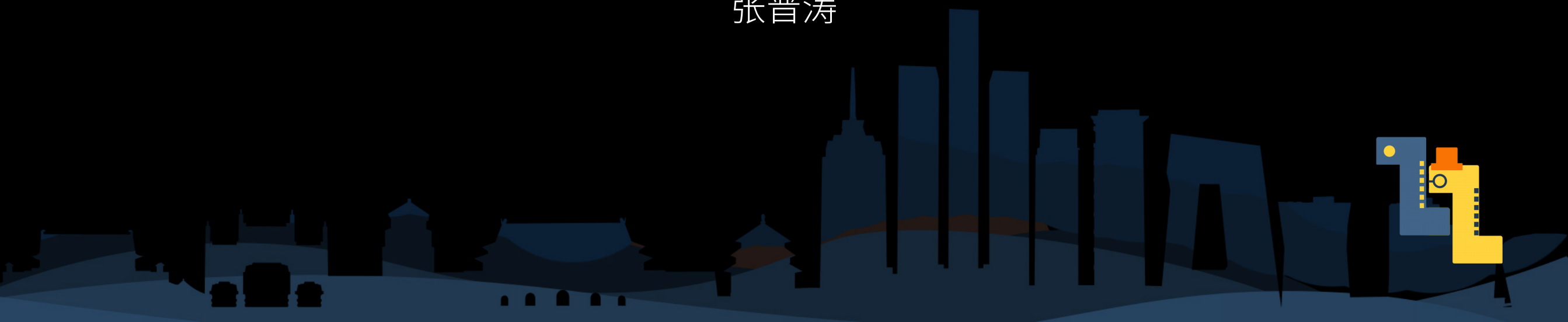


# 基于 Docker 的 CI/CD 实践

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张晋涛



- 张晋涛 (TaoBeier)
- Linux/C/Python...
- Container/Docker/Kubernetes
- <https://github.com/tao12345666333>
- <http://moelove.info>

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1

# Docker

Build, Manage and Secure Your Apps  
Anywhere. Your Way.

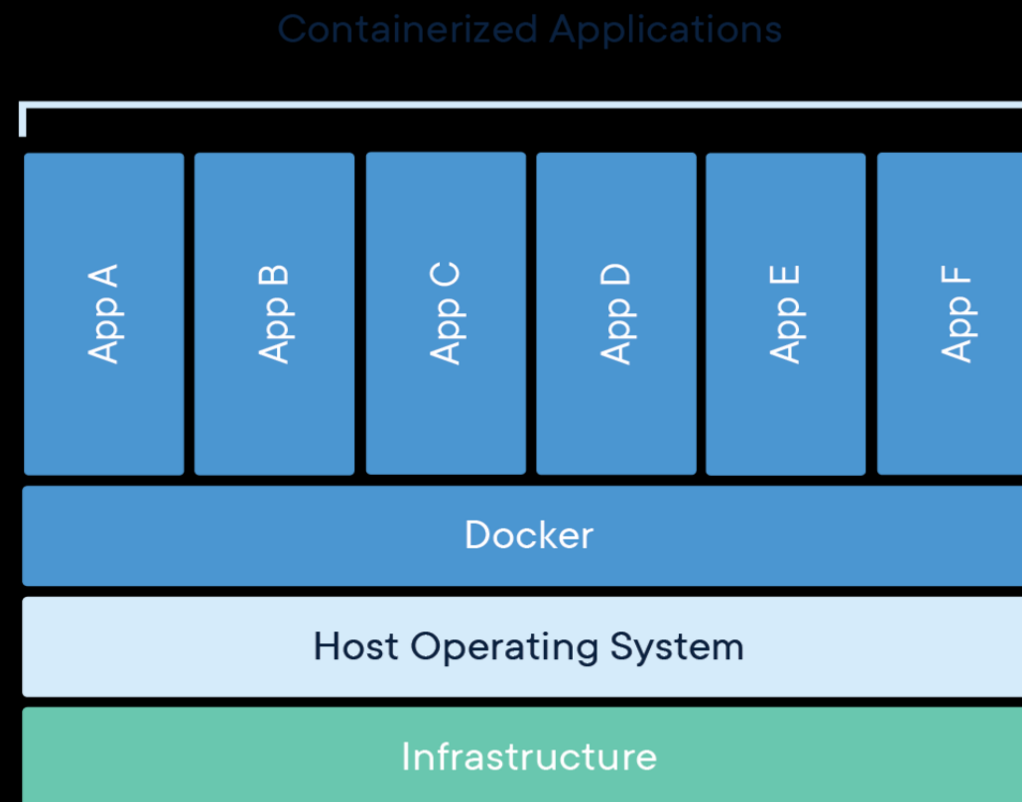
One Container Platforms.





