Service Engineering Research Area
ICCLAB SPLAB

Zurich University of Applied Sciences
zh aw School of Engineering
InIT Institute of Applied Information Technology

Serverless Applications:

Tools, Languages, Providers and (Research) Challenges

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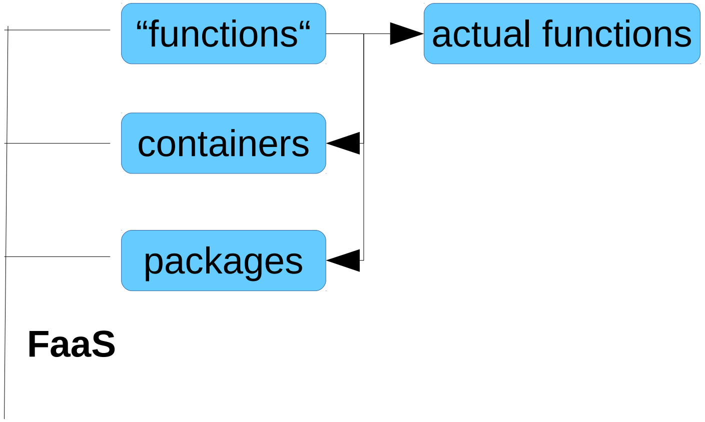
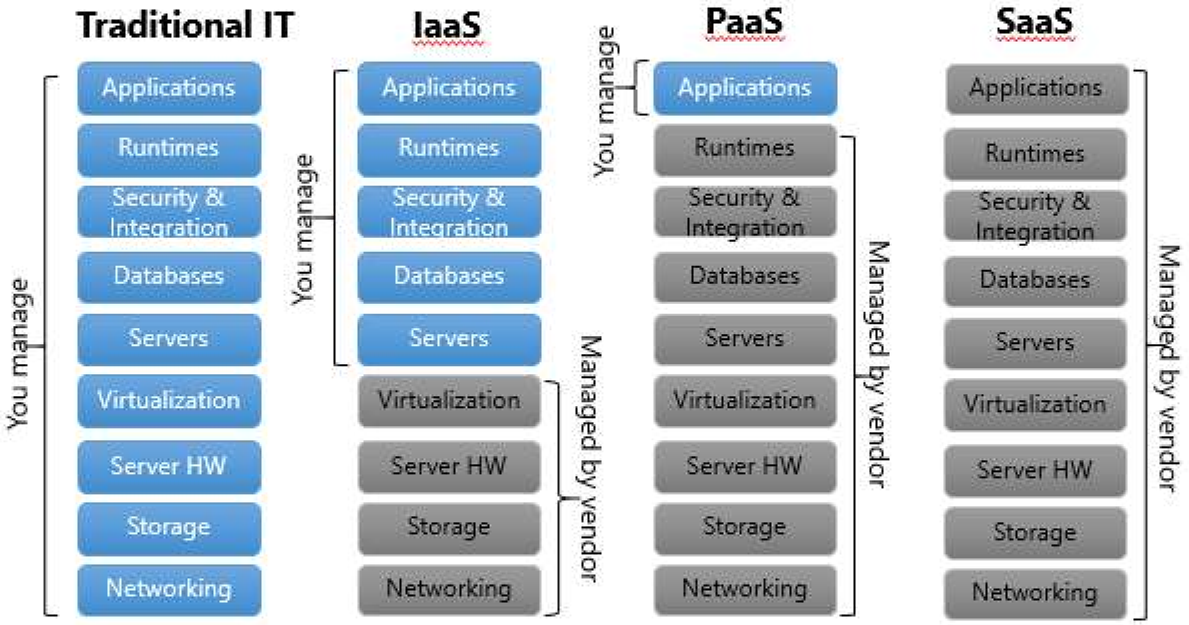
Jun 22, 2017 | Serverless Meetup

What is FaaS?

- running functions in the cloud (“hosted functions“)
- real “pay per use“ (per invocation, per load × time unit, e.g. MB/100ms)
- seemingly “serverless“

