

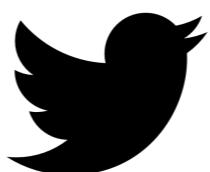


Python in the Land of Serverless

David Przybilla



dav009



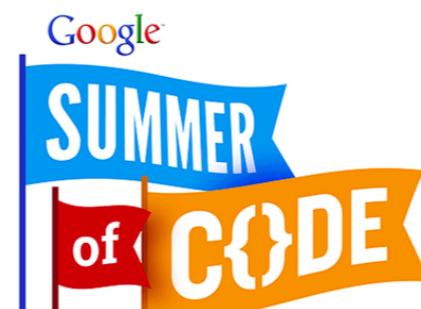
dav009



last time in here was
~9 years ago

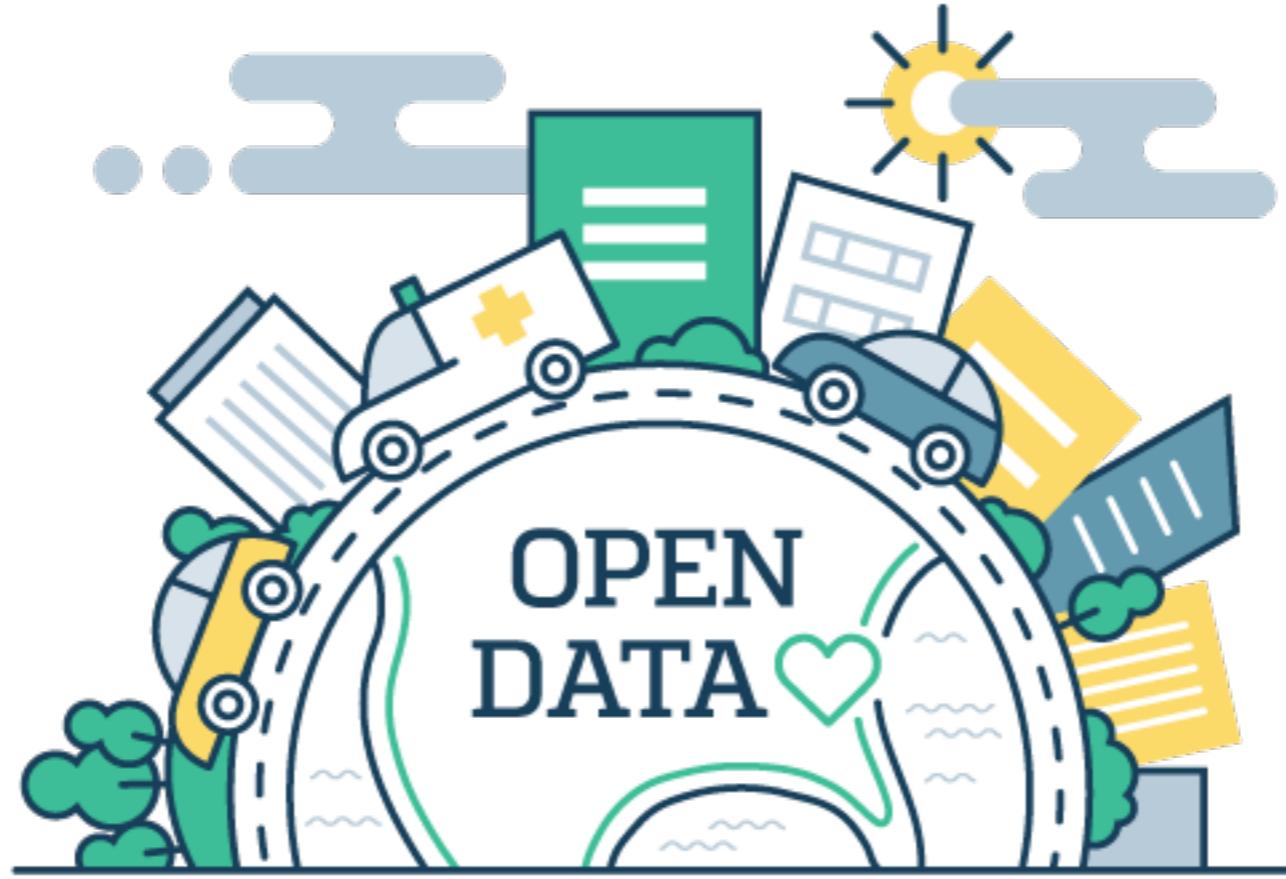
NLP

Data Engineering





Gov spending dataset



Gov spending dataset

How to access datasets

ColombiaDev



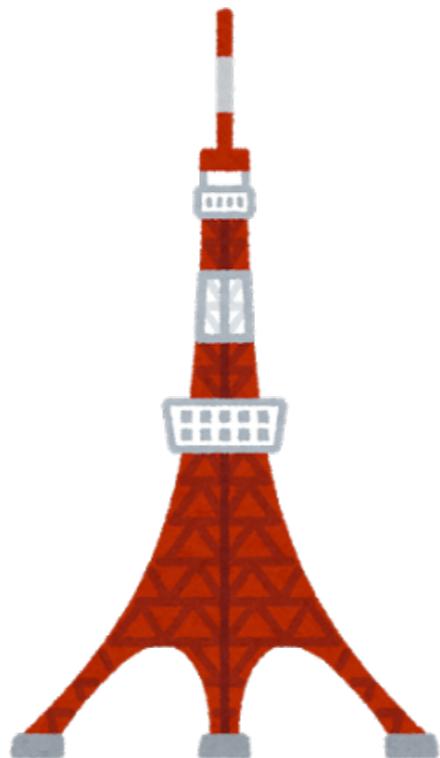
Encuesta de Salarios

.Ops + Golang + Python..





Tokyo





cool problems to solve



check our booth

..a bit of context...

Roughly 1.5 years ago...

I joined HDE

first week..started looking at projects..



first week..started looking at projects..

Github repos...



first week..started looking at projects..

Github repos...

New project I had to work on...



turns out some projects were built
on “serverless”

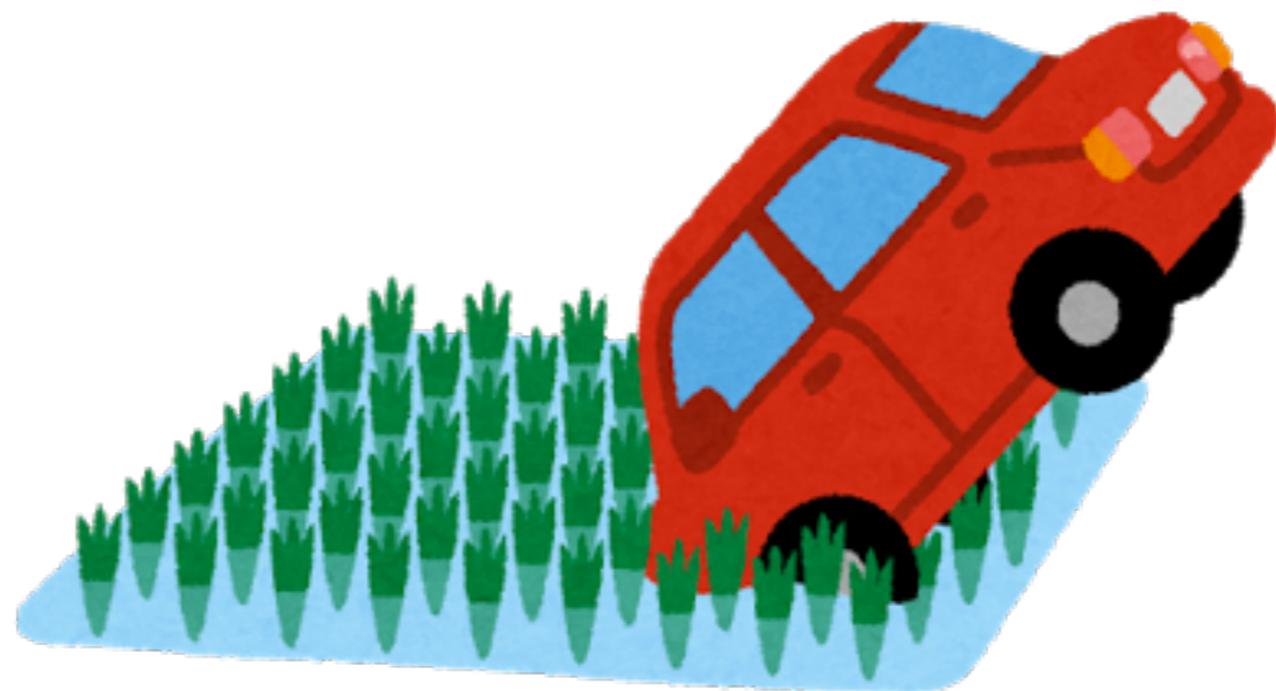
so in this talk I will guide you through:

some of the tools



some of the use cases

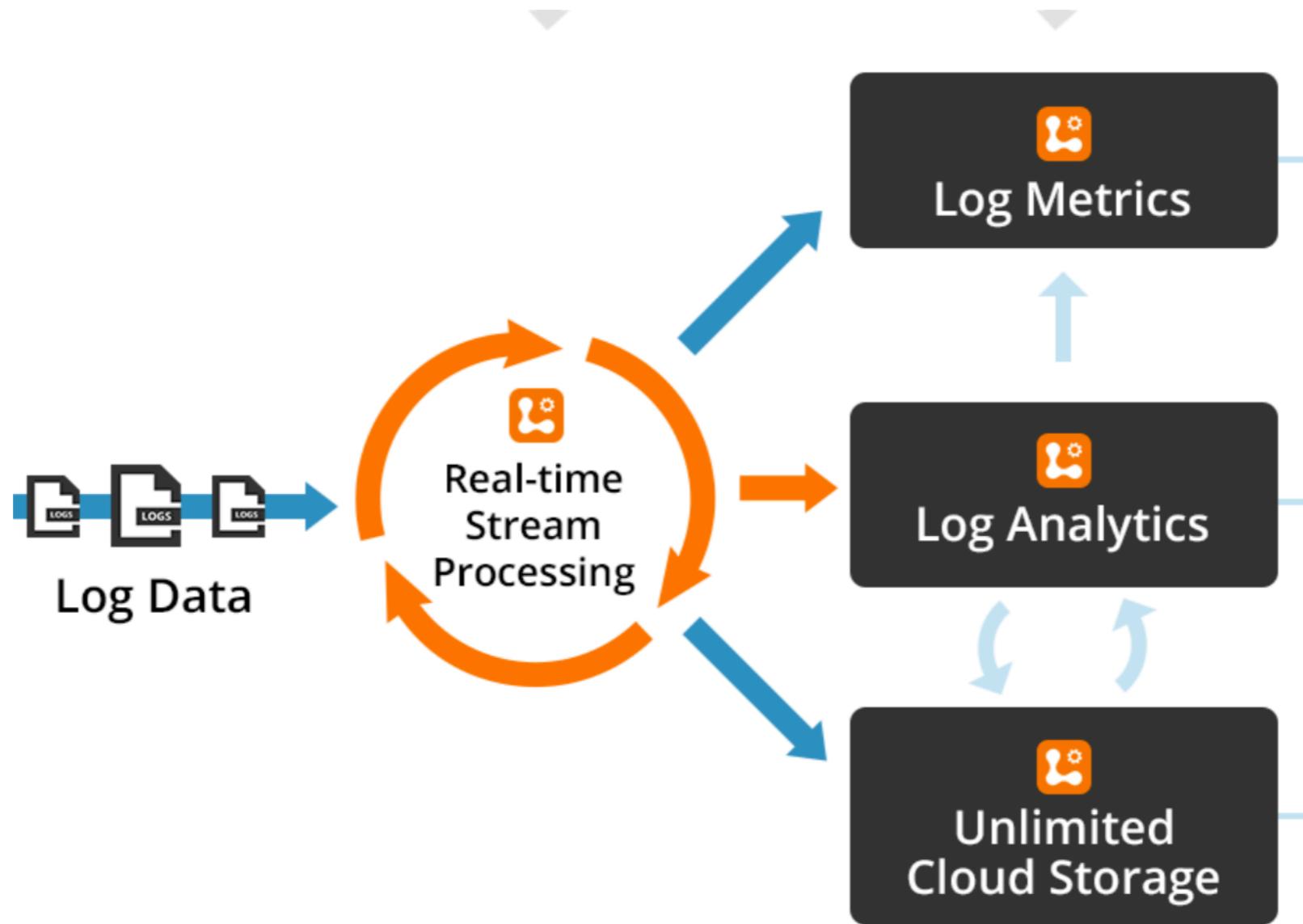
some common mistakes

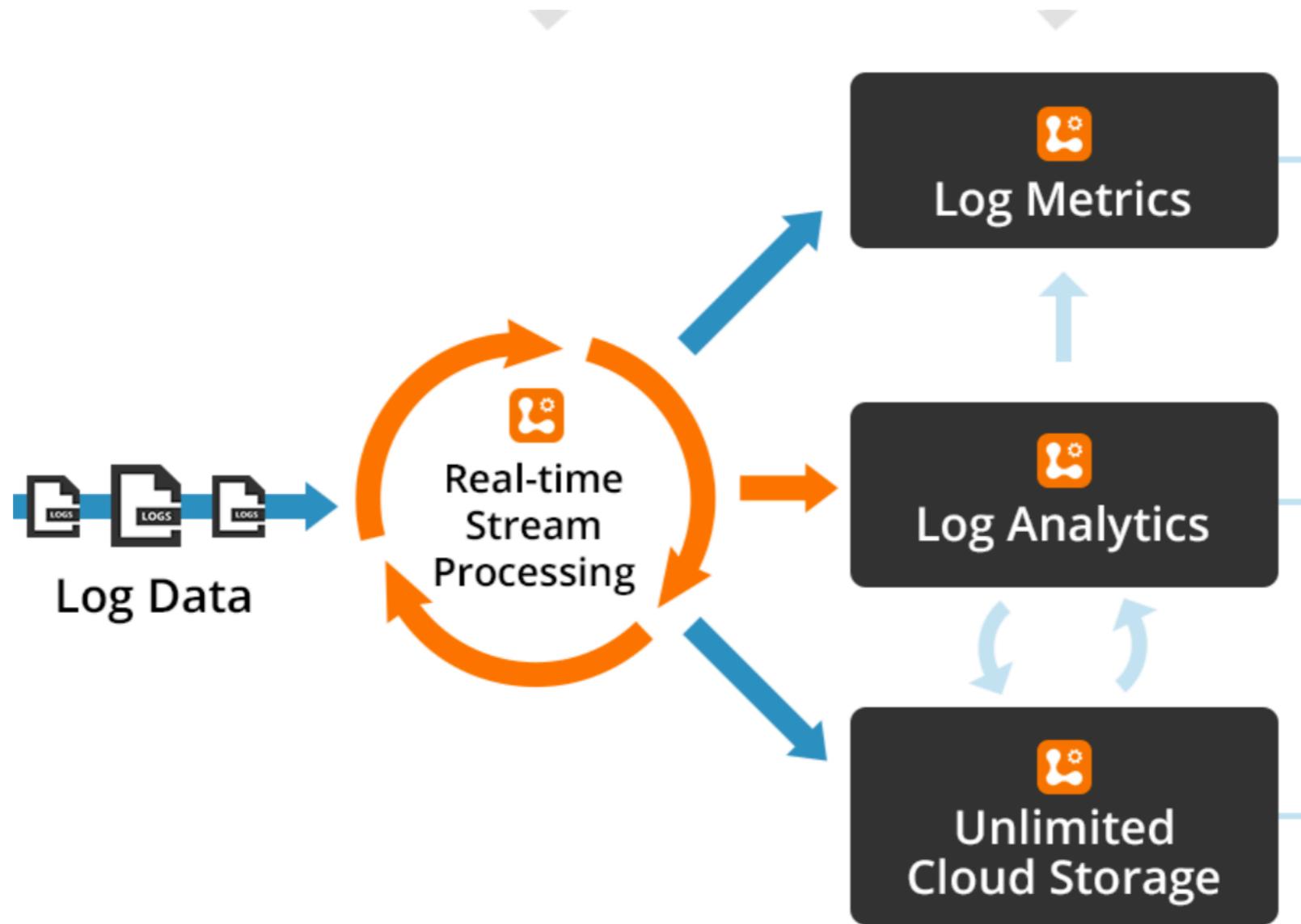


...my opinion...



my first task:
log stream processing





near realtime

If you have been doing data pipelines, probably you would go for:

If you have been doing data pipelines, probably you would go for:



If you have been doing data pipelines, probably you would go for:



a lot to configure
a lot to manage

a lot to configure
a lot to manage

zookeeper..
yarn cluster..
driver instance..
JVM..
HDFS..