# Container 是什么

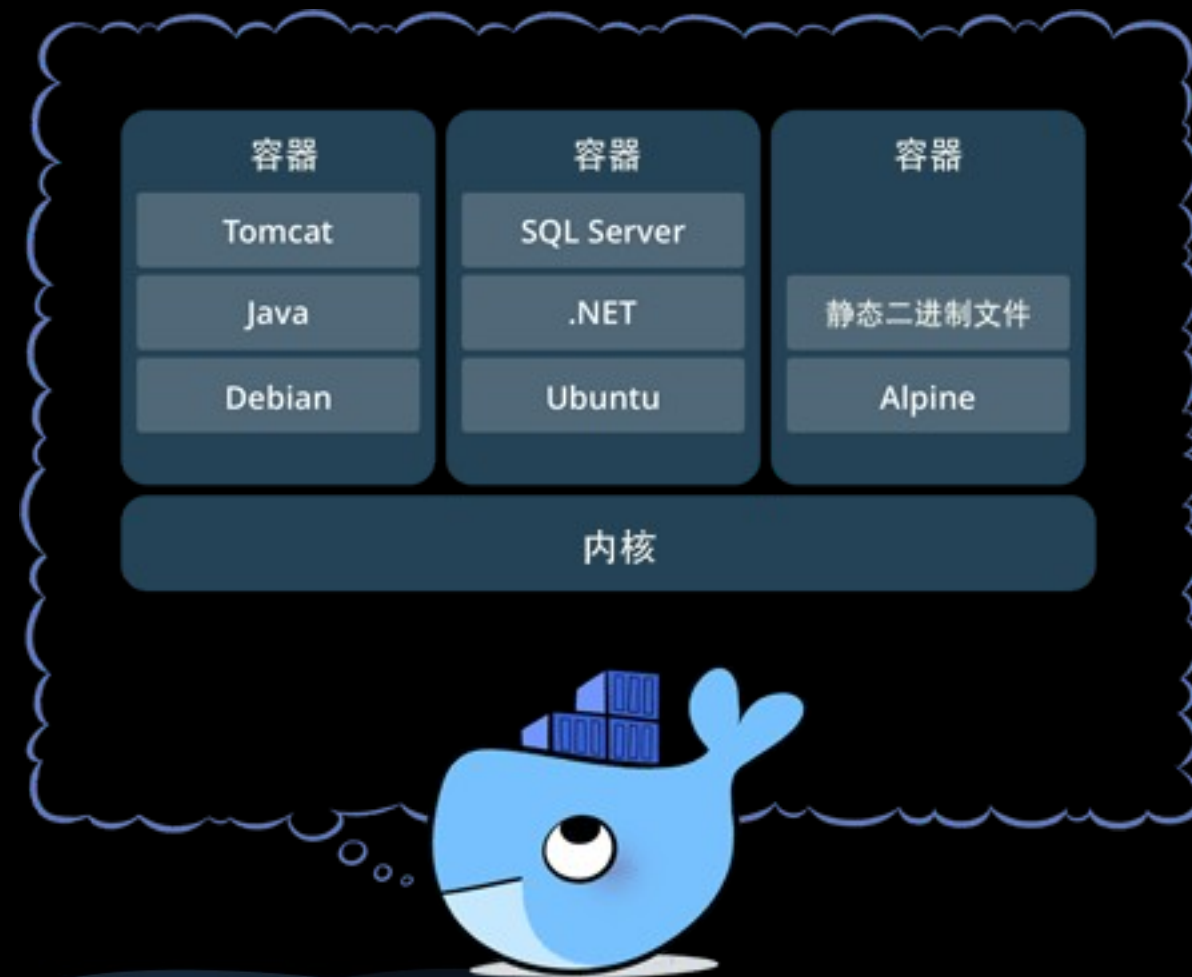
- ◆ 容器一种标准化的软件单元
- ◆ 容器镜像是轻量，可执行的软件包
- ◆ 容器是一种轻量，具备安全性的软件运行时
- ◆ 同一宿主机上可运行多个容器
- ◆ 由于 COW 支持，可节约磁盘占用
- ◆ OCI Runtime & OCI Image & OCI Runtime Bundle





