GNU Taler Merchant Manual

Release 0.9.0

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1.1 About GNU Taler

GNU Taler is an open protocol for an electronic payment system with a free software reference implementation. GNU Taler offers secure, fast and easy payment processing using well understood cryptographic techniques. GNU Taler allows customers to remain anonymous, while ensuring that merchants can be held accountable by governments. Hence, GNU Taler is compatible with anti-money-laundering (AML) and know-your-customer (KYC) regulation, as well as data protection regulation (such as GDPR).

1.2 About this manual

This manual targets system administrators who want to install a GNU Taler merchant backend.

We expect some moderate familiarity with the compilation and installation of Free Software packages. An understanding of cryptography is not required.

This first chapter of the manual will give a brief overview of the overall Taler architecture, describing the environment in which the Taler backend operates. The second chapter then explains how to install the software, including key dependencies. The third chapter will explain how to configure the backend, including in particular the configuration of the bank account details of the merchant.

The last chapter gives some additional information about advanced topics which will be useful for system administrators but are not necessary for operating a basic backend.

1.3 Architecture overview

Taler is a pure payment system, not a new crypto-currency. As such, it operates in a traditional banking context. In particular, this means that in order to receive funds via Taler, the merchant must have a regular bank account, and payments can be executed in ordinary currencies such as USD or EUR. Taler can also be used as a regional currency; for such scenarios, the Taler system also includes its own stand-alone bank.

The Taler software stack for a merchant consists of four main components:

- A frontend which interacts with the customer’s browser. The frontend enables the customer to build a shopping cart and place an order. Upon payment, it triggers the respective business logic to satisfy the order. This component is not included with Taler, but rather assumed to exist at the merchant. The Merchant API Tutorial gives an introduction for how to integrate Taler with Web shop frontends.

- A back-office application that enables the shop operators to view customer orders, match them to financial transfers, and possibly approve refunds if an order cannot be satisfied. This component is not included with Taler, but
rather assumed to exist at the merchant. The Merchant Backend API provides the API specification that should be reviewed to integrate such a back-office with the Taler backend.

- A Taler-specific payment *backend* which makes it easy for the frontend to process financial transactions with Taler. This manual primarily describes how to install and configure this backend.

- A *DBMS* which stores the transaction history for the Taler backend. For now, the GNU Taler reference implementation only supports PostgreSQL, but the code could be easily extended to support another DBMS. Please review the PostgreSQL documentation for details on how to configure the database.

The following image illustrates the various interactions of these key components:

![Diagram of Taler Merchant components](image)

Basically, the backend provides the cryptographic protocol support, stores Taler-specific financial information in a DBMS and communicates with the GNU Taler exchange over the Internet. The frontend accesses the backend via a RESTful API. As a result, the frontend never has to directly communicate with the exchange, and also does not deal with sensitive data. In particular, the merchant’s signing keys and bank account information are encapsulated within the Taler merchant backend.

A typical deployment will additionally include a full-blown Web server (like Apache or Nginx). Such a Web server would be responsible for TLS termination and access control to the /private/ and /management/ API endpoints of the merchant backend. Please carefully review the section on *secure setup* before deploying a Taler merchant backend into production.
This chapter describes some of the key concepts used throughout the manual.

2.1 Instances

The backend allows a single HTTP server to support multiple independent shops with distinct business entities sharing a single backend. An instance is the name or identifier that allows the single HTTP server to determine which shop a request is intended for. Each instance has its own base URL in the REST API of the merchant backend (/instances/$INSTANCE/). Each instance can use its own bank accounts and keys for signing contracts. All major accounting functionality is separate per instance. Access to each instance is controlled via a bearer token (to be set in the HTTP “Authorization” header). All instances share the same database, top-level HTTP(S) address and the main Taler configuration (especially the accepted currency and exchanges).

Note: This documentation does not use the term “user” or “username” in conjunction with instances as that might create confusion between instances with paying customers using the system. We also do not use the term “account” in conjunction with instances, as that might cause confusion with bank accounts. That said, conceptually it is of course acceptable to consider instances to be the “users” or “accounts” of a merchant backend and the bearer token is equivalent to a passphrase.

2.2 Instance Bank Accounts

To receive payments, an instance must have configured one or more bank accounts. When configuring the bank account of an instance, one should ideally also provide the address and credentials of an HTTP service implementing the Taler Bank Revenue HTTP API. Given such a service, the GNU Taler merchant backend can automatically reconcile wire transfers from the exchange to the merchant’s bank account with the orders that are being settled.

This documentation exclusively uses the term account for the bank accounts of a merchant or shop that may be associated with an instance.
2.3 Inventory

The Taler backend offers inventory management as an optional function. Inventory is tracked per instance and consists of products sold in units. Inventory can be finite (physical stock) or infinite (for digital products). Products may include previews (images) to be shown to the user as well as other meta-data. Inventory management allows the frontend to lock products, reserving a number of units from stock for a particular (unpaid) order. The backend can keep track of how many units of a product remain in stock and ensure that the number of units sold does not exceed the number of units in stock.

Inventory management is optional, and it is possible for the frontend to include products in orders that are not in the inventory. The frontend can also override prices of products in the inventory or set a total price for an order that is different from the price of the sum of the products in the order.

2.4 Orders and Contracts

In Taler, users pay merchants for orders. An order is first created by the merchant. To create an order, the merchant must specify the specific terms of the order. Order terms include details such as the total amount to be paid, payment fees the merchant is willing to cover, the set of products to deliver, a delivery location and many other details. The merchant API specification specifies the full set of possible order terms.

After an order is created, it is claimed by a wallet. Once an order is claimed by a specific wallet, only that wallet will be able to pay for this order, to the exclusion of other wallets even if they see the same order URL. Sharing order URLs is explicitly allowed: if a user shares an order URL with another user, that other user should be given the opportunity to purchase the same product.

