Orchestra

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B12

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CONTENTS

Orchestra is an open source system to orchestrate teams of experts as they complete complex projects with the help of automation.

CHAPTER

ONE

GETTING STARTED WITH ORCHESTRA IN 5 MINUTES

What follows is a simple 5-minute guide to getting up and running with Orchestra that assumes some basic Python and Django experience, but not much else. For a deeper introduction, you might want to check out our *Key Concepts*, and for in-depth information on using and developing with Orchestra, take a look at our *API documentation*.

1.1 Install Dependencies

Orchestra requires Python 3 and Django version 1.11 or higher to run, so make sure you have them installed. We recommend setting up a virtual environment to isolate your Python dependencies, and we're fond of virtualenvwrapper to make that process easier. Make sure to create your virual environment with Python 3 by passing `--python=/path/to/bin/python3` if it isn't your default development setup.

Orchestra requires a number of Python dependencies to run. You can install them by simply pulling down and installing our `requirements.txt` file:

```
wget https://raw.githubusercontent.com/b12io/orchestra/stable/requirements.txt
pip install -r requirements.txt
```

1.2 Create a Django Project

Orchestra is a Django app, which means that it must be run within a Django project (for more details, read the Django tutorial on this topic). Start a project with `django-admin startproject your_project`, replacing `your_project` with your favorite project name (but don't name it `orchestra`, which will conflict with our namespace). From here on out, this document will assume that you stuck with `your_project`, and you should replace it appropriately.

1.3 Install and Configure Orchestra

Next, let's get Orchestra installed and running. To get the code, just install using pip: `pip install orchestra`.

Orchestra has a number of custom settings that require configuration before use. First, download the default Orchestra settings file and place it next to the project settings file:

```
wget https://raw.githubusercontent.com/b12io/orchestra/stable/example_project/example_
↪project/orchestra_settings.py
mv orchestra_settings.py your_project/your_project
```

Next, edit the `orchestra_settings.py` file:

- Add `'simple_workflow'` to `settings.ORCHESTRA_WORKFLOWS` in the "General" section if you want to run the demo workflow (*instructions below*), and add `'journalism_workflow'` if you want to run the *journalism workflow*.
- Adjust your email settings. By default, Orchestra will direct all messages to the console, but for a realistic registration workflow you'll want to set up a real mail server that can actually send emails.
- Change settings like the `ORCHESTRA_PROJECT_API_SECRET` from `'CHANGEME'` to more appropriate values.
- Optionally, add 3rd party credentials in the "3rd Party Integrations" section so that Orchestra can store files on Amazon S3, use Google Apps and Slack to help communicate with expert workers, and track usage in Google Analytics.

Then, at the bottom of your existing settings file (`your_project/your_project/settings.py`), import the Orchestra settings:

```
from .orchestra_settings import setup_orchestra
setup_orchestra(__name__)
```

You'll also need to set up Orchestra's URLs, so that Django knows where to route users when they view Orchestra in the browser. If you don't have any URLs of your own yet, you can just download our bare-bones example file with `wget https://raw.githubusercontent.com/b12io/orchestra/stable/example_project/example_project/urls.py`.

Alternatively, make sure to add the following code inside the `urlpatterns` variable in `your_project/your_project/urls.py`:

```
# Admin Views
url(r'^orchestra/admin/',
    include(admin.site.urls)),

# Registration Views
# Eventually these will be auto-registered with the Orchestra URLs, but for
# now we need to add them separately.
url(r'^orchestra/accounts/',
    include('registration.backends.default.urls')),

# Optionally include these routes to enable user hijack functionality.
url(r'^orchestra/switch/', include('hijack.urls')),

# Logout then login is not available as a standard django
# registration route.
url(r'^orchestra/accounts/logout_then_login/$',
    auth_views.logout_then_login,
    name='logout_then_login'),

# Orchestra URLs
url(r'^orchestra/',
    include('orchestra.urls', namespace='orchestra')),

# Beanstalk Dispatch URLs
url(r'^beanstalk_dispatch/',
    include('beanstalk_dispatch.urls')),
```

And ensure the following imports are at the top of your `your_project/your_project/urls.py`:

```
from django.conf.urls import include
from django.conf.urls import url
```

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```
from django.contrib import admin
from django.contrib.auth import views as auth_views
```

Finally, you'll need to get the database set up. Create your database with `python manage.py migrate`. You'll also want to make sure you have loaded our example workflows and set up some user accounts to try them out. To load the workflows, run:

```
python manage.py loadworkflow <APP_LABEL> <WORKFLOW_VERSION>
```

If you would like to load all of the workflows, then run:

```
python manage.py loadallworkflows
```

The example workflows we currently release with Orchestra are:

- A *simple demo workflow* with one human and one machine step. Its app label is `simple_workflow`, its workflow slug is `simple_workflow`, and the latest version is `v1`.
- A more complicated *journalism workflow*. Its app label is `journalism_workflow`, its workflow slug is `journalism`, and the latest version is `v1`.

Each of our example workflows provides a set of sample users already configured with proper certifications. To load them, run:

```
python manage.py loadworkflowsampledata <WORKFLOW_SLUG>/<WORKFLOW_VERSION>
```

To load sample data for both of these workflows, run:

```
python manage.py loadworkflowsampledata simple_workflow/v1
python manage.py loadworkflowsampledata journalism/v1
```

In addition, you can use the Orchestra admin (http://127.0.0.1:8000/orchestra/admin) to create new users and certifications of your own at any time once Orchestra is running. If you haven't created an admin account for your Django project, you can load a sample one (username: `admin`, password: `admin`) with `python manage.py loaddata demo_admin`. Note that when you log into Django with the `admin` account, you will see errors related to the *Orchesta timer*. This is because the admin user is not a Worker on the platform, and thus has no time-tracking information.

We provide the option to use the third-party package django-hijack to act on behalf of users. To enable this setting, ensure that the following setting is set `HIJACK_ALLOW_GET_REQUESTS = True`, in addition to including the urls referenced above.

Now Orchestra should be ready to go! If you're confused about any of the above, check out our barebones example project.

1.4 Run Orchestra

Now that Orchestra is configured, all that remains is to fire it up! Run your Django project with `python manage.py runserver` (you'll want to switch to something more robust in production, of course), and navigate to `http://127.0.0.1:8000/orchestra/app` in your favorite browser.

If you see the Orchestra sign-in page, your setup is working! If you loaded the simple workflow's sample data above, logging in as its user (username `demo`, password `demo`) should show you a dashboard with no available tasks.

1.5 Run the Example Project Demo

To give you a feel for what it means to run an Orchestra workflow from end to end, we've included a very simple example workflow with two steps, one machine and one human. The machine step takes a URL and extracts a random image from the page. The human step asks an expert to rate how "awesome" the image is on a scale from one to five. If you're interested in how we defined the workflow, take a look at the code, though we walk through a more interesting example in *this documentation*.

We've written an interactive script to walk through this simple workflow. To run it:

- Make sure you added `simple_workflow` to your `ORCHESTRA_WORKFLOWS` setting following the previous section.
- Make sure you loaded the workflow and its sample data following the previous section. This should have created a user with username `demo` and password `demo`.
- Run the interactive walkthrough:

```
python manage.py interactive_simple_workflow_demo
```

The script will walk you through using *the Orchestra Client API* to create a new project based on the simple workflow, explaining which API calls to use, what their output looks like, and how machine steps interact with human steps and pass data back and forth.

If you don't want to go to the trouble of running the script yourself, take a look at the transcript of expected output.

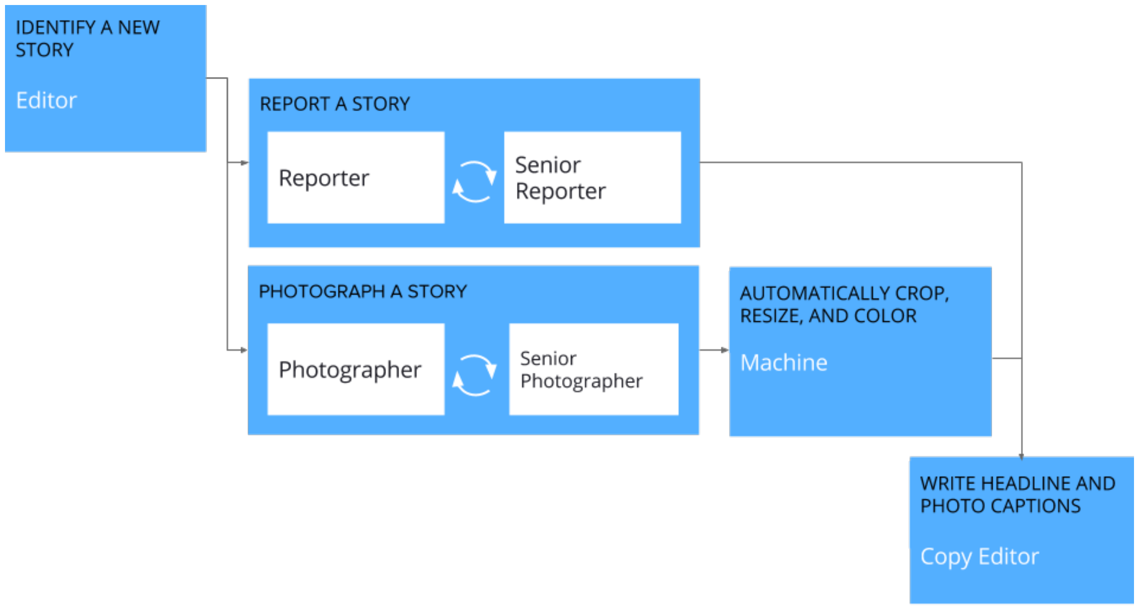
CHAPTER

TWO

EXAMPLE USE CASE: THE NEWSROOM

Below we'll walk you through an example of how Orchestra could be used in a newsroom by journalists, editors, and photographers to craft a story. The code for this example can be found in our github repo.

2.1 The workflow



The image above depicts our example workflow, which is composed of the following steps:

- An editor finds a good story and sends a reporter off to investigate.
- The reporter writes up a draft article.
- A more experienced reporter then reviews the article and suggests improvements.
- In parallel with the reporting step, a photographer captures photos for the story.
- A senior photographer reviews the photos and selects the best ones.
- The selected photos are resized and recolored for display across different media.
- Finally, a copy editor adds headlines and photo captions to complete the story.

To make things work in practice, there's also a hidden machine step at the beginning of the workflow to set up some google documents and folders for article writing and image storage.

2.2 Running the workflow

2.2.1 Setup

If you haven't followed the *getting started guide* to set up Orchestra yet, you should do that now. Also, make sure that `'journalism_workflow'` is in your `INSTALLED_APPS` setting, and that you have loaded the workflow into the database (`python manage.py loadworkflow journalism_workflow v1`).

The journalism workflow requires Google Apps integration to run, so make sure in `orchestra_settings.py` you set `settings.GOOGLE_APPS` to `True`, and fill in values for `settings.GOOGLE_SERVICE_EMAIL`, `settings.GOOGLE_P12_PATH`, and `settings.GOOGLE_PROJECT_ROOT_ID`. To get started, sign up for a Google API console account. Set up a service account, and retrieve that account's service email and .p12 key file. As a summary, the variables do the following:

- `settings.GOOGLE_SERVICE_EMAIL` is the ID that Google will grant you when you sign up for a service account.
- `settings.GOOGLE_P12_PATH` is a path on the filesystem to a .p12 key file you will receive when you sign up for the service account.
- `settings.GOOGLE_PROJECT_ROOT_ID` is the ID of the parent folder in Google Drive in which Orchestra will create project-specific subfolders. For example, if you create a parent folder in Google Drive and its URL is `https://drive.google.com/drive/u/0/folders/XYZ`, you should set `settings.GOOGLE_PROJECT_ROOT_ID = 'XYZ'`. Note that your service account needs to have access to this folder, either because you gave it domain-wide access or because you explicitly shared the folder with the service account.

Next, make sure you have the journalism workflow sample data installed by running (if you haven't already) `python manage.py loadworkflowsampledata journalism/v1`. This will create the following accounts:

- username: `journalism-editor`, password: `editor`. A worker with `editor` certification.
- username: `journalism-reporter-1`, password: `reporter`. A worker with entry-level `reporter` certification.
- username: `journalism-reporter-2`, password: `reporter`. A worker with review-level `reporter` certification.
- username: `journalism-photographer-1`, password: `photographer`. A worker with entry-level `photographer` certification.
- username: `journalism-photographer-2`, password: `photographer`. A worker with review-level `photographer` certification.
- username: `journalism-copy-editor`, password: `copy-editor`. A worker with `copy_editor` certification.

2.2.2 Start the workflow

The journalism workflow comes with a management script to start and monitor the workflow. To start the workflow:

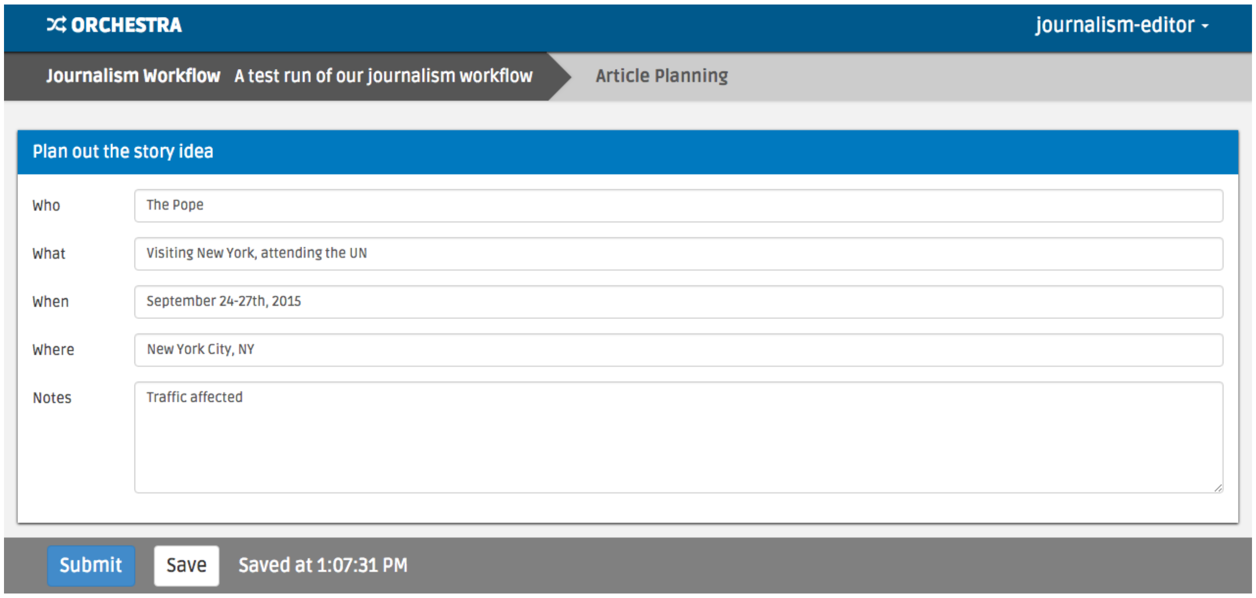
- Make sure Orchestra is running with `python manage.py runserver`.
- In another tab, run:

  ```
  python manage.py journalism_workflow_ctl --new
  ```

This will take a bit (because it is automatically running the document creation workflow step), but will eventually return a project id (probably `1`), which you should store for future use, and output JSON info about the project.

2.2.3 Complete the steps

To navigate the workflow, first log in as the `journalism-editor` user and request a new task. The interface should look like the image below:

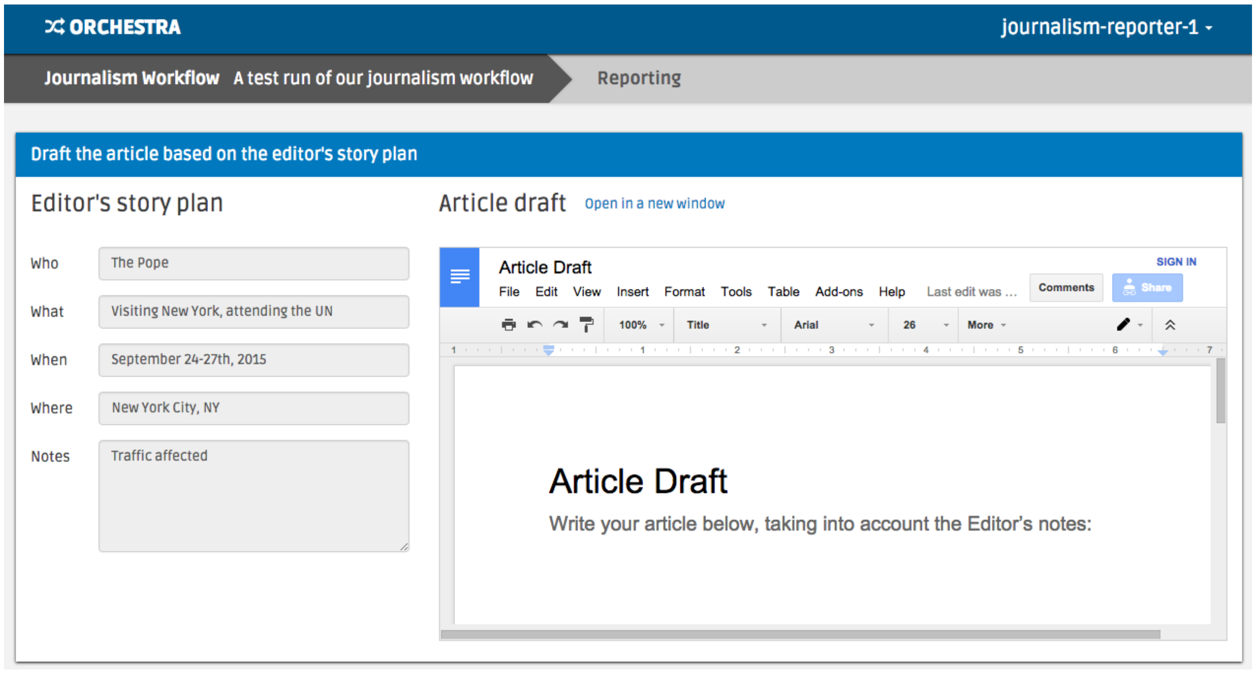


Plan out the story idea

Who	The Pope
What	Visiting New York, attending the UN
When	September 24-27th, 2015
Where	New York City, NY
Notes	Traffic affected

Fill out the high-level story idea and submit the task.

Next, log in as the `journalism-reporter-1` worker, and you should now have a reporting task available. The interface looks like the image below–use the google doc to write your article.



Draft the article based on the editor's story plan

Editor's story plan

Who	The Pope
What	Visiting New York, attending the UN
When	September 24-27th, 2015
Where	New York City, NY
Notes	Traffic affected

Article draft

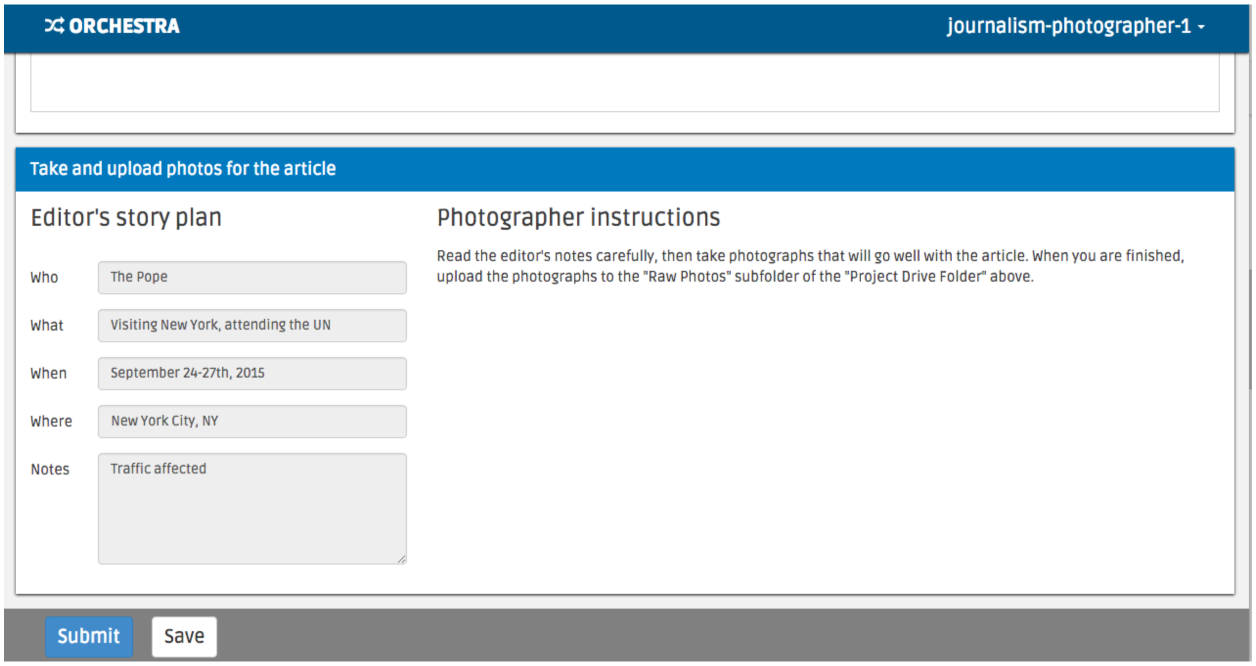
Article Draft

Article Draft

Write your article below, taking into account the Editor's notes:

When you submit, you'll note that the task appears in the 'Awaiting Review' section. That's your cue to log in as `journalism-reporter-2` and review the work. Once you're satisfied with it, accept it.

In parallel to logging in as a reporter, you can log in as `journalism-photographer-1` and `journalism-photographer-2` to take and review photographs relevant to the article. You should see an interface like the image below, which encourages you to add photos to a shared 'Raw Photos' folder. The interface should look like the below:



Take and upload photos for the article

Editor's story plan

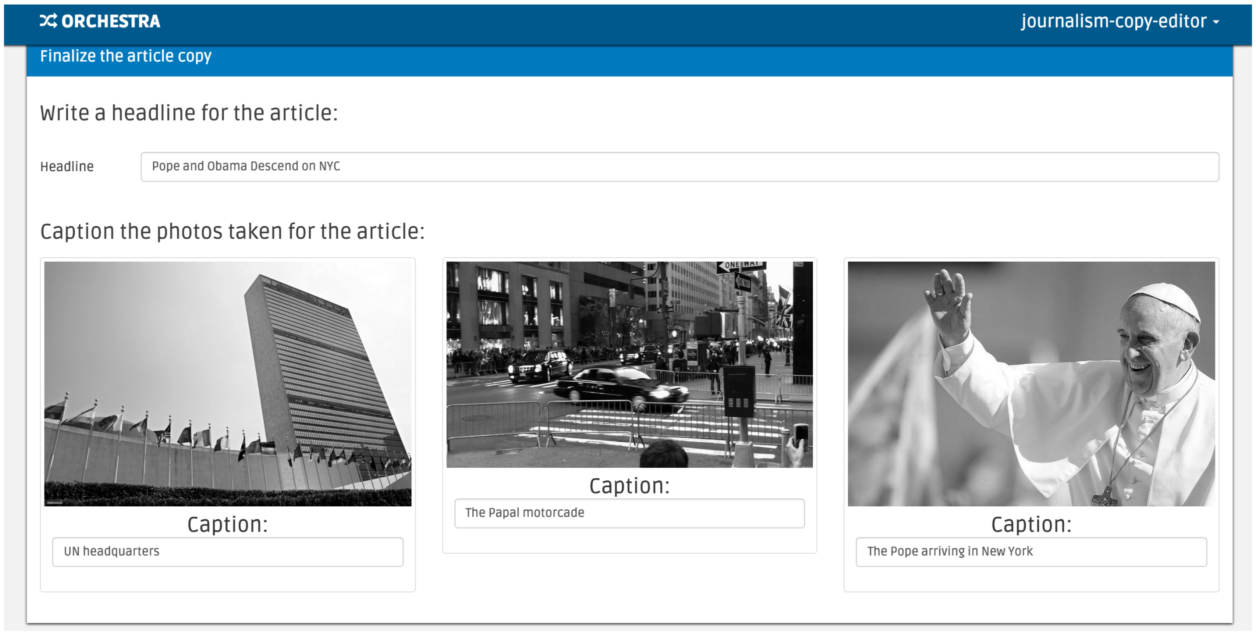
Who	The Pope
What	Visiting New York, attending the UN
When	September 24-27th, 2015
Where	New York City, NY
Notes	Traffic affected

Photographer instructions

Read the editor's notes carefully, then take photographs that will go well with the article. When you are finished, upload the photographs to the "Raw Photos" subfolder of the "Project Drive Folder" above.

Once you've accepted the photography as `journalism-photographer-2`, the machine task to auto-process the photos should run. Our implementation simply makes any images in 'Raw Photos' greyscale, but you could imagine more complicated adjustments.

Finally, log in as `journalism-copy-editor` to give the article a headline and caption the photos. You should observe that your photos have been greyscaled as desired, as in the image below:



Finalize the article copy

Write a headline for the article:

Headline: Pope and Obama Descend on NYC

Caption the photos taken for the article:

Caption: UN headquarters

Caption: The Papal motorcade

Caption: The Pope arriving in New York

Once you submit the task, the workflow is done! You've successfully coordinated 6 expert workers and 2 machine tasks to tell a story.

2.2.4 Verify the final JSON output

You'll note that our workflow didn't actually lay the article out in its final print or electronic form. That's because, in reality, this workflow would have been kicked off by a newsroom's content management system with auto-layout capabilities based on the JSON the project produced. To see the JSON that the workflow produces for input into such a system, run:

```
python manage.py journalism_workflow_ctl --finish -p <PROJECT_ID>
```

where <PROJECT_ID> is the project id you were given when you created the project.

You should see output like:

```
{'articleDocument': 'https://docs.google.com/document/d/someid',
 'headline': 'Your Headline',
 'photos': [{'caption': 'Your Caption 1',
             'src': 'https://docs.google.com/uc?id=someid'},
            {'caption': 'Your Caption 2',
      'src': 'htps://docs.google.com/uc?id=someid2'},
      ...
     ]
 }
```

which summarizes all of the work accomplished in the workflow.

2.3 The code

All of the code used to create the new room workflow is located in our github repo. There are three main components to the code: The workflow definition, the interface implementations for the human steps, and the python code for the machine steps.

2.3.1 The workflow definition

The workflow is defined in journalism_workflow/workflow.json, and its latest version (version 1) is defined in journalism_workflow/v1/version.json. These files declaratively defines the steps listed above, in programmatic form.

workflow.json defines the workflow with a name and short description:

```
{
  "slug": "journalism",
  "name": "Journalism Workflow",
  "description": "Create polished newspaper articles from scratch.",
}
```

It also describes certifications required by the workflow:

```
{
  "certifications": [
    {
      "slug": "editor",
      "name": "Editor",
      "description": "Trained in planning story ideas"
    },
    {
```

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```
      "slug": "reporter",
      "name": "Reporter",
      "description": "Trained in researching and writing articles"
    },
    {
      "slug": "photographer",
      "name": "Photographer",
      "description": "Trained in taking photos for articles"
    },
    {
      "slug": "copy_editor",
      "name": "Copy Editor",
      "description": "Trained in assembling photos and text into article layout"
    }
  ]
}
```

And provides the location of a python function to load sample data:

```
{
  "sample_data_load_function": {
    "path": "journalism_workflow.load_sample_data.load"
  }
}
```

`version.json` defines the steps of the workflow. Check out the source for all of the step definitions, but here we'll list two.

