VMware Tanzu Build Service 1.4 Documentation

Tanzu Build Service 1.4

You can find the most up-to-date technical documentation on the VMware website at:

https://docs.vmware.com/

VMware, Inc.
3401 Hillview Ave.
Palo Alto, CA 94304
www.vmware.com

Contents

Tanzu Build Service 1.4 Documentation 10
- Overview 10
- Build Service Concepts 10
  - Image Resource 10
  - Builder 10
  - ClusterStore 10
  - ClusterStack 10
- Build Service Components 11
- Build Service Dependencies 11
  - Buildpacks 11
  - Stacks 11
  - Descriptors 11
  - Updating Build Service Dependencies 11
- Troubleshooting 11

TBS Release Notes 13
- v1.4.3 13
  - New Features 13
  - Breaking Changes 13
  - Bug Fixes 13
  - Product Snapshot 13
  - Security Scanning 13
  - Product Dependencies 14
  - Upgrade Path 14
- v1.4.2 14
  - Breaking Changes 14
  - Bug Fixes 14
  - Product Snapshot 14
  - Product Dependencies 15
  - Upgrade Path 15
- v1.4.1 15
- v1.4.0 15

Installing Tanzu Build Service 16
- Prerequisites 16

Installing Tanzu Build Service 17
Relocate Images to a Registry 18
Installation 18
Additional Configuration 20
Upgrading Tanzu Build Service 20
Installing Tanzu Build Service (Air-Gapped) 21
Relocate Images to a Registry (Air-Gapped) 21
Installation (Air-Gapped) 22
Additional Configuration 23
Updating Build Service Dependencies (Air-gapped) 23
Upgrading Tanzu Build Service (Air-Gapped) 24
Uninstalling Tanzu Build Service 24
Ensuring Access to Cluster Builders 24
Ensuring the Run Image is Readable 24
Next Steps 25

Installing Windows Components (Beta) 25

Getting Started with Tanzu Build Service 25
Prerequisites 25
Assumptions 26
Installation 26
Relocate Images to a Registry 27
Install Tanzu Build Service 27
Verify Installation 27
Create an Image 28

Installing Tanzu Build Service without kapp controller 28
Prerequisites 28
Installing 30
Relocate Images to a Registry 30
Install Tanzu Build Service 31
Install Tanzu Build Service Public Registry 31
Installing with a CA certificate for internal registry 32
Import Tanzu Build Service Dependencies 33
Additional Configuration 34
Configuring TKGI as an OIDC Provider 35
Installation to Air-Gapped Environment 35
Relocate Images to a Registry (Air-Gapped) 35
Installing (Air-Gapped) 36

Additional Configuration 37
Import Tanzu Build Service Dependencies (Air-Gapped) 38
Relocate Tanzu Build Service Dependency Images (Air-Gapped) 38
Import Tanzu Build Service Dependency Resources (Air-Gapped) 38
Verify Installation 39
Upgrading Tanzu Build Service 39
Uninstalling Tanzu Build Service 39
Updating Build Service Dependencies 39
Ensuring Access to Cluster Builders 40
Ensuring the Run Image is Readable 40
Next Steps 40
Kubernetes Permissions for Installation 40

Accessing Tanzu Build Service 44

Updating Build Service Dependencies 45
Updating Dependencies 45
Automatically Update Dependencies 45
Bulk Update 46
Cluster Stacks Update 47
Cluster Store Update 48
Updating Buildpacks From Tanzu Network 48
Offline Update of Dependencies 49

Managing Secrets 51
Overview 51
Create Secrets 51
Create a Docker Hub Registry Secret 52
Create a GCR Registry Secret 52
Create an Artifactory, Harbor, or ACR Registry Secret 52
Create a Git SSH Secret 53
Create a Git Basic Auth Secret 54
List Secrets 54
Delete Secrets 55
Encrypting Secrets at Rest 55

Using SecretGen controller Secrets to use private cluster builders 55
When to use Synchronized Secrets 55
Installing the Carvel secret-gen-controller 55
Managing Secret Synchronization 56

Create a Synchronized Secret 56
Update a Synchronized Secret 56
Stop Synchronizing a Secret 56

Managing Image Resources and Builds 58

Image Resources 59
Creating Image Resources 59
Source Code 59
Builders 59
Creating an Image Resource With Source Code in a Git Repository 59
Create an Image Resource With Source Code In A Blob Store 60
Creating an Image Resource With Local Source Code 61
Buildpack Configuration 62
Buildpack Configuration Use Cases 62
Buildpack Configuration Documentation 62
Buildpack Configuration in Image Resources 62
Patching Image Resources 63
Saving Image Resources 64
Listing Images 65
Filter Image Resources 65
Image Resource Rebuilds 65
Trigger an Image Resource Rebuild 66
Viewing the Status of an Image Resource 66
Deleting an Image Resource 67
Managing Image Resources with YAML 67
Image Resource Additional Tags 67
Using a registry for caching 67
Using Secrets 67
Debugging with Image Resource Status 68
Image Resource Service Bindings 68
Creating an Image Resource with Service Bindings 68

Builds 69
Listing Builds 70
Viewing Build Details for an Image 70
Image Resource Status shows ImagePullBackOff 72
Getting Build Logs 72
Viewing Bill of Materials 74
Offline Builds 75

Image Signing with cosign 75
Cosign Signing Secret 75
Adding Cosign Annotations 76
Push Cosign Signature to a Different Location 76
Cosign Legacy Docker Media Types 77

Managing ClusterStacks 78
Create a ClusterStack 79
Update a ClusterStack 79
Save a ClusterStack 80
Get ClusterStack Status 80
Delete a ClusterStack 80
List all ClusterStacks 81
How to update an Image for Stack updates only? 81

Managing Stores 82
Creating Buildpacks and Buildpackages 82
Listing ClusterStores 83
Creating a ClusterStore 83
Saving a ClusterStore 83
Adding Buildpackages to a ClusterStore 83
Adding Buildpackages to a ClusterStore from Tanzu Network 84
Offline Adding Buildpackages to a ClusterStore from Tanzu Network 84
Removing Buildpackages from a ClusterStore 85
Get ClusterStore Status 85
Migrating Buildpacks 86
Corresponding kpack Resource 87

Descriptors 88
About descriptors 88
Lite descriptor 88
Full descriptor 88
Descriptor comparison 88

Managing Builders 90
Creating a Builder 91
Patching a Builder 92
Saving Builders 93
Deleting Builders 94
Retrieving Builder Details 94

Listing Builders 95
Corresponding kpack Resources 95
Pinning Buildpack versions 95
Update Lifecycle 96

Managing Custom Stacks 97
Creating a CustomStack 97
Source Configuration 98
Destination Configuration 98
Example CustomStack from Registry Images 98
Example CustomStack from ClusterStack 100
Debugging CustomStacks 101

RBAC in Tanzu Build Service 102
RBAC using Projects Operator 102
RBAC Support in Tanzu Build Service 102
Build Service User Role 102
Build Service Admin Role 103

Using Tanzu Build Service in CI 104
Example: Using Tanzu Build Service in CI/CD 104

Frequently Asked Questions 110
How do Cloud Native Buildpacks (CNBs), kpack, and Tanzu Build Service overlap and differ? 110
Why do I see two images in the image registry after a successful build? 110
How does TBS work in air gapped environments? 110
Is there documentation on supported Tanzu Buildpacks? 111
Why do I get an X509 error from Build Service when trying to create an image in my registry? 111
How do I configure a secret to publish images to Dockerhub? 111
How can I configure an image resource to pull from a private GitHub repository? 111
Why do some builds fail with "Error: could not read run image: *"? 111
Why don't my image builds appear in my Harbor v1.X.X registry? 112
How do I fix "unsupported status code 500" when creating a builder on my Harbor v2.X.X registry? 112
How do I configure credentials for using gcr as my installation registry? 112
Can I configure a proxy for my Tanzu Build Service? 112
How do I build my app locally using kpack builders? 113
What can I do with the kp --dry-run and --output flags? 113
Does TBS support Azure Devops for git repositories 114
Why do I get a "repository does not exist" error when I use ECR Registry? 114

How do I troubleshoot a failed build? 115
How do I troubleshoot an UNAUTHENTICATED error? 115
Why does TBS leave behind pods after builds on my Cluster? 116
How do I check what version of TBS I am using? 116
How does TBS use windows-based images? 116
What is the relationship between a kpack image resource and an OCI image? 116
Pinning the Tanzu Net Updater 117

Additional resources for Tanzu Build Service 118
Concourse Kpack resource 118
Helpful Articles 118
Helpful Videos 118
Helpful Repositories 118

Tanzu Build Service 1.4 Documentation

This topic provides an overview of Tanzu Build Service.

Overview

Tanzu Build Service uses the open-source Cloud Native Buildpacks project to turn application source code into container images. Build Service executes reproducible builds that align with modern container standards, and additionally keeps image resources up-to-date. It does so by leveraging Kubernetes infrastructure with kpack, a Cloud Native Buildpacks Platform, to orchestrate the image lifecycle. The kpack CLI tool, kp can aid in managing kpack resources.

Build Service helps you develop and automate containerized software workflows securely and at scale.

Build Service Concepts

Build Service reduces operational overhead and improves security by automating the building of application images. It relies on `Image`, `Builder`, `ClusterStore` and `ClusterStack` to achieve these results.

Image Resource

An `Image` resource defines the source of the application, build time environment and registry destination. This source code could reside in git, a blobstore, or as code on a workstation.

For more information see the Managing Images and Builds page.

Builder

A `Builder` references the Stack and Buildpacks that are used in the process of building source code. They "provide" the Buildpacks that run against the application and the OS images upon which the application is built and run.

For more information see the Managing Builders page.

ClusterStore

A `ClusterStore` serves as a repository for Cloud Native Buildpacks available for use in Builders. One can populate a store with Buildpacks they create and package.

For more information see the Managing ClusterStores page.

ClusterStack

A `ClusterStack` defines a pair of build and run OS images. Critical security vulnerabilities are addressed by building apps on the most up-to date stack. The stacks used by Build Service to build applications are referenced in the Builders.

For more information see the Managing ClusterStacks page.

Build Service Components

Tanzu Build Service ships with the following components:

- kpack
- kpack CLI (kp)
- CNB lifecycle

Build Service Dependencies

Buildpacks

Tanzu Build Service utilize Tanzu Buildpacks.

Stacks

Stack Documentation is available on the Tanzu Buildpacks documentation.

The following Stacks and their updates can be found on the Tanzu Build Service Dependencies page.

Name	ID
tiny	io.paketo.stacks.tiny
base	io.buildpacks.stacks.bionic
full	io.buildpacks.stacks.bionic

Descriptors

Tanzu Build Service descriptors are curated sets of dependencies, including stacks and buildpacks, that are continuously released on VMware Tanzu Network to resolve all workload Critical and High CVEs. Descriptors are imported into Tanzu Build Service to update the entire cluster.

There are two types of descriptor, `lite` and `full`. The different descriptors can apply to different use cases and workload types. You can configure which descriptor is imported when installing Tanzu Build Service.

For more information, see Descriptors.

Updating Build Service Dependencies

Build Service allows the user to update Buildpacks and Stacks via the `kp` CLI. You can learn more about updating Build Service dependencies here.

Troubleshooting

For troubleshooting failed builds, check the FAQ section of our docs.

If you are unable to resolve your problem, please contact Tanzu VMware Support.

TBS Release Notes

v1.4.3

Release Date: March, 04, 2022

New Features

- Bump kpack to use lifecycle 0.13.3 which adds support for bom entries in the `io.buildpacks.build.metadata` image label in Buildpack API 0.7 in addition to the existing sbom layer formats which establishes a migration path.
- When dependency updates are paused, the pinned descriptor version is 100.0.267

Breaking Changes

None

Bug Fixes

- Full windows functionality has been restored
- The restricted pod security standard is now applied to all build pods which could previously violate security policies
- When deploying with kapp controller, the deployment will no longer reconcile diffs indefinitely
- Certs are now correctly verified by the TanzuNetDependencyUpdater when using a private registry

Product Snapshot

Tanzu Build Service 1.4.3 ships with the following components:

- kpack 0.5.1
- kpack cli v0.4.2
- CNB lifecycle v0.13.3

Tanzu Build Service supports and utilizes Tanzu Buildpacks.

Security Scanning

This section provides context for the CVEs that may show up in security scans of TBS

- github.com/containerd/containerd | CVE-2021-43816 | CRITICAL
    - Containerd is not used as a container runtime in TBS code and therefore never

interacts with volume mounts at all

- org.apache.logging.log4j:log4j-core | CVE-2021-44228 | CRITICAL
- org.apache.logging.log4j:log4j-core | CVE-2021-45105 | HIGH
    - These CVEs have been patched, however show up in some scans of TBS dependencies such as builders or the Java & Node.js buildpacks. Scanners report these up because some log4j files provided by third-party vendors have been patched but have maintained the same file name which the scanners assume are vulnerable.

Product Dependencies

Build Service can be installed on any Kubernetes cluster (v1.19 or later).

Upgrade Path

v1.3.* can be upgraded to v1.4.*. Please follow the install process to upgrade.

v1.4.2

Release Date: January, 11, 2022

This release includes a few notable new features:

- TBS can now import a "full" or "lite" descriptor which will use different sets of buildpacks for different use cases. See intallation for more details.
- The mechanism to sync secrets to build namespaces has changed. Users should now leverage the Carvel secretgen-controller for copying secrets to build namespaces. See the Secret Synchronization page for more defails.

Breaking Changes

- Installation steps have changed slightly. Some flags have changed and you must specify a descriptor name as part of installation. See intallation for more details.
- Secrets copied to Build namespaces using the old secret-syncing mechanism will be cleaned up. Only copies of secrets will be deleted, original secrets with the `com.vmware.tanzu.buildservice.sync: "true"` label will not be deleted.

Bug Fixes

- Fix http(s) proxy support with git using HTTP_PROXY, HTTPS_PROXY, and NO_PROXY env vars

Product Snapshot

Tanzu Build Service 1.4.2 ships with the following components:

- kpack 0.5.0
- kpack cli v0.4.2
- CNB lifecycle v0.13.2

Tanzu Build Service supports and utilizes Tanzu Buildpacks.

Product Dependencies

Build Service can be installed on any Kubernetes cluster (v1.19 or later).

Upgrade Path

v1.3.* can be upgraded to v1.4.*. Please follow the install process to upgrade.

v1.4.1

TBS version 1.4.1 has been skipped, please use 1.4.2 or later.

v1.4.0

TBS version 1.4.0 has been skipped, please use 1.4.2 or later.

Installing Tanzu Build Service

This topic describes how to install and configure Tanzu Build Service.

We recommend installing TBS with the Tanzu CLI and kapp controller. If you want to view the previous method of installation, see Installing without kapp controller.

Reasons to use the previous installation method include:

- You do not want to install kapp controller on your cluster
- You want to make custom changes to the TBS installation via `ytt` templating or overlays

Prerequisites

Before you install Build Service, you must:

- Be on Kubernetes cluster v1.19 or later
- Ensure that all worker nodes have at least 50 GB of ephemeral storage allocated to them.
    - To do this on TKGs, mount a 50GB volume at `/var/lib/containerd` to the worker nodes in the `TanzuKubernetesCluster` resource that corresponds to your TKGs cluster. These instructions show how to configure storage on worker nodes.
- Have access to a container registry to install Tanzu Build Service and store the application images that will be created.
    - Although the documentation references specific registries for the purpose of providing examples, any registry that adheres to the Docker Registry HTTP API V2 is supported
    - If installing using the `lite` descriptor, 1GB of registry storage is recommended
    - If installing using the `full` descriptor, which is intended for production use and offline environments, 10 GB of available storage is recommended
    - This registry space suggestion does not include the space that will be used for application images built by TBS
- Ensure your Kubernetes cluster is configured with a default `StorageClass`. Tanzu Build Service will default to using 2G of cache if a default `StorageClass` is defined. Build Service utilizes `PersistentVolumeClaims` to cache build artifacts, which reduces the time of subsequent builds.

  For more information, see Persistent Volumes in the Kubernetes documentation. And for information on defining a default StorageClass, see Changing the default StorageClass
- Download Carvel imgpkg. Version 0.12.0 or higher is required.

- Download and install the Tanzu CLI.
    - Only the `package` and `secret` plug-ins are required.
- Install Carvel kapp controller and secret gen controller on your cluster.
- Navigate to the following pages in Tanzu Network and accept all EULAs highlighted in yellow.
    - Tanzu Build Service
    - Tanzu Build Service Dependencies
    - Buildpacks for VMware Tanzu
    - Stacks for VMware Tanzu
- Find the latest Tanzu Build Service version by checking the Tanzu Build Service page on Tanzu Network. Just knowing the version is sufficient.
- Download the `kp` CLI for your operating system from the Tanzu Build Service page on Tanzu Network. The `kp` CLI help text is published here.
    - These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.
- Download the `docker` CLI to authenticate with registries.

Note: Clusters running with Containerd 1.4.1, 1.5.6, and 1.5.7 are not compatible with TBS. Notably, TKG 1.2.1 and TKGi 1.13.0 & 1.13.1 use these versions of Containerd, a different version must be used.

Note: TKGs clusters running Kubernetes 1.20.0-1.20.6 are not compatible with TBS.

Installing Tanzu Build Service

1. Set up environment variables for use during the installation.

```
export INSTALL_REGISTRY_HOSTNAME=<IMAGE-REGISTRY>
export INSTALL_REPOSITORY=<IMAGE-REPOSITORY>
export INSTALL_REGISTRY_USERNAME=<REGISTRY-USERNAME>
export INSTALL_REGISTRY_PASSWORD=<REGISTRY-PASSWORD>
export TANZUNET_REGISTRY_USERNAME=<TANZUNET_REGISTRY_USERNAME>
export TANZUNET_REGISTRY_PASSWORD=<TANZUNET_REGISTRY_PASSWORD>
export TBS_VERSION=<LATEST-TBS-VERSION>
```

Where:

- `IMAGE-REGISTRY` is the hostname of the registry that will be used.
- `IMAGE-REPOSITORY` is the repository in your registry that you want to relocate images to.
    - Dockerhub has the form `my-dockerhub-username/build-service` or `index.docker.io/my-dockerhub-username/build-service`
    - gcr.io has the form `gcr.io/my-project/build-service`
    - Harbor has the form `my-harbor.io/my-project/build-service`

- `REGISTRY-USERNAME` is the username of the registry that will be used. You should be able to `docker push` to `IMAGE-REPOSITORY` with this credential. `gcr.io` expects `_json_key`.
- `REGISTRY-PASSWORD` is the password of the registry that will be used. You should be able to `docker push` to `IMAGE-REPOSITORY` with this credential.
- `TANZUNET_REGISTRY_USERNAME` is the username you use to access TanzuNet.
- `TANZUNET_REGISTRY_PASSWORD` is the password you use to access TanzuNet.
    - For Google Cloud Registry, use the contents of the service account JSON key.
- `LATEST-TBS-VERSION` is from the Tanzu Network Release page.

Relocate Images to a Registry

This procedure relocates images from the Tanzu Network registry to an internal image registry via a local machine.

The local machine must have write access to the install registry.

1. Log in to the Tanzu Network registry with your Tanzu Network credentials (`TANZUNET_REGISTRY_USERNAME` & `TANZUNET_REGISTRY_PASSWORD`):

```
docker login registry.tanzu.vmware.com
```

1. Log in to the image registry where you want to store the images by running:

```
docker login ${INSTALL_REGISTRY_HOSTNAME}
```

1. Copy the Tanzu Build Service package repository to your registry with the Carvel tool `imgpkg` by running:

```
imgpkg copy -b registry.tanzu.vmware.com/build-service/package-repo:$TBS_VERSION --to-repo=${INSTALL_REPOSITORY}
```

For example:

- Dockerhub `imgpkg copy -b registry.tanzu.vmware.com/build-service/package-repo:$TBS_VERSION --to-repo=my-dockerhub-account/build-service`
- GCR `imgpkg copy -b registry.tanzu.vmware.com/build-service/package-repo:$TBS_VERSION --to-repo=gcr.io/my-project/build-service`
- Artifactory `imgpkg copy -b registry.tanzu.vmware.com/build-service/package-repo:$TBS_VERSION --to-repo=artifactory.com/my-project/build-service`
- Harbor `imgpkg copy -b registry.tanzu.vmware.com/build-service/package-repo:$TBS_VERSION --to-repo=harbor.io/my-project/build-service`

Installation

1. Create a namespace called tbs-install for deploying the package by running:

```
kubectl create ns tbs-install
```

This namespace keeps the installation objects grouped together logically.

1. Create a secret to pull in the package repository:

```
tanzu secret registry add tbs-install-registry \
  --username ${INSTALL_REGISTRY_USERNAME} --password ${INSTALL_REGISTRY_PASSWOR
D} \
  --server ${INSTALL_REGISTRY_HOSTNAME} \
  --export-to-all-namespaces --yes --namespace tbs-install
```

2. Add the Tanzu Build Service package repository to the cluster by running:

```
tanzu package repository add tbs-repository \
    --url "${INSTALL_REPOSITORY}:${TBS_VERSION}" \
    --namespace tbs-install
```

1. You should be able to get the status of the package repository, and ensure the status updates to `Reconcile succeeded` by running:

```
tanzu package repository get tbs-repository --namespace tbs-install
```

1. Create a `tbs-values.yml` file by using the following sample as a guide. This file should be kept for future use.

```
---
kp_default_repository: <INSTALL_REPOSITORY>
kp_default_repository_username: <INSTALL_REGISTRY_USERNAME>
kp_default_repository_password: <INSTALL_REGISTRY_PASSWORD>
pull_from_kp_default_repo: true
tanzunet_username: <TANZUNET_REGISTRY_USERNAME>
tanzunet_password: <TANZUNET_REGISTRY_PASSWORD>
descriptor_name: <DESCRIPTOR-NAME>
enable_automatic_dependency_updates: true
ca_cert_data: <CA_CERT_CONTENTS> (optional)
```

   Where:

   - `INSTALL_REPOSITORY` is a writable repository in your registry. Tanzu Build Service dependencies are written to this location. Same value as used during relocation.
   - `INSTALL_REGISTRY_USERNAME` is the registry username. Same value as used during relocation.
   - `INSTALL_REGISTRY_PASSWORD` is the registry password. Same value as used during relocation.
   - `TANZUNET_REGISTRY_USERNAME` is used to pull dependencies from tanzu network. Same value used during relocation
   - `TANZUNET_REGISTRY_PASSWORD` is used to pull dependencies from tanzu network. Same value used during relocation
   - `DESCRIPTOR-NAME` is the name of the descriptor to import automatically. For more information about which descriptor to choose for your workload and use case, see Descriptors. Available options:
     - `full` contains all dependencies.

    - `lite` smaller footprint used for speeding up installs. Requires Internet access on the cluster.

- `CA_CERT_CONTENTS` *must be provided when using registry that is signed by a Custom Cert*. This should be the value of the PEM-encoded CA certificate.

Additional Configuration

Additional fields can be added to `tbs-values.yml`:

- `admin_users` is a comma separated list of users who will be granted admin privileges on Build Service.
- `admin_groups`: a comma separated list of groups that will be granted admin privileges on Build Service.
- `http_proxy`: The HTTP proxy to use for network traffic.
- `https_proxy`: The HTTPS proxy to use for network traffic.
- `no_proxy`: A comma-separated list of hostnames, IP addresses, or IP ranges in CIDR format that should not use a proxy.