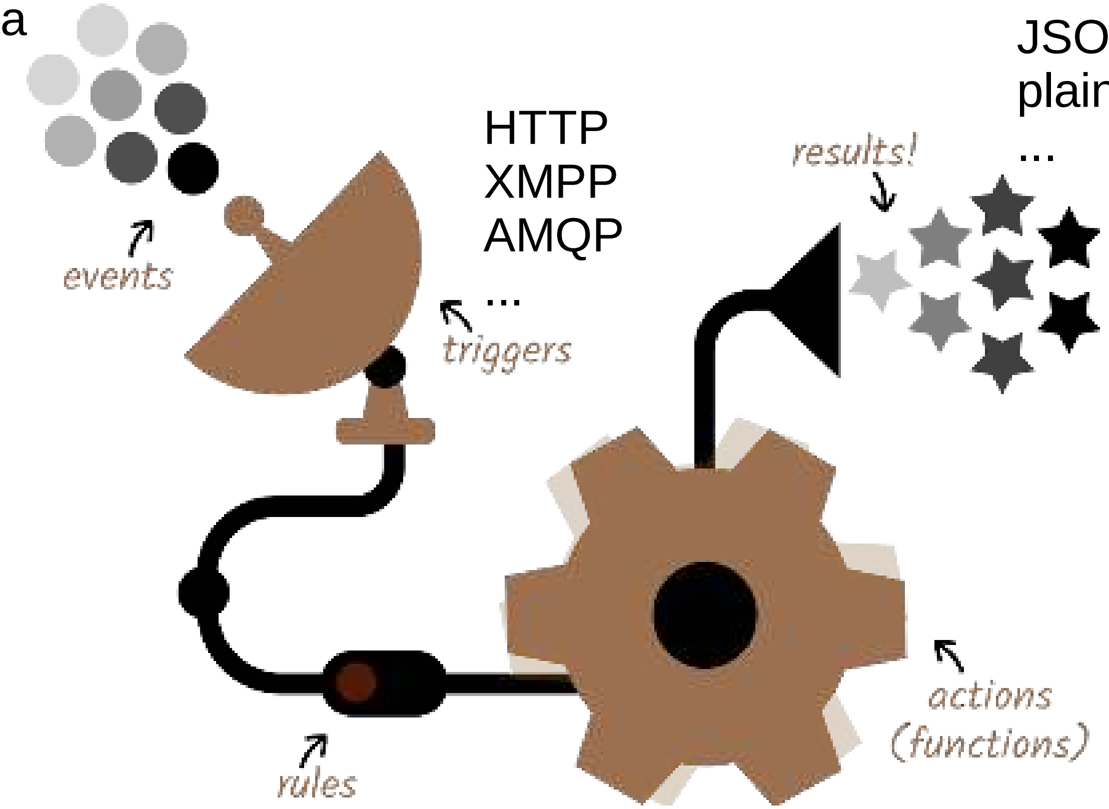




[mazikglobal.com]

Examples of FaaS: Process

monitoring event
sensor data
log entry
git push
...



HTTP
XMPP
AMQP
...

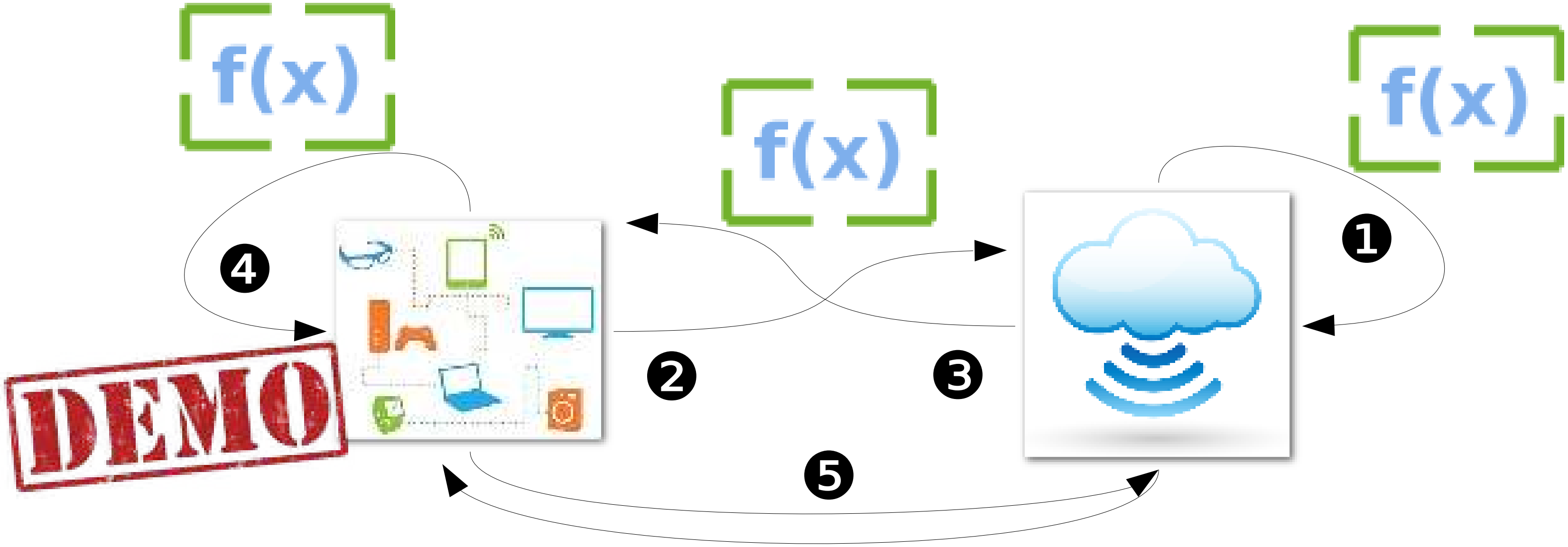
JSON
plain text
...

