



BlueXP workload factory for Databases documentation

Database workloads

NetApp
November 11, 2024

Table of Contents

- BlueXP workload factory for Databases documentation 1
- Release notes 2
 - What’s new with BlueXP workload factory for Databases 2
 - Known limitations for BlueXP workload factory for Databases 4
- Get started 6
 - Learn about BlueXP workload factory for Databases 6
 - Quick start for BlueXP workload factory for Databases 11
- Use Database workloads 13
 - Explore savings in BlueXP workload factory for Databases 13
 - Create a database server in BlueXP workload factory for Databases 18
 - Detect a Microsoft SQL Server instance 27
 - Create a Microsoft SQL database in BlueXP workload factory for Databases 28
 - Automate with Codebox in BlueXP workload factory for Databases 31
- Administer and monitor 32
 - Manage Microsoft SQL Server instances in BlueXP workload factory 32
 - Manage clones 34
 - Monitor databases in BlueXP workload factory 38
 - Optimize SQL server 39
- Knowledge and support 40
 - Register for support 40
 - Get help for BlueXP workload factory for Databases 42
- Legal notices 48
 - Copyright 48
 - Trademarks 48
 - Patents 48
 - Privacy policy 48
 - Open source 48

BlueXP workload factory for Databases documentation

Release notes

What's new with BlueXP workload factory for Databases

Learn what's new with Databases.

3 November 2024

Continuously optimize your Microsoft SQL Server workloads with Databases

BlueXP workload factory introduces continuous guidance and guardrails to ensure ongoing optimization and adherence to best practices for the storage component of your Microsoft SQL Server workloads on Amazon FSx for NetApp ONTAP. This feature continuously scans your Microsoft SQL Server estate offline, providing you with a comprehensive report of insights, opportunities, and recommendations to help you achieve peak performance, cost-efficiency, and compliance.

[Optimize your SQL Server workloads](#)

Terraform support

You can now use Terraform from the Codebox to deploy Microsoft SQL Server.

- [Create a database server](#)
- [Use Terraform from Codebox](#)

29 September 2024

Explore savings for detected Microsoft SQL servers on FSx for Windows File Server

You can now explore savings of detected Microsoft SQL servers on Amazon EC2 with FSx for Windows File Server storage in the savings calculator. Depending on your SQL server and storage requirements, you might find that FSx for ONTAP storage is the most cost effective for your database workloads.

[Explore savings with FSx for ONTAP for your database workloads](#)

1 September 2024

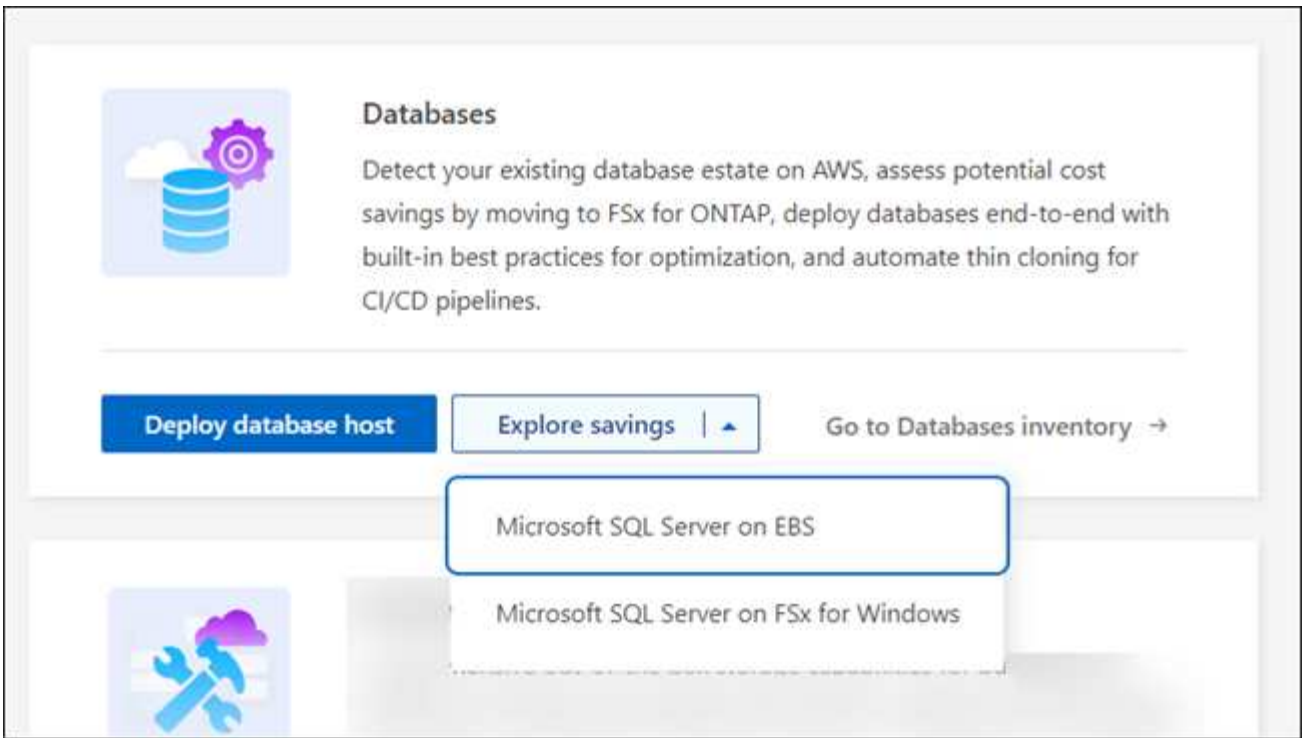
Explore savings via customization

You can now customize configuration settings for Microsoft SQL server on Amazon EC2 with FSx for Windows File Server and Elastic Block Store storage in the savings calculator. Depending on your storage requirements, you might find that FSx for ONTAP storage is the most cost effective for your database workloads.

[Explore savings with FSx for ONTAP for your database workloads](#)

Navigate to the savings calculator from the home page

You can now navigate to the savings calculator from the [workload factory console](#) home page. Select from Elastic Block Store and FSx for Windows File Server to get started.



4 August 2024

Savings calculator enhancements

- Cost estimate descriptions

You can now learn how cost estimates are calculated in the savings calculator. You'll be able to review descriptions of all calculations for your Microsoft SQL Server instances using Amazon Elastic Block Store storage as compared to using Amazon FSx for ONTAP storage.

- Support for Always On availability group

Databases now provides cost savings calculations for the Always On availability group deployment type with Microsoft SQL Server using Amazon Elastic Block Store.

- Optimize SQL server licensing with FSx for ONTAP

The Databases calculator determines whether the SQL license edition you use with Amazon Elastic Block Store storage is optimized for your database workloads. You'll get a recommendation for the optimal SQL license with FSx for ONTAP storage.

- Multiple SQL server instances

Databases now provides cost savings calculations for a configuration hosting multiple Microsoft SQL Server instances using Amazon Elastic Block Store.

- Customize calculator settings

Now you can customize settings for Microsoft SQL Server, Amazon EC2, and Elastic Block Store to explore savings manually. The savings calculator will determine the best configuration based on cost.

[Explore savings with FSx for ONTAP for your database workloads](#)

7 July 2024

Initial release of BlueXP workload factory for Databases

The initial release includes the capability to explore savings with Amazon FSx for NetApp ONTAP as the storage environment for your database workloads, detect, manage, and deploy Microsoft SQL Servers, deploy and clone databases, and monitor these jobs within workload factory.

[Learn about Databases](#)

Known limitations for BlueXP workload factory for Databases

Known limitations identify platforms, devices, or functions that are not supported by this release of the product, or that do not interoperate correctly with it. Review these limitations carefully.

AMI image version support

We only show up to four recent versions or revisions of AMI images for each SQL version. We don't allow installation from an AMI image that is older than the latest four versions.

Custom AMI

Deployment with a custom AMI assumes that install media is present in the image. This is needed for FCI configuration for the following reasons:

- To uninstall and reconfigure to form the FCI cluster
- When selecting a collation other than the collation set in the image for standalone deployment

As part of deployment, workload factory doesn't install a custom AMI with multiple Microsoft SQL Server instances. Only the default Microsoft SQL Server instance is selected and configured as part of deployment.

Roll back and retry for failed deployments

Rollback and retry for failed deployments aren't supported in workload factory. You can roll back or retry a failed stack from the CloudFormation console in AWS.

Active Directory and DNS resource rollback

The following DNS resources aren't removed from Active Directory and DNS when you roll back a test or failed deployment from the CloudFormation console in AWS:

- Each node of the SQL deployment to its management IP address
- Windows Cluster name to the reserved secondary IP addresses of EC2 instances in cases of FCI
- SQL FCI name to the two reserved IP addresses from both EC2 instances in FCI

You'll need to cleanup these up manually or wait for the domain to purge stale entries.

Always On availability groups configuration support

Managing Always On availability groups configurations isn't supported in workload factory.

User-managed Active Directory security groups

If you select "user-managed Active Directory" during Microsoft SQL Server deployment in workload factory, you must provide a security group that allows traffic between the EC2 instances to the directory service for deployment. Workload factory doesn't automatically attach the security group for user-managed Active Directory like it does for AWS Managed Microsoft AD.

Custom encryption keys

Custom encryption keys for FSx for ONTAP aren't listed based on service applicability. You must choose the appropriate key. AWS managed keys are filtered based on applicability to service.

CloudFormation template

A downloaded or copied Codebox-generated CloudFormation template (YAML file) has a limited retention period of seven days.

Sandbox support

The maximum number of sandbox clones that can be created from a database server is 90.

Microsoft SQL Server detection and management

Microsoft SQL Server detection isn't saved. Each time you access Databases in workload factory, Microsoft SQL Server detection runs again to identify SQL installations in the region.

Explore savings

In the Inventory tab, the estimated cost shown for each Microsoft SQL instance is calculated at the FSx for ONTAP file system level and not for volumes hosting the SQL instance.

Multiple FSx for ONTAP file systems

Workload Factory doesn't support creating or saving configurations for Microsoft SQL Server with multiple FSx for ONTAP file systems. Only one FSx for ONTAP file system configuration deployment is supported.

Regional availability for Microsoft SQL Server deployment in a private network with Terraform

Microsoft SQL Server deployment in a private network with no outbound connectivity using Terraform is only supported in us-east-1 (N. Virginia) region.

Get started

Learn about BlueXP workload factory for Databases

BlueXP workload factory for Databases is an end-to-end database deployment and maintenance service with built-in best practices for optimization, automatic thin cloning, and monitoring and resolution capabilities.

What is BlueXP workload factory for Databases?

