



Hewlett Packard
Enterprise

HPE Swarm Learning Installation and Configuration Guide

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Revision history

Part number	Publication date	Edition	Summary of changes
10-191041-Q222	April 2022	1	New manual
10-191041-Q322	July 2022	2	<p>Content related to Swarm Learning 1.1.0 is updated:</p> <ul style="list-style-type: none">• <u>Environment variables</u> section updated for <code>SL_WAIT_FOR_FULL_QUORUM_SECONDS</code>, <code>SWCI_TASK_MAX_WAIT_TIME</code>, and <code>SWOP_KEEP_CONTAINERS</code>• <u>Installing HPE Swarm Learning Management UI (SLM-UI)</u> section updated.• <u>Running Swarm Learning using CLI</u> section updated for primary and secondary APLS IP and Port information.• <u>Starting SWCI nodes</u> section updated with a note on <code>swci-init</code> script file.• <u>Upgrading Swarm Learning</u> section added.

Table Continued



Part number	Publication date	Edition	Summary of changes
10-191041-Q223	April 2023	3	<p>Content related to Swarm Learning 2.0 is updated:</p> <ul style="list-style-type: none"> • Updated <u>Prerequisites</u>. • <u>Installing HPE Swarm Learning Management UI (SLM-UI)</u> updated with SLM-UI feature. • <u>Running SLM-UI Installer</u> updated for SLM-UI Installer. • Added the following sections: <ul style="list-style-type: none"> ◦ <u>Running Swarm Learning examples using SLM-UI</u> ◦ <u>Adding a Swarm Host</u> ◦ <u>Creating a Project</u> ◦ <u>Adding Swarm Nodes</u> ◦ <u>Creating a task</u> ◦ <u>Creating Task Runners</u> ◦ <u>Creating a Contract</u> ◦ <u>Executing a Task</u> ◦ <u>Managing the Global Settings</u> ◦ <u>Starting SLM-UI manually</u> • <u>Running Swarm Learning</u> updated for DNS, SL node and SN node and Machine Learning parameters. • <u>Starting Sentinel node</u> updated for sn-api-service, --sentinel-ip and sn-p2p-service parameters. • <u>Starting Swarm Learning Node</u> updated for sn-api-service and sl-fs-service parameters. • <u>Starting SWOP node</u> section updated with sn parameters. • <u>IP address of host systems</u> and <u>Exposed port numbers</u> sections updated with new content. • <u>Environment variables</u> section updated with SL_MAKE_ME_ADMIN and SL_LEADER_FAILURE_BASE_TIMEOUT. • <u>Versioning and upgrade</u> section updated with new content.
10-191041-Q323	August 2023	4	<ul style="list-style-type: none"> • Added the following sections:

Part number	Publication date	Edition	Summary of changes
			<ul style="list-style-type: none"> ◦ <u>Centralized Swarm diagnostic</u> ◦ <u>Running Swarm with SE Linux</u> ◦ <u>Running Swarm with Podman</u> • <u>Prerequisites</u> section updated with Podman version. • <u>Installing the License Server</u> updated with new content. • <u>Creating a Project in SLM-UI</u> section updated with new screenshot. • <u>Adding Swarm nodes</u> section updated with new screenshot. • <u>Starting Sentinel node</u> updated with new parameter – v \<blockchain path on host machine \>:/platform/swarm/SMLNODE. • <u>Environment variables</u> section updated with SL_RAM_INTENSIVE. • <u>Running Swarm Learning examples using SLM-UI</u> section updated with new content. • <u>Starting SLM-UI manually</u> section updated with new content.



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DRAFT



Introduction

HPE Swarm Learning is a decentralized, privacy-preserving Machine Learning (ML) framework. Swarm Learning framework utilizes the computing power at, or near, the distributed data sources to run the ML algorithms that train the models. It uses the security of a blockchain platform to share learnings with peers safely and securely. In Swarm Learning, training of the model occurs at the edge, where data is most recent, and where prompt, data-driven decisions are mostly necessary. In this completely decentralized architecture, only the insights learned are shared with the collaborating ML peers, not the raw data. This tremendously enhances data security and privacy.

There are various types of Swarm nodes - SN, SL, SWOP, and SWCI. For more information about the architecture of Swarm Learning, how these nodes work, how model training happens, see the *HPE Swarm Learning User Guide*.

Prerequisites

HPE recommends that you run each Swarm Network node, and Swarm Learning node on dedicated systems to get the best performance from the platform. The recommended requirements for each system are as follows:

NOTE: Configuration of the ML user nodes are driven by the complexity of the ML algorithm. GPUs may be needed.

Hardware

- Any x86-64 hardware.
- System memory of 32 GB or more. Hard disk space of 200 GB or more.
- Qualified with HPE Edgeline, Proliant DL380, and Apollo 6500.

Network

- A minimum of one or a maximum four open TCP/IP ports in each node. All swarm nodes **must be able to access** the ports of every other node. For more information on port details that must be opened, see [Exposed ports](#).
- Stable internet connectivity to download Swarm Learning package and Docker images.

Operating systems

- Linux - Qualified on Ubuntu 22.04, RHEL 8.5, SLES 15.
- For Swarm SLM-UI installer, any x86-64 hardware running Linux, Windows, or Mac.

Container hosting platform

- HPE Swarm Learning is qualified with Docker 20.10.5 and Podman 4.0.2. Configure Docker/Podman to use IPv4.
- Configure Docker to run as a non-root user. For more details, see [Manage Docker as a non-root user](#).
- Configure network proxy settings for Docker. For more details, see [HTTP/HTTPS proxy](#).

Machine Learning framework

Qualified with Keras 2.9.0 (TensorFlow 2 backend) and PyTorch 1.5 based ML models implemented using Python3.

NOTE: Python version must be between 3.6 to 3.9.

Multi system cluster requirements

Synchronized time across all systems using NTP.

NOTE: 'Qualified' in this section means that HPE has qualified the product with the respective versions. Swarm Learning may work with other versions as well.

HPE Swarm Learning Installation

Procedure

1. **Installing the License Server**
2. **Installing HPE Swarm Learning Management UI (SLM-UI)**

Installing the License Server

Procedure

1. After purchasing Swarm Learning from HPE, you will receive an email with a download link **Access Your Products**.
2. From the email, click **Access Your Products**. You are redirected to **MY HPE SOFTWARE CENTER**.
3. If you have the HPE Passport account, enter the credentials and **Sign In**. If you do not have it, create the HPE Passport Account and **Sign In**.
After signing in, you should see the Software Notification Message Receipt page listing the products.
4. Download APLS container and run it using the following procedures.

- a. Login to the HPE docker registry using your HPE Passport email id and password `hpe_eval`.

```
docker login hub.myenterpriselicense.hpe.com -u <HPE-PASSPORT-EMAIL-ID> -p hpe_eval
```

- b. Enable Docker content trust.

```
export DOCKER_CONTENT_TRUST=1
```

- c. Pull the image with a tag.

```
docker pull hub.myenterpriselicense.hpe.com/hpe_eval/autopass/apls:9.14
```

- d. Configure Data persistence.

In order to retain configurations and installed licenses across containers, HPE recommends you to create a volume to persist the `/hpe` directory. This directory contains the following details:

Image Directory	Subdirectories	Description
/hpe	AutoPass/LicenseServer/data	License server configuration directory. Contains database, logs and configuration files required to persist setup across containers transactions such as restarts, deletion or upgrades to new image tags.
	..data/conf	
	..data/log	
	..data/database	

HPE recommends you to create the volume using the `docker volume create` command and assign a volume name such as `apls-volume`, as follows:

```
docker volume create apls-volume
```

- e. Create and run the APLS container.