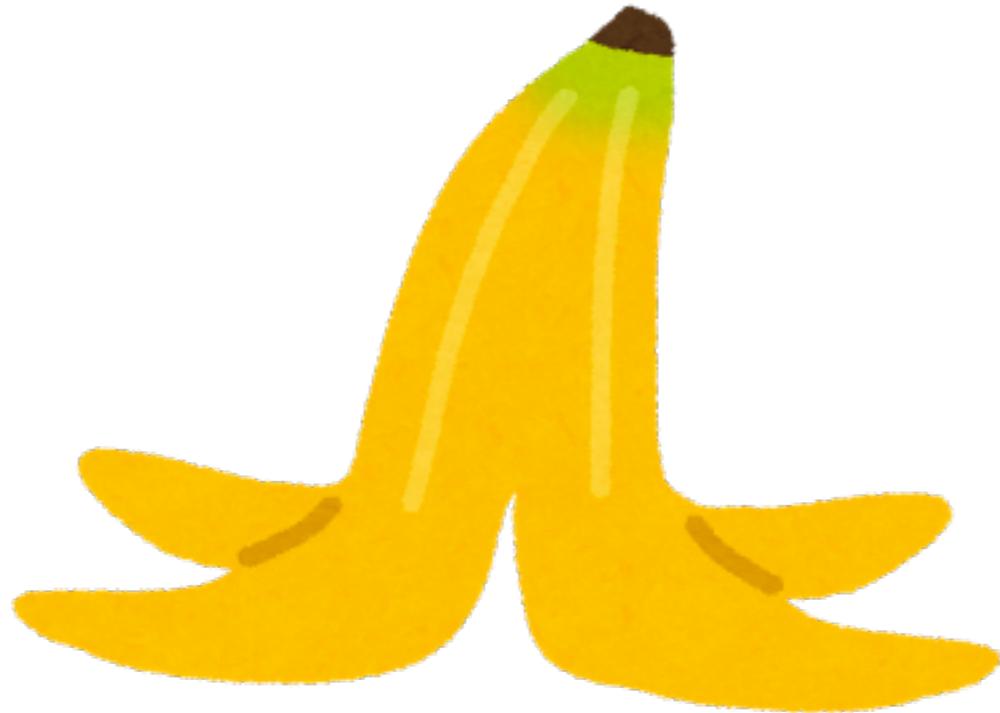
a lot to configure
a lot to **manage**

zookeeper..
yarn cluster..
driver instance..
JVM..
HDFS..



you have to make sure
those parts are running
smoothly

you have to make sure
those parts are running
smoothly



I met Jeff

I met Jeff



a coworker
ops engineer

He loves Serverless

And he has good
reasons for it...

he does not want to do
any server management



So Jeff suggested to use
serverless to solve our
stream processing problem

I raised my eyebrow in
doubt:



“Serverless”??

a quite controversial &
confusing term..

“Serverless”

1. Fully managed services, managed on your behalf

Databases (DynamoDB)...

Storage (s3)...

Queues (kafka as a service, sqs...)

heroku...

“Serverless”

2. Function as a Service (FaaS)

AWS lambda

Azure functions

Kubeless

Google Cloud functions..

Nuclio

..openwhisk....

...many more.....

Function as a service

Upload your code and it will
run...

Upload your code and it will
run...

you **don't care** on top of
what is running..

Upload your code and it will
run...

you **don't care** on top of
what is running..

you only focus on your
business logic

(i) zero administration

- Focus on a single function

zero administration

- Focus on a single function
- Managed by provider

zero administration

- Focus on a single function
- Managed by provider
- You gain peace of mind

zero administration

- Focus on a single function
- Managed by provider
- You gain peace of mind
- cost: more integration with your vendor(vendor lock-in)

(ii) You are billed by
number of invocations

so how does this looks
like in python?

```
def handler(event, context):  
    # do something  
    pass
```

```
def handler(event, context):  
    # do something  
    url = event['url']  
    scrape(url)
```

```
def handler(event, context):  
    # do something  
    database = # magic  
    username = event['username']  
    database.find(username)
```

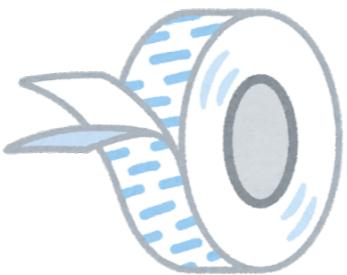
so how do I **deploy** my
function?

in order run your project on
FaaS:

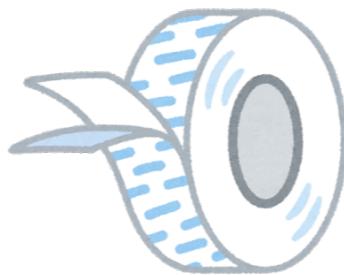
0. define your function
1. package your function
2. upload your package
3. call your function

tools address those steps

(tools) 0. define function (infrastructure / glue**)**

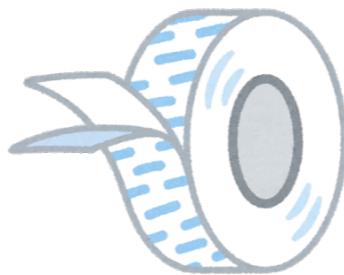


(tools) 0. define function (infrastructure / glue**)**



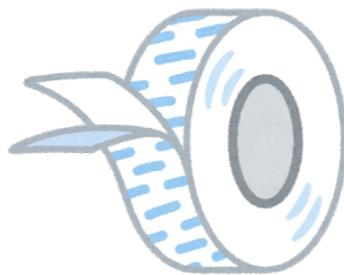
- runtime (python, golang, js..)

(tools) 0. define function (infrastructure / glue**)**



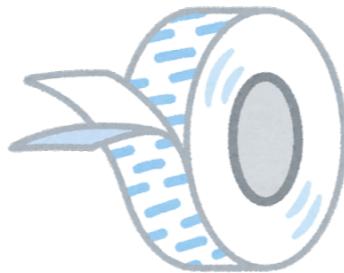
- runtime (python, golang, js..)
- memory (128mb, 500?..)

(tools) 0. define function (infrastructure / glue**)**



- runtime (python, golang, js..)
- memory (128mb, 500?..)
- access to resources

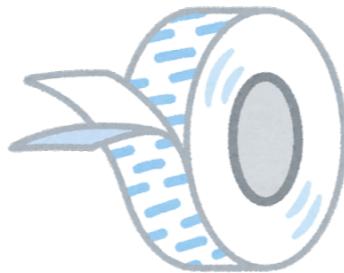
(tools) 0. define function (infrastructure / glue**)**



- runtime (python, golang, js..)
- memory (128mb, 500?..)
- access to resources

mouse & clicking

(tools) 0. define function (**infrastructure / glue**)

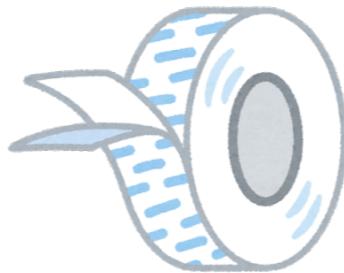


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mouse & clicking



(tools) 0. define function (**infrastructure / glue**)

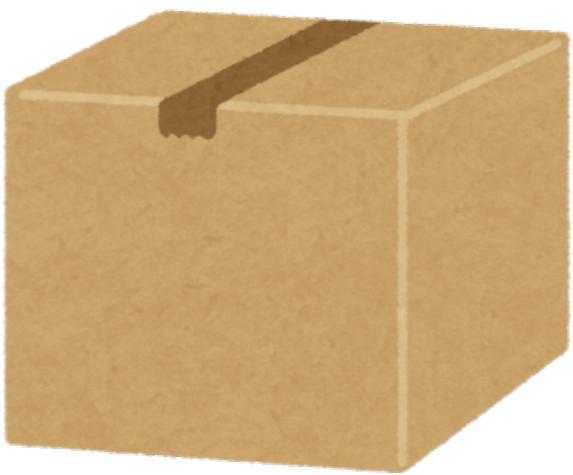


- runtime (python, golang, js..)
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- access to resources

mouse & clicking

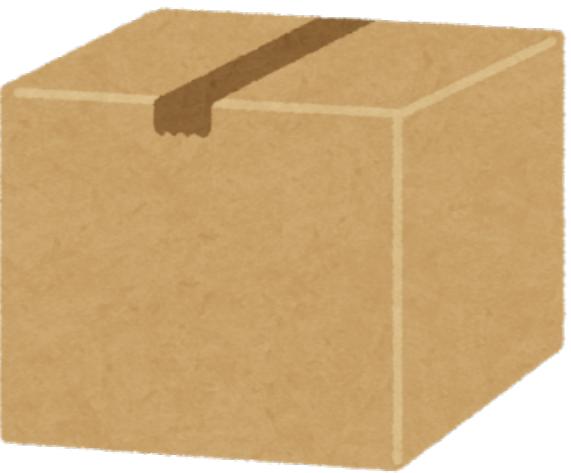


1. package your function



1. package your function

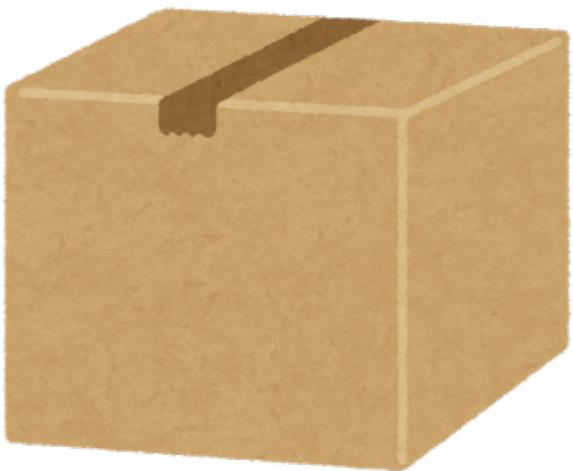
your function
code



1. package your function

your function
code

+ dependencies



2. upload package

“deploying it”

3. call your function

3. call your function

“what triggers it?”



