Fortanix®

User Guide

FORTANIX CONFIDENTIAL COMPUTING MANAGER – CREATE IMAGE

VERSION 6.0

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1.0 INTRODUCTION

Welcome to the Fortanix Confidential Computing Manager (CCM) User Guide. This document describes the steps to create an application image in the Fortanix Confidential Computing Manager. The users are provided the ability to quickly and easily navigate the interface to run containerized applications accordingly.

A Fortanix Confidential Computing Manager (CCM) image is a particular software release or a version of an application. Each image is associated with one enclave hash (MRENCLAVE).

When an image is first created in Fortanix Confidential Computing Manager, it is in an unapproved state. After configurable approval actions are taken, the image is considered approved. When an image is approved, Fortanix CCM knows that enclaves with the associated hash (MRENCLAVE) are trusted instances of the corresponding application and will issue certs with the application's domain name(s) to those enclaves.

DOCUMENT IDENTIFICATION INFORMATION

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2.0 CONTACT INFORMATION

CONTACT INFORMATION

ITEM	PRIMARY	ALTERNATE
NAME	Fortanix	
EMAIL ADDRESS	Fortanix Support Link	
CONTACT NUMBER	N/A	
TITLE	N/A	
SUPPORT HOURS	8am – 5pm Monday – Friday	

3.0   DESCRIPTION OF SERVICES

3.1   FORTANIX CONFIDENTIAL COMPUTING MANAGER

Fortanix Confidential Computing Manager provides "data-in-use" protection for your container workloads. It leverages the Intel® Software Guard Extensions (SGX) technology to run code and data in CPU-hardened "enclaves" or a "Trusted Execution Environment" (TEE). The enclave is a trusted area of memory where critical aspects of the application functionality are protected, helping keep code and data confidential and unmodified.

3.2   INTEL® SGX

Intel® SGX is an extension to the x86 architecture that allows running applications in a completely isolated secure enclave. The application is not only isolated from other applications running on the same system, but also from the Operating System and possible Hypervisor. This prevents administrators from tampering with the application once it is started. The memory of secure enclaves is also encrypted to thwart physical attacks.

The technology also supports storing persistent data securely such that it can only be read by the secure enclave. In addition, you can prove remotely that your application is running in a secure enclave using remote attestation.

3.3   INTEL ATTESTATION AND WHY IT IS REQUIRED

Since enclaves are instantiated on platforms by untrusted code, before enclaves are provisioned with application confidential information, it is essential to be able to confirm that the desired enclave was correctly instantiated on a platform protected by Intel SGX. This is done by a remote attestation process. Remote attestation consists of using Intel SGX instructions and platform software to generate a "quote" that combines the enclave digest with a digest of relevant enclave data and a platform-unique asymmetric key into a data structure that is sent to a remote server over an authenticated channel. If the remote server concludes that the enclave was instantiated as intended and is running on a genuine Intel SGX-capable processor, it will provision the enclave as required.

3.4   NAVIGATION BUTTONS

The Navigation buttons for Fortanix Confidential Computing Manager are located on the left panel of the GUI and identify the screen functionality. The following table illustrates button functions:

NAVIGATION BUTTONS

MENU LIST	FUNCTIONALITY
INFRASTRUCTURE	Click this menu item to see: • All the Compute Nodes that are part of your cluster. You can view SGX software version, secure application's information, and attestation status of each of these Compute Nodes on which your Fortanix Confidential Computing Manager components are running. • All the Compute Clusters that you have configured in Fortanix CCM.
GROUP	Click this menu item to create a group, which is a collection of users and objects. A group helps users to manage identities and create third-party groups. It also helps in organizing and securing applications, datasets, workflows, and other resources that belong to the group.
APPLICATIONS	Click this menu item to see: • All the Fortanix Confidential Computing Manager secured applications deployed on the cluster. An application is a way to let the service know which all parameters to configure for a Source Container Image to run in SGX and where to push the converted Image. • All the Fortanix Confidential Computing Manager secured Docker images for the applications deployed on the cluster. • All the application configurations used to customize the behavior for EDP/EnclaveOS applications.

TASKS	Click this menu item to see all the requests that need Administrator approval. For example, node enrolment, application domain approval, application image approval, and certificate issuance.
TOOLS	Click this menu item to access the SGX Converter tool to convert an application.
USERS	Click this menu item to see the list of users added to Fortanix Confidential Computing Manager. The Users page also allows you to edit the properties of a user and add new users.

4.0   CREATING AN IMAGE OF YOUR APPLICATION

You can use the Fortanix Confidential Computing Manager to create an image of your applications after you make changes.

4.1   PREREQUISITES

- For Enclave OS application - the Tag of the Docker image for the application.
- For EDP application - the `sigstruct.bin` file which is used to register the enclave with Fortanix Confidential Computing Manager.
- For ACI application - the Tag of the Docker image for the application.

4.2   CREATE AN IMAGE OF ENCLAVE OS APPLICATIONS

1. After you create an Enclave OS application, click the **Applications** menu list in the CCM UI left navigation bar, and select the required Enclave OS application for which you want to configure an application image.