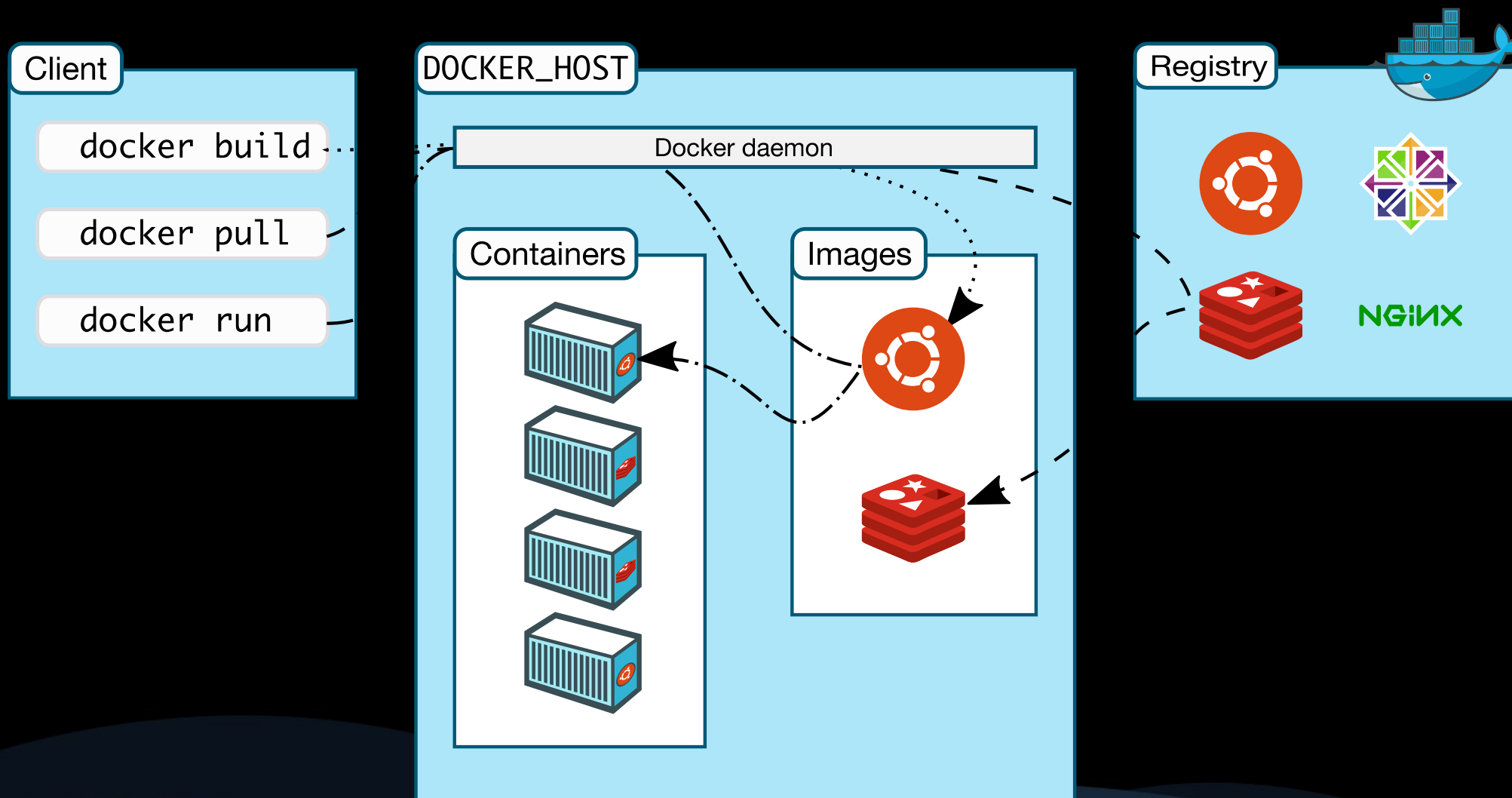
# Docker 是什么

- ◆ 可用于构建，部署，管理容器的工具 / 平台
- ◆ OCI 实现
- ◆ 容器编排（Swarm）





# Docker 是什么





◆ `docker run -i -t debian /bin/bash`



2

# CI

Continuous Integration.



### 传统做法：

- ◆ Master 分支开发

### 改良做法：

- ◆ 特性分支开发
- ◆ 合并特性分支

### 集成地狱：

- ◆ 冲突
- ◆ 不稳定

### 纯手工：

- ◆ `python test_foo.py`
- ◆ `python test_bar.py`

### 多版本：

- ◆ `active/deactive`
- ◆ `python test_foo.py`
- ◆ `python test_bar.py`

### 工具化：

- ◆ Tox
- ◆ CI 服务

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# CI 实践

Continuous Integration practice.





## 一个简单的例子

- ◆ 解析请求的开始行返回
- ◆ Tornado httputil 的源码

```
19 import collections
18 import re
17
16 RequestStartLine = collections.namedtuple(
15     "RequestStartLine", ["method", "path", "version"]
14 )
13
12
11 def parse_request_start_line(line: str) -> RequestStartLine:
10     try:
9         method, path, version = line.split(" ")
8     except ValueError:
7         raise HTTPInputError("Malformed HTTP request line")
6     if not re.match(r"^HTTP/1\.[0-9]$", version):
5         raise HTTPInputError(
4             "Malformed HTTP version in HTTP Request-Line: %r" % version
3         )
2     return RequestStartLine(method, path, version)
1
25
1 class HTTPInputError(Exception):
2     pass
3
```

## ◆ Tornado httputil 的测试

```
1  #!/usr/bin/env python
2  # coding=utf-8
3  import unittest
4  from httputil import parse_request_start_line
5
6  class ParseRequestStartLineTest(unittest.TestCase):
7      METHOD = "GET"
8      PATH = "/foo"