Below is the definition of the human step that takes an editor's story idea and asks a reporter to write an article based on it:

```
{
  "slug": "reporting",
  "name": "Reporting",
  "description": "Research and draft the article text",
  "is_human": true,
  "creation_depends_on": [
    "article_planning"
  ],
  "required_certifications": [
    "reporter"
  ],
  "review_policy": {
    "policy": "sampled_review",
    "rate": 1,
    "max_reviews": 1
  },
  "creation_policy": {
    "policy_function": {
      "path": "orchestra.creation_policies.always_create",
    }
  },
  "user_interface": {
    "angular_module": "journalism_workflow.v1.reporter",
    "angular_directive": "reporter",
    "javascript_includes": [
      "journalism_workflow/v1/reporter/js/modules.js",
```

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```
      "journalism_workflow/v1/reporter/js/controllers.js",
      "journalism_workflow/v1/reporter/js/directives.js"
    ]
  }
}
```

Note that we've specified step dependencies with `creation_depends_on`, required worker skills with `required_certifications`, and user interface javascript files with `user_interface`. In addition, we've asked that all reporters have their work reviewed by a senior reporter by specifying a sampled `review_policy` with a rate of 100% (`rate` goes from 0 to 1). We've also specified a `creation_policy`. Creation policies can be used to conditionally create a task based on previous step and project information.

Next, we show a machine step, in this case the step that takes our photographers' output (a directory of images), and processes those images for layout:

```
{
  "slug": "photo_adjustment",
  "name": "Photo Adjustment",
  "description": "Automatically crop and rescale images",
  "is_human": false,
  "creation_depends_on": [
    "photography"
  ],
  "execution_function": {
    "path": "journalism_workflow.v1.adjust_photos.autoadjust_photos"
  }
}
```

The basic arguments are similar, but we specify the step type as not human (`"is_human": false`), and instead of a user interface, we pass a python function to execute (`autoadjust_photos` here).

2.3.2 The interface implementations

In order for our workflows to be usable by experts, we need to display an interface for each human step. Orchestra uses angular.js for all of our interfaces. The interfaces all live under journalism_workflow/static/journalism_workflow.

Remember that in our *workflow definition*, we specified user interfaces with JSON that looked like this:

```
{
  "angular_module": "journalism_workflow.v1.editor",
  "angular_directive": "editor",
  "javascript_includes": [
    "journalism_workflow/v1/editor/js/modules.js",
    "journalism_workflow/v1/editor/js/controllers.js",
    "journalism_workflow/v1/editor/js/directives.js"
  ],
  "stylesheet_includes": []
}
```

Orchestra will automatically inject the specified `angular_directive` into the website, which should be implemented in the files listed in `javascript_includes`. To have CSS available in your interface, just list the file paths in `stylesheet_includes`.

An angular interface is composed of a few things: a controller that sets up state for the interface, a directive that injects the interface into a website, a module that registers the controllers and directives, and a partial that contains an html template for the interface. The angular docs do a better job of explaining these than we will, but here are a couple of things to keep in mind:

- In our directives, we use:

  ```
  scope: {
    taskAssignment: '=',
  }
  ```

  to ensure that the input data for a step is available (it will be accessible at `taskAssignment.task.data`

- In our controllers, we use:

  ```
  MyController.$inject = ['$scope', 'orchestraService'];
  ```

  to ensure that the task data is passed to the controller. `orchestraService` has useful convenience functions for dealing with the task data like `orchestraService.taskUtils.prerequisiteData($scope.taskAssignment, stepSlug, dataKey)`, which will get the taskAssignment for the previous step called `step_slug` (and optionally the data specified by `data_key`).

And of course, please refer to the newsroom workflow step interfaces as examples.

2.3.3 The machine steps

Our workflow has two machine steps, one for creating documents and folders, and one for adjusting images.

A machine step is just a Python function with a simple signature:

```
def my_machine_step(project_data, prerequisites):
  # implement machine-y goodness
  return { 'output_data_key': 'value' }
```

It takes two arguments, a python dictionary containing global project data and a python dictionary containing state from all prerequisite workflow steps (and their prerequisites, and so on). The function can do whatever it likes, and returns a JSON-encodable dictionary containing state that should be made available to future steps (in the `prerequisites` argument for a machine step, and in the angular scope for a human interface).

For example, our image adjustment step (in journalism_workflow/v1/adjust_photos.py) gets the global project directory from `project_data`, uses Orchestra's Google Apps integration to create a new subfolder for processed photos, downloads all the raw photos, uses pillow to process them (for now it just makes them greyscale), then re-uploads them to the new folder.

2.3.4 Providing sample data

In the *workflow definition*, we specified a module and function name for loading sample data with JSON that looked like:

```
{
  "sample_data_load_function": {
    "path": "journalism_workflow.load_sample_data.load"
  }
}
```

This function should create Django model objects (typically Users, `Workers`, and `WorkerCertifications`) that are helpful for a sample run through the workflow. The function has a simple signature, and might look like (for example):

