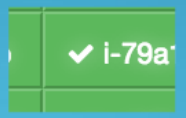
a b

How is Prezi.com like FibPro?
How is Prezi like FibInc?

Prezi

Similar problems led us to split up monolithic web app.
2 generations of HTTP-based RPC systems used.
Log sink one of the first services split off of monolith.
RPC metadata (request id, source, etc) important debug tool.
Per-service monitoring

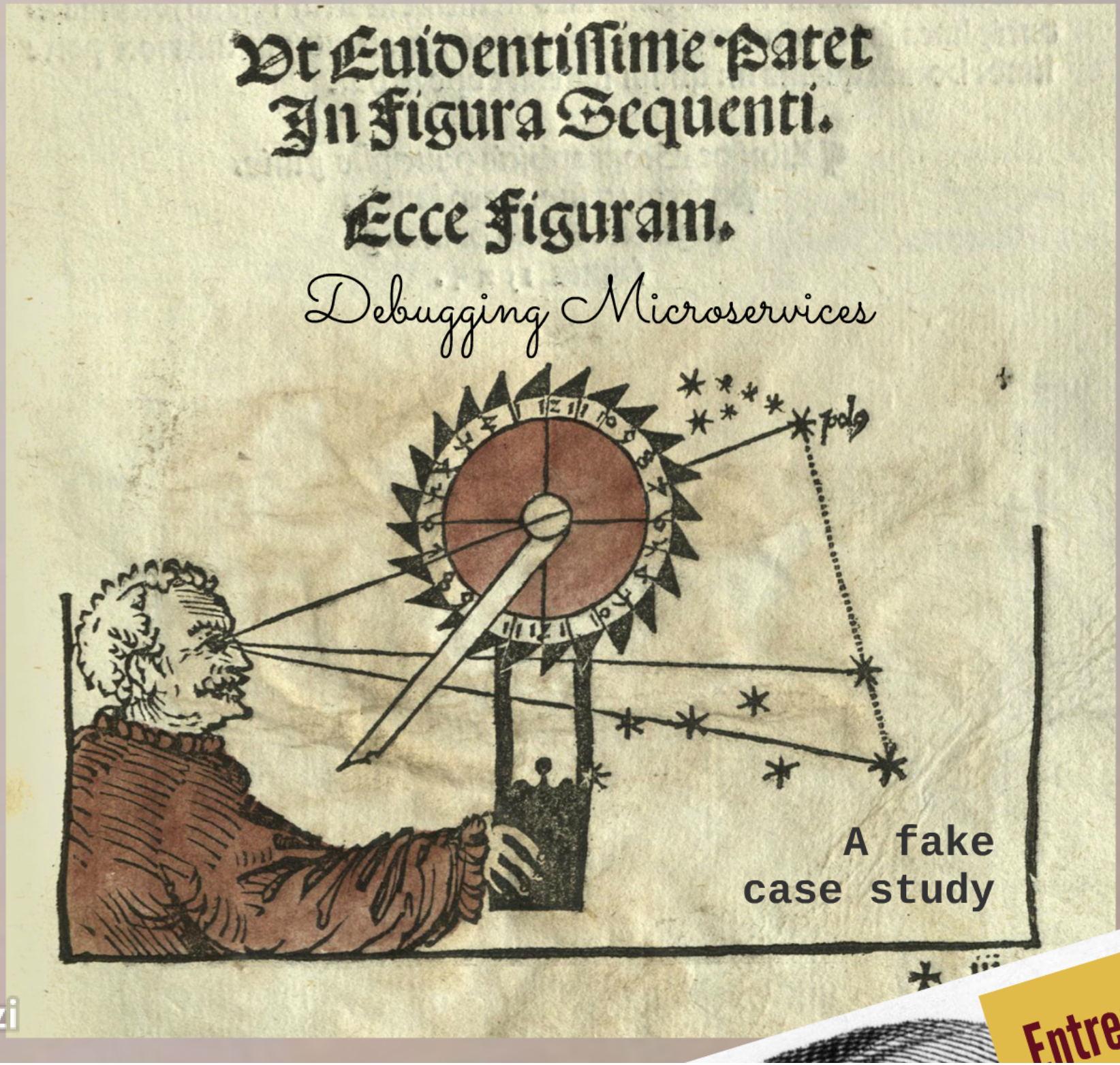


Thank you

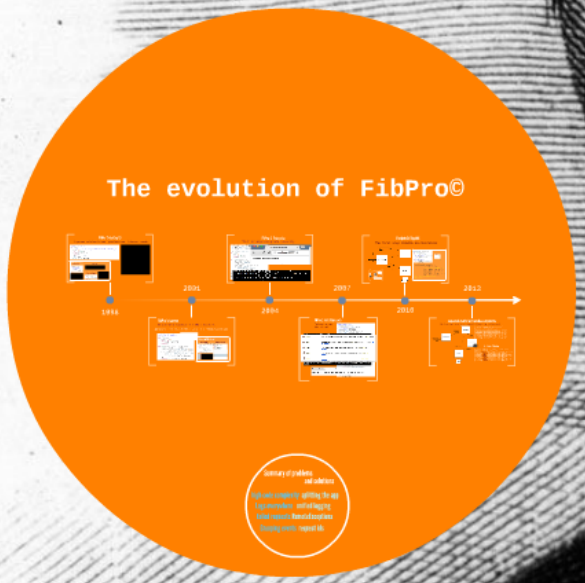
Next steps for FibPro
API descriptions, versioning
service discovery
multiple environments
microservice tests

Prezi

$$\frac{a+b}{a} = \frac{a}{b} = \varphi \approx 1{,}61803$$


Vt Euidentissime patet
In Figura Sequenti.
Ecce Figuram.
Debugging Microservices
polo
A fake
case study
Entrepreneur

Fibonacci



Entrepreneur profile

Leonardo Bonacci

Mathematician,
Engineer,
Co-founder and CTO
of FibInc.