9      VERSION = "HTTP/1.1"
10
11     def test_parse_request_start_line(self):
12         start_line = " ".join([self.METHOD, self.PATH, self.VERSION])
13         parsed_start_line = parse_request_start_line(start_line)
14         self.assertEqual(parsed_start_line.method, self.METHOD)
15         self.assertEqual(parsed_start_line.path, self.PATH)
16         self.assertEqual(parsed_start_line.version, self.VERSION)
```

```
(MoeLove) → app git:(master) X python -m unittest -v httputil_test.py  
test_parse_request_start_line (httputil_test.ParseRequestStartLineTest) ... ok
```

```
-----  
Ran 1 test in 0.000s
```

OK

```
(MoeLove) → app git:(master) X 
```

- ◆ 使用 flake8
- ◆ FutureWarning 中内容是由于当前使用了 3.7 （ bpo-30349 ）
- ◆ 可安装最新代码解决

```
(env) → app git:(master) X
```

```
(env) → app git:(master) X flake8 httputil.py httputil_test.py
```

```
/home/tao/workspace/.env/MoeLove/lib/python3.7/site-packages/pycodestyle.py:113: FutureWarning: Possible nested set at position 1
```

```
EXTRANEOUS_WHITESPACE_REGEX = re.compile(r'[[({} | []]),;:;:;:]')
```

```
(env) → app git:(master) X
```



# 做点改变



- ◆ 使用 pytest
- ◆ 增加 pytest-flake8 插件

```
(env) → app git:(master) X
(env) → app git:(master) X py.test
===== test session starts =====
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1
rootdir: /home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app, inifile:
plugins: flake8-1.0.2
collected 1 item

httputil_test.py . [100%]

===== 1 passed in 0.01 seconds =====
```





