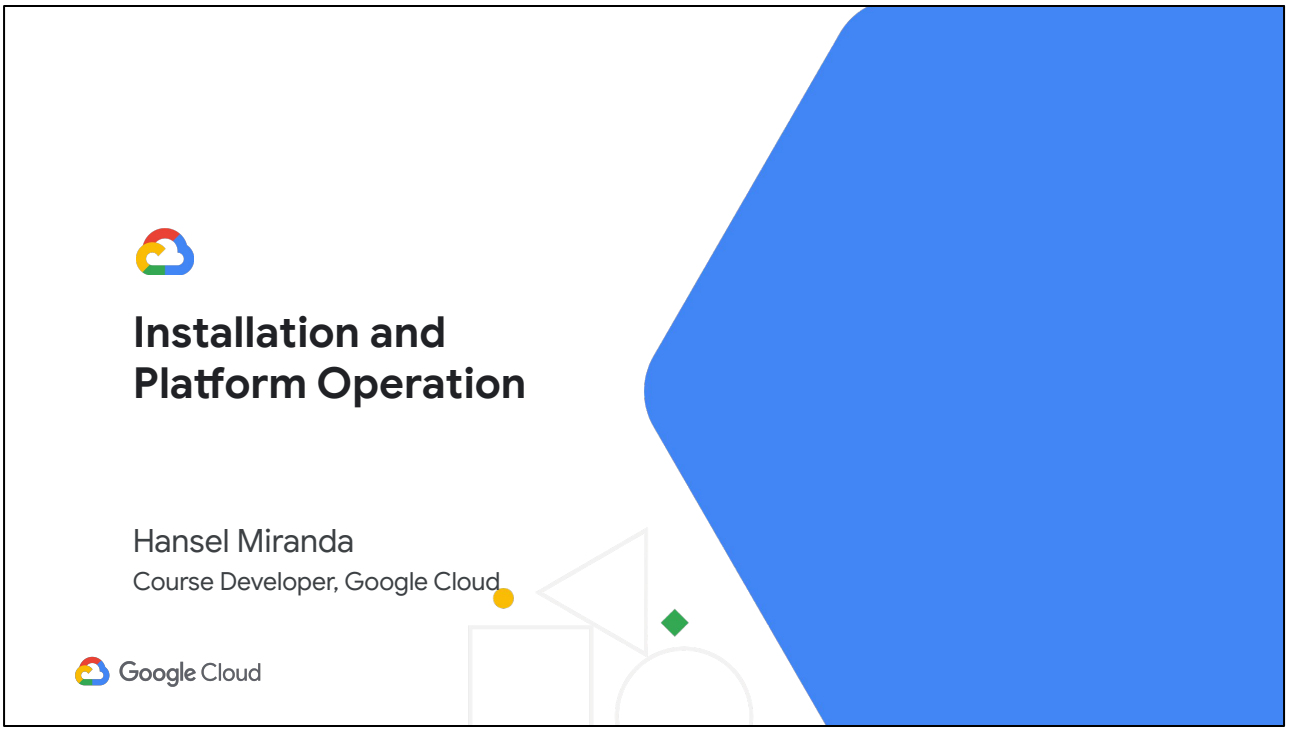


In this module, you will learn the hybrid installation process and complete a lab to install Apigee hybrid on Google Kubernetes Engine.

You will also learn about the tools to manage the hybrid runtime components and configure your cluster resources.

We will also discuss the process to backup and restore your hybrid runtime data.

Agenda

Installation Process

Lab

Platform Operation

Backup and Restore

Google Cloud

Let’s start with the installation process. This process guides you through the high-level steps needed to install the Apigee hybrid runtime plane.

In this lecture, we will review these steps and the contents of the hybrid software distribution package.

We will also discuss the strategy used to configure the hybrid runtime plane.

Process overview

To install Apigee hybrid, you will generally follow the steps below:

- Set up your Google Cloud account, project, and organization.
- Enable APIs and create an Apigee organization, environment group, and environment.
- Download apigeectl, the hybrid software package to be installed.
- Calculate the approximate size of the Kubernetes clusters, and create and configure them.
- For each cluster, create an overrides.yaml file with your hybrid-specific configuration.
- Apply the configuration.
- Create a simple API proxy to verify operation.

Google Cloud

The process to install Apigee hybrid is as follows:

- Set up your Google cloud account, project, and organization.
- Enable relevant APIs and create an Apigee organization, environment group, and environment.
- Download apigeectl, the hybrid software package for the version you plan to install.
- Determine the size of your Kubernetes clusters based on your API proxy workload and performance requirements,and then create the clusters.
- The hybrid software includes configuration for most resources deployed in a cluster. You use an overrides file to override some of the configuration and provide any required properties.
- The configuration specified in this file is then applied to your hybrid clusters.
- When all the hybrid services are running, deploy a simple API proxy to verify the installation.

Distribution

The Apigee hybrid distribution is hosted by Google Cloud and publicly available.

- The current version of the distribution is maintained in a text file and available on Google Cloud.

  Location of the current version of the text file:

  https://storage.googleapis.com/apigee-release/hybrid/apigee-hybrid-setup/current-version.txt?ignoreCache=1

- Location of the current version of the hybrid distribution:

  https://storage.googleapis.com/apigee-release/hybrid/apigee-hybrid-setup/<version>/apigeectl_<platform>_<bit>.tar.gz

version: the value from the current-version.txt file. Example: 1.2.0

platform: mac or linux

bit: 32 or 64

Google Cloud

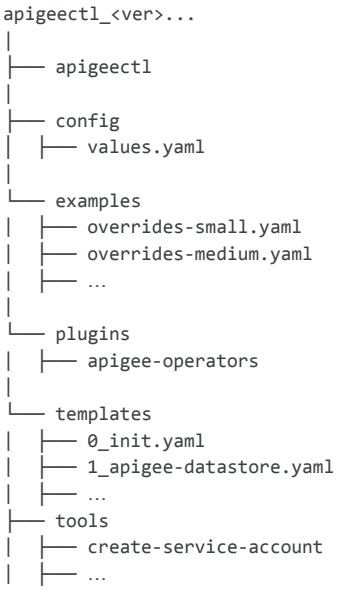
You download the current or a specific version of the hybrid software distribution from a public storage location on Google Cloud.

The location URL contains the version number of the distribution and the platform on which you plan to install hybrid.

You can get the list of version numbers from the Apigee hybrid release website at docs.apigee.com/release.

Package structure

The Apigee hybrid distribution package uses the file structure shown.



Google Cloud

The hybrid distribution package contains a top-level directory with a name that begins with apigeectl, followed by the version and platform.

Lets review the contents of this directory...

Directory contents

Path	Purpose
apigeectl	Command-line interface (CLI) for installing and managing hybrid in a Kubernetes cluster.

Google Cloud

apigeectl is a command-line executable that is used to install and manage Apigee hybrid in a Kubernetes cluster.

apigeectl is a wrapper for kubectl, which is a tool that lets you manage Kubernetes clusters. You must have kubectl installed and set up on your Kubernetes administration machine to use the apigeectl command.

We will discuss the usage of apigeectl later in this module.

Directory contents

Path	Purpose
apigeectl	Command-line interface (CLI) for installing and managing hybrid in a Kubernetes cluster.
/config	Contains **deployment spec** configuration for the runtime plane with primary default config values.yaml that will be overridden by local configurations (or accepted as defaults).

Google Cloud

The config subdirectory contains the deployment specification of the Apigee hybrid runtime resources, and their configuration in YAML file format.