Company profile

FibInc Corporation

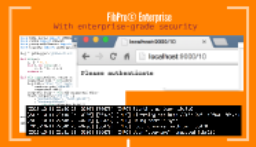
Creator of FibPro©.
Today, the worldwide
leader in the
Fibonacci as a Service
(FaaS) market.

FibInc

The evolution of FibPro©

1998

2001



2004

2007

2010

2013

Summary of problems and solutions

high code complexity splitting the app

Logs everywhere unified logging

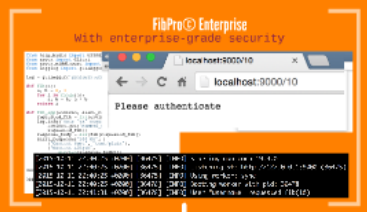
failed requests RemoteExceptions

Grouping events request ids

The evolution of FibPro©

1998

2001



2004

2007

2010

2013

Summary of problems and solutions

high code complexity, splitting the app

FibPro© desktop 1.0

A proven solution to meet your business' fibonacci needs.

```
#!/usr/bin/env python

def fib(n):
    # from http://en.literateprograms.org/Fibonacci_numbers_(Python)
    a, b = 0, 1
    for i in range(n):
        a, b = b, a + b
    return a

if __name__ == "__main__":
    import sys
    print fib(int(sys.argv[1]))
```

```
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 1
1
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 2
1
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 3
2
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 4
3
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 5
5
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 6
8
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 7
13
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 8
21
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 9
34
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 10
55
```

Debugging FibPro© desktop 1.0

Print statements

```
def fib(n):
    a, b = 0, 1
    for i in range(n):
        # print internal
        # state for each
        # iteration
        print ("i = %s, " +\
               "a = %s, " +\
               "b = %s") % (i,a,b)
        a, b = b, a + b
    return a
```

```
i = 0, a = 0, b = 1
i = 1, a = 1, b = 1
i = 2, a = 1, b = 2
i = 3, a = 2, b = 3
```

Stack traces

```
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 4.5
Traceback (most recent call last):
  File "./fibpro_v1.py", line 11, in <module>
    print fib(int(sys.argv[1]))
ValueError: invalid literal for int() with base 10: '4.5'
```

Interactive Debugging

```
def fib(n):
    a, b = 0, 1
    for i in range(n):
        a, b = b, a + b
    import pdb;pdb.set_trace()
    return a
```

```
-> return a
(Pdb) l
  3     def fib(n):
  4         a, b = 0, 1
  5         for i in range(n):
  6             a, b = b, a + b
  7         import pdb;pdb.set_trace()
  8 ->      return a
  9
 10     if __name__ == "__main__":
 11         import sys
 12         print fib(int(sys.argv[1]))
```

```
if __name__ == "__main__":
    import sys
    print fib(int(sys.argv[1]))
```

Debugging FibPro© desktop 1.0

Print statements

```
def fib(n):
    a, b = 0, 1
    for i in range(n):
        # print internal
        # state for each
        # iteration
        print ("i = %s, " +\
               "a = %s, " +\
               "b = %s") % (i,a,b)
        a, b = b, a + b
    return a
```

```
i = 0, a = 0, b = 1
i = 1, a = 1, b = 1
i = 2, a = 1, b = 2
i = 3, a = 2, b = 3
```

Stack traces

```
neumarkmbp:fibpro neumark $ ./fibpro_v1.py 4.5
Traceback (most recent call last):
  File "./fibpro_v1.py", line 11, in <module>
    print fib(int(sys.argv[1]))
ValueError: invalid literal for int() with base 10: '4.5'
```

Interactive Debugging

```
def fib(n):
    a, b = 0, 1
    for i in range(n):
        a, b = b, a + b
    import pdb;pdb.set_trace()
    return a
```

```
-> return a
(Pdb) l
  3     def fib(n):
  4         a, b = 0, 1
  5         for i in range(n):
  6             a, b = b, a + b
  7         import pdb;pdb.set_trace()
  8 ->      return a
  9
 10     if __name__ == "__main__":
 11         import sys
 12         print fib(int(sys.argv[1]))
```

FibPro© server

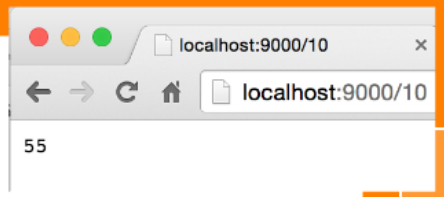
An intranet solution for SMB customers.

