

NODUS Cloud OS

User Guide 5.2.0

January 2021



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Welcome

The NODUS Cloud OS User Guide will show you how to use the NODUS Cloud OS user interface and command line interface.

NODUS Cloud OS for intelligent cloud management gives immediate access to all computational resources, whether on-premises or in the cloud, on any leading cloud service provider. This highly flexible and customizable solution enables HPC or enterprise systems to 'burst' scheduled workloads to an external cloud on demand. NODUS Cloud OS includes all the necessary tools to facilitate moving HPC and enterprise workloads and applications to the cloud and/or extending on-premises resources.

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Revision History

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Revision History

Date	Release
February 2018	Moab/NODUS Cloud Bursting 1.1.0
November 2018	NODUS 3.0.0
July 2019	NODUS Cloud OS 3.2.0
October 2019	NODUS Cloud OS 3.2.3
December 2019	NODUS Cloud OS 4.0.0
April 2020	NODUS Cloud OS 4.0.1
June 2020	NODUS Cloud OS 5.0.0
September 2020	NODUS Cloud OS 5.1.0
January 2021	NODUS Cloud OS 5.2.0

Related Documentation

- *Cloud Business Value Process Spreadsheet*
<http://support.adaptivecomputing.com/Cloud-Business-Value-Process-Spreadsheet.xlsx>
- *NODUS Cloud OS Quick Start Guide*
[NODUS Cloud OS Quick Start Guide \(Adaptive Computing Support Portal / Product Documentation / NODUS Cloud OS\)](#)

Chapter 1: NODUS Cloud OS Platform Installation

This chapter provides information about the installer, which contains the entire NODUS Cloud Platform, along with dependencies to install it.

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1.1 Prerequisites

This section contains the following information:

- [Operating System](#)
- [Supported Browsers](#)
- [Linux Packages](#)
- [Traffic](#)
- [Obtaining Credentials from the Cloud Service Providers](#)
- [Stacks](#)
- [Site Availability](#)

1.1.1 Operating System

NODUS platform can be installed on many different Linux distributions and has been tested on these operating systems:

- CentOS 7
- Oracle 7.7
- Red Hat 7

Note: Refer to the chosen operating system's product specifications for minimum requirements.

1.1.2 Supported Browsers

The NODUS UI supports these web browsers:

- Google Chromium (latest version)
- Google Chrome (latest version)
- Mozilla Firefox (latest version)
- Microsoft Edge (two latest major versions)
- Apple Safari (two latest major versions)

1.1.3 Linux Packages

The following Linux packages must be installed on the NODUS platform server prior to the software installation:

- mongodb-server
- nginx

1.1.4 Traffic

To enable access to the NODUS platform server, the following ports need to be open with external access:

- 22 (SSH) - user direct access / Moab job routing
- 80 (HTTP) - connection to the NODUS UI
- 443 (HTTPS) - optional, if you secure your HTTP connection
- 12001 (Cluster API) - RESTful API that communicates with the clusters
- 12345 (NODUS-web-API) - the NODUS Platform API server that communicates with your UI

Note: The NODUS platform server installation will enable these ports on the server. Ports 80 and 443 are used for the UI, but can be changed to reflect your requirements.

1.1.5 Obtaining Credentials from the Cloud Service Providers

These are the supported cloud service providers:

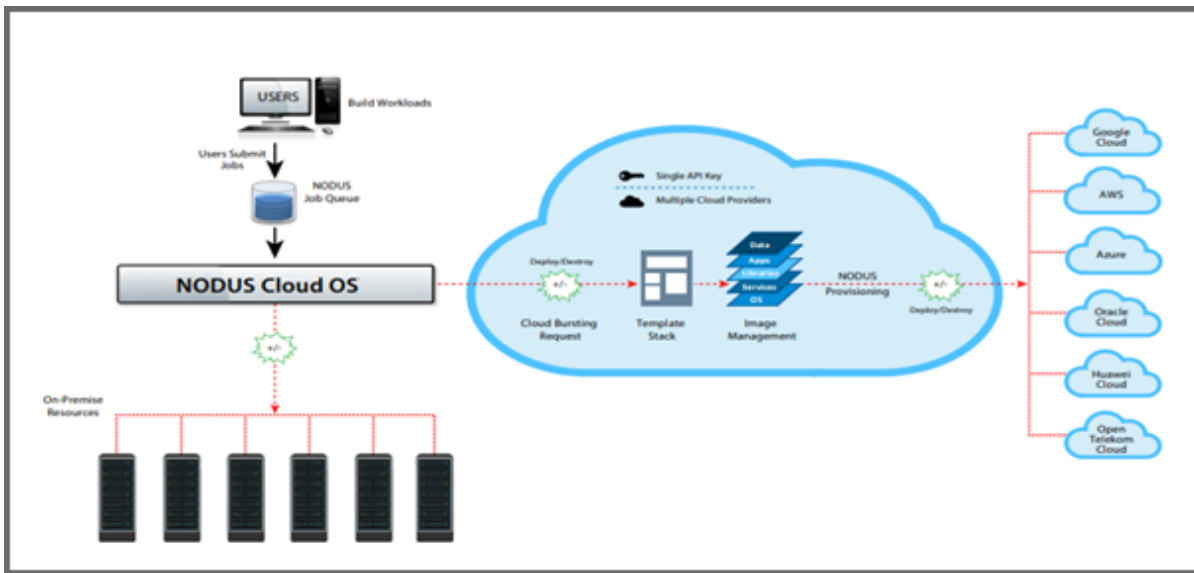
-  Amazon Web Services (AWS)
-  Google Cloud
-  Microsoft Azure
-  Oracle Cloud
-  Huawei Cloud
-  Open Telekom Cloud (OTC)

Note: For unsupported cloud service providers, please contact us at nodus@adaptivecomputing.com to inquire about adding the provider into NODUS Cloud OS.

NODUS requires Programmatic access to deploy nodes and cluster networks on your cloud provider's resources. The steps below will help you obtain the proper cloud credentials. See the appendices [Creating Accounts for NODUS Providers](#) and [Obtaining Cloud Service Provider Account Information and Credentials](#) for additional information.

Refer to the providers' support pages for detailed information. **Note:** If you need a private IP address created within a provider or you cannot get provider credentials / correct admin level credentials, please contact us at nodus@adaptivecomputing.com.

NODUS Overview



Continue with the steps for your chosen provider below to obtain credentials:

- [Google Cloud](#)
- [AWS](#)
- [Microsoft Azure](#)
- [Oracle Cloud](#)
- [Huawei Cloud](#)
- [Open Telekom Cloud](#)

Google Cloud

1. Create a service account.
2. From the **Service account** list, select **New service account**.
3. In the **Service account name** field, enter a name.
4. From the **Role** list, select **Project / Owner**.
5. Click **Create**. A JSON file that contains your key downloads to your computer.

See <https://cloud.google.com/docs/authentication/production> for additional information.

AWS

AWS has two forms of credentials, both require admin privileges to set up:

- Programmatic access (access key, secret key) is a floating set of coupled values.
- EC2 roles only exist within AWS and are attached to AWS instances.

These accounts must have valid permissions associated in order to use NODUS. NODUS can deploy clusters using either programmatic access or EC2 roles. However, stack builds can only be done with Programmatic access.

NODUS requires Programmatic access to access the provider's resources. For example, if NODUS is outside of the AWS environment, access keys are required. If NODUS is running inside AWS, the best practice is to use IAM roles instead. An IAM role is a defined set of permissions. It is not associated with a specific user or group and any trusted entity can assume the role to perform a specific business task. NODUS supports both access methods.

When creating a cluster via **nodus cluster:aws:create**, the flag `--role` can be used to set the cluster to use EC2 role instead of Programmatic access. If the cluster entry already exists, then **nodus cluster:aws:update** can be used with flag `--role` or `--no-role` to switch on EC2 role use or turn it off, respectfully.

1. Sign in to the AWS Management Console and open the **IAM** console.
2. In the navigation pane, select **Users**.
3. Select the name of the user whose access keys you want to create, and then select the **Security credentials** tab.
4. In the **Access keys** section, select **Create access key**.
5. To view the new access key pair, select **Show**. You will not have access to the secret access key again after this dialog box closes.
6. To download the key pair, select **Download .csv file**. Store the keys in a secure location. You will not have access to the secret access key again after this dialog box closes.
7. After you download the `.csv` file, select **Close**. When you create an access key, the key pair is active by default, and you can use the pair right away.

See <https://docs.aws.amazon.com/general/latest/gr/aws-sec-cred-types.html> for additional information.

Microsoft Azure

1. Run the script **account-scripts_azure.sh**.

See <https://docs.microsoft.com/en-us/azure/automation/shared-resources/credentials> for additional information.

Oracle Cloud

1. On the Oracle account to be used, create a compartment.
2. Within that compartment, create a VPC (virtual private cloud) network.
3. Within that VPC, create at least one subnet.

See <https://docs.cloud.oracle.com/iaas/Content/home.htm> for additional information.

Huawei Cloud

1. On the Huawei account to be used, create a VPC.
2. Within that VPC, create a subnet.

See <https://support.huaweicloud.com/intl/en-us/vpc/index.html> for additional information.

Open Telekom Cloud

1. On the Open Telekom Cloud (OTC) account to be used, create a VPC.
2. Within that VPC, create a subnet.

See <https://open-telekom-cloud.com/en/products-services/virtual-private-cloud> for additional information.

1.1.6 Stacks

To launch instances in the cloud, a stack must first be created using credentials with appropriate cloud permissions and policies.

The stack consists of the base OS (CentOS 7), services, libraries, applications, and any data that is needed so that once the instance starts up, it is ready to begin processing jobs. NODUS allows customization options to conform to cloud configurations (proxy, vpc, subnet, etc.).

Two images are generated from the stack build process: a base OS image and a prebuilt/configured image snapshot. You can use a stock image from the marketplace or account to build a private image. Cluster software used is Torque, Ansible, Maui, and Serf.

See the CLI Commands section [Stacks](#) for additional information.

1.1.7 Site Availability

Before building a stack or deploying a cluster, make sure that the site hashicorp.com (the supplier of Terraform) is not blocked by a firewall as this will prevent the Terraform process from completing.

1.2 Installation Steps

1. In a browser, access the server via the IP or hostname (e.g., `http://x.x.x.x/`) to verify that `nginx` is started and the default port is available. If the site is unreachable, then the firewall may be enabled or the `nginx` server is not running.
 - A. Connect to the server via a command line and run **`sudo systemctl start nginx`**.
 - B. Access `http://x.x.x.x/` once again:
 - If you get a `Welcome to CentOS` message, the default port number is available and you can proceed with the installation. Or if the site is still unreachable, then the firewall may be enabled and the NODUS install cannot proceed.
 - If any other data is displayed on the browser, the default port may be in use and your administrator should assign you another port number that will be used in step 6.
2. Log in to the installation user for the operating system where NODUS is to be installed to get a command line shell.
3. Untar the NODUS distribution file with the command **`tar xf Nodus_Cloud_OS-<version>.tgz`**. This will produce a directory with the installation files needed to install NODUS.
 - A. Look at the files via **`ls`**. You should see a file called `nodus-<version>`.
 - B. Change to the installation directory with the command **`cd nodus-<version>`**.
4. Because a license key is needed to install NODUS, save the license key in a file on the server. You will also need to provide a username that will be used to access the web server files. For security purposes, never use `root` as the username.
5. Install NODUS with the command **`./install-nodus.sh <username> <license file>`**.

6. (optional) If there is already a process using port 80 (from step 1), change the nginx port number with the command **sudo <edit> /etc/nginx/nginx.conf**.

A. Replace these lines:

```
listen 80 default_server;
listen [::] :80 default_server;
```

With these lines:

```
listen <new port> default_server;
listen [::] :<new port> default_server;
```

7. Restart the nginx server with the command **sudo systemctl restart nginx**.
8. The NODUS services use the file `/NODUS/.nodusrc` to modify the functionality of NODUS. This file contains the following parameters:

`MONGO_HOST=localhost`

This parameter defines the Mongo DB server that is hosting the NODUS database. The default value is `localhost`.

`MONGO_PORT=27017`

This parameter defines the port that the Mongo DB server is listening on. The default value is `27017`.

`MONGO_DATABASE=nodus`

This parameter defines the database in the Mongo DB and saves the NODUS information. The default value is `nodus`.

`MONGO_USER=`

This **REQUIRED** parameter defines the user in the Mongo DB that is authorized to access the NODUS information. This value is configured at installation.

`MONGO_PASSWORD=`

This **REQUIRED** parameter defines the password for the `MONGO_USER` in the Mongo DB that is authorized to access the NODUS information. This value is configured at installation.

`LICENSE_PATH=/NODUS/.license`

This parameter defines the location of the license key that is needed to use NODUS. The default value is `/NODUS/.license`.

`BURST_INTERVAL_MS=60000`

This parameter defines the number of milliseconds for NODUS to check all the clusters that are set to `Bursting`. The default value is 60000 (1 minute).

`PARALLEL_TRANSACTIONS=10`

This parameter defines the maximum parallel transaction for deploying/destroying nodes. The default value is 10.

Note: If a parameter does not exist in the file, the default value is used.

1.3 Verifying the Installation

1. Check the UI configuration files by editing `/NODUS/nodus4-ui-desktop-app/build/assets/config.json`. This file tells the UI the address and port of the API, and which providers will be used. You can edit the providers to only show which ones you will supply licenses to. The file looks similar to this:

```
{
  "server": "http://<server Address>:12345",
  "providers": ["aws", "google", "azure", "oracle", "huawei",
    "otc"]
}
```

2. Verify the API in a browser by entering **`http://<server_address>:12345/`**. The browser should display `{"reason": "unknown", "message": "Not Found"}`. If not, rerun step 1 and/or step 2.
3. Verify the UI in a browser by entering **`http://<server_address>/`**. You should be prompted to enter a license or to log in. If not, rerun step 1 and/or step 2.

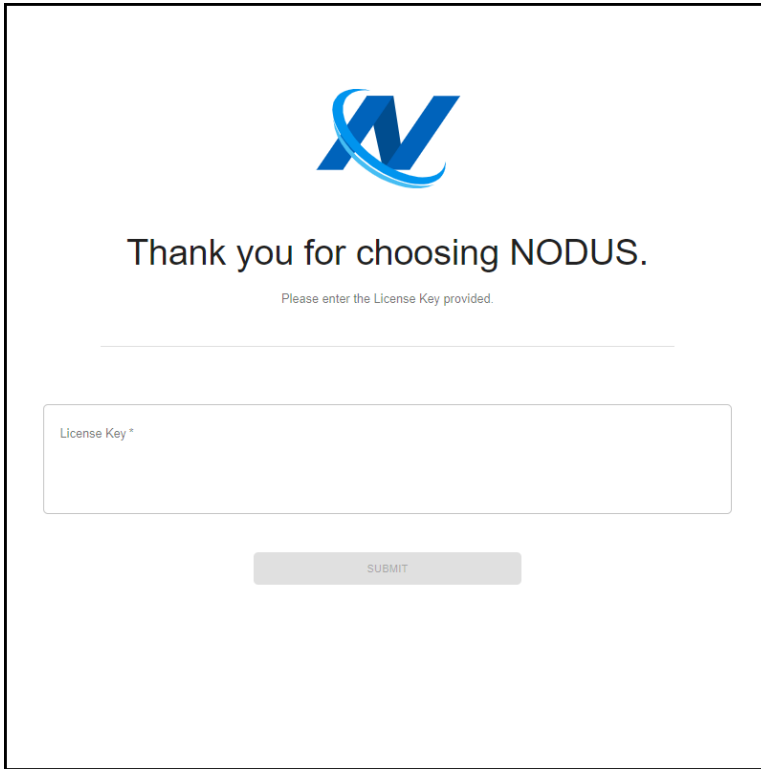
1.4 Adding the Server License Key

Follow one of the procedures below to add a license key:

- [Adding the License Key via the NODUS GUI](#)
- [Adding the License Key from a Terminal](#)

Adding the License Key via the NODUS GUI

1. Go to `http://<web_server_address>` and enter the license key that was provided. **Note:** `web_server_address` refers to the server where the NODUS platform is installed.

A screenshot of a web interface for adding a license key. At the top center is a blue logo consisting of a stylized 'N' with a swoosh. Below the logo, the text "Thank you for choosing NODUS." is displayed in a large, dark font. Underneath this, in a smaller font, is the instruction "Please enter the License Key provided." Below the instruction is a horizontal line, followed by a text input field with the placeholder text "License Key *". At the bottom center of the form is a gray button labeled "SUBMIT".

Adding the License Key from a Terminal

1. Log in to the `<user_name>@<web_server_address>` that you installed NODUS as in the section [Installation Steps](#).
2. Add the license key that was provided to `/NODUS/.license`. **Note:** If the license type is Multi-User, then add the user license to `~/nodus/.userKey`.
3. Verify that the license is working by running command **nodus license**.

1.5 Modifying the Code

Modification of the code without the approval of Adaptive Computing is discouraged as this may result in an unstable environment.

1.6 Disaster Recovery

NODUS helps facilitate disaster recovery by enabling you to back up and restore your database by using the following commands.

- To back up the NODUS database to file, use **\$ nodus db:backup [OPTIONS]**
- To restore the NODUS database from backup, use **\$ nodus db:restore [OPTIONS]**

See the section [Misc](#) in the chapter **NODUS CLI Commands** for additional information.

Chapter 2: Using the NODUS GUI

This chapter provides information about using the NODUS GUI to run your workloads in the cloud.

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2.1 Creating a NODUS Account

You can have one of two different types of accounts, depending on how your server is set up: Site Account or Multi-User Account.

1. To create an account, go to `http://<web_server_address>` and click **Create a NODUS account**.
Note: `web_server_address` refers to the server where the NODUS platform is installed.
2. Follow the instructions and complete the registration process. Your username and password are required for future logins. The password must be at least 8 characters long, contain at least 1 lowercase, 1 uppercase, 1 numeric, and 1 special character such as `!@#$%^&*`.

Site Account

Upon successful registration, you will be logged in to `http://<web_server_address>`.

Multi-User Account

This message appears: Account Creation Successful! In order to access NODUS you will need a USER KEY. If you do not already have one, please contact Adaptive Computing at `license@adaptivecomputing.com!`

2.2 Credentials Manager

Credentials are required by the cloud service providers in order to access their environment and resources. Adding and saving them now means that you can easily select them with just one click when creating a cluster.

1. To add credentials, log in to your NODUS Cloud OS user account at `http://<web_server_address>`. The **Cluster Manager** screen opens.

2. On the **Applications** menu, click **Credentials Manager**:

In Use	Name	Provider	Date/Time Created	Actions
+	awscredentials	Amazon	May 12, 2020 3:50 PM	...
+	googlecredentials	Google	May 12, 2020 3:54 PM	...
+	azurecredentials	Microsoft	May 12, 2020 3:55 PM	...
+	oraclecredentials	Oracle	May 12, 2020 3:56 PM	...
+	huaweicredentials	HUAWEI	May 12, 2020 3:57 PM	...
+	otccredentials		May 12, 2020 3:57 PM	...

The **Credentials Manager** screen shows this information: In Use, Name, Provider, Date/Time Created, and Actions (...). Edit Collaborators, Set, & Delete. **Note:** For Edit Collaborators, the License Type must be Site.

Note: From the **Applications** menu, you can also create clusters, build stacks, submit jobs, and view a job's output file. See the sections [Cluster Manager](#), [Stack Manager](#), [Job Manager](#), and [File Manager](#) for information.

3. Select the appropriate cloud service provider and enter the desired name for the credentials.
4. Enter your account credentials. Alternatively, click **Upload Credential**.
5. Click **Save** to finish adding the credentials for this provider.

Note: Clicking the name of a credential shows information about it.

Repeat the steps in this section to add credentials for another provider if desired.

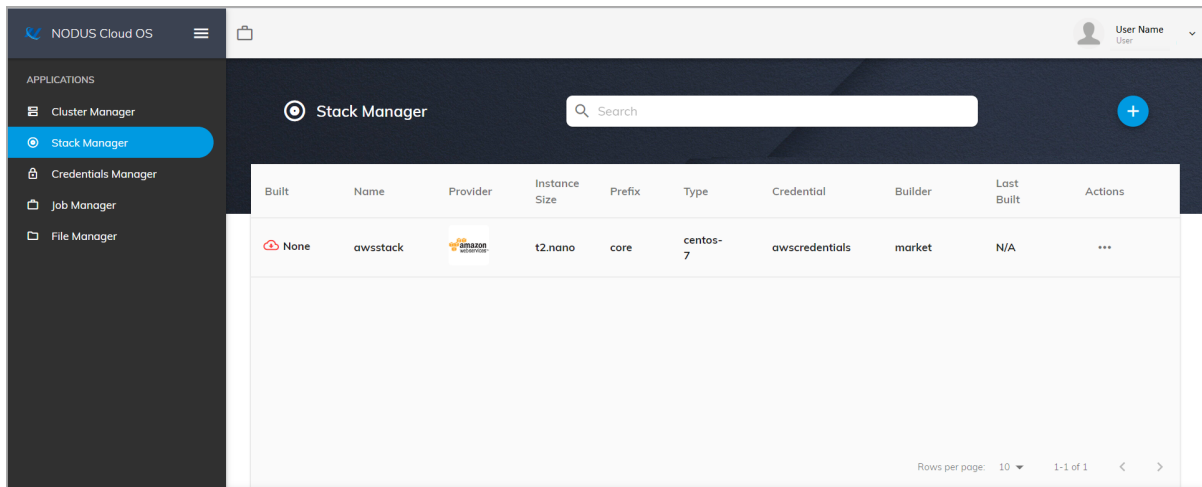
2.3 Stack Manager

This section contains the following information:

- [Viewing Stacks](#)
- [Creating a Stack](#)
- [Building a Stack](#)

2.3.1 Viewing Stacks

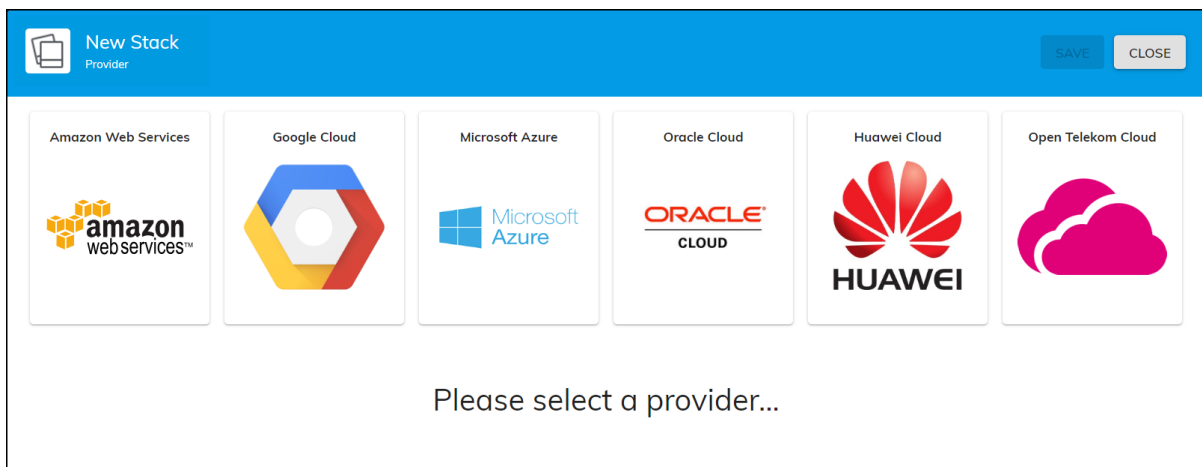
1. On the **Applications** menu, click **Stack Manager**:



On the **Stack Manager** screen, you can create new stacks and see a list of all your current stacks and information such as: Built (Success / Failed / None), Name, Provider, Instance Size, Prefix, Type, Builder, Last Built, and Actions (Edit Collaborators, Edit, Build, Logs, & Delete). **Note:** For Edit Collaborators, the License Type must be Site.