To **run the APLS** Docker container, user can use `docker cli` using the following instructions:

Docker CLI

```
docker run -d \  
--name apls \  
-v apls-volume:/hpe \  
-p 5814:5814 \  
--restart unless-stopped \  
hub.myenterpriselicense.hpe.com/hpe_eval/autopass/apls:9.14
```

NOTE: In case the APLS container does not work, then user can choose to install APLS software using the APLS installer. User can select the AutoPass License Server (APLS) Installer link under 'Additional Notes' and download the **APLS** software. To install the APLS software on a host machine (Linux or Windows), see *AutoPass License Server User Guide*, which is part of the downloaded APLS software.

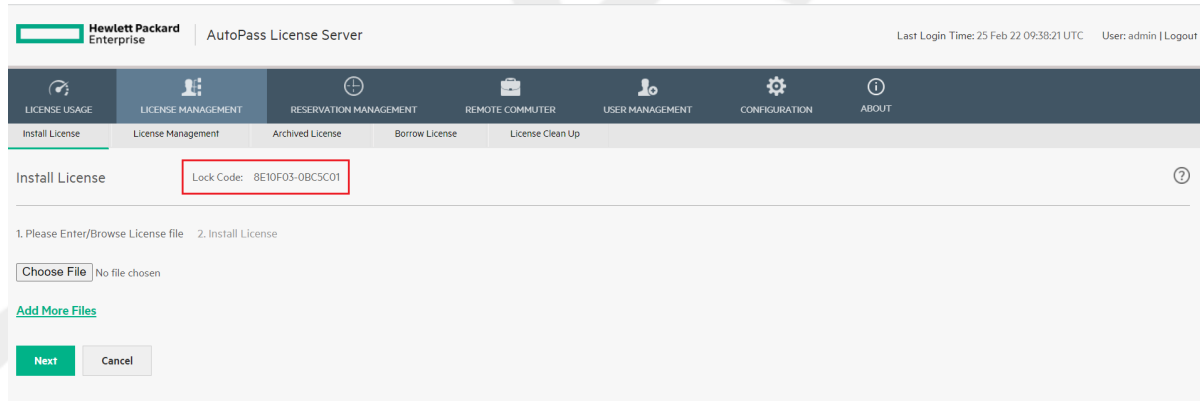
- From a browser, access the APLS management console using the URL `https://<localhost>:5814` on the host machine where you installed the license server.

The default user name is *admin*, and the password is *password*.

NOTE: These instructions assume that the host IP of license server is *<localhost>* and the external port is *5814*. Host IP is the IP of the system where the license server is running. Modify these values to match the actual IP and external port on your system.

If the web browser cannot connect to the APLS management console, check your network proxy settings and firewall policies. Consider techniques like port forwarding to work around firewall policies. If necessary, work with your network administrator to diagnose and resolve connectivity problems.

- In the APLS web GUI, go to **License Management** -> **Install License** and note down the lock code.



- Go to the Software Notification Message Receipt page and click **Access Your Products**. You will be navigated to the **MY HPE SOFTWARE CENTER** home page. After signing in with your HPE Passport credentials, you will see the **Activate** page.
- Activate the license:
 - Select the number of licenses to activate and click **Next**.

NOTE: You can select the number of licenses to be installed on the host machines. For example, if you have 5 licenses, you can install 2 on Windows, and 3 on Linux machines.

- Designate yourself or for another user for activation. Click **Next**.
- Enter the lock code you got from the **Install Licenses** page in the HPE Serial Number field and click **Activate**.

9. Once you activate the licenses, you will see the **Download Files** page. Select the keys and the software and download them.
10. Install and manage the Swarm Learning license:
 - a. Open the APLS management console.
 - b. Select **License Management** -> **Install License**.
 - c. Select **Choose** file to upload the license file that you downloaded and click **Next**.
 - d. Select the required feature IDs and click **Install Licenses**.

License Management

Select Product: All

Feature ID: Version	Product Number	Capacity	Start Date	Expiry Date	Installed On	Installed By	Lock Code
<input type="checkbox"/> Multi-TaskRunner-Contract-Support E-LTU (1100000396:1)	HPE-Swarm	100	30 Jan 22 00:00:00 UTC	Forever	25 Feb 22 09:38:24 UTC	admin	any
<input type="checkbox"/> Swarm Command Interface E-LTU (1100000388:1)	HPE-Swarm	100	30 Jan 22 00:00:00 UTC	Forever	25 Feb 22 09:38:24 UTC	admin	any
<input type="checkbox"/> Swarm Workload Orchestrator Process E-LTU (1100000390:1)	HPE-Swarm	100	30 Jan 22 00:00:00 UTC	Forever	25 Feb 22 09:38:24 UTC	admin	any
<input type="checkbox"/> Swarm Network Node (1100000380:1)	HPE-Swarm	100	30 Jan 22 00:00:00 UTC	Forever	25 Feb 22 09:38:24 UTC	admin	any
<input type="checkbox"/> Multi-Training-Contract-Support E-LTU (1100000394:1)	HPE-Swarm	100	30 Jan 22 00:00:00 UTC	Forever	25 Feb 22 09:38:24 UTC	admin	any
<input type="checkbox"/> Swarm Learning Node (1100000378:1)	HPE-Swarm	100	30 Jan 22 00:00:00 UTC	Forever	25 Feb 22 09:38:24 UTC	admin	any

6 items found, displaying all items.

Archive

For more information on installing and managing licenses, see the chapter *HPE AutoPass License Server License Management* in *AutoPass License Server User Guide*.

Object Missing

This object is not available in the repository.

Object Missing

This object is not available in the repository.

Object Missing

This object is not available in the repository.

Installing HPE Swarm Learning Management UI (SLM-UI)

About this task

Installing Swarm Learning is a two-step process.

1. Using SLM-UI Installer, you can install the SLM-UI on one host.
2. Using SLM-UI, you can install SL in multiple hosts and run the examples.

Procedure

1. Navigate to the **MY HPE SOFTWARE CENTER** home page.
2. Perform the following actions after signing in with your HPE Passport credentials:
 - a. Go to **My Activations** and select your ordered product.
 - b. Go to **Action** pull down and then select **Download/Re-download** page.
 - c. Select and download listed software files.
 - The tar file containing docs and scripts.
 - The signature file for the above tar file.
 - The docker digest hash file (JSON).
 - Download the Swarm Learning SLM-UI installer for your platform, Mac, Windows, or Linux.

Running SLM-UI Installer

Procedure

1. Run the SLM-UI Installer Web App. This is launched in a web browser.



IMPORTANT: For Mac users, HPE recommends you to run the downloaded SLM-UI installer from the terminal window only.

When you run the SLM-UI installer on Windows, web browsers such as Google Chrome and Microsoft Edge, are only supported. Internet Explorer browser is not supported.

The installer has a few configurable options. To change the default options, run the installer from a command prompt. Use the following optional flags to customize the configuration or behavior of the installer:

-port

Defines the port for the application to run. The default value is 30302.

Example, `-port 30355`

-logs

If enabled, displays the detailed message. To enable, use the command, `-logs verbose`.

-version

Defines the version of SLM-UI to be installed. Default value: 2.0.0.

