PaaSTA
Running Applications at Yelp

Nathan Handler
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Who am I?

- Nathan Handler / @nathanhandler
- Site Reliability Engineer at Yelp
- Ubuntu/Debian Developer and freenode staff
- PaaSTA Developer
Yelp’s Mission
Connecting people with great local businesses.
Yelp Stats
As of Q1 2016

90M
102M
70%
32
History

- Monolithic Python application (~3M LoC)
- Builds/deployments took a long time
  - Bottleneck on how often we can deploy
- Mistakes are painful
  - Large impact
  - Difficult to find
  - Slow to fix
Service Oriented Architecture v1

- Split features into different applications
- Smaller services allowed for faster pushes
- Easier to reason about issues
- Able to scale services independently
What is a service?

- Standalone application
- Stateless
- Separate git repository
- Typically at Yelp:
  - HTTP API
  - Python, Pyramid, uWSGI
  - virtualenv
Deploying Services v1

- Statically defined list of hosts to deploy a service on
- Operations decides which hosts to deploy to
- Monitoring manually configured in Nagios
- Manual deployment system via rsync
Does Not Scale
Does Not Scale
PaaSTA

- Yelp's Platform as a Service
- Builds, Deploys, Connects, and Monitors services
- Glue around existing and established open source tools

https://github.com/yelp/paasta
#paasta on irc.freenode.net
An open, distributed platform as a service

<table>
<thead>
<tr>
<th>Branch</th>
<th>Description</th>
<th>Latest commit</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>master</td>
<td>Merge pull request #532 from Yelp/maintenance-schema-port</td>
<td>78e0b04</td>
<td>an hour ago</td>
</tr>
<tr>
<td>debian</td>
<td>Released 0.19.7 via make release</td>
<td></td>
<td>a day ago</td>
</tr>
<tr>
<td>docs/source</td>
<td>Fixed some nits.</td>
<td></td>
<td>9 hours ago</td>
</tr>
<tr>
<td>general_itests</td>
<td>Update copyright for 2016</td>
<td></td>
<td>8 days ago</td>
</tr>
<tr>
<td>paasta_itests</td>
<td>revert fast bouncing and move uninstall_cache to itest</td>
<td></td>
<td>a day ago</td>
</tr>
<tr>
<td>paasta_tools</td>
<td>Specify schema/port in paasta_maintenance</td>
<td></td>
<td>6 hours ago</td>
</tr>
<tr>
<td>tests</td>
<td>Merge branch 'add-named-tuples'</td>
<td></td>
<td>10 hours ago</td>
</tr>
<tr>
<td>yelp_package</td>
<td>Released 0.19.7 via make release</td>
<td></td>
<td>a day ago</td>
</tr>
<tr>
<td>.coveragerc</td>
<td>Add .coveragerc file</td>
<td></td>
<td>6 months ago</td>
</tr>
<tr>
<td>.github_changelog_generator</td>
<td>Added automatic changelog</td>
<td></td>
<td>6 months ago</td>
</tr>
<tr>
<td>.gitignore</td>
<td>Have travis build deb packages and upload them to bintray</td>
<td></td>
<td>2 months ago</td>
</tr>
<tr>
<td>.pre-commit-config.yaml</td>
<td>Fix up itests to use the new cookiecutter method</td>
<td></td>
<td>14 days ago</td>
</tr>
<tr>
<td>.travis.yml</td>
<td>Only deploy to pypi on py27 build, to prevent pypi deployments from m...</td>
<td></td>
<td>2 months ago</td>
</tr>
<tr>
<td>CHANGELOG.md</td>
<td>updated changelog</td>
<td></td>
<td>7 days ago</td>
</tr>
<tr>
<td>LICENSE</td>
<td>Update copyright for 2016</td>
<td></td>
<td>8 days ago</td>
</tr>
<tr>
<td>Makefile</td>
<td>Update copyright for 2016</td>
<td></td>
<td>8 days ago</td>
</tr>
<tr>
<td>README.md</td>
<td>Switch from readthedocs.org-&gt;readthedocs.io</td>
<td></td>
<td>21 days ago</td>
</tr>
</tbody>
</table>
PaaS TA Components