To prevent unauthorized wallets from claiming an order, merchants can specify that claims require authorization in the form of a claim token. This is useful in case the order ID is predictable (say because an existing order ID scheme with predictable order IDs from the merchant frontend is used) and at the same time malicious actors claiming orders is problematic (say because of limited stocks). The use of claim tokens is optional, but if a claim token is used, it must be provided to the wallet as part of the order URI.

Additionally, when stocks are limited, you can configure Taler to set a product lock on items (say, while composing the shopping cart). These locks will ensure that the limited stock is respected when making offers to consumers.

A wallet may pay for a claimed order, at which point the order turns into a (paid) contract. Orders have a configurable expiration date (the pay_deadline) after which the commercial offer expires and any stock of products locked by the order will be automatically released, allowing the stock to be sold in other orders. When an unpaid order expires, the customer must request a fresh order if they still want to make a purchase.

Once a contract has been paid, the merchant should fulfill the contract. It is possible for the merchant to refund a contract order, for example if the contract cannot be fulfilled after all. Refunds are only possible after the customer paid and before the exchange has wired the payment to the merchant. Once the funds have been wired, refunds are no longer allowed by the Taler exchange. The wire deadline specifies the latest point in time by which an exchange must wire the funds, while the (earlier) refund deadline specifies the earliest point in time when an exchange may wire the funds. Thus, refunds are always possible between the time of purchase and the refund deadline, but may remain possible until the wire deadline.

Contract information is kept for legal reasons in the merchant database. The main legal reason is typically to provide tax records in case of a tax audit. After the legal expiration (by default: a decade), contract information is deleted when running the garbage collector using taler-merchant-dbinit.
2.5 Transfers

The Taler backend can be used to verify that the exchange correctly wired all of the funds to the merchant. However, if no Taler Bank Revenue HTTP API was provided for the respective bank account, the backend does not have access to the incoming wire transfers of the merchant’s bank account. In this case, merchants should manually provide the backend with wire transfer data that specifies the wire transfer subject and the amount that was received. Given this information, the backend can detect and report any irregularities that might arise.

2.6 Rewards

Taler does not only allow a Website to be paid, but also to make voluntary, non-contractual payments to visitors, called rewards. Such rewards could be granted as a reward for filling in surveys or watching advertisements. For rewards, there is no contract; rewards are always voluntary actions by the Web site that do not arise from a contractual obligation. Before a Web site can create rewards, it must establish a reserve. Once a reserve has been established, the merchant can grant rewards, allowing wallets to pick up the reward.

Note: Rewards are an optional feature, and exchanges may disable rewards (usually if they see compliance issues). In this case, the reward feature will not be available.

2.7 Reserves

A reserve is a pool of electronic cash at an exchange under the control of a private key. Merchants withdraw coins from a reserve when granting rewards. A reserve is established by first generating the required key material in the merchant backend, and then wiring the desired amount of funds to the exchange.

An exchange will automatically close a reserve after a fixed period of time (typically about a month), wiring any remaining funds back to the merchant. While exchange APIs exist to (1) explicitly open a reserve to prevent it from being automatically closed and to (2) explicitly close a reserve at any time, the current merchant backend does not make use of these APIs.
This chapter describes how to install the GNU Taler merchant backend.

3.1 Installing from source

The following instructions will show how to install a GNU Taler merchant backend from source. The package sources can be find in our download directory.

GNU Taler components version numbers follow the MAJOR.MINOR.MICRO format. The general rule for compatibility is that MAJOR and MINOR must match. Exceptions to this general rule are documented in the release notes. For example, Taler merchant 1.3.0 should be compatible with Taler exchange 1.4.x as the MAJOR version matches. A MAJOR version of 0 indicates experimental development, and you are expected to always run all of the latest releases together (no compatibility guarantees).

First, the following packages need to be installed before we can compile the backend:

- “Sphinx RTD Theme” Python package aka python3-sphinx-rtd-theme on Debian-based systems (for GNUnet documentation support, can be omitted if GNUnet is configured with --disable-documentation)
- libsqlite3 >= 3.16.2
- GNU libunistring >= 0.9.3
- libcurl >= 7.26 (or libgnurl >= 7.26)
- libqrencode >= 4.0.0 (Taler merchant only)
- GNU libgcrypt >= 1.6 (1.10 or later highly recommended)
- libsodium >= 1.0
- libargon2 >= 20171227
- libjansson >= 2.7
- PostgreSQL >= 15, including libpq
- GNU libmicrohttpd >= 0.9.71
- GNUnet >= 0.20 (from source tarball)
- Python3 with jinja2

If you are on Debian stable or later, the following command may help you install these dependencies:
apt-get install
libqrencode-dev
libsqlite3-dev
libtld1-dev
libunistring-dev
libsodium-dev
libargon2-dev
libcurl4-gnutls-dev
libgcrypt20-dev
libhansson-dev
libpq-dev
libmicrohttpd-dev
python3-jinja2
postgresql-15

Before you install GNUnet, you must download and install the dependencies mentioned in the previous section, otherwise the build may succeed, but could fail to export some of the tooling required by GNU Taler.

On Ubuntu, you also need to install pkg-config, for example:

$ apt-get install pkg-config

To install GNUnet, unpack the tarball and change into the resulting directory, then proceed as follows:

$ ./configure
# Each dependency can be fetched from non standard locations via
# the '--with-<LIBNAME>' option. See './configure --help'.
$ make
# make install
# ldconfig

If you did not specify a prefix, GNUnet will install to /usr/local, which requires you to run the last step as root. The ldconfig command (also run as root) makes the shared object libraries (.so files) visible to the various installed programs.

Please note that unlike most packages, if you want to run the make check command, you should run it only after having done make install. The latter ensures that necessary binaries are copied to the right place.

In any case, if make check fails, please consider filing a bug report with the Taler bug tracker.

There is no need to actually run a GNUnet peer to use the Taler merchant backend – all the merchant needs from GNUnet is a number of headers and libraries!