2. On the following page, click the **+ IMAGE** button to configure the image of the Enclave OS application.
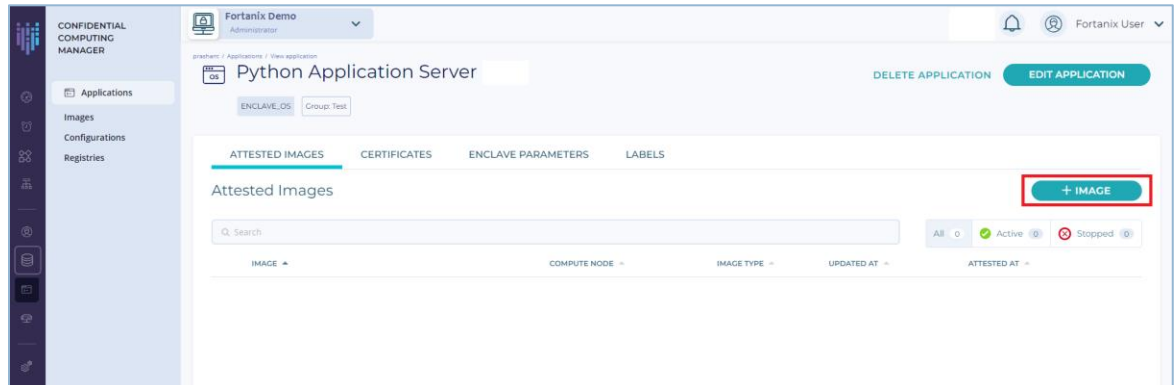

FIGURE 1: IMAGES TAB

3. In the **Add image** form, select the **Image Type** as **Intel SGX** or **AWS Nitro Enclaves** depending on the platform used.

4. Enter the **REGISTRY CREDENTIALS** for the **Output image name**. Here, the registry credentials are the credentials needed to access the private docker registry where the image will be pushed. Since the input image is stored in a public registry, there is no need to provide credentials for the input image.
   - If you have added a registry in a particular account as described in _User's Guide: Image Registry_, then the check box **Use saved credentials** will be selected by default and the registry names for the output image will be filled automatically for the **Add Registry Credentials** fields.
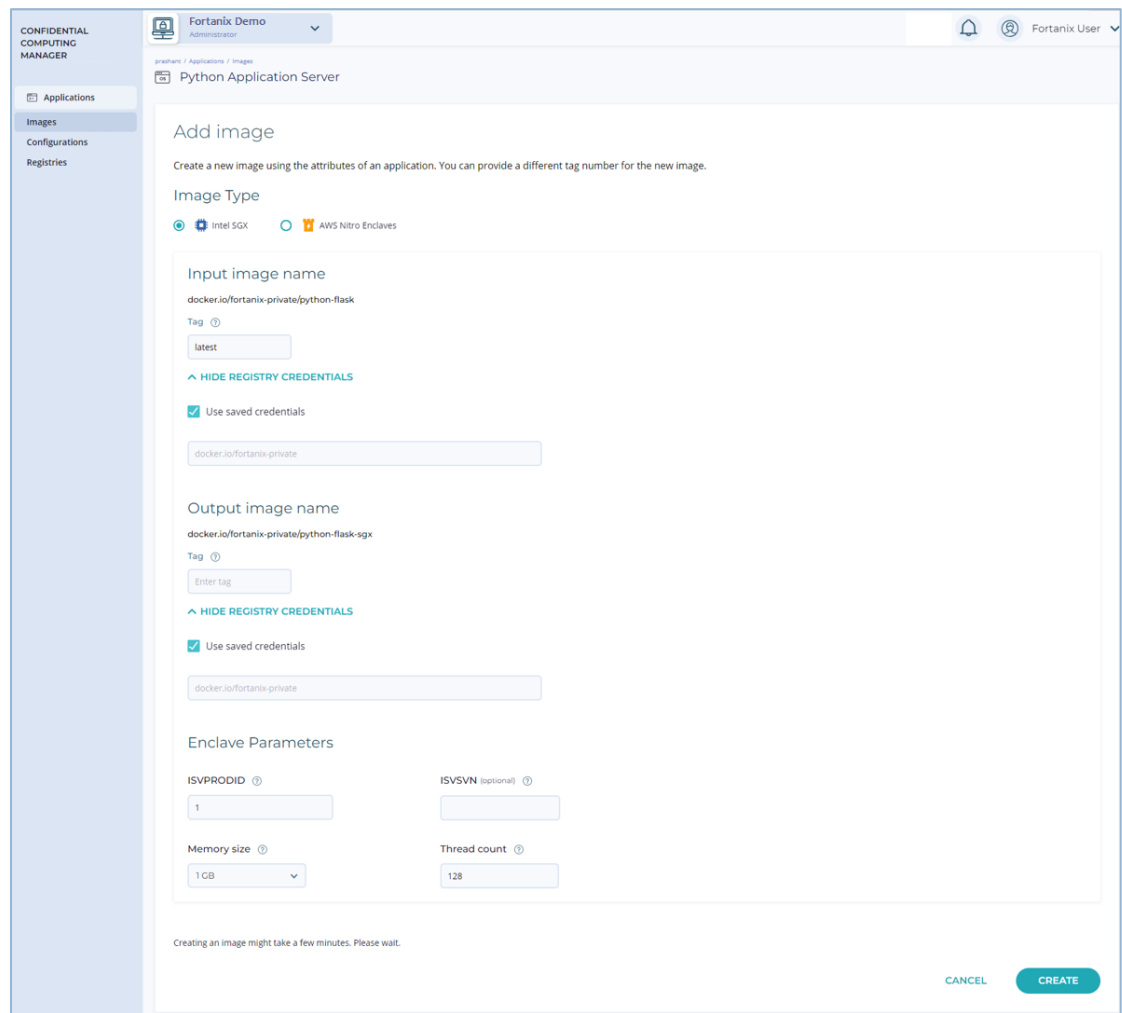
FIGURE 2: ADD SAVED REGISTRY CREDENTIALS

- If you have not saved any Registry Credentials, then manually enter the registry credentials for the **Output image name**.