You can see the full values schema by running:

```
tanzu package available get buildservice.tanzu.vmware.com/$TBS_VERSION --values-schema
 --namespace tbs-install
```

1. Install the package by running:

```
tanzu package install tbs -p buildservice.tanzu.vmware.com -v $TBS_VERSION -n tbs-inst
all -f tbs-values.yml --poll-timeout 30m
```

Note: >**Note:** Installing with Tanzu Network credentials automatically relocates buildpack dependencies to your registry. This install process can take some time and the `--poll-timeout` flag increases the timeout duration. Using the `lite` descriptor speeds this up significantly. If the command times out, periodically run the installation verification step provided in the following optional step. Image relocation continues in the background.

Upgrading Tanzu Build Service

To upgrade Tanzu Build Service to a newer version, run the following steps.

1. Relocate the new package repository:

```
imgpkg copy -b registry.tanzu.vmware.com/build-service/package-repo:$NEW_TBS_VERSION -
-to-repo=${INSTALL_REPOSITORY}
```

1. Add the Tanzu Build Service package repository to the cluster by running:

```
tanzu package repository add tbs-repository \
    --url "${INSTALL_REPOSITORY}:${NEW_TBS_VERSION}" \
```

```
    --namespace tbs-install
```

1. Install the package with the same `tbs-values.yml` file used during initial installation by running:

```
tanzu package install tbs -p buildservice.tanzu.vmware.com -v $NEW_TBS_VERSION -n tbs-install -f tbs-values.yml --poll-timeout 30m
```

Installing Tanzu Build Service (Air-Gapped)

Tanzu Build Service can be installed to a Kubernetes Cluster and registry that are air-gapped from external traffic.

An air-gapped environment will often use an internal registry with a self-signed CA certificate and you will need access to this CA certificate file to install TBS.

Note: If you are using a CA certificate that is trusted (eg. Lets Encrypt) you will not need the CA certificate file.

1. Set up environment variables for use during the installation.

```
export INSTALL_REGISTRY_HOSTNAME=<IMAGE-REGISTRY>
export INSTALL_REPOSITORY=<IMAGE-REPOSITORY>
export INSTALL_REGISTRY_USERNAME=<REGISTRY-USERNAME>
export INSTALL_REGISTRY_PASSWORD=<REGISTRY-PASSWORD>
export TBS_VERSION=<LATEST-TBS-VERSION>
```

Where:

- `IMAGE-REGISTRY` is the hostname of the private registry that will be used.
- `IMAGE-REPOSITORY` is the repository in your registry that you want to relocate images to.
    - Harbor has the form `my-harbor.io/my-project/build-service`
- `REGISTRY-USERNAME` is the username of the private registry that will be used. You should be able to `docker push` to `IMAGE-REPOSITORY` with this credential.
- `REGISTRY-PASSWORD` is the password of the private registry that will be used. You should be able to `docker push` to `IMAGE-REPOSITORY` with this credential.
- `LATEST-TBS-VERSION` is from the Tanzu Network Release page.

Note: The IMAGE-REPOSITORY must be the IMAGE-REGISTRY appended with the destination repository for the images. For example, `IMAGE-REGISTRY/some-repo/build-service`.

Relocate Images to a Registry (Air-Gapped)

This procedure relocates images from the Tanzu Network registry to an internal image registry via local machine(s).

1. Log in to the Tanzu Network registry with your Tanzu Network credentials:

```
docker login registry.tanzu.vmware.com
```

1. Copy the Tanzu Build Service package repository to your local machine as a tar with the Carvel tool `imgpkg` by running:

```
imgpkg copy -b registry.tanzu.vmware.com/build-service/package-repo:$TBS_VERSION --to-tar=/tmp/tanzu-build-service.tar
```

1. Move the output file `tanzu-build-service.tar` to a machine that has access to the air-gapped environment. The machine must have write access to the internal registry.
2. Log in to the image registry where you want to store the images by running:

```
docker login ${INSTALL_REGISTRY_HOSTNAME}
```

1. Copy the images from your local machine to the internal registry:

```
imgpkg copy --tar /tmp/tanzu-build-service.tar \
  --to-repo=${INSTALL_REPOSITORY} \
  --registry-ca-cert-path <PATH-TO-CA>
```

Where:

- `PATH-TO-CA` is the path to the registry CA certificate file.

For example:

- Artifactory `imgpkg copy --tar /tmp/tanzu-build-service.tar --to-repo=artifactory.com/my-project/build-service --registry-ca-cert-path ca.crt`
- Harbor `imgpkg copy --tar /tmp/tanzu-build-service.tar --to-repo=harbor.io/my-project/build-service --registry-ca-cert-path ca.crt`

Installation (Air-Gapped)

1. Create a namespace called `tbs-install` for deploying the package by running:

```
kubectl create ns tbs-install
```

This namespace keeps the installation objects grouped together logically.

1. Add the Tanzu Build Service package repository to the cluster by running:

```
tanzu package repository add tbs-repository \
    --url "${IMAGE-REPOSITORY}:${TBS_VERSION}" \
    --namespace tbs-install
```

1. You should be able to get the status of the package repository, and ensure the status updates to `Reconcile succeeded` by running:

```
tanzu package repository get tbs-repository --namespace tbs-install
```

1. Create a `tbs-values.yml` file by using the following sample as a guide. This file should be kept for future use.

```
---
kp_default_repository: $INSTALL_REPOSITORY
kp_default_repository_username: $INSTALL_REGISTRY_USERNAME
kp_default_repository_password: $INSTALL_REGISTRY_PASSWORD
pull_from_kp_default_repo: true
ca_cert_data: <CA_CERT_CONTENTS>
```

Where:

- `INSTALL_REPOSITORY` is a writable repository in your internal registry. Tanzu Build Service dependencies are written to this location. Same value as used during relocation.
- `INSTALL_REGISTRY_USERNAME` is the internal registry username. Same value as used during relocation.
- `INSTALL_REGISTRY_PASSWORD` is the internal registry password. Same value as used during relocation.
- `CA_CERT_CONTENTS` *must be provided when using registry that is signed by a Custom Cert.* This should be the value of the PEM-encoded CA certificate.

Additional Configuration

Additional fields can be added to `tbs-values.yml`.

- `admin_users` is a comma separated list of users who will be granted admin privileges on Build Service.
- `admin_groups`: a comma separated list of groups that will be granted admin privileges on Build Service.
- `http_proxy`: The HTTP proxy to use for network traffic.
- `https_proxy`: The HTTPS proxy to use for network traffic.
- `no_proxy`: A comma-separated list of hostnames, IP addresses, or IP ranges in CIDR format that should not use a proxy.

You can see the full values schema by running:

```
tanzu package available get buildservice.tanzu.vmware.com/$TBS_VERSION --values-schema
 --namespace tbs-install
```

1. Install the package by running:

```
tanzu package install tbs -p buildservice.tanzu.vmware.com -v $TBS_VERSION -n tbs-inst
all -f tbs-values.yml
```

Updating Build Service Dependencies (Air-gapped)

When running in an air-gapped environment, TBS cannot pull dependencies automatically from external internet. Therefore, dependencies must be imported manually as a part of installation for TBS to work.

More, TBS dependencies must be kept up to date manually or in a CI/CD automated way in order to

keep application images patched. To learn more about keeping dependencies up-to-date in an offline environment, see Updating Build Service Dependencies

Upgrading Tanzu Build Service (Air-Gapped)

1. To upgrade Tanzu Build Service to a newer version in an air-gapped environment, the same relocation steps listed here must be followed with a new `TBS_VERSION`.
2. Then the same installation steps can be followed using the same `tbs-values.yml` file used for initial installation.

Re-importing dependencies is not required for upgrading TBS.

Uninstalling Tanzu Build Service

To uninstall Tanzu Build Service, uninstall the package using the `tanzu` cli:

```
tanzu package installed delete tbs -n tbs-install -y
```

Note: All Tanzu Build Service resources will be deleted. Registry images created by TBS will not be deleted.

To delete the Tanzu Build Service package repository:

```
tanzu package repository delete tbs-repository --namespace tbs-install
```

Ensuring Access to Cluster Builders

In order to use Cluster Builders, such as the ones installed with Tanzu Build Service, we suggest to install Tanzu Build Service to a repository that is accessible by the nodes in the kubernetes cluster without credentials.

If this is not desired, see When to use Synchronized Secrets.

Ensuring the Run Image is Readable

Build Service relies on the run-image being publicly readable or readable with the registry credentials configured in a project/namespace for the builds to be executed successfully.

The location of the run image can be identified by running the following command:

```
kp clusterstack status <stack-name>
```

If the cluster stack run image is not public, you may need to create a registry secret in any namespace where Images or Builds will be used. For more details on secrets in Tanzu Build Service, see Managing Secrets

This can be done with the `kp` CLI:

```
kp secret create my-registry-creds --registry example-registry.io --registry-user my-r
egistry-user --namespace build-namespace
```

Next Steps

Visit the Managing Images and Builds page to learn how to create and manage a new image.

Installing Windows Components (Beta)

Important: This feature is in beta because of its limitations. Beta features might undergo changes before the end of the beta stage.

This beta feature receives full VMware support.

Note: TBS on Windows does not currently support self-signed registry certificates. Please use a public registry or a non-self-signed cert.

Tanzu Build Service supports building .NET Framework application images. Building .NET Framework images will require a Kubernetes Cluster with windows nodes provisioned.

After the windows nodes are provisioned, the Tanzu Build Service Windows Dependencies (Stacks, Buildpacks, Builders, etc.) can be used to build .NET Framework applications and keep them patched. These must be imported with the `kp` cli and the Dependency Descriptor (`windows-descriptor-<version>.yaml`) file from the Tanzu Build Service Dependencies for Microsoft Windows page:

```
kp import -f /tmp/windows-descriptor-<version>.yaml
```

The following features are not yet supported on windows nodes of Tanzu Build Service

- Caching of build artifacts (which reduces the time of subsequent builds)
- Preloading of ClusterBuilder images
- Self-signed registry certificate

Getting Started with Tanzu Build Service

This topic describes how to get started with a typical installation of Tanzu Build Service and create an Image.

This page is meant to serve as a quick-start guide and may not include some configurations required for your specific environment. For more details on installation, see Installing Tanzu Build Service.

Prerequisites

Before you install Build Service, you must:

- Have access to the Kubernetes cluster satisfying the minimum required permissions.
- Users must navigate to the following dependencies pages in Tanzu Network and accept all EULAs highlighted in yellow.

1. Tanzu Build Service Dependencies
2. Buildpacks for VMware Tanzu
3. Stacks for VMware Tanzu

- Ensure your Kubernetes cluster is configured with default `StorageClass`. Tanzu Build Service will default to using 2G of cache if a default `StorageClass` is defined. Build Service utilizes `PersistentVolumeClaims` to cache build artifacts, which reduces the time of subsequent builds.

  For more information, see Persistent Volumes in the Kubernetes documentation. And for information on defining a default StorageClass, see Changing the default StorageClass

- Download three Carvel CLIs for your operating system. These tools will facilitate the installation of Tanzu Build Service on your cluster. They can be found on their respective Tanzu Network pages:
  - kapp is a deployment tool that allows users to manage Kubernetes resources in bulk.
  - ytt is a templating tool that understands YAML structure. Version 0.35.0 or higher is required.
  - kbld is needed to map relocated images to k8s config.
  - imgpkg is tool that relocates container images and pulls the release configuration files. Version 0.12.0 or higher is required.
- Find the latest Tanzu Build Service version by checking the Tanzu Build Service page on Tanzu Network. Just knowing the version is sufficient.
- Download the `kp` CLI for your operating system from the Tanzu Build Service page on Tanzu Network. The `kp` CLI help text is published here.
  - These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.

Assumptions

For this example setup, we will make the following assumptions:

- You are installing TBS 1.4.2 (This is the latest version at the time of writing. Go to the Tanzu Build Service page to find the most up-to-date version).
- You are using a registry named `my.registry.io` with credentials
  - Username: `my-user`
  - Password: `my-password`
- Your registry uses a self-signed CA certificate and you have access to the cert in a file `/tmp/ca.crt`
  - The nodes on your cluster must also be configured to trust this CA certificate so they can pull in images. Configuration for this depends on the cluster provider
- You are using an "online" environment that has access to the internet

Installation

Relocate Images to a Registry

This procedure relocates images from the Tanzu Network registry to your registry.

1. Log in to your image registry:

```
docker login my.registry.io --tlscacert /tmp/ca.crt
```

2. Log in to the Tanzu Network registry with your Tanzu Network credentials:

```
docker login registry.tanzu.vmware.com
```

3. Relocate the images with the Carvel tool `imgpkg` by running:

```
imgpkg copy -b "registry.tanzu.vmware.com/build-service/bundle:1.4.2" --to-repo my.reg
istry.io/some-repo/tbs --registry-ca-cert-path /tmp/ca.crt
```

4. Pull the Tanzu Build Service bundle locally using `imgpkg`:

```
imgpkg pull -b "my.registry.io/tbs:1.4.2" -o /tmp/bundle
```

Install Tanzu Build Service

Use the Carvel tools `kapp`, `ytt`, and `kbld` to install Build Service and define the required Build Service parameters by running:

```
ytt -f /tmp/bundle/config/ \
 -f /tmp/ca.crt \
 -v kp_default_repository='my.registry.io/tbs' \
 -v kp_default_repository_username='my-user' \
 -v kp_default_repository_password='my-password' \
 --data-value-yaml pull_from_kp_default_repo=true \
 -v tanzunet_username='tanzunet-username' \
 -v tanzunet_password='tanzunet-password' \
 -v descriptor_name='lite' \
 --data-value-yaml enable_automatic_dependency_updates=true \
 | kbld -f /tmp/bundle/.imgpkg/images.yml -f- \
 | kapp deploy -a tanzu-build-service -f- -y
```

Verify Installation

To verify your Build Service installation:

List the cluster builders available in your installation:

```
kp clusterbuilder list
```

You should see an output that looks as follows:

```
NAME       READY    STACK                          IMAGE
base       true     io.buildpacks.stacks.bionic    <image@sha256:digest>
default    true     io.buildpacks.stacks.bionic    <image@sha256:digest>
full       true     io.buildpacks.stacks.bionic    <image@sha256:digest>
```

```
tiny        true      io.paketo.stacks.tiny          <image@sha256:digest>
```

Create an Image

You can now create a Tanzu Build Service Image to start building you app and keep it patched with the latest Stack and Buildpack Dependencies.

We will assume you are using the `default` namespace, use `-n` when using `kp` to set a specific namespace.

1. Create a Kubernetes Secret that will allow your Builds to push to the desired registry with the `kp` cli:

```
kp secret create my-registry-creds --registry my.registry.io --registry-user my-user
```

You will be prompted for your password (`my-password`).

2. Create the Tanzu Build Service Image:

We will use a sample java-maven app:

```
kp image create my-image --tag my.registry.io/tbs/test-app --git https://github.com/buildpacks/samples --sub-path ./apps/java-maven --wait
```

Installing Tanzu Build Service without kapp controller

This topic describes the method of installing Tanzu Build Service without kapp controller. The recommended method uses the `tanzu` cli and kapp controller and can be found here.

Reasons to use the previous installation method include:

- You do not want to install kapp controller on your cluster
- You want to make custom changes to the TBS installation via `ytt` templating or overlays

Prerequisites

Before you install Build Service, you must:

- Be on Kubernetes cluster v1.19 or later
- Have access to the Kubernetes cluster satisfying the minimum required permissions.
- Ensure that all worker nodes have at least 50 GB of ephemeral storage allocated to them.
    - To do this on TKGs, mount a 50GB volume at `/var/lib/containerd` to the worker nodes in the `TanzuKubernetesCluster` resource that corresponds to your TKGs cluster. These instructions show how to configure storage on worker nodes.
- Have access to a container registry to install Tanzu Build Service and store the application images that will be created.
    - Although the documentation references specific registries for the purpose of providing examples, any registry that adheres to the Docker Registry HTTP API V2 is supported

    - If installing using the `lite` descriptor, 1GB of registry storage is recommended
    - If installing using the `full` descriptor, which is intended for production use and offline environments, 10 GB of available storage is recommended
    - This registry space suggestion does not include the space that will be used for application images built by TBS
- Ensure your Kubernetes cluster is configured with default `StorageClass`. Tanzu Build Service will default to using 2G of cache if a default `StorageClass` is defined. Build Service utilizes `PersistentVolumeClaims` to cache build artifacts, which reduces the time of subsequent builds.

  For more information, see Persistent Volumes in the Kubernetes documentation. And for information on defining a default StorageClass, see Changing the default StorageClass
- Download four Carvel CLIs for your operating system. These tools will facilitate the installation of Tanzu Build Service on your cluster. They can be found on their respective Tanzu Network pages:
    - kapp is a deployment tool that allows users to manage Kubernetes resources in bulk.
    - ytt is a templating tool that understands YAML structure.
    - kbld is needed to map relocated images to k8s config.
    - imgpkg is tool that relocates container images and pulls the release configuration files. Note: imgpkg 0.12.0 or higher is required for installation. If it is not available on TanzuNet, it can be found here
- Navigate to the following pages in Tanzu Network and accept all EULAs highlighted in yellow.
    - Tanzu Build Service
    - Tanzu Build Service Dependencies
    - Buildpacks for VMware Tanzu
    - Stacks for VMware Tanzu
- Find the latest Tanzu Build Service version by checking the Tanzu Build Service page on Tanzu Network. Just knowing the version is sufficient.
- Download the `kp` CLI for your operating system from the Tanzu Build Service page on Tanzu Network. The `kp` CLI help text is published here.
    - These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.
- Download the `docker` CLI to authenticate with registries.
- Download the Dependency Descriptor file (`descriptor-<version>.yaml`) from the latest release on the Tanzu Build Service Dependencies page on Tanzu Network. This file contains paths to images that contain dependency resources Tanzu Build Service needs to execute image builds.

Note: Clusters running with Containerd 1.4.1, 1.5.6, and 1.5.7 are not compatible with TBS. Notably, TKG 1.2.1 and TKGi 1.13.0 & 1.13.1 use these versions of Containerd, a

different version must be used.

Note: TKGs clusters running Kubernetes 1.20.0-1.20.6 are not compatible with TBS.

Installing

Create a kubernetes cluster where you would like to install build service and target the cluster as follows:

```
kubectl config use-context <CONTEXT-NAME>
```

Relocate Images to a Registry

This procedure relocates images from the Tanzu Network registry to an internal image registry.

1. Log in to the image registry where you want to store the images by running:

```
docker login <IMAGE-REGISTRY>
```

Where `IMAGE-REGISTRY` is the name of the image registry where you want to store the images.

2. Log in to the Tanzu Network registry with your Tanzu Network credentials:

```
docker login registry.tanzu.vmware.com
```

3. Relocate the images with the Carvel tool `imgpkg` by running:

```
imgpkg copy -b "registry.tanzu.vmware.com/build-service/bundle:<TBS-VERSION>" --to-rep
o <IMAGE-REPOSITORY>
```

Where `TBS-VERSION` is the version full version (1.4.x) of Tanzu Build Service you want to install and `IMAGE-REPOSITORY` is the repository in your registry that you want to relocate images to.

Note: When relocating, the IMAGE-REPOSITORY must be the IMAGE-REGISTRY appended with the destination repository for the images. For example, `IMAGE-REGISTRY/some-repo/build-service`.

Exception: When relocating to Dockerhub, you must provide the Dockerhub username and a repository name that imgpkg will use for relocation. For example, `my-dockerhub-account/build-service`.

For example:

- Dockerhub `imgpkg copy -b "registry.tanzu.vmware.com/build-service/bundle:<TBS-VERSION>" --to-repo my-dockerhub-account/build-service`
- GCR `imgpkg copy -b "registry.tanzu.vmware.com/build-service/bundle:<TBS-VERSION>" --to-repo gcr.io/my-project/build-service`
- Artifactory `imgpkg copy -b "registry.tanzu.vmware.com/build-service/bundle:<TBS-`

`VERSION>" --to-repo artifactory.com/my-project/build-service`

- Harbor `imgpkg copy -b "registry.tanzu.vmware.com/build-service/bundle:<TBS-VERSION>" --to-repo harbor.io/my-project/build-service`

Note: During relocation, imgpkg will report the following: `Skipped layer due to it being non-distributable. If you would like to include non-distributable layers, use the --include-non-distributable flag.` This is due to windows-based images shipped with TBS and can be ignored. For more details see the faq.

Install Tanzu Build Service

There are two ways to install Tanzu Build Service:

1. Using a public registry (eg. GCR, Dockerhub) or an internal registry that uses a trusted certificate (eg. Lets Encrypt)
2. Using an internal registry that uses a self-signed CA certificate (eg. Harbor, Artifactory)

Install Tanzu Build Service Public Registry

1. Pull the Tanzu Build Service bundle image locally using `imgpkg`:

   ```
   imgpkg pull -b "<IMAGE-REPOSITORY>:<TBS-VERSION>" -o /tmp/bundle
   ```

   Where `TBS-VERSION` and `IMAGE-REPOSITORY` are the same values used during relocation.

2. Use the Carvel tools `kapp`, `ytt`, and `kbld` to install Build Service and define the required Build Service parameters:

   Tanzu Build Service ships with a dependency updater that can update ClusterStacks, ClusterStores, ClusterBuilders, and the CNB Lifecycle from TanzuNet automatically. Enabling this feature will keep Images up to date with the latest security patches and fixes, and is *highly recommended*. To enable this feature, include your TanzuNet credentials, `descriptor_name`, and `enable_automatic_dependency_updates` when running the install command below:

   ```
   ytt -f /tmp/bundle/config/ \
    -v kp_default_repository='<IMAGE-REPOSITORY>' \
    -v kp_default_repository_username='<REGISTRY-USERNAME>' \
    -v kp_default_repository_password='<REGISTRY-PASSWORD>' \
    --data-value-yaml pull_from_kp_default_repo=true \
    -v tanzunet_username='<TANZUNET-USERNAME>' \
    -v tanzunet_password='<TANZUNET-PASSWORD>' \
    -v descriptor_name='<DESCRIPTOR-NAME>' \
    --data-value-yaml enable_automatic_dependency_updates=true \
    | kbld -f /tmp/bundle/.imgpkg/images.yml -f- \
    | kapp deploy -a tanzu-build-service -f- -y
   ```

   You can check the status of the DependencyUpdater by running `kubectl -n build-service get TanzuNetDependencyUpdater dependency-updater -o yaml`

Alternatively, if you prefer to manage dependencies manually, leave the TanzuNet credentials, `descriptor_name`, and `enable_automatic_dependency_updates` out of the install.

```
ytt -f /tmp/bundle/config/ \
 -v kp_default_repository='<IMAGE-REPOSITORY>' \
 -v kp_default_repository_username='<REGISTRY-USERNAME>' \
 -v kp_default_repository_password='<REGISTRY-PASSWORD>' \
 --data-value-yaml pull_from_kp_default_repo=true \
 | kbld -f /tmp/bundle/.imgpkg/images.yml -f- \
 | kapp deploy -a tanzu-build-service -f- -y
```

Where:

- `IMAGE-REPOSITORY` is the image repository where Tanzu Build Service images exist.

  > **Note:** This is identical to the IMAGE-REPOSITORY argument provided during imgpkg relocation command.

- `REGISTRY-USERNAME` is the username you use to access the registry. `gcr.io` expects `_json_key` as the username when using JSON key file authentication.
- `REGISTRY-PASSWORD` is the password you use to access the registry.

  > **Note:** [Managing Secrets](managing-secrets.html) for more information about how the registry username and password are used in Tanzu Build Service.

- `TANZUNET-USERNAME` is the username you use to access TanzuNet
- `TANZUNET-PASSWORD` is the password you use to access TanzuNet
- `DESCRIPTOR-NAME` is the name of the descriptor to import automatically. For more information about which descriptor to choose for your workload and use case, see Descriptors. Available options:
  - `full` contains all dependencies.
  - `lite` smaller footprint used for speeding up installs. Requires Internet access on the cluster.