For example, this file contains the replicaCountMin and replicaCountMax properties of the runtime message processor component installed in your cluster.

You usually override some of these configuration properties in separate files when installing and configuring Apigee hybrid.

Directory contents

Path	Purpose
apigeectl	Command-line interface (CLI) for installing and managing hybrid in a Kubernetes cluster.
/config	Contains **deployment spec** configuration for the runtime plane with primary default config values.yaml that will be overridden by local configurations (or accepted as defaults).
/examples	Examples of overrides.yaml files for **small, medium, and large deployments** that override certain properties in the *values.yaml* spec and are used as jumpstart configurations.

Google Cloud

The examples subdirectory contains sample override.yaml files for small-, medium-, and large-sized deployments of Apigee hybrid.

These files can be used as initial configurations for your type of deployment and should be updated as the requirements of your hybrid deployment change over time.

The directory also contains a sample private overrides.yaml file that is used for hybrid runtime images from a different repository.

Directory contents

Path	Purpose
apigeectl	Command-line interface (CLI) for installing and managing hybrid in a Kubernetes cluster.
/config	Contains **deployment spec** configuration for the runtime plane with primary default config values.yaml that will be overridden by local configurations (or accepted as defaults).
/examples	Examples of overrides.yaml files for **small, medium, and large deployments** that override certain properties in the *values.yaml* spec and are used as jumpstart configurations.
/plugins	Contains runtime initialization components for apigee deployments, Istio ingress gateway, etc.

Google Cloud

The plugins subdirectory contains deployment specifications for Apigee hybrid system components that are installed in the cluster.

This includes the apigee-operators, apigee-resources, and apigee-envoyfilter configuration files.

These system components manage the creation and release of hybrid components in the cluster, provide certificate management for hybrid components, and customize the Istio ingress gateway configuration.

Directory contents

Path	Purpose
apigeectl	Command-line interface (CLI) for installing and managing hybrid in a Kubernetes cluster.
/config	Contains **deployment spec** configuration for the runtime plane with primary default config values.yaml that will be overridden by local configurations (or accepted as defaults).
/examples	Examples of overrides.yaml files for **small, medium, and large deployments** that override certain properties in the *values.yaml* spec and are used as jumpstart configurations.
/plugins	Contains runtime initialization components for apigee deployments, Istio, etc.
/templates	Hybrid **configuration templates** that define runtime service components like MP, MART, Synchronizer, and Cassandra, which are merged into the values.yaml file by apigeectl.

Google Cloud

The templates subdirectory contains template deployment specifications for the hybrid runtime components.

These templates are used to generate the values of the configuration properties for each component during installation of the hybrid runtime plane.

The hybrid runtime component configuration is organized into template files based on their scope of operation: organization, environment, and cluster.

Directory contents

Path	Purpose
apigeectl	Command-line interface (CLI) for installing and managing hybrid in a Kubernetes cluster.
/config	Contains **deployment spec** configuration for the runtime plane with primary default config values.yaml that will be overridden by local configurations (or accepted as defaults).
/examples	Examples of overrides.yaml files for **small, medium, and large deployments** that override certain properties in the *values.yaml* spec and are used as jumpstart configurations.
/plugins	Contains runtime initialization components for apigee deployments, Istio, etc.
/templates	Hybrid **configuration templates** that define runtime service components like MP, MART, Synchronizer, and Cassandra, which are merged into the values.yaml file by apigeectl.
/tools	Contains the *create-service-account* and other tools used for hybrid **management tasks.**

Google Cloud

The tools subdirectory contains the create-service-account tool that is used to create various Google Cloud service accounts.

These service accounts are used by the runtime components to securely access the Apigee hybrid management plane and Google Cloud services.

Other tools included in this directory enable you to pull and push runtime images to a user defined repository, clean up cassandra pods, and dump pod logs from your Kubernetes cluster.

Setup

The recommended setup tasks to install Apigee hybrid:

1. Create the Kubernetes cluster.

Google Cloud

After you download the hybrid software distribution, follow these steps to install the runtime plane:

First, based on your sizing requirements, create the cluster on your Kubernetes platform.

Setup

The recommended setup tasks to install Apigee hybrid:

1. Create the Kubernetes cluster.
2. Install cert-manager in the cluster.

Google Cloud

Apigee hybrid uses cert-manager to manage certificates used by the various components in the runtime plane.

Cert-manager is a native Kubernetes certificate management controller that helps with issuing and renewing of certificates.

You install cert-manager from a GitHub repository using the kubectl apply command.

Setup

The recommended setup tasks to install Apigee hybrid:

1. Create the Kubernetes cluster.
2. Install cert-manager in the cluster.
3. Install Anthos Service Mesh (ASM) in the cluster.

Google Cloud

Apigee hybrid uses Anthos Service Mesh to provide the Istio ingress gateway connectivity for your hybrid runtime plane.

Anthos Service Mesh is a suite of tools that helps you monitor and manage a reliable service mesh on-premises or on Google Cloud.

Apigee hybrid uses the Istio distribution provided with Anthos Service Mesh.

Setup

The recommended setup tasks to install Apigee hybrid:

1. Create the Kubernetes cluster.
2. Install cert-manager in the cluster.
3. Install Anthos Service Mesh (ASM) in the cluster.
4. Download and unpack the distribution package to a suitable directory on your machine:

   apigeectl_<platform>_<bit>.tar.gz → ${HOME}/apigee/apigeectl.<ver>

Google Cloud

Next, unpack the hybrid software distribution in a suitable directory on your administration machine.

In the example shown, the distribution is unpacked in the apigee directory under the user's home directory.

Setup

The recommended setup tasks to install Apigee hybrid:

1. Create the Kubernetes cluster.
2. Install cert-manager in the cluster.
3. Install Anthos Service Mesh (ASM) in the cluster.
4. Download and unpack the distribution package to a suitable directory on your machine:

   apigeectl_<platform>_<bit>.tar.gz → ${HOME}/apigee/apigeectl.<ver>
5. Add environment variables to your shell.

Google Cloud

Set up shell environment variables for your Google Cloud project ID, region, zone, hybrid organization, etc.

These variables are used for cluster authentication and to run other hybrid installation commands.

Setup

The recommended setup tasks to install Apigee hybrid:

6. Create a directory structure for certificates, service accounts, and override files.
   ```
   $mkdir ${HOME}/apigee/hybrid-files
   ```

Google Cloud

Next, set up your administration machine with a recommended directory structure on the file system.

Create a subdirectory named hybrid-files under the HOME/apigee directory. You can give the directory any name you want.

This is used to store files for TLS certificates, service accounts, override configuration, and hybrid tools, which are all used in the hybrid runtime installation process.

Setup

The recommended setup tasks to install Apigee hybrid:

6. Create a directory structure for certificates, service accounts, and override files.
   $mkdir ${HOME}/apigee/hybrid-files
7. Create symbolic links to point to the distribution sub-directories like tools and config.

Google Cloud

Create symbolic links to the tools, config, templates, and plugins subdirectories from within the hybrid-files directory.

These links enable you to run the apigeectl command line tool from there.

Setup

The recommended setup tasks to install Apigee hybrid:

6. Create a directory structure for certificates, service accounts, and override files.
   $mkdir ${HOME}/apigee/hybrid-files
7. Create symbolic links to point to the distribution sub-directories like tools and config.
8. Create the necessary certificates, keys, and service accounts.

