
tozti Documentation

Release 0.1

the tozti project

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This project is part of our scholarship at the [ENS de Lyon](#), specifically the [software project](#) course of the M1 of Foundation of Computer Science supervised by Eddy Caron with the help of Damien Reimert.

CHAPTER 1

User's Guide

This part of the documentation is directed towards associations and association members which want to use this project.

This part of the documentation contains specifications and explanations about the inner workings of the project.

2.1 Quickstart

To start working on tozti you only need python3 and git (you should be able to install them from your package manager). Make sure you have at least python 3.5 (for the `async/await` syntax) and `setuptools` installed:

```
python3 --version
python3 -m ensurepip --upgrade # may need root privileges
```

One good way to organize yourself is to create a `tozti` folder somewhere:

```
mkdir tozti && cd tozti
```

A good practice when working on python projects is to setup a virtual environnement (`venv`). A `venv` behaves much like a separated python installation: it has it's own separated list of installed packages so that when you are working on two projects that need different version of a specific package you just put them in different `venvs` and install different versions on each. For more informations see the `venv` module and **PEP 405**. You may create a `venv` named `venv` inside the `tozti` folder with:

```
python3 -m venv venv # create it
source venv/bin/activate # activate it
```

Now that you are inside the `venv` (you should see `(venv)` at the beginning of your prompt), the `pip` and `python` commands will be aliased to the ones from the `venv`. To deactivate it just issue `deactivate`. Now you can clone the repos, install them inside your `venv` and start `tozti`:

```
git clone git@github.com:tozti/tozti && cd tozti
pip install -r requirements.txt
python3 -m tozti dev # from the root of the repo
```

Extensions are located inside the `extensions` folder. To build one, make sure you have the `npm` package, then type:

```
npm install    # only needed when you change package.json
npm run build  # build the *.vue files to browser-compatible javascript
```

2.2 Architecture

Tozti serves 3 main HTTP namespaces:

- `/static`: usual static files (javascript, css, images, etc)
- `/api`: REST endpoints to interact with the server
- anything else will be responded to with the main `index.html`

2.2.1 Extensions

The tozti core is really lightweight but it has the ability to load extensions. During the startup, the server will search for extensions in the `extensions` subfolder of the tozti repository root.

Directory structure and `server.py`

An extension is a folder (whose name will determine the prefix under which the extension's files are served) containing at least a `server.py` file (or `server/__init__.py`). This file must contain a global variable `MANIFEST` that is a dictionary containing the following keys (any one being optional):

The tozti core is really lightweight but it has the ability to load extensions. For now, you only need to know that extension is a folder providing a python file (`server.py`), describing how the extension works on the server (its routes, which files must be included from the client...). An extension can be installed by pasting its folder inside tozti's `extensions/` folder. During startup, the server will go through every subfolders of `extensions/` and try to load them as an extension.

`includes` A list of css or js files that must be included in the main `index.html`. Usually you will put there "main.js" which contains the code to register or patch components. The file paths must be relative to the `dist` subfolder of the extension (see below).

`_god_mode` Beware, this can be dangerous if used incorrectly! This should be a function taking as argument the main `aihttp.web.Application` object. You can use it to register custom middlewares or do otherwise weird stuff.

The extension can contain a `dist` folder. The content of this folder will be served at the URL `/static/<extension-name>`.

Vuejs initialization

- See example in branch [sample-extension](#).
- See an [intro](#) and some [doc](#) on components.
- See [template syntax](#).

2.3 API

The tozti core provides an API to perform operations on the database prefixed with `/api/store`. This API is largely inspired by [JSON API](#) so you are encouraged to go take a look at their specification.

2.3.1 Error format

The format of the errors follows [JSON API errors](#). If a request raised an error, the server will send back a response with status code 500, 404 or 400. This response might send back a json object with an entry `errors` containing a list of json objects with the following properties:

code The name of the error

status Status code of the error

title Short description of the error

detail More about this error. This entry might not be present.

traceback Traceback of the error. This entry might not be present and is included only if tozti is launched in dev mode.