> **Note:** You may want to pin your TBS to a specific descriptor version and temporarily pause the automatic update of dependencies. For details, see the FAQ section "Pinning the Tanzu Net Updater"

Installing with a CA certificate for internal registry

To install Tanzu Build Service with an internal registry that requires providing a CA certificate such as Harbor, use the normal installation command with the CA certificate file passed in with a `-f` flag:

```
ytt -f /tmp/bundle/config/ \
 -f <PATH-TO-CA> \
 -v kp_default_repository='<IMAGE-REPOSITORY>' \
```

```
-v kp_default_repository_username='<REGISTRY-USERNAME>' \
-v kp_default_repository_password='<REGISTRY-PASSWORD>' \
--data-value-yaml pull_from_kp_default_repo=true \
-v tanzunet_username='<TANZUNET-USERNAME>' \
-v tanzunet_password='<TANZUNET-PASSWORD>' \
-v descriptor_name='<DESCRIPTOR-NAME>' \
--data-value-yaml enable_automatic_dependency_updates=true \
| kbld -f /tmp/bundle/.imgpkg/images.yml -f- \
| kapp deploy -a tanzu-build-service -f- -y
```

Where:

- `PATH-TO-CA` is the path to the registry root CA. This CA is required to enable Build Service to interact with internally deployed registries. This is the CA that was used while deploying the registry.
- `IMAGE-REPOSITORY` is the image repository where Tanzu Build Service images exist.

  Note: This is identical to the IMAGE-REPOSITORY argument provided during imgpkg relocation command.

  Exception: When using Dockerhub as your registry target, only use your DockerHub account for this value. For example, my-dockerhub-account (without /build-service). Otherwise, you will encounter an error similar to: `Error: invalid credentials, ensure registry credentials for 'index.docker.io/my-dockerhub-account/build-service/tanzu-buildpacks_go' are available locally`

- `REGISTRY-USERNAME` is the username you use to access the registry. `gcr.io` expects `_json_key` as the username when using JSON key file authentication.
- `REGISTRY-PASSWORD` is the password you use to access the registry.

  Note: [Managing Secrets](managing-secrets.html) for more information about how the registry username and password are used in Tanzu Build Service.

- `TANZUNET-USERNAME` is the username you use to access TanzuNet
- `TANZUNET-PASSWORD` is the password you use to access TanzuNet

Import Tanzu Build Service Dependencies

Warning: Tanzu Build Service ships with a automatic dependency updater. If you have enabled this feature during install by passing in your TanzuNet credentials you **MUST** skip this step. To check if you have a TanzuNetDependencyUpdater in your cluster, run: `kubectl get TanzuNetDependencyUpdaters -A`

The Tanzu Build Service Dependencies (Stacks, Buildpacks, Builders, etc.) are used to build applications and keep them patched.

These must be imported with the `kp` cli and the Dependency Descriptor (`descriptor-<version>.yaml`) file from the Tanzu Build Service Dependencies page:

When importing with kp cli, you must `docker login` to both `registry.tanzu.vmware.com` and `registry.pivotal.io`.

```
kp import -f /tmp/descriptor-<version>.yaml
```

When importing to a registry that uses a self-signed CA certificate:

```
kp import -f /tmp/descriptor-<version>.yaml --registry-ca-cert-path <path-to-ca-cert>
```

Using the `--show-changes` flag will give a summary of the resource changes for the import. You will also be asked to confirm the import. Confirmation can be skipped with `--force`.

Successfully performing a `kp import` command requires that your Tanzu Network account has access to the images specified in the Dependency Descriptor file. Users can only access these images if they agree to the dependency EULAs.

Users must navigate to the following dependencies pages in Tanzu Network and accept all EULAs highlighted in yellow.

1. Tanzu Build Service Dependencies
2. Buildpacks for VMware Tanzu
3. Stacks for VMware Tanzu

Note: `kp import` will fail if it cannot access the images in all of the above Tanzu Network pages.

Note: You must be logged in locally to the registry used for `IMAGE-REGISTRY` during relocation and both urls for the Tanzu Network registry (`registry.tanzu.vmware.com` and `registry.pivotal.io`).

Additional Configuration

Other optional parameters can be added using the `-v` flag:

- `admin_users` is a comma separated list of users who will be granted admin privileges on Build Service.
- `admin_groups`: a comma separated list of groups that will be granted admin privileges on Build Service.
- `http_proxy`: The HTTP proxy to use for network traffic.
- `https_proxy`: The HTTPS proxy to use for network traffic.
- `no_proxy`: A comma-separated list of hostnames, IP addresses, or IP ranges in CIDR format that should not use a proxy.

Note: When proxy server is enabled using `http_proxy` and/or `https_proxy`, traffic to the kubernetes API server will also flow through the proxy server. This is a known limitation and can be circumvented by using `no_proxy` to specify the kubernetes API

server.

Configuring TKGI as an OIDC Provider

The authentication and authorization processes for Build Service use a combination of RBAC rules and third-party authentication, including OpenID Connect (OIDC). You may configure UAA as an OIDC provider for your TKGI deployment to provide authentication for Build Service.

To configure UAA as an OIDC provider for your TKGI deployment:

1. Navigate to the OpsManager Installation Dashboard.
2. Click the TKGI tile.
3. Select **UAA**.
4. Under **Configure created clusters to use UAA as the OIDC provider**, select **Enable**.
5. Ensure the values in the **UAA OIDC Groups Prefix** and **UAA OIDC Username Prefix** fields are the same and record them. For example, `"oidc:"`. You will need these values during the installation of Build Service.

   Note: Ensure you add a `:` at the end of the desired prefix.

6. Click **Save**.
7. In the OpsManager Installation Dashboard, click **Review Pending Changes**, then **Apply Changes**.

Installation to Air-Gapped Environment

Note: The TanzuNetDependencyUpdater cannot be used in air-gapped environments. Do not include Tanzu Net credentials for air-gapped installations.

Tanzu Build Service can be installed to a Kubernetes Cluster and registry that are air-gapped from external traffic.

An air-gapped environment will often use an internal registry with a self-signed CA certificate and you will need access to this CA certificate file to install TBS.

Note: If you are using a CA certificate that is trusted (eg. Lets Encrypt) you will not need the CA certificate file.

Relocate Images to a Registry (Air-Gapped)

This procedure relocates images from the Tanzu Network registry to an internal image registry via a local machine.

The local machine must have write access to the internal registry.

1. Log in to the image registry where you want to store the images by running:

```
docker login <IMAGE-REGISTRY>
```

Where `IMAGE-REGISTRY` is the name of the image registry where you want to store the images.

2. Log in to the Tanzu Network registry with your Tanzu Network credentials:

```
docker login registry.tanzu.vmware.com
```

3. Copy the Tanzu Build Service bundle to your local machine as a tar with the Carvel tool `imgpkg` by running:

```
imgpkg copy -b registry.tanzu.vmware.com/build-service/bundle:<TBS-VERSION> --to-tar=/
tmp/tanzu-build-service.tar
```

Where `TBS-VERSION` is the version of Tanzu Build Service you want to install.

4. Move the output file `tanzu-build-service.tar` to a machine that has access to the air-gapped environment.
5. Unpackage the images from your local machine to the internal registry:

```
imgpkg copy --tar /tmp/tanzu-build-service.tar \
  --to-repo=<IMAGE-REPOSITORY> \
  --registry-ca-cert-path <PATH-TO-CA>
```

Where:

- `IMAGE-REPOSITORY` is the repository in your registry that you want to relocate images to.
- `PATH-TO-CA` is the path to the registry CA certificate file.

Note: The IMAGE-REPOSITORY must be the IMAGE-REGISTRY appended with the destination repository for the images. For example, `IMAGE-REGISTRY/some-repo/build-service`.

Exception: When relocating to Dockerhub, you must provide the Dockerhub username and an image name that imgpkg will use for relocation. For example, `my-dockerhub-account/build-service`.

For example:

- Dockerhub `imgpkg copy --tar /tmp/tanzu-build-service.tar --to-repo=my-dockerhub-account/build-service --registry-ca-cert-path ca.crt`
- GCR `imgpkg copy --tar /tmp/tanzu-build-service.tar --to-repo=gcr.io/my-project/build-service --registry-ca-cert-path ca.crt`
- Artifactory `imgpkg copy --tar /tmp/tanzu-build-service.tar --to-repo=artifactory.com/my-project/build-service --registry-ca-cert-path ca.crt`
- Harbor `imgpkg copy --tar /tmp/tanzu-build-service.tar --to-repo=harbor.io/my-project/build-service --registry-ca-cert-path ca.crt`

Installing (Air-Gapped)

Note: The TanzuNetDependencyUpdater cannot be used in air-gapped environments. Do not include Tanzu Net credentials for air-gapped installations.

Once the images have been relocated, installation is the same as a regular install.

1. Pull the Tanzu Build Service bundle image locally using `imgpkg`:

```
imgpkg pull -b "<IMAGE-REPOSITORY>:<TBS-VERSION>" -o /tmp/bundle
```

Where `TBS-VERSION` and `IMAGE-REPOSITORY` are the same values used during relocation.

2. Use the Carvel tools `kapp`, `ytt`, and `kbld` to install Build Service and define the required Build Service parameters by running:

```
ytt -f /tmp/bundle/config/ \
 -f <PATH-TO-CA> \
 -v kp_default_repository='<IMAGE-REPOSITORY>' \
 -v kp_default_repository_username='<REGISTRY-USERNAME>' \
 -v kp_default_repository_password='<REGISTRY-PASSWORD>' \
 --data-value-yaml pull_from_kp_default_repo=true \
 | kbld -f /tmp/bundle/.imgpkg/images.yml -f- \
 | kapp deploy -a tanzu-build-service -f- -y
```

Where:

- `PATH-TO-CA` is the path to the registry root CA. This CA is required to enable Build Service to interact with internally deployed registries. This is the CA that was used while deploying the registry.
- `IMAGE-REPOSITORY` is the image repository where Tanzu Build Service images exist.

  Note: This is identical to the IMAGE-REPOSITORY argument provided during imgpkg relocation command.

- `REGISTRY-USERNAME` is the username you use to access the registry. `gcr.io` expects `_json_key` as the username when using JSON key file authentication.
- `REGISTRY-PASSWORD` is the password you use to access the registry.

  Note: [Managing Secrets](managing-secrets.html) for more information about how the registry username and password are used in Tanzu Build Service.

Additional Configuration

Other optional parameters can be added using the `-v` flag:

- `admin_users` is a comma separated list of users who will be granted admin privileges on Build Service.
- `admin_groups`: a comma separated list of groups that will be granted admin privileges on Build Service.

Import Tanzu Build Service Dependencies (Air-Gapped)

The Tanzu Build Service Dependencies (Stacks, Buildpacks, Builders, etc.) are used to build applications and keep them patched.

For air-gapped environments, dependencies must be imported with the `kp` cli and the Dependency Descriptor bundle image (`registry.tanzu.vmware.com/tbs-dependencies/full`) from the Tanzu Build Service Dependencies page.

Relocate Tanzu Build Service Dependency Images (Air-Gapped)

1. First, find the latest version of the descriptor from the Tanzu Build Service Dependencies page.
2. To import these dependencies into an air-gapped environment, they must first be pulled locally. Use `imgpkg` and the `<VERSION>` from the previous step:

```
imgpkg copy -b registry.tanzu.vmware.com/tbs-dependencies/full:<VERSION> \
  --to-tar=tbs-dependencies.tar
```

Note: You must be logged in locally to the Tanzu Network registry.

1. Move the output file `tbs-dependencies.tar` to a machine that has access to the air-gapped environment.
2. Then the dependencies must be uploaded to the Tanzu Build Service registry:

```
imgpkg copy --tar=tbs-dependencies.tar \
  --to-repo <IMAGE-REPOSITORY> \
  --registry-ca-cert-path <PATH-TO-CA>
```

Where:

- `IMAGE-REPOSITORY` is the internal image repository where dependency images will be relocated. This should be the same as `kp_default_repository` from installation.
- `PATH-TO-CA` is the path to the registry CA certificate file.

Note: You must be logged in locally to the registry used for `IMAGE-REPOSITORY`.

Import Tanzu Build Service Dependency Resources (Air-Gapped)

After the dependency images are uploaded to the internal registry, you can successfully import these images and create the corresponding Tanzu Build Service resources.

Use the following commands with `imgpkg`, `kbld`, and the `kp` CLI:

```
imgpkg pull -b <IMAGE-REPOSITORY>:<VERSION> \
  -o /tmp/descriptor-bundle \
  --registry-ca-cert-path <PATH-TO-CA>
```

```
kbld -f /tmp/descriptor-bundle/.imgpkg/images.yml \
  -f /tmp/descriptor-bundle/tanzu.descriptor.v1alpha3/descriptor-<VERSION>.yaml \
  | kp import -f - --registry-ca-cert-path <PATH-TO-CA>
```

Verify Installation

Verify your Build Service installation by first targeting the cluster Build Service has been installed on.

To verify your Build Service installation:

1. Download the `kp` binary from the Tanzu Build Service page on Tanzu Network.
2. List the cluster builders available in your installation:

```
kp clusterbuilder list
```

You should see an output that looks as follows:

```
NAME        READY    STACK                          IMAGE
base        true     io.buildpacks.stacks.bionic    <image@sha256:digest>
default     true     io.buildpacks.stacks.bionic    <image@sha256:digest>
full        true     io.buildpacks.stacks.bionic    <image@sha256:digest>
tiny        true     io.paketo.stacks.tiny          <image@sha256:digest>
```

Upgrading Tanzu Build Service

To upgrade Tanzu Build Service to a newer version, run the same commands as installation, kapp will update resources if they already exist. Re-importing dependencies is not required for upgrading TBS.

Uninstalling Tanzu Build Service

To uninstall Tanzu Build Service simply run the following `kapp` command:

```
kapp delete -a tanzu-build-service
```

Note: All Tanzu Build Service resources will be deleted. Registry images created by TBS will not be deleted.

Updating Build Service Dependencies

Note: If you enabled the TanzuNetDependencyUpdater during install (This can be verified by running `kubectl get TanzuNetDependencyUpdater -A` you do not need to do anything to manage your TBS dependencies

Use the following documentation to keep applications patched and up-to-date with Tanzu Build Service:

To keep dependencies up-to-date, see Updating Build Service Dependencies

To manage Stacks, see Managing Stacks

To manage Buildpack Stores, see Managing Stores

Ensuring Access to Cluster Builders

In order to use Cluster Builders, such as the ones installed with Tanzu Build Service, we suggest to install Tanzu Build Service to a repository that is accessible by the nodes in the kubernetes cluster without credentials.

If this is not desired, see When to use Synchronized Secrets.

Ensuring the Run Image is Readable

Build Service relies on the run-image being publicly readable or readable with the registry credentials configured in a project/namespace for the builds to be executed successfully.

The location of the run image can be identified by running the following command:

```
kp clusterstack status <stack-name>
```

If the cluster stack run image is not public, you may need to create a registry secret in any namespace where Images or Builds will be used. For more details on secrets in Tanzu Build Service, see Managing Secrets

This can be done with the `kp` CLI:

```
kp secret create my-registry-creds --registry example-registry.io --registry-user my-r
egistry-user --namespace build-namespace
```

Next Steps

Visit the Managing Images and Builds page to learn how to create and manage a new image.

Kubernetes Permissions for Installation

The minimum Kubernetes RBAC permissions required to install Tanzu Build Service are as follows. This includes the namespaces required for the Kubernetes Roles:

```
---
apiVersion: v1
kind: Namespace
metadata:
  name: build-service
---
apiVersion: v1
kind: Namespace
metadata:
  name: kpack
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: build-service-install-cluster-role
```

```
rules:
  - apiGroups:
      - "admissionregistration.k8s.io"
    resources:
      - mutatingwebhookconfigurations
      - validatingwebhookconfigurations
    verbs:
      - '*'
  - apiGroups:
      - "rbac.authorization.k8s.io"
    resources:
      - clusterroles
      - clusterrolebindings
    verbs:
      - '*'
  - apiGroups:
      - "apiextensions.k8s.io"
    resources:
      - customresourcedefinitions
    verbs:
      - '*'
  - apiGroups:
      - "storage.k8s.io"
    resources:
      - storageclasses
    verbs:
      - get
      - list
      - watch
  - apiGroups:
      - kpack.io
    resources:
      - builds
      - builds/status
      - builds/finalizers
      - images
      - images/status
      - images/finalizers
      - builders
      - builders/status
      - clusterbuilders
      - clusterbuilders/status
      - clusterstores
      - clusterstores/status
      - clusterstacks
      - clusterstacks/status
      - sourceresolvers
      - sourceresolvers/status
    verbs:
      - '*'
  - apiGroups:
      - "projects.vmware.com"
    resources:
      - projects
    verbs:
      - '*'
---
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
```

```
metadata:
  name: build-service-install-role
  namespace: build-service
rules:
  - apiGroups:
      - ""
    resources:
      - configmaps
      - secrets
      - serviceaccounts
      - services
      - namespaces
    verbs:
      - '*'
  - apiGroups:
      - "rbac.authorization.k8s.io"
    resources:
      - roles
      - rolebindings
    verbs:
      - '*'
  - apiGroups:
      - apps
    resources:
      - deployments
      - daemonsets
    verbs:
      - '*'
---
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  name: kpack-install-role
  namespace: kpack
rules:
  - apiGroups:
      - ""
    resources:
      - services
      - serviceaccounts
      - namespaces
      - secrets
      - configmaps
    verbs:
      - '*'
  - apiGroups:
      - "rbac.authorization.k8s.io"
    resources:
      - roles
      - rolebindings
    verbs:
      - '*'
  - apiGroups:
      - apps
    resources:
      - deployments
      - daemonsets
    verbs:
      - '*'
```

The `kapp` command used to install Tanzu Build Service requires access to ConfigMaps in the namespace that will be used to run `kapp`:

```
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  name: kapp-role
  namespace: <my-kapp-namespace>
rules:
  - apiGroups:
      - ""
    resources:
      - configmaps
    verbs:
      - '*'
```

Where the namespace `<my-kapp-namespace>` must be the namespace of the Kubernetes context that `kapp` will be run in.

Accessing Tanzu Build Service

To use your Build Service installation, gain kubeconfig access to the Kubernetes Cluster that has the Build Service installed. For example, if you are using TKGI (formerly PKS):

```
tkgi login -a <tkg-api-url> -u <username> -p <password>
tkgi get-credentials <clustername> -a <tkg-api-url> -u <username> -p <password>
```

You can use the `kp` CLI, downloaded as part of the installation to interact with Build Service. The `kp` CLI uses the local `KUBECONFIG` utilized by `kubectl`. All operations will be performed on kubernetes current-context namespace.

The `kp` CLI help text is published here.

```
$ kp
kp controls the kpack installation on Kubernetes.

kpack extends Kubernetes and utilizes unprivileged kubernetes primitives to provide
builds of OCI images as a platform implementation of Cloud Native Buildpacks (CNB).
Learn more about kpack @ https://github.com/pivotal/kpack

Usage:
  kp [command]

Available Commands:
  build          Build Commands
  builder        Builder Commands
  clusterbuilder Cluster Builder Commands
  clusterstack   Cluster Stack Commands
  clusterstore   Cluster Store Commands
  completion     Generate completion script
  help           Help about any command
  image          Image commands
  import         Import dependencies for stores, stacks, and cluster builders
  secret         Secret Commands
  version        Display kp version

Flags:
  -h, --help   help for kp

Use "kp [command] --help" for more information about a command.
```

Note: These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.

Updating Build Service Dependencies

Keeping applications up-to-date with the latest dependency patches is a core feature of Tanzu Build Service. Updates to dependencies will be propagated to application images. The resources that account for these patches are:

- **ClusterStacks** - Update a ClusterStack to patch operating system packages.
- **ClusterStores** - Update a ClusterStore to patch the Cloud Native Buildpacks used to build your applications.

You can use the `kp` CLI to update any resource. The help text is published here.

Note: These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.

Updating Dependencies

Automatically Update Dependencies

Tanzu Build Service ships with a dependency updater that can update ClusterStacks, ClusterStores, ClusterBuilders, and the CNB Lifecycle from TanzuNet automatically. Enabling this feature will keep Images up to date with the latest security patches and fixes.

You can run `kubectl get TanzuNetDependencyUpdater -A` to check if you have a TanzuNetDependencyUpdater set up already. If you have one, there is nothing you need to do to manage your dependencies in TBS.

If you would like to enable this feature after install, you can create the following resources:

1. A secret with you TanzuNet credentials (`kp secret create dependency-updater-secret --registry registry.tanzu.vmware.com --registry-user <TANZUNET_USERNAME>`) in the namespace where you would like your dependency updater to be in.
2. A service account that contains that secret. (If the secret was created using `kp`, it will automatically be added to the `default` service account in that namespace.
3. A `TanzuNetDependencyUpdater` resource:

```
---
apiVersion: buildservice.tanzu.vmware.com/v1alpha1
kind: TanzuNetDependencyUpdater
metadata:
  name: dependency-updater
  namespace: <NAMESPACE>
spec:
  serviceAccountName: <SERVICE-ACCOUNT>
```

```
productSlug: tbs-dependencies
checkEvery: 1m
descriptorName: <DESCRIPTOR-NAME>
descriptorVersion: <DESCRIPTOR-VERSION>
```

- The `productSlug` field corresponds to the product name in TanzuNet
- The `checkEvery` field is the frequency that the updater will check for new descriptor file releases
- The `serviceAccountName` field is the name of the service account from step 2
- The `descriptorName` field is the name of the descriptor to import automatically. Available options can be found on the Tanzu Network Build Service Dependencies page. Current available options at time of release:
  - `full` contains all dependencies - for production use.
  - `lite` smaller footprint used for speeding up installs. Requires internet access on the cluster.
- The `descriptorVersion` (optional) field can be used to pin to a specific version of the descriptor. This is only recommended for use to protect from breaking changes. This can usually be left blank.

Bulk Update

Note: If you want to be alerted when a new descriptor file is published, we recommend using an RSS reader and watching the Tanzu Build Service Dependencies TanzuNet feed for updates https://network.tanzu.vmware.com/rss

The Bulk Update workflow can update all dependencies (ClusterStacks, ClusterStores and ClusterBuilders) in Tanzu Build Service using the `kp import` command.

1. Download the Dependency Descriptor file (`descriptor-<version>.yaml`) from the latest release on the Tanzu Build Service Dependencies page on Tanzu Network.

Note: You can see all of the buildpackages versions that will be imported by looking at the `buildpackage-versions-.yaml` file from the [Tanzu Build Service Dependencies](https://network.tanzu.vmware.com/products/tbs-dependencies/) release.

2. Docker login to the TanzuNet registry (both urls)

```
docker login registry.tanzu.vmware.com
docker login registry.pivotal.io
```

3. Use the `kp` CLI

Warning: Tanzu Build Service ships with a automatic dependency updater. If you have enabled this feature during install by passing in your TanzuNet credentials you **MUST** skip this step. To check if you have a TanzuNetDependencyUpdater in your cluster, run: `kubectl get TanzuNetDependencyUpdaters -A`

```
kp import -f descriptor-<version>.yaml
```

The following ClusterStacks will be updated with the latest Operating System patches: `base`, `default`, `full`, and `tiny`.

The following ClusterStore will be updated with the latest Cloud Native Buildpacks: `default`

Using the `--show-changes` flag will give a summary of the resource changes for the import. You will also be asked to confirm the import. Confirmation can be skipped with `--force`.

Cluster Stacks Update

This section described how to update individual cluster stacks. This provides a more fine-grained way to patch operating system packages.