Developer

git push

git pull

docker push

Marathon

Sensu

Docker Registry
PaaSTA Components

Developer ➔ git push ➔ git
A simple service

- Dockerfile
- htdocs
  - index.php
  - status
- Makefile
DOCKER_TAG ?= $(USER)-dev

test:
    @echo 'Unit testing'

ittest: cook-image
    paasta local-run --healthcheck --service devops

cook-image:
    docker build -t $(DOCKER_TAG) .
$ cat Makefile

DOCKER_TAG ?= $(USER)-dev

test:
    @echo 'Unit testing'

itest: cook-image
    paasta local-run --healthcheck --service devops

cook-image:
    docker build -t $(DOCKER_TAG) .
Docker

- Containers: like lightweight VMs
- Provides a language (Dockerfile) for describing container image
- Reproducible builds (mostly)
- Provides software flexibility

docker.com
FROM ubuntu:xenial
MAINTAINER Nathan Handler <nhandler@yelp.com>

RUN apt-get update && DEBIAN_FRONTEND=noninteractive apt-get -y install \
    apache2 \n    libapache2-mod-php

ENV APACHE_RUN_USER www-data
ENV APACHE_RUN_GROUP www-data
ENV APACHE_LOG_DIR /var/log/apache2
ENV APACHE_LOCK_DIR /var/lock/apache2
ENV APACHE_PID_FILE /var/run/apache2.pid

RUN rm -f /var/www/html/index.html
COPY htdocs /var/www/html/

CMD ["/usr/sbin/apache2", "-D", "FOREGROUND", ",-C", "listen 8888"]
EXPOSE 8888
$ paasta check

✓ yelpsoa-config directory for devops found in /nail/etc/services
✓ deploy.yaml exists for a Jenkins pipeline
✗ No 'security-check' entry was found in your deploy.yaml.
   Please add a security-check entry *AFTER* the itest entry in deploy.yaml so your docker image can be checked against known security vulnerabilities.
✗ No 'performance-check' entry was found in your deploy.yaml.
   Please add a performance-check entry *AFTER* the security-check entry in deploy.yaml so your docker image can be checked for performance regressions.
✓ Jenkins build pipeline found
✓ Git repo found in the expected location.
✓ Found Dockerfile
✓ A Makefile is present
✓ The Makefile contains a tab character
✓ The Makefile contains a docker tag
✓ The Makefile responds to `make cook-image`
✓ The Makefile responds to `make itest`
✓ The Makefile responds to `make test`
✓ Found marathon.yaml file.
✓ All entries in deploy.yaml correspond to a marathon or chronos entry
✓ All marathon instances have a corresponding deploy.yaml entry
✓ monitoring.yaml found for Sensu monitoring
✓ Your service uses Sensu and team 'nhandler' will get alerts
✓ Found smartstack.yaml file
✓ Instance 'demo' of your service is using smartstack port 20973 and will be automatically load balanced
✓ Successfully validated schema: marathon-nova-devc.yaml
PaaSTA Components

Developer

- git push
- git pull
PaaSTA Components

- Developer
  - git push
  - git pull
  - git push
- git
- Docker
  - docker push
- Registry
$ cat deploy.yaml

```yaml
---
pipeline:
  - instancename: itest
  - instancename: push-to-registry
  - instancename: dev.everything
```
$ git tag

pasta-nova-devc.demo-20160503T231914-deploy
pasta-nova-devc.demo-20160503T234021-stop
pasta-nova-devc.demo-20160503T234202-start
Declarative control

- Describe end goal, not path
- Helps us achieve fault tolerance.

"Deploy 6de16ff2 to prod"

vs.