After installing GNUnet, unpack the GNU Taler exchange tarball, change into the resulting directory, and proceed as follows:

$ ./configure
# Each dependency can be fetched from non standard locations via
# the '--with-<LIBNAME>' option. See './configure --help'.
$ make
# make install

If you did not specify a prefix, the exchange will install to /usr/local, which requires you to run the last step as root. You have to specify --with-gnunet=/usr/local if you installed GNUnet to /usr/local in the previous step.
There is no need to actually run a Taler exchange to use the Taler merchant backend – all the merchant needs from the Taler exchange is a few headers and libraries!

Please note that unlike most packages, if you want to run the `make check` command, you should run it only after having done `make install`. The latter ensures that necessary binaries are copied to the right place.

In any case, if `make check` fails, please consider filing a bug report with the Taler bug tracker.

The following steps assume all dependencies are installed.

First, unpack the GNU Taler merchant tarball and change into the resulting directory. Then, use the following commands to build and install the merchant backend:

```
$ ./configure [--prefix=PFX] \
   [--with-gnunet=GNUNETPFX] \
   [--with-exchange=EXCHANGEPFX]
$ # Each dependency can be fetched from non standard locations via
$ # the '--with-<LIBNAME>' option. See './configure --help'.
$ make
$ make install
```

If you did not specify a prefix, the exchange will install to `/usr/local`, which requires you to run the last step as `root`.

You have to specify `--with-exchange=/usr/local` and/or `--with-gnunet=/usr/local` if you installed the exchange and/or GNUnet to `/usr/local` in the previous steps.

Depending on the prefixes you specified for the installation and the distribution you are using, you may have to edit `/etc/ld.so.conf`, adding lines for `GNUNETPFX/lib/` and `EXCHANGEPFX/lib/` and `PFX/lib/` (replace the prefixes with the actual paths you used). Afterwards, you should run `ldconfig`. Without this step, it is possible that the linker may not find the installed libraries and launching the Taler merchant backend would then fail.

Please note that unlike most packages, if you want to run the `make check` command, you should run it only after having done `make install`. The latter ensures that necessary binaries are copied to the right place.

In any case, if `make check` fails, please consider filing a bug report with the Taler bug tracker.

### 3.2 Installing the GNU Taler binary packages on Debian

To install the GNU Taler Debian packages, first ensure that you have the right Debian distribution. At this time, the packages are built for Debian bookworm.

You need to add a file to import the GNU Taler packages. Typically, this is done by adding a file `/etc/apt/sources.list.d/taler.list` that looks like this:

```
deb [signed-by=/etc/apt/keyrings/taler-systems.gpg] https://deb.taler.net/apt/debian_ bookworm main
```

Next, you must import the Taler Systems SA public package signing key into your keyring and update the package lists:

```
# wget -O /etc/apt/keyrings/taler-systems.gpg https://taler.net/taler-systems.gpg
# apt update
```

**Note:** You may want to verify the correctness of the Taler Systems SA key out-of-band.

Now your system is ready to install the official GNU Taler binary packages using `apt`.

### 3.2. Installing the GNU Taler binary packages on Debian
To install the Taler merchant backend, you can now simply run:

```
# apt install taler-merchant
```

Note that the package does not complete the integration of the backend with the HTTP reverse proxy (typically with TLS certificates). A configuration fragment for Nginx or Apache will be placed in `/etc/{apache,nginx}/conf-available/taler-merchant.conf`. You must furthermore still configure the database and the instances, and may need to extend the fragment with access control restrictions for non-default instances.

### 3.3 Installing the GNU Taler binary packages on Trisquel

To install the GNU Taler Trisquel packages, first ensure that you have the right Trisquel distribution. Packages are currently available for Trisquel GNU/Linux 10.0. Simply follow the same instructions provided for Ubuntu.

### 3.4 Installing the GNU Taler binary packages on Ubuntu

To install the GNU Taler Ubuntu packages, first ensure that you have the right Ubuntu distribution. At this time, the packages are built for Ubuntu Lunar and Ubuntu Jammy. Make sure to have `universe` in your `/etc/apt/sources.list` (after `main`) as we depend on some packages from Ubuntu `universe`.

A typical `/etc/apt/sources.list.d/taler.list` file for this setup would look like this for Ubuntu Lunar:

```
deb [signed-by=/etc/apt/keyrings/taler-systems.gpg] https://deb.taler.net/apt/ubuntu/lunar taler-lunar
```

For Ubuntu Jammy use this instead:

```
deb [signed-by=/etc/apt/keyrings/taler-systems.gpg] https://deb.taler.net/apt/ubuntu/jammy taler-jammy
```

The last line is crucial, as it adds the GNU Taler packages.

Next, you must import the Taler Systems SA public package signing key into your keyring and update the package lists:

```
# wget -O /etc/apt/keyrings/taler-systems.gpg \
https://taler.net/taler-systems.gpg
# apt update
```

**Note:** You may want to verify the correctness of the Taler Systems key out-of-band.

Now your system is ready to install the official GNU Taler binary packages using apt.

To install the Taler merchant backend, you can now simply run:

```
# apt install taler-merchant
```

Note that the package does not complete the integration of the backend with the HTTP reverse proxy (typically with TLS certificates). A configuration fragment for Nginx or Apache will be placed in `/etc/{apache,nginx}/conf-available/taler-merchant.conf`. You must furthermore still configure the database and the instances, and may need to extend the fragment with access control restrictions for non-default instances.
HOW TO CONFIGURE THE MERCHANT’S BACKEND

The installation already provides reasonable defaults for most of the configuration options. However, some must be provided, in particular the database that the backend should use. By default, the file $HOME/.config/taler.conf is where the Web shop administrator specifies configuration values that augment or override the defaults. Note that when using our binary packages, the systemd service files force the use of /etc/taler.conf as the main configuration file.

