OpenShift Dedicated 4

Builds

Performing and interacting with builds in OpenShift Dedicated 4

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Legal Notice

Abstract

This document provides an overview of builds and build configurations in OpenShift Dedicated 4, and provides instructions on the various ways to perform and manage builds.

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CHAPTER 1. UNDERSTANDING IMAGE BUILDS

1.1. BUILDS

A *build* is the process of transforming input parameters into a resulting object. Most often, the process is used to transform input parameters or source code into a runnable image. A **BuildConfig** object is the definition of the entire build process.

OpenShift Dedicated uses Kubernetes by creating containers from build images and pushing them to a container image registry.

Build objects share common characteristics including inputs for a build, the requirement to complete a build process, logging the build process, publishing resources from successful builds, and publishing the final status of the build. Builds take advantage of resource restrictions, specifying limitations on resources such as CPU usage, memory usage, and build or pod execution time.

The OpenShift Dedicated build system provides extensible support for *build strategies* that are based on selectable types specified in the build API. There are three primary build strategies available:

- Docker build
- Source-to-Image (S2I) build
- Custom build

By default, Docker builds and S2I builds are supported.

The resulting object of a build depends on the builder used to create it. For Docker and S2I builds, the resulting objects are runnable images. For Custom builds, the resulting objects are whatever the builder image author has specified.

Additionally, the Pipeline build strategy can be used to implement sophisticated workflows:

- Continuous integration
- Continuous deployment

1.1.1. Docker build

The Docker build strategy invokes the docker build command, and it expects a repository with a ***Dockerfile*** and all required artifacts in it to produce a runnable image.

1.1.2. Source-to-Image (S2I) build

Source-to-Image (S2I) is a tool for building reproducible, Docker-formatted container images. It produces ready-to-run images by injecting application source into a container image and assembling a new image. The new image incorporates the base image (the builder) and built source and is ready to use with the **buildah run** command. S2I supports incremental builds, which re-use previously downloaded dependencies, previously built artifacts, etc.

The advantages of S2I include the following:

Image flexibility	S2I scripts can be written to inject application code into almost any existing Docker-formatted container image, taking advantage of the existing ecosystem. Note that, currently, S2I relies on **tar** to inject application source, so the image needs to be able to process tarred content.
Speed	With S2I, the assemble process can perform a large number of complex operations without creating a new layer at each step, resulting in a fast process. In addition, S2I scripts can be written to re-use artifacts stored in a previous version of the application image, rather than having to download or build them each time the build is run.
Patchability	S2I allows you to rebuild the application consistently if an underlying image needs a patch due to a security issue.
Operational efficiency	By restricting build operations instead of allowing arbitrary actions, as a ***Dockerfile*** would allow, the PaaS operator can avoid accidental or intentional abuses of the build system.
Operational security	Building an arbitrary ***Dockerfile*** exposes the host system to root privilege escalation. This can be exploited by a malicious user because the entire Docker build process is run as a user with Docker privileges. S2I restricts the operations performed as a root user and can run the scripts as a non-root user.
User efficiency	S2I prevents developers from performing arbitrary **yum install** type operations, which could slow down development iteration, during their application build.
Ecosystem	S2I encourages a shared ecosystem of images where you can leverage best practices for your applications.
Reproducibility	Produced images can include all inputs including specific versions of build tools and dependencies. This ensures that the image can be reproduced precisely.

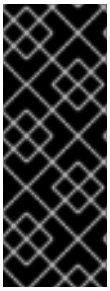
1.1.3. Custom build

The Custom build strategy allows developers to define a specific builder image responsible for the entire build process. Using your own builder image allows you to customize your build process.

A Custom builder image is a plain Docker-formatted container image embedded with build process logic, for example for building RPMs or base images.

Custom builds run with a very high level of privilege and are not available to users by default. Only users who can be trusted with cluster administration permissions should be granted access to run custom builds.

1.1.4. Pipeline build



IMPORTANT

The Pipeline build strategy is deprecated in OpenShift Dedicated 4. Equivalent and improved functionality is present in the OpenShift Pipelines based on Tekton.

Jenkins images on OpenShift are fully supported and users should follow Jenkins user documentation for defining their Jenkinsfile in a job or store it in a Source Control Management system.

The Pipeline build strategy allows developers to define a *Jenkins pipeline* for execution by the Jenkins pipeline plug-in. The build can be started, monitored, and managed by OpenShift Dedicated in the same way as any other build type.

Pipeline workflows are defined in a Jenkinsfile, either embedded directly in the build configuration, or supplied in a Git repository and referenced by the build configuration.

CHAPTER 2. UNDERSTANDING BUILD CONFIGURATIONS

The following sections define the concept of a build, **BuildConfig**, and outline the primary build strategies available.

2.1. BUILDCONFIGS

A build configuration describes a single build definition and a set of triggers for when a new build is created. Build configurations are defined by a **BuildConfig**, which is a REST object that can be used in a POST to the API server to create a new instance.

A *build configuration*, or **BuildConfig**, is characterized by a *build strategy* and one or more sources. The strategy determines the process, while the sources provide its input.

Depending on how you choose to create your application using OpenShift Dedicated, a **BuildConfig** is typically generated automatically for you if you use the web console or CLI, and it can be edited at any time. Understanding the parts that make up a **BuildConfig** and their available options can help if you choose to manually change your configuration later.

The following example **BuildConfig** results in a new build every time a container image tag or the source code changes:

BuildConfig object definition

```
kind: BuildConfig
apiVersion: build.openshift.io/v1
metadata:
  name: "ruby-sample-build" 1
spec:
  runPolicy: "Serial" 2
  triggers: 3
    -
      type: "GitHub"
      github:
        secret: "secret101"
    - type: "Generic"
      generic:
        secret: "secret101"
    -
      type: "ImageChange"
  source: 4
    git:
      uri: "https://github.com/openshift/ruby-hello-world"
  strategy: 5
    sourceStrategy:
      from:
        kind: "ImageStreamTag"
        name: "ruby-20-centos7:latest"
  output: 6
    to:
      kind: "ImageStreamTag"
      name: "origin-ruby-sample:latest"
  postCommit: 7
      script: "bundle exec rake test"
```

1. This specification creates a new **BuildConfig** named **ruby-sample-build**.
2. The **runPolicy** field controls whether builds created from this build configuration can be run simultaneously. The default value is **Serial**, which means new builds run sequentially, not simultaneously.
3. You can specify a list of triggers, which cause a new build to be created.
4. The **source** section defines the source of the build. The source type determines the primary source of input, and can be either **Git**, to point to a code repository location, **Dockerfile**, to build from an inline Dockerfile, or **Binary**, to accept binary payloads. It is possible to have multiple sources at once. Refer to the documentation for each source type for details.
5. The **strategy** section describes the build strategy used to execute the build. You can specify a **Source** , **Docker**, or **Custom** strategy here. This example uses the **ruby-20-centos7** container image that Source-To-Image uses for the application build.
6. After the container image is successfully built, it is pushed into the repository described in the **output** section.
7. The **postCommit** section defines an optional build hook.

CHAPTER 3. CREATING BUILD INPUTS

Use the following sections for an overview of build inputs, instructions on how to use inputs to provide source content for builds to operate on, and how to use build environments and create secrets.

3.1. BUILD INPUTS

A *build input* provides source content for builds to operate on. You can use the following *build inputs* to provide sources in OpenShift Dedicated, listed in order of precedence:

- Inline Dockerfile definitions
- Content extracted from existing images
- Git repositories
- Binary (Local) inputs
- Input secrets
- External artifacts

You can combine multiple inputs in a single build. However, as the inline Dockerfile takes precedence, it can overwrite any other file named Dockerfile provided by another input. Binary (local) input and Git repositories are mutually exclusive inputs.

You can use input secrets when you do not want certain resources or credentials used during a build to be available in the final application image produced by the build, or want to consume a value that is defined in a Secret resource. External artifacts can be used to pull in additional files that are not available as one of the other build input types.

When you run a build:

1. A working directory is constructed and all input content is placed in the working directory. For example, the input Git repository is cloned into the working directory, and files specified from input images are copied into the working directory using the target path.
2. The build process changes directories into the **contextDir**, if one is defined.
3. The inline Dockerfile, if any, is written to the current directory.
4. The content from the current directory is provided to the build process for reference by the Dockerfile, custom builder logic, or ***assemble*** script. This means any input content that resides outside the **contextDir** will be ignored by the build.

The following example of a source definition includes multiple input types and an explanation of how they are combined. For more details on how each input type is defined, see the specific sections for each input type.

```
source:
  git:
    uri: https://github.com/openshift/ruby-hello-world.git (1)
  images:
  - from:
      kind: ImageStreamTag
      name: myinputimage:latest
```

```
    namespace: mynamespace
  paths:
  - destinationDir: app/dir/injected/dir (2)
    sourcePath: /usr/lib/somefile.jar
contextDir: "app/dir" (3)
dockerfile: "FROM centos:7\nRUN yum install -y httpd" (4)
```

1. The repository to be cloned into the working directory for the build.
2. */usr/lib/somefile.jar* from **myinputimage** will be stored in *<workingdir>/app/dir/injected/dir*.
3. The working directory for the build will become *<original_workingdir>/app/dir*.
4. A Dockerfile with this content will be created in *<original_workingdir>/app/dir*, overwriting any existing file with that name.

3.2. DOCKERFILE SOURCE

When you supply a **dockerfile** value, the content of this field is written to disk as a file named *Dockerfile*. This is done after other input sources are processed, so if the input source repository contains a *Dockerfile* in the root directory, it will be overwritten with this content.

The source definition is part of the **spec** section in the **BuildConfig**:

```
source:
  dockerfile: "FROM centos:7\nRUN yum install -y httpd" (1)
```

1. The **dockerfile** field contains an inline Dockerfile that will be built.

Additional resources

- The typical use for this field is to provide a **Dockerfile** to a Docker strategy build.

3.3. IMAGE SOURCE

You can add additional files to the build process with images. Input images are referenced in the same way the **From** and **To** image targets are defined. This means both container images and imagestreamtags can be referenced. In conjunction with the image, you must provide one or more path pairs to indicate the path of the files or directories to copy the image and the destination to place them in the build context.

The source path can be any absolute path within the image specified. The destination must be a relative directory path. At build time, the image will be loaded and the indicated files and directories will be copied into the context directory of the build process. This is the same directory into which the source repository content (if any) is cloned. If the source path ends in */.* then the content of the directory will be copied, but the directory itself will not be created at the destination.

Image inputs are specified in the **source** definition of the **BuildConfig**:

```
source:
  git:
    uri: https://github.com/openshift/ruby-hello-world.git
```

```
images: (1)
- from: (2)
    kind: ImageStreamTag
    name: myinputimage:latest
    namespace: mynamespace
  paths: (3)
  - destinationDir: injected/dir (4)
    sourcePath: /usr/lib/somefile.jar (5)
- from:
    kind: ImageStreamTag
    name: myotherinputimage:latest
    namespace: myothernamespace
  pullSecret: mysecret (6)
  paths:
  - destinationDir: injected/dir
    sourcePath: /usr/lib/somefile.jar
```

1. An array of one or more input images and files.
2. A reference to the image containing the files to be copied.
3. An array of source/destination paths.
4. The directory relative to the build root where the build process can access the file.
5. The location of the file to be copied out of the referenced image.
6. An optional secret provided if credentials are needed to access the input image.

NOTE

This feature is not supported for builds using the Custom Strategy.

3.4. GIT SOURCE

When specified, source code is fetched from the supplied location.

If you supply an inline Dockerfile, it overwrites the ***Dockerfile*** (if any) in the **contextDir** of the Git repository.

The source definition is part of the **spec** section in the **BuildConfig**:

```
source:
  git: (1)
    uri: "https://github.com/openshift/ruby-hello-world"
    ref: "master"
  contextDir: "app/dir" (2)
  dockerfile: "FROM openshift/ruby-22-centos7\nUSER example" (3)
```

1. The **git** field contains the URI to the remote Git repository of the source code. Optionally, specify the **ref** field to check out a specific Git reference. A valid **ref** can be a SHA1 tag or a branch name.
2.

The **contextDir** field allows you to override the default location inside the source code repository where the build looks for the application source code. If your application exists inside a sub-

3 If the optional **dockerfile** field is provided, it should be a string containing a Dockerfile that overwrites any Dockerfile that may exist in the source repository.

If the **ref** field denotes a pull request, the system will use a **git fetch** operation and then checkout **FETCH_HEAD**.

When no **ref** value is provided, OpenShift Dedicated performs a shallow clone (**--depth=1**). In this case, only the files associated with the most recent commit on the default branch (typically **master**) are downloaded. This results in repositories downloading faster, but without the full commit history. To perform a full **git clone** of the default branch of a specified repository, set **ref** to the name of the default branch (for example **master**).

WARNING

Git clone operations that go through a proxy that is performing man in the middle (MITM) TLS hijacking or reencrypting of the proxied connection will not work.

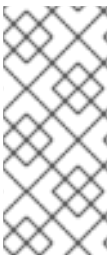
3.4.1. Using a proxy

If your Git repository can only be accessed using a proxy, you can define the proxy to use in the **source** section of the **BuildConfig**. You can configure both an HTTP and HTTPS proxy to use. Both fields are optional. Domains for which no proxying should be performed can also be specified in the **NoProxy** field.

NOTE

Your source URI must use the HTTP or HTTPS protocol for this to work.

```
source:
  git:
    uri: "https://github.com/openshift/ruby-hello-world"
    httpProxy: http://proxy.example.com
    httpsProxy: https://proxy.example.com
    noProxy: somedomain.com, otherdomain.com
```



NOTE

For Pipeline strategy builds, given the current restrictions with the Git plug-in for Jenkins, any Git operations through the Git plug-in will not leverage the HTTP or HTTPS proxy defined in the **BuildConfig**. The Git plug-in only will use the proxy configured in the Jenkins UI at the Plugin Manager panel. This proxy will then be used for all git interactions within Jenkins, across all jobs.