New stack versions will be provided on the Tanzu Build Service Dependencies page on Tanzu Network.

To update specific cluster stacks, go to the latest release of the Tanzu Build Service Dependencies page on Tanzu Network to find the image references and their `<sha256>` sums. Example commands will be provided on this page.

Use the following `kp` CLI commands to update the desired stack:

```
kp clusterstack update base \
  --build-image registry.tanzu.vmware.com/tbs-dependencies/build-base@<sha256> \
  --run-image registry.tanzu.vmware.com/tbs-dependencies/run-base@<sha256>

kp clusterstack update default \
  --build-image registry.tanzu.vmware.com/tbs-dependencies/build-full@<sha256> \
  --run-image registry.tanzu.vmware.com/tbs-dependencies/run-full@<sha256>

kp clusterstack update full \
  --build-image registry.tanzu.vmware.com/tbs-dependencies/build-full@<sha256> \
  --run-image registry.tanzu.vmware.com/tbs-dependencies/run-full@<sha256>

kp clusterstack update tiny \
  --build-image registry.tanzu.vmware.com/tbs-dependencies/build-tiny@<sha256> \
  --run-image registry.tanzu.vmware.com/tbs-dependencies/run-tiny@<sha256>
```

Note: Both build and run images need to be provided to update the stack.

The updated ClusterStack can be viewed with the following command:

```
kp clusterstack status <stack-name>
```

Example output

```
$ kp clusterstack status tiny
Status:         Ready
Id:             io.paketo.stacks.tiny
Run Image:      gcr.io/build-service-dev/test/run@sha256:34b01fd9a3745fcaa345f89939382
91c931f7977cc2bee78ed377da2edc55e3d
Build Image:    gcr.io/build-service-dev/test/build@sha256:5288d9c5b7cf7068d07b5a184f3
```

```
ec2f124fbc5842401b8b23c74485c4d2ba23a
```

Cluster Store Update

ClusterStores contain all of the buildpackages (one or more packaged Cloud Native Buildpacks) to be used by Builders to build application images.

You can update Cloud Native Buildpacks in Tanzu Build Service by adding new buildpackage versions to the store.

To list the buildpackages available in a store:

```
kp clusterstore status <store-name>
```

Example output

```
$ kp clusterstore status default
Status:    Ready

BUILDPACKAGE ID                 VERSION    HOMEPAGE
paketo-buildpacks/procfile      1.4.0      https://github.com/paketo-buildpacks/procfi
le
tanzu-buildpacks/dotnet-core    0.0.3
tanzu-buildpacks/go             1.0.5
tanzu-buildpacks/httpd          0.0.38
tanzu-buildpacks/java           2.5.0      https://github.com/pivotal-cf/tanzu-java
tanzu-buildpacks/nginx          0.0.45
tanzu-buildpacks/nodejs         1.1.0
tanzu-buildpacks/php            0.0.3
```

To show a complete list of all buildpacks available in a store:

```
kp clusterstore status <store-name> --verbose
```

Update a store with one or more buildpackages with:

```
kp clusterstore add <store-name> -b <buildpackage-image1> -b <buildpackage-image2>
```

Note: Any number of buildpackages can be added to a store at a time with multiple `-b` flags.

Updating Buildpacks From Tanzu Network

New Cloud Native Buildpacks (packaged as buildpackages) will be available on Tanzu Network and should be uploaded to a Tanzu Build Service to keep application images patched.

New versions of the Java, NodeJS, and Go buildpacks will be released on their respective Tanzu Network pages: Java, NodeJS and Go. New versions of all other buildpacks will be released on the Tanzu Build Service Dependencies page.

Here is a list of how to update each buildpack that is included with Tanzu Build Service by default:

```
kp clusterstore add default -b registry.tanzu.vmware.com/tanzu-java-buildpack/java:<ve
rsion>
kp clusterstore add default -b registry.tanzu.vmware.com/tanzu-nodejs-buildpack/nodejs
:<version>
kp clusterstore add default -b registry.tanzu.vmware.com/tanzu-go-buildpack/go:<versio
n>
kp clusterstore add default -b registry.tanzu.vmware.com/tbs-dependencies/tanzu-buildp
acks_dotnet-core:<version>
kp clusterstore add default -b registry.tanzu.vmware.com/tbs-dependencies/tanzu-buildp
acks_php:<version>
kp clusterstore add default -b registry.tanzu.vmware.com/tbs-dependencies/tanzu-buildp
acks_nginx:<version>
kp clusterstore add default -b registry.tanzu.vmware.com/tbs-dependencies/tanzu-buildp
acks_httpd:<version>
kp clusterstore add default -b registry.tanzu.vmware.com/tbs-dependencies/paketo-build
packs_procfile:<version>
```

Additionally, multiple buildpackages can be added to Build Service by passing multiple image references:

```
kp clusterstore add <store-name> \
  -b registry.tanzu.vmware.com/buildpacakge-1 \
  -b registry.tanzu.vmware.com/buildpackage-2 \
  -b registry.tanzu.vmware.com/buildpackage-3
```

Offline Update of Dependencies

If your Tanzu Build Service installation is in an offline/air-gapped environment, you can update stores with the following offline workflow:

1. Find the latest version of the Dependency Descriptor bundle image (`registry.tanzu.vmware.com/tbs-dependencies/full`) from the latest release on the Tanzu Build Service Dependencies page on Tanzu Network.
2. Download the following CLIs for your operating system:

- kp.
- imgpkg
- kbld

3. Download the dependency images for Tanzu Build Service to your local machine with `imgpkg` using the `VERSION` found from Tanzu Network in step 1:

```
docker login registry.tanzu.vmware.com

imgpkg copy -b registry.tanzu.vmware.com/tbs-dependencies/full:<VERSION> \
  --to-tar=tbs-dependencies.tar
```

4. Move the output file `tbs-dependencies.tar` to a machine that has access to the "offline" environment
5. Upload the dependency images to the registry used to deploy Tanzu Build Service:

```
docker login <build-service-registry>
```

```
imgpkg copy --tar=tbs-dependencies.tar \
  --to-repo <IMAGE-REPOSITORY>
```

Where `IMAGE-REPOSITORY` is the repository used to install Tanzu Build Service. This should be the same value as `IMAGE-REPOSITORY` used in the Installation Steps.

6. Now that dependencies are relocated to the internal registry, you can use the following commands to update the necessary resources:

```
imgpkg pull -b <IMAGE-REPOSITORY>:<VERSION> \
  -o /tmp/descriptor-bundle \
  --registry-ca-cert-path <PATH-TO-CA>

kbld -f /tmp/descriptor-bundle/.imgpkg/images.yml \
  -f /tmp/descriptor-bundle/tanzu.descriptor.v1alpha3/descriptor-<VERSION>.yaml \
  | kp import -f -
```

Managing Secrets

Overview

VMware Tanzu Build Service uses Kubernetes secrets to manage credentials.

- To publish images to a Registry, you must use a Registry secret.
- To use source code stored in a private Git repository, you must use a Git secret.

Secrets are namespaced and can only be used for image configurations that exist in the same namespace. For more information about Kubernetes secrets, see Secrets in the Kubernetes documentation.

For more information about secret synchronization, see the Secret Synchronization page.

You can manage secrets with the `kp` CLI. The help text is published here.

```
$ kp secret
Secret Commands

Usage:
  kp secret [command]

Available Commands:
  create      Create a secret configuration
  delete      Delete secret
  list        List secrets

Flags:
  -h, --help   help for secret

Use "kp secret [command] --help" for more information about a command.
```

Note: These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.

Create Secrets

You can create secrets using the `kp` CLI and script them with environment variables.

Secrets are created in the Kubernetes `current-context` namespace, unless you specify a different namespace using the `--namespace` or `-n` flag. Kubernetes automatically adds these secrets to the `default` service account in the same namespace.

Note: The `kp` CLI does not validate the secret against the specified registry or Git at

the time of secret creation. Incorrect credentials will be reported as they are used during an image build.

Create a Docker Hub Registry Secret

You can create a Docker Hub registry secret using the `--dockerhub` flag.

```
kp secret create SECRET-NAME --dockerhub DOCKER-HUB-ID
```

Where:

- `SECRET-NAME` is the name you give your secret.
- `DOCKER-HUB-ID` is your Docker Hub user ID.

When prompted, enter your Docker Hub password. Alternatively, you can use the `DOCKER_PASSWORD` environment variable to bypass the password prompt.

The Docker Hub registry secret is stored as a `kubernetes.io/dockerconfigjson` secret.

Examples:

```
$ kp secret create secret1 --dockerhub my-dockerhub-id
dockerhub password:
"secret1" created

$ DOCKER_PASSWORD="my-password" kp secret create secret2 --dockerhub my-dockerhub-id
"secret2" created
```

Create a GCR Registry Secret

You can create a GCR registry secret using the `--gcr` flag.

```
kp secret create SECRET-NAME --gcr GCR-SERVICE-ACCOUNT-PATH
```

Where:

- `SECRET-NAME` is the name you give your secret.
- `GCR-SERVICE-ACCOUNT-PATH` is the path to your GCR service account json file.

Alternatively use the `GCR_SERVICE_ACCOUNT_PATH` environment variable instead of the `--gcr` flag.

The GCR registry secret is stored as a `kubernetes.io/dockerconfigjson` secret.

Examples:

```
$ kp secret create secret1 --gcr /tmp/my-gcr-service-account.json
"secret1" created

$ GCR_SERVICE_ACCOUNT_PATH="/tmp/my-gcr-service-account.json" kp secret create secret2
"secret2" created
```

Create an Artifactory, Harbor, or ACR Registry Secret

You can create an Artifactory, Harbor, or ACR secret using the `--registry` and `--registry-user`

flags.

```
kp secret create SECRET-NAME --registry REGISTRY-URL --registry-user REGISTRY-USER-ID
```

Where:

- `SECRET-NAME` is the name you give your secret.
- `REGISTRY-URL` is the URL of the registry. This should only be the domain for the registry and should not contain folders or projects. Example: registry.io and not registry.io/project.
- `REGISTRY-USER-ID` is your registry user ID.

When prompted, enter your registry password. Alternatively, you can use the `REGISTRY_PASSWORD` environment variable to bypass the password prompt.

The Artifactory, Harbor, or ACR registry secret is stored as a `kubernetes.io/dockerconfigjson` secret.

Examples:

```
$ kp secret create secret1 \
  --registry registry.tanzu.vmware.com \
  --registry-user someuser@pivotal.io
registry password:
"secret1" created

$ REGISTRY_PASSWORD="my-password" kp secret create secret2 \
  --registry registry.tanzu.vmware.com \
  --registry-user someuser@pivotal.io
"secret2" created
```

Create a Git SSH Secret

You can create a Git SSH secret by specifying a Git SSH URL and private SSH key.

```
kp secret create SECRET-NAME --git-url GIT-SSH-URL --git-ssh-key PRIVATE-SSH-KEY-PATH
```

Where:

- `SECRET-NAME` is the name you give your secret.
- `GIT-SSH-URL` is the Git SSH domain URL. This is not the full repository URL. For example, value should be `git@github.com` for GitHub.
- `PRIVATE-SSH-KEY-PATH` is the path to your private SSH key.

Alternatively, use the `GIT_SSH_KEY_PATH` environment variable instead of the `--git-ssh-key` flag.

The Git SSH secret is stored as a `kubernetes.io/ssh-auth` secret.

Examples:

```
$ kp secret create secret1 \
  --git-url git@github.com \
  --git-ssh-key /tmp/private-repo-git-deploy-key
"secret1" created
```

```
$ GIT_SSH_KEY_PATH="/tmp/private-repo-git-deploy-key" kp secret create secret2 \
  --git-url git@github.com \
"secret2" created
```

Create a Git Basic Auth Secret

You can create a Git basic auth secret by providing your Git username and password

```
kp secret create SECRET-NAME --git-url GIT-DOMAIN-URL --git-user GIT-USERNAME
```

Where:

- `SECRET-NAME` is the name you give your secret.
- `GIT-DOMAIN-URL` is the Git domain url. This is not the full repository url. For example, value should be `https://github.com` for GitHub.
- `GIT-USERNAME` is your Git username.

When prompted, enter your Git password. Alternatively, you can use the `GIT_PASSWORD` environment variable to bypass the password prompt.

The Git basic auth secret is stored as a `kubernetes.io/basic-auth` secret.

Examples:

```
$ kp secret create secret1 \
  --git-url https://github.com \
  --git-user someone@vmware.com
git password:
"secret1" created

$ GIT_PASSWORD="my-password" kp secret create secret2 \
  --git-url https://github.com \
  --git-user someone@vmware.com
"secret2" created
```

List Secrets

To list the names and the targets for your secrets:

```
kp secret list
```

Unless you specify a namespace using the `--namespace` or `-n` flag, running the `kp secret list` command lists secrets for the Kubernetes `current-context` namespace.

Example:

```
$ kp secret list
NAME                   TARGET
default-token-qrdbr
docker-hub-creds       https://index.docker.io/v1/
gcr-creds              gcr.io
git-creds              https://github.com
git-ssh-creds          git@github.com
harbor-creds           registry.tanzu.vmware.com
```

The `default-token-xxxxx` secret is automatically added to the `default` service account by Kubernetes

Delete Secrets

To delete secrets:

```
kp secret delete SECRET-NAME
```

Where `SECRET-NAME` is the name of the secret you want to delete.

Unless you specify a namespace using the `--namespace` or `-n` flag, secrets are deleted from the Kubernetes `current-context` namespace. There is no confirmation required from the user.

Encrypting Secrets at Rest

Because Tanzu Build Service uses standard Kubernetes secrets, administrators may configure the cluster to encrypt secrets at rest. For more information, see the following link: https://kubernetes.io/docs/tasks/administer-cluster/encrypt-data/

Using SecretGen controller Secrets to use private cluster builders

When to use Synchronized Secrets

To enable the use of Cluster Builders from private registries, a Secret with registry credentials must exist in the namespace of the Image using that Cluster Builder.

You can configure this secret manually for each namespace, but Tanzu Build Service in tandem with the Carvel secret-gen-controller provides functionality to synchronize secrets across namespaces to simplify this process.

This feature is applicable in the following cases:

- You have installed Tanzu Build Service to a private registry and do not wish to make Cluster Builders imported by `kp` publicly readable.
- You have used `kp` to create a Cluster Builder in a private registry and do not wish to make it publicly readable.

Synchronized secrets are attached to build pods as `imagePullSecrets` so that the Cluster Builder Image can be pulled at build time.

Note: Synchronizing secrets with write access is not recommended. Instead, create and synchronize read-only secrets. A synced secret is not created during installation because the credentials provided for installation must be writable.

Installing the Carvel secret-gen-controller

In order to manage secrets across namespaces, Tanzu Build Service utilizes the carvel secret-gen-controller. Tanzu Build Service will automatically create placeholder secrets in namespaces that contain Build resources and then the secret-gen-controller will populate these placeholders across namespaces with the corresponding sync-secret in the secret-syncer namespace.

Please follow the secret-gen-controller install docs to install the controller.

Managing Secret Synchronization

Currently, the `kp` CLI does not support adding and removing synchronized secrets. However, this may be achieved by using the `kubectl` CLI.

Create a Synchronized Secret

To start synchronizing a secret to all namespaces with builds, first create the secret in the build-service namespace using the kubectl cli.

Example Secret:

```
apiVersion: v1
data:
  .dockerconfigjson: <SECRET DATA>
kind: Secret
metadata:
  name: my-synced-secret
  namespace: build-service
type: kubernetes.io/dockerconfigjson
```

Then create a secretExport resource

Example secretExport resource:

```
apiVersion: secretgen.carvel.dev/v1alpha1
kind: SecretExport
metadata:
  name: my-synced-secret
  namespace: build-service
spec:
  toNamespace: "*"
```

Once the TBS secret-syncer controller creates the placeholder, this secret will be automatically copied to the build namespace.

For more detailed information on the carvel secret-gen-controller please review the carvel docs

Update a Synchronized Secret

To update a secret and roll-out those changes to all namespaces that use Builds, simply update the secret(s) that have a corresponding secretExport resource located in the `build-service` namespace. Once this secret is updated the change will be rolled-out across namespaces.

Stop Synchronizing a Secret

To stop synchronizing a secret, delete the secret from the `build-service` namespace or remove the corresonding secretExport resource from the secret located in the `build-service` namespace.

Managing Image Resources and Builds

This topic contains the following sections:

- Image Resources
- Builds

The `kp` CLI can be used to manage image resources and builds. The help text is published here.

```
$ kp image
Image commands

Usage:
  kp image [command]

Aliases:
  image-resource, images, imgs, img

Available Commands:
  create      Create an image resource
  delete      Delete an image resource
  list        List image resources
  patch       Patch an existing image resource
  save        Create or patch an image resource
  status      Display status for an image resource
  trigger     Trigger an image resource build

Flags:
  -h, --help   help for image

Use "kp image [command] --help" for more information about a command.
```

```
$ kp build
Build Commands

Usage:
  kp build [command]

Aliases:
  build, builds, blds, bld

Available Commands:
  list        List builds for an image resource
  logs        Tails logs for an image resource build
  status      Display status for an image resource build

Flags:
  -h, --help   help for build
```

```
Use "kp build [command] --help" for more information about a command.
```

Note: These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.

Image Resources

Image resources provide a configuration for Tanzu Build Service to build and maintain a Docker image utilizing Tanzu, Paketo, and custom Cloud Native Buildpacks.

Build Service will monitor the inputs to the image resource to rebuild the image when the underlying source or buildpacks have changed.

The following procedures describe how to create and manage image resources in Build Service with the `kp` CLI.

Creating Image Resources

Prerequisites:

- Access to a cluster running Build Service.
- Configured write secrets for your Docker registry.

Source Code

The `kp` CLI supports creating Image Resources using source code from the following locations:

- Git based source
- Blob store
- Local machine

You can specify only one location for app source code.

Builders

Users can select a Builder (namespaced-scoped) or a Cluster Builder (cluster-scoped) to be used to create image resource builds. You can use any of the available Builders or Cluster Builders with any of the source types (git, blob, or local).

If you do not use the `--builder` or `--cluster-builder` flags, the `default` Cluster Builder will be used.

For more information on Builders, see Managing Builders.

Creating an Image Resource With Source Code in a Git Repository

To create an image resource using source code from a git repository run:

```
kp image create <name> \
  --tag <tag> \
  [--builder <builder> or --cluster-builder <cluster-builder>] \
  --namespace <namespace> \
  --env <env> \
  --sub-path <sub-path> \
  --wait \
  --git <git-repo> \
  --git-revision <git-revision>
```

Where:

- `name`: The name of the image resource.
- `tag`: The registry location where the image will be created.
- `builder`: (optional) Builder name to be used in the image resource. Cannot be used with `cluster-builder`.
- `cluster-builder`: (optional) Cluster Builder name to be used in the image resource. Defaults to `default` when `builder` is not set. Cannot be used with `builder`.
- `namespace`: (optional) The Kubernetes namespace for the image resource. Defaults to the local Kubernetes current-context namespace.
- `env` (optional): Image resource environment variable configuration as key=val pairs (`env_var=env_val`). The `--env` flag can be specified multiple times.
- `sub-path` (optional): Build code at the sub path located within the source code directory.
- `cache-size` (optional): The cache size used for subsequent builds. Must be a valid kubernetes quantity (default 2G).
- `wait` flag (optional) Waits for image create to be reconciled and tails resulting build logs.
- `git-repo` Git repository URL of the source code.
- `git-revision` (optional) The Git revision of the code that the image is built against. Can be either a `branch`, `tag` or a commit `sha`. When you target the image resource against a branch, Build Service triggers a build for every new commit. Defaults to `main`.

Note: If the `git-repo` is a private repository, you must configure the git credentials. For more information, see Create Secrets.

Create an Image Resource With Source Code In A Blob Store

Users can specify source code in a blob store saved as a compressed file (`zip`, `tar.gz`, `.tar`) or a `.jar` file.

To create an image resource using source code from blob store:

```
kp image create <name> \
  --tag <tag> \
  [--builder <builder> or --cluster-builder <cluster-builder>] \
```

```
  --namespace <namespace> \
  --env <env> \
  --sub-path <sub-path> \
  --wait \
  --blob <blob-url>
```

Where:

- `name`: The name of the image resource.
- `tag`: The registry location where the image will be created.
- `builder`: (optional) Builder name to be used in the image resource. Cannot be used with `cluster-builder`.
- `cluster-builder`: (optional) Cluster Builder name to be used in the image resource. Defaults to `default` when `builder` is not set. Cannot be used with `builder`.
- `namespace`: (optional) The Kubernetes namespace for the image resource. Defaults to the local Kubernetes current-context namespace.
- `env` (optional): Image resource environment variable configuration as key=val pairs (`env_var=env_val`). The `--env` flag can be specified multiple times.
- `sub-path` (optional): Build code at the sub path located within the source code directory.
- `cache-size` (optional): The cache size used for subsequent builds. Must be a valid kubernetes quantity (default 2G).
- `wait` flag (optional) Waits for image create to be reconciled and tails resulting build logs.
- `blob-url` URL of the source code blob file.

Note: The source code file in the blob store must be publicly viewable or the `blob-url` must contain the basic authentication credentials.

Creating an Image Resource With Local Source Code

Users can apply local source code from a directory, compressed source code (`zip`, `tar.gz`, `.tar`), or a `.jar` file.

To create an image resource using source code from a local machine run:

```
kp image create <name> \
  --tag <tag> \
  --local-path <source-path> \
  [--builder <builder> or --cluster-builder <cluster-builder>] \
  --namespace <namespace> \
  --env <env> \
  --cache \
  --registry-ca-cert-path <path-to-ca-cert> \
  --registry-verify-certs
```

Where:

- `name`: The name of the image resource.

- `tag`: The registry location where the image will be created.
- `source-path` Path to local source code.
- `builder`: (optional) Builder name to be used in the image resource. Cannot be used with `cluster-builder`.
- `cluster-builder`: (optional) Cluster Builder name to be used in the image resource. Defaults to `default` when `builder` is not set. Cannot be used with `builder`.
- `namespace`: (optional) The Kubernetes namespace for the image resource. Defaults to the local Kubernetes current-context namespace.
- `env` (optional): image resource environment variable configuration as key=val pairs (`env_var=env_val`). The `--env` flag can be specified multiple times.
- `cache-size` (optional): The cache size used for subsequent builds. Must be a valid kubernetes quantity (default 2G).
- `--wait` flag (optional) Waits for image create to be reconciled and tails resulting build logs.
- `registry-ca-cert-path` (optional) Add CA certificate for registry API
- `registry-verify-certs` (optional) Set whether to verify server's certificate chain and host name (default true)

Buildpack Configuration

Image resources use buildpacks to build application images in a registry. The buildpacks contain the dependencies needed for these builds and you can add buildpack configuration to Tanzu Build Service Image Resources.

Buildpack Configuration Use Cases

Common use cases for setting buildpack configuration include:

- Selecting a specific version or version line of a dependency (Go 1.15.*, Java 1.8)
- Language-specific configuration (Go build target)
- Buildpack-specific configuration

Buildpack Configuration Documentation

Buildpack configuration details can be found in the documentation for that specific buildpack.

Use `kp clusterstore status <store-name> --verbose` to find the homepage of the desired buildpack.

Buildpack Configuration in Image Resources

Buildpack configuration – including manually selecting buildpacks to use – can be set in two ways in Tanzu Build Service Image Resources. The configuration depends on the specific buildpack, find buildpack details in Buildpack Configuration Documentation.