Your Python
functions!

max 1 per hour
triggers/actions
default params
...

[openwhisk.org]

Examples of FaaS: Environment



1) input from cloud, output to cloud
   e.g. incident management system
2) input from devices, ...
   e.g. robot vision processing
3) e.g. cloud-controlled CPS (door locks)
4) e.g. microphone to USB light
5) e.g. 1000s of microphones to USB lights

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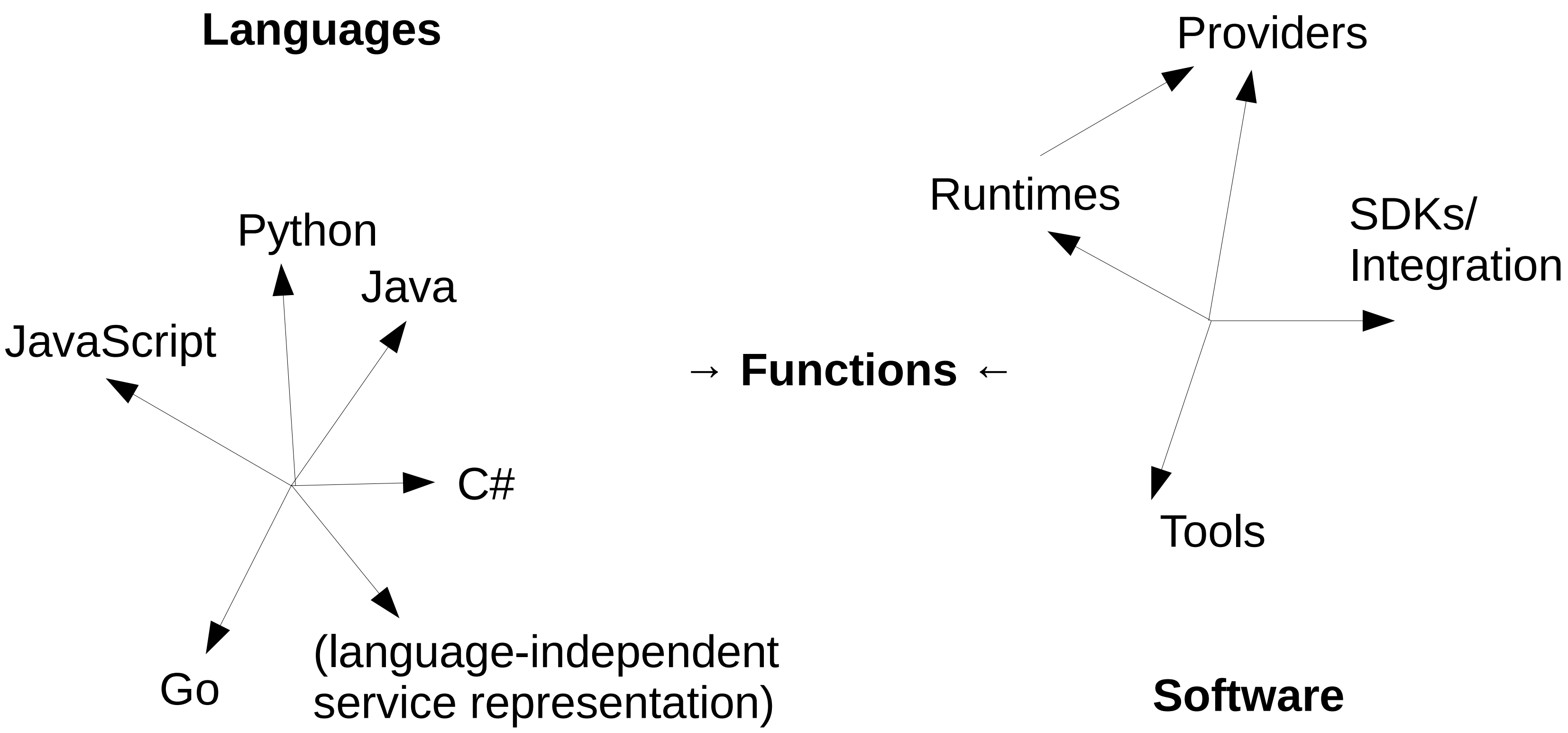
The FaaS Space