Example, `-version 2.0.0`

-timeoutDuration

Defines installer timeout duration for individual installation tasks. The default value is 300 seconds.

Example, `-timeoutDuration 600`



What is Swarm Learning?

Swarm Learning is a decentralized, privacy-preserving Machine Learning framework. This framework utilizes the computing power at, or near, the distributed data sources to run the Machine Learning algorithms that train the models. It uses the security of a block chain platform to share learnings with peers in a safe and secure manner. In Swarm Learning, training of the model occurs at the edge, where data is most recent, and where prompt, data-driven decisions are mostly necessary. In this completely decentralized architecture, only the insights learned are shared with the collaborating ML peers, not the raw data. This tremendously enhances data security and privacy.

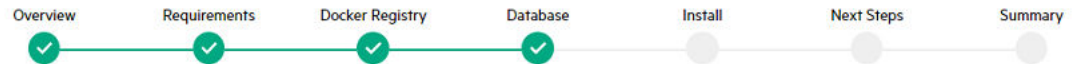
Installing Swarm Learning is a two-step process.

1. Firstly, using this SLM-UI Installer, you should install Swarm Learning Management UI (SLM-UI) on one host.
2. Using SLM-UI, you can install Swarm Learning on multiple hosts and run the examples (details in 'Next Steps' tab)

Next

2. Click **Next** in the **Overview** screen.
3. Review the **Requirements** and ensure that you have the hosts identified with required configuration, and click **Next**.
4. In the **Docker Registry Access**, enter your HPE Passport credentials and click **Next**.
5. In the **Database**, click **Next** if you want to use the default values.

NOTE:



Configure Database

The SLM-UI installer will provide a default Postgres database for the app to use with the following default values. If you choose to customize any of the following fields, please make sure directories, ports, etc. exist and will be accessible to the host user.

Postgres container name	Docker network
<input type="text" value="slm-ui-postgres"/>	<input type="text" value="slm-ui-network"/>
Database port number (Optional) [Ⓢ]	Cancel customization
<input type="text" value="5432"/>	
Database username	
<input type="text" value="postgres"/>	
Database password	
<input type="text" value="Password"/>	

[Back](#)[Next](#)

If you want to configure the database with customized values, then make sure that those customized field values are valid.

-
6. Install the SLM-UI by providing the following details.

Install SLM-UI

Swarm Installation Location ^①

/opt/hpe/swarm-learning

The directory above must already exist, and the Linux user specified below needs to have a write permission to the above directory. If you change it to a custom directory, please make sure they also have a write permission as well on the custom directory.

Host Server Name or IP Address ^①

IP Address

HTTP Port

80

SSH Port Number (Optional) ^②

22

HTTPS Port

443

Username

Username

Docker network

slm-ui-network

Password

Password

Logs directory

./logs

[View Less Options -](#)

[Back](#)

[Run](#)

7. Click **Run**.
A success message is displayed as **SLM-UI install successful**.
8. Click **Next**.
9. Review **Next Steps** and click **Next**.

Next Steps

1. Install License Server: ✓

2. Generate Swarm Learning Licenses: ✓

3. Install Licenses: ✓

4. SLM-UI: ✓

Back

Next

10. Review the **Summary** screen, which displays all the installed hosts. Click **Finish**.

This concludes the installation of SLM-UI installer. The SLM-UI will be launched in a separate browser window.

Sign In

to Swarm Learning

Email

example@my.com

Password

Enter your password

Sign In

[Need an account?](#)

User can login into the SLM-UI using default account (Username: **admin**; Password: **admin**).

After logging in to the SLM-UI, user can run the examples. User can also create the custom account.

Running Swarm Learning examples using SLM-UI

About this task



TIP:



User can get a quick intuition and overview of SLM-UI by looking at this [video](#).

Before you start using the SLM-UI, HPE recommends you to read the *HPE Swarm Learning User Guide* to understand about the architecture of Swarm Learning, how these nodes work, how model training happens, and Swarm Learning Concepts section.

Perform the following steps to run the SL examples using SLM-UI.

1. For ease of use, users can extract the `examples` folder from the documentation tar ball on their laptops.
2. Users must generate x.509 certificates for their own environment. HPE-provided `gen-cert` utility under `swarm-learning/examples/utils` can be used for generating self-signed certificates just for the purposes of running the examples. Run the `gen-cert` utility on one of the Linux host to generate the self-signed certificates. Ensure that these certificates are copied to your laptop under the `examples` folder.
3. User can use Linux remote desktop to get the SLM-UI be displayed on the local browser (instead of the remote laptop browser). With this, the SLM-UI's file open dialog box shows all local Linux files to the user. This makes it easier to upload the training artifacts like certs, SWOP profile, Task yaml, etc.

Alternatively, user can use cross-platform file sharing to mount the artifacts directory from the Linux machine on his laptop.
4. User can use the provided template files and the generated certificates for the examples and import them into the SLM-UI installer.

NOTE: HPE recommends that users use their own certificates in actual production environment.

Procedure

1. **Adding a Swarm Host**
2. **Creating a Project**
3. **Adding Swarm Nodes**
4. **Creating a Task**
5. **Creating Task Runners**
6. **Creating a Contract**
7. **Executing a Task**
8. **Managing the Global Settings**
9. **Centralized Swarm diagnostic**



Adding a Swarm Host in SLM-UI

Procedure

1. In the **Hosts**, click **Add Host**.

NOTE: User needs to repeat these steps for all the hosts on which the Swarm Learning needs to be installed.

2. Enter the Host address.
3. Select the Swarm version number from the drop-down menu.
4. Enter the Swarm Install Path.
The default installation directory is `/opt/hpe/swarm-learning`. This directory path must have write permission.
5. Enter the Host username and password.
6. Enter the HPE Passport username.
7. Click **Create** to create the Swarm host.



Creating a Project in SLM-UI

Procedure

1. In the **My Projects**, click **Create Project**.

Project in SLM-UI is a logical representation of a particular Swarm training.

Projects help to view deployment topology and monitor the progress for the given Swarm training. They define what all Swarm nodes (and associated host nodes) a training will run, the model being used, the x.509 certificates, SWOP and Task yaml files for a particular training. Multiple Projects can be defined in a single instance of SLM-UI.

Project artifacts are created under the `swarm-learning/slm-ui/projects/<project number>` automatically once the project is saved.

NOTE: HPE recommends that users avoid editing these files directly on the host machine.

2. Enter the project name.
3. Select the Swarm version number from the drop-down menu.

4. Upload the following files:

- a. Upload your Certificate and CA Certificate files to be used with your swarm nodes.
- b. Upload your Certificate and CA Certificate files to be used with SWCI node used by the SLM-UI.

Certificates

Upload your Certificate and CA Certificate files to be used with your swarm nodes.

Certificate upload

Upload

CA Certificate upload

Upload

Upload your Certificate and CA Certificate files to be used with SWCI node used by the SLM-UI

SWCI Public Certificate upload

Upload

SWCI Private Certificate upload

Upload

SWCI CA Certificate upload

Upload

- c. Upload the Machine Learning model file.

Machine Learning Model

Model upload

Upload

- d. Upload the SWOP Profile schema file.

SWOP Profile

SWOP profile upload

Upload

- e. Upload the SWCI tasks file.

SWCI TASKS

SWCI task upload

Upload

NOTE:

- For standard examples, this artifacts are available as part of tar file. User can extract the examples on their laptop.
- In a two node example, the network names should be `host-1-net` for the sentinel node and `host-2-net` for the non-sentinel node, respectively.