5. Enter the image **Tag** which is the tag value of the Docker image.

6. If you selected the **Image Type** as **Intel SGX**, enter the following details:

   - **ISVPRODID** is a numeric product identifier. A user must choose a unique value in the range of 0-65535 for their applications.

   - **ISVSVN** is a numeric security version to be assigned to the Enclave. This number should be incremented if security relevant change is made to the application.

   - **Memory size** – Select the memory size from the drop down to change the memory size of the enclave.

   - **Thread count** – Change the thread count to support the application.

If you selected the **Image Type** as **AWS Nitro**, enter the following details:

- **Memory size**

- **CPU count** - CPU count is the number of CPUs dedicated to an enclave out of all the CPUs available to the host machine.

  📌**NOTE:** The Memory size and CPU count can be overridden at runtime with the following environment variables:

  - `MEM_SIZE`
  - `CPU_COUNT`

- **File Persistence** – This option is selected by default. This feature allows you to save the filesystem changes to an encrypted container mount. It allows the Nitro system to access a managed security object in Fortanix DSM to be able to encrypt and decrypt the Linux Unified Key Setup (LUKS) overlay file system. *For more details, refer to User's Guide: AWS Nitro File Persistence*.

  📌**NOTE:** For the File Persistence feature to work, you **must** configure the app certificate since when a Nitro image runs, it must be configured ahead of time to receive a certificate, which will authorize access to Fortanix DSM to obtain the keys for the Linux Unified Key Setup (LUKS) volume. Without the app certificate, this feature will not work.

7. Click **CREATE** to create the image (**Figure 2**).

8. An image approval task is created and added which is visible on the **Tasks** page. You can approve the task to approve the application image.

   Refer to User's Guide: Domain and Application Image Approval to approve the application image tasks for the Enclave OS application.

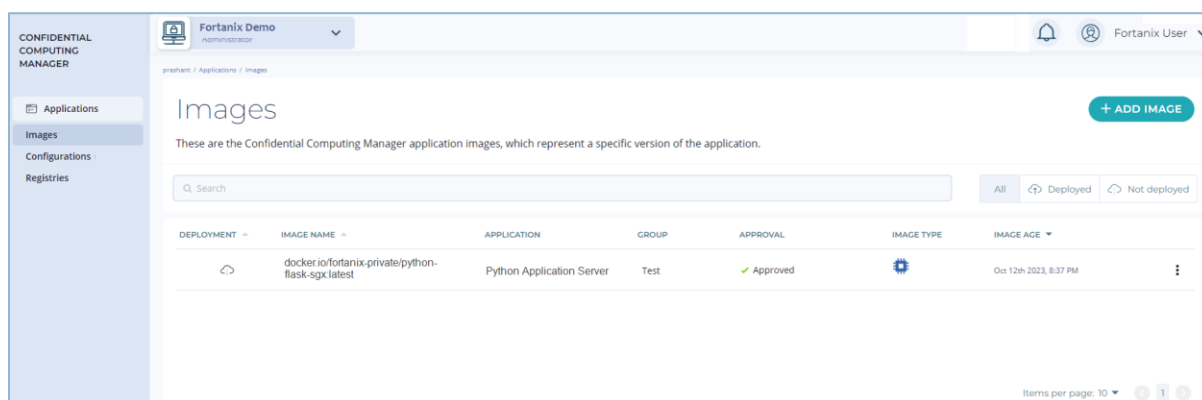9. After it is approved, a green tick will appear in the **Approval status** column for that image.

FIGURE 3: IMAGE CREATED AND APPROVED

NOTE: The Source Image tag and Output Image tag are optional fields and by default, the tag value is "latest" internally. If the user is entering a different tag value, then it can either be different values or the same. Once an image of an application is created, it will be pushed to the specified location in the **Output Image Name** of the application.

4.2.1   SGX1 AND SGX2 APPLICATION SUPPORT

When an application is converted, the converter app supports signing and running the application in both SGX1 and SGX2 hardware. After the application is converted, the application will have both SGX1 and SGX2 signatures, and the correct signature would be used depending on the hardware available.

The converted container will have two different MRENCLAVE values corresponding to SGX1 and SGX2 respectively. This allows you to run the same converted container on both SGX1 and SGX2 hardware.

On the hardware that supports dynamically adding pages to an enclave, pages for unallocated memory are not included in the initial enclave image, so the enclave can start faster. On hardware without that support, the initial enclave image includes zeroed pages for unallocated memory.