Google Cloud

A TLS certificate and key are needed for the runtime ingress gateway that handles API proxy traffic. For trial installations of Apigee hybrid, you can use a self-signed certificate.

Components in the hybrid runtime plane use Google Cloud service accounts to communicate with the management plane and with other Google Cloud services.

You can create these service accounts by using the create-service-account tool that is included in the Apigee hybrid distribution package.

Setup

The recommended setup tasks to install Apigee hybrid:

6. Create a directory structure for certificates, service accounts, and override files.
   `$mkdir ${HOME}/apigee/hybrid-files`
7. Create symbolic links to point to the distribution sub-directories like tools and config.
8. Create the necessary certificates, keys, and service accounts.
9. Create an overrides file to configure the cluster.

Google Cloud

The Apigee hybrid installer: apigeectl uses defaults for most cluster configuration settings for the hybrid runtime plane components.

However, a few settings do not have defaults, and you can override others.

You provide values for these settings in an overrides.yaml configuration file.

You can use one of the sample overrides.yaml files provided in the hybrid distribution as a starting point for your cluster configuration.

The overrides.yaml file is usually created in a subdirectory named “overrides” in the hybrid-files directory.

Setup

The recommended setup tasks to install Apigee hybrid:

6. Create a directory structure for certificates, service accounts, and override files.
   `$mkdir ${HOME}/apigee/hybrid-files`
7. Create symbolic links to point to the distribution sub-directories like tools and config.
8. Create the necessary certificates, keys, and service accounts.
9. Create an overrides file to configure the cluster.
10. Install the Apigee hybrid runtime.

Google Cloud

After the overrides.yaml file is created, run the apigeectl command from within the hybrid-files directory to install Apigee hybrid.

You first initialize the hybrid system namespaces by running the apigeectl init command. This installs the hybrid system components in the cluster.

After all the pods are running, you run the apigeectl apply command. The apply command installs the Apigee hybrid runtime components in your cluster.

You can use the apigeectl check-ready command to test whether all the pods in the cluster are ready.

Setup

The recommended setup tasks to install Apigee hybrid:

6. Create a directory structure for certificates, service accounts, and override files.
   `$mkdir ${HOME}/apigee/hybrid-files`
7. Create symbolic links to point to the distribution sub-directories like tools and config.
8. Create the necessary certificates, keys, and service accounts.
9. Create an overrides file to configure the cluster.
10. Install the Apigee hybrid runtime.
11. Enable synchronizer to authenticate against the management plane.

Google Cloud

Finally, you enable the required permissions for the synchronizer runtime component to authenticate against the hybrid management plane.

Overrides strategy

```
gcp:
  region: gcp-region
  projectID: gcp-project-id

k8sCluster:
  name: cluster-name
  region: cluster-region

org: org-name

instanceID: “unique-id”

virtualhosts:
  - name: env-group-name
    sslCertPath: ./certs/cert-name.pem
    sslKeyPath: ./certs/key-name.key

envs:
  - name: environment-name
    serviceAccountPaths:
      synchronizer: ./sa/sync-sa.json
      udca: ./sa/udca-sa.json
...
```

Sample overrides.yaml file fragment

Apigee's install tool (apigeectl) uses an overrides strategy:

- Default values are provided in the config/values.yaml file, which should never be directly edited.
- The default values can be overridden by configurations supplied by you in a yaml file called "overrides.yaml."
- There can be more than one "overrides" file. It is a best practice to version your override files in source control.
- Name your override files to convey the use case for which they are created.

For example: *"official-prod.yaml"* or "*experimental-dev.yaml*"

- Overrides may describe one or more components of a configuration or the entire configuration.

Google Cloud

When you install Apigee hybrid, you provide configuration properties that are used to configure hybrid components in your cluster.

The properties override the default values that come with the hybrid software distribution.

Using this strategy, you can have multiple override files that configure your cluster with different resource configurations, based on certain criteria. For example, you may have different config settings for a production cluster versus a non-production cluster.

You can also have separate override files where each file configures all the components needed for a single runtime environment in the cluster.

Override file versioning

- Over time, you will accumulate multiple versions of the apigee tools and changes to override files.
- It is a best practice to maintain versions of the tool and overrides files in source control.
- If rollbacks become necessary, you can apply the previous version of the files to your cluster.
- It is recommended that you test and practice your installation, upgrade, and rollback procedures before production installation.

Google Cloud

It is a best practice to maintain your override.yaml files in source control.

This allows versioning of your configuration and makes it easier to roll back to a previous version if needed.

Namespaces

Kubernetes Namespaces used by Apigee Hybrid

Namespace	Purpose
apigee	Contains runtime plane components like runtime, cassandra, and UCDA.
apigee-system	Used to deploy and maintain ApigeeDeployment (AD) resources and validate deployment configurations.
cert-manager	Provides PKI certificate management for runtime plane components.
default	Always present in Kubernetes; the namespace given to services if one isn't supplied.
istio-system	Services supplied by Istio, such as ingress gateways.

The Apigee hybrid installation process creates multiple namespaces in your Kubernetes cluster.

These namespaces logically group the runtime components by the type of functionality they provide.

The apigee-system, cert-manager, and istio-system namespaces contain system components needed for creating the hybrid workload components, for certificate management, and for the istio ingress gateway.

All of the hybrid workload components are deployed in the apigee namespace in your cluster.

Verifying the installation

To verify the installation, create a basic API proxy that tests the connectivity between the management plane, runtime plane components, and backend.

If you don't have your own test backend, consider *httpbin.org*.

The basic API proxy should cover the following use cases:

- API key verification
- Backend connectivity
- Quota and/or spike arrest

Verify the following in the management plane via the hybrid UI:

- Performance tab
- Trace
- Analytics

You can also verify the following in the Google Cloud Console:

- Log entries in Cloud Logging
- Metrics in Cloud Monitoring

Google Cloud

After Apigee hybrid is installed, you can verify that it is operating as expected.

Create a test environment in the hybrid UI and configure this environment in the hybrid runtime plane.

Then create or upload a simple API proxy using the hybrid UI and deploy it to the test environment.

This test API proxy can use a mock backend as the target of the API.

Send multiple requests to the API. You can use curl, Postman, or any REST client to generate HTTP requests.

Confirm that the API proxy is returning the expected response from the backend.

You can add API key verification or quota policies to the test API proxy to verify that the runtime datastore is functioning as expected. This will confirm that the MART, Message Processor, and Cassandra runtime components are functioning as expected.

In addition, you can start Trace sessions to debug your proxy and view Analytics in the hybrid UI.

Using the Google Cloud Console, you can view log messages to troubleshoot the hybrid runtime components and view metrics to track resource usage of the cluster components.