BlueXP workload factory for Databases detects, assesses, plans, provisions, and moves Microsoft SQL Server data to Amazon FSx for NetApp ONTAP (FSx for ONTAP) deployments optimized to meet your performance and cost expectations while adhering to industry best practices. Throughout the life cycle, workload factory delivers continuous optimization and management for databases on FSx for ONTAP.

For more information about workload factory, refer to the [workload factory overview](#).

Workload factory benefits for self-managed databases

Workload factory offers the following beneficial best practices and automation for self-managed databases.

Best practices

- Integrated knowledge from AWS Cloud, Microsoft Windows and SQL servers, and NetApp ONTAP for SQL server deployments on EC2 instances.
- Total cost of ownership optimized deployment.
- End-to-end deployment automation that follows AWS, Microsoft and ONTAP best practices.
- “Quick create” deployment mode helps you avoid potential pitfalls with manual configuration.

Automation with workload factory Codebox

Workload factory introduces built-in automation with the *Codebox*. The Codebox offers the following automation benefits:

- **Code snippet generation:** Infrastructure-as-Code (IaC) snippets are generated during resource creation, allowing seamless integration with existing orchestration workflows.
- **Infrastructure-as-code co-pilot:** the Codebox is an Infrastructure-as-code (IaC) co-pilot that helps developers and DevOps generate code to execute any operation supported by workload factory.
- **Code viewer and automation catalog:** the Codebox provides a code viewer for quick analysis of automation and an automation catalog for quick future re-use.

Workload factory for Databases features

Workload factory for Databases offers the following features:

- **Simple, fast deployments:** simplify and streamline your provisioning experience by selecting answers to specification questions and eliminating the time typically required to investigate how to provision and configure your Microsoft SQL Server on AWS.
- **Automated orchestration:** available via the workload factory user interface with *Quick* and *Advanced*

create deployment modes, workload factory's Chatbot, and API with AWS CloudFormation.

- **Built-in features:** utilize NetApp, Microsoft, and Amazon best practices and AWS resource selections built in to deployment configuration.
- **Cost estimation:** assess potential cost savings with the Savings calculator that estimates and details storage, compute, SQL licensing, snapshot, and clone itemized costs for existing Microsoft SQL Server deployments with Elastic Block Store and FSx for Windows File Server compared with FSx for ONTAP.
- **Reusable automation templates:** create, re-use, and customize CloudFormation templates from the workload factory Codebox for future Microsoft SQL Server deployments in multiple environments.
- **AWS resource discovery and provisioning:** automatically detect Microsoft SQL Servers on FSx for ONTAP, FSx for Windows File Servers, and Elastic Block Store deployed from your AWS account. The Databases Inventory serves as a launching point for exploring costs savings opportunities for servers in other AWS storage systems or a management tool for FSx for ONTAP based servers and instances.
- **Sandbox creation:** create an on-demand, isolated database environment that can be used for testing, integration, diagnostics, and training, without affecting production data.
- **Database creation:** create a user database for your existing Microsoft SQL Servers with *Quick* or *Advanced* create modes to configure your database collation, file names, and sizes. Storage configuration is included.
- **Job Monitoring:** monitor and track database job execution progress and diagnose and troubleshoot issues in case any failure occurs.
- **Continuous optimization:** continuously scans your Microsoft SQL Server estate offline, providing you with a comprehensive report of insights, opportunities, and recommendations to help you achieve operational excellence.

Tools to use workload factory

You can use workload factory with the following tools:

- **Workload factory console:** the workload factory console provides a visual interface that gives you a holistic view of your applications and projects
- **BlueXP console:** the BlueXP console provides a hybrid interface experience so that you can use BlueXP workload factory along with other BlueXP services
- **REST API:** Workload factory REST APIs let you deploy and manage your FSx for ONTAP file systems and other AWS resources
- **CloudFormation:** AWS CloudFormation code lets you perform the actions you defined in the workload factory console to model, provision, and manage AWS and third-party resources from the CloudFormation stack in your AWS account.
- **Terraform BlueXP Workload Factory provider:** Terraform lets you build and manage infrastructure workflows generated in the workload factory console.

Benefits of Amazon FSx for ONTAP for self-managed databases

- **Durability, availability, and reliability:** FSx for ONTAP offers multiple features that enhance the durability and availability of self-managed databases hosted on FSx for ONTAP, such as high availability supporting Single and Multiple Availability Zones deployments, application-aware snapshots, improved disaster recovery using replication, and efficient backup.
- **Performance and scalability:** FSx for ONTAP offers performance optimization with high throughput, low latency, high-speed network connections, and scalability with multiple file systems for scaling aggregate performance required for a workload.

- **Data management and efficiency:** FSx for ONTAP offers multiple features that enhance data management and efficiency, such as space efficient thin clones, thin provisioning, compression and deduplication, and tiering infrequently accessed data to the capacity pool.

[Learn about FSx for ONTAP for workload factory.](#)

Operational modes in workload factory

Three different operational modes - *basic*, *read* and *automate* - offer flexible options for deployment inside and outside of workload factory. Gain immediate value at zero-trust in *basic* mode with code snippets for use outside workload factory. Get incremental value with incremental trust in *read* and *automate* modes.

Learn more about [operational modes in workload factory](#).

Tools to use workload factory

You can use BlueXP workload factory with the following tools:

- **Workload factory console:** the workload factory console provides a visual interface that gives you a holistic view of your applications and projects
- **REST API:** workload factory REST APIs let you deploy and manage Microsoft SQL Server and other AWS resources
- **CloudFormation:** AWS CloudFormation code lets you perform the actions you defined in the workload factory console to model, provision, and manage AWS and third-party resources from the CloudFormation stack in your AWS account.
- **Terraform BlueXP workload factory provider:** Terraform lets you build and manage infrastructure workflows generated in the workload factory console.

Deployment details

Supported configurations

Workload factory for Microsoft SQL Server supports both high availability (Always on Failover Cluster Instances) and single instance deployments according to AWS, NetApp ONTAP and SQL Server best practices.

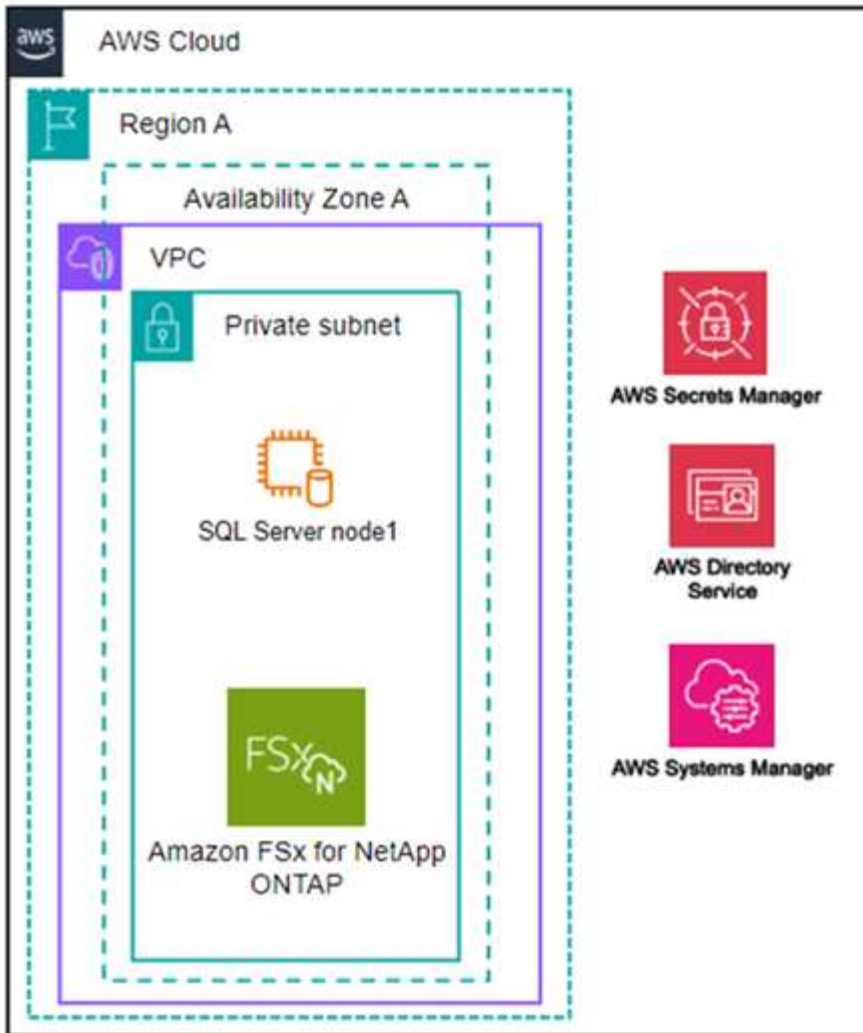
SQL Server Version	Windows Server 2016	Windows Server 2019	Windows Server 2022
SQL Server 2016	Yes	Yes	No
SQL Server 2019	Yes	Yes	Yes
SQL Server 2022	No	Yes	Yes

Deployment architectures

Single Availability Zone and Multiple Availability Zones deployment architectures are supported for Databases.