2.3.2 Concepts and Data Structures

Resources

Resources and [resource objects](#) are the main concept of the store API. A resource is what we would call an entity in SQL or hypermedia on the web. A *resource object* is represented as a json object with the following properties:

id An [UUIDv4](#) which uniquely identifies a resource.

type The name of a *type object*.

attributes An arbitrary JSON object where each attribute is constrained by the type of the resource.

relationships A JSON object where the keys are relationship names (just strings) and values are *relationship objects*.

meta A JSON object containing some metadata about the resource. For now it only contains `created` and `last-modified` which are two self-explanatory dates in ISO 8601 format (UTC time zone).

Relationships

A relationship is a way to create a directed and tagged link between two resources. Relationships can be *to-one* (resp. *to-many*) in which case they link to one (resp. a sequence) of other resources. Practically, a *resource object* is a JSON object with the following properties (beware, here we diverge a little from the [JSON API spec](#)):

self An URL pointing to the current relationship object. This URL can be used to operate on this relationship.

data In the case of a *to-one* relationship, this is a *linkage object*, in the case of a *to-many* relationship, this is an array of *linkage objects*.

Linkages are simply pointers to a resource. They are JSON objects with three properties:

id The ID of the target resource.

type The type of the target resource.

href An URL pointing to the target resource.

Types

A *type object* is simply a JSON object with the following properties:

attributes A JSON object where keys are allowed (and required) attribute names for resource objects and values are JSON Schemas. A [JSON Schema](#) is a format for doing data validation on JSON. For now we support the Draft-04 version of the specification (which is the latest supported by the library we use).

relationships A JSON object where the keys are allowed (and required) relationship names and keys are relationship description objects.

Relationship description objects are of 2 kinds, let's start with the simple one:

arity Either "to-one" or "to-many", self-explanatory.

type This property is optional and can be used to restrict what types the targets of this relationship can be. It can be either the name of a type object or an array of names of allowed type objects.

The other kind of relationship description exists because relationships are directed. As such, because sometimes bidirectional relationships are useful, we would want to specify that some relationship is the reverse of another one. To solve that, instead of giving `arity` and `type`, you may give `reverse-of` property is a JSON object with two properties: `type` (a type URL) and `path` (a valid relationship name for that type). This will specify a new *to-many* relationship that will not be writeable and automatically filled by the Store engine. It will contain as target any resource of the given type that have the current resource as target in the given relationship name.

Let's show an example, we will consider two types: users and groups.

```
// http://localhost/types/user.json
{
  "attributes": {
    "login": {"type": "string"},
    "email": {"type": "string", "format": "email"}
  },
  "relationships": {
    "groups": {
      "reverse-of": {
        "type": "group",
        "path": "members"
      }
    }
  }
}
```

```
// http://localhost/types/group.json
{
  "attributes": {
    "name": {"type": "string"}
  },
  "relationships": {
    "members": {
      "arity": "to-many",
      "type": "user"
    }
  }
}
```

Now when creating a user you cannot specify it's groups, but you can specify members when creating (or updating) a given group and the system will automagically take care of filling the `groups` relationship with the current up-to-date content.

2.3.3 Endpoints

We remind that the API is quite similar to what [JSON API](#) proposes. In the following section, type `warrior` is the type defined as:

```
{
  'attributes': {
    'name': { 'type': 'string' },
    'honor': { 'type': 'number' }
  },
  'relationships': {
    'weapon': {
      'arity': 'to-one',
      'type': 'weapon',
    },
    'kitties': {
      'arity': 'to-many',
      'type': 'cat'
    }
  }
}
```

A warrior has a name and a certain quantity of honor. He also possesses a weapon, and can be the (proud) owner of several cats (or no cats).

Resources

Fetching an object

To fetch an object, you must execute a GET request on `/api/store/resources/{id}` where `id` is the ID of the resource.

Error code:

- 404 if `id` corresponds to no known objects.
- 400 if an error occurred when processing the object (for example, one of the object linked to it doesn't exist anymore in the database).
- 200 if the request was successful.

Returns: If the request is successful, the server will send back a *resource object* under JSON format.