"Commit 6de16ff2 should be running in prod"

Gas pedal vs. Cruise Control
Description: A demo PaaSTa service for OSCON 2016
Monitored By: team nhandler
Runbook: Please set a `runbook` field in your monitoring.yaml. Like "y/rb-mesos"
Docs: https://trac.yelpcorp.com/wiki/HowToService/Monitoring/monitoring.yaml
Git Repo: git@git.yelpcorp.com:services/devops
Jenkins Pipeline: https://jenkins.yelpcorp.com/view/services-devops
Deployed to the following clusters:
  - nova-devc (N/A)
Smartstack endpoint(s):
Dashboard(s):
  - https://uchiwa.yelpcorp.com/#/events?q=devops (Sensu Alerts)
PaaS Components

- Developer
  - git push
  - git pull
- Docker Registry
  - docker push
- git
  - git push
- Marathon
Scheduling: Mesos + Marathon

- Mesos is an "SDK for distributed systems", not batteries-included.
- Requires a framework
  - Marathon
  - Chronos for scheduled batches
- Can run many frameworks on the same cluster
- Supports Docker as task executor

mesosphere.io
mesos.apache.org
$ cat marathon-nova-devc.yaml

---
demo:
  cpus: 0.1
  instances: 3
  mem: 500
  monitoring:
    alert_after: 0m
    bounce_method: brutal
  deploy_group: dev.everything
PaaSTA Components

Developer

git push

git pull

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docker push

Marathon

Docker Registry
Bounce Strategies

- **Brutal**: Stops old versions and starts the new version, without regard to safety.
- **Uptendown**: Brings up the new version of the service and waits until all instances are healthy before stopping the old versions.
- **Downthenup**: Stops any old versions and waits for them to die before starting the new version.
- **Crossover**: Starts the new version, and gradually kills instances of the old versions as new instances become healthy.
Hello OSCON 2016 Attendees!

It looks like I'm on physical host srv1-useast1bddevc.dev.yelpcorp.com

And my docker hostname is 57f6916b5fbb

Want some phpinfo?

<table>
<thead>
<tr>
<th>PHP Version 7.0.4-7ubuntu2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System</strong></td>
</tr>
<tr>
<td><strong>Server API</strong></td>
</tr>
<tr>
<td><strong>Virtual Directory Support</strong></td>
</tr>
<tr>
<td><strong>Configuration File (php.ini) Path</strong></td>
</tr>
<tr>
<td><strong>Loaded Configuration File</strong></td>
</tr>
<tr>
<td><strong>Scan this dir for additional .ini files</strong></td>
</tr>
</tbody>
</table>

**Additional .ini files parsed**

- /etc/php/7.0/apache2/conf.d/10-openssl.ini
- /etc/php/7.0/apache2/conf.d/10-pdo.ini
- /etc/php/7.0/apache2/conf.d/20-calendar.ini
- /etc/php/7.0/apache2/conf.d/20-chtype.ini
- /etc/php/7.0/apache2/conf.d/20-exif.ini
- /etc/php/7.0/apache2/conf.d/20-fileinfo.ini
- /etc/php/7.0/apache2/conf.d/20-ftp.ini
- /etc/php/7.0/apache2/conf.d/20-gettext.ini
- /etc/php/7.0/apache2/conf.d/20-iconv.ini
- /etc/php/7.0/apache2/conf.d/20-json.ini
- /etc/php/7.0/apache2/conf.d/20-mbstring.ini
- /etc/php/7.0/apache2/conf.d/20-posix.ini
- /etc/php/7.0/apache2/conf.d/20-readline.ini
- /etc/php/7.0/apache2/conf.d/20-shmop.ini
- /etc/php/7.0/apache2/conf.d/20-sockets.ini
- /etc/php/7.0/apache2/conf.d/20-sysvmsg.ini
- /etc/php/7.0/apache2/conf.d/20-sysvsem.ini
- /etc/php/7.0/apache2/conf.d/20-sysvshm.ini
- /etc/php/7.0/apache2/conf.d/20-tokenizer.ini

<table>
<thead>
<tr>
<th><strong>PHP API</strong></th>
<th>20151012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PHP Extension</strong></td>
<td>20151012</td>
</tr>
<tr>
<td><strong>Zend Extension</strong></td>
<td>320151012</td>
</tr>
<tr>
<td><strong>Zend Extension Build</strong></td>
<td>API320151012,NTS</td>
</tr>
<tr>
<td><strong>PHP Extension Build</strong></td>
<td>API20151012,NTS</td>
</tr>
</tbody>
</table>

**Debug Build**

no

**Thread Safety**

disabled

**Zend Signal Handling**

disabled

**Zend Memory Manager**

enabled

**Zend Multibyte Support**

disabled

**IPv6 Support**

enabled

**DTrace Support**

enabled

**Registered PHP Streams**

https, ftps, compress.zlib, php file, glob, data, http, ftp, phar
Hello OSCON 2016 Attendees!