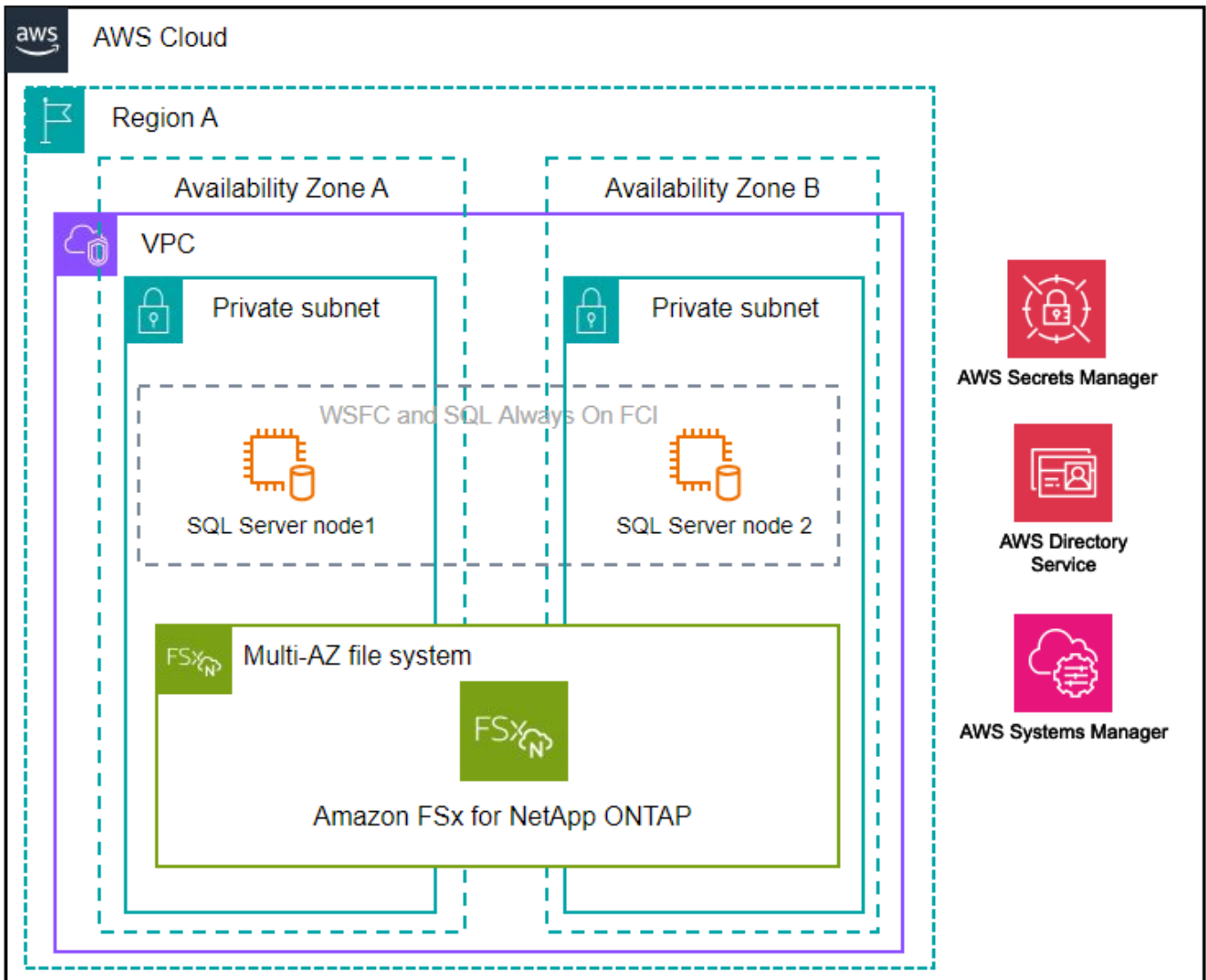
Single Availability Zone

The following diagram displays standalone architecture with a Single Availability Zone in a single region.



Multiple Availability Zones

The following diagram displays two-node high-availability (HA) architecture with failover cluster instance (FCI) cluster in a single region.



Integrated AWS services

Databases includes the following integrated AWS services:

- CloudFormation
- Simple Notification Service
- CloudWatch
- Systems Manager
- Secrets Manager

Supported regions

Databases is supported in all commercial regions where FSx for ONTAP is supported. [View supported Amazon regions.](#)

The following AWS regions aren't supported:

- China regions

- GovCloud (US) regions
- Secret Cloud
- Top Secret Cloud

Getting help

Amazon FSx for NetApp ONTAP is an AWS first-party solution. For questions or technical support issues associated with your FSx for ONTAP file system, infrastructure, or any solution using this service, use the Support Center in your AWS Management Console to open a support case with AWS. Select the “FSx for ONTAP” service and appropriate category. Provide the remaining information required to create your AWS support case.

For general questions about workload factory or workload factory applications and services, refer to [Get help for BlueXP workload factory for Databases](#).

Quick start for BlueXP workload factory for Databases

With BlueXP workload factory for Databases, you can get started immediately in *basic* mode. If you’d like to use workload factory to discover hosts, manage resources, and more, you can get started in a few steps.

You must have an AWS account to use Databases.

Follow these steps to get started.

1

Log in to BlueXP workload factory

You’ll need to [set up an account with workload factory](#) and log in using one of the [console experiences](#).

2

Add credentials and permissions

Choose between [basic](#), [read](#), and [automate operational modes](#).

If you operate in *basic* mode, you don’t need to go any further. You can start using Databases to copy partially completed code samples. In the Databases tile, click **Deploy database host**. [Learn how to deploy a database server](#).

If you operate in *read* or *automate* mode, you’ll need to [add credentials to an account manually](#) which includes selecting workload capabilities, such as Databases and GenAI, and creating the IAM policies to ensure you have the correct permissions for operating in *read* or *automate* mode.

3

Deploy a database server

Lastly, if you chose to operate in *automate* mode, you must [deploy](#) or [detect a database server](#) to manage your host resources and before adding user databases.

What’s next

When you have FSx for ONTAP managed hosts in your Databases inventory, you can [create a user database](#) or [clone your host to create a sandbox](#).

When you have Elastic Block Store hosts in your Databases inventory, you can [explore savings with the Storage savings calculator](#).

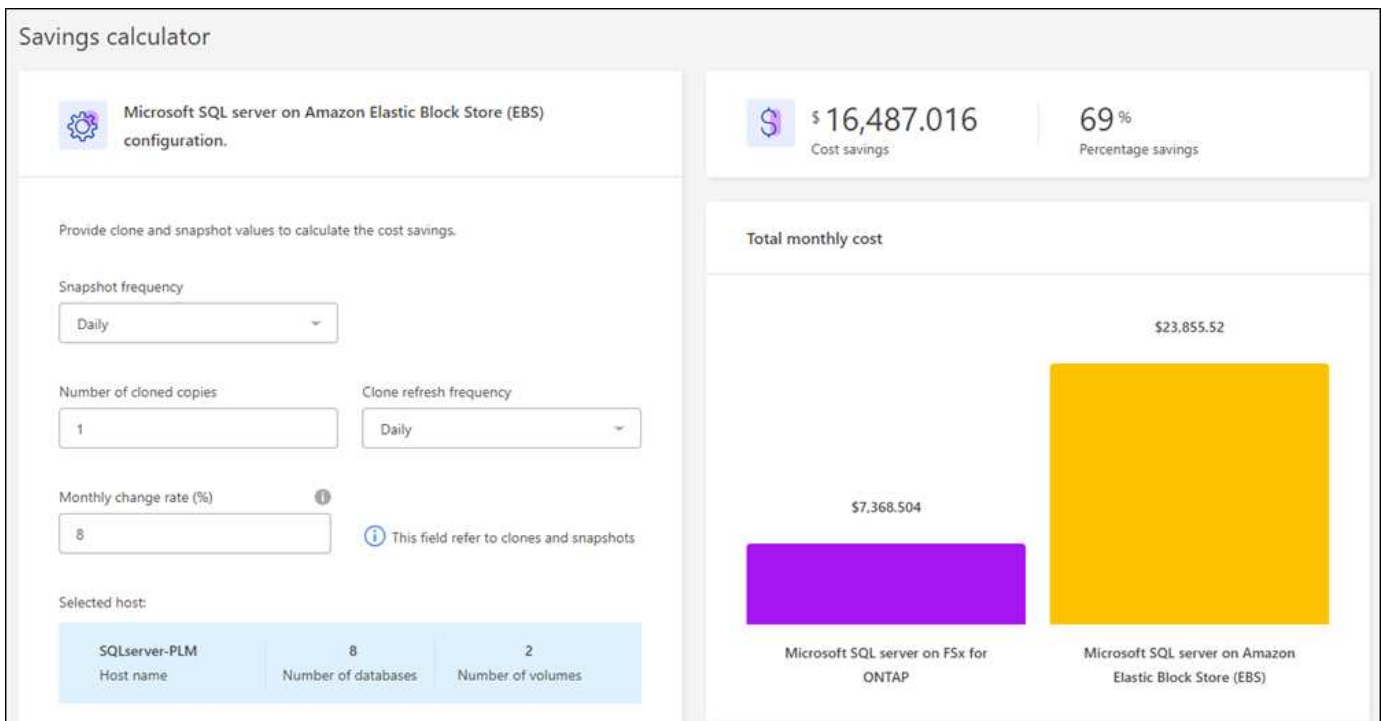
Use Database workloads

Explore savings in BlueXP workload factory for Databases

Explore savings in BlueXP workload factory for Databases for your database workloads by comparing the costs of using Amazon Elastic Block Store (EBS) and FSx for Windows File Server storage with FSx for ONTAP storage.

Workload factory provides a savings calculator so you can compare various cost components of running Microsoft SQL Server workloads like storage, compute, SQL license, snapshots, and clones for your database workloads on FSx for ONTAP file systems against Elastic Block Store (EBS) and FSx for Windows File Server storage. Depending on your storage requirements, you might find that FSx for ONTAP file systems are the most cost effective for your database workloads.

The calculator displays whether the storage for the database workloads on these Microsoft SQL Servers would cost less if you used an FSx for ONTAP file system.



If workload factory determines that you could save money by running these workloads on an FSx for ONTAP file system, you can deploy Microsoft SQL over FSx for ONTAP directly from the calculator in workload factory. When you have multiple Microsoft SQL Server instances over Elastic Block Store or FSx for Windows File Server storage, we'll recommend an FSx for ONTAP configuration with a single SQL instance.

Calculator options

Two calculator options are available for making the cost comparison between your systems and FSx for ONTAP — customization and detection.

Explore savings via customization: You provide the configuration settings for Microsoft SQL server on Amazon EC2 with EBS or FSx for Windows File Server including the region, deployment model, SQL server edition, monthly data change rate, snapshot frequency, and more.

Explore savings for detected hosts: workload factory links to your existing Microsoft SQL servers and pulls in the details to the calculator for automatic comparison. You'll need to grant automate permissions to use this calculator option. You can change the use case, but all other details are automatically determined in the calculation.

Explore savings via customization

Follow the steps under the tab for your storage type.

Amazon Elastic Block Store (EBS)

Steps

1. Log in using one of the [console experiences](#).
2. From Databases, select **Explore savings** then **Microsoft SQL Server on EBS**.
3. In the Savings calculator, provide the following details:
 - a. **Region**: Select a region from the dropdown menu.
 - b. **Deployment model**: Select a deployment model from the dropdown menu.
 - c. **SQL server edition**: Select the SQL server edition from the dropdown menu.
 - d. **Monthly data change rate (%)**: Enter the percentage that clone and snapshot data changes on average per month.
 - e. **Snapshot frequency**: Select a snapshot frequency from the dropdown menu.
 - f. **Number of cloned copies**: Enter the number of cloned copies in the EBS configuration.
 - g. **Monthly SQL BYOL cost (\$)**: Optionally, enter the monthly SQL BYOL cost in dollars.
 - h. Under EC2 specifications, provide the following:
 - **Machine description**: Optionally, enter a name to describe the machine.
 - **Instance type**: Select the EC2 instance type from the dropdown menu.
 - i. Under Volume types, provide the following details for at least one volume type. IOPS and throughput apply to certain disk type volumes.
 - **Number of volumes**
 - **Storage amount per volume (GiB)**
 - **Provisioned IOPS per volume**
 - **Throughput MB/s**
 - j. If you selected the Always On availability deployment model, provide details for **Secondary EC2 specifications** and **Volume types**.
4. Review the calculations and recommendation provided on the page.