# 做点改变



```
(env) → app git:(master) X py.test --flake8
```

```
===== test session starts =====
```

```
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1
```

```
rootdir: /home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app, inifile:
```

```
plugins: flake8-1.0.2
```

```
collected 3 items
```

```
httputil.py .
```

```
[ 33%]
```

```
httputil_test.py ..
```

```
[100%]
```

```
===== warnings summary =====
```

```
/home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app/env/lib/python3.7/site-packages/pycodestyle.py:113: FutureWarning: Possible nested set at position 1
```

```
EXTRANEOUS_WHITESPACE_REGEX = re.compile(r'[[({} | []]),;:]')
```

```
/home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app/env/lib/python3.7/site-packages/flake8/plugins/manager.py:410: DeprecationWarning: Using or importing the ABCs from 'collections' instead of from 'collections.abc' is deprecated, and in 3.8 it will stop working
```

```
isinstance(method, collections.Callable)):
```

```
-- Docs: https://docs.pytest.org/en/latest/warnings.html
```

```
===== 3 passed, 2 warnings in 0.30 seconds =====
```



# 忽略 Warning

```
(env) → app git:(master) X cat setup.cfg
```

```
[tool:pytest]
```

```
filterwarnings =
```

```
    ignore::FutureWarning
```

```
(env) → app git:(master) X py.test --flake8
```

```
===== test session starts =====
```

```
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1
```

```
rootdir: /home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app, inifile: setup.cfg
```

```
plugins: flake8-1.0.2
```

```
collected 3 items
```

```
httputil.py s
```

```
[ 33%]
```

```
httputil_test.py s.
```

```
[100%]
```

```
===== 1 passed, 2 skipped in 0.02 seconds =====
```

```
(env) → app git:(master) X
```



## 改进：脚本化

- ◆ 这里使用了 Make
- ◆ 根据个人习惯

```
1 export PYTHONPATH=.
2 all: test lint
3
4 test:
5     @py.test -v
6
7 lint:
8     @py.test --flake8
```



## 改进：脚本化

```
(env) → app git:(master) X make test
```

```
===== test session starts =====
```

```
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1 -- /home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app/env/bin/python3.7
```

```
cachedir: .pytest_cache
```

```
rootdir: /home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app, inifile: setup.cfg
```

```
plugins: flake8-1.0.2
```

```
collected 1 item
```

```
httputil_test.py::ParseRequestStartLineTest::test_parse_request_start_line PASSED
```

```
[100%]
```

```
===== 1 passed in 0.01 seconds =====
```

```
(env) → app git:(master) X make lint
```

```
===== test session starts =====
```

```
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1
```

```
rootdir: /home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app, inifile: setup.cfg
```

```
plugins: flake8-1.0.2
```

```
collected 3 items
```

```
httputil.py .
```

```
[ 33%]
```

```
httputil_test.py ..
```

```
[100%]
```

```
===== 3 passed in 0.27 seconds =====
```

```
(env) → app git:(master) X
```



## 改进：工具化（多版本）

- ◆ 这里使用了 Tox
- ◆ 多版本测试

```
1  [tox]  
  1 envlist = py36,py37  
  2  
  3 [testenv]  
  4 deps =  
  5     pytest  
  6     pytest-flake8  
  7 commands =  
  8     pytest  
  9     pytest --flake8
```



## 改进：工具化（多版本）



```
py37 runtests: commands[0] | pytest
```

```
===== test session starts =====
```

```
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1
```

```
rootdir: /home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app, inifile: setup.cfg
```

```
plugins: flake8-1.0.2
```

```
collected 1 item
```

```
httputil_test.py .
```

```
[100%]
```

```
===== 1 passed in 0.01 seconds =====
```

```
py37 runtests: commands[1] | pytest --flake8
```

```
===== test session starts =====
```

```
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1
```

```
rootdir: /home/tao/workspace/Talk-Is-Cheap/python/lab/pycon/app, inifile: setup.cfg
```

```
plugins: flake8-1.0.2
```

```
collected 4 items
```

```
httputil.py s
```

```
[ 25%]
```

```
httputil_test.py s.
```

```
[ 75%]
```

```
setup.py s
```

```
[100%]
```

```
===== 1 passed, 3 skipped in 0.02 seconds =====
```

```
----- summary -----
```

```
py36: commands succeeded
```

```
py37: commands succeeded
```

```
congratulations :)
```

```
→ app git:(master) X
```

