
narrenschiff

Release 3.4.1

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Sep 03, 2021

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1.1 Introduction

`narrenschiff` is a configuration management tool for Kubernetes inspired by Ansible. It can be used to easily source control your manifests, deployment workflows, and to encrypt secrets. In addition to encrypting secrets, it can also encrypt whole configuration files. In essence, it is a wrapper around various tools (e.g. `helm`, and `kubectl`). All tools are executed locally on the host OS.

1.1.1 Requirements

- Python 3.6 or higher
- `kubectl` v1.20 or higher
- `helm` v3.0 or higher
- `gcloud` 343.0.0 or higher

1.1.2 Installation

You can easily install it with `pip`:

```
pip install narrenschiff
```

We advise you to install it in `virtualenv`.

1.1.3 Quickstart

To install `Narrenschiff` in `virtualenv` execute:

```
$ mkdir infrastructure && cd infrastructure
$ git init
$ python3 -m venv env && echo 'env' > .gitignore
$ . env/bin/activate
$ pip install narrenschiff
```

Initialize a course project, and encrypt a treasure:

```
$ narrenschiff dock --autogenerate --location postgres/
$ narrenschiff chest stash --treasure postgresPassword --value "Password123!" --location_
postgres/
```

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Create a template for Secret Kubernetes resource, using encrypted treasure:

```
$ mkdir postgres/files/
$ cat > postgres/files/secret.yaml << EOF
---
apiVersion: v1
kind: Secret
type: Opaque
metadata:
  name: postgres
data:
  POSTGRES_PASSWORD: "{{ postgresPassword | b64enc }}"
EOF
```

Create a course:

```
$ cat > postgres/course.yaml << EOF
---
- name: Add secret to default namespace
  kubect1:
    command: apply
    args:
      filename:
        - secret.yaml
    namespace: "default"
EOF
```

Deploy:

```
$ narrenschiff sail --set-course postgres/course.yaml
```

That's it! Secret is now deployed to your cluster. Head over to [General Overview](#) to get familiar with Narrenschiff terminology, or to [Getting Started](#) to learn how to make your first project.

1.2 General Overview

Basic unit of narrenschiff is a course i.e. file or group of files storing tasks that are to be performed in sequential order. course is YAML file e.g.:

```
- name: Deploy config map
  kubect1:
    command: apply
    args:
      filename: "configmap.yaml"
- name: Apply namespaces and RBAC settings
  kubect1:
    command: apply
    args:
      filename:
```

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- namespaces.yaml # filenames are referenced relative to files/ dir
- rbac.yaml

Each YAML file in the project is treated as a template file i.e. each course can have template variables. Template language that is powering Narrenschiff is Jinja2.

File paths are referenced relative to the `files/` directory in the *course project* root. `files/` is reserved for Jinja2 templates of Kubernetes manifests.

The basic directory layout should resemble something like this:

```

infrastructure/ <-- root project (all commands are executed from here)
├── .narrenschiff.yaml <-- root project configuration
├── webapp <-- course project
│   ├── files <-- Templates for you manifest files
│   │   ├── app
│   │   │   ├── configmap.yaml
│   │   │   └── deployment.yaml
│   │   ├── db
│   │   │   ├── deployment.yaml
│   │   │   └── secret.yaml
│   │   ├── namespaces.yaml
│   │   └── rbac.yaml
│   ├── chest <-- directory with arbitrary nesting may be used in addition to chest.yaml
│   │   ├── database.yaml
│   │   └── secrets.yaml
│   ├── vars <-- directory with arbitrary nesting may be used in addition to vars.yaml
│   │   ├── common.yaml
│   │   ├── domains.yaml
│   │   ├── apps
│   │   │   └── prod.yml
│   ├── overrides <-- encrypted helm values.yaml overrides i.e. secretmaps
│   │   └── values.yaml
│   ├── tasks.yaml <-- course file describing the deployment process
│   ├── secretmap.yaml <-- paths to encrypted files
│   ├── chest.yaml <-- encrypted variables
│   └── vars.yaml <-- cleartext variables

```

`files/` directory is a directory reserved for your Kubernetes manifests. With narrenschiff you can use Jinja2 templating language to inject variables into the manifests.

You can use `vars.yaml` and `chest.yaml` to define variables for you project. `vars.yaml` or `vars/` directory contains unencrypted variables. `chest.yaml` or `chest/` directory is a place to stash your *treasures* (i.e. keys, secrets, passwords, etc.). Both `vars/` and `chest/` directories can have arbitrary nesting and files within them can have arbitrary names. However, all variable names contained across these files **must** be unique! All boolean values must be quoted.

You can also encrypt files and commit them to your source code safely. Files are encrypted, and stored at desired location, and relative paths to the files are saved in `secretmap.yaml`. For example, when you deploy a Helm chart, it is often common to override default `values.yaml`. However, this is unencrypted file which can be used to configure secrets. You can stash your `values.yaml` override as a secretmap, and commit it to the source code without any worry of passwords and secrets leaking.

Chest files have flat dictionary structure. No nesting of the keys is allowed:

```
dbPassword: 6Wziywgso3YsosQNfMeufodDZxEa0yuJHM+ch9Pxe5u1u2Z05e7G9bP0hEIVYo8n
hashKey: uSn/rKMdbMArR0SnWcbtP1Z64/Y8LI8LNOZGbVZUmm5ioFLV/NwP60cyTNGgMSGi
```

The app is deployed as:

```
$ narrenschiff sail --set-course webapp/tasks.yaml
```

After you execute this, the following happens:

1. All variables from `vars` files, `chests`, and `secretmaps` are collected (only those files that are contained within the course project are used - course project is the directory in which the executed course is located)
 1. Load `vars.yaml`
 2. Load all files from the `vars/` directory if it exists
 3. Load and decrypt all variables from `chest.yaml`
 4. Load all files from the `chest/` directory if it exists
 5. Load all variables from `secretmap.yaml`
 6. Merge all files
2. Variables are checked for duplicates, if there are any, the ship cannot take this course
3. Course file is supplied with collected variables and executed
4. Tasks are executed in sequential order, each YAML file is supplied with collected variables, and `secretmaps` are decrypted

You can either use `chest.yaml` or `chest.yml` file per *course project*, but not both. Choose one extension, and stick to it. A *course project* is a directory where course file is located.

Treasure is encrypted using password (key) and salt (spice). These are stored in simple text files. The root of the project must contain the `.narrenschiff.yaml` configuration file that stores paths to these files. Keep in mind that while `.narrenschiff.yaml` should be source controlled, password and salt file should never be committed to your repo! Here is the example of the configuration file:

```
# .narrenschiff.yaml
key: ~/.infrastructure/password.txt # path to file containing password for encrypting
↳files
spice: ~/.infrastructure/salt.txt # path to file containing salt (salt should be random
↳and long)
```

If you have a fairly complex course, and you want to execute only a specific set of tasks, you can use *beacons*:

```
- name: List all namespaces
  kubect1:
    command: get namespaces

- name: List all pods
  kubect1:
    command: get pods
  beacons:
    - always
    - pods

- name: Check pod resources
```

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```

kubect1:
  command: top pods
beacons:
  - stats
  - pods
- name: Check node resources
kubect1:
  command: top nodes
beacons:
  - stats

```

Now you can easily select which collection of tasks you want to execute:

```
narrenschiff sail --set-course stats.yaml --follow-beacons stats,pods
```

Note that `always` is a special keyword for beacons! Tasks marked with `always` are always executed, regardless of the beacons you specified on the command line.

1.2.1 Glossary

course Templated YAML file containing list of tasks to be performed.

course project Directory in which the main course is located. This directory also contains `vars.yaml`, `chest.yaml`, `secretmap.yaml`, and other files needed to run the course.

treasure Sensitive information, keys, secrets, and passwords are stored

chest File or files in which your treasure is stored.

key Master password for encrypting strings

spice Salt used for encrypting strings

secretmap Encrypted file (currently only supported for `helm` module)

1.3 Getting Started

This guide will lead you from set up of a project to deployment of a service. You can follow this guide using a custom namespace in your existing cluster or, better yet, using Minikube. You need to have `kubect1` installed in order for `narrenschiff` to work. **Everything you write using `narrenschiff` will be executed locally** on the host operating system (just as you would execute `kubect1` or `helm` locally).

1.3.1 Before you Start

We advise you to test this tool using Minikube. This section will briefly cover how to setup and use Minikube, and how to switch between contexts (i.e. clusters).

Execute following comands in order to install Minikube:

```
curl -Lo minikube https://storage.googleapis.com/minikube/releases/latest/minikube-linux-  
↪amd64  
sudo cp minikube /usr/local/bin/minikube  
sudo chmod +x /usr/local/bin/minikube
```

When starting Minikube `kubectl` should automatically change contexts (i.e. the cluster the `kubectl` is associated with). You can check the current context with:

```
kubectl config current-context
```

And you can switch to your context with:

```
kubectl config use-context <CONTEXT_NAME>
```

Start Minikube with:

