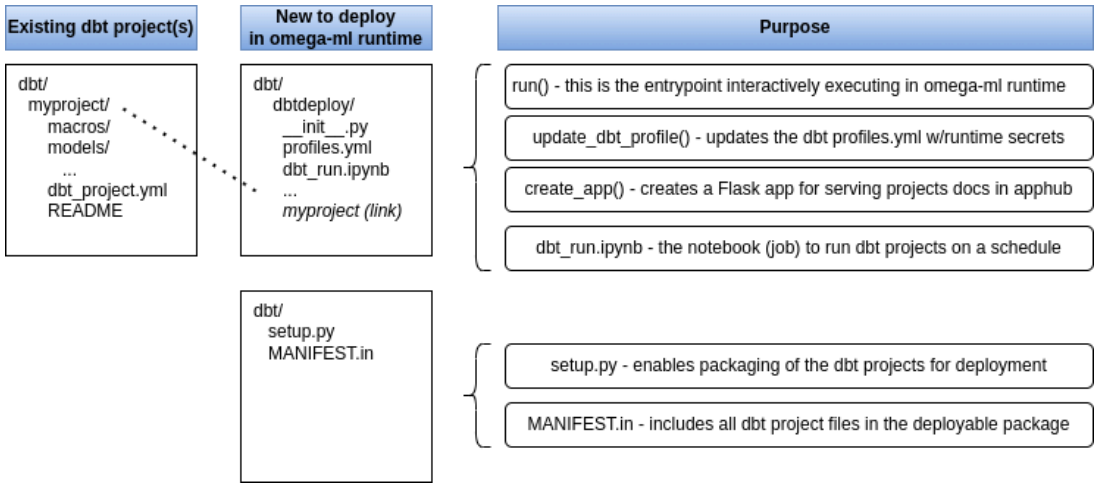
Deploying dbt projects

dbt projects can be deployed to run on the omega-ml runtime as an ad-hoc or a scheduled job as follows. dbt projects are essentially a collection of files that make up a SQL-based workflow. This means we can easily deploy dbt projects to omega-ml as a script, and run them on schedule or on-demand.

The steps to deploy dbt projects to omega-ml are as follows:

1. Package the dbt project(s) and deploy to omega-ml
2. Schedule a job to run the dbt project(s)
3. Serve the dbt project(s) documentation via omegaml's apphub (or browse locally)

Here's a quick schematic overview of the components involved:



The following sections provide a step-by-step guide to deploy dbt projects to omega-ml, explaining each component. If you are just looking to deploy dbt projects without regard to all the gory details, follow the Quick Start section.

Quick Start

If you are looking to deploy dbt projects to omega-ml without going through all the details, here's a quick start guide:

1. Copy the *dbtdeploy* application to your dbt project's root directory:

```
$ cp -r /path/to/omegaml/examples/dbt/dbtdeploy /path/to/dbt
```

2. Update the *profiles.yml* file in the *dbtdeploy* directory with your connection details:

```
$ cp /path/to/dbt/myproject/profiles.yml /path/to/dbt/dbtdeploy/profiles.yml
```

3. Link your dbt project(s) into the *dbtdeploy* directory:

```
$ ln -s /path/to/dbt/myproject /path/to/dbt/dbtdeploy/myproject
```

4. Package the *dbtdeploy* application and deploy to omega-ml:

```
$ om scripts put /path/to/dbt/dbtdeploy dbt/dbtdeploy
```

5. Run the dbt project on-demand:

```
$ om runtime script dbtdeploy run project=myproject
```

6. Schedule the dbt project to run on a schedule:

```
# store the dbt_run notebook in om.jobs
$ om jobs put /path/to/dbt/dbt_run.ipynb dbt_run

# update the dbt_run notebook to run the dbt project(s)
$ om shell jupyter
```

7. Serve the dbt project documentation via omegaml's apphub:

```
# package the app
$ om scripts put /path/to/dbt/dbtdeploy apps/dbtdeploy
$ om runtime restart app dbtdeploy

Alternatively, serve the docs locally by running the following command:

$ FLASK_APP=/path/to/dbt/dbtdeploy:create_app flask run
```

Create the dbtdeploy application

While we could package each dbt project separately, it is easier to use a single package, and include all dbt projects in one step. We'll call this the *dbtdeploy* script.