Additional resources

- You can find instructions on how to configure proxies through the Jenkins UI at JenkinsBehindProxy.

3.4.2. Adding Source Clone Secrets

Builder Pods require access to any Git repositories defined as source for a build. Source clone secrets are used to provide the builder Pod with access it would not normally have access to, such as private repositories or repositories with self-signed or untrusted SSL certificates.

Prerequisites

- The following source clone secret configurations are supported.
  - .gitconfig File
  - Basic Authentication
  - SSH Key Authentication
  - Trusted Certificate Authorities

NOTE

You can also use combinations of these configurations to meet your specific needs.

Procedure

Builds are run with the **builder** service account, which must have access to any source clone secrets used.

- Run the following command to grant access:

```
$ oc secrets link builder mysecret
```

NOTE

Limiting secrets to only the service accounts that reference them is disabled by default. This means that if **serviceAccountConfig.limitSecretReferences** is set to **false** (the default setting) in the master configuration file, linking secrets to a service is not required.

3.4.2.1. Automatically adding a source clone secret to a build configuration

When a **BuildConfig** is created, OpenShift Dedicated can automatically populate its source clone secret reference. This behavior allows the resulting **Builds** to automatically use the credentials stored in the referenced **Secret** to authenticate to a remote Git repository, without requiring further configuration.

To use this functionality, a **Secret** containing the Git repository credentials must exist in the namespace in which the **BuildConfig** is later created. This **Secret** must additionally include one or more annotations prefixed with **build.openshift.io/source-secret-match-uri-**. The value of each of these annotations is a URI pattern, defined as follows. When a **BuildConfig** is created without a source clone secret reference and its Git source URI matches a URI pattern in a **Secret** annotation, OpenShift Dedicated will automatically insert a reference to that **Secret** in the **BuildConfig**.

Prerequisites

A URI pattern must consist of:

- a valid scheme (***://**, **git://**, **http://**, **https://** or **ssh://**).
- a host (***** or a valid hostname or IP address optionally preceded by ***.**).
- a path (/***** or / followed by any characters optionally including ***** characters).

In all of the above, a ***** character is interpreted as a wildcard.

IMPORTANT

URI patterns must match Git source URIs which are conformant to RFC3986. Do not include a username (or password) component in a URI pattern.

For example, if you use **ssh://git@bitbucket.atlassian.com:7999/ATLASSIAN/jira.git** for a git repository URL, the source secret must be specified as **ssh://bitbucket.atlassian.com:7999/*** (and not **ssh://git@bitbucket.atlassian.com:7999/***).

```
$ oc annotate secret mysecret \
    'build.openshift.io/source-secret-match-uri-1=ssh://bitbucket.atlassian.com:7999/*'
```

Procedure

If multiple **Secrets** match the Git URI of a particular **BuildConfig**, OpenShift Dedicated will select the secret with the longest match. This allows for basic overriding, as in the following example.

The following fragment shows two partial source clone secrets, the first matching any server in the domain **mycorp.com** accessed by HTTPS, and the second overriding access to servers **mydev1.mycorp.com** and **mydev2.mycorp.com**:

```
kind: Secret
apiVersion: v1
metadata:
  name: matches-all-corporate-servers-https-only
  annotations:
    build.openshift.io/source-secret-match-uri-1: https://*.mycorp.com/*
data:
  ...

kind: Secret
apiVersion: v1
metadata:
  name: override-for-my-dev-servers-https-only
  annotations:
    build.openshift.io/source-secret-match-uri-1: https://mydev1.mycorp.com/*
    build.openshift.io/source-secret-match-uri-2: https://mydev2.mycorp.com/*
data:
  ...
```

- Add a **build.openshift.io/source-secret-match-uri-** annotation to a pre-existing secret using:

```
$ oc annotate secret mysecret \
    'build.openshift.io/source-secret-match-uri-1=https://*.mycorp.com/*'
```

-

3.4.2.2. Manually adding a source clone secret

Source clone secrets can be added manually to a build configuration by adding a **sourceSecret** field to the **source** section inside the **BuildConfig** and setting it to the name of the **secret** that you created (**basicsecret**, in this example).

```
apiVersion: "v1"
kind: "BuildConfig"
metadata:
  name: "sample-build"
spec:
  output:
    to:
      kind: "ImageStreamTag"
      name: "sample-image:latest"
  source:
    git:
      uri: "https://github.com/user/app.git"
    sourceSecret:
      name: "basicsecret"
  strategy:
    sourceStrategy:
      from:
        kind: "ImageStreamTag"
        name: "python-33-centos7:latest"
```

Procedure

You can also use the **oc set build-secret** command to set the source clone secret on an existing build configuration.

- To set the source clone secret on an existing build configuration, run:

```
$ oc set build-secret --source bc/sample-build basicsecret
```

Additional resources

- Defining Secrets in the **BuildConfig** provides more information on this topic.

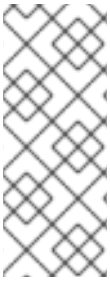
3.4.2.3. Creating a secret from a .gitconfig file

If the cloning of your application is dependent on a **.gitconfig** file, then you can create a secret that contains it. Add it to the builder service account and then your **BuildConfig**.

Procedure

- To create a secret from a **.gitconfig** file:

```
$ oc create secret generic <secret_name> --from-file=<path/to/.gitconfig>
```



NOTE

SSL verification can be turned off if **sslVerify=false** is set for the **http** section in your **.gitconfig** file:

```
[http]
        sslVerify=false
```

3.4.2.4. Creating a secret from a .gitconfig file for secured Git

If your Git server is secured with two-way SSL and user name with password, you must add the certificate files to your source build and add references to the certificate files in the **.gitconfig** file.

Prerequisites

- Git credentials

Procedure

Add the certificate files to your source build and add references to the certificate files in the **.gitconfig** file.

1. Add the **client.crt**, **cacert.crt**, and **client.key** files to the **/var/run/secrets/openshift.io/source/** folder in the application source code.
2. In the **.gitconfig** file for the server, add the **[http]** section shown in the following example:

```
# cat .gitconfig
[user]
        name = <name>
        email = <email>
[http]
        sslVerify = false
        sslCert = /var/run/secrets/openshift.io/source/client.crt
        sslKey = /var/run/secrets/openshift.io/source/client.key
        sslCaInfo = /var/run/secrets/openshift.io/source/cacert.crt
```

3. Create the secret:

```
$ oc create secret generic <secret_name> \
--from-literal=username=<user_name> \ 1
--from-literal=password=<password> \ 2
--from-file=.gitconfig=.gitconfig \
--from-file=client.crt=/var/run/secrets/openshift.io/source/client.crt \
--from-file=cacert.crt=/var/run/secrets/openshift.io/source/cacert.crt \
--from-file=client.key=/var/run/secrets/openshift.io/source/client.key
```

1. The user's Git user name.
2. The password for this user.

IMPORTANT

To avoid having to enter your password again, be sure to specify the S2I image in your builds. However, if you cannot clone the repository, you still must specify your user name and password to promote the build.

Additional resources

- **/var/run/secrets/openshift.io/source/** folder in the application source code.

3.4.2.5. Creating a secret from source code basic authentication

Basic authentication requires either a combination of **--username** and **--password**, or a **token** to authenticate against the SCM server.

Prerequisites

- User name and password to access the private repository.

Procedure

1. Create the **secret** first before using the user name and password to access the private repository:

```
$ oc create secret generic <secret_name> \
    --from-literal=username=<user_name> \
    --from-literal=password=<password> \
    --type=kubernetes.io/basic-auth
```

2. Create a basic authentication secret with a token:

```
$ oc create secret generic <secret_name> \
    --from-literal=password=<token> \
    --type=kubernetes.io/basic-auth
```

3.4.2.6. Creating a secret from source code SSH key authentication

SSH key based authentication requires a private SSH key.

The repository keys are usually located in the **$HOME/.ssh/** directory, and are named **id_dsa.pub**, **id_ecdsa.pub**, **id_ed25519.pub**, or **id_rsa.pub** by default.

Procedure

1. Generate SSH key credentials:

```
$ ssh-keygen -t rsa -C "your_email@example.com"
```

NOTE

Creating a passphrase for the SSH key prevents OpenShift Dedicated from building. When prompted for a passphrase, leave it blank.

Two files are created: the public key and a corresponding private key (one of **id_dsa**, **id_ecdsa**, **id_ed25519**, or **id_rsa**). With both of these in place, consult your source control management (SCM) system's manual on how to upload the public key. The private key is used to access your private repository.

2. Before using the SSH key to access the private repository, create the secret:

```
$ oc create secret generic <secret_name> \
    --from-file=ssh-privatekey=<path/to/ssh/private/key> \
    --type=kubernetes.io/ssh-auth
```

3.4.2.7. Creating a secret from source code trusted certificate authorities

The set of TLS certificate authorities (CA) that are trusted during a **git clone** operation are built into the OpenShift Dedicated infrastructure images. If your Git server uses a self-signed certificate or one signed by an authority not trusted by the image, you can create a secret that contains the certificate or disable TLS verification.

If you create a secret for the **CA certificate**, OpenShift Dedicated uses it to access your Git server during the **git clone** operation. Using this method is significantly more secure than disabling Git's SSL verification, which accepts any TLS certificate that is presented.

Procedure

- Create a secret with a CA certificate file.

  a. If your CA uses Intermediate Certificate Authorities, combine the certificates for all CAs in a **ca.crt** file. Run the following command:

  ```
  $ cat intermediateCA.crt intermediateCA.crt rootCA.crt > ca.crt
  ```

  b. Create the secret:

  ```
  $ oc create secret generic mycert --from-file=ca.crt=</path/to/file> 1
  ```

  1 You must use the key name **ca.crt**.

3.4.2.8. Source secret combinations

You can combine the different methods for creating source clone secrets for your specific needs.

3.4.2.8.1. Creating a SSH-based authentication secret with a .gitconfig file

You can combine the different methods for creating source clone secrets for your specific needs, such as a SSH-based authentication secret with a **.gitconfig** file.

Prerequisites

- SSH authentication
- .gitconfig file

Procedure

- Create a SSH-based authentication secret with a **.gitconfig** file

```
$ oc create secret generic <secret_name> \
    --from-file=ssh-privatekey=<path/to/ssh/private/key> \
    --from-file=<path/to/.gitconfig> \
    --type=kubernetes.io/ssh-auth
```

3.4.2.8.2. Creating a secret that combines a .gitconfig file and CA certificate

You can combine the different methods for creating source clone secrets for your specific needs, such as a secret that combines a **.gitconfig** file and CA certificate.

Prerequisites

- .gitconfig file
- CA certificate

Procedure

- Create a secret that combines a **.gitconfig** file and CA certificate

```
$ oc create secret generic <secret_name> \
    --from-file=ca.crt=<path/to/certificate> \
    --from-file=<path/to/.gitconfig>
```

- builds/creating-build-inputs.adoc

3.4.2.8.3. Creating a basic authentication secret with a CA certificate

You can combine the different methods for creating source clone secrets for your specific needs, such as a secret that combines a basic authentication and CA certificate.

Prerequisites

- Basic authentication credentials
- CA certificate

Procedure

- Create a basic authentication secret with a CA certificate

```
$ oc create secret generic <secret_name> \
    --from-literal=username=<user_name> \
    --from-literal=password=<password> \
    --from-file=ca-cert=</path/to/file> \
    --type=kubernetes.io/basic-auth
```

- builds/creating-build-inputs.adoc

3.4.2.8.4. Creating a basic authentication secret with a .gitconfig file

You can combine the different methods for creating source clone secrets for your specific needs, such as a secret that combines a basic authentication and **.gitconfig** file.

Prerequisites

- Basic authentication credentials
- **.gitconfig** file

Procedure

- Create a basic authentication secret with a **.gitconfig** file

```
$ oc create secret generic <secret_name> \
    --from-literal=username=<user_name> \
    --from-literal=password=<password> \
    --from-file=</path/to/.gitconfig> \
    --type=kubernetes.io/basic-auth
```

- builds/creating-build-inputs.adoc

3.4.2.8.5. Creating a basic authentication secret with a .gitconfig file and CA certificate

You can combine the different methods for creating source clone secrets for your specific needs, such as a secret that combines a basic authentication, **.gitconfig** file, and CA certificate.

Prerequisites

- Basic authentication credentials
- **.gitconfig** file
- CA certificate

Procedure

- Create a basic authentication secret with a **.gitconfig** file and CA certificate

```
$ oc create secret generic <secret_name> \
    --from-literal=username=<user_name> \
    --from-literal=password=<password> \
    --from-file=</path/to/.gitconfig> \
    --from-file=ca-cert=</path/to/file> \
    --type=kubernetes.io/basic-auth
```

3.5. BINARY (LOCAL) SOURCE

Streaming content from a local file system to the builder is called a **Binary** type build. The corresponding value of **BuildConfig.spec.source.type** is **Binary** for such builds.

This source type is unique in that it is leveraged solely based on your use of the **oc start-build**.

NOTE

Binary type builds require content to be streamed from the local file system, so automatically triggering a binary type build (e.g. via an image change trigger) is not possible, because the binary files cannot be provided. Similarly, you cannot launch binary type builds from the web console.

To utilize binary builds, invoke **oc start-build** with one of these options:

- **--from-file**: The contents of the file you specify are sent as a binary stream to the builder. You can also specify a URL to a file. Then, the builder stores the data in a file with the same name at the top of the build context.
- **--from-dir** and **--from-repo**: The contents are archived and sent as a binary stream to the builder. Then, the builder extracts the contents of the archive within the build context directory. With **--from-dir**, you can also specify a URL to an archive, which will be extracted.
- **--from-archive**: The archive you specify is sent to the builder, where it is extracted within the build context directory. This option behaves the same as **--from-dir**; an archive is created on your host first, whenever the argument to these options is a directory.