```
minikube start --driver=docker
```

You can stop and delete cluster with:

```
minikube stop  
minikube delete
```

1.3.2 Setting up a Project

There are two ways to start a project. Manually, and using a built in `narrenschiff dock` command. We advise you to set your projects manually. If this is your first time you are using `narrenschiff`, please review the following section, as it describes the fundamental anatomy of a project.

Manually

Start managing your infrastructure by first laying out a basic directory structure:

```
mkdir infrastructure  
cd infrastructure  
git init  
pipenv python --three  
pipenv install narrenschiff  
mkdir project  
touch project/course.yaml  
touch project/vars.yaml  
touch project/chest.yaml  
touch project/secretmap.yaml  
touch .narrenschiff.yaml
```

All course projects will be managed in subdirectories of `infrastructure/` (consider this to be your *main project*). In the root of your infrastructure repo you need to place a `.narrenschiff.yaml` configuration file. This configuration file contains password (key) and salt (spice) that are used to encrypt all files and strings across all of your course projects.

Each course project needs to contain special files that are used to store cleartext and cyphertext variables. These are:

- `vars.yaml` - Used to store variables in cleartext
- `chest.yaml` - Used to store encrypted variables
- `secretmap.yaml` - Used to store paths to encrypted files

All variables contained in these files are injected in your templates when you start deploying with narrenschiff. There is one rule that you need to remember: **no duplicates are allowed!** See [Vars Files](#) for detailed explanation.

Last file that needs to be explained is `course.yaml`. The name of this file can be arbitrary, and you can have multiple of these. This is actually the file which contains configuration, deployment, and other instructions. In essence a `course` is the most basic unit of narrenschiff. `course` files are YAML files that contain list of tasks to be performed written using a special syntax. Consequently, the project which contains `course` files, is called a *course project*. In this example a course project is `project/`.

narrenschiff dock

You can easily start a project using `narrenschiff dock`. It is advisable to run `narrenschiff` from `virtualenv`. For this example, we'll use `pipenv` but you can use any other dependency management too:

```
mkdir infrastructure
cd infrastructure
git init
pipenv python --three
pipenv install narrenschiff
pipenv shell
narrenschiff dock --location project --autogenerate
```

This will create a *course project* on path `project/`. `--autogenerate` flag will generate *key* and *spice* for the project (in the home directory of the user), and add them to `.narrenschiff.yaml`.

1.3.3 Configuring a Project

Configuration of a project is fairly simple. You only need to setup `.narrenschiff.yaml` and accompanying files for *key* and *spice*. If you've used `narrenschiff dock` this should already be done for you. However, when you're setting up a main project manually, you'll have to do this step manually too.

Key and *spice* must not be committed into your source code! Store them somewhere else. They are usually stored in the home directory of a user executing `narrenschiff`:

```
mkdir ~/.infrastructure
cd ~/.infrastructure
head -c 30 /dev/urandom | base64 > password.txt
head -c 30 /dev/urandom | base64 > salt.txt
```

Now you can update your configuration file:

```
# Paste this into your .narrenschiff.yaml configuration file
key: ~/.infrastructure/password.txt
spice: ~/.infrastructure/salt.txt
```

1.3.4 Deploying Your First Service

As an example, we will deploy PostgreSQL. Typically, you deploy database as `StatefulSet`, however in this example we will stick to simple `Deployment`, just to make our life easier. Execute this commands from your *main project*:

```
mkdir -p postgres/files
touch postgres/course.yaml
touch postgres/vars.yaml
touch postgres/chest.yaml
touch postgres/secretmap.yaml
touch postgres/files/deployment.yaml
touch postgres/files/secret.yaml
touch postgres/files/configmap.yaml
```

The way you would usually run postgres in a docker is like so:

```
docker run --name postgres \
-e POSTGRES_USER=user \
-e POSTGRES_PASSWORD=password \
-e POSTGRES_DB=db \
-d postgres:latest
```

When translating this to Kubernetes manifests, we obviously need to split this into several resources: `Deployment` (for the container itself), `ConfigMap` (for database name and user name), and `Secret` (for password). We will place all these manifests in `files/` directory in the *course project*. In narrenschiff, `files/` within a *course project* is reserved for Kubernetes manifests. You can write these configuration using Jinja2 templating language, and narrenschiff will inject variables from vars files into the manifests.

Let's write Kubernetes manifests. `ConfigMap` is straightforward:

```
# postgres/files/configmap.yaml
---
apiVersion: v1
kind: ConfigMap
metadata:
  name: postgres
  labels:
    app: postgres
data:
  POSTGRES_USER: user
  POSTGRES_DB: db
```

Nothing new here. However, for the secret, we want to utilize encryption. Normally, secrets in Kubernetes are not encrypted in manifests (only base64 encoded). The original reason narrenschiff was made is precisely to overcome this problem - so we can encrypt a secret and source control our infrastructure without compromising it. We'll use narrenschiff `chest` to encrypt our password, and store it in the `chest.yaml`.

```
narrenschiff chest stash --location postgres/ --treasure postgresPassword --value_
↪ Password123!
```

If you take a look inside `chest.yaml` you'll find your secret:

```
cat postgres/chest.yaml
postgresPassword: 3GghhpUTDrGvGroyh05J/4TLlpSKUX1hBn3FkgLVd/vq0n6dgCD8+nEB08kYdd2G
```

The name of our secret variables is `postgresPassword`. And we can use it now anywhere in our manifests. But naturally, we'll use it to define a `Secret`:

```
# postgres/files/secret.yaml
---
apiVersion: v1
kind: Secret
type: Opaque
metadata:
  name: postgres
  labels:
    app: postgres
data:
  POSTGRES_PASSWORD: "{{ postgresPassword | b64enc }}"
```

You'll notice that instead of usual base64 encoded string we have `"{{ postgresPassword | b64enc }}"`. This is Jinja2 syntax. It says "hey, replace what's between the double curly braces, and then apply the `b64enc` filter". When you execute deployment with `narrenschiff sail`, all secrets across chest files will be collected, decrypted, and passed to Jinja2 templates for rendering. Then, Jinja2 will replace this secret in a template, but not before passing it through `b64enc` filter (which encodes string with base64). The end product is what you would normally write as a configuration, the only difference being, you can now safely commit it, and track it with source control, without worrying about secrets being leaked. Only people with *key* and *spice* can decrypt a secret.

This is how it will actually look when rendered:

```
---
apiVersion: v1
kind: Secret
type: Opaque
metadata:
  name: postgres
  labels:
    app: postgres
data:
  POSTGRES_PASSWORD: "UGFzc3dvcmQxMjMhCg=="
```

But you don't really need to be concerned with how it looks when rendered. Finally, we'll define a `Deployment`:

```
# postgres/files/deployment.yaml
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: postgres
  labels:
    app: postgres
spec:
  replicas: 1
  selector:
    matchLabels:
```

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```

  app: postgres
template:
  metadata:
    labels:
      app: postgres
  spec:
    containers:
      - name: postgres
        image: postgres:latest
        ports:
          - containerPort: 5432
        envFrom:
          - configMapRef:
              name: postgres
          - secretRef:
              name: postgres

```

For example, if you want to pin down the version of the postgres, and be able to update it easily later, you can replace `image: postgres:latest` with `image: "{{ postgresDockerImage }}"`, and add to your `vars.yaml` specific version as: `postgresDockerImage: "postgres:12-alpine"`.

Now, all we have to do is to deploy this to our cluster. We would usually do this like so:

```
kubectl apply -f secret.yaml,configmap.yaml,deployment.yaml --namespace default
```

However, we don't have ordinary Kubernetes manifests anymore. Now we're using templated manifests. Therefore we need to write the equivalent command using Narrenschiff. Open `course.yaml` and write the following:

```

# postgres/course.yaml
- name: Deploy postgres
  kubectl:
    command: apply
    args:
      filename:
        - secret.yaml
        - configmap.yaml
        - deployment.yaml
    namespace: "default"

```

In Narrenschiff, this is called a *tasks*, and *course* is a collection of tasks.

Now, all you have to do is to deploy this to our cluster. Or, in other words, set a course and sail this crazy ship:

```
narrenschiff sail --follow-course postgres/course.yaml
```

The output should be similar to this:

```

* [ 2020-07-17 19:33:27.852325 ] * [ Deploy postgres ] *****

secret/postgres created
configmap/postgres created
deployment.apps/postgres created

```

1.4 Courses

A course in Narrenschiff is a collection of tasks. A single task corresponds to a single command line you would typically execute using e.g. `kubect1` or `helm`.

