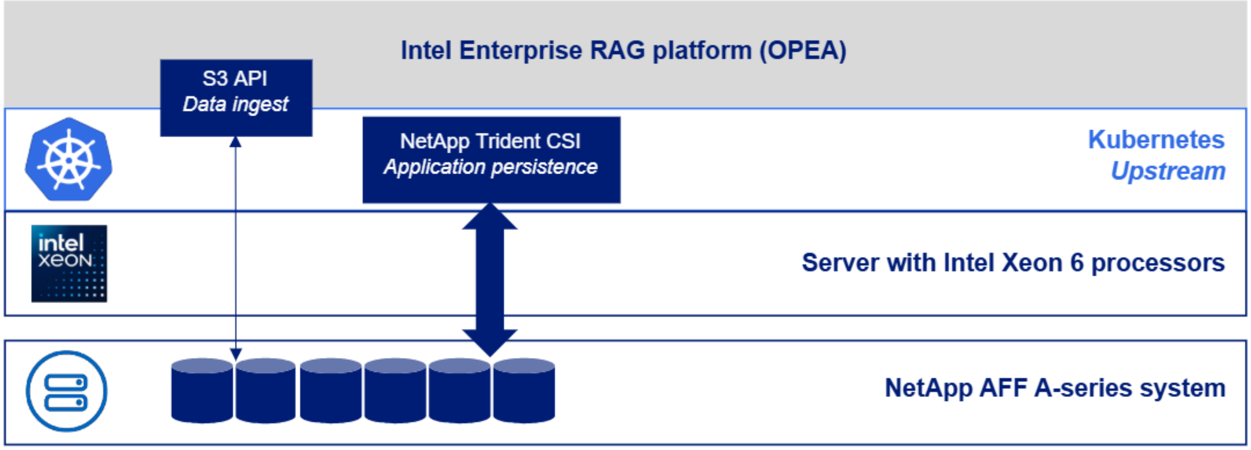
The solution is deployed on a Kubernetes cluster consisting of Intel Xeon–based app nodes. At least three nodes are required to implement basic high availability for the Kubernetes control plane. We validated the solution using the following cluster layout.

Table 3) Kubernetes cluster layout.

Node	Role	Quantity
Servers with Intel Xeon 6 processors and 1TB RAM	App node, control plane node	2
Generic server	Control plane node	1

The following figure depicts a “software stack view” of the solution.

Figure 3) Reference design for Enterprise RAG with NetApp and Intel.


Intel Enterprise RAG platform (OPEA)
S3 API
Data ingest
NetApp Trident CSI
Application persistence
Kubernetes
Upstream
intel
xeon
Server with Intel Xeon 6 processors
NetApp AFF A-series system

Deployment steps

Deploy ONTAP storage appliance

Deploy and provision your NetApp ONTAP storage appliance. Refer to the ONTAP hardware systems documentation for details.