In each of the previously listed cases:

- If your **BuildConfig** already has a **Binary** source type defined, it will effectively be ignored and replaced by what the client sends.
- If your **BuildConfig** has a **Git** source type defined, it is dynamically disabled, since **Binary** and **Git** are mutually exclusive, and the data in the binary stream provided to the builder takes precedence.

Instead of a file name, you can pass a URL with HTTP or HTTPS schema to **--from-file** and **--from-archive**. When using **--from-file** with a URL, the name of the file in the builder image is determined by the **Content-Disposition** header sent by the web server, or the last component of the URL path if the header is not present. No form of authentication is supported and it is not possible to use custom TLS certificate or disable certificate validation.

When using **oc new-build --binary=true**, the command ensures that the restrictions associated with binary builds are enforced. The resulting **BuildConfig** will have a source type of **Binary**, meaning that the only valid way to run a build for this **BuildConfig** is to use **oc start-build** with one of the **--from** options to provide the requisite binary data.

The **dockerfile** and **contextDir** source options have special meaning with binary builds.

dockerfile can be used with any binary build source. If **dockerfile** is used and the binary stream is an archive, its contents serve as a replacement Dockerfile to any Dockerfile in the archive. If **dockerfile** is used with the **--from-file** argument, and the file argument is named **dockerfile**, the value from **dockerfile** replaces the value from the binary stream.

In the case of the binary stream encapsulating extracted archive content, the value of the **contextDir** field is interpreted as a subdirectory within the archive, and, if valid, the builder changes into that subdirectory before executing the build.

3.6. INPUT SECRETS AND CONFIGMAPS

In some scenarios, build operations require credentials or other configuration data to access dependent resources, but it is undesirable for that information to be placed in source control. You can define *input secrets* and *input ConfigMaps* for this purpose.

For example, when building a Java application with Maven, you can set up a private mirror of Maven Central or JCenter that is accessed by private keys. In order to download libraries from that private mirror, you have to supply the following:

1. A ***settings.xml*** file configured with the mirror's URL and connection settings.
2. A private key referenced in the settings file, such as ***~/.ssh/id_rsa***.

For security reasons, you do not want to expose your credentials in the application image.

This example describes a Java application, but you can use the same approach for adding SSL certificates into the ***/etc/ssl/certs*** directory, API keys or tokens, license files, and more.

3.6.1. Adding input secrets and ConfigMaps

In some scenarios, build operations require credentials or other configuration data to access dependent resources, but it is undesirable for that information to be placed in source control. You can define *input secrets* and *input ConfigMaps* for this purpose.

Procedure

To add an input secret and/or ConfigMap to an existing **BuildConfig**:

1. Create the ConfigMap, if it does not exist:

```
$ oc create configmap settings-mvn \
    --from-file=settings.xml=<path/to/settings.xml>
```

   This creates a new ConfigMap named ***settings-mvn***, which contains the plain text content of the ***settings.xml*** file.

2. Create the secret, if it does not exist:

```
$ oc create secret generic secret-mvn \
    --from-file=id_rsa=<path/to/.ssh/id_rsa>
```

   This creates a new secret named ***secret-mvn***, which contains the base64 encoded content of the ***id_rsa*** private key.

3. Add the ConfigMap and secret to the **source** section in the existing **BuildConfig**:

```
source:
  git:
    uri: https://github.com/wildfly/quickstart.git
  contextDir: helloworld
  configMaps:
    - configMap:
        name: settings-mvn
  secrets:
    - secret:
        name: secret-mvn
```

To include the secret and ConfigMap in a new **BuildConfig**, run the following command:

```
$ oc new-build \
    openshift/wildfly-101-centos7~https://github.com/wildfly/quickstart.git \
    --context-dir helloworld --build-secret “secret-mvn” \
    --build-config-map "settings-mvn"
```

During the build, the ***settings.xml*** and ***id_rsa*** files are copied into the directory where the source code is located. In OpenShift Dedicated S2I builder images, this is the image working directory, which is set using the **WORKDIR** instruction in the ***Dockerfile***. If you want to specify another directory, add a **destinationDir** to the definition:

```
source:
  git:
    uri: https://github.com/wildfly/quickstart.git
  contextDir: helloworld
  configMaps:
    - configMap:
        name: settings-mvn
      destinationDir: ".m2"
  secrets:
    - secret:
        name: secret-mvn
      destinationDir: ".ssh"
```

You can also specify the destination directory when creating a new **BuildConfig**:

```
$ oc new-build \
    openshift/wildfly-101-centos7~https://github.com/wildfly/quickstart.git \
    --context-dir helloworld --build-secret “secret-mvn:.ssh” \
    --build-config-map "settings-mvn:.m2"
```

In both cases, the ***settings.xml*** file is added to the ***./.m2*** directory of the build environment, and the ***id_rsa*** key is added to the ***./.ssh*** directory.

3.6.2. Source-to-image strategy

When using a **Source** strategy, all defined input secrets are copied to their respective **destinationDir**. If you left **destinationDir** empty, then the secrets are placed in the working directory of the builder image.

The same rule is used when a **destinationDir** is a relative path; the secrets are placed in the paths that are relative to the image’s working directory. The final directory in the **destinationDir** path is created if it does not exist in the builder image. All preceding directories in the **destinationDir** must exist, or an error will occur.

NOTE

Input secrets are added as world-writable (have **0666** permissions) and will be truncated to size zero after executing the ***assemble*** script. This means that the secret files will exist in the resulting image, but they will be empty for security reasons.

Input ConfigMaps are not truncated after the ***assemble*** script completes.

3.6.3. Docker strategy

When using a **Docker** strategy, you can add all defined input secrets into your container image using the **ADD** and **COPY** instructions in your ***Dockerfile***.

If you do not specify the **destinationDir** for a secret, then the files will be copied into the same directory in which the ***Dockerfile*** is located. If you specify a relative path as **destinationDir**, then the secrets will be copied into that directory, relative to your ***Dockerfile*** location. This makes the secret files available to the Docker build operation as part of the context directory used during the build.

Example of a Dockerfile referencing secret and ConfigMap data

```
FROM centos/ruby-22-centos7

USER root
COPY ./secret-dir /secrets
COPY ./config /

# Create a shell script that will output secrets and ConfigMaps when the image is run
RUN echo '#!/bin/sh' > /input_report.sh
RUN echo '(test -f /secrets/secret1 && echo -n "secret1=" && cat /secrets/secret1)' >>
/input_report.sh
RUN echo '(test -f /config && echo -n "relative-configMap=" && cat /config)' >> /input_report.sh
RUN chmod 755 /input_report.sh

CMD ["/bin/sh", "-c", "/input_report.sh"]
```

NOTE

Users should normally remove their input secrets from the final application image so that the secrets are not present in the container running from that image. However, the secrets will still exist in the image itself in the layer where they were added. This removal should be part of the ***Dockerfile*** itself.

3.6.4. Custom strategy

When using a **Custom** strategy, all the defined input secrets and ConfigMaps are available inside the builder container in the ***/var/run/secrets/openshift.io/build*** directory. The custom build image is responsible for using these secrets and ConfigMaps appropriately. The **Custom** strategy also allows secrets to be defined as described in Custom Strategy Options.

There is no technical difference between existing strategy secrets and the input secrets. However, your builder image might distinguish between them and use them differently, based on your build use case.

The input secrets are always mounted into the ***/var/run/secrets/openshift.io/build*** directory or your builder can parse the **$BUILD** environment variable, which includes the full build object.

3.7. EXTERNAL ARTIFACTS

It is not recommended to store binary files in a source repository. Therefore, you may find it necessary to define a build which pulls additional files (such as Java ***.jar*** dependencies) during the build process. How this is done depends on the build strategy you are using.

For a **Source** build strategy, you must put appropriate shell commands into the ***assemble*** script:

.s2i/bin/assemble File

-

```
#!/bin/sh
APP_VERSION=1.0
wget http://repository.example.com/app/app-$APP_VERSION.jar -O app.jar
```

.s2i/bin/run File

```
#!/bin/sh
exec java -jar app.jar
```

For a **Docker** build strategy, you must modify the ***Dockerfile*** and invoke shell commands with the **RUN** instruction:

Excerpt of *Dockerfile*

```
FROM jboss/base-jdk:8

ENV APP_VERSION 1.0
RUN wget http://repository.example.com/app/app-$APP_VERSION.jar -O app.jar

EXPOSE 8080
CMD [ "java", "-jar", "app.jar" ]
```

In practice, you may want to use an environment variable for the file location so that the specific file to be downloaded can be customized using an environment variable defined on the **BuildConfig**, rather than updating the ***Dockerfile*** or ***assemble*** script.

You can choose between different methods of defining environment variables:

- Using the ***.s2i/environment*** file] (only for a Source build strategy)
- Setting in **BuildConfig**
- Providing explicitly using **oc start-build --env** (only for builds that are triggered manually)

3.8. USING DOCKER CREDENTIALS FOR PRIVATE REGISTRIES

You can supply builds with a ***.docker/config.json*** file with valid credentials for private container registries. This allows you to push the output image into a private container image registry or pull a builder image from the private container image registry that requires authentication.

NOTE

For the OpenShift Dedicated container image registry, this is not required because secrets are generated automatically for you by OpenShift Dedicated.

The ***.docker/config.json*** file is found in your home directory by default and has the following format:

```
auths:
  https://index.docker.io/v1/: 1
    auth: "YWRfbGzhcGU6R2labnRib21ifTE=" 2
    email: "user@example.com" 3
```

1. URL of the registry.
2. Encrypted password.
3. Email address for the login.

You can define multiple container image registry entries in this file. Alternatively, you can also add authentication entries to this file by running the **docker login** command. The file will be created if it does not exist.

Kubernetes provides **Secret** objects, which can be used to store configuration and passwords.

Prerequisites

- *.docker/config.json* file

Procedure

1. Create the secret from your local *.docker/config.json* file:

```
$ oc create secret generic dockerhub \
    --from-file=.dockerconfigjson=<path/to/.docker/config.json> \
    --type=kubernetes.io/dockerconfigjson
```

   This generates a JSON specification of the secret named **dockerhub** and creates the object.

2. Once the secret is created, add it to the builder service account. Each build is run with the **builder** role, so you must give it access your secret with the following command:

```
$ oc secrets link builder dockerhub
```

3. Add a **pushSecret** field into the **output** section of the **BuildConfig** and set it to the name of the **secret** that you created, which in the above example is **dockerhub**:

```
spec:
  output:
    to:
      kind: "DockerImage"
      name: "private.registry.com/org/private-image:latest"
    pushSecret:
      name: "dockerhub"
```

   You can use the **oc set build-secret** command to set the push secret on the build configuration:

```
$ oc set build-secret --push bc/sample-build dockerhub
```

4. Pull the builder container image from a private container image registry by specifying the **pullSecret** field, which is part of the build strategy definition:

```
strategy:
  sourceStrategy:
    from:
      kind: "DockerImage"
```

```
    name: "docker.io/user/private_repository"
  pullSecret:
    name: "dockerhub"
```

You can use the **oc set build-secret** command to set the pull secret on the build configuration:

```
$ oc set build-secret --pull bc/sample-build dockerhub
```

NOTE

This example uses **pullSecret** in a Source build, but it is also applicable in Docker and Custom builds.

3.9. BUILD ENVIRONMENTS

As with pod environment variables, build environment variables can be defined in terms of references to other resources or variables using the Downward API. There are some exceptions, which are noted.

You can also manage environment variables defined in the **BuildConfig** with the **oc set env** command.

NOTE

Referencing container resources using **valueFrom** in build environment variables is not supported as the references are resolved before the container is created.

3.9.1. Using build fields as environment variables

You can inject information about the build object by setting the **fieldPath** environment variable source to the **JsonPath** of the field from which you are interested in obtaining the value.

NOTE

Jenkins Pipeline strategy does not support **valueFrom** syntax for environment variables.

Procedure

- Set the **fieldPath** environment variable source to the **JsonPath** of the field from which you are interested in obtaining the value:

```
env:
  - name: FIELDREF_ENV
    valueFrom:
      fieldRef:
        fieldPath: metadata.name
```

3.9.2. Using secrets as environment variables

You can make key values from Secrets available as environment variables using the **valueFrom** syntax.

Procedure

- To use a secret as an environment variable, set the **valueFrom** syntax:

```
apiVersion: v1
kind: BuildConfig
metadata:
  name: secret-example-bc
spec:
  strategy:
    sourceStrategy:
      env:
      - name: MYVAL
        valueFrom:
          secretKeyRef:
            key: myval
            name: mysecret
```

3.10. WHAT IS A SECRET?

The **Secret** object type provides a mechanism to hold sensitive information such as passwords, OpenShift Dedicated client configuration files, **dockercfg** files, private source repository credentials, and so on. Secrets decouple sensitive content from the pods. You can mount secrets into containers using a volume plug-in or the system can use secrets to perform actions on behalf of a pod.

YAML Secret Object Definition

```
apiVersion: v1
kind: Secret
metadata:
  name: test-secret
  namespace: my-namespace
type: Opaque 1
data: 2
  username: dmFsdWUtMQ0K 3
  password: dmFsdWUtMg0KDQo=
stringData: 4
  hostname: myapp.mydomain.com 5
```

1. Indicates the structure of the secret's key names and values.
2. The allowable format for the keys in the **data** field must meet the guidelines in the **DNS_SUBDOMAIN** value in the Kubernetes identifiers glossary.
3. The value associated with keys in the **data** map must be base64 encoded.
4. Entries in the **stringData** map are converted to base64 and the entry will then be moved to the **data** map automatically. This field is write-only; the value will only be returned via the **data** field.
5. The value associated with keys in the **stringData** map is made up of plain text strings.

3.10.1. Properties of secrets

Key properties include:

- Secret data can be referenced independently from its definition.

- Secret data volumes are backed by temporary file-storage facilities (tmpfs) and never come to rest on a node.
- Secret data can be shared within a namespace.

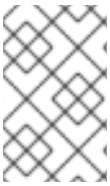
3.10.2. Types of Secrets

The value in the **type** field indicates the structure of the secret's key names and values. The type can be used to enforce the presence of user names and keys in the secret object. If you do not want validation, use the **opaque** type, which is the default.

