Getting started with PHP on AWS Lambda

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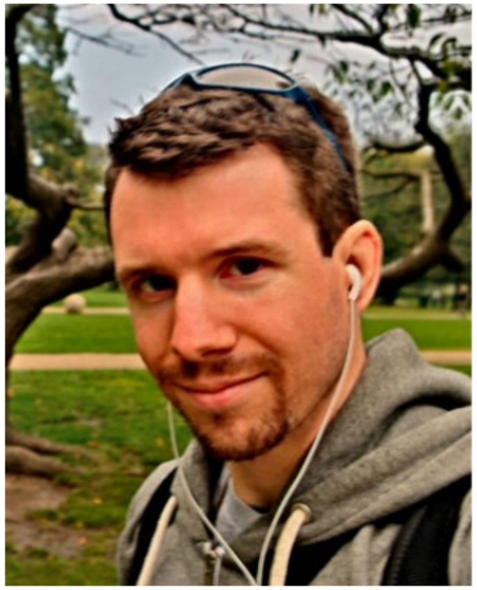
About me

- Senior PHP Developer
- Linux, PHP, MySQL since 2001
- studied at TU München
- working for Bringmeister in Berlin

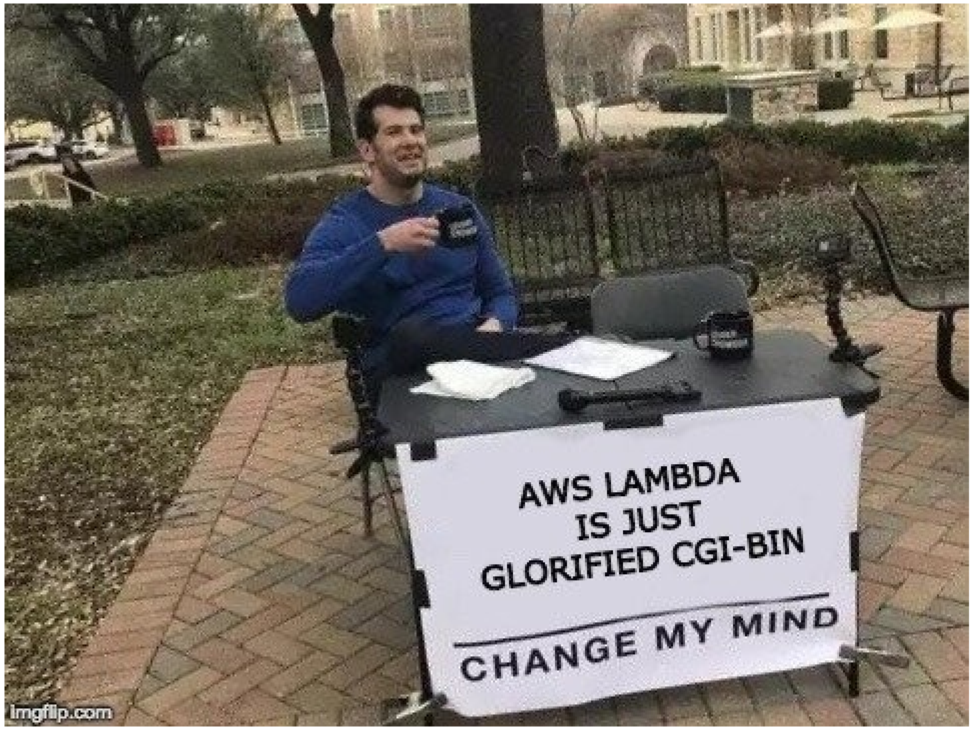


What is AWS Lambda?

- event-driven, serverless computing platform
- a managed service that runs code in response to events
- computing resources are automatically managed (scaling)
- purpose: build smaller, on-demand applications that are responsive to events
- starting a Lambda instance (VM) within 100ms of an event
- now also available for PHP!

sources:
https://en.wikipedia.org/wiki/AWS_Lambda
https://aws.amazon.com/de/blogs/apn/aws-lambda-custom-runtime-for-php-a-practical-example/

Serverless $\overset{?}{=}$ proprietary CGI



AWS Firecracker (microVM)

- lightweight virtual machine for serverless computing
- higher security level and isolation (uses own kernel, KVM)
- decreases startup time (100ms)
- decreases memory overhead (5MB)
- increases hardware utilization
- designed for short-lived workloads

sources:
https://firecracker-microvm.github.io/
https://fosdem.org/2019/schedule/event/containers_firecracker/attachments/slides/3188/export/events/attachments/containers_firecracker/slides/3188/Firecracker_as_a_container_runtime_FOSDEM2019_4_3.pdf