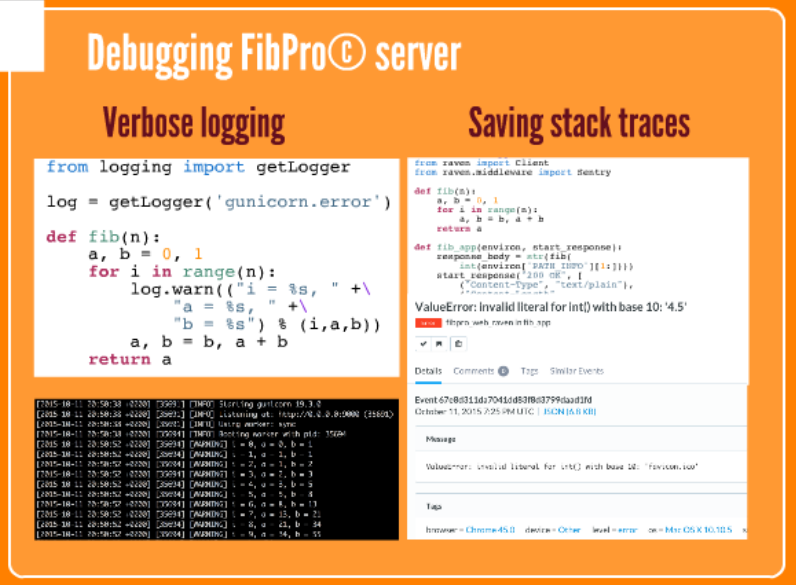
```
gunicorn -b 0.0.0.0:9000 -w 1 -t 0 'fibpro_web:app'
```

```
#!/usr/bin/env python

def fib(n):
    a, b = 0, 1
    for i in range(n):
        a, b = b, a + b
    return a

def app(environ, start_response):
    response_body = str(fib(
        int(environ['PATH_INFO'][1:])))
    start_response("200 OK", [
        ("Content-Type", "text/plain"),
        ("Content-Length",
            str(len(response_body)))
    ])
    return iter([response_body])
```





Prezi

Debugging FibPro© server

Verbose logging

```
from logging import getLogger

log = getLogger('gunicorn.error')

def fib(n):
    a, b = 0, 1
    for i in range(n):
        log.warn(("i = %s, " +\
                  "a = %s, " +\
                  "b = %s") % (i,a,b))
        a, b = b, a + b
    return a
```

```
[2015-10-11 20:50:38 +0200] [35691] [INFO] Starting gunicorn 19.3.0
[2015-10-11 20:50:38 +0200] [35691] [INFO] Listening at: http://0.0.0.0:9000 (35691)
[2015-10-11 20:50:38 +0200] [35691] [INFO] Using worker: sync
[2015-10-11 20:50:38 +0200] [35694] [INFO] Booting worker with pid: 35694
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 0, a = 0, b = 1
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 1, a = 1, b = 1
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 2, a = 1, b = 2
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 3, a = 2, b = 3
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 4, a = 3, b = 5
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 5, a = 5, b = 8
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 6, a = 8, b = 13
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 7, a = 13, b = 21
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 8, a = 21, b = 34
[2015-10-11 20:50:52 +0200] [35694] [WARNING] i = 9, a = 34, b = 55
```

Saving stack traces

```
from raven import Client
from raven.middleware import Sentry

def fib(n):
    a, b = 0, 1
    for i in range(n):
        a, b = b, a + b
    return a

def fib_app(environ, start_response):
    response_body = str(fib(
        int(environ['PATH_INFO'][1:])))
    start_response("200 OK", [
        ("Content-Type", "text/plain"),
```

ValueError: invalid literal for int() with base 10: '4.5'

Error fibpro_web_raven in fib_app

Details | Comments 0 | Tags | Similar Events

Event 67e8d311da7041dd83f8d3799daad1fd
October 11, 2015 7:25 PM UTC | JSON (6.8 KB)

Message

```
ValueError: invalid literal for int() with base 10: 'favicon.ico'
```

Tags

browser = Chrome 45.0 device = Other level = error os = Mac OS X 10.10.5

FibPro© Enterprise

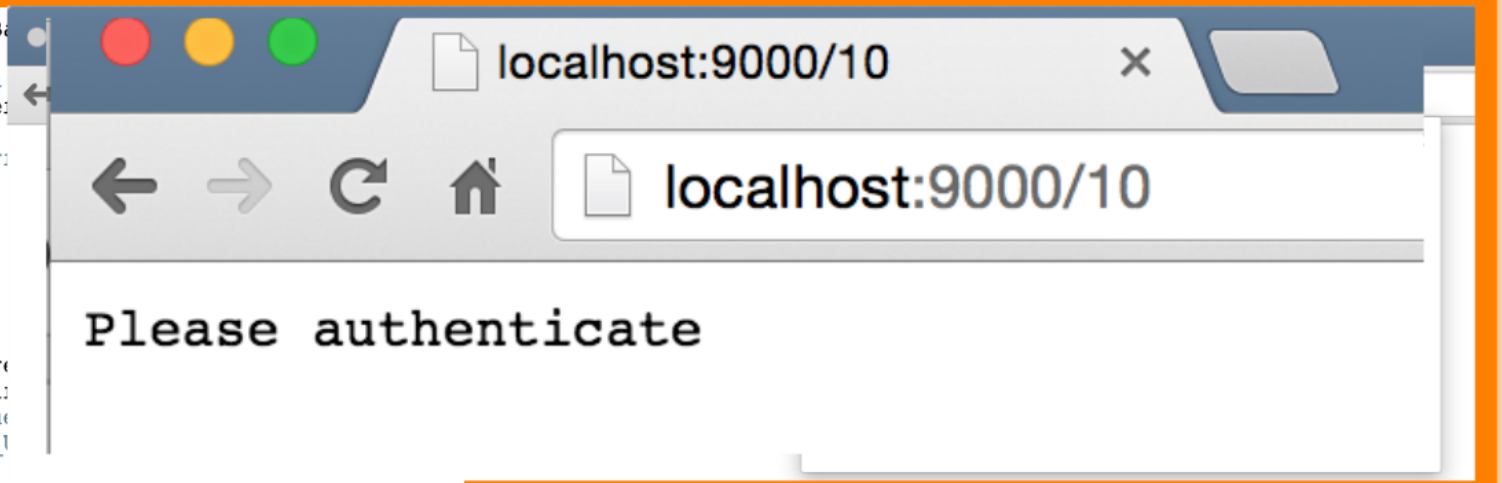
With enterprise-grade security

```
from http_basic import HTTPBa
from raven import Client
from raven.middleware import
from logging import getLogge

log = getLogger('gunicorn.er

def fib(n):
    a, b = 0, 1
    for i in range(n):
        a, b = b, a + b
    return a

def fib_app(environ, start_r
    requested_fib = int(envi
    log.info('User "%s" requ
        environ.get('REMOTE_
        requested_fib))
    response_body = str(fib(requested_fib))
    start_response("200 OK", [
        ("Content-Type", "text/plain"),
        ("Content-Length",
            str(len(response_body)))
use
app
```




```
[2015-10-11 22:40:25 +0200] [36475] [INFO] Starting gunicorn 19.3.0
[2015-10-11 22:40:25 +0200] [36475] [INFO] Listening at: http://127.0.0.1:9000 (36475)
[2015-10-11 22:40:25 +0200] [36475] [INFO] Using worker: sync
[2015-10-11 22:40:25 +0200] [36478] [INFO] Booting worker with pid: 36478
[2015-10-11 22:41:31 +0200] [36478] [INFO] User "username" requested fib(10)
```