4.1 Configuration format

All GNU Taler components are designed to possibly share the same configuration files. When installing a GNU Taler component, the installation deploys default values in configuration files located at ${prefix}/share/taler/config.d/ where ${prefix} is the installation prefix. Different components must be installed to the same prefix.

In order to override these defaults, the user can write a custom configuration file and either pass it to the component at execution time using the -c option, or name it taler.conf and place it under $HOME/.config/ which is where components will look by default. Note that the systemd service files pass -c /etc/taler.conf, thus making /etc/taler.conf the primary location for the configuration.

A config file is a text file containing sections, and each section contains maps options to their values. Configuration files follow basically the INI syntax:

```
[section1]
value1 = string
value2 = 23

[section2]
value21 = string
value22 = /path22
```

Comments start with a hash (#). Throughout the configuration, it is possible to use $-substitution for options relating to names of files or directories. It is also possible to provide defaults values for those variables that are unset, by using the following syntax: ${VAR:-default}. There are two ways a user can set the value of $-prefixable variables:

1. by defining them under a [paths] section:
   ```
   [paths]
   TALER_DEPLOYMENT_SHARED = ${HOME}/shared-data
   ...
   [section-x]
   path-x = ${TALER_DEPLOYMENT_SHARED}/x
   ```

2. or by setting them in the environment:
The configuration loader will give precedence to variables set under [path] over environment variables.

The utility `taler-config`, which gets installed along with the exchange, can be used to get and set configuration values without directly editing the configuration file. The option `-f` is particularly useful to resolve pathnames, when they use several levels of $-expanded variables. See `taler-config --help`.

The repository `git://git.taler.net/deployment` contains example code for generating configuration files under `deployment/netzbon/`.

### 4.2 Using `taler-config`

The tool `taler-config` can be used to extract or manipulate configuration values; however, the configuration use the well-known INI file format and is generally better edited by hand to preserve comments and structure.

Run

```
$ taler-config -s $SECTION
```

to list all of the configuration values in section `$SECTION`.

Run

```
$ taler-config -s $SECTION -o $OPTION
```

to extract the respective configuration value for option `$OPTION` in section `$SECTION`.

Finally, to change a setting, run

```
$ taler-config -s $SECTION -o $OPTION -V $VALUE
```

to set the respective configuration value to `$VALUE`. Note that you have to manually restart affected Taler components after you change the configuration to make the new configuration go into effect.

Some default options will use $-variables, such as `$DATADIR` within their value. To expand the `$DATADIR` or other $-variables in the configuration, pass the `-f` option to `taler-config`. For example, compare:

```
$ taler-config --section exchange-offline --option MASTER_PRIV_FILE
$ taler-config -f --section exchange-offline --option MASTER_PRIV_FILE
```

While the configuration file is typically located at `~/.config/taler.conf`, an alternative location can be specified to any GNU Taler component using the `-c` option.

### 4.3 Backend options

The following table describes the options that commonly need to be modified. Here, the notation `[SECTION]/OPTION` denotes the option `OPTION` under the section `[SECTION]` in the configuration file.
4.3.1 Service address

The following option sets the transport layer address used by the merchant backend:

\[[MERCHANT]/SERVE = tcp | unix\]

If this option is set to

- tcp then we need to set the TCP port in \[[MERCHANT]/PORT\];
- unix then we need to set the unix domain socket path and mode in \[[MERCHANT]/UNIXPATH\] and \[[MERCHANT]/UNIXPATH_MODE\]. The latter takes the usual permission mask given as a number, e.g. 660 for user/group read-write access.

The frontend can then connect to the backend over HTTP using the specified address. If frontend and backend run within the same operating system, the use of a UNIX domain socket is recommended to avoid accidentally exposing the backend to the network.

To run the Taler backend on TCP port 8888, use:

\$$\text{taler-config -s MERCHANT -o SERVE -V tcp}$$
\$$\text{taler-config -s MERCHANT -o PORT -V 8888}$$

Note: When using the Debian/Ubuntu packages, these options are already configured in the \[/etc/taler/conf.d/merchant.conf\] configuration file. If you need to change them, you should edit \[/etc/taler/merchant-overrides.conf\]. By default, the Taler merchant package will use a UNIX domain socket at \[/run/taler/merchant-httpd/merchant-http.sock\]. For the best possible security it is recommended to leave this in place and configure a reverse proxy (Nginx or Apache) as described below.

4.3.2 Currency

Which currency the Web shop deals in, i.e. “EUR” or “USD”, is specified using the option

\[[TALER]/CURRENCY\]

When testing with the Taler demonstration exchange at \https://exchange.demo.taler.net/\ you must set this value to KUDOS:

\$$\text{taler-config -s TALER -o CURRENCY -V KUDOS}$$

Note: When using the Debian/Ubuntu packages, these options should be configured in the \[/etc/taler/taler.conf\] configuration file (alternatively, you can also edit \[/etc/taler/merchant-overrides.conf\]). However, you must edit the \[taler.conf\] file manually and must not use \[taler-config\] to do this, as that would inline the include directives and destroy the carefully setup path structure.
4.3.3 Database

In principle it is possible for the backend to support different DBMSs. The option

```
[MERCHAND/DB
```

specifies which DBMS is to be used. However, currently only the value `postgres` is supported. This is also the default.

In addition to selecting the DBMS software, the backend requires DBMS-specific options to access the database.

**Note:** The `taler-merchant-dbconfig` tool can be used to automate the database setup. When using the Debian/Ubuntu packages, the user should already have been created, so you can just run the tool without any arguments and should have a working database configuration.

For the `postgres` backend, you need to specify:

```
[MERCHANDDB-postgres]
CONFIG = "postgres://...
```

This option specifies a PostgreSQL access path, typically using the format `postgres://$DBNAME`, where `$DBNAME` is the name of the PostgreSQL database you want to use. Suppose `$USER` is the name of the user who will run the backend process (usually `taler-merchant-httpd`). Then, you need to first run:

```
$ sudo -u postgres createuser -d $USER
```

as the PostgreSQL database administrator (usually `postgres`) to grant `$USER` the ability to create new databases. Next, you should as `$USER` run:

```
$ createdb $DBNAME
```

to create the backend’s database. Here, `$DBNAME` must match the database name given in the configuration file.