No longer required

- building, shrinking, uploading containers
- nginx, php-fpm
- host / kernel updates
- load balancers
- auto-scaling groups
- blue green deployments
- over-provisioning

Getting started

- compile PHP binary (bootstrap layer)
- composer.json, populate vendor folder (vendor layer)
- create php files (application layer)
- create zip files for php binary, php application, vendor folder
- set up a IAM role in AWS
- setup Lambda layers in AWS (upload zip files)
- create Lambda function in AWS (upload zip file)
- update Lambda function in AWS (upload zip file)

feels like how we deployed 10 years ago?

Compile php binary

```
# Build PHP for Lambda
FROM amazonlinux:2017.03.1.20170812 as builder

RUN sed -i 's;^releasever.*;releasever=2017.03;;' /etc/yum.conf && \
  yum clean all && \
  yum install -y autoconf bison gcc gcc-c++ libcurl-devel libxml2-devel openssl-devel

RUN curl -sL https://github.com/php/php-src/archive/php-7.3.1.tar.gz | tar -xz && \
  cd php-src-php-7.3.1 && \
  ./buildconf --force && \
  ./configure --prefix=/opt/php/ --with-openssl --with-curl --with-mysqli --with-pdo-mysql \
  --with-zlib --enable-mbstring --without-sqlite3 --without-pdo-sqlite --without-pear && \
  make install

# Create runtime container for use with lambdaci
FROM lambci/lambda:provided as runtime

COPY --from=builder /opt/php/bin/php /opt/bin/php


# sources:
# https://hub.docker.com/r/lambci/lambda/
# https://github.com/akrabat/lambda-php/tree/2019-01-31-article/hello-world
```

Compile PHP binary #2

Compile php binary:

```
docker build -t lambda-php-runtime .
```

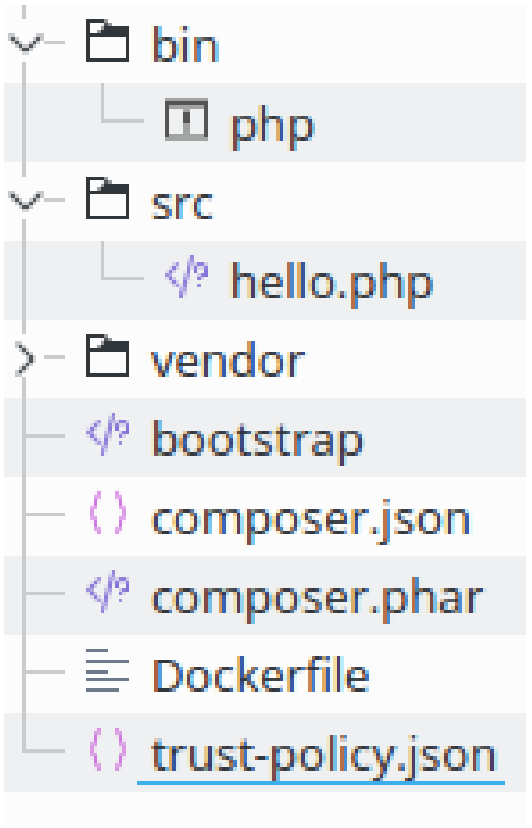
Test php binary:

```
docker run --rm --entrypoint /opt/bin/php lambda-php-runtime -v
docker run --rm --entrypoint /opt/bin/php lambda-php-runtime -m
docker run --rm --entrypoint /opt/bin/php lambda-php-runtime -r 'echo 0.7+0.1;'
docker run --rm --entrypoint /opt/bin/php lambda-php-runtime -r 'echo
json_encode(0.7+0.1);'
```

Copy php binary from container to host:

```
docker run --rm --entrypoint bash lambda-php-runtime -c "cat /opt/bin/php" >bin/php
```

PHP Lambda Project



```
bin
  php
src
  hello.php
vendor
bootstrap
composer.json
composer.phar
Dockerfile
trust-policy.json
```

hello.php:

```
<?php
    function hello($eventData)
    {
        print_r($eventData);
        return 'Hello all!';
    }
```

