Captain Shove Documentation

Release 0.1

Mozilla Foundation

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Contents

Captain Shove is a system for remote command execution for multiple projects via a central frontend.

Code https://github.com/mozilla/captain

Documentation http://captain.readthedocs.org/

Issue tracker https://github.com/mozilla/captain/issues

IRC `#capshove` on irc.mozilla.org

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CHAPTER 1

Overview

Captain Shove is a system for remote command execution for multiple projects via a central frontend. Projects define a whitelist of acceptable commands. Users use the Captain web frontend to execute commands on a remote machine running a Shove daemon. Captain then shows info about the result of executing that command including the return code, console log and its current favorite ice cream flavor.

Captain is the frontend portion of the system, and is a Django project. Shove is a process that executes commands on the remote machine. The two systems communicate via RabbitMQ; Captain sends messages to Shove processes via queues, and Shove processes send the results and logs of command executions back to Captain via queues.

Server Architecture

Since we (Mozilla) built it for our own setup, Captain Shove was designed with a few things in mind:

- Servers are organized into clusters, and each cluster may host one or more projects.
- Each cluster has at least one "admin" node, which performs tasks like minifying CSS and JS or pulling translation files during a deployment. Once these tasks are done, the admin node syncs code on the other servers in the cluster that actually serve the site.
- Admin nodes perform commands for all the projects in the cluster.
- The commands we want to execute should be executed on the admin node; executing commands on each individual application server is handled by another system (in our case, commander).
- There is a single RabbitMQ cluster that most admin nodes already connect to for other reasons.

In our setup, Captain lives in its own cluster, and Shove processes are installed on any admin node that we want to run commands on. The *project setup documentation* has more info on how to register an individual project with Captain.

Captain

Captain is a Django-based site that presents an interface for sending commands to Shove and showing the results of those commands. Users log into Captain using Persona and are given permission by an administrator to run commands on certain projects registered with Captain.

Note: The command history and logs are visible to all users who can access the site; we run Captain behind a VPN so the logs aren't visible to the public.

Shove

The Shove process runs on the admin nodes for each cluster and is responsible for executing commands it receives from Captain. The Shove configuration includes a dictionary that maps project names to directories on the filesystem of the admin node. These directories are usually a checkout of the project's repository, and all commands are run with this directory as the working directory.

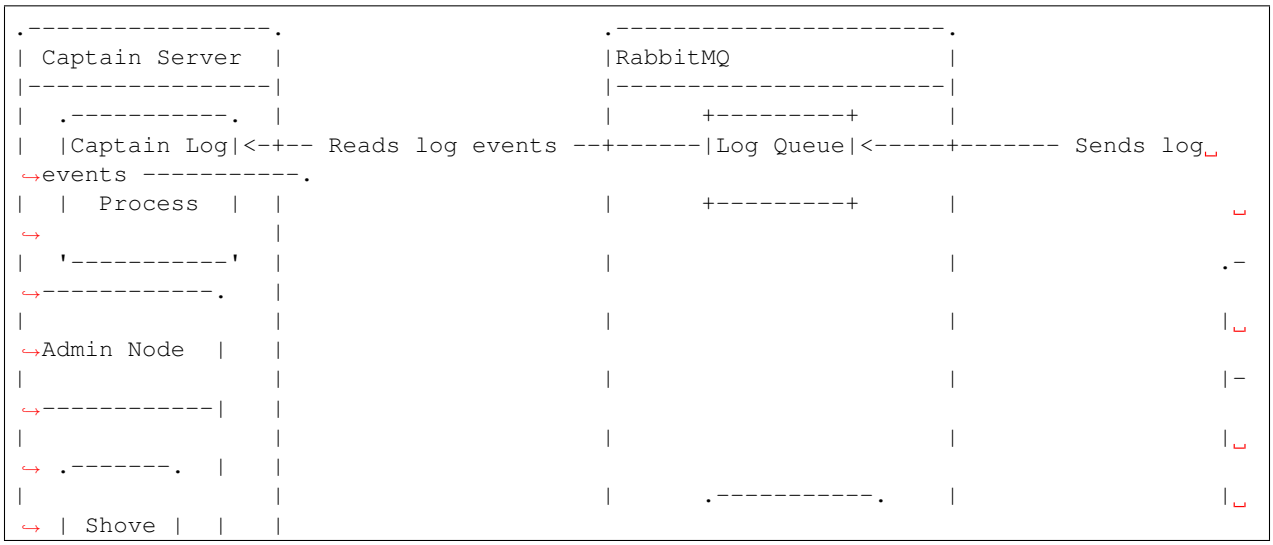
Shove will only run whitelisted commands; each project should have a whitelist stored in the `bin/commands.procfile` relative to the project's directory in the Shove configuration. A procfile maps a command name to an actual shell command. When Shove receives an order, it looks up the procfile for the requested project, and looks for a command matching the command name in the order. If it finds one, it executes that command and sends the logs back to Captain.