FibPro© 365 (fibpro.com)

Fibonacci in the cloud

```
#!/usr/bin/env python
# dependencies
from raven import Client
from raven.middleware import Sentry
# fibpro modules
from const import SENTRY_DSN
from http_basic import HTTPBasic
from user_db import init_user_db, get_user
from util import log, http_response
from pricing import update_user_credit
```

```
(virtualenv)neumarkmbp:365 neumark $ ./start.sh
```

S	**Sentry** (4)	**[FibInc FibPro] ERROR: ValueError: invalid literal for int() with base 10: 'favicon.ico'** – View on Se... VIEW IN SENTRY	10:08 AM
S	Sentry	[FibInc FibPro] ERROR: ValueError: math domain error – View on Sentry. Sentry. New Event on Fi... VIEW IN SENTRY	10:33 AM
S	**Sentry**	**[FibInc FibPro] ERROR: NameError: global name 'log' is not defined** – View on Sentry. Sentry. Ne... VIEW IN SENTRY	11:25 AM
S	**Sentry**	**[FibInc FibPro] ERROR: AttributeError: 'function' object has no attribute 'get'** – View on Sentry. S... VIEW IN SENTRY	10:07 AM
S	**Sentry**	**[FibInc FibPro] ERROR: NameError: global name 'logarithm' is not defined** – View on Sentry. Sent... VIEW IN SENTRY	11:25 AM

```
h; Intel Mac OS X 10_10_5) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/45.0.2454.101 Safari/
537.36"
```

```
return http_response(start_response,
```

localhost:9000/1

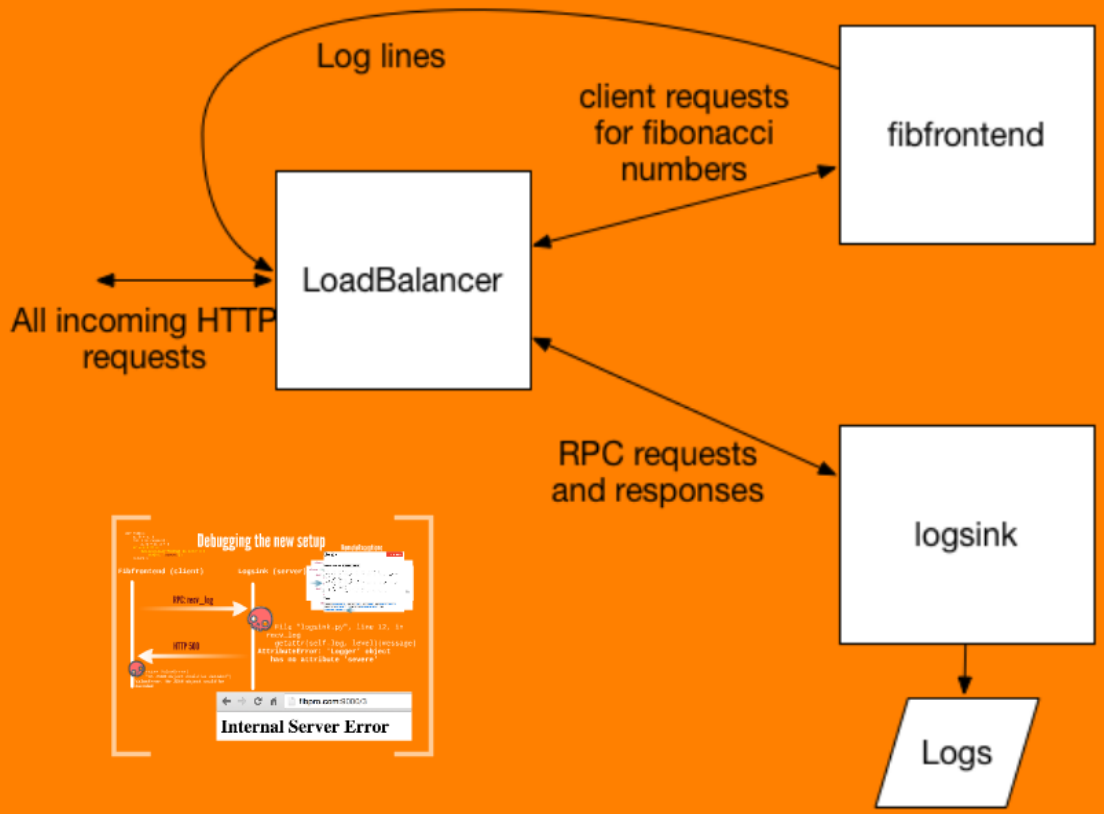
```
Error: fib(1) costs 1, user username has insufficient credit(0)
```

```
Client(SENTRY_DSN))
```