PHP Lambda Project #2

bootstrap:

```
#!/opt/bin/php
<?php
error_reporting(E_ALL);
require __DIR__ . '/vendor/autoload.php';
do {
    $request = getNextRequest();
    $handlerFunction = preg_replace('/[^a-zA-Z0-9_]+/', '', $_ENV['_HANDLER']);
    require_once $_ENV['LAMBDA_TASK_ROOT'] . '/src/' . $handlerFunction . '.php';
    $response = $handlerFunction($request);
    sendResponse($request['invocationId'], $response);
} while (true);
```

PHP Lambda Project #3

Local testing:

```
docker run --rm -v "$PWD":/var/task lambda-php-runtime hello '{"Hello": "bephpug"}'


START RequestId: 52fdfc07-2182-154f-163f-5f0f9a621d72 Version: $LATEST

Array(

    [invocationId] => 52fdfc07-2182-154f-163f-5f0f9a621d72

    [payload] => Array([Hello] => bephpug)

)

END RequestId: 52fdfc07-2182-154f-163f-5f0f9a621d72

REPORT RequestId: 52fdfc07-2182-154f-163f-5f0f9a621d72  Init Duration: 9.52 ms
Duration: 2.04 ms      Billed Duration: 100 ms Memory Size: 1536 MB    Max Memory
Used: 24 MB

"Hello all!"
```

Setup AWS Lambda

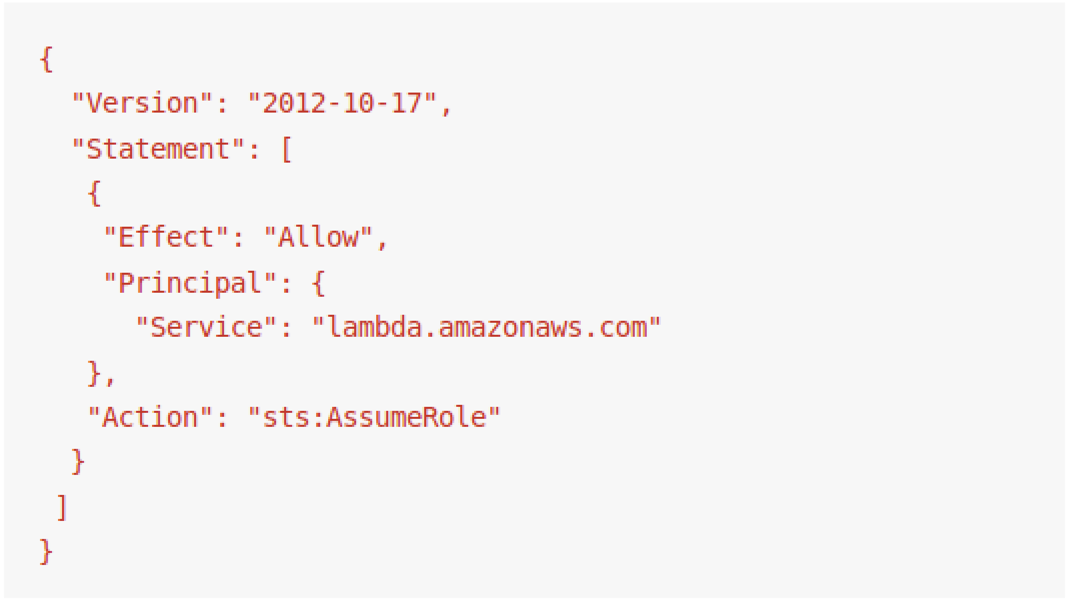
Create zip files (layers):

```
zip -r runtime.zip bootstrap bin
zip -r vendor.zip vendor/
zip hello.zip src/hello.php
```

source:
https://aws.amazon.com/de/blogs/apn/aws-lambda-custom-runtime-for-php-a-practical-example/

Setup AWS Lambda: IAM

trust-policy.json:



```
{
  "Version": "2012-10-17",
  "Statement": [
   {
    "Effect": "Allow",
    "Principal": {
      "Service": "lambda.amazonaws.com"
   },
   "Action": "sts:AssumeRole"
  }
 ]
}
```

source:
https://aws.amazon.com/de/blogs/apn/aws-lambda-custom-runtime-for-php-a-practical-example/

Setup AWS Lambda: create layers

```
aws iam create-role \
    --role-name LambdaPhp --path "/service-role/" \
    --assume-role-policy-document file://trust-policy.json

aws lambda publish-layer-version \
    --layer-name php-runtime --region eu-central-1 \
    --zip-file fileb://runtime.zip

aws lambda publish-layer-version \
    --layer-name php-vendor --region eu-central-1 \
    --zip-file fileb://vendor.zip
```

source:
https://aws.amazon.com/de/blogs/apn/aws-lambda-custom-runtime-for-php-a-practical-example/