The *dbtdeploy* script is a small Python package that provides a utility function, *update_dbt_profile*, that updates the dbt *profiles.yml* file with omega-ml defaults. This is useful to ensure that the dbt project can connect to the SQL database, however without storing the connection details in the dbt project itself. We also include a *run* function in order to run the dbt project on demand using the omega-ml runtime. Later we will add a Flask application to serve the dbt project documentation, and also provide an example of how to run dbt projects on a schedule.

Here's how to create the "dbtdeploy" application:

1. Create the dbtdeploy application directory structure:

```
# in /path/to/dbt
$ mkdir dbtdeploy
$ touch dbtdeploy/__init__.py
$ touch dbtdeploy/setup.py
$ touch dbtdeploy/MANIFEST.in
$ touch dbtdeploy/profiles.yml
```

2. Update the *setup.py* and *MANIFEST.in* files:

```
# dbtdeploy/setup.py
from setuptools import setup, find_packages

setup(
    name='dbtdeploy',
    version='0.1',
    packages=find_packages(),
    include_package_data=True,
    install_requires=[
        'dbt-core',
    ]
)

# dbtdeploy/MANIFEST.in
include *.in
recursive-include dbtdeploy *
```

3. Update the __init__.py file for the dbtdeploy application:

```
# /path/to/dbt/myproject/__init__.py
def update_dbt_profile(fn=None, mod=None, om=None, **vars):
    """
    update dbt profiles.yaml with omegaml defaults

    Usage:
        import omegaml as om
        mod = om.scripts.get('dbt/foo', install=True)
        update_dbt_profile(mod=mod, om=om)
    """
    from pathlib import Path
    default_fn = Path(getattr(mod, '__file__', __file__)).parent / 'profiles.yml'
    fn = Path(fn) if fn else default_fn
    if not fn.exists():
        raise FileNotFoundError(f'dbt profiles.yml not found at {fn}')
    vars.update(**om.defaults) if om else None
    with open(fn, 'r') as f:
        profiles = f.read()
    with open(fn, 'w') as f:
        profiles = profiles.format(**vars)
        f.write(profiles)
    return fn.parent

def run(om=None, project=None, *args, **kwargs):
    from pathlib import Path
    import subprocess
    dbt_dir = Path(__file__).parent
    project_dir = dbt_dir / project
    cmd = f"dbt run -d --profiles-dir {dbt_dir} --project-dir {project_dir}"
    update_dbt_profile(f"{dbt_dir}/profiles.yml", om=om, **kwargs)
    results = subprocess.run(cmd, shell=True, check=True, capture_output=True)
    return results.stdout.decode('utf-8')
```

Include your dbt project(s)

Now we're ready to package up all dbt projects, by linking each dbt project into the *dbtdeploy* script. This way we can keep the dbt project(s) as is, and update the *dbtdeploy* script with a single command.

1. Copy your profiles.yml from *$HOME/.dbt/profiles.yml*

   ```
   $ cp /path/to/dbt/myproject/profiles.yml dbtdeploy/profiles.yml
   ```

2. Update the *profiles.yml* to remove any secrets and replace with them with *{OMEGA_VARIABLE}* placeholders.

   The *profiles.yml* file should look something like this (adopt to the specific variables used in your omega-ml qualifier context):

```
myproject:
    target: prod
    outputs:
      prod:
        type: sqlserver
        driver: '{OMEGA_SQL_SERVER_DRIVER}' # (The ODBC Driver installed on your system)
        server: {OMEGA_SQL_SERVER_HOST}
        port: 1433
        database: {OMEGA_SQL_SERVER_DB}
        schema: schema_name
        user: {OMEGA_SQL_SERVER_USER}
        password: {OMEGA_SQL_SERVER_PASSWORD}
```

3. Link each dbt project into the directory of the dbtdeploy application:

   ```
   $ ln -s /path/to/dbt/myproject dbtdeploy/myproject
   ```

Deploy and run the dbtdeploy application

Every time we update the dbt project(s), we need to update the dbtdeploy application and deploy it to omega-ml.

1. Package the dbtdeploy application:

   ```
   $ om scripts put . dbtdeploy dbt/dbtdeploy
   ```

2. We can now run the dbt project on-demand, running in the omega-ml runtime, using the following command:

   ```
   $ om runtime script dbtdeploy run project=myproject
   ```

3. For testing and debugging, add *--local* to run the script locally:

   ```
   $ om runtime --local script dbtdeploy run project=myproject
   ```

Schedule dbt projects

To run the dbt project as a scheduled job, we need to create a job (notebook) that runs one or all dbt projects. This notebook, we'll call it *dbt_run*, should look as follows and be stored in om.jobs.