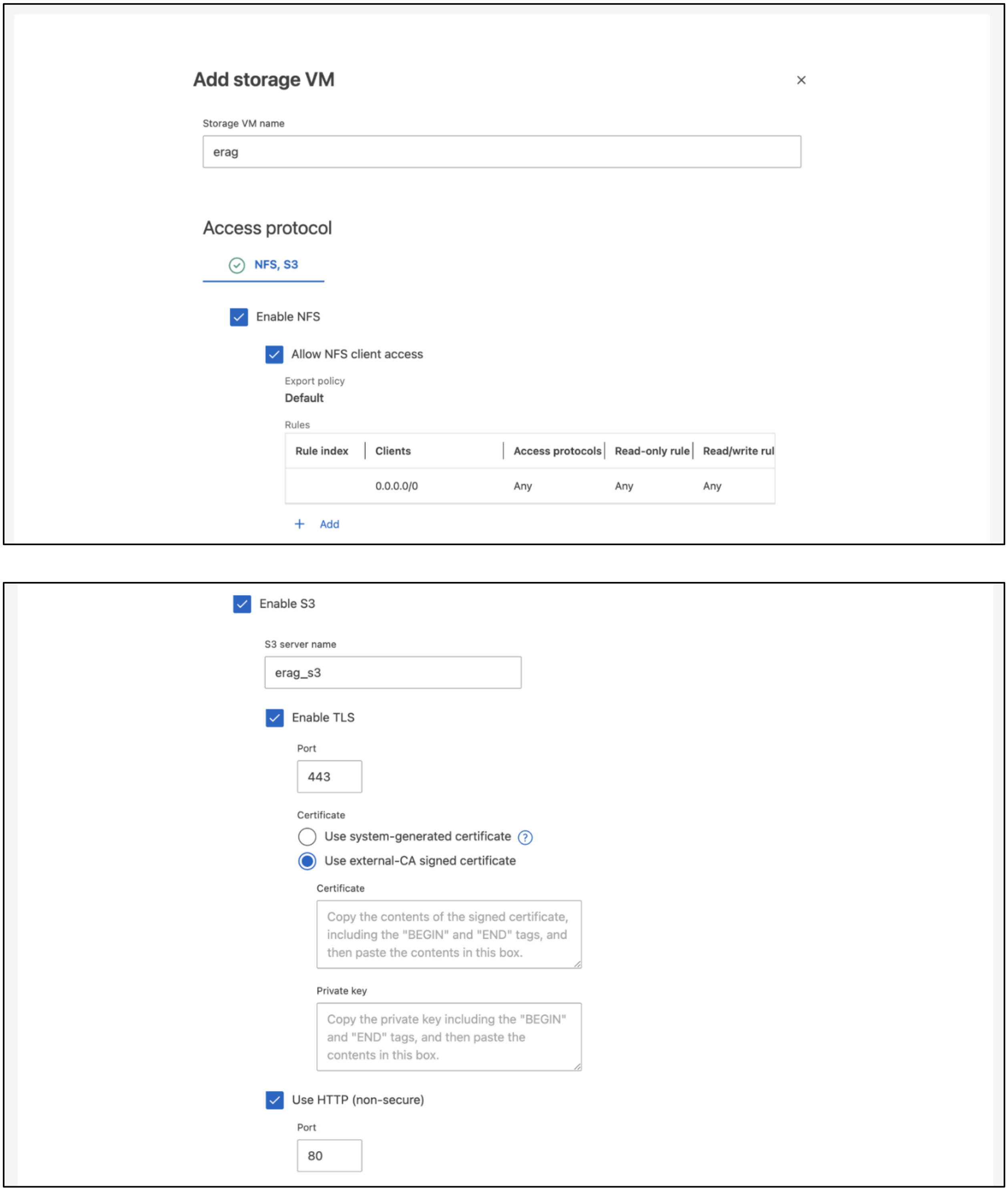
Configure an ONTAP SVM for NFS and S3 access

Configure an ONTAP storage virtual machine (SVM) for NFS and S3 access on a network that is accessible by your Kubernetes nodes.

To create an SVM using ONTAP System Manager, navigate to Storage > Storage VMs, and click the + Add button. When enabling S3 access for your SVM, choose the option to use an external-CA (certificate authority) signed certificate, not a system-generated certificate. You can use either a self-signed certificate or a certificate that is signed by a publicly trusted CA. For additional details, refer to the ONTAP documentation.

The following screenshot depicts the creation of an SVM using ONTAP System Manager. Modify details as needed based on your environment.

Figure 4) SVM creation using ONTAP System Manager.



Add storage VM ×

Storage VM name

erag

Access protocol

NFS, S3

☑ Enable NFS

☑ Allow NFS client access

Export policy
Default

Rules

Rule index	Clients	Access protocols	Read-only rule	Read/write rul
	0.0.0.0/0	Any	Any	Any

+ Add

☑ Enable S3

S3 server name

erag_s3

☑ Enable TLS

Port

443

Certificate

○ Use system-generated certificate ?

● Use external-CA signed certificate

Certificate

Copy the contents of the signed certificate, including the "BEGIN" and "END" tags, and then paste the contents in this box.

Private key

Copy the private key including the "BEGIN" and "END" tags, and then paste the contents in this box.

☑ Use HTTP (non-secure)

Port

80

Configure S3 permissions

Configure S3 user/group settings for the SVM that you created in the previous step. Make sure you have a user with full access to all S3 API operations for that SVM. Refer to the ONTAP S3 documentation for details.