It looks like I'm on physical host srv1-useast1bdevc.dev.yelpcorp.com

And my docker hostname is 57f6916b5fbb
Hello OSCON 2016 Attendees!

It looks like I'm on physical host `srv1-useast1advc.dev.yelpcorp.com`

And my docker hostname is a542b19a8ebe
Discovery in PaaSTA: Smartstack

Metadata

HTTP request
Latency Zones

Superregion
Region
Habitat
demo:
  advertise: [region]
  discover: region
  proxy_port: 20973
Pipeline: https://jenkins.yelpcorp.com/view/services-devops

cluster: nova-devc
  instance: demo
  Git sha: 6de16ff2
  State: Running - Desired state: Started
  Marathon: Healthy - up with (3/3) instances. Status: Running.
  Mesos: Healthy - (3/3) tasks in the TASK_RUNNING state.
  Smartstack:
    Name  LastCheck  LastChange  Status
    useast1-devc - Healthy - in haproxy with (3/3) total backends UP in this namespace.
Cluster: mesosstage
Dashboards:
  Marathon RO: http://marathon.paasta-mesosstage.yelp/
  Smartstack: http://paasta-mesosstage.yelp:3212
  Chronos RO: http://chronos.paasta-mesosstage.yelp/
  Mesos: http://mesos.paasta-mesosstage.yelp
Mesos Status: OK
  quorum: masters: 3 configured quorum: 2
  frameworks:
    framework: chronos-2.4.0 count: 1
    framework: marathon count: 1
  CPUs: 1.00 / 7 in use (14.29%)
  Memory: 3.03 / 42.85GB in use (7.07%)
  Disk: 10.00 / 153.81GB in use (6.50%)
  tasks: running: 9 staging: 1 starting: 0
  slaves: active: 7 inactive: 0
Marathon Status: OK
  marathon apps: 5
  marathon tasks: 9
  marathon deployments: 0
Chronos Status: OK
  Enabled chronos jobs: 1

$ paasta metastatus
$ cat monitoring.yaml

---
team: nhandler
page: true
notification_email: nhandler+devops@yelp.com
<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>alert_after</td>
<td>0</td>
</tr>
<tr>
<td>dependencies</td>
<td></td>
</tr>
<tr>
<td>executed</td>
<td>2016-05-04 19:59:05</td>
</tr>
<tr>
<td>handler</td>
<td>default</td>
</tr>
<tr>
<td>interval</td>
<td>60</td>
</tr>
<tr>
<td>issued</td>
<td>2016-05-04 19:59:05</td>
</tr>
<tr>
<td>name</td>
<td>check_marathon_services_replication.devops.demo</td>
</tr>
<tr>
<td>notification_email</td>
<td><a href="mailto:nhandler+devops@yelp.com">nhandler+devops@yelp.com</a></td>
</tr>
</tbody>
</table>
| output                 | - Service devops.demo has 3 out of 3 expected instances in useast1-devc (OK: 100%)
| page                   | true                                                                 |
| project                |                                                                      |
| realtime_every         | -1                                                                   |
| runbook                | Please set a `runbook` field in your monitoring.yaml. Like "y/rb-mesos". Docs: https://trac.yelpcorp.com/wiki/HowToService/Monitoring/monitoring.yaml |
| source                 | paasta-nova-devc                                                      |
| status                 | 0                                                                    |
| team                   | nhandler                                                             |
| ticket                 | false                                                                |
| tip                    | Please set a `tip` field in your monitoring.yaml. Docs: https://trac.yelpcorp.com/wiki/HowToService/Monitoring/monitoring.yaml |
| ttl                    |                                                                      |
| history                | 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 |
PaaSTA Components

Developer

git push

git pull

docker push

git

Docker Registry

Marathon

Sensu
Autoscaling