Prezi

A separate logsink

The first step towards microservices




```python
from rpc import Client, Server, ServerConfig
from logging import getLogger

class LogSinkServer(Server):
    log = getLogger('gunicorn.error')

    # runs in the logsink process
    def recv_log(self, message=None, level='info'):
        if message:
            getattr(self.log, level)(message)
            return True
        return False

class LogSinkClient(Client):
    # runs in the client process
    def send_log(self, message, level='info'):
        return self.call('logsink', 'recv_log', {
            'message': message,
            'level': level})
```

```
>>> from fibpro.logsink import LogSinkClient
>>> LogSinkClient().send_log("test_msg")
```

```
accept(0004)=0005 from [127.0.0.1:53521]
GET /api/logsink/?req=eyJhcmdzIjp7ImxldmVsIjoiaW5mbyIsImlc3
NhZZUiOiJ0ZXN0X2izZyJ0LCJtZXRob2QiOiJyZWN2X2xvZyJ9 HTTP/1.1
http-in.clihdr[0005:ffffffff]: Host: fibpro.com:9000
http-in.clihdr[0005:ffffffff]: Connection: keep-alive
http-in.clihdr[0005:ffffffff]: Accept-Encoding: gzip, deflate
clihdr[0005:ffffffff]: Accept: */*
clihdr[0005:ffffffff]: User-Agent: python-requests/2.8.0
srvrep[0005:0006]: HTTP/1.1 200 OK
logsink.srvhdr[0005:0006]: Server: gunicorn/19.3.0
logsink.srvhdr[0005:0006]: Date: Tue, 13 Oct 2015 09:34:04 GMT
logsink.srvhdr[0005:0006]: Connection: close
logsink.srvhdr[0005:0006]: Content-Type: text/plain
logsink.srvhdr[0005:0006]: Content-Length: 4
```

```
{
  "args": {"level":"info","message":"test_msg"},
  "method":"recv_log"
}
```

Prezi

```python
from rpc import Client, Server, ServerConfig
from logging import getLogger

class LogSinkServer(Server):
    log = getLogger('gunicorn.error')

    # runs in the logsink process
    def recv_log(self, message=None, level='info'):
        if message:
            getattr(self.log, level)(message)
            return True
        return False

class LogSinkClient(Client):
    # runs in the client process
    def send_log(self, message, level='info'):
        return self.call('logsink', 'recv_log', {
            'message': message,
            'level': level})
```

The RPC "framework"

```
>>> from fibpro.logsink import LogSinkClient
>>> LogSinkClient().send_log("test_msg")
```

```
accept(0004)=0005 from [127.0.0.1:53521]
GET /api/logsink/?req=eyJhcmdzIjp7ImxldmVsIjoiaW5mbyIsIm1lc3
NhZ2UiOiJ0ZXN0X21zZyJ9LCJtZXRob2QiOiJyZWN2X2xvZyJ9 HTTP/1.1
http-in.clihdr[0005:ffffffff]: Host: fibpro.com:9000
http-in.clihdr[0005:ffffffff]: Connection: keep-alive
http-in.clihdr[0005:ffffffff]: Accept-Encoding: gzip, deflate
clihdr[0005:ffffffff]: Accept: */*
clihdr[0005:ffffffff]: User-Agent: python-requests/2.8.0
srvrep[0005:0006]: HTTP/1.1 200 OK
logsink.srvhdr[0005:0006]: Server: gunicorn/19.3.0
logsink.srvhdr[0005:0006]: Date: Tue, 13 Oct 2015 09:34:04 GMT
logsink.srvhdr[0005:0006]: Connection: close
logsink.srvhdr[0005:0006]: Content-Type: text/plain
logsink.srvhdr[0005:0006]: Content-Length: 4
```

```
{
  "args": {"level":"info","message":"test_msg"},
  "method":"recv_log"
}
```

The RPC "framework"

```
class Server(RPCBase):

    def wsgi_app(self, environ, start_response):
        method, args = self.decode_arguments(
            environ['QUERY_STRING'][(len(self.ARG_PREFIX)-1):])
        returned = getattr(self, method)(**args)
        return http_response(start_response,
            body=self.encode_result(returned))

    def app(self):
        return Sentry(self.wsgi_app,
            RavenClient(SENTRY_DSN))

class Client(RPCBase):

    def __init__(self, server_config=None):
        self.server_config = server_config or ServerConfig()

    def construct_url(self, service, method, args):
        return "%s%s%s" % (
            self.server_config.endpoints[service],
            self.ARG_PREFIX,
            self.encode_arguments(method, args))

    def call(self, service, method, args=None):
        url = self.construct_url(service, method, args or {})
        return self.decode_result(requests.get(url).text)
```

```
def fib(n):
    a, b = 0, 1
    for i in range(n):
        a, b = b, a + b
    if a % 2 == 0:
        log.send_log("fib(%s) is even" % (
            str(n), "severe"))
    return a
```

Debug

Fibfrontend (client)

```
def fib(n):
    a, b = 0, 1
    for i in range(n):
        a, b = b, a + b
    if a % 2 == 0:
        log.send_log("fib(%s) is even" % (
            str(n), "severe"))
    return a
```

Debugging the new setup

RemoteExceptions

Fibfrontend (client)

Logsink (server)

RPC: recv_log

```
File "logsink.py", line 12, in recv_log
  getattr(self.log, level)(message)
AttributeError: 'Logger' object has no attribute 'severe'
```