Example: Suppose that an object of type `warrior` and id `a0d8959e-f053-4bb3-9acc-cec9f73b524e` exists in the database. Then:

```
>> GET /api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e
200
{
  'data': {
    'id': 'a0d8959e-f053-4bb3-9acc-cec9f73b524e',
    'type': 'warrior',
    'attributes': {
      'name': 'Pierre',
      'honor': 9000
    },
    'relationships': {
      'self': {
        'self': '/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/self'
      },
    }
  },
}
```

```

        'data': {
            'id': 'a0d8959e-f053-4bb3-9acc-cec9f73b524e',
            'type': 'warrior',
            'href': '/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e'
        },
        'weapon': {
            'self': '/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/
↪friend',
            'data': {
                'id': '1bb2ff78-cefb-4ce1-b057-333f5baed577',
                'type': 'weapon',
                'href': '/api/store/resources/1bb2ff78-cefb-4ce1-b057-333f5baed577'
            }
        },
        'kitties': {
            'self': '/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/
↪friend',
            'data': [ {
                'id': '6a4d05f1-f04a-4a94-923e-ad52a54456e6',
                'type': 'cat',
                'href': '/api/store/resources/6a4d05f1-f04a-4a94-923e-ad52a54456e6'
            } ]
        },
        'meta': {
            'created': '2018-02-05T23:13:26',
            'last-modified': '2018-02-05T23:13:26'
        }
    }
}

```

Creating an object

To create an object, you must execute a POST request on `/api/store/resources` where the body is a JSON object representing the object you want to send. The object must be encapsulated inside a `data` entry.

Error code:

- 404 if one of the object targeted by a relationship doesn't exist
- 400 if an error occurred when processing the object. For example, if the json object which was sent is malformed, or if the body of the request is not JSON.
- 200 if the request was successful.

Returns: If the request is successful, the server will send back a *resource object* under JSON format.

Example: Suppose that an object of type `warrior` and id `a0d8959e-f053-4bb3-9acc-cec9f73b524e` exists in the database. Then:

```

>> POST /api/store/resources {'data': {'type': 'warrior',
    'attributes': {'name': Pierre, 'honor': 9000},
    'relationships': {
        'weapon': {'data': {'id': <id_weapon>}},
        'kitties': {'data': [{'id': <kitty_1_id>}]}
    }}}
200

```

```

{
  'data':{
    'id':'a0d8959e-f053-4bb3-9acc-cec9f73b524e',
    'type':'warrior',
    'attributes':{
      'name':'Pierre',
      'honor': 9000
    },
    'relationships':{
      'self':{
        'self':'/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/self
↪',
        'data':{
          'id':'a0d8959e-f053-4bb3-9acc-cec9f73b524e',
          'type':'warrior',
          'href':'/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e'
        }
      },
      'weapon':{
        'self':'/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/
↪friend',
        'data':{
          'id':'1bb2ff78-cefb-4ce1-b057-333f5baed577',
          'type':'weapon',
          'href':'/api/store/resources/1bb2ff78-cefb-4ce1-b057-333f5baed577'
        }
      },
      'kitties':{
        'self':'/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/
↪friend',
        'data': [{
          'id':'6a4d05f1-f04a-4a94-923e-ad52a54456e6',
          'type':'cat',
          'href':'/api/store/resources/6a4d05f1-f04a-4a94-923e-ad52a54456e6'
        }]
      }
    },
    'meta':{
      'created':'2018-02-05T23:13:26',
      'last-modified':'2018-02-05T23:13:26'
    }
  }
}

```

Editing an object

To edit an object, you must execute a PATCH request on `/api/store/resources/{id}` where `id` is the ID you want to update. The body of the request must be a JSON object representing the change you want to operate on the object. The object must be encapsulated inside a `data` entry. Remark: you don't need to provide every entries.

Error code:

- 404 if `id` corresponds to no known objects.
- 400 if an error occurred when processing the object. For example, if the json object which was send is malformed, or if the body of the request is not JSON.

- 200 if the request was successful.

Returns: If the request is successful, the server will send back a *resource object* under JSON format representing the object (after changes are applied).