Agenda

Installation Process

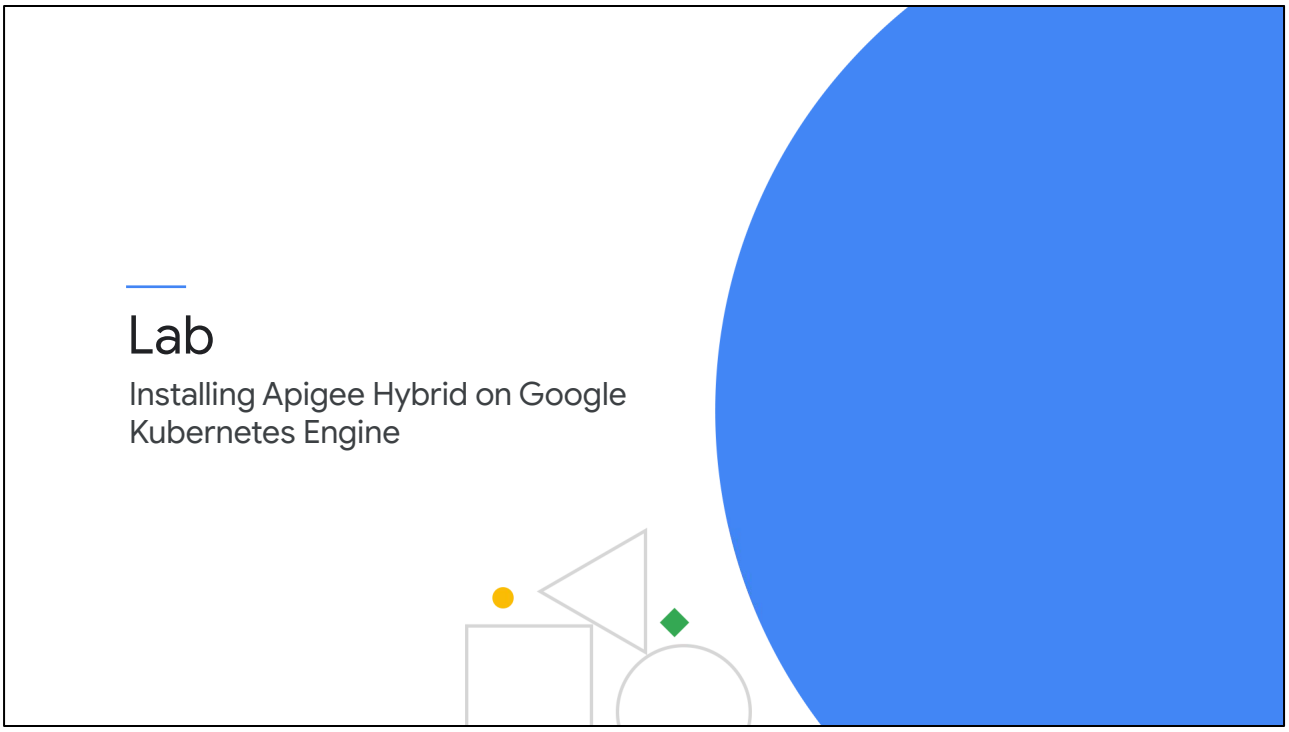
Lab

Platform Operation

Backup and Restore

Google Cloud

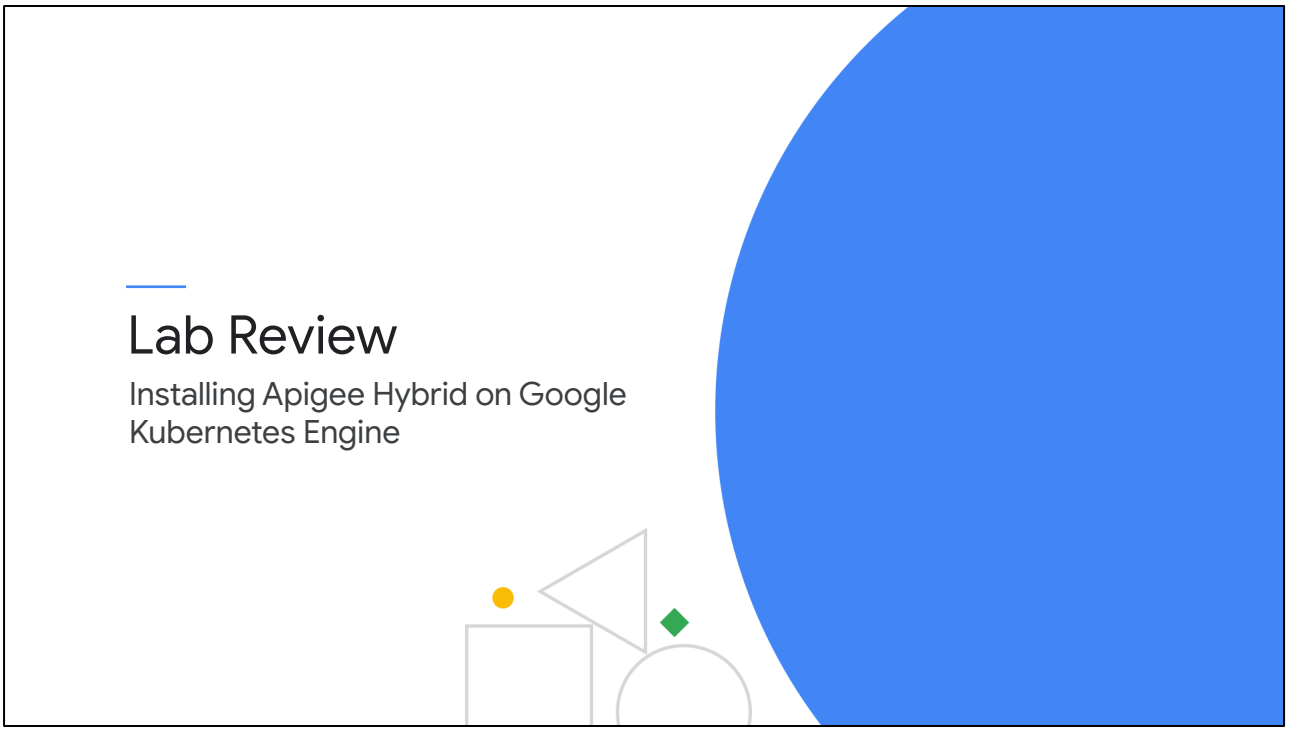
We will now do a lab: Installing Apigee Hybrid on Google Kubernetes Engine.



In this lab you install the Apigee hybrid runtime plane on Google Kubernetes Engine.

You use Cloud Shell in the Google Cloud Console to configure a 3-node Kubernetes cluster with the Apigee hybrid runtime services.

Using the hybrid management UI hosted in Google Cloud, you deploy a test API proxy to your runtime environment and validate the installation by sending a request to the proxy and verifying the response.



In this lab you installed the Apigee hybrid runtime plane on Google Kubernetes Engine.

You configured a Kubernetes cluster with the Apigee hybrid runtime services, using the apigeectl command line tool in Cloud Shell.

You created a test environment in the hybrid UI and configured it in the runtime plane.

You also validated the installation by deploying an API proxy to the test environment and verified that the proxy works as expected.

By completing this lab, you learned about the various components that are used in the cluster and the process to install Apigee hybrid.

Agenda

Installation Process

Lab

Platform Operation

Backup and Restore

Google Cloud

In this lecture we discuss the tools used to operate the Apigee hybrid runtime platform.

Using apigeectl

- apigeectl is a command-line interface (CLI) for installing and managing hybrid in a Kubernetes cluster. You must have kubectl installed and set up on your Kubernetes administration machine to use the apigeectl command.
- The tool is located at /apigeectl under the base installation directory of the hybrid distribution.
- Usage takes the format: `apigeectl [command] [flags]`

Command	Description
init	Initializes the hybrid cluster with prerequisite components like Apigee Operators and CRDs.
apply	Creates the Apigee hybrid **runtime** components in your Kubernetes cluster and/or applies configuration changes from the overrides.yaml file.
check-ready	Checks the **status** of the hybrid component pods. When all component pods are ready, the message "All containers ready" is output with an exit status of 0.
delete	Deletes hybrid components from the cluster.