This is a general anatomy of a task:

```
- name: Deploy nginx container with basic auth # name of the task (required)
  kubect1: # module you're using (required)
    command: apply
    args:
      filename:
        - nginx/app/secret.yaml
        - nginx/app/configmap.yaml
        - nginx/app/deployment.yaml
      namespace: default
    beacons: # tags for alternative execution path (optional)
      - dev # chose whatever value ("always" is a reserved becaon)
```

name of the task describes what task should do. On the other hand, the module you are writing describes what the task is actually doing. Names are required, so your infrastructure configuration becomes a self-documenting repo. Name is an arbitrary description. Module, however, can only be whatever is implemented in Narrenschiff. At this moment, there are several modules available to use:

- `kubect1`
- `helm`
- `gcloud`
- `kustomization`
- `wait_for_pod`

For more info about modules, visit the [Modules](#) section.

Everything nested under module (in this case `command`, `args`, `filename`, `namespace`) is unique to the module. These options are covered in the module documentation.

beacons are optional, and they provide you a way for alternative execution path of your course. In other words, you can choose which part of the course you want to execute using beacons. Since they are optional, if you don't need them, don't add them. See [Beacons](#) for detailed overview.

Tasks in a course are executed sequentially. When you execute a course with `narrenschiff sail` all variables are gathered, templates rendered, tasks collected in ordered list, and executed one by one.

You can combine multiple courses in a single course using an import feature. For example, you may want to separate your cluster creation from cluster configuration:

```
touch project/course.yaml
touch project/gke.yaml
touch project/init.yaml
```

And in your `course.yaml` you would import other courses as:

```
---
# project/course.yaml
- name: Make cluster with gcloud
  import_course: "gke.yaml"
```

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```
- name: Configure cluster
  import_course: "init.yaml"
```

All imports are relative to the *course project directory*. So for example, if you have two courses that share the same set of tasks, you can put them in e.g. `includes/` and import them wherever you need:

```
touch postgres/includes/repo.yaml
touch postgres/deployment.yaml
touch postgres/upgrade.yaml
```

And in one of the courses, you can import the task as:

```
---
# postgres/deployment.yaml
- name: Update helm repo
  import_course: "includes/repo.yaml"

# other tasks
[...]
```

1.5 Vars Files

There are three types of variable files in Narrenschiff:

- vars - plain variables i.e. non-encrypted variables
- chest vars - encrypted variables
- secretmap vars - variables that store paths to files encrypted using Narrenschiff

1.5.1 Plain Variables

These are the most basic of all variable types. Plain variables give you ability to easily reuse variables across your templates. These variables also support arbitrary nesting of variables.

```
# vars.yaml
clusterName: clusty-mc-cluster # simple "flat" variable
namespaces: # variable with nesting
  dev: development
  stage: staging
  prod: production
```

You can use these variables anywhere in your course files, or in any template file located in `files/`. For example:

```
# course to create a cluster
---
- name: Cluster create
  gcloud:
    command: "container clusters create {{ clusterName }}"
    args:
      num-nodes: 3
```


In the following example we will use the Jinja2 templating feature to loop through nested variable, and create Kubernetes resources across multiple namespace in one file (instead of writing multiple files):

```
# files/namespaces.yaml
{% for key, value in namespaces.items() -%}
---
apiVersion: v1
kind: Namespace
metadata:
  name: "{{ value }}"
  labels:
    name: "{{ value }}"
{% endfor %}
```

Plain vars are stored in `vars.yaml` or in `vars/` directory. If you are using `vars/` directory, you can name vars files within it whatever you want, and nest them however you need. The only rule you have to remember is that variable names must be unique across all vars files (you can't have variable with the same name in chests, and in vars, or secretmaps).

Since vars files (and chests too) are YAML files, all boolean values must be quoted.

1.5.2 Chest

Chest variables behave similar to plain variables. However, there are two important differences:

- You have a command line tool to manage them
- Chest vars don't support arbitrary nesting (they have a flat dictionary structure)

You can also use `chest.yaml` as well as `chest/` directory with custom named files. However, the same rule applies for the chest variable names: they have to be unique across all vars files.

```
# chest.yaml
# the following two are ok:
dbPassword: enSkvMbU3Sa3YimjyqR3rskZHx3tUYlIpC5U1Xpo3k/qntCCp+HyJfTtjg++tSTF
hashingKey: j9gc0niSm1ADGK/95jVr7ugeUe87wDsCBhUp1zGtw3oJ4nz+h9JJKHfHdmYWFz8b

# nesting of variables is not supported for chest files!
mystery: # this is NOT OK
  dbPassword: enSkvMbU3Sa3YimjyqR3rskZHx3tUYlIpC5U1Xpo3k/qntCCp+HyJfTtjg++tSTF
  hashingKey: j9gc0niSm1ADGK/95jVr7ugeUe87wDsCBhUp1zGtw3oJ4nz+h9JJKHfHdmYWFz8b
```

When using secrets in your templates, there is no any special step that you have to take in order to decrypt them. Narrenschiff does that for you when it collects all the variables. However, when you're using them with secret files, you have to follow Kubernetes way of writing Secret resources, so you'll have to base64 encode them. Narrenschiff offers you a custom Jinja filter (`b64enc`) to easily to that:

```
---
apiVersion: v1
kind: Secret
type: Opaque
metadata:
  name: postgres
  labels:
    app: postgres
```

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```
data:
  DB_PASSWORD: "{{{ dbPassword | b64enc }}"
  SECRET_KEY: "{{{ hashingKey | b64enc }}"
```

`narrenschiff chest` offers you a number of ways to work with secrets. You can either encrypt them on the command line, and paste them into chest files yourself (with `narrenschiff chest lock` and `narrenschiff chest unlock`), or you can dynamically update `chest.yaml` (with `narrenschiff chest stash` and `narrenschiff chest loot`).

Lock and unlock are useful when you want to try things out. They don't require a location to use (but you need to execute them from the root of the project).

```
$ narrenschiff chest lock --value 'password'
enSkvMbU3Sa3YimjyqR3rskZHx3tUYlIpC5U1Xpo3k/qntCCp+HyJfTtjg++tSTF
$ narrenschiff chest lock --value 'key'
j9gc0niSm1ADGK/95jVr7ugeUe87wDsCBhUp1zGtw3oJ4nz+h9JJKHfHdmYWFz8b
$ narrenschiff chest unlock --value enSkvMbU3Sa3YimjyqR3rskZHx3tUYlIpC5U1Xpo3k/
↳qntCCp+HyJfTtjg++tSTF
password
$ narrenschiff chest unlock --value j9gc0niSm1ADGK/
↳95jVr7ugeUe87wDsCBhUp1zGtw3oJ4nz+h9JJKHfHdmYWFz8b
key
```

However, it's often easier to update `chest.yaml` dynamically, and not worry about whether you copy/pasted whole string from the command line (are you sure you haven't missed that first or last character when selecting?):

```
$ narrenschiff chest stash --treasure dbPassword --value password --location project/
$ narrenschiff chest loot --treasure dbPassword --location project/
```

Also if you want to update `chest.yaml` with treasure that lies on your filesystem, you can test if the encryption works with lock and unlock:

```
$ narrenschiff chest lock --value "$( cat ~/Downloads/service-account.json )"
```

And you can stash it automatically with:

```
$ narrenschiff chest stash --location project/ --treasure serviceAccount --value "$( cat _
↳~/Downloads/service-account.json )"
```

If you're in a hurry and you'll need to skim through all variables to find something, you can dump all chest variables to STDOUT with `narrenschiff chest dump`:

```
$ narrenschiff chest dump --location examples/

dbPassword: password
hashingKey: key
```

1.5.3 Secretmap

Secretmap variables store paths to encrypted files. Encrypted files don't support Jinja2 templating, and they are only reserved for use with the `helm` module.

These variables are stashed in `secretmap.yaml`, and this file can only be dynamically updated.

The most basic of commands is `narrenschiff secretmap stash`

```
$ narrenschiff secretmap stash --treasure dev --location project/ --source ~/repos/
↳source/dev.yaml --destination overrides/dev.yaml
$ tree project/
project/
├── overrides
│   └── dev.yaml
├── secretmap.yaml
└── course.yaml
```

As you can see, `--destination` is a *path relative to the root of the course project*. Note, it is **not** a path relative to the root project of your infrastructure (where `.narrenschiff.yaml` file is located). The course project is `project` that contains in its root files such as `secretmap.yaml` and `chest.yaml`. So, in other words, it's a path relative to the `secretmap.yaml`. `--source` on the other hand, can be any path on your filesystem. If you inspect `dev.yaml`, after encryption, in `overrides/`, you'll see that content of the file has been encrypted indeed. And if you inspect `secretmap.yaml` you'll find a relative path to the encrypted file:

```
$ cat project/secretmap.yaml
dev: overrides/dev.yaml
```

How do you reference this in your Narrenschiff configuration? When `narrenschiff sail` gets executed, it needs to decrypt the file before it can be used. We instruct Narrenschiff that following variable is not a simple variable, but a path to a file, with a custom narrenschiff Jinja2 filter:

```
- name: Install Prometheus
  helm:
    command: install
    name: redis
    chart: bitnami/redis
    version: 10.7.11
    opts:
      - atomic
    args:
      namespace: development
      values:
        - "{{ dev | secretmap }}"
```

Therefore, when working with secretmaps, you'll have to pipe your variable to `secretmap` filter in your courses i.e. `{{ dev | secretmap }}`.