To view the MRENCLAVE values in the Fortanix CCM UI:

1.   Go to the detailed view of an image, and select the **ENCLAVE** tab.

2. Notice the **MRENCLAVE (SGX1)** and **MRENCLAVE (SGX2)** fields under the **MRENCLAVE Values** section.
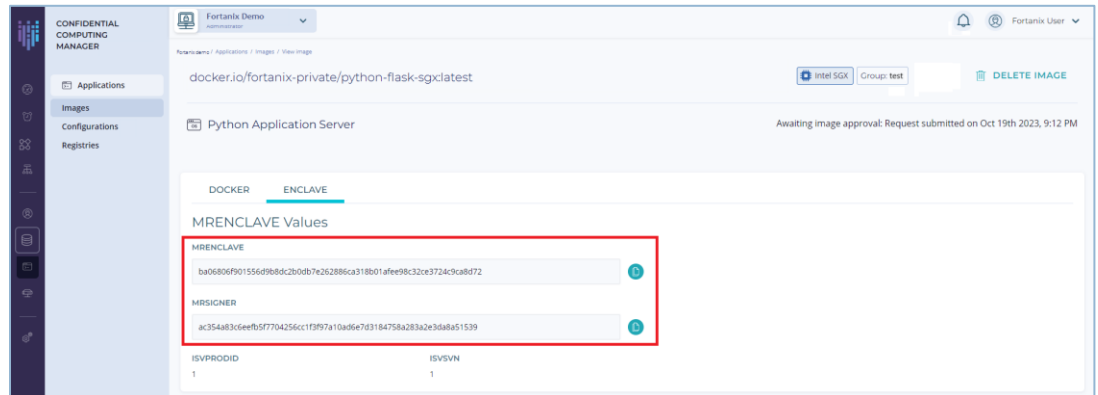

FIGURE 4: MRENCLAVE VALUES

4.3 CREATE AN IMAGE FOR EDP APPLICATIONS

1. After you create an EDP application, click the **Applications** menu item in the CCM UI left navigation bar and select the required EDP application for which you want to configure an application image.

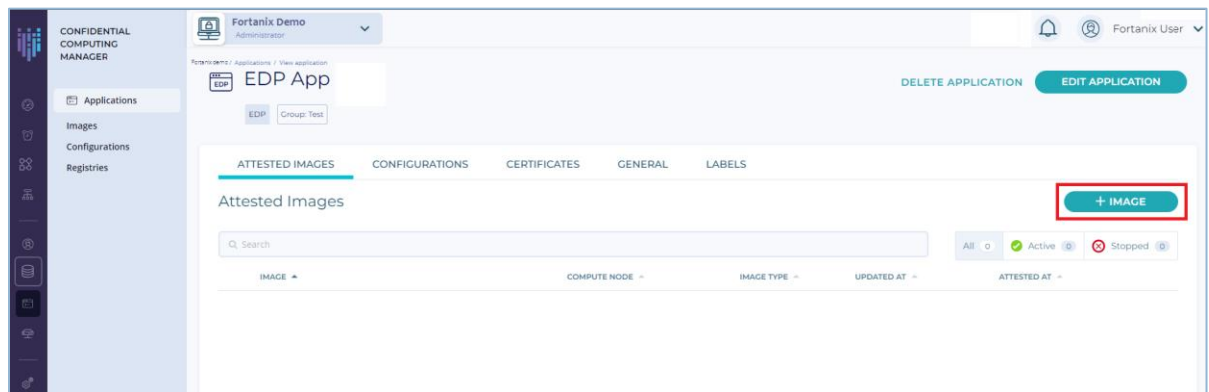2. On the following page, click the **+ IMAGE** button to configure the image of the EDP application.

FIGURE 5: IMAGES TAB

3. In the **Add image** form, fill in the following details:

- **Image Version:** Enter the version of the image.
- **Image Type:** Select **Intel SGX** or **AWS Nitro Enclaves** as the platform.

   If you select the Image Type as **Intel SGX**, you have to add the Sigstruct details. The SIGSTRUCT for an enclave is generated when an application is signed. It is used to register the enclave with Fortanix Confidential Computing Manager.

o **Enclave Configuration SIGSTRUCT:** Three options are available to add SIGSTRUCT:

- **Upload Enclave SIGSTRUCT**: To upload an enclave `sigstruct.bin` file, click the **UPLOAD** button as shown in **Figure 6**. Here is a sample sigstruct.bin file.

  OR

- **Paste Base64-encoded Enclave SIGSTRUCT**: You can also paste a Base64-encoded SIGSTRUCT binary in the text box provided.

  OR

- **Enter Enclave SIGSTRUCT Parameters**: Enter the following parameters:

  - **MRENCLAVE**: This is the identity or hash of the enclave.
  - **MRSIGNER**: This is the identity of the signer of the enclave.
  - **ISVPRODID**: This is the numeric product identifier to be assigned to the enclave. Choose a unique value in the range 0-65535 for each application.
  - **ISVSVN**: This is the numeric security version to be assigned to the enclave. Increment this value when a security-relevant change is made to the application.

  📌 **NOTE**: The **Enclave SIGSTRUCT Parameters** section is automatically filled when you either upload a `sigstruct.bin` file or paste a base64 encoded enclave SIGSTRUCT.

If you select the Image Type as **AWS Nitro Enclaves**, you have to add the Enclave Configuration JSON details which are unique enclave measurements that includes a series of Hashes and Platform. The JSON measurements for an enclave are generated when an application is signed. It is used to register the enclave with Fortanix Confidential Computing Manager.

o **Enclave Configuration JSON:** Three options are available to add measurements:

- **Upload Measurement JSON**: To upload an enclave `measurement.json` file, click the **UPLOAD** button as shown in **Figure 7**.
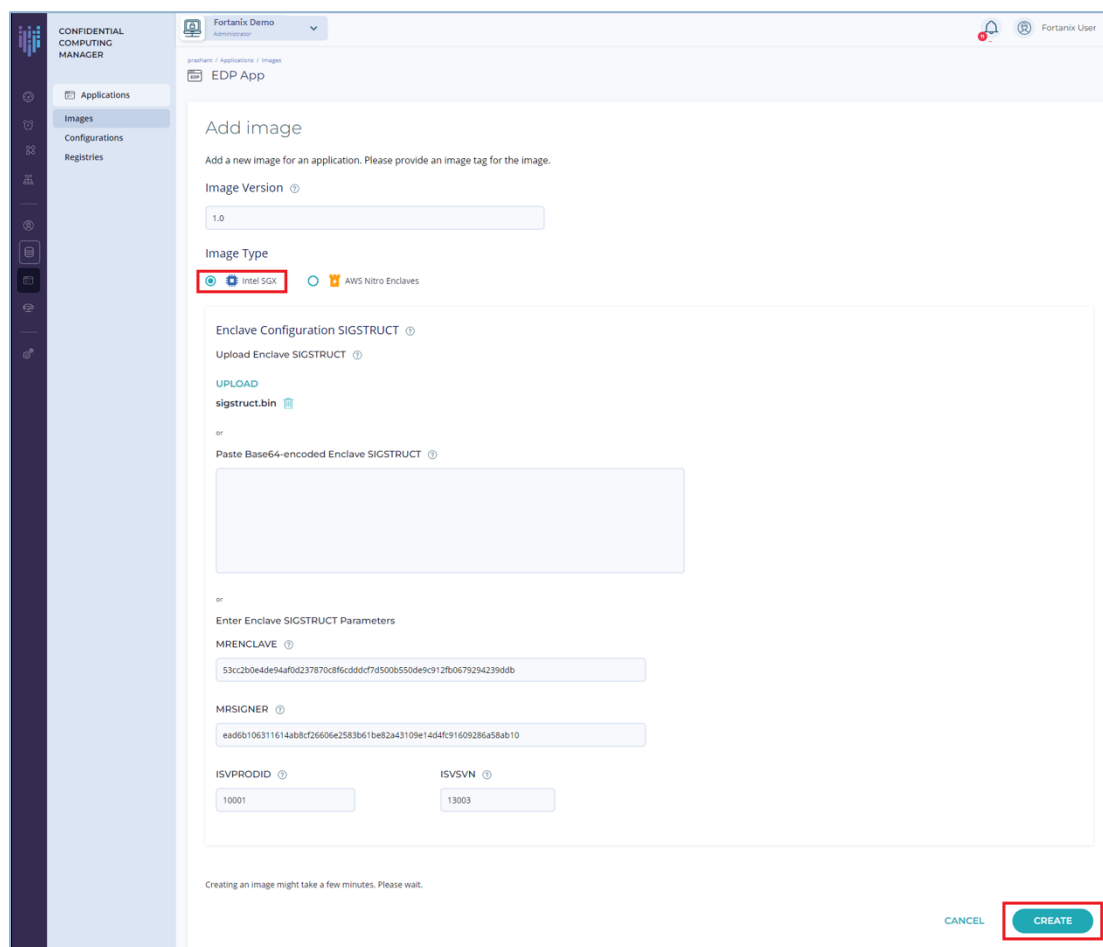
  OR

- **Paste Measurement JSON**: You can also paste the JSON enclave measurements in the text box provided.

<div align="center">OR</div>

- **Enter Measurement**: Enter the following parameters:

  - **PCR0**: This is the hash of the enclave image file.
  - **PCR1**: This is the hash of the Linux kernel and bootstrap.
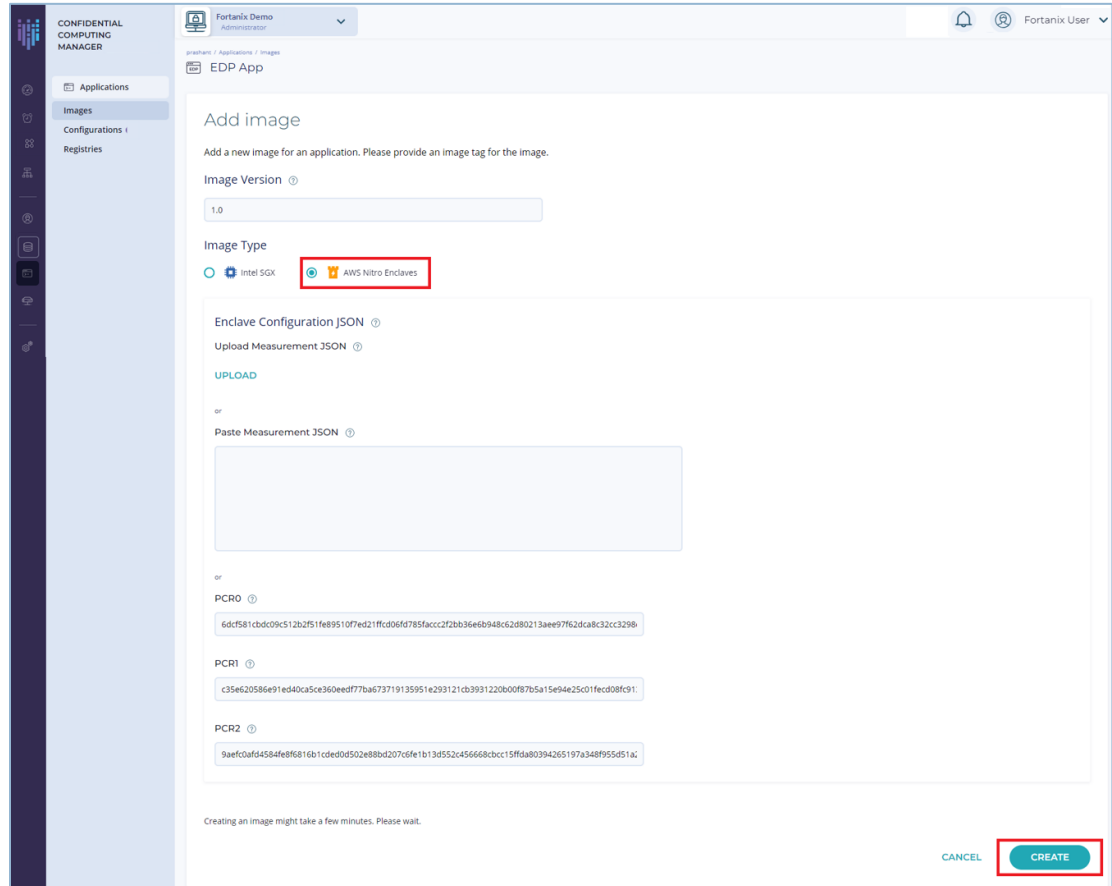 - **PCR2**: This is the Hash of the user application.