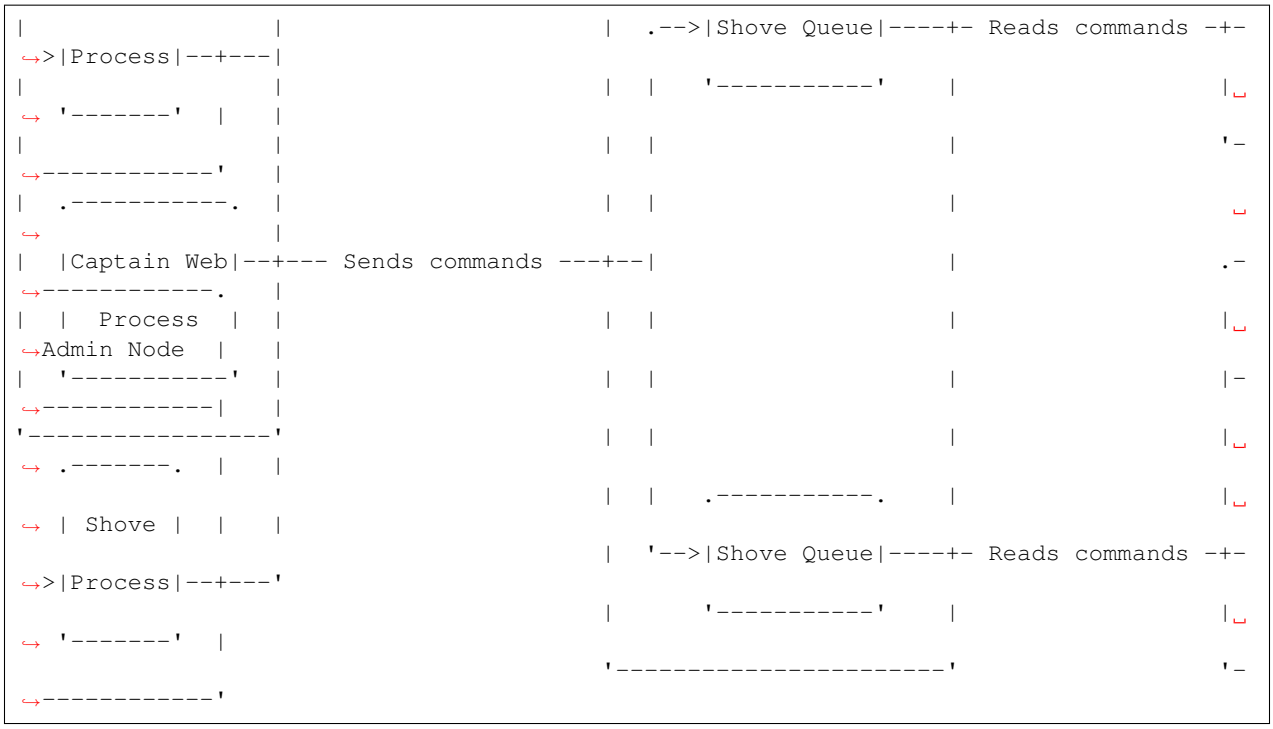
Communication Flow

Captain and Shove communicate via RabbitMQ. Each instance of Shove creates a queue that it listens to for commands. When you create a project in Captain, you give it the name of this queue, and Captain will send commands for that project to the queue.