Setup AWS Lambda: create function

```
aws lambda create-function --function-name php-hello --handler hello \
    --runtime provided --region eu-central-1 \
    --zip-file fileb://hello.zip \
    --role "arn:aws:iam::<given output from trust-policy upload>" \
    --layers "arn:aws:lambda:<given output from runtime zip upload>" \
                 "arn:aws:lambda:<given output from vendor zip upload" \
    --memory-size 128 --timeout 5
```

source:
https://aws.amazon.com/de/blogs/apn/aws-lambda-custom-runtime-for-php-a-practical-example/

Setup AWS Lambda: deploy function

```
zip hello.zip src/hello.php

aws lambda update-function-code --function-name php-hello \
    --zip-file fileb://hello.zip \
    --region eu-central-1
```

source:
https://aws.amazon.com/de/blogs/apn/aws-lambda-custom-runtime-for-php-a-practical-example/

Setup AWS Lambda: execute function

```
aws lambda invoke --function-name php-hello \
    --region eu-central-1 --log-type Tail --query 'LogResult' \
     --output text --payload '{"Hello": "bephpug"}' \
    output.txt | base64 --decode


cat output.txt
"Hello all!"
```

source:
https://aws.amazon.com/de/blogs/apn/aws-lambda-custom-runtime-for-php-a-practical-example/

Problems

- Event loop
  - you need to close your resources manually (!!)
  - you need to take care for memory leaks (!)
- Error handling
- Logging (read-only file system, only /tmp is writable)
- Caching
- Memory limit
- Maximum execution time
- Scaling PHP ≠ scaling databases
- Globals are not pre-populated ($_GET, $_POST, $_REQUEST, etc.)

Problems: API Gateway handling

```
function hello($eventData)
{
    $responseData = ...;
    $response = [];
    $response["isBase64Encoded"] = false;
    $response["statusCode"] = 200;
    $response["headers"] = ['Content-type' => 'application/json'];
    $response["body"] = json_encode($responseData);
    return $response;
}
```

Limitations

- max. 3 GB RAM
- max. execution time 15 min.
- max. layers: 5
- zip package: 50 MB (zipped), 250 MB (unzipped, incl. layers)
- /tmp storage: 512 MB
- Concurrent executions: 1000 (can be increased)

source: https://docs.aws.amazon.com/en_en/lambda/latest/dg/limits.html

Pricing

- Number of requests

  0.20 USD per 1M additional requests (1M requests for free per month)

- Duration of requests (billing rounded to 100ms)