Now you should be able to create the tables and indices. To do this, run as `$USER` (usually `taler-merchant-httpd`):

```
$ taler-merchant-dbinit
```

You may improve your security posture if you now REVOKE the rights to CREATE, DROP or ALTER tables from `$USER`. However, if you do so, please be aware that you may have to temporarily GRANT those rights again when you update the merchant backend. For details on how to REVOKE or GRANT these rights, consult the PostgreSQL documentation.

**Note:** Taler may store sensitive business and customer data in the database. Any operator SHOULD thus ensure that backup operations are encrypted and secured from unauthorized access.
4.3.4 Exchange

To add an exchange to the list of trusted payment service providers, you create a section with a name that starts with “MERCHANT-EXCHANGE-”. In that section, the following options need to be configured:

- The EXCHANGE_BASE_URL option specifies the exchange’s base URL. For example, to use the Taler demonstrator, specify:

```ini
[MERCHANT-EXCHANGE-demo]
EXCHANGE_BASE_URL = "https://exchange.demo.taler.net/
```

- The MASTER_KEY option specifies the exchange’s master public key in base32 encoding. For the Taler demonstrator, use:

```ini
[MERCHANT-EXCHANGE-demo]
MASTER_KEY = "FH1Y8ZMHCTPQ0YFSZECDH8C9407JR3YN0MF1706PTG24Q4NEWGV0"
```

- The CURRENCY option specifies the exchange’s currency. For the Taler demonstrator, use:

```ini
[MERCHANT-EXCHANGE-demo]
CURRENCY = "KUDOS"
```

Note that multiple exchanges can be added to the system by using different identifiers in place of demo in the example above. Note that all of the exchanges actually used will use the same currency. If the currency does not match the main CURRENCY option from the TALER section, the respective MERCHANT-EXCHANGE- section is automatically ignored. If you need support for multiple currencies, you need to deploy one backend per currency.

Note: Manually setting up exchanges is only recommended under special circumstances. In general, GNU Taler distributions will include trustworthy exchanges (for each currency) in the default configuration, and there is rarely a good reason for trusting an exchange that has no relationship with the GNU Taler development team.

4.4 Sample backend configuration

The following is an example for a complete backend configuration:

```ini
[TALER]
CURRENCY = KUDOS

[MERCHANTABILITY]
SERVE = TCP
PORT = 8888
DATABASE = postgres

[MERCHANTABILITY-postgres]
CONFIG = postgres:///donations

[merchant-exchange-NAME]
EXCHANGE_BASE_URL = https://exchange.demo.taler.net/
MASTER_KEY = FH1Y8ZMHCTPQ0YFSZECDH8C9407JR3YN0MF1706PTG24Q4NEWGV0
# If currency does not match [TALER] section, the exchange
# will be ignored!
CURRENCY = KUDOS
```
Given the above configuration, the backend will use a PostgreSQL database named `donations` running on the same host.

The backend will deposit the coins it receives to the exchange at https://exchange.demo.taler.net/, which has the master key FH1Y8ZMHCTPQ0YFSZEC0C9407JR3YN0MF1706PTG24Q4NEWGV0.

### 4.5 Launching the backend

Assuming you have configured everything correctly, you can launch the merchant backend as `USER` using

```
$ taler-merchant-httpd &
$ taler-merchant-webhook &
$ taler-merchant-wirewatch &
```

You only need to run `taler-merchant-webhook` if one of the instances is configured to trigger web hooks. Similarly, `taler-merchant-wirewatch` is only required if instances have accounts configured with automatic import of wire transfers via a bank wire gateway.

To ensure these processes runs always in the background and also after rebooting, you should use systemd, cron or some other init system of your operating system to launch the process. You should also periodically re-start these services to prevent them from exhausting the memory utilization of the PostgreSQL database. Consult the documentation of your operating system for how to start and stop daemons.

**Note:** When using the Debian/Ubuntu packages, the systemd configuration will already exist. You only need to enable and start the service using `systemctl enable taler-merchant-httpd` and `systemctl start taler-merchant-httpd`. Additionally, you should review the `/etc/apache2/sites-available/taler-merchant.conf` or `/etc/nginx/sites-available/taler-merchant` (these files contain additional instructions to follow), symlink it to `sites-enabled/` and restart your HTTP server. After that, you should be able to visit the merchant backend at the respective HTTP(S) endpoint.

If everything worked as expected, the command

```
$ wget -O - http://localhost:8888/config
```

should return some basic configuration status data about the service.

Please note that your backend might then be globally reachable without any access control. You can either:

- Use the `--auth=$TOKEN` command-line option to set an access token to be provided in an `Authorize: Bearer $TOKEN` HTTP header. Note that this can be used at anytime to override access control, but remains only in effect until a first instance is created or an existing instance authentication setting is modified.

- Set the `TALER_MERCHANT_TOKEN` environment variable to `$TOKEN` for the same effect. This method has the advantage of `$TOKEN` not being visible as a command-line interface to other local users on the same machine.

- Set up an instance with an authentication token before some unauthorized person has a chance to access the backend. As the backend is useless without any instance and the chances of remote attackers during the initial configuration is low, this is probably sufficient for most use-cases. Still, keep the first two scenarios in mind in case you ever forget your access token!

Production systems should additionally be configured to bind to a UNIX domain socket and use TLS for improved network privacy, see *Secure setup.*
CHAPTER

FIVE

INSTANCE SETUP

First of all, we recommend the use of the single-page administration application (SPA) that is served by default at the base URL of the merchant backend. You can use it to perform all steps described in this section (and more!), using a simple Web interface instead of the `wget` commands given below.