Additionally, scroll down to the bottom of the page to **Export PDF** or **View calculations**.

Amazon FSx for Windows File Server

Steps

1. Log in using one of the [console experiences](#).
2. From Databases, select **Explore savings** then **Microsoft SQL Server on FSx for Windows**.
3. In the Savings calculator, provide the following details:
 - a. **Region**: Select a region from the dropdown menu.
 - b. **Deployment model**: Select a deployment model from the dropdown menu.
 - c. **SQL server edition**: Select the SQL server edition from the dropdown menu.
 - d. **Monthly data change rate (%)**: Enter the percentage that clone and snapshot data changes on average per month.
 - e. **Snapshot frequency**: Select a snapshot frequency from the dropdown menu.

- f. **Number of cloned copies:** Enter the number of cloned copies in the EBS configuration.
 - g. **Monthly SQL BYOL cost (\$):** Optionally, enter the monthly SQL BYOL cost in dollars.
 - h. Under FSx for Windows File Server settings, provide the following:
 - **Deployment type:** Select the deployment type from the dropdown menu.
 - **Storage type:** SSD storage is the supported storage type.
 - **Total storage capacity:** Enter the storage capacity and select the capacity unit for the configuration.
 - **Provisioned SSD IOPS:** Enter the provisioned SSD IOPS for the configuration.
 - **Throughput (MB/s):** Enter throughput in MB/s.
 - i. Under EC2 specifications, select the **Instance type** from the dropdown menu.
4. Review the calculations and recommendation provided on the page.

Additionally, scroll down to the bottom of the page to **Export PDF** or **View calculations**.

Explore savings for detected hosts

Workload factory enters the detected Elastic Block Store and FSx for Windows File Server host characteristics so that you can explore savings automatically.

Before you begin

Complete the following prerequisites before you begin:

- Make sure you [grant automate permissions](#) in your AWS account to detect Elastic Block Store (EBS) and FSx for Windows systems in your Databases inventory.
- Detect hosts in EBS and FSx for Windows storage in your Databases inventory. [Learn how to detect hosts](#).

Follow the steps under the tab for your storage type.

Amazon Elastic Block Store (EBS)

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Explore savings** then **Microsoft SQL Server on FSx for Windows** from the dropdown menu.

If workload factory detects EBS hosts, you'll be redirected to the Explore savings tab. If workload factory doesn't detect EBS hosts, you'll be redirected to the calculator to [explore savings via customization](#).

3. In the Explore savings tab, click **Explore savings** of the database server using EBS storage.
4. In the Savings calculator, optionally, provide the following details on clones and snapshots in your EBS storage for a more accurate cost savings estimate.
 - a. **Snapshot frequency**: Select a snapshot frequency from the dropdown menu.
 - b. **Clone refresh frequency**: Select the frequency that clones refresh from the dropdown menu.
 - c. **Number of cloned copies**: Enter the number of cloned copies in the EBS configuration.
 - d. **Monthly change rate**: Enter the percentage that clone and snapshot data changes on average per month.
5. Review the calculations and recommendation provided on the page.

Additionally, scroll down to the bottom of the page to **Export PDF** or **View calculations**.

Amazon FSx for Windows File Server

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Explore savings** then **Microsoft SQL Server on FSx for Windows** from the dropdown menu.

If workload factory detects FSx for Windows hosts, you'll be redirected to the Explore savings tab. If workload factory doesn't detect FSx for Windows hosts, you'll be redirected to the calculator to [explore savings via customization](#).

3. In the Explore savings tab, click **Explore savings** of the database server using FSx for Windows File Server storage.
4. In the Savings calculator, optionally, provide the following details on clones (shadow copies) and snapshots in your FSx for Windows storage for a more accurate cost savings estimate.
 - a. **Snapshot frequency**: Select a snapshot frequency from the dropdown menu.

If FSx for Windows shadow copies are detected, the default value is **Daily**. If shadow copies aren't detected, the default value is **No snapshot frequency**.

- b. **Clone refresh frequency**: Select the frequency that clones refresh from the dropdown menu.
- c. **Number of cloned copies**: Enter the number of cloned copies in the FSx for Windows configuration.
- d. **Monthly change rate**: Enter the percentage that clone and snapshot data changes on average per month.

5. Review the calculations and recommendation provided on the page.

Additionally, scroll down to the bottom of the page to **Export PDF** or **View calculations**.

Deploy Microsoft SQL Server on AWS EC2 using FSx for ONTAP

If you'd like to switch to FSx for ONTAP to realize cost savings, click **Create** to create the recommended configuration(s) directly from the Create new Microsoft SQL server wizard or click **Save** to save the recommended configuration(s) for later.



Workload factory doesn't support saving or creating multiple FSx for ONTAP file systems.

Deployment methods

In *automate* mode, you can deploy the new Microsoft SQL server on AWS EC2 using FSx for ONTAP directly from workload factory. You can also copy the content from the Codebox window and deploy the recommended configuration using one of the Codebox methods.

In *basic* mode, you can copy the content from the Codebox window and deploy the recommended configuration using one of the Codebox methods.

Create a database server in BlueXP workload factory for Databases

Creating a new Microsoft SQL Server, or database host, in BlueXP workload factory for Databases requires an FSx for ONTAP file system deployment and resources for Active Directory.

About this task

You'll need AWS account credentials and *automate* permissions.

Before you begin, learn about the available storage deployment types for the database host configuration, Active Directory deployment, workload factory modes of operation, and the requirements to complete this operation.

After deployment, you'll need to [enable remote connection on the Microsoft SQL Server](#).

FSx for ONTAP file system deployments

Creating a new Microsoft SQL Server requires an FSx for ONTAP file system as the storage backend. You can use an existing FSx for ONTAP file system or create a new file system. If you select an existing FSx for ONTAP file system as your database server storage backend, we create a new storage VM for the Microsoft SQL workloads.

FSx for ONTAP file systems have two Microsoft SQL Server deployment models: *Failover Cluster Instance (FCI)* or *Standalone*. Different resources are created for the FSx for ONTAP file system depending on the FSx for ONTAP deployment model you select.

- **Failover Cluster Instance (FCI) Microsoft SQL deployment:** A Multiple Availability Zone FSx for NetApp ONTAP file system is deployed when a new FSx for ONTAP file system is selected for FCI deployment. Separate volumes and LUNs are created for data, log, and tempdb files for an FCI deployment. An additional volume and LUN are created for Quorum or witness disk for Windows cluster.

- **Standalone Microsoft SQL deployment:** A Single Availability Zone FSx for ONTAP file system is created when a new Microsoft SQL Server is created. In addition, separate volumes and LUNs are created for data, log, and tempdb files.

Microsoft Multi-path I/O configuration

Microsoft SQL Server deployment models both require LUN creation using the iSCSI storage protocol. Workload factory configures Microsoft Multi-path I/O (MPIO) as part of configuring LUNs for SQL Server over FSx for ONTAP. MPIO is configured based on AWS and NetApp best practices.

For more information, refer to [SQL Server High Availability Deployments Using Amazon FSx for NetApp ONTAP](#).

Active Directory

The following occurs for Active Directory (AD) during deployment:

- A new Microsoft SQL service account is created in the domain if you don't provide an existing SQL service account.
- The Windows cluster, node host names, and Microsoft SQL FCI name are added as managed computers to the Microsoft SQL service account.
- The Windows cluster entry is assigned permissions to add computers to the domain.

Resource rollback

If you decide to rollback your Domain Name System (DNS) resources, the resource records in AD and DNS are not removed automatically. You can remove the records from the DNS server and AD as follows.

- For user-managed AD, first [remove the AD computer](#). Then, connect to the DNS server from DNS manager and [delete the DNS Resource Records](#).
- For AWS Managed Microsoft AD, [install the AD administration tools](#). Next, [remove the AD computer](#). Lastly, connect to the DNS server from DNS manager and [delete the DNS Resource Records](#).

Workload factory operation modes

Workload factory offers three operational modes depending on how comfortable you are with letting workload factory manage your AWS resources.

Basic mode: in this mode of operation, you don't need to associate any AWS account credentials in workload factory. You can copy or download a partially filled YAML template from the Codebox to be completed outside workload factory.

Read mode: in this mode of operation, you provide AWS account credentials with read permissions which lets you complete the *Quick create* or *Advanced create* form and then copy or download it. You can also redirect to CloudFormation from workload factory with the completed form details. And you will be able to manage the deployed database server in workload factory.

Automate mode: in this mode of operation, you provide AWS account credentials with automate permissions which lets you create and manage AWS resources within workload factory.

Before you begin

Ensure you have the following prerequisites before you create a new database host.

Credentials and permissions

You must have [AWS account credentials and automate mode permissions](#) to create a new database host in workload factory.

Alternatively, you can use the Codebox to copy an empty template or create a completed template so that you can deploy a database outside of workload factory using REST API, AWS CLI, or AWS CloudFormation. [Learn more about Codebox automation.](#)

Active Directory

When connecting to Active Directory, you must have administrative access with permissions to do the following:

- Join the domain
- Create Computer Objects
- Create objects in the default Organization Unit (OU)
- Read all properties
- Make the domain user a local admin on the AD nodes
- Create a Microsoft SQL Server service user in the AD, if it doesn't exist already

Step 1: Create a database server

You can use *Quick create* or *Advanced create* deployment modes to complete this task in workload factory with *Automate* mode permissions. You can also use the following tools available in the Codebox: REST API, CloudFormation, and Terraform. [Learn how to use Codebox for automation.](#)



When using Terraform from Codebox, the code you copy or download hides `fsxadmin` and `vsadmin` passwords. You'll need to re-enter the passwords when you run the code. You'll need to include the following permissions for the user account in addition to *Automate* mode permissions: `iam:TagRole` and `iam:TagInstanceProfile`.

Quick create



In *Quick create*, FCI is the default deployment model, Windows 2016 is the default Windows version, and SQL 2019 Standard Edition is the default SQL version.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Deploy database host**.
3. Select **Quick create**.
4. Under **AWS settings**, provide the following:
 - a. **AWS credentials:** Select AWS credentials with *automate* permissions to deploy the new database host.

AWS credentials with *automate* permissions let workload factory deploy and manage the new database host from your AWS account within workload factory.