For the full list of commands, see the apigeectl CLI reference

Google Cloud

The apigeectl executable is included in the distribution package and installed in your apigeectl directory.

You use this tool to initialize and configure your Kubernetes cluster with the hybrid runtime system components and workloads.

When running the tool, provide the command name and any optional flags on the command line.

The command specifies the operation you want to perform, for example: init, apply, or check-ready. Flags specify command parameters.

To initialize the cluster with the hybrid system components, use the init command.

You use the apply command to apply your configuration and install the Apigee hybrid workloads into the cluster.

The check-ready command can be used to check whether all of the components in the cluster are running.

The complete list of commands is documented on the CLI reference page on the Apigee documentation website at cloud.google.com.

apigeectl flags

Flags allow you to specify optional parameters to the apigeectl command. Some flags allow you to control the scopes (and components) that the command applies configuration changes to.

Flag	Scope	Components
--datastore	Storage	Cassandra
--env --all-envs	Environment	Runtime Synchronizer UDCA
--org	Organization	Apigee Connect Agent MART Watcher
--telemetry	Reporting	Logger Metrics

Google Cloud

You can control the scope of the command used with apigeectl by using optional flags.

The flags shown here determine the set of runtime components that the apigeectl command applies the configuration to.

The datastore flag applies the configuration changes to the Cassandra component in the cluster.

The env flag applies the configuration changes to the Runtime, Synchronizer, and UDCA cluster components for the specified environment.

The all-envs flag applies the configuration changes to these components for all environments under the organization specified in your overrides config file.

The org flag applies the configuration changes to the Apigee Connect, MART, and Watcher components for the specified organization.

The telemetry flag applies the configuration changes to the logger and metrics components in the cluster.

More apigeectl flags

Flag	Description
--all	Used with the delete command. Deletes the entire Apigee hybrid installation except ASM (Istio) and cert-manager from your cluster.
--dry-run	Executes the specified command without changing the cluster. Use with --print-yaml to output the rendered object specification to a file.
-f --file-override-config	YAML file that contains custom config properties for the hybrid deployment. The default value is ./overrides.yaml. An overrides file is required for the apply, check-ready, delete, and init commands. You must specify the full path with this flag.
--print-yaml	Prints the configuration template output to stdout. See Print the configuration to a file.
-s, --settings virtualhosts	Use this flag to apply changes to the virtualhosts property.

Google Cloud

For the full list of flags, see the apigeectl CLI reference.

The all flag is used with the delete command and deletes the entire Apigee hybrid installation except Anthos Service Mesh and cert-manager from your cluster.

The dry-run flag allows you to check for any errors in the configuration without applying them to your cluster.

When used with the print-yaml flag, the complete cluster configuration for your hybrid runtime plane can be output to a file. You can then save the file in source control.

The f flag allows you to provide a specific override yaml configuration file for your cluster components. If the file is not specified, the command looks for a file named overrides.yaml in the current directory.

The settings flag is used to apply changes to the virtualhosts property to the cluster.

The complete list of flags is documented on the CLI reference page on the Apigee documentation website at cloud.google.com.

Runtime component management: apigeectl

To make a configuration change to a hybrid runtime plane component, edit your overrides file and apply the changes with apigeectl.

For example, to change the replica count on the runtime MP component:

- Edit the overrides.yaml file to update the replicaCountMin/replicaCountMax entries.
- Use apigeectl to apply the change to the cluster:

```
$ apigeectl apply --env {env_name} -f
./my_overrides.yaml
```

- Check the readiness status of a hybrid runtime component using this command:

```
$ apigeectl check-ready -f ./my_overrides.yaml
```

overrides.yaml

```
...
runtime:
  replicaCountMin: 2
  replicaCountMax: 4
  resources:
    cpu: 1000m
    memory: 1Gi
...
```

Google Cloud

Here is an example of how to use the apigeectl command.

In this example, you would like to change the minimum and maximum number of replicas for the runtime message processor component in your cluster.

You first change the overrides.yaml configuration file on your file system.

Then, run the apigeectl apply command, passing in the environment name, and the name and location of the overrides config file.

You can then use the check-ready command to determine whether the component pods are up and running with the new configuration.

The **apigeectl** command uses **kubectl** behind the scenes to do its work. The **apigeectl** command options (**apply** and **delete**, and the use of YAML configuration files, are similar to their kubectl counterparts. To learn more about how objects are managed in a Kubernetes cluster, see the following topics:

- Imperative Management of Kubernetes Objects Using Configuration Files
- Overview of kubectl

Runtime component management: kubectl

- kubectl commands can be used to fetch information about the status of various objects in the cluster:
  - To get a list of all pods in the *apigee* namespace:

    ```
    $ kubectl get pods -n apigee
    ```

  - For more detailed information about a given pod:

    ```
    $ kubectl describe pods {POD_NAME} -n apigee
    ```

    where {POD_NAME} is obtained from the get pods command above.

  - To get a shell for an apigee-runtime pod:

    ```
    $ kubectl exec -it -n apigee {runtime_pod_name} --container apigee-runtime
    -- /bin/bash
    ```

- Details on kubectl and the list of commands are on the Kubernetes docs page.

Google Cloud

apigeectl uses the Kubernetes command line tool: kubectl.

Kubectl enables you to manage and control Kubernetes clusters.

You can use kubectl to list and describe cluster resources, like pods, and check on their current status.

You can also start command shells to access the containers running in those pods for debugging purposes.

ApigeeDeployment

- Apigee hybrid uses a Kubernetes Custom Resource Definition (CRD) called ApigeeDeployment (AD) to define, update, and release stateless Apigee hybrid components in the cluster.
- ApigeeDeployments can be managed using kubectl commands. To get a list of all the ADs in your cluster, run:

```
$kubectl get ad -n {namespace}
NAME                                    AGE
apigee-mart-my_org                      4h
apigee-runtime-my_org-my_env            4h
apigee-synchronizer-my_org-my_env       4h
apigee-udca-my_org-my_env               4h
```

- Hybrid uses a custom controller called apigee-operators (ao), along with the CRD, to maintain the desired state of hybrid resources. The controller:
  - Validates the ApigeeDeployment configuration using an admission webhook before persisting it in the cluster.
  - Implements the release of message processors in the cluster.

Google Cloud

The Kubernertes CustomResourceDefinition API resource allows you to define custom resources in your cluster.

Using a CRD object, you can create a custom resource with a name and schema that you specify.

Apigee hybrid uses a CustomResourceDefinition called ApigeeDeployment.

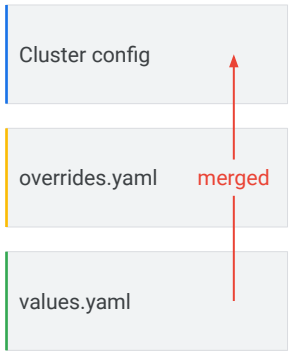
The ApigeeDeployment objects can be managed by using kubectl commands.

Along with the Apigee Operators custom controller, they validate deployment configurations and deploy hybrid runtime resources in the cluster.

The **apigee-deployment-admissionhook** is a HTTP callback used for validating requests for changes to ApigeeDeployment resources

Configuring hybrid

- Apigee hybrid maintains its default component configuration in the file:
  `{hybrid_base_install_dir}/config/values.yaml`
- As part of the installation process, you create an overrides.yaml file that typically includes only a subset of the configuration properties in values.yaml.
- When you apply a configuration to a cluster, your overrides are merged with the defaults to create the complete Kubernetes cluster configuration.
- Not all properties in the values.yaml file are editable, and some overrides are mandatory, such as *gcpProjectID*.
- If you want to modify a component's defaults, first copy its YAML from *values.yaml* into your overrides file, and modify it there. DO NOT modify the values.yaml file directly.



