Chapter 1. Using the Katzenpost test network

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Katzenpost provides a ready-to-deploy Docker image [https://github.com/katzenpost/katzenpost/tree/main/docker] for developers who need a non-production test environment for developing and testing client applications. By running this image on a single computer, you avoid the need to build and manage a complex multi-node mix net. The image can also be run using Podman [https://podman.io/]

The test mix network includes the following components:

- Three directory authority (PKI [https://katzenpost.network/docs/specs/pki/]) nodes
- Six mix [https://katzenpost.network/docs/specs/mixnet/] nodes, including one node serving also as both gateway and service provider.
- Two chat applications[1]

Requirements

Before running the Katzenpost docker image, make sure that the followingsoftware[2] is installed.

- A Debian GNU Linux [https://debian.org] or Ubuntu [https://ubuntu.com] system
- Git [https://git-scm.com/]
- Go [https://go.dev/]
- GNU Make [https://www.gnu.org/software/make/]
- Docker [https://www.docker.com], Docker Compose [https://docs.docker.com/compose/], and (optionally) Podman [https://podman.io]

Note

If both Docker and Podman are present on your system, Katzenpost uses Podman. Podman is a drop-in daemonless equivalent to Docker that does not require superuser privileges to run.

[1] dwrob: What chat application is there other than ping? Is thie ping called by *make run-ping* the same as the regular KP ping? Katzen should not be documented in this chapter, because it is not specific to the testnet. However, we can link from here to its documentation if we like.

[2] dwrob: Add minimum hardware specs?

On Debian, these software requirements can be installed with the following commands (running as superuser). **Apt** will pull in the needed dependencies.

```
# apt update
# apt install git golang make docker docker-compose podman
```

Preparing to run the container image

Complete the following procedure to obtain, build, and deploy the Katzenpost test network.

1. Install the Katzenpost code repository, hosted at https://github.com/katzenpost. The main Katzenpost repository contains code for the server components as well as the docker image. Clone the repository with the following command (your directory location may vary):

   ```
   ~$ git clone https://github.com/katzenpost/katzenpost.git
   ```

2. Navigate to the new `katzenpost` subdirectory and ensure that the code is up to date.

   ```
   ~$ cd katzenpost
   ~/katzenpost$ git checkout main
   ~/katzenpost$ git pull
   ```

3. (Optional) Create a development branch and check it out.

   ```
   ~/katzenpost$ git checkout -b devel
   ```

4. (Optional) If you are using Podman, complete the following steps:

   1. Point the DOCKER_HOST environment variable at the Podman process.

      ```
      $ export DOCKER_HOST=unix:///var/run/user/$(id -u)/podman/podman.sock
      ```

   2. Set up and start[3] the Podman server (as superuser).

      ```
      $ podman system service -t 0 $DOCKER_HOST &
      $ systemctl --user enable --now podman.socket
      $ systemctl --user start podman.socket
      ```

Operating the test mixnet

Navigate to `katzenpost/docker`. The `Makefile` contains target operations to create, manage, and test the self-contained Katzenpost container network. To invoke a target, run a command with the using the following pattern:

```
~/katzenpost/docker$ make target
```

Running **make** with no target specified returns a list of available targets[4]:

Table 1.1. Makefile targets

[none]	Display this list of targets.
run	Run the test network[5] in the background.

[3] dwrob: The third command was not specified in prior documentation, but I had to do it. Maybe the other *systemctl* command is unnecessary.

[4] dwrob: Each of the targets needs a non-trivial description, including an explanation of when you would use it and why.

[5] dwrob: These run commands are backwards. They also should be given less ambiguous names, maybe run-background and run-foreground.

start	Run the test network in the foreground until **Ctrl-C**.
stop	Stop the test network.
wait	Wait for the test network to have consensus.[6]
watch	Display live log entries until **Ctrl-C**.
status	Show test network consensus status.
show-latest-vote	Show latest consensus vote.
run-ping	Send a ping over the test network.
clean-bin	Stop all components and delete binaries.
clean-local[7]	Stop all components, delete binaries, and delete data..
clean-local-dryrun	Show what clean-local would delete.
clean	The above, plus cleans includes go_deps image[8].