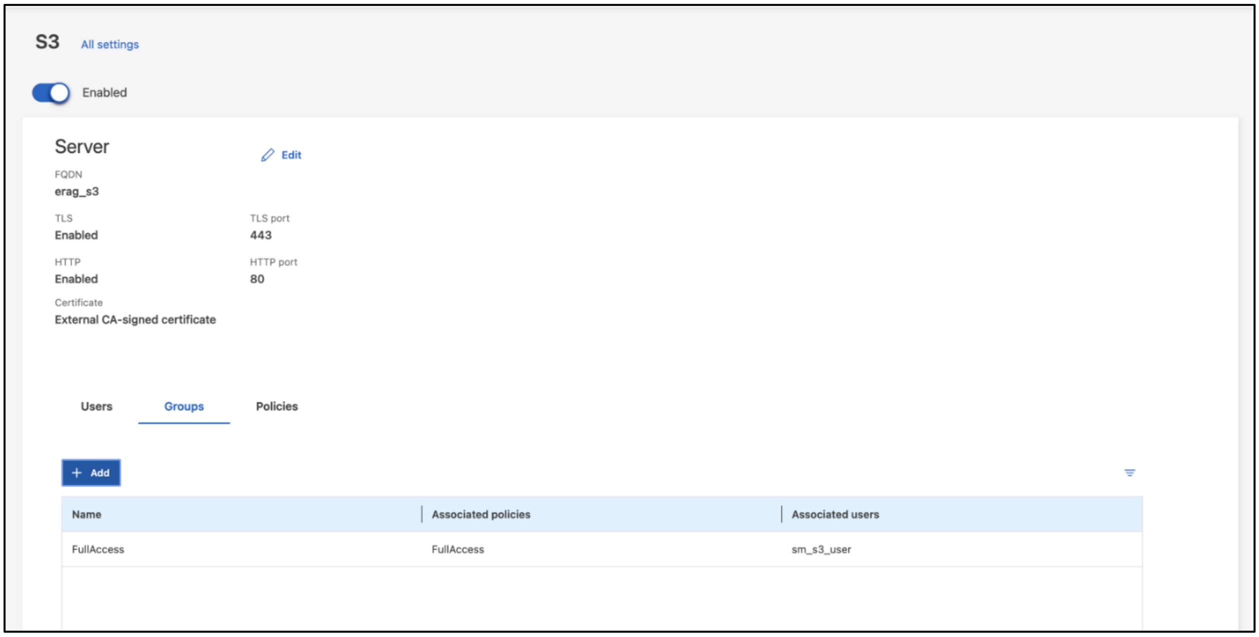
Note: This user will be needed for the Intel AI for Enterprise RAG application's data ingest service.

If you created your SVM using ONTAP System Manager, System Manager will have automatically created a user named `sm_s3_user` and a policy named `FullAccess` when you created your SVM, but no permissions will have been assigned to `sm_s3_user`.

To edit permissions for this user, navigate to Storage > Storage VMs, click the name of the SVM that you created in the previous step, click Settings, and then click the pencil icon next to "S3."

To give `sm_s3_user` full access to all S3 API operations, create a new group that associates `sm_s3_user` with the `FullAccess` policy as depicted in the following screenshot.

Figure 5) S3 permissions.