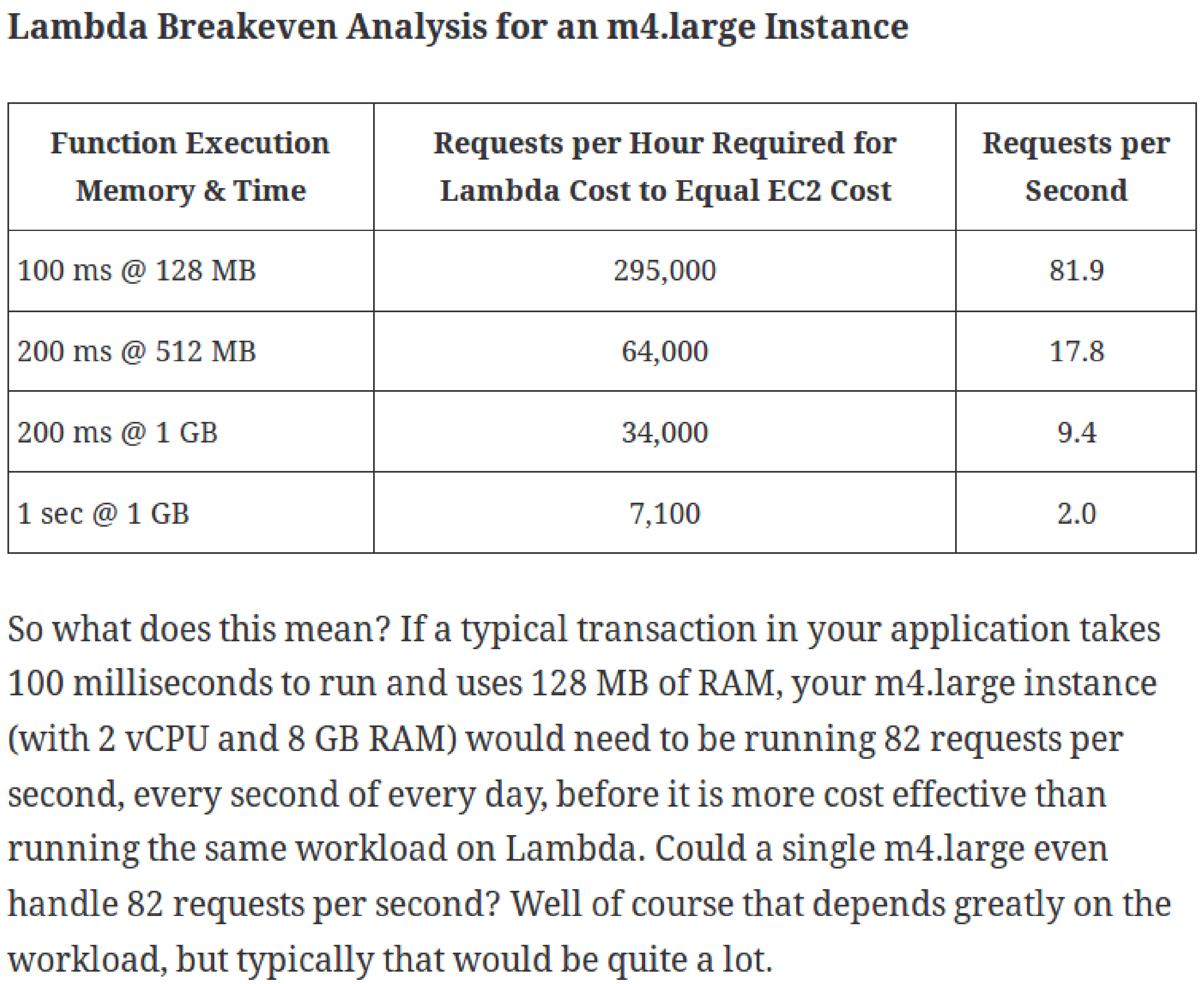
  0.00001667 USD per GB-second (400k GB-seconds for free per month)

- Example comparison (duration)

  Lambda: 8 x 1 GB = 9.6 USD per day (if continuously running)

  EC2: T3 Large 8 GB, 2 vCPU = 2.3 USD per day (on demand)

sources:
https://www.ec2instances.info
https://aws.amazon.com/lambda/pricing/



Lambda Breakeven Analysis for an m4.large Instance

Function Execution Memory & Time	Requests per Hour Required for Lambda Cost to Equal EC2 Cost	Requests per Second
100 ms @ 128 MB	295,000	81.9
200 ms @ 512 MB	64,000	17.8
200 ms @ 1 GB	34,000	9.4
1 sec @ 1 GB	7,100	2.0

So what does this mean? If a typical transaction in your application takes 100 milliseconds to run and uses 128 MB of RAM, your m4.large instance (with 2 vCPU and 8 GB RAM) would need to be running 82 requests per second, every second of every day, before it is more cost effective than running the same workload on Lambda. Could a single m4.large even handle 82 requests per second? Well of course that depends greatly on the workload, but typically that would be quite a lot.

source: https://www.trek10.com/blog/lambda-cost/

Use cases

- cronjobs (don’t pay for idle)
- websites with unknown traffic spikes
- event based workers (kinesis, sqs, s3, etc.)
- event based backend tasks (image resizing, creating pdfs, sending emails, etc.)
- integration with database events, e.g. RDS Aurora:

```
CALL lambda_async('arn:aws:lambda:...', '{"operation": "ping"}');

SELECT lambda_sync('arn:aws:lambda:...', '{"operation": "ping"}');
```

source: https://docs.aws.amazon.com/AmazonRDS/latest/AuroraUserGuide/AuroraMySQL.Integrating.Lambda.html

Thanks for listening!

Questions?

slides and sources:
https://github.com/thomasbley/php-lambda

Further reading

- PHP JIT:
  https://wiki.php.net/rfc/jit
- Using opcache for php-cli:
  https://tideways.com/profiler/blog/dodge-the-thundering-herd-with-file-based-opcache-in-php7
- Disable eval():
  https://github.com/mk-j/PHP_diseval_extension