1. Creating a `buildpack.yml` file at the root of the application source code.

Example `buildpack.yml` for a Go app to use the latest Go 1.15 version and build with the path `./cmd/package`:

```
go:
  version: 1.15.*
  targets: ["./cmd/package"]
```

2. Setting environment variables on an Image Resource.

Tanzu Build Service Image Resources can have environment variables configured which will be set in all Builds and in the final exported registry image. These can be used for buildpack configuration.

Example `kp` command to create an image resource for a Go app to build with the path `./cmd/package`:

```
kp image create my-image \
  --tag registry.io/my-repo \
  --git https://github.com/my-go-app \
  --env BP_GO_TARGETS="./cmd/package"
```

Patching Image Resources

Users can patch their existing image resources with the `kp` CLI. Running a patch will trigger a new build of the image resource if any of the build inputs are changed.

Patch image resources with the following commands:

- With Source Code in a Git Repository

  ```
  kp image patch <name> \
      [--builder <builder> or --cluster-builder <cluster-builder>] \
      --namespace <namespace> \
      --env <env> \
      --wait \
      --git <git-repo> \
      --git-revision <git-revision>
  ```

- With Source Code In A Blob Store

  ```
  kp image patch <name> \
      [--builder <builder> or --cluster-builder <cluster-builder>] \
      --namespace <namespace> \
      --env <env> \
      --wait \
      --blob <blob-url>
  ```

- With Local Source Code

  ```
  kp image patch <name> \
      [--builder <builder> or --cluster-builder <cluster-builder>] \
      --namespace <namespace> \
      --env <env> \
      --wait \
      --local-path <source-path>
  ```

Where:

- `name`: The name of the image resource to patch.
- `namespace`: (optional) The Kubernetes namespace for the image resource. Defaults to the local Kubernetes current-context namespace.
- `env` (optional): Image resource environment variable configuration as key=val pairs (`env_var=env_val`). The `--env` flag can be specified multiple times.
- `cache-size` (optional): The cache size used for subsequent builds. Must be a valid kubernetes quantity (default 2G).
- `git-repo` Git repository URL of the source code. Must select one of `git-repo`, `blob-url`, or `source-path`
- `git-revision` (optional) The Git revision of the code that the image is built against. Can be either a `branch`, `tag` or a commit `sha`. When you target the image resource against a branch, Build Service triggers a build for every new commit. Defaults to `main`.
- `blob-url` URL of the source code blob file. Must select one of `git-repo`, `blob-url`, or `source-path`
- `source-path` Path to local source code. Must select one of `git-repo`, `blob-url`, or `source-path`

Note: If the `git-repo` is a private repository, you must configure the git credentials. For more information, see Create Secrets.

Note: The `tag` location in a registry and `name` of an image resource cannot be modified. To change these fields, you must create a new image resource.

Saving Image Resources

Users can create or patch an Image Resource using the `save` command. The `kp image save` command is used exactly the same as `kp image create` or `kp image patch`, but it will determine if an image resource needs to be created or patched.

Note: For handling source code changes in the Tanzu Build Service process, we recommend utilizing the `kp image save --wait` command within a CI/CD pipeline to update the source code referenced in the image resource.

This can be accomplished by updating the `--git-revision` field with a new commit ID. For many TBS customers this commit ID references source code that has undergone unit testing, so that they can be confident that the resulting image can be deployed or promoted to higher level environments.

```
kp image save my-image \
  --tag my-registry.com/my-repo \
  --git https://my-repo.com/my-app.git \
  --git-revision my-branch
```

Listing Images

To list all the image resources in a Kubernetes namespace:

```
kp image list --namespace <namespace>
```

Example

```
$ kp image list -n example1

NAME            READY     LATEST REASON    LATEST IMAGE         NAMESPACE
test-image1     True      CONFIG           first/image:sha      example1
test-image2     False     BUILDPACK        second/image:sha     example1
```

To list all the image resources across all Kubernetes namespaces:

```
kp image list --all-namespaces
```

Example

```
$ kp image list -A

NAME            READY     LATEST REASON    LATEST IMAGE         NAMESPACE
test-image1     True      CONFIG           first/image:sha      example1
test-image2     True      BUILDPACK        second/image:sha     example1
test-image3     True      BUILDPACK        third/image:sha      example2
test-image4     False     CONFIG           fourth/image:sha     example2
```

Filter Image Resources

Users can further filter the list of image resources by applying the `--filter` flag and specifying a filter and value. This command is useful for traversing large number of image resources by narrowing the list to only display image resources that possess certain attributes.

```
$ kp image list --filter ready=false -A

NAME            READY     LATEST REASON    LATEST IMAGE         NAMESPACE
test-image2     False     BUILDPACK        second/image:sha     example1
test-image4     False     CONFIG           fourth/image:sha     example2
```

See below for the current supported filters and values:

```
builder=string
clusterbuilder=string
latest-reason=commit,trigger,config,stack,buildpack
ready=true,false,unknown
```

Image Resource Rebuilds

Rebuilds happen in three ways:

1. An imperative rebuild occurs when you patch an image resource with `kp image patch`.

2. An automatic rebuild occurs when build inputs change (source code, stack, or buildpacks).
3. A user can trigger a rebuild manually.

An imperative rebuild will be initiated if any of the following changes are made to an image resource:

- An update to the commit, branch, Git repository, or other arguments to `kp image patch`.
- You upload a new copy of the local source code by running `kp image patch --local-path <source-path>`, where `<source-path>` is the source code path.

For more information, see Patching Image Resources.

Build Service auto-rebuilds image resources when one or more of the following build inputs change:

- New buildpack versions are made available via updates to a Cluster Store.
    - New Buildpack versions are made available on Tanzu Network.
    - To update buildpacks, you must add new buildpack versions from Tanzu Network to a Cluster Store. See Updating Build Service Dependencies for more details.
- There is a new commit on a branch or tag Tanzu Build Service is tracking.
- There is a new Cluster Stack (ie. base OS image) available, such as `full`, `tiny`, or `base`.
    - New Stack versions are made available on the Tanzu Build Service Dependencies page on Tanzu Network.
    - You can get updates to Stacks from the Tanzu Network Registry by using the `kp` CLI. See Updating Build Service Dependencies for more details.

Trigger an Image Resource Rebuild

You can initiate a manual rebuild using `kp`:

```
kp image trigger <image-name> --namespace <namespace>
```

This is useful for debugging image resource builds.

Viewing the Status of an Image Resource

When a user creates an image resource using the above workflow, they are configuring Tanzu Build Service to start creating builds of the image resource which create container images to be pushed to a registry.

If a particular build associated with an image resource fails, check the status of the image resource by running:

```
kp image status <image-name> --namespace <namespace>
```

Where `image-name` is the name of the image resource. See Listing Image Resources to get image names.

The following is an example output of this command:

```
Status:          Not Ready
Message:         --
```

```
LatestImage:     gcr.io/myapp@sha256:9d7b1fbf7f5cb0f8efe797f30e598b5e38bb1c08ada143d4c
96e4f78111a9239

Last Successful Build
Id:         1
Reason:     CONFIG

Last Failed Build
Id:         2
Reason:     COMMIT
```

Deleting an Image Resource

This procedure describes how to delete a Build Service image resource with the `kp` CLI.

Warning: Deleting an image resource deletes the image resource and all the builds that the image resource owns. It does not delete the app images generated by those builds from the registry.

To delete an image resource:

```
kp image delete <image> --namespace <namespace>
```

Where `image` is the name of the image resource.

When you successfully delete an image resource, you will see this message:

```
"<image>" deleted
```

Managing Image Resources with YAML

Build Services image resources can be created by applying the kpack image resources to cluster via `kubectl`.

Use the `default` service account for Build Service registry and git secrets.

Image Resource Additional Tags

With the addition of kpack apiVersion kpack.io/v1alpha2, additional tags can be specified on image resources. Additional tags are not currently configurable via the `kp` cli, applying yaml configuration with `kubectl` is required. See kpack docs for details.

Using a registry for caching

TBS Image resource can be configured to use a registry as the build cache instead of a persistent volume. Currently, configuring the registry cache is not supported with kp and kubectl must be used.

For more details see the kpack image config docs for how to set the cache tag.

Using Secrets

Use the `default` service account for Build Service registry and git secrets. kpack will default to the

`default` service account if no service account is specified.

Debugging with Image Resource Status

Using `kubectl` is a good way to debug Image Resources.

When an image resource has successfully built with its current configuration, its status will report the up to date fully qualified built image reference.

This information is available with `kubectl get image <image-name> -o yaml`.

```
status:
  conditions:
  - lastTransitionTime: "2020-01-17T16:16:36Z"
    status: "True"
    type: Succeeded
  - lastTransitionTime: "2020-01-17T16:16:36Z"
    status: "True"
    type: BuilderReady
  latestImage: index.docker.io/sample/image@sha256:d3eb15a6fd25cb79039594294419de2328f
14b443fa0546fa9e16f5214d61686
  ...
```

When a build fails the image resource status will report the condition Succeeded=False. The image resource status also includes the status of the builder being used by the image resource. If the builder is not ready, you may want to inspect that builder. More details in Managing Builders.

```
status:
  conditions:
  - lastTransitionTime: "2020-01-17T16:13:48Z"
    status: "False"
    type: Succeeded
    message: "Some error occurred"
  - lastTransitionTime: "2020-01-17T16:16:36Z"
    status: "False"
    type: BuilderReady
   message: "Some builder error occurred"
  ...
```

If further debugging is required, inspect the image resource's latest Build status discussed in Viewing Build Details for an Image Resource.

Image Resource Service Bindings

Tanzu Build Service supports application service bindings as described in the Kubernetes Service Bindings specification.

The `kp` CLI does not currently support creating service bindings, you should use `kubectl`.

Creating an Image Resource with Service Bindings

kpack documentation can be found here.

To create a service binding in your application image, you must create *either* of the following:

- A Provisioned Service

- A Kubernetes Secret that follows the guidelines provided in Well-known Secret Entry

Note: Check the desired buildpack documentation for details on the service bindings it supports. You can access these docs [here] (https://docs.vmware.com/en/VMware-Tanzu-Buildpacks/services/tanzu-buildpacks/GUID-index.html).

The following is an example that can be used with `kubectl apply`. It creates a `production-db` service binding for a maven app.

Example:

```
apiVersion: kpack.io/v1alpha2
kind: Image
metadata:
  name: sample-binding-with-secret
spec:
  tag: my-registry.com/repo
  builder:
    kind: ClusterBuilder
    name: default
  source:
    git:
      url: https://github.com/buildpack/sample-java-app.git
      revision: 0eccc6c2f01d9f055087ebbf03526ed0623e014a
  build:
    services:
    - name: production-db-secret
      kind: Secret
---
apiVersion: v1
kind: Secret
metadata:
  name: production-db-secret
type: servicebinding.io/mysql
stringData:
  type: mysql
  provider: bitnami
  host: localhost
  port: 3306
  username: root
  password: root
```

Builds

The procedures in this section describe how to view information and logs for image resource builds using the `kp` CLI.

Listing Builds

Build Service stores the ten most recent successful builds and the ten most recent failed builds.

To see a the list of builds for an image resource run:

```
kp build list <image-name> --namespace <namespace>
```

If the `namespace` is not specified, it defaults to the kubernetes current-context namespace. And if the `image-name` is not specified, the builds for all the image resources in your namespace are listed.

The following is an example of the output for this command:

```
BUILD    STATUS    IMAGE                              REASON
1        SUCCESS   gcr.io/myapp@sha256:some-sha1   CONFIG
2        SUCCESS   gcr.io/myapp@sha256:some-sha2   COMMIT
3        SUCCESS   gcr.io/myapp@sha256:some-sha3   STACK
4        FAILURE   gcr.io/myapp@sha256:some-sha4   CONFIG+
5        BUILDING  gcr.io/myapp@sha256:some-sha5   BUILDPACK
```

The following describes the fields in the example output:

- `BUILD`: Describes the index of builds in the order that they were built.
- `STATUS`: Describes the status of a previous build image.
- `IMAGE`: The full image reference for the app image produced by the build.
- `REASON`: Describes why an image rebuild occurred. These reasons include:
    - `CONFIG`: Occurs when a change is made to commit, branch, Git repository, or build fields on the image's configuration file and you run `kp image apply`.
    - `COMMIT`: Occurs when new source code is committed to a branch or tag that Build Service is monitoring for changes.
    - `BUILDPACK`: Occurs when new buildpack versions are made available through an updated builder.
    - `STACK`: Occurs when a new base OS image, called a `run image`, is available.
    - `TRIGGER`: Occurs when a new build is manually triggered.

Note: A rebuild can occur for more than one reason. When there are multiple reasons for a rebuild, the `kp` CLI output shows the primary `Reason` and appends a `+` sign to the `Reason` field. The priority rank for the `Reason`, from highest to lowest, is `CONFIG`, `COMMIT`, `BUILDPACK`, `STACK`, and `TRIGGER`.

Viewing Build Details for an Image

To display retrieve a detailed Bill of Materials for a particular build:

```
kp build status <image> -b <build-number>
```

Where:

- `image-name` is the name of the image resource the build is associated with
- `build-name` (optional) is the index of the build from listing builds. Defaults to latest build.

The following is an example of the output for this command:

```
Image:      gcr.io/myapp@sha256:f87b614257af05c3301c1554c4f15131793caec3adf55e45d2c612
e90445765a
Status:     SUCCESS
Reason:     CONFIG
            resources
            - source: {}
             + source:
             +   git:
          +     revision: 948b2eff6a21580a44a0f4d8c609a2af45359d41
          +     url: https://github.com/paketo-buildpacks/samples
            +   subPath: go/mod

Started:    2021-02-02 18:34:33
Finished:   2021-02-02 18:41:03

Pod Name:   build-pod-xyz

Builder:    gcr.io/my-builder:base@sha256:grtewwads0asdvf09asdf
Run Image:  gcr.io/base-image:run@sha256:asdas098asdas

Source:     Git
Url:        http://github.com/myapp
Revision:   ad123ad

BUILDPACK ID        BUILDPACK VERSION
io.java.etc         123
io.kotlin.etc       321
```

The following describes the fields in the example output:

- `Image`: The full image reference for the app image produced by the build.
- `Status`: Describes the status of a previous build image.
- `Reason`: Describes why an image resource build occurred and the change diff. The reason could be one or more of these:
    - `CONFIG`: Occurs when a change is made to commit, branch, Git repository, or build fields on the image's configuration file and you run `kp image apply`.
    - `COMMIT`: Occurs when new source code is committed to a branch or tag that Build Service is monitoring for changes.
    - `BUILDPACK`: Occurs when new buildpack versions are made available through an updated builder.
    - `STACK`: Occurs when a new base OS image (called a `run image`) is available.
    - `TRIGGER`: Occurs when a new build is manually triggered.
- `Started`: When a build started.

- `Finished`: When a build finished.
- `Pod Name`: The name of the Pod being used for the Build.
- `Builder`: The full image tag for the builder image used by the build.
- `Run Image`: The full image tag for the run image used by the app.
- `Source`: Describes where the source code used to build the image is coming from. Can be `Git`, `Blob`, or `Local Source`.
- `Url`: The Git repository URL for `Git` source, the Blob file URL for `Blob` source. Unset for `Local Source`.
- `Revision`: The Git commit sha of the source code used to create the build for `Git` source.
- `BUILDPACK ID`: A list of buildpack ids the build used.
- `BUILDPACK VERSION`: A list of buildpack versions the build used.

Image Resource Status shows ImagePullBackOff

If the Build is currently waiting for a container, the Build status will show details in the output of `kp build status`.

Here is an example output:

```
Image:             --
Status:            BUILDING
Reason:            CONFIG
Status Reason:     ImagePullBackOff
Status Message:    A container image currently cannot be pulled: Back-off pulling image
 "gcr.io/my-builder:base@sha256:grtewwads0asdvf09asdf"

Pod Name:     build-pod-xyz

Builder:     gcr.io/my-builder:base@sha256:grtewwads0asdvf09asdf
Run Image:   gcr.io/base-image:run@sha256:asdas098asdas

Source:       Git
Url:          http://github.com/myapp
Revision:     ad123ad

BUILDPACK ID         BUILDPACK VERSION
```

If you are seeing this error and you are using a Cluster Builder, you may need to configure a Synced Secret. See When to use Synchronized Secrets.

Getting Build Logs

An image resource that a user creates will cause builds to be initiated for that image. Builds are where Cloud Native Buildpacks are run and apps get built into images.

Build logs are a good way to debug issues and to get information about how your app is being built.

If you get logs of a build in progress, the logs will be tailed and will terminate when the build completes.

To get logs from a build run:

```
kp build logs <image> --build <build-number> --namespace <namespace>
```

Where:

- `image-name` is the name of the image resource the build is associated with
- `build-name` (optional) is the index of the build from listing builds. Defaults to latest build.

The following is an example of the output of the command:

```
===> PREPARE
Build reason(s): CONFIG
CONFIG:
  r e s o u r c e s :  { }
  -  s o u r c e :  { }
  +  s o u r c e :
  +      g i t :
 +      revision: 446dbda043ca103d33e2cad389d43f289e63f647
 +      url: https://github.com/some-org/some-repo
Loading secret for "gcr.io" from secret "gcr" at location "/var/build-secrets/gcr"
Cloning "https://github.com/some-org/some-repo" @ "446dbda043ca103d33e2cad389d43f289e6
3f647"...
Successfully cloned "https://github.com/some-org/some-repo" @ "446dbda043ca103d33e2cad
389d43f289e63f647" in path "/workspace"
===> DETECT
tanzu-buildpacks/node-engine 0.1.2
tanzu-buildpacks/npm-install 0.1.1
tanzu-buildpacks/npm-start   0.0.2
===> ANALYZE
Previous image with name "gcr.io/test-app" not found
===> RESTORE
===> BUILD
Tanzu Node Engine Buildpack 0.1.2
  Resolving Node Engine version
    Candidate version sources (in priority order):
                -> ""
      <unknown> -> "*"

    Selected Node Engine version (using ): 14.15.1

  Executing build process
    Installing Node Engine 14.15.1
      Completed in 2.495s

  Configuring environment
    NODE_ENV     -> "production"
    NODE_HOME    -> "/layers/tanzu-buildpacks_node-engine/node"
    NODE_VERBOSE -> "false"

    Writing profile.d/0_memory_available.sh
      Calculates available memory based on container limits at launch time.
      Made available in the MEMORY_AVAILABLE environment variable.

Tanzu NPM Install Buildpack 0.1.1
  Resolving installation process
    Process inputs:
      node_modules      -> "Not found"
```

```
      npm-cache         -> "Not found"
      package-lock.json -> "Not found"

    Selected NPM build process: 'npm install'

  Executing build process
    Running 'npm install --unsafe-perm --cache /layers/tanzu-buildpacks_npm-install/np
m-cache'
      Completed in 3.591s

  Configuring environment
    NPM_CONFIG_LOGLEVEL   -> "error"
    NPM_CONFIG_PRODUCTION -> "true"
    PATH                  -> "$PATH:/layers/tanzu-buildpacks_npm-install/modules/node_
modules/.bin"

Tanzu NPM Start Buildpack 0.0.2
  Assigning launch processes
    web: node server.js
===> EXPORT
Adding layer 'tanzu-buildpacks/node-engine:node'
Adding layer 'tanzu-buildpacks/npm-install:modules'
Adding layer 'tanzu-buildpacks/npm-install:npm-cache'
Adding 1/1 app layer(s)
Adding layer 'launcher'
Adding layer 'config'
Adding label 'io.buildpacks.lifecycle.metadata'
Adding label 'io.buildpacks.build.metadata'
Adding label 'io.buildpacks.project.metadata'
*** Images (sha256:0abdbaf1f25c3c13cdb918d06906670b84dd531bc7301177b11284dac68bdb9c):
      gcr.io/test-app
      gcr.io/test-app:b1.20210203.225422
Adding cache layer 'tanzu-buildpacks/node-engine:node'
Adding cache layer 'tanzu-buildpacks/npm-install:modules'
Adding cache layer 'tanzu-buildpacks/npm-install:npm-cache'
===> COMPLETION
Build successful
```

Viewing Bill of Materials

The kp cli allows you to view the bill of materials in an image built by a Build.

```
kp build status <image-name> --bom
```

For generating the bill of materials, the kp CLI will read metadata from the image (generated by the build) in the registry.

Note: You must have credentials to access the image registry on your machine.

As an example:

```
$ kp build status --bom my-app-image | jq
[
  {
    "buildpack": {
```

```
      "id": "tanzu-buildpacks/node-engine",
      "version": "0.1.2"
    },
    "metadata": {
      "licenses": [],
      "name": "Node Engine",
      "sha256": "b981046a0ea3d5594a7f04fae3afdfa1983bc65f4e26e768b38a2d67057ac75c",
      "stacks": [
        "io.buildpacks.stacks.bionic",
        "org.cloudfoundry.stacks.cflinuxfs3"
      ],
      "uri": "file:///dependencies/b981046a0ea3d5594a7f04fae3afdfa1983bc65f4e26e768b38
a2d67057ac75c",
      "version": "14.15.1"
    },
    "name": "node",
    "version": "14.15.1"
  },
  {
    "buildpack": {
      "id": "tanzu-buildpacks/npm-install",
      "version": "0.1.1"
    },
    "metadata": {
      "launch": true
    },
    "name": "node_modules"
  }
]
```


Offline Builds

Tanzu Build Service supports offline/air-gapped builds with Tanzu Buildpacks. Offline builds use pre-packaged dependencies and do not need to download from anywhere off-cluster to create application images.

When using Tanzu Buildpacks the build will execute as an offline build. For details on how to configure buildpacks, see Buildpack Configuration in Images.

Note: Offline builds only ensure buildpack dependencies are offline. The application build and custom configuration must also not reach off-cluster to be completely offline.

Image Signing with cosign

Tanzu Build Service supports cosign image signing.

Images signed with cosign require using `kubectl` instead of `kp`.

Cosign Signing Secret

Images can be signed with cosign when a cosign formatted secret is added to the service account used to build the image. The secret can be added using the cosign CLI or manually.

To create a cosign signing secret through the cosign CLI, when targetted to the Kubernetes cluster, use: `cosign generate-key-pair k8s://[NAMESPACE]/[NAME]`

Alternatively, create the cosign secret and provide your own cosign key files manually to Kubernetes by running the following command:

```
% kubectl create secret generic <secret-name> --from-literal=cosign.password=<password
> --from-file=</path/to/cosign.key>
```

- `<secret-name>`: The name of the secret. Ensure that the secret is created in the same namespace as the eventual image resource.
- `<password>`: The password provided to encrypt the private key. If not present, an empty password will be used.
- `</path/to/cosign.key>`: The cosign private key file generated with `cosign generate-key-pair`.

After adding the cosign secret, the secret must be added to the list of `secrets` attached to the service account resource that is building the image.

Adding Cosign Annotations

By default, the build number and build timestamp information will be added to the cosign signing annotations. Users can specify additional cosign annotations under the spec key.

```
cosign:
  annotations:
  - name: "annotationName"
    value: "annotationValue"
```

One way these annotations can be viewed is through verifying cosign signatures. The annotations will be under the `optional` key in the verified JSON response. For example, this can be done with:

```
% cosign verify -key /path/to/cosign.pub registry.example.com/project/image@sha256:<DI
GEST>
```

Which provides a JSON response similar to:

```
{
  "critical": {
    "identity": {
      "docker-reference": "registry.example.com/project/image"
    }, "image": {
      "docker-manifest-digest": "sha256:<DIGEST>"
    }, "type": "cosign container image signature"
  }, "optional": {
    "buildNumber": "1",
    "buildTimestamp": "20210827.175240",
    "annotationName": "annotationValue"
  }
}
```

Push Cosign Signature to a Different Location

Cosign signatures can be pushed to a different registry from where the image is located. To enable this, add the corresponding annotation to the cosign secret resource.

```
metadata:
  name: ...
  namespace: ...
  annotations:
    kpack.io/cosign.repository: other.registry.com/project/image
data:
  cosign.key: ...
  cosign.password: ...
```

This will be equivalent to setting `COSIGN_REPOSITORY` as specified in cosign Specifying Registry

The same service account that has that cosign secret attached, and would be used for signing and building the image, would require that the registry credentials for this other repository be placed under the listed `secrets` and is not required to be listed in `imagePullSecrets`. It should be noted that if you wish to push the signatures to the same registry but a different path from the image, the credential used must have access to both paths. You cannot use two separate credentials for the same registry with different paths.