Enabled

Server

FQDN: erag_s3

TLS: Enabled

TLS port: 443

HTTP: Enabled

HTTP port: 80

Certificate: External CA-signed certificate

Name	Associated policies	Associated users
FullAccess	FullAccess	sm_s3_user

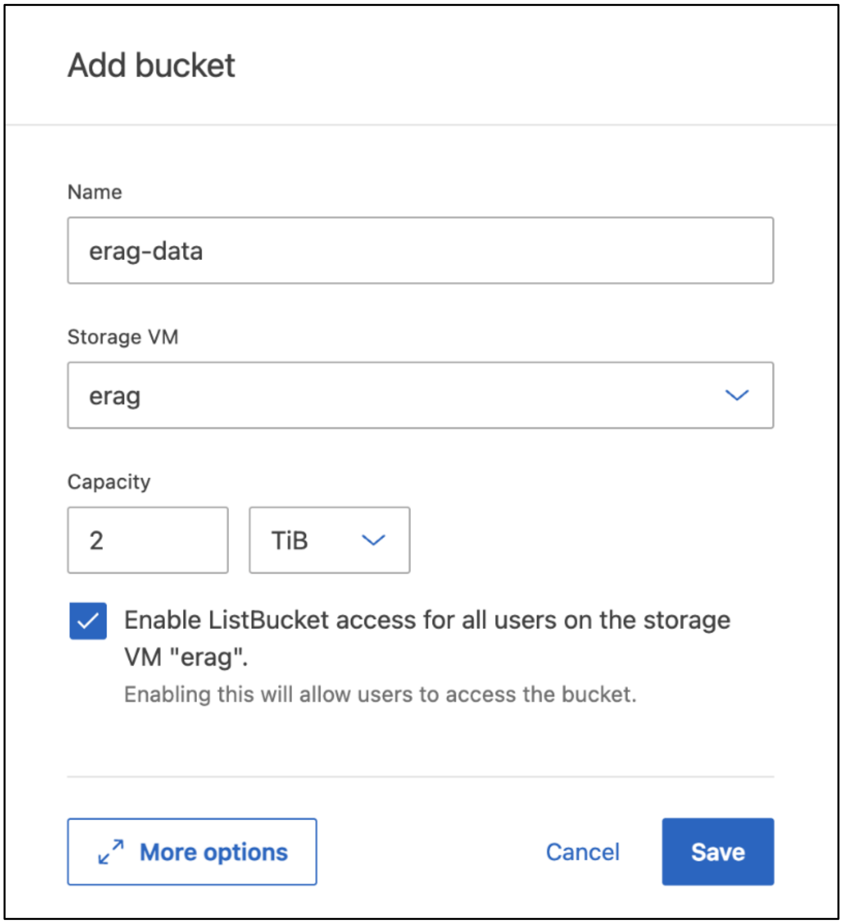
Create an S3 bucket

Create an S3 bucket within the SVM that you created previously.

To create an SVM using ONTAP System Manager, navigate to Storage > Buckets, and click the + Add button. For additional details, refer to the [ONTAP S3 documentation](https://docs.netapp.com/).

The following screenshot depicts the creation of an S3 bucket using ONTAP System Manager.

Figure 6) Create an S3 bucket.



Add bucket

Name

erag-data

Storage VM

erag

Capacity

2 TiB

☑ Enable ListBucket access for all users on the storage VM "erag".

Enabling this will allow users to access the bucket.

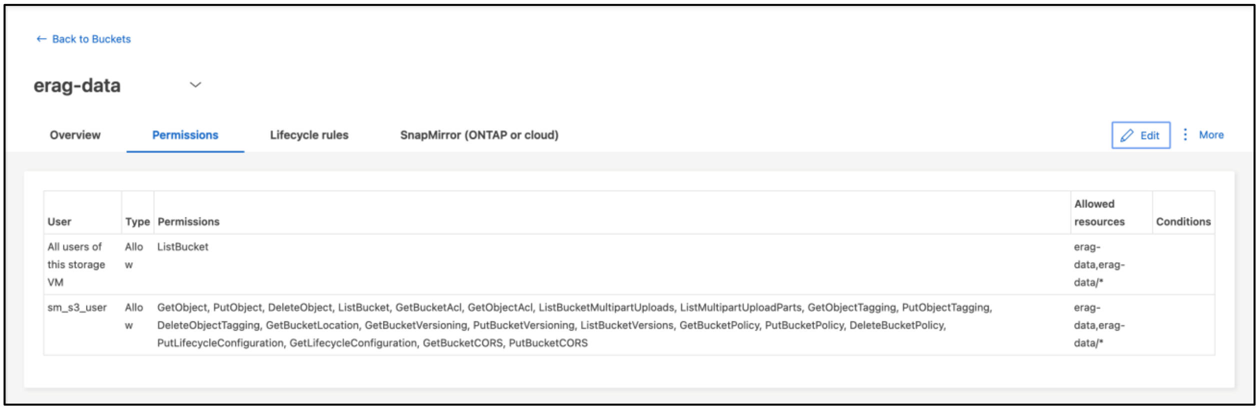
Configure S3 bucket permissions

Configure permissions for the S3 bucket that you created in the previous step. Ensure that the user you configured in a prior step has the following permissions: `GetObject`, `PutObject`, `DeleteObject`, `ListBucket`, `GetBucketAcl`, `GetObjectAcl`, `ListBucketMultipartUploads`, `ListMultipartUploadParts`, `GetObjectTagging`, `PutObjectTagging`, `DeleteObjectTagging`, `GetBucketLocation`, `GetBucketVersioning`, `PutBucketVersioning`, `ListBucketVersions`, `GetBucketPolicy`, `PutBucketPolicy`, `DeleteBucketPolicy`, `PutLifecycleConfiguration`, `GetLifecycleConfiguration`, `GetBucketCORS`, `PutBucketCORS`.

To edit S3 bucket permissions using ONTAP System Manager, navigate to Storage > Buckets, click the name of your bucket, click Permissions, and then click Edit. Refer to the ONTAP S3 documentation for additional details.

The following screenshot depicts the necessary bucket permissions in ONTAP System Manager.

Figure 7) S3 bucket permissions.