The inverse operation of `stash` is `loot`. You can decrypt a file and place it somewhere on your filesystem with:

```
$ narrenschiff secretmap loot --treasure dev --location project/ --destination /tmp/dev.
↳yaml
```

However, editing file in such a way is cumbersome. Fortunately, we have `alter` available. It will open a file in your preferred editor (or `vi`):

```
$ narrenschiff secretmap alter --treasure dev --location project/
```

If you want to change default editor, change EDITOR environment variable to preferred editor.

Sometimes you just want to preview the file. Narrenschiff got you covered here also. Use peek to dump file content to STDOUT:

```
$ narrenschiff secretmap peek --treasure dev --location project/
```

When you have many secretmaps in a course project, it's really hard to peek and manually search through all of them. Narrenschiff gives you ability to grep over those encrypted files with search:

```
$ narrenschiff secretmap search --match "ClusterIP" --location project/
```

A really powerful feature of Narrenschiff secretmap search is that match pattern can be a Python regex expression.

If you have two secretmaps within a course project that you want to compare, you can use diff:

```
$ narrenschiff secretmap diff --location project/ dev prod
```

And finally, you can delete secretmaps with:

```
$ narrenschiff secretmap destroy --treasure dev --location project/
```

1.5.4 Rules

There is one rule that you need to remember: **no duplicates are allowed!** narrenschiff collects all variables in all var files, and if you have duplicate names, the program will exit with an error. And you should also keep in mind this tiny rule:

1. All variables from vars files, chests, and secretmap are collected (only those files that are contained within the *course project* are used)
1. Load vars.yaml
2. Load all files from the vars/ directory if it exists
3. Load and decrypt all variables from chest.yaml
4. Load all files from the chest/ directory if it exists
5. Load all variables from secretmap.yaml
6. Merge all files
2. Variables are checked for duplicates, if there are any narrenschiff sail will fail

Jokes aside, there is no variable file precedence as in [Ansible](#). All vars files are created equal, and each treasure name within it is unique. If you have duplicates, Narrenschiff will let you know, so you can fix this. Not having to think about vars file precedence [streamlines thought process](#), leaving you more time to think about your infrastructure, rather than the quirks of the tool you're using.

1.6 Beacons

If you only want to execute a part of the course, then you should use beacons. Beacons are essentially tags on you tasks that allow you to create special paths of execution.

Note: We advise you to test the example using Minikube. You can find instructions on how to setup Minikube [here](#) and also in the [official documentation](#).

Let's look at simple example:

```
# examples/stats/course.yaml
- name: List all namespaces
  kubectl:
    command: get namespaces
  beacons:
    - always

- name: List all pods in default namespace
  kubectl:
    command: get pods
    args:
      namespace: default
  beacons:
    - default

- name: List all pods in kube-system namespace
  kubectl:
    command: get pods
    args:
      namespace: kube-system
  beacons:
    - kube-system
```

Beacons are passed to narrenschiff with `--follow-beacons` flag, like so:

```
$ narrenschiff sail --follow-beacons default --set-course examples/stats/course.yaml
* [ 2020-07-20 10:47:36.901965 ] * [ List all namespaces ] *****

NAME                STATUS    AGE
default             Active    2d17h
kube-node-lease     Active    2d17h
kube-public         Active    2d17h
kube-system         Active    2d17h

* [ 2020-07-20 10:47:36.959850 ] * [ List all pods in default namespace ] ***

NAME                READY    STATUS    RESTARTS   AGE
postgres-7bf8d6b875-hp58b  1/1     Running   1           2d15h
```

What happened? `always` is a reserved beacon in Narrenschiff. When you execute a course, if you have any task tagged with `always` it will always execute in addition to the tasks targeted by supplied beacon. In this case, we chose to execute

only those tasks marked with default i.e. `--follow-beacons default`.

A task can be marked with multiple beacons e.g.

beacons:

- dev
- stage
- prod

And you can also select multiple beacons from the command line:

```
$ narrenschiff sail --follow-beacons dev,stage --set-course course.yaml
```

Here's a practical example. If you are using Helm to manage your applications, you can pack the upgrade instructions in a single course, but separate environments using beacons.

```
# helm/postgres.yaml
- name: Add bitnami repo to Helm
  helm:
    command: repo add jetstack https://charts.bitnami.com/bitnami
  beacons:
    - always

- name: Update repo
  helm:
    command: repo update
  beacons:
    - always

- name: Upgrade Postgres on development
  helm:
    command: upgrade
    name: postgres
    chart: bitnami/postgresql
    version: 11.8.0
    opts:
      - atomic
      - cleanup-on-fail
      - reuse-values
    args:
      namespace: development
      values:
        - "{{ values | secretmap }}"
  beacons:
    - dev

- name: Upgrade Postgres on staging
  helm:
    command: upgrade
    name: postgres
    chart: bitnami/postgresql
    version: 9.1.1
    opts:
      - atomic
```

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```

- cleanup-on-fail
- reuse-values
args:
  namespace: staging
  values:
    - "{{ values | secretmap }}"
beacons:
- stage

- name: Upgrade Postgres on production
  helm:
    command: upgrade
    name: postgres
    chart: bitnami/postgresql
    version: 9.1.1
    opts:
      - atomic
      - cleanup-on-fail
      - reuse-values
    args:
      namespace: production
      values:
        - "{{ values | secretmap }}"
    beacons:
      - prod

```

Now, if you want to upgrade only your service on the development environment, you can do this without executing other tasks in the course:

```
$ narrenschiff sail --follow-beacons dev --set-course helm/postgres.yaml
```

Beacons can only be used on tasks. They cannot be used on course imports (i.e. `import_course` does not support beacons).

1.7 .narrenschiff.yaml

Every project needs to contain `.narrenschiff.yaml` configuration file. This file is used to point to the password, and the salt, as well as to define the cluster context. This file should be committed to the source code of your project.

Files containing password, and salt, should never be committed to the source code!

```

# Example of configuration file
key: ./password.txt # path to file containing password for encrypting files
spice: ./salt.txt # path to file containing salt (salt should be random and long)

# If you are managing multiple clusters, your project may be tied to one
# particular cluster. Instead of switching context manually with:
#
# kubectl config use-context CONTEXT_NAME
#
# you can define context in this section of your project configuration file.

```

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```

# If you are not sure which context you are using, check it with:
#
#   kubectl config get-contexts
#
# or:
#
#   kubectl config current-context
#
# context.name is the name of the context [default: undefined]
# context.use defines whether to use context switching before executing tasks
#   value is (quoted) boolean string [default: "false"]
context:
  name: cloud_provider_project_id_region_zone_project_title
  use: "false"

```

1.8 Modules

1.8.1 kubectl

Description

Execute `kubectl` commands. Interact with your Kubernetes cluster.

Requirements

- `kubectl`

Parameters

Parameter	Comment
command	Any <code>kubectl</code> command with nested subcommands
args	flag/value pairs, a flag needs to be listed by its full name (e.g. you can't use <code>f</code> for <code>-f/--filename</code> , you have to use <code>filename</code>)
opts	flags without arguments i.e. switches

Examples

```

# Both get (command) and namespaces (subcommand) are inputs for parameter "command"
# kubectl get namespaces
- name: List all namespaces
  kubectl:
    command: get namespaces

# "args" parameter accepts only flag/value pairs

```

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```

# kubectl get pods --namespaces default
- name: List all pods in default namespace
  kubectl:
    command: get pods
    args:
      namespace: default

# Use "opts" when you need flags without input values
# kubectl get pods --all-namespaces
- name: List pods in all namespaces
  kubectl:
    command: get pods
    opts:
      - all-namespaces

# If you need to create a namespace you can just put a whole command in "command"
↳parameter
# kubectl create namespace cert-manager
- name: Create namespace for cert-manager
  kubectl:
    command: create namespace cert-manager

# Value of a flag depends on underlying input kubectl is expecting
# kubectl apply -f project/files/secretmap.yaml,project/files/configmap.yaml,project/
↳files/deployment.yaml --namespace development
- name: Deploy application
  kubectl:
    command: apply
    args:
      filename:
        - secretmap.yaml # in Narrenschiff paths are relative to files/ dir in a course
↳project
        - configmap.yaml
        - deployment.yaml
      namespace: development

# If you have a single file that you have to pass to -f, you can also use this syntax
# kubectl apply -f project/files/configmap.yaml
- name: Deploy config map
  kubectl:
    command: apply
    args:
      filename: configmap.yaml

# You can also apply configurations from URLs
# kubectl apply -f https://raw.githubusercontent.com/jetstack/cert-manager/release-0.8/
↳deploy/manifests/00-crds.yaml --namespace cert-manager
- name: Install cert-manager
  kubectl:
    command: apply
    args:
      filename:

```

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```

- https://raw.githubusercontent.com/jetstack/cert-manager/release-0.8/apply/
↳ manifests/00-crds.yaml
  namespace: cert-manager

# You can mix URLs with file paths
- name: Deploy applications
  kubectl:
  command: apply
  args:
  filename:
  - secretmap.yaml
  - configmap.yaml
  - deployment.yaml
  - https://raw.githubusercontent.com/kubernetes/kubectl/master/testdata/apply/
↳ deploy-clientside.yaml
  namespace: development

```

Status

Warning: This module is experimental.