Once Shove has executed a command, it sends the return code and logs back to a log event queue specified in the command it received. A process included in the Captain codebase listens to this queue and updates Captain's database with the results of the command when it receives these events.

The following is a diagram of the processes and queues involved with the system:





Security

There are a few features to point out when evaluating the security of Captain Shove:

- Commands are whitelisted by the procfile for each project, so only developers with commit access to a project's repository can specify a command to run.
- RabbitMQ includes access control features that allow you to restrict certain users to only be able to read or write to certain queues. For example, Shove users should only be able to read their own queues and write to the log queue, and the Captain user should only be able to read the log queue and write to the Shove queues.
- Captain uses standard Django username/password authentication for the admin interface, and Persona authentication for the user-facing side. Admins can create projects and grant permissions (using the django-guardian library) to certain users to allow them to run commands on a project.

Example Flow

The following is an example from start to finish of executing a command with Captain Shove:

1. User logs into Captain via Persona.
2. User enters a command named "pwd" into a form for the "Firefox Flicks" project and submits.
3. Captain creates a log entry in it's database for this submission.
4. Knowing that Flicks is on the "generic" cluster, Captain sends a message to the queue for the generic cluster that contains an order to run the "pwd" command on the "Firefox Flicks" project as well as the ID of the log entry it created and the name of the queue it is listening for log events on.
    - The user sees a message confirming the command has been sent and will have to revisit the page after the results are saved to be able to view the output.

5. The Shove process on the generic cluster admin node, which has been listening on the generic cluster queue, receives the message and looks up the directory for “Firefox Flicks” in it’s configuration.
6. Once it finds the directory, Shove reads in the procfile for Flicks and looks for a command named “pwd”.
7. When it finds the command, it takes the shell command listed in the procfile and spins off a subprocess to execute the command.
8. Shove waits for the command to finish and captures the output of the command, including any errors, and the return code.
9. Shove combines the output of the command, return code, and the ID of the log entry in Captain into a log event message and sends it to the logging queue specified in the command from Captain.
10. The Captain logging process, which is listening on the logging queue, receives the logging event and saves the output and return code to the log in the database specified by the log entry ID.

CHAPTER 2

Installing Captain and Shove

These instructions are for installing Captain and Shove in a production setup. If you want to work on Captain or Shove as a developer, see the *Contributing* page.

Prerequisites

- Python 2.6 or 2.7
- A database (or use Django's SQLite support)
- A running instance of RabbitMQ

Setting up Shove

Shove installs as a normal Python package. It's not on PyPI yet, but you can install it using pip:

```
pip install git+https://github.com/mozilla/shove.git#egg=shove
```

This should install the `shove` executable into your environment, which is used to start the Shove daemon.

Shove requires a settings file; an example settings file can be found in the Shove source code. The `SHOVE_SETTINGS_FILE` environment variable should contain an absolute file path to the settings file you want to use.

The settings file contains details for connecting to RabbitMQ, as well as a mapping of project IDs to directories that projects are contained in. You must edit this dictionary to include file paths to any projects that you want Shove to be able to run commands for.

Setting up Captain

Captain is a Django project. It's intended to be run as a WSGI application. The WSGI file for Captain is located at `captain/wsgi.py` under the repository root.

You can retrieve the code for Captain by cloning `https://github.com/mozilla/captain.git` using git.