User	Type	Permissions	Allowed resources	Conditions
All users of this storage VM	Allow	ListBucket	erag-data,erag-data/*	
sm_s3_user	Allow	GetObject, PutObject, DeleteObject, ListBucket, GetBucketAcl, GetObjectAcl, ListBucketMultipartUploads, ListMultipartUploadParts, GetObjectTagging, PutObjectTagging, DeleteObjectTagging, GetBucketLocation, GetBucketVersioning, PutBucketVersioning, ListBucketVersions, GetBucketPolicy, PutBucketPolicy, DeleteBucketPolicy, PutLifecycleConfiguration, GetLifecycleConfiguration, GetBucketCORS, PutBucketCORS	erag-data,erag-data/*	

Create bucket cross-origin resource sharing rule

Using the ONTAP CLI, create a bucket cross-origin resource sharing (CORS) rule for the bucket that you created in a previous step:

```
ontap::> bucket cors-rule create -vserver erag -bucket erag-data -allowed-origins *erag.com -
allowed-methods GET,HEAD,PUT,DELETE,POST -allowed-headers *
```

This rule allows OPEA for Intel AI for Enterprise RAG web application to interact with the bucket from within a web browser.

Deploy servers

Deploy your servers and install Ubuntu 22.04 LTS on every server.

After Ubuntu is installed, install the NFS utilities on every server. To install the NFS utilities, run the following command:

```
 apt-get update && apt-get install nfs-common
```

Install Kubernetes

Install Kubernetes on your servers using Kubespray. Refer to the Kubespray documentation for details.

Install Trident CSI driver

Install the NetApp Trident CSI driver in your Kubernetes cluster. Refer to the Trident installation documentation for details.

Create a Trident back end

Create a Trident back end for the SVM that you created previously. When creating your back end, use the `ontap-nas` driver. Refer to the Trident back-end documentation for details.

Create a storage class

Create a Kubernetes storage class corresponding to the Trident back end that you created in the previous step. Refer to the Trident storage class documentation for details.

OPEA for Intel AI for Enterprise RAG

Install OPEA for Intel AI for Enterprise RAG in your Kubernetes cluster. Refer to the Intel AI for Enterprise RAG deployment documentation for details. Be sure to take note of the required configuration file modifications that are described later in this paper. You must make these modifications before executing the installation playbook in order for the Intel AI for Enterprise RAG application to work correctly with your ONTAP storage system.

Enable use of ONTAP S3

When installing OPEA for Intel AI for Enterprise RAG, edit your main configuration file to enable use of ONTAP S3 as your source data repository.

To enable use of ONTAP S3, set the following values within the `edp` section.

Note: By default, the Intel AI for Enterprise RAG application ingests data from all existing buckets in your SVM. If you have multiple buckets in your SVM, you can modify the `bucketNameRegexFilter` field so that data is ingested only from certain buckets.

```
edp:
  enabled: true
  namespace: edp
  dpGuard:
    enabled: false
  storageType: s3compatible
  s3compatible:
    region: "us-east-1"
    accessKeyId: "<your_access_key>"
    secretAccessKey: "<your_secret_key>"
    internalUrl: "https://<your_ONTAP_S3_interface>"
    externalUrl: "https://<your_ONTAP_S3_interface>"
    bucketNameRegexFilter: ".*"
```

Configure scheduled synchronization settings

When installing the OPEA for Intel AI for Enterprise RAG application, enable `scheduledSync` so that the application automatically ingests new or updated files from your S3 buckets.

When `scheduledSync` is enabled, the application automatically checks your source S3 buckets for new or updated files. Any new or updated files that are found as part of this synchronization process are automatically ingested and added to the RAG knowledge base. The application checks your source buckets based on a preset time interval. The default time interval is 60 seconds, meaning that the application checks for changes every 60 seconds. You might want to change this interval to suit your specific needs.

To enable `scheduledSync` and set the synchronization interval, set the following values in `deployment/components/edp/values.yaml`:

```
celery:
  config:
    scheduledSync:
      enabled: true
      syncPeriodSeconds: "60"
```

Change volume access modes

In `deployment/components/gmc/microservices-connector/helm/values.yaml`, for each volume in the `pvc` list, change the `accessMode` to `ReadWriteMany`.

```
pvc:
  modelLlm:
    name: model-volume-llm
    accessMode: ReadWriteMany
    storage: 100Gi
  modelEmbedding:
    name: model-volume-embedding
    accessMode: ReadWriteMany
    storage: 20Gi
  modelReranker:
    name: model-volume-reranker
    accessMode: ReadWriteMany
    storage: 10Gi
  vectorStore:
    name: vector-store-data
    accessMode: ReadWriteMany
    storage: 20Gi
```

(Optional) Disable SSL certificate verification

If you used a self-signed certificate when enabling S3 access for your SVM, you must disable SSL certificate verification. If you used a certificate that is signed by a publicly trusted CA, you can skip this step.