NOTE: The **Enter Measurement** section is automatically filled when you either upload a `measurement.json` file or paste the JSON enclave measurements.

FIGURE 6: CREATE AN EDP APPLICATION IMAGE FOR INTEL SGX PLATFORM

FIGURE 7: CREATE AN EDP APPLICATION FOR AWS NITRO PLATFORM

4. Click **CREATE** to create the EDP application image.

5. An image approval task is created and added which is visible on the **Tasks** page. You can approve the task to approve the image.

    Refer to [*User's Guide: Domain and Application Image Approval*](#) *to approve the application image tasks for the EDP application.*

6. After the image is approved, a green tick will appear in the **Approval status** column for that image.
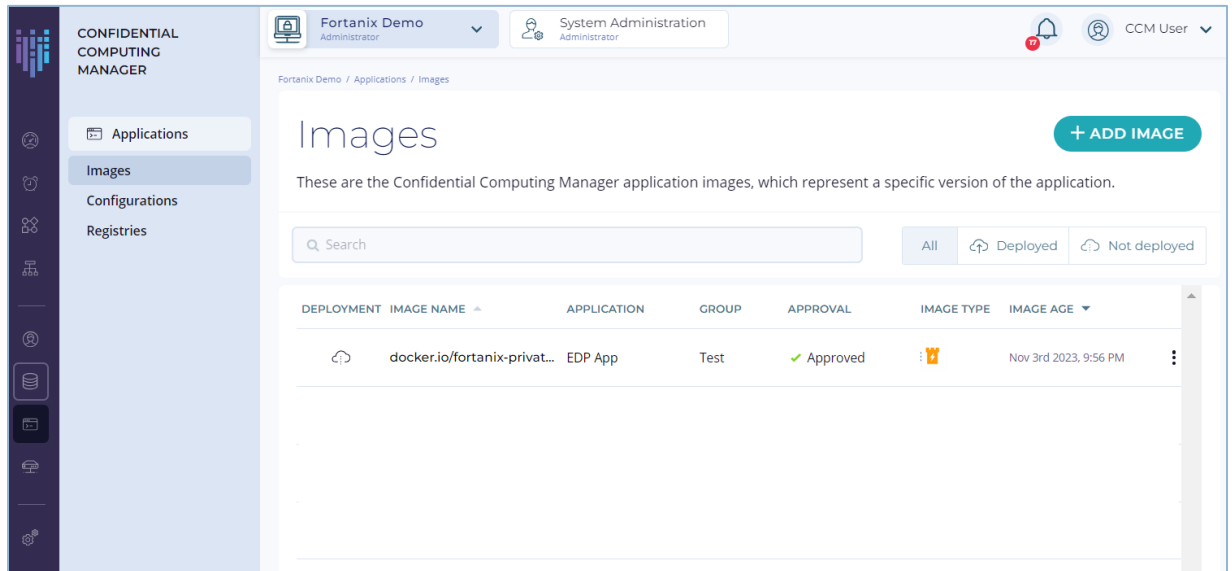
FIGURE 8: IMAGE CREATED AND APPROVED

4.4   CREATE AN IMAGE FOR ACI APPLICATIONS

1. After you create an ACI application, click the **Applications** menu item in the CCM UI left
    navigation bar and select the required ACI application for which you want to configure an
    application image.

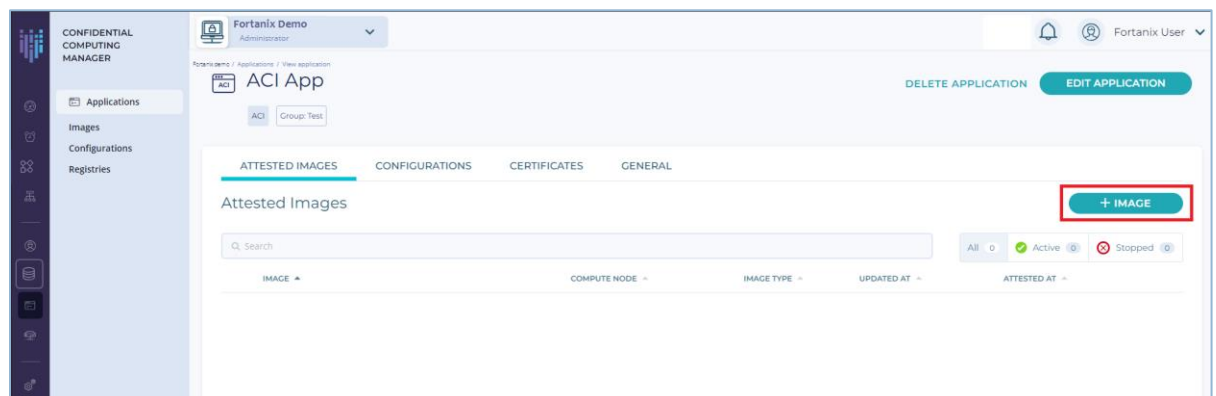2. On the following page, click the **+ IMAGE** button to configure the image of the ACI application.