Specify one of the following types to trigger minimal server-side validation to ensure the presence of specific key names in the secret data:

- **kubernetes.io/service-account-token**. Uses a service account token.
- **kubernetes.io/dockercfg**. Uses the ***.dockercfg*** file for required Docker credentials.
- **kubernetes.io/dockerconfigjson**. Uses the ***.docker/config.json*** file for required Docker credentials.
- **kubernetes.io/basic-auth**. Use with Basic Authentication.
- **kubernetes.io/ssh-auth**. Use with SSH Key Authentication.
- **kubernetes.io/tls**. Use with TLS certificate authorities.

Specify **type= Opaque** if you do not want validation, which means the secret does not claim to conform to any convention for key names or values. An **opaque** secret, allows for unstructured **key:value** pairs that can contain arbitrary values.



NOTE

You can specify other arbitrary types, such as **example.com/my-secret-type**. These types are not enforced server-side, but indicate that the creator of the secret intended to conform to the key/value requirements of that type.

3.10.3. Updates to secrets

When you modify the value of a secret, the value (used by an already running pod) will not dynamically change. To change a secret, you must delete the original pod and create a new pod (perhaps with an identical PodSpec).

Updating a secret follows the same workflow as deploying a new container image. You can use the **kubectl rolling-update** command.

The **resourceVersion** value in a secret is not specified when it is referenced. Therefore, if a secret is updated at the same time as pods are starting, then the version of the secret will be used for the pod will not be defined.

NOTE

Currently, it is not possible to check the resource version of a secret object that was used when a pod was created. It is planned that pods will report this information, so that a controller could restart ones using a old **resourceVersion**. In the interim, do not update the data of existing secrets, but create new ones with distinct names.

3.10.4. Creating secrets

You must create a secret before creating the pods that depend on that secret.

When creating secrets:

- Create a secret object with secret data.
- Update the pod's service account to allow the reference to the secret.
- Create a pod, which consumes the secret as an environment variable or as a file (using a **secret** volume).

Procedure

- Use the create command to create a secret object from a JSON or YAML file:

```
$ oc create -f <filename>
```

For example, you can create a secret from your local ***.docker/config.json*** file:

```
$ oc create secret generic dockerhub \
    --from-file=.dockerconfigjson=<path/to/.docker/config.json> \
    --type=kubernetes.io/dockerconfigjson
```

This command generates a JSON specification of the secret named **dockerhub** and creates the object.

YAML Opaque Secret Object Definition

```
apiVersion: v1
kind: Secret
metadata:
  name: mysecret
type: Opaque 1
data:
  username: dXNlci1uYW1l
  password: cGFzc3dvcmQ=
```

1 Specifies an *opaque* secret.

Docker Configuration JSON File Secret Object Definition

```
apiVersion: v1
kind: Secret
metadata:
  name: aregistrykey
  namespace: myapps
type: kubernetes.io/dockerconfigjson 1
data:

.dockerconfigjson:bm5ubm5ubm5ubm5ubm5ubm5ubm5ubmdnZ2dnZ2dnZ2dnZ2dnZ2dnZ2cg
YXV0aCBrZXIzCg== 2
```

1. Specifies that the secret is using a Docker configuration JSON file.
2. The output of a base64-encoded the Docker configuration JSON file

3.10.4.1. Using secrets

After creating secrets, you can create a pod to reference your secret, get logs, and delete the pod.

Procedure

1. Create the pod to reference your secret:

```
$ oc create -f <your_yaml_file>.yaml
```

2. Get the logs:

```
$ oc logs secret-example-pod
```

3. Delete the pod:

```
$ oc delete pod secret-example-pod
```

Additional resources

- Example YAML files with secret data:

  YAML Secret That Will Create Four Files

```
apiVersion: v1
kind: Secret
metadata:
  name: test-secret
data:
  username: dmFsdWUtMQ0K      (1)
  password: dmFsdWUtMQ0KDQo=  (2)
stringData:
  hostname: myapp.mydomain.com  (3)
  secret.properties: |-         (4)
    property1=valueA
    property2=valueB
```

  1. File contains decoded values.
  2. File contains decoded values.
  3. File contains the provided string.
  4. File contains the provided data.

  YAML of a Pod Populating Files in a Volume with Secret Data

```
apiVersion: v1
kind: Pod
metadata:
  name: secret-example-pod
spec:
  containers:
    - name: secret-test-container
      image: busybox
      command: [ "/bin/sh", "-c", "cat /etc/secret-volume/*" ]
      volumeMounts:
          # name must match the volume name below
          - name: secret-volume
            mountPath: /etc/secret-volume
            readOnly: true
  volumes:
    - name: secret-volume
      secret:
        secretName: test-secret
  restartPolicy: Never
```

YAML of a Pod Populating Environment Variables with Secret Data

```
apiVersion: v1
kind: Pod
metadata:
  name: secret-example-pod
spec:
  containers:
    - name: secret-test-container
      image: busybox
      command: [ "/bin/sh", "-c", "export" ]
      env:
        - name: TEST_SECRET_USERNAME_ENV_VAR
          valueFrom:
            secretKeyRef:
              name: test-secret
              key: username
  restartPolicy: Never
```

YAML of a Build Config Populating Environment Variables with Secret Data

```
apiVersion: v1
kind: BuildConfig
metadata:
  name: secret-example-bc
spec:
  strategy:
    sourceStrategy:
      env:
      - name: TEST_SECRET_USERNAME_ENV_VAR
        valueFrom:
          secretKeyRef:
            name: test-secret
            key: username
```

3.11. SERVICE SERVING CERTIFICATE SECRETS

Service serving certificate secrets are intended to support complex middleware applications that need out-of-the-box certificates. It has the same settings as the server certificates generated by the administrator tooling for nodes and masters.

Procedure

To secure communication to your service, have the cluster generate a signed serving certificate/key pair into a secret in your namespace.

- Set the **service.alpha.openshift.io/serving-cert-secret-name** annotation on your service with the value set to the name you want to use for your secret.
  Then, your **PodSpec** can mount that secret. When it is available, your pod will run. The certificate will be good for the internal service DNS name, **<service.name>.<service.namespace>.svc**.

  The certificate and key are in PEM format, stored in **tls.crt** and **tls.key** respectively. The certificate/key pair is automatically replaced when it gets close to expiration. View the expiration date in the **service.alpha.openshift.io/expiry** annotation on the secret, which is in RFC3339 format.

NOTE

In most cases, the service DNS name **<service.name>.<service.namespace>.svc** is not externally routable. The primary use of **<service.name>.<service.namespace>.svc** is for intracluster or intraservice communication, and with re-encrypt routes.

Other pods can trust cluster-created certificates (which are only signed for internal DNS names), by using the CA bundle in the */var/run/secrets/kubernetes.io/serviceaccount/service-ca.crt* file that is automatically mounted in their pod.

The signature algorithm for this feature is **x509.SHA256WithRSA**. To manually rotate, delete the generated secret. A new certificate is created.

3.12. SECRETS RESTRICTIONS

To use a secret, a pod needs to reference the secret. A secret can be used with a pod in three ways:

- To populate environment variables for containers.
- As files in a volume mounted on one or more of its containers.
- By kubelet when pulling images for the pod.

Volume type secrets write data into the container as a file using the volume mechanism. **imagePullSecrets** use service accounts for the automatic injection of the secret into all pods in a namespaces.

When a template contains a secret definition, the only way for the template to use the provided secret is to ensure that the secret volume sources are validated and that the specified object reference actually points to an object of type **Secret**. Therefore, a secret needs to be created before any pods that depend on it. The most effective way to ensure this is to have it get injected automatically through the use of a service account.

Secret API objects reside in a namespace. They can only be referenced by pods in that same namespace.

Individual secrets are limited to 1MB in size. This is to discourage the creation of large secrets that would exhaust apiserver and kubelet memory. However, creation of a number of smaller secrets could also exhaust memory.

CHAPTER 4. MANAGING BUILD OUTPUT

Use the following sections for an overview of and instructions for managing build output.

4.1. BUILD OUTPUT

Builds that use the **Docker** or **Source-to-Image (S2I)** strategy result in the creation of a new container image. The image is then pushed to the container image registry specified in the **output** section of the **Build** specification.

If the output kind is **ImageStreamTag**, then the image will be pushed to the integrated OpenShift Dedicated registry and tagged in the specified imagestream. If the output is of type **DockerImage**, then the name of the output reference will be used as a Docker push specification. The specification may contain a registry or will default to DockerHub if no registry is specified. If the output section of the build specification is empty, then the image will not be pushed at the end of the build.

Output to an ImageStreamTag

```
spec:
  output:
    to:
      kind: "ImageStreamTag"
      name: "sample-image:latest"
```

Output to a Docker Push Specification

```
spec:
  output:
    to:
      kind: "DockerImage"
      name: "my-registry.mycompany.com:5000/myimages/myimage:tag"
```

4.2. OUTPUT IMAGE ENVIRONMENT VARIABLES

Docker and **Source-to-Image (S2I)** strategy builds set the following environment variables on output images:

Variable	Description
OPENSHIFT_BUILD_NAME	Name of the build
OPENSHIFT_BUILD_NAMESPACE	Namespace of the build
OPENSHIFT_BUILD_SOURCE	The source URL of the build
OPENSHIFT_BUILD_REFERENCE	The Git reference used in the build
OPENSHIFT_BUILD_COMMIT	Source commit used in the build

Additionally, any user-defined environment variable, for example those configured with **S2I**] or **Docker** strategy options, will also be part of the output image environment variable list.

4.3. OUTPUT IMAGE LABELS

Docker and **Source-to-Image (S2I)** builds set the following labels on output images:

Label	Description
io.openshift.build.commit.author	Author of the source commit used in the build
io.openshift.build.commit.date	Date of the source commit used in the build
io.openshift.build.commit.id	Hash of the source commit used in the build
io.openshift.build.commit.message	Message of the source commit used in the build
io.openshift.build.commit.ref	Branch or reference specified in the source
io.openshift.build.source-location	Source URL for the build

You can also use the **BuildConfig.spec.output.imageLabels** field to specify a list of custom labels that will be applied to each image built from the **BuildConfig**.

Custom Labels to be Applied to Built Images

```
spec:
  output:
    to:
      kind: "ImageStreamTag"
      name: "my-image:latest"
    imageLabels:
    - name: "vendor"
      value: "MyCompany"
    - name: "authoritative-source-url"
      value: "registry.mycompany.com"
```

CHAPTER 5. USING BUILD STRATEGIES

The following sections define the primary supported build strategies, and how to use them.

5.1. DOCKER BUILD

The Docker build strategy invokes the docker build command, and it expects a repository with a ***Dockerfile*** and all required artifacts in it to produce a runnable image.

5.1.1. Replacing Dockerfile FROM image

You can replace the **FROM** instruction of the ***Dockerfile*** with the **from** of the **BuildConfig**. If the ***Dockerfile*** uses multi-stage builds, the image in the last **FROM** instruction will be replaced.

Procedure

To replace the **FROM** instruction of the ***Dockerfile*** with the **from** of the **BuildConfig**.

```
strategy:
  dockerStrategy:
    from:
      kind: "ImageStreamTag"
      name: "debian:latest"
```

5.1.2. Using Dockerfile path

By default, Docker builds use a Dockerfile (named ***Dockerfile***) located at the root of the context specified in the **BuildConfig.spec.source.contextDir** field.

The **dockerfilePath** field allows the build to use a different path to locate your Dockerfile, relative to the **BuildConfig.spec.source.contextDir** field. It can be a different file name than the default ***Dockerfile*** (for example, ***MyDockerfile***), or a path to a Dockerfile in a subdirectory (for example, ***dockerfiles/app1/Dockerfile***).

Procedure

To use the **dockerfilePath** field for the build to use a different path to locate your Dockerfile, set:

```
strategy:
  dockerStrategy:
    dockerfilePath: dockerfiles/app1/Dockerfile
```

5.1.3. Using Docker environment variables

To make environment variables available to the Docker build process and resulting image, you can add environment variables to the **dockerStrategy** definition of the **BuildConfig**.

The environment variables defined there are inserted as a single **ENV** Dockerfile instruction right after the **FROM** instruction, so that it can be referenced later on within the Dockerfile.

Procedure

The variables are defined during build and stay in the output image, therefore they will be present in any container that runs that image as well.

For example, defining a custom HTTP proxy to be used during build and runtime:

```
dockerStrategy:
...
  env:
    - name: "HTTP_PROXY"
      value: "http://myproxy.net:5187/"
```

You can also manage environment variables defined in the **BuildConfig** with the **oc set env** command.

5.1.4. Adding Docker build arguments

You can set Docker build arguments using the **BuildArgs** array. The build arguments will be passed to Docker when a build is started.

Procedure

To set Docker build arguments, add entries to the **BuildArgs** array, which is located in the **dockerStrategy** definition of the **BuildConfig**. For example:

```
dockerStrategy:
...
  buildArgs:
    - name: "foo"
      value: "bar"
```

5.2. SOURCE-TO-IMAGE (S2I) BUILD

Source-to-Image (S2I) is a tool for building reproducible, Docker-formatted container images. It produces ready-to-run images by injecting application source into a container image and assembling a new image. The new image incorporates the base image (the builder) and built source and is ready to use with the **buildah run** command. S2I supports incremental builds, which re-use previously downloaded dependencies, previously built artifacts, etc.

The advantages of S2I include the following:

Image flexibility	S2I scripts can be written to inject application code into almost any existing Docker-formatted container image, taking advantage of the existing ecosystem. Note that, currently, S2I relies on **tar** to inject application source, so the image needs to be able to process tarred content.
Speed	With S2I, the assemble process can perform a large number of complex operations without creating a new layer at each step, resulting in a fast process. In addition, S2I scripts can be written to re-use artifacts stored in a previous version of the application image, rather than having to download or build them each time the build is run.
Patchability	S2I allows you to rebuild the application consistently if an underlying image needs a patch due to a security issue.
Operational efficiency	By restricting build operations instead of allowing arbitrary actions, as a ***Dockerfile*** would allow, the PaaS operator can avoid accidental or intentional abuses of the build system.