2.3.2 Creating a Stack

1. To create a new stack, on the **Stack Manager** screen, click the add icon (+). The **New Stack** screen shows the cloud service providers that you have credentials for:



2. Select the cloud service provider that you want to create a stack in.

3. Enter the desired information for the new stack: Name, Type, Prefix, Credential, Head Node Size, Subnet Network, and Description.
Clicking the **Advanced** button shows these additional fields: Private IP, Proxy, Source Image, SSH Username, Security, and Volume. **Note:** The available fields vary based on the provider.
4. Click **Save**. The state shows `None` until it is built.
5. Repeat the steps in this section to create additional clusters as desired.

2.3.3 Building a Stack

1. To build a stack, under **Actions**, click **Build**. The state changes to `Success`. If it fails, the state changes to `Failed`.

2.4 Building Stacks into Images

This section contains the following information:

- [Building Stacks](#)
- [Building Customer Defined Images](#)

2.4.1 Building Stacks

NODUS cluster stacks need to be built for your provider and in the regions you want to use with a NODUS cluster.

If you just want to deploy another cluster in the same region using the same credentials, then stack rebuilds should not be necessary.

By default, NODUS images are built on top of the marketplace image CentOS 7.

Alternatively, it can be configured to build NODUS images on top of an existing image. **Note:** See <https://wiki.centos.org/About/Product> for minimum requirements for CentOS 7.

Successful Build

A successful stack build looks like this:

```
==> Builds finished. The artifacts of successful builds are:
--> market-server: AMIs were created:
us-east-1: ami-00d17452c46306a94

--> market-server:
--> market-node: AMIs were created:
us-east-1: ami-082631c41bb6b0761

--> market-node:

=== BUILD COMPLETE :: Wed Jun 17 2020 09:19:34 GMT-0400 ===
```

2.4.2 Building Customer Defined Images

This process enables you to create custom stacks and install all the software you need to run your jobs and to customize the cluster nodes to be able to spin up and burst a cluster to meet the needs of the jobs to be run. You will need to create a custom head and compute node image. This enables you to test the cluster before creating the images. After testing, always prepare the compute node before preparing the head node for imaging.

Follow the procedures below.

2.4.2.A Creating a Cluster and Downloading the SSH Key

1. From the NODUS GUI, create a 1 node cluster and then deploy it. See the section [Creating a Cluster](#) for information about creating clusters.
2. Click the information icon at the end of the row of the created cluster and note the following: Cluster ID, SSH Username, and Head Node Public IP.
3. At the top right of the GUI, next to your user name, click **User SSH Key** to download a .pem file to access the head node of a cluster via SSH.

2.4.2.B Connecting to the NODUS Server CLI

1. Connect to the NODUS server CLI by using the SSH key with the command **ssh -i <ssh_key> <gui_user>@<nodus_server>** (for example, `ssh -i nodus5-SSH-Key nodus5@nodus50.nodusplatform.com`).

2. (Optional) This step enables you to transfer files, if needed, to the head node for use in configuring the head node and the compute node. To send files to a cluster, use the command **scp -ir ~/.nodus/clusters/<id_string> <ssh_username>@<head_node_public_ip>**: (for example, `scp -ir ~/.nodus/clusters/5f50f2b67b54c0573864e4b2/keys/id_rsa MPI2/linux@15.236.191.137:`).

2.4.2.C Preparing the Compute Node Image

1. Log in to the cluster head node by using the command **nodus cluster:ssh <cluster_name> --admin**.
2. (Optional) This step enables you to transfer files, if needed, from the head node to the compute node for use in configuring the compute node. Transfer files to the compute node by copying the files needed to the non-shared directory by using **/nodus/share**.
3. Find the compute node's IP address by using the command **cat /etc/hosts**.
4. Find the line that has **NODUS-<example>-0**. The start of the line is the IP address.
5. Connect to the compute node by using **ssh <ip_address>**.
6. Modify the compute node to install the software and modifications you need to run your jobs. The **/NODUS/share** directory has all of the transferred files.
7. When you are finished installing software, test the installation by running jobs through the cluster that you just modified. **Warning: Do not turn on bursting on the cluster that you are modifying! Bursting will delete compute nodes that are idle, and delete all your configuration changes.** See the section [Job Manager](#) for information on running jobs.
8. When you are ready to image the cluster, prepare it for imaging with the script **/NODUS/scripts/prepare-custom-image.sh node**.
9. Exit the compute node.

2.4.2.D Preparing the Head Node Image

Modify the compute node to install the software and modifications you need to run your jobs.

1. On the head node, prepare it with the script **/NODUS/scripts/prepare-custom-image.sh server**.
2. Exit the head node.
3. Continue creating images for your chosen provider below:

- [Creating Images for AWS](#)
- [Creating Images for OTC](#)

Creating Images for AWS

1. Go to <https://aws.amazon.com/>.
2. On the **AWS Console**, click **EC2 Dashboard**.
3. Search for the Cluster ID string by **Name**. This finds the node and server.
4. Select the node instance.
 - A. Select **Actions / Image** tab / **Create Image**.
 - B. Enter the **Image Name** as **<prefix>-node-<number>**. The number is revision or date.
 - C. Click **Create Image**.
5. Select the server instance.
 - A. Select **Actions / Image** tab / **Create Image**.
 - B. Enter the **Image Name** as **<prefix>-server-<number>**. The number is revision or date.
 - C. Click **Create Image**.
6. From the NODUS GUI, now you can create a cluster with the exact same image that was modified previously. When creating a cluster, replace `core` with the `<prefix>` defined in the previous steps.

Creating Images for OTC

1. Go to <https://open-telekom-cloud.com/en> and click **Open Telekom Cloud Console**.
2. On the **OTC Console**, under **Computing**, click **Elastic Cloud Server**.
3. Search for the Cluster ID string by **Name**. This finds the node and server.
4. Select the node entry, and then from the **More** drop-down, click **Create Image**.
 - A. On the **Image Information** panel, in the **Name** field, specify the name as **<prefix>-node**. Where `<prefix>` is the user defined name for the image, for example `custom-node`. The `<prefix>` for the node and server must be the same.
 - B. Click **Create Now** and then click **Submit**.

5. Select the server head node entry, and then from the **More** drop-down, click **Create Image**.
 - A. On the **Image Information** panel, in the **Name** field, specify the name as **<prefix>server**. Where **<prefix>** is the user defined name for the image, for example **custom-server**. The **<prefix>** for the node and server must be the same.
 - B. Click **Create Now** and then click **Submit**.
6. From the NODUS GUI, now you can create a cluster with the exact same image that was modified previously. When creating a cluster, replace **core** with the **<prefix>** defined in the previous steps.

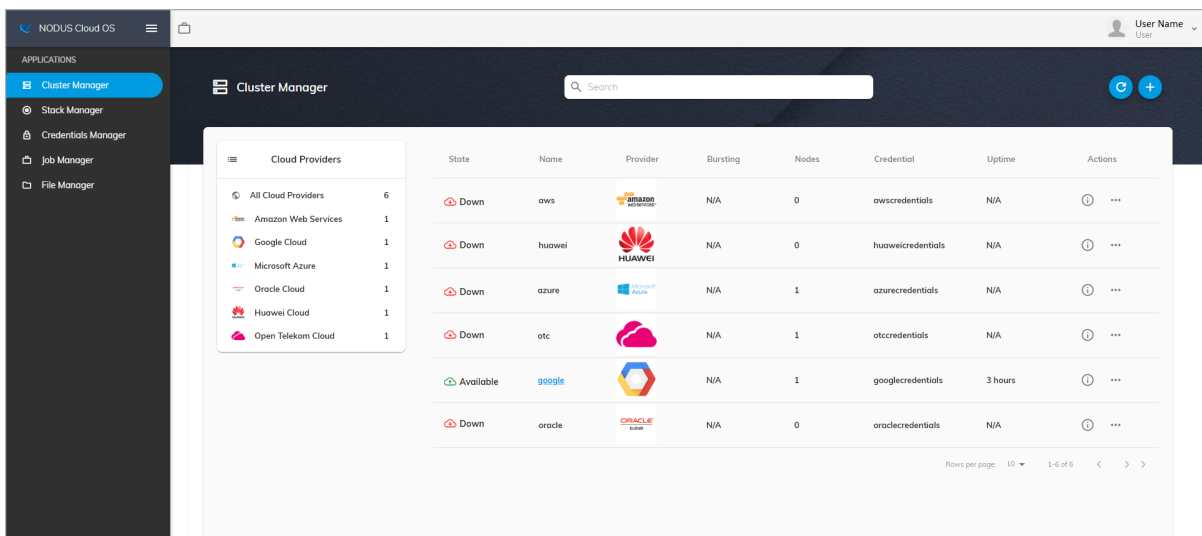
2.5 Cluster Manager

This section contains the following information:

- [Viewing Clusters](#)
- [Creating a Cluster](#)
- [Deploying a Cluster](#)
- [Deleting a Cluster](#)

2.5.1 Viewing Clusters

1. On the **Applications** menu, click **Cluster Manager**:



On the **Cluster Manager** screen, you can configure new clusters and see a list of all your current clusters and information such as their State ( Available /  Down /  Failed), Name, Provider, Bursting, Nodes, Credential, Uptime, and Actions (Information / Edit Collaborators, Edit, Deploy, Destroy, Logs, Delete & Cluster SSH Key). The Actions vary based on the State and License Type (see the notes below for additional information).

Notes:

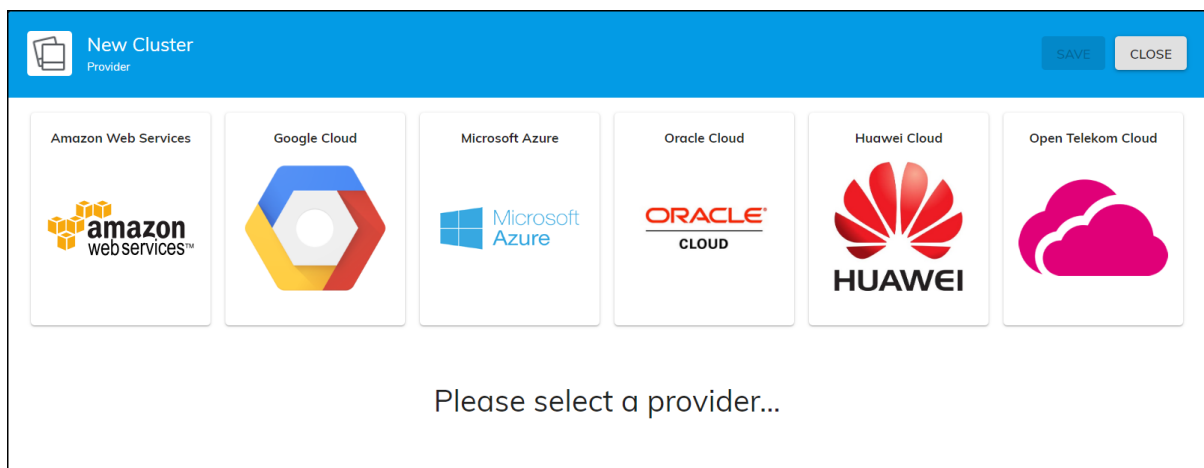
- Clicking **User SSH Key** next to your user name will download a .pem file that can be used to access the head node of a cluster via SSH. This provides you full control over the cluster.
- Clicking the refresh icon () at the top right of the cluster list, refreshes the list.
- Clicking the add icon () at the top right opens the **New Cluster** screen.
- Clicking the name of a cluster shows this information:
 - **Cluster Info** - Jobs Submitted (Total, Today, This Month, This Year, Blocked Jobs), Queue (Running, Queued, Total Jobs), Nodes (Available, Busy, Down, Offline, Total Nodes), and Activities Log (All, Job).
 - **Queue** - ID, Name, State ( Queued,  Running,  Completed), Submitted, Cores, Nodes, and Actions ().
 - **Nodes** -  (Deploy, Destroy), Name, State ( Available,  Busy,  Deploying,  Offline,  Destroying,  Down), Cores, and Load Avg. Nodes are available by default, but can be taken down by selecting **Destroy**. A node that is down has been deprovisioned in the cloud service provider and does not count as a billable resource. A node that is offline is still provisioned in the cloud service provider and isn't being used to run jobs at the moment, but counts as a billable resource.
 - **Configuration** - Cluster ID, Head Node Size, Image Name, Cluster IP, SSH Username, Date/Time Created, Availability Zone, and Download Cluster SSH Key.
- Clicking the information icon (**i**) at the end of the row shows additional details about the cluster, including: Cluster ID, SSH Username, Manager, Created, Modified, Expected Deploy Time, Actual Deploy Time, Uptime, Head Node Public IP, Prefix, Region, Head Node Size, and Compute Node Sizes. The buttons **Deploy/Destroy** and **Logs** also show.
- Clicking the horizontal ellipsis (...) at the end of the cluster row shows actions that you can take regarding the cluster:
 - **Edit** - Modifies the configuration of the cluster. **Note:** The cluster must be in a Down state to edit.
 - **Deploy** - Deploys the cluster into an available state.

- **Destroy** - Destroys the head node and the linked compute nodes so that they are no longer in a state to do work. This also means that you will not be billed further for these cloud resources. After a cluster is destroyed, the state shows as `Down`.
 - **Logs** - Shows information about the provisioning. A screen shows information in real-time about the cluster's state. Additionally, these logs contain information for deploy and destroy.
 - **Delete** - Permanently deletes the cluster. **Note:** The cluster must be down before it can be deleted.
 - **Cluster SSH Key** - Downloads the cluster SSH key.
 - **Edit Collaborators** - Shares the cluster. **Note:** The License Type must be Site.
-

2.5.2 Creating a Cluster

If you have already added your cloud credentials for the chosen provider, follow the steps below to create a new cluster, which can then be deployed at any time. If you have not yet added your credentials, you must first follow the steps in the section [Credentials Manager](#).

1. To create a new cluster, on the **Cluster Manager** screen, click the add icon (+). The **New Cluster** screen shows the cloud service providers that you have credentials for:



2. Select the cloud service provider that you want to deploy a cluster in.

3. Enter the desired information for the new cluster, such as: Name, OS Type, Prefix, Credential, Head Node Size, Manager, Region, Availability Zone, Bursting Configuration, Compute Nodes, Size, Count, and Description.

Clicking the **Advanced** button shows these additional fields: Subnet, VPC, Security Group, Elastic IP Address, Private IP, Proxy, Server Volume (GB), Node Volume (GB), and Packages.

Notes: The available fields vary based on the provider. Multiple Compute Node Instances of different sizes can be added. The available Regions, Availability Zones, Server Instance Sizes, Compute Node Instance Sizes, and quantity of instances may vary based on your provider account status.

4. Click **Save**. The state shows `Down` until it is deployed.
5. Repeat the steps in this section to create additional clusters as desired.

2.5.3 Deploying a Cluster

1. To deploy a cluster, click the ellipsis and then click **Deploy**. The state changes to `Available`.

2.5.4 Deleting a Cluster

To delete a cluster, it must first be down.

1. Click the ellipsis for the desired cluster and then click **Destroy**.
2. After the state changes to `Down`, click **Delete**.

2.6 Job Manager

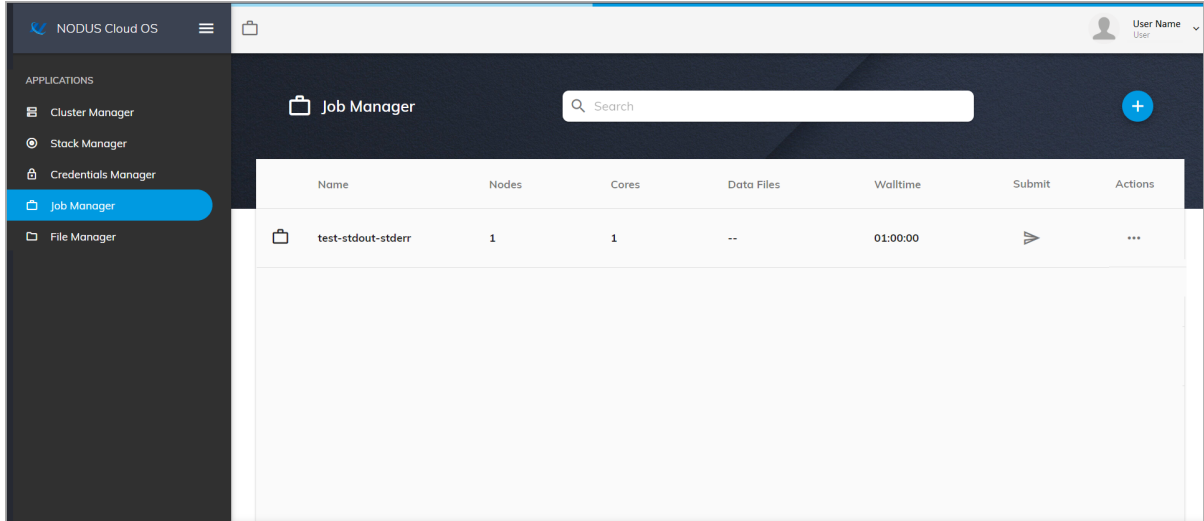
You can add jobs and submit them to either an existing cluster or a temporary on demand cluster by using Job Manager.

This section contains the following information:

- [Adding a New Job](#)
- [Adding a Temporary On Demand Job](#)

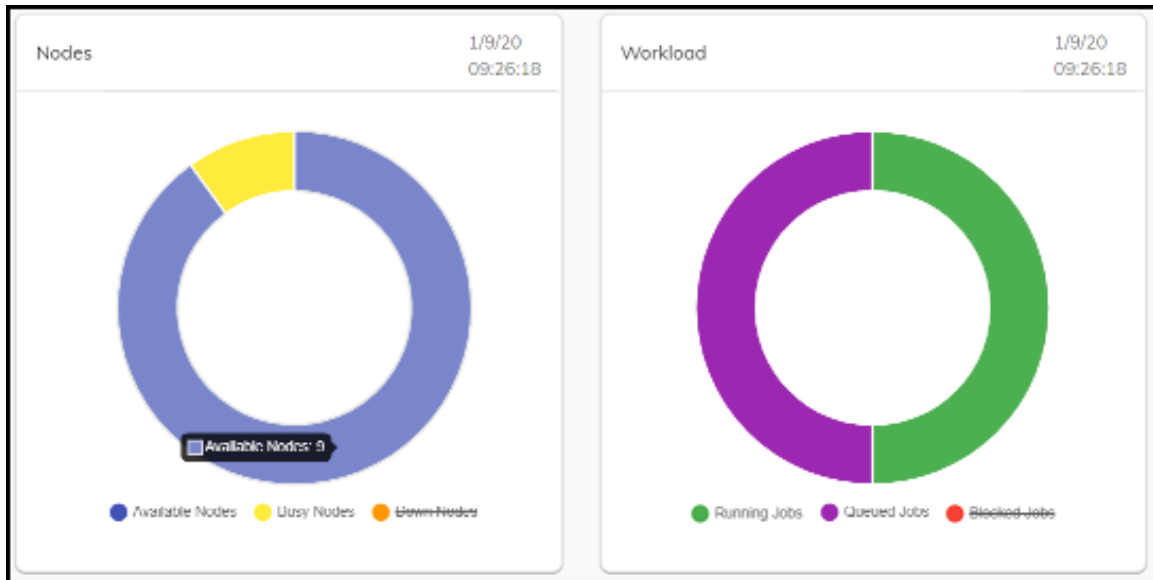
2.6.1 Adding a New Job

1. To add a new job, on the **Applications** menu, click **Job Manager**. The **Job Manager** screen opens:



This screen shows this information: Name, Nodes, Cores, Data Files, Walltime, Submit, and Actions (Edit, Copy, & Delete).

2. Click the add icon (+) at the top right to open the **New Job** screen.
3. On the **Job Info** panel, enter the desired information for the new job: Name, Walltime, Number of Nodes, Number of Cores per Node, and Description. This can be edited after the job is saved by clicking the name of the job.
4. On the **Script** panel, either edit the script for this job or click **Upload Script**. This can be edited after the job is saved by clicking the name of the job.
5. On the **Data Files** panel, click **Upload Data** to upload any data files that the job may require. This can be edited after the job is saved by clicking the name of the job.
6. After selecting a sample job, then select the cluster type: **Named Cluster**. If there are no created clusters or ones that meet the hardware requirements of the job, then certain named clusters may not appear.
7. Click **Save** to finish adding the job.
8. Click **Submit**. The job is queued and runs on the selected cluster. The cluster details screen shows the submitted job information:
 - **Cluster Info** - Jobs Submitted (Over All, Today, This Month, This Year), Queue (Running, Queued), Nodes (Available, Busy, Down, Offline), Activities Log (All, Job), and Nodes/Workload graph (see below).



This graph shows the status of Available Nodes, Busy Nodes, & Down Nodes, and the status of the Running Jobs, Queued Jobs, & Blocked Jobs. Click to deselect nodes and jobs to narrow the display results. Hover over the graph to see the number of nodes or jobs.

- **Queue** - ID, Name, State, Time, Node Count, Executing Nodes, and Actions (⊗). **Note:** After a job completes, it only shows here temporarily, but can be viewed in [File Manager](#).
- **Nodes** - ☐ (Deploy, Destroy), Name, State (🌐 All Nodes, 🟢 Available, 🟡 Busy, 🟠 Offline, 🛑 Down), Cores, Load Avg, and Actions (Deploy, Destroy).
- **Configuration** - Cluster Information (Cluster ID, Head Node Size, Image Name, Cluster IP, SSH Username, Date/Time Created, Availability Zone, and Download Cluster SSH Key), Cluster Compute Nodes (Resize Cluster), and Bursting Service (View Logs, Burst Once & Enable Service / Disable Service). **Note:** See the sections [Bursting Configurations](#) and [Bursting Service](#) for information about bursting.

Note: Jobs can also quickly be run from any screen at any time by clicking the **Quick Launch / Briefcase** icon (📁) near the top left of the screen.

2.6.2 Adding a Temporary On Demand Job

Follow one of the options below to add a temporary on demand job:

- [Using the Add Icon](#)
- [Using the Quick Launch Icon](#)
- [Using the Submit Icon](#)

Using the Add Icon

1. On the **Applications** menu, click **Job Manager**.
2. Click the add icon (+) at the top right to open the **New Job** screen.
3. On the **Job Info** panel, enter the desired information for the new job: Name, Walltime, Number of Nodes, Number of Cores per Node, and Description. This can be edited after the job is saved by clicking the name of the job.
4. On the **Script** panel, either edit the script for this job or click **Upload Script**. This can be edited after the job is saved by clicking the name of the job.
5. On the **Data Files** panel, click **Upload Data** to upload any data files that the job may require. This can be edited after the job is saved by clicking the name of the job.
6. To run an on demand job, select **On Demand**, which will add On Demand Configuration options:

The screenshot shows the 'New Job' screen in the NODUS GUI, specifically the 'Job Info' panel. The top header is blue with a briefcase icon, the text 'mpi-test Job Details', and 'SAVE' and 'CLOSE' buttons. Below the header are three tabs: 'Job Info' (selected), 'Script', and 'Data Files'. The main form area contains several input fields: 'Name *' with the value 'mpi-test', 'Walltime' with '01:00:00', '# of Nodes *' with '1', and 'Cores per Node *' with '2'. To the right of these is an 'On Demand' toggle switch, which is currently turned on. Below these fields is a section titled 'On Demand Configuration' containing several dropdown menus: 'Provider *', 'Type *', 'Prefix *', 'Credential *', 'Head Node Size *', 'Manager *', and 'Region *'. At the bottom is a large text area for 'Description'.

7. Complete the required fields.

These are the **On Demand Types**:

- **Destroy Full Cluster** - The full cluster is destroyed including the head node.
 - **Destroy Compute Nodes** - The head node stays active and the compute nodes are destroyed.
 - **Offline Compute Nodes** - The head node stays active and the compute nodes go offline.
 - **Persist Cluster** - The head and compute nodes stays active.
-

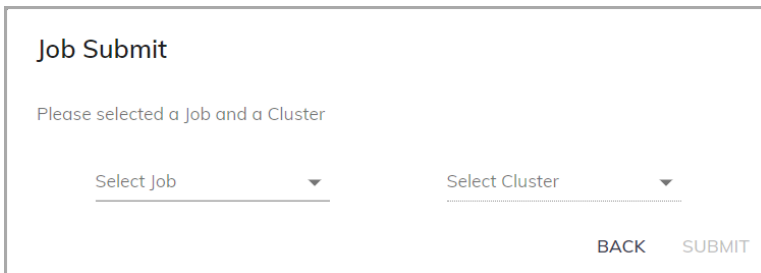
8. Click **Save** to finish adding the job.