```
from django.contrib.auth.models import User

def load(workflow_version):
  user = User.objects.update_or_create(
    username='test_user',
    defaults={
      'first_name': 'Test',
      'last_name': 'User',
  })
  user.set_password('test')
```

Once that function is defined, sample data can be loaded with:

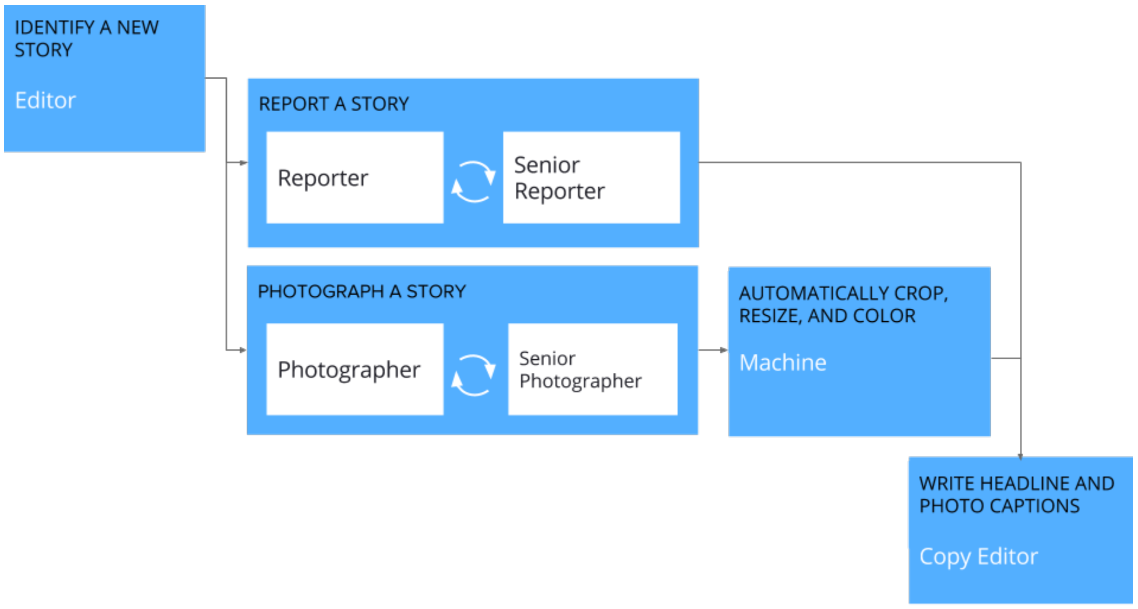
```
python manage.py loadworkflowsampledata <WORKFLOW_SLUG>/<WORKFLOW_VERSION>
```

CHAPTER

THREE

KEY CONCEPTS

Let's first recap our example *reporting workflow*:



- An editor finds a good story and sends a reporter off to investigate.
- The reporter writes up a draft article.
- A more experienced reporter then reviews the article and suggests improvements.
- In parallel with the reporting step, a photographer captures photos for the story.
- A senior photographer reviews the photos and selects the best ones.
- The selected photos are resized and recolored for display across different media.
- Finally, a copy editor adds headlines and photo captions to complete the story.

We'll now walk you through major Orchestra concepts based on the example above.

3.1 Workflows

- The entire process above is called a **workflow**, comprised of five component **steps**.
- Two of these steps require **review**, where more experienced experts review the original work performed. Custom review policies (e.g., sampled or systematic review) for tasks can be easily created in Orchestra.
- The photo resizing step is a **machine step**, completed by automation rather than by experts.
- Each step emits a JSON blob with structured data generated by either humans or machines.
- Steps have access to data emitted by previous steps that they depend on. In the example, the copy editor has access to both the story and the resized photos.

3.2 Project Distribution

- **Projects** are a series of interconnected **tasks**. A project is an instance of a workflow; a task is an instance of a step.
  - *An editor with a story about local elections would create an elections project, with tasks for a reporter/photographer/copy editor.*
- **Tasks** are carried out by an **expert** or by a **machine**.
  - *Photographers capture the story.*
  - *Machines resize and recolor the photos.*
- Experts can come from anywhere, from a company's employees to freelancers on platforms like Upwork.

3.3 Hierarchical Review

- **Core experts** do the initial work on a task.
- **Reviewers** provide feedback to other experts to make their work even better.
- The core expert **submits** the task when their work is complete.
- The reviewer can choose to **accept** the task, which is either selected for further review or marked as complete.
- They could also choose to **return** the task, requesting changes from and giving feedback to the worker they are reviewing.

3.4 Worker Certification

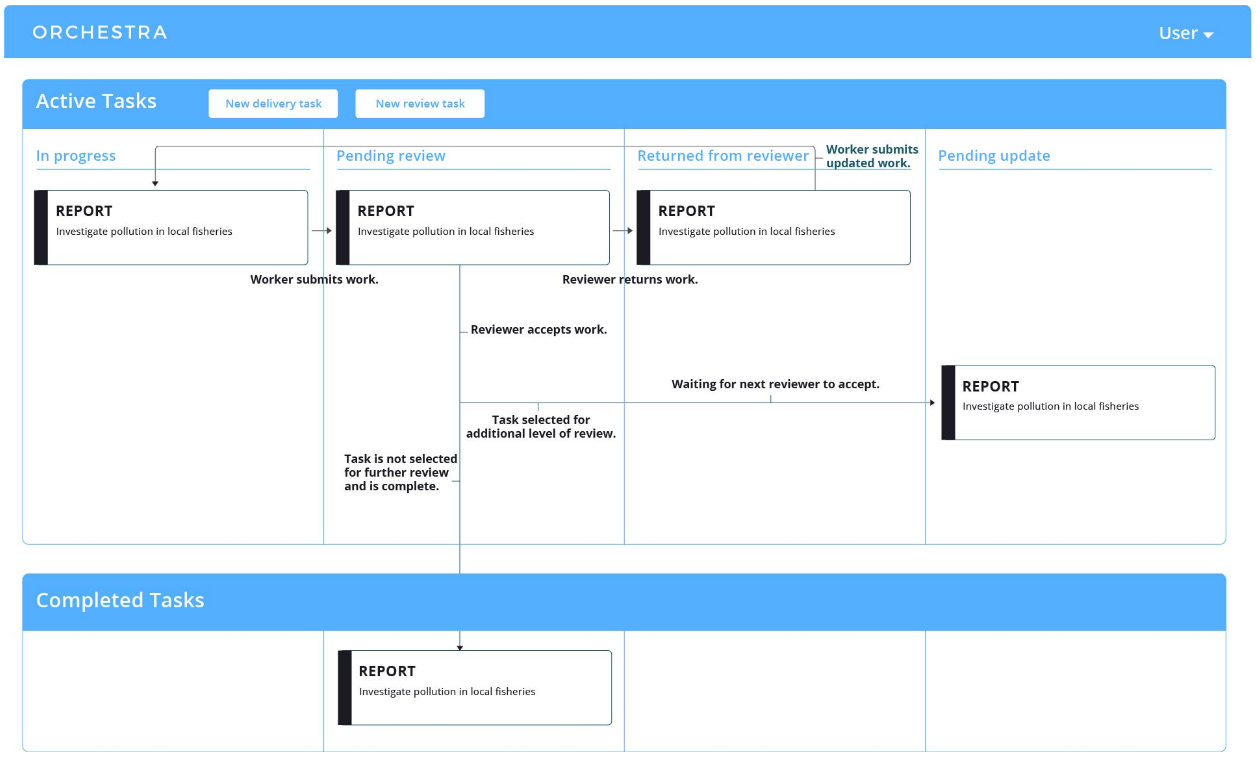
- Certifications allow experts to work on tasks they're great at.
- Experts can work toward all sorts of certifications, picking up practice tasks to build experience.
  - *Joseph is a solid reporter but needs a little more practice as a photographer—let's give him some simple tasks so he can improve!*
- Experts need additional certification to work in a reviewer role.
  - *Amy has been reporting for quite some time and would be great at mentoring new reporters.*

3.5 Life of a Task

Below are two images of the Orchestra dashboard, the launching point for expert workers. Click to see how tasks move differently across the dashboard for core workers and reviewers.

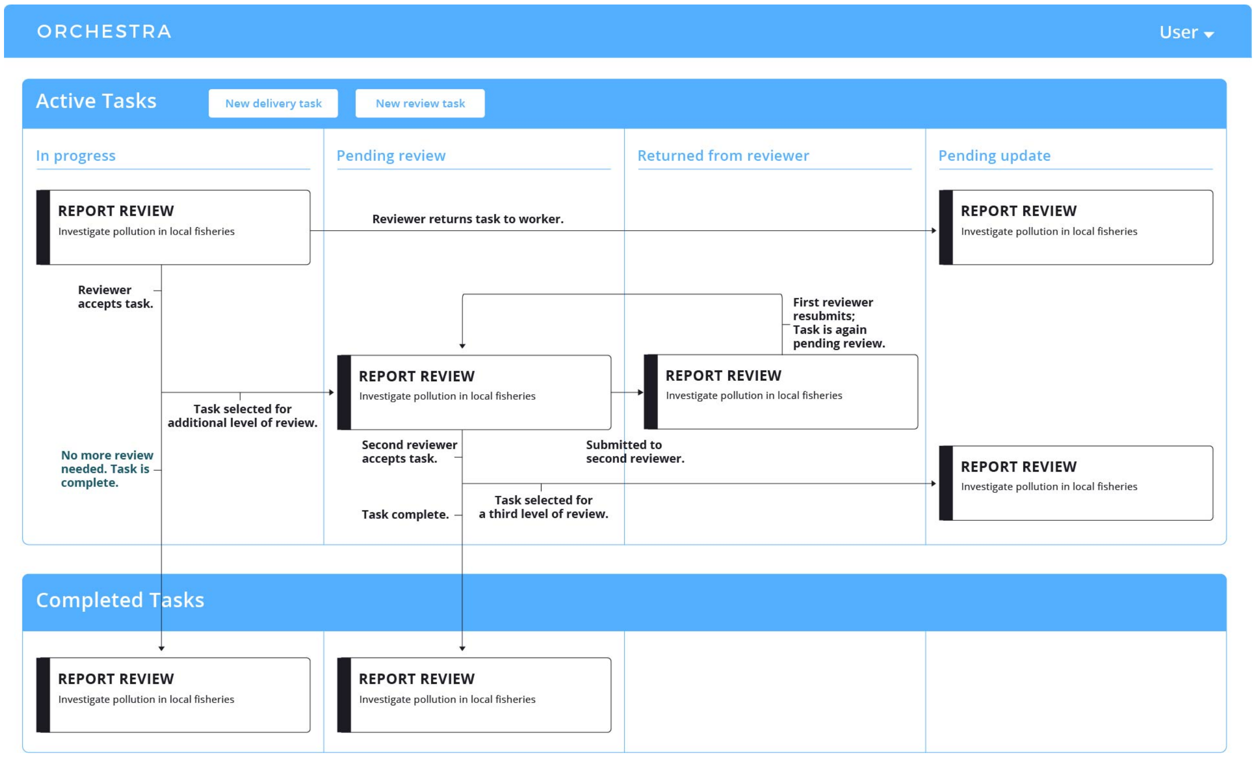
3.5.1 Core Expert

A core expert performs initial task work which will later be reviewed. The diagram below shows a task's movement through the core worker's dashboard.


ORCHESTRA
User
Active Tasks
New delivery task
New review task
In progress
Pending review
Returned from reviewer
Worker submits updated work.
Pending update
REPORT
Investigate pollution in local fisheries
Worker submits work.
Reviewer returns work.
Reviewer accepts work.
Waiting for next reviewer to accept.
Task selected for additional level of review.
Task is not selected for further review and is complete.
Completed Tasks

3.5.2 Reviewer

A reviewer evaluates the core expert's work and provides feedback. The diagram below shows a task's movement through a reviewer's dashboard.


ORCHESTRA
User
Active Tasks
New delivery task
New review task
In progress
Pending review
Returned from reviewer
Pending update
REPORT REVIEW
Investigate pollution in local fisheries
Reviewer returns task to worker.
Reviewer accepts task.
First reviewer resubmits; Task is again pending review.
Task selected for additional level of review.
No more review needed. Task is complete.
Second reviewer accepts task.
Submitted to second reviewer.
Task complete.
Task selected for a third level of review.
Completed Tasks

CHAPTER

FOUR

FEATURE WALKTHROUGH

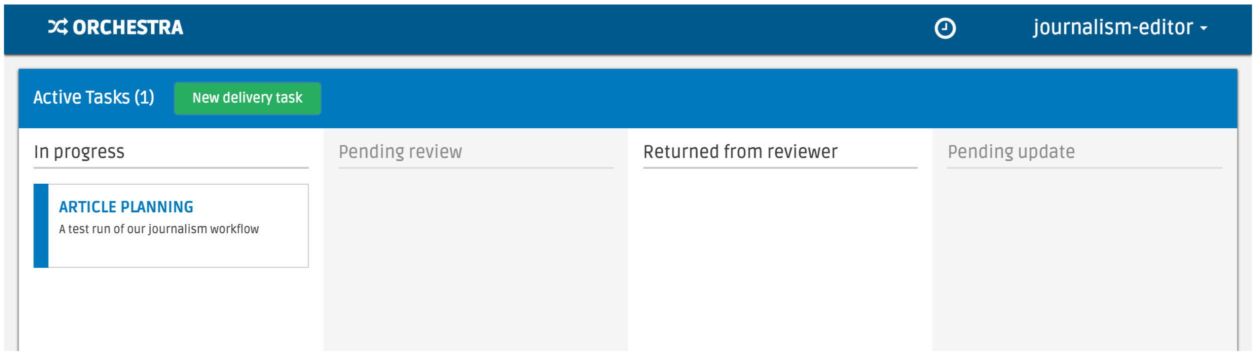
Below, we'll walk through the various features in Orchestra.

4.1 Time Tracking

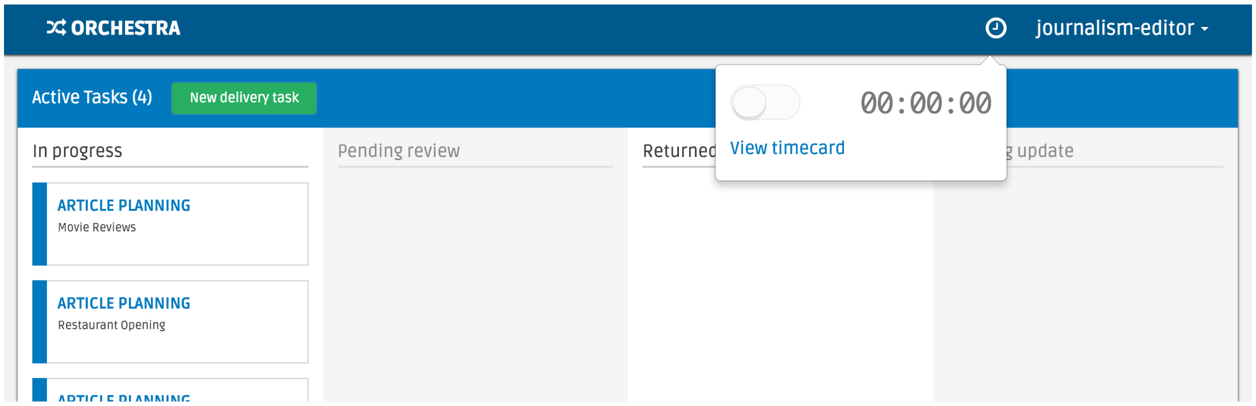
Workers can track time spent on a task using the timer/timecard feature. We provide both a timer widget that workers can turn on to track time, and a timecard page where workers can update and manually create time entries.

4.1.1 Timer

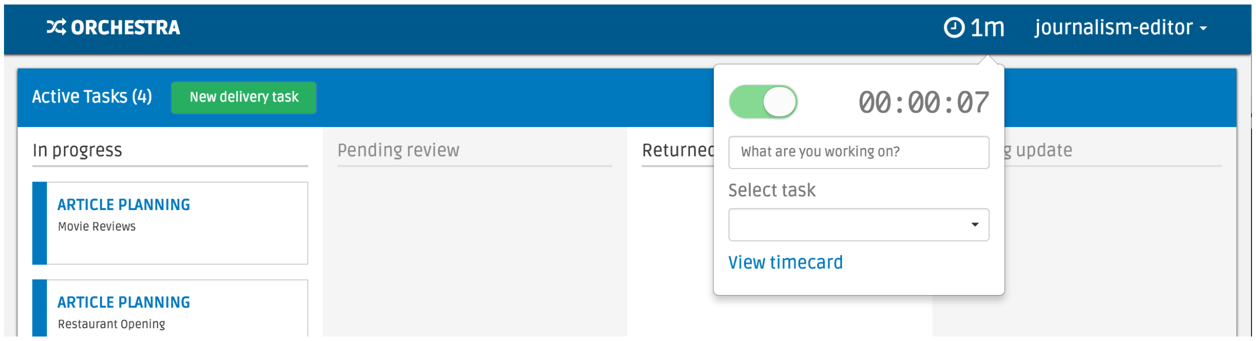
The navigation bar in the task dashboard and task pages has a timer icon.



If you click on the timer icon, a dropdown appears that allows the worker to toggle a timer to track their work time.



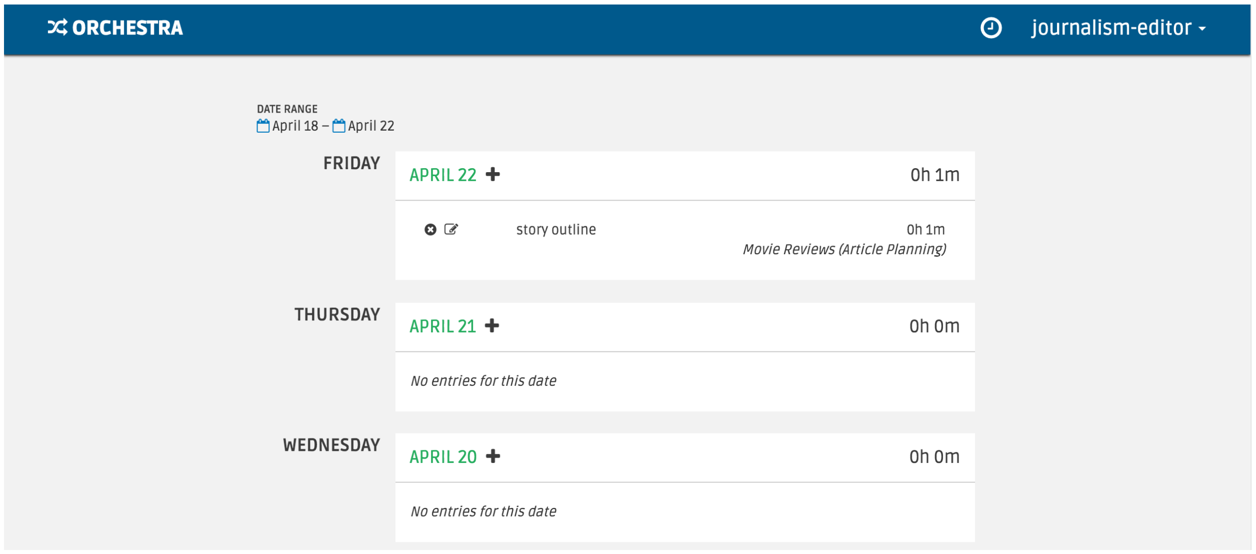
After the timer is started, the worker can add a description and specify the task they are working on. If the timer is started in a task interface, the task field is pre-populated.



When the timer is stopped, a time entry is automatically created for the amount of time worked. A worker can go to the timecard page to edit and manually add time entries.

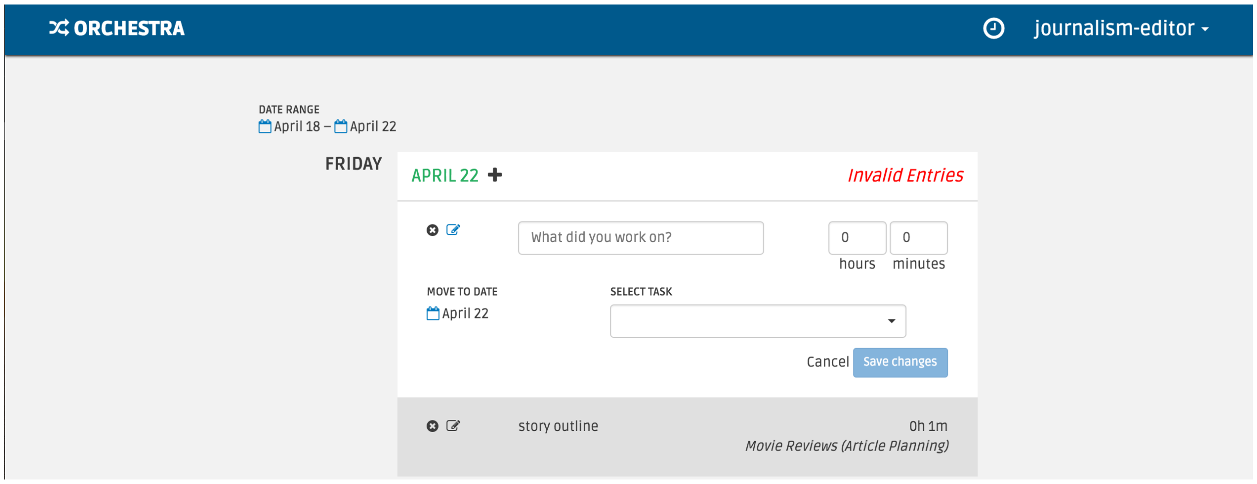
4.1.2 Timecard

The timecard page by default shows a list of time entries for the current work week, starting on Monday, grouped by date. You can use the date range pickers at the top to change the entries shown.