AWS credentials with *read* permissions let workload factory generate a CloudFormation template for you to use in the AWS CloudFormation console.

If you don't have AWS credentials associated in workload factory and you want to create the new server in workload factory, follow **Option 1** to go to the Credentials page. Manually add the required credentials and permissions for *automate* mode for Database workloads.

If you want to complete the create new server form in workload factory so you can download a complete YAML file template for deployment in AWS CloudFormation, follow **Option 2** to ensure you have the required permissions to create the new server within AWS CloudFormation. Manually add the required credentials and permissions for *read* mode for Database workloads.

Optionally, you can download a partially completed YAML file template from the Codebox to create the stack outside workload factory without any credentials or permissions. Select **CloudFormation** from the dropdown in the Codebox to download the YAML file.

- b. **Region & VPC:** Select a Region and VPC network.

Ensure security groups for an existing interface endpoint allow access to HTTPS (443) protocol to the selected subnets.

AWS service interface endpoints (SQS, FSx, EC2, CloudWatch, CloudFormation, SSM) and the S3 gateway endpoint are created during deployment if not found.

VPC DNS attributes `EnableDnsSupport` and `EnableDnsHostnames` are modified to enable endpoint address resolution if they aren't already set to `true`.

- c. **Availability zones:** Select availability zones and subnets according to the Failover Cluster Instance (FCI) deployment model.



FCI deployments are only supported on Multiple Availability Zone (MAZ) FSx for ONTAP configurations.

Subnets should not share the same route table for high availability.

- i. In the **Cluster configuration - Node 1** field, select the primary availability zone for the MAZ FSx for ONTAP configuration from the **Availability zone** dropdown menu and a subnet from the primary availability zone from the **Subnet** dropdown menu.
 - ii. In the **Cluster configuration - Node 2** field, select the secondary availability zone for the MAZ FSx for ONTAP configuration from the **Availability zone** dropdown menu and a subnet from the secondary availability zone from the **Subnet** dropdown menu.
5. Under **Application settings**, enter a user name and password for **Database credentials**.
6. Under **Connectivity**, provide the following:
 - a. **Key pair**: Select a key pair.
 - b. **Active Directory**:
 - i. In the **Domain name** field, select or enter a name for the domain.
 - A. For AWS-managed Active Directories, domain names appear in the dropdown menu.
 - B. For a user-managed Active Directory, enter a name in the **Search and Add** field, and click **Add**.
 - ii. In the **DNS address** field, enter the DNS IP address for the domain. You can add up to 3 IP addresses.

For AWS-managed Active Directories, the DNS IP address(es) appear in the dropdown menu.
 - iii. In the **User name** field, enter the user name for the Active Directory domain.
 - iv. In the **Password** field, enter a password for the Active Directory domain.
7. Under **Infrastructure settings**, provide the following:
 - a. **FSx for ONTAP system**: Create a new FSx for ONTAP file system or use an existing FSx for ONTAP file system.
 - i. **Create new FSx for ONTAP**: Enter user name and password.

A new FSx for ONTAP file system may add 30 minutes or more of installation time.
 - ii. **Select an existing FSx for ONTAP**: Select FSx for ONTAP name from the dropdown menu, and enter a user name and password for the file system.

For existing FSx for ONTAP file systems, ensure the following:

 - The routing group attached to FSx for ONTAP allows routes to the subnets to be used for deployment.
 - The security group allows traffic from the subnets used for deployment, specifically HTTPS (443) and iSCSI (3260) TCP ports.
 - b. **Data drive size**: Enter the data drive capacity and select the capacity unit.
8. Summary:
 - a. **Preview default**: Review the default configurations set by Quick create.
 - b. **Estimated cost**: Provides an estimate of charges that you might incur if you deployed the resources shown.
9. Click **Create**.

Alternatively, if you want to change any of these default settings now, create the database server with **Advanced create**.

You can also select **Save configuration** to deploy the host later.

Advanced create

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Deploy database host**.
3. Select **Advanced create**.
4. For **Deployment model**, select **Failover Cluster Instance** or **Single instance**.
5. Under **AWS settings**, provide the following:
 - a. **AWS credentials:** Select AWS credentials with *automate* permissions to deploy the new database host.

AWS credentials with *automate* permissions let workload factory deploy and manage the new database host from your AWS account within workload factory.

AWS credentials with *read* permissions let workload factory generate a CloudFormation template for you to use in the AWS CloudFormation console.

If you don't have AWS credentials associated in workload factory and you want to create the new server in workload factory, follow **Option 1** to go to the Credentials page. Manually add the required credentials and permissions for *automate* mode for Database workloads.

If you want to complete the create new server form in workload factory so you can download a complete YAML file template for deployment in AWS CloudFormation, follow **Option 2** to ensure you have the required permissions to create the new server within AWS CloudFormation. Manually add the required credentials and permissions for *read* mode for Database workloads.

Optionally, you can download a partially completed YAML file template from the Codebox to create the stack outside workload factory without any credentials or permissions. Select **CloudFormation** from the dropdown in the Codebox to download the YAML file.

- b. **Region & VPC:** Select a Region and VPC network.

Ensure security groups for an existing interface endpoint allow access to HTTPS (443) protocol to the selected subnets.

AWS Service interface endpoints (SQS, FSx, EC2, CloudWatch, Cloud Formation, SSM) and S3 gateway endpoint are created during deployment if not found.

VPC DNS attributes `EnableDnsSupport` and `EnableDnsHostnames` are modified to enable resolve endpoint address resolution if not already set to `true`.

- c. **Availability zones:** Select availability zones and subnets according to the deployment model you selected.



FCI deployments are only supported on Multiple Availability Zone (MAZ) FSx for ONTAP configurations.

Subnets should not share the same route table for high availability.

For single instance deployments

- i. In the **Cluster configuration - Node 1** field, select an availability zone from the **Availability zone** from the dropdown menu and a subnet from the **Subnet** dropdown menu.

For FCI deployments

- i. In the **Cluster configuration - Node 1** field, select the primary availability zone for the MAZ FSx for ONTAP configuration from the **Availability zone** dropdown menu and a subnet from the primary availability zone from the **Subnet** dropdown menu.
- ii. In the **Cluster configuration - Node 2** field, select the secondary availability zone for the MAZ FSx for ONTAP configuration from the **Availability zone** dropdown menu and a subnet from the secondary availability zone from the **Subnet** dropdown menu.

- d. **Security group**: Select an existing security group or create a new security group.

Three security groups get attached to the SQL nodes (EC2 instances) during new server deployment.

1. A workload security group is created to allow ports and protocols required for Microsoft SQL and Windows cluster communication on nodes.
2. In case of AWS-managed Active Directory, the security group attached to the directory service gets automatically added to the Microsoft SQL nodes to allow communication with Active Directory.
3. For an existing FSx for ONTAP file system, the security group associated with it is added automatically to the SQL nodes which allows communication to the file system. When a new FSx for ONTAP system is created, a new security group is created for the FSx for ONTAP file system and the same security group also gets attached to SQL nodes.

For a user-managed Active Directory, ensure the security group configured on the AD instance allows traffic from subnets used for deployment. The security group should allow communication to the Active Directory domain controllers from the subnets where EC2 instances for Microsoft SQL are configured.

6. Under **Application settings**, provide the following:

- a. Under **SQL Server install type**, select **License included AMI** or **Use custom AMI**.

- i. If you select **License included AMI**, provide the following:

- A. **Operating system**: Select **Windows server 2016**, **Windows server 2019**, or **Windows server 2022**.
- B. **Database edition**: Select **SQL Server Standard Edition** or **SQL Server Enterprise Edition**.
- C. **Database version**: Select **SQL Server 2016**, **SQL Server 2019**, or **SQL Server 2022**.
- D. **SQL Server AMI**: Select a SQL Server AMI from the dropdown menu.

- ii. If you select **Use custom AMI**, select an AMI from the dropdown menu.

- b. **SQL Server collation**: Select a collation set for the server.



If the selected collation set isn't compatible for installation, we recommend that you select the default collation "SQL_Latin1_General_CP1_CI_AS".

- c. **Database name:** Enter the database cluster name.
- d. **Database credentials:** Enter a user name and password for a new service account or use existing service account credentials in the Active Directory.

7. Under **Connectivity**, provide the following:

- a. **Key pair:** Select a key pair to connect securely to your instance.
- b. **Active Directory:** Provide the following Active Directory details:
 - i. In the **Domain name** field, select or enter a name for the domain.
 - A. For AWS-managed Active Directories, domain names appear in the dropdown menu.
 - B. For a user-managed Active Directory, enter a name in the **Search and Add** field, and click **Add**.
 - ii. In the **DNS address** field, enter the DNS IP address for the domain. You can add up to 3 IP addresses.

For AWS-managed Active Directories, the DNS IP address(es) appear in the dropdown menu.
 - iii. In the **User name** field, enter the user name for the Active Directory domain.
 - iv. In the **Password** field, enter a password for the Active Directory domain.

8. Under **Infrastructure settings**, provide the following:

- a. **DB Instance type:** Select the database instance type from the dropdown menu.
- b. **FSx for ONTAP system:** Create a new FSx for ONTAP file system or use an existing FSx for ONTAP file system.
 - i. **Create new FSx for ONTAP:** Enter user name and password.

A new FSx for ONTAP file system may add 30 minutes or more of installation time.

- ii. **Select an existing FSx for ONTAP:** Select FSx for ONTAP name from the dropdown menu, and enter a user name and password for the file system.

For existing FSx for ONTAP file systems, ensure the following:

- The routing group attached to FSx for ONTAP allows routes to the subnets to be used for deployment.
- The security group allows traffic from the subnets used for deployment, specifically HTTPS (443) and iSCSI (3260) TCP ports.

- c. **Snapshot policy:** Enabled by default. Snapshots are taken daily and have a 7-day retention period.

The snapshots are assigned to volumes created for SQL workloads.

- d. **Data drive size:** Enter the data drive capacity and select the capacity unit.
- e. **Provisioned IOPS:** Select **Automatic** or **User-provisioned**. If you select **User-provisioned**, enter the IOPS value.
- f. **Throughput capacity:** Select the throughput capacity from the dropdown menu.

In certain regions, you may select 4 GBps throughput capacity. To provision 4 GBps of throughput capacity, your FSx for ONTAP file system must be configured with a minimum of 5,120 GiB of SSD storage capacity and 160,000 SSD IOPS.

- g. **Encryption:** Select a key from your account or a key from another account. You must enter the encryption key ARN from another account.

FSx for ONTAP custom encryption keys aren't listed based on service applicability. Select an appropriate FSx encryption key. Non-FSx encryption keys will cause server creation failure.