FIGURE 9: IMAGE TAB

3. On the **Add Image** form, fill in the following details:

    •   **Tag:** Enter the tag value of the docker image.

    ⚠️ **WARNING:** If an image of an existing ACI application already has the same tag value as
    the current ACI application image, then it will give an error. Use a new tag value.
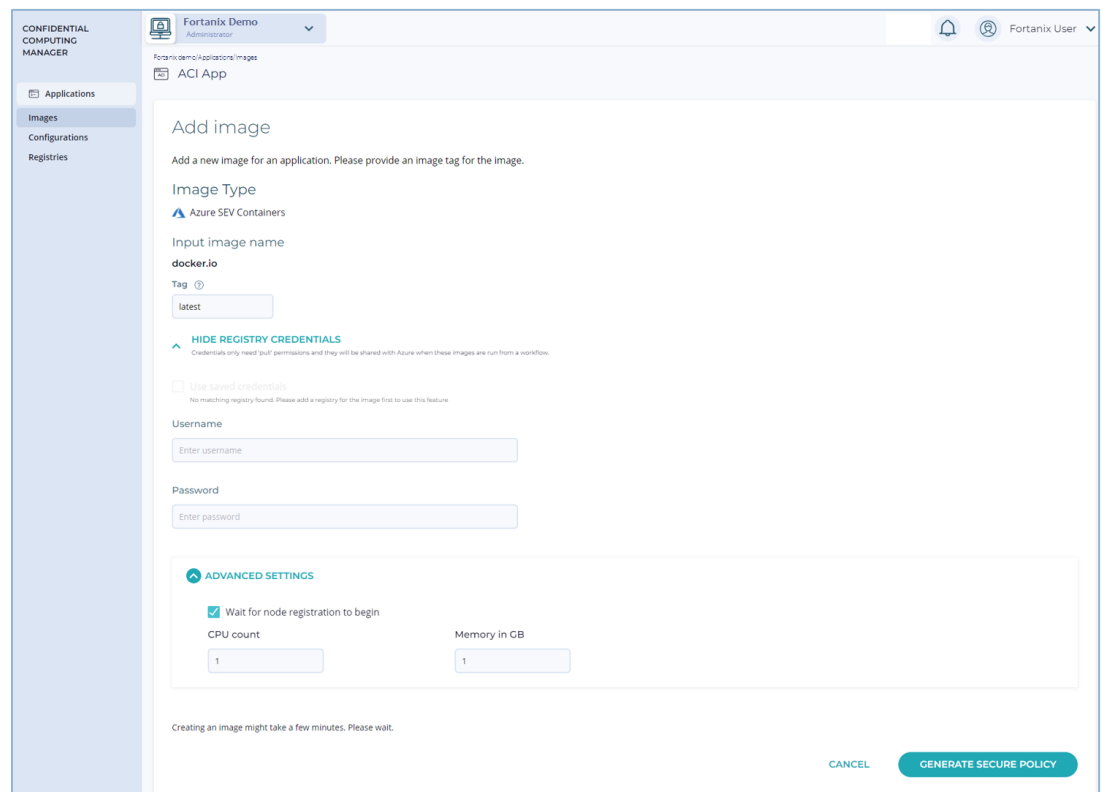
- **Add Registry Credentials:** Enter the **REGISTRY CREDENTIALS** for the **Input image name**. Here, the registry credentials are the credentials needed to access the private docker registry where the image will be pulled. Since the input image is stored in a public registry, there is no need to provide credentials for the input image.

  📌 **NOTE:** If a registry credential is given, then the image name must have a domain. For example, if the image is from Docker Hub, then the domain prefix is not required. However, if a registry credential is given, then the image name must start with `docker.io/` or similar.

    o If you have added a registry in a particular account as described in the article *User's Guide: Image Registry* of Fortanix CCM, then the check box **Use saved credentials** will be selected by default.

FIGURE 10: ADD SAVED REGISTRY CREDENTIALS

- **Advanced Settings:** It is recommended to always select the **Wait for node registration to begin** check box unless the application has special requirements. Selecting this check box

does not allow the execution, before the Fortanix ACI node agent has retrieved the signed app certificate from the Fortanix CCM backend cluster.

- o **CPU Count:** Enter the number of CPU cores. By default, the value is `1`.
- o **Memory in GB:** Enter the amount of required RAM in GB units. By default, the value is `1`.

4. Click the **GENERATE SECURE POLICY** button to initiate the build of the JSON Fortifier template, which is used to deploy the confidential ACI container group.

📌**NOTE:** The creation of an application image may take up to a few minutes.

5. An image approval task is created and added which is visible on the **Tasks** page. You can approve the task to approve the image.

Refer to *User's Guide: Domain and Application Image Approval* to approve the application image tasks for the ACI application.