Starting and monitoring the mixnet

Either of two command targets, **run** and **start**, can be used to start the mix network. The first They differ only in that **start** quickly detaches and runs the network in the background, while **run** runs the network in the foreground.

Note

When running **run** or **start** , be aware of the following considerations:

- If you intend to use Docker, you need to run **make** as superuser. If you are using **sudo** to elevate your privileges, you need to edit `katzenpost/docker/Makefile` to prepend **sudo** to each command contained in it.
- If you have Podman installed on your system and you nonetheless want to run Docker, you can override the default behavior by adding the argument **docker=docker** to the command as in the following:

  ```
  ~/katzenpost/docker$ make run docker=docker
  ```

The first time that you use **run** or **start**, the docker image will be downloaded, built, and installed. This takes several minutes.

Starting the network for the first time with **run** lets you observe the installation process as command output:

```
~/katzenpost/docker$ make run
...
<output>
...
```

Alternatively, you can install using **start**, which returns you to a command prompt. You can then use **watch** to view the further progress of the installation:

[6] dwrob: What is the difference between doing this and not doing this? Is something gated by it?

[7] dwrob: These description names could be clearer. *Local* does not say much to me, and the *clean* should probably be *clean-all*, with an explanation of what *all* means.

[8] dwrob: We need to explain what this is.

```
~/katzenpost/docker$ make start
...
~/katzenpost/docker$ make watch
...
<output>
...
```

Once installation is complete, there is a further delay as the mix servers vote and reach a consensus.

You can confirm that installation and configuration are complete by issuing the **status** command from the same or another terminal. When the network is ready for use, **status** begins returning consensus information similar to the following:

```
~/katzenpost/docker$ make status
...
00:15:15.003 NOTI state: Consensus made for epoch 1851128 with 3/3 signatures: &
...
```

Testing the mixnet

At this point, you should have a locally running mix network. You can test whether it is working correctly by using **ping**, which launches a packet into the network and watches for a successful reply. Run the following command:

```
~/katzenpost/docker$ make run-ping
```

If the network is functioning properly, the resulting output contains a line similar to the following:

```
17:02:15.627 INFO gateway1_client: OnACK with SURBID [0123456789abcdef012345678
!Success rate is 100.000000 percent 1/1)
```

lf **ping** fails to receive a reply, it eventually times out with an error message:

```
error: failure waiting for reply, timeout reached
.~Success rate is 0.000000 percent 0/1)
```

If this happens, try the command again.

Note

If you attempt use **ping** too quickly after starting the mixnet, and consensus has not been reached, the utility may crash with an error message or hang indefinitely. If this happens, issue (if necessary) a **Ctrl-C** key sequence to abort, check the consensus status with the **status** command, and then retry **ping**.

Shutting down the mixnet

The mix network continues to run in the terminal where you started it until you issue a **Ctrl-C** key sequence, or until you issue the following command in another terminal:

```
~/katzenpost/docker$ make stop
```

When you stop the network, the binaries and data are left in place. This allows for a quick restart.

Uninstalling and cleaning up

Several command targets can be used to uninstall the Docker image and restore your system to a clean state. The following examples demonstrate the commands and their output.