Example: We suppose the object with id a0d8959e-f053-4bb3-9acc-cec9f73b524e exists in the database. Then:

```
>> PATCH /api/store/resources {'data': {'type': 'warrior',
    'attributes': {'name': 'Luc'},
    'relationships': {
        'weapon': {'data': {'id': <id_weapon_more_powerfull>}},
    }}
200
{
  'data': {
    'id': 'a0d8959e-f053-4bb3-9acc-cec9f73b524e',
    'type': 'warrior',
    'attributes': {
      'name': 'Luc',
      'honor': 9000
    },
    'relationships': {
      'self': {
        'self': '/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/self
→',
        'data': {
          'id': 'a0d8959e-f053-4bb3-9acc-cec9f73b524e',
          'type': 'warrior',
          'href': '/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e'
        }
      },
      'weapon': {
        'self': '/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/
→friend',
        'data': {
          'id': '<id_weapon_more_powerfull>',
          'type': 'weapon',
          'href': '/api/store/resources/<id_weapon_more_powerfull>'
        }
      },
      'kitties': {
        'self': '/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/
→friend',
        'data': [ {
          'id': '6a4d05f1-f04a-4a94-923e-ad52a54456e6',
          'type': 'cat',
          'href': '/api/store/resources/6a4d05f1-f04a-4a94-923e-ad52a54456e6'
        } ]
      },
      'meta': {
        'created': '2018-02-05T23:13:26',
        'last-modified': '2018-02-05T23:13:26'
      }
    }
  }
}
```


Deleting an object

To delete an object, you must execute a `DELETE` request on `/api/store/resources/{id}` where `id` is the ID you want to update. Remark: you don't need to provide every entries.

Error code:

- 404 if `id` corresponds to no known objects.
- 200 if the request was successful.

Returns: If the request is successful, the server will send back an empty JSON object.

Example: We suppose the object with id `a0d8959e-f053-4bb3-9acc-cec9f73b524e` exists in the database. Then:

```
>> DELETE /api/store/resources
200
{ }
```

Relationships

In the same way that you can act on resources, you can also act on relationships.

Fetching a relationship

To fetch a relationship, you must execute a `GET` request on `/api/store/resources/{id}/{rel}` where `id` is the ID of the resource possessing the relationship you want to access, and `rel` the name of the relationship.

Error code:

- 404 if `id` corresponds to no known objects or `rel` is an invalid relationship name.
- 400 if an error occurred when processing the object.
- 200 if the request was successful.

Returns: If the request is successful, the server will send back a *relationship object* under JSON format.

Example: Suppose that an object of type `warrior` and id `a0d8959e-f053-4bb3-9acc-cec9f73b524e` exists in the database. Then:

```
>> GET /api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/kitties
200
{
  "data": {
    "self": "/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/kitties
↪", "data": [{
      "id": "93b41bf0-73e8-4b37-b2b9-d26d758c2539",
      "type": "cat",
      "href": "/api/store/resources/93b41bf0-73e8-4b37-b2b9-d26d758c2539"
    }, {
      "id": "dff2b520-c3b0-4457-9dfe-cb9972188e48",
      "type": "cat",
      "href": "/api/store/resources/dff2b520-c3b0-4457-9dfe-cb9972188e48"
    }
  ]
}
```

```
>> GET /api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/weapon
200
{
  "data": {
    "self": "/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/weapon
↪", "data": {
      "id": "34078dd5-516d-42dd-816d-6fbfd82a2da9",
      "type": "weapon",
      "href": "/api/store/resources/34078dd5-516d-42dd-816d-6fbfd82a2da9"
    }
  }
}
```

Updating a relationship

To update a relationship (which is not an automatic relationship), you must execute a PUT request on `/api/store/resources/{id}/{rel}` where `id` is the ID of the resource possessing the relationship you want to access, and `rel` the name of the relationship. The content of your request is a JSON object containing:

- for a `to-one` relationship the ID of the new target
- for a `to-many` relationship several IDs representing the new targets

Error code:

- 404 if `id` corresponds to no known objects or `rel` is an invalid relationship name.
- 400 if an error occurred when processing the object.
- 200 if the request was successful.

Returns: If the request is successful, the server will send back a *relationship object* under JSON format.

Example: Suppose that an object of type `warrior` and id `a0d8959e-f053-4bb3-9acc-cec9f73b524e` exists in the database. We also suppose that its relationship `kitties` possesses two targets having id `<id1>` and `<id2>`. The relationship `weapon` targets `<id_sword>`. Then:

```
>> PUT /api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/kitties {'data': ↪
↪[{'id': <id3>}]}
200
{
  "data": {
    "self": "/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/kitties
↪", "data": [{
      "id": <id3>,
      "type": "cat",
      "href": "/api/store/resources/<id3>"
    }
  ]
}
```

```
>> PUT /api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/weapon {'data': ↪
↪{'id': <id_shotgun>}}
200
{
  "data": {
    "self": "/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/weapon
↪", "data": [
```

```

        "id": <id_shotgun>,
        "type": "weapon",
        "href": "/api/store/resources/<id_shotgun>"
    ]
}

```

Adding new targets to a relationship

To add new targets to a to-many relationship, you must execute a POST request on `/api/store/resources/{id}/{rel}` where `id` is the ID of the resource possessing the relationship you want to access, and `rel` the name of the relationship. The content of your request is a JSON object containing the ids of the objects you want to add to the relationship.