AWS-managed keys are filtered based on service applicability.

- h. **Tags:** Optionally, you can add up to 40 tags.
- i. **Simple Notification Service:** Optionally, you can enable the Simple Notification Service (SNS) for this configuration by selecting an SNS topic for Microsoft SQL Server from the dropdown menu.
 - i. Enable the Simple Notification Service.
 - ii. Select an ARN from the dropdown menu.
- j. **CloudWatch monitoring:** Optionally, you can enable CloudWatch monitoring.

We recommend enabling CloudWatch for debugging in case of failure. The events that appear in the AWS CloudFormation console are high-level and don't specify the root cause. All detailed logs are saved in the `C:\cfn\logs` folder in the EC2 instances.

In CloudWatch, a log group is created with the name of the stack. A log stream for every validation node and SQL node appear under the log group. CloudWatch shows script progress and provides information to help you understand if and when deployment fails.

- k. **Resource rollback:** This feature isn't currently supported.

9. Summary

- a. **Estimated cost:** Provides an estimate of charges that you might incur if you deployed the resources shown.

- 10. Click **Create** to deploy the new database host.

Alternatively, you can save the configuration.

Step 2: Enable remote connection on the Microsoft SQL Server

After the server deploys, workload factory does not enable remote connection on the Microsoft SQL Server. To enable the remote connection, complete the following steps.

Steps

1. Use computer identity for NTLM by referring to [Network security: Allow Local System to use computer identity for NTLM](#) in Microsoft documentation.
2. Check dynamic port configuration by referring to [A network-related or instance-specific error occurred while establishing a connection to SQL Server](#) in Microsoft documentation.
3. Allow the required client IP or subnet in the security group.

What's next

Now you can [create a database in BlueXP workload factory for Databases](#).

Detect a Microsoft SQL Server instance

Detect a Microsoft SQL Server instance in BlueXP workload factory for Databases.

This task is for detecting an *undetected instance*.

About this task

When AWS credentials are associated in workload factory, Databases allows automated discovery of Microsoft SQL Servers beginning with SQL server 2016 with the following AWS storage types:

- FSx for ONTAP
- Elastic Block Store (EBS)
- FSx for Windows File Server

In Databases, discovered instances are categorized as follows:

- *Undetected instances*: undetected instances that have been automatically discovered by workload factory. Instances are undetected in the following cases:
 - Microsoft SQL Server authentication fails.
 - The FSx for ONTAP file system for the Microsoft SQL Server isn't registered with your account in workload factory.
- *Unmanaged instances*: detected instances that are not managed by workload factory
- *Managed instances*: detected instances that are managed by workload factory

The first step to managing a Microsoft SQL Server instance, or host instance, in workload factory for Databases is detecting an undetected database server instance.

Before you begin

The requirements for detecting an undetected database server instance are as follows:

- You must have [AWS account credentials](#) to detect a database server instance in workload factory.
- The storage type for the instance must be one of the following:
 - FSx for ONTAP
 - Elastic Block Store (EBS)
 - FSx for Windows File Server
- EC2 instances must have a role/instance profile that allows SSM connection for detection to work.

When a Microsoft SQL instance is detected, the existing environment isn't modified. Detection happens through AWS Systems Manager Session Manager (SSM). Without the right IAM instance profile, detection will fail. [Learn more about SSM troubleshooting](#).

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Inventory** tab.
4. Click the dropdown arrow to expand the row of the host to detect.

The host expands and host instances appear.

5. Click the three dots menu of the instance to detect.
6. Click **Detect**.
7. In the **Detect instance** dialog, provide the Microsoft SQL Server user name and password or FSx for ONTAP user name and password.

Workload factory validates your Microsoft SQL credentials or FSx for ONTAP credentials.

If either of these credentials isn't available, workload factory tries to install the `aws.tools.SimpleSystemsManagement` module in PowerShell.

8. Click **Detect**.

Detected instance information appears.

9. Select **Yes, Manage instance via Workload Factory** or **No**.
10. Click **Done**.

What's next

When the storage type for the host instance is FSx for ONTAP, you can [manage the instance via workload factory](#).

Create a Microsoft SQL database in BlueXP workload factory for Databases

Creating a new Microsoft SQL database enables you to manage the resource within BlueXP workload factory for Databases.

About this task

Upon database creation, two new volumes are created in the FSx for ONTAP file system consisting of independent LUNs to host data and log files for the database. The database files in the new database are thin-provisioned and consume only a few MBs of the total size allocated for the new database.

If you want to segregate storage for the database, you can do this by using a *virtual mount point*. The virtual mount point lets you consolidate databases to a few common drives on the host.

Creating a database in workload factory requires automate mode permissions. Alternatively, in basic mode, you can copy or download a partially completed code template to complete the operation outside workload factory. [Learn about operational modes in workload factory](#) to decide which mode you'd like to use.



Microsoft SQL Servers using SMB protocol don't support database creation.

Before you begin

Ensure you complete the following prerequisites before you create a new database.

Credentials and permissions

You must have [AWS account credentials and read or automate mode permissions](#) to create a new database in workload factory.

Alternatively, you can use the Codebox to copy a template so that you can deploy a database outside of

workload factory using REST API. [Learn more about Codebox automation.](#)

Windows host

You must have enough drive letters available on the Microsoft SQL Server to create new drives for the new database if you use *Quick create* mode.

Microsoft SQL Server

You must have a managed Microsoft SQL Server in workload factory for Databases to host the new database.

AWS Systems Manager

Ensure the `NT Authority\SYSTEM` user privilege is enabled in the Microsoft SQL host via AWS System Manager.

Create a database

You can use *Quick create* or *Advanced create* deployment modes to complete this task in workload factory with *read* or *automate* mode permissions.

Quick create

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Inventory** tab.
4. In the Inventory tab, select a database server with a managed SQL server instance to create the database in.
5. Click the three dots menu of the managed instance and then select **Create user database**.
6. On the Create user database page, under Database information, provide the following:
 - a. **Database name:** Enter name for the database.
 - b. **Collation:** Select a collation for the database. The default collation "SQL_Latin1_General_CP1_CI_AS" on Microsoft SQL Server is selected.
7. Under File settings, provide the following:
 - a. **File settings mode:** Select **Quick create**.
 - b. **File names & path:**
 - **Data file name:** Enter the data file name.
 - **Log file name:** Enter the log file name.
 - c. **File sizes:** Enter the data size and log size for the database.
8. Click **Create**.

Alternatively, if you want to change any of these default settings now, change the **File settings mode** to **Advanced create**.

Advanced create

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Inventory** tab.
4. In the Inventory tab, select a database server with a managed SQL server instance to create the database in.
5. Click the three dots menu of the managed instance and then select **Create user database**.
6. Select **Create user database**.
7. On the Create user database page, under Database information, provide the following:
 - a. **Database name:** Enter name for the database.
 - b. **Collation:** Select the collation for the database. The default collation "SQL_Latin1_General_CP1_CI_AS" on Microsoft SQL Server is selected.
8. Under File settings, provide the following:
 - a. **File settings mode:** Select **Advanced create**.
 - b. **File names & path:**
 - i. **Data file:** Select a drive letter and enter the data file name.

Optionally, click the box for **Virtual mount point**.

ii. **Log file**: Select a drive letter and enter the log file name.

Optionally, click the box for **Virtual mount point**.

c. **File sizes**: Enter the data size and log size for the database.

9. Click **Create**.

If you created the database host, you can check the job's progress in the **Job monitoring** tab.

Automate with Codebox in BlueXP workload factory for Databases

You can automate host deployment, database creation, and more with Codebox in BlueXP workload factory for Databases. Codebox is an infrastructure as code (IaC) co-pilot that helps you generate code to execute any operations supported by workload factory.

Learn more about [Codebox automation](#) and how to use it.

Administer and monitor

Manage Microsoft SQL Server instances in BlueXP workload factory

Manage Microsoft SQL Server instances to monitor instance and database status, resource utilization, protection, and storage performance in BlueXP workload factory for Databases.

Databases can only manage Microsoft SQL Server instances with FSx for ONTAP file system storage.

Microsoft SQL Server instance management

Microsoft SQL Server instance management includes the following tasks:

- Manage a host instance
- View a managed instance
- View databases
- Unmanage a host instance

To complete any of these tasks, you must [detect one or more host instances](#).

Manage a host instance

Manage a detected or unmanaged Microsoft SQL Server instances for a host.

To manage a host instance in a private network with no external connectivity, the following endpoints need to be available in the VPC with association to the subnets where SQL servers are present. Ensure the interface endpoints allow port 443 in the attached Security Group.

- S3 Gateway/endpoint
- ssm
- ssmmessages
- fsx

Before you begin

Complete the following prerequisites before you begin:

- You must have a detected instance in the host that is available for management.
- PowerShell7 is required to manage the database instance. Install PowerShell7 manually by referring to [Microsoft PowerShell documentation for Windows](#).
- All manage operations are run by the AWS System Manager Agent using `NT Authority\SYSTEM` user privilege. Provide the following permissions for `NT Authority\SYSTEM` user in the database server:
 - "ALTER SETTINGS"
 - "CONTROL SERVER"

- "ALTER ANY DATABASE"
- "VIEW ANY DEFINITION"
- "CONNECT ANY DATABASE"
- "CREATE ANY DATABASE"

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Inventory** tab.
4. Click **Manage** in the row of the host to manage.
5. Select one or more host instances to manage.
6. Click **Manage**.

The operation fails when the Microsoft SQL Server is missing certain PowerShell modules and management scripts. Workload factory triggers a prepare resource job to install missing modules and scripts which you can view in the Job monitoring tab. When the job completes, retry to manage the host instance.

View a managed instance

You can view a managed instance by following these steps.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Inventory** tab.
4. Click the dropdown arrow to expand the row of the host to view its managed instances.

The host expands and the host instances appear.

5. Click the three dots menu of the instance to view and then select **View instance**.

Result

The overview of the instance appears in the Inventory tab.

View databases

You can view the databases managed by the managed instance by following these steps.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Inventory** tab.
4. Click the dropdown arrow to expand the row of the host to view its databases.

The host expands and the host instances appear.

5. Click the three dots menu of the instance containing the databases to view.
6. Select **View databases**.

Result

The list of databases in the instance appears in the Inventory tab.

Unmanage a host instance

Unmanage a host instance by following these steps.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Inventory** tab.
4. Click the dropdown arrow to expand the row of the host instance to unmanage.

The host expands and the host instances appear.

5. Click the three dots menu of the instance to unmanage.
6. Select **Unmanage**.

Result

The host instance is now unmanaged.