HTTP 500

```
raise ValueError(
    "No JSON object could be decoded")
ValueError: No JSON object could be decoded
```

RemoteExceptions

Sentry

View on Sentry

```
class
class Cli
    def r
    i
    r
    def c
    u
    r
```

New Event on FibInc FibPro

```
RemoteException: Traceback (most recent call last):
  File "/Users/neumark/git/fibpro-microservices/fibpro/rpc.py", line
75, in wsgi_app
    getattr(self, method)(**args))
  File "/Users/neumark/git/fibpro-microservices/fibpro/logsink.py",
line 12, in recv_log
    getattr(self.log, level)(message)
AttributeError: 'Logger' object has no attribute 'severe'
```

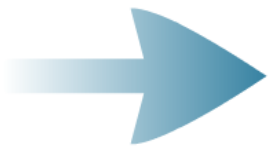
{})

Tags

de

browser = **Chrome 45.0** | device = **Other** | level = **error** | os = **Mac OS X 10.10.5**

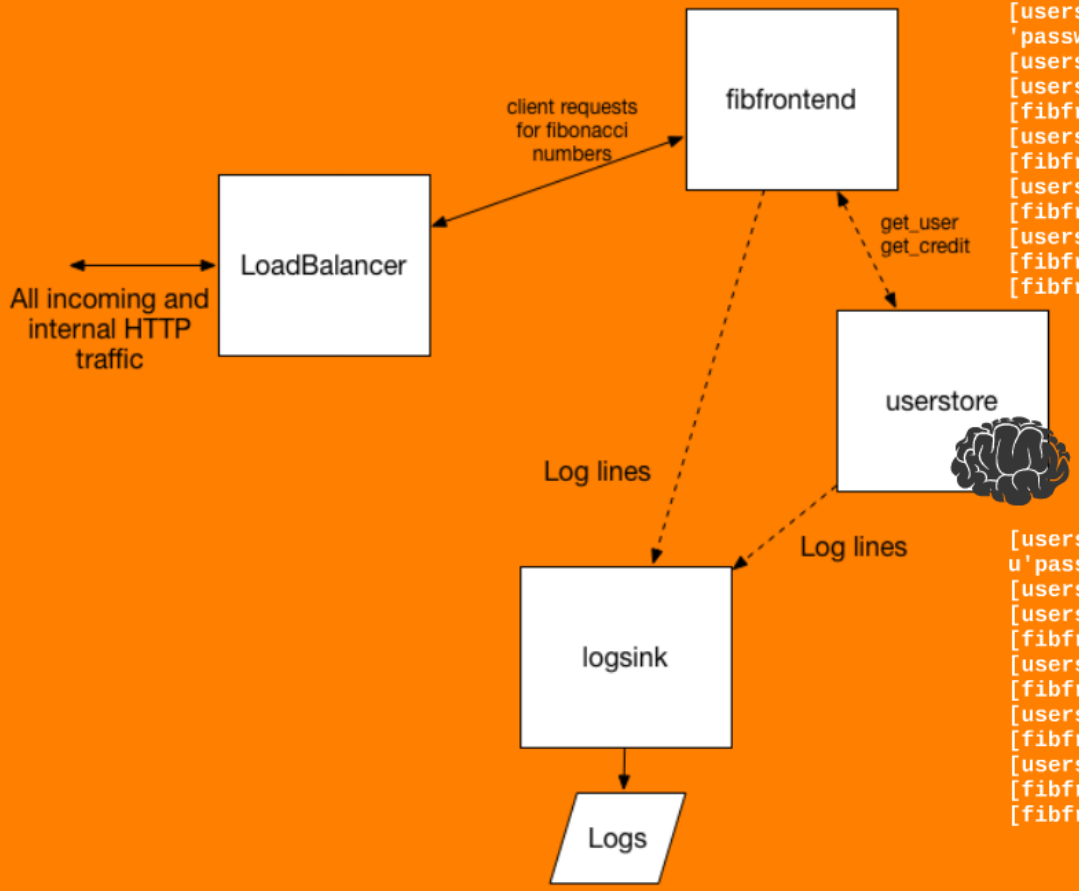
sentry:user = **ip:127.0.0.1** | server_name = **neumarkmbp.local** | url = **http://fibpro.com:9000/3**



Prezi

Separated stateful and stateless components

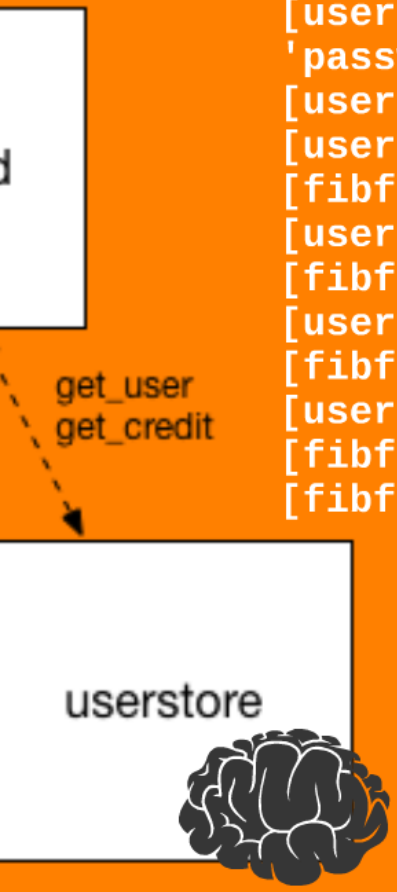
the Userstore service is separated from from Fibfrontend.




```
[userstore] Added user: {'username': u'username',
'password': u'password'} with credit 4
[userstore] Credit for username set to 4
[userstore] Credit for username incremented -1 yielding 3
[fibfrontend] username used 1 credit, balance: 3
[userstore] Credit for username incremented -1 yielding 2
[fibfrontend] username used 1 credit, balance: 2
[userstore] Credit for username incremented -1 yielding 1
[fibfrontend] username used 1 credit, balance: 1
[userstore] Credit for username incremented -1 yielding 0
[fibfrontend] username used 1 credit, balance: 0
[fibfrontend] User "username" denied fib(3), credit: 0
```