Operational security	Building an arbitrary ***Dockerfile*** exposes the host system to root privilege escalation. This can be exploited by a malicious user because the entire Docker build process is run as a user with Docker privileges. S2I restricts the operations performed as a root user and can run the scripts as a non-root user.
User efficiency	S2I prevents developers from performing arbitrary **yum install** type operations, which could slow down development iteration, during their application build.
Ecosystem	S2I encourages a shared ecosystem of images where you can leverage best practices for your applications.
Reproducibility	Produced images can include all inputs including specific versions of build tools and dependencies. This ensures that the image can be reproduced precisely.

5.2.1. Performing Source-to-Image (S2I) incremental builds

S2I can perform incremental builds, which means it reuses artifacts from previously-built images.

Procedure

To create an incremental build, create a **BuildConfig** with the following modification to the strategy definition:

```
strategy:
  sourceStrategy:
    from:
      kind: "ImageStreamTag"
      name: "incremental-image:latest" 1
    incremental: true 2
```

1. Specify an image that supports incremental builds. Consult the documentation of the builder image to determine if it supports this behavior.
2. This flag controls whether an incremental build is attempted. If the builder image does not support incremental builds, the build will still succeed, but you will get a log message stating the incremental build was not successful because of a missing ***save-artifacts*** script.

Additional resources

- See S2I Requirements for information on how to create a builder image supporting incremental builds.

5.2.2. Overriding Source-to-Image (S2I) builder image scripts

You can override the ***assemble***, ***run***, and ***save-artifacts*** S2I scripts provided by the builder image.

Procedure

To override the ***assemble***, ***run***, and ***save-artifacts*** S2I scripts provided by the builder image, either:

1. Provide an ***assemble***, ***run***, or ***save-artifacts*** script in the ***.s2i/bin*** directory of your application source repository, or

2. Provide a URL of a directory containing the scripts as part of the strategy definition. For example:

```
strategy:
  sourceStrategy:
    from:
      kind: "ImageStreamTag"
      name: "builder-image:latest"
    scripts: "http://somehost.com/scripts_directory" 1
```

1 This path will have ***run***, ***assemble***, and ***save-artifacts*** appended to it. If any or all scripts are found they will be used in place of the same named script(s) provided in the image.

NOTE

Files located at the **scripts** URL take precedence over files located in ***.s2i/bin*** of the source repository.

5.2.3. Source-to-Image (S2I) environment variables

There are two ways to make environment variables available to the source build process and resulting image. Environment files and **BuildConfig** environment values. Variables provided will be present during the build process and in the output image.

5.2.3.1. Using Source-to-Image (S2I) environment files

Source build enables you to set environment values (one per line) inside your application, by specifying them in a ***.s2i/environment*** file in the source repository. The environment variables specified in this file are present during the build process and in the output image.

If you provide a ***.s2i/environment*** file in your source repository, S2I reads this file during the build. This allows customization of the build behavior as the ***assemble*** script may use these variables.

Procedure

For example, to disable assets compilation for your Rails application during the build:

- Add **DISABLE_ASSET_COMPILATION=true** in the ***.s2i/environment*** file.

In addition to builds, the specified environment variables are also available in the running application itself. For example, to cause the Rails application to start in **development** mode instead of **production**:

- Add **RAILS_ENV=development** to the ***.s2i/environment*** file.

Additional resources

- The complete list of supported environment variables is available in the using images section for each image.

5.2.3.2. Using Source-to-Image (S2I) BuildConfig environment

You can add environment variables to the **sourceStrategy** definition of the **BuildConfig**. The environment variables defined there are visible during the ***assemble*** script execution and will be defined in the output image, making them also available to the ***run*** script and application code.

Procedure

- For example, to disable assets compilation for your Rails application:

```
sourceStrategy:
...
  env:
    - name: "DISABLE_ASSET_COMPILATION"
      value: "true"
```

Additional resources

- The Build environment section provides more advanced instructions.
- You can also manage environment variables defined in the **BuildConfig** with the **oc set env** command.

5.2.4. Ignoring Source-to-Image (S2I) source files

Source to image supports a **.s2iignore** file, which contains a list of file patterns that should be ignored. Files in the build working directory, as provided by the various input sources, that match a pattern found in the **.s2iignore** file will not be made available to the **assemble** script.

For more details on the format of the **.s2iignore** file, see the source-to-image documentation.

5.2.5. Creating images from source code with s2i

Source-to-Image (S2I) is a framework that makes it easy to write images that take application source code as an input and produce a new image that runs the assembled application as output.

The main advantage of using S2I for building reproducible container images is the ease of use for developers. As a builder image author, you must understand two basic concepts in order for your images to provide the best possible S2I performance: the build process and S2I scripts.

5.2.5.1. Understanding the S2I build process

The build process consists of the following three fundamental elements, which are combined into a final container image:

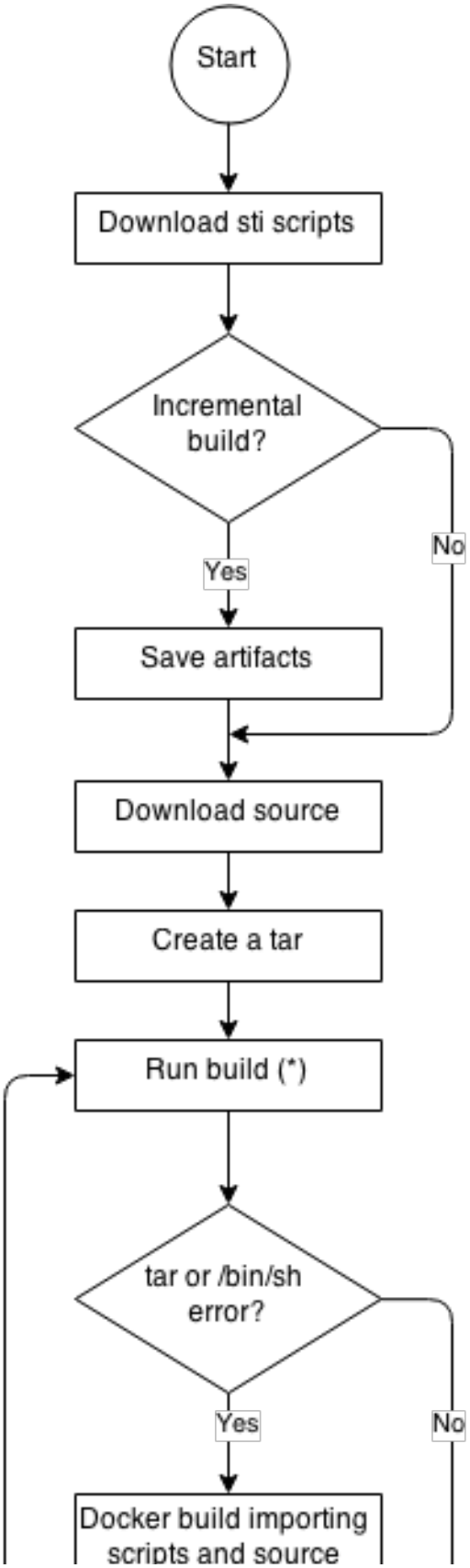
- sources
- S2I scripts
- builder image

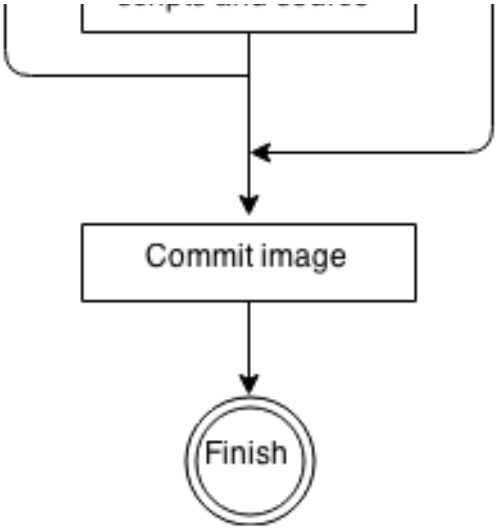
During the build process, S2I must place sources and scripts inside the builder image. To do so, S2I creates a **tar** file that contains the sources and scripts, then streams that file into the builder image. Before executing the **assemble** script, S2I un-tars that file and places its contents into the location specified by the **io.openshift.s2i.destination** label from the builder image, with the default location being the /**tmp** directory.

For this process to happen, your image must supply the **tar** archiving utility (the **tar** command available in **$PATH**) and the command line interpreter (the **/bin/sh** command); this allows your image to use the fastest possible build path. If the **tar** or **/bin/sh** command is not available, the **s2i build** process is forced to automatically perform an additional container build to put both the sources and the scripts inside the image, and only then run the usual build.

See the following diagram for the basic S2I build workflow:

Figure 5.1. Build Workflow





Run build's responsibility is to un-tar the sources, scripts and artifacts (if such exist) and invoke the **assemble** script. If this is the second run (after catching **tar** or **/bin/sh** not found error) it is responsible only for invoking **assemble** script, since both scripts and sources are already there.

5.2.5.2. Writing S2I scripts

You can write S2I scripts in any programming language, as long as the scripts are executable inside the builder image. S2I supports multiple options providing **assemble/run/save-artifacts** scripts. All of these locations are checked on each build in the following order:

1. A script specified in the BuildConfig
2. A script found in the application source **.s2i/bin** directory
3. A script found at the default image URL (**io.openshift.s2i.scripts-url** label)

Both the **io.openshift.s2i.scripts-url** label specified in the image and the script specified in a **BuildConfig** can take one of the following forms:

- **image:///path_to_scripts_dir** - absolute path inside the image to a directory where the S2I scripts are located
- **file:///path_to_scripts_dir** - relative or absolute path to a directory on the host where the S2I scripts are located
- **http(s)://path_to_scripts_dir** - URL to a directory where the S2I scripts are located

Table 5.1. S2I Scripts

Script	Description

Script	Description
assemble (required)	The ***assemble*** script builds the application artifacts from a source and places them into appropriate directories inside the image. The workflow for this script is: 1. Restore build artifacts. If you want to support incremental builds, make sure to define ***save-artifacts*** as well (optional). 2. Place the application source in the desired location. 3. Build the application artifacts. 4. Install the artifacts into locations appropriate for them to run.
run (required)	The ***run*** script executes your application.
save-artifacts (optional)	The ***save-artifacts*** script gathers all dependencies that can speed up the build processes that follow. For example: • For Ruby, **gems** installed by Bundler. • For Java, **.m2** contents. These dependencies are gathered into a tar file and streamed to the standard output.
usage (optional)	The ***usage*** script allows you to inform the user how to properly use your image.
test/run (optional)	The ***test/run*** script allows you to create a simple process to check if the image is working correctly. The proposed flow of that process is: 1. Build the image. 2. Run the image to verify the ***usage*** script. 3. Run **s2i build** to verify the ***assemble*** script. 4. Run **s2i build** again to verify the ***save-artifacts*** and ***assemble*** scripts save and restore artifacts functionality. (optional) 5. Run the image to verify the test application is working.  **NOTE** The suggested location to put the test application built by your ***test/run*** script is the ***test/test-app*** directory in your image repository. See the S2I documentation for more information.

5.2.5.2.1. Example S2I Scripts

The following example S2I scripts are written in Bash. Each example assumes its tar contents are unpacked into the **/tmp/s2i** directory.

Example 5.1. assemble script:

```
#!/bin/bash

# restore build artifacts
if [ "$(ls /tmp/s2i/artifacts/ 2>/dev/null)" ]; then
    mv /tmp/s2i/artifacts/* $HOME/.
fi

# move the application source
mv /tmp/s2i/src $HOME/src

# build application artifacts
pushd ${HOME}
make all

# install the artifacts
make install
popd
```

Example 5.2. run script:

```
#!/bin/bash

# run the application
/opt/application/run.sh
```

Example 5.3. *save-artifacts* script:

```
#!/bin/bash

pushd ${HOME}
if [ -d deps ]; then
    # all deps contents to tar stream
    tar cf - deps
fi
popd
```

Example 5.4. usage script:

```
#!/bin/bash

# inform the user how to use the image
cat <<EOF
This is a S2I sample builder image, to use it, install
https://github.com/openshift/source-to-image
EOF
```

5.3. CUSTOM BUILD

The Custom build strategy allows developers to define a specific builder image responsible for the entire build process. Using your own builder image allows you to customize your build process.

A Custom builder image is a plain Docker-formatted container image embedded with build process logic, for example for building RPMs or base images.

Custom builds run with a very high level of privilege and are not available to users by default. Only users who can be trusted with cluster administration permissions should be granted access to run custom builds.

5.3.1. Using FROM image for custom builds

You can use the **customStrategy.from** section to indicate the image to use for the custom build

Procedure

To set the **customStrategy.from** section:

```
strategy:
  customStrategy:
    from:
      kind: "DockerImage"
      name: "openshift/sti-image-builder"
```

5.3.2. Using secrets in custom builds

In addition to secrets for source and images that can be added to all build types, custom strategies allow adding an arbitrary list of secrets to the builder pod.

Procedure

To mount each secret at a specific location:

```
strategy:
  customStrategy:
    secrets:
      - secretSource: 1
          name: "secret1"
        mountPath: "/tmp/secret1" 2
      - secretSource:
          name: "secret2"
        mountPath: "/tmp/secret2"
```

1. **secretSource** is a reference to a secret in the same namespace as the build.
2. **mountPath** is the path inside the custom builder where the secret should be mounted.

5.3.3. Using environment variables for custom builds

To make environment variables available to the Custom build process, you can add environment variables to the **customStrategy** definition of the **BuildConfig**.

The environment variables defined there are passed to the pod that runs the custom build.