5. Click **Save Project** to create the Project.

My Projects

Manage your projects here

Create project

Project name	Created	Author		
FD	6/14/2023	admin	🗑️	📄
Minist2Node	6/21/2023	admin	🗑️	📄

Adding Swarm Nodes

About this task

The following procedure can be used to add the SN node and the SWOP node.

Procedure

1. In the **Projects** tab, click the created Project name which is displayed under **Project name** field.
The system displays the **Project Nodes**, **Tasks**, **Task Runners**, **Contracts** and **Settings** tabs.
2. Click **Add nodes** under **Project Nodes** tab.
3. Add the Swarm Node by providing the following details.

Add Swarm Node

Please fill out the form to add a new Swarm node.

Swarm Node Type*

Swarm Node Name*

Is Sentinel

☐ This is a sentinel node

Sentinel Address*

Host Address*

Public Cert*

Private Cert*

Use Project CA Path

☒ Use Project CA Path

Exposed SN Api Port

Exposed P2P Port

Docker Network

[Show advanced](#)

Cancel

NOTE:

- a. In a two node example, the network names must be `host-1-net` for the sentinel node and `host-2-net` for the non-sentinel node, respectively as this are as specified in the associated SWOP profile.
- b. The node launch may fail if the correct Cert is not provided for each sub-type of the certificate option.
- c. For SWOP nodes, user can specify the correct proxy server ENV variables as part of **Show Advanced > Node parameters**. Otherwise, ML application may not build and/or model related data files would NOT be downloaded correctly.

Docker Network

[Hide advanced](#)

SN Api Service

SN P2P Service

Sentinel Api Service

Node Parameters

Create

Cancel

For example,

```
-e https_proxy=http://web-proxy.XYZ.net:8080 -e http_proxy=http://web-proxy.XYZ.net:8080
```

-
4. Click **Create** to add the swarm node.

Creating a task

Procedure

1. In the **Tasks** tab, click **Create new task**.
2. Create a task by providing the following details.

Create Task

Please fill out the form to Create new Task.

SN Name*

Select SN

Task Name*

Select task file

Create Cancel

3. Click **Create** to create the task. The created task is displayed under the Task List.

Creating Task Runners

Procedure

1. In the **MyProjects**, click the **Project name** link.
2. In the **Task Runners** tab, click **Create new task runner**.

If you are running concurrent Swarm training, you need to create multiple task runners. If you are running a single training, the default task runner would be good enough and this step is optional.

3. Create new Task Runner by providing the following details.

Create new Task Runner

Please fill out the form to add task runner.

Task runner name*

Enter Task Runner Name

Create Cancel

4. Click **Create**. The Task Runner id created and displayed under **Task Runner** list.

Task Runner list			Create new task runner
Name	Created	State	
defaulttaskbb.taskdb.smf.hoe	2023-03-21T07:17:51.000Z	COMPLETE	Reset

Creating a Contract

Procedure

1. In the **MyProjects**, click the **Project name** link.
2. In the **Contracts** tab, click **Create new contract**.

If you are running concurrent Swarm training, you need to create multiple contracts. If you are running a single training, the default contract would be good enough and this step is optional.

3. Create new contract by providing the following details.

Create new Contract

Please fill out the form to add contract.

Contract name*

Create

Cancel

4. Click **Create**. The contract is created.

Contracts

Name	Type	Created	Completed Peers	Min Peers	Peer Count	
defaultbb.cqdb.sml.hpe	TRAINING	2023-03-21T07:17:38.000Z	2	2	2	Reset

Create new contract

Executing a Task

About this task

After you create the task, perform the following steps to execute the task. User can use the Execute Task to execute various types of Swarm tasks on a task runner and see the progress of the execution of the task.

Procedure

1. In the **Task List**, click **Execute**.
2. Execute the task by providing the following details.

Execute Task

Please fill out the form to execute Task.

⚠ Executing a task will reset any training contracts and task runners that it uses.

Task Runner*

Select Task Runner

of peers*

1

Contract*

defaultbb.cqdb.sml.hpe

ⓘ ML models must be updated to match the selected training contract.

Create

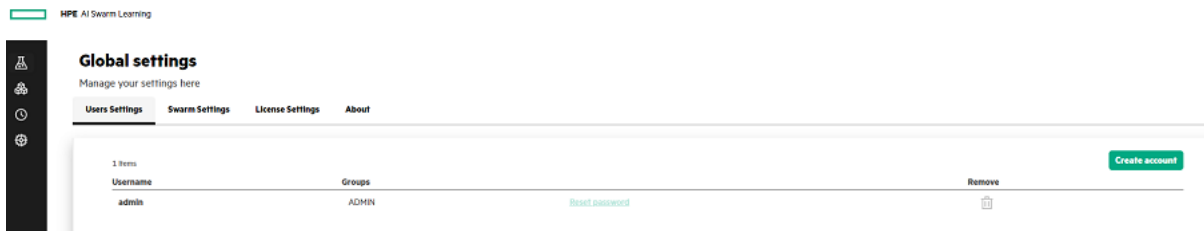
Cancel

NOTE: The **Contract*** field is displayed only if the **Task Type** is set as **RUN_SWARM**.

3. Click **Create** to execute the task.

Managing the Global Settings

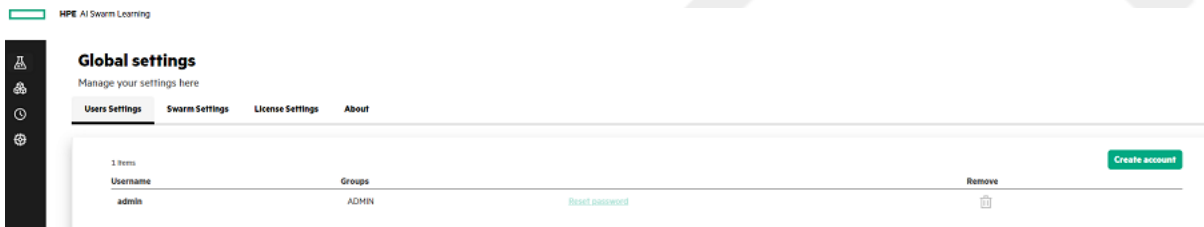
The Global settings feature allows the user to create multiple custom user accounts, configure swarm settings and configure License server settings. It also displays the version number of swarm software.



Configuring the User Settings

Procedure

1. In the **User Settings**, click **Create Account**.
2. Enter the Username and the Password.
You can also generate the password by clicking the **Generate Password** link.
3. Click **Create** to create the User account.