Regardless of which tool you use, the first step for using the backend involves the creation of a default instance. The default instance can also create / delete / configure other instances, similar to the root account on UNIX. When no instance exists and `taler-merchant-httpd` was started without the `--auth` option, then the backend is reachable without any access control (unless you configured some in the reverse proxy).

The following documentation shows how to handle any instance. Thus, if you want to have multiple instances, you may need to perform the steps multiple times, once for each instance.

**Note:** A potential security concern is that normal API usage leaks instance existence. This means unauthorized users can distinguish between the case where the instance does not exist (HTTP 404) and the case where access is denied (HTTP 403). This is concern can be addressed using a properly configured reverse proxy.

### 5.1 Setup without the Web interface

Instances can be created by POSTing a request to `/management/instances` without using the Web interface. This could be useful if you want to create many instances programmatically. To create an instance without the Web interface create a file `instance.json` with an InstanceConfigurationMessage:

```json
{
    "accounts": [{"payto_uri":"$PAYTO_URI"}],
    "id": "default",
    "name": "example.com",
    "address": { "country": "zz" },
    "auth": { "method": "external" },
    "jurisdiction": { "country": "zz" },
    "use_stefan": false,
    "default_wire_transfer_delay": { "d_ms": 1209600000 },
    "default_pay_delay": { "d_ms": 1209600000 }
}
```

In the text above, you must replace `$PAYTO_URI` with your actual payto://-URI. You may also leave the account array empty. The instance owner must then configure the accounts before the instance becomes usable.

Be sure to replace KUDOS with the fiat currency if the setup is for an actual bank. The `name` field will be shown as the name of your shop. The `address` field is expected to contain your shop’s physical address. The various defaults specify defaults for transaction fees your shop is willing to cover, how long offers made to the customer are valid, and
how long the exchange has before it must wire the funds to your bank account. Those defaults can be modified for individual orders. For details, see the contract terms specification.

You can then create the instance using:

```
```

The base URL for the instance will then be http://localhost:8888/instances/default. You can create additional instances by changing the id value to identifies other than default.

Endpoints to modify (reconfigure), permanently disable (while keeping the data) or purge (deleting all associated data) instances exist as well and are documented in the Merchant Backend API documentation.
The Taler backend does not include even the most basic forms of access control or transport layer security. Thus, production setups must deploy the Taler backend behind an HTTP(S) server that acts as a reverse proxy, performs TLS termination and authentication and then forwards requests to the backend.

### 6.1 Using UNIX domain sockets

To ensure that the merchant backend is not exposed directly to the network, you should bind the backend to a UNIX domain socket:

```bash
$ taler-config -s MERCHANT -o SERVE -V unix
$ taler-config -s MERCHANT -o UNIXPATH -V "/some/path/here.sock"
```

Do not use a UNIX domain socket path in “/tmp”: systemd (or other init systems) may give Web servers a private “/tmp” thereby hiding UNIX domain sockets created by other users/processes in “/tmp”.

If UNIX domain sockets are for some reason not possible, you may use a host-based firewall to block access to the TCP port of the merchant backend, but this is not recommended. If you do need a TCP socket, you should instead strongly consider using the “BIND_TO” option to at least bind it only to “localhost”.

### 6.2 Reverse proxy configuration

#### 6.2.1 Nginx

For Nginx, a possible basic reverse proxy configuration would be:

```nginx
proxy_pass http://unix:/some/path/here.sock;
proxy_redirect off;
proxy_set_header Host $host;
proxy_set_header X-Forwarded-Host "example.com";
proxy_set_header X-Forwarded-Proto "https";
```

Note that the above assumes your domain name is example.com and that you have TLS configured. Leave out the last line if your Nginx reverse proxy does not have HTTPS enabled. Make sure to restart the taler-merchant-httpd process after changing the SERVE configuration.
6.2.2 Apache

In Apache, make sure you have `mod_proxy`, `mod_proxy_http` and `mod_headers` enabled:

```
$ a2enmod proxy
$ a2enmod proxy_http
$ a2enmod headers
```

Then configure your Apache reverse proxy like this (you may change the endpoint):

```
<Location />
ProxyPass "unix:/some/path/here.sock|http://example.com/"
RequestHeader add "X-Forwarded-Proto" "https"
</Location>
```

Note that the above again assumes your domain name is `example.com` and that you have TLS configured. Note that you must add the `https` header unless your site is not available via TLS.

6.3 Access control

All endpoints with `/private/` in the URL must be restricted to authorized users of the respective instance. Specifically, the HTTP server must be configured to only allow access to `$BASE_URL/private/` to the authorized users of the default instance, and to `$BASE_URL/instances/$ID/private/` to the authorized users of the instance `$ID`.

By default, the GNU Taler merchant backend simply requires the respective HTTP requests to include an “Authorization” header with a “Bearer” token set to the respective shared secret which must begin with “secret-token:” (following RFC 8959).

Note that all of the other endpoints (without `/private/`) are expected to be fully exposed to the Internet, and wallets may have to interact with those endpoints directly without client authentication.

6.4 Status code remapping

Normal API usage leaks instance existence information. Distinguishing between 404 (Not found) and 403 (Forbidden) is useful for diagnostics.

For higher security (by leaking less information), you can add the following fragment, which remaps all 404 response codes to 403.

6.4.1 Nginx

```
error_page 404 =403 /empty.gif;
```
6.4.2 Apache

```
cond %{STATUS} = 404
set-status 403
```
CHAPTER
SEVEN

CUSTOMIZATION

7.1 Legal conditions for using the service

The service has well-known API endpoints to return its legal conditions to the user in various languages and various formats. This section describes how to setup and configure the legal conditions.

7.2 Terms of Service

The service has an endpoint “/terms” to return the terms of service (in legal language) of the service operator. Client software show these terms of service to the user when the user is first interacting with the service. Terms of service are optional for experimental deployments, if none are configured, the service will return a simple statement saying that there are no terms of service available.