Adding request ids to logs

```
[userstore] - Added user: {'username': u'username', 'password':
u'password'} with credit 4
[userstore] - Credit for username set to 4
[userstore] 3b9d41f8 Credit for username incremented -1 yielding 3
[fibfrontend] 3b9d41f8 username used 1 credit, balance: 3
[userstore] 0a5eb154 Credit for username incremented -1 yielding 2
[fibfrontend] 0a5eb154 username used 1 credit, balance: 2
[userstore] a9ee3a98 Credit for username incremented -1 yielding 1
[fibfrontend] a9ee3a98 username used 1 credit, balance: 1
[userstore] 7642f208 Credit for username incremented -1 yielding 0
[fibfrontend] 7642f208 username used 1 credit, balance: 0
[fibfrontend] aaff62f3 User "username" denied fib(3), credit: 0
```




```
[userstore] Added user: {'username': u'username',
'password': u'password'} with credit 4
[userstore] Credit for username set to 4
[userstore] Credit for username incremented -1 yielding 3
[fibfrontend] username used 1 credit, balance: 3
[userstore] Credit for username incremented -1 yielding 2
[fibfrontend] username used 1 credit, balance: 2
[userstore] Credit for username incremented -1 yielding 1
[fibfrontend] username used 1 credit, balance: 1
[userstore] Credit for username incremented -1 yielding 0
[fibfrontend] username used 1 credit, balance: 0
[fibfrontend] User "username" denied fib(3), credit: 0
```

Adding request ids to logs

```
[userstore] - Added user: {'username': u'username', 'password':
u'password'} with credit 4
[userstore] - Credit for username set to 4
[userstore] 3b9d41f8 Credit for username incremented -1 yielding 3
[fibfrontend] 3b9d41f8 username used 1 credit, balance: 3
[userstore] 0a5eb154 Credit for username incremented -1 yielding 2
[fibfrontend] 0a5eb154 username used 1 credit, balance: 2
[userstore] a9ee3a98 Credit for username incremented -1 yielding 1
[fibfrontend] a9ee3a98 username used 1 credit, balance: 1
[userstore] 7642f208 Credit for username incremented -1 yielding 0
[fibfrontend] 7642f208 username used 1 credit, balance: 0
[fibfrontend] aaff62f3 User "username" denied fib(3), credit: 0
```

Summary of problems and solutions

high code complexity splitting the app

Logs everywhere unified logging

failed requests RemoteExceptions

Grouping events request ids

2 gener

Log sin

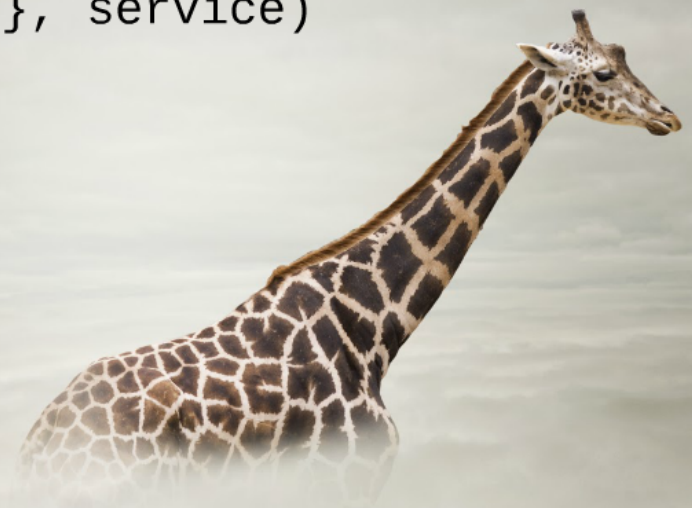
RPC me

Per-ser

Prezi

Monitoring

```
from rpc import Client
client = Client()
services = client.server_config.get_services()
for service in services:
    print service, client.call('ping',
        {}, service)
```



watch -n 1 python fibpro/monitor.py

Typically monitored:

#requests

%exceptions

call time

a

b

How is Prezi.com like FibPro?
How is Prezi like FibInc?

Prezi

Similar problems led us to split up monolithic web app.

2 generations of HTTP-based RPC systems used.

Log sink one of the first services split off of monolith.

RPC metadata (request id, source, etc) important debug tool.

Per-service monitoring

Thank you

Next steps for FibPro

API descriptions, versioning

service discovery

multiple environments

microservice tests

Prezi

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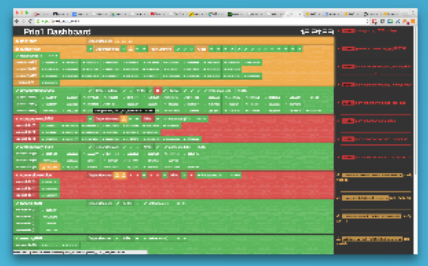