Configuring the Swarm Settings

Procedure

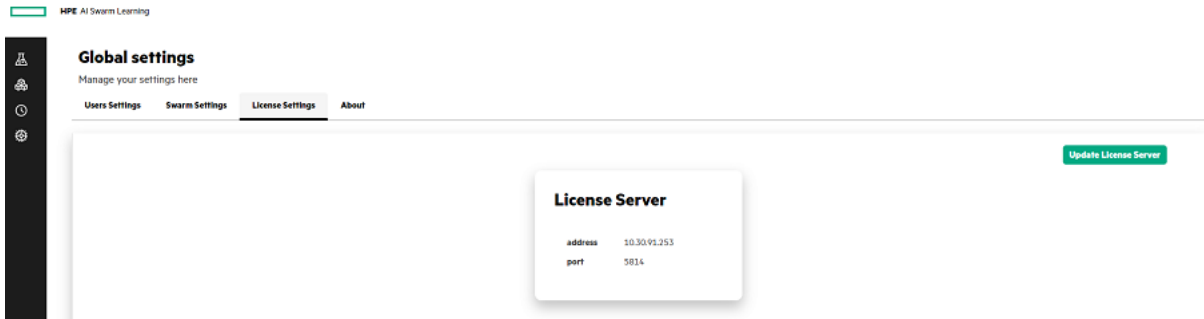
1. In the **Swarm Settings**, click **Add Version**.
2. Enter the Swarm Version number.
3. In the **Swarm Bundle**, select the Swarm version files from your local drive or drag and drop the Swarm version files.
4. Select the **Set as default** checkbox if you want to set this Swarm version as the default version number in the SLM-UI.
5. Select the **Set as evaluation** checkbox if you are using the community version of Swarm Learning.
For more information, see [Versioning and upgrade](#) section.
6. Click **Create** to create the Swarm version.



Configuring the License Settings

Procedure

1. In the **License Settings**, click **Update License Server**.
2. Enter the License Server Address and the License Server Port.
3. Click **Update** to update the License server.



Centralized Swarm diagnostics

About this task

Centralized Swarm diagnostics utility can be used to collect and upload the logs from all the hosts associated with a project. This can be sent to HPE to report Swarm issues.

Centralized Swarm Diagnostics

This utility will collect and upload the logs from all the hosts associated with this project to the below host/VM.

Host Address* ⓘ

Select Host Address

Create

Cancel

Procedure

1. In the **Projects** tab, click **Collect Log** icon.

My Projects

Manage your projects here

Create project

Project name	Created	Author		
FD	6/14/2023	admin	🗑️	📄
Mnist2Node	6/21/2023	admin	🗑️	📄

2. Select **Host Address** from the Host Address drop-down menu.

Centralized Swarm Diagnostics

This utility will collect and upload the logs from all the hosts associated with this project to the below host/VM.

Host Address*

Select Host Address

Create

Cancel

NOTE: The sshpass utility must be installed in the VM. (*apt install sshpass*).

3. Click **Create** to complete the Log Collection.

Log Collection Completed!
From hosts : XX.XX.XX.117, XX.XX.XX.139
All logs copied to Host XX.XX.XX.117 @
logs/Swarm_Diag_1_1687348965794.tar.gz

Starting SLM-UI manually

SLM-UI containers are automatically started by the SLM-UI installer. But, if it is not running on the host, users need to manually start it using the following commands.

1. Initially, run `<swarm-learning>/slm-ui/scripts/run-postgres -pw" supersecretpassword"`. (supersecretpassword is a default database password. User can change this default database password using external tools like pgAdmin).
2. Then, run `<swarm-learning>/slm-ui/scripts/run-slm-ui -pw" supersecretpassword"`. Most of the other arguments of the above commands are optional. If you have changed the defaults, then you can use the following arguments to specify them.

The following arguments are the optional arguments for `run-postgres`:

Argument	Description
<code>-d --data <dir></code>	Directory where DB data will be persisted to default: <code>/opt/hpe/swarm-learning/slm-ui/data</code>
<code>-u --user <string></code>	Postgres database username. default: <code>postgres</code>
<code>-pw --password <string></code>	Postgres database password. This is a mandatory argument.
<code>-po --port <number></code>	Postgres database port. default: <code>5432</code>
<code>-n --network <string></code>	Docker network where database and SLM-UI communicate. default: <code>slm-ui-network</code>
<code>-h --help /h</code>	help

The following arguments are the optional arguments for `run-slm-ui`:

Argument	Description
<code>-nw --network <name></code>	Docker network where SLM-UI and database communicate. default: <code>slm-ui-network</code>
<code>-l --log <dir></code>	Directory where log files will be saved to. default: <code>./logs</code>
<code>-pu --public-cert <name></code>	Public Certificate Name.
<code>-pr --private-cert <name></code>	Private Certificate Name.
<code>-ca --ca-cert <name></code>	Certificate Authority Certificate Name.
<code>-h --help /h</code>	help

Versioning and Upgrade

Upgrading Swarm Learning

To upgrade to a latest version:

- Delete the existing host from the SLM-UI. Click the remove icon in host page to delete the host.
This step deletes all swarm artifacts (docs, examples, lib, and scripts), but not the user created artifacts like workspace folder or SLM-UI project folder, and hence preserving user generated artifacts.
This step is not applicable, if you are running any older version of Swarm Learning (version < 2.0.0).
- Add the host again with new version on the same install location that was used earlier. For more information, see **Adding a Swarm Host in SLM-UI**.

SLM-UI can handle multiple hosts each with their own version of Swarm and hence supporting a manual rolling upgrade, where users can upgrade one host at a time. However on a given host machine, if multiple versions are installed, only the last installed version is seen active. All nodes in a Swarm Learning running cluster must be running the same version of the product.

For example, Hosts A, B, C can have Swarm 1.1.0 version and a training can be started using these hosts. Simultaneously, Hosts E and D can have Swarm 2.0.0 version installed and an independent training can be started within the E and D hosts. SLM-UI can support both these multi-version configurations and trigger the training.

Running Swarm Learning using CLI



TIP: Before you start running the following commands, HPE recommends you to read the *HPE Swarm Learning User Guide* to understand about the architecture of Swarm Learning, how these nodes work, how model training happens, and so on.

For examples of how to provide options to the various run commands, see the *Examples* chapter in *HPE Swarm Learning User Guide*.



IMPORTANT:

- Ensure that network proxy settings are configured correctly and the containers are able to communicate to each other.
- Ensure that Docker is configured to run as a non-root user by adding your current user ID as part of the Docker group.
- Ensure that the system time is synchronized across the systems by using NTP.

Start and run Swarm Learning in the following order. Make sure that License Server is started and the licenses are installed.

1. The Sentinel Node
2. Start the Swarm Network node before starting any of the associated Swarm Learning nodes.
3. After the training is completed, stop all the containers using the script `stop-swarm` on all nodes.

The scripts in the `swarm-learning/scripts/bin` directory is used to start these components. To run the scripts, a bash shell and a Linux environment is required.

NOTE: The default directory where Swarm Learning is installed is `/opt/hpe/swarm-learning`. If the user has changed the default installation directory, all the run commands can be found in that location.

All start scripts take the following common options for configuring the Docker run command that is used to start the container.

NOTE: These options do not apply to the `swarm-learning/scripts/bin/stop-swarm` script. These options are similar to those of the Docker run command.

Parameter name	Description	Default value
<code>--hostname <name></code>	The host name assigned to the docker container.	<code>--name</code> , if it is specified. Otherwise, Docker assigns a host name.
<code>--name <name></code>	The name assigned to the docker container.	Docker assigns a random name to the container.
<code>--network <network name></code>	The docker network that the container should belong to.	Docker's default bridge network.