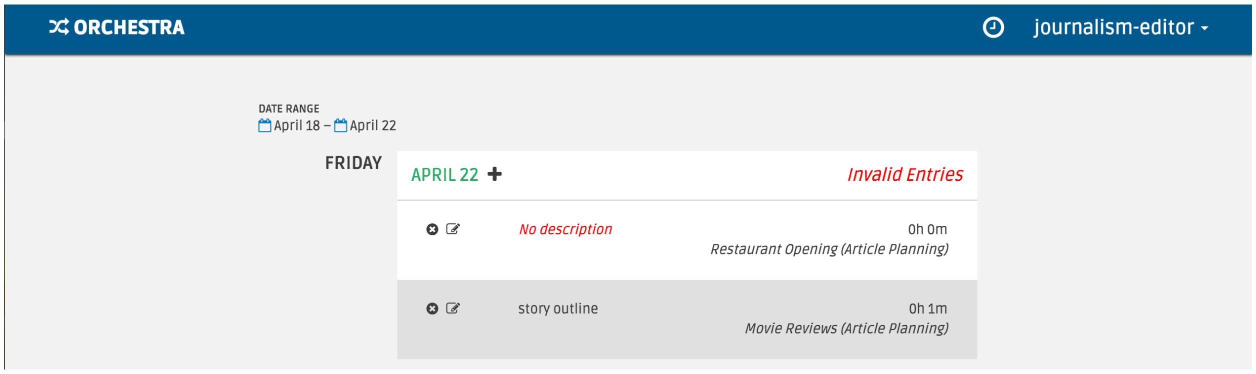
The time to the right of the date shows the total time worked that day.

A time entry can be manually added (versus automatically added by stopping the timer) by clicking the plus icon next to each date.



Each time entry can be edited by clicking the pencil icon, or deleted by clicking the x icon.

If a time entry is missing a description or a task, the missing fields are highlighted and the total hours for the day is hidden.



4.1.3 Quirks

- Time entries automatically created when the timer is stopped have the date set to the current UTC timestamp date. This means that the date might be different than the date in the worker's time zone. In general, handling time entries across multiple time zones is difficult, and we are still working on a better user experience.
- Time entries automatically created when the timer is stopped have the work time set to the hours:minutes:seconds displayed in the timer. However, the timecard page only shows hours:minutes for time entries for readability. Time entries are rounded up to the minute, and the sum for the day reflects the sum of the *rounded* times, **not** the rounding of the sum of unrounded times.

CHAPTER

FIVE

ORCHESTRA BOTS

Below, we'll walk through the various bots available in Orchestra.

5.1 StaffBot

5.1.1 Overview

`StaffBot` provides a simple way to ask/automatically staff a group of `Workers` to work on a particular `Task`. The goal is reduce the human load when finding a `Worker` for a `Task`. `StaffBot` staffing begins in one of two ways:

- A user clicks on the `Staff` button in the project management or team information card in the Orchestra user interface.
- A `Task` has an *Assignment Policy* that calls on StaffBot. allows a user to interact with Orchestra.

Once `StaffBot` becomes aware of a task to be staffed, it tries staffing qualified `Workers` in two ways:

- First, it looks for `Workers` who have requested work hours in the `Work availability` tab of their account settings but have not yet worked or been assigned their desired number of hours of work that day. It automatically assigns these workers the highest-priority tasks for which they are qualified.
- If a task can not be automatically assigned to a `Worker`, `StaffBot` reaches out to qualified `Workers` and offers them a `Task` to work on via Slack/email and the `Available tasks` interface. `Workers` can then either accept or reject the task and start working on it.

Logic

When multiple tasks can be staffed, Orchestra prioritizes them in descending order of priority.

To staff a task, `StaffBot` considers candidate `Workers` who have `WorkerCertification` objects for that task. It narrows those `Workers` to ones with the `WorkerCertification.staffbot_enabled` field set to `True` (it is `True` by default). If there are multiple candidate `Workers`, Orchestra prioritizes in descending order of the `WorkerCertification.staffing_priority` integer field (`0` by default). If `Workers` have the same `staffing_priority`, `StaffBot` will prioritize them randomly.

In priority order, `StaffBot` first looks for any `Worker` that has a `WorkerAvailability` for today. It considers three numbers:

- The number of hours the `Worker` is estimated to work that day if the task is assigned to them. This is the sum of the number of hours the `Worker` has tracked on their timecard, any hours it has already assigned the `Worker` that day, and the estimate of hours of work for this `Task` (estimated by the `Task.assignable_hours_function`).

- The number of hours the `Worker` can work. This is the minimum of `Worker.max_autostaff_hours_per_day` (the `Worker`'s assignable limit) and `WorkerAvailability.hours_available_DAY` (the maximum hours the `Worker` requested for the day).
- The maximum number of automatically assignable tasks per `Worker` per day (`settings.ORCHESTRA_MAX_AUTOSTAFF_TASKS_PER_DAY`), which is a failsafe to make sure an error doesn't cause an out-of-control assignment condition.

If the hours the `Worker` can work is greater than the hours the `Worker` is estimated to work including this new `Task` (and the number of tasks assigned to them isn't more than the day's maximum), the `Task` will be automatically assigned to the `Worker`.

If no `Worker` meets the automatic staffing condition, then `StaffBot` sends requests to `Workers` to see if any prefer to pick up tasks rather than be automatically assigned a Task. Specifically, it sends requests in order of `staffing_priority` to `settings.ORCHESTRA_STAFFBOT_WORKER_BATCH_SIZE` `Workers` every `settings.ORCHESTRA_STAFFBOT_BATCH_FREQUENCY`. These requests are send via Slack and email, and appear in the `Available tasks` list in the Orchestra user interface.

Utility functions

There are several utility functions to help operationalize `StaffBot`. You should call these through `cron` or some other scheduling utility:

- `orchestra.communication.staffing.address_staffing_requests` runs the automatic staffing and staffing request functionality described above.
- `orchestra.communication.staffing.remind_workers_about_available_tasks` sends a reminder to any worker who has unclaimed task still available.
- `orchestra.communication.staffing.warn_staffing_team_about_unstaffed_tasks` warns administrators on the internal Slack channel `ORCHESTRA_STAFFBOT_STAFFING_GROUP_ID` about tasks that have not been staffed for more than `ORCHESTRA_STAFFBOT_STAFFING_MIN_TIME`.

Assignment Policy

`StaffBot` can automatically staff projects by specifying an Assignment Policy. Orchestra supports custom logic for assigning `Workers` to tasks, and `StaffBot` leverages this by asking qualified `Workers` if they would like to work on a `Task` as soon as the `Task` is available. To specify the `StaffBot` auto-assignment policy, which uses the same logic as the `/staffbot staff` command, add the following to the `Step` configuration in your `version.json` file. Following the Journalism Workflow Example we have:

```
[...step definition...]
"assignment_policy": {
    "policy_function": {
        "entry_level": {
            "path": "orchestra.bots.assignment_policies.staffbot_autoassign"
        }
    }
},
[...step definition...]
```

Now, for entry-level tasks within the defined step, `StaffBot` will automatically try to staff this `Task`. If the task requires review, manual assignment is necessary unless we add a `reviewer` key to the policy function:

```
[...step definition...]
"assignment_policy": {
```

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```
    "policy_function": {
        "entry_level": {
            "path": "orchestra.bots.assignment_policies.staffbot_autoassign"
        },
        "reviewer": {
            "path": "orchestra.bots.assignment_policies.staffbot_autoassign"
        }
    }
},
[...step definition...]
```

Detailed Description Function

The `detailed_description_function` is used to dynamically describe a `Task` when `StaffBot` makes requests to `Workers`, offering them the opportunity to work on the `Task`. The function is given a `task_details` dictionary and can be passed extra `kwargs` as shown below:

```
[...step definition...]
"detailed_description_function": {
     "path": "my_project.orchestra_helpers.get_detailed_description",
     "kwargs": {
         "text": "Task text"
     }
}
[...step definition...]
```

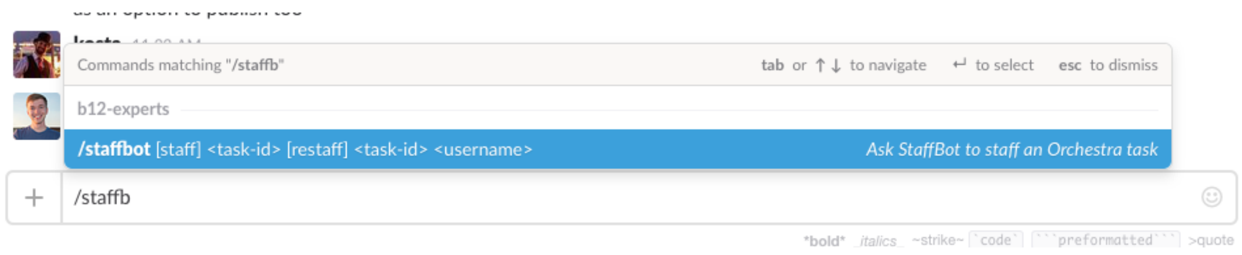
```
# my_project/orchestra_helpers.py

def get_detailed_description(task_details **kwargs):
  return '''A new task is available!
            Find out more about {} at example.com/projects/{}!'''.format(
            kwargs.get('text'), task_details['project']['id'])
```

5.1.2 Usage

Automatic Task Staffing in Orchestra

`StaffBot` allows interaction with Orchestra via Slack to assign or reassign an expert to a task. To use `StaffBot`, simply type `/staffbot` into your slack window, and will see an autocomplete similar to:



Commands matching "/staffb"   tab or ↑↓ to navigate   ↵ to select   esc to dismiss

b12-experts

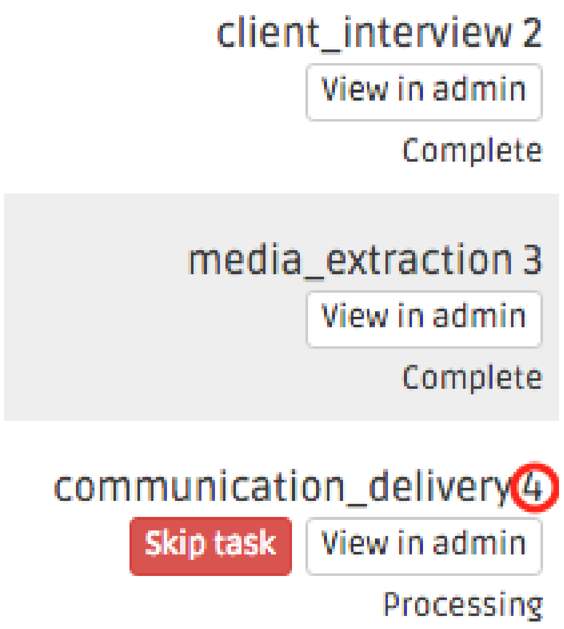
/staffbot [staff] <task-id> [restaff] <task-id> <username>   Ask StaffBot to staff an Orchestra task

/staffb

You can send two different commands to `StaffBot`: 1) `staff`, and 2) `restaff`.

Using the `staff` command

To use the `staff` command, you need to specify a `<task-id>` of a task that is unassigned. You can find the `<task-id>` in the project view (shown below) or from notification emails/Slack messages about a project.



In this example, you have just finished the `client_interview` task and need to add someone to the `communication_delivery` task with id `4` (shown in red), so you can type:

```
/staffbot staff 4
```

`Staffbot` will then reach out to eligible experts asking them if they would like to work on the task. Once one of them accepts, they will be added to the private Slack channel for the project and can begin working on the task.

If a task has a review step, you can use `StaffBot` to assign an expert to the review step once the first expert has submitted their work for review.

Using the `restaff` command

You can also use the `restaff` command to offer a task to a different expert. This will be useful if a expert is unable to complete the task. Following the example above, assume that the worker `joshblum` accepted the task `4`. To restaff this task you can type:

```
/staffbot restaff 4 joshblum
```

This will offer the task again to eligible experts, and once a new expert accepts, `joshblum` will be removed and the new expert will be added.