# 在我电脑上都是好的。???



- ◆ 增加了一处变量 通过 ARG

```
10 FROM python:3.7
9
8 LABEL maintainer="Jintao Zhang <zhangjintao9020@gmail.com>"
7
6 WORKDIR /app
5 ARG requirements=requirements.txt
4
3 ADD . /app
2
1 RUN pip install --no-cache-dir -r $requirements
l1 CMD python -m httputil
```





```
→ app git:(master) X docker build -t local/app .
Sending build context to Docker daemon 30.72kB
Step 1/7 : FROM python:3.7
---> a9d071760c82
Step 2/7 : LABEL maintainer="Jintao Zhang <zhangjintao9020@gmail.com>"
---> Using cache
---> 4e1ea07a6c93
Step 3/7 : WORKDIR /app
---> Using cache
---> e2f38c41f2fb
Step 4/7 : ARG requirements=requirements.txt
---> Using cache
---> 871364754634
Step 5/7 : ADD . /app
---> Using cache
---> 09524c2f4cad
Step 6/7 : RUN pip install --no-cache-dir -r $requirements
---> Using cache
---> 77b4018803db
Step 7/7 : CMD python -m httputil
---> Using cache
---> 57ae363b640c
Successfully built 57ae363b640c
Successfully tagged local/app:latest
→ app git:(master) X docker run --rm local/app
RequestStartLine(method='GET', path='/foo', version='HTTP/1.1')
→ app git:(master) X
```



## 容器化：测试镜像

```
→ app git:(master) X docker build --build-arg requirements=requirements-dev.txt -t local/app:test .  
Sending build context to Docker daemon 30.72kB  
Step 1/7 : FROM python:3.7  
---> a9d071760c82  
Step 2/7 : LABEL maintainer="Jintao Zhang <zhangjintao9020@gmail.com>"  
---> Using cache  
---> 4e1ea07a6c93  
Step 3/7 : WORKDIR /app  
---> Using cache  
---> e2f38c41f2fb  
Step 4/7 : ARG requirements=requirements.txt  
---> Using cache  
---> 871364754634  
Step 5/7 : ADD . /app  
---> Using cache  
---> 09524c2f4cad  
Step 6/7 : RUN pip install --no-cache-dir -r $requirements  
---> Using cache  
---> a58c097059e5  
Step 7/7 : CMD python -m httputil  
---> Using cache  
---> 04ea9d970791  
Successfully built 04ea9d970791  
Successfully tagged local/app:test  
→ app git:(master) X
```



## 容器化：执行测试

```
→ app git:(master) X docker run --rm local/app:test make
===== test session starts =====
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1 -- /usr/local/bin/python
cachedir: .pytest_cache
rootdir: /app, inifile: setup.cfg
plugins: flake8-1.0.2
collecting ... collected 1 item

httputil_test.py::ParseRequestStartLineTest::test_parse_request_start_line PASSED [100%]

===== 1 passed in 0.02 seconds =====
===== test session starts =====
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1
rootdir: /app, inifile: setup.cfg
plugins: flake8-1.0.2
collected 4 items

httputil.py . [ 25%]
httputil_test.py .. [ 75%]
setup.py . [100%]

===== 4 passed in 0.44 seconds =====
→ app git:(master) X
```



- ◆ 利用 WebHooks
- ◆ GitLab CI / Travis-CI / CircleCI / Jenkins

```
1 ARG tag=3.7-alpine
1 FROM python:$tag
2
3 LABEL maintainer="Jintao Zhang <zhangjintao9020@gmail.com>"
4
5 WORKDIR /app
6 ARG requirements=requirements.txt
7
8 ADD . /app
9
10 RUN pip install --no-cache-dir -r $requirements
11 CMD python -m httputil
```