- **clean-bin**[9]

  To stop the network and delete the compiled binaries, run the following command:

```
~/katzenpost/docker$ make clean-bin
[ -e voting_mixnet ] && cd voting_mixnet && DOCKER_HOST=unix:///run/user/1000/
Stopping voting_mixnet_auth3_1        ... done
Stopping voting_mixnet_servicenode1_1 ... done
Stopping voting_mixnet_metrics_1      ... done
Stopping voting_mixnet_mix3_1         ... done
Stopping voting_mixnet_auth2_1        ... done
Stopping voting_mixnet_mix2_1         ... done
Stopping voting_mixnet_gateway1_1     ... done
Stopping voting_mixnet_auth1_1        ... done
Stopping voting_mixnet_mix1_1         ... done
Removing voting_mixnet_auth3_1        ... done
Removing voting_mixnet_servicenode1_1 ... done
Removing voting_mixnet_metrics_1      ... done
Removing voting_mixnet_mix3_1         ... done
Removing voting_mixnet_auth2_1        ... done
Removing voting_mixnet_mix2_1         ... done
Removing voting_mixnet_gateway1_1     ... done
Removing voting_mixnet_auth1_1        ... done
Removing voting_mixnet_mix1_1         ... done
removed 'running.stamp'
rm -vf ./voting_mixnet/*.alpine
removed './voting_mixnet/echo_server.alpine'
removed './voting_mixnet/fetch.alpine'
removed './voting_mixnet/memspool.alpine'
removed './voting_mixnet/panda_server.alpine'
removed './voting_mixnet/pigeonhole.alpine'
removed './voting_mixnet/ping.alpine'
removed './voting_mixnet/reunion_katzenpost_server.alpine'
removed './voting_mixnet/server.alpine'
removed './voting_mixnet/voting.alpine'
```

  This command leaves in place the cryptographic keys, the state data, and the logs.

- **clean-local**[10]

  To delete both compiled binaries and data, run the following command:

```
~/katzenpost/docker$ make clean-local
[ -e voting_mixnet ] && cd voting_mixnet && DOCKER_HOST=unix:///run/user/1000/
Removing voting_mixnet_mix2_1         ... done
Removing voting_mixnet_auth1_1        ... done
Removing voting_mixnet_auth2_1        ... done
Removing voting_mixnet_gateway1_1     ... done
Removing voting_mixnet_mix1_1         ... done
Removing voting_mixnet_auth3_1        ... done
Removing voting_mixnet_mix3_1         ... done
Removing voting_mixnet_servicenode1_1 ... done
```

[9] dwrob: *make clean* requires superuser privileges. That seems strange since I installed via podman without elevated privileges. Is this a bug? The problems seems to be with cache and code repo files.

[10] dwrob: I need more description of what this is removing. Run/start still very quickly start the network after this clean operation.

```
Removing voting_mixnet_metrics_1      ... done
removed 'running.stamp'
rm -vf ./voting_mixnet/*.alpine
removed './voting_mixnet/echo_server.alpine'
removed './voting_mixnet/fetch.alpine'
removed './voting_mixnet/memspool.alpine'
removed './voting_mixnet/panda_server.alpine'
removed './voting_mixnet/pigeonhole.alpine'
removed './voting_mixnet/reunion_katzenpost_server.alpine'
removed './voting_mixnet/server.alpine'
removed './voting_mixnet/voting.alpine'
git clean -f -x voting_mixnet
Removing voting_mixnet/
git status .
On branch main
Your branch is up to date with 'origin/main'.
```

- **clean**[11]

  To stop the the network and delete the binaries, the data, and the go_deps image, run the following command as superuser:

  ```
  ~/katzenpost/docker$ sudo make clean
  ```

- **clean-local-dryrun**

  ```
  ~/katzenpost/docker$ make clean-local-dryrun
  git clean -n -x voting_mixnet
  Would remove voting_mixnet/
  ```

```
~/katzenpost/docker$ make clean
```

For a preview of the components that **clean-local** would remove, without actually deleting anything, running **clean-local-dryrun** generates output as follows:

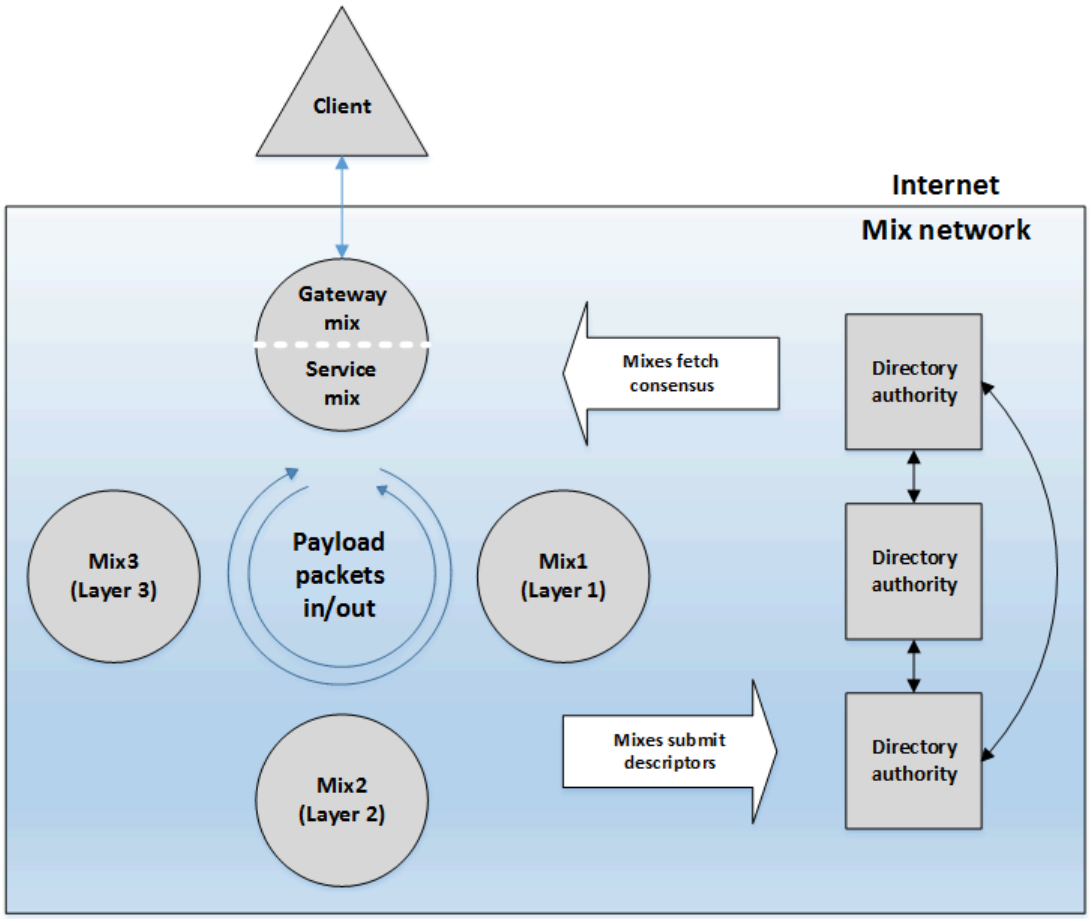
Network components and topology

There needs to be an interpretation of this diagram. including the ways that the testnet differs from production network.

Unclear: terminology around providers, gateways

[11] dwrob: Again, I need a fuller inventory. I see that a lot of repo code is removed, and the cache. We could be more descriptive. Also, as noted, there is something weird with permissions needed for this command.. It makes no sense that I can set the testnet up as a reegular user, but I need to be root to remove it

Figure 1.1. Test network topology



Discuss how to view these components, where their configuration files are, etc.

Table 1.2. Network hosts[12]

Host type	Identifier	IP	Port	Spool.DB	User.DB	Panda
Directory authority	auth1	127.0.0.1	30001			
Directory authority	auth2	127.0.0.1	30002			
Directory authority	auth3	127.0.0.1	30003			
Service provider	provider1	127.0.0.1	30004	✓	✓	✓
Service provider	provider2	127.0.0.1	30005	✓	✓	
Mix	mix1	127.0.0.1	30006			
Mix	mix2	127.0.0.1	30007			
Mix	mix3	127.0.0.1	30008			

[12] dwrob: I will define/describe each of these component types in a separate section, because they are general and not specific to the testnet. These host types will be linked to that.