Table Continued



Parameter name	Description	Default value
<code>--pull</code>	Pull the docker image from its repository before running it.	False, the image is not pulled from its repository, if it is already available locally
<code>--sudo</code>	Prefix the Docker commands with "sudo".	False, if the current user belongs to the docker group; true otherwise.
<code>-d, --detach</code>	Run the container in the background.	A pseudo-terminal is allocated if the launcher has an associated terminal; otherwise, the container is run in the background
<code>-i, --interactive</code>	Keep STDIN open even if not attached to a terminal.	STDIN is kept open if a pseudo-terminal is allocated to the container; otherwise, it is closed.
<code>-t, --tty</code>	Allocate a pseudo-terminal for the container.	A pseudo-terminal is allocated if the launcher has an associated terminal; otherwise, the container is run in the background.
<code>-e, --env var=val</code>	Set an environment variable inside the container.	
<code>-l, --label key=val</code>	Set metadata on a container.	
<code>-p, --publish host-port:container-port</code>	Publish a container port to the host.	
<code>-u, --user { name uid } [: { group gid }]</code>	User and group ID to use inside the container.	
<code>-v, --volume host-path:container-path</code>	Bind mount a volume.	
<code>-w, --workdir container-path</code>	Working directory inside the container.	
<code>--dns</code>	The IP address of the custom DNS server. If there are more than one custom DNS servers, then for each DNS, repeat the same argument with different IP address.	
<code>--rm</code>	Request Docker to automatically remove the container when it exits.	
<code>-h, --help</code>	This (helpful) message.	
<code>--primary-apls-ip <IP address or DNS name></code>	The IP address on which the primary Autopass License Server is serving license requests.	None

Table Continued

Parameter name	Description	Default value
<code>--secondary-apls-ip <IP address or DNS name></code>	The IP address on which the secondary Autopass License Server is serving license requests.	None
<code>--primary-apls-port <port number></code>	The port number on which the primary Autopass License Server is serving license requests.	5814
<code>--secondary-apls-port <port number></code>	The port number on which the secondary Autopass License Server is serving license requests.	The value assigned to <code>--primary-apls-port</code>
<code>--apls-pdf <path to license PD file></code>	The path to the license PD file to be used.	None
<code>--cacert <path to certificates file></code>	The path to the file containing the list of CA certificates.	None
<code>--capath <path to certificates directory></code>	The path to the directory containing CA certificate files.	None
<code>--cert <path to certificate file></code>	The path to the certificate file that provides the component's ID.	None
<code>--key <path to key file></code>	The path to the private key file corresponding to the certificate.	None
<code>--socket-path <SPIFFE Workload API socket></code>	Path, volume or container hosting the socket on which the SPIFFE Agent serves the Workload API.	None
<code>--host-ip <IP address or DNS name></code> (Mandatory parameter)	The IP address or DNS name of the host system on which this Swarm Learning node is created.	
<code>--sn-ip <IP address or DNS name></code>	The IP address or DNS name of the host system on which the Swarm Network (SN) node with which this Swarm Learning node must associate, is running.	
<code>--sn-api-port <port number></code>	Host port for the API Server of the associated Swarm Network node	30304
<code>--sn-api-service <fqdn>:<port number></code>	Fully Qualified Domain Name for the SN API Service of associated SN node. Here, Port number is optional.	
<code>--sl-fs-port <port number></code>	Host port for this Swarm Learning node's File Server.	30305
<code>--sl-fs-service <fqdn>:<port number></code>	Fully Qualified Domain Name and optional port for this Swarm Learning node's file service.	

User machine learning container parameters

Parameter name	Description	Default value
<code>--ml-image <ML image name></code> (Optional parameter)	Name of the User's Machine Learning image.	
<code>--ml-entrypoint <entrypoint></code> (Optional parameter)	Entry point to the Machine Learning container.	
<code>--ml-cmd <command></code> (Optional parameter)	Command to the Machine Learning container.	
<code>--ml-w <directory path></code> (Optional parameter)	Working directory of the Machine Learning container.	
<code>--ml-name <container name></code> (Optional parameter)	Name of the Machine Learning container.	
<code>--ml-v <host-path:container-path></code> (Optional parameter)	Bind mount a volume for the Machine Learning container.	
<code>--ml-e <environmental-variable-name=value></code> (Optional parameter)	To pass environmental variable to the Machine Learning container.	
<code>--ml-user <uid:gid> -</code> (Optional parameter)	<p>The access privilege with which the ML container needs to be spawned on the host.</p> <p>If <code>--ml-user</code> is not provided, then ML container would be spawned with current host user's <code>uid:gid</code>.</p> <p>If only <code>uid</code> of the host user is provided, then ML container would be spawned with specified host user's <code>uid</code> and primary <code>gid</code>.</p> <p>If <code>uid:gid</code> of the host user is provided, then ML container would be spawned with specified host user's <code>uid:gid</code>.</p>	
For AMD GPUs, one may need to use the following parameters:	For more information, see https://developer.amd.com/resources/rocm-learning-center/deep-learning/ .	

Table Continued

Parameter name	Description	Default value
<code>--ml-device</code>	Expose host devices to the container, as a list of strings.	None
<code>--ml-ipc</code>	Sets the IPC mode for the container.	None
<code>--ml-shm-size</code>	Size of <code>/dev/shm</code> (for example, 1G).	None
<code>--ml-group-add</code>	List of additional group names and/or IDs that the container process will run as.	None
<code>--ml-cap-add</code>	Add kernel capabilities.	None
<code>--ml-security-opt</code>	A list of string values to customize labels for MLS systems, such as SELinux.	None
<code>--ml-privileged</code>	Provides extended privileges to this container.	None

Starting Sentinel node

Use the `swarm-learning/scripts/bin/run-sn` script to start Sentinel and Swarm Network (SN) nodes. This script accepts the following parameters:

Parameter name	Description	Default value
<code>--host-ip <IP address or DNS name></code>	The IP address or DNS name of the host system on which this Swarm Network node is created.	None
<code>--sentinel</code>	<p>If this flag is passed, this node does the Blockchain initialization and make configuration information ready to be shared with other SN nodes. Also it does not expect sentinel node IP to be passed.</p> <p>If this flag is not passed this node is a regular SN node and needs a sentinel node IP for initialization.</p>	
<code>--sentinel-ip <IP address or DNS name></code>	Any running SN node's host IP address or DNS name can be passed as a value. If this parameter is not specified, this Swarm Network node makes itself as the sentinel.	None
<code>--sn-api-port <port number></code>	The host port for this Swarm Network node's API Server.	None
<code>--sn-api-service <fqdn>:<port number></code>	Fully Qualified Domain Name for the SN API Service of associated SN node. Here, Port number is optional.	

Table Continued

Parameter name	Description	Default value
<code>--sn-p2p-port <port number></code>	The host port for this Swarm Network node's P2P communications.	None
<code>--sn-p2p-service <fqdn>:<port number></code>	Fully Qualified Domain Name for the SN P2P Service of associated SN node. Here, Port number is optional.	
<code>-v \<blockchain path on host machine>\>:/platform/swarm/SMLNODE</code>	The host path where user wants to persist blockchain across SN restart.	By default, Blockchain data will not be preserved over SN restart.

Starting Swarm Learning node

Use the `swarm-learning/scripts/bin/run-sl` script to start a Swarm Learning (SL) node. This script accepts the following parameters:

NOTE:

- This script starts only one Swarm Learning node at a time. To launch multiple Swarm Learning nodes, you must invoke this script as many times as desired and on appropriate host systems.
- HPE recommends to use SWOP to automatically launch SL and ML nodes, which is a preferred way. For more information on launching, *HPE Swarm Learning User Guide*.