3. call your function

“what triggers it?”

function is called whenever:

3. call your function

“what triggers it?”

function is called whenever:

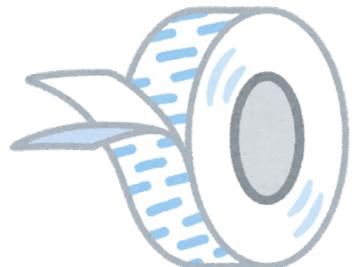
url gets hit..

an object is uploaded to s3..

a record is added to your database..

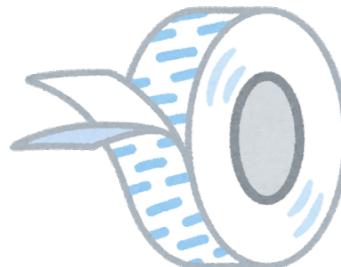
while queue is not empty..

3. call your function



Deeply entangled on your cloud provider services

3. call your function



Deeply entangled on your cloud provider services

(infrastructure /glue)

mouse & clicking



tooling address those steps

deploying:
infrastructure + code

back to my story. .



back to my story..

first week..
started looking at repos..



One of them is an API

something.com/endpointA

something.com/endpointB

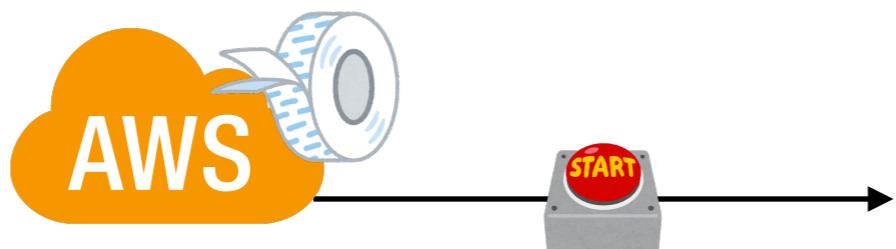
something.com/endpointC

my team was an early adopter of this
technology

they stitched projects with the tools
available back then

request to
[urlA](#)

request to
urlA

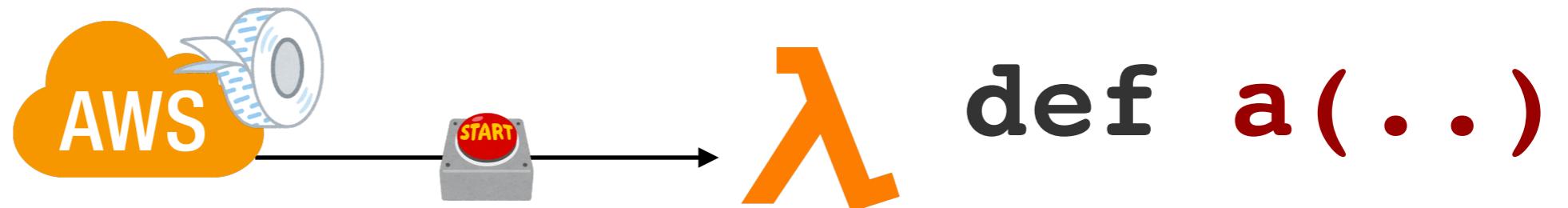


request to
urlA

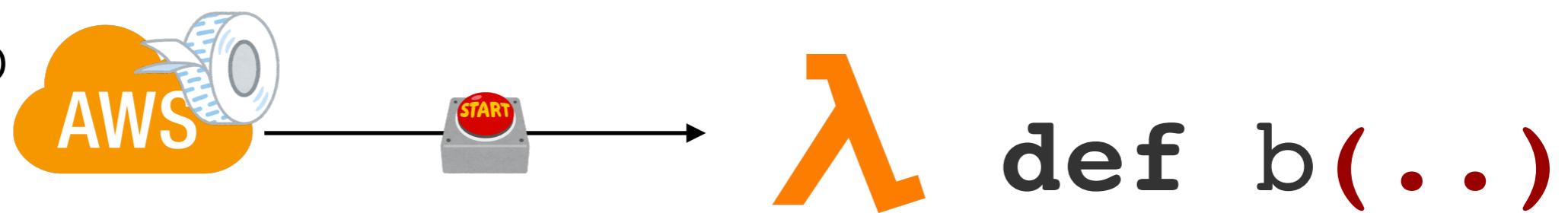


def a(. .)

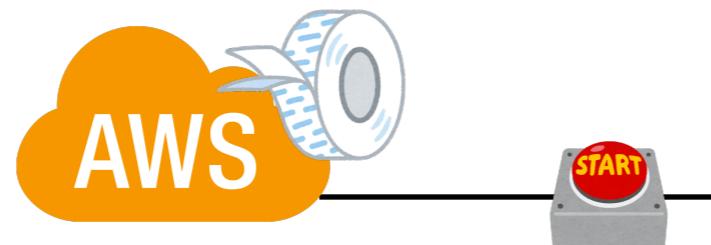
request to
urlA



request to
urlB



request to
urlA



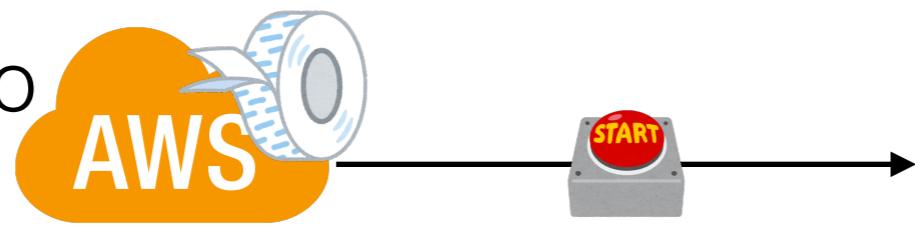
def a(..)

request to
urlB



def b(..)

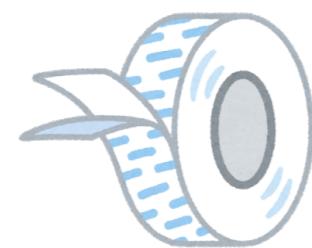
request to
urlC



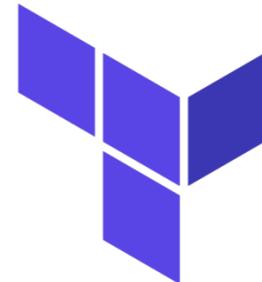
def c(..)

deploy: makefiles

deploy: makefiles



glue:



HashiCorp
Terraform

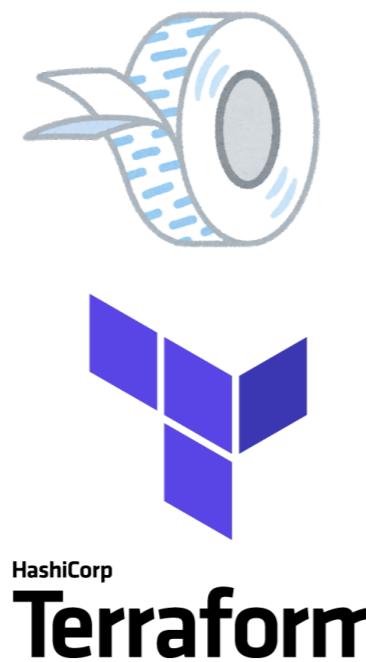
3 functions to deploy

3 functions to deploy

3 functions to package

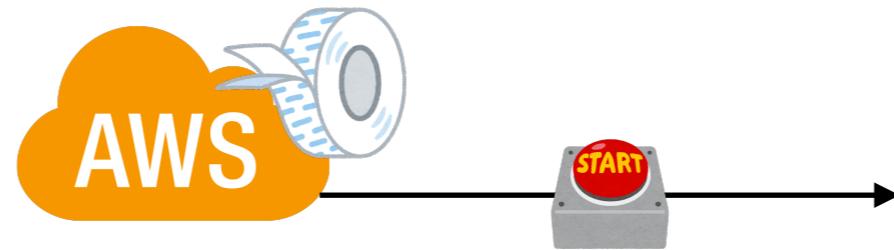
3 functions to deploy

3 functions to package

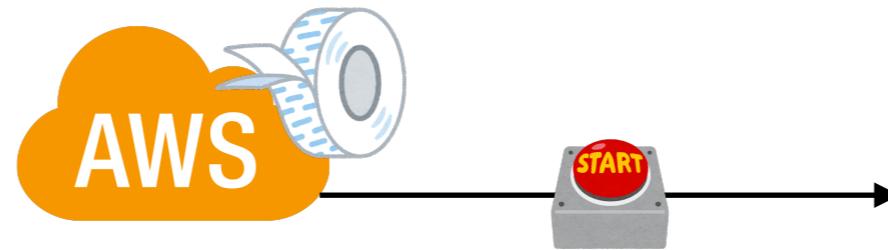


lots of glue :

- many pieces to move
- to worry about
- hard to test



changing this kind of trigger(url)
on terraform is painful



changing this kind of trigger(url)
on terraform is painful

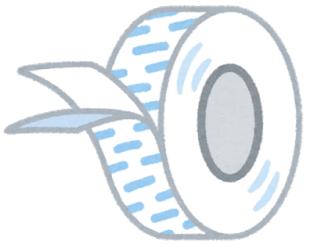


running terraform is scary
you might **destroy** other infrastructure

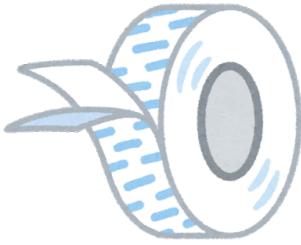
if for whatever reason you want to
move to non-serverless.. it is harder..

if for whatever reason you want to move to non-serverless.. it is harder..

why?