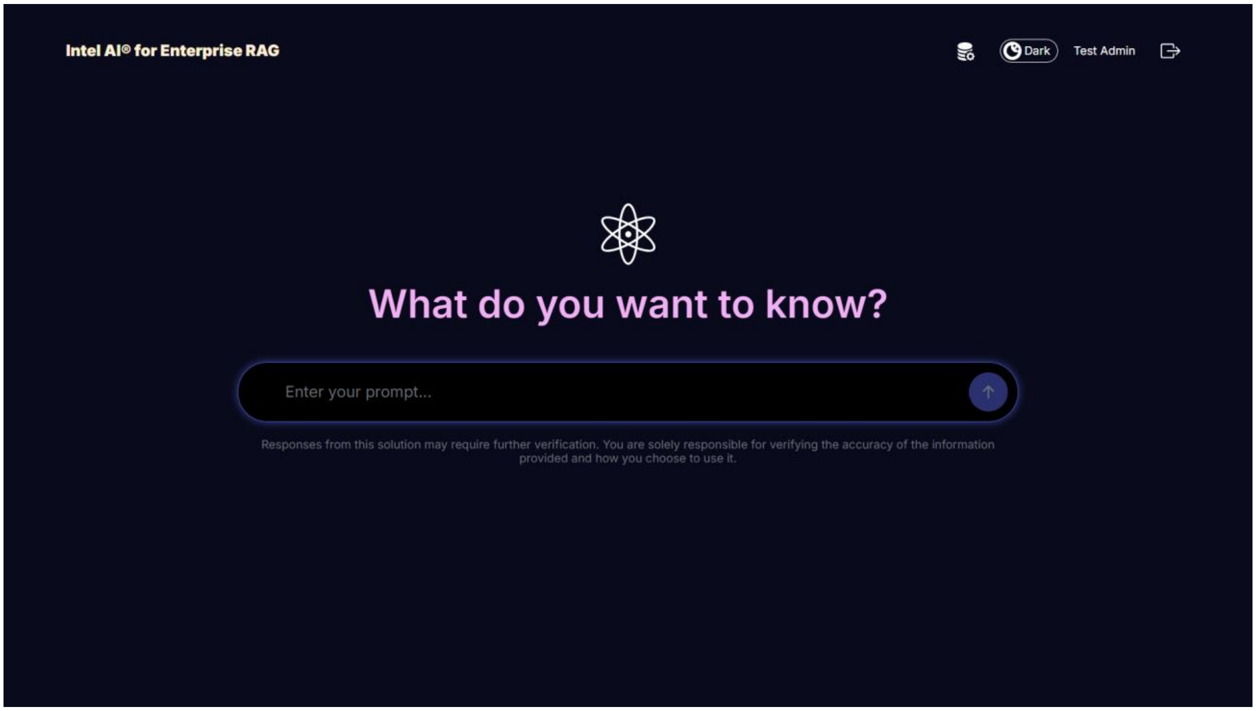
To disable SSL certificate verification, set the following values in `deployment/components/edp/values.yaml`:

```
edpExternalUrl: "https://s3.erag.com"
edpExternalSecure: "true"
edpExternalCertVerify: "false"
edpInternalUrl: "edp-minio:9000"
edpInternalSecure: "true"
edpInternalCertVerify: "false"
```

Access OPEA for Intel AI for Enterprise RAG UI

Access the OPEA for Intel AI for Enterprise RAG UI. Refer to the Intel AI for Enterprise RAG deployment documentation for details.

Figure 8) OPEA for Intel AI for Enterprise RAG UI.



Responses from this solution may require further verification. You are solely responsible for verifying the accuracy of the information provided and how you choose to use it.

Ingest data for RAG

You can now ingest files for inclusion in RAG-based query augmentation. There are multiple options for ingesting files. Choose the appropriate option for your needs.

Note: After a file has been ingested, the OPEA for Intel AI for Enterprise RAG application automatically checks for updates to the file and ingests the updates accordingly.

Option 1: Upload directly to your S3 bucket

To ingest many files at once, we recommend uploading the files to your S3 bucket (the bucket that you created earlier) by using the S3 client of your choice. Popular S3 clients include the AWS CLI, the Amazon SDK for Python (Boto3), s3cmd, S3 Browser, Cyberduck, and Commander One. If the files are of a supported type, any files that you upload to your S3 bucket will be automatically ingested by the OPEA for Intel AI for Enterprise RAG application.