Procedure

To define a custom HTTP proxy to be used during build:

```
customStrategy:
...
  env:
    - name: "HTTP_PROXY"
      value: "http://myproxy.net:5187/"
```

You can also manage environment variables defined in the **BuildConfig** with the **oc set env** command.

5.3.4. Using custom builder images

By allowing you to define a specific builder image responsible for the entire build process, OpenShift Dedicated's Custom build strategy was designed to fill a gap created with the increased popularity of creating container images. When there is a requirement for a build to still produce individual artifacts (packages, JARs, WARs, installable ZIPs, and base images, for example), a *Custom builder image* using the Custom build strategy is the perfect match to fill that gap.

A Custom builder image is a plain container image embedded with build process logic, for example for building RPMs or base container images.

Additionally, the Custom builder allows implementing any extended build process, for example a CI/CD flow that runs unit or integration tests.

To fully leverage the benefits of the Custom build strategy, you must understand how to create a Custom builder image that will be capable of building desired objects.

5.3.4.1. Custom builder image

Upon invocation, a custom builder image will receive the following environment variables with the information needed to proceed with the build:

Table 5.2. Custom Builder Environment Variables

Variable Name	Description
BUILD	The entire serialized JSON of the **Build** object definition. If you must use a specific API version for serialization, you can set the **buildAPIVersion** parameter in the custom strategy specification of the build configuration.
SOURCE_REPOSITORY	The URL of a Git repository with source to be built.
SOURCE_URI	Uses the same value as **SOURCE_REPOSITORY**. Either can be used.
SOURCE_CONTEXT_DIR	Specifies the subdirectory of the Git repository to be used when building. Only present if defined.
SOURCE_REF	The Git reference to be built.

Variable Name	Description
ORIGIN_VERSION	The version of the OpenShift Dedicated master that created this build object.
OUTPUT_REGISTRY	The container image registry to push the image to.
OUTPUT_IMAGE	The container image tag name for the image being built.
PUSH_DOCKERCFG_PATH	The path to the container registry credentials for running a **podman push** or **docker push** operation.

5.3.4.2. Custom builder workflow

Although custom builder image authors have great flexibility in defining the build process, your builder image must still adhere to the following required steps necessary for seamlessly running a build inside of OpenShift Dedicated:

1. The **Build** object definition contains all the necessary information about input parameters for the build.
2. Run the build process.
3. If your build produces an image, push it to the build's output location if it is defined. Other output locations can be passed with environment variables.

5.4. PIPELINE BUILD

IMPORTANT

The Pipeline build strategy is deprecated in OpenShift Dedicated 4. Equivalent and improved functionality is present in the OpenShift Pipelines based on Tekton.

Jenkins images on OpenShift are fully supported and users should follow Jenkins user documentation for defining their Jenkinsfile in a job or store it in a Source Control Management system.

The Pipeline build strategy allows developers to define a *Jenkins pipeline* for execution by the Jenkins pipeline plug-in. The build can be started, monitored, and managed by OpenShift Dedicated in the same way as any other build type.

Pipeline workflows are defined in a Jenkinsfile, either embedded directly in the build configuration, or supplied in a Git repository and referenced by the build configuration.

5.4.1. Understanding OpenShift Dedicated pipelines

Pipelines give you control over building, deploying, and promoting your applications on OpenShift Dedicated. Using a combination of the Jenkins Pipeline Build Strategy, Jenkinsfiles, and the OpenShift Dedicated Domain Specific Language (DSL) (provided by the Jenkins Client Plug-in), you can create advanced build, test, deploy, and promote pipelines for any scenario.

OpenShift Dedicated Jenkins Sync Plugin

The OpenShift Dedicated Jenkins Sync Plugin keeps **BuildConfig** and Build objects in sync with Jenkins Jobs and Builds, and provides the following:

- Dynamic job/run creation in Jenkins.
- Dynamic creation of slave pod templates from ImageStreams, ImageStreamTags, or ConfigMaps.
- Injecting of environment variables.
- Pipeline visualization in the OpenShift web console.
- Integration with the Jenkins git plugin, which passes commit information from
- Synchronizing secrets into Jenkins credential entries OpenShift builds to the Jenkins git plugin.

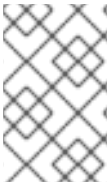
OpenShift Dedicated Jenkins Client Plugin

The OpenShift Dedicated Jenkins Client Plugin is a Jenkins plugin which aims to provide a readable, concise, comprehensive, and fluent Jenkins Pipeline syntax for rich interactions with an OpenShift Dedicated API Server. The plugin leverages the OpenShift command line tool (**oc**) which must be available on the nodes executing the script.

The Jenkins Client Plug-in must be installed on your Jenkins master so the OpenShift Dedicated DSL will be available to use within the JenkinsFile for your application. This plug-in is installed and enabled by default when using the OpenShift Dedicated Jenkins image.

For OpenShift Dedicated Pipelines within your project, you will must use the Jenkins Pipeline Build Strategy. This strategy defaults to using a **jenkinsfile** at the root of your source repository, but also provides the following configuration options:

- An inline **jenkinsfile** field within your **BuildConfig**.
- A **jenkinsfilePath** field within your **BuildConfig** that references the location of the **jenkinsfile** to use relative to the source **contextDir**.



NOTE

The optional **jenkinsfilePath** field specifies the name of the file to use, relative to the source **contextDir**. If **contextDir** is omitted, it defaults to the root of the repository. If **jenkinsfilePath** is omitted, it defaults to **jenkinsfile**.

5.4.2. Providing the Jenkinsfile for pipeline builds

The **jenkinsfile** uses the standard groovy language syntax to allow fine grained control over the configuration, build, and deployment of your application.

You can supply the **jenkinsfile** in one of the following ways:

- A file located within your source code repository.
- Embedded as part of your build configuration using the **jenkinsfile** field.

When using the first option, the **jenkinsfile** must be included in your applications source code repository at one of the following locations:

- A file named **jenkinsfile** at the root of your repository.

- A file named **jenkinsfile** at the root of the source **contextDir** of your repository.
- A file name specified via the **jenkinsfilePath** field of the **JenkinsPipelineStrategy** section of your BuildConfig, which is relative to the source **contextDir** if supplied, otherwise it defaults to the root of the repository.

The **jenkinsfile** is executed on the Jenkins slave pod, which must have the OpenShift Client binaries available if you intend to use the OpenShift DSL.

Procedure

To provide the Jenkinsfile, you can either:

1. Embed the Jenkinsfile in the build configuration.
2. Include in the build configuration a reference to the Git repository that contains the Jenkinsfile.

Embedded Definition

```
kind: "BuildConfig"
apiVersion: "v1"
metadata:
  name: "sample-pipeline"
spec:
  strategy:
    jenkinsPipelineStrategy:
      jenkinsfile: |-
        node('agent') {
          stage 'build'
          openshiftBuild(buildConfig: 'ruby-sample-build', showBuildLogs: 'true')
          stage 'deploy'
          openshiftDeploy(deploymentConfig: 'frontend')
        }
```

Reference to Git Repository

```
kind: "BuildConfig"
apiVersion: "v1"
metadata:
  name: "sample-pipeline"
spec:
  source:
    git:
      uri: "https://github.com/openshift/ruby-hello-world"
  strategy:
    jenkinsPipelineStrategy:
      jenkinsfilePath: some/repo/dir/filename 1
```

1 The optional **jenkinsfilePath** field specifies the name of the file to use, relative to the source **contextDir**. If **contextDir** is omitted, it defaults to the root of the repository. If **jenkinsfilePath** is omitted, it defaults to ***Jenkinsfile***.

5.4.3. Using environment variables for pipeline builds

To make environment variables available to the Pipeline build process, you can add environment variables to the **jenkinsPipelineStrategy** definition of the **BuildConfig**.

Once defined, the environment variables will be set as parameters for any Jenkins job associated with the **BuildConfig**

Procedure

To define environment variables to be used during build:

```
jenkinsPipelineStrategy:
...
  env:
    - name: "FOO"
      value: "BAR"
```

You can also manage environment variables defined in the **BuildConfig** with the **oc set env** command.

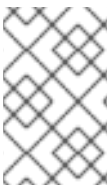
5.4.3.1. Mapping between BuildConfig environment variables and Jenkins job parameters

When a Jenkins job is created or updated based on changes to a Pipeline strategy **BuildConfig**, any environment variables in the **BuildConfig** are mapped to Jenkins job parameters definitions, where the default values for the Jenkins job parameters definitions are the current values of the associated environment variables.

After the Jenkins job's initial creation, you can still add additional parameters to the job from the Jenkins console. The parameter names differ from the names of the environment variables in the **BuildConfig**. The parameters are honored when builds are started for those Jenkins jobs.

How you start builds for the Jenkins job dictates how the parameters are set.

- If you start with **oc start-build**, the values of the environment variables in the **BuildConfig** are the parameters set for the corresponding job instance. Any changes you make to the parameters' default values from the Jenkins console are ignored. The **BuildConfig** values take precedence.
- If you start with **oc start-build -e**, the values for the environment variables specified in the **-e** option take precedence.
    - If you specify an environment variable not listed in the **BuildConfig**, they will be added as a Jenkins job parameter definitions.
    - Any changes you make from the Jenkins console to the parameters corresponding to the environment variables are ignored. The **BuildConfig** and what you specify with **oc start-build -e** takes precedence.
- If you start the Jenkins job with the Jenkins console, then you can control the setting of the parameters with the Jenkins console as part of starting a build for the job.



NOTE

It is recommended that you specify in the **BuildConfig** all possible environment variables to be associated with job parameters. Doing so reduces disk I/O and improves performance during Jenkins processing.

5.4.4. Pipeline build tutorial

This example demonstrates how to create an OpenShift Pipeline that will build, deploy, and verify a **Node.js/MongoDB** application using the **nodejs-mongodb.json** template.

Procedure

1. Create the Jenkins master:

```
$ oc project <project_name> 1
$ oc new-app jenkins-ephemeral 2
```

1. Select the project that you want to use or create a new project with **oc new-project <project_name>**.

2. If you want to use persistent storage, use **jenkins-persistent** instead.

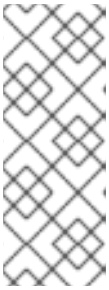
2. Create a file named **nodejs-sample-pipeline.yaml** with the following content:

NOTE

This creates a **BuildConfig** that employs the Jenkins pipeline strategy to build, deploy, and scale the **Node.js/MongoDB** example application.

```
kind: "BuildConfig"
apiVersion: "v1"
metadata:
  name: "nodejs-sample-pipeline"
spec:
  strategy:
    jenkinsPipelineStrategy:
      jenkinsfile: <pipeline content from below>
    type: JenkinsPipeline
```

3. Once you create a **BuildConfig** with a **jenkinsPipelineStrategy**, tell the pipeline what to do by using an inline **jenkinsfile**:



NOTE

This example does not set up a Git repository for the application.

The following **jenkinsfile** content is written in Groovy using the OpenShift DSL. For this example, include inline content in the **BuildConfig** using the YAML Literal Style, though including a **jenkinsfile** in your source repository is the preferred method.

```
def templatePath = 'https://raw.githubusercontent.com/openshift/nodejs-
ex/master/openshift/templates/nodejs-mongodb.json' 1
def templateName = 'nodejs-mongodb-example' 2
pipeline {
  agent {
    node {
      label 'nodejs' 3
    }
```

```
}
options {
  timeout(time: 20, unit: 'MINUTES') 4
}
stages {
  stage('preamble') {
      steps {
          script {
              openshift.withCluster() {
                  openshift.withProject() {
                      echo "Using project: ${openshift.project()}"
                  }
              }
          }
      }
  }
  stage('cleanup') {
    steps {
      script {
          openshift.withCluster() {
              openshift.withProject() {
                openshift.selector("all", [ template : templateName ]).delete() 5
                if (openshift.selector("secrets", templateName).exists()) { 6
                  openshift.selector("secrets", templateName).delete()
                }
              }
          }
      }
    }
  }
  stage('create') {
    steps {
      script {
          openshift.withCluster() {
              openshift.withProject() {
                openshift.newApp(templatePath) 7
              }
          }
      }
    }
  }
  stage('build') {
    steps {
      script {
          openshift.withCluster() {
              openshift.withProject() {
                def builds = openshift.selector("bc", templateName).related('builds')
                timeout(5) { 8
                  builds.untilEach(1) {
                    return (it.object().status.phase == "Complete")
                  }
                }
              }
          }
      }
```

```
      }
    }
    stage('deploy') {
      steps {
        script {
            openshift.withCluster() {
              openshift.withProject() {
                def rm = openshift.selector("dc", templateName).rollout()
                timeout(5) { 9
                  openshift.selector("dc", templateName).related('pods').untilEach(1) {
                    return (it.object().status.phase == "Running")
                  }
                }
              }
            }
        }
      }
    }
    stage('tag') {
      steps {
        script {
            openshift.withCluster() {
              openshift.withProject() {
                openshift.tag("${templateName}:latest", "${templateName}-staging:latest") 10
              }
            }
        }
      }
    }
  }
}
```

1. Path of the template to use.
2. Name of the template that will be created.
3. Spin up a **node.js** slave pod on which to run this build.
4. Set a timeout of 20 minutes for this pipeline.
5. Delete everything with this template label.
6. Delete any secrets with this template label.
7. Create a new application from the **templatePath**.
8. Wait up to five minutes for the build to complete.
9. Wait up to five minutes for the deployment to complete.
10. If everything else succeeded, tag the **$ {templateName}:latest** image as **$ {templateName}-staging:latest**. A pipeline **BuildConfig** for the staging environment can watch for the **$ {templateName}-staging:latest** image to change and then deploy it to the staging environment.

NOTE

The previous example was written using the **declarative pipeline** style, but the older **scripted pipeline** style is also supported.