1.8.2 kustomization

Description

A very simple wrapper around `kubectl apply -k`.

Requirements

- kubectl

Parameters

Parameter	Comment
N/A	Module does not support additional parameters

Examples

```

# This module executes "kubectl apply -k <directory>"
- name: Deploy app
  kustomization: app/ # in Narrenschiff paths are relative to files/ dir in a course.
↳ project

```

Status

Warning: This module is experimental.

1.8.3 helm

Description

Execute `helm` commands. Deploy, upgrade, and delete your charts.

Requirements

- `kubectl`
- `helm`

Parameters

Parameter	Comment
<code>command</code>	Any helm command with nested subcommands
<code>args</code>	flag/value pairs, a flag needs to be listed by its full name
<code>opts</code>	flags without arguments i.e. switches
<code>chart</code>	name of the chart
<code>name</code>	name of the chart release

Examples

```
# If you have a simple command with an argument you can write it like this
# helm repo add stable https://kubernetes-charts.storage.googleapis.com/
- name: Add stable repo to Helm
  helm:
    command: repo add stable https://kubernetes-charts.storage.googleapis.com/

# Command (repo) and its subcommand (update) are both placed in the "command"
# parameter of Narrenschiff helm module
# helm repo update
- name: Update repo for stable charts
  helm:
    command: repo update

# use "chart" and "name" to define chart and its release
# helm install ingress-controller stable/nginx-ingress --atomic --namespace default
- name: Install Ingress controller
  helm:
    command: install
    name: ingress-controller # release of the chart
    chart: stable/nginx-ingress # chart you're using from the chart repo
    opts: # all switches are listed in opts as YAML list
```

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```
- atomic
args: # all flags with inputs go under args
namespace: default
version: 1.41.1

# You can use "set" to set values on the command line
- name: Install cert-manager
helm:
  command: install
  name: cert-manager
  chart: jetstack/cert-manager
  opts:
    - atomic
  args:
    namespace: cert-manager
    version: v0.12.0
    set: # set is a YAML list of key/value pairs
      - ingressShim.defaultIssuerName=letsencrypt-prod
      - ingressShim.defaultIssuerKind=ClusterIssuer
      - ingressShim.defaultIssuerGroup=cert-manager.io

# In Narrenschiff you can combine "set" with templating if you need to set some secrets
- name: Install PostgreSQL
helm:
  command: install
  name: postgres
  chart: bitnami/postgresql
  opts:
    - atomic
  args:
    version: 9.1.1
    set:
      - "global.postgresql.postgresqlPassword={{ postgresqlPassword }}"

# Values can be used when you have URLs as your chart values
- name: Upgrade Chart Museum
helm:
  command: upgrade
  name: museum
  chart: stable/chartmuseum
  opts:
    - atomic
    - cleanup-on-fail
  args:
    version: 2.13.0
    values:
      - https://github.com/helm/charts/blob/master/stable/chartmuseum/values.yaml

# Files in "values" are always passed as secretmaps!
- name: Install Graylog
helm:
  command: install
```

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```

name: "graylog"
chart: stable/graylog
opts:
  - atomic
args:
  namespace: "graylog"
  version: 1.6.9
  values:
    - "{{ ingress | secretmap }}"
    - "{{ service | secretmap }}"

```

Status

Warning: This module is experimental.

1.8.4 gcloud

Description

Execute `gcloud` commands. Manage GKE.

Execution of the module will fail for the commands that require user input. Use `--quiet` instead. See [gcloud docs](#) for more info.

Requirements

- `gcloud`

Parameters

Parameter	Comment
<code>command</code>	Any <code>gcloud</code> command with nested subcommands
<code>args</code>	flag/value pairs, a flag needs to be listed by its full name
<code>opts</code>	flags without arguments i.e. switches

Examples

```

# gcloud container clusters create test-cluster --enable-ip-alias --quiet --num-nodes 1 -
↪-machine-type n1-standard-2 --zone europe-west1-a
- name: Create the cluster
gcloud:
  command: "container clusters create test-cluster"
  args:
    num-nodes: 1
    machine-type: n1-standard-2

```

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```

    zone: europe-west1-a
  opts:
    - enable-ip-alias # opts are always listed as a YAML list
    - quiet

# If you do not need any flags or switches you can place everything under the "command"
- name: Get credentials for the cluster
  gcloud:
    command: "container clusters get-credentials test-cluster"

- name: Enable Kubernetes API
  gcloud:
    command: "services enable container.googleapis.com"

```

Status

Warning: This module is experimental.

1.8.5 wait_for_pod

Description

Wait for a pod to be ready.

Requirements

- kubectl

Parameters

Parameter	Comment
namespace	Namespace in which the pod is located
threshold_replicas	How many replicast should be ready in order for task to be considered completed
grep_pod_name	Pod you are waiting

Examples

```

- name: Wait for a pod
  wait_for_pod:
    namespace: cert-manager
    threshold_replicas: 1 # This is 1 in e.g. 1/2
    grep_pod_name: cert-manager-webhook # not a full name, only a part

```

Status

Warning: This module is experimental.

1.9 Examples

1.9.1 Deploying WordPress and MySQL with Persistent Volumes

This examples is taken from the official Kubernetes [documentation](#) which is licensed under [CC BY 4.0](#). The example will be adapted to fit deployment process in Narrenschiff.

Before you Start

We advise you to use Minikube as you follow along this tutorial. Minikube is easy to setup, and manage. See the installation process in the [official documentation](#), or see our [getting started](#) tutorial.

You can find the source code for this tutorial in the official Narrenschiff [repo](#) under the `examples/` directory. The example in the repo uses `.narrenschiff.yaml` configuration from the repo itself. But, for completeness, we will show you how to properly start a project.

Start the Project

Start by installing Narrenschiff and making a project.

```
$ mkdir wordpress && cd wordpress
$ git init
$ python3 -m venv env && echo 'env' >> .gitignore
$ . env/bin/activate
$ pip install narrenschiff
```

Now you are ready to make a course project. In the root project, execute following command:

```
$ narrenschiff dock --autogenerate --location wordpress
```

Stash Your Treasure in a Chest

We need a password for MySQL and we'll start by stashing the password in the chest.

```
$ narrenschiff chest stash --treasure 'mysqlPassword' --value 'Password123!' --location_
↪wordpress/
```

In the next section we'll add Kubernetes resources to our project.

Add Resource Configuration for MySQL and Wordpress

We'll add MySQL password to the template of the Secret. Place the template under `wordpress/files/mysql/secret.yaml`:

```
# wordpress/files/mysql/secret.yaml
---
apiVersion: v1
kind: Secret
type: Opaque
metadata:
  name: mysql-pass
data:
  MYSQL_ROOT_PASSWORD: "{{ mysqlPassword | b64enc }}"
```

Remember, `files/` is reserved in a course project for templates. All templates are referenced in courses relative to this directory.

Make the following files in `wordpress/files/mysql` (filenames are in the comments):

```
# wordpress/files/mysql/service.yaml
---
apiVersion: v1
kind: Service
metadata:
  name: wordpress-mysql
  labels:
    app: wordpress
spec:
  ports:
    - port: 3306
  selector:
    app: wordpress
    tier: mysql
  clusterIP: None

# wordpress/files/mysql/pvc.yaml
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: mysql-pv-claim
  labels:
    app: wordpress
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 50Mi

# wordpress/files/mysql/deployment.yaml
---
apiVersion: apps/v1
```

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```

kind: Deployment
metadata:
  name: wordpress-mysql
  labels:
    app: wordpress
spec:
  selector:
    matchLabels:
      app: wordpress
      tier: mysql
  strategy:
    type: Recreate
  template:
    metadata:
      labels:
        app: wordpress
        tier: mysql
    spec:
      containers:
      - image: mysql:5.6
        name: mysql
        envFrom:
          - secretRef:
              name: mysql-pass
        ports:
          - containerPort: 3306
            name: mysql
        volumeMounts:
          - name: mysql-persistent-storage
            mountPath: /var/lib/mysql
      volumes:
      - name: mysql-persistent-storage
        persistentVolumeClaim:
          claimName: mysql-pv-claim

```

These are all simple manifests. We didn't have any need to use templating here. But the neat thing about Narrenschiff is that you can add templating to whatever manifest you need whenever you need it. We will now proceed to write manifests for the Wordpress itself:

```

# wordpress/files/wordpress/secret.yaml
---
apiVersion: v1
kind: Secret
type: Opaque
metadata:
  name: wordpress-env
data:
  WORDPRESS_DB_PASSWORD: "{{ mysqlPassword | b64enc }}"

# wordpress/files/wordpress/service.yaml
---
apiVersion: v1