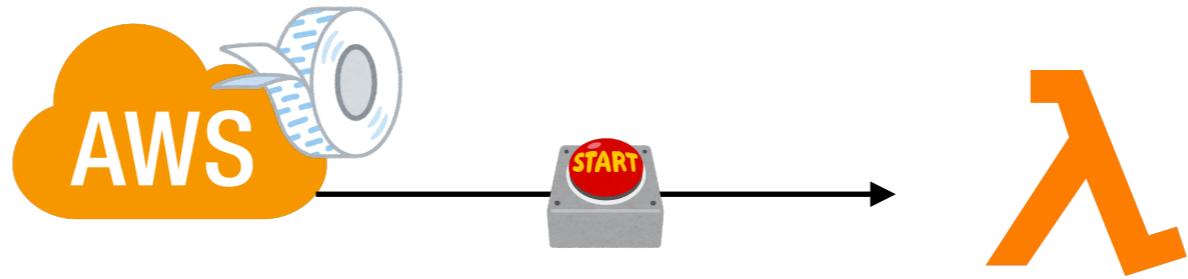
because all that **glue** that triggers the functions
you have to implement that **glue** in a different way



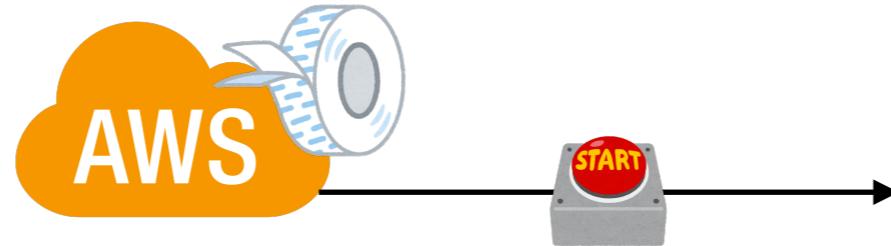
3 different lambdas..
also make people structure their
project like 3 independent projects..

with tools available today
you can avoid this..

any request
to
something.com

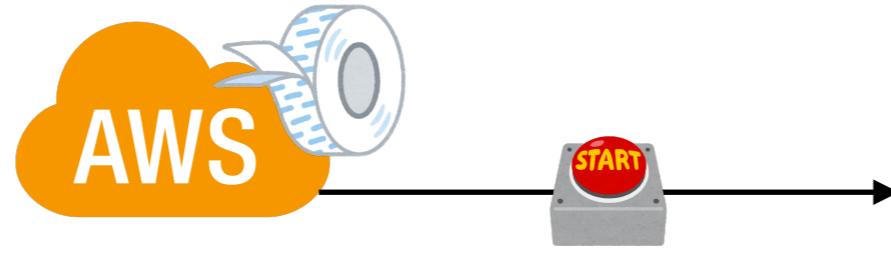


any request
to
something.com



wsgi wrapper
(like a flask app)

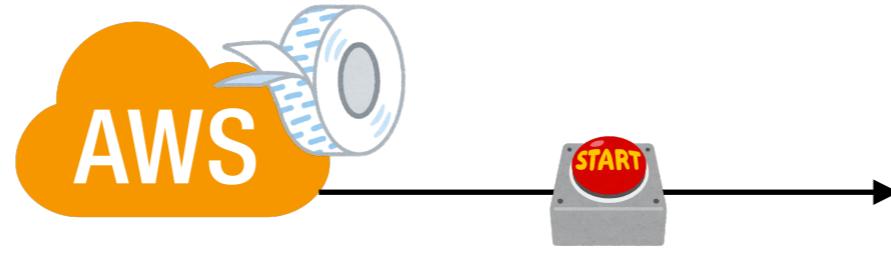
any request
to
something.com



wsgi wrapper
(like a flask app)

wsgi wrapper?

any request
to
something.com

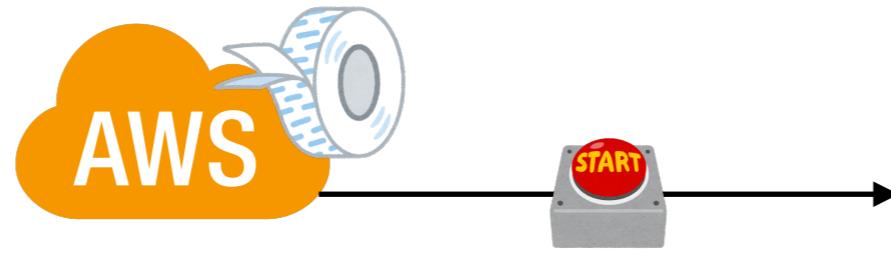


wsgi wrapper
(like a flask app)

wsgi wrapper?

translates requests arriving to **def handler(..)** into wsgi
requests

any request
to
something.com



wsgi wrapper
(like a flask app)

wsgi wrapper?

translates requests arriving to **def handler(..)** into wsgi
requests

it means we can use tools like **flask**, **django** ..

you can use **all tools already available** and all that come with them

testing is easier

you can use **all tools already available** and all that come with them

testing is easier

you can make your api with the same tools, and have serverless “for free”

you can use **all tools already available** and all that come with them

testing is easier

you can make your api with the same tools, and have serverless “for free”



minimal implementation of that
wrapper (python3) is available at:

<https://github.com/slank/awsgi>

so if you have a dummy
flask app

```
from flask import (
    Flask,
    jsonify,
)
```

```
app = Flask(__name__)
```

```
@app.route('/endpointB')
def endpoint_b():
    # ...
    return jsonify(status=200, message='OK')
```

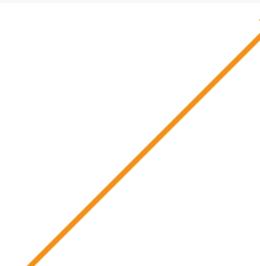
to make it serverless you just need to
add this function:

to make it server less you just need to add this function:

```
def handler(event, context):  
    return awsgi.response(app, event, context)
```

to make it server less you just need to add this function:

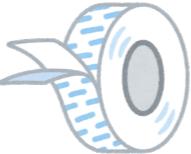
```
def handler(event, context):  
    return awsgi.response(app, event, context)
```



wsgi app

- can run it locally

- can run it locally
- easy to test routing

- can run it locally
- easy to test routing
- less glue 

API building serverless tools:

API building server less tools:

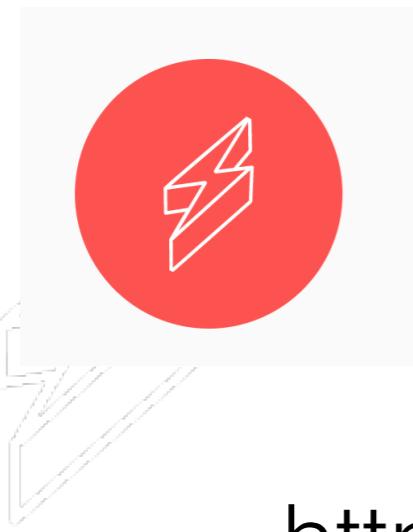
serverless

chalice

zappa

...

there are more..many..



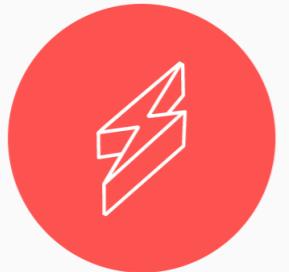
Serverless

<https://github.com/serverless/serverless>

<https://serverless.com/>



serverless



serverless

Good:

- many plugins
- got funding
- particularly good when you are building apis
- it is **not sluggish** (for the given use case)
- provide you easy way to **handle environments** (stg, prd)
- great community



serverless

Bad:

no plan building:



serverless

Bad:

no plan building:

deploying:

infrastructure + code



serverless

Bad:

no plan building:

deploying:

infrastructure + code

it does not tell you what will change before deploying



serverless

Bad:

changing something in config file can leak infrastructure

It is dangerous to leave infrastructure leaking behind



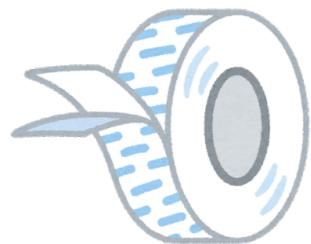
serverless

How to use it?



serverless

How to use it?