Languages

Python

Java

JavaScript

C#

Go

(language-independent service representation)

→ **Functions** ←

Providers

Runtimes

SDKs/ Integration

Tools

Software

The FaaS Space

AWS Lambda

Google Cloud Platform
Functions

OpenWhisk

Azure

webtask

hook.io

PyWren
[Lambda]

Chalice
[Lambda]

Apex
[Lambda]

Zappa
[Lambda]

Dawson
[Lambda]

Serverless Framework
[Lambda, OW, GCF, AF]

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FaaS (Docker)

Kubeless

Funktion

Fission

Picasso

Effe

Docker-LambCI

OpenLambda

Lever OS

Whisk-Mocha
[OpenWhisk]

X-Ray
[Lambda]

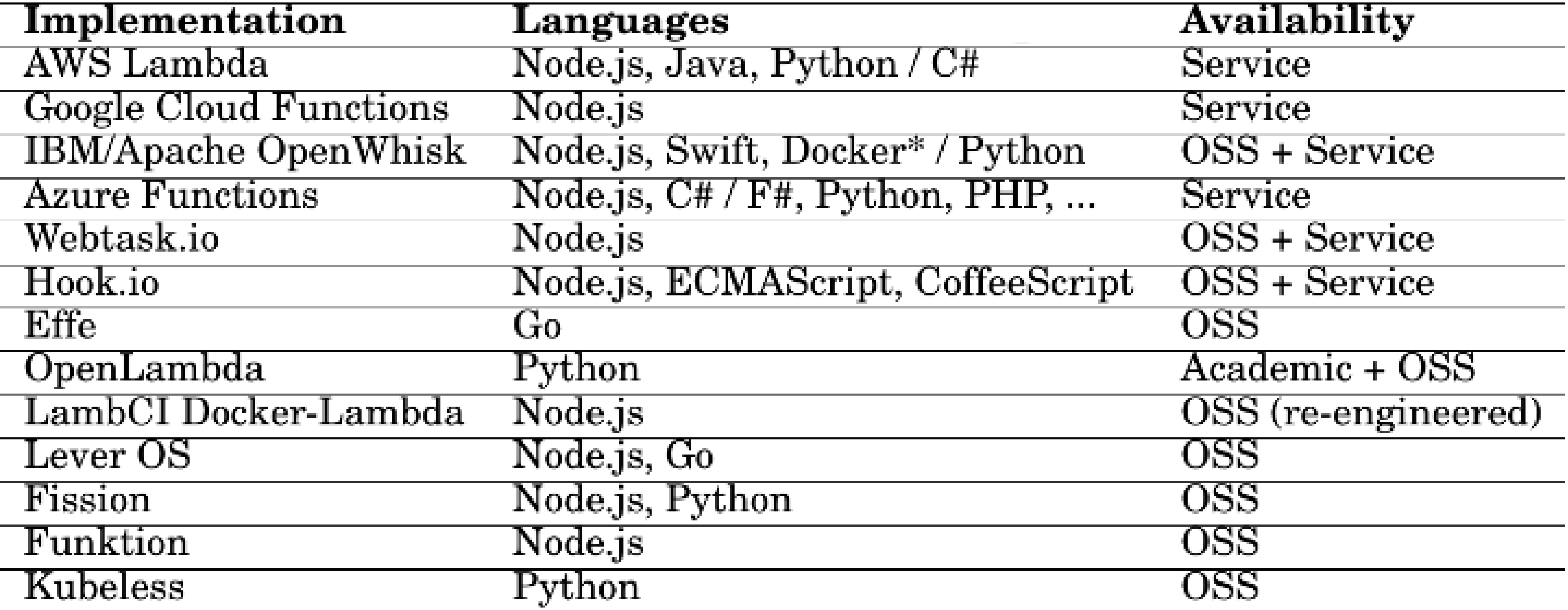
Step Functions
[Lambda]

MR Refarg
[Lambda]

LambDash
[Lambda]