9. On the **Job Manager** screen, click the arrow on your newly created job to submit your job. NODUS will create a NODUS defined cluster name. **Note:** If you want to define your own cluster name, use the option just below before submitting your job, selecting your job defined here.

The defined cluster and node will be deployed, the job will run, and then your defined cluster will be destroyed based on your on demand type chosen.

Using the Quick Launch Icon

1. On the **Applications** menu, click **Job Manager**.
2. On the **Job Manager** screen, click the **Quick Launch / Briefcase** icon (📁) near the top left of the screen. The **Job Submit** dialog box opens:



Job Submit

Please selected a Job and a Cluster

Select Job ▼ Select Cluster ▼

BACK SUBMIT

3. Select your job from the drop-down list, select **On Demand** from the **Select Cluster** drop-down, and then click **Submit**.

4. Enter the cluster configuration options:

New Cluster

ADVANCEDSAVECLOSE

Name *

centos-7

OS Type *

centos-7

Prefix *

core

Credential *

▼

Head Node Size *

s1.large - vCPU: 2

Manager *

Torque

Region *

▼

Availability Zone *

▼

Bursting Configuration:

Persistent: ☐

Bursting: ☒

Min: ☐

Max: ☐

Compute Nodes: ⓘ

Size *

s1.large - vCPU: 2

Count *

0

+

⌵

Description

5. Click **Save** to finish adding the job and then click **Submit**.

The defined cluster and node will be deployed, the job will run, and then your defined cluster will be destroyed based on your on demand type chosen.

Using the Submit Icon

1. On the **Applications** menu, click **Job Manager**.
2. Click the submit () icon:

Job Manager

Search

Name	Nodes	Cores	Data Files	Walltime	Submit	Actions
 mpi-test	1	2	--	01:00:00		...

Rows per page: 10 < >

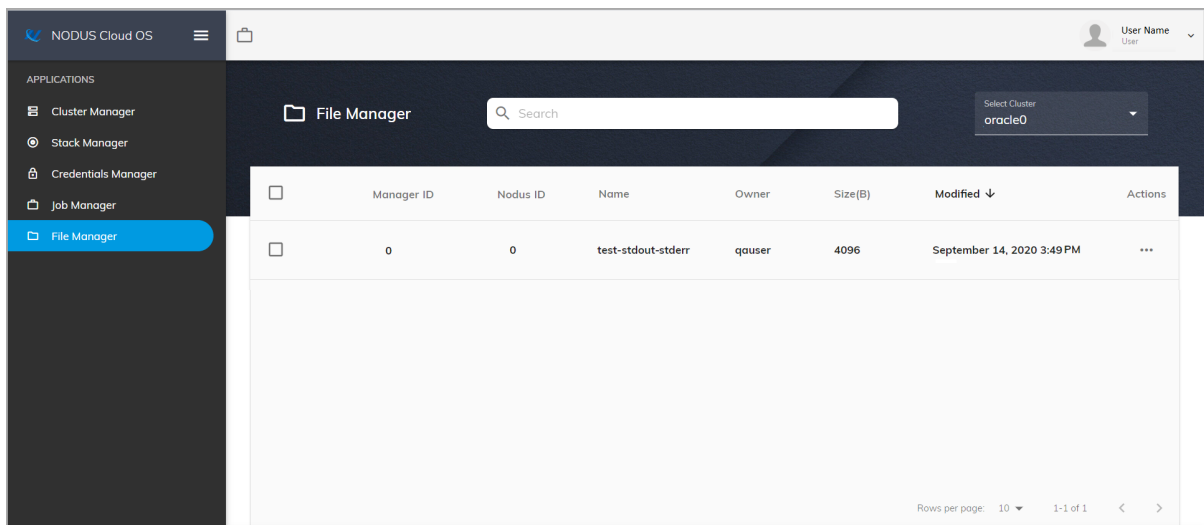
3. Enter the cluster configuration options.
4. Click **Save** to finish adding the job and then click **Submit**.

The defined cluster and node will be deployed, the job will run, and then your defined cluster will be destroyed based on your on demand type chosen.

2.7 File Manager

You can view, download, and delete a job's standard output file or error file using **File Manager**.

1. On the **Applications** menu, click **File Manager**, and then from the **Select Cluster** drop-down list at the top right, select a cluster:



The **File Manager** screen shows this information: Manager ID, Nodus ID, Name, Owner, Size(B), Modified, and Actions.

2. Click the ellipsis at the end of a row and select the desired option: View STD-Out, Download STD-Out, View STD-Err, Download STD-Err, or Delete.

2.8 Bursting

This section contains the following information:

- [Bursting Configurations](#)
- [Bursting Service](#)

2.8.1 Bursting Configurations

The NODUS burst function detects what jobs are in the queue and automatically spins up, takes offline, or shuts down nodes depending on the total requirements for the queue. If there are not enough online nodes to run all jobs, bursting will bring on as many nodes as needed. If there are more nodes than needed, the excess nodes will be taken offline. If the job queue is empty, all nodes will be shut down after a specified period of time.

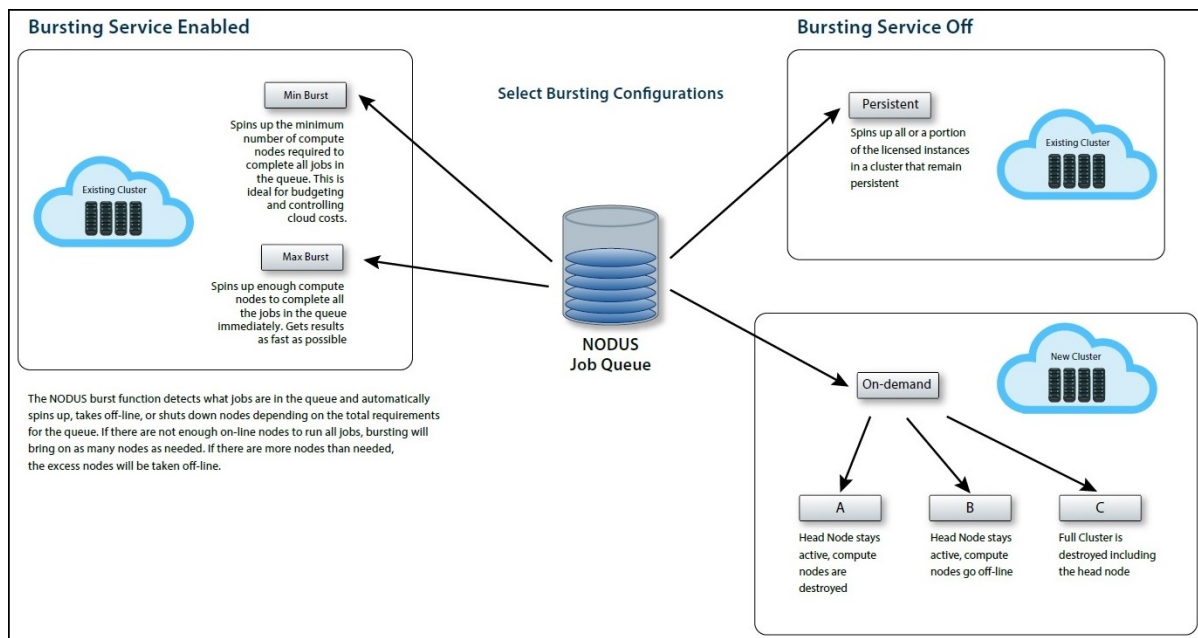
Min Burst spins up the minimum number of compute nodes required to complete all jobs in the queue, which is ideal for budgeting and controlling cloud costs.

Max Burst spins up enough compute nodes to complete all the jobs in the queue immediately; this gets results as fast as possible. Max Burst is limited by the size of the cluster and will not create new nodes.

Persistent bursting spins up all or a portion of the licensed instances in a cluster that remain persistent for a period of time and brings nodes online or shuts them down as needed.

On demand bursting spins up the number of nodes required to run one job now; this is an isolated cluster, not for sharing with other jobs. The on demand types are: Destroy Compute Nodes (the head node stays active and the compute nodes are destroyed), Offline Compute Nodes (the head node stays active and the compute nodes go offline), and Destroy Full Cluster (the full cluster is destroyed including the head node).

See the diagram below for details.



2.8.2 Bursting Service

To manage cluster cloud bursting configurations, on the **Cluster Manager** screen, select a cluster and click the **Configuration** tab. The **Cluster Information** screen displays:

Cluster Information

Cluster ID: 5ed7bbc32331eb7ac268e616
Head Node Size: Standard_DS2_v2 - vCPU: 2, Mem (GB): 7
Image Name: core-server
Cluster IP: 52.152.137.140
SSH Username: centos
Date/Time Created: June 3, 2020 11:03 AM

DOWNLOAD CLUSTER SSH KEY

Bursting Service: Off

Bursting Service Min Max

VIEW LOGS BURST ONCE

Cluster Compute Nodes

Size	Count
Standard_DS2_v2 - vCPU: 2, Mem (GB): 7	1

RESIZE CLUSTER

Bursting Service (Off/On) - Disable or enable bursting functionality for a single cluster:

-  (disabled) - The cluster remains in its current state.
-  (enabled) - Jobs are run and compute nodes are provisioned to handle the jobs:
 -  (Min) - Min Burst spins up the minimum number of nodes required to complete all jobs in the queue. This is ideal for budgeting and controlling cloud costs.
 -  (Max) - Max Burst spins up enough nodes (as set from the jobs' node count) to complete all the jobs in the queue immediately. This gets results as fast as possible.

Burst Once - This spins up or tears down nodes as required to complete all the jobs in the queue. Select a one time bursting size - Min or Max.

2.9 Cloud Budget Analysis

Now that you have successfully run one job in the cloud by completing the steps above, you can run all your jobs in the cloud and begin developing your cloud budget. See the appendix [NODUS Workload Considerations](#) for additional information.

Chapter 3: NODUS CLI Procedures

In this chapter:

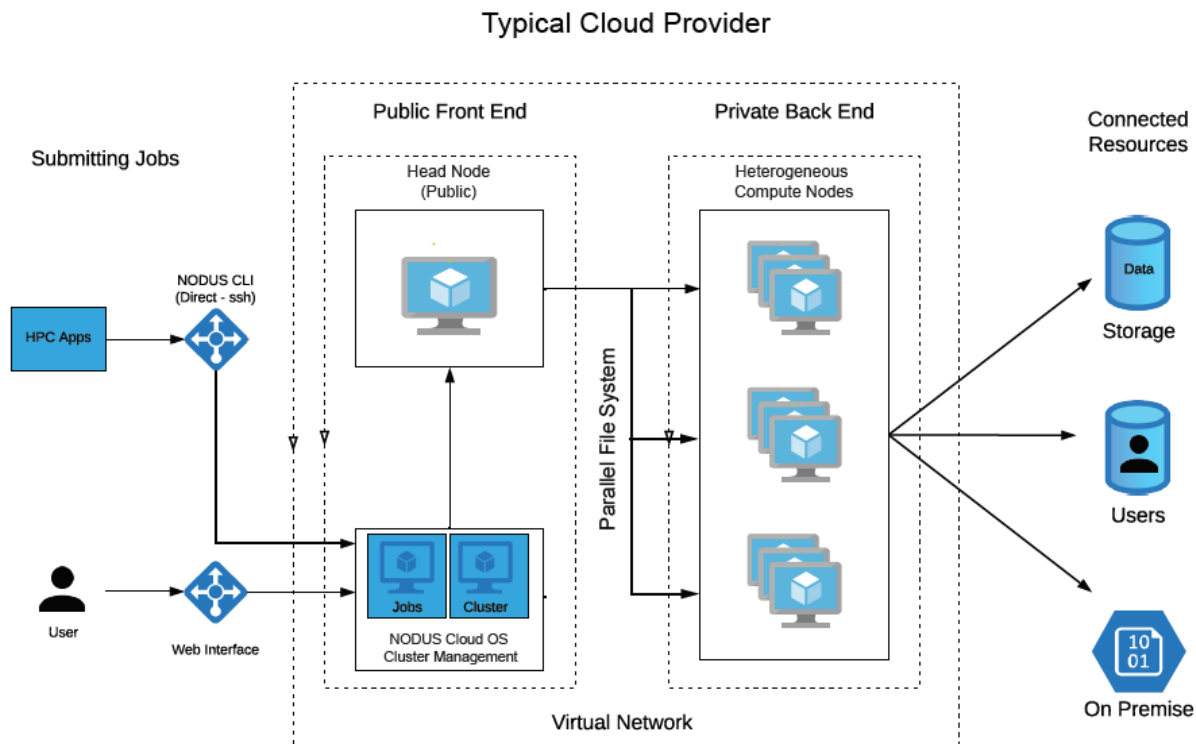
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3.1 Users

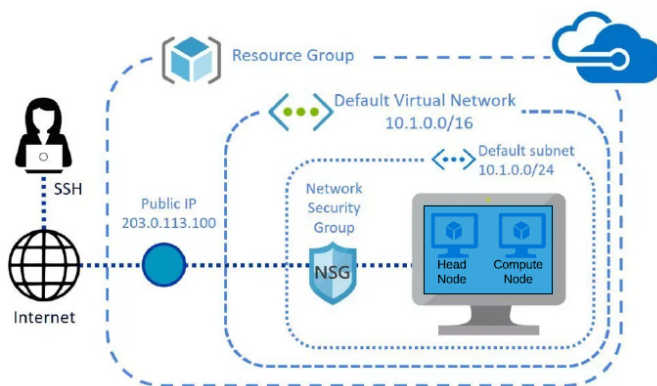
A NODUS user is just a registered Linux system user that enables using NODUS in various capacities, permissions, and NODUS license permitting.

See the CLI Commands section [Users](#) for information about user commands.

3.2 Architecture



NODUS Cluster Resources



3.3 CLI Usage

This section contains the following information:

- [Jobs](#)
- [Building Images](#)

3.3.1 Jobs

Show standard error messages: **\$ nodus job:output ID CLUSTER [OPTIONS]**

3.3.2 Building Images

After a cluster is associated with a set of credentials and a stack file, use the command **\$ nodus stack:build STACK [OPTIONS]** to create the image.

3.4 Cluster Actions

This section contains the following information:

- [Connecting to a Cluster](#)
- [Destroying a Cluster](#)
- [Viewing All Clusters](#)

3.4.1 Connecting to a Cluster

1. To connect to a deployed cluster via SSH, use the command **nodus cluster:ssh CLUSTER**.

3.4.2 Destroying a Cluster

1. Assuming the cluster was deployed properly through the above CLI commands, a cluster can be destroyed using the command **\$ nodus cluster:destroy CLUSTER [OPTIONS]**.
2. The cluster should be destroyed before you delete it, or you will have to destroy it manually. To remove all information about the cluster, use the command **nodus cluster:remove CLUSTER**.

3.4.3 Viewing All Clusters

1. To view all saved clusters, deployed or not, use the command **nodus cluster:list**.

3.5 Job Actions

1. To submit a job to a cluster, use the command **nodus job:submit JOB CLUSTER**.

3.6 Bursting Actions

The NODUS burst function looks at what jobs are queued on your cluster and automatically spins up or tears down nodes depending on the total requirements for the queue. If there are not enough online nodes to run all jobs, bursting will bring on as many nodes as needed. If there are more nodes than needed, the excess nodes will be destroyed. If the job queue is empty, all nodes will be destroyed.

1. To start the bursting service, use the command **\$ nodus cluster:burst CLUSTER --start**.
2. To stop the bursting service, use the command **\$ nodus cluster:burst CLUSTER --stop**.
3. To run a single burst cycle, use the command **\$ nodus cluster:burst CLUSTER**.

3.7 Common CLI Commands

This section contains common NODUS CLI commands:

- [Cluster Management](#)
- [Cluster Monitoring](#)
- [Cluster Jobs](#)
- [Admin Commands](#)

See the chapter [NODUS CLI Commands](#) for detailed information.

3.7.1 Cluster Management

This section contains the following information:

- [Cluster Deploy](#)
- [Cluster Destroy](#)
- [Cluster SSH](#)
- [Cluster Resize](#)

3.7.1.A Cluster Deploy

This deploys nodes on a cluster:

```
$ nodus cluster:deploy CLUSTER --target HOSTNAME
```

See [cluster:deploy CLUSTER](#) for additional information.

3.7.1.B Cluster Destroy

This destroys nodes on a cluster:

```
$ nodus cluster:destroy CLUSTER --target HOSTNAME
```

See [cluster:destroy CLUSTER](#) for additional information.

3.7.1.C Cluster SSH

This connects to a cluster:

```
$ nodus cluster:ssh CLUSTER [OPTIONS]
```

See [cluster:ssh CLUSTER](#) for additional information.

3.7.1.D Cluster Resize

This resizes a cluster:

```
$ nodus cluster:resize CLUSTER [[INSTANCE COUNT] ...] [OPTIONS]
```

See [cluster:resize CLUSTER](#) for additional information.

3.7.2 Cluster Monitoring

This section contains the following information:

- [Cluster Show](#)
- [Cluster Jobs Queue](#)
- [Cluster List](#)
- [Cluster Members](#)
- [Cluster pbsnodes](#)

3.7.2.A Cluster Show

This gets general information about the cluster (i.e., cluster username, public IP, node list...):

```
$ nodus cluster:show CLUSTER
```

3.7.2.B Cluster Jobs Queue

This displays JSON information about the jobs queue:

```
$ nodus cluster:qstat CLUSTER
```

3.7.2.C Cluster List

This lists all user clusters:

```
$ nodus cluster:list
```

3.7.2.D Cluster Members

This displays serf members from the head node:

```
$ nodus cluster:members CLUSTER [OPTIONS]
```

3.7.2.E Cluster pbsnodes

This displays a detailed description of compute nodes on the cluster:

```
$ nodus cluster:pbsnodes CLUSTER [OPTIONS]
```

3.7.3 Cluster Jobs

This section contains the following information:

- [Cluster Burst](#)
- [Job Submit](#)

3.7.3.A Cluster Burst

This runs a single burst cycle that spins up and tears down nodes depending on workload:

\$ nodus cluster:burst CLUSTER [OPTIONS] --mode max --start

Note: [--mode max] is optional.

3.7.3.B Job Submit

This remotely runs a local job script on a cluster:

\$ nodus job:submit JOB CLUSTER [OPTIONS]

3.7.4 Admin Commands

This section contains the following information:

- [Delete User](#)

3.7.4.A Delete User

This deletes a user from the system:

sudo nodus admin delete-users <username>

Chapter 4: NODUS CLI Commands

This chapter contains a list of CLI commands.

In this chapter:

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4.1 Actions

This section contains the following commands:

- `action:list`
- `action:remove ACTION`
- `action:show ACTION`

action:list		
Description		
List action entries from database.		
Usage		
\$ nodus action:list [OPTIONS]		
Arguments		
NAME	Name Identifier	
TYPE	(centos-7) Image Type	
CLUSTER	Cluster Name or ID	
Options		
-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

--id=id	Filter by Affected ID
--type=action cluster credential job provider stack user	Filter by Action Type

Examples

```
$ nodus action:list
```

```
$ nodus action:list --format json
```

action:remove ACTION**Description**

Remove action entries from database.

Usage

```
$ nodus action:remove ACTION [[ACTION] ...] [OPTIONS]
```

Argument

ACTION	Action ID
--------	-----------

Option

-h	--help	Show Help
----	--------	-----------

Example

```
action:remove 5e8f6a8ac86619500ab573da
```

action:show ACTION**Description**

Display details of a particular action entry from the database.

Usage

```
$ nodus action:show ACTION [OPTIONS]
```

Argument

ACTION	Action ID
--------	-----------

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus action:show 5ea06014df12871f264716eb
```

```
$ nodus action:show 5ea06014df12871f264716eb --format json
```

4.2 Users

This section contains the following commands:

- `user:add USERNAME`
- `user:list`
- `user:remove USERNAME`
- `user:show USER`
- `user:update USERNAME`

user:add USERNAME

Description

Registers linux user as a NODUS user.

Usage

```
$ nodus user:add USERNAME [OPTIONS]
```

Argument

USERNAME	Linux Username
----------	----------------

Options

-e	--email=email	Email Address
-f	--first=first	First Name (Given Name)
-h	--help	Show Help
-l	--last=last	Last Name (Family Name)
	--[no-]admin	Make User Admin
	--[no-]ui	Allow User to Login via Web App / UI

Examples

```
$ nodus user:add jdoe
```

```
$ nodus user:add jdoe --admin
```

user:list

Description

List user entries from database.

Usage

```
$ nodus user:list [OPTIONS]
```

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus user:list
```

```
$ nodus user:list --format json
```

user:remove USERNAME**Description**

Remove NODUS user(s).

Usage

```
$ nodus user:remove USERNAME [OPTIONS]
```

Argument

USERNAME	Username of the system user
----------	-----------------------------

Options

-h	--help	Show Help
	--clean	Remove User Home Directory from Filesystem
	--force	Force Remove User Home Directory from Filesystem

Examples

```
$ nodus user:remove jdoe
```

```
$ nodus user:remove jdoe --clean
```

```
$ nodus user:remove jdoe --force
```

user:show USER**Description**

Display details of a particular user entry from the database.

Usage

```
$ nodus user:show USER [OPTIONS]
```

Argument

USERNAME	User Name or ID
----------	-----------------

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus user:show jdoe
```

```
$ nodus user:show jdoe --format json
```


user:update USERNAME**Description**

Update NODUS user details.

Usage

\$ nodus user:update USERNAME [OPTIONS]

Argument

USERNAME	Linux Username
----------	----------------

Options

-e	--email=email	Email Address
-f	--first=first	First Name (Given Name)
-h	--help	Show Help
-l	--last=last	Last Name (Family Name)
-u	--[no-]ui	Allow User to Login via Web App / UI
	--[no-]admin	Make User Admin
	--pass	Change Password
	--private=private	Path to Private SSH Key
	--public=public	Path to Public SSH Key

Example

\$ nodus user:update jdoe --admin

4.3 Credentials

This section contains the following commands:

- [credential:add FILE NAME](#)
- [credential:list](#)
- [credential:list CREDENTIAL](#)
- [credential:remove CREDENTIAL](#)
- [credential:share CREDENTIAL USERNAME](#)
- [credential:show CREDENTIAL](#)
- [credential:unshare CREDENTIAL](#)

credential:add FILE NAME**Description**

Create credential entry with information from file.

Usage

```
$ nodus credential:add FILE NAME --provider PROVIDER
```

Arguments

FILE	Credential File (Absolute / Relative) Path
------	--

NAME	Credential Name
------	-----------------

Options

-d	--description=description	Description of Credential
-h	--help	Show Help
-p	--provider=aws gcp huawei azure oracle otc	(required) Provider Code

Examples

```
$ nodus credential:add /home/user/Downloads/credential.json myCredential --provider aws
```

```
$ nodus credential:add ~/Downloads/credential.json myCredential --provider aws
```

credential:list**Description**

List credential entries from database.

Usage

```
$ nodus credential:list [OPTIONS]
```

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus credential:list [OPTIONS]
```

```
$ nodus credential:list --format json
```

credential:list CREDENTIAL**Description**

Update credential entry.