Error code:

- 404 if `id` corresponds to no known objects or `rel` is an invalid relationship name.
- 403 if the relationship is not a too-many relationship
- 400 if an error occurred when processing the object.
- 200 if the request was successful.

Returns: If the request is successful, the server will send back a *relationship object* under JSON format.

Example: Suppose that an object of type `warrior` and id `a0d8959e-f053-4bb3-9acc-cec9f73b524e` exists in the database. We also suppose that its relationship `kitties` possesses one targets having id `<id1>`. Then:

```

>> POST /api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/kitties {'data
↪': [{'id': <id2>}, {'id': <id3>}]}
200
{
  "data": {
    "self": "/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/kitties
↪", "data": [{
      "id": <id1>,
      "type": "cat",
      "href": "/api/store/resources/<id1>"
    }, {
      "id": <id2>,
      "type": "cat",
      "href": "/api/store/resources/<id2>"
    }, {
      "id": <id3>,
      "type": "cat",
      "href": "/api/store/resources/<id3>"
    }
  ]
}

```

Deleting a relationship

To fetch some targets from a to-many relationship, you must execute a DELETE request on `/api/store/resources/{id}/{rel}` where `id` is the ID of the resource possessing the relationship you want to access,

and `rel` the name of the relationship. The content of your request is a JSON object containing the ids of the objects you want to remove from the relationship.

Error code:

- 404 if `id` corresponds to no known objects or `rel` is an invalid relationship name.
- 403 if the relationship is not a too-many relationship
- 400 if an error occurred when processing the object.
- 200 if the request was successful.

Returns: If the request is successful, the server will send back a *relationship object* under JSON format.

Example: Suppose that an object of type `warrior` and id `a0d8959e-f053-4bb3-9acc-cec9f73b524e` exists in the database. We also suppose that its relationship `kitties` possesses three targets having ids `<id1>`, `<id2>` and `<id3>`. Then:

```
>> DELETE /api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/kitties {'data
↪': [{'id': <id1>}, {'id': <id3>}]}
200
{
  "data": {
    "self": "/api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/kitties
↪", "data": [{
      "id": <id2>,
      "type": "cat",
      "href": "/api/store/resources/<id2>"
    }]
  }
}
```

```
>> DELETE /api/store/resources/a0d8959e-f053-4bb3-9acc-cec9f73b524e/weapon
403
{
  "errors": [{
    "code": "BAD_RELATIONSHIP",
    "title": "a relationship is invalid",
    "status": "403",
    "detail": "to-one relationships cannot be deleted"
  }]
}
```

Types

Fetching all instances of a given type

To fetch all instances of a given type `<type>`, you must execute a GET request on `/api/store/by-type/<type>`.

Error code:

- 404 if the type doesn't exists
- 400 if an error occurred when processing the object.
- 200 if the request was successful.

Returns: If the request is successful, the server will send back a list of linkage objects encapsulated under a *data* entry. Each linkage object points toward a ressource having type `<type>`

Example: To fetch every warrior present inside our store, you can proceed as following:

```
>> GET /api/store/by-type/warrior
200
{
  "data": [
    {
      "id": "60f1677b-2bbb-4fd9-9a7a-3a20dbf7b5af",
      "type": "core/user",
      "href": "/api/store/resources/60f1677b-2bbb-4fd9-9a7a-3a20dbf7b5af"
    }, {
      "id": "605ab4bc-172b-416e-8a13-186cf3cd1e2e",
      "type": "core/user",
      "href": "/api/store/resources/605ab4bc-172b-416e-8a13-186cf3cd1e2e"
    }
  ]
}
```

Remark: Most of the time, type names are under this form: `<ext-name>/<type-name>` where `<ext-name>` is the name of the extension defining the type `<type-name>`. To fetch of instances of this type, send a GET request on `/api/store/by-type/<ext-name>/<type-name>`.

2.4 Developing Extensions

2.4.1 Getting Started

Our first extension

Let's see how to create a simple extension to *tozti*. Everything defined by an extension lives inside the same folder, whose name is the name of the extension.