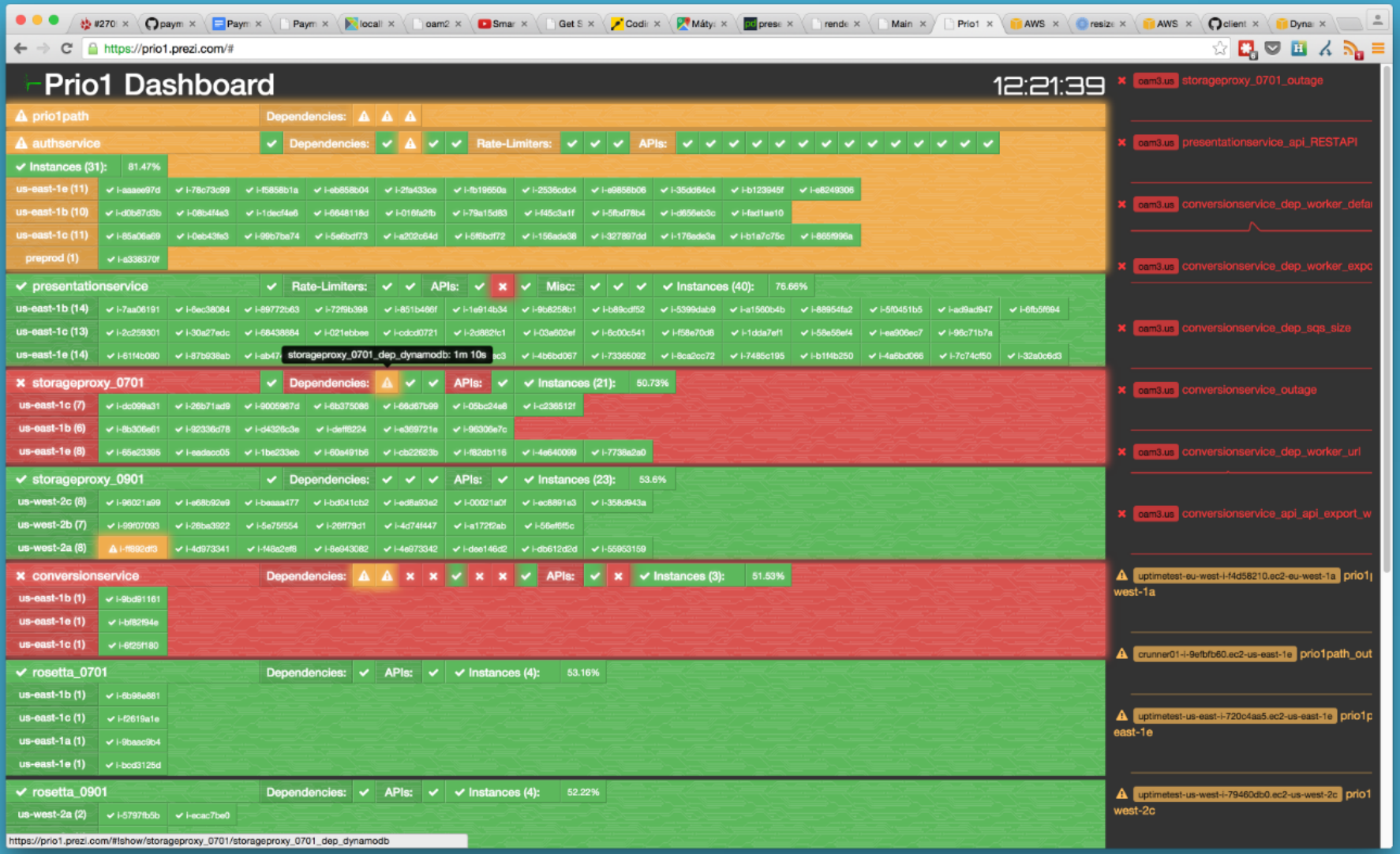
https://prio1.prezi.com/#
Prio1 Dashboard
12:21:39
prio1path
Dependencies:
authservice
Dependencies:
Rate-Limiters:
APIs:
Instances (31):
81.47%
us-east-1e (11)
us-east-1b (10)
us-east-1c (11)
preprod (1)
presentationservice
Rate-Limiters:
APIs:
Misc:
Instances (40):
76.66%
us-east-1b (14)
us-east-1c (13)
us-east-1e (14)
storageproxy_0701_dep_dynamodb: 1m 10s
storageproxy_0701
Dependencies:
APIs:
Instances (21):
50.73%
us-east-1c (7)
us-east-1b (6)
us-east-1e (8)
storageproxy_0901
Dependencies:
APIs:
Instances (23):
53.6%
us-west-2c (8)
us-west-2b (7)
us-west-2a (8)
conversionservice
Dependencies:
APIs:
Instances (3):
51.53%
us-east-1b (1)
us-east-1e (1)
us-east-1c (1)
rosetta_0701
Dependencies:
APIs:
Instances (4):
53.16%
us-east-1b (1)
us-east-1c (1)
us-east-1a (1)
us-east-1e (1)
rosetta_0901
Dependencies:
APIs:
Instances (4):
52.22%
us-west-2a (2)
https://prio1.prezi.com/#!show/storageproxy_0701/storageproxy_0701_dep_dynamodb
oam3.us storageproxy_0701_outage
oam3.us presentationservice_api_RESTAPI
oam3.us conversionservice_dep_worker_defa
oam3.us conversionservice_dep_worker_expo
oam3.us conversionservice_dep_sqs_size
oam3.us conversionservice_outage
oam3.us conversionservice_dep_worker_url
oam3.us conversionservice_api_api_export_w
uptimetest-eu-west-i-f4d58210.ec2-eu-west-1a prio1
west-1a
crunner01-i-9efbfb60.ec2-us-east-1e prio1path_out
uptimetest-us-east-i-720c4aa5.ec2-us-east-1e prio1
east-1e
uptimetest-us-west-i-79460db0.ec2-us-west-2c prio1
west-2c

Prezi

Thank you

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