# 自动化: GitLab CI

```
1 # Author: Jintao Zhang <zhangjintao9020@gmail.com>
1 image: docker:latest
2
3 services:
4   - docker:dind
5
6 variables:
7   DOCKER_DRIVER: overlay2
8
9 stages:
10  - test
11
12 test36:
13   stage: test
14   script:
15     - docker build --build-arg tag=3.6 --build-arg requirements=requirements-dev.txt -t local/app:test .
16     - docker images
17     - docker run --rm local/app:test make
18
19 test37:
20   stage: test
21   script:
22     - docker build --build-arg tag=3.7 --build-arg requirements=requirements-dev.txt -t local/app:test .
23     - docker images
24     - docker run --rm local/app:test make
```



# 自动化: test36

```
Successfully built d266eb0f4919
Successfully tagged local/app:test
$ docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
local/app            test                d266eb0f4919       Less than a second ago   926MB
python               3.6                0c4b4dbe1e58       36 hours ago         918MB
$ docker run --rm local/app:test make
===== test session starts =====
platform linux -- Python 3.6.6, pytest-3.8.2, py-1.6.0, pluggy-0.7.1 -- /usr/local/bin/python
cachedir: .pytest_cache
rootdir: /app, inifile: setup.cfg
plugins: flake8-1.0.2
collecting ... collected 1 item

httputil_test.py::ParseRequestStartLineTest::test_parse_request_start_line PASSED [100%]

===== 1 passed in 0.02 seconds =====
===== test session starts =====
platform linux -- Python 3.6.6, pytest-3.8.2, py-1.6.0, pluggy-0.7.1
rootdir: /app, inifile: setup.cfg
plugins: flake8-1.0.2
collected 4 items

httputil.py . [ 25%]
httputil_test.py .. [ 75%]
setup.py . [100%]

===== 4 passed in 0.44 seconds =====
Job succeeded
```

test36

Retry

Duration: 56 seconds

Timeout: 1h (from project)

Runner: ci (#1)

Commit [146e200d](#)

fix

✓ test37

➔ ✓ test36



# 自动化: test37

```
Successfully built e955e978ce8c
Successfully tagged local/app:test
$ docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
local/app            test               e955e978ce8c       Less than a second ago  931MB
python              3.7               7a35f2e8feff       36 hours ago        923MB
$ docker run --rm local/app:test make
===== test session starts =====
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1 -- /usr/local/bin/python
cachedir: .pytest_cache
rootdir: /app, inifile: setup.cfg
plugins: flake8-1.0.2
collecting ... collected 1 item

httputil_test.py::ParseRequestStartLineTest::test_parse_request_start_line PASSED [100%]

===== 1 passed in 0.02 seconds =====
===== test session starts =====
platform linux -- Python 3.7.0, pytest-3.8.2, py-1.6.0, pluggy-0.7.1
rootdir: /app, inifile: setup.cfg
plugins: flake8-1.0.2
collected 4 items

httputil.py . [ 25%]
httputil_test.py .. [ 75%]
setup.py . [100%]

===== 4 passed in 0.44 seconds =====
Job succeeded
```

## test37

Duration: 44 seconds

Timeout: 1h (from project)

Runner: ci (#1)

Commit [146e200d](#) 

fix

→  test37

 test36



## 优化：加速及缩小体积

```
1 test37:
2   stage: test
3   script:
4     - docker build --build-arg tag=3.7-alpine --build-arg requirements=requirements-dev.txt -t local/app:py37 .
5     - docker images
6     - docker run --rm local/app:py37 py.test -v
7     - docker run --rm local/app:py37 py.test --flake8
```

```
11 ARG tag=3.7-alpine
10 FROM python:$tag
9
8 LABEL maintainer="Jintao Zhang <zhangjintao9020@gmail.com>"
7
6 WORKDIR /app
5 ARG requirements=requirements.txt
4
3 ADD . /app
2
1 RUN pip install --no-cache-dir -r $requirements -i https://mirrors.ustc.edu.cn/pypi/web/simple
12 CMD python -m httputil
```



4

CD

Continuous Delivery and Continuous Deployment



◆交付：

- ◆ `python setup.py sdist`
- ◆ 纯工程压缩包（取决于实际情况）
- ◆ Docker 镜像

◆部署：

- ◆ `pip install`
- ◆ `python run.py`
- ◆ `Docker run` / `docker-compose` / Kubernetes

5

# CD 实践

Base on GitLab CI.