Manage clones

Create a sandbox clone in BlueXP workload factory for Databases

Creating a sandbox clone of a database in BlueXP workload factory for Databases lets you use the clone for development, testing, integration, analytics, training, QA, and more without altering the source database.

About this task

A sandbox clone is created from the most recent snapshot on the source database. It may be cloned in the same Microsoft SQL Server as the source database or cloned in another Microsoft SQL Server as long as they share the same FSx for ONTAP file system.

Before you begin

Ensure you complete the following prerequisites before you create a sandbox clone.

Credentials and permissions

You must have [AWS account credentials and read or automate mode permissions](#) to create a sandbox clone in workload factory.

Alternatively, you can use the Codebox to copy a partially completed template or create a completed template so that you can create the sandbox clone outside of workload factory using REST API. [Learn more about Codebox automation](#).

Microsoft SQL Server

You must have a managed Microsoft SQL Server in workload factory for Databases to host the new sandbox clone.

AWS Systems Manager

Ensure the `NT Authority\SYSTEM` user privilege is enabled in the Microsoft SQL host via AWS Systems Manager.

Source database

You need a source database available for the clone.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Sandboxes** tab.
4. In the Sandboxes tab, select **Create new sandbox**.
5. On the Create new sandbox page, under Database source, provide the following:
 - a. **Source database host**: Select the source database host.
 - b. **Source database instance**: Select the source database instance.
 - c. **Source database**: Select the source database to clone from.
6. Under Database target, provide the following:
 - a. **Target database host**: Select a target database host for the sandbox clone that is in the same VPC and has the same FSx for ONTAP file system as the source host.
 - b. **Target database instance**: Select the target database instance for the sandbox clone.
 - c. **Target database**: Enter a name for the sandbox clone.
7. **Mount**: When cloning a SQL database that has multiple data and/or log files, workload factory clones all files under the auto-assigned or defined drive letter.

Select one of the following options:

- a. **Auto-assign mount point**
- b. **Define mount point path**

Provide the following to define the mount point path:

- Enter the drive letter for the data file path.
 - Enter the drive letter for the log file path.
8. **Define tag**: Select a tag to define the sandbox clone.
 9. Click **Create**.

To check the job's progress, go to the **Job monitoring** tab.

Check the integrity of the data in a sandbox clone

Run an integrity check to determine if sandbox clone data is intact or corrupt in BlueXP workload factory for Databases.

About this task

When you create a sandbox clone from a source database while it is busy, the clone's data may not be in sync with the most recent snapshot of the source database. This operation checks the integrity of all the objects in the sandbox clone to determine if the sandbox clone data is current.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Sandboxes** tab.
4. In the Sandboxes tab, click the three dots menu of the sandbox clone to check integrity for.
5. Select **Run integrity check**.
6. In the Integrity check dialog, click **Integrity check**.
7. Check the status of the integrity check in Sandboxes or in Job monitoring.

If the integrity check fails, we recommend that you do not use the sandbox clone and create a new sandbox clone.

Revert a sandbox clone in BlueXP workload factory for Databases

Revert a database clone to its original version at the time of creation in BlueXP workload factory for Databases.

About this task

When you clone a database, the clone at creation is a *baseline* clone. The data in the cloned database is the same as the source database at the time of creation. As data in a sandbox database clone changes over time, you might want to revert the data back to the baseline when the clone was first created. This operation is called re-baselining a clone. Re-baselining a clone rather than creating a new clone saves space; however, any changes made to the sandbox clone will be deleted.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Sandboxes** tab.
4. In the Sandboxes tab, click the three dots menu of the sandbox clone you want to revert.
5. Select **Re-baseline**.
6. In the Re-baseline dialog, click **Re-baseline**.

Refresh a sandbox clone in BlueXP workload factory for Databases

Refresh a database clone in BlueXP workload factory for Databases so that it is equivalent to the source database at the current moment or a previous point in time.

About this task

Refreshing a clone updates the clone either to the source database at the current moment or to a snapshot of the source database taken at a previous point in time. Any changes made to the sandbox clone will be deleted.

Before you begin

A refresh is only possible when the source database is active.

To refresh a database clone from a snapshot, the source database must have at least one snapshot for the operation.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Sandboxes** tab.
4. In the Sandboxes tab, click the three dots menu of the sandbox clone you want to refresh.
5. Select **Refresh**.
6. In the Refresh dialog, select one of the following options:
 - a. **Refresh to current time**
 - b. **Refresh to point in time**

For this option, select the database snapshot from the dropdown menu to refresh to.

7. Click **Refresh**.

Connect a sandbox clone to CI/CD tools

Connect a sandbox clone to a continuous integration and continuous delivery (CI/CD) pipeline with REST API code to improve software delivery via automation in BlueXP workload factory for Databases.

About this task

To deliver a new version of software automatically to your database clone, you should connect to a CI/CD pipeline. Use the REST API code provided from this operation to make the connection.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Sandboxes** tab.
4. In the Sandboxes tab, click the three dots menu of the sandbox clone to connect to CI/CD tools.
5. Select **Connect to CI/CD tools**.
6. In the CI/CD dialog, copy or download the REST API code needed to connect to CI/CD tools.
7. Click **Close**.

View connection information of a sandbox clone

View and copy the connection information of a sandbox clone in BlueXP workload factory for Databases.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.

3. In Databases, select the **Sandboxes** tab.
4. In the Sandboxes tab, click the three dots menu of the sandbox clone to view its connection information.
5. Select **Show connection info**.
6. In the Show connection info dialog, copy the connection information if needed.
7. Click **Close**.

Split a sandbox clone from the source database

In BlueXP workload factory for Databases, splitting a sandbox clone from its source database creates a new database which will consume a certain amount of storage capacity. The clone gets deleted when the split is complete and the new database appears in the Inventory.

Before you begin

Consider how much storage capacity is needed for the new database. If needed, [increase file system capacity](#) for the FSx for ONTAP file system before you begin.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Sandboxes** tab.
4. In the Sandboxes tab, click the three dots menu of the sandbox clone you want to split.
5. Select **Split**.
6. In the Split dialog, click **Split**.

Split a sandbox clone from the source database

Delete a sandbox clone in BlueXP workload factory for Databases when you no longer need it and want to free up storage capacity.

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, click **Go to Databases Inventory**.
3. In Databases, select the **Sandboxes** tab.
4. Click the three dots menu of the sandbox clone you want to delete.
5. Select **Delete**.
6. In the Delete dialog, click **Delete**.

Monitor databases in BlueXP workload factory

Track database jobs and monitor databases within BlueXP workload factory for Databases.

About this task

Databases provides job monitoring so you can track job progress, and diagnose and troubleshoot in case any failure occurs. In addition, filters by type and status, the search function, and the option to download the jobs table help with database jobs navigation and reporting.

Job monitoring supports up to three levels of monitoring depending on the job. For example, for new database and sandbox clone creation, job monitoring tracks parent jobs and sub-jobs.

Job monitoring levels

- Level 1 (parent job): Tracks the host deployment job.
- Level 2 (sub-job): Tracks the sub-jobs related to the host deployment parent job.
- Level 3 (task): Lists the sequence of actions taken on each resource.

Job status

The job monitoring feature tracks *in progress*, *completed*, and *failed* jobs daily, weekly, bi-weekly, and monthly.

Job events retention

Job monitoring events are retained in the user interface for 30 days.

Monitor jobs

Steps

1. Log in using one of the [console experiences](#).
2. In the Databases tile, select **Go to Databases Inventory**.
3. In Databases, select the **Job monitoring** tab.
4. In the Job monitoring tab, use the filters or search to narrow job results. You can also download a jobs report.
5. Click the three dots menu of the job and click **Go to CloudFormation** to view the job log in the AWS CloudFormation console.

Optimize SQL server

Knowledge and support

Register for support

Before you can open a support case with NetApp technical support, you need to add a NetApp Support Site account to workload factory and then register for support.

Support registration is required to receive technical support specific to Workload Factory and its storage solutions and services. You must register for support from the BlueXP console, which is a separate web-based console from Workload Factory.

Registering for support does not enable NetApp support for a cloud provider file service. For technical support related to a cloud provider file service, its infrastructure, or any solution using the service, refer to "Getting help" in the Workload Factory documentation for that product.

[Amazon FSx for ONTAP](#)

Support registration overview

Registering your account ID support subscription (your 20 digit 960xxxxxxx serial number located on the Support Resources page in BlueXP) serves as your single support subscription ID. Each BlueXP account-level support subscription must be registered.

Registering enables capabilities like opening support tickets and automatic case generation. Registration is completed by adding NetApp Support Site (NSS) accounts to BlueXP as described below.

Register your account for NetApp support

To register for support and activate support entitlement, one user in your account must associate a NetApp Support Site account with their BlueXP login. How you register for NetApp support depends on whether you already have a NetApp Support Site (NSS) account.

Existing customer with an NSS account

If you're a NetApp customer with an NSS account, you simply need to register for support through BlueXP.

Steps

1. In the upper right of the Workload Factory console, select **Help > Support**.

Selecting this option opens the BlueXP console a new browser tab and loads the Support dashboard.

2. In the upper right of the BlueXP console, select the Settings icon, and select **Credentials**.
3. Select **User Credentials**.
4. Select **Add NSS credentials** and follow the NetApp Support Site (NSS) Authentication prompt.
5. To confirm that the registration process was successful, select the Help icon, and select **Support**.

The **Resources** page should show that your account is registered for support.

 <p>9601111222224444455555 Account Serial Number</p>	 <p>Registered for Support Support Registration</p>
---	--

Note that other BlueXP users will not see this same support registration status if they have not associated a NetApp Support Site account with their BlueXP login. However, that doesn't mean that your BlueXP account is not registered for support. As long as one user in the account has followed these steps, then your account has been registered.

Existing customer but no NSS account

If you're an existing NetApp customer with existing licenses and serial numbers but *no* NSS account, you need to create an NSS account and associate it with your BlueXP login.

Steps

1. Create a NetApp Support Site account by completing the [NetApp Support Site User Registration form](#)
 - a. Be sure to select the appropriate User Level, which is typically **NetApp Customer/End User**.
 - b. Be sure to copy the BlueXP account serial number (960xxxx) used above for the serial number field. This will speed up the account processing.
2. Associate your new NSS account with your BlueXP login by completing the steps under [Existing customer with an NSS account](#).

Brand new to NetApp



If you are brand new to NetApp and you don't have an NSS account, follow each step below.

Steps

1. In the upper right of the Workload Factory console, select **Help > Support**.

Selecting this option opens the BlueXP console a new browser tab and loads the Support dashboard.