The FaaS Space: Runtimes

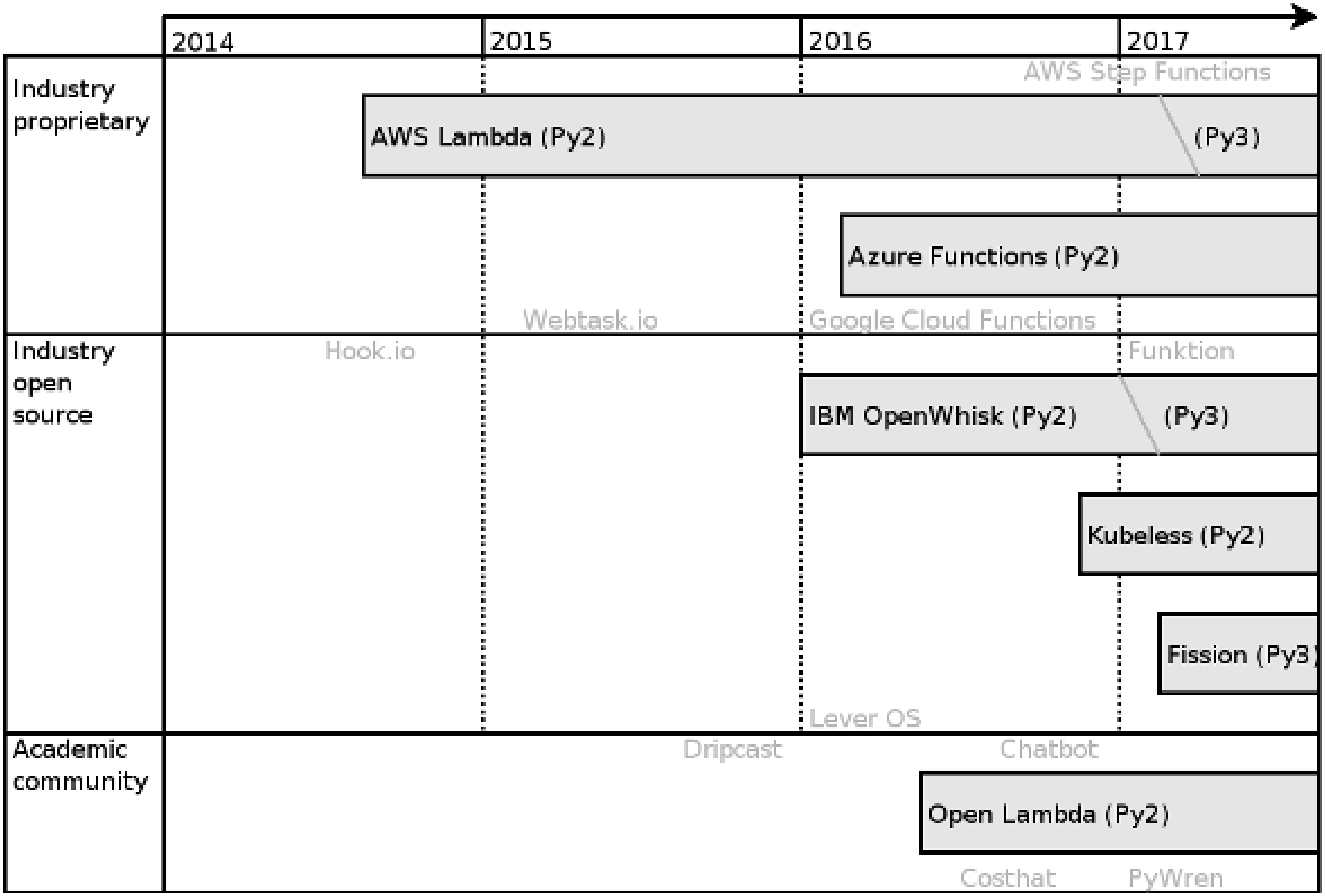
Function-as-a-Service offerings in greater detail...



Implementation	Languages	Availability
AWS Lambda	Node.js, Java, Python / C#	Service
Google Cloud Functions	Node.js	Service
IBM/Apache OpenWhisk	Node.js, Swift, Docker* / Python	OSS + Service
Azure Functions	Node.js, C# / F#, Python, PHP, ...	Service
Webtask.io	Node.js	OSS + Service
Hook.io	Node.js, ECMAScript, CoffeeScript	OSS + Service
Effe	Go	OSS
OpenLambda	Python	Academic + OSS
LambCI Docker-Lambda	Node.js	OSS (re-engineered)
Lever OS	Node.js, Go	OSS
Fission	Node.js, Python	OSS
Funktion	Node.js	OSS
Kubeless	Python	OSS

Trend: Sooner or later → gaps will be filled

The FaaS Space: Python runtimes



FaaS Synopsis in Python

AWS Lambda:

```
def lambda_handler(event, context):
        ‘‘‘
        event: dict
        context: meta information object
        returns: dict, string, number, ...
        ‘‘‘
        # ...
        return “result“
```

OpenWhisk:

```
def handler(input):
        ‘‘‘
        input: dict
        returns: dict
        ‘‘‘
        # ...
        return {}
```

Fission:

```
def main():
        ‘‘‘
        input: via flask.request.get_data()
        returns: str
        ‘‘‘
        # ...
        return “result“
```