Dependencies

Captain comes with almost all of its dependencies included in the `vendor` directory, and `wsgi.py` automatically alters the Python import path to include them. There are a few compiled dependencies that aren't included: They are specified in `requirements/compiled.txt` and can be installed on your target system using pip:

```
pip install -r requirements/compiled.txt
```

Note: Alternatively, you can create system packages for the compiled requirements and have them installed via a server automation framework like Puppet.

Settings

Once you've installed the dependencies, you need to create a settings file by copying `captain/settings/local.py-dist` to `captain/settings/local.py` and editing the contents:

```
cp captain/settings/local.py-dist captain/settings/local.py
vi captain/settings/local.py
```

The comments in the file and the Django settings documentation will help explain how to configure the settings for your setup.

Database

Next, you must initialize the database using the `syncdb` and `migrate` commands:

```
python manage.py syncdb
python manage.py migrate
```

Static Content

There are two directories that need to be served up by a static webserver alongside Captain: the `static` directory and the `media` directory. `static` contains all the static CSS, JavaScript, and images for the site, while `media` contains the raw logs sent back from Shove.

The filesystem paths for these directories are configured by the `MEDIA_ROOT` and `STATIC_ROOT` settings in the settings file, and default to being located at the root of the repository. The public-facing URLs for them are controlled by the `MEDIA_URL` and `STATIC_URL` settings, and default to `/static` and `/media`.

Once you've configured these settings (if necessary), you must populate the `static` directory by running the following command:

```
python manage.py collectstatic
```

This should fill `static` with files. Then you must use the web server of your choice to serve these files alongside the rest of the Captain interface.

Finished!

After that, you should be ready to run the site via whatever WSGI-compliant web server you prefer.

Log Event Listener

Captain includes a command that listens for log events from Shove. After configuring Captain using the steps above, you should be able to start the process with this command:

```
python manage.py monitor_shove_logs
```

Note: You should probably use a process control system like supervisord to manage this process as well as the Shove process.

CHAPTER 3

Deploying a Project with Captain

So you want to execute commands for your project using Captain? Great! Assuming there's an instance of Captain running that you want to use, here's how you add your project to it:

1. Add your commands to your project.

Captain works on the assumption that commands that projects want to run (such as deploying, downloading new translations, etc.) are specified in the code for the project itself in a file called `bin/commands.procfile`.

The file is in the same format as a Heroku Procfile, which specifies one command per line in the following format:

```
mycommand: python myscript.py
anothercommand: python manage.py some_management_command
git_yolo: git commit -am "DEAL WITH IT" && git push -f origin master
```

Warning: Any syntax errors in the format will cause the command in question to not be available.

Note: Commands from the procfile are executed in the environment that the Shove process is running in. The current working directory for the command is set to the root of your project as specified in the Shove configuration.

2. Setup and configure Shove to recognize your project.

If you haven't already, set up an instance of Shove on the machine you want to run your commands on using the directions in the *Installation documentation*.

In the Shove configuration file, add an entry to the `PROJECTS` setting with a name for your project and the path to the directory where your project's code is stored:

```
PROJECTS = {
    'myproject': '/data/www/myproject-web'
}
```

3. Create a project entry in Captain and grant permissions.

Next, a user with admin access to Captain should create a new Project entry. The project will need the queue name for the Shove instance that will be running the command (found in the Shove configuration) and the project name used as the key in the `PROJECTS` setting in Shove.

It's a good practice to also create a user group using the admin interface and grant permission to run commands on the project to that group. That way, you can just add users to the group instead of granting permission to each individual user.

If you set up a group, you'll need to add any users that want to run commands to that group. Otherwise, grant permission directly to the users that need it. In either case, the link for managing object permissions can be found on the detail page for the project in the admin interface.

4. Test running a command on the project.

Lastly, you'll need to test running a command on the project by sending a command via Captain and inspecting the output when the result returns. If no result is returned, this may indicate a problem with how Shove was configured, and you should check the Shove output for any errors or warnings.