To configure the terms of service response, there are two options in the configuration file for the service:

• TERMS_ETAG: The current “Etag” to return for the terms of service. This value must be changed whenever the terms of service are updated. A common value to use would be a version number. Note that if you change the TERMS_ETAG, you MUST also provide the respective files in TERMS_DIR (see below).

• TERMS_DIR: The directory that contains the terms of service. The files in the directory must be readable to the service process.

7.3 Privacy Policy

The service has an endpoint “/pp” to return the terms privacy policy (in legal language) of the service operator. Clients should show the privacy policy to the user when the user explicitly asks for it, but it should not be shown by default. Privacy policies are optional for experimental deployments, if none are configured, the service will return a simple statement saying that there is no privacy policy available.

To configure the privacy policy response, there are two options in the configuration file for the service:

• PRIVACY_ETAG: The current “Etag” to return for the privacy policy. This value must be changed whenever the privacy policy is updated. A common value to use would be a version number. Note that if you change the PRIVACY_ETAG, you MUST also provide the respective files in PRIVACY_DIR (see below).

• PRIVACY_DIR: The directory that contains the privacy policy. The files in the directory must be readable to the service process.
7.4 Legal policies directory layout

The TERMS_DIR and PRIVACY_DIR directory structures must follow a particular layout. You may use the same directory for both the terms of service and the privacy policy, as long as you use different ETAGs. Inside of the directory, there should be sub-directories using two-letter language codes like “en”, “de”, or “jp”. Each of these directories would then hold translations of the current terms of service into the respective language. Empty directories are permitted in case translations are not available.

Then, inside each language directory, files with the name of the value set as the TERMS_ETAG or PRIVACY_ETAG must be provided. The extension of each of the files should be typical for the respective mime type. The set of supported mime types is currently hard-coded in the service, and includes “.epub”, “.html”, “.md”, “.pdf” and “.txt” files. If other files are present, the service may show a warning on startup.

7.4.1 Example

A sample file structure for a TERMS_ETAG of “tos-v0” would be:

- TERMS_DIR/en/tos-v0.txt
- TERMS_DIR/en/tos-v0.html
- TERMS_DIR/en/tos-v0.pdf
- TERMS_DIR/en/tos-v0.epub
- TERMS_DIR/en/tos-v0.md
- TERMS_DIR/de/tos-v0.txt
- TERMS_DIR/de/tos-v0.html
- TERMS_DIR/de/tos-v0.pdf
- TERMS_DIR/de/tos-v0.epub
- TERMS_DIR/de/tos-v0.md

If the user requests an HTML format with language preferences “fr” followed by “en”, the service would return TERMS_DIR/en/tos-v0.html lacking a version in French.

7.5 Generating the Legal Terms

The taler-terms-generator script can be used to generate directories with terms of service and privacy policies in multiple languages and all required data formats from a single source file in .rst format and GNU gettext translations in .po format.

To use the tool, you need to first write your legal conditions in English in reStructuredText (rst). You should find a templates in $PREFIX/share/terms/*.rst where $PREFIX is the location where you installed the service to. Whenever you make substantive changes to the legal terms, you must use a fresh filename and change the respective ETAG. The resulting file must be called $ETAG.rst and the first line of the file should be the title of the document.

Once you have written the $ETAG.rst file in English, you can generate the first set of outputs:

$$\texttt{taler-terms-generator -i $ETAG}$$

Afterwards, you should find the terms in various formats for all configured languages (initially only English) in $PREFIX/share/terms/. The generator has a few options which are documented in its man page.
7.6 Adding translations

Translations must be available in subdirectories `locale/$LANGUAGE/LC_MESSAGES/$ETAG.po`. To start translating, you first need to add a new language:

```
$ taler-terms-generator -i $ETAG -l $LANGUAGE
```

Here, `$LANGUAGE` should be a two-letter language code like `de` or `fr`. The command will generate a file `locale/$LANGUAGE/LC_MESSAGES/$ETAG.po` which contains each English sentence or paragraph in the original document and an initially empty translation. Translators should update the `.po` file. Afterwards, simply re-run

```
$ taler-terms-generator -i $ETAG
```

to make the current translation(s) available to the service.

**Note:** You must restart the service whenever adding or updating legal documents or their translations.

7.7 Updating legal documents

When making minor changes without legal implications, edit the `.rst` file, then re-run the step to add a new language for each existing translation to produce an updated `.po` file. Translate the sentences that have changed and finally run the generator (without `-l`) on the ETAG (`-i $ETAG`) to create the final files.

When making major changes with legal implications, you should first rename (or copy) the existing `.rst` file and the associated translation files to a new unique name. Afterwards, make the major changes, update the `.po` files, complete the translations and re-create the final files. Finally, do not forget to update the ETAG configuration option to the new name and to restart the service.

7.8 Mustach HTML Templates

The installation process will install various HTML templates to be served to trigger the wallet interaction. You may change those templates to your own design. The templating language used is Mustach, and the templates are in the `share/taler/merchant/templates/` directory.

7.9 Static files

The merchant backend also has the ability to serve small static files under the `/static/{FILENAME}` endpoint. This is used by the templating logic to load a CSS file, but you can also put other resources such as images or JavaScript.
7.10 Internationalization

Both templates and static files can be internationalized. This is done by having the language of the resource be a part of the filename. For templates the format is \{BASENAME\}.{LANGUAGE}.must. The language is mandatory for templates, the default language is English (en).

For static files, the format is \{BASENAME\}.{LANGUAGE}.{EXT} for internationalized files, and \{BASENAME\}.{EXT} for resources that do not support internationalization. The HTTP client will always request /static/{BASENAME}. {EXT}. If \{BASENAME\}.{EXT} exists, that resource is returned. Otherwise, an internationalized file based on the language preferences indicated by the browser is returned.

7.11 Limitations

All of the static files must fit into memory and it must be possible for the process to hold open file handles for all of these files. You may want to increase the ulimit of the taler-merchant-httpd process if you have many static files. Note that Mustach templates do not increase the number of open files.