Usage

```
$ nodus credential:list CREDENTIAL [OPTIONS]
```

Argument		
CREDENTIAL		Credential Name or ID
Options		
-d	--description=description	Description
-h	--help	Show Help
-n	--name=name	Name Identifier
Examples		
\$ nodus credential:list myCredential --name newCredential		

credential:remove CREDENTIAL

Description		
Remove credential entries from database.		
Usage		
\$ nodus credential:remove CREDENTIAL [OPTIONS]		
Argument		
CREDENTIAL	Credential Name or ID	
Options		
-f	--force	Force Removal from Database
-h	--help	Show Help
Example		
credential:remove myCredential		

credential:share CREDENTIAL USERNAME

Description		
Share your credential to another user.		
Usage		
\$ nodus credential:share CREDENTIAL USERNAME		
Arguments		
CREDENTIAL	Credential Name or ID	
USERNAME	Linux Username	
Options		
-h	--help	Show Help
Examples		
\$ nodus credential:share myCredential otherUser		

credential:show CREDENTIAL**Description**

Display details of a particular credential entry from the database.

Usage

```
$ nodus credential:show CREDENTIAL [OPTIONS]
```

Argument

CREDENTIAL	Credential Name or ID
------------	-----------------------

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus credential:show myCredential
```

```
$ nodus credential:show myCredential --format json
```

credential:unshare CREDENTIAL**Description**

Unshare your credential to another user.

Usage

```
$ nodus credential:unshare CREDENTIAL [USERNAME] [OPTIONS]
```

Arguments

CREDENTIAL	Credential Name or ID
USERNAME	Linux Username

Options

-h	--help	Show Help
	--all	Remove all shared users

Examples

```
$ nodus credential:unshare myCredential otherUser
```

```
$ nodus credential:unshare myCredential --all
```

4.4 Stacks

This section contains the following commands:

- `stack:aws:create NAME TYPE`
- `stack:aws:update STACK`
- `stack:azure:create NAME TYPE`
- `stack:azure:update STACK`
- `stack:build STACK`
- `stack:gcp:create NAME TYPE`
- `stack:gcp:update STACK`
- `stack:huawei:create NAME TYPE`
- `stack:huawei:update STACK`
- `stack:list`
- `stack:log CLUSTER TYPE`
- `stack:oracle:create NAME TYPE`
- `stack:oracle:update STACK`
- `stack:otc:create NAME TYPE`
- `stack:otc:create STACK`
- `stack:remove STACK`
- `stack:set STACK CREDENTIAL`
- `stack:share STACK USERNAME`
- `stack:show STACK`
- `stack:unshare STACK`

stack:aws:create NAME TYPE

Description

Create new Amazon Web Services (AWS) stack configuration entry.

Usage

`$ nodus stack:aws:create NAME TYPE [CREDENTIAL] [OPTIONS]`

Arguments

NAME	Associated Name
TYPE	(centos-7) Image Type
CREDENTIAL	Set Credential

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	(required) [default: t2.micro] Instance Type
-p	--prefix=prefix	(required) [default: nodus] Output Image Prefix
-r	--region=region	(required) Region ID
-s	--source=source	Source Image ID
-u	--username=username	SSH Username
	--private	Provision via Private IP
	--proxy=proxy	HTTP(S) Proxy URL
	--security=security	Security Group ID
	--subnet=subnet	Subnet ID
	--volume=volume	Storage Volume (GB)

Examples

```
$ nodus stack:aws:create myStack centos-7 myCred --region=us-east-2
$ nodus stack:aws:create myStack centos-7 --prefix=myNodus --region=us-east-2 --instance=t2.large
$ nodus stack:aws:create myStack centos-7 --region us-east-2 --proxy $http_proxy
$ nodus stack:aws:create myStack centos-7 --region=us-east-2 --custom --source=ami-04152c3a27c49a944 --username=ec2-user --instance=t2.xlarge
```

stack:aws:update STACK**Description**

Update Google Cloud Platform (GCP) cluster configuration entry.

Usage

```
$ nodus stack:aws:update STACK [OPTIONS]
```

Arguments

STACK	Stack Name or ID
-------	------------------

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	Instance Type
-n	--name=name	Name Identifier
-p	--prefix=prefix	Output Image Prefix

Options		
-r	--region=region	Region ID
-s	--source=source	Source Image ID
-t	--type=centos-7	OS Type
-u	--username=username	SSH Username
	--no-proxy	Remove HTTP(S) Proxy
	--no-security	Remove Security Group
	--no-subnet	Remove Subnet
	--no-volume	Remove Extended Root Storage Volume
	--[no-]private	Provision via Private IP
	--proxy=proxy	HTTP(S) Proxy URL
	--security=security	Security Group ID
	--subnet=subnet	Subnet ID
	--volume=volume	Extended Root Storage Volume (GB)
Examples		
\$ nodus stack:aws:update myStack --name newStack		
\$ nodus stack:aws:update myStack --region=us-east-2		
\$ nodus stack:aws:update myStack --prefix=myNodus --region=us-east-2 --instance=t2.large		
\$ nodus stack:aws:update myStack --region us-east-2 --proxy \$http_proxy		
\$ nodus stack:aws:update myStack --region=us-east-2 --custom --source=ami-04152c3a27c49a944 --username=ec2-user --instance=t2.xlarge		

stack:azure:create NAME TYPE

Description

Create new Microsoft Azure stack configuration entry.

Usage

```
$ nodus stack:azure:create NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

NAME	Associated Name
TYPE	(centos-7) Image Type
CREDENTIAL	Set Credential

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	(required) [default: Standard_DS2_v2] Instance

		Type ID
-p	--prefix=prefix	(required) [default: nodus] Output Image Prefix
-s	--source=source	Source Image ID
-u	--username=username	SSH Username
	--offer=offer	Source Image Offer
	--os-type=os-type	Source Image OS Type
	--publisher=publisher	Source Image Publisher
	--resource=resource	(required) Managed Resource Group Name
	--sku=sku	Source Image SKU
	--source-resource=source-resource	Source Resource Group Name

Examples

```
$ nodus stack:azure:create myStack centos-7 myCred --resource=myResourceGroup --instance=Standard_DS2_v2
```

```
$ nodus stack:azure:create myStack centos-7 --prefix=myNodus --resource=myResourceGroup --instance=Standard_DS2_v2
```

stack:azure:update STACK

Description

Update Microsoft Azure stack configuration entry.

Usage

```
$ nodus stack:azure:update STACK [OPTIONS]
```

Arguments

STACK	Stack Name or ID
-------	------------------

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	(required) [default: Standard_DS2_v2] Instance Type ID
-n	--name=name	Name Identifier
-p	--prefix=prefix	(required) [default: nodus] Output Image Prefix
-s	--source=source	Source Image ID
-t	--type=centos-7	OS Type
-u	--username=username	SSH Username
	--os-type=os-type	Source Image OS Type
	--publisher=publisher	Source Image Publisher

Options		
	--resource=resource	(required) Managed Resource Group Name
	--sku=sku	Source Image SKU
	--source-resource=source-resource	Source Resource Group Name
Examples		
\$ nodus stack:azure:update myStack --name newStack		
\$ nodus stack:azure:update myStack --resource=myResourceGroup --instance=Standard_DS2_v2		
\$ nodus stack:azure:update myStack --prefix=myNodus --resource=myResourceGroup --instance=Standard_DS2_v2		

stack:build STACK

Description		
Generates images compatible with NODUS clusters. Generate two images: 'nodus-server'; 'nodus-node'.		
Usage		
\$ nodus stack:build STACK [OPTIONS]		
Argument		
STACK	Stack Name or ID	
Options		
-S	--slow	Sequential Builds
-h	--help	Show Help
-s	--stack=server node	Sub-Stack
Examples		
\$ nodus stack:build myStack		
\$ nodus stack:build myStack --stack server		

stack:gcp:create NAME TYPE

Description		
Create new Google Cloud Platform (GCP) stack configuration entry.		
Usage		
\$ nodus stack:gcp:create NAME TYPE [CREDENTIAL] [OPTIONS]		
Arguments		
NAME	Associated Name	

TYPE	(centos-7) Image Type
CREDENTIAL	Set Credential
Options	
-c	--custom Managed Image
-d	--disk=disk Disk Size (GB)
-h	--help Show Help
-i	--instance=instance (required) [default: n1-standard-1] Instance Type ID
-p	--prefix=prefix (required) [default: nodus] Output Image Prefix
-s	--source=source Source AMI ID
-u	--username=username SSH Username
-z	--zone=zone (required) Availability Zone ID
	--[no-]account Auth via Service Account
	--disk=disk Extended Root Disk Size (GB)
	--proxy=proxy HTTP(S) Proxy URL
	--subnet=subnet Subnet Self Link ID
Examples	
\$ nodus stack:gcp:create myStack centos-7 myCred --zone=us-east1-b --instance=n1-standard-1	
\$ nodus stack:gcp:create myStack centos-7 --prefix=myNodus --zone=us-east1-b --instance=n1-standard-1	

stack:gcp:update STACK

Description

Update Google Cloud Platform (GCP) stack configuration entry.

Usage

\$ nodus stack:gcp:update STACK [OPTIONS]

Arguments

STACK Stack Name or ID

Options

-c	--custom	Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	Instance Type ID
-n	--name=name	Name Identifier
-p	--prefix=prefix	Output Image Prefix
-s	--source=source	Source AMI ID

Options		
-t	--type=centos-7	OS Type
-u	--username=username	SSH Username
-w	--walltime=walltime	Job walltime
-z	--zone=zone	Availability Zone ID
	--[no-]account	Auth via Service Account
	--disk=disk	Extended Root Disk Size (GB)
	--no-disk	Remove Disk
	--no-proxy	Remove HTTP(S) Proxy
	--no-subnet	Remove Subnet
	--proxy=proxy	HTTP(S) Proxy URL
	--subnet=subnet	Subnet Self Link ID
Examples		
\$ nodus stack:gcp:update myStack --name newStack		
\$ nodus stack:gcp:update myStack --zone=us-east1-b --instance=n1-standard-1		
\$ nodus stack:gcp:update myStack --prefix=myNodus --zone=us-east1-b --instance=n1-standard-1		

stack:huawei:create NAME TYPE

Description

Create new Huawei Cloud stack configuration entry.

Usage

```
$ nodus stack:huawei:create NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

NAME	Associated Name
TYPE	(centos-7) Image Type
CREDENTIAL	Set Credential

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	(required) [default: s2.medium.2] Instance Type ID
-p	--prefix=prefix	(required) [default: nodus] Output Image Prefix
-r	--region=region	(required) Region ID
-s	--source=source	Source Image ID
-u	--username=username	SSH Username

-z	--zone=zone	(required) Availability Zone ID
	--security=security	Security Group ID
	--subnet=subnet	(required) Subnet Network ID
	--volume=volume	Storage Volume (GB)

Examples

```
$ nodus stack:huawei:create myStack centos-7 myCred --region=ap-southeast-1 --
zone=ap-southeast-1a --subnet=41dcc08c-b044-4af1-b298-8770a479d60a --
instance=s2.medium.2
```

```
$ nodus stack:huawei:create myStack centos-7 --prefix=myNodus --region=ap-southeast-1
--zone=ap-southeast-1a --subnet=41dcc08c-b044-4af1-b298-8770a479d60a --
instance=s2.medium.2
```

stack:huawei:update STACK**Description**

Update Huawei Cloud stack configuration entry.

Usage

```
$ nodus stack:huawei:update STACK [OPTIONS]
```

Arguments

STACK	Stack Name or ID
-------	------------------

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	Instance Type ID
-n	--name=name	Name Identifier
-p	--prefix=prefix	Output Image Prefix
-r	--region=region	Region ID
-s	--source=source	Source Image ID
-t	--type=centos-7	OS Type
-u	--username=username	SSH Username
-z	--zone=zone	Availability Zone ID
	--no-security	Remove Security Group
	--no-volume	Remove Extended Root Storage Volume
	--security=security	Security Group ID
	--subnet=subnet	Subnet Network ID
	--volume=volume	Extended Root Storage Volume (GB)

Examples

```
$ nodus stack:huawei:update myStack --name newStack
```

```
$ nodus stack:huawei:update myStack --region=ap-southeast-1 --zone=ap-southeast-1a --  
subnet=41dcc08c-b044-4af1-b298-8770a479d60a --instance=s2.medium.2
```

```
$ nodus stack:huawei:update myStack --prefix=myNodus --region=ap-southeast-1 --  
zone=ap-southeast-1a --subnet=41dcc08c-b044-4af1-b298-8770a479d60a --  
instance=s2.medium.2
```

stack:list**Description**

List stack entries from database.

Usage

```
$ nodus stack:list [OPTIONS]
```

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus stack:list
```

```
$ nodus stack:list --format json
```

stack:log CLUSTER TYPE**Description**

Display stack build logs.

Usage

```
$ nodus stack:log CLUSTER TYPE [OPTIONS]
```

Arguments

STACK	Stack Name or ID
TYPE	(master build) [default: master] Log Type

Options

-d	--debug	Debug Logs
-f	--follow	Follow File Output Stream
-h	--help	Show Help
-n	--lines=lines	Last N Lines
	--follow	Follow File Output Stream

Example

```
$ nodus stack:log myCluster
```

stack:oracle:create NAME TYPE**Description**

Create new Oracle Cloud stack configuration entry.

Usage

```
$ nodus stack:oracle:create NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

NAME	Associated Name
TYPE	(centos-7) Image Type
CREDENTIAL	Set Credential

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	(required) [default: VM.Standard2.1] Instance Type ID
-n	--subnet=subnet	(required) Subnet OCID
-p	--prefix=prefix	(required) [default: nodus] Output Image Prefix
-r	--region=region	(required) Region ID
-s	--source=source	Source Image ID
-u	--username=username	SSH Username

Example

```
$ nodus stack:oracle:create myStack centos-7 myCred --prefix=myNodus --region=us-ashburn-1 --subnet=ocid1.subnet.oc1.iad.aaaaaaa7v2znysxlclowk7rhgkgldvjaxmkkjpiktnahnusgknhw5pcvi6q
```

stack:oracle:update STACK**Description**

Update Oracle Cloud stack configuration entry.

Usage

```
$ nodus stack:oracle:update STACK [OPTIONS]
```

Arguments

STACK	Stack Name or ID
-------	------------------

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help

Options		
-i	--instance=instance	Instance Type ID
-n	--name=name	Name Identifier
-n	--subnet=subnet	(required) Subnet OCID
-p	--prefix=prefix	Output Image Prefix
-r	--region=region	Region ID
-s	--source=source	Source Image ID
-t	--type=centos-7	OS Type
-u	--username=username	SSH Username
Examples		
\$ nodus stack:oracle:update myStack --name newStack		
\$ nodus stack:oracle:update myStack --prefix=myNodus --region=us-ashburn-1 --subnet=ocid1.subnet.oc1.iad.aaaaaaa7v2znysxlclowk7rhgkglvjaxmkkjpiktnahnusgknhw5pcvi6q		

stack:otc:create NAME TYPE

Description

Create new OpenTelekom Cloud stack configuration entry.

Usage

```
$ nodus stack:otc:create NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

NAME	Associated Name
TYPE	(centos-7) Image Type
CREDENTIAL	Set Credential

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	(required) [default: s2.medium.2] Instance Type ID
-p	--prefix=prefix	(required) [default: nodus] Output Image Prefix
-s	--source=source	Source Image ID
-u	--username=username	SSH Username
	--private	Provision via Private IP
	--proxy=proxy	HTTP(S) Proxy URL
	--security=security	Security Group ID
	--subnet=subnet	(required) Subnet Network ID
	--volume=volume	Extended Root Storage Volume (GB)

Examples

```
$ nodus stack:otc:create myStack centos-7 myCred --subnet 3bc69be8-3ebc-434c-b828-9aeb5a8ec78a --instance s2.medium.2
```

```
$ nodus stack:otc:create myStack centos-7 --prefix myNodus --subnet 3bc69be8-3ebc-434c-b828-9aeb5a8ec78a --instance s2.medium.2
```

```
$ nodus stack:otc:create myStack centos-7 --subnet 3bc69be8-3ebc-434c-b828-9aeb5a8ec78a --proxy $http_proxy
```

stack:otc:create STACK**Description**

Create new OpenTelekom Cloud stack configuration entry.

Usage

```
$ nodus stack:otc:create STACK [CREDENTIAL] [OPTIONS]
```

Arguments

STACK	Stack Name or ID
CREDENTIAL	Set Credential

Options

-c	--custom	Use Managed Image
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	Instance Type ID
-n	--name=name	Name Identifier
-p	--prefix=prefix	Output Image Prefix
-s	--source=source	Source Image ID
-t	--type=centos-7	OS Type
-u	--username=username	SSH Username
	--no-proxy	Remove HTTP(S) Proxy
	--no-security	Remove Security Group
	--no-volume	Remove Extended Root Storage Volume
	--[no-]private	Provision via Private IP
	--proxy=proxy	HTTP(S) Proxy URL
	--security=security	Security Group ID
	--subnet=subnet	Subnet Network ID
	--volume=volume	Extended Root Storage Volume (GB)

Examples

```
$ nodus stack:otc:create myStack myCred --name newStack
```

```
$ nodus stack:otc:create myStack --subnet 3bc69be8-3ebc-434c-b828-9aeb5a8ec78a --
```



```
instance s2.medium.2
$ nodus stack:otc:create myStack --prefix myNodus --subnet 3bc69be8-3ebc-434c-b828-9aeb5a8ec78a --instance s2.medium.2
$ nodus stack:otc:create myStack --subnet 3bc69be8-3ebc-434c-b828-9aeb5a8ec78a --proxy $http_proxy
```

stack:remove STACK

Description

Remove stack entries from database.

Usage

```
$ nodus stack:remove STACK [OPTIONS]
```

Argument

STACK	Stack Name or ID
-------	------------------

Options

-h	--help	Show Help
	--[no-]clean	Remove Files Created for Cluster

Examples

```
$ nodus stack:remove myStack
$ nodus stack:remove myStack --no-clean
$ nodus stack:remove myStack --force
```

stack:set STACK CREDENTIAL

Description

Associate stack entry with credential entry.

Usage

```
$ nodus stack:set STACK CREDENTIAL [OPTIONS]
```

Arguments

STACK	Stack Name or ID
CREDENTIAL	Credential Name or ID

Option

-h	--help	Show Help
----	--------	-----------

Example

```
$ nodus stack:set myStack myCredential
```

stack:share STACK USERNAME**Description**

Share your stack to another user.

Usage

```
$ nodus stack:share STACK USERNAME
```

Argument

STACK	Stack Name or ID
USERNAME	Linux Username

Options

-h	--help	Show Help
----	--------	-----------

Examples

```
$ nodus stack:share myStack otherUser
```

stack:show STACK**Description**

Display details of a particular stack entry from the database.

Usage

```
$ nodus stack:show STACK [OPTIONS]
```

Argument

STACK	Stack Name or ID
-------	------------------

Options

-f	--format=text json xml	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus stack:show myStack
```

```
$ nodus stack:show myStack --format json
```

stack:unshare STACK**Description**

Unshare your stack to another user.

Usage

```
$ nodus stack:unshare STACK [USERNAME] [OPTIONS]
```

Argument

STACK	Stack Name or ID
USERNAME	Linux Username

Options

-h	--help	Show Help
	--all	Remove all shared users

Examples

```
$ nodus stack:unshare myStack otherUser
```

```
$ nodus stack:unshare myStack --all
```

4.5 Clusters

This section contains the following commands:

- `cluster:aws:create NAME TYPE MANAGER`
- `cluster:aws:update CLUSTER`
- `cluster:azure:create NAME TYPE MANAGER`
- `cluster:azure:update CLUSTER`
- `cluster:burst CLUSTER`
- `cluster:cores CLUSTER`
- `cluster:deploy CLUSTER`
- `cluster:destroy CLUSTER`
- `cluster:gcp:create NAME TYPE MANAGER`
- `cluster:gcp:update CLUSTER`
- `cluster:huawei:create NAME TYPE`
- `cluster:huawei:update CLUSTER`
- `cluster:list`
- `cluster:local:create`
- `cluster:local:update CLUSTER`
- `cluster:log`
- `cluster:members CLUSTER`
- `cluster:nodes CLUSTER`
- `cluster:oracle:create NAME TYPE MANAGER`
- `cluster:oracle:update CLUSTER`

- `cluster:otc:create NAME TYPE MANAGER`
- `cluster:otc:update CLUSTER`
- `cluster:ovpn CLUSTER`
- `cluster:queue CLUSTER`
- `cluster:releasehold CLUSTER`
- `cluster:remove CLUSTER`
- `cluster:remove-output CLUSTER ID`
- `cluster:resize CLUSTER`
- `cluster:service CLUSTER`
- `cluster:set CLUSTER CREDENTIAL`
- `cluster:share CLUSTER USERNAME`
- `cluster:show CLUSTER`
- `cluster:ssh CLUSTER`
- `cluster:sshfs CLUSTER`
- `cluster:sync CLUSTER TYPE`
- `cluster:unshare CLUSTER`

cluster:aws:create NAME TYPE MANAGER

Description

Create new Amazon Web Services (AWS) cluster configuration entry.

Usage

`$ nodus cluster:aws:create NAME TYPE MANAGER [CREDENTIAL] [OPTIONS]`

Arguments

NAME	Name Identifier
TYPE	(centos-7) Image Type
MANAGER	(torque slurm) HPC Workload Manager
CREDENTIAL	Set Credential

Options

-P	--package=package	Packages
-b	--[no-]burstOnDeploy	Initiate Burst Service post Deploy
-d	--description=description	Description
-h	--help	Show Help

-i, --instance=instance	(required) Server Instance Type ID
-m --mode=min max	[default: min] Bursting Mode
-p, --prefix=prefix	(required) [default: nodus] Source Image Root Prefix (example: nodus)
-r, --region=region	(required) Region ID
-z --zone=zone	Availability Zone ID
--eip=eip	Elastic IP ID
--idle-purge=idle-purge	[default: 600] Node Idle Purge Time(s)
--job-completed-dropoff	Completed Jobs Queue Time
--node-volume=node-volume	Expanded Node Root Volume (GB)
--private	Provision via Private IP
--role	Auth via EC2 Role
--security=security	Security Group ID
--server-volume=server-volume	Expanded Server Root Volume (GB)
--subnet=subnet	Subnet ID
--vpc=vpc	VPC Network Self Link ID

Examples

```
$ nodus cluster:aws:create myCluster centos-7 torque myCred --prefix myNodus --region us-east-2 --instance=t2.large --job-completed-dropoff=60
```

```
$ nodus cluster:aws:create myCluster centos-7 slurm --region us-east-2 --package git --package python3 --package perl
```

```
$ nodus cluster:aws:create myCluster centos-7 torque --region us-east-2 --instance-e=t2.large --vpc=vpc-03ceecbf61bb37c99 --subnet=subnet-05aa121e98148d0ce --security=sg-09cda11597d6fd926
```

cluster:aws:update CLUSTER

Description

Update Amazon Web Services (AWS) cluster configuration entry.

Usage

```
$ nodus cluster:aws:update CLUSTER [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-P --package=package	Add Package
-R --no-package=no-package	Remove Package

Options		
-b	--[no-]burstOnDeploy	Initiate Burst Service post Deploy
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	Server Instance Type ID
-m	--mode=min max	Bursting Mode
-n	--name=name	Name Identifier
-p	--prefix=prefix	Source Image Root Prefix (Ex: nodus)
-r	--region=region	Region ID
-t	--type=centos-7	OS Type
-z	--zone=zone	Availability Zone ID
	--eip=eip	Elastic IP ID
	--force	Skip Checks
	--idle-purge=idle-purge	Node Idle Purge Time(s)
	--job-completed-dropoff	Completed Jobs Queue Time
	--manager=torque slurm	HPC Workload Manager
	--no-eip	Remove Elastic IP
	--no-node-volume	Remove Expanded Node Root Volume
	--no-security	Remove Security Group
	--no-server-volume	Remove Expanded Server Root Volume
	--no-subnet	Remove Subnet
	--no-vpc	Remove VPC
	--no-zone	Remove Zone
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--[no-]private	Provision via Private IP
	--[no-]role	Auth via EC2 Role
	--security=security	Security Group ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--subnet=subnet	Subnet ID
	--vpc=vpc	VPC ID

Examples

```
$ nodus cluster:aws:update myCluster --name newCluster
```

```
$ nodus cluster:aws:update myCluster --job-completed-dropoff=60
```

```
$ nodus cluster:aws:update myCluster --instance=t2.large
```

```
$ nodus cluster:aws:update myCluster --vpc=vpc-03ceecbf61bb37c99 --subnet=subnet-05aa121e98148d0ce --security=sg-09cda11597d6fd926
```

cluster:azure:create NAME TYPE MANAGER**Description**

Create new Microsoft Azure cluster configuration entry.