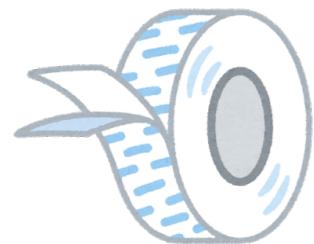


1. define glue in .yml file



serverless

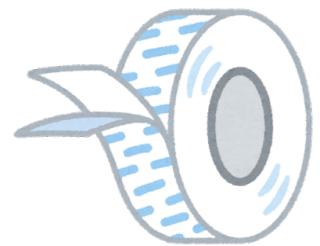
How to use it?



1. define glue in .yml file
2. do `sls deploy`



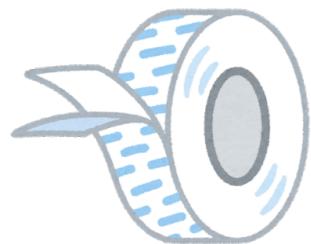
serverless



.yml file



serverless



.yml file

- I want a function with this memory..
- I want a function with this name...
- I want it to get called when X and Y happens





serverless

`sls deploy`

- Package + upload



serverless



serverless has a lot fo plugins that you can add to your .yml file.

don't use it to manage infrastructure.



serverless

serverless “applications”

code + glue + infrastructure

i.e: serverless service to get a slack bot via FaaS

- > `serverless install --url <service-github-url>`
- > `sls deploy`

Chalice

<https://github.com/aws/chalice>

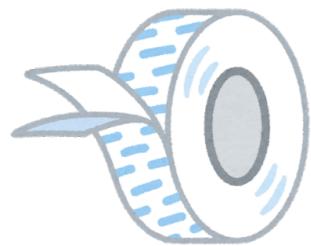
```
> chalice new-project my_sample_project  
> chalice deploy
```

- comes with “wsgi wrapper”
- purely focused on AWS
- aimed at API particular case



Zappa

How to use it?

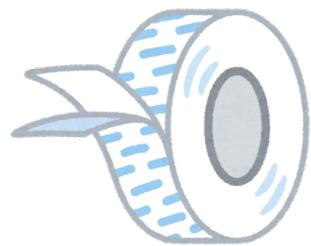


1. define glue in `.json` file



Zappa

How to use it?



1. define glue in `.json` file
2. some of the glue code is defined as python decorators

```
@task
```

```
@task
def make_pie():
    """ This takes a long time!
    ingredients = get_ingredients()
    pie = bake(ingredients)
    deliver(pie)
```

```
@task
```

```
def make_soup():
    ingredients = get_ingredients()
    soup = bake(ingredients)
    deliver(soup)
```



Zappa

How to use it?

it has some cool decorators

it lacks plugins/addons

good

if you are building APIs

if you have lots of cron/async calls

Another use case..

you have a lot of data to
process in batch

you have a lot of data to
process in batch



text..
numbers..

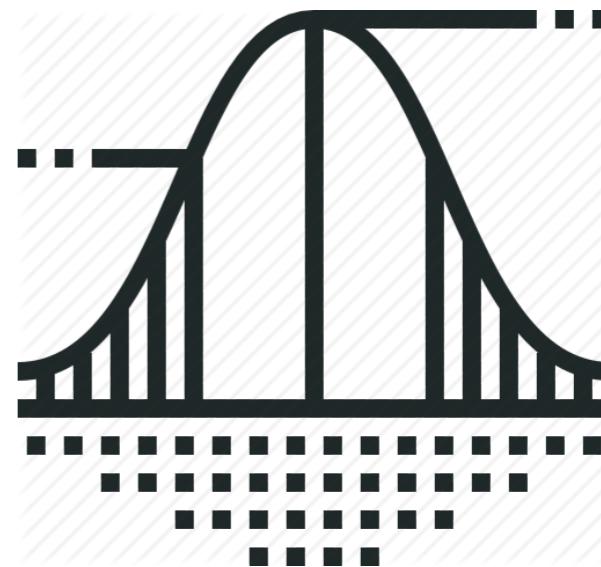
map & reduce..right?

map & reduce..right?

get me a spark cluster
use pyspark ..done



→
 f
count frequencies



→
clean wikipedia
etl
data preprocessing



compute to TB datasets across hundreds of functions

this is a great use case for FaaS

this is a great use case for FaaS

pywren

<https://github.com/pywren/pywren>

pywren

benchmark of

- 80 GB/sec read
- 60 GB/sec write

pywren

No knowledge of AWS required

pywren

No knowledge of AWS required

No large (expensive) cluster up

pywren

No knowledge of AWS required

No large (expensive) cluster up

Using vanilla python

pywren

> pywren-setup

pywren

> pywren-setup

essentially :

1. takes a python function (creates a FaaS)

pywren

> pywren-setup

essentially :

1. takes a python function (creates a FaaS)
2. takes **data** and uploads it to s3

pywren

> pywren-setup

essentially :

1. takes a python function (creates a FaaS)
2. takes **data** and uploads it to s3
3. runs your python function in **parallel** on the data uploaded to s3

pywren

```
def add_one(x):  
    return x + 1
```

pywren

```
def add_one(x):  
    return x + 1
```

[0, 1...9]

pywren

```
def clean_text(text):  
    # clean text  
    return cleaned_text
```

pywren

```
def clean_text(text):  
    # clean text  
    return cleaned_text
```



wikidump (100G)

pywren

```
def add_one(x):  
    return x + 1
```

pywren

```
def add_one(x):  
    return x + 1
```

creates lambda



λ

pywren

```
def add_one(x):  
    return x + 1
```

creates lambda



λ

[0 , 1...9]

pywren

```
def add_one(x):  
    return x + 1
```

creates lambda



```
[0, 1..9]
```

uploads data
to

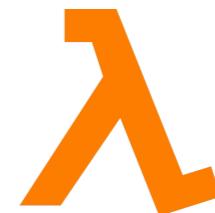
part1



pywren

```
def add_one(x):  
    return x + 1
```

creates lambda



[0, 1...9]

uploads data
to

part1



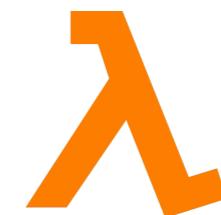
part2



pywren

```
def add_one(x):  
    return x + 1
```

creates lambda



[0, 1...9]

uploads data
to

part1



part2



part3



pywren

```
def add_one(x): [0, 1...9]
    return x + 1
```

pywren

```
def add_one(x):  
    return x + 1  
[0, 1...9]
```

```
add_one(0)
```

$$\lambda$$

pywren

```
def add_one(x):  
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[0, 1...9]
```

add_one(0) **add_one(1)**

λ

λ

pywren

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def add_one(x):  
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```

[0 , 1...9]

add_one(0)

 λ

add_one(1)

 λ

add_one(2)

 λ

.....

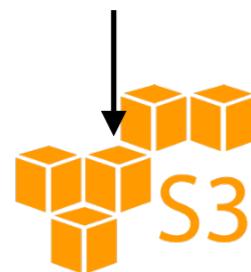
pywren

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λ



add_one(1)

λ

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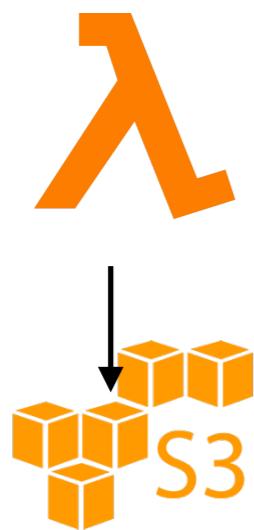
.....

pywren

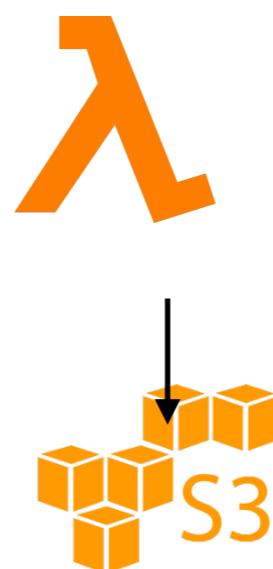
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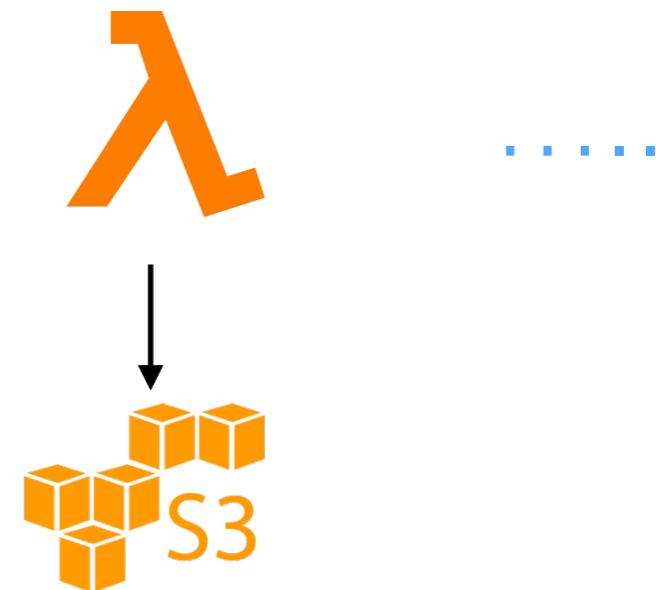
add_one(0)