Suppose we call it `extension-name`. Browse to the `extensions/` folder and proceed to create a folder `extension-name`. The only requirement for *tozti* to recognize an extension is for this extension to provide a file `server.py` declaring a dictionary `MANIFEST`. Thus a minimal definition would be like so:

```
MANIFEST = {}
```

Well done, you've just created your first extension!

Defining an API endpoint

The previous extension currently does nothing. We will now see how to add new API endpoints to the application.

At the moment our `MANIFEST` is empty. To declare new routes, we must import some modules:

```
from tozti.utils import RouterDef
from aiohttp import web
import logbook
```

- `RouterDef` allows us to define a new router and therefore new request handlers.
- `web` from `aiohttp` enables us to send back to the user simple responses.
- `logger` is a simple utility to pretty print information in the server logs.

We define a logger, which will enable us to output useful information to the console:

```
logger = logbook.Logger("tozti-routing")
```

Then, we create an empty router:

```
router = RouterDef()
```

And we add one endpoint to it. We call it `hello_world`, and make it accessible from the URL `<tozti>/api/extension-name/hello_world`:

```
hello_world = router.add_route('/hello_world')
```

Finally, we define how our extension should behave when this endpoint is requested. In this example, we respond to GET requests on this endpoint with some dummy text:

```
@hello_world.get
async def hello_world_get(req):
    logger.info("hello world")
    return web.Response(text='Hello world!')
```

Similar decorators are available for the usual HTTP methods: `@hello_world.post`, etc.

Unfortunately, for now *tozti* still isn't aware of this new request handler we just defined. This is where MANIFEST comes into use: We simply add the router in the MANIFEST dict under the key `router`:

```
MANIFEST = {
    'router': router,
}
```

In fact, MANIFEST is where we declare anything that *tozti* should be made aware of.

And now, if you launch the server again, and visit the URL `<tozti>/api/extension-name/hello_world`, your web browser should display a blank web page with the text “*Hello world!*”. If you look in the server logs, some `hello world` must have appeared.

Providing custom javascript to the tozti application

If the previous paragraph showed how to serve content on specific URLs, this is *not* how we modify the behavior of the *tozti* application. *tozti* is a single-page app built with the framework **Vue.js**. Therefore if you want to be able to interact with the application and define new interactions, you need to be able to serve custom *javascript* code to the client.

As a convention, all static assets must be put inside a folder `dist` inside your extension folder. Let's create a file called `index.js` inside `extension-name/dist/`:

```
tozti.store.commit('registerWidget', {
    template: '<div class="uk-placeholder">A widget coming directly from our extension!</div>'
})
```

As you might have guessed, we need to inform *tozti* of the existence of this file, inside MANIFEST:

```
MANIFEST = {
    # ..
    'includes': ['index.js']
}
```

Once again, start the server and visit the URL `<tozti>/`. A new widget should have appeared inside the Dashboard. As stated below, adding CSS files in this `includes` list in exactly the same fashion allows the inclusion of custom CSS to *tozti*.

Quick note on file structure

Most extensions do not serve directly their javascript files to *tozti*. They often split their code in separate files, and use some build process to obtain a single file `build.js` out of their code. This is the file that they send to the client. We will not describe here how to setup such a build process, as it would end up very much opinionated, and still would have to differ between extensions. However it is very much recommended to proceed in such a way, and the sample extensions available on our github page provide some insight as to how things can be organised.

Going further with MANIFEST

Here are a complete list of keys that MANIFEST can possess:

router This is used to declare new API endpoints. It should be an instance of `tozti.utils.RouterDef`. More precisely it must have an `add_prefix()` method and it will be passed to `aiohttp.web.UrlDispatcher.add_routes()`. Every route declared will be prefixed by `/api/<extension-name>`.

includes A list of css or js filenames that must be included in the main `index.html`. Usually you will put there your `main.js` which contains the code to register or patch components.

dependencies A list of names of extensions that must be loaded before this extension in order for it to be working as intended.

For more advanced user, you can also add signals for the `aiohttp.web` in the MANIFEST. Please see [aiohttp server documentation](#) to learn more about signals.