The backend determines the MIME type based on the file’s extension. The list of supported extensions is hard-coded and includes common text and image formats.

The current backend only provides a limited set of variables for the Mustach template expansion, and does not make use of scopes and other Mustach features.
This section describes the general upgrade procedure. Please see the release notes for your specific version to check if a particular release has special upgrade requirements.

Please note that upgrades are ONLY supported for released version of the merchant. Attempting to upgrade from or to a version in Git is not supported and may result in subtle data loss.

To safely upgrade the merchant, you should first stop the existing `taler-merchant-httpd` process, backup your merchant database (see PostgreSQL manual), and then install the latest version of the code.

If you REVOKED database permissions, ensure that the rights to CREATE, DROP, and ALTER tables are GRANTed to `$USER` again. Then, run:

```
$ taler-merchant-dbinit
```

To upgrade the database to the latest schema. After that, you may again REVOKE the database permissions. Finally, restart the merchant services processes, either via your systemd or init system, or directly.
Chapter 8. Upgrade procedure
9.1 Database Scheme

The merchant database must be initialized using taler-merchant-dbinit. This tool creates the tables required by the Taler merchant to operate. The tool also allows you to reset the Taler merchant database, which is useful for test cases but should never be used in production. Finally, taler-merchant-dbinit has a function to garbage collect a database, allowing administrators to purge records that are no longer required.

The database scheme used by the merchant looks as follows:
9.2 Benchmarking

The merchant codebase offers the taler-merchant-benchmark tool to populate the database with fake payments. The main goal of the benchmarking tool is to serve as a starting point (!) for merchants that are interested in developing stress tests to see how far their infrastructure can scale. As is, it currently is not actually good at stressing the payment system.

The taler-unified-setup.sh script can be used to launch all required services and clients. However, the resulting deployment is simplistic (everything on the local machine, one single-threaded process per service type) and not optimized for performance at all. However, this can still be useful to assess the performance impact of changes to the code or configuration.

Various configuration files that can be used in the code snippets in this section can be found in the src/merchant-tools/ directory of the merchant. These are generally intended as starting points. Note that the configuration files ending in .edited are created by taler-unified-setup.sh and contain some options that are determined at runtime by the setup logic provided by taler-unified-setup.sh.

See Taler Exchange Manual for how to use taler-unified-setup.sh to setup the system and in particular on how to specify the bank to be used.

9.2.1 Running taler-merchant-benchmark

You can run the tool as follows:

```bash
$ CONF=benchmark-rsa.conf
taler-unified-setup.sh -emwt -c "$CONF" -f -u exchange-account-1
time taler-merchant-benchmark ordinary -c "$CONF".edited -u exchange-account-1 -f -p 20
```

The current tool has already a few options, but we expect that to deliver relevant results it will need to be customized to better reflect the workload of a particular merchant. This customization would at this point likely involve writing (C) code. We welcome contributions to make it easier to customize the benchmark and/or to cover more realistic workloads from the start.

The tool takes all of the values it needs from the command line, with some of them being common to all subcommands:

- `--exchange-account-section=SECTION` Specifies which configuration section specifies the bank account for the exchange that should be used for the benchmark. For the example configuration above, the SECTION value provided must be `exchange-account-exchange`.
- `--fakebank` Specifies that the benchmark should expect to interact with a fakebank (instead of libeufin).

The tool comes with two operation modes: `ordinary`, and `corner`. The first just executes normal payments, meaning that it uses the default instance and make sure that all payments get aggregated. The second gives the chance to leave some payments unaggregated, and also to use merchant instances other than the default (which is, actually, the one used by default by the tool).

Note: the ability of driving the aggregation policy is useful for testing the back-office facility.

Any subcommand is also equipped with the canonical `--help` option, so feel free to issue the following command in order to explore all the possibilities. For example:

```bash
$ taler-merchant-benchmark corner --help
```

will show all the options offered by the `corner` mode. Among the most interesting, there are:

- `--two-coins=TC` This option instructs the tool to perform $TC$ many payments that use two coins, because normally only one coin is spent per payment.
• --unaggregated-number=UN This option instructs the tool to perform \textit{UN} (one coin) payments that will be left unaggregated.

As for the ordinary subcommand, it is worth explaining the following option:

• --payments-number=PN Instructs the tool to perform \textit{PN} payments.
10.1 Installing Taler using Docker

This section provides instructions for the merchant backend installation using 'Docker'.

For security reasons, we run Docker against a VirtualBox instance, so the docker command should connect to a docker-machine instance that uses the VirtualBox driver.

Therefore, the needed tools are: “docker“, “docker-machine“, and “docker-compose“. Please refer to Docker’s official\textsuperscript{1} documentation in order to get those components installed, as that is not in this manual’s scope.

Before starting to build the merchant’s image, make sure a “docker-machine“ instance is up and running.

Because all of the Docker source file are kept in our “deployment“ repository, we start by checking out the git://

\texttt{git.taler.net/deployment} codebase:

\begin{verbatim}
$ git clone git://git.taler.net/deployment
\end{verbatim}

Now we actually build the merchant’s image. From the same directory as above:

\begin{verbatim}
$ cd deployment/docker/merchant/
$ docker-compose build
\end{verbatim}

If everything worked as expected, the merchant is ready to be launched. From the same directory as the previous step:

\begin{verbatim}
# Recall: the docker-machine should be up and running.
$ docker-compose up
\end{verbatim}

You should see some live logging from all the involved containers. At this stage of development, you should also ignore some (harmless) error message from postresql about already existing roles and databases.

To test if everything worked as expected, it suffices to issue a simple request to the merchant, for example:

\begin{verbatim}
$ wget -O - http://$(docker-machine ip)/
# A greeting message should be returned by the merchant.
\end{verbatim}

\textsuperscript{1} \url{https://docs.docker.com/}
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