Parameter name	Description	Default value
<code>--host-ip <IP address or DNS name></code>	The IP address or DNS name of the host system on which this Swarm Network node is created.	None
<code>--sn-ip <IP address or DNS name></code>	The IP address or DNS name of the host system on which the Swarm Network node with which this Swarm Learning node must associate, while running.	None
<code>--sn-api-port <port number></code>	The host port for this Swarm Network node's API Server.	None
<code>--sn-api-service <fqdn>:<port number></code>	Fully Qualified Domain Name for the SN API Service of associated SN node. Here, Port number is optional.	
<code>--sn-docker-name <container name></code>	Docker container name for the associated Swarm Network node.	None
<code>--sl-fs-port</code>	The host port for this Swarm Learning node's File Server.	None
<code>--sl-fs-service <fqdn>:<port number></code>	Fully Qualified Domain Name and optional port for this Swarm Learning node's file service.	

Starting SWCI nodes

Use the `swarm-learning/scripts/bin/run-swci` to launch SWCI. The SWCI command prompt is displayed when the launch is successful. You can enter any command from a pre-defined set of commands. It supports a list of well-defined commands that are self-explanatory. There is a built-in online help, that lists all supported commands and further one can drill down and see help for each command.

```
SWCI:2 > help HELP
HELP [command:string]
Help without parameter lists all supported commands.
Help with command name show help content for the specified command.
SWCI:3 >
```

NOTE: You must launch the SWCI node after the SN nodes are started.

The run-swci script accepts the following parameters:

Parameter		Default value
<code>--usr-dir <dir></code>	The host directory that must be used as the user directory by this SWCI node.	None
<code>--init-script-name <swci-init file></code>	Name of the SWCI script file. This file must be located inside the user directory at the top level.	swci-init

NOTE:

- If you need to use the `swci-init` script file as-is (default), `--usr-dir` option must be specified and SWCI looks for this default script file under this user directory.
- If you want to run a script file with a different filename, you must explicitly specify the `--init-script-name` and `--usr-dir`.
- If the `--usr-dir` is not specified, the SWCI runs in an interactive mode.

Starting SWOP nodes

Use the `swarm-learning/scripts/bin/run-swop` script to start SWOP nodes. This script accepts the following parameters:

Parameter name	Description	Default value
<code>--usr-dir <dir></code> (Mandatory Parameter)	Host directory that should be used as the user directory by this SWOP node.	
<code>--profile-file-name <swop-profile file></code> (Mandatory Parameter)	This file should be located inside the user directory, at the top-level itself.	

Table Continued

Parameter name	Description	Default value
<code>--sn-ip <IP address or DNS name></code>	The IP address or DNS name of the host system with which this SWOP node must associate with the corresponding Swarm Network node.	None
<code>--sn-api-port <port number></code>	The host port for this Swarm Network node's API Server.	None
<code>--sn-api-service <fqdn>:<port number></code>	Fully Qualified Domain Name for the SN API Service of associated SN node. Here, Port number is optional.	None

Stopping Swarm Learning node

Use the `swarm-learning/scripts/bin/stop-swarm` script to stop all Swarm Network and Swarm Learning nodes that are running on a host system.

NOTE: This script does not operate across systems. It must be invoked on each host system to stop the Swarm Learning platform completely.

This script accepts the following parameters:

Parameter name	Description	Default value
<code>--all</code>	This parameter stops all components, SL, SN, SWCI, and SWOP.	None
<code>--sl</code>	This parameter stops Swarm Learning nodes.	None
<code>--sn</code>	This parameter stops Swarm Network nodes.	None
<code>--swci</code>	This parameter stops SWCI nodes.	None
<code>--swop</code>	This parameter stops SWOP nodes.	None
<code>--keep</code>	<p>This parameter keep stopped containers - they are removed by default.</p> <p>This parameter is optional. When it is specified, the containers are stopped but not removed. In this case, the Log output from the containers are still available after the script has run. The leftover containers can be removed, either manually or by invoking this script again without the <code>--keep</code> parameter.</p>	None
<code>--sudo</code>	This parameter specifies that <code>sudo</code> must be used when invoking Docker to stop or remove the Swarm Learning nodes.	None

Uninstalling the Swarm Learning package

Use the `swarm-learning/scripts/bin/uninstall` script to uninstall the Swarm Learning package. This script does not accept command line parameters. It should be run on every node where Swarm Learning package is installed.

On the host where it is run, the script stops all Swarm Learning components removes the docker container images, and deletes the "docs", "examples", and the "scripts" directories installed under `swarm-learning`.

CAUTION:

- This command deletes all user created artifacts under the "examples" directory.
 - If needed, any log output produced by the containers must be saved before invoking the script. Logs are not available after the script is executed.
 - Also, the output files that have been written under the "examples" directory by previous runs may need to be saved.
-

Running Swarm with Podman

- Install podman-base package `podman`.
- Install `podman-docker` package from system package manager. This package maps docker commands to respective podman commands.
- Enable `podman.socket`. It can be root or rootless. For more information on setting rootless podman socket, see [**https://docs.podman.io/en/latest/markdown/podman-system-service.1.html**](https://docs.podman.io/en/latest/markdown/podman-system-service.1.html).



Running Swarm with SE Linux



TIP: User must consult their system administrator before running Swarm with SE Linux in their system or doing any security related changes on the system.

When SE Linux is enabled, it restricts access to various system resources. Before starting Swarm, user must apply appropriate security context labels to `workspace`. For more information, see *Platform specific SE Linux guide*.

To get access to various system resources, user needs to apply `svirt_sandbox_file_t` security context label to `workspace_path` using the `chcon` command.

```
chcon -Rt svirt_sandbox_file_t <workspace_path>
```

For more information, see [**docker_selinux_security_policy**](#).

SN changes to support SE Linux

For SE Linux environment, `workspace` label set by `chcon` are sufficient.

SWOP changes to support SE Linux

SWOP needs access to host podman socket which is restricted by default. To get access to host podman socket, user needs to pass the following parameter in `run-swop` script:

```
--docker-socket-file="<podman socket path>"  
--security-opt=label=type:container_runtime_t
```

- `docker-socket-file` parameter exposes `podman.socket` to SWOP container; and
- `container_runtime_t` label allows the container to interact with the `container.runtime` and access the socket.

NOTE: Paths in SWOP profile need to be labeled accordingly.

SL or ML changes to support SE Linux

For SE Linux environment, `workspace` label set by `chcon` are sufficient.

Configuring Swarm Learning

This chapter provides information about various configurations involved in the Swarm Learning.

IP address of host systems

The `--host-ip` and `slhostip` IP addresses in the run scripts and the SWOP profile are the IP addresses of the host machine, where the respective containers are running on the host machine. Based on access, user can even use the FQDN of the host system.

By default, Swarm Learning framework uses a Docker bridge network. For improved isolation, users can even use a user-defined bridge network.

While using the user-defined bridge network, the options `--ip` and `ip` field of `slnetworkopts` in SWOP profile are the IP addresses of the container themselves. This case is specific to the reverse proxy examples or scenarios where user wants to use the fixed IP addresses for containers.

Exposed port numbers

Depending on the type of Swarm Learning components that are running on a host, some or all these ports must be opened to allow the Swarm Learning containers to communicate with each other:

- A Swarm Network peer-to-peer port on the hosts running Swarm Network nodes. By default, port 30303 is used.
- A Swarm Network API server port on the hosts running Swarm Network nodes. By default, port 30304 is used.
- Swarm Learning file server port on the hosts running Swarm Learning nodes. By default, port 30305 is used.
- A License Server API port on the host running the License Server. By default, port 5814 is used.
- (Optional). An SWCI API server port that is used by the SWCI node to run a REST based API service. By default, port 30306 is used.