_god_mode Beware, this can be dangerous if used incorrectly! This should be a function taking as argument the main `aiohttp.web.Application` object. You can use it to register custom middlewares or do otherwise weird stuff.

on_response_prepare This should be a function. It is a hook for changing HTTP headers for streamed responses and WebSockets.

on_startup This should be a function. Will be called during the startup of the application. Usefull to launch background services for exemple.

on_cleanup This should be a function. Will be called on application cleanup. You can use it to close connections to the database for exemple.

on_shutdown This should be a function. Will be closed on application shutdown.

Having a more complex server

Sometimes you can find that putting the whole server part inside `server.py` is a bit too restrictive. As your extension grow you'll probably want to refactor it in several files. Tozti provide a way to do so. Instead of creating a `server.py` file, you could create a `server/` folder, and inside it write a file `__init__.py` defining (at least) the MANIFEST structure.

2.4.2 Using Tozti's JS api

Defining routes on the client side

If you read *Getting Started* you learned how to define new API endpoints. But you might want that your extension also provide some endpoints on the client, to display a special page for example.

You can take a look at how the extension *vue-counter* of the [sample-extensions](#) repository uses this mechanism to define a counter reachable on `<tozti>/counter`.

Tozti's extensions are using *vue*, so it is natural that we use *vue-router* in order to define new routes.

Imagine you want to define a new 'page' displaying a component called *Calendar* that can be accessed on `<tozti>/mycalendar`. Then, you must add the following lines in your `index.js`:

```
tozti.routes.unshift(  
  { path: '/mycalendar', component: Calendar }  
)
```

Adding items in the menu bar

An exemple can be found in the extension *add-menu-item* that can be found in the repository [sample-extensions](#).

Every extensions can add items in the sidebar. We will focus on what we call *menu items*: items that are attached to *tozti* as a whole, not to a workspace.

The corresponding method allowing to do that is called `tozti.addItem`. Here are following examples of usage:

- Adding an item with the text 'item' associated with the route *target/*:

```
tozti.addItem('item', 'target/')
```

- Adding an item with the text 'item' associated with the route *target/* and the icon 'nc-home-52':

```
tozti.addItem('item', 'target/',  
  props = { 'icon': 'nc-home-52' }  
)
```

2.5 API Reference

2.5.1 tozti.utils

exception `tozti.utils.APIError (msg=None, status=None, **kwargs)`

Base class for API errors.

to_response()

Create an *aiohttp.web.Response* signifying the error.

class `tozti.utils.ExtendedJSONEncoder (skipkeys=False, ensure_ascii=True, check_circular=True, allow_nan=True, sort_keys=False, indent=None, separators=None, default=None)`

JSON encoder handling *datetime.datetime* and *uuid.UUID*.

class `tozti.utils.RouteDef (path, name=None)`

Definition of a route.

The method `get()`, `post()`, `put()`, etc can be used as decorators to specify the handler for the given HTTP method.

any (*handler*)

Decorator used to specify handler for every method.

delete (*handler*)

Decorator used to specify DELETE method handler.

get (*handler*)

Decorator used to specify GET method handler.

head (*handler*)

Decorator used to specify HEAD method handler.

options (*handler*)

Decorator used to specify OPTIONS method handler.

patch (*handler*)

Decorator used to specify PATCH method handler.

post (*handler*)

Decorator used to specify GET method handler.

put (*handler*)

Decorator used to specify PUT method handler.

register (*app*)

Add all our routes to the given `aiohttp.web.Application`.

route (**meth*)

Decorator (with arguments) used to specify HTTP handler.

class `tozti.utils.RouterDef`

Handle route definitions.

This object can be used as argument to `aiohttp.web.UrlDispatcher.add_routes()`.

Sample usage:

```
router = RouterDef()
route = router.add_route('/foo')

@route.get
def handle_get(req):
    return ...
```

See `aiohttp` for more informations on resources and routing.

add_prefix (*prefix*)

Prefix every contained route.

add_route (*path, name=None*)

Add and return a route with given path to the router.

`tozti.utils.json_response (data, **kwargs)`

Wrapper for `aiohttp.web.json_response` with extended JSON encoder.

`tozti.utils.validate (inst, schema)`

Validate data against a `JsonSchema`.

2.5.2 `tozti.store`

2.5.3 `tozti.app`

CHAPTER 3

Project internals

For the internal organisation, workflows and anything related to the *software project* course, see [meta/index](#). If you want to write tests, a small documentation is available at [meta/tests](#).

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