Pipeline Jobs 4

Test

✓ test36



✓ test37



Build

✓ build-dist



✓ build-image





```
writing httputil.egg-info/PKG-INFO
writing dependency_links to httputil.egg-info/dependency_links.txt
writing top-level names to httputil.egg-info/top_level.txt
writing manifest file 'httputil.egg-info/SOURCES.txt'
reading manifest file 'httputil.egg-info/SOURCES.txt'
writing manifest file 'httputil.egg-info/SOURCES.txt'
running check
warning: check: missing required meta-data: url

creating httputil-0.0.0
creating httputil-0.0.0/httputil.egg-info
copying files to httputil-0.0.0...
copying README.md -> httputil-0.0.0
copying httputil.py -> httputil-0.0.0
copying setup.cfg -> httputil-0.0.0
copying setup.py -> httputil-0.0.0
copying httputil.egg-info/PKG-INFO -> httputil-0.0.0/httputil.egg-info
copying httputil.egg-info/SOURCES.txt -> httputil-0.0.0/httputil.egg-info
copying httputil.egg-info/dependency_links.txt -> httputil-0.0.0/httputil.egg-info
copying httputil.egg-info/not-zip-safe -> httputil-0.0.0/httputil.egg-info
copying httputil.egg-info/top_level.txt -> httputil-0.0.0/httputil.egg-info
Writing httputil-0.0.0/setup.cfg
creating dist
Creating tar archive
removing 'httputil-0.0.0' (and everything under it)
Uploading artifacts...
dist/*.tar.gz: found 1 matching files
Uploading artifacts to coordinator... ok      id=42 responseStatus=201 Created token=Vw2926HT
Job succeeded
```

build-dist

Retry

Duration: 15 seconds

Timeout: 1h (from project)



Runner: ci (#1)

Job artifacts

The artifacts will be removed in 6 days

Keep

Download

Browse

Commit [330c0e9c](#)



add build

✓ Pipeline #14 from master

build



✓ build-image

➔ ✓ build-dist

```
Step 5/8 : ARG requirements=requirements.txt
---> Running in fldec44b53f8
Removing intermediate container fldec44b53f8
---> 3e59a1060549
Step 6/8 : ADD . /app
---> 7026cd4fe4b7
Step 7/8 : RUN pip install --no-cache-dir -r $requirements -i https://mirrors.ustc.edu.cn/pypi/web/simple
---> Running in 51d6117bfd1f
Looking in indexes: https://mirrors.ustc.edu.cn/pypi/web/simple
Obtaining file:///app (from -r requirements.txt (line 1))
Installing collected packages: httputil
  Running setup.py develop for httputil
Successfully installed httputil
Removing intermediate container 51d6117bfd1f
---> 84e1f4954f13
Step 8/8 : CMD python -m httputil
---> Running in 298162d3f5e3
Removing intermediate container 298162d3f5e3
---> f1b804c279a0
Successfully built f1b804c279a0
Successfully tagged local/app:py37
$ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED
local/app	py37	f1b804c279a0	Less than a second ago
84.1MB			
registry.docker-cn.com/library/python	3.7-alpine	cf41883b24b8	2 days ago
78.1MB			

Job succeeded

## build-image

Retry

Duration: 24 seconds

Timeout: 1h (from project) ?

Runner: ci (#1)

Commit [330c0e9c](#) 

add build

 Pipeline #14 from master

build

  build-image build-dist

```
12 deploy:
11   stage: deploy
10   image: "centos"
9   script:
8     - 'ssh-agent || (yum install -y openssh-clients)'
7     - eval $(ssh-agent -s)
6     - echo "$SSH_PRIVATE_KEY" | tr -d '\r' | ssh-add - > /dev/null
5     - mkdir -p ~/.ssh
4     - chmod 700 ~/.ssh
3     - ssh-keyscan -p $SSH_PORT $DEPLOY_HOST >> ~/.ssh/known_hosts
2     - chmod 644 ~/.ssh/known_hosts
1
```



## 相关链接

- 代码仓库: <https://github.com/tao12345666333/httputil>
- CI 地址: <https://gitlab.com/taobeier/httputil>



# THANK YOU



MoeLove



TaoBeier\_