4. Create the Pipeline **BuildConfig** in your OpenShift cluster:

```
$ oc create -f nodejs-sample-pipeline.yaml
```

   a. If you do not want to create your own file, you can use the sample from the Origin repository by running:

```
$ oc create -f
https://raw.githubusercontent.com/openshift/origin/master/examples/jenkins/pipeline/nodejs-sample-pipeline.yaml
```

5. Start the Pipeline:

```
$ oc start-build nodejs-sample-pipeline
```

NOTE

Alternatively, you can start your pipeline with the OpenShift Web Console by navigating to the Builds → Pipeline section and clicking **Start Pipeline**, or by visiting the Jenkins Console, navigating to the Pipeline that you created, and clicking **Build Now**.

Once the pipeline is started, you should see the following actions performed within your project:

- A job instance is created on the Jenkins server.
- A slave pod is launched, if your pipeline requires one.
- The pipeline runs on the slave pod, or the master if no slave is required.
  - Any previously created resources with the **template=nodejs-mongodb-example** label will be deleted.
  - A new application, and all of its associated resources, will be created from the **nodejs-mongodb-example** template.
  - A build will be started using the **nodejs-mongodb-example BuildConfig**.
    - The pipeline will wait until the build has completed to trigger the next stage.
  - A deployment will be started using the **nodejs-mongodb-example** deployment configuration.
    - The pipeline will wait until the deployment has completed to trigger the next stage.
  - If the build and deploy are successful, the **nodejs-mongodb-example:latest** image will be tagged as **nodejs-mongodb-example:stage**.
- The slave pod is deleted, if one was required for the pipeline.

NOTE

The best way to visualize the pipeline execution is by viewing it in the OpenShift Web Console. You can view your pipelines by logging in to the web console and navigating to Builds → Pipelines.

5.5. ADDING SECRETS WITH WEB CONSOLE

You can add a secret to your build configuration so that it can access a private repository.

Procedure

To add a secret to your build configuration so that it can access a private repository:

1. Create a new OpenShift Dedicated project.
2. Create a secret that contains credentials for accessing a private source code repository.
3. Create a build configuration.
4. On the build configuration editor page or in the **create app from builder image** page of the web console, set the **Source Secret**.
5. Click the **Save** button.

5.6. ENABLING PULLING AND PUSHING

You can enable pulling to a private registry by setting the **Pull Secret** and pushing by setting the **Push Secret** in the build configuration.

Procedure

To enable pulling to a private registry:

- Set the **Pull Secret** in the build configuration.

To enable pushing:

- Set the **Push Secret** in the build configuration.

CHAPTER 6. PERFORMING BASIC BUILDS

The following sections provide instructions for basic build operations including starting and canceling builds, deleting BuildConfigs, viewing build details, and accessing build logs.

6.1. STARTING A BUILD

You can manually start a new build from an existing build configuration in your current project.

Procedure

To manually start a build, run:

```
$ oc start-build <buildconfig_name>
```

6.1.1. Re-running a build

You can manually re-run a build using the **--from-build** flag.

Procedure

To manually re-run a build, run:

```
$ oc start-build --from-build=<build_name>
```

6.1.2. Streaming build logs

You can specify the **--follow** flag to stream the build's logs in stdout.

Procedure

To manually stream a build's logs in stdout, run:

```
$ oc start-build <buildconfig_name> --follow
```

6.1.3. Setting environment variables when starting a build

You can specify the **--env** flag to set any desired environment variable for the build.

Procedure

To specify a desired environment variable, run:

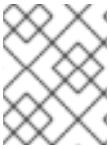
```
$ oc start-build <buildconfig_name> --env=<key>=<value>
```

6.1.4. Starting a build with source

Rather than relying on a Git source pull or a Dockerfile for a build, you can can also start a build by directly pushing your source, which could be the contents of a Git or SVN working directory, a set of prebuilt binary artifacts you want to deploy, or a single file. This can be done by specifying one of the following options for the **start-build** command:

Option	Description
--from-dir=<directory>	Specifies a directory that will be archived and used as a binary input for the build.
--from-file=<file>	Specifies a single file that will be the only file in the build source. The file is placed in the root of an empty directory with the same file name as the original file provided.
--from-repo=<local_source_repo>	Specifies a path to a local repository to use as the binary input for a build. Add the **--commit** option to control which branch, tag, or commit is used for the build.

When passing any of these options directly to the build, the contents are streamed to the build and override the current build source settings.



NOTE

Builds triggered from binary input will not preserve the source on the server, so rebuilds triggered by base image changes will use the source specified in the build configuration.

Procedure

For example, the following command sends the contents of a local Git repository as an archive from the tag **v2** and starts a build:

```
$ oc start-build hello-world --from-repo=../hello-world --commit=v2
```

6.2. CANCELING A BUILD

You can cancel a build using the web console, or with the following CLI command.

Procedure

To manually cancel a build, run:

```
$ oc cancel-build <build_name>
```

6.2.1. Canceling multiple builds

You can cancel multiple builds with the following CLI command.

Procedure

To manually cancel multiple builds, run:

```
$ oc cancel-build <build1_name> <build2_name> <build3_name>
```

6.2.2. Canceling all builds

You can cancel all builds from the build configuration with the following CLI command.

Procedure

To cancel all builds, run:

```
$ oc cancel-build bc/<buildconfig_name>
```

6.2.3. Canceling all builds in a given state

You can cancel all builds in a given state (for example, **new** or **pending**), ignoring the builds in other states.

Procedure

To cancel all in a given state, run:

```
$ oc cancel-build bc/<buildconfig_name>
```

6.3. DELETING A BUILDCONFIG

You can delete a **BuildConfig** using the following command.

Procedure

To delete a **BuildConfig**, run:

```
$ oc delete bc <BuildConfigName>
```

This also deletes all builds that were instantiated from this **BuildConfig**. Specify the **--cascade=false** flag if you do not want to delete the builds:

```
$ oc delete --cascade=false bc <BuildConfigName>
```

6.4. VIEWING BUILD DETAILS

You can view build details with the web console or by using the **oc describe** CLI command.

This displays information such as:

- The build source
- The build strategy
- The output destination
- Digest of the image in the destination registry
- How the build was created

If the build uses the **Docker** or **Source** strategy, the **oc describe** output also includes information about the source revision used for the build, including the commit ID, author, committer, and message.

Procedure

To view build details, run:

```
$ oc describe build <build_name>
```

6.5. ACCESSING BUILD LOGS

You can access build logs using the web console or the CLI.

Procedure

To stream the logs using the build directly, run:

```
$ oc describe build <build_name>
```

6.5.1. Accessing BuildConfig logs

You can access **BuildConfig** logs using the web console or the CLI.

Procedure

To stream the logs of the latest build for a BuildConfig, run:

```
$ oc logs -f bc/<buildconfig_name>
```

6.5.2. Accessing BuildConfig logs for a given version build

You can access logs for a given version build for a **BuildConfig** using the web console or the CLI.

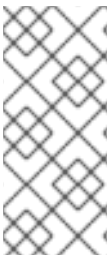
Procedure

To stream the logs for a given version build for a BuildConfig, run:

```
$ oc logs --version=<number> bc/<buildconfig_name>
```

6.5.3. Enabling log verbosity

You can enable a more verbose output by passing the **BUILD_LOGLEVEL** environment variable as part of the **sourceStrategy** or **dockerStrategy** in a **BuildConfig**.



NOTE

An administrator can set the default build verbosity for the entire OpenShift Dedicated instance by configuring **env/BUILD_LOGLEVEL**. This default can be overridden by specifying **BUILD_LOGLEVEL** in a given **BuildConfig**. You can specify a higher priority override on the command line for non-binary builds by passing **--build-loglevel** to **oc start-build**.

Available log levels for Source builds are as follows:

Level 0	Produces output from containers running the ***assemble*** script and all encountered errors. This is the default.
Level 1	Produces basic information about the executed process.

Level 2	Produces very detailed information about the executed process.
Level 3	Produces very detailed information about the executed process, and a listing of the archive contents.
Level 4	Currently produces the same information as level 3.
Level 5	Produces everything mentioned on previous levels and additionally provides docker push messages.

Procedure

To enable more verbose output, pass the **BUILD_LOGLEVEL** environment variable as part of the **sourceStrategy** or **dockerStrategy** in a **BuildConfig**:

```
sourceStrategy:
...
  env:
    - name: "BUILD_LOGLEVEL"
      value: "2" 1
```

1 Adjust this value to the desired log level.

CHAPTER 7. TRIGGERING AND MODIFYING BUILDS

The following sections outline how to trigger builds and modify builds using build hooks.

7.1. BUILD TRIGGERS

When defining a **BuildConfig**, you can define triggers to control the circumstances in which the **BuildConfig** should be run. The following build triggers are available:

- Webhook
- Image change
- Configuration change

7.1.1. Webhook triggers

Webhook triggers allow you to trigger a new build by sending a request to the OpenShift Dedicated API endpoint. You can define these triggers using GitHub, GitLab, Bitbucket, or Generic webhooks.

Currently, OpenShift Dedicated webhooks only support the analogous versions of the push event for each of the Git-based source code management systems (SCMs). All other event types are ignored.

When the push events are processed, the OpenShift Dedicated master host confirms if the branch reference inside the event matches the branch reference in the corresponding **BuildConfig**. If so, it then checks out the exact commit reference noted in the webhook event on the OpenShift Dedicated build. If they do not match, no build is triggered.

NOTE

oc new-app and **oc new-build** will create GitHub and Generic webhook triggers automatically, but any other needed webhook triggers must be added manually (see Setting Triggers).

For all webhooks, you must define a **Secret** with a key named **WebHookSecretKey** and the value being the value to be supplied when invoking the webhook. The webhook definition must then reference the secret. The secret ensures the uniqueness of the URL, preventing others from triggering the build. The value of the key will be compared to the secret provided during the webhook invocation.

For example here is a GitHub webhook with a reference to a secret named **mysecret**:

```
type: "GitHub"
github:
  secretReference:
    name: "mysecret"
```

The secret is then defined as follows. Note that the value of the secret is base64 encoded as is required for any **data** field of a **Secret** object.

```
- kind: Secret
  apiVersion: v1
  metadata:
    name: mysecret
```

```
  creationTimestamp:
data:
  WebHookSecretKey: c2VjcmV0dmFsdWUx
```

Additional resources

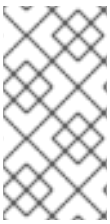
- GitHub
- GitLab
- Bitbucket

7.1.1.1. Using GitHub webhooks

GitHub webhooks handle the call made by GitHub when a repository is updated. When defining the trigger, you must specify a **secret**, which will be part of the URL you supply to GitHub when configuring the webhook.

Example GitHub webhook definition:

```
type: "GitHub"
github:
  secretReference:
    name: "mysecret"
```



NOTE

The secret used in the webhook trigger configuration is not the same as **secret** field you encounter when configuring webhook in GitHub UI. The former is to make the webhook URL unique and hard to predict, the latter is an optional string field used to create HMAC hex digest of the body, which is sent as an **X-Hub-Signature**header.

The payload URL is returned as the GitHub Webhook URL by the **oc describe** command (see Displaying Webhook URLs), and is structured as follows:

```
http://<openshift_api_host:port>/oapi/v1/namespaces/<namespace>/buildconfigs/<name>/webhooks/<s
cret>/github
```

Prerequisites

- Create a **BuildConfig** from a GitHub repository.

Procedure

1. To configure a GitHub Webhook:
   a. After creating a **BuildConfig** from a GitHub repository, run:

   ```
   $ oc describe bc/<name-of-your-BuildConfig>
   ```

   This generates a webhook GitHub URL that looks like:

```
<https://api.starter-us-east-
1.openshift.com:443/oapi/v1/namespaces/nsname/buildconfigs/bcname/webhooks/<secret>
/github>.
```

b. Cut and paste this URL into GitHub, from the GitHub web console.

c. In your GitHub repository, select **Add Webhook** from **Settings → Webhooks**.

d. Paste the URL output (similar to above) into the **Payload URL** field.

e. Change the **Content Type** from GitHub's default **application/x-www-form-urlencoded** to **application/json**.

f. Click **Add webhook**.
You should see a message from GitHub stating that your webhook was successfully configured.

Now, whenever you push a change to your GitHub repository, a new build will automatically start, and upon a successful build a new deployment will start.

NOTE

Gogs supports the same webhook payload format as GitHub. Therefore, if you are using a Gogs server, you can define a GitHub webhook trigger on your **BuildConfig** and trigger it by your Gogs server as well.

2. Given a file containing a valid JSON payload, such as **payload.json**, you can manually trigger the webhook with **curl**:

```
$ curl -H "X-GitHub-Event: push" -H "Content-Type: application/json" -k -X POST --data-
binary @payload.json
https://<openshift_api_host:port>/oapi/v1/namespaces/<namespace>/buildconfigs/<name>/web
hooks/<secret>/github
```

The **-k** argument is only necessary if your API server does not have a properly signed certificate.

Additional resources

- GitHub
- Gogs

7.1.1.2. Using GitLab webhooks

GitLab webhooks handle the call made by GitLab when a repository is updated. As with the GitHub triggers, you must specify a **secret**. The following example is a trigger definition YAML within the **BuildConfig**:

```
type: "GitLab"
gitlab:
  secretReference:
    name: "mysecret"
```

The payload URL is returned as the GitLab Webhook URL by the **oc describe** command (see Displaying Webhook URLs), and is structured as follows:

```
http://<openshift_api_host:port>/oapi/v1/namespaces/<namespace>/buildconfigs/<name>/webhooks/<secret>/gitlab
```

Procedure

1. To configure a GitLab Webhook:
   a. Describe the **BuildConfig** to get the webhook URL:

      ```
      $ oc describe bc <name>
      ```

   b. Copy the webhook URL, replacing **<secret>** with your secret value.
   c. Follow the GitLab setup instructions to paste the webhook URL into your GitLab repository settings.
2. Given a file containing a valid JSON payload, such as **payload.json**, you can manually trigger the webhook with **curl**:

   ```
   $ curl -H "X-GitLab-Event: Push Hook" -H "Content-Type: application/json" -k -X POST --data-binary @payload.json https://<openshift_api_host:port>/oapi/v1/namespaces/<namespace>/buildconfigs/<name>/webhooks/<secret>/gitlab
   ```

   The **-k** argument is only necessary if your API server does not have a properly signed certificate.