Usage

```
$ nodus cluster:azure:create NAME TYPE MANAGER [CREDENTIAL] [OPTIONS]
```

Arguments

NAME	Name Identifier
TYPE	(centos-7) Image Type
MANAGER	(torque slurm) HPC Workload Manager
CREDENTIAL	Set Credential

Options

-P	--package=package	Packages
-R	--resource=resource	(required) Image Resource Group Name
-b	--[no-]burstOnDeploy	Initiate Burst Service post Deploy
-d	--description=description	Description
-h	--help	Show Help
-i,	--instance=instance	(required) [default: Standard_DS2_v2] Server Instance Type ID
-m	--mode=min max	[default: min] Bursting Mode
-p,	--prefix=prefix	(required) [default: nodus] Source Image Root Prefix (example: nodus)
-r,	--region=region	(required) Region ID
	--idle-purge=idle-purge	[default: 600] Node Idle Purge Time(s)
	--job-completed-dropoff	Completed Jobs Queue Time
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--server-volume=server-volume	Expanded Server Root Volume (GB)

Example

```
$ nodus cluster:azure:create myCluster centos-7 torque myCred --region=eastus --instance=Standard_DS2_v2 --resource=myResourceGroup --job-completed-dropoff=60
```

```
$ nodus cluster:azure:create myCluster centos-7 slurm --prefix=myNodus --region=westus --instance=Standard_DS2_v2 --resource=myResourceGroup
```

cluster:azure:update CLUSTER**Description**

Update Microsoft Azure cluster configuration entry.

Usage		
nodus cluster:azure:update CLUSTER [OPTIONS]		
Arguments		
CLUSTER	Cluster Name or ID	
Options		
-P	--package=package	Add Package
-R	--no-package=no-package	Remove Package
-R	--resource=resource	Image Resource Group Name
-b	--[no-]burstOnDeploy	Initiate Burst Service post Deploy
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	Server Instance Type ID
-m	--mode=min max	Bursting Mode
-n	--name=name	Name Identifier
-p	--prefix=prefix	Prefix Source Image Root Prefix (Ex: nodus)
-r	--region=region	Region ID
-t	--type=centos-7	OS Type
	--force	Skip Checks
	--idle-purge=idle-purge	Node Idle Purge Time(s)
	--job-completed-dropoff	Completed Jobs Queue Time
	--manager=torque slurm	HPC Workload Manager
	--no-node-volume	Remove Expanded Node Root Volume
	--no-server-volume	Remove Expanded Server Root Volume
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--server-volume=server-volume	Expanded Server Root Volume (GB)
Examples		
\$ nodus cluster:azure:update myCluster --name newCluster		
\$ nodus cluster:azure:update myCluster --job-completed-dropoff=60		
\$ nodus cluster:azure:update myCluster --prefix=myNodus --region=eastus --resource-e=myResourceGroup		

cluster:burst CLUSTER

Description

Manage cluster bursting state or manual burst.

Usage

\$ nodus cluster:burst CLUSTER [OPTIONS]

Argument		
CLUSTER		Cluster Name or ID
Options		
-f	--force	Skip State Checks
-h	--help	Show Help
-m	--mode=min max	Bursting Mode
	--raw	Raw Details
	--start	Start bursting service Daemon
	--status	Check Service Status
	--stop	Stop bursting service Daemon
Examples		
\$ nodus cluster:burst myCluster		
\$ nodus cluster:burst myCluster --start		
\$ nodus cluster:burst myCluster --stop		
\$ nodus cluster:burst myCluster --status		
\$ nodus cluster:burst myCluster --mode max --start		

cluster:cores CLUSTER

Description

Get cluster core information.

Usage

```
$ nodus cluster:cores CLUSTER [OPTIONS]
```

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus cluster:cores myCluster
```

cluster:deploy CLUSTER

Description

Modify cloud resources based on cluster configuration entry.

Usage

```
$ nodus cluster:deploy CLUSTER [OPTIONS]
```

Argument

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-h	--help	Show Help
-t	--target=target	Node Hostname
	--[no-]plan	Show Plan

Examples

```
$ nodus cluster:deploy myCluster
```

```
$ nodus cluster:deploy myCluster --no-plan
```

cluster:destroy CLUSTER**Description**

Destroy cloud resources based on cluster configuration entry.

Usage

```
$ nodus cluster:destroy CLUSTER [OPTIONS]
```

Argument

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-f	--force	Skip Checks
-h	--help	Show Help
-t	--target=target	Node Hostname
	--plan	Show Plan

Examples

```
$ nodus cluster:destroy myCluster
```

```
$ nodus cluster:destroy myCluster --no-plan
```

cluster:gcp:create NAME TYPE MANAGER**Description**

Create new Google Cloud Platform (GCP) cluster configuration entry.

Usage

```
$ nodus cluster:gcp:create NAME TYPE MANAGER [CREDENTIAL] [OPTIONS]
```

Arguments

NAME	Name Identifier
TYPE	(centos-7) Image Type
MANAGER	(torque slurm) HPC Workload Manager
CREDENTIAL	Set Credential

Options

-P	--package=package	Packages
-b	--[no-]burstOnDeploy	Initiate Burst Service post Deploy
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	(required) [default: n1-standard-1] Server Instance Type ID
-m	--mode=min max	[default: min] Bursting Mode
-p	--prefix=prefix	(required) [default: nodus] Source Image Root Prefix (example: nodus)
-r	--region=region	(required) Region ID
-z	--zone=zone	(required) Availability Zone ID
	--account	Auth via Service Account
	--firewall=firewall	Firewall Self Link ID
	--idle-purge=idle-purge	[default: 600] Node Idle Purge Time(s)
	--job-completed-dropoff	Completed Jobs Queue Time
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--subnet=subnet	Subnet Self Link ID
	--vpc=vpc	VPC Network Self Link ID

Example

```
$ nodus cluster:gcp:create myCluster centos-7 torque myCred --region=us-east1 --zone=us-east1-b --instance=n1-standard-1 --job-completed-dropoff=60
```

```
$ nodus cluster:gcp:create myCluster centos-7 slurm --prefix=myNodus --region=us-east1 --zone=us-east1-b --instance=n1-standard-1
```

cluster:gcp:update CLUSTER**Description**

Update Google Cloud Platform (GCP) cluster configuration entry.

Usage

```
nodus cluster:gcp:update CLUSTER [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-P	--package=package	Add Package
-R	--no-package=no-package	Remove Package

Options		
-b	--[no-]burstOnDeploy	Initiate Burst Service post Deploy
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	Server Instance Type ID
-m	--mode=min max	Bursting Mode
-n	--name=name	Name Identifier
-p	--prefix=prefix	Prefix Source Image Root Prefix (Ex: nodus)
-r	--region=region	Region ID
-t	--type=centos-7	OS Type
-z	--zone=zone	Availability Zone ID
	--[no-]account	Auth via Service Account
	--firewall=firewall	Firewall Self Link ID
	--force	Skip Checks
	--idle-purge=idle-purge	Node Idle Purge Time(s)
	--job-completed-dropoff	Completed Jobs Queue Time
	--manager=torque slurm	HPC Workload Manager
	--no-firewall	Remove Firewall
	--no-node-volume	Remove Expanded Node Root Volume
	--no-server-volume	Remove Expanded Server Root Volume
	--no-subnet=no-subnet	Remove Subnet
	--no-vpc=no-vpc	Remove VPC
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--subnet=subnet	Subnet Self Link ID
	--vpc=vpc	VPC Network Self Link ID

Examples

```
$ nodus cluster:gcp:update myCluster --name newCluster
```

```
$ nodus cluster:gcp:update myCluster --job-completed-dropoff=60
```

```
$ nodus cluster:gcp:update myCluster --prefix=myNodus --region=us-east1 --zone=us-east1-b
```

cluster:huawei:create NAME TYPE

Description

Create new Huawei Cloud cluster configuration entry.

Usage

```
$ nodus cluster:huawei:create NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments		
NAME		Name Identifier
TYPE		(centos-7) Image Type
MANAGER		(torque slurm) HPC Workload Manager
CREDENTIAL		Set Credential
Options		
-P	--package=package	Add Package
-b	--[no-]burstOnDeploy	Initiate Burst Service post Deploy
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	(required) [default: s2.medium.2] Server Instance Type ID
-m	--mode=min max	[default: min] Bursting Mode
-p	--prefix=prefix	(required) [default: nodus] Source Image Root Prefix (example: nodus)
-r	--region=region	(required) Region ID
-z	--zone=zone	(required) Availability Zone ID
	--fip=fip	Floating IP Address
	--idle-purge=idle-purge	[default: 600] Node Idle Purge Time(s)
	--job-completed-dropoff	Completed Jobs Queue Time
	--network=network	Subnet Network ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--security=security	Security Group ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--subnet=subnet	Subnet ID
Examples		
\$ nodus cluster:huawei:create myCluster centos-7 torque myCred --instance=s2.medium.2 --job-completed-dropoff=60		
\$ nodus cluster:huawei:create myCluster centos-7 slurm --prefix=myNodus --instance=e=s2.medium.2		

cluster:huawei:update CLUSTER

Description

Update Huawei Cloud cluster configuration entry.

Usage

```
$ nodus cluster:huawei:update CLUSTER [OPTIONS]
```

Arguments		
CLUSTER		Cluster Name or ID
Options		
-P	--package=package	Add Package
-R	--no-package=no-package	Remove Package
-b	--[no-]burstOnDeploy	Initiate Burst Service post Deploy
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	Server Instance Type ID
-m	--mode=min max	Bursting Mode
-n	--name=name	Name Identifier
-p	--prefix=prefix	Prefix Source Image Root Prefix (Ex: nodus)
-r	--region=region	Region ID
-t	--type=centos-7	OS Type
-z	--zone=zone	Availability Zone ID
	--fip=fip	Floating IP Address
	--force	Skip Checks
	--idle-purge=idle-purge	Node Idle Purge Time(s)
	--job-completed-dropoff	Completed Jobs Queue Time
	--manager=torque slurm	HPC Workload Manager
	--network=network	Subnet Network ID
	--no-fip	Remove Floating IP Address
	--no-network	Remove Subnet Network
	--no-node-volume	Remove Expanded Node Root Volume
	--no-security	Remove Security Group
	--no-server-volume	Remove Expanded Server Root Volume
	--no-subnet=no-subnet	Remove Subnet
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--security=security	Security Group ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--subnet=subnet	Subnet Self Link ID
Examples		
\$ nodus cluster:huawei:update myCluster --name newCluster		
\$ nodus cluster:huawei:update myCluster --job-completed-dropoff=60		
\$ nodus cluster:huawei:update myCluster --prefix=myNodus --instance=s2.medium.2		

cluster:list**Description**

List cluster entries from database.

Usage

```
$ nodus cluster:list [OPTIONS]
```

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus cluster:list
```

```
$ nodus cluster:list --format json
```

cluster:local:create**Description**

Create new On Premises cluster configuration entry.

Usage

```
$ nodus cluster:local:create NAME [OPTIONS]
```

Arguments

NAME	Name Identifier
------	-----------------

Options

-d	--description=description	Description
-h	--help	Show Help

Examples

```
$ nodus cluster:local:create myCluster
```

cluster:local:update CLUSTER**Description**

Update On Premises cluster configuration entry.

Usage

```
$ nodus cluster:local:update CLUSTER [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-d	--description=description	Description
----	---------------------------	-------------

Options

-h	--help	Show Help
-n	--name=name	Name Identifier

Examples

```
$ nodus cluster:local:update myCluster --name newCluster
```

cluster:log**Description**

Display cluster logs.

Usage

```
$ nodus cluster:log CLUSTER TYPE [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
TYPE	(init plan deploy destroy master burst) [default: master] Log Type

Options

-d	--debug	Debug Logs
-f	--follow	Follow File Output Stream
-h	--help	Show Help
-n	--lines=lines	Last N Lines

Examples

```
$ nodus cluster:log myCluster
```

```
$ nodus cluster:log myCluster burst
```

cluster:members CLUSTER**Description**

Get cluster information as reported by 'serf members'.

Usage

```
$ nodus cluster:members CLUSTER [OPTIONS]
```

Argument

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Example

```
$ nodus cluster:members myCluster
```


cluster:nodes CLUSTER**Description**

Get cluster node information.

Usage

```
$ nodus cluster:nodes CLUSTER [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus cluster:nodes myCluster
```

cluster:oracle:create NAME TYPE MANAGER**Description**

Create new Oracle Cloud cluster configuration entry.

Usage

```
$ nodus cluster:oracle:create NAME TYPE MANAGER [CREDENTIAL] [OPTIONS]
```

Arguments

NAME	Name Identifier
TYPE	(centos-7) Image Type
MANAGER	(torque slurm) HPC Workload Manager
CREDENTIAL	Set Credential

Options

-P	--package=package	Packages
-b	--[no-]burstOnDeploy	Initiate Burst Service post Deploy
-d	--description=description	Description
-h	--help	Show Help
-i	--instance=instance	(required) [default: VM.Standard2.1] Server Instance Type ID
-m	--mode=min max	[default: min] Bursting Mode
-p	--prefix=prefix	(required) [default: nodus] Source Image Root Prefix (example: nodus)
-r	--region=region	(required) Region ID
	--idle-purge=idle-purge	[default: 600] Node Idle Purge Time(s)

<code>--job-completed-dropoff</code>	Completed Jobs Queue Time
<code>--node-volume=node-volume</code>	Expanded Node Root Volume (GB)
<code>--security=security</code>	Security Group ID
<code>--server-volume=server-volume</code>	Expanded Server Root Volume (GB)

Example

```
$ nodus cluster:oracle:create myCluster centos-7 torque myCred --prefix=myNodus --region=us-ashburn-1 --instance=VM.Standard2.1 --job-completed-dropoff=60
```

```
$ nodus cluster:oracle:create myCluster centos-7 slurm --region=us-ashburn-1 --instance=VM.Standard2.1
```

cluster:oracle:update CLUSTER**Description**

Update Oracle Cloud cluster configuration entry.

Usage

```
nodus cluster:oracle:update CLUSTER [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
---------	--------------------

Options

<code>-P --package=package</code>	Add Package
<code>-R --no-package=no-package</code>	Remove Package
<code>-b --[no-]burstOnDeploy</code>	Initiate Burst Service post Deploy
<code>-d --description=description</code>	Description
<code>-h --help</code>	Show Help
<code>-i --instance=instance</code>	Server Instance Type ID
<code>-m --mode=min max</code>	Bursting Mode
<code>-n --name=name</code>	Name Identifier
<code>-p --prefix=prefix</code>	Prefix Source Image Root Prefix (Ex: nodus)
<code>-r --region=region</code>	Region ID
<code>-t --type=centos-7</code>	OS Type
<code>--force</code>	Skip Checks
<code>--idle-purge=idle-purge</code>	Node Idle Purge Time(s)
<code>--job-completed-dropoff</code>	Completed Jobs Queue Time
<code>--manager=torque slurm</code>	HPC Workload Manager
<code>--no-node-volume</code>	Remove Expanded Node Root Volume
<code>--no-server-volume</code>	Remove Expanded Server Root Volume

Options

<code>--node-volume=node-volume</code>	Expanded Node Root Volume (GB)
<code>--server-volume=server-volume</code>	Expanded Server Root Volume (GB)

Examples

```
$ nodus cluster:oracle:update myCluster --name newCluster
```

```
$ nodus cluster:oracle:update myCluster --job-completed-dropoff=60
```

```
$ nodus cluster:oracle:update myCluster --prefix=myNodus
```

cluster:otc:create NAME TYPE MANAGER**Description**

Create new OpenTelekom Cloud cluster configuration entry.

Usage

```
$ nodus cluster:otc:create NAME TYPE MANAGER [CREDENTIAL] [OPTIONS]
```

Arguments

NAME	Name Identifier
TYPE	(centos-7) Image Type
MANAGER	(torque slurm) HPC Workload Manager
CREDENTIAL	Set Credential

Options

<code>-P --package=package</code>	Packages
<code>-b --[no-]burstOnDeploy</code>	Initiate Burst Service post Deploy
<code>-d --description=description</code>	Description
<code>-h --help</code>	Show Help
<code>-i --instance=instance</code>	(required) [default: s2.medium.2] Server Instance Type ID
<code>-m --mode=min max</code>	[default: min] Bursting Mode
<code>-p --prefix=prefix</code>	(required) [default: nodus] Source Image Root Prefix (example: nodus)
<code>--fip=fip</code>	Floating IP Address
<code>--idle-purge=idle-purge</code>	[default: 600] Node Idle Purge Time(s)
<code>--job-completed-dropoff</code>	Completed Jobs Queue Time
<code>--network=network</code>	Subnet Network ID
<code>--node-volume=node-volume</code>	Expanded Node Root Volume (GB)
<code>--private</code>	Provision via Private IP
<code>--security=security</code>	Security Group ID
<code>--server-volume=server-volume</code>	Expanded Server Root Volume (GB)

<code>--subnet=subnet</code>	Subnet ID
<code>--zone=zone</code>	Availability Zone ID

Example

```
$ nodus cluster:otc:create myCluster centos-7 torque myCred --prefix=myNodus --instance=s2.medium.2 --job-completed-dropoff=60
```

```
$ nodus cluster:otc:create myCluster centos-7 slurm --instance=s2.medium.2
```

cluster:otc:update CLUSTER**Description**

Update OpenTelekom Cloud cluster configuration entry.

Usage

```
$ nodus cluster:otc:update CLUSTER [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
---------	--------------------

Options

<code>-P</code>	<code>--package=package</code>	Add Package
<code>-R</code>	<code>--no-package=no-package</code>	Remove Package
<code>-b</code>	<code>--[no-]burstOnDeploy</code>	Initiate Burst Service post Deploy
<code>-d</code>	<code>--description=description</code>	Description
<code>-h</code>	<code>--help</code>	Show Help
<code>-i</code>	<code>--instance=instance</code>	Server Instance Type ID
<code>-m</code>	<code>--mode=min max</code>	Bursting Mode
<code>-n</code>	<code>--name=name</code>	Name Identifier
<code>-p</code>	<code>--prefix=prefix</code>	Prefix Source Image Root Prefix (Ex: nodus)
<code>-t</code>	<code>--type=centos-7</code>	OS Type
	<code>--fip=fip</code>	Floating IP Address
	<code>--force</code>	Skip Checks
	<code>--idle-purge=idle-purge</code>	Node Idle Purge Time(s)
	<code>--job-completed-dropoff</code>	Completed Jobs Queue Time
	<code>--manager=torque slurm</code>	HPC Workload Manager
	<code>--network=network</code>	Subnet Network ID
	<code>--no-fip</code>	Remove Floating IP Address
	<code>--no-network</code>	Remove Subnet Network
	<code>--no-node-volume</code>	Remove Expanded Node Root Volume
	<code>--no-security</code>	Remove Security Group
	<code>--no-server-volume</code>	Remove Expanded Server Root Volume

Options

<code>--no-subnet=no-subnet</code>	Remove Subnet
<code>--no-zone</code>	Remove Availability Zone
<code>--node-volume=node-volume</code>	Expanded Node Root Volume (GB)
<code>--[no-]private</code>	Provision via Private IP
<code>--security=security</code>	Security Group ID
<code>--server-volume=server-volume</code>	Expanded Server Root Volume (GB)
<code>--subnet=subnet</code>	Subnet Self Link ID
<code>--zone=zone</code>	Availability Zone ID

Examples

```
$ nodus cluster:otc:update myCluster --name newCluster
$ nodus cluster:otc:update myCluster --job-completed-dropoff=60
$ nodus cluster:otc:update myCluster --prefix=myNodus --instance=s2.medium.2
```

cluster:ovpn CLUSTER**Description**

Installs OpenVPN on head node and can download the ovpn file that is generated.

Usage

```
$ nodus cluster:ovpn CLUSTER [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
---------	--------------------

Options

<code>-h</code>	<code>--help</code>	Show Help
-----------------	---------------------	-----------

Examples

```
$ nodus cluster:ovpn myCluster
```

cluster:queue CLUSTER**Description**

Get workload queue information.

Usage

```
$ nodus cluster:queue CLUSTER [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
---------	--------------------

Options

<code>-f</code>	<code>--format=text json</code>	[default: text] Output Format
-----------------	---------------------------------	-------------------------------

Options

-h	--help	Show Help
----	--------	-----------

Examples

```
$ nodus cluster:queue myCluster
```

cluster:releasehold CLUSTER**Description**

Release all job holds.

Usage

```
$ nodus cluster:releasehold CLUSTER [OPTIONS]
```

Argument

CLUSTER	Cluster Name or ID
---------	--------------------

Option

-h	--help	Show Help
----	--------	-----------

Example

```
$ nodus cluster:releasehold myCluster
```

cluster:remove CLUSTER**Description**

Remove cluster entries from database.

Usage

```
$ nodus cluster:remove CLUSTER [OPTIONS]
```

Argument

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-h	--help	Show Help
	--[no-]clean	Remove Files Created for Cluster
	--force	Force Removal from Database

Examples

```
cluster:remove myCluster
```

```
cluster:remove myCluster --no-clean
```

```
cluster:remove myCluster --force
```

cluster:remove-output CLUSTER ID**Description**

Delete job directory from cluster.

Usage

```
$ nodus cluster:remove-output CLUSTER ID [ID]... [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
JOB	NODUS Job ID

Options

-h	--help	Show Help
----	--------	-----------

Examples

```
$ nodus cluster:remove-output myCluster 0
```

```
$ nodus cluster:remove-output myCluster 0 1 2
```

cluster:resize CLUSTER**Description**

Alter cluster configuration by modifying instance types and their counts.

Usage

```
$ nodus cluster:resize CLUSTER [[INSTANCE COUNT] ...] [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
INSTANCE	Instance ID Code
COUNT	Number of Instances [0,inf)

Options

-f	--force	Ignore Checks
-h	--help	Show Help
-p	--purge	Purge All Existing Node Groups Except Given Args
-s	--server=server	New Instance ID Code for Server

Examples

```
$ nodus cluster:resize myCluster t2.micro 4 t2.xlarge 1
```

```
$ nodus cluster:resize myCluster t2.nano 5 --purge
```

cluster:service CLUSTER**Description**

Restarts service on the cluster head node.

Usage

```
$ nodus cluster:service CLUSTER SERVICE
```

Arguments

CLUSTER Cluster Name or ID

SERVICE (serf|pbs_server|pbs_mom|trqau-
thd|maui|mariadb|munge|slurmdbd|slurmctld|slurmd|slurmrestd) Service
Name

Options

-h	--help	Show Help
-----------	---------------	-----------

Examples

```
$ nodus cluster:service myCluster pbs_server
```

cluster:set CLUSTER CREDENTIAL**Description**

Associate cluster entry with credential entry.