6. After the image is approved, a green tick would appear in the **Approval status** column for that image.
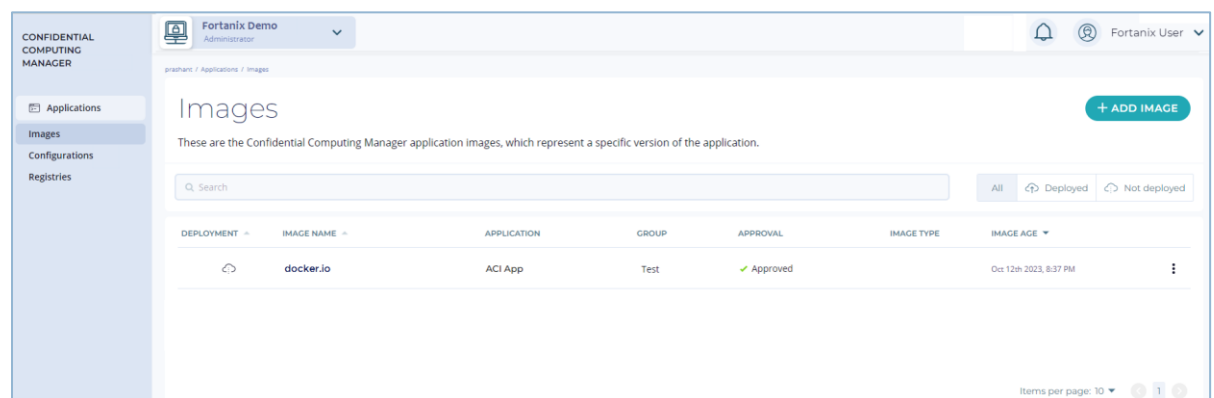
FIGURE 11: IMAGE CREATED AND APPROVED

5.0 DEPLOY THE ACI APPLICATION USING AZURE PORTAL

You can deploy the application image to Fortanix ACI either through the Azure Portal or with the Azure CLI.

1. Navigate to the **Applications → Image** menu item and select the required image from the list.

2. Next, click the **POLICY** tab to view the JSON Azure Resource Manager (ARM) template encoding of the security policy generated earlier in *Section: Create an Image for ACI Application*.
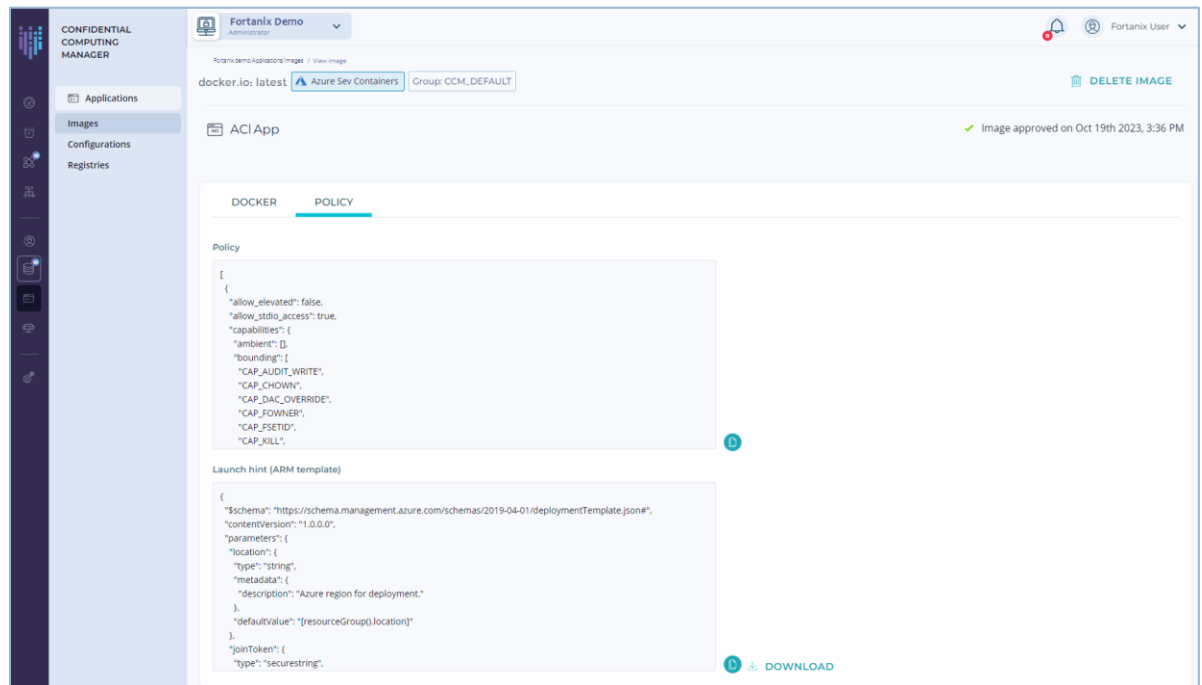

FIGURE 12: JSON ARM TEMPLATE

3. Click the **DOWNLOAD** button to save the ARM template for the deployment procedure. *Refer to User's Guide: Deploying ACI Using Azure Portal to create an image for the EDP application.*

6.0   DOCUMENT INFORMATION

6.1   DOCUMENT LOCATION

The latest published version of this document is located at the URL:

https://support.fortanix.com/hc/en-us/articles/360043529411-User-s-Guide-Create-an-Image

6.2   DOCUMENT UPDATES

This document will typically be updated on a periodic review and update cycle.

For any urgent document updates, please send an email to: support@fortanix.com