The notebook essentially has three parts:

1. Import the dbtdeploy application, and update the dbt profile with omega-ml defaults
2. Run each dbt project
3. Generate and save the dbt docs, so they is available for later inspection or serving via omegaml's apphub

Here's how to create the job:

1. Create a job (notebook) to run the dbtdeploy application:

```
# in /path/to/dbt/dbt_run.ipynb
# store this in om.jobs (om jobs put dbt_run.ipynb dbt_run)
[1] # cron: 0 0 * * 1
    # comment: run every Monday at midnight
[2] # (1) import dbt project and prepare dbt profile
    dbtdeploy = om.scripts.get('dbt/dbtdeploy', install=True)
    dbt_dir = Path(dbtdeploy.__file__).parent
    dbtdeploy.update_dbt_profile(f"{dbt_dir}/profiles.yml", om=om)
[3] # (2) run dbt projects (repeat (2) and (3) for each dbt project)
    project_dir =  dbt_dir / 'foo`
    !dbt run --profiles-dir $dbt_dir --project-dir $project_dir
[4] # (3) generate docs and save to om.datasets as dbt/<project>/report.zip
    # generate docs
    !dbt docs generate --profiles-dir $dbt_dir --project-dir $project_dir --target-path report
```

```
!python -m zipfile -c report.zip $project_dir/report
!om datasets put ./report.zip $project/report.zip
```

2. Save the notebook to om.jobs:

```
$ om jobs put dbtdeploy/dbt_run.ipynb dbt_run
```

Serve the dbt project documentation

Finally, we can serve the dbt project documentation via omegaml's apphub or locally. For this we need to create a Flask application that serves the dbt project:

1. Update the *dbtdeploy/__init__.py* file:

```
# add this to path/to/dbt/myproject/__init__.py
def create_app(server=None, uri=None, **kwargs):
    import os
    import uuid

    from functools import lru_cache
    from flask import Flask, abort
    from flask import Blueprint
    from zipfile import ZipFile

    import omegaml as om

    server = server or Flask(__name__)
    server.config.setdefault('SECRET_KEY', os.environ.get('SECRET_KEY') or uuid.uuid4().hex)

    app = Blueprint('foo', __name__,
                    url_prefix=uri,
                    template_folder='templates')

    file_cache = lru_cache(maxsize=100)
    om = om.setup()

    @app.route('/')
    def index():
        # present a list of project reports stored in om.datasets
        # -- each project report is stored as dbt/<project>/report.zip
        href = "<a href='{uri}/{project}/index'>{project}</a><br>"
        projects = [href.format(project=os.path.basename(os.path.dirname(project)),
                                uri=uri or '') for project in om.datasets.list('dbt/*')]
        text = "<p>select a project to view its dbt report</p>"
        return text + "\n".join(projects) if projects else "No projects found"

    @app.route('/<project>/index')
    def project(project):
        # open the project report's index.html
        _send_report_file.cache_clear()
        project_dir = f'dbt/{project}'
        return _send_report_file(project_dir, 'index.html')

    @app.route('/<project>/<path:path>')
    def static_file(project, path):
        # open a static file from the project report
        project_dir = f'dbt/{project}'
        return _send_report_file(project_dir, path)

    @app.errorhandler(404)
    def handle_exception(e):
        return {
            "code": e.code,
            "description": e.description,
            "exception": str(e),
        }, 404

    @file_cache
    def _send_report_file(project_dir, filename):
        report_fn = f'{project_dir}/report.zip'
        try:
            with om.datasets.get(report_fn) as f:
                zipfile = ZipFile(f)
                data = zipfile.read(f'report/{filename}')
                zipfile.close()
```

```
                except Exception as e:
                    abort(404, str(e))
                return data

            server.register_blueprint(app)
            return server
```

3. Serve the docs locally by running the following command:

    $ FLASK_APP=dbtdeploy:create_app flask run

2. Serve the dbt project documentation via omegaml's apphub:

```
# package the app
$ om scripts put . dbtdeploy apps/dbtdeploy
$ om runtime restart app dbtdeploy
```