- Puzzle ITC GmbH

Setup

Command line tool

This guide shows you how to install the `helm` CLI tool. `helm` can be installed either from source or from pre-built binary releases. We are going to use the pre-built releases. `helm` binaries can be found on Helm's release page for the usual variety of operating systems.

Setup introduction

This training depends on the installation of `helm`. Follow the instructions on the subsequent pages to complete the setup on your platform of choice.

Installation for Windows

Installation for Windows

Install the `helm` CLI binary on your system:

1. Download the latest release
2. Unzip it
3. Find the `helm` binary in the unpacked directory and move it to its desired destination
    - The desired destination should be listed in your $PATH environment variable (`echo $PATH`)

> **Note**
> Windows quick hack: Copy the `helm` binary directly into the folder `C:\Windows`.

If the `$PATH` variable doesn't contain a suitable directory, it can be changed in the advanced system settings:

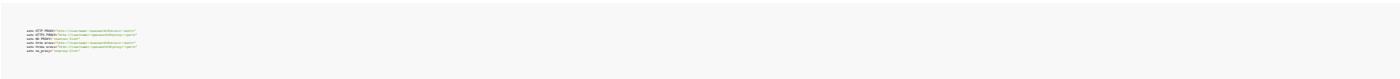
- How to set the path and environment variables in Windows

Proxy configuration

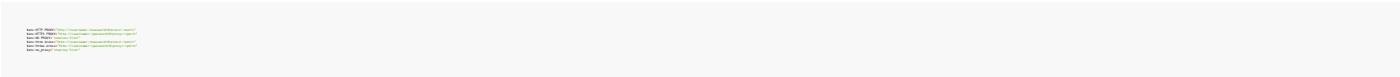
> **Note**
> If you have direct access to the internet from your location, the proxy configuration is not required.

Set your HTTP proxy environment variables so that a chart repository can be added to your Helm repos in a later lab. It is recommended to set the lowercase and uppercase variables, as the helm command takes them all into account.

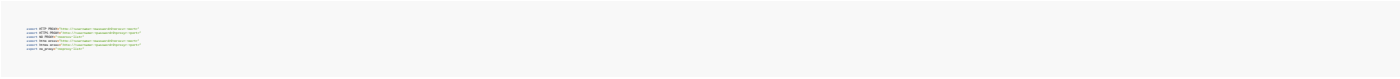
In Windows cmd:



In Windows Powershell:



In Git Bash:



Replace `<username>` and `<password>` with your credentials. If you have special characters in your password, escape them with their corresponding hexadecimal values according to this article .

Verification

Now, verify your installation .

Installation for macOS

Installation for macOS

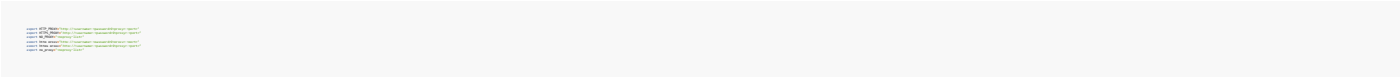
Install the `helm` CLI binary on your system:

1. Download the latest release
2. Unpack it (e.g. `tar -zxvf <filename>`)
3. Find the `helm` binary in the unpacked directory and move it to its desired destination (e.g. `mv darwin-amd64/helm ~/bin/`)
   - The desired destination should be listed in your $PATH environment variable (`echo $PATH`)

Proxy configuration

> **Note**
> If you have direct access to the internet from your location, the proxy configuration is not required.

Set your HTTP proxy environment variables so that a chart repository can be added to your Helm repos in a later lab. It is recommended to set the lowercase and uppercase variables, as the helm command takes them all into account.



Replace `<username` > and `<password>` with your credentials. If you have special characters in your password, escape them with their corresponding hexadecimal values according to this article .

Verification

Now, verify your installation .

Installation for Linux

Installation for Linux

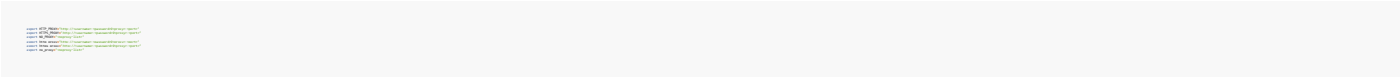
Install the `helm` CLI binary on your system:

1. Download the latest release
2. Unpack it (e.g. `tar -zxvf <filename>`)
3. Find the `helm` binary in the unpacked directory and move it to its desired destination (e.g. `mv linux-amd64/helm ~/.local/bin/`)
   - The desired destination should be listed in your $PATH environment variable (`echo $PATH`)

Proxy configuration

> **Note**
> If you have direct access to the internet from your location, the proxy configuration is not required.

Set your HTTP proxy environment variables so that a chart repository can be added to your Helm repos in a later lab. It is recommended to set the lowercase and uppercase variables, as the helm command takes them all into account.



Replace `<username` > and `<password>` with your credentials. If you have special characters in your password, escape them with their corresponding hexadecimal values according to this article .

Verification

Now, verify your installation .

Verify the installation

Verify the installation

To verify the installation, run the following command and check if `Version` is what you expected:

```
```

The output should be similar to this:

```
version.BuildInfo{Version:"v3.7.0", GitCommit:"eeac83883cb4014fe60267ec6373570374ce770b", GitTreeState:"clean", GoVersi
on:"go1.16.8"}
```

First steps with helm

The `helm` binary has many subcommands. Invoke `helm --help` (or simply `-h`) to get a list of all subcommands; `helm <subcommand> --help` gives you detailed help about a subcommand.

Next steps

When you're ready to go, head on over to the labs and begin with the training!

Labs

The purpose of these labs is to convey Helm basics by providing hands-on tasks for people. Helm is a Cloud Native Foundation project to define, install and manage applications in Kubernetes and any Kubernetes distribution like OpenShift.

It can be used to package multiple Kubernetes resources into a single logical deployment unit.

But it’s not just a package manager.

Helm is a deployment management for Kubernetes. It can:

- do a repeatable deployment
- manage dependencies, reuse and share
- manage multiple configurations
- update, rollback and test application deployments

Goals of these labs:

- Help you get started with this modern technology
- Explain to you the basic concepts
- Show you how to deploy your first applications on Kubernetes using Helm

Prerequisites

- We assume you have knowledge about Kubernetes and understand the concepts of Pods , Deployments , Services , Ingress and Secrets .
- Make sure you have access to the internet from your shell. If required, set appropriate proxy settings in your shell. This is only needed for lab 2 to access the Artifact Hub.

Helm Overview

Ok, let’s start with Helm. First, you have to understand the following 3 Helm concepts: **Chart**, **Repository** and **Release**.

A **Chart** is a Helm package. It contains all of the resource definitions necessary to run an application, tool, or service inside of a Kubernetes cluster. Think of it like the Kubernetes equivalent of a Homebrew formula, an Apt dpkg, or a Yum RPM file.

A **Repository** is the place where charts can be collected and shared. It’s like Perl’s CPAN archive or the Fedora Package Database, but for Kubernetes packages.

A **Release** is an instance of a chart running in a Kubernetes cluster. One chart can often be installed many times in the same cluster. Each time it is installed, a new release is created. Consider a MySQL chart. If you want two databases running in your cluster, you can install that chart twice. Each one will have its own release, which will in turn have its own release name.

With these concepts in mind, we can now explain Helm like this:

> Helm installs charts into Kubernetes, creating a new release for each installation. To find new charts, you can search Helm chart repositories.

Getting started

After this short introduction, make sure you have completed setup . You’re then ready to start with the first lab !

1. Getting started

Task 1.1: Web IDE

The first thing we're going to do is to explore our lab environment and get in touch with the different components.

> **Note**
> You can also use your local installation of the cli tools. Make sure you completed the setup before you continue with this lab.

> **Note**
> The URL and Credentials to the Web IDE will be provided by the teacher. Use Chrome for the best experience.

Once you're successfully logged into the web IDE open a new Terminal by hitting `CTRL + SHIFT + ¨` or clicking the Menu button –> Terminal –> new Terminal and check the installed kubectlversion by executing the following command:

```
kubectl version
```

The Web IDE Pod consists of the following tools:

- oc
- kubectl
- kustomize
- helm
- kubectx
- kubens
- tekton cli
- odo
- argocd

The files in the home directory under `/home/project` are stored in a persistence volume, so please make sure to store all your persistence data in this directory.

Task 1.2: Login

Make sure you have access to the Mobiliar `kubedev` Kubernetes cluster and `kubectl` is configured to use the right context. For these labs, we use the Rancher project with the name `helm` .

Task 1.3: Namespace

For the following labs, we are going to create a namespace. You can choose any name, we suggest using e.g. your username.

You can create your namespace with:

```
kubectl create namespace <namespace>
```

> **Note**
> We are going to use `<namespace>` as a placeholder for your created namespace. Each time you see a `<namespace>` somewhere in a command, replace it with your chosen namespace name.

Task 1.3: Helm CLI

The Helm CLI is a self-contained binary written in the Go programming language. The most recent release can be found on the official GitHub page . In this chapter, you will learn how to get help and how to enable the autocompletion feature.

Task 1.1: Getting familiar with the CLI

You can get help for each command of the CLI with the flag `--help` .

```
helm --help
```

You will see a list of the available commands and flags. If you prefer to browse the manual in the browser you'll find it in the online documentation .

```
Usage:
  helm [command]

Available Commands:
  completion  generate autocompletion scripts for the specified shell
  create      create a new chart with the given name
  dependency  manage a chart\'s dependencies
  env         helm client environment information
  get         download extended information of a named release
  help        Help about any command
  history     fetch release history
  install     install a chart
  lint        examine a chart for possible issues
  list        list releases
  package     package a chart directory into a chart archive
  plugin      install, list, or uninstall Helm plugins
  pull        download a chart from a repository and (optionally) unpack it in local directory
  repo        add, list, remove, update, and index chart repositories
  rollback    roll back a release to a previous revision
  search      search for a keyword in charts
  show        show information of a chart
  status      display the status of the named release
  template    locally render templates
  test        run tests for a release
  uninstall   uninstall a release
  upgrade     upgrade a release
  verify      verify that a chart at the given path has been signed and is valid
  version     print the client version information

Flags:
      --debug                       enable verbose output
  -h, --help                        help for helm
      --kube-apiserver string       the address and the port for the Kubernetes API server
      --kube-as-group stringArray   group to impersonate for the operation, this flag can be repeated to specify multip
le groups.
      --kube-as-user string         username to impersonate for the operation
      --kube-ca-file string         the certificate authority file for the Kubernetes API server connection
      --kube-context string         name of the kubeconfig context to use
      --kube-token string           bearer token used for authentication
      --kubeconfig string           path to the kubeconfig file
  -n, --namespace string            namespace scope for this request
      --registry-config string      path to the registry config file (default "/home/bbuehlmann/.config/helm/registry.j
son")
      --repository-cache string     path to the file containing cached repository indexes (default "/home/bbuehlmann/.c
ache/helm/repository")
      --repository-config string    path to the file containing repository names and URLs (default "/home/bbuehlmann/.c
onfig/helm/repositories.yaml")

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

You can use the `--help` flag on each command and subcommand of the CLI.