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add_one(2)

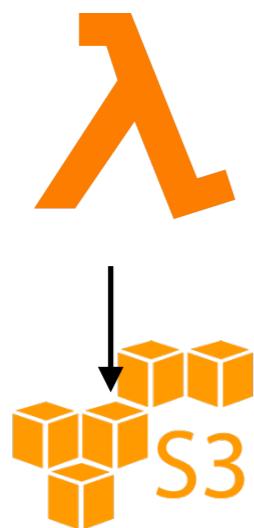


pywren

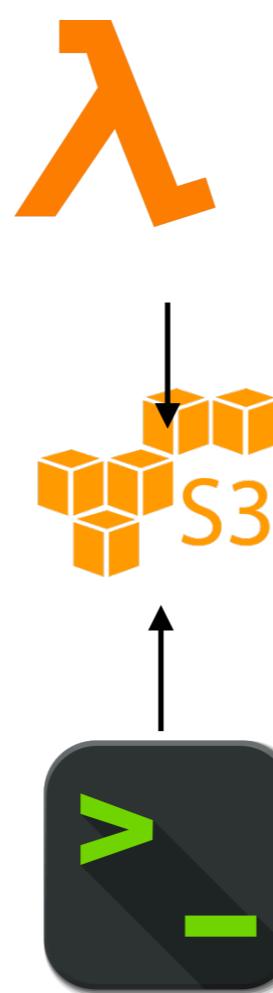
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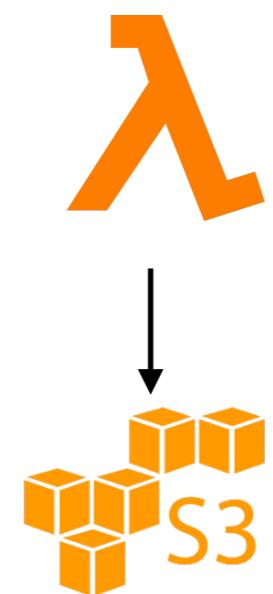
add_one(0)



add_one(1)



add_one(2)



.....

pywren

how does it look like ?

```
import pywren  
  
xlist = np.arange(10) //data
```

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> python sample.py

pywren

good for:

- ETL tasks..
- Scraping..
- Data crunching in general..

spark-on-lambda

<https://github.com/qubole/spark-on-lambda>

similar to pywren

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looks experimental though

spark-on-lambda

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similar to pywren

looks experimental though
same as spark..

just executors are lambda functions

spark-on-lambda

Scanning 1 TB of Data
1000 Lambda executors took 47s
cost turns out to be \$1.18.

spark-on-lambda

Scanning 1 TB of Data
1000 Lambda executors took 47s
cost turns out to be \$1.18.

on regular spark
50 r3.Xlarge instances..
2 or 3 mins just to setup + start

remarks..

no multiprocessing..
module

common mistakes

structure your project as
any other python project

structure your project as
any other python project

don't think of it as FaaS

if your project has many
FaaS

if your project has many
FaaS

it is a single project, with
different entry points

immutability

FaaS is built on top of
containers

containers for the same function
sometimes gets reused..

```
db_connection = connect(something)
```

```
def handler(a,b):  
    db_connection.query(something(a))
```

1st run

```
> db_connection = connect(something)
```

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1st run

```
db_connection = connect(something)
```

```
> def handler(a,b):  
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```

2nd run

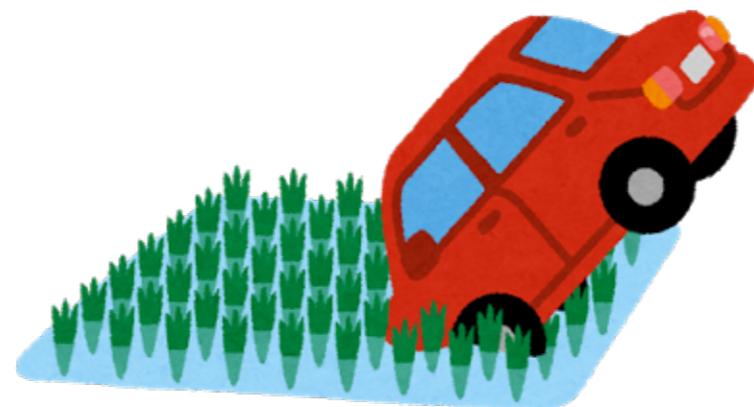
```
db_connection = connect(something)
```

```
> def handler(a,b):  
    db_connection.query(something(a))
```

as in any project

as in any project

mutable globals are not desirable



```
list_of_users = [ 'admin' ]
def handler(a,b):
    list_of_users = list_of_users + a[ 'user' ]
    do_something(list_of_users)
```

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intended input to `do_something`
['admin' , user1]

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intended input to `do_something`
['admin' , user1]

intended input to `do_something`
['admin' , user2]

actual input to `do_something`
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```
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```

intended input to `do_something`

