universität innsbruck

Serverless Computing – Cheap, Easy and Powerful

DIH-WEST

Sashko Ristov

Agenda

- Introduction
  - About me
  - Introduction for the workshop
- FaaS
  - Task 1: Create a Simple Function
- BaaS Services
  - Task 2: Recognize faces from images
- Infrastructure-as-a-Code
  - Task 3: Deploy a function with Terraform
- Automation
  - Task 4: GitHub Actions + Terraform

Positions

- (June 2022 -) Assistant Professor (QE)
- 6 years Postdoctoral University Assistant (DPS)
- 3 years Assistant Professor (Skopje, N. Macedonia)
- 4 years Teaching and Research Assistant (Skopje, N. Macedonia)
- 8 years in Macedonian Telecom

Publications in 2022

- Journals / Magazines $\times 4$
  - **S. Ristov**, D. Kimovski, T. Fahringer, "FaaScinating Resilience for Serverless Function Choreographies in Federated Clouds," in *IEEE Trans. on Network and Service Management*, 2022.
  - **S. Ristov**, S. Pedratscher, T. Fahringer, “xAFCL: Run scalable function choreographies across multiple FaaS systems,” in *IEEE Transactions on Services Computing*, pp. 1–1, 2022
  - S. Pedratscher, **S. Ristov**, T. Fahringer, "M2FaaS: Transparent and Fault Tolerant FaaSification of Node.js Monolith Code Blocks", in *Elsevier Fut. Gen. Comp. Sys.*, Accepted on Apr. 19, 2022.
  - D. Kimovski, **S. Ristov**, R. Prodan, "Decentralized Machine Learning for Intelligent Health Care Systems on the Computing Continuum", in *IEEE Computer*, Accepted Jan. 2022.
- Top Conferences $\times 3$
  - **S. Ristov**, M. Hautz, C. Hollaus, R. Prodan. “Simulate Serverless Workflows and Their Twins and Siblings in Federated FaaS,” *ACM Symp. on Cloud Computing* (*SoCC*’22), San Francisco, Nov. 2022
  - **S. Ristov** and P. Gritsch. "FaaSt: Optimize makespan of serverless workflows in federated commercial FaaS," (*IEEE CLUSTER ’22*). Heidelberg, Germany, 182–194, 2022.
  - **S. Ristov**, S. Brandacher, M. Felderer, R. Breu, “GoDeploy: Portable Deployment of Serverless Functions in Federated FaaS”, *IEEE Cloud Summit 2022*, Fairfax, Virginia, USA, Oct. 2022
- Workshops $\times 2$
  - **S. Ristov**, C. Hollaus, and M. Hautz. "