Usage

```
$ nodus cluster:set CLUSTER CREDENTIAL [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
----------------	--------------------

CREDENTIAL	Credential Name or ID
-------------------	-----------------------

Option

-h	--help	Show Help
-----------	---------------	-----------

Example

```
$ nodus cluster:set myCluster myCredential
```

cluster:share CLUSTER USERNAME**Description**

Share your cluster to another user.

Usage

```
$ nodus cluster:share CLUSTER USERNAME
```

Arguments

CLUSTER	Cluster Name or ID
----------------	--------------------

USERNAME	Linux Username
-----------------	----------------

Options

-h	--help	Show Help
-----------	---------------	-----------

Examples

```
$ nodus cluster:share myCluster otherUser
```

cluster:show CLUSTER**Description**

Display details of a particular cluster entry from the database.

Usage

```
$ nodus cluster:show CLUSTER [OPTIONS]
```

Argument

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-b	--backup	Show TF State Backup
-f	--format=text json	[default: text] Output Format
-h	--help	Show Help
-k	--keys	Show Keys
-s	--state	Show TF State

Example

```
$ nodus cluster:show myCluster
```

cluster:ssh CLUSTER**Description**

SSH into the head node of cluster.

Usage

```
$ nodus cluster:ssh CLUSTER [OPTIONS]
```

Argument

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-d	--details	Show SSH Details Instead
-f	--force	Ignore Checks
-h	--help	Show Help
-p	--private	Force Private IP Use
	--admin	Use Default Sudoer Instead

Example

```
$ nodus cluster:ssh myCluster
```

```
$ nodus cluster:ssh myCluster --details
$ nodus cluster:ssh myCluster --admin
$ nodus cluster:ssh myCluster --admin --details
```

cluster:sshfs CLUSTER

Description

Mount/Unmount a remote file system over SSH.

Usage

```
$ nodus cluster:sshfs CLUSTER [OPTIONS]
```

Argument

CLUSTER	Cluster Name or ID
---------	--------------------

Options

--mount	Mount the Directory
--unmount	Unmount the Directory
--destination	Where to Mount the Directory

Example

```
$ nodus cluster:sshfs myCluster --mount /mnt/beefs --destination ~/mnt
$ nodus cluster:sshfs myCluster --unmount ~/mnt
```

cluster:sync CLUSTER TYPE

Description

Synchronizes data with cluster. Used for version upgrades, maintenance, and development purposes.

Usage

```
$ nodus cluster:sync CLUSTER TYPE [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
TYPE	(api scripts users) Type

Options

-h	--help	Show Help
	--force	Skip State Check

Examples

```
$ nodus cluster:sync myCluster api
$ nodus cluster:sync myCluster scripts
$ nodus cluster:sync myCluster users
```

cluster:unshare CLUSTER**Description**

Unshare your cluster to another user.

Usage

```
$ nodus cluster:unshare CLUSTER [USERNAME] [OPTIONS]
```

Arguments

CLUSTER	Cluster Name or ID
USERNAME	Linux Username

Options

-h	--help	Show Help
	--all	Remove all shared users

Examples

```
$ nodus cluster:unshare myCluster otherUser
```

```
$ nodus cluster:unshare myCluster --all
```

4.6 Jobs

This section contains the following commands:

- [job:aws:create SCRIPT NAME TYPE](#)
- [job:aws:update NAME](#)
- [job:azure:create SCRIPT NAME TYPE](#)
- [job:azure:update NAME](#)
- [job:cancel ID CLUSTER](#)
- [job:create SCRIPT NAME](#)
- [job:gcp:create SCRIPT NAME TYPE](#)
- [job:gcp:update NAME](#)
- [job:huawei:create SCRIPT NAME TYPE](#)
- [job:huawei:update NAME](#)
- [job:list](#)
- [job:oracle:create SCRIPT NAME TYPE](#)
- [job:oracle:update NAME](#)

- [job:otc:create SCRIPT NAME TYPE](#)
- [job:otc:update NAME](#)
- [job:output ID CLUSTER](#)
- [job:remove JOB](#)
- [job:show JOB](#)
- [job:submit JOB CLUSTER](#)
- [job:submit-od JOB](#)
- [job:update NAME](#)

job:aws:create SCRIPT NAME TYPE

Description

Create new AWS on-demand job entry.

Usage

```
$ nodus job:aws:create SCRIPT NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

SCRIPT	(Absolute / Relative) File path to job script
NAME	Job Name
TYPE	(centos-7) Image Type
MANAGER	(torque slurm) HPC Workload Manager
CREDENTIAL	Credential Name or ID

Options

-P	--package=package	Add Package
-c	--cores=cores	(required) [default: 1] Number of required cores per node
-d	--description=description	Description of the job
-f	--dataFile=dataFile	(Absolute / Relative) File path to data file
-h	--help	Show Help
-n	--nodes=nodes	(required) [default: 1] Number of required nodes
-p	--prefix=prefix	(required) [default: nodus] Source Image Root Prefix (Ex: nodus)
-r	--region=region	(required) Region ID
-w	--walltime=walltime	[default: 24:00:00] Job maximum wall-time
-z	--zone=zone	Availability Zone ID
	--node-instance=node-instance	(required) Node Instance Type ID

Options

<code>--node-volume=node-volume</code>	Expanded Node Root Volume (GB)
<code>--on-demand-d=persist offline down destroy</code>	(required) On-Demand Behavior
<code>--server-instance=server-instance</code>	(required) Server Instance Type ID
<code>--server-volume=server-volume</code>	Expanded Server Root Volume (GB)

Examples

```
$ nodus job:aws:create ~/Documents/myScript.sh myJob centos-7 --nodes=2 --cores=16 --on-demand destroy
```

```
$ nodus job:aws:create ~/Documents/myScript.sh myJob centos-7 --dataFile-e=~/Documents/data0.dat --dataFile=~/Documents/data1.dat --on-demand down
```

job:aws:update NAME**Description**

Update AWS on-demand job entry.

Usage

```
$ nodus job:aws:update NAME [OPTIONS]
```

Arguments

JOB	Job Name
-----	----------

Options

<code>-P --package=package</code>	Add Package
<code>-R --no-package=no-package</code>	Remove Package
<code>-a --add-df=add-df</code>	Absolute Path to any data files to be added
<code>-c --cores=cores</code>	Number of required cores per node
<code>-d --description=description</code>	Description of the job
<code>-h --help</code>	Show Help
<code>-n --nodes=nodes</code>	Number of required nodes
<code>-p --prefix=prefix</code>	Source Image Root Prefix (Ex: nodus)
<code>-r --remove-df=remove-df</code>	Absolute Path to any data files to be removed
<code>-s --script=script</code>	Absolute File path to job script
<code>-t --type=centos-7</code>	OS Type
<code>-w --walltime=walltime</code>	Job walltime
<code>--credential=credential</code>	Add Credential
<code>--manager=torque slurm</code>	HPC Workload Manager
<code>--name=name</code>	Name Identifier
<code>--no-credential=no-credential</code>	Remove Credential

Options		
	--no-node-volume	Remove Expanded Node Root Volume
	--no-server-volume	Remove Expanded Server Root Volume
	--no-zone	Remove Zone
	--node-instance=node-instance	Node Instance Type ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--on-demand=persist offline down destroy	On-Demand Behavior
	--region=region	Region ID
	--server-instance=server-instance	Server Instance Type ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--zone=zone	Availability Zone ID

Examples

```
$ nodus job:aws:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh
```

```
$ nodus job:aws:update myJob --description="My Job" --script-t=/home/jdoe/Documents/myScript.sh --nodes=2 --cores=16 --walltime="00:30:00" --remove-df=/home/jdoe/Documents/file0.dat --add-df=/home/jdoe/Documents/file1.dat
```

job:azure:create SCRIPT NAME TYPE

Description

Create new AWS on-demand job entry.

Usage

```
$ nodus job:azure:create SCRIPT NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

SCRIPT	(Absolute / Relative) File path to job script
NAME	Job Name
TYPE	(centos-7) Image Type
MANAGER	(torque slurm) HPC Workload Manager
CREDENTIAL	Credential Name or ID

Options

-P	--package=package	Package
-c	--cores=cores	(required) [default: 1] Number of required cores per node
-d	--description=description	Description of the job
-f	--dataFile=dataFile	(Absolute / Relative) File path to data file
-g	--resource=resource	(required) Image Resource Group Name

Options		
-h	--help	Show Help
-n	--nodes=nodes	(required) [default: 1] Number of required nodes
-p	--prefix=prefix	(required) [default: nodus] Source Image Root Prefix (Ex: nodus)
-r	--region=region	(required) Region ID
-w	--walltime=walltime	[default: 24:00:00] Job maximum wall-time
	--node-instance=node-instance	(required) Node Instance Type ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--on-demand=persist offline down destroy	(required) On-Demand Behavior
	--server-instance=server-instance	(required) Server Instance Type ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
Examples		
\$ nodus job:azure:create ~/Documents/myScript.sh myJob centos-7 --nodes=2 --cores=16 --on-demand destroy		
\$ nodus job:azure:create ~/Documents/myScript.sh myJob centos-7 --dataFile=~/Documents/data0.dat --dataFile=~/Documents/data1.dat --on-demand down		

job:azure:update NAME

Description

Update Azure on-demand job entry.

Usage

\$ nodus job:azure:update NAME [OPTIONS]

Arguments

JOB	Job Name
-----	----------

Options

-P	--package=package	Add Package
-R	--no-package=no-package	Remove Package
-a	--add-df=add-df	Absolute Path to any data files to be added
-c	--cores=cores	Number of required cores per node
-d	--description=description	Description of the job
-g	--resource=resource	(required) Image Resource Group Name
-h	--help	Show Help
-n	--nodes=nodes	Number of required nodes
-p	--prefix=prefix	Source Image Root Prefix (Ex: nodus)

Options		
-r	--remove-df=remove-df	Absolute Path to any data files to be removed
-s	--script=script	Absolute File path to job script
-t	--type=centos-7	OS Type
-w	--walltime=walltime	Job walltime
-z	--zone=zone	Availability Zone ID
	--[no-]account	Auth via Service Account
	--firewall=firewall	Firewall Self Link ID
	--force	Skip Checks
	--idle-purge=idle-purge	Node Idle Purge Time (s)
	--manager=torque slurm	HPC Workload Manager
	--no-firewall	Remove Firewall
	--no-node-volume	Remove Expanded Node Root Volume
	--no-server-volume	Remove Expanded Server Root Volume
	--no-subnet=no-subnet	Remove Subnet
	--no-vpc=no-vpc	Remove VPC
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--subnet=subnet	Subnet Self Link ID
	--vpc=vpc	VPC Network Self Link ID
Examples		
\$ nodus cluster:gcp:update myCluster --name newCluster		
\$ nodus cluster:gcp:update myCluster --prefix=myNodus --region=us-east1 --zone=us-east1-b		

job:cancel ID CLUSTER

Description

Cancel Submitted Job.

Usage

```
$ nodus job:cancel ID CLUSTER [OPTIONS]
```

Arguments

ID	Torque Job ID
CLUSTER	Cluster Name or ID

Option

-h	--help	Show Help
----	--------	-----------

Example

```
$ nodus job:cancel 0.nodus-server myCluster
```

job:create SCRIPT NAME**Description**

Create new job entry.

Usage

```
$ nodus job:create SCRIPT NAME [OPTIONS]
```

Arguments

SCRIPT	(Absolute/Relative) File Path to Job Script
NAME	Job Name

Options

-c	--cores=cores	(required) [default: 1] Number of required cores per node
-d	--description=description	Description of the job
-f	--dataFile=dataFile	(Absolute/Relative) File path to data file
-h	--help	Show Help
-n	--nodes=nodes	(required) [default: 1] Number of required nodes
-w	--walltime=walltime	[default: 24:00:00] Job maximum wall-time
	--override=override	Override 'nodes', 'cores', and 'walltime' with raw flag string

Examples

```
$ nodus job:create ~/Documents/myScript.sh myJob
```

```
$ nodus job:create ~/Documents/myScript.sh myJob --nodes=2 --cores=16
```

```
$ nodus job:create ~/Documents/myScript.sh myJob --dataFile=~/Documents/data0.dat -  
-dataFile=~/Documents/data1.dat
```

```
$ nodus job:create ~/Documents/myScript.sh myJob --override "-N myJobName --  
procs=16" --dataFile=~/Documents/data0.dat
```

job:gcp:create SCRIPT NAME TYPE**Description**

Update Google Cloud Platform (GCP) cluster configuration entry.

Usage

```
$ nodus job:gcp:create SCRIPT NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

SCRIPT	(Absolute / Relative) File path to job script
NAME	Job Name

Arguments		
TYPE		(centos-7) Image Type
MANAGER		(torque slurm) HPC Workload Manager
CREDENTIAL		Credential Name or ID
Options		
-P	--package=package	Add Package
-c	--cores=cores	(required) [default: 1] Number of required cores per node
-d	--description=description	Description of the job
-f	--dataFile=dataFile	(Absolute / Relative) File path to data file
-h	--help	Show Help
-n	--nodes=nodes	(required) [default: 1] Number of required nodes
-p	--prefix=prefix	(required) [default: nodus] Source Image Root Prefix (Ex: nodus)
-r	--region=region	(required) Region ID
-w	--walltime=walltime	[default: 24:00:00] Job maximum wall-time
-z	--zone=zone	Availability Zone ID
	--node-instance=node-instance	(required) Node Instance Type ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--on-demand=persist offline down destroy (required)	On-Demand Behavior
	--server-instance=server-instance	(required) Server Instance Type ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
Examples		
\$ nodus job:gcp:create ~/Documents/myScript.sh myJob centos-7 --nodes=2 --cores=16 --on-demand destroy		
\$ nodus job:gcp:create ~/Documents/myScript.sh myJob centos-7 --dataFile=~/Documents/data0.dat --dataFile=~/Documents/data1.dat --on-demand down		

job:gcp:update NAME

Description

Update Google Cloud Platform (GCP) on-demand job entry.

Usage

```
$ nodus job:gcp:update NAME [OPTIONS]
```

Arguments		
JOB		Job Name
Options		
-P	--package=package	Add Package
-R	--no-package=no-package	Remove Package
-a	--add-df=add-df	Absolute Path to any data files to be added
-c	--cores=cores	Number of required cores per node
-d	--description=description	Description
-h	--help	Show Help
-n	--nodes=nodes	Number of required nodes
-p	--prefix=prefix	Source Image Root Prefix (Ex: nodus)
-r	--remove-df=remove-df	Absolute Path to any data files to be removed
-s	--script=script	Absolute File path to job script
-t	--type=centos-7	OS Type
-w	--walltime=walltime	Job walltime
	--credential=credential	Add Credential
	--manager=torque slurm	HPC Workload Manager
	--name=name	Name Identifier
	--no-credential=no-credential	Remove Credential
	--no-node-volume	Remove Expanded Node Root Volume
	--no-server-volume	Remove Expanded Server Root Volume
	--no-zone	Remove Zone
	--node-instance=node-instance	Node Instance Type ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--on-demand=persist offline down destroy	On-Demand Behavior
	--region=region	Region ID
	--server-instance=server-instance	Server Instance Type ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--zone=zone	Availability Zone ID
Examples		
\$ nodus job:gcp:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh		
\$ nodus job:gcp:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh --nodes=2 --cores=16 --walltime="00:30:00" --remove-df=/home/jdoe/Documents/file0.dat --add-df=/home/jdoe/Documents/file1.dat		

job:huawei:create SCRIPT NAME TYPE**Description**

Update Huawei cluster configuration entry.

Usage

```
$ nodus job:huawei:create SCRIPT NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

SCRIPT	(Absolute / Relative) File path to job script
NAME	Job Name
TYPE	(centos-7) Image Type
MANAGER	(torque slurm) HPC Workload Manager
CREDENTIAL	Credential Name or ID

Options

-P --package=package	Packages
-c --cores=cores	(required) [default: 1] Number of required cores per node
-d --description=description	Description of the job
-f --dataFile=dataFile	(Absolute / Relative) File path to data file
-h --help	Show Help
-n --nodes=nodes	(required) [default: 1] Number of required nodes
-p --prefix=prefix	(required) [default: nodus] Source Image Root Prefix (Ex: nodus)
-r --region=region	(required) Region ID
-w --walltime=walltime	[default: 24:00:00] Job maximum wall-time
-z --zone=zone	Availability Zone ID
--node-instance=node-instance	(required) Node Instance Type ID
--node-volume=node-volume	Expanded Node Root Volume (GB)
--on-demand=persist offline down destroy	(required) On-Demand Behavior
--server-instance=server-instance	(required) Server Instance Type ID
--server-volume=server-volume	Expanded Server Root Volume (GB)

Examples

```
$ nodus job:huawei:create ~/Documents/myScript.sh myJob centos-7 --nodes=2 --cores=16 --on-demand destroy
```

```
$ nodus job:huawei:create ~/Documents/myScript.sh myJob centos-7 --dataFile=~/Documents/data0.dat --dataFile=~/Documents/data1.dat --on-demand down
```

job:huawei:update NAME**Description**

Update Huawei on-demand job entry.

Usage

\$ nodus job:huawei:update NAME [OPTIONS]

Arguments

JOB	Job Name
-----	----------

Options

-P	--package=package	Add Package
-R	--no-package=no-package	Remove Package
-a	--add-df=add-df	Absolute Path to any data files to be added
-c	--cores=cores	Number of required cores per node
-d	--description=description	Description of the job
-h	--help	Show Help
-n	--nodes=nodes	Number of required nodes
-p	--prefix=prefix	Source Image Root Prefix (Ex: nodus)
-r	--remove-df=remove-df	Absolute Path to any data files to be removed
-s	--script=script	Absolute File path to job script
-t	--type=centos-7	OS Type
-w	--walltime=walltime	Job walltime
	--credential=credential	Add Credential
	--manager=torque slurm	HPC Workload Manager
	--name=name	Name Identifier
	--no-credential=no-credential	Remove Credential
	--no-node-volume	Remove Expanded Node Root Volume
	--no-server-volume	Remove Expanded Server Root Volume
	--no-zone	Remove Zone
	--node-instance=node-instance	Node Instance Type ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--on-demand=persist offline down destroy (required)	On-Demand Behavior
	--region=region	Region ID
	--server-instance=server-instance	Server Instance Type ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--zone=zone	Availability Zone ID

Examples

```
$ nodus job:huawei:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh
```

```
$ nodus job:huawei:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh --nodes=2 --cores=16 --walltime="00:30:00" --remove-df=/home/jdoe/Documents/file0.dat --add-df=/home/jdoe/Documents/file1.dat
```

job:list**Description**

List job entries from database.

Usage

```
$ nodus job:list [CLUSTER] [OPTIONS]
```

Argument

CLUSTER	Cluster Name or ID
---------	--------------------

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus job:list
```

```
$ nodus job:list --format json
```

```
$ nodus job:list myCluster
```

job:oracle:create SCRIPT NAME TYPE**Description**

Create new Oracle on-demand job entry.

Usage

```
$ nodus job:oracle:create SCRIPT NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

SCRIPT	(Absolute / Relative) File path to job script
NAME	Job Name
TYPE	(centos-7) Image Type
MANAGER	(torque slurm) HPC Workload Manager
CREDENTIAL	Credential Name or ID

Options

-P	--package=package	Packages
-c	--cores=cores	(required) [default: 1] Number of required

Options		
		cores per node
-d	--description=description	Description of the job
-f	--dataFile=dataFile	(Absolute / Relative) File path to data file
-h	--help	Show Help
-n	--nodes=nodes	(required) [default: 1] Number of required nodes
-p	--prefix=prefix	(required) [default: nodus] Source Image Root Prefix (Ex: nodus)
-r	--region=region	(required) Region ID
-w	--walltime=walltime	[default: 24:00:00] Job maximum wall-time
	--node-instance=node-instance	(required) Node Instance Type ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--on-demand=persist offline down destroy	(required) On-Demand Behavior
	--server-instance=server-instance	(required) Server Instance Type ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)

Examples

```
$ nodus job:oracle:create ~/Documents/myScript.sh myJob centos-7 --nodes=2 --cores=16 --on-demand destroy
```

```
$ nodus job:oracle:create ~/Documents/myScript.sh myJob centos-7 --dataFile=~/Documents/data0.dat --dataFile=~/Documents/data1.dat --on-demand down
```

job:oracle:update NAME

Description

Update Oracle on-demand job entry.

Usage

```
$ nodus job:oracle:update NAME [OPTIONS]
```

Arguments

JOB	Job Name
-----	----------

Options

-P	--package=package	Add Package
-R	--no-package=no-package	Remove Package
-a	--add-df=add-df	Absolute Path to any data files to be added
-c	--cores=cores	Number of required cores per node
-d	--description=description	Description of the job
-h	--help	Show Help

Options		
-n	--nodes=nodes	Number of required nodes
-p	--prefix=prefix	Source Image Root Prefix (Ex: nodus)
-r	--remove-df=remove-df	Absolute Path to any data files to be removed
-s	--script=script	Absolute File path to job script
-t	--type=centos-7	OS Type
-w	--walltime=walltime	Job walltime
	--credential=credential	Add Credential
	--manager=torque slurm	HPC Workload Manager
	--name=name	Name Identifier
	--no-credential=no-credential	Remove Credential
	--no-node-volume	Remove Expanded Node Root Volume
	--no-server-volume	Remove Expanded Server Root Volume
	--no-zone	Remove Zone
	--node-instance=node-instance	Node Instance Type ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--on-demand=persist offline down destroy	On-Demand Behavior
	--region=region	Region ID
	--server-instance=server-instance	Server Instance Type ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--zone=zone	Availability Zone ID

Examples

```
$ nodus job:oracle:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh
```

```
$ nodus job:oracle:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh --nodes=2 --cores=16 --walltime="00:30:00" -remove-df=/home/jdoe/Documents/file0.dat --add-df=/home/jdoe/Documents/file1.dat
```

job:otc:create SCRIPT NAME TYPE

Description

Create new Open Telekom Cloud (OTC) on-demand job entry.

Usage

```
$ nodus job:otc:create SCRIPT NAME TYPE [CREDENTIAL] [OPTIONS]
```

Arguments

SCRIPT	(Absolute / Relative) File path to job script
--------	---

Arguments		
NAME		Job Name
TYPE		(centos-7) Image Type
MANAGER		(torque slurm) HPC Workload Manager
CREDENTIAL		Credential Name or ID
Options		
-P	--package=package	Packages
-c	--cores=cores	(required) [default: 1] Number of required cores per node
-d	--description=description	Description of the job
-f	--dataFile=dataFile	(Absolute / Relative) File path to data file
-h	--help	Show Help
-n	--nodes=nodes	(required) [default: 1] Number of required nodes
-p	--prefix=prefix	(required) [default: nodus] Source Image Root Prefix (Ex: nodus)
-w	--walltime=walltime	[default: 24:00:00] Job maximum wall-time
-z	--zone=zone	Availability Zone ID
	--node-instance=node-instance	(required) Node Instance Type ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--on-demand=persist offline down destroy	(required) On-Demand Behavior
	--server-instance=server-instance	(required) Server Instance Type ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
Examples		
\$ nodus job:otc:create ~/Documents/myScript.sh myJob centos-7 --nodes=2 --cores=16 --on-demand destroy		
\$ nodus job:otc:create ~/Documents/myScript.sh myJob centos-7 --dataFile=~/Documents/data0.dat --dataFile=~/Documents/data1.dat --on-demand down		

job:otc:update NAME

Description

Update Open Telekom Cloud (OTC) on-demand job entry.

Usage

```
$ nodus job:otc:update NAME [OPTIONS]
```

Arguments

JOB	Job Name
-----	----------

Options		
-P	--package=package	Add Package
-R	--no-package=no-package	Remove Package
-a	--add-df=add-df	Absolute Path to any data files to be added
-c	--cores=cores	Number of required cores per node
-d	--description=description	Description of the job
-h	--help	Show Help
-n	--nodes=nodes	Number of required nodes
-p	--prefix=prefix	Source Image Root Prefix (Ex: nodus)
-r	--remove-df=remove-df	Absolute Path to any data files to be removed
-s	--script=script	Absolute File path to job script
-t	--type=centos-7	OS Type
-w	--walltime=walltime	Job walltime
	--credential=credential	Add Credential
	--manager=torque slurm	HPC Workload Manager
	--name=name	Name Identifier
	--no-credential=no-credential	Remove Credential
	--no-node-volume	Remove Expanded Node Root Volume
	--no-server-volume	Remove Expanded Server Root Volume
	--no-zone	Remove Zone
	--node-instance=node-instance	Node Instance Type ID
	--node-volume=node-volume	Expanded Node Root Volume (GB)
	--on-demand=persist offline down destroy	On-Demand Behavior
	--server-instance=server-instance	Server Instance Type ID
	--server-volume=server-volume	Expanded Server Root Volume (GB)
	--zone=zone	Availability Zone ID

Examples

```
$ nodus job:otc:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh
```

```
$ nodus job:otc:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh --nodes=2 --cores=16 --walltime="00:30:00" -r-remove-df=/home/jdoe/Documents/file0.dat --add-df=/home/jdoe/Documents/file1.dat
```

job:output ID CLUSTER

Description

Display stdout or stderr of from.