5.2 SanityBot

5.2.1 Setup

SanityBot periodically looks at the state of a project and reminds the project team about various things that seem off. For details and motivation, see the original project description. SanityBot currently warns project team members in the project team's Slack channel.

Project Configuration

To specify which sanity checks to run, and how frequently to run them, update version.json for the workflow you are sanity-checking with an optional sanity_checks entry. As an example:

```
[...workflow definition...]
"sanity_checks": {
  "sanity_check_function": {
      "path": "path.to.sanity.check.function"
  },
  "check_configurations": {
    "check_slug1": {
      "handlers": [{"type": "slack_project_channel", "message": "<message here>",
↪"steps": ["step_slug1", ...]}],
      "repetition_seconds": 3600
    },
    ...
  },
}
...
```

Here's a walkthrough of the configuration above:

- sanity_check_function is called periodically and generates SanityCheck objects. The function prototype is def sanity_check_function(project: Project) -> List[SanityCheck]:.
- check_configurations maps SanityCheck.check_slug values to a configuration, which consists of a list of handlers and a repetition interval.
- in v1, the only handler is slack_project_channel, which messages the team slack project, tagging the experts assigned to the tasks specified by in steps.
- An optional repetition_seconds contains the number of seconds to wait before re-issuing/re-handling a SanityCheck. If repetition_seconds does not appear in the map, that SanityCheck is not repeated.

Scheduling function

To operationalize SanityBot, you should call orchestra.bots.sanitybot.create_and_handle_sanity_checks through cron or some other scheduling utility. This function will look at all active projects with sanity_checks in their workflow definitions, and call the appropriate sanity_check_function to trigger sanity checks.

CHAPTER

SIX

OUR MOTIVATION

B12 has open sourced Orchestra as part of our goal to build a brighter future of work.

We are a startup that's passionate about improving how people do creative and analytical work. We have a strong team of engineers and designers who have worked extensively on systems that help people work productively online. Beyond focusing on profit, we believe that the products and experiences we design should be considerate of their greater social context and impact.

CHAPTER

SEVEN

HOW TO CONTRIBUTE TO ORCHESTRA

So you want to get involved in developing Orchestra. Great! We're excited to have your support. This document lays down a few guidelines to help the whole process run smoothly.

7.1 Getting involved

First, if you find a bug in the code or documentation, check out our open issues and pull requests to see if we're already aware of the problem. Also feel free to reach out to us on the discussion forum to ask questions or make suggestions.

If you've uncovered something new, please create an issue describing the problem. If you've written code that fixes an issue, create a pull request (PR) so it's easy for us to incorporate your changes.

7.2 Setting up for Development

We have a *.editorconfig* specified in the top level providing editor defaults for our code style. We recommend to install an EditorConfig plugin so your editor automatically adheres to our style :).

We recommend using a virtualenv to install the required packages in `requirements.txt`. In addition, we use Gulp as a frontend build system. To build the frontend resources you can run `make gulp_build` once npm is installed.

7.3 Development Workflow

Github provides a nice overview on how to create a pull request.

Some general rules to follow:

- Do your work in a fork of the Orchestra repo.
- Create a branch for each feature/bug in Orchestra that you're working on. These branches are often called "feature" or "topic" branches.
- Use your feature branch in the pull request. Any changes that you push to your feature branch will automatically be shown in the pull request.
- Keep your pull requests as small as possible. Large pull requests are hard to review. Try to break up your changes into self-contained and incremental pull requests, if need be, and reference dependent pull requests, e.g. "This pull request builds on request #92. Please review #92 first."
- Include unit tests with your pull request. We love tests and use CircleCI to check every pull request and commit. Check out our tests in `orchestra/tests` to see examples of how to write unit tests. Before submitting a PR, make sure that running `make test` from the root directory of the repository succeeds.

- Additionally, we try to maintain high code coverage. Aim for 100% for every new file you create!
- Once you submit a PR, you'll get feedback on your code, sometimes asking for a few rounds of changes before your PR is accepted. After each round of comments, make changes accordingly, then squash all changes for that round into a single commit with a name like 'changes round 0'.
- After your PR is accepted, you should squash all of your changes into a single commit before we can merge them into the main codebase.
- If your feature branch is not based off the latest master, you will be asked to rebase it before it is merged. This ensures that the commit history is linear, which makes the commit history easier to read.
- How do you rebase on to master, you ask? After syncing your fork against the Orchestra master, run:

```
git checkout master
git pull
git checkout your-branch
git rebase master
```

- How do you squash changes, you ask? Easy:

```
git log
<find the commit hash that happened immediately before your first commit>
git reset --soft $THAT_COMMIT_HASH$
git commit -am "A commit message that summarizes all of your changes."
git push -f origin your-branch
```

- Remember to reference any issues that your pull request fixes in the commit message, for example 'Fixes #12'. This will ensure that the issue is automatically closed when the PR is merged.

7.4 Quick Style Guide

We generally stick to PEP8 for our coding style, use spaces for indenting, and make sure to wrap lines at 79 characters.

We have a linter built in to our test infrastructure, so `make test` won't succeed until the code is cleaned up. To run the linter standalone, just run `make lint`. Of course, sometimes you'll write code that will never make the linter happy (for example, URL strings longer than 80 characters). In that case, just add a `# noqa` comment to the end of the line to tell the linter to ignore it. But use this sparingly!

When working on frontend resources, we use Gulp as a frontend build system. This means that after making any changes to frontend resources, you must run `make gulp_build` to include the modified resources. This moves resources to the `build` folder, compiling scss and linting your javascript.

For stylesheets we only compile scss files so if your file is at `orchestra/common/static/common/scss/example.scss`, to include it in an HTML file you should write `{% static 'common/css/example.css' %}">` as the static file path.

When including angular templates, we wrap references to static files with the function `$static(static_url_path)`. The `$static` function is defined in the base template, and for development simply returns the url it is given. The purpose is to decouple static file storage from the Django path, so if you host your static files on a CDN, you can simply override this function and put the appropriate urls.

CHAPTER

EIGHT

API REFERENCE

8.1 Client API

Endpoints for communicating with Orchestra.

All requests must be signed using HTTP signatures:

```
from httpsig.requests_auth import HTTPSignatureAuth

auth = HTTPSignatureAuth(key_id=settings.ORCHESTRA_PROJECT_API_KEY,
                         secret=settings.ORCHESTRA_PROJECT_API_SECRET,
                         algorithm='hmac-sha256')
response = requests.get('https://www.example.com/orchestra/api/project/create_project
↪', auth=auth)
```

POST /orchestra/api/project/create_project

Creates a project with the given data and returns its ID.

Query Parameters

- **task_class** – One of *real* or *training* to specify the task class type.
- **workflow_slug** – The slug corresponding to the desired project's workflow.
- **workflow_version_slug** – The slug corresponding to the desired version of the workflow.
- **description** – A short description of the project.
- **priority** – An integer describing the priority of the project, with higher numbers describing a greater priority.
- **project_data** – Other miscellaneous data with which to initialize the project.

Example response:

```
{
  "project_id": 123,
}
```

POST /orchestra/api/project/project_information

Retrieve detailed information about a given project.

Query Parameters

- **project_id** – The ID for the desired project.

Example response:

```
{
    "project": {
        "id": 123,
        "short_description": "Project Description",
        "priority": 10,
        "scratchpad_url": "http://review.document.url",
        "task_class": 1,
        "project_data": {
            "sample_data_item": "sample_data_value_new"
        },
        "workflow_slug": "sample_workflow_slug",
        "workflow_version_slug": "v1",
        "start_datetime": "2015-09-23T20:16:02.667288Z"
    },
    "steps": [
        ["sample_step_slug", "Sample step description"]
    ],
    "tasks": {
        "sample_step_slug": {
            "id": 456,
            "project": 123,
            "status": "Processing",
            "step_slug": "sample_step_slug",
            "latest_data": {
              "sample_data_item": "sample_data_value_new"
            },
            "assignments": [
                {
                    "id": 558,
                    "iterations": [
                        {
                            "id": 92134,
                            "start_datetime": "2015-09-20T12:02:14.214553",
                            "end_datetime": "2015-09-23T20:16:15.821171",
                            "submitted_data": {
                                "sample_data_item": "sample_data_value_old",
                            },
                            "status": 'Requested Review'
                        }
                    ],
                    "worker": "sample_worker_username",
                    "task": 456,
                    "in_progress_task_data": {
                        "sample_data_item": "sample_data_value_new"
                    },
                    "status": "Processing",
                    "start_datetime": "2015-09-23T20:16:17.355291Z"
                }
            ]
        }
    }
}
```

GET `/orchestra/api/project/workflow_types`

Return all stored workflows and their versions.

Example response:

```
{
    "workflows": {
        "journalism": {
            "name": "Journalism Workflow",
            "versions": {
                "v1": {
                    "name": "Journalism Workflow Version 1",
                    "description": "Create polished newspaper articles from␣
↪scratch."
                },
                "v2": {
                    "name": "Journalism Workflow Version 2",
                    "description": "Create polished newspaper articles from␣
↪scratch."
                }
            }
        },
        "simple_workflow": {
            "name": "Simple Workflow",
            "versions": {
                "v1": {
                    "name": "Simple Workflow Version 1",
                    "description": "Crawl a web page for an image and rate it."
                }
            }
        }
    }
}
```

CHAPTER

NINE

CORE REFERENCE

Core reference still in progress.

Contents

9.1 Models

9.2 Task Lifecycle

CHAPTER

TEN

INDICES AND TABLES

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- modindex
- search

HTTP ROUTING TABLE

/orchestra