```
helm install --help
```

This will print out the documentation for the `install command`. Play around and get familiar with the different commands of the Helm CLI.

Task 1.1: Autocompletion

> **Note**
> This step is only needed when you're not working with the Web IDE we've provided. The autocompletion is already installed in the Web IDE

If you are using the Helm CLI on Linux or Mac OS X you can enable the autocompletion feature . With autocompletion it's even easier to learn the commands, subcommands and their flags. Last but not least it improves the productivity while using Helm.

The autocompletion feature can be enabled for `bash` , `zsh` and `fish` .

The following example enables autocompletion in the current `bash` :

```
source <(helm completion bash)
```

After typing `helm` you can autocomplete the commands and subcommands with a double tap the tabulator key. This works even for installed releases on the cluster: A double tab after `helm get all` prints out all installed helm releases.

To install autocompletion permanently for `bash` you can use the following command:

```
echo "source <(helm completion bash)" >> ~/.bashrc
source ~/.bashrc
```

This appends the command `source <(helm completion bash)` to the end of file `~/.bashrc` which will be sourced on launch of the `bash` .

2. A simple chart

In this lab we are going to create our very first Helm chart and deploy it.

Task 2.1: Create Chart

First, let’s create our chart. Open your favorite terminal and make sure you’re in the workspace for this lab, e.g. `cd ~/<workspace-helm-training>` :

```
helm create mychart
```

You will now find a `mychart` directory with the newly created chart. It already is a valid and fully functional chart which deploys a nginx instance. Have a look at the generated files and their content. For an explanation of the files, visit the [Helm Developer Documentation](). In a later section you’ll find all the information about Helm templates.

Because you cannot pull the `nginx` container image on your cluster, you have to use the `<registry-url>/puzzle/k8s/kurs/nginx` container image. Change your `values.yaml` to contain the following part:

```yaml
image:
  repository: <registry-url>/puzzle/k8s/kurs/nginx
  tag: stable
  pullPolicy: IfNotPresent
```

Task 2.2: Install Release

Before actually deploying our generated chart, we can check the (to be) generated Kubernetes resources with the following command:

```
helm install --dry-run --debug --namespace $USER myfirstrelease ./mychart
```

Finally, the following command creates a new release and deploys the application:

```
helm install --namespace $USER myfirstrelease ./mychart
```

> **Note**
> Use the `helm upgrade -i` command, instead of `helm install` or `helm upgrade` depending on whether the release is already installed or not.

With `kubectl get pods --namespace $USER` you should see a new Pod:

```
NAME                                     READY   STATUS    RESTARTS   AGE
myfirstrelease-mychart-6d4956b75-ng8x4   1/1     Running   0          2m21s
```

You can list the newly created Helm release with the following command:

```
helm ls --namespace $USER
```

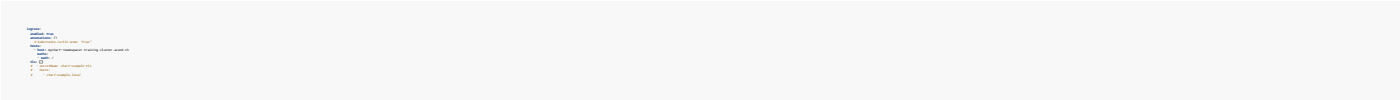
```
NAME            NAMESPACE       REVISION  UPDATED                                 STATUS    CHART         APP VERSION
myfirstrelease  <namespace>     1         2021-04-14 14:29:58.808282266 +0200 CEST  deployed  mychart-0.1.01.16.0
```

Task 2.3: Expose the application

Our freshly deployed nginx is not yet accessible from outside the Kubernetes cluster. To expose it, we have to make sure a so called ingress resource will be deployed as well.

A look into the file `templates/ingress.yaml` reveals that the rendering of the ingress and its values is configurable through values(`values.yaml`):

Therefore, we need to change this value inside our `values.yaml` file.



Note

It might take some time until your ingress hostname is accessible, as the DNS name first has to be propagated correctly.

Apply the change by upgrading our release:

```
helm upgrade --namespace $USER myfirstrelease .mychart
```

This will result in something similar to:

```
Release "myfirstrelease" has been upgraded. Happy Helming!
NAME: myfirstrelease
LAST DEPLOYED: Wed Dec  2 14:44:42 2020
NAMESPACE: <namespace>
STATUS: deployed
REVISION: 2
NOTES:
1. Get the application URL by running these commands:
  http://mychart-<namespace>.training.cluster.acend.ch/
```

Check whether the ingress was successfully deployed by accessing the URL `http://mychart-<namespace>.training.cluster.acend.ch/`

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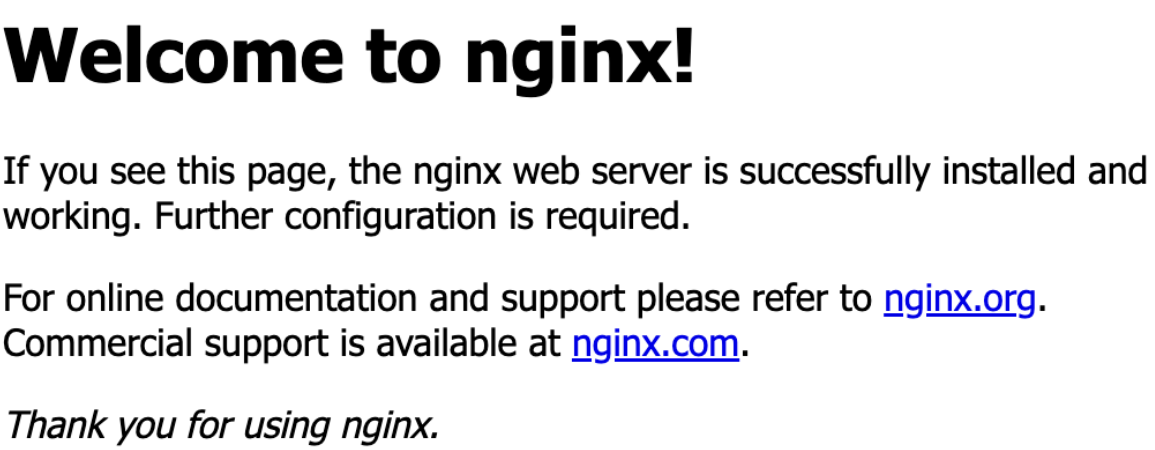
You should see the Nginx welcome page.



Task 2.4: Overwrite value using commandline param

An alternative way to set or overwrite values for charts we want to deploy is the `--set name=value` parameter. `--set name=value` can be used when installing a chart as well as upgrading.

Update the replica count of your nginx Deployment to 2 using `--set name=value`

Solution Task 2.4

```
helm upgrade --namespace NAME --set replicaCount=2 myfirstrelease ./mychart
```

Values that have been set using `--set` can be reset by helm upgrade with `--reset-values` .

Verify the replicaCount with the following command:

```
kubectl get pods --namespace NAME
```

```
NAME                                     READY   STATUS    RESTARTS   AGE
myfirstrelease-mychart-c95cb97d6-g76rc   1/1     Running   0          10m
myfirstrelease-mychart-c95cb97d6-tqztc   1/1     Running   0          8m25s
```

Task 2.5: Rollback a release

Helm also provides the functionality to roll back a release to a specific revision number. Every change you make to a release by installing, upgrading and even rollback, it will increase the `REVISION` . The deployed revision can be displayed with the following command:

```
helm ls --namespace $USER
```

```
NAME            NAMESPACE       REVISION  UPDATED                                 STATUS    CHART        APP VERSION
myfirstrelease  <namespace>     3         2021-04-14 14:29:58.808282266 +0200 CEST  deployed  mychart-0.1.01.16.0
```

Let’s now rollback our release `myfirstrelease` to revision 2.

```
helm rollback myfirstrelease 2 --namespace $USER
```

The replicaCount should be back down to 1 after the rollback. Check if that’s true with the following command:

```
kubectl get pods --namespace $USER
```

```
NAME                                  READY   STATUS    RESTARTS   AGE
myfirstrelease-mychart-c95cb97d6-g76rc   1/1     Running   0          10m
```

Task 2.6 Explore values.yaml

Have a look at the `values.yaml` file in your chart and study all the possible configuration params introduced in a freshly created chart.

Task 2.7: Remove release

To remove an application, simply remove the Helm release with the following command:

```
helm uninstall myfirstrelease --namespace $USER
```

Do this with our deployed release. With `kubectl get pods --namespace $USER` you should no longer see your application Pod.

3. A more complex application

In this extended lab, we are going to deploy an existing, more complex application with a Helm chart from the Artifact Hub.

Artifact Hub

Check out Artifact Hub where you’ll find a huge number of different Helm charts. For this lab, we’ll use the WordPress chart by Bitnami , a publishing platform for building blogs and websites.

WordPress

As this WordPress Helm chart is published in Bitnami’s Helm repository, we’re first going to add it to our local repo list:

> **Note**
> Note that the proxy variables must be set according to the instructions in the setup chapter.

```
helm repo add bitnami https://charts.bitnami.com/bitnami
```

Let’s check if that worked:

```
helm repo list
```

```
NAME    URL
bitnami https://charts.bitnami.com/bitnami
```

Now look at the available configuration for this Helm chart. Usually you can find it in the `values.yaml` or in the chart’s readme file. You can also check it on its Artifact Hub page .

We are going to override some of the values. For that purpose, create a new `values.yaml` file locally on your workstation (e.g. `~/<workspace>/values.yaml`) with the following content:

```yaml
persistence:
  size: 1Gi
service:
  type: ClusterIP
updateStrategy:
  type: Recreate
  rollingUpdate: null

ingress:
  enabled: true
  hostname: wordpress-<namespace>.training.cluster.acend.ch
  extraTls:
  - hosts:
    - wordpress-<namespace>.training.cluster.acend.ch

mariadb:
  primary:
    persistence:
      size: 1Gi
```

It might take some time until your ingress hostname is accessible, as the DNS name first has to be propagated correctly.

If you look inside the Chart.yaml file of the WordPress chart, you’ll see a dependency to the MariaDB Helm chart . All the MariaDB values are used by this dependent Helm chart and the chart is automatically deployed when installing WordPress.

The WordPress and MariaDB charts use the following container images (at the time of writing):

- `docker.io/bitnami/wordpress:5.4.0-debian-10-r6`
- `docker.io/bitnami/mariadb:10.3.22-debian-10-r60`

As we cannot access these images, we'll have to overwrite them. Add the following to your `values.yaml` file in order to do so:

```
image:
  registry: registry.puzzle.ch
  repository: puzzle/k8s-workshop/wordpress
mariadb:
  image:
    registry: registry.puzzle.ch
    repository: puzzle/k8s-workshop/mariadb
```

You have to merge the `mariadb` part with the already defined `mariadb` part from the lab instructions above. Your final `values.yaml` should look like:

```
image:
  registry: registry.puzzle.ch
  repository: puzzle/k8s-workshop/wordpress
persistence:
  enabled: false
service:
  type: ClusterIP
updateStrategy:
  type: Recreate
  rollingUpdate: null
ingress:
  enabled: true
  hostname: wordpress-<namespace>.training.cluster.aeno.ch
mariadb:
  image:
    registry: registry.puzzle.ch
    repository: puzzle/k8s-workshop/mariadb
  primary:
    persistence:
      enabled: no
```

Make sure to replace `<namespace>` .

The image tag remains as already defined in the orginial `values.yaml` file from the chart.

The `Chart.yaml` file allows us to define dependencies on other charts. In our Wordpress chart we use the `Chart.yaml` to add a `mariadb` to store the WordPress data in.

```
dependencies:
  - condition: mariadb.enabled
    name: mariadb
    repository: https://charts.bitnami.com/bitnami
    version: 9.x.x
```

Helm's best practices suggest to use version ranges instead of a fixed version whenever possible. The suggested default therefore is patch-level version match:

```
version: ~3.5.7
```

This is e.g. equivalent to `>= 3.5.7, < 3.6.0` Check this SemVer readme chapter for more information on version ranges.

> **Note**
> For more details on how to manage **dependencies**, check out the Helm Dependencies Documentation .

Subcharts are an alternative way to define dependencies within a chart: A chart may contain another chart (inside of its `charts/` directory) upon which it depends. As a result, when installing the chart, it will install all of its dependencies from the `charts/` directory.

We are now going to deploy the application in a specific version (which is not the latest release on purpose). Also note that we define our custom `values.yaml` file with the `-f` parameter:

```
helm upgrade -i wordpress bitnami/wordpress -f values.yaml --version 10.0.2 --namespace ns000
```

Look for the newly created resources with `helm ls` and `kubectl get deploy,pod,ingress,pvc` :

```
helm ls --namespace $USER
```

which gives you:

```
NAME      NAMESPACE       REVISION  UPDATED                                 STATUS    CHART             APP VERSION
wordpress <namespace>         1     2021-03-25 14:27:38.231722961 +0100 CET deployed  wordpress-15.0.2  5.7.0
```

and

```
kubectl get deploy,pod,ingress,pvc --namespace $USER
```

which gives you:

```
NAME                         READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/wordpress    1/1     1            1           2m6s

NAME                               READY   STATUS    RESTARTS   AGE
pod/wordpress-6bf6df9c5d-w4fpx     1/1     Running   0          2m6s
pod/wordpress-mariadb-0            1/1     Running   0          2m6s

NAME                              HOSTS                                                ADDRESS      PORTS   AGE
ingress.extensions/wordpress      wordpress-<namespace>.training.cluster.acend.ch           10.100.1.10  80      2m6s

NAME                                               STATUS   VOLUME                                     CAPACITY   ACCESS MODES   STORAGECLASS            AGE
persistentvolumeclaim/data-wordpress-mariadb-0     Bound    pvc-859fe3b4-b598-4f86-b7ed-a3a183f700fd   1Gi        RWO            cloudscale-volume-ssd   2m6s
persistentvolumeclaim/wordpress                    Bound    pvc-83ebf739-0b0e-45a2-936e-e925141a0d35   1Gi        RWO            cloudscale-volume-ssd   2m7s
```

In order to check the values used in a given release, execute:

```
helm get values wordpress --namespace $USER
```

which gives you:

```
USER-SUPPLIED VALUES:
ingress:
  enabled: true
  hostname: wordpress-<namespace>.training.cluster.acend.ch
  extraTls:
  - hosts:
    - wordpress-<namespace>.training.cluster.acend.ch
mariadb:
  primary:
    persistence:
      size: 1Gi
persistence:
  size: 1Gi
service:
  type: ClusterIP
updateStrategy:
  type: Recreate
  rollingUpdate: null
```

As soon as all deployments are ready (meaning pods `wordpress` and `mariadb` are running) you can open the application with the URL `https://wordpress-<namespace>.training.cluster.acend.ch` from your Ingress resource defined in `values.yaml` .

Upgrade

We are now going to upgrade the application to a newer Helm chart version. When we installed the Chart, a couple of secrets were needed during this process. In order to do the upgrade of the Chart now, we need to provide those secrets to the upgrade command, to be sure no sensitive data will be overwritten:

- wordpressPassword
- mariadb.auth.rootPassword
- mariadb.auth.password

> **Note**
> This is specific to the wordpress Bitami Chart, and might be different when installing other Charts.

Use the following commands to gather the secrets and store them in environment variables. Make sure to replace `<namespace>` with your current value.