Usage

```
$ nodus job:output ID CLUSTER [OPTIONS]
```

Arguments

JOB	NODUS Job ID
CLUSTER	Cluster ID or Name

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help
-t	--type=stdout stderr	[default: stdout] Output Type

Examples

```
$ nodus job:output 0 myCluster
```

```
$ nodus job:output 0 myCluster --format json
```

job:remove JOB

Description

Remove job entries from database.

Usage

```
$ nodus job:remove JOB [OPTIONS]
```

Argument

JOB	Job Name or ID
-----	----------------

Option

-h	--help	Show Help
----	--------	-----------

Example

```
job:remove myJob
```

job:show JOB

Description

Display job entry.

Usage

```
$ nodus job:show JOB [OPTIONS]
```

Argument

JOB	Job ID or Name
-----	----------------

Options

-f	--format=text json	[default: text] Output Format
-h	--help	Show Help

Examples

```
$ nodus job:show myJob
```

```
$ nodus job:show myJob --format json
```

job:submit JOB CLUSTER**Description**

Submit a job to the cluster.

Usage

```
$ nodus job:submit JOB CLUSTER [OPTIONS]
```

Arguments

JOB	Job Name or ID
CLUSTER	Cluster Name or ID

Option

-h	--help	Show Help
----	--------	-----------

Example

```
$ nodus job:submit myJob myCluster
```

job:submit-od JOB**Description**

Submit on-demand job.

Usage

```
$ nodus job:submit-od JOB [CREDENTIAL] [OPTIONS]
```

Arguments

JOB	Job Name or ID
CREDENTIAL	Credential Name or ID

Option

-h	--help	Show Help
----	--------	-----------

Example

```
$ nodus job:submit-od myJob myCredential
```

job:update NAME**Description**

Update job configuration entry.

Usage

```
$ nodus job:update NAME [OPTIONS]
```

Argument

JOB	Job Name
-----	----------

Options

-a	--add-df=add-df	Absolute Path to any data files to be added
-c	--cores=cores	Number of required cores per node
-d	--description=description	Description of the job
-h	--help	Show Help
-n	--nodes=nodes	Number of required nodes
-r	--remove-df=remove-df	Absolute Path to any data files to be removed
-s	--script=script	Absolute File path to job script
-w	--walltime=walltime	Job walltime

Examples

```
$ nodus job:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh
```

```
$ nodus job:update myJob --description="My Job" --script=/home/jdoe/Documents/myScript.sh --nodes=2 --cores=16 --walltime="00:30:00" --remove-df=/home/jdoe/Documents/file0.dat --add-df=/home/jdoe/Documents/file1.dat
```

4.7 Providers

This section contains the following commands:

- [provider:instance](#)
- [provider:region](#)

provider:instance

Description

List provider instances.

WARNING Non-exhaustive list.

WARNING Availability is dependent on region and demand.

WARNING Eligibility is strictly dependent on your account.

Usage

```
$ nodus provider:instance [OPTIONS]
```

Argument		
PROVIDER	(aws gcp huawei azure oracle otc)	Cloud Provider
Options		
-f	--format=text json	[default: text] Output Format
-h	--help	Show Help
Examples		
\$ nodus provider:instance		
\$ nodus provider:instance --format json		

provider:region		
Description		
List provider regions and zones.		
WARNING Non-exhaustive list.		
WARNING Availability and eligibility is strictly dependent on your account.		
Usage		
\$ nodus provider:region [OPTIONS]		
Argument		
PROVIDER	(aws gcp huawei azure oracle otc)	Cloud Provider
Options		
-f	--format=text json	[default: text] Output Format
-h	--help	Show Help
Examples		
\$ nodus provider:region		
\$ nodus provider:region --format json		

4.8 Misc

This section contains the following commands:

- [daemon](#)
- [db:backup](#)
- [db:drop](#)
- [db:restore](#)
- [help](#)

- [license](#)
- [upgrade](#)

daemon

Description

Manage Master Bursting Daemon. Run 'daemon --init' to initialize the bursting daemon.

Usage

```
$ nodus daemon [OPTIONS]
```

Options

-h	--help	Show Help
	--init	Initializes and Starts Bursting Service
	--restart	Restart Bursting Service
	--start	Start Bursting Service
	--status	Check Bursting Service Status
	--stop	Stop Bursting Service

Examples

```
$ nodus daemon --init
```

```
$ nodus daemon --status
```

db:backup

Description

Backup NODUS database To File.

Usage

```
$ nodus db:backup [OPTIONS]
```

Options

-h	--help	Show Help
-u	--user=user	Username

Examples

```
$ nodus db:backup
```

```
$ nodus db:backup --user myUser
```

db:drop

Description

Drop a NODUS database.

Usage

```
$ nodus db:drop [OPTIONS]
```

Options

-h	--help	Show Help
-u	--user=user	Username

Examples

```
$ nodus db:drop
```

```
$ nodus db:drop --user myUser
```

db:restore**Description**

Restore NODUS database From Backup.

Usage

```
$ nodus db:restore [OPTIONS]
```

Options

-h	--help	Show Help
-u	--user=user	Username

Examples

```
$ nodus db:restore
```

help**Description**

Display help for nodus.

Usage

```
$ nodus help [COMMAND]
```

Argument

COMMAND	Command to show help for
---------	--------------------------

Option

--all	See all commands in CLI
-------	-------------------------

license**Description**

Show current license information.

Usage

\$ nodus license [OPTIONS]		
Options		
-h	--help	Show Help
	--main	Check main license
Example		
\$ nodus license		

upgrade		
Description		
Prepare or Finish Upgrade Process.		
Usage		
\$ nodus upgrade [OPTIONS]		
Options		
-h	--help	Show Help
Example		
\$ nodus upgrade		

Appendix A: Creating Accounts for NODUS Providers

If you don't have credentials through your company, you can get them by following the procedures below.

In this appendix:

A.1 Creating an AWS Account	114
A.2 Creating a Google Cloud Account	114
A.3 Creating a Huawei Cloud Account	115
A.4 Creating a Microsoft Azure Account	115
A.5 Creating an OTC Account	115
A.6 Creating an Oracle Cloud Account	115

A.1 Creating an AWS Account

1. Go to <https://aws.amazon.com/> and click **Create an AWS account**.
2. Follow the steps and enter your account information and then click **Continue**.
3. Choose **Personal** or **Professional**.
4. Enter your company information and accept the customer agreement.
5. Choose **Create Account and Continue**.
6. Provide a payment method and verify your phone number.
7. Click **My Security Credentials / Access keys (access key ID and secret key) / Create New Access Key** and create a new one, then download the file with the access key and secret key. **Note:** If you forget the secret key, you will have to delete it and create a new one.

A.2 Creating a Google Cloud Account

1. Go to <https://cloud.google.com/> and click **Get started for free**.
2. Follow the steps on the screen to complete account registration.

A.3 Creating a Huawei Cloud Account

1. Go to <https://intl.huaweicloud.com/en-us/> and click **Register**.
2. Follow the steps on the screen to complete account registration.

A.4 Creating a Microsoft Azure Account

1. Go to <https://azure.microsoft.com/en-us/free/> and click **Start Free**.
2. On the **Sign in** page, click **Create one!**.
3. Click **Next** and then provide the rest of your user information (i.e., username, passwords, credit/debit, etc.).
4. Run the script **Azure.sh** to configure the Azure account.

A.5 Creating an OTC Account

1. Go to <https://open-telekom-cloud.com/en> and click **Open Telekom Cloud Console**.
2. Click **Register** and follow the steps on the screen to complete account registration.

A.6 Creating an Oracle Cloud Account

1. Go to <https://www.oracle.com/cloud/> and click **View Accounts**.
2. Click **Create an account** and follow the steps on the screen to complete account registration.

See the appendix [Obtaining Cloud Service Provider Account Information and Credentials](#) below for additional information.

Appendix B: Obtaining Cloud Service Provider Account Information and Credentials

Follow the checklists below to prepare accounts and get credentials for the chosen cloud service provider.

In this appendix:

B.1	AWS	116
B.2	Google Cloud	116
B.3	Huawei Cloud	116
B.4	Microsoft Azure	117
B.5	OTC	118
B.6	Oracle Cloud	118

B.1 AWS

- Create Key: IAM / Security Status / Manage Security Credentials / Access Keys / Create New Access Key
- Copy and fill Credentials File Template

B.2 Google Cloud

- Select Project / IAM / Service Accounts / Create Key (JSON)

B.3 Huawei Cloud

Create Images (see <https://support-intl.huaweicloud.com/en-us/>):

- Create a virtual private cloud (VPC) network
- Create a subnet on the VPC
- Create a stack file (where: network = {network_id} of the subnet)

B.4 Microsoft Azure

Azure Template Credential File

This is a template credential file for Azure:

```
{
  "client_id": " ",
  "client_secret": " ",
  "subscription_id": " ",
  "tenant_id": " "
  "region": " "
}
```

Obtaining Azure Credential Information

Follow these steps to obtain credential information.

client_id/tenant_id

1. On the Azure homepage (<https://portal.azure.com/>), under the **Azure services** section, click **App registrations**.
2. Under **Display name**, click the requested application (e.g., nodus) and copy/paste the **Application (client) ID** into the template between the quotes for the **client_id** variable, and copy/paste the **Directory (tenant) ID** into the template between the quotes for the **tenant_id** variable.
Note: If you have not previously registered an application, for this step, first click **Register an application** and enter the required information.

client_secret

Since Azure hides the client key, we can make another one that coexists with the one that is hidden by Azure.

3. Under the **Azure services** section, click **App registrations**.
4. Under **Display name**, click the requested application (e.g., nodus).
5. Under the **Manage** section on the left side of the page, click **Certificates & secrets**.
6. In the **Client secrets** section, click **New client secret**.
7. Add a **Description** and specify an **Expiration** time frame.
8. Copy/paste the **Value** into the template between the quotes for the **client_secret** variable.

subscription_id

9. Under the **Navigate** section, click **Subscriptions**.
10. Copy/paste the **Subscription ID** into the template between the quotes for the **subscription_id** variable.

region

11. Enter the desired region into the template between the quotes for the **region** variable.
For example, the region can be **eastus** or **westus**.

B.5 OTC

Create Images (see <https://open-telekom-cloud.com/en/products-services/virtual-private-cloud>):

- Create VPC network
- Create subnet on VPC
- Create stack file (where: network = {network_id} of the subnet)

B.6 Oracle Cloud

Create Images (see <https://docs.cloud.oracle.com/iaas/Content/home.htm>):

- Create VPC network
- Create subnet on VPC

Appendix C: Job Preparation

The Job script can be run using standard shell scripts such as batch, Perl, Geant4, or Python. The Job script files are stored in the `Input` folder and the results are stored in the `Output` (head node) folder.

Example Job Script

```
#!/bin/bash

set -x

cd input

PROCESSORS=1

TASKNAME=geant4

cp Dockerfile.template Dockerfile

sed -i -e "s/___FILE___/$FILE/g" Dockerfile

sed -i -e "s/___PROCESSORS___/$PROCESSORS/g" Dockerfile

sudo docker build -t $TASKNAME .

sudo docker run -v $PWD/../output:/app/output $TASKNAME
```

Example Input Dockerfile.template Contents

```
FROM ifurther/geant4

RUN mkdir BUILD

RUN mkdir output

RUN sed -i -e "s/g4root.hh/g4csv.hh/g" /src/geant4.10.05.p01/examples/extended/radioactivedecay/rdecay01/include/HistoManager.hh

RUN cd BUILD; cmake -DGeant4_DIR=/app/geant4.10.5.1-install/lib/Geant4-10.5.1/ /src/geant4.10.05.p01/examples/extended/radioactivedecay/rdecay01/
```

Appendix C: Job Preparation

```
RUN cd BUILD; make -j __PROCESSORS__ rdecay01

RUN cd BUILD; make install

RUN . /app/geant4.10.5.1-install/bin/geant4.sh ; /usr/local/bin/rdecay01 ./BUILD/__FILE__.mac

CMD mv *.csv output
```

Note: This program creates CSV files and moves them to the `Output` folder according to the script.

Appendix D: Configuring NODUS to be a Secure Server

Follow the steps below to configure NODUS to be a secure server.

1. Edit the file `/NODUS/nodus4-ui-desktop-app/build/assets/config.json`:
 - A. Replace `http://` with `https://`.
 - B. Save the file.
2. Edit the file `nodus-web-api.json`:
 - A. Add the following lines to identify the server's private key location and the certificate file (this is an example):

```
{
  "https_key_file" : "/example/directory/privkey.pem",
  "https_cert_file": "/example/directory/fullchain.pem"
}
```

- B. Save the file.
3. Enter **`systemctl restart nodus-web-api`** to restart the NODUS web API.

Appendix E: Credential JSON Examples

Credential JSON files should look like the below:

- [AWS](#)
- [Google Cloud](#)
- [Huawei Cloud](#)
- [Microsoft Azure](#)
- [OTC](#)
- [Oracle Cloud](#)

AWS

```
{  
  "access_key": "",  
  "secret_key": ""  
}
```

nodus_cluster_permissions.json

```
{  
  "Version": "2012-10-17",  
  "Statement": [  
    {  
      "Sid": "VisualEditor0",  
      "Effect": "Allow",  
      "Action": [  
        "ec2:AuthorizeSecurityGroupIngress",  
        "ec2:DescribeInstances",  
        "ec2:ModifyVolumeAttribute",  
        "ec2:ReplaceRouteTableAssociation",  
        "aws-marketplace:*",  
      ]  
    }  
  ]  
}
```

```
"ec2:DeleteVpcEndpoints",
"ec2:CreateKeyPair",
"ec2:AcceptTransitGatewayVpcAttachment",
"ec2:AttachInternetGateway",
"ec2:ReportInstanceState",
"route53:ListHostedZonesByName",
"ec2:UpdateSecurityGroupRuleDescriptionsIngress",
"ec2:DeleteRouteTable",
"ec2:DescribeVolumeStatus",
"ec2:StartInstances",
"ec2:CreateNetworkInterfacePermission",
"ec2:RevokeSecurityGroupEgress",
"ec2:CreateRoute",
"ec2:CreateInternetGateway",
"ec2:DescribeScheduledInstanceAvailability",
"ec2:DescribeVolumes",
"ec2>DeleteInternetGateway",
"ec2:UnassignPrivateIpAddresses",
"ec2:RejectTransitGatewayVpcAttachment",
"ec2:DescribeKeyPairs",
"ec2:DescribeReservedInstancesListings",
"ec2:DisassociateTransitGatewayRouteTable",
"ec2:ImportKeyPair",
"ec2:CreateTags",
"ec2:DescribeVpcClassicLinkDnsSupport",
"ec2:ModifyNetworkInterfaceAttribute",
"route53:ListVPCAssociationAuthorizations",
"ec2:RunInstances",
"ec2:StopInstances",
"ec2:AssignPrivateIpAddresses",
"ec2:DisassociateRouteTable",
"route53:CreateVPCAssociationAuthorization",
```

```
"ec2:DescribeVolumeAttribute",
"ec2:CreateVolume",
"ec2:ReplaceNetworkAclAssociation",
"ec2:CreateVpcEndpointServiceConfiguration",
"ec2:RevokeSecurityGroupIngress",
"ec2:CreateNetworkInterface",
"ec2:DescribeVpcEndpointServicePermissions",
"ec2:CreateTransitGatewayVpcAttachment",
"ec2:DescribeScheduledInstances",
"ec2:DescribeImageAttribute",
"ec2>DeleteNatGateway",
"ec2:DescribeReservedInstancesModifications",
"ec2:EnableTransitGatewayRouteTablePropagation",
"ec2:DescribeSubnets",
"ec2:CreateSubnet",
"ec2:ModifyVpcEndpoint",
"ec2:AttachVolume",
"ec2:DisassociateAddress",
"ec2:ModifyVpcEndpointServicePermissions",
"ec2:MoveAddressToVpc",
"ec2:CreateNatGateway",
"ec2:CreateVpc",
"ec2:DescribeVpcEndpointServices",
"ec2:DescribeSpotInstanceRequests",
"ec2:DescribeVpcAttribute",
"ec2:ModifySubnetAttribute",
"ec2:DescribeTransitGatewayRouteTables",
"ec2:DescribeAvailabilityZones",
"ec2:DescribeNetworkInterfaceAttribute",
"ec2:DescribeVpcEndpointConnections",
"ec2:DescribeInstanceStatus",
"ec2:ReleaseAddress",
```

```
"ec2:RebootInstances",
"ec2:ModifyInstanceMetadataOptions",
"ec2:AssignIpv6Addresses",
"ec2:AcceptVpcEndpointConnections",
"route53:ListHostedZones",
"ec2:DescribeClassicLinkInstances",
"ec2:DisassociateSubnetCidrBlock",
"ec2:DescribeVpcEndpointConnectionNotifications",
"ec2:DescribeSecurityGroups",
"ec2>DeleteVpcEndpointConnectionNotifications",
"ec2:RestoreAddressToClassic",
"ec2:DescribeVpcs",
"ec2:DisableVpcClassicLink",
"ec2:DisableVpcClassicLinkDnsSupport",
"ec2:ModifyVpcTenancy",
"route53:AssociateVPCWithHostedZone",
"ec2:DescribeStaleSecurityGroups",
"ec2>DeleteSubnet",
"ec2:ModifyVpcEndpointServiceConfiguration",
"ec2:UnmonitorInstances",
"ec2:DetachClassicLinkVpc",
"ec2:MonitorInstances",
"ec2:CreateTransitGatewayRouteTable",
"route53:GetHostedZone",
"ec2:DescribeVolumesModifications",
"ec2:AssociateVpcCidrBlock",
"ec2:ReplaceRoute",
"ec2:AssociateRouteTable",
"ec2:DisassociateVpcCidrBlock",
"ec2:DescribeInternetGateways",
"ec2>DeleteVolume",
"ec2>DeleteTransitGatewayVpcAttachment",
```

```
"ec2:ReplaceNetworkAclEntry",
"ec2:AssociateTransitGatewayRouteTable",
"ec2:UnassignIpv6Addresses",
"ec2:DescribeNetworkInterfacePermissions",
"ec2:DescribeReservedInstances",
"route53:UpdateHostedZoneComment",
"ec2:RejectVpcEndpointConnections",
"ec2:DescribeNetworkAcls",
"ec2:DescribeRouteTables",
"ec2:EnableVpcClassicLink",
"ec2:DescribeEgressOnlyInternetGateways",
"ec2:DetachVolume",
"ec2:ModifyVolume",
"ec2:DisableTransitGatewayRouteTablePropagation",
"ec2:UpdateSecurityGroupRuleDescriptionsEgress",
"ec2:CreateVpcEndpointConnectionNotification",
"route53:DisassociateVPCFromHostedZone",
"ec2:ResetNetworkInterfaceAttribute",
"ec2:DescribeReservedInstancesOfferings",
"ec2:CreateRouteTable",
"ec2>DeleteNetworkInterface",
"ec2:DescribeFleetInstances",
"ec2:DetachInternetGateway",
"ec2:DescribeVpcEndpointServiceConfigurations",
"ec2:ModifyVpcEndpointConnectionNotification",
"ec2:DescribeInstanceCreditSpecifications",
"ec2:DescribeVpcClassicLink",
"ec2>DeleteTransitGatewayRouteTable",
"route53>DeleteVPCAssociationAuthorization",
"ec2:GetTransitGatewayRouteTablePropagations",
"ec2:AssociateSubnetCidrBlock",
"route53:ChangeTagsForResource",
```

```
"ec2:DeleteVpc",
"ec2:CreateEgressOnlyInternetGateway",
"ec2:DescribeVpcEndpoints",
"ec2:AssociateAddress",
"ec2:DeleteKeyPair",
"ec2:DescribeAddresses",
"ec2:DeleteTags",
"ec2:DescribeInstanceAttribute",
"ec2:DeleteVpcEndpointServiceConfigurations",
"ec2:DeleteNetworkInterfacePermission",
"ec2:DescribeNetworkInterfaces",
"ec2:CreateSecurityGroup",
"ec2:CreateNetworkAcl",
"ec2:ModifyVpcAttribute",
"ec2:ModifyInstanceAttribute",
"ec2:GetTransitGatewayRouteTableAssociations",
"ec2:AuthorizeSecurityGroupEgress",
"ec2:AttachClassicLinkVpc",
"ec2:ModifyTransitGatewayVpcAttachment",
"ec2>DeleteEgressOnlyInternetGateway",
"ec2:TerminateInstances",
"ec2:DetachNetworkInterface",
"ec2:DescribeIamInstanceProfileAssociations",
"ec2:DescribeTags",
"ec2>DeleteRoute",
"ec2:DescribeNatGateways",
"ec2:AllocateAddress",
"ec2:DescribeImages",
"ec2:DescribeSpotFleetInstances",
"ec2:CreateVpcEndpoint",
"ec2>DeleteSecurityGroup",
"ec2:AttachNetworkInterface",
```

Appendix E: Credential JSON Examples

```
        "ec2:EnableVpcClassicLinkDnsSupport",
        "ec2:DescribeTransitGatewayVpcAttachments",
        "ec2:CreateNetworkAclEntry"
    ],
    "Resource": "*"
}
]
```

nodus_stack_permissions.json

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "VisualEditor0",
      "Effect": "Allow",
      "Action": [
        "ec2:ModifyVolumeAttribute",
        "ec2:DescribeInstances",
        "ec2:UnmonitorInstances",
        "aws-marketplace:*",
        "ec2:MonitorInstances",
        "ec2:CreateKeyPair",
        "ec2:DescribeVolumesModifications",
        "ec2:CreateImage",
        "ec2:DescribeSnapshots",
        "ec2>DeleteVolume",
        "ec2:DescribeVolumeStatus",
        "ec2:ModifySnapshotAttribute",
        "ec2:StartInstances",
        "ec2:DescribeVolumes",

```



```
"ec2:DescribeKeyPairs",
"ec2:DetachVolume",
"ec2:ResetImageAttribute",
"ec2:DisableFastSnapshotRestores",
"ec2:ImportKeyPair",
"ec2:CreateTags",
"ec2:RegisterImage",
"ec2:RunInstances",
"ec2:DescribeFastSnapshotRestores",
"ec2:StopInstances",
"ec2:CreateVolume",
"ec2:DescribeVolumeAttribute",
"ec2:CreateSnapshots",
"ec2:DescribeImageAttribute",
"ec2>DeleteKeyPair",
"ec2:AttachVolume",
"ec2:DeregisterImage",
"ec2>DeleteSnapshot",
"ec2>DeleteTags",
"ec2:DescribeInstanceAttribute",
"ec2:DescribeRegions",
"ec2:ModifyImageAttribute",
"ec2:EnableFastSnapshotRestores",
"ec2:CreateSnapshot",
"ec2:DescribeInstanceState",
"ec2:RebootInstances",
"ec2:TerminateInstances",
"ec2:DescribeTags",
"ec2:ResetSnapshotAttribute",
"ec2:DescribeSecurityGroups",
"ec2:DescribeImages",
"ec2:DescribeStaleSecurityGroups"
```

```
    ],  
    "Resource": "*"    
  }  
]  
}
```

Google Cloud

```
{  
  "type": "",  
  "project_id": "",  
  "private_key_id": "",  
  "private_key": ""  
}
```

Huawei Cloud

```
{  
  "username": "",  
  "password": "",  
  "domain_name": "",  
  "tenant_name": "",  
}
```

Microsoft Azure

```
{
```

Appendix E: Credential JSON Examples

```
"client_secret": "",  
"subscription_id": "",  
"tenant_id": ""  
}
```

OTC

```
{  
  "username" : "",  
  "password" : "",  
  "domain_name": "",  
  "tenant_name": ""  
}
```

Oracle Cloud

```
{  
  "user_ocid" : "",  
  "tenancy_ocid" : "",  
  "compartment_ocid" : "",  
  "availability_domain": "",  
  "key_file" : ""  
  "fingerprint"  
}
```

Appendix F: Writing NODUS Scripts

The environment variables below can be used to write NODUS scripts.

Variable	Description
ENVIRONMENT	BATCH
HISTCONTROL	ignoredups
HISTSIZE	1000
HOME	/home/linux
HOSTNAME	nodus-c3-15xlarge-2-node-0
LANG	en_US.UTF-8
LESSOPEN	/usr/bin/lesspipe.sh %s
LOADEDMODULES	
LOGNAME	linux
MAIL	/var/spool/mail/linux
MODULEPATH	/usr/share/Modules/modulefiles:/etc/modulefiles
MODULESHOME	/usr/share/Modules
no_proxy	127.0.0.1,localhost,169.254.169.254
NO_PROXY	127.0.0.1,localhost,169.254.169.254
PATH	/usr/local/bin:/usr/local/sbin:/bin:/usr/bin:/usr/local/sbin:/usr/sbin:/home/linux/.local/bin:/home/linux/bin
PBS_ENVIRONMENT	PBS_BATCH
PBS_GPUFILE	/var/spool/torque/aux//63.nodus-servergpu
PBS_JOBCOOKIE	E36EE984E318A76438F6A28EB31CC5DB
PBS_JOBID	63.nodus-server
PBS_JOBNAME	env
PBS_MICFILE	/var/spool/torque/aux//63.nodus-servermic
PBS_MOMPORT	15003
PBS_NODEFILE	/var/spool/torque/aux//63.nodus-server
PBS_NODENUM	0
PBS_NP	1
PBS_NUM_NODES	1
PBS_NUM_PPN	1
PBS_O_HOME	/home/linux
PBS_O_HOST	nodus-server

Variable	Description
PBS_O_INITDIR	/NODUS/jobs/63
PBS_O_LANG	en_US.UTF-8
PBS_O_LOGNAME	linux
PBS_O_MAIL	/var/spool/mail/linux
PBS_O_PATH	/usr/local/bin:/usr/local/sbin:/usr/local/maui/ bin:/usr/local/maui/sbin:/usr/local/bin:/bin:/usr/ bin:/usr/local/sbin:/usr/sbin
PBS_O_QUEUE	batch
PBS_O_SERVER	nodus-server
PBS_O_SHELL	/bin/sh
PBS_O_WORKDIR	/NODUS/jobs/63
PBS_QUEUE	batch
PBS_TASKNUM	1
PBS_VERSION	TORQUE-6.1.3
PBS_VNODENUM	0
PBS_WALLTIME	3600
PWD	/NODUS/jobs/63
SHELL	/bin/bash
SHLVL	2
USER	linux

Appendix G: Known Issues and Troubleshooting

This appendix contains information on known issues and troubleshooting:

- [Error refreshing state](#)
- [WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!](#)
- [Error applying plan](#)
- [Cluster Fails to Deploy](#)
- [Error creating Floating IP](#)

Error refreshing state

Issue

While deploying a cluster, the logs display the following error.