```
[ 'admin' , user2 ]
```

actual input to `do_something`

```
[ 'admin' , user1 ]
```

actual input to `do_something`

```
[ 'admin' , user1 , user2 ]
```

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list_of_users = [ 'admin' ]  
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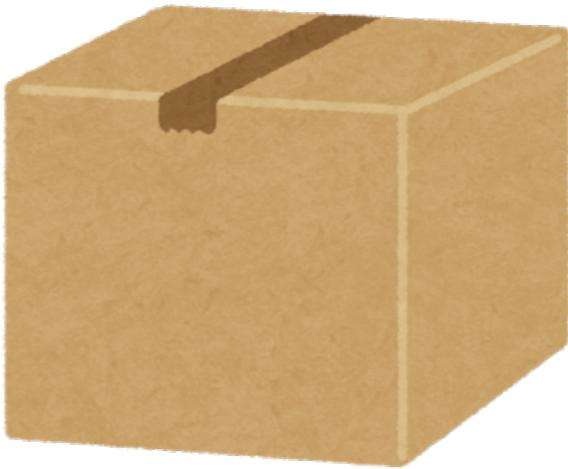
don't mutate



..security..



Dependencies.. please
update them



delete old functions

you don't pay if you don't use them
so you don't get reminded in your bill



if you don't use
them, delete them



sounds easy..but..in a large organisation:
- you got no idea who is the owner



sounds easy..but..in a large organisation:

- you got no idea who is the owner
- is it **safe** to delete?



straight up your permissions

only give needed permissions

DDoS are wallet attacks

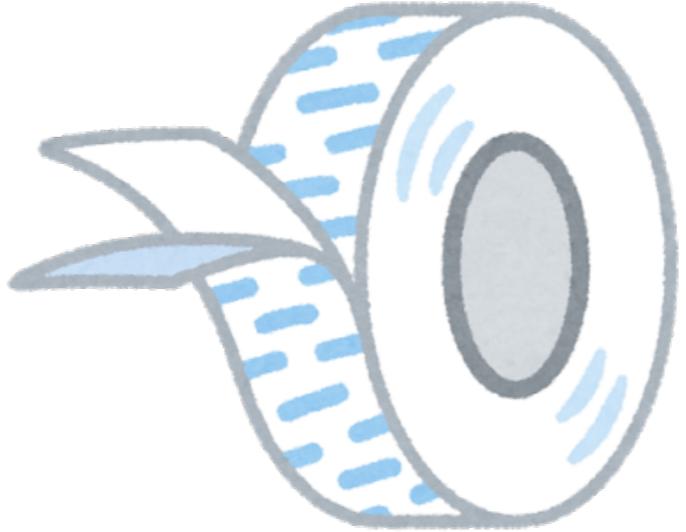


concluding

lots of new tools are yet
to come...

serverless provides a peace of mind.:
it will be running
it won't be down

but you agree on going full on using your
cloud provider features

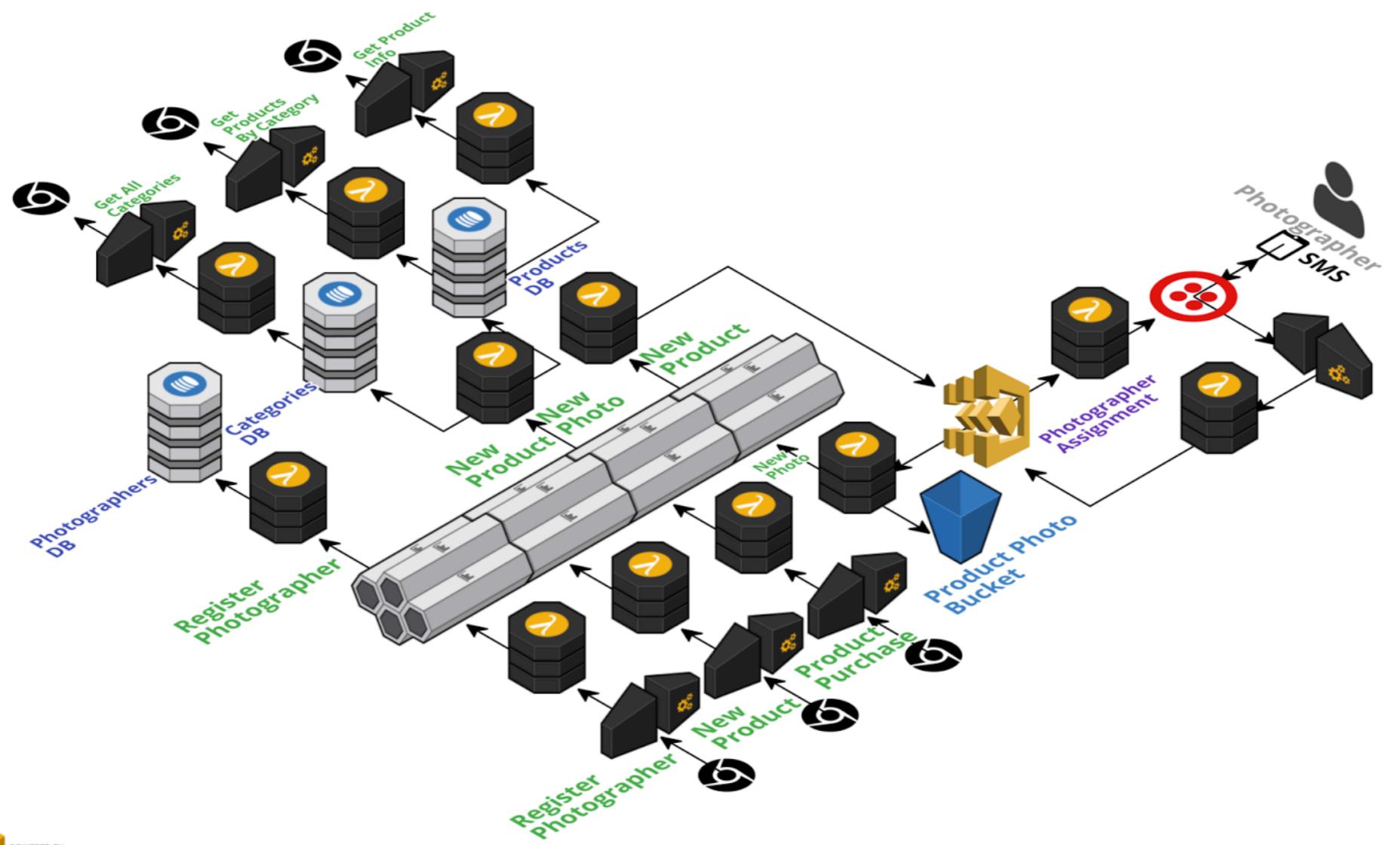


There is a lot of glue..
lots of events here and
there....

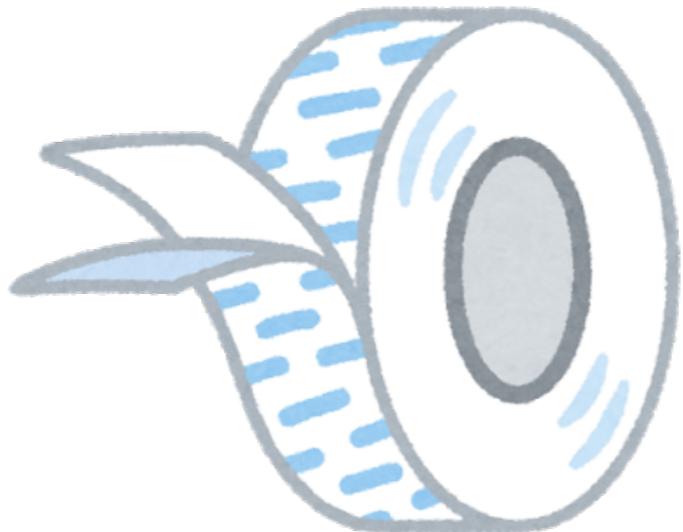
serverless is [in my opinion]
cheaper not simpler

data crunching : yes
handling small events: yes

total complexity of your
system might grow

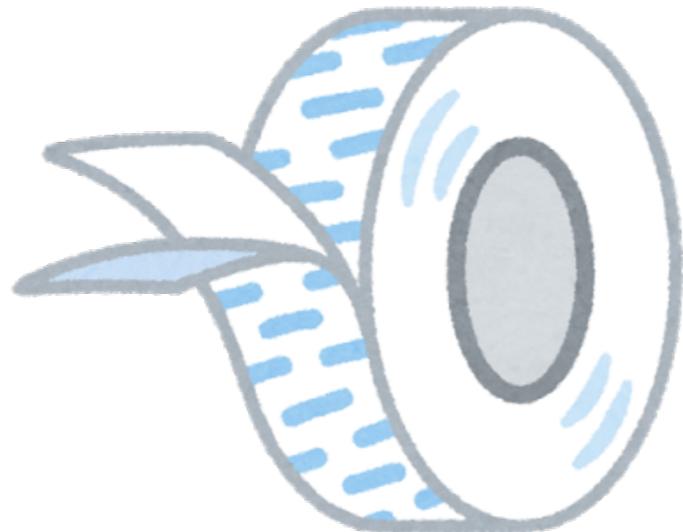


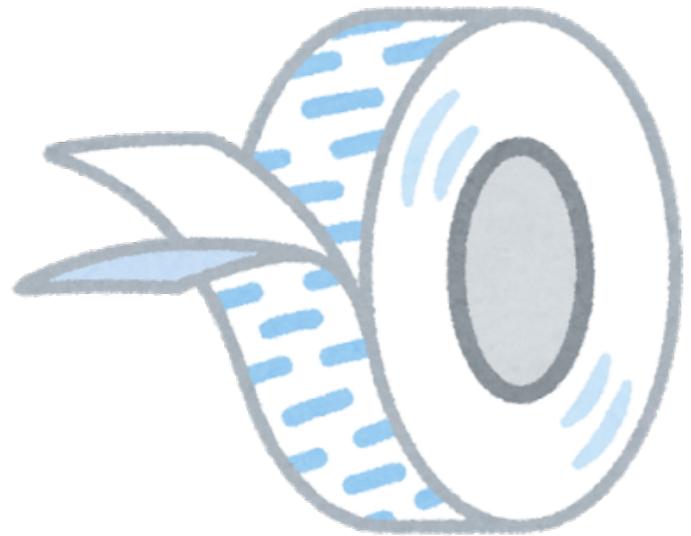
this is your extra
complexity: glue, wiring



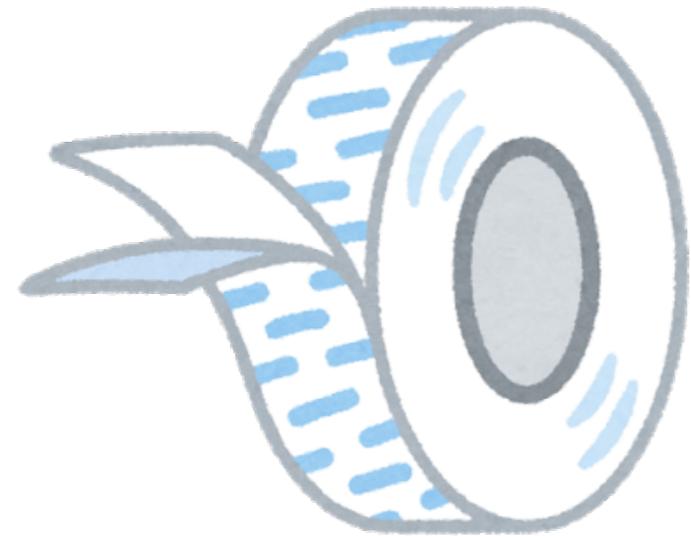


glue is hard to test





this is the **hard part..**
integration testing



does the event triggers the
expected behaviour?

it is getting more
popular..



many surveys seems to indicate FaaS adaption is as fast as that of containers

I guess new tools will
help tame this
complexity

I guess now you are
wondering.

should I use server less or not?

If you find yourself in any
of these situations:

you have a developer **complaining**
about having to spin up infrastructure
before they can **get something done**

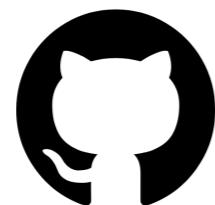
maybe you are a data scientist
annoyed by how difficult is to
run your experiment

then maybe is worth
trying it

by the way, yes..

we built our stream
processing system on top of
FaaS

Gracias!



dav009



dav009