Google Cloud

Apigee hybrid uses a layered approach to configure your cluster.

The default configuration is stored in a file called values.yaml in the config subdirectory under the apigeectl directory in the hybrid distribution.

To install Apigee hybrid, you create an overrides configuration file that includes mandatory properties and other properties that override the default values in the values.yaml file.

Not all default properties can be overridden. For those that can and should be modified, the best practice is to provide the new values in the overrides.yaml config file instead of directly modifying the values.yaml file. This approach preserves your modified values during product upgrades.

Using overrides

- You can create as many overrides files as you want, where each one serves a specific requirement.
  - For example, you might have an overrides file that tunes your cluster for production, and another for creating a testing cluster. You can then maintain these files in your source control system.
- Use the -f option with apigeectl to specify the location and name of an overrides file:

```
$apigeectl apply -f ./test_env_override.yaml
```

- The hybrid installation contains sample overrides files to help set up your hybrid deployment. They are located in the directory: `{hybrid_base_install_dir}/examples`
- It is a good practice to copy and modify the overrides file that most closely matches your installation requirements.
- See the full configuration properties documentation for reference.

Google Cloud

It is also a best practice to maintain multiple override files in source control.

You can have one overrides file for your production clusters and a separate one for a non-production cluster.

You can also have separate override files for each hybrid environment in the cluster.

A good practice is to maintain a set of override files where each file contains only the configuration required for each group of components.

For example, you can have a common.yaml overrides file for components like cassandra, logging, and metrics.

Another file can contain the configuration properties for the hybrid organization and resources like mart and apigee connect.

Environment-level properties for the runtime, synchronizer, and udca components can be in their own overrides file, one file per hybrid environment.

Virtual host configuration can also be in its own overrides configuration file.

Using this strategy, you can control changes to a subset of components in the cluster

by updating and applying only the specific overrides file.

Checking for configuration errors

Check for errors in your hybrid cluster configuration using options with the apigeectl command:

- Use the --dry-run flag to check for errors in your overrides.yaml file without modifying your cluster.

```
$ apigeectl apply -f ./my_overrides.yaml --dry-run=true (kubectl v1.17.x)
$ apigeectl apply -f ./my_overrides.yaml --dry-run=client (kubectl v1.18.x)
```

- Use the --print-yaml and dry-run flags to print the cluster configuration to a file.
  - This is useful for debugging and enables you to store the configuration in source control for reference.
  - Be aware that the output contains password and secrets that you might not want to store.

```
$ apigeectl apply -f ./my_overrides.yaml --dry-run=client --print-yaml >
apigee-hybrid.yaml
```

Google Cloud

The apigeectl tool contains useful command line flags called dry-run and print-yaml.

You can use the dry-run flag with the apply command to check for errors in your configuration without making any changes to the cluster.

When the dry-run flag is combined with the print-yaml flag, you can generate your entire cluster configuration.

You can then save this configuration to a file and maintain it in source control for reference.

Agenda

Installation Process

Lab

Platform Operation

Backup and Restore

Google Cloud

In this lecture, we discuss procedures to perform backups of your hybrid runtime plane datastore.

We will also discuss how to restore your cluster from a backup.

Runtime Cassandra

- Apigee hybrid uses a Cassandra ring installed in the runtime plane to provide data persistence for KMS, KVM, Quota, and other data needed by API proxies.
- Cassandra is a replicated database that is configured to have at least 3 copies of your data in each cluster.
- Cassandra uses streaming replication to maintain the data replicas in each region.
- In hybrid, Cassandra backups are not enabled by default. It is a good practice, however, to enable Cassandra backups in case your data is accidentally deleted.

Google Cloud

Apigee hybrid uses a Cassandra database to store your hybrid runtime data.

Cassandra is a replicated database that is configured to have at least 3 copies of your data in each cluster. Cassandra uses streaming replication and read repairs to maintain the data replicas at any given point.

The Cassandra runtime data store is deployed to your Kubernetes cluster as a StatefulSet. The Cassandra pod reads and writes data using a PersistentVolume. If the pod is deleted and re-created, it will continue to have access to the PersistentVolume.

In hybrid, Cassandra backups are **not** enabled by default. It is a good practice, however, to enable Cassandra backups in case your data is accidentally deleted.

Cassandra backups

Entities that are backed up:

- Cassandra schema including the user schema (Apigee keyspace definitions)
- Cassandra partition token information per node
- A daily snapshot of the Cassandra data

Backup data storage:

- Backed-up data is stored in a Cloud Storage bucket that you must create.
- You can also store backups on a server file system.

The entities that are backed up in this process include the Cassandra schema, partition token information per node, and a daily snapshot of the data.

The backup is stored in a Cloud Storage bucket that you must create before enabling the Cassandra backup.

You can also back up your datastore to a server file system. This topic is covered in later slides in this section.

Scheduling backups

Backups are scheduled as cron jobs in the runtime plane. To schedule Cassandra backups:

1. Create a service account with the standard roles/storage.objectAdmin role. This role allows you to write backup data to Cloud Storage.

   Use the `create-service-account` tool that is part of the hybrid distribution in the `<base-install-dir>/tools` directory.

   ```
   $ create-service-account apigee-cassandra ./service-accounts
   ```

Google Cloud

To schedule backups, you must perform a set of steps.

First, create a service account with the storage.objectAdmin role. This service account role allows you to back up data to Cloud Storage.

To create this service account, use the create-service-account tool in the tools directory in the hybrid distribution.

Name the service account apigee-cassandra, and store the service account json key file in the service-accounts subdirectory.

Scheduling backups

Backups are scheduled as cron jobs in the runtime plane. To schedule Cassandra backups:

1. Create a service account with the standard roles/storage.objectAdmin role. This role allows you to write backup data to Google Cloud Storage.

   Use the `create-service-account` tool that is part of the hybrid distribution in the `<base-install-dir>/tools` directory.

   ```
   $ create-service-account apigee-cassandra ./service-accounts
   ```

2. Create a Cloud Storage bucket. Specify a reasonable data retention policy (15 days) for the bucket.

Google Cloud

Create a storage bucket in Cloud Storage.

Specify a data retention policy for the bucket. 15 days is a reasonable period.

Scheduling backups

Backups are scheduled as cron jobs in the runtime plane. To schedule Cassandra backups:

1. Create a service account with the standard roles/storage.objectAdmin role. This role allows you to write backup data to Google Cloud Storage.

   Use the `create-service-account` tool that is part of the hybrid distribution in the `<base-install-dir>/tools` directory.

   ```
   $ create-service-account apigee-cassandra ./service-accounts
   ```

2. Create a Cloud Storage bucket. Specify a reasonable data retention policy (15 days) for the bucket.
3. Edit the overrides.yaml file to configure Cassandra backup:

overrides.yaml

```
cassandra:
  ...
  backup:
    enabled: true
    serviceAccountPath:
"./service-accounts/apigee-cassandra.json"
    dbStorageBucket: "gs://cassandra-bkup"
    schedule: "45 23 * * 6"
 ...
```

Google Cloud

Update your overrides.yaml file and add the backup configuration properties to the cassandra stanza.

These properties enable the backup, set the path to the service account file and the Cloud Storage bucket, and configure a cron schedule to run the backup.