NOTE:

1. If you use different ports other than the default port, you must open those ports accordingly. For instance, in our MNIST example, we are using ports 16000 and 18000 for the SL File server ports, which must be opened.
 2. If you use a reverse proxy, you need to open only the SN peer-to-peer port (30303) for each SN node.
-

Environment variables

The environment variables are passed to containers or added to the environment variable through profile or configuration files. The following environment variables are available to set and modify:

Environment variable name	Description
SWARM_LOOPBACK	<p>Used to bypass Swarm Learning to help you quickly develop, integrate, and test your model code with Swarm Learning package.</p> <p>If SWARM_LOOPBACK is set to 'True', then all Swarm functionality will be bypassed, except parameter validation.</p> <p>This can help you to verify and test integration of the model code with Swarm without spawning any Swarm Learning containers.</p>
LOGS_DIR	Sets the directory for Swarm components log, it is set usually by Docker file.
USR_DIR	Sets the directory for Swarm components, it is set usually by Docker file.
SN_ETH_PORT_EXT	Sets an Ethernet port for Swarm Network node.
SN_I_AM_SENTINEL	<p>Sets a Swarm Network node to become the Sentinel node, only when it is set to true.</p> <p>Default value: False</p>
SN_START_MINING	<p>Starts mining on non-sentinel nodes. (Optional)</p> <p>Default value: False</p>
SL_MAKE_ME_ADMIN	<p>Determines whether an SL node can participate in leader election or not.</p> <p>Default value: True</p> <p>If SL_MAKE_ME_ADMIN is set to 'False', the corresponding SL node will not participate in leader election. If user doesn't want to make a slow node (with less compute power, network band width etc) as a leader, then this can be set to 'False'.</p>
SL_LEADER_FAILURE_BASE_TIMEOUT	<p>Sets the minimum timeout value (in seconds). If Swarm merging does not happen within this timeout, a new SL leader node is selected. The swarm training continues to run, regardless of SL leader node failures. This timeout will kickin after <code>min_peers</code> nodes have completed their local training.</p> <p>Default value: 120 seconds</p> <p>This variable may need tunning depending on the ML application complexity.</p>

Table Continued

Environment variable name	Description
SL_WAIT_FOR_FULL_QUORUM_SECONDS	<p>Sets the maximum time for an SL leader node to wait for full quorum after minPeers are ready for merge. This parameter lets you to maximize the number of peers participating in the merge process.</p> <p>Default value: 30 secs</p>
SL_RAM_INTENSIVE	<p>Optimizes the usage of RAM in the SL leader node for coordinate and geometric median merge methods. Unlike mean merge method, coordinate and geometric median merge methods involve memory intensive operations. If SL Leader node has limited hardware (RAM) configuration, then merging the intermediate model parameters using the median methods can result in memory issues. For such scenarios, user can set up the SL_RAM_INTENSIVE flag to 'False' for merging the model parameters layer by layer. This 'False' option is based on I/O operations and is time consuming, hence the default option is set to 'True'.</p> <p>User can pass this parameter in slenvvars option within SWOP profile. This option can be different for each SL node depending on its hardware capacity.</p> <p>Example: 'slenvvars : [SL_RAM_INTENSIVE : False]'</p> <p>Default value: True</p>
SWCI_TASK_MAX_WAIT_TIME	<p>Specifies a maximum timeout value for the completion of a task. This value must be set in minutes, and the default is 120 mins (2 hours).</p>
SWCI_MODE	<p>Enables SWCIs web interface instead of command line interface. Allowed values are CLI and WEB.</p> <p>Default value: CLI</p>
SWCI_STARTUP_SCRIPT	<p>This is a default start script of SWCI.</p>
SWCI_WEB_PORT	<p>Port on which SWCI API server listens when run in WEB mode.</p> <p>Default value: 30306</p>
SWOP_PROFILE	<p>Indicates default profile for SWOP.</p>
SWOP_KEEP_CONTAINERS	<p>SL, ML pair containers and host volumes created by SWOP are not removed. This option can be enabled to retain the stopped containers for debugging.</p> <p>Default value: False</p>
SWARM_ID_CACERT	<p>Indicates user CA certificates file.</p>
SWARM_ID_CAPATH	<p>Indicates user CA certificates directory.</p>
SWARM_ID_CERT	<p>Indicates user certificates file.</p>

Table Continued



Environment variable name	Description
SWARM_ID_KEY	Indicates user SSH key file.
SWARM_SPIFFE_WORKLOAD_API_SOCKET_PATH	Used for acquiring a SPIFFE identity. It points to the UNIX domain socket on which the SPIFFE agent is serving the SPIFFE workload API. For more information, https://spiffe.io/ .

GNU General Public License

This product includes code licensed under the GNU General Public License, the GNU Lesser General Public License, and/or certain other open source licenses. A complete machine-readable copy of the source code corresponding to such code is available upon request. This offer is valid to anyone in receipt of this information and shall expire three years following the date of the final distribution of this product version by Hewlett Packard Enterprise Company. To obtain such source code, send a check or money order in the amount of US \$10.00 to:

Hewlett Packard Enterprise Company

Attn: General Counsel

1701 E Mossy Oaks Rd

Spring, TX 77389

U.S.A.

Support and other resources

Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:
<https://www.hpe.com/info/assistance>
- To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:
<https://www.hpe.com/support/hpesc>

Information to collect

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

Accessing updates

- Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.
- To download product updates:

Hewlett Packard Enterprise Support Center

<https://www.hpe.com/support/hpesc>

My HPE Software Center

<https://www.hpe.com/software/hpesoftwarecenter>

- To subscribe to eNewsletters and alerts:
<https://www.hpe.com/support/e-updates>
- To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center **More Information on Access to Support Materials** page:

<https://www.hpe.com/support/AccessToSupportMaterials>

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- ❗ **IMPORTANT:** Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HPE Account set up with relevant entitlements.
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Remote support

Remote support is available with supported devices as part of your warranty or contractual support agreement. It provides intelligent event diagnosis, and automatic, secure submission of hardware event notifications to Hewlett Packard Enterprise, which initiates a fast and accurate resolution based on the service level of your product. Hewlett Packard Enterprise strongly recommends that you register your device for remote support.

If your product includes additional remote support details, use search to locate that information.

HPE Get Connected

<https://www.hpe.com/services/getconnected>

HPE Tech Care Service

<https://www.hpe.com/services/techcare>

HPE Complete Care

<https://www.hpe.com/services/completecure>

Customer self repair

Hewlett Packard Enterprise customer self repair (CSR) programs allow you to repair your product. If a CSR part needs to be replaced, it will be shipped directly to you so that you can install it at your convenience. Some parts do not qualify for CSR.

For more information about CSR, contact your local service provider.

Warranty information

To view the warranty information for your product, see the [warranty check tool](#).

Regulatory information

To view the regulatory information for your product, view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at the Hewlett Packard Enterprise Support Center:

<https://www.hpe.com/support/Safety-Compliance-EnterpriseProducts>

Additional regulatory information

Hewlett Packard Enterprise is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements such as REACH (Regulation EC No 1907/2006 of the European Parliament and the Council). A chemical information report for this product can be found at:

<https://www.hpe.com/info/reach>

For Hewlett Packard Enterprise product environmental and safety information and compliance data, including RoHS and REACH, see:

<https://www.hpe.com/info/ecodata>

For Hewlett Packard Enterprise environmental information, including company programs, product recycling, and energy efficiency, see:

<https://www.hpe.com/info/environment>

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