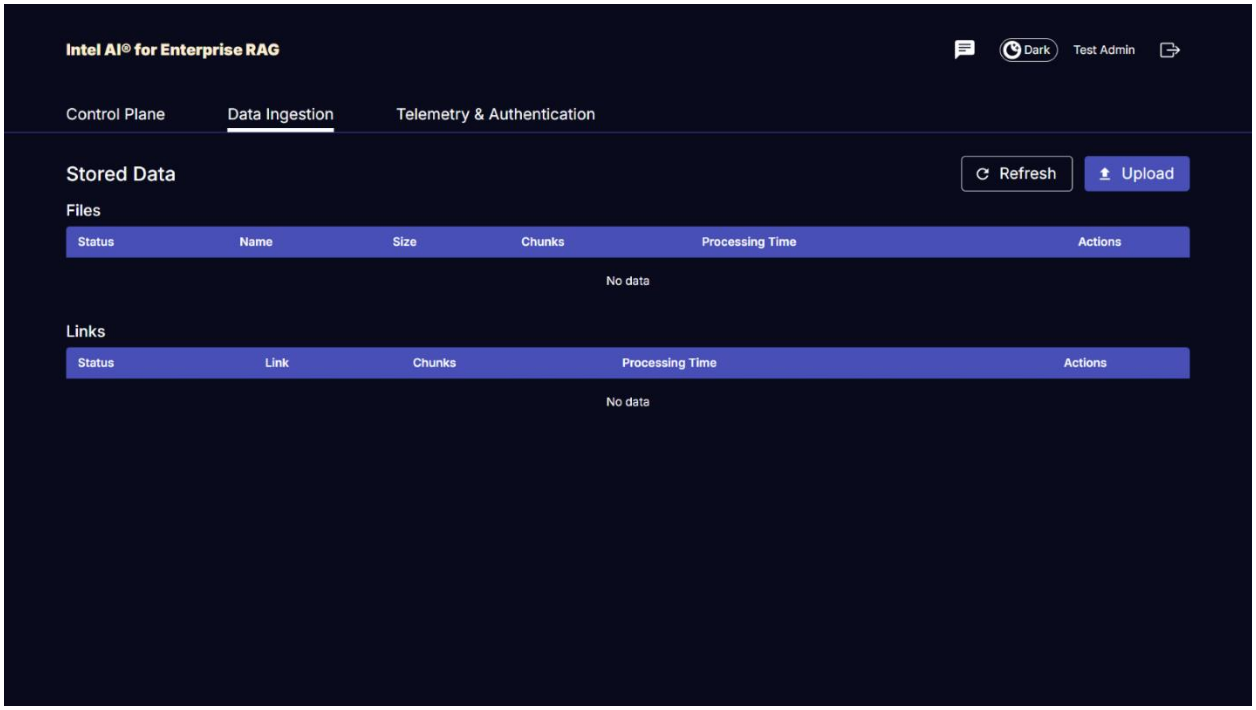
Note: At the time of this writing, the following file types are supported: PDF, HTML, TXT, DOC, DOCX, PPT, PPTX, MD, XML, JSON, JSONL, YAML, XLS, XLSX, CSV, TIFF, JPG, JPEG, PNG, and SVG.

You can use the OPEA for Intel AI for Enterprise RAG UI to confirm that your files were properly ingested. Refer to the Intel AI for Enterprise RAG UI documentation for details. Note that it can take some time for the application to ingest a large number of files.

Option 2: Upload using the UI

If you need to ingest only a small number of files, you can ingest them using the OPEA for Intel AI for Enterprise RAG UI. Refer to the Intel AI for Enterprise RAG UI documentation for details.

Figure 9) Data ingest UI.



Stored Data

Files

Status	Name	Size	Chunks	Processing Time	Actions

No data

Links

Status	Link	Chunks	Processing Time	Actions

No data

Execute chat queries

You can now “chat” with the OPEA for Intel AI for Enterprise RAG application by using the included chat UI. When responding to your queries, the application performs RAG using your ingested files. This means that the application automatically searches for relevant information within your ingested files and incorporates this information when responding to your queries.

Sizing guidance

As part of our validation effort, we conducted performance testing in coordination with Intel. This testing resulted in the sizing guidance outlined in the following table.

Table 4) Sizing guidance.

Characterizations	Values	Comment
Model size	Up to 20 billion parameters	Llama-8B, Llama-13B, Mistral 7B, Qwen 14B, DeepSeek Distill 8B
Data types supported	INT4, INT8, BF16	Models tested are a combination of data types with activation-aware weight quantization (AWQ) and speculative decoding (optimization techniques applied).
Input size	~2K tokens	~4 pages
Output size	~2K tokens	~4 pages
Concurrent users	Up to 32 concurrent users	“Concurrent users” refers to prompt requests that are submitting queries at the same time.