Cosign Legacy Docker Media Types

To sign images in a registry that does not fully support OCI media types, legacy equivalents can be used by adding the corresponding annotation to the cosign secret resource:

```
metadata:
  name: ...
  namespace: ...
  annotations:
    kpack.io/cosign.docker-media-types: "1"
data:
  cosign.key: ...
  cosign.password: ...
```

This will be equivalent to setting `COSIGN_DOCKER_MEDIA_TYPES=1` as specified in the cosign registry-support

Managing ClusterStacks

A ClusterStack is a cluster scoped resource that provides the build and run images for the Cloud Native Buildpack stack that will be used in a Builder.

Most users automatically configure three ClusterStack resources via the TBS installation process. These ClusterStacks are referenced in three corresponding ClusterBuilder resources.

Additional information about security and patching cadence for these stacks and their ideal use cases can be found here. More detailed release notes for the stacks can be accessed by following the links in the table below.

Name	ID
tiny	io.paketo.stacks.tiny
base	io.buildpacks.stacks.bionic
full	io.buildpacks.stacks.bionic

The `kp` CLI can be used to manage clusterstack. The help text is published here.

```
$ kp clusterstack
Cluster Stack Commands

Usage:
  kp clusterstack [command]

Aliases:
  clusterstack, csk

Available Commands:
  create      Create a cluster stack
  delete      Delete a cluster stack
  list        List cluster stacks
  save        Create or update a cluster stack
  status      Display cluster stack status
  update      Update a cluster stack

Flags:
  -h, --help   help for clusterstack

Use "kp clusterstack [command] --help" for more information about a command.
```

Note: These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.

Note: Only Build Service Admins (i.e. users with the `pb-admin-role` kubernetes ClusterRole) can perform clusterstack commands.

Create a ClusterStack

Users can create a clusterstack using build and run images from a Docker registry or the local machine. The run and build images provided during clusterstack creation will be uploaded to the `canonical repository`, which is the `docker-repository` specified during TBS install.

- If using a Docker registry for the stack images:

```
kp clusterstack create <clusterstack-name> \
 --build-image <location of build-image> \
 --run-image <location of run-image>
```

Note: The user must have read access to the source Docker registry and write access to the canonical registry on the local machine.

Example:

```
kp csk create my-clusterstack \
 -b gcr.io/test/stack/run:latest
 -r gcr.io/test/stack/build:latest
```

- If using local stack images created with `docker save`:

```
kp clusterstack create <clusterstack-name> \
 --build-image <path to build-image>.tar \
 --run-image <path to run-image>.tar
```

Note: The user must have write access to the canonical registry on the local machine.

Example:

```
kp csk create my-clusterstack \
  -b ./local-build-image.tar \
  -r ./local-run-image.tar
```

Update a ClusterStack

Users can update a stack using build and run images from a Docker registry or the local machine. The run and build images provided during clusterstack update will be uploaded to the `canonical repository`, which is the `docker-repository` specified during TBS install.

- If using a Docker registry:

```
kp clusterstack update <stack-name> \
 --build-image <location of build-image> \
```

```
--run-image <location of run-image>
```

Note: The user must have read access to the source Docker registry and write access to the canonical registry on the local machine.

Example:

```
kp csk update my-clusterstack \
 -b gcr.io/test/stack/run:latest
 -r gcr.io/test/stack/build:latest
```

- If using local stack images created with `docker save`:

```
kp clusterstack update <stack-name> \
 --build-image <path to build-image>.tar \
 --run-image <path to run-image>.tar
```

Note: The user must have write access to the canonical registry on the local machine.

Example:

```
kp csk update my-clusterstack \
  -b ./local-build-image.tar \
  -r ./local-run-image.tar
```

Save a ClusterStack

Users can create or update a ClusterStack using the `save` command. The `kp clusterstack save` command is used exactly the same as `kp clusterstack create` and `kp clusterstack update`, but it will determine if a clusterstack needs to be created or updated.

Get ClusterStack Status

Users can get the current status of a clusterstack:

```
kp clusterstack status <stack-name>
```

The following is an example of the output for this command:

```
Status:          Ready
ID:             org.cloudfoundry.stacks.cflinuxfs3
Run Image:      paketo/run:full-cnb
Build Image:    paketo/build:full-cnb
```

Delete a ClusterStack

Users can delete an existing clusterstack:

```
kp clusterstack delete <stack-name>
```

Note: User will not be asked for a confirmation before deletion.

List all ClusterStacks

Users can view the list of all ClusterStacks created:

The following is an example of the output for this command:

```
NAME        READY    ID
base        True     io.buildpacks.stacks.bionic
default     True     io.buildpacks.stacks.bionic
full        True     org.cloudfoundry.stacks.cflinuxfs3
tiny        True     io.paketo.stacks.tiny
```

How to update an Image for Stack updates only?

To achieve Stack only updates for an Image, you can pin the Buildpack versions in the Builder used for creating the Image.

Managing Stores

A Store is a cluster level resource that provides a collection of buildpacks that can be utilized by Builders. Buildpacks are distributed and added to a store in buildpackages which are docker images containing one or more buildpacks.

Build Service ships with a curated collection of Tanzu buildpacks for Java, Nodejs, Go, PHP, nginx, and httpd and Paketo buildpacks for procfile, and .NET Core. Detailed documentation about the buildpacks that are installed with TBS can be found here. It is important to keep these buildpacks up-to-date. Updates to these buildpacks are provided on Tanzu Network.

In addition to supported Tanzu and Paketo buildpacks, custom buildpackages can be uploaded to Build Service stores.

The `kp` CLI can be used to manage clusterstores. The help text is published here.

```
$ kp clusterstore
ClusterStore Commands

Usage:
  kp clusterstore [command]

Aliases:
  clusterstore, clusterstores, clstrcsrs, clstrcsr, csrs, csr

Available Commands:
  add         Add buildpackage(s) to cluster store
  create      Create a cluster store
  delete      Delete a cluster store
  list        List cluster stores
  remove      Remove buildpackage(s) from cluster store
  save        Create or update a cluster store
  status      Display cluster store status

Flags:
  -h, --help   help for clusterstore
```

Note: These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.

Creating Buildpacks and Buildpackages

Documentation for creating buildpacks is available here.

Documentation for creating buildpackages is available here.

Note: Only Build Service Admins can perform store commands.

Listing ClusterStores

Users can view the existing stores with:

```
kp clusterstore list
```

Creating a ClusterStore

Tanzu Build Service ships with a `default` store containing all of the supported buildpacks. Users can create additional stores with:

```
kp clusterstore create <store-name> -b <buildpackage-1> -b <buildpackage-2>
```

Examples:

```
kp clusterstore create my-store -b my-registry.com/my-buildpackage
kp clusterstore create my-store -b my-registry.com/my-buildpackage -b my-registry.com/
my-other-buildpackage
kp clusterstore create my-store -b ../path/to/my-local-buildpackage.cnb
```

Buildpackages will be uploaded to the registry used during installation.

Note: The user must have read access to the source Docker registry and write access to the registry used for installation on the local machine.

Saving a ClusterStore

Users can create or update a ClusterStore using the `save` command. The `kp clusterstore save` command is used exactly the same as `kp clusterstore create`, but it will determine if a clusterstore needs to be created or updated.

```
kp clusterstore save <store-name> -b <buildpackage-1> -b <buildpackage-2>
```

Adding Buildpackages to a ClusterStore

Users can add multiple buildpackages at a time from a registry or from a file on the local machine.

This command is useful for users that want to only consume certain buildpacks rather than update all dependencies with `kp import`.

- If using a Docker registry:

  ```
  kp clusterstore add <store-name> -b <buildpackage-1> -b <buildpackage-2> ...
  ```

Note: The user must have read access to the source Docker registry and write access to the registry used for installation on the local machine.

- If using local `.cnb` buildpackage files created as described in the buildpackages docs:

```
kp clusterstore add <store-name> -b <path-to-buildpackage-1>.cnb -b <path-to-bu
ildpackage-2>.cnb ...
```

Adding Buildpackages to a ClusterStore from Tanzu Network

Updated versions of all supported Buildpacks will be available on Tanzu Network as registry images. Updated Buildpacks will be found in the following locations:

- Java
- NodeJS
- Go
- PHP, .NET Core, nginx, httpd, procfile

Here is a list of how to update each buildpack that is included with Tanzu Build Service by default:

```
kp clusterstore add default registry.tanzu.vmware.com/tanzu-java-buildpack/java:<versi
on>
kp clusterstore add default registry.tanzu.vmware.com/tanzu-nodejs-buildpack/nodejs:<v
ersion>
kp clusterstore add default registry.tanzu.vmware.com/tanzu-go-buildpack/go:<version>
kp clusterstore add default registry.tanzu.vmware.com/tbs-dependencies/paketo-buildpac
ks_dotnet-core:<version>
kp clusterstore add default registry.tanzu.vmware.com/tbs-dependencies/tanzu-buildpack
s_php:<version>
kp clusterstore add default registry.tanzu.vmware.com/tbs-dependencies/tanzu-buildpack
s_nginx:<version>
kp clusterstore add default registry.tanzu.vmware.com/tbs-dependencies/tanzu-buildpack
s_httpd:<version>
kp clusterstore add default registry.tanzu.vmware.com/tbs-dependencies/paketo-buildpac
ks_procfile:<version>
```

Offline Adding Buildpackages to a ClusterStore from Tanzu Network

If your Tanzu Build Service installation is in an offline/air-gapped environment, you can update stores with the following offline workflow:

1. Find the latest version of the Dependency Descriptor bundle image (`registry.tanzu.vmware.com/tbs-dependencies/full`) from the latest release on the Tanzu Build Service Dependencies page on Tanzu Network.
2. Download the following CLIs for your operating system:

- kp.
- imgpkg
- kbld

4. Download the dependency images for Tanzu Build Service to your local machine with `imgpkg`:

```
docker login registry.tanzu.vmware.com

imgpkg copy -b registry.tanzu.vmware.com/tbs-dependencies/full:<VERSION> \
  --to-tar=tbs-dependencies.tar
```

5. Move the output file `tbs-dependencies.tar` to a machine that has access to the "offline" environment
6. Upload the dependency images to the registry used to deploy Tanzu Build Service:

```
docker login <build-service-registry>

imgpkg copy --tar=tbs-dependencies.tar \
  --to-repo <IMAGE-REPOSITORY>
```

Where `IMAGE-REPOSITORY` is the repository used to install Tanzu Build Service. This should be the same value as `IMAGE-REPOSITORY` used in the Installation Steps.

7. Now that dependencies are relocated to the internal registry, you can use the following commands to update the necessary resources:

```
imgpkg pull -b <IMAGE-REPOSITORY>:<VERSION> \
  -o /tmp/descriptor-bundle \
  --registry-ca-cert-path <PATH-TO-CA>

kbld -f /tmp/descriptor-bundle/.imgpkg/images.yml \
  -f /tmp/descriptor-bundle/tanzu.descriptor.v1alpha3/descriptor-<VERSION>.yaml \
  | kp import -f -
```

Removing Buildpackages from a ClusterStore

Users can remove a buildpackage from a ClusterStore by referencing the buildpackage Id and version.

```
kp clusterstore remove <store> -b <buildpackage-id>@<buildpackage-version>
```

Examples:

```
kp clusterstore remove my-store -b buildpackage@1.0.0
kp clusterstore remove my-store -b buildpackage@1.0.0 -b other-buildpackage@2.0.0
```

The ClusterStore status shows the list of buildpackage Id and version

Get ClusterStore Status

Users can use the `kp` CLI to get details about a store including buildpackages and their buildpacks, as well as meta-buildpacks. Meta-buildpacks are buildpacks that indicate the order that other buildpacks run:

To view the buildpackages in a store:

```
kp clusterstore status <store-name>
```

Example:

```
$kp clusterstore status default

Status:    Ready

BUILDPACKAGE ID                          VERSION    HOMEPAGE
paketo-buildpacks/go                     0.1.3      https://github.com/paketo-buildpacks/
go
paketo-buildpacks/procfile               2.0.2      https://github.com/paketo-buildpacks/
procfile
paketo-buildpacks/procfile               3.0.0      https://github.com/paketo-buildpacks/
procfile
tanzu-buildpacks/dotnet-core             0.0.4
tanzu-buildpacks/dotnet-core             0.0.7
tanzu-buildpacks/dotnet-core             0.0.6
tanzu-buildpacks/go                      1.0.6
tanzu-buildpacks/go                      1.0.7
tanzu-buildpacks/go                      1.0.9
tanzu-buildpacks/go                      1.0.5
tanzu-buildpacks/httpd                   0.0.38
tanzu-buildpacks/httpd                   0.0.39
tanzu-buildpacks/httpd                   0.0.40
tanzu-buildpacks/java                    3.8.0      https://github.com/pivotal-cf/tanzu-j
ava
tanzu-buildpacks/java                    3.5.0      https://github.com/pivotal-cf/tanzu-j
ava
tanzu-buildpacks/java                    4.1.0      https://github.com/pivotal-cf/tanzu-j
ava
tanzu-buildpacks/java                    4.0.0      https://github.com/pivotal-cf/tanzu-j
ava
tanzu-buildpacks/java-native-image       3.6.0      https://github.com/pivotal-cf/tanzu-j
ava-native-image
tanzu-buildpacks/java-native-image       3.9.0      https://github.com/pivotal-cf/tanzu-j
ava-native-image
tanzu-buildpacks/java-native-image       3.4.2      https://github.com/pivotal-cf/tanzu-j
ava-native-image
tanzu-buildpacks/java-native-image       3.10.0     https://github.com/pivotal-cf/tanzu-j
ava-native-image
tanzu-buildpacks/nginx                   0.0.48
tanzu-buildpacks/nginx                   0.0.46
tanzu-buildpacks/nodejs                  1.1.0
tanzu-buildpacks/nodejs                  1.2.3
tanzu-buildpacks/nodejs                  1.2.2
tanzu-buildpacks/php                     0.0.3
tanzu-buildpacks/php                     0.0.5
```

To view buildpackages & their individual buildpacks as well as display the order of meta-buildpacks use the `--verbose` flag

```
kp clusterstore status <store-name> --verbose
```

Migrating Buildpacks

Build Service will never automatically remove buildpackages from the store unless you explicitly remove them. In this way, users can continue to use older buildpacks until the operator is ready to

migrate them.

How you migrate is entirely dependent on the configuration of your Builder resources: * Builders that do not provide a buildpack version will automatically update to the latest buildpack version if it is available. * Builders that explicitly specify a buildpack version will not update automatically.

With the above in mind, migrating buildpackages in the store is as simple as `kp clusterstore add`ing newer buildpackages and `kp clusterstore remove`ing older buildpackages as necessary.

If you'd like fine-grained control over buildpack updates, you can create multiple stores to manage buildpack versions. Then, you can point individual builders at the desired store. Each store can be updated as needed without affecting other builders or fanning out large, sweeping changes.

Corresponding kpack Resource

All Build Service builders utilize cluster scoped Store Resources.

Descriptors

This topic describes the descriptors that are available so you can choose which option to configure depending on your use case.

About descriptors

Tanzu Build Service descriptors are curated sets of dependencies, including stacks and buildpacks, that are continuously released on VMware Tanzu Network to resolve all workload Critical and High CVEs. Descriptors are imported into Tanzu Build Service to update the entire cluster.

There are two types of descriptor, `lite` and `full`, available on the Tanzu Network Build Service Dependencies page. The different descriptors can apply to different use cases and workload types. For the differences between the descriptors, see Descriptor comparison.

You configure which descriptor is imported when installing Tanzu Build Service.

Lite descriptor

The Tanzu Build Service `lite` descriptor is the default descriptor selected if none is configured.

It contains a smaller footprint to speed up installation time. However, it does not support all workload types. For example, the `lite` descriptor does not contain the PHP buildpack.

The `lite` descriptor only contains the `base` stack. The `default` stack is installed, but is identical to the `base` stack. For more information, see Stacks.

Full descriptor

The Tanzu Build Service `full` descriptor contains more dependencies, which allows for more workload types.

The dependencies are pre-packaged so builds don't have to download them from the Internet. This can speed up build times and allows builds to occur in airgapped environments.

The `full` descriptor contains the following stacks, which support different use cases:

- `base`
- `default` (identical to `base`)
- `full`
- `tiny`

For more information, see Stacks. Due to the larger footprint of `full`, installations might take longer.

Descriptor comparison

Both `lite` and `full` descriptors are suitable for production environments.

	lite	full
Faster installation time	Yes	No
Dependencies pre-packaged	No	Yes
Contains base stack	Yes	Yes
Contains full stack	No	Yes
Contains tiny stack	No	Yes
Supports Java workloads	Yes	Yes
Supports Node.js workloads	Yes	Yes
Supports Go workloads	Yes	Yes
Supports Python workloads	Yes	Yes
Supports .NET Core workloads	Yes	Yes
Supports PHP workloads	No	Yes
Supports static workloads	Yes	Yes
Supports binary workloads	Yes	Yes

Managing Builders

A Builder is a Tanzu Build Service resource used to manage Cloud Native Buildpack builders.

Builders contain a set of buildpacks and a stack that will be used to create images.

There are two types of Builders:

- Cluster Builders: Cluster-scoped Builders
- Builders: Namespace-scoped Builders

Note: Only Build Service Admins can manage Cluster Builders.

The `kp` CLI can be used to manage builders and clusterbuilders. The help text is published here.

```
$ kp builder
Builder Commands

Usage:
  kp builder [command]

Aliases:
  builder, builders, bldrs, bldr

Available Commands:
  create      Create a builder
  delete      Delete a builder
  list        List available builders
  patch       Patch an existing builder configuration
  save        Create or patch a builder
  status      Display status of a builder

Flags:
  -h, --help   help for builder

Use "kp builder [command] --help" for more information about a command.
```

```
$ kp clusterbuilder
ClusterBuilder Commands

Usage:
  kp clusterbuilder [command]

Aliases:
  clusterbuilder, clusterbuilders, clstrbldrs, clstrbldr, cbldrs, cbldr, cbs, cb

Available Commands:
  create      Create a cluster builder
```

```
  delete      Delete a cluster builder
  list        List available cluster builders
  patch       Patch an existing cluster builder configuration
  save        Create or patch a cluster builder
  status      Display cluster builder status

Flags:
  -h, --help   help for clusterbuilder
```

Note: These docs assume kp cli v0.4.* from TBS release v1.4.*. If a feature is not working, you may need to upgrade your cli.

Creating a Builder

Use the `kp` cli to create a Builder:

- Cluster Builder:

```
kp clusterbuilder create <name> --tag <tag> --order <order> --stack <stack> --s
tore <store>
```

```
kp clusterbuilder create <name> --tag <tag> --stack <stack> --store <store> --b
uildpack <buildpack>
```

- Builder:

```
kp builder create <name> --tag <tag> --order <order> --stack <stack> --store <s
tore> --namespace <namespace>
```

```
kp builder create <name> --tag <tag> --stack <stack> --store <store> --namespac
e <namespace> --buildpack <buildpack>
```

Where:

- `name`: The name of the builder.
- `tag`: The registry location where the builder will be created.
- `stack`: The name of the stack to be used by the builder.
- `store`: The name of the store containing the buildpacks that will be used by the builder.
- `namespace` The kubernetes namespace for the builder (for Builders only)
- `order`: The local path to the buildpack order YAML that the builder will use. Sample order YAML files will be available on the VMware Tanzu Build Service Dependencies page on Tanzu Network. For more information about listing buildpacks in groups in the order YAML, see builder.toml in the Buildpacks.io documentation.

  Example order YAML file that would be used by a builder designed to build NodeJS and Java apps:

```
- group:
  - id: tanzu-buildpacks/nodejs
```

```
- group:
  - id: tanzu-buildpacks/java
```

- `buildpack`: Buildpack id and optional version in the form of either '@' or ''. Repeat for each buildpack in order, or supply once with comma-separated list. This cannot be combined with `--order`. All supplied buildpacks will be in the same group.

Patching a Builder

You can update a Builder resource using the `kp` cli. To update a builder given a `name`, run:

- Cluster Builder:

```
kp clusterbuilder patch <name> --order <order> --stack <stack> --store <store>
```

```
kp clusterbuilder patch <name> --stack <stack> --store <store> --buildpack <bui
ldpack>
```

- Builder:

```
kp builder patch <name> --order <order> --stack <stack> --store <store> --names
pace <namespace>
```

```
kp builder patch <name> --stack <stack> --store <store> --namespace <namespace>
 --buildpack <buildpack>
```

`kp ccb patch` and `kp cb patch` are respective aliases.

Where:

- `name`: The name of the builder.
- `stack`: The name of the stack to be used by the builder.
- `store`: The name of the store containing the buildpacks that will be used by the builder.
- `namespace` The kubernetes namespace for the builder (for Builders only)
- `order`: The local path to the buildpack order YAML that the builder will use. Sample order YAML files will be available on the VMware Tanzu Build Service Dependencies page on Tanzu Network. For more information about listing buildpacks in groups in the order YAML, see builder.toml in the Buildpacks.io documentation.

  Example order YAML file that would be used by a builder designed to build NodeJS and Java apps:

```
---
- group:
  - id: paketo-buildpacks/bellsoft-liberica
  - id: paketo-buildpacks/gradle
- group:
  - id: paketo-buildpacks/nodejs
```

- `buildpack`: Buildpack id and optional version in the form of either '@' or ''. Repeat for each buildpack in order, or supply once with comma-separated list. This cannot be combined with

`--order`. All supplied buildpacks will be in the same group.

Note: The `tag` (location in a registry) of a builder cannot be modified. To change this field, you must create a new builder.

Saving Builders

Users can create or update a Builder/ClusterBuilder using the `save` command. The `kp builder/clusterbuilder save` command is used exactly the same as `kp builder/clusterbuilder create` and `kp builder/clusterbuilder update`, but it will determine if a builder/clusterbuilder needs to be created or updated.

To save a Builder/ClusterBuilder:

- Cluster Builder:

```
kp clusterbuilder save <name> --tag <tag> --order <order> --stack <stack> --sto
re <store>
```

```
kp clusterbuilder save <name> --tag <tag> --stack <stack> --store <store> --bui
ldpack <buildpack>
```

- Builder:

```
kp builder save <name> --tag <tag> --order <order> --stack <stack> --store <sto
re> --namespace <namespace>
```

```
kp builder save <name> --tag <tag> --stack <stack> --store <store> --namespace
<namespace> --buildpack <buildpack>
```

Where:

- `name`: The name of the builder.
- `tag`: The registry location where the builder will be created.
- `stack`: The name of the stack to be used by the builder.
- `store`: The name of the store containing the buildpacks that will be used by the builder.
- `namespace` The kubernetes namespace for the builder (for Builders only)
- `order`: The local path to the buildpack order YAML that the builder will use. Sample order YAML files will be available on the VMware Tanzu Build Service Dependencies page on Tanzu Network. For more information about listing buildpacks in groups in the order YAML, see builder.toml in the Buildpacks.io documentation.

  Example order YAML file that would be used by a builder designed to build NodeJS and Java apps:

```
---
- group:
  - id: paketo-buildpacks/bellsoft-liberica
```

```
  - id: paketo-buildpacks/gradle
- group:
  - id: paketo-buildpacks/nodejs
```

- `buildpack`: Buildpack id and optional version in the form of either '@' or ''. Repeat for each buildpack in order, or supply once with comma-separated list. This cannot be combined with `--order`. All supplied buildpacks will be in the same group.

Deleting Builders

To delete a Builder:

- Cluster Builder:

```
kp clusterbuilder delete <builder name>
```

- Builder:

```
kp builder delete <builder name> --namespace <namespace>
```

Warning: Deleting a builder will prevent image configs that reference that builder from successfully building again.

Retrieving Builder Details

To get builder details:

- Cluster Builder:

```
kp clusterbuilder status <builder-name>
```

- Builder:

```
kp builder status <builder-name> --namespace <namespace>
```

Example:

```
$ kp clusterbuilder status tiny

Status:       Ready
Image:        gcr.io/my-repo/tiny@sha256:07d94db2e3e9f43cba67c389f1c83e4eac821aa83084a
88136ed8d431b37f008
Stack:        io.paketo.stacks.tiny
Run Image:    gcr.io/cf-build-service-dev-219913/ssuresh/install/run@sha256:e9159f0ef2
3c28b943cfb1b5d5be9638b67211f6ff0bd3fae35ff4b499136152

BUILDPACK ID                                VERSION    HOMEPAGE
paketo-buildpacks/graalvm                   4.0.0      https://github.com/paketo-bui
ldpacks/graalvm
tanzu-buildpacks/go-dist                    0.1.3
paketo-buildpacks/gradle                    3.5.0      https://github.com/paketo-bui
ldpacks/gradle
paketo-buildpacks/sbt                       3.6.0      https://github.com/paketo-bui
```

```
ldpacks/sbt
paketo-buildpacks/maven                         3.2.1      https://github.com/paketo-bui
ldpacks/maven
tanzu-buildpacks/dep                            0.0.10
paketo-buildpacks/spring-boot                   3.5.0      https://github.com/paketo-bui
ldpacks/spring-boot
paketo-buildpacks/leiningen                     1.2.1      https://github.com/paketo-bui
ldpacks/leiningen
paketo-buildpacks/spring-boot-native-image      2.0.0      https://github.com/paketo-bui
ldpacks/spring-boot-native-image
paketo-buildpacks/executable-jar                3.1.3      https://github.com/paketo-bui
ldpacks/executable-jar
tanzu-buildpacks/go-build                       0.0.23
paketo-buildpacks/environment-variables         2.1.2      https://github.com/paketo-bui
ldpacks/environment-variables
paketo-buildpacks/procfile                      3.0.0      https://github.com/paketo-bui
ldpacks/procfile
paketo-buildpacks/image-labels                  2.0.6      https://github.com/paketo-bui
ldpacks/image-labels
tanzu-buildpacks/dep-ensure                     0.0.29
tanzu-buildpacks/go-mod-vendor                  0.0.26
tanzu-buildpacks/java-native-image              3.10.0     https://github.com/pivotal-cf
/tanzu-java-native-image
tanzu-buildpacks/go                             1.0.9


DETECTION ORDER
Group #1
  tanzu-buildpacks/go@1.0.9
Group #2
  tanzu-buildpacks/java-native-image@3.10.0
Group #3
  paketo-buildpacks/procfile@3.0.0
```

Listing Builders

To list all builders available to the current user:

- Cluster Builder:

  ```
  kp clusterbuilder list
  ```

- Builder:

  ```
  kp builder list --namespace <namespace>
  ```

Corresponding kpack Resources

All Build Service Builders are represented as kpack resources.

- Builder
- ClusterBuilder

Pinning Buildpack versions

You can pin buildpack versions by specifying the version for buildpacks in the order file.

As an **example**, consider the clusterbuilder created below:

```
kp cb create pinned \
  --tag my-registry.io/example/pinned \
  --order order.yaml
```

where the contents of order.yaml file is

```
- group:
  - id: tanzu-buildpacks/php
    version: 0.0.5
- group:
  - id: tanzu-buildpacks/nodejs
    version: 1.3.0
```

Note: When a buildpack version is pinned, Images that use the Builder will not initiate new Builds due to new Buildpack versions. For best practice, only pin a buildpack version when necessary.

Update Lifecycle

All builders make use of a lifecycle. A lifecycle orchestrates buildpack execution, then assembles the resulting artifacts into a final app image. Within Build Service, it will be uploaded to the canonical registry, which is the docker-repository specified during TBS install. More information on lifecycles can be found here.

To update the lifecycle that will be used by builders:

```
```
kp lifecycle update --image <image-tag>
```
```

Note: You must have credentials to access the registry on your machine.

Managing Custom Stacks

A CustomStack is a resource that allows users to create a customized ClusterStack from Ubuntu 18.04 (Bionic Beaver) and UBI7/UBI8 non-minimal based OCI images.

Note: Customstacks created with UBI7/UBI8 images do not currently support adding packages, mixins, or caCerts. Currently, only the Java Tanzu Buildpacks support CustomStacks that use UBI images

CustomStacks can be used to:

- Convert a pre-existing base image that you'd like to use with TBS into a ClusterStack resource.
- Add required stack metadata to base images.
- Add CA certificates to build and/or run image.
- Add packages and mixin labels to build and/or run image.
- Set CNB user and group IDs.

Creating a CustomStack

A CustomStack is created by running `kubectl apply` with a resource configuration file. The following defines the relevant fields of the CustomStack resource spec in more detail:

- `source`: The location of base images used for building the stack. See more info in Source Configuration.
- `destination`: The location to publish built images and optional ClusterStack. See more info in Destination Configuration.
- `caCerts`: References to config maps of CA certificates to add to one or both of the stack images.
- `packages`: List of packages to install on one or both of the stack images. A list of all available packages can be found here.
- `mixins`: List of mixin labels to add to one or both of the stack images. Information on the mixins concept can be found here.
- `service-account-name`: Name of service account with secret containing credentials to push to registry.
- `user`: User and group ID of the CNB user
    - Not required if the user is already present in metadata.

- If the user and/or group ID do not exist on the image, they will be created.

Source Configuration

The `source` field describes the base images for the CustomStack. It can be configured in exactly one of the following ways:

- Registry Images

```
source:
  registryImages:
    build:
      image: <build-base-image>
    run:
      image: <run-base-image>
```

  - `build-base-image`: The fully qualified reference of the build base image.
  - `run-base-image`: The fully qualified reference of the run base image.

- Stack

```
stack:
  name: <cluster-stack-name>
  kind: ClusterStack
```

  - `cluster-stack-name`: Name of ClusterStack to base CustomStack images on.

Destination Configuration

The `destination` field describes where the built images will be published and if a ClusterStack should be created.

```
destination:
  build:
    tag: <output-build-image-tag>
  run:
    tag: <output-run-image-tag>
  stack: # Optional
    name: <output-cluster-stack-name>
    kind: ClusterStack
```

- `output-build-image-tag`: The registry location where the build image will be created.
- `output-run-image-tag`: The registry location where the run image will be created.
- `output-cluster-stack-name`: Name of ClusterStack to create with CustomStack images

Example CustomStack from Registry Images

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: build-ca-certs
data:
  cert-1: |
```

```
    -----BEGIN CERTIFICATE-----
    ...
    -----END CERTIFICATE-----
  cert-2: |
    -----BEGIN CERTIFICATE-----
    ...
    -----END CERTIFICATE-----
---
apiVersion: v1
kind: ConfigMap
metadata:
  name: run-ca-certs
data:
  cert-3: |
    -----BEGIN CERTIFICATE-----
    ...
    -----END CERTIFICATE-----
---
apiVersion: stacks.stacks-operator.tanzu.vmware.com/v1alpha1
kind: CustomStack
metadata:
  name: stack-sample
spec:
  source:
    registryImages:
      build:
        image: paketobuildpacks/build@sha256:ae88191cc5bfd0dcd2938954f20d5df5060a562af
8e3d65a92a815612054537c
      run:
        image: paketobuildpacks/run@sha256:48f67dcb3f2b27403de80193e34abd3172b3fbdfdd8
7e452721aba90ea68fc66
  destination:
    build:
      tag: my.registry.io/final-build-image
    run:
      tag: my.registry.io/final-run-image
    stack: # Optional
      name: stack-sample-cluster-stack
      kind: ClusterStack
  caCerts: # Optional
    buildRef: # Optional
      name: build-ca-certs
    runRef: # Optional
      name: run-ca-certs
  packages: # Optional
    - name: cowsay
    - name: cowsay-off
    - name: fortune
      phase: build
    - name: rolldice
      phase: run
  mixins: # Optional
    - name: set=build-utils
      phase: build
    - name: set=run-utils
      phase: run
    - name: set=shared-utils
  serviceAccountName: default
  user: # Optional
```

```
    userID: 1000
    groupID: 1000
```

Example CustomStack from ClusterStack

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: build-ca-certs
data:
  cert-1: |
    -----BEGIN CERTIFICATE-----
    ...
    -----END CERTIFICATE-----
  cert-2: |
    -----BEGIN CERTIFICATE-----
    ...
    -----END CERTIFICATE-----
---
apiVersion: v1
kind: ConfigMap
metadata:
  name: run-ca-certs
data:
  cert-3: |
    -----BEGIN CERTIFICATE-----
    ...
    -----END CERTIFICATE-----
---
apiVersion: stacks.stacks-operator.tanzu.vmware.com/v1alpha1
kind: CustomStack
metadata:
  name: stack-sample
spec:
  source:
    stack:
      name: stack-sample-cluster-stack
      kind: ClusterStack
  destination:
    build:
      tag: my.registry.io/final-build-image
    run:
      tag: my.registry.io/final-run-image
    stack: # Optional
      name: final-stack-sample-cluster-stack
      kind: ClusterStack
  caCerts: # Optional
    buildRef: # Optional
      name: build-ca-certs
    runRef: # Optional
      name: run-ca-certs
  packages: # Optional
    - name: cowsay
    - name: cowsay-off
    - name: fortune
      phase: build # Optional
    - name: rolldice
      phase: run # Optional
```

```
  mixins: # Optional
    - name: set=build-utils
      phase: build # Optional
    - name: set=run-utils
      phase: run # Optional
    - name: set=shared-utils
  serviceAccountName: default
  user: # Optional
    userID: 1000 # Optional
    groupID: 1000 # Optional
```

Debugging CustomStacks

When a CustomStack is created, a pod is created in the same namespace which will modify the base image and push the resulting stack image to the registry. The pod will be named `stack-pod-<customstack-name>-<number>`, where:

- `customstack-name`: The name of your CustomStack
- `number`: The revision of your CustomStack. This will be incremented by one each time a new spec is applied.

The ten latest pods are kept around for debugging purposes. To debug a failing CustomStack, check the logs of the corresponding pod: `kubectl logs <pod-name> -c <create-build-image/create-run-image>`, where:

- `pod-name`: The name of the pod
- `create-build-image/create-run-image`: The container whose logs you would like to see.
    - `create-build-image` for logs related to creating the build image.
    - `create-run-image` for logs related to create the run image.

RBAC in Tanzu Build Service

Given that Tanzu Build Service supports functionality most customers would likely want to restrict to only certain users, we encourage utilization of RBAC as a best practice if Tanzu Build Service is to be broadly deployed for usage by many users.

RBAC using Projects Operator

Projects Operator can be installed on the cluster to simplify RBAC management.

Projects Operator extends kubernetes with a `Project` CRD and corresponding controller. Projects are intended to provide isolation of kubernetes resources on a single kubernetes cluster. A `Project` is essentially a kubernetes namespace along with a corresponding set of RBAC rules.

As part of the Projects Operator installation, you can specify the ClusterRole to apply for each `Project` using the `CLUSTER_ROLE_REF` environment variable. The TBS installation comes with a ClusterRole called build-service-user-role which can be used for this purpose.

RBAC Support in Tanzu Build Service

Tanzu Build Service is installed with 2 Kubernetes ClusterRoles that can be used for RBAC for Build Service users and admins:

- `build-service-user-role`
- `build-service-admin-role`

Build Service User Role

This should be used for users that will create Images and Builds.

To view the configuration for this role:

```
kubectl get clusterrole build-service-user-role -o yaml
```

To use this ClusterRole you should create a RoleBinding with an existing user.

Example:

```
---
apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: my-build-service-user-role-binding
  namespace: my-build-namespace
roleRef:
  apiGroup: rbac.authorization.k8s.io
```

```
  kind: ClusterRole
  name: build-service-user-role
subjects:
- kind: User
  name: my-user
```

Build Service Admin Role

This should be used for admin users that will operate Tanzu Build Service.

To view the configuration for this role:

```
kubectl get clusterrole build-service-admin-role -o yaml
```

To use this ClusterRole you should create a RoleBinding or ClusterRoleBinding with an existing user.

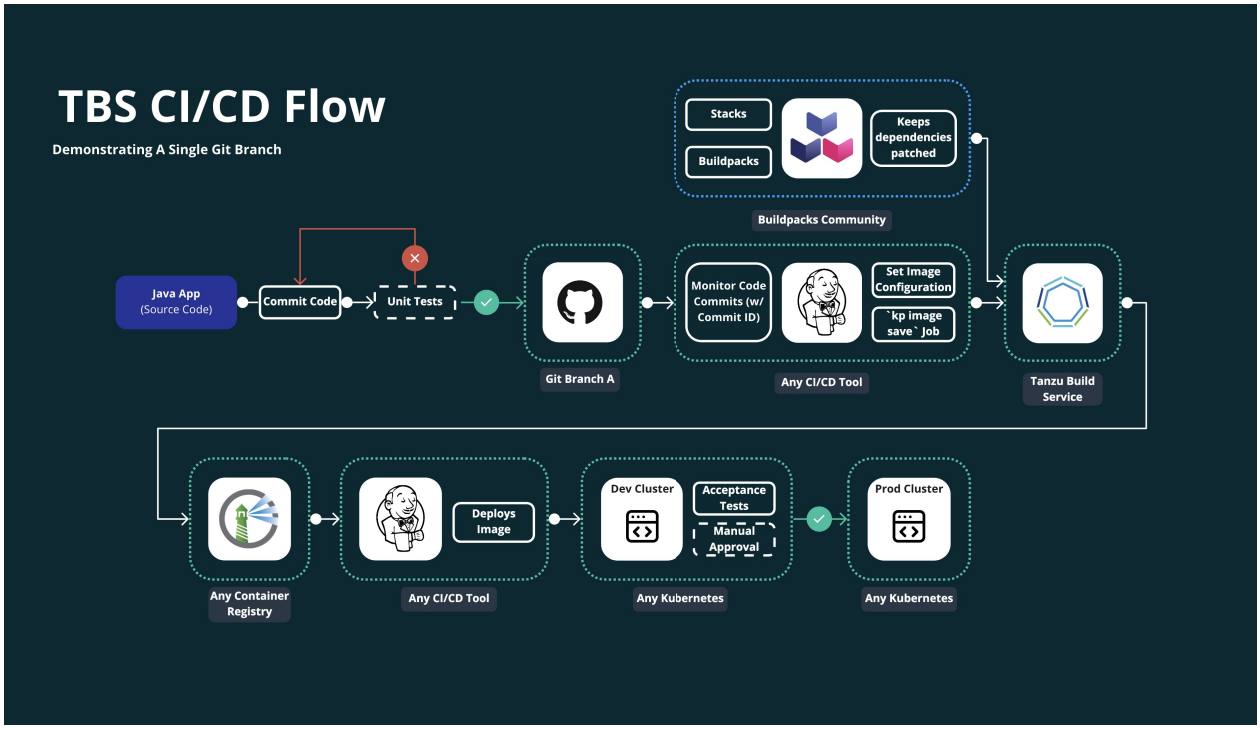
Example:

```
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: my-build-service-admin-role-binding
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: build-service-admin-role
subjects:
- kind: User
  name: my-cluster-wide-admin-user
```

Using Tanzu Build Service in CI

This topic describes how to best leverage Tanzu Build Service in a Continuous Integration context to build applications and keep them up-to-date at scale.

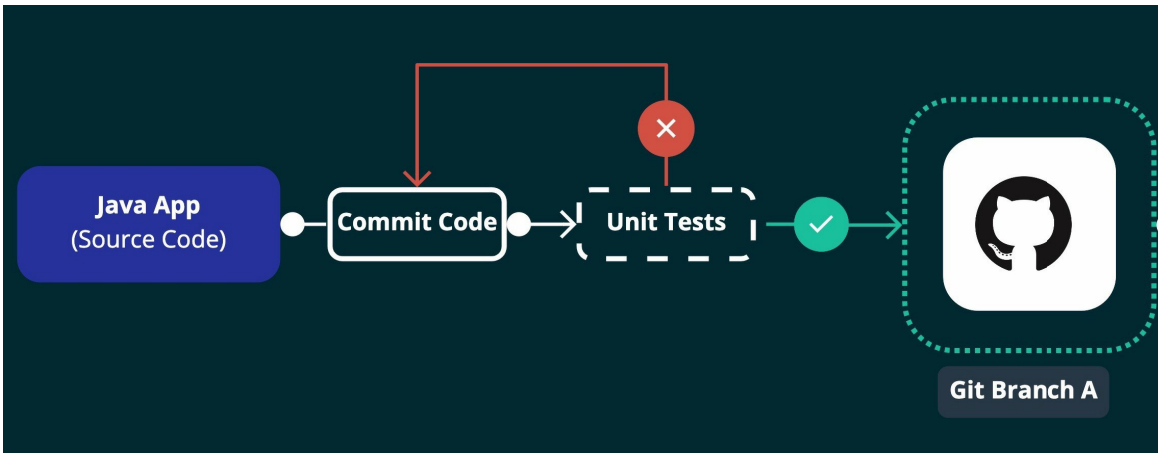
Example: Using Tanzu Build Service in CI/CD



This example shows using an Image resource with git source in a development-to-production CI/CD pipeline flow.

Let's split this up into each step.

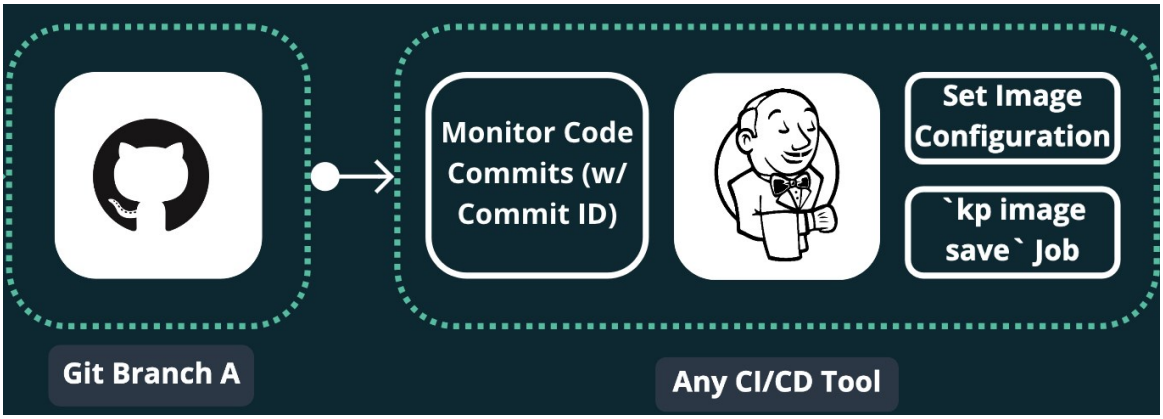
1. Run unit tests & merge to branch



This step shows a typical initial unit testing CI flow.

1. Developer pushes code to feature branch
2. CI/CD runs unit tests on that branch
3. Once tests have passed, the feature branch is merged to release branch (Git Branch A)

2. Update Tanzu Build Service Image Configuration in CI/CD



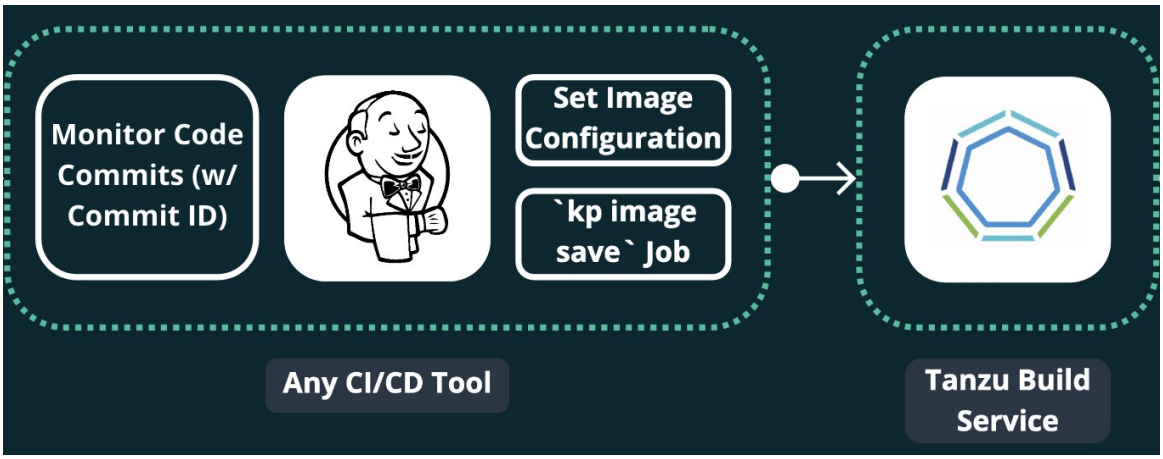
After unit tests pass, CI/CD must tell TBS to build the registry image using the git commit that passed tests.

For example:

Jenkins job that runs the following after unit tests with the successful `<git-commit>`:

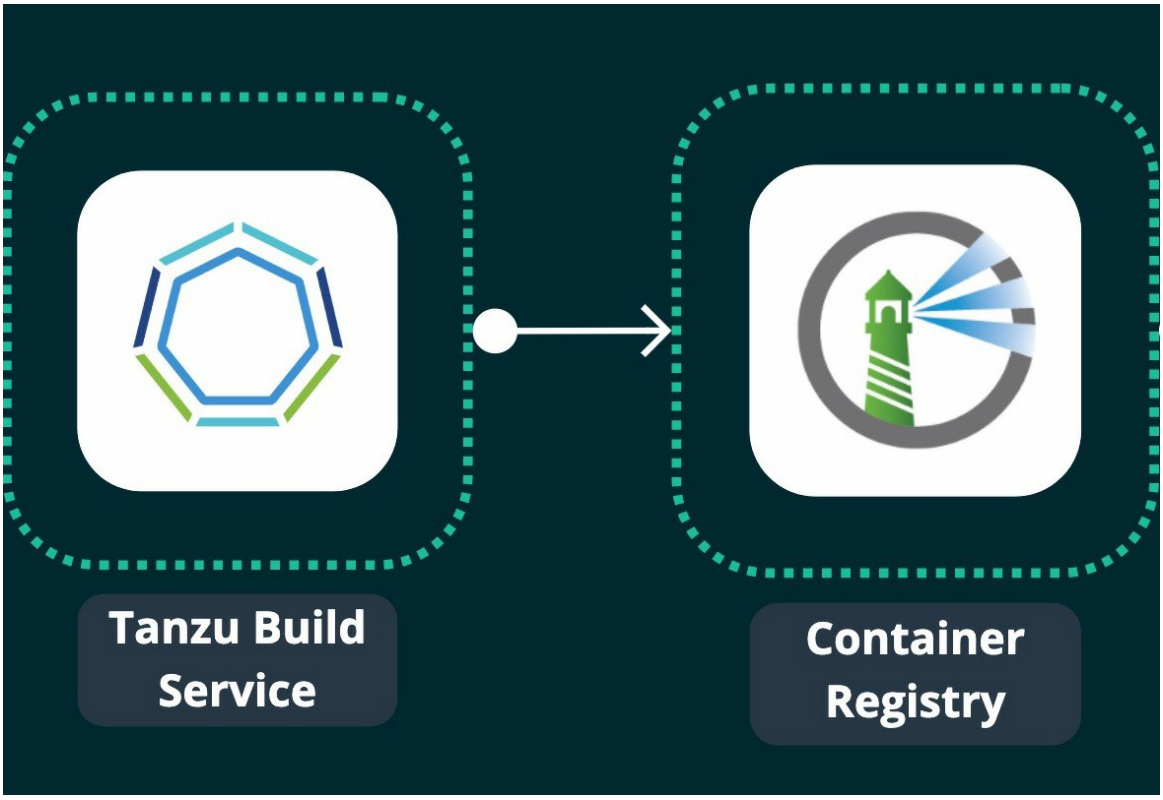
```
kp image save my-image --git-revision <git-commit>
```

3. Tanzu Build Service builds the OCI registry image using the git commit



Here TBS works its magic and builds a new registry image using the git commit set in the previous step and the latest app dependencies (Stacks & Buildpacks).

4. Tanzu Build Service pushes the built image to your registry



After the build finishes, TBS writes the resulting image to a container registry such as Harbor.

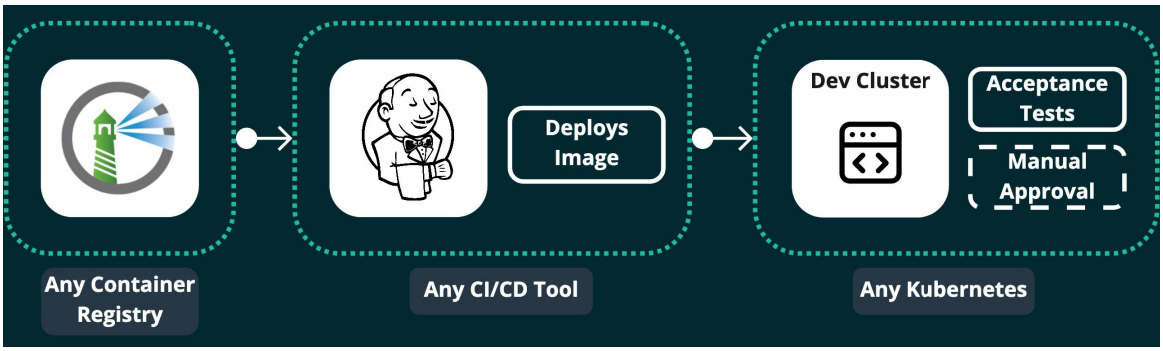
This image reference can be found with:

```
kp image status <image-name>
```

or

```
kp build status <image-name> -b <build-number>
```

5. Using CI/CD, deploy the built image to a Dev/QA Kubernetes cluster

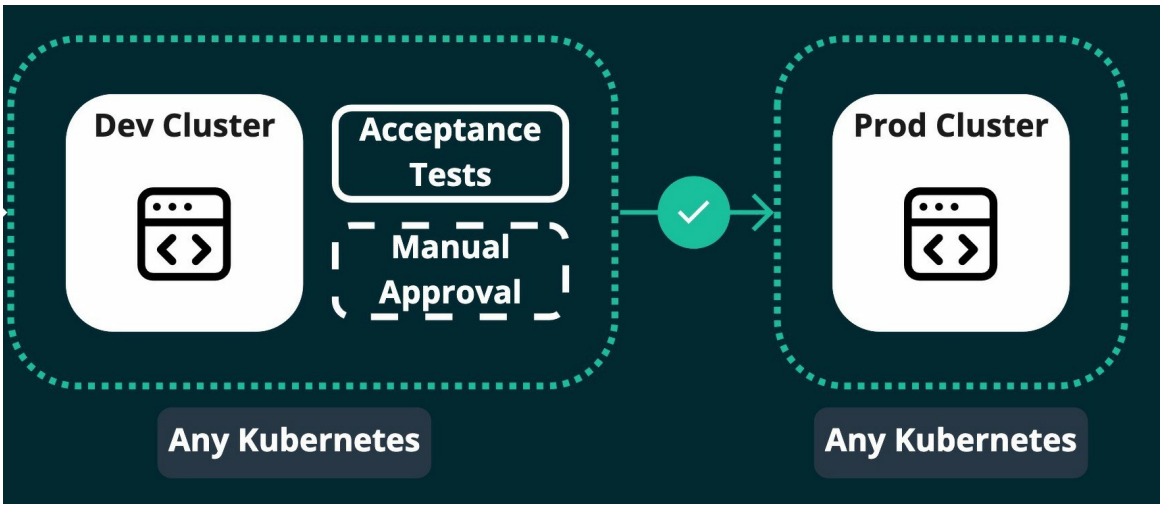


Now that the image is available in your registry, it can be deployed to any kubernetes cluster. In this example, it is deployed to a Dev Cluster for acceptance testing and QA/manual approval.

There are a couple of ways to trigger this job:

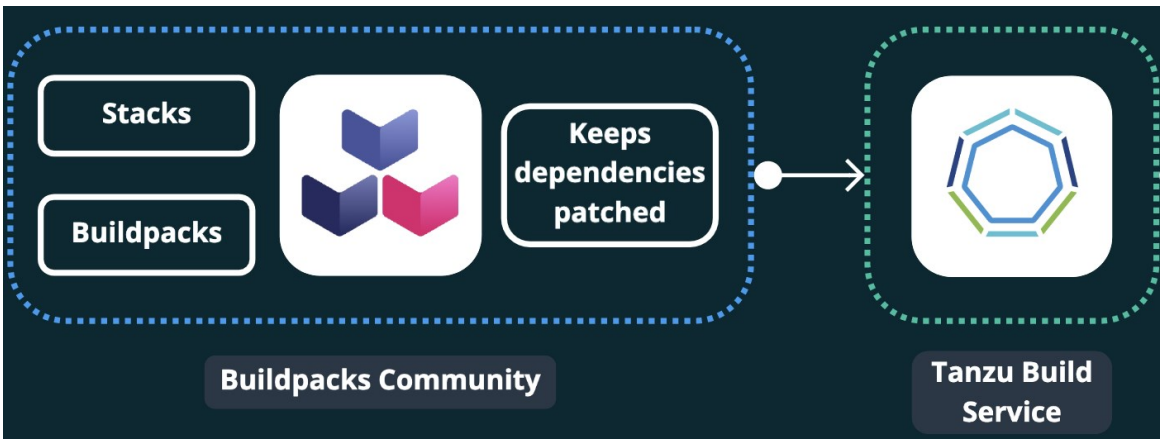
- Using registry webhooks (such as Harbor's) to trigger a CI/CD job
- If you are using Concourse CI: the Concourse kpack Resource
- Write your own polling mechanism to check for new images in your registry

6. Once the app has been vetted, deploy to production!



The same way the image was deployed to the Dev Cluster, the image can be pushed to production.

7. Bonus: Dependencies are kept up to date for secure app images



Images are kept up to date with the latest dependencies provided via Stacks and Buildpacks from the Cloud Native Buildpacks community which are released for TBS as Tanzu Buildpacks on Tanzu Network.

As of TBS 1.2, these dependencies are automatically updated. These dependency updates can also be done with the kp cli in CI/CD by running:

```
kp import -f descriptor.yaml
```

When dependencies are updated, affected apps are rebuilt to be promoted using steps 5 & 6.

Frequently Asked Questions

How do Cloud Native Buildpacks (CNBs), kpack, and Tanzu Build Service overlap and differ?

CNBs are build tools that adhere to the CNB v3 Specification and transform source code into an OCI compliant runnable image. The v3 specification, lifecycle, and local CLI (`pack`) are governed by the open source Cloud Native Buildpacks project.

kpack is a collection of open source resource controllers that together function as a Kubernetes native build service. The product provides a declarative image type that builds an image and schedules image rebuilds when dependencies of the image change. kpack is a platform implementation of CNBs in that it utilizes CNBs and the v3 lifecycle to execute image builds.

Tanzu Build Service is a commercial product owned and operated by VMware that utilizes kpack and CNBs. Build Service provides additional abstractions intended to ease the use of the above technologies in Enterprise settings. These abstractions are covered in detail throughout the documentation on this site. Additionally, customers of Build Service are entitled to support and VMware Tanzu buildpacks.

Why do I see two images in the image registry after a successful build?

By default Build Service will tag each built image twice. The first tag will be the configured image tag. The second tag will be a unique tag with the build number and build timestamp. The second tag is added to ensure that previous images are not deleted on registries that garbage collect untagged images.

How does TBS work in air gapped environments?

Build Service is installed and deployed using Carvel tools. Therefore, the `imgpkg copy` command can create a `.tar` file composed of the kubernetes config and images required to successfully install Build Service. The `imgpkg copy` command also ensures that all the images can be relocated to air-gapped registries, and by providing the credentials to the air-gapped registry when executing the `kapp install` command, Build Service can then use that secret to pull images from said registry, hence working in air-gapped environments.

Currently, `kbld package` and `kbld unpackage` must be used to import dependencies to an air-gapped environment.

For more details on air-gapped installation, see Installation to Air-Gapped Environment.

For more details on air-gapped builds, see Offline Builds.

Is there documentation on supported Tanzu Buildpacks?

Yes, documentation is available on Tanzu Buildpacks Documenation.

Why do I get an X509 error from Build Service when trying to create an image in my registry?

When interacting with a registry or a git repo that has been deployed using a self signed certificate, Build Service must be provided with the certificate during install time. Unfortunately, you will either need to target a registry that does not have self signed certificates or re-install Build Service to work with this registry.

How do I configure a secret to publish images to Dockerhub?

1. Create a dockerhub secret with the `kp` cli:

   ```
   kp secret create my-dockerhub-creds --dockerhub DOCKERHUB-USERNAME
   ```

   Where `DOCKERHUB-USERNAME` is your dockerhub username You will be prompted for your dockerhub password

How can I configure an image resource to pull from a private GitHub repository?

1. Create a github secret with the `kp` cli:

   Using a git ssh key

   ```
   kp secret create my-git-ssh-cred --git git@github.com --git-ssh-key PATH-TO-GIT
   HUB-PRIVATE-KEY
   ```

   Where `PATH-TO-GITHUB-PRIVATE-KEY` is the absolute local path to the github ssh private key

   Or with a basic auth github username and password

   ```
    kp secret create my-git-cred --git https://github.com --git-user GITHUB-USERNA
   ME
   ```

   Where `GITHUB-USERNAME` is your github username You will be prompted for your github password

Why do some builds fail with "Error: could not read run image: *"?

The run image must be publicly readable or readable with the registry credentials configured in a project/namespace.

To see where the build service run image is located run: `kp stack status STACK-NAME`.

If you cannot make the run image publicly readable, you must `kp` to create a registry secret within the namespace where your builds reside. This can be accomplished using `kp secret create`.

Why don't my image builds appear in my Harbor v1.X.X registry?

There is a known bug in Harbor that, at times, prevents the UI from showing images. If you are unable to see a recently built image in the Harbor UI, try pulling it using the `docker` CLI to verify that it exists.

How do I fix "unsupported status code 500" when creating a builder on my Harbor v2.X.X registry?

Some builders are very large and can overwhelm Harbor's default database connection. You can remediate this issue by increasing the `database.maxOpenConns` setting in the helm `values.yaml` file. Increase this value from 100 to 300. The exact setting can be found here.

How do I configure credentials for using gcr as my installation registry?

You can use Google Container Registry for your Tanzu Build Service installation registry.

If you have trouble configuring the registry credentials for gcr when following the install docs, use the following to set the gcr credentials:

```
registry_name="_json_key"
registry_password="$(cat /path/to/gcp/service/account/key.json)"
ytt -f /tmp/bundle/config/ \
 -v docker_repository='<IMAGE-REPOSITORY>' \
 -v docker_username="$registry_name" \
 -v docker_password="$registry_password" \
 | kbld -f /tmp/bundle/.imgpkg/images.yml -f- \
 | kapp deploy -a tanzu-build-service -f- -y
```

Can I configure a proxy for my Tanzu Build Service?

TBS can be configured with a proxy at installation time by specifying additional parameters:

- `http_proxy`: The HTTP proxy to use for network traffic.
- `https_proxy`: The HTTPS proxy to use for network traffic.
- `no_proxy`: A comma-separated list of hostnames, IP addresses, or IP ranges in CIDR format that should not use a proxy.

Note: When proxy server is enabled using `http_proxy` and/or `https_proxy`, traffic to

the kubernetes API server will also flow through the proxy server. This is a known limitation and can be circumvented by using `no_proxy` to specify the kubernetes API server.

```
ytt -f /tmp/bundle/config/ \
 -v docker_repository='<IMAGE-REPOSITORY>' \
 -v docker_username='<REGISTRY-USERNAME>' \
 -v docker_password='<REGISTRY-PASSWORD>' \
 -v http_proxy='<HTTP-PROXY-URL>' \
 -v https_proxy='<HTTPS-PROXY-URL>' \
 -v no_proxy='<KUBERNETES-API-SERVER-URL>' \
 | kbld -f /tmp/bundle/.imgpkg/images.yml -f- \
 | kapp deploy -a tanzu-build-service -f- -y
```

How do I build my app locally using kpack builders?

You can use the pack cli with your kpack builders to test them locally before checking in your code. By using your kpack builder locally, you can guarantee that the buildpacks, stacks, and lifecycle used to build the image config will also be used by the pack CLI, resulting in a container image that is the exact same, whether it is built by `kpack` or `pack`.

Note: Make sure that you `docker login` to the image repository containing your kpack builder.

```
pack build my-app --path ~/workspace/my-app --builder gcr.io/my-project/my-image:latest --trust-builder
```

What can I do with the kp --dry-run and --output flags?

From kp CLI v1.0.3+ the `--dry-run` and `--output` flags are made available to kp commands that create or update any kpack Kubernetes resources.

The `--dry-run` flag lets you perform a quick validation with no side-effects as no objects are sent to the server. And the `--output` flag lets you view the resource in yaml or json format.

The `--dry-run-with-image-upload` flag is similar to the `--dry-run` flag in that no kpack Kubernetes resources are updated. This flag is provided as a convenience for kp commands that can output Kubernetes resource with generated container image references.

For example, consider the command below

```
$ kp clusterstack create test-stack \
 --dry-run \
 --output yaml \
 --build-image gcr.io/paketo-buildpacks/build@sha256:f550ab24b72586cb26215817b874b9e9ec2ca615ede03206833286934779ab5d \
 --run-image gcr.io/paketo-buildpacks/run@sha256:21c1fb65033ae5a765a1fb44bfefdea37024ceac86ac6098202b891d27b8671f

Creating ClusterStack... (dry run)
```

```
Uploading to 'gcr.io/my-project/my-repo'... (dry run)
 Skipping 'gcr.io/my-project/my-repo/build@sha256:f550ab24b72586cb26215817b874b
9e9ec2ca615ede03206833286934779ab5d'
 Skipping 'gcr.io/my-project/my-repo/run@sha256:21c1fb65033ae5a765a1fb44bfefdea
37024ceac86ac6098202b891d27b8671f'
apiVersion: kpack.io/v1alpha1
kind: ClusterStack
metadata:
  creationTimestamp: null
  name: test-stack
spec:
  buildImage:
    image: gcr.io/my-project/my-repo/build@sha256:f550ab24b72586cb26215817b874b9e9ec2c
a615ede03206833286934779ab5d
  id: io.buildpacks.stacks.bionic
  runImage:
    image: gcr.io/my-project/my-repo/run@sha256:21c1fb65033ae5a765a1fb44bfefdea37024ce
ac86ac6098202b891d27b8671f
status:
  buildImage: {}
  runImage: {}
```

The resource yaml output above has the relocated build and run image urls. However, the images were never uploaded.

If you now apply the resource output using `kubectl apply -f` as shown below, then the resource will be created but will be faulty since the referenced images do not exist.

```
$ kp clusterstack create test-stack \
 --dry-run \
 --output yaml \
 --build-image gcr.io/paketo-buildpacks/build@sha256:f550ab24b72586cb26215817b874b9e9e
c2ca615ede03206833286934779ab5d \
 --run-image gcr.io/paketo-buildpacks/run@sha256:21c1fb65033ae5a765a1fb44bfefdea37024c
eac86ac6098202b891d27b8671f \
 | kubectl apply -f -
Creating ClusterStack... (dry run)
Uploading to 'gcr.io/my-project/my-repo'... (dry run)
 Skipping 'gcr.io/my-project/my-repo/build@sha256:f550ab24b72586cb26215817b874b
9e9ec2ca615ede03206833286934779ab5d'
 Skipping 'gcr.io/my-project/my-repo/run@sha256:21c1fb65033ae5a765a1fb44bfefdea
37024ceac86ac6098202b891d27b8671f'
clusterstack.kpack.io/test-stack created
```

Running the same command above with the `--dry-run-with-image-upload` flag (instead of `--dry-run`) ensures the created resource refers to images exist.

Does TBS support Azure Devops for git repositories

Yes! Azure DevOps Git is fully supported as of TBS 1.2

Why do I get a "repository does not exist" error when I use ECR Registry?

ECR is supported but requires manually creating each repository that TBS will use. With other

registries, the repositories will be created automatically.

How do I troubleshoot a failed build?

Like many Kubernetes native products, operating TBS involves orchestrating resources that depend on each other to function. If a resource is in a "not ready" state it is likely that there is a problem with one of the resources it depends on.

If you are encountering a not ready `Image`, check and see which builder it uses and then check the status of that builder for additional information that could help you troubleshoot the problem.

```
$ kp image status <image-name>

$ kp clusterbuilder status <clusterbuilder-name>
```

Similarly, if a builder resource is in a "not ready" state, it is possible that there is a problem with the `clusterstack` or `clusterstore` resources it is referencing.

```
$ kp clusterstack status <clusterstack-name> --verbose

$ kp clusterstore status <clusterstore-name> --verbose
```

All Build Service concepts are also Kubernetes resources. Therefore, customers can interact with them using the `kubectl` CLI to see all the information that can be provided by the Kubernetes API.

```
$ kubectl describe image <image-name>

$ kubectl describe clusterbuilder <clusterbuilder-name>
```

How do I troubleshoot an UNAUTHENTICATED error?

During `imgpkg copy`

1. Ensure you are logged in locally to both registries with:

```
docker logout registry.tanzu.vmware.com && docker login registry.tanzu.vmware.com
docker logout <tbs-registry> && docker login <tbs-registry>
```

2. On linux, if you have installed `docker` with `snap` you will need to copy `/root/snap/docker/471/.docker/config.json` to `~/.docker/config.json` which is where `imgpkg` is looking for the docker credentials
3. Ensure your credentials have write access to your registry with `docker push <registry>/<build-service-repository>` this is the same repository used during install with the `ytt/kapp` command

During `kp import`

1. Ensure you are logged in locally to both registries with:

```
docker logout registry.tanzu.vmware.com && docker login registry.tanzu.vmware.com
docker logout <tbs-registry> && docker login <tbs-registry>
```

2. Ensure the credentials used to install TBS have write access to your registry as they sometimes differ from local credentials

- Use `docker login <tbs-registry>` using the credentials used to install TBS with `ytt/kapp`
- Try to `docker push <tbs-registry>/<build-service-repository>` this is the same repository used during install with the `ytt/kapp` command

Why does TBS leave behind pods after builds on my Cluster?

All TBS builds happen in pods. By default, TBS will not delete the last ten successful builds and the last ten failed builds for the purpose of providing historical logging and debugging. If this behavior is not desired, users can configure the number of stored build pods by modifying the `failedBuildHistoryLimit` and `successBuildHistoryLimit` on the Image resource. This is not currently supported in the `kp` CLI, but users can apply yaml configuration using `kubectl` to update these fields. Follow this link for documentation.

How do I check what version of TBS I am using?

After successfully installing tanzu-build-service In terminal run the command `kubectl describe configMap build-service-version -n build-service`

Under the `data` field you will see the version of TBS you are currently using. EX:

```
data:
  version: 1.3.0
```

Note: This will only work for TBS versions 1.2 and above

How does TBS use windows-based images?

When running `imgpkg copy`, the command will output the following message:

```
Skipped layer due to it being non-distributable. If you would like to include non-dist
ributable layers, use the --include-non-distributable flag
```

This is because TBS ships with windows images to support windows builds. Windows images contain "foreign layers" that are references to proprietary windows layers that cannot be distributed without proper Microsoft licensing.

By default, `imgpkg` will not relocate the proprietary windows layers to your registry. TBS also will not pull any windows layers to the cluster unless windows builds are being run so if you do not need windows this message can be ignored.

What is the relationship between a kpack *image resource* and an *OCI image*?

"Image resource" describes a kubernetes custom resource that produces OCI images by way of build resources. This resource will continue producing new builds that, when successful, output

container images to the registry as configured by the image resource.

Pinning the Tanzu Net Updater

When you configure the Tanzu Network Auto Updater during installation, dependencies are pulled in from network.tanzu.vmware.com as they are released to keep the all app OCI images up-to-date and patched.

Using the steps from the installation docs will result in all dependencies to stay up-to-date with the latest buildpacks.

To pin to a TBS "descriptor" version, find the desired version of the descriptor from the TBS Dependencies Tanzu Network page. Run the following command to re-install TBS:

```
ytt -f /tmp/bundle/config/ \
 -v kp_default_repository='<IMAGE-REPOSITORY>' \
 -v kp_default_repository_username='<REGISTRY-USERNAME>' \
 -v kp_default_repository_password='<REGISTRY-PASSWORD>' \
 --data-value-yaml pull_from_kp_default_repo=true \
 -v tanzunet_username='<TANZUNET-USERNAME>' \
 -v tanzunet_password='<TANZUNET-PASSWORD>' \
 -v descriptor_name='<DESCRIPTOR-NAME>' \
 -v descriptor_version='<DESCRIPTOR-VERSION>' \
 | kbld -f /tmp/bundle/.imgpkg/images.yml -f- \
 | kapp deploy -a tanzu-build-service -f- -y
```

Where:

- `DESCRIPTOR-VERSION` is the desired descriptor version from the TBS Dependencies Tanzu Network page.

Additional resources for Tanzu Build Service

Concourse Kpack resource

The Concourse Kpack resource helps in the integration of Kpack in a Concourse based CI/CD pipeline. This Concourse resource is capable of triggering Image builds based on a commit SHA. The Git repo for the Concourse Kpack resource provides guidance on usage within a pipeline.

Note: The Kpack Image must be created within a TBS cluster before referring to it within a pipeline using the Concourse Kpack resource

Note: The Concourse Kpack resource currently only supports GKE and TKGI clusters

Helpful Articles

- Getting Started with VMware Tanzu Build Service 1.0

  (September 03, 2020 - Tony Vetter)

  This covers installation of Tanzu Build Service on local Kubernetes cluster (using Docker Desktop) and demonstrates the auto build of app images for Code and OS updates.

- VMware Tanzu Build Service, a Kubernetes-Native Way to Build Containers, Is Now GA

  (September 03, 2020 - Brad Bock)

  A big picture overview of Tanzu Build Service, integration with CI/CD and links on getting started.

Helpful Videos

- Introduction to Tanzu Build Service 1.0

  (September 22, 2020 - Tony Vetter)

  This covers the different components of TBS, the benefits it offers, and a demo of how TBS can auto update your application images for different reasons - Code update, Config change or Stack update.

Helpful Repositories

- kpdemo - https://github.com/matthewmcnew/kpdemo

  A tool to visualize and demo kpack.

Demos include auto Image creation for Stack and Buildpack updates.