For example, the configuration shown will schedule a backup using the service account json file (generated from the create-service-account command above, and stored in the filepath ./service-accounts/apigee-cassandra.json). The data is backed up to the Cloud Storage bucket at gs://cassandra-bkup. The cron schedule to run the backup is as configured.

Scheduling backups

Backups are scheduled as cron jobs in the runtime plane. To schedule Cassandra backups:

1. Create a service account with the standard roles/storage.objectAdmin role. This role allows you to write backup data to Cloud Storage.

   Use the `create-service-account` tool that is part of the hybrid distribution in the `<base-install-dir>/tools` directory.

   ```
   $ create-service-account apigee-cassandra ./service-accounts
   ```

2. Create a Cloud Storage bucket. Specify a reasonable data retention policy (15 days) for the bucket.
3. Edit the overrides.yaml file to configure Cassandra backup:
4. Apply the changes to the runtime cluster:

   ```
   $ apigeectl apply --datastore -f overrides.yaml
   ```

   When you apply the backup configuration, Kubernetes recreates the Cassandra nodes, so allow for enough time before backup starts.

overrides.yaml

```
cassandra:
  ...
  backup:
    enabled: true
    serviceAccountPath:
"./service-accounts/apigee-cassandra.json"
    dbStorageBucket: "gs://cassandra-bkup"
    schedule: "45 23 * * 6"
 ...
```

Google Cloud

Use the apigeectl command to apply the override configuration changes to the cluster.

Pass in the datastore flag that indicates the cassandra component and the path to the overrides.yaml file that contains your backup config properties.

Allow for sufficient time in the cron schedule for the backup to begin after the configuration changes are applied to the cluster.

Viewing backup logs

- When a backup job is scheduled and running, you can view progress by monitoring the backup pod log.
- Get a list of the pods to determine the backup pod name:

```
$kubectl get pods -n <namespace>
NAME                                        READY     STATUS      RESTARTS   AGE
apigee-cassandra-backup-1554515580-pff6s    0/1       Running     0          54s
```

- Run the kubectl logs command to view the pod log. Partial output follows:

```
$kubectl logs -f apigee-cassandra-backup-1554515580-pff6s
```

```
...
INFO: Backup 20190406190808 completed
waiting result
to get schema from 10.32.0.28
INFO: /tmp/schema.cql has been generated
...
```

```
...
Copying from <TDIN>...
/ [1 files][    0.0 B/    0.0 B]
Operation completed over 1 objects.
INFO: backup created tarball and
transferred the file to
gs://cassandra-bkup/apigeecluster/dc-1
finished uploading schema.cql
```

Google Cloud

The backup job creates a schema.cql file and uploads it to the Cloud Storage bucket. It then instructs the Cassandra node to back up the data and waits for the data to be uploaded.

You can monitor a backup job that has started based on your configured cron schedule.

First, use the kubectl get pods command to determine the name of the pod running the backup job.

Run the kubectl logs command, passing in the name of the pod running the backup job.

You will see output in the pod log as the backup job executes.

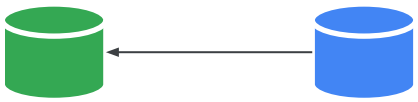
Note the backup snapshot timestamp. It is used to configure your override properties when your backup is restored.

Restore process

- Restoration takes the data from the backup location and restores it into a new cluster with the same number of pods.
- The new cluster must have a namespace that is different from the runtime plane cluster used for the original hybrid install.

To restore Cassandra backups:

1. Create a new Kubernetes cluster with a new namespace.



Google Cloud

The restore process takes the data from the backup location and restores it into a new cluster with the same number of pods.

The new cluster must have a namespace that is different from your existing runtime plane cluster.

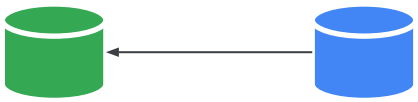
To restore Cassandra backups, first create a new cluster with a new namespace.

Restore process

- Restoration takes the data from the backup location and restores it into a new cluster with the same number of pods.
- The new cluster must have a namespace that is different from the runtime plane cluster used for the original hybrid install.

To restore Cassandra backups:

1. Create a new Kubernetes cluster with a new namespace.
2. Create a new overrides-restore.yaml file.



Google Cloud

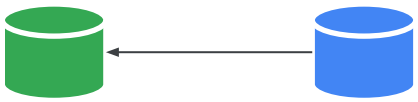
Create a new overrides yaml file to configure the new cluster.

Restore process

- Restoration takes the data from the backup location and restores it into a new cluster with the same number of pods.
- The new cluster must have a namespace that is different from the runtime plane cluster used for the original hybrid install.

To restore Cassandra backups:

1. Create a new Kubernetes cluster with a new namespace.
2. Create a new overrides-restore.yaml file.
3. Copy the complete configuration from your original overrides.yaml file into the new one.



Google Cloud

Copy the complete configuration from your original overrides.yaml file into the new one.

overrides-restore.yaml

4. Modify the overrides-restore.yaml file:

   Add a namespace element.

   Add the cassandra.restore properties.

   - snapshotTimestamp is the timestamp associated with the backup you are restoring.

5. Initialize the cluster:

   ```
   $apigeectl init -f
   ./overrides-restore.yaml
   ```

6. Apply the overrides-restore.yaml to the cluster:

   ```
   $apigeectl apply -f
   ./overrides-restore.yaml
   ```

Google Cloud

overrides.yaml

```
namespace: your-restore-namespace
...
cassandra:
  storage:
    type: gcepd
    capacity: 50Gi
    gcepd:
      replicationType: regional-pd
  nodeSelector:
    key: cloud.google.com/gke-nodepool
    value: apigee-data
  ...
  restore:
    enabled: true
    snapshotTimestamp: "20190417002207"
    serviceAccountPath:
"./service-accounts/apigee-cassandra.json"
    dbStorageBucket: "gs://cassandra-bkup"
    image:
      pullPolicy: Always
...
```

Modify the new overrides yaml file to add the new namespace element.

Add the restore configuration properties to the cassandra stanza.

Specify the timestamp of the backup snapshot to restore, the path to the service account file, and the Cloud Storage bucket.

To use the new cluster with the restored runtime datastore, you must re-install the Apigee hybrid runtime components in the cluster.

Use the apigeectl init command to initialize the new cluster with the Apigee hybrid system components.

Then, use the apigeectl apply command to apply the configuration overrides from the new file to the cluster.

Viewing restore logs

- You can check the restore job logs to search for any errors:

```
$kubectl get pods -n <namespace>
NAME                            READY     STATUS      RESTARTS   AGE
apigee-cassandra-restore-b4lgf 0/1       Completed   0          51m
```

- Run the kubectl logs command to view the pod log. Partial output follows:

```
$kubectl logs -f apigee-cassandra-restore-b4lgf -n <namespace>
```

```
...
INFO: download successfully extracted the
backup files from
gs://cassandra-bkup/apigeecluster/dc-1
   finished downloading schema.cql
   to create schema from 10.32.0.28
...
```

```
...
INFO: Restore 20190405011309 completed
INFO:
./apigee/data/cassandra/data/ks1/user-9fbae96057
1411e99652c7b15b2db6cc restored successfully
INFO: Restore 20190405011309 completed
waiting on waiting nodes $pid to finish  106
Restore finished
```

Google Cloud

To monitor the progress of the restore job, first use the kubectl get pods command to determine the name of the pod running the job.

Run the kubectl logs command, passing in the name of the pod running the restore job.