Note: *The sizing guidance presented above is based on performance validation & test results collected using Intel Xeon 6 processors with 96 cores. For customers with similar I/O token and model size requirements we recommend using servers with Xeon 6 processors with 96 or 128 cores.*

Conclusion

Enterprise RAG systems and LLMs are technologies that work together to help organizations provide accurate and context-aware responses. These responses involve information retrieval based on a vast collection of private and internal enterprise data. By using RAG, APIs, vector embeddings, and high-performance storage systems to query document repositories that contain company data, the data is processed faster and securely. The NetApp AIPod Mini combines NetApp’s intelligent data infrastructure with ONTAP data management capabilities and Intel Xeon 6 processors, Intel AI for Enterprise RAG, and the OPEA software stack to help you deploy high-performance RAG applications and put organizations on the path to AI leadership.

Acknowledgment

This document is the work of Sathish Thyagarajan and Michael Ogelsby, members of the NetApp Solutions Engineering team. The authors would also like to thank the Enterprise AI product team at Intel—Ajay Mungara, Mikolaj Zyczynski, Igor Konopko, Ramakrishna Karamsetty, Michal Prostko, Shreejan Mistry, and Ned Fiori—and other team members at NetApp—Lawrence Bunka, Bobby Oommen, and Jeff Liborio—for their continued support and help during the validation of this solution.

Bill of Materials

The following was the BOM used for the functional validation of this solution and can be used for reference. Any server or networking component (or even existing network with preferably 100GbE bandwidth) that aligns with the following configuration could be used.

For the App server:

Part no.	Product description	Quantity
222HA-TN-OTO-37	Hyper SuperServer SYS-222HA-TN /2U	2
P4X-GNR6972P-SRPL2-UCC	Intel Xeon 6972P 2P 128C 2G 504M 500W SGX512	2
RAM	MEM-DR564MC-ER64(x16)64GB DDR5-6400 2RX4 (16Gb) ECC RDIMM	32
	HDS-M2N4-960G0-E1-TXD-NON-080(x2) SSD M.2 NVMe PCIe4 960GB 1DWPD TLC D, 80mm	2
	WS-1K63A-1R(x2)1U 692W/1600W redundant single output power supply. Heat dissipation of 2361 BTU/Hr with Max Temp 59 C (approx.)	4

For the control server:

Part no.	Product description	Quantity
511R-M-OTO-17	OPTIMIZED UP 1U X13SCH-SYS, CSE-813MF2TS-R0RCNBP, PWS-602A-1R	1
P4X-GNR6972P-SRPL2-UCC	P4D-G7400-SRL66(x1) ADL Pentium G7400	1
RAM	MEM-DR516MB-EU48(x2)16GB DDR5-4800 1Rx8 (16Gb) ECC UDIMM	1
	HDS-M2N4-960G0-E1-TXD-NON-080(x2) SSD M.2 NVMe PCIe4 960GB 1DWPD TLC D, 80mm	2

For the network switch:

Part no.	Product description	Quantity
DCS-7280CR3A	Arista 7280R3A 28x100 GbE	1

NetApp AFF storage:

Part no.	Product description	Quantity
AFF-A20A-100-C	AFF A20 HA System, -C	1
X800-42U-R6-C	Jumper Crd, In-Cab, C13-C14, -C	2
X97602A-C	Power Supply,1600W, Titanium, -C	2
X66211B-2-N-C	Cable,100GbE, QSFP28-QSFP28, Cu,2m, -C	4
X66240A-05-N-C	Cable,25GbE, SFP28-SFP28, Cu,0.5m, -C	2
X5532A-N-C	Rail,4-Post, Thin, Rnd/Sq-Hole, Sm, Adj,24-32, -C	1
X4024A-2-A-C	Drive Pack 2X1.92TB, NVMe4, SED, -C	6
X60130A-C	IO Module,2PT,100GbE, -C	2
X60132A-C	IO Module,4PT,10/25GbE, -C	2
SW-ONTAPB-FLASH-A20-C	SW, ONTAP Base Package, Per TB, Flash, A20, -C	23

Where to find additional information

To learn more about the information described in this document, review the following documents and/or websites:

- NetApp product documentation
  https://www.netapp.com/support-and-training/documentation/ONTAP S3 configuration workflow
  https://docs.netapp.com/us-en/ontap/s3-config/workflow-concept.html
- OPEA project
  https://github.com/opea-project/Enterprise-RAG/tree/main
- OPEA Enterprise RAG deployment playbook
  https://github.com/opea-project/Enterprise-RAG/tree/main/deployment/playbooks

Version history

Version	Date	Document version history
Version 1.0	June 2025	Initial release

Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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