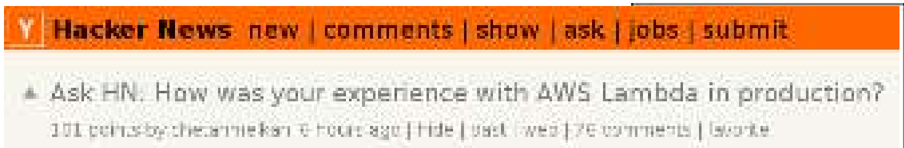
Azure Functions:

```
def main():
        from AzureHTTPHelper import\
        HTTPHelper
        input = HTTPHelper().post
        # ...
        open(os.environ[“res“], “w“).write(\
        json.dumps({“body“: “...“}))
main()
```

Further differences:

- function scoping (e.g. with/without export in JavaScript)
- function naming (mangling on client or service side)

FaaS Challenges (Engineers‘ View)



▲ Ask HN: How was your experience with AWS Lambda in production?

101 points by chetanmelkani 6 hours ago | hide | past | web | 76 comments | favorite

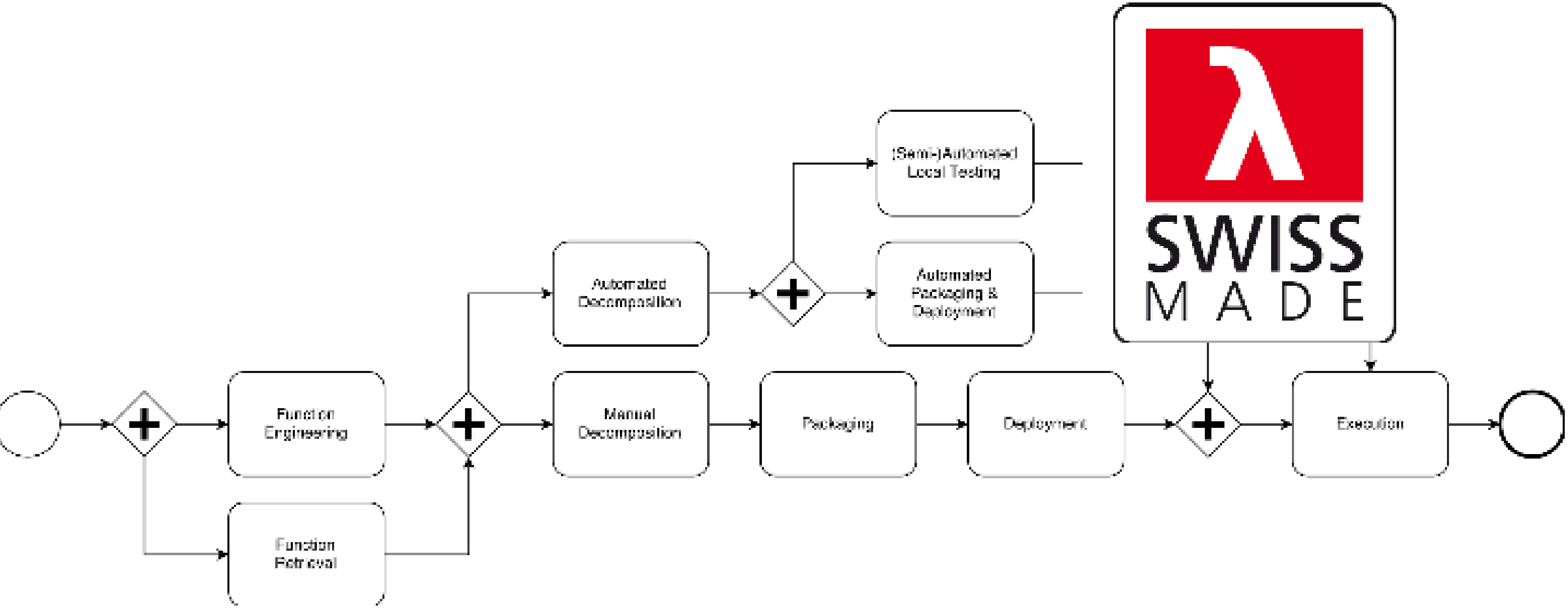
User	Development complicated	Monitoring insufficient	API/language substandard	Deployment slow	Expensive	Integration poor	all positive
callumlocke	X	X	X	X			
weeefun		X		X			
scrollaway	X	X	X		X		
CSDude		X		X			
davidvanleeuwen						X	
lanestp	X					X	
dblooman	X	X					
cameronmaske	X	X			X		
petarb	X	X		X		X	
beefsack							X
kehers			X		X	X	
tracker	X						
alexcasalboni							X
cntlzw		X				X	
xer							X
marcfowler						X	
Jdam							X
rmccue						X	
eknkc		X					
akhatri_aus		X		X			