It may be useful to add a test command like `pwd` to the procfile to test for errors in Shove as opposed to errors in the command itself.

Controlling Permissions

Captain controls who can run commands on projects using project-level permissions. The interface for these permissions is a link titled "Object Permissions" on the detail page of a project in the admin interface.

Permissions can be assigned to individual users, or groups. It is recommended that you use groups, as it's easier to add a user to a group than to give permission to a user. Permissions can also be revoked, or you can remove a user from a group if you're using groups to manage permissions.

CHAPTER 4

Contributing

Developer Setup

Prerequisites:

- Python 2.6 or 2.7
- pip
- virtualenv
- RabbitMQ

Note: While it is technically possible to work on Captain or Shove without RabbitMQ installed for very small changes, it is highly recommended to install it anyway.

Once you have the prerequisites installed, you must set up the Shove daemon:

```
# Clone the repository
git clone https://github.com/mozilla/shove.git
cd shove

# Create a virtualenv and activate it
# You should consider using virtualenvwrapper instead: http://virtualenvwrapper.
↪readthedocs.org/
virtualenv venv
source venv/bin/activate

# Install shove in development mode
python setup.py develop

# Copy the settings file
cp settings.py-dist settings.py
# You must edit settings.py with the settings for your setup! It is commented with␣
↪info on what
```

```
# you need to change.

# Start the shove daemon.
shove
```

Once Shove is running, you must set up the Captain frontend:

```
# Clone the repository
git clone https://github.com/mozilla/captain.git
cd shove

# Create a virtualenv and activate it
# You should consider using virtualenvwrapper instead: http://virtualenvwrapper.
↪readthedocs.org/
virtualenv venv
source venv/bin/activate

# Install libraries needed for development
pip install -r requirements/dev.txt

# Copy the settings file
cp captain/settings/local.py-dist captain/settings/local.py
# You must edit local.py with the settings for your setup! It is commented with info␣
↪on what
# you need to change.

# Initialize the database
python manage.py sync
python manage.py migrate

# Start the development server
python manage.py runserver
```

You should now have both Captain and Shove running and connected to RabbitMQ.

The last step is to start the Captain logging event process. The process listens for messages on the logging queue and saves them to the database to update Captain with the results of a command. To run it, run the following in a new terminal:

```
# Enter the captain directory.
cd captain

# Activate the virtualenv.
source venv/bin/activate

# Run the logging daemon.
python manage.py monitor_shove_logs
```

Running the Tests

```
# Enter the captain directory.
cd captain

# Activate the virtualenv.
source venv/bin/activate
```

```
# Run the tests.
python manage.py test
```

Changing the Database

Captain uses South to generate and run migrations for the database. The South documentation has more information on how to generate and run migrations when the models change.

Make sure to check for new migrations whenever you pull new code!

Third-party Libraries

Third-party libraries for Captain are listed in pip requirements files in the `requirements` directory. There are three files:

- `prod.txt`: Non-compiled libraries required for production.
- `compiled.txt`: Compiled libraries required for production.
- `dev.txt`: Libraries that are required for development (e.g. for running the tests). This also pulls in the requirements from `prod.txt` and `compiled.txt`.

In addition, the libraries from `prod.txt` are also included in a directory called `vendor`. This is used to import the libraries in a production environment where there isn't a PyPI mirror to install the libraries from.

If you add a new third-party library to Captain, make sure to add it to the appropriate requirements file. If you add to or update `prod.txt`, you'll also need to update vendor. This can be done with using pip like so:

```
# Executed from the repository root.
pip install -I --install-option="--home=`pwd`/vendor" library-name==1.2
```

Note: Make sure that any requirements in `prod.txt` are pinned to a specific version or commit.

Where to Find Us

We hang out on IRC on irc.mozilla.org in `#capshove`.

Additionally, we'll respond to issues in both the captain and shove projects.

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CHAPTER 6

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