```

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```
kind: Service
metadata:
  name: wordpress
  labels:
    app: wordpress
spec:
  ports:
    - port: 80
  selector:
    app: wordpress
    tier: frontend
  type: LoadBalancer

# wordpress/files/wordpress/pvc.yaml
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: wp-pv-claim
  labels:
    app: wordpress
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 100Mi

# wordpress/files/wordpress/deployment.yaml
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: wordpress
  labels:
    app: wordpress
spec:
  selector:
    matchLabels:
      app: wordpress
      tier: frontend
  strategy:
    type: Recreate
  template:
    metadata:
      labels:
        app: wordpress
        tier: frontend
    spec:
      containers:
        - image: wordpress:5.5-apache
          name: wordpress
```

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```

env:
  - name: WORDPRESS_DB_HOST
    value: wordpress-mysql
envFrom:
  - secretRef:
      name: wordpress-env
ports:
  - containerPort: 80
    name: wordpress
volumeMounts:
  - name: wordpress-persistent-storage
    mountPath: /var/www/html
volumes:
  - name: wordpress-persistent-storage
    persistentVolumeClaim:
      claimName: wp-pv-claim

```

Deploy

Before deployment, we have to write the course:

```

# wordpress/course.yaml
---
- name: Deploy Mysql
  kubectl:
    command: apply
    args:
      filename:
        - mysql
- name: Deploy Wordpress
  kubectl:
    command: apply
    args:
      filename:
        - wordpress

```

Finally apply your changes to the cluster:

```
$ narrenschiff sail --set-course wordpress/course.yaml
```

Verify

You can verify that wordpress is deployed by accessing it through your web browser to finish the installation:

```
$ minikube service wordpress --url
```

Copy and paste the URL to your web browser, and you can complete the wordpress installation. Use `minikube stop` && `minikube delete` to stop and delete the cluster.

1.9.2 Deploying Moodle and MariaDB using Helm

This example will show you how to use secretmaps and Narrenschiff helm module in order to deploy two services to the cluster.

Before you Start

We advise you to use Minikube as you follow along this tutorial. Minikube is easy to setup, and manage. See the installation process in the [official documentation](#), or see our [getting started](#) tutorial.

You can find the source code for this tutorial in the official Narrenschiff [repo](#) under the `examples/` directory. The example in the repo uses `.narrenschiff.yaml` configuration from the repo itself. But, for completeness, we will show you how to properly start a project.

Start the Project

Start by installing Narrenschiff and making a project.

```
$ mkdir moodle && cd moodle
$ git init
$ python3 -m venv env && echo 'env' >> .gitignore
$ . env/bin/activate
$ pip install narrenschiff
```

Now you are ready to make a course project. In the root project, execute following command:

```
$ narrenschiff dock --autogenerate --location moodle
```

Stash Your Treasure in a Chest

When deploying application with helm, you can use `--set` to set values on the command line, or `--values` to read in values from a file. `--set` is useful when you want to edit a single value, but when you need to enter more complex configuration, you would use `--values`.

Because we need to supply database password in two different charts, we will use `--set` to supply it at course runtime. However, all other values specific to the charts themselves can be configured with `--values`.

Therefore we will start with the most basic. Stashing our MariaDB password in the course chest.

```
$ narrenschiff chest stash --location moodle/ --treasure databasePassword --value
↪ 'Password123!'
```

Prepare Overrides for values.yaml

Narrenschiff's helm module can work with `values.yaml`. But by default, these files need to be encrypted. Values file oftentimes contains sensitive information such as passwords, so it's better to have it encrypted. Make the `overrides/` directory in your course file, and make these two files within it:

```
# moodle/overrides/mariadb.yaml
---
replication:
  enabled: false
```

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```
master:
  resources:
    limits:
      cpu: 500m
      memory: 512Mi
    requests:
      cpu: 50m
      memory: 128Mi

  livenessProbe:
    enabled: false
  readinessProbe:
    enabled: false

  persistence:
    enabled: true
    mountPath: /bitnami/mariadb
    accessModes:
      - ReadWriteOnce
    size: 500Mi

# moodle/overrides/moodle.yaml
---
moodleUsername: admin
moodlePassword: Password123!
moodleEmail: admin@moodle.local

mariadb:
  enabled: false
  secret:
    requirePasswords: false

livenessProbe:
  enabled: false
readinessProbe:
  enabled: false

service:
  type: NodePort
  port: 80
  httpsPort: 443
  nodePorts:
    http: "30080"
    https: "30443"
  externalTrafficPolicy: Cluster

ingress:
  enabled: false
  certManager: false
  hostname: moodle.local
```

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```

persistence:
  enabled: true
  accessMode: ReadWriteOnce
  size: 500Mi

resources:
  requests:
    memory: 512Mi
    cpu: 500m

```

Encrypt them using:

```

$ narrenschiff secretmap stash --source moodle/overrides/mariadb.yaml --destination_
↪ overrides/mariadb.yaml --treasure mariadb --location moodle
$ narrenschiff secretmap stash --source moodle/overrides/moodle.yaml --destination_
↪ overrides/moodle.yaml --treasure moodle --location moodle

```

If you inspect your secretmap file, you will see that it contains paths to the encrypted files:

```

$ cat moodle/secretmap.yaml
mariadb: overrides/mariadb.yaml
moodle: overrides/moodle.yaml

```

Update vars.yaml

It's a good idea to respect DRY principle in your course files. For this purpose, we will utilize `vars.yaml` and define common cleartext variables:

```

# moodle/vars.yaml
namespace: default

database:
  user: moodle
  name: moodle

```

Deploy

Before deployment, we have to write the course:

```

# moodle/course.yaml
---
- name: Add bitnami repo
  helm:
    command: repo add bitnami https://charts.bitnami.com/bitnami

- name: Update helm repo
  helm:
    command: repo update

- name: Install MariaDB database

```

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```

helm:
  command: upgrade
  name: mariadb
  chart: bitnami/mariadb
  opts:
    - install
    - atomic
    - cleanup-on-fail
  args:
    namespace: "{{ namespace }}"
    version: 7.9.2
    values:
      - "{{ mariadb | secretmap }}"
    set:
      - "db.user={{ database.user }}"
      - "db.password={{ databasePassword }}"
      - "db.name={{ database.name }}"
- name: Install Moodle
  helm:
    command: upgrade
    name: moodle
    chart: bitnami/moodle
    opts:
      - install
      - atomic
      - cleanup-on-fail
    args:
      namespace: "{{ namespace }}"
      version: 8.1.1
      values:
        - "{{ moodle | secretmap }}"
      set:
        - "externalDatabase.user={{ database.user }}"
        - "externalDatabase.password={{ databasePassword }}"
        - "externalDatabase.database={{ database.name }}"
        - "externalDatabase.host=mariadb.{{ namespace }}.svc.cluster.local"

```

Finally apply changes to the cluster:

```
$ narrenschiff sail --set-course moodle/course.yaml
```

Verify

You can verify that Moodle is deployed by accessing it through your web browser:

```
$ minikube service moodle --url
```

Use `minikube stop` && `minikube delete` to stop and delete the cluster.

CONTRIBUTOR GUIDE

2.1 Contributing

2.1.1 Setup development environment

If you decide to contribute to the code base, you'll first have to fork the project on GitHub, and then clone the project in the local environment. You'll need a GitHub account in order to make a fork.

Make a clone of the repository, and install dependencies (just replace `<your_github_username>` with your actual GitHub username). This project is currently using `pipenv` to manage its dependencies. This could be changed in the future.

```
git clone https://github.com/<your_github_username>/narrenschiff.git
pipenv install --dev
```

This project is using `unittest` framework from the Python standard library. After you clone the repo, you can run tests to make sure everything is working:

```
make test
```

If you want to contribute to documentation, you can build it locally:

```
cd docs/
make html
```

Now that you have the development environment all setup, it's best to make a new branch for your feature (or bug fix!), and make changes there:

```
git checkout -b my-new-feature
```

When you finish coding, use `make test` to test the changes. If all is good, push the branch to your fork, and make a pull request. Don't forget to add unit tests for the new feature.

2.1.2 Keeping your fork synced with upstream

If you followed the previously described setup, then you can easily keep your fork up-to-date with the original repository. First, you need to add the upstream repository to your project:

```
git remote add upstream https://github.com/petarnikolovski/narrenschiff
```

Then, you can fetch changes made to the master, and push them to your fork:

```
git fetch upstream
git merge upstream/master
git push origin master
```

2.1.3 Coding Style

This project is mainly styled according to PEP8. Please use `flake8` to check the style of your code before making a pull request. This project comes with `.flake8` configuration file.

2.2 API

2.2.1 Narrenschiff

`narrenschiff.narrenschiff.narrenschiff()`

Base command.

Returns Void

Return type None

2.2.2 Task

exception `narrenschiff.task.AmbiguousOptions`

Use when tasks have undefined YAML tags.

class `narrenschiff.task.Task(task)`

Parse the smallest unit of the course.

Each dictionary item from the task list should be wrapped with this class:

```
course = [{'name': 'Kustomize', 'kustomization': 'examples/app/'}]
tasks = [Task(t) for t in course]

task = tasks[0]
task.name # --> 'Kustomize'
task.kustomization # --> instance of Kustomization class
```

class `narrenschiff.task.TasksEngine(tasks, beacons, dry_run_enabled)`

Run course.

run()

Start executing tasks.

Returns Void

Return type None

2.2.3 Templating

class narrenschiff.templating.**ChestVars**(*template_directory*)

Load chest files.

load_vars()

Load variables.

Returns Variables to be used for template rendering

Return type dict

class narrenschiff.templating.**PlainVars**(*template_directory*)

Load cleartext variable files.

class narrenschiff.templating.**SecretmapVars**(*template_directory*)

Load secretmap files.

class narrenschiff.templating.**Template**(*args, **kwargs)

Load and manipulate templates and template environment.

clear_templates()

Delete all templates from the /tmp directory.

Returns Void

Return type None

find_duplicates(*values*)

Find duplicate keys.

Parameters **values** (list of str) – List of keys from var and chest files.

Returns List of duplicates

Return type list of str

load_vars()

Load variables.

Returns Variables to be used for template rendering

Return type dict

This is the order in which files containing variables are loaded:

1. Load vars.yaml if it exists
2. Load all files from the vars/ directory if it exists
3. Load and decrypt all variables from chest.yaml
4. Load all files from the chest/ directory if it exists
5. Load all variables from secretmap.yaml
6. Merge all files

Important: Files must not contain duplicate variable names!

render(*path*)

Render template on the given path.

Parameters **path** (str) – Path to the template file

Returns Rendered template

Return type str

render_all_files()

Render all templates from the directory.

Returns Void

Return type None

Templates are copied to /tmp and location of rendered templates is saved in `self.tmp`.

set_course(path)

Prepare Jinja2 templating environment.

Parameters path (str) – Path of the `tasks.yaml` file

Returns Void

Return type None

Directory containing the course (e.g. `tasks.yaml`) file will be the directory from where the templates are taken to be rendered.

exception narrenschiff.templating.TemplateException

Use for exceptions regarding template manipulation.

class narrenschiff.templating.Vars(name, template_directory)

Manipulate files containing variables.

load_vars()

Load variables.

Returns Variables to be used for template rendering

Return type dict

exception narrenschiff.templating.VarsFileNotFoundError

Missing files containing variables.

2.2.4 Chest

class narrenschiff.chest.AES256Cipher(keychain)

Encode and/or decode strings.

decrypt(ciphertext)

Decrypt ciphertext.

Parameters ciphertext (str) – Ciphertext

Returns Plaintext

Return type str

encrypt(plaintext)

Encrypt plaintext.

Parameters plaintext (str) – Plaintext

Returns Ciphertext

Return type str

pbkdf2()

Derive a 32 bytes (256 bits) key.

Returns Password hash

Return type `byte string`

class `narrenschiff.chest.Chest`(*keychain, path*)

Manipulate chest file.

load_chest_file()

Load chest file with encrypted values.

Returns Serialized YAML object

Return type `dict`

show(*variable*)

Show decrypted value of the variable.

Parameters

- **variable** (`str`) – Variable name
- **value** (`str`) – Value of the variable

Returns Decrypted value

Return type `str`

update(*variable, value*)

Add or update chest file.

Parameters

- **variable** (`str`) – Variable name to update
- **value** (`str`) – Value of the variable

Returns `Void`

Return type `None`

2.2.5 Secret Maps

exception `narrenschiff.secretmap.CourseLocationError`

Raise exception if course is not found.

class `narrenschiff.secretmap.Secretmap`(*args, **kwargs)

Manage secret maps. Secret maps are paths to encrypted files.

clear_all_files()

Delete all decrypted files.

Returns `Void`

Return type `None`

decrypt(*dest, treasure*)

Decrypts file and stores it to given destination.

Parameters

- **dest** (`str`) – Destination filepath of the decrypted file
- **treasure** (`str`) – Name of the variable

Returns Void

Return type None

destroy(*treasure*)

Delete secretmap file and remove key from the config file.

Parameters **treasure** (str) – Name of the secretmap variable

Returns Void

Return type None

diff(*secretmaps*)

Compare secretmaps line by line.

Parameters **secretmaps** (tuple) – Two secretmaps that should be compared

Returns Void

Return type None

edit(*treasure*)

Edit an encrypted file.

Parameters **treasure** (str) – Name of the variable

Returns Void

Return type None

find(*match, treasure*)

Match a pattern in a treasure and print to STDOUT.

Parameters

- **match** (str) – Pattern to match
- **treasure** (str) – Name of the secretmap variable

Returns Void

Return type None

peek(*treasure*)

Print encrypted file to STDOUT.

Parameters **treasure** (str) – Name of the secretmap variable

Returns Void

Return type None

render_all_files()

Decrypt and copy all files at the given destination.

upsert(*src, dest, treasure*)

Encrypts file and inserts data to config file.

Parameters

- **src** (str) – Source filepath for encryption
- **dest** (str) – Destination filepath of the encrypted file
- **treasure** (str) – Name of the variable

Returns Void

Return type None

2.2.6 Common

exception `narrenschiff.common.AmbiguousConfiguration`

Give warning that something is wrong with configuration.

class `narrenschiff.common.DeleteFile(path)`

Delete file from the file system, ideally in secure manner.

delete()

Delete the file.

class `narrenschiff.common.Singleton(name, bases, attrs, **kwargs)`

Define the Singleton.

`narrenschiff.common.flatten(lst)`

Flatten list.

Parameters `lst` (list) – A list to be flattened

Returns Flattened list

Return type list

`narrenschiff.common.get_chest_file_path(location)`

Check if there are duplicate chest files, and return paths if there are not.

Parameters `location` (str) – Relative path to course project directory

Returns Absolute path to chest file

Return type str

Raises `narrenschiff.common.AmbiguousConfiguration`

2.2.7 Config

exception `narrenschiff.config.ConfigurationException`

Use this when something goes wrong with the configuration.

class `narrenschiff.config.Keychain`

Bundle password and salt.

class `narrenschiff.config.KubectlContext`

Handle context switching.

switch()

Switch kubectl context.

class `narrenschiff.config.NarrenschiffConfiguration`

Load configuration file.

This class should never be called directly, nor it should be inherited from. Other classes should use it by composition principle (see implementation of e.g. `narrenschiff.config.Keychain`). This should make classes that depend on subset of config easier to test.

2.2.8 Filters

You can extend Jinja with custom filters. The filters should be in the `narrenschiff.filters` module.

`narrenschiff.filters.b64enc(value)`

Encode a string using base64.

Parameters `value` (str) – Text to be encoded

Returns Encoded text

Return type str

Use this filter for k8s secrets. Values for secrets need to be encoded before the `Secret` resource is deployed to k8s.

`narrenschiff.filters.rtrim(value)`

Strip trailing whitespace.

Parameters `value` (str) – Text to be processed

Returns Text without trailing whitespace

Return type str

`narrenschiff.filters.secretmap(value)`

Label path with `{{secretmap}}`.

Parameters `value` (str) – Path

Returns Labeled path

Return type str

2.2.9 Modules

Modules are way of implementing CLI commands e.g. `kubectl.narrenschiff` can be extended with new modules. All modules should reside in `narrenschiff.modules` package.

Common

class `narrenschiff.modules.common.NarrenschiffModule(command)`

Abstract class/Interface for the module classes. A module must inherit from this class.

Variables `DRY_RUN_FLAG` – int

The subprocess module does not have a way of indicating whether a command was run with dry run or not, since that is the responsibility of `narrenschiff.modules.common.NarrenschiffModule.execute()` method. If module or subcommand of module is not supporting dry run, than `DRY_RUN_FLAG` is a reserved return code (rc) that indicates that program should not exit, and output should be printed in special color (blue).

abstract property `cmd`

Get command that module needs to execute later.

Returns Full command with all parameters

Return type str

property `dry_run`

Return a dry run flag.

Returns `--dry-run` string

Return type `str`

In general most commands use `--dry-run` so there is no need to override this. However, there are exceptions for some commands where this flag is differently named. This property offers extensibility to the modules that may use different flag.

abstract `dry_run_supported(cmd)`

Check if command supports `-dry-run`.

Parameters `cmd` (`str`) – Command that module should execute

Returns Boolean indicating whether command supports dry run

Return type `bool`

echo(`output, rc`)

Print output to console, and exit if return code is different from 0.

Parameters

- **output** (`str`) – stdout or stderr of a process
- **rc** (`int`) – Return code of the process

Returns `Void`

Return type `None`

execute(`dry_run_enabled=False`)

Parse command and its arguments, and execute the module.

Parameters `dry_run_enabled` (`bool`) – Boolean indicating whether user turned on dry run for the task

Returns `Void`

Return type `None`

subprocess(`cmd`)

Execute command with shell, and return output and return code.

Parameters `cmd` (`str`) – Command to execute

Returns Output and return code

Return type `tuple`

Example:

```
output, rc = self.subprocess('kubectl get pods')
```

exception `narrenschiff.modules.common.NarrenschiffModuleException`

Use when something goes wrong in modules.

Kubectl

class narrenschiff.modules.kubectl.**Kubectl**(*command*)
kubectl module.

property cmd

Get command that module needs to execute later.

Returns Full command with all parameters

Return type str

sanitize_filenames()

Change relative paths to absolute paths corresponding to rendered files.

Returns Void

Return type None

update_filename_argument()

Update filename argument as a properly formatted string.

Returns Void

Return type None

Kustomization

class narrenschiff.modules.kustomization.**Kustomization**(*command*)
kustomization module. Wrapper around kubectl apply -k dir/.

property cmd

Get command that module needs to execute later.

Returns Full command with all parameters

Return type str

Helm

class narrenschiff.modules.helm.**Helm**(*command*)
helm module.

property cmd

Get command that module needs to execute later.

Returns Full command with all parameters

Return type str

dry_run_supported(cmd)

Check if command supports --dry-run.

Parameters **cmd** (str) – Command that module should execute

Returns Boolean indicating whether command supports dry run

Return type bool

parse_secretmaps_args()

Mutate secretmap arguments. Expand secretmap paths to match files in the /tmp directory.

Returns Void

Return type None

exception `narrenschiff.modules.helm.HelmException`
 Raise when something is wrong with Helm module.

gcloud

class `narrenschiff.modules.gcloud.Gcloud(command)`
 gcloud module.

property `cmd`

Get command that module needs to execute later.

Returns Full command with all parameters

Return type `str`

dry_run_supported(`cmd`)

Check if command supports `-dry-run`.

Parameters `cmd` (`str`) – Command that module should execute

Returns Boolean indicating whether command supports dry run

Return type `bool`

Wait for Pod

class `narrenschiff.modules.wait_for_pod.WaitForPod(command)`
 Use this module when you need to wait for a pod to become ready.

property `cmd`

Get command that module needs to execute later.

Returns Full command with all parameters

Return type `str`

dry_run_supported(`cmd`)

Check if command supports `-dry-run`.

Parameters `cmd` (`str`) – Command that module should execute

Returns Boolean indicating whether command supports dry run

Return type `bool`

execute()

Parse command and its arguments, and execute the module.

Parameters `dry_run_enabled` (`bool`) – Boolean indicating whether user turned on dry run for the task

Returns Void

Return type None

2.2.10 CLI

Deploy

`narrenschiff.cli.sail.sail(course)`

Turn tasks into actions.

Parameters `course` (str) – The path to `course` file. A file containing tasks specified in the YAML format. Tasks are executable pieces of configuration. Course is Jinja2 templated file (as are all the kubernetes manifest files)

Returns Void

Return type None

Chest

`narrenschiff.cli.chest.chest(ctx)`

Load keys and spices.

Returns Void

Return type None

`narrenschiff.cli.chest.loot(keychain, treasure, value, location)`

Display value from the chest file.

Parameters

- **keychain** (narrenschiff.chest.Keychain) – Object containing key and spice
- **treasure** (str) – Name of the variable
- **location** (str) – Path to the course directory

Returns Void

Return type None

`narrenschiff.cli.chest.stash(keychain, treasure, value, location)`

Dynamically update chest file. Override old value if exists.

Parameters

- **keychain** (narrenschiff.chest.Keychain) – Object containing key and spice
- **treasure** (str) – Name of the variable
- **value** (str) – Value of the variable
- **location** (str) – Path to the course directory

Returns Void

Return type None

`narrenschiff.cli.chest.lock(keychain, value)`

Encrypt string and print it to STDOUT.

Parameters

- **keychain** (narrenschiff.chest.Keychain) – Object containing key and spice
- **value** (str) – Value of the variable

Returns Void

Return type None

`narrenschiff.cli.chest.unlock(keychain, value)`

Decrypt string and print it to STDOUT.

Parameters

- **keychain** (`narrenschiff.chest.Keychain`) – Object containing key and spice
- **value** (`str`) – Value of the variable

Returns Void

Return type None

Secret Map

`narrenschiff.cli.secretmap.secretmap(ctx)`

Encrypt, decrypt, and edit files.

Returns Void

Return type None

`narrenschiff.cli.secretmap.stash(keychain, source, destination, treasure, location)`

Encrypt and stash file.

Parameters

- **keychain** (`narrenschiff.chest.Keychain`) – Object containing key and spice
- **source** (`str`) – Source filepath for encryption
- **destination** (`str`) – Destination filepath of the encrypted file
- **treasure** (`str`) – Name of the variable
- **location** (`str`) – Location of the secretmap file

Returns Void

Return type None

`narrenschiff.cli.secretmap.loot(keychain, destination, treasure, location)`

Decrypt file from stash.

Parameters

- **keychain** (`narrenschiff.chest.Keychain`) – Object containing key and spice
- **destination** (`str`) – Destination filepath of the decrypted file
- **treasure** (`str`) – Name of the variable
- **location** (`str`) – Location of the secretmap file

Returns Void

Return type None

`narrenschiff.cli.secretmap.peek(keychain, treasure, location)`

Print content of the encrypted file to STDOUT.

Parameters

- **keychain** (`narrenschiff.chest.Keychain`) – Object containing key and spice

- **treasure** (str) – Name of the variable
- **location** (str) – Location of the secretmap file

Returns Void

Return type None

`narrenschiff.cli.secretmap.alter(keychain, treasure, location)`

Decrypt and edit the file. After edits, the file is encrypted again.

Parameters

- **keychain** (narrenschiff.chest.Keychain) – Object containing key and spice
- **treasure** (str) – Name of the variable
- **location** (str) – Location of the secretmap file

Returns Void

Return type None

`narrenschiff.cli.secretmap.destroy(keychain, treasure, location)`

Delete secretmap file and corresponding key in the secretmap.

Parameters

- **keychain** (narrenschiff.chest.Keychain) – Object containing key and spice
- **treasure** (str) – Name of the variable
- **location** (str) – Location of the secretmap file

Returns Void

Return type None

You cannot undo this action!

`narrenschiff.cli.secretmap.search(keychain, location, match)`

Search for a pattern in secretmaps.

Parameters

- **keychain** (narrenschiff.chest.Keychain) – Object containing key and spice
- **location** (str) – Location of the secretmap file
- **match** (str) – Pattern you are looking for

Returns Void

Return type None

`narrenschiff.cli.secretmap.diff(keychain, location, match)`

Compare secretmaps line by line.

It can only compare secretmaps in the same course project.

Parameters

- **location** (str) – Location of the secretmap file
- **secretmaps** (str) – Two secretmaps that should be compared

Returns Void

Return type None

Lint

`narrenschiff.cli.lint.lint(ctx, location)`

Lint project files. Check if they are valid Jinja2 templates.

Parameters `location` (str) – Path to the directory

Returns Void

Return type None

Environment

`narrenschiff.cli.env.env(formatted)`

Show environment info.

Autocompletion

`narrenschiff.cli.autocomplete.autocomplete()`

Manage autocomplete script for your environment.

Returns Void

Return type None

`narrenschiff.cli.autocomplete.add(shell)`

Add autocomplete script to your environment.

Parameters `shell` (str) – Type of the shell you are using

Returns Void

Return type None

2.2.11 Logging

`class narrenschiff.log.NarrenschiffLogger(*args, **kwargs)`

Set narrenschiff log level and print to STDOUT.

`set_verbosity(verbosity)`

Set verbosity of the logger.

Parameters `verbosity` (int) – Verbosity level

Verbosity can be from 1 to 5, corresponding to five log levels.

2.2.12 Autocomplete

`class narrenschiff.autocomplete.ShellAutocomplete`

Set autocompletion.

`add()`

Add narrenschiff autocomplete to shell config.

Returns Void

Return type None

add_autocompletion(*path*)

Add autocompletion to the config file.

Parameters **path** (str) – Path to configuration file

Returns Void

Return type None

autocompletion_enabled(*config*)

Check if the file contains the autocompletion tag.

Parameters **config** (list of str) – Configuration file

Returns Confirmation whether file contains autocompletion tag

Return type bool

autocompletion_script()

Return autocompletion script.

Returns Autocompletion script

Return type list of str

get_abs_path(**args*)

Join arguments, and return absolute path.

Parameters **args** (list of str) – Paths to be joined

Returns Absolute path

Return type str

If the first argument is tilde (~) then the method will expand user.

get_config_file()

Get type of the config file.

Returns Name of the config file

Return type str

This method returns either `.bashrc` (which will later be edited for the current user), or `activate` which symbolises activate script of your virtualenv.

read_file(*path*)

Read configuration file.

Parameters **path** (str) – Path to the file to read

Returns File as a list

Return type list of str

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