```
Error: Error refreshing state: 1 error occurred:

* provider.azurearm: Error building account: Error getting authenticated
object ID: Error listing Service Principals: autorest.DetailedError{Ori-
ginal:adal.tokenRefreshError{message:"adal: Refresh request failed. Status
Code = '400'. Response body: {\"error\": \"unauthorized_client\", \"error_
description\": \"AADSTS700016: Application with identifier 'f46f18e7-2047-
4b18-b801-1579f731f057' was not found in the directory '82c76c0f-4c88-4dfa-
af71-055fa67876fd'. This can happen if the application has not been
installed by the administrator of the tenant or consented to by any user in
the tenant. You may have sent your authentication request to the wrong ten-
ant.
```

Solution

Cross-check the `client_secret` for the given `client_id` with the system administrator to determine the issue. The `client_secret` either no longer exists or has expired; therefore, another `client_secret` needs to be generated or given to the user, and their credentials file updated to reflect the new `client_secret`.

WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!

Issue

Providers reuse a pool of IP addresses for the head node. You may want to connect to this node via Secure Shell (SSH). Since the SSH key is tied to your account on the NODUS server, a message similar to the following may display when connecting to an IP address that has been reused.

```

@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!  @
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
IT IS POSSIBLE THAT SOMEONE IS DOING SOMETHING NASTY!
Someone could be eavesdropping on you right now (man-in-the-middle attack)!
It is also possible that a host key has just been changed.
The fingerprint for the ECDSA key sent by the remote host is
SHA256:TPfwqpRrL2HB34ln4bar5hP+FiN3tTsecR5lIBOHRJk.

Please contact your system administrator.
Add correct host key in ~/.ssh/known_hosts to get rid of this message.
Offending ECDSA key in ~/.ssh/known_hosts:36
  remove with:
  ssh-keygen -f ~/.ssh/known_hosts -R "#.#.#.#"
ECDSA host key for #.#.#.# has changed and you have requested strict check-
ing.
Host key verification failed.
```

Solution

Follow the instructions in your message to correct this issue.

Error applying plan

Issue

While deploying or resizing a cluster, the logs display an error similar to the following.

```
Error: Error applying plan:
1 error occurred:
* oci_core_instance.nodus-cluster-VM-Standard2-2-node-1: 1 error occurred:
* oci_core_instance.nodus-cluster-VM-Standard2-2-node-1: Service error:LimitExceeded. The following service limits were exceeded: vm-standard2-2-count. Request a service limit increase from the service limits page in the console.
. http status code: 400. Opc request id: 3dd1b-cd1a550b6f1148ea32ac0986512/0780130618F448D9EB693213AF75B0A9/6139656939DE1-86B0C9C22D172B925DE
```

Solution

The services limits were exceeded by the provider. Clean up existing resources that could be hanging, lost, or currently deployed, and try again.

Cluster Fails to Deploy

Issue

While deploying a cluster, the logs display an error similar to the following.

```
data.provider_ami.this: Refreshing state...
module.nodus-t2-micro-node-0.data.provider_ami.this: Refreshing state...

Error: Your query returned no results. Please change your search criteria
and try again.

on data.tf line 5, in data "provider_ami" "this":
5: data "provider_ami" "this" {
```

Solution

When creating the cluster, the `Prefix` field must contain the correct value.

Error creating Floating IP

Issue

While deploying a cluster, the logs display an error similar to the following.

```
Error: Error creating Floating IP: Action Forbidden

on network/main.tf line 87, in resource "provider_compute_floatingip_v2"
"server": 87: resource "provider_compute_floatingip_v2" "server" {

{
  "shortMessage": "Command failed with exit code 1: bash -euo pipefail -c
\"TF_LOG=TRACE TF_LOG_PATH=logs/deploy.debug.log
/home/qauser/.nodus/bin/terraform apply -lock=true -lock-timeout=0s -
input=false -refresh=true -auto-approve -compact-warnings -parallelism=100
terraform.tfplan 2>&1 | tee --append
/home/qauser/.nodus/clusters/5f773d90b7fb245d17c69bed/logs/master.log | tee
--append
/home/qauser/.nodus/clusters/5f773d90b7fb245d17c69bed/logs/deploy.log\"",
  "command": "bash -euo pipefail -c \"TF_LOG=TRACE TF_LOG_
PATH=logs/deploy.debug.log /home/qauser/.nodus/bin/terraform apply -
lock=true -lock-timeout=0s -input=false -refresh=true -auto-approve -
compact-warnings -parallelism=100 terraform.tfplan 2>&1 | tee --append
/home/qauser/.nodus/clusters/5f773d90b7fb245d17c69bed/logs/master.log | tee
--append
/home/qauser/.nodus/clusters/5f773d90b7fb245d17c69bed/logs/deploy.log\"",
  "exitCode": 1,
  "failed": true,
  "timedOut": false,
  "isCanceled": false,
  "killed": false
}
```

Solution

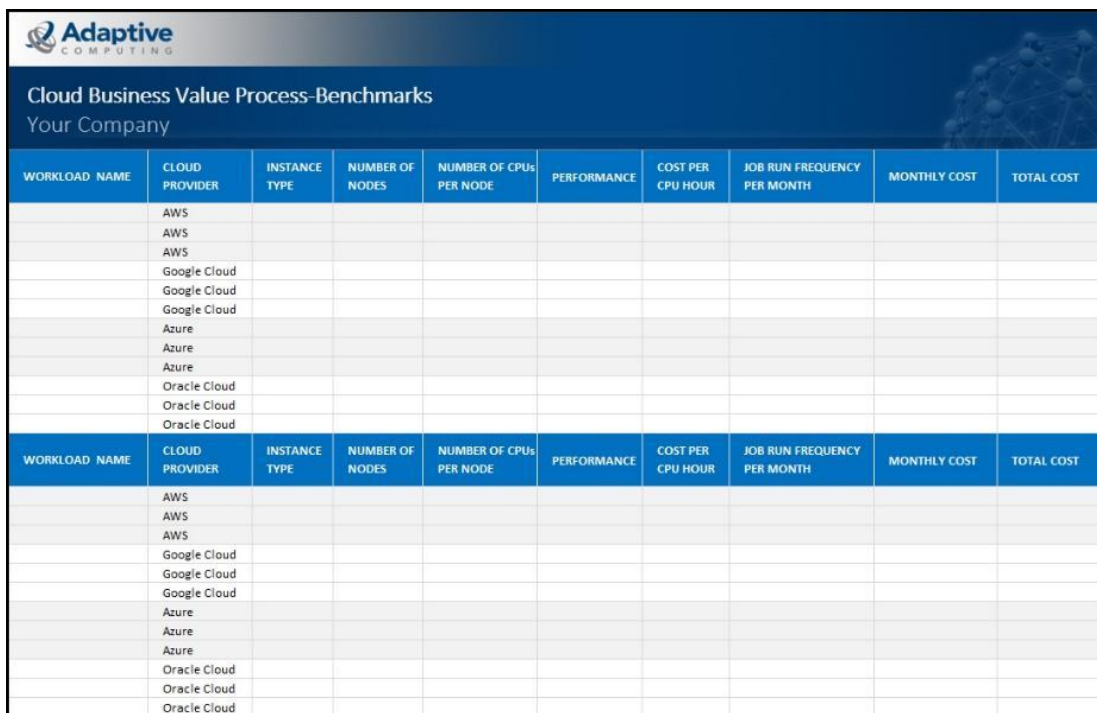
Decrease the number of IP addresses that are in use in your cloud provider account.

Appendix H: NODUS Workload Considerations

Listed below are some of the considerations and questions that need to be answered when running workloads in the cloud. All of these may not be appropriate for each of your workloads, or you may have additional considerations.

1. Not all workloads can be effectively run in the cloud, so each workload should be tested for cloud appropriateness by running them in the cloud and collecting statistics.
 - NODUS Cloud OS has multi-cloud capabilities and will run workloads in the cloud from the UI on one or more of the major cloud service providers.
 - Run your workload on each cloud service provider and record the statistics for each one in the Cloud Business Value Process Benchmark Report (see Figure 1 Benchmarks).
 - HTC (High-Throughput Computing) workloads and small scale HPC (High-Performance Computing) workloads that are not memory-, communication-, large-data-, or bandwidth-intensive are ideal for migrating to cloud environments.

2. Cloud OpEx costs are difficult to model without actually running the workload in the cloud.
 - Build a cost and performance model based on the statistics from (Figure 1) below. This will help you develop your cloud budget. See the attached [Cloud Business Value Process Spreadsheet](#). It is also available on adaptivecomputing.com (Support Portal Home / Product Download / NODUS Cloud OS).



Adaptive COMPUTING									
Cloud Business Value Process-Benchmarks									
Your Company									
WORKLOAD NAME	CLOUD PROVIDER	INSTANCE TYPE	NUMBER OF NODES	NUMBER OF CPUs PER NODE	PERFORMANCE	COST PER CPU HOUR	JOB RUN FREQUENCY PER MONTH	MONTHLY COST	TOTAL COST
	AWS								
	AWS								
	AWS								
	Google Cloud								
	Google Cloud								
	Google Cloud								
	Azure								
	Azure								
	Azure								
	Oracle Cloud								
	Oracle Cloud								
	Oracle Cloud								
WORKLOAD NAME	CLOUD PROVIDER	INSTANCE TYPE	NUMBER OF NODES	NUMBER OF CPUs PER NODE	PERFORMANCE	COST PER CPU HOUR	JOB RUN FREQUENCY PER MONTH	MONTHLY COST	TOTAL COST
	AWS								
	AWS								
	AWS								
	Google Cloud								
	Google Cloud								
	Google Cloud								
	Azure								
	Azure								
	Azure								
	Oracle Cloud								
	Oracle Cloud								
	Oracle Cloud								

Figure 1: Benchmarks

- When using NODUS Cloud OS, expenditures move from capital expenses (CapEx) to operational expenses (OpEx) because you are gaining capacity without buying more hardware. This allows for the immediate availability of resources and the ability to scale up clusters instantaneously.
3. Choose the appropriate delivery model for each of your workloads.
 - NODUS Cloud OS accommodates on-premises, even your laptop, SaaS, and cloud-hosted delivery models, which are very easy to implement because of the low barriers to entry using NODUS Cloud OS. The delivery model for each workload could be different.

4. Do you want to run your workload independent from or as part of your on-premises cluster?
- NODUS Cloud OS offers superior usability when devising cloud and on-premises integration strategies.
 - NODUS Cloud OS works with any HPC or enterprise job scheduler or without a workload scheduler.
 - In the diagram below (Figure 2) the workload has burst to the cloud automatically based on backlog. The job is seen by the scheduler as part of the on-premises cluster. NODUS Cloud OS has the capability to seamlessly integrate on-premises and cloud resources. See the section [Bursting](#) for additional information.

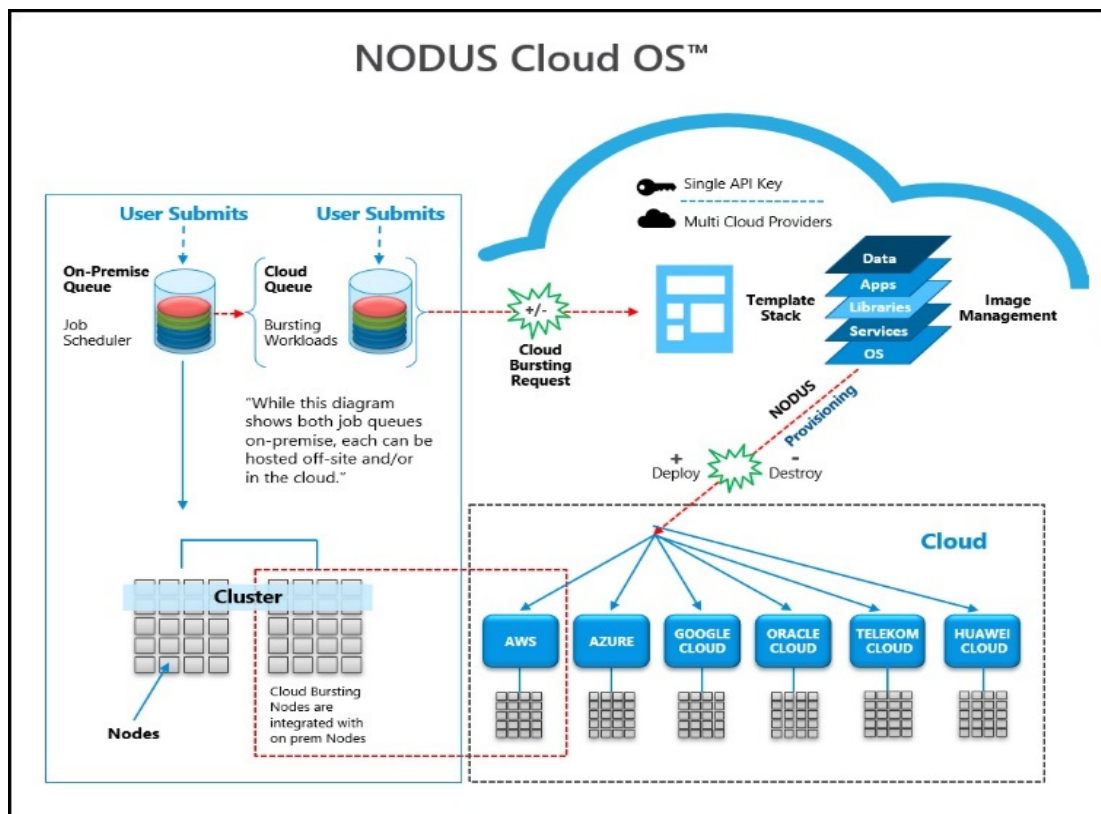


Figure 2: NODUS Cloud OS Bursting Becoming On-Premises

- In the diagram below (Figure 3) the workload has burst to the cloud on demand and is running in the cloud independently of the on-premises cluster.

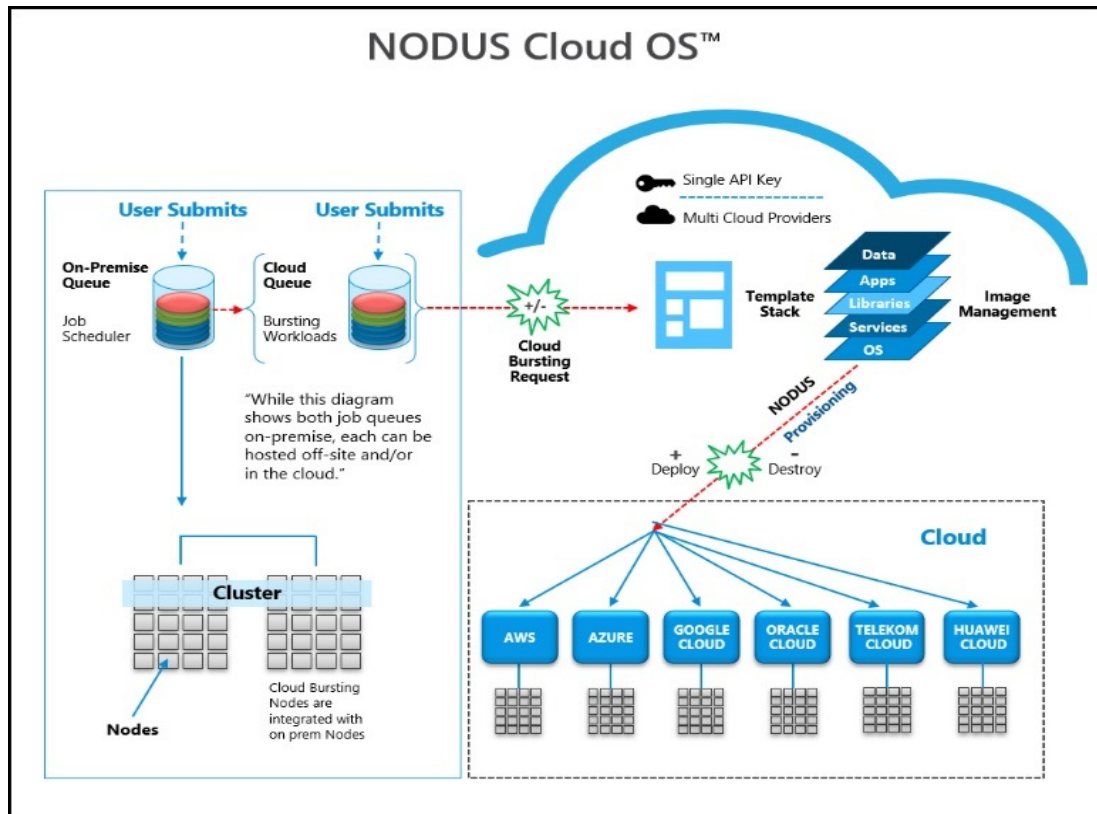


Figure 3: NODUS Cloud OS Bursting Off-Premises

5. Which workloads can be run in the cloud on VMs and which need bare metal?

- Can you get the performance you need from VMs?
- Virtualization layers can often cause slower performance, although VMs can be easily moved to and from similar clouds and are less expensive.
- You may have to run your workload on bare metal to get the performance results required.

6. Which workloads require additional licenses to run in the cloud and which do not?
 - Determine if your workload requires additional licensing to run in the cloud.
 - License sharing can be difficult in international organizations and will increase costs. License sharing is easier to manage with regional workloads, making these better suited to run in the cloud and are less expensive.
 - Use vendors or open-source software with cloud-friendly terms.
7. Which of your workloads require moving large amounts of data to the cloud and which do not?
 - Look at each job, the amount of data it requires, and then make a determination.
 - Consider compute, memory, and storage when assessing data requirements.
 - Test your data transfer line.
 - Move your data first and then spin up the nodes to run your workload in the cloud.
 - NODUS Cloud OS has a data movement feature, which can automatically move the data and proliferate it.
8. Which public cloud service providers match which of your workloads? One size does not fit all.
 - Using NODUS Cloud OS, you can test your workloads on each one of the cloud service providers. Within the NODUS Cloud OS interface, select the cloud service provider that your job will run on. The nodes will shut down when the job completes, and you can then select another cloud service provider to test your workload on. For example, one workload should run on AWS and another should run on Google Cloud.
 - NODUS Cloud OS supports all major public clouds, and can be configured to support any public cloud of any size.
 - After calculating the cost for a workload, multiply that cost by the number of times the workload runs each month. Repeat this for each cloud service provider (Figure 1).

- A blank worksheet is provided if you want to test other cloud service providers (Figure 4). See the attached *Cloud Business Value Process Spreadsheet*.

[illegible]

Figure 4: Worksheet

- A budget sheet is included for you to summarize your testing results and prepare your Cloud Business Value Process Budget Report for management (Figure 5). See the attached [Cloud Business Value Process Spreadsheet](#).

 Cloud Business Value Process - Budget Your Company									
WORKLOAD NAME	CLOUD PROVIDER	INSTANCE TYPE	NUMBER OF NODES	NUMBER OF CPUS PER NODE	PERFORMANCE	COST PER CPU HOUR	JOB RUN FREQUENCY PER MONTH	MONTHLY COST	TOTAL COST

Figure 5: Budget

Test your workloads in the cloud one at a time (the most cloud-friendly ones first) and begin collecting statistics.

Enter the gathered statistical data into the attached spreadsheet. In a very short period, you will know which of your workloads can be run in the cloud, and on which cloud service provider using which instance type. We recommend that you run each workload using at least three different instance types for each cloud service provider to determine the best cost/performance for each workload (Figure 1).

When testing is concluded, your cloud budget will be determined.

Glossary

Bursting: The event of clusters and nodes being deployed to run jobs, then being destroyed.

Cluster: A collection of compute instances consisting of a head node and compute nodes.

Cluster Size: The number of compute nodes.

Compute Nodes: The servers, typically designed for fast computations and large amounts of I/O, that provide the storage, networking, memory, and processing resources.

Compute Node Size: An instance type or hardware configuration (for example, n1-standard-2 - vCPU: 2, Mem (GB): 7.50).

Core: An individual hardware-based execution unit within a processor that can independently execute a software execution thread and maintain its execution state separate from the execution state of all other cores within the processor.

Credentials: Authentication information required to access the respective cloud service provider from code.

Custom Job: A job that is customizable and configurable.

Head Node: The server that manages the delegation of jobs.

Image: A snapshot of an OS.

Job: A workload submitted to a scheduler for the purpose of scheduling resources on which the workload executes when started up by the scheduler. Typically, a user creates a script that executes the workload (one or more applications) and submits the script to the scheduler where it becomes a job.

Job Script: A program to be run on a cluster (generally a shell script).

On Demand Cluster: A cluster that carries out a specific job then is removed.

Provisioning: The event of configuring a node or cluster with its stack and getting it into a ready-to-work state.

Scheduler: The specialized software between the user and the HPC cluster/datacenter system that manages submitted workloads or jobs. This includes queuing jobs, prioritizing queued jobs for execution, scheduling and allocating requested resources for each job, and starting jobs when their requested resources become available and the jobs have the highest priority.

Stack: An instance of software packages that defines the operating system components.

Thread: The quantity of software execution threads the core can simultaneously track.

Torque (Terascale Open-source Resource and Queue manager): An industry-standard resource manager solution with a built-in scheduler.

Walltime: The job's time limit (HH:MM:SS).

Workload: Jobs to be run and/or jobs in the queue.

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