2. Locate your account ID serial number from the Support Resources page.

 <p>96015585434285107893 Account serial number</p>	 <p>Not Registered Add your NetApp Support Site (NSS) credentials to BlueXP Follow these instructions to register for support in case you don't have an NSS account yet.</p>
---	---

3. Navigate to [NetApp's support registration site](#) and select **I am not a registered NetApp Customer**.
4. Fill out the mandatory fields (those with red asterisks).
5. In the **Product Line** field, select **Cloud Manager** and then select your applicable billing provider.
6. Copy your account serial number from step 2 above, complete the security check, and then confirm that you read NetApp's Global Data Privacy Policy.

An email is immediately sent to the mailbox provided to finalize this secure transaction. Be sure to check your spam folders if the validation email doesn't arrive in few minutes.

7. Confirm the action from within the email.

Confirming submits your request to NetApp and recommends that you create a NetApp Support Site account.

8. Create a NetApp Support Site account by completing the [NetApp Support Site User Registration form](#)
 - a. Be sure to select the appropriate User Level, which is typically **NetApp Customer/End User**.
 - b. Be sure to copy the account serial number (960xxxx) used above for the serial number field. This will speed up the account processing.

After you finish

NetApp should reach out to you during this process. This is a one-time onboarding exercise for new users.

Once you have your NetApp Support Site account, associate the account with your BlueXP login by completing the steps under [Existing customer with an NSS account](#).

Get help for BlueXP workload factory for Databases

NetApp provides support for Workload Factory and its cloud services in a variety of ways. Extensive free self-support options are available 24x7, such as knowledgebase (KB) articles and a community forum. Your support registration includes remote technical support via web ticketing.

Get support for FSx for ONTAP

For technical support related to FSx for ONTAP, its infrastructure, or any solution using the service, refer to "Getting help" in the Workload Factory documentation for that product.

[Amazon FSx for ONTAP](#)

To receive technical support specific to Workload Factory and its storage solutions and services, use the support options described below.

Use self-support options

These options are available for free, 24 hours a day, 7 days a week:

- [Documentation](#)

The Workload Factory documentation that you're currently viewing.

- [Knowledge base](#)

Search through the Workload Factory knowledge base to find helpful articles to troubleshoot issues.

- [Communities](#)

Join the Workload Factory community to follow ongoing discussions or create new ones.

Create a case with NetApp support

In addition to the self-support options above, you can work with a NetApp Support specialist to resolve any issues after you activate support.

Before you get started

To use the **Create a Case** capability, you must first register for support. associate your NetApp Support Site credentials with your Workload Factory login. [Learn how to register for support.](#)

Steps

1. In the upper right of the Workload Factory console, select **Help > Support**.

Selecting this option opens the BlueXP console a new browser tab and loads the Support dashboard.

2. On the **Resources** page, choose one of the available options under Technical Support:

- a. Select **Call Us** if you'd like to speak with someone on the phone. You'll be directed to a page on netapp.com that lists the phone numbers that you can call.

- b. Select **Create a Case** to open a ticket with a NetApp Support specialist:

- **Service:** Select **Workload Factory**.

- **Case Priority:** Choose the priority for the case, which can be Low, Medium, High, or Critical.


To learn more details about these priorities, hover your mouse over the information icon next to the field name.

- **Issue Description:** Provide a detailed description of your problem, including any applicable error messages or troubleshooting steps that you performed.

- **Additional Email Addresses:** Enter additional email addresses if you'd like to make someone else aware of this issue.

- **Attachment (Optional):** Upload up to five attachments, one at a time.


Attachments are limited to 25 MB per file. The following file extensions are supported: txt, log, pdf, jpg/jpeg, rtf, doc/docx, xls/xlsx, and csv.

ntapitdemo 

NetApp Support Site Account

Service Working Environment


Select Select

Case Priority 



Low - General guidance



Issue Description

Provide detailed description of problem, applicable error messages and troubleshooting steps taken.

Additional Email Addresses (Optional) 

Type here

Attachment (Optional)  Upload 

No files selected  

After you finish

A pop-up will appear with your support case number. A NetApp Support specialist will review your case and get back to you soon.

For a history of your support cases, you can select **Settings > Timeline** and look for actions named "create support case." A button to the far right lets you expand the action to see details.

It's possible that you might encounter the following error message when trying to create a case:

"You are not authorized to Create a Case against the selected service"

This error could mean that the NSS account and the company of record it's associated with is not the same company of record for the BlueXP account serial number (ie. 960xxxx) or the working environment serial number. You can seek assistance using one of the following options:

- Use the in-product chat
- Submit a non-technical case at <https://mysupport.netapp.com/site/help>

Manage your support cases (Preview)

You can view and manage active and resolved support cases directly from BlueXP. You can manage the cases associated with your NSS account and with your company.

Case management is available as a Preview. We plan to refine this experience and add enhancements in upcoming releases. Please send us feedback by using the in-product chat.

Note the following:

- The case management dashboard at the top of the page offers two views:
 - The view on the left shows the total cases opened in the past 3 months by the user NSS account you provided.
 - The view on the right shows the total cases opened in the past 3 months at your company level based on your user NSS account.

The results in the table reflect the cases related to the view that you selected.

- You can add or remove columns of interest and you can filter the contents of columns like Priority and Status. Other columns provide just sorting capabilities.

View the steps below for more details.

- At a per-case level, we offer the ability to update case notes or close a case that is not already in Closed or Pending Closed status.

Steps

1. In the upper right of the Workload Factory console, select **Help > Support**.

Selecting this option opens the BlueXP console a new browser tab and loads the Support dashboard.

2. Select **Case Management** and if you're prompted, add your NSS account to BlueXP.

The **Case management** page shows open cases related to the NSS account that is associated with your BlueXP user account. This is the same NSS account that appears at the top of the **NSS management** page.

3. Optionally modify the information that displays in the table:

- Under **Organization's cases**, select **View** to view all cases associated with your company.
- Modify the date range by choosing an exact date range or by choosing a different time frame.

Search: Cases opened on the last 3 months ▼ Create a case

Date created	Last updated	Priority	Status (5)	
December 22, 2022	December 29, 2022	Medium (P3)	Assigned	...
December 21, 2022	December 28, 2022	Medium (P3)	Active	...
December 15, 2022	December 27, 2022	Medium (P3)	Pending customer	...
December 14, 2022	December 26, 2022	Low (P4)	Solution proposed	...

- Filter the contents of the columns.

Search: Cases opened on the last 3 months ▼ Create a case

Last updated	Priority	Status (5)	
December 29, 2022	Critical (P1)	<input checked="" type="checkbox"/> Active <input checked="" type="checkbox"/> Pending customer	...
December 28, 2022	High (P2)	<input checked="" type="checkbox"/> Solution proposed <input checked="" type="checkbox"/> Pending closed	...
December 27, 2022	Medium (P3)	<input type="checkbox"/> Closed	...
December 26, 2022	Low (P4)	Apply Reset	...

- Change the columns that appear in the table by selecting + and then choosing the columns that you'd like to display.

Search: Cases opened on the last 3 months ▼ Create a case

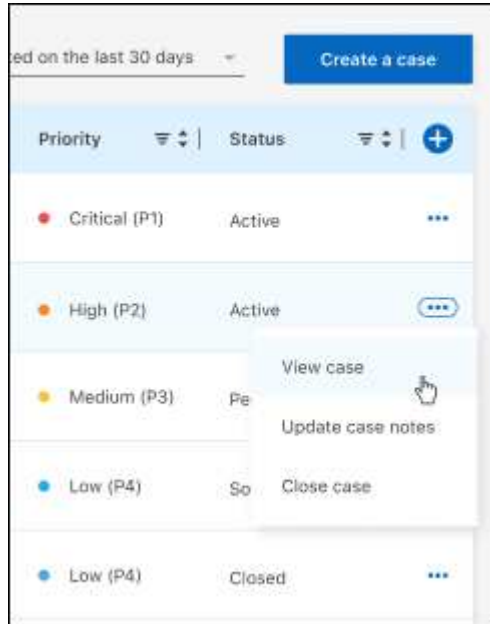
Last updated	Priority	Status (5)	
December 29, 2022	Critical (P1)	<input checked="" type="checkbox"/> Last updated <input checked="" type="checkbox"/> Priority	...
December 28, 2022	High (P2)	<input checked="" type="checkbox"/> Cluster name	...
December 27, 2022	Medium (P3)	<input type="checkbox"/> Case owner <input type="checkbox"/> Opened by	...
December 26, 2022	Low (P4)	Apply Reset	...

4. Manage an existing case by selecting **...** and selecting one of the available options:

- **View case:** View full details about a specific case.
- **Update case notes:** Provide additional details about your problem or select **Upload files** to attach up to a maximum of five files.

Attachments are limited to 25 MB per file. The following file extensions are supported: txt, log, pdf, jpg/jpeg, rtf, doc/docx, xls/xlsx, and csv.

- **Close case:** Provide details about why you're closing the case and select **Close case**.



Legal notices

Legal notices provide access to copyright statements, trademarks, patents, and more.

Copyright

<https://www.netapp.com/company/legal/copyright/>

Trademarks

NETAPP, the NETAPP logo, and the marks listed on the NetApp Trademarks page are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.

<https://www.netapp.com/company/legal/trademarks/>

Patents

A current list of NetApp owned patents can be found at:

<https://www.netapp.com/pdf.html?item=/media/11887-patentspage.pdf>

Privacy policy

<https://www.netapp.com/company/legal/privacy-policy/>

Open source

Notice files provide information about third-party copyright and licenses used in NetApp software.

- [Workload Factory](#)
- [Workload Factory for Databases](#)
- [Workload Factory for GenAI](#)
- [Workload Factory for VMware](#)

Copyright information

Copyright © 2024 NetApp, Inc. All Rights Reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

LIMITED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (b)(3) of the Rights in Technical Data -Noncommercial Items at DFARS 252.227-7013 (FEB 2014) and FAR 52.227-19 (DEC 2007).

Data contained herein pertains to a commercial product and/or commercial service (as defined in FAR 2.101) and is proprietary to NetApp, Inc. All NetApp technical data and computer software provided under this Agreement is commercial in nature and developed solely at private expense. The U.S. Government has a non-exclusive, non-transferrable, nonsublicensable, worldwide, limited irrevocable license to use the Data only in connection with and in support of the U.S. Government contract under which the Data was delivered. Except as provided herein, the Data may not be used, disclosed, reproduced, modified, performed, or displayed without the prior written approval of NetApp, Inc. United States Government license rights for the Department of Defense are limited to those rights identified in DFARS clause 252.227-7015(b) (FEB 2014).

Trademark information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.