Additional resources

- GitLab

7.1.1.3. Using Bitbucket webhooks

Bitbucket webhooks handle the call made by Bitbucket when a repository is updated. Similar to the previous triggers, you must specify a **secret**. The following example is a trigger definition YAML within the **BuildConfig**:

```
type: "Bitbucket"
bitbucket:
  secretReference:
    name: "mysecret"
```

The payload URL is returned as the Bitbucket Webhook URL by the **oc describe** command (see Displaying Webhook URLs), and is structured as follows:

```
http://<openshift_api_host:port>/oapi/v1/namespaces/<namespace>/buildconfigs/<name>/webhooks/<secret>/bitbucket
```

Procedure

1. To configure a Bitbucket Webhook:

a. Describe the 'BuildConfig' to get the webhook URL:

```
$ oc describe bc <name>
```

b. Copy the webhook URL, replacing **<secret>** with your secret value.

c. Follow the Bitbucket setup instructions to paste the webhook URL into your Bitbucket repository settings.

2. Given a file containing a valid JSON payload, such as **payload.json**, you can manually trigger the webhook with **curl**:

```
$ curl -H "X-Event-Key: repo:push" -H "Content-Type: application/json" -k -X POST --data-binary @payload.json
https://<openshift_api_host:port>/oapi/v1/namespaces/<namespace>/buildconfigs/<name>/webhooks/<secret>/bitbucket
```

The **-k** argument is only necessary if your API server does not have a properly signed certificate.

Additional resources

- Bitbucket

7.1.1.4. Using generic webhooks

Generic webhooks are invoked from any system capable of making a web request. As with the other webhooks, you must specify a secret, which will be part of the URL that the caller must use to trigger the build. The secret ensures the uniqueness of the URL, preventing others from triggering the build. The following is an example trigger definition YAML within the **BuildConfig**:

```
type: "Generic"
generic:
  secretReference:
    name: "mysecret"
  allowEnv: true 1
```

1 Set to **true** to allow a generic webhook to pass in environment variables.

Procedure

1. To set up the caller, supply the calling system with the URL of the generic webhook endpoint for your build:

```
http://<openshift_api_host:port>/oapi/v1/namespaces/<namespace>/buildconfigs/<name>/webhooks/<secret>/generic
```

The caller must invoke the webhook as a **POST** operation.

2. To invoke the webhook manually you can use **curl**:

```
$ curl -X POST -k
https://<openshift_api_host:port>/oapi/v1/namespaces/<namespace>/buildconfigs/<name>/webhooks/<secret>/generic
```

The HTTP verb must be set to **POST**. The insecure **-k** flag is specified to ignore certificate validation. This second flag is not necessary if your cluster has properly signed certificates.

The endpoint can accept an optional payload with the following format:

```
git:
  uri: "<url to git repository>"
  ref: "<optional git reference>"
  commit: "<commit hash identifying a specific git commit>"
  author:
    name: "<author name>"
    email: "<author e-mail>"
  committer:
    name: "<committer name>"
    email: "<committer e-mail>"
  message: "<commit message>"
env: 1
  - name: "<variable name>"
    value: "<variable value>"
```

1 Similar to the **BuildConfig** environment variables, the environment variables defined here are made available to your build. If these variables collide with the **BuildConfig** environment variables, these variables take precedence. By default, environment variables passed by webhook are ignored. Set the **allowEnv** field to **true** on the webhook definition to enable this behavior.

3. To pass this payload using **curl**, define it in a file named ***payload_file.yaml*** and run:

```
$ curl -H "Content-Type: application/yaml" --data-binary @payload_file.yaml -X POST -k
https://<openshift_api_host:port>/oapi/v1/namespaces/<namespace>/buildconfigs/<name>/web
hooks/<secret>/generic
```

The arguments are the same as the previous example with the addition of a header and a payload. The **-H** argument sets the **Content-Type** header to **application/yaml** or **application/json** depending on your payload format. The **--data-binary** argument is used to send a binary payload with newlines intact with the **POST** request.

NOTE

OpenShift Dedicated permits builds to be triggered by the generic webhook even if an invalid request payload is presented (for example, invalid content type, unparsable or invalid content, and so on). This behavior is maintained for backwards compatibility. If an invalid request payload is presented, OpenShift Dedicated returns a warning in JSON format as part of its **HTTP 200 OK** response.

7.1.1.5. Displaying webhook URLs

You can use the following command to display webhook URLs associated with a **BuildConfig**. If the command does not display any webhook URLs, then no webhook trigger is defined for that build configuration. See Setting Triggers to manually add triggers.

Procedure

- To display any webhook URLs associated with a **BuildConfig**

```
$ oc describe bc <name>
```

7.1.2. Using image change triggers

Image change triggers allow your build to be automatically invoked when a new version of an upstream image is available. For example, if a build is based on top of a RHEL image, then you can trigger that build to run any time the RHEL image changes. As a result, the application image is always running on the latest RHEL base image.

NOTE

Imagestreams that point to container images in v1 container registries only trigger a build once when the imagestreamtag becomes available and not on subsequent image updates. This is due to the lack of uniquely identifiable images in v1 container registries.

Procedure

Configuring an image change trigger requires the following actions:

1. Define an **ImageStream** that points to the upstream image you want to trigger on:

```
kind: "ImageStream"
apiVersion: "v1"
metadata:
  name: "ruby-20-centos7"
```

This defines the imagestream that is tied to a container image repository located at ***<system-registry>/<namespace>*/ruby-20-centos7**. The ***<system-registry>*** is defined as a service with the name **docker-registry** running in OpenShift Dedicated.

2. If an imagestream is the base image for the build, set the from field in the build strategy to point to the imagestream:

```
strategy:
  sourceStrategy:
    from:
      kind: "ImageStreamTag"
      name: "ruby-20-centos7:latest"
```

In this case, the **sourceStrategy** definition is consuming the **latest** tag of the imagestream named **ruby-20-centos7** located within this namespace.

3. Define a build with one or more triggers that point to imagestreams:

```
type: "imageChange" (1)
imageChange: {}
type: "imageChange" (2)
imageChange:
  from:
    kind: "ImageStreamTag"
    name: "custom-image:latest"
```

(1) An image change trigger that monitors the **ImageStream** and **Tag** as defined by the build strategy's **from** field. The **imageChange** object here must be empty.

2 An image change trigger that monitors an arbitrary imagestream. The **imageChange** part in this case must include a **from** field that references the **ImageStreamTag** to monitor.

When using an image change trigger for the strategy imagestream, the generated build is supplied with an immutable Docker tag that points to the latest image corresponding to that tag. This new image reference will be used by the strategy when it executes for the build.

For other image change triggers that do not reference the strategy imagestream, a new build will be started, but the build strategy will not be updated with a unique image reference.

Since this example has an image change trigger for the strategy, the resulting build will be:

```
strategy:
  sourceStrategy:
    from:
      kind: "DockerImage"
      name: "172.30.17.3:5001/mynamespace/ruby-20-centos7:<immutableid>"
```

This ensures that the triggered build uses the new image that was just pushed to the repository, and the build can be re-run any time with the same inputs.

You can pause an image change trigger to allow multiple changes on the referenced imagestream before a build is started. You can also set the **paused** attribute to true when initially adding an **ImageChangeTrigger** to a **BuildConfig** to prevent a build from being immediately triggered.

```
type: "ImageChange"
imageChange:
  from:
    kind: "ImageStreamTag"
    name: "custom-image:latest"
  paused: true
```

In addition to setting the image field for all **Strategy** types, for custom builds, the **OPENSHIFT_CUSTOM_BUILD_BASE_IMAGE** environment variable is checked. If it does not exist, then it is created with the immutable image reference. If it does exist then it is updated with the immutable image reference.

If a build is triggered due to a webhook trigger or manual request, the build that is created uses the **<immutableid>** resolved from the **ImageStream** referenced by the **Strategy**. This ensures that builds are performed using consistent image tags for ease of reproduction.

Additional resources

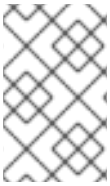
- v1 container registries

7.1.3. Configuration change triggers

A configuration change trigger allows a build to be automatically invoked as soon as a new **BuildConfig** is created.

The following is an example trigger definition YAML within the **BuildConfig**:

```
type: "ConfigChange"
```



NOTE

Configuration change triggers currently only work when creating a new **BuildConfig**. In a future release, configuration change triggers will also be able to launch a build whenever a **BuildConfig** is updated.

7.1.3.1. Setting triggers manually

Triggers can be added to and removed from build configurations with **oc set triggers**.

Procedure

- To set a GitHub webhook trigger on a build configuration, use:

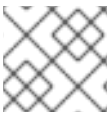
```
$ oc set triggers bc <name> --from-github
```

- To set an imagechange trigger, use

```
$ oc set triggers bc <name> --from-image='<image>'
```

- To remove a trigger, add **--remove**:

```
$ oc set triggers bc <name> --from-bitbucket --remove
```



NOTE

When a webhook trigger already exists, adding it again regenerates the webhook secret.

For more information, consult the help documentation with **oc set triggers --help**

7.2. BUILD HOOKS

Build hooks allow behavior to be injected into the build process.

The **postCommit** field of a **BuildConfig** object executes commands inside a temporary container that is running the build output image. The hook is executed immediately after the last layer of the image has been committed and before the image is pushed to a registry.

The current working directory is set to the image's **WORKDIR**, which is the default working directory of the container image. For most images, this is where the source code is located.

The hook fails if the script or command returns a non-zero exit code or if starting the temporary container fails. When the hook fails it marks the build as failed and the image is not pushed to a registry. The reason for failing can be inspected by looking at the build logs.

Build hooks can be used to run unit tests to verify the image before the build is marked complete and the image is made available in a registry. If all tests pass and the test runner returns with exit code 0, the build is marked successful. In case of any test failure, the build is marked as failed. In all cases, the build log will contain the output of the test runner, which can be used to identify failed tests.

The **postCommit** hook is not only limited to running tests, but can be used for other commands as well. Since it runs in a temporary container, changes made by the hook do not persist, meaning that the hook execution cannot affect the final image. This behavior allows for, among other uses, the installation and

usage of test dependencies that are automatically discarded and will be not present in the final image.

7.2.1. Configuring post commit build hooks

There are different ways to configure the post build hook. All forms in the following examples are equivalent and execute **bundle exec rake test --verbose**.

Procedure

- Shell script:

```
postCommit:
  script: "bundle exec rake test --verbose"
```

The **script** value is a shell script to be run with **/bin/sh -ic**. Use this when a shell script is appropriate to execute the build hook. For example, for running unit tests as above. To control the image entry point, or if the image does not have **/bin/sh**, use **command** and/or **args**.

NOTE

The additional **-i** flag was introduced to improve the experience working with CentOS and RHEL images, and may be removed in a future release.

- Command as the image entry point:

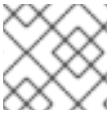
```
postCommit:
  command: ["/bin/bash", "-c", "bundle exec rake test --verbose"]
```

In this form, **command** is the command to run, which overrides the image entry point in the exec form, as documented in the Dockerfile reference. This is needed if the image does not have **/bin/sh**, or if you do not want to use a shell. In all other cases, using **script** might be more convenient.

- Command with arguments:

```
postCommit:
  command: ["bundle", "exec", "rake", "test"]
  args: ["--verbose"]
```

This form is equivalent to appending the arguments to **command**.



NOTE

Providing both **script** and **command** simultaneously creates an invalid build hook.

7.2.2. Using the CLI to set post commit build hooks

The **oc set build-hook** command can be used to set the build hook for a build configuration.

Procedure

1. To set a command as the post-commit build hook:

```
$ oc set build-hook bc/mybc \
    --post-commit \
    --command \
    -- bundle exec rake test --verbose
```

2. To set a script as the post-commit build hook:

```
$ oc set build-hook bc/mybc --post-commit --script="bundle exec rake test --verbose"
```

CHAPTER 8. SETTING UP ADDITIONAL TRUSTED CERTIFICATE AUTHORITIES FOR BUILDS

Use the following sections to set up additional certificate authorities (CA) to be trusted by builds when pulling images from an image registry.

The procedure requires a Dedicated administrator to create a ConfigMap and add additional CAs as keys in the ConfigMap.

- The ConfigMap must be created in the **openshift-config** namespace.
- **domain** is the key in the ConfigMap; **value** is the PEM-encoded certificate.
  - Each CA must be associated with a domain. The domain format is **hostname[..port]**.
- The ConfigMap name must be set in the **image.config.openshift.io/cluster** cluster scoped configuration resource's **spec.additionalTrustedCA** field.

NOTE

OpenShift Dedicated administrators are required to use the **registry-cas** ConfigMap.

8.1. ADDING CERTIFICATE AUTHORITIES TO THE CLUSTER

You can add certificate authorities (CAs) to the cluster for use when pushing and pulling images via the following procedure.

Prerequisites

- You must have Dedicated administrator privileges.
- You must have access to the registry's public certificates, usually a **hostname/ca.crt** file located in the **/etc/docker/certs.d/** directory.

Procedure

1. Create a ConfigMap in the **openshift-config** namespace containing the trusted certificates for the registries that use self-signed certificates. For each CA file, ensure the key in the ConfigMap is the registry's hostname in the **hostname[..port]** format:

```
$ oc create configmap registry-cas -n openshift-config \
--from-file=myregistry.corp.com..5000=/etc/docker/certs.d/myregistry.corp.com:5000/ca.crt \
--from-file=otherregistry.com=/etc/docker/certs.d/otherregistry.com/ca.crt
```

2. Update the cluster image configuration:

```
$ oc patch image.config.openshift.io/cluster --patch '{"spec":{"additionalTrustedCA":
{"name":"registry-cas"}}}' --type=merge
```

8.2. ADDITIONAL RESOURCES

- Create a ConfigMap

- Secrets and ConfigMaps