You will see output in the pod log as the restore job executes and completes.

Configuring file system backups

You can store backups of your Cassandra database to compressed files in the file system of a server you specify.

Follow these steps to configure file system backups:

1. Set up the server and configure SSH.
    - After setup and configuration, verify that the server can be reached from the apigee-cassandra pods in the runtime plane over SSH.
2. Set up the backup schedule and destination.

Google Cloud

You can store backups of your Cassandra database to compressed files in the file system of a server you specify.

Backups occur on a schedule that you specify in your overrides file. The connection to the server is by secure SSH.

To configure a file system backup, you must first set up a server and install and configure SSH. As part of this process, you create a key pair.

The public key is copied to the server, and the location of the private key is configured in your overrides config file.

Test the SSH connection between your Cassandra pods in the runtime cluster and your backup server.

Next, you configure your overrides.yaml file with the backup configuration.

Configuring file system backups - overrides.yaml

To set up the backup schedule and destination:

1. Edit your overrides.yaml config file to add entries for the cassandra backup. Specify:
   - Path to the SSH private key file
   - File system server IP address
   - Storage location on the file system to contain the backup
   - cloudProvider property with value "HYBRID"
   - Cron schedule for the backup

2. Apply the changes to your cluster using apigeectl:

```
$ apigeectl apply --datastore -f overrides.yaml
```

overrides.yaml

```
cassandra:
  ...
  backup:
    enabled: true
    keyFile: "./keys/ssh_private.key"
    server: "34.56.78.90"
    storageDirectory:
"/home/apigee/cassbackup"
    cloudProvider: "HYBRID"
    schedule: "45 23 * * 6"
 ...
```

Google Cloud

Edit your overrides.yaml configuration file to add the backup properties.

Set the enabled property to true, and provide the path to the SSH private key file and the backup server IP address.

Set the directory location where the backup files are to be stored on the backup server.

Set the required cloudProvider property to HYBRID, and set the cron schedule for the backup.

Finally, apply the configuration changes to your cluster using the apigeectl command with the datastore flag.

Configuring file system restore

Restoration takes the data from the backup file with the timestamp you specify and restores it into a new Cassandra cluster with the same number of pods.

To set up the restore configuration:

1. Create a new Kubernetes cluster with a new namespace.
2. Create a new overrides-restore.yaml file.
3. Copy the complete configuration from your original overrides.yaml file into the new one.

Google Cloud

The restore process takes the data from the backup location and restores it into a new cluster with the same number of pods.

The new cluster must have a namespace that is different from your existing runtime plane cluster.

To restore Cassandra backups, first create a new cluster with a new namespace.

Create a new overrides yaml file to configure the new cluster.

Then, copy the complete configuration from your original overrides.yaml file into the new one.

overrides-restore.yaml

4. Modify the overrides-restore.yaml file:

   Add a namespace element.

   Add the cassandra.restore properties.

   - snapshotTimestamp is the timestamp associated with the backup you are restoring.

5. Initialize the cluster:

   ```
   $apigeectl init -f ./overrides-restore.yaml
   ```

6. Apply the overrides-restore.yaml to the cluster:

   ```
   $apigeectl apply -f ./overrides-restore.yaml
   ```

overrides.yaml

```
namespace: your-restore-namespace
...
cassandra:
  ...
  restore:
    enabled: true
    keyFile: "./keys/ssh_private.key"
    server: "34.56.78.90"
    storageDirectory:
"/home/apigee/cassbackup"
    cloudProvider: "HYBRID"
    snapshotTimestamp: "20190417002207"
  ...
```

Google Cloud

Modify the new overrides yaml file to add the new namespace element.

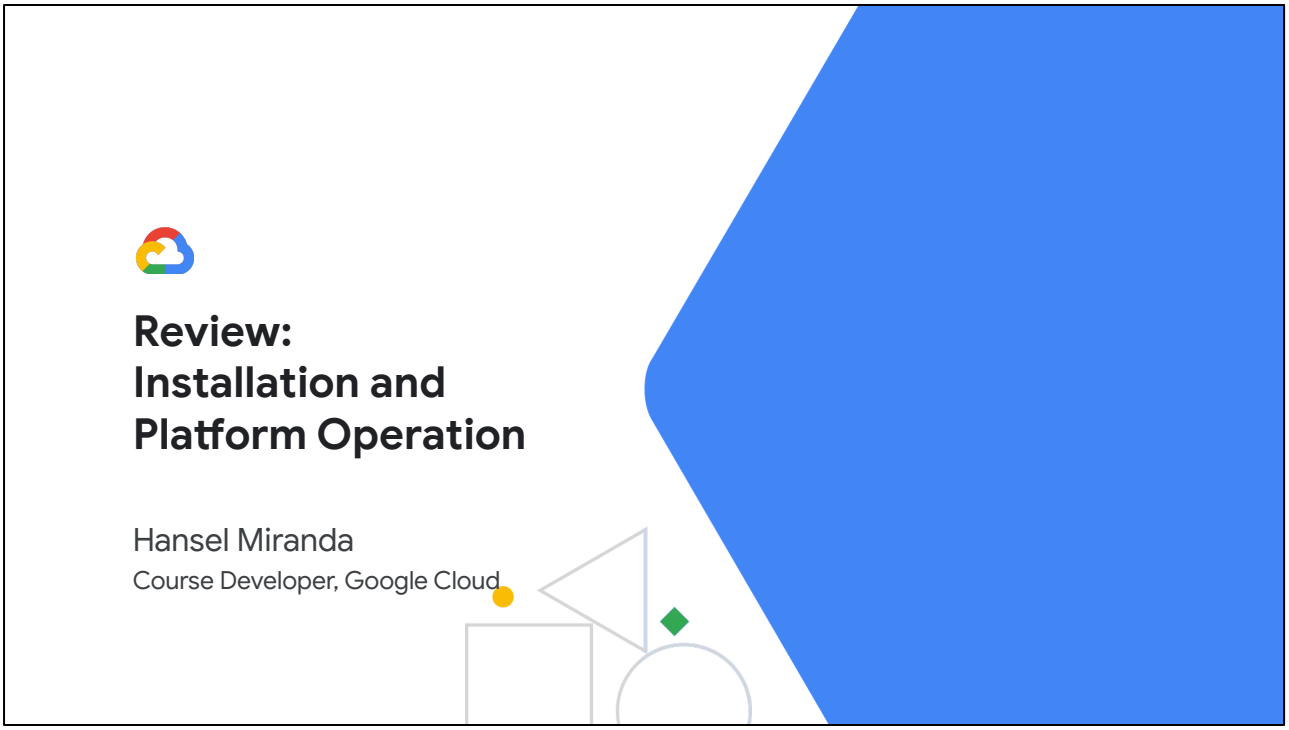
Add the restore configuration properties to the cassandra stanza.

Specify the timestamp of the backup snapshot to restore and the other properties used to configure the backup.

To use the new cluster with the restored runtime datastore, you must re-install the Apigee hybrid runtime components in the cluster.

Use the apigeectl init command to initialize the new cluster with the Apigee hybrid system components.

Then, use the apigeectl apply command to apply the configuration overrides from the new file to the cluster.



In this module you learned how to install and configure Apigee hybrid on a Kubernetes platform. You installed hybrid on Google Kubernetes Engine in a lab.

You also learned how to use the apigeectl tool to initialize and configure the hybrid runtime cluster.

Finally, you learned about the backup and restore process for the runtime datastore component used in hybrid.