use frameworks

do some crazy stuff to get metrics

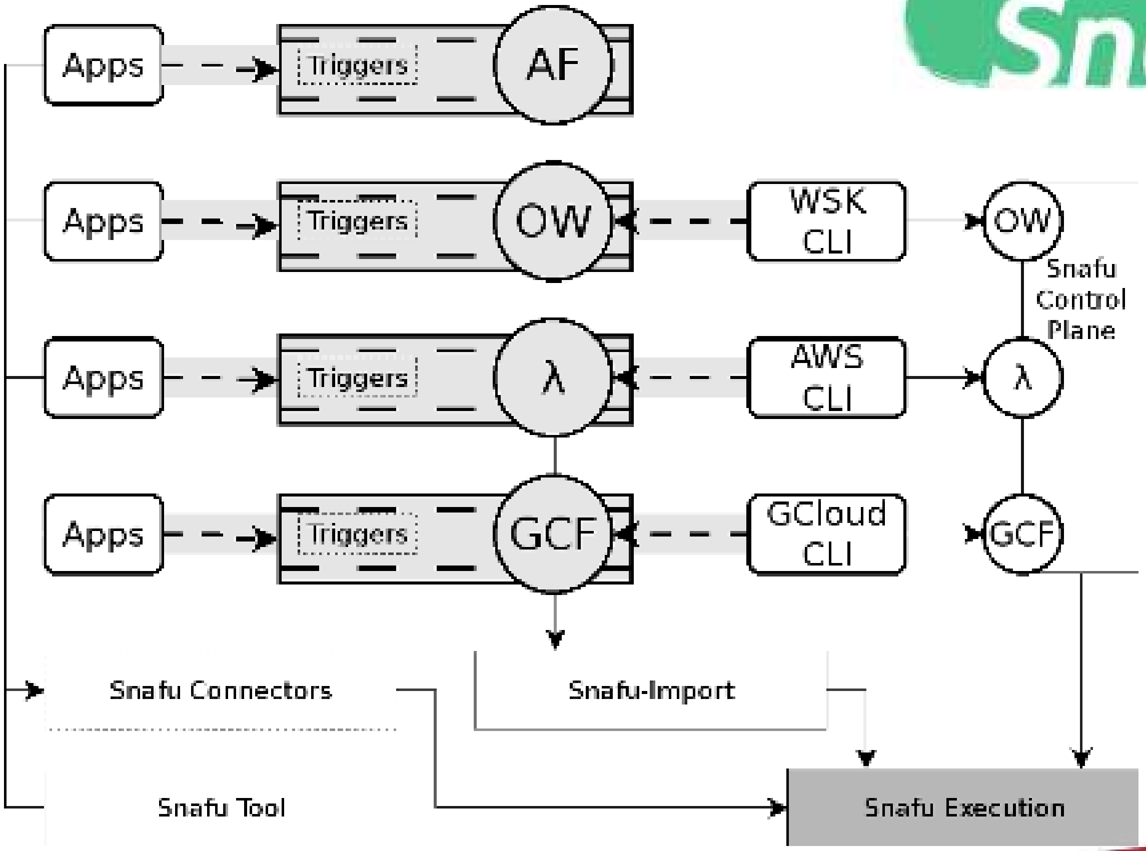
API gateway is terrible

FaaS Programmer Perspective



Snafu

The Swiss Army Knife of Serverless Computing



DEMO

FaaSification

→ Process of automated decomposition of software application into a set of deployed and readily composed function-level services.

FaaSification := code analysis + transformation + deployment + on-demand activation

Integration Categories:

- generic (code/function unit generation)
- single-provider integration
- multi-provider integration

Depth Categories:

- shallow (file to function)
- medium (function to lines)
- deep (line to many lines)

Decomposition Categories:

- static code analysis
- dynamic code analysis

“Lambdafication“:

- FaaSification to Lambda

Languages:
Java & Python

Termite

Podilizer

DEMO

The FaaS Space

AWS Lambda

Google Cloud Platform Functions

OpenWhisk

Azure

webtask

hook.io

PyWren [Lambda]

Chalice [Lambda]

Apex [Lambda]

Zappa [Lambda]

Dawson [Lambda]

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Serverless Framework [Lambda, OW, GCF, AF]

FaaS (Docker)

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Termite

Whisk-Mocha [OpenWhisk]

Podilizer

X-Ray [Lambda]

Step Functions [Lambda]

Lambada

MR Refarg [Lambda]

LambDash [Lambda]

Further Reading and FaaS Fun

Lama, Lambackup:

- https://arxiv.org/abs/1701.05945

Podilizer:

- https://arxiv.org/abs/1702.05510

Snafu:

- https://arxiv.org/abs/1703.07562

Lambada

- https://arxiv.org/abs/1705.08169

On arXiv Analytics:

On GitHub:

[github.com/serviceprototypinglab]

PyParis

Tutorial slides + transcript @ blog.zhaw.ch/icclab

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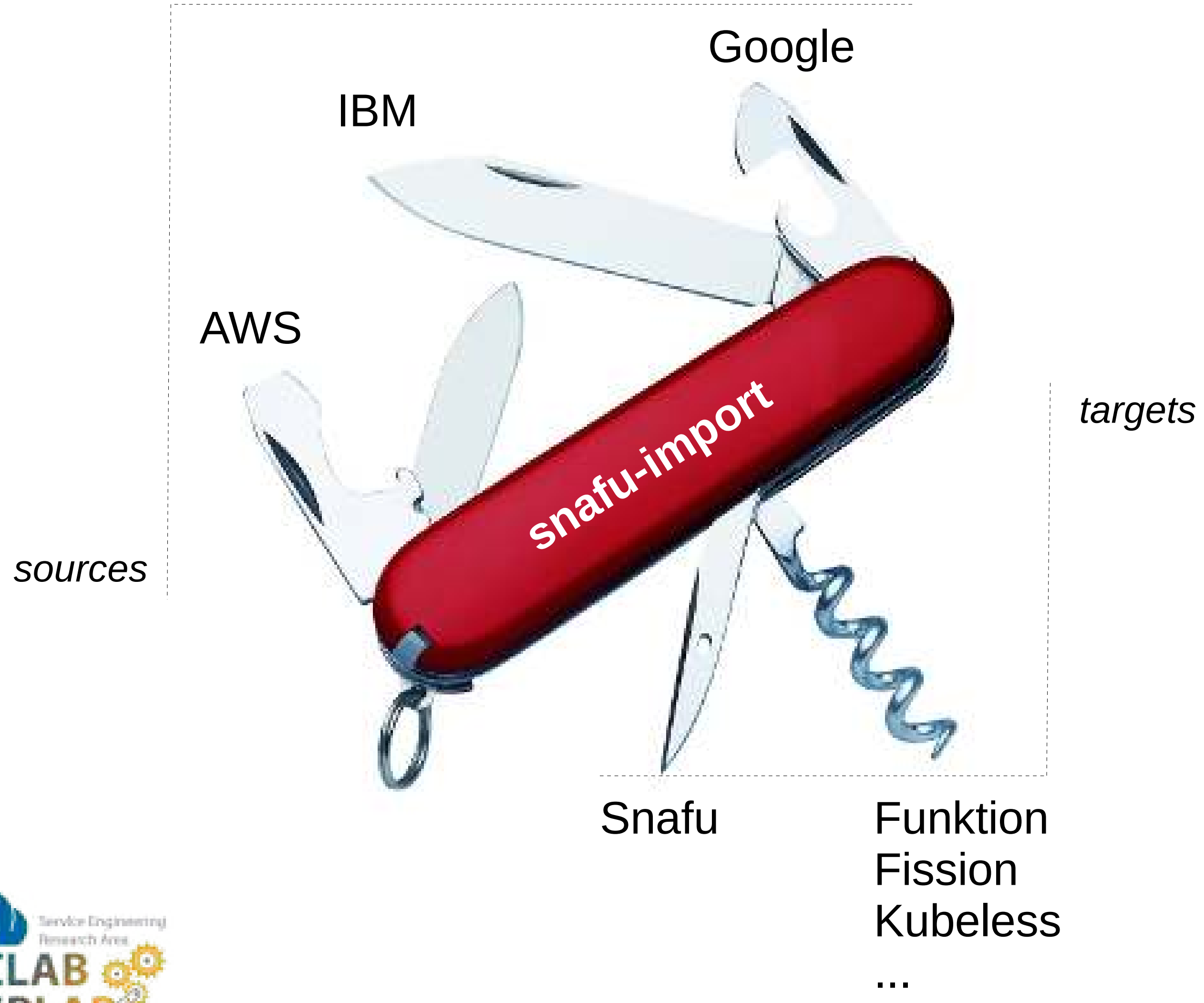
BACKUP...

Snafu

Integration into the wider FaaS ecosystem



Google

IBM

AWS

sources

targets

Snafu

Funktion
Fission
Kubeless
...

```
$ snafu-import \
--source <s> \
--target <t>
```

```
$ alias aws="aws \
--endpoint-url \
http://localhost:10000"

$ wsk property set \
--apihost \
localhost:10000

$ ./tools/patch-gcloud
```