```
export WORDPRESS_PASSWORD=$(kubectl get secret wordpress -o jsonpath="{.data.wordpress-password}" --namespace &lt;NAME&gt; | base64 --decode)
```

```
export MARIADB_ROOT_PASSWORD=$(kubectl get secret wordpress-mariadb -o jsonpath="{.data.mariadb-root-password}" --namespace &lt;NAME&gt; | base64 --decode)
```

```
export MARIADB_PASSWORD=$(kubectl get secret wordpress-mariadb -o jsonpath="{.data.mariadb-password}" --namespace &lt;NAME&gt; | base64 --decode)
```

Then do the upgrade with the following command:

```
helm upgrade -f values.yaml --set wordpressPassword=$WORDPRESS_PASSWORD --set mariadb.auth.rootPassword=$MARIADB_ROOT_PASSWORD --set mariadb.auth.password=$MARIADB_PASSWORD --version v15.2.13 wordpress bitnami/wordpress --namespace &lt;NAME&gt;
```

And then observe the changes in your WordPress and MariaDB Apps

Cleanup

```
helm uninstall wordpress --namespace &lt;NAME&gt;
```

Additional Task

Study the Helm best practices as an optional and additional task.

4. Debugging Helm

Debugging templates can be tricky because the rendered templates are sent to the Kubernetes API server which may reject the YAML files for reasons other than formatting.

There are a few commands that can help you debug:

- `helm lint` is your go-to tool for verifying that your chart follows best practices.
- `helm install --dry-run --debug --generate-name <chart> --namespace $USER` or `helm template --debug <chart>` : We've seen this trick already. It's a great way to render your templates without applying them to the cluster.
- `helm template -s templates/<template-file> . --debug | cat -n -` render a single file to the standard output
- `helm get manifest <release> --namespace $USER` : This is a good way to see what templates are installed on the server.
- `helm get values <release> --namespace $USER` : This helps you to understand which values are used for a release.

When your YAML is failing to parse but you want to see what is generated, one easy way to retrieve the YAML is to comment out the problem section in the template and then re-run `helm install --dry-run --debug --generate-name <chart> .`

```
apiVersion: v2
# some: problem section
# {{ .Values.foo | quote }}
```

The above will be rendered and returned with the comments intact:

```
apiVersion: v2
# some: problem section
#  "bar"
```

This provides a quick way of viewing the generated content without YAML parse errors blocking.

Task 4.1: Get the chart

Get the `error-chart` chart by either downloading the repository's ZIP file or by cloning it from GitHub:

```
git clone https://github.com/puzzle/error-chart.git && cd error-chart
```

Task 4.2: Fix the chart

The `error-chart` chart contains some deliberate errors. Try to find all of these errors and fix them, then install the chart using `myrelease` as release name. You can use one or several ways shown above to do so. The goal of this task is a successfully running `myrelease-error-chart` pod in your own namespace.

If you try to install the chart with following command, you will get an error:

```
helm install my-error-chart . --dry-run
```

Hints

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YAML

YAML has some strict formatting rules. Check if all files conform to these rules. There is a bad formatting in the `ingress.yaml` template. Use the `helm template -s templates/ingress.yaml . --debug | cat -n -` command to render the ingress template. Be aware that the first two lines (`---` YAML directive marker and the `# Source: error-chart/templates/ingress.yaml` YAML comment are not considered).

Kubernetes resource definitions

Find out what resource files are not correct resource definitions.

Values

Check whether all defined values in `values.yaml` look ok to you. Also check if those values used in the templates reference the correct ones.

Solution

Ingress path

The first error we get when trying to install the chart or when using the `helm lint` command is this:

```
[ERROR] templates/ingress.yaml: unable to parse YAML
  error converting YAML to JSON: yaml: line 15: found character that cannot start any token
```

“found character that cannot start any token” probably doesn’t ring a bell so we try to find out what’s wrong with line 15 in file `templates/ingress.yaml` . Beware that line 15 corresponds to line 15 of the rendered file! If you want to know what is on line 15 in the rendered file, you can execute the following command:

```
helm template -s templates/ingress.yaml . --debug | cat -n -
```

Opening the file and going to the appropriate line containing `paths:` , we notice that a tab instead of whitespace characters was used to indent. Replace it with whitespace characters.

Deployment empty selector

The second error we get when trying to install the chart reads:

```
Error: release myrelease failed: Deployment.apps "myrelease-error-chart" is invalid: spec.selector: Invalid value: v1.L
abelSelector{MatchLabels:map[string]string(nil), MatchExpressions:[]v1.LabelSelectorRequirement(nil)}: empty selector i
s invalid for deployment
```

If you look at the deployment template or its rendered form you’ll notice that something’s wrong with the selector:

```
  selector:
    matchLabels:
    app.kubernetes.io/name: {{ include "error-chart.name" . }}
    app.kubernetes.io/instance: {{ .Release.Name }}
```

Those two key-value pairs `app.kubernetes.io/name` and `app.kubernetes.io/instance` should be indented by two more whitespaces to look like this:

```
    selector:
      matchLabels:
        app.kubernetes.io/name: {{ include "error-chart.name" . }}
        app.kubernetes.io/instance: {{ .Release.Name }}
```

Ingress host

The host value seems to be incorrect (parts of the url were replaced by placeholders in the following message):

```
Error: release myrelease failed: Ingress.extensions "myrelease-error-chart" is invalid: spec.rules[0].host: Invalid val
ue: "helmtechlab-errorchart-<namespace>.training.cluster.acend.ch": a DNS-1123 subdomain must consist of lower case alp
hanumeric characters, '-' or '.', and must start and end with an alphanumeric character (e.g. 'example.com', regex used
 for validation is '[a-z0-9]([-a-z0-9]*[a-z0-9])?(\.[a-z0-9]([-a-z0-9]*[a-z0-9])?)*')
```

If you look closely, you'll notice that the placeholder `<namespace>` is still in the host's value. This does not correspond to hostname conventions. The file `templates/ingress.yaml` reveals that the host's value is defined in the `values.yaml` file. Fix the `host` value.

Deployment image tag

Even though the chart could successfully be installed the pod has a status of `InvalidImageName` . Looking at the rendered deployment we notice that the image is missing a tag:

```
      spec:
        containers:
        - image: 'nginxinc/nginx-unprivileged:'
          imagePullPolicy: IfNotPresent
```

As with the ingress host, the used value seems to be wrong. The ingress template has the following definition of `image:` :

```
          image: "{{ .Values.image.repository }}:{{ .Values.image.tags }}"
```

So let's have a look at the `values.yaml` file:

```
image:
  repository: nginxinc/nginx-unprivileged
  tag: stable
  pullPolicy: IfNotPresent
```

There's no variable `tags` , instead it's named `tag` . Fix that in the template so that the `image:` line reads:

```
          image: "{{ .Values.image.repository }}:{{ .Values.image.tag }}"
```

You might also have to change the `repository:` value because Docker Hub might not be accessible from the used environment.

Compare with solution

You can find the solution in the repository under the `solution` branch. If you want to check if your solution is correct, you can simply compare your workspace against the solution branch.

```
git diff origin/master
```

5. Go templating

In this lab we are going to learn how to use Go templating in Helm templates.

Task 5.1: Create a new Helm chart

Let's create a new Helm chart with the name `gotemplatechart` and remove all default templates from the `templates` folder.

Solution

```
```

Task 5.2: Add a ConfigMap template

As the template directory is completely empty, it's time to create our first template. For the purpose of this lab we're going to use a simple ConfigMap template. If you don't exactly understand what a ConfigMap is, consider reading the Kubernetes documentation on how to configure a pod to use a ConfigMap .

Create the template called `gotemplatechart/templates/configmap.yaml` :

```
```

We can now render the template with the following command:

```
```

If everything went ok we can deploy a release of the chart in our namespace:

```
```

Task 5.3: The first Go template directive

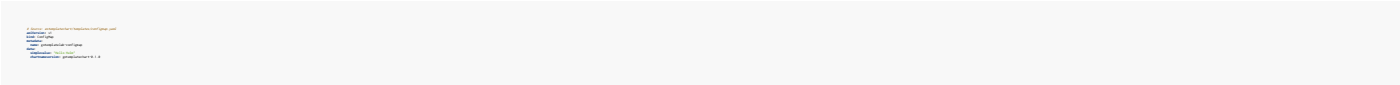
As our first Go template directives we are going to add so-called built-in objects: the chart name and version `{{ .Chart.Name }}-{{ .Chart.Version }}` .

The template directive is enclosed in double curly braces `{{` and `}}` .

Update the `gotemplatechart/templates/configmap.yaml` :

```
```

Rendering the new template again with `helm template gotemplatechart ...` (see task 2) will therefore result in the following output:



The directives `{{ .Chart.Name }}` and `{{ .Chart.Version }}` inject the name and version of the actual chart. But where are those values coming from?

Within those directives data is accessible through a data structure. The leading `.` represents the root of the object structure and is the entrypoint to access data in templates. Built-in objects such as a chart, release, file, template, values and more are therefore accessible in a similar fashion. Check the official Helm documentation about built-in objects for further and more in-depth information.

The `.Chart` data structure obviously comes from the `Chart.yaml` file and represents the values of this file.

Task 5.4: Add data from values.yaml

As you could have guessed by now, the `values.yaml` file allows us to configure values and parameters used during the rendering of the templates to replace strings, parameters, functions or even to control whether a part of a template is rendered at all. Let's add a couple more directives to our ConfigMap.

Remove the default content of the `values.yaml` and replace it with the following:

Now also add your favorite color to be rendered in the ConfigMap as data under the key `myFavoriteColor`. Edit the `gotemplatechart/templates/configmap.yaml` file accordingly.

Use `helm template gotemplatechart ...` again (as in task 2) to see what your rendered Kubernetes resources look like.

Note

The output should look like this:

```
---
# Source: gotemplatechart/templates/configmap.yaml
apiVersion: v1
kind: ConfigMap
...
data:
  ...
  myFavoriteColor: blue
```

Solution Task 5.4

Task 5.5: Structured data

As mentioned in task 3, data within the built-in objects can be structured and values can be nested.

Update the ConfigMap template so that the following `values.yaml` will result in the same rendered resource as in task 4.

Solution Task 5.5

> **Note**
> The official Helm best practices suggest using flat values over nested ones:
>
> > In most cases, flat should be favored over nested. The reason for this is that it is simpler for template developers and users.

Template functions and pipelines

As for now we have learned how to place values unmodified within templates. There are cases where we want to do something with the value before we place it in a resource. With functions and pipelines we can achieve exactly that.

When injecting strings like e.g. our favorite color in a template, we want to quote the strings:

```
{{ .Values.favorite.color }} --> blue
{{ quote .Values.favorite.color }} --> "blue"
```

The quote function therefore adds double quotes around the value. Functions follow the syntax `functionName arg1 arg2 ...` .

Helm has over 60 functions available. Some are defined in the Go template language , others in the Sprig template library .

Similar to Linux pipes known from shell commands, e.g. `ps -aux | grep ps` , you can use pipes in Go templates as well:

```
{{ .Values.favorite.color | upper | quote }} --> "BLUE"
{{ .Values.favorite.color | b64enc | quote }} --> "Ymx1ZQ==" # blue base64 encoded
{{ .Values.favorite.color | repeat 2 | quote }} --> "BLUEBLUE"
{{ .Values.favorite.band | default "Pink Floyd" | quote }} --> "Pink Floyd" # the our values.yaml doesn't consist of th
e favorite --> band value therefore the default value is rendered
{{ printf "%s%s" .Release.Name .Chart.Name | quote }} --> "release-namegotemplatechart"
```

Task 5.6: Add functions and pipelines

Make the required changes to your ConfigMap template so that it renders to the following output:

```yaml
# Source: gotemplatechart/templates/configmap.yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: gotemplatelab-configmap
data:
  simplevalue: "Hello Helm"
  chartnameversion: "gotemplatechart-0.1.0"
  myFavoriteColor: "blue"
```

Solution Task 5.6

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: gotemplatelab-configmap
data:
  simplevalue: "Hello Helm"
  chartnameversion: {{ printf "%s-%s" .Chart.Name .Chart.Version | quote }}
  myFavoriteColor: {{ .Values.favorite.color | quote }}
```

Conditionals

If then else control structures are very common in templating languages like Go Templating and basically look like this

```
{{ if condition as pipeline }}
  # do this
{{ else if condition as pipeline }}
  # do that
{{ else}}
  # do else
{{ end }}
```

> **Note: Conditional Operators**
> With `and`, `or`, `not`, `eq` being functions, conditions therefore look like this `{{ if and .Values.favorite.band (eq .Values.favorite.band "The Rolling Stones") }}` For this condition to be true, the value `.Values.favorite.band` must be set and is set to "The Rolling Stones"

Task 5.7: Add a condition

Let's add an example condition to our ConfigMap:

- When the favorite drink is water, coke, beer or wine, add a new line to the ConfigMap data part `glass: true`
- When its coffee or tea: `mug: true`

We start with adding the favorite drink to your `values.yaml`

```yaml
favorite:
  color: blue
  drink: [replace with your favorite drink]
```

Now edit the ConfigMap template accordingly.

Solution Task 5.7

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: gotemplatelab-configmap
data:
  simplevalue: "Hello Helm"
  chartnameversion: {{ printf "%s-%s" .Chart.Name .Chart.Version | quote }}
  myFavoriteColor: {{ .Values.favorite.color | quote }}
  {{ if and .Values.favorite.drink (or (eq .Values.favorite.drink "water") (eq .Values.favorite.drink "coke") (eq .Values.favorite.drink "beer") (eq .Values.favorite.drink "wine")) }}glass: true{{ else if and .Values.favorite.drink (or (eq .Values.favorite.drink "coffee") (eq .Values.favorite.drink "tea")) }}mug: true{{ end }}
```

This condition is mostly unreadable due to the fact that we need to make sure the spaces for the next key and value set are correct.

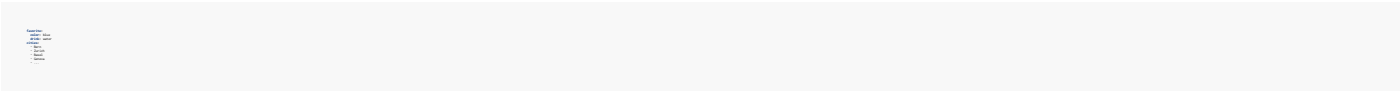
Check out Helm's documentation about controlling whitespace for more details on how to control whitespaces and adapt your ConfigMap.

A more readable version could look like this:

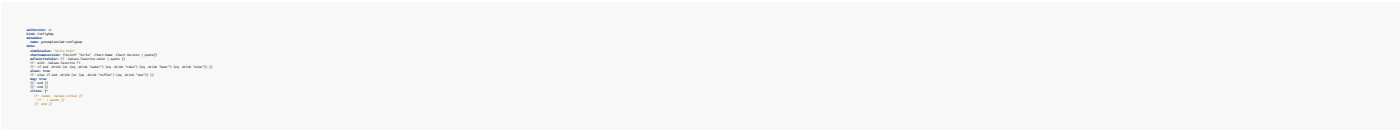
The `with` Operator allows you to set the current scope (`.`) to a particular object, in our case the favorite object.

Loops in Helm templates

The `range` Operator allows you to implement loops in Helm templates. E.g. to iterate over a list of cities:



We can implement the template as follows:



Check out Helm's documentation about developing templates for more details on templating with Helm.

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6. Your own complex Helm chart

Let’s create a bit more complex Chart.

In this Lab we are covering folling topics:

- 6.1 Deploy the Chart and add a database to the app
- 6.2 Template the database resources
- 6.3 Deploy the same app with a database dependency instead of your own database deployment
- 6.4 Writing tests for your Helm Charts
- 6.5 Deploy you app with Helm hooks
- 6.6 Prepare and deploy your app for different environments
- 6.7 Publish your Chart

We already prepared a Helm chart skeleton for this, you can clone the Chart with following command:

```
git clone https://github.com/puzzle/helm-example-chart.git lab6 && cd lab6
```

Let’s have a closer look at its directory structure and components. The Chart consists of the following files and folders:

```
.
├── Chart.yaml
├── charts
├── templates
│   ├── NOTES.txt
│   ├── _helpers.tpl
│   ├── app-deployment.yaml
│   ├── app-ingress.yaml
│   ├── app-service.yaml
│   ├── mariadb-deployment.yaml
│   ├── mariadb-secret.yaml
│   ├── mariadb-service.yaml
│   └── tests
│       └── test-connection.yaml
└── values.yaml
```

Looking at the `templates/` directory, we notice that there already are a few files:

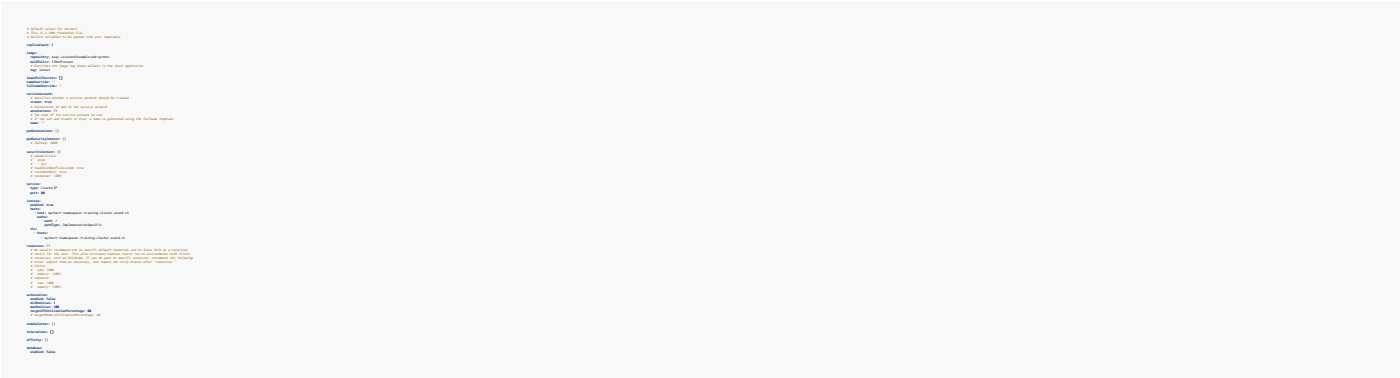
- `NOTES.txt` : The “help text” for your chart which will be displayed to your users when they run `helm install`
- `app-deployment.yaml` : A basic manifest for creating a Kubernetes deployment
- `app-service.yaml` : A basic manifest for creating a service endpoint for your deployment
- `app-ingress.yaml` : A basic manifest for creating a ingress to expose your app deployment
- `_helpers.tpl` : A place to put template helpers that you can re-use throughout the chart
- `tests/` : A directory to put test files for testing the deployed Helm chart

Furthermore the are some resources (prefixed with `mariadb-`) for a database backend which we’re going to use in the next lab section. For now you can ignore them.

> **Note**
> For details on chart templating, check out the Helm’s getting started guide .

values.yaml

In the `values.yaml` file we defined our values used in our templates:



When instantiating a release from a chart, we can overwrite these values according to our own environment-specific conditions.

So, we can for instance create a `values-dev.yaml` where we keep our development environment values and then use `helm upgrade/install -f values-dev.yaml` to update or instantiate a release for the given environment. A different approach is to keep the files under version control and use branches for the different stages.

> **Note**
> For details on the values file, check out the Helm documentation about values files .

Templates

All our Kubernetes resource files are in the `templates` folder. Let's have a closer look at `templates/app-deployment.yaml` :

We can see that they look similar to the well-known Kubernetes resource files, but we have some control elements starting and ending with two curly brackets (`{{ }}`). These template files are rendered through a Go template rendering engine. More will be covered on `Go templates` in an upcoming lab.

> **Note**
> For details on templating, check out the Helm documentation about template functions and pipelines .

_helpers.tpl

Inside the template folder you can also find a `_helpers.tpl` file.

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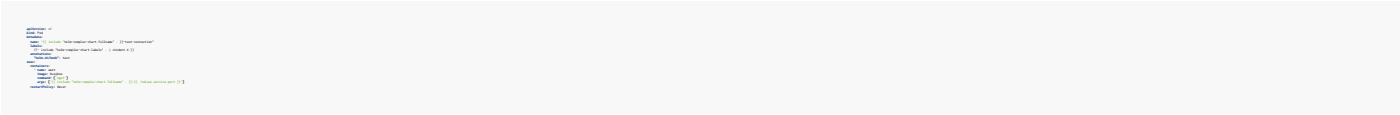
As you can see, you can also define named templates in Helm and then use these named templates.

Have a look at:

you can then access this `helm-complex-chart.labels` in your `app-deployment.yaml` like follows:

Tests

Helm has the capability to test the deployed Kubernetes resources. In the `/test` directory we can define multiple test jobs for the deployed Helm chart. A test job is defined by a Pod resource which specifies a container with a given command to run. If the container exits successfully (exit code 0), the test was successful. Further the test Pod must contain following annotation `helm.sh/hook: test` to run during the Helm deployment. Inside the `/test` directory you can find already a simple test job. This test job starts a busybox image with a wget command to check if the deployed app is reachable by its service name.



You can execute the tests on a given release with the following command:

What tests are useful:

- Verify the configuration, eg. username and passwords are correct
- Make sure the deployed application is reachable over the service
- Run functional smoke tests for example logging into an application

Task 6.1: Change Chart.yaml

Study the Helm documentation about the Chart.yaml file , then change the description to `My awesome app` and add yourself to the list of maintainers.

Solution

```
apiVersion: v2
name: helm-complex-chart
description: My awesome app
type: application
version: 0.1.0
appVersion: 1.16.0
maintainers:
  - name: YOUR_NAME
    email: YOUR_EMAIL_ADDRESS
```

Continue with the lab “Deploy your awesome application ”.

6.1 Deploy your awesome application

Using the generated and modified Helm chart, we are going to deploy our own awesome application.

Task 6.1.1: Deploy the chart

Let’s deploy our awesome application. Therefore we need to adjust ingress configuriation in the values file.

```
ingress:
  enabled: true
  hosts:
    - host: helm-complex-chart-<namespace>.training.cluster.acend.ch
      paths:
        - path: /
          pathType: ImplementationSpecific
  tls:
    - hosts:
        - helm-complex-chart-<namespace>.training.cluster.acend.ch
```

Solution

To create a release from our chart, we run the following command within our chart directory:

```
helm install myapp . --namespace NAME
```

This will create a new release with the name `myapp` . If we already had installed a release and wanted to update the existing one, we’d use the following command:

```
helm upgrade -i myapp . --namespace NAME
```

Check whether the ingress was successfully deployed by accessing the URL `http://helm-complex-chart-<namespace>.training.cluster.acend.ch/`

Task 6.1.2: Connect to the database

In order for the python application to be able to connect to a database, we need to add some environment variables to our deployment. The goal of this task is to allow a user to set them via values. Change your Application Deployment Template in `templates/app-deployment.yaml` and include the new environment variables:

- `MYSQL_DATABASE_NAME` with the value `acenddb`
- `MYSQL_DATABASE_PASSWORD` references the database password value from the secret you created in task 1
- `MYSQL_DATABASE_ROOT_PASSWORD` references the the database root password value from the secret you created

in task 1

- `MYSQL_DATABASE_USER` with the value `acend`
- `MYSQL_URI` with the value `mysql://$(MYSQL_DATABASE_USER):$(MYSQL_DATABASE_PASSWORD)@{{ .Release.Name }}-mariadb/$(MYSQL_DATABASE_NAME)`

And enclose all environment variables in a conditional If-statement with following condition: `database.enabled == true`

Solution Task 6.1.2

Add the following changes in the `values.yaml` to enable the database:

Enabling this property will render the environment variable block in the deployment template, as well all the `mariadb-*.yaml` templates. To upgrade your existing release run:

Task 6.1.3: Check

Check whether the attachment of the new backend worked by either looking at the Pod's logs: In there the application tells you which backend it uses, this should of course be the database. Or simply access the application in your browser, create an entry, re-deploy the application Pod (e.g. by scaling it down and up again) and check if your entry is still there.

Solution Task 6.1.3

First we need to execute the following command to determine the pod name

Next execute the following command to show the logs

```
kubectl logs myapp-helm-complex-chart-7cc85f99db-n4lsc
```

As you can see in the log output, our application is now connected to the freshly deployed database

Never log sensitive informations like database connection strings which contain the password in plain text!

```
Using DB:  mysql://acend:mysuperpassword123@myapp-helm-complex-chart-mariadb/acenddb
 * Serving Flask app 'run' (lazy loading)
 * Environment: production
   WARNING: This is a development server. Do not use it in a production deployment.
   Use a production WSGI server instead.
 * Debug mode: off
2021-10-08 11:17:17,783 WARNING:  * Running on all addresses.
   WARNING: This is a development server. Do not use it in a production deployment.
2021-10-08 11:17:17,784 INFO :  * Running on http://10.42.5.2:5000/ (Press CTRL+C to quit)
2021-10-08 11:17:20,688 INFO : 185.79.235.174 - - [08/Oct/2021 11:17:20] "GET / HTTP/1.1" 200 -
2021-10-08 11:17:21,758 INFO : 185.79.235.174 - - [08/Oct/2021 11:17:21] "GET / HTTP/1.1" 200 -
```

Task 6.1.8: Clean up

Uninstall the app

```
helm uninstall myapp --namespace $USER
```

6.2 Template the database backend

In this lab we are going to templates the resources that are necessary to deploy a MariaDB database as a backend to our `example-web-python` application. Before we start creating those templates we want to have a look at a couple of best practices.

Resource names

When looking at the app templates of our `mychart` chart, the name of the resource is always defined by a helper function:

Resources within the same Namespace and of the same resource type must have unique names. Since a Helm chart can be instantiated multiple times in different releases, it's best to include the release name as part of the resource name:

```
<releasename>-<chartname>
```

Have a look at the helper function in `mychart/templates/_helpers.tpl` for more details and keep this concept in mind when creating new templates.

Labels

There are a couple of recommended Kubernetes labels , which help to make interoperability between different tools and concepts easier and define a kind of standard.

We use the following two labels as so-called selector labels. These are labels that are used on services to define which pods belong to them:

- `app.kubernetes.io/name` : Resource name
- `app.kubernetes.io/instance` : Release name

And a couple of additional ones to label our resources with supplemental information:

- `helm.sh/chart` : Chart name, e.g. `mychart-0.1.0`
- `app.kubernetes.io/version` : Chart version, e.g. `1.16.0`
- `app.kubernetes.io/managed-by: Helm`

Similar to the resource name we can also use helpers to generate the necessary labels. There are two helper functions you can use to generate these labels

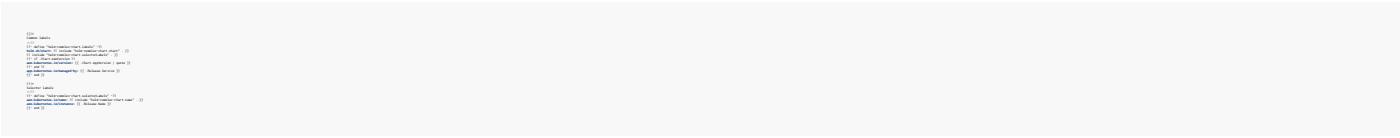
- `{{- include "helm-complex-chart.selectorLabels" . }}` to generate the so-called selector labels. Primary you can use this function in Service templates under `.spec.selector`
- `{{- include "helm-complex-chart.labels" . }}` to generate the Helm common labels. Mainly used for the `.metadata.labels` in any resource template.

Task 6.2.1: Add a new helper function

As mentioned above, the `_helpers.tpl` file provides some neat functions to generate the Labels and Selectors for Kubernetes resources. But if we take a closer look, we see that we can not simply use the same labels and selectors. Because we have two different deployments, each with its own service, we need to ensure

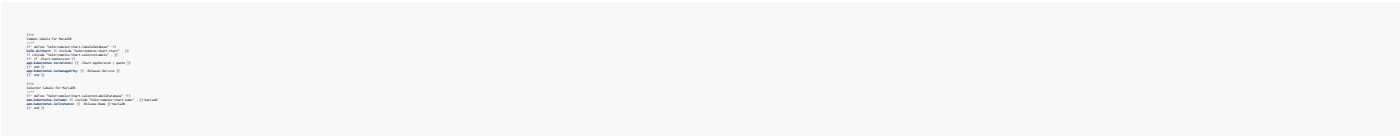
that the selector and labels ardistinct for both deployments and services.

Let’s open the `_helpers.tpl` file and scroll down to the helper function for the labels.



Now we’re going to add the same functions to generate the labels for the MariaDB resources. Add following content to the helpers file, so that we have two new helper functions.

- `helm-complex-chart.labelsDatabase` to generate the common labels for MariaDB
- `helm-complex-chart.selectorLabelsDatabase` to generate the service selector labels for MariaDB



Task 6.2.2: Edit the MariaDB template files

We want to add a MariaDB database and use it as a backend for our `example-web-python` application. Using the following Kubernetes resource file, let’s take a look at the template files for the MariaDB database:

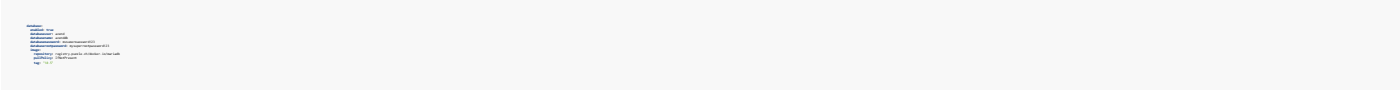
There are three template files which are neccessary for the MariaDB deployment.

- `deployment-mariadb.yaml`
- `service-mariadb.yaml`
- `secret-mariadb.yaml`

But first add the new values for the configuration of the database connection and set the `database.enabled` value to true.

Replace following block at the end of `values.yaml`

with following content:



> **Note**
> Remember the `--dry-run` option from lab 2. This allows you to render the templates without applying them to the cluster.

Deployment

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Let’s examine the MariaDB Deployment template first. As we can see, the deployment of the MariaDB is very similar to the App Deployment. Make following changes to create a reusable template

- Replace `metadata.labels` with the template function `helm-complex-chart.labelsDatabase` we created before
- Replace `spec.selector.matchLabels` with the template function we created before
- Replace `spec.template.metadata.labels` with the template function `helm-complex-chart.labelsDatabase` we created before
- Replace `spec.template.spec.containers[0].image` with
- Replace `spec.template.spec.containers[0].imagePullPolicy` with
- Replace under `spec.template.spec.containers[0].env` the values from following keys
  - `MYSQL_USER` value with `.Values.database.databaseuser`
  - `MYSQL_DATABASE` value with `.Values.database.databaseuser`

Secret

Furthermore you have already a Secret `mariadb-secret.yaml` which contains the passwords for the Database Make following changes to create a reusable template

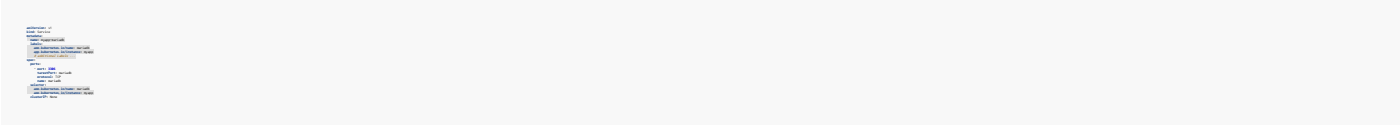
- Replace `metadata.labels` with the template function `helm-complex-chart.labelsDatabase` we created before
- Replace under `data` the values from following keys
  - `mariadb-root-password` with **base64 encoded** `.Values.database.databaseuser` value
  - `mariadb-password` with **base64 encoded** `.Values.database.databaseuser` value

When creating the template files, make sure that a user can specify the `mariadb-password` and `mariadb-root-password` from the secret using a variable.

Service

To connect to the database, we also have a service Make the following changes to create a reusable template

- Replace `metadata.name` with
- Replace `metadata.labels` with the template function we created before
- Replace `metadata.spec.selector` with the template function we created before



When your changes are ready, upgrade the already deployed release with the new version.

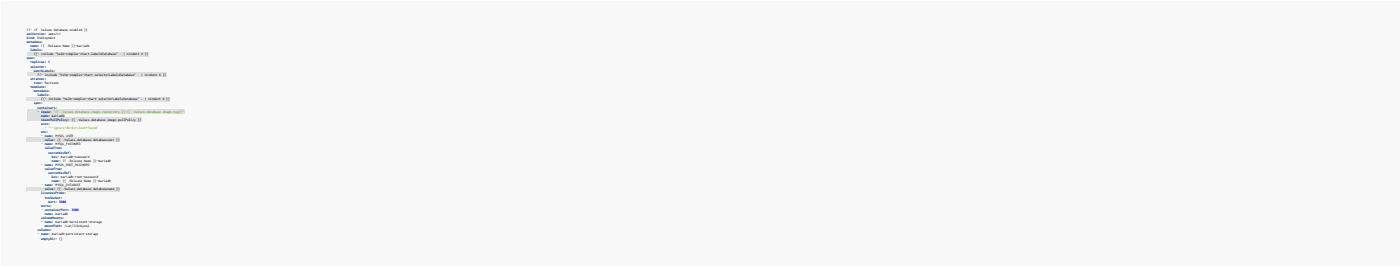
6.2.2: Solution

The template file for the MariaDB database `templates/deployment-mariadb.yaml` could look like this.

The following points need to be taken into consideration when creating the template:

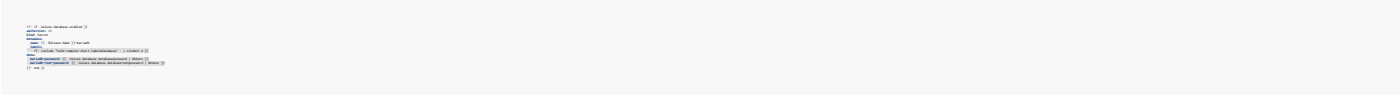
- The helper `helm-complex-chart.fullname` will return `release-helm-complex-chart`. Since our first deployment for the `example-web-python` application already uses this name, we have to choose a name for the mariadb instead.
  - Let's take `<releasename>-mariadb` instead. As an alternative, we could also alter the full name helper to accept an additional name, which would be different for each deployment.
- The same applies to the label `app.kubernetes.io/name`. We can't therefore use the included `helm-complex-chart.labels`. We could also alter the helper function or in our case simply just add the labels directly.
- In the deployment templates we reference our secrets by again using the full name `<releasename>-mariadb`.

Deployment



Secret

The secret `templates/mariadb-secret.yaml` file should look like this:



Note the `| b64enc`, which is a built-in function to encode strings with base64.

Service

The service at `templates/mariadb-service.yaml` for our MySQL database should look similar to this:

```yaml
{{- if .Values.database.enabled }}
apiVersion: v1
kind: Service
metadata:
  name: {{ .Release.Name }}-mariadb
  labels:
    {{- include "helm-complex-chart.labelsDatabase" . | nindent 4 }}
spec:
  ports:
    - port: 3306
      targetPort: mariadb
      protocol: TCP
      name: mariadb
  selector:
    {{- include "helm-complex-chart.selectorLabelsDatabase" . | nindent 4 }}
  clusterIP: None
{{- end }}
```

Values

Then we need to add the following to our `values.yaml` :

```yaml
database:
  enabled: true
  databaseuser: acend
  databasename: acenddb
  databasepassword: mysuperpassword123
  databaserootpassword: mysuperrootpassword123
  image:
    repository: registry.puzzle.ch/docker.io/mariadb
    pullPolicy: IfNotPresent
    tag: "10.5"
```

Install

Finally, to install the release run:

```
helm upgrade -i myapp . --namespace $USER
```

Task 6.2.5: Cleanup

If you’re happy with the result, clean up your namespace:

```
helm uninstall myapp --namespace $USER
```

6.3 Backend as a Dependency

In the previous lab we've manually added a database deployment to our awesome application. Instead of creating your own templates and deployments, we can also integrate other helm charts as dependencies. We have seen this already in lab 3 but are now going to go into more detail in this lab.

Helm Dependencies

Helm dependencies allow you to integrate other helm charts within your helm chart. It helps to reduce code duplication and to centralize certain functionality and to simply use well maintained helm charts in your deployments.

Dependencies are managed in the Chart.yaml, the dependencies itself are stored in the `charts/` directory of your chart.

In lab 3 we had a look at the wordpress chart, which has a mariadb dependency.

Conditions

Conditions can be used to enable and disable dependencies. For example, if your dev environment has a built-in memory database and only your test and prod environment use the mariadb from the dependency.

Check this link to learn more about the concept of conditions and tags.

Choosing Helm Chart as Dependencies

When adding dependencies to your helm charts there are a couple of things you should consider before doing so.

- Be aware of the fact to your helm chart is depending on something you might not have under your control.
- Make sure the helm chart you use as dependency is well maintained, updated regularly and the app version is very close to the actual version of the deployed application.
- Explore the chart, especially when using third party helm charts
  - general architecture
  - Functionality: Does the chart really implement all the features you need.
  - Security: Check the default images, do they run as root, the security context of pod and filesystem, Service accounts
  - Resource Limits and Requests
- Study default values in the values.yaml
- If the chart doesn't match your needs perfectly, consider implementing the functionality yourself.

- Reduce the number of dependencies.
- Update your dependencies regularly.

Task 6.3.1: Use the mariadb bitnami chart as dependency

Let’s now replace the mariadb backend, we’ve manually created in the previous lab with a mariadb chart dependency.

Delete the three templates from the previous lab.

- `templates/service-mariadb.yaml`
- `templates/deployment-mariadb.yaml`
- `templates/secret-mariadb.yaml`

Then we need to add the dependency to the `Chart.yaml`

```yaml
apiVersion: v2
name: mychart
description: My awesome app
type: application
version: 0.1.0
appVersion: 1.16.0
dependencies:
- condition: mariadb.enabled
  name: mariadb
  repository: https://charts.bitnami.com/bitnami
  version: 11.x.x
maintainers:
  - name: Acend user
    email: info@acend.ch
```

Since we already added the bitnami repository in lab 3 (`helm repo add bitnami https://charts.bitnami.com/bitnami`), after we added the dependency to the Chart.yaml, we can simply run

```
helm dependency build .
```

This will download the dependent chart to the `charts/` and update the `Chart.lock` file to the latest matching version according to the version defined in the `Chart.yaml` . The Chart.lock contains the exact version of the moment the dependencies were updates, and it’s use to recreate that exact version combinations. In order to update the dependency versions of the Chart.lock file you can simply run `helm dependency update` .

Next we have to add the configuration of our mariadb dependency to the `values.yaml` . Since the name of our dependency in the `Chart.yaml` is `mariadb` , the configuration of the mariadb must be defined under the mariadb root element. Let’s add the following configuration right after the database section from lab 6.2

```yaml
mariadb:
  enabled: true
  auth:
    rootPassword: mysuperrootpassword123
    database: acenddb
    username: acend
    password: mysuperpassword123
  primary:
    persistence:
      enabled: false
```

Update your deployment to match the keys in the `values.yaml` to your environment variables defined in the deployment:

After editing the files we can now install the release.

Verify the installation and check whether the new database was deployed.

> **Note**
> The whole deployment will take a while until both pods are ready and deployed.

To check if your deployment is working open the browser and enter the url of your app `https://helm-complex-chart-<namespace>-training.cluster.acend.ch` : Add some new entries and the execute following command to restart the application pod.

After the new pod is created, you can reload the website and you should still the persisted entries.

Task 6.3.2: Explore the bitnami mariadb chart

Use the `--dry-run` option or the `template` command to have a look at the new k8s resources introduced by the dependency. Explore the chart source code and have a look at alle the possible configuration options .

Task 6.3.3: Cleanup

If you’re happy with the result, clean up your namespace:

6.4 Test

Task 6.4.1: Add a test to your chart

As we learned in the previous section, Helm gives us the availability to run automated tests during the Helm deployment. Now it's time to write our first test. The test should meet the following requirements:

- Image: mariadb
- Env Variables:
  - `MYSQL_DATABASE_HOST` from secret
  - `MYSQL_DATABASE_USER` from secret
  - `MYSQL_DATABASE_PASSWORD` from secret
- Command: `mysql --host=$MYSQL_DATABASE_HOST --user=$MYSQL_DATABASE_USER --password=$MYSQL_DATABASE_PASSWORD`
- Annotation: `helm.sh/hook: test`

Open the test file `templates/tests/test-connection.yaml` and start to modify it.

Solution Task 6.4.4

To install your release run:

To run the test manually:

Then you should see following output

Task 6.4.5: Cleanup

If you're happy with the result, clean up your namespace:

6.5 Helm hooks

In the previous lab we learned how to deploy our python example application and connect it to a MariaDB. In this chapter we are going to look at a mechanism of Helm called hooks, which let's chart developers intervene / interact at certain points in a release's life cycle.

Task 6.5.1: Chart Hooks

At some point when developing helm charts we would like to interact or alter certain behaviour of our deployed resources. For example in this usecase we would like to have test data available in our database when releasing our chart. With the hook functionality of helm we can alter the life cycle and intervene at certain points. Hooks are regular templates specially annotated that causes Helm to utilize them differently. The tests used in the previous chapter are a special case of helm hooks. The following hooks are available for you to alter the behaviour of the chart:

- **pre-install**: Executes after templates are rendered, but before any resources are created in Kubernetes
- **post-install**: Executes after all resources are loaded into Kubernetes
- **pre-delete**: Executes on a deletion request before any resources are deleted from Kubernetes
- **post-delete**: Executes on a deletion request after all of the release's resources have been deleted
- **pre-upgrade**: Executes on an upgrade request after templates are rendered, but before any resources are updated
- **post-upgrade**: Executes on an upgrade request after all resources have been upgraded
- **pre-rollback**: Executes on a rollback request after templates are rendered, but before any resources are rolled back
- **post-rollback**: Executes on a rollback request after all resources have been modified
- **test**: Executes when the Helm test subcommand is invoked

Hooks are controlled and configured via kubernetes annotations. For example to configure the life cycle the hook should be hooked into we use the annotation:

```
# ...
  annotations:
    "helm.sh/hook": post-install
# ...
```

The resource can even implement multiple hooks:

```
# ...
  annotations:
    "helm.sh/hook": post-install, post-upgrade
# ...
```

When working with multiple hooks hooking into the same life cycle stage, we can alter the execution or runtime behaviour by giving them different weights with the annotation:

```
# ...
  annotations:
    "helm.sh/hook-weight": "-5"
# ...
```

Hook weights can be positive or negative numbers but must be represented as strings. When Helm starts the execution cycle of hooks of a particular Kind it will sort those hooks in ascending order.

Task 6.5.2: Example hook

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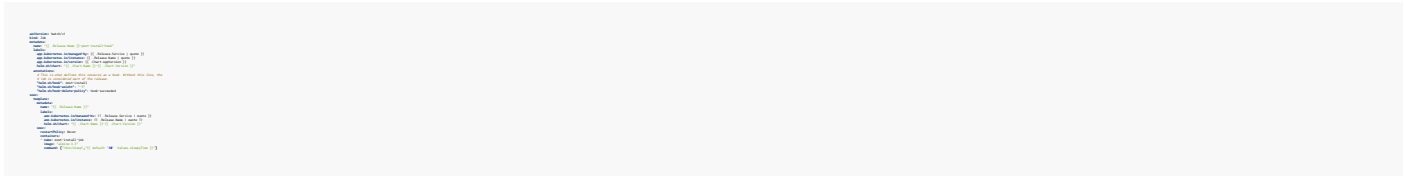
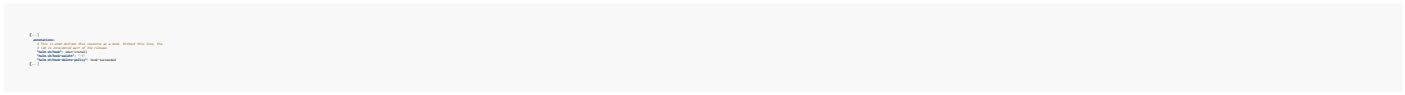
In this example we would like to populate our database with some test data before finishing our install / upgrade life cycle. We can use a helm hook to inject our logic after installing or upgrading our helm release. Create the following hook `templates/hook.yaml` :



This basic hook creates a kubernetes Job which sleeps for <.Value.sleepyTime> or 10 seconds after the installation life cycle of your helm chart.

Notice the `metadata.annotations` block which tells Helm how the hook should interact during the release's life cycle:



Let's install the release and check whether the hook was deployed. First open a second terminal and run the following command:

The output of the `kubectl get pod` command should show the deployment of the `post-install-hook` pod.

Task 6.5.3: Write your own hook

It's time to get our hands dirty! Write two hooks to alter the release's life cycle:

- Create a post-install/post-upgrade hook to create a database table `test` and populate it with data of your favor. In the example solution we create a table `test` with two fields: An autoincrement index `id` and a char field called `name` to store some strings. Ensure this job is running after the job below.
- Create a post-install/post-upgrade hook to drop the table `test` if it exists to have a clean state before releasing. Ensure this job is running before the job above.

To interact with the MariaDB deployed you can use the image `registry.puzzle.ch/docker.io/mariadb:10.5` for example. You can interact and access the database with `$ mysql --host=<hostname> --user=<username> --password=<password> --database=<database> -e <sqlCommand>` .

First Post-install / -upgrade hook:

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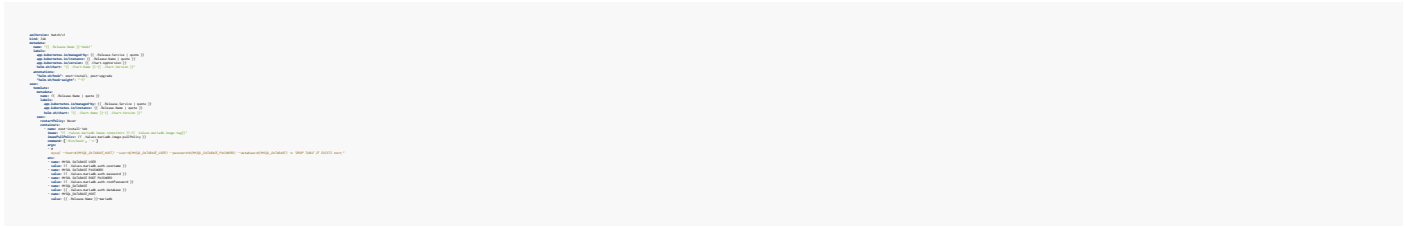
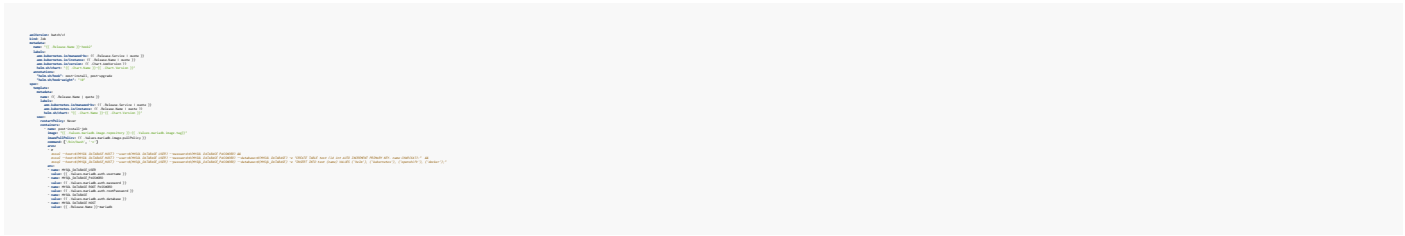


Second Post-install / -upgrade hook:



Deploy the new hooks with the following command:

Task 6.5.4: Verify your hook

When you created your hooks, install or upgrade your helm release with `helm install ...` or `helm upgrade ...`.
To verify if the data was created and persisted in the database use:


```
+----+------------+
| id | name       |
+----+------------+
|  1 | helm       |
|  2 | kubernetes |
|  3 | openshift  |
|  4 | docker     |
+----+------------+
```

Task 6.5.5: Cleanup

Uninstall the app

6.6 Deploy your Chart with different environment configurations

One of the most typical challenges when deploying an application is the handling of different deployment environments.

A typical use case is to deploy your application into a Development and Production environment. Helm is a great solution for handling this challenge. In this lab we are going to show you how to prepare your Helm releases for different environments.

Task 6.6.1 Create a devlopment release

Let us start with a new value file for the Development environment. Create a new file called `values-dev.yaml` and add following content to the file

- Set the number of replicas to `1`
- Change the Ingress configuration to match the following path schema `http://mychart-develop-<namespace>.training.cluster.acend.ch/`
- Because we don't need any persistence for the Development environment, disable the database with `database.enabled: false`

```
replicaCount: 1
ingress:
  enabled: true
  hosts:
    - host: mychart-develop-<namespace>.training.cluster.acend.ch
      paths:
        - path: /
          pathType: ImplementationSpecific
  tls: []
database:
  enabled: false
```

You can specify the '–values'/'-f' flag multiple times. The priority will be given to the last (right-most) file specified. For example, if both myvalues.yaml and override.yaml contained a key called 'Test', the value set in override.yaml would take precedence.

Now install the development release with the following command. First pass the `values.yaml` file which contains all the default values. Then pass the `values-dev.yaml` as second file argument. So the `values-dev.yaml` will overwrite the default Chart values.

```
helm upgrade -i mypgchart  -f values.yaml -f values-dev.yaml --namespace NAME
```

Task 6.6.2 Create a production release

Create for the Production environment e new value files named `values-prod.yaml` and add the following settings to the file

- Due to the higher load in our production environment, we change the number of replicas to `3`
- For production usage we also want to persist the data. To enable the database set `database.enabled` to `true`
- Change the database user under `database.databaseuser` to `acend-prod`
- As a best practice, never use the same password in different environemnts. Change the password under `database.databasename`
- Change the Ingress configuration to match the following path schema `mychart-production-<namespace>.training.cluster.acend.ch`

Task 6.6.3 Solution

The `values-prod.yaml` should look as follow:

```
replicaCount: 3

canary:
  enabled: true
  ingress:
    host: myrent-production-<namespace>.training.cluster.acend.ch
    path:
      - /
    pathType: ImplementationSpecific
  hpa: {}

database:
  enabled: true
  username: postgres
  databaseName: acendmrent
```

Install the production release with the following command. Again pass first the default values with `-f values-yaml` and then the production values with `-d values-prod.yaml`

```
helm upgrade -i myapprent . -f values.yaml -f values-prod.yaml --namespace k123
```

Task 6.6.8: Clean up

Uninstall the app

```
helm uninstall myapprent --namespace k123
helm uninstall myapp-mc --namespace k123
```

6.7 Optional: Publish your chart

In this lab we will learn how to publish our Helm chart and make it accessible to the public by using GitHub pages.

> **Note**
> To work through this lab, you need a personal GitHub account. See Hosting chart repositories for a lot of different strategies how to serve a Helm repository.

GitHub pages provides an easy way to expose static files over HTTP(S) to the public. Everyone with a GitHub account can use this feature. The files to expose must be located in the `docs/` subdirectory or on a separate branch which can be configured in the repository settings.

Task 67.1: Linting your chart

Linting the Helm chart and fix the errors before packaging and publishing is a good practice:

```
helm lint ./mychart
```

The linter recommends to add an icon to the chart. We can safely ignore this hint :)

```
==> Linting mychart
[INFO] Chart.yaml: icon is recommended

1 chart(s) linted, 0 chart(s) failed
```

Task 67.2: Package your chart

Helm chart packages are compressed `tgz` archives. Use the `helm package` command to create such an archive:

```
mkdir docs && helm package -d docs ./mychart
```

This will create an archive with the name `mychart-0.1.0.tgz` inside the `docs` directory. The chart version is defined in `Chart.yaml` and will be appended to the filename.

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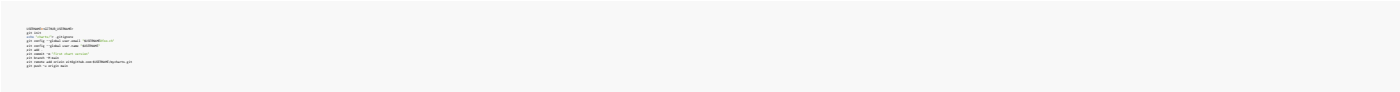
```
❯ tree
.
├── docs
│   └── mychart-0.1.0.tgz
└── mychart
    ├── Chart.yaml
    ├── charts
    ├── templates
    │   ├── deployment-mariadb.yaml
    │   ├── deployment.yaml
    │   ├── _helpers.tpl
    │   ├── hpa.yaml
    │   ├── ingress.yaml
    │   ├── NOTES.txt
    │   ├── secret.yaml
    │   ├── serviceaccount.yaml
    │   ├── service.yaml
    │   └── tests
    │       └── test-connection.yaml
    └── values.yaml
```

Task 67.3: Create a new Github Repository

We will use GitHub pages to publish our packages and make them accessible to the public.

Replace `<GITHUB_USERNAME>` with your personal GitHub account.



> **Note**
> If you want to access your Git repository over HTTPS use the following url pattern for the origin
> `https://github.com/$USERNAME/mycharts.git`

Task 67.4: Activate GitHub Pages

On the GitHub website navigate to `Settings -> Pages` of your newly created repository `mycharts`. Select the `main` branch and `/docs` repository and click *Save*.

You will see a message with the URL under which the Chart repository will be exposed:

```
https://<GITHUB_USERNAME>.github.io/mycharts/
```

Task 67.5: Create an index file

The Helm repository must provide an `index.yaml` file which list all contained packages and provide some metadata about them. Create an index file inside the `docs` directory. Replace `<GITHUB_USERNAME>` with your personal GitHub account.

This creates an index file with the following content:

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```yaml
apiVersion: v1
entries:
  mychart:
  - apiVersion: v2
    appVersion: 1.16.0
    created: "2021-09-02T10:05:54.135132319+02:00"
    description: A Helm chart for Kubernetes
    digest: 43745683f4e51e95524042f96de0072d798473a63a6e1f0d116c60ac7ef784f3
    maintainers:
    - email: john@doe.org
      name: John Doe
    name: mychart
    type: application
    urls:
    - https://johndoe.github.io/mycharts/mychart-0.1.0.tgz
    version: 0.1.0
generated: "2021-09-02T10:05:54.134536373+02:00"
```

Task 67.6 Verifying your repository

Register your GitHub pages as a new Helm repository:

```
USERNAME=<GITHUB_USERNAME>
helm repo add mycharts https://$USERNAME.github.io/mycharts/
```

Verify that your published chart is found by Helm:

```
helm repo update
helm search repo mycharts/mychart
```

You should the the following output:

```
NAME                CHART VERSION   APP VERSION     DESCRIPTION
mycharts/mychart    0.1.0           1.16.0          A Helm chart for Kubernetes
```

Task 67.7 Installing chart from repository

When your newly created repository is successfully registered you can install the published chart with the following command:

```
helm upgrade -i myapp-from-repo mycharts/mychart
```

Task 67.8: Clean up

Uninstall the app

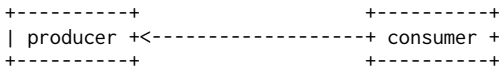
```
helm uninstall myapp-from-repo
```

The repository can be removed by using

```
helm repo remove mycharts
```

Optional: 7. Create your own chart

In this section were going to show you how to modify a Helm chart from an existing Kubernetes deployment. To provide you an easy entry point, we have already prepared a Helm chart skeleton. This chart contains all necessary template files. With this chart, we want to deploy two java microservices, one which produces random data when it's REST interface is called. The other microservice consumes then the data and exposes it to its endpoint.



Imagine you're being a java development team embracing the DevOps culture and your job is to deploy the two services you designed to your Kubernetes cluster.

Task 7.1: Get the chart skeleton

Clone the repository we have prepared for you containing all the needed template files to get you started.

```
git clone https://github.com/puzzle/helm-basic-chart.git
```

After cloning the chart you have following structure:

```
.
├── Readme.md
└── helm-basic-chart
    ├── Chart.yaml
    ├── templates
    │   ├── _helpers.tpl
    │   ├── consumer-deployment.yaml
    │   ├── consumer-ingress.yaml
    │   ├── consumer-service.yaml
    │   ├── producer-deployment.yaml
    │   ├── producer-ingress.yaml
    │   ├── producer-service.yaml
    │   └── tests
    │       └── test-connection.yaml
    └── values.yaml
```

The template files are always prefixed with the according application (e.g. `consumer-deployment.yaml` and `producer-deployment.yaml`) and suffixed with the resource they represent. This is a best approach we like to follow in order to keep our files ordered by the applications and for readability purposes.

The setup is quite simple here, for each application we have a deployment, a service and an ingress. If you inspect the files in the folder you will realize that we have a lot of hard coded properties we maybe would like to change in order to bring the applications to multiple environments.

7.1 Refactor 1

Task 7.1.1: Make the Ingress resource more configurable

After cloning the repository and inspecting the templates already created for you, you will notice some potential for improvement. For example the hostname of the applications should not be hard-coded. When deploying to multiple environments you will run into conflicts.

Modify the **consumer and producer** ingress templates and extract following variables to make them configurable:

- Extract `.spec.rules.host` as value
- Extract `.spec.tls.hosts[0]` as value, use the same value as above

> **Note**
>
> If you want to test the chart locally you can execute following command
>
> ```
> helm template -s templates/consumer-ingress.yaml ./helm-basic-chart --debug | cat -n -
> ```

First let us define the new variables in our `values.yaml` file. Replace `<username>` with your username

```
producer:
  host: producer-<username>.labapp.acend.ch

consumer:
  tag: latest
  host: consumer-<username>.labapp.acend.ch
```

Next replace the hard coded values for the host value in our `consumer-ingress.yaml` file.

```
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  annotations:
    kubernetes.io/tls-acme: "true"
  labels:
    app: {{ include "helm-basic-chart.fullname" . }}-consumer
  name: {{ include "helm-basic-chart.fullname" . }}-consumer
spec:
  rules:
    - host: {{ .Values.consumer.host }}
      http:
        paths:
          - backend:
              service:
                name: {{ include "helm-basic-chart.fullname" . }}-consumer
                port:
                  number: 8080
            path: /
            pathType: ImplementationSpecific
  tls:
    - hosts:
        - {{ .Values.consumer.host }}
      secretName: consumer-labapp-acend-ch
```

Replace the same value in our `producer-ingress.yaml` file.

```
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  annotations:
    kubernetes.io/tls-acme: "true"
  labels:
    app: {{ include "helm-basic-chart.fullname" . }}-producer
  name: {{ include "helm-basic-chart.fullname" . }}-producer
spec:
  rules:
    - host: {{ .Values.producer.host }}
      http:
        paths:
          - backend:
              service:
                name: {{ include "helm-basic-chart.fullname" . }}-producer
                port:
                  number: 8080
            path: /
            pathType: ImplementationSpecific
  tls:
    - hosts:
        - {{ .Values.producer.host }}
      secretName: producer-labapp-acend-ch
```

Afterwards we can install our Helm Chart with following command.

```
helm upgrade -i myrelease --namespace $USER ./helm-basic-chart
```

Verify your deployment! Check if your pods are running and healthy!

```
kubectl get pods
```

This should return something like this:

```
kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
data-consumer-7686976d88-2wbh5      1/1     Running   0          72s
data-producer-786d6bb688-qpg4c      1/1     Running   0          72s
```

Pay attention to the `1/1` status in the ready section! After checking if our pods are ready and therefore will accept traffic from the service, check if the application is running correctly:

Both applications (data-producer and data-consumer) you just deployed expose an endpoint `/data` which will return a random double data json. Try to verify if your deployment is running correctly by using curl.

If you are struggling with curl you can use the following syntax:

When the problem will be a redirect or certificate problem, try the flags `-L` and `-k` to mitigate the error.

If your application returns the data point when consuming the consumers `/data` endpoint, then both applications work.

Task 7.1.2: Make the deployments more configurable

Not just the ingresses could use some improvements. Also the deployments could be more configurable. In order to keep up to date with the current requirements your task is to adapt the following things:

Producer Deployment:

- Extract the image tag from the `.spec.containers[0].image` on Line 22 field as value
- Extract the `.spec.containers[0].resources` block from line 51 as value `consumer.resources` . Make use of the `toYaml` and the `nindent` function.
- Extract the `.spec.containers[0].env["QUARKUS_LOG_LEVEL"]` on line 26 block as value

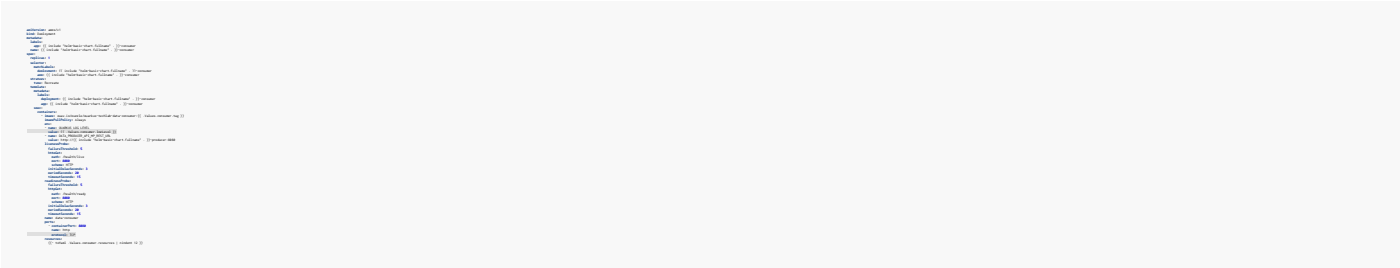
Consumer Deployment:

- Extract the `.spec.containers[0].resources` block from line 51 as value `producer.resources` . Make use of the `toYaml` and the `nindent` function.
- Extract the `.spec.containers[0].env["QUARKUS_LOG_LEVEL"]` on line 26 block as value `producer.logLevel`

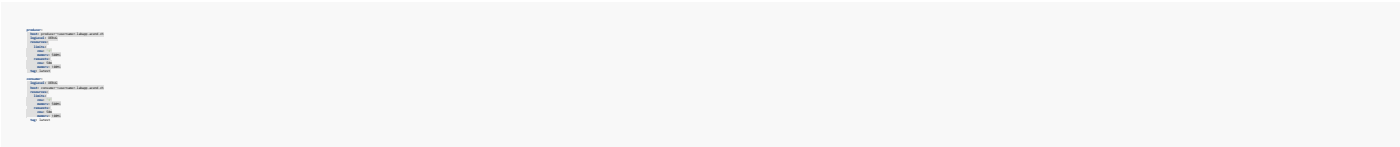
> **Note**
> Take a look at the official Helm documentation for a list of built in functions.
>
> Built In Helm functions

producer-deployment.yaml

consumer-deployment.yaml



values.yaml



Task 7.1.3: Upgrade the chart

Execute following command to update our helm release.

Finally, you can visit your application with the URL provided from the Route: `https://consumer-<username>.training.cluster.acend.ch/data`

Replace **<username>** with your username or get the URL from your route.

Or you could access the `data` endpoint using curl:

When you open the URL you should see the producers data

```
{"data":{"BACKENDADDRESS":
```

If you only see `Your new Cloud-Native application is ready!` , then you forgot to append the `/data` path to the URL.

Task 7.1.4: Prepare another release

At this point we have a configurable Helm chart and a running release. Next we gonna use the cart for another release. We consider to release it into a production environment. therefore we have to adjust some values. First copy the existing `values.yaml` to `values-production.yaml` .

```
├── helm
│   ├── Chart.yaml
│   ├── charts
│   ├── templates
│   │   ├── _helpers.tpl
│   │   ├── consumer-deployment.yaml
│   │   ├── consumer-ingress.yaml
│   │   ├── consumer-service.yaml
│   │   ├── producer-deployment.yaml
│   │   ├── producer-ingress.yaml
│   │   └── producer-service.yaml
│   ├── values-production.yaml
│   └── values.yaml
```

Open the `values-production.yaml` and change following values.

- Debug log level is too high in a production environment, change it to `INFO`
- The resource requirements are usually higher in a production environment than in a development environment. Increase the Memory Limits to `750Mi`
- To avoid DNS collisions we need to chang the host to, change it to `producer-<username>-prod.training.cluster.acend.ch` and `consumer-<username>-prod.training.cluster.acend.ch`

values-production.yaml

```
producer:
  ingress:
    hosts:
      - host: producer-<username>-prod.training.cluster.acend.ch
        path: /data
  resources:
    limits:
      memory: 750Mi
    requests:
      memory: 50Mi
      cpu: 100m
  log:
    level: INFO
consumer:
  backend: INFO
  ingress:
    hosts:
      - host: consumer-<username>-prod.training.cluster.acend.ch
        path: /data
  resources:
    limits:
      memory: 750Mi
    requests:
      memory: 50Mi
      cpu: 100m
  log:
    level: INFO
```

Task 7.1.6: Install and verify production release

Now we have prepared our values file for the production environment. Next we can install the chart again, but with a different name and different values. Execute the Helm install command and pass the new created production values as parameter.

```
helm upgrade -i myrelease-prod --values values-production.yaml --namespace $USER ./helm/basic-chart
```

Use the helm list command to list all releases in your namespace

```
helm ls --namespace $USER
```

You should see following output with de development and the production release

```
NAME            NAMESPACE       REVISION        UPDATED                                 STATUS          CHART
                 APP VERSION
myrelease       default         1               2022-05-19 13:26:56.278026261 +0200 CEST        deployed        helm-ba
sic-chart-0.1.0  1.16.0
myrelease-prod  default         1               2022-05-19 13:26:36.570013792 +0200 CEST        deployed        helm-ba
sic-chart-0.1.0  1.16.0
```

Task 7.1.7: Cleanup

7.2 Refactor 2

If you take a closer look at your Chart you will still recognize some weak spots. For example the producer and consumer will look like a lot of code duplication. We don't like code duplication at all! The only big difference is the `"consumer"` or `"producer"` pre- or suffixed everywhere.

Just for fun: How much lines of code are actually different?

```
bc -l <<< "$(diff -U0 templates/consumer-deployment.yaml templates/producer-deployment.yaml | wc -l)"/2
```

When considering the differences and how they affect the service, we can easily see the flaw of this Chart. The entire Chart is a duplication. Both services could use the same Chart and just be two instances / releases!

There are now two possibilities achieving the reduction of code duplication here: instantiation or composition.

7.2.1 Instantiate the Chart two times

The idea is simple: Instead of having a Chart consisting of two deployments, two services and two ingresses, reduce all resources to one! Eliminate the specifics in the variable names (if you like), if you're lazy you can just remove half of the Chart and continue.

Template files

Start of by removing all the resources for the one of the two services and rename them by removing the prefix "producer" or "consumer". After doing so, your Chart's structure should look something like this:

```
$ tree
.
├── helm-basic-chart
│   ├── Chart.yaml
│   ├── templates
│   │   ├── deployment.yaml
│   │   ├── _helpers.tpl
│   │   ├── ingress.yaml
│   │   ├── service.yaml
│   │   └── tests
│   │       └── test-connection.yaml
│   └── values.yaml
└── Readme.md
```

Values

Update your variables by removing top most yaml-object "consumer" or "producer". So there is only one configuration for one service left in your `values.yaml` file. Add another value called `serviceName` to your `values.yaml` .

Your `values.yaml` should look like this (might differ if you deleted the consumer or producer part):

```yaml
# values.yaml

host: consumer-<username>.training.cluster.acend.ch
image:
  name: quay.io/puzzle/quarkus-techlab-data-consumer
  tag: latest
logLevel: INFO
resources:
  limits:
    cpu: '1'
    memory: 750Mi
  requests:
    cpu: 50m
    memory: 100Mi
serviceName:
producerServiceName:
```

Deployment

Update your deployment, service and ingress and edit the values accordingly. So your `{{ .Values.producer.image.tag }}` will become `{{ .Values.image.tag }}` .

Change the hard-coded occurrences of `data-producer` or `data-consumer` in your templates to `{{ .Values.serviceName }}`. If you fancy you can remove the suffixes `-producer` or `-consumer` in your templates as well.

deployment.yaml:

Service

service.yaml:

Ingress

ingress.yaml:

Task 7.2.2 Install release

Install the release with the configuration for the producer. As we learned in previous chapters, we can overwrite values from the `values.yaml` with the help of the `--set variable=value` parameter of the helm-cli. Overwrite the values for the producer like the following:

- `host`: `producer-<username>.training.cluster.acend.ch`
- `image.name`: `quay.io/puzzle/quarkus-techlab-data-producer`
- `serviceName`: `producer`

Call the release data-producer and install it!

After you installed the producer service you can verify the deployment if you'd like to be sure you did everything right!

Let's do the same thing and deploy the consuming service accordingly. Overwrite the following values for

the data-consumer microservice:

- `host` : `consumer-<username>.training.cluster.acend.ch`
- `image.name` : `puzzle/quarkus-techlab-data-consumer`
- `serviceName` : `data-consumer`
- `producerServiceName` : `producer-helm-basic-chart-producer`

```
helm upgrade -i consumer helm-basic-chart/ --set fullnameOverride="consumer-training.cluster.acend.ch" --set image.name=quay.io/puzzle/quarkus-techlab-data-consumer --set serviceName=data-consumer --set producerServiceName=producer-helm-basic-chart-producer
```

At the end, verify your two releases again and test if they are still delivering data as they did before!

```
curl -kL $(kubectl get ingress -o=jsonpath='{.items[?(@.metadata.name=="consumer")].spec.rules[0].host}')/data
[{"name":"A small Banana"}]
```

Task 7.2.3 Clean up

Uninstall the two releases again to have a fresh ground for the second option!

```
helm uninstall producer
helm uninstall consumer
```

7.3 Composition

Instead of instantiating the Chart two times manually by hand, we can also define a composition of two Charts in a single Chart. In other 2words we create a new Helm Chart and add the Chart we just wrote twice as a dependency to the chart.

In Helm we can make a composition of already existing Charts and own templates and define it as a new Chart. This is a very common use case if we mix self created resources with own templated resources.

How do we achieve this? Maybe first a bit of theoretical input:

We can declare dependencies in the `Chart.yaml` like the following:

```
# Chart.yaml
dependencies:
  - name: memcached
    version: "1.1.*"
    repository: "https://another.example.com/charts"
  - name: nginx
    version: "1.2.3"
    repository: "file:///../dependency_charts/nginx"
  - name: helm-basic-chart
    alias: chart1
    alias: chart2
```

In the example above we can see the `dependency` block of the `Chart.yaml` . We define three dependencies in the Chart and add `memcached` , `nginx` and `helm-basic-chart` as a dependency. As you can see the syntax varies a bit, let’s check it for a second:

- `name` : The ’name’ should be the name of a chart, where that name must match the name in that chart’s ‘Chart.yaml’ file
- `version` : The ‘version’ field should contain a semantic version or version range
- `repository` : The ‘repository’ URL should point to a Chart Repository or to a Chart in your local filesystem
- `alias` : The ‘alias’ of a dependency (this is very handy to import the same Chart twice)

If we add a dependency without the repository defined, Helm will try to find the defined dependency in either your added repositories or the `/charts` directory in your Chart’s directory.

So let’s get some work done!

Task 7.3.1 Create a new Chart

Create a new Chart `parent` and empty the templates folder, since we don’t need any additional templates in the Chart other than the dependencies.

```
helm create parent
rm -rf parent/templates/*
```

Task 7.3.2 Copy the dependecies

Duplicate the Chart we created in the section before. Copy the duplicated Chart from the section before into your new Chart’s `/charts` directory.

Your new Chart’s structure should look like this:

```
$ tree parent/
parent/
├── Chart.yaml
├── charts
│   └── helm-basic-chart
│       ├── Chart.yaml
│       ├── templates
│       │   ├── _helpers.tpl
│       │   ├── deployment.yaml
│       │   ├── service.yaml
│       │   └── service.yaml
│       │       tests
│       │           └── test-connection.yaml
│       └── values.yaml
└── templates
    └── values.yaml
```

Task 7.3.3 Add the chart as dependency

Add two new dependencies to your `parent` Chart's dependencies with the aliases `producer` and `consumer`. Since we have the `helm-basic-chart` (or the name you chose in the dependency) in the local `/charts` directory, we don't need to add any `repository` in the dependency definition.

```yaml
# Chart.yaml

apiVersion: v2
name: parent
description: A Helm chart for Kubernetes
type: application
version: 0.1.0
appVersion: "1.16.0"
dependencies:
- name: helm-basic-chart
  version: "0.1.0"
  alias: producer
- name: helm-basic-chart
  version: "0.1.0"
  alias: consumer
```

Task 7.3.4 Configure the values

When we add dependencies to your Helm Charts we can configure them in the parent's `values.yaml`. We can override configuration of dependencies in a parent chart by adding configuration in the `values.yaml` prefixed by the dependencies name or alias. For example if we have a dependency `nginx` in your `Chart.yaml` we can override the configuration of the nginx's `url` property like the following:

```yaml
# parent/values.yaml
nginx:
    url: samplehost
```

It is your task to configure the two dependencies so they will work just as they worked before!

In our example we added two dependencies: `consumer` and `producer`. We can define two blocks of configuration in the parent's `Chart.yaml`:

```yaml
# parent/values.yaml

consumer:
  # Consumer's config

producer:
  # Producer's config
```

```yaml
consumer:
  host: consumer-<username>.training.cluster.acend.ch
  image:
    name: quay.io/puzzle/quarkus-techlab-data-consumer
    tag: latest
  logLevel: INFO
  resources:
    limits:
      cpu: '1'
      memory: 750Mi
    requests:
      cpu: 50m
      memory: 100Mi
  serviceName: consumer
  producerServiceName: producer-helm-basic-chart-producer

producer:
  host: producer-<username>.training.cluster.acend.ch
  image:
    name: quay.io/puzzle/quarkus-techlab-data-producer
    tag: latest
  logLevel: INFO
  resources:
    limits:
      cpu: '1'
      memory: 750Mi
    requests:
      cpu: 50m
      memory: 100Mi
  serviceName: producer
```

Task 7.3.5 Install the release

Install a Helm Chart release `myrelease` and verify if the two services are running correctly!

```
helm upgrade -i myrelease parent/.
```

Task 7.3.5 Verify the release

```
curl -kL $(kubectl get ingress <releasename>-consumer --template="{{(index .spec.rules 0).host}}")/data
{"data":0.4145158804475594}
```

Task 7.3.6 Clean up

Congratulations! You succeeded in the Chapter and the only thing left is to do some cleanup afterwards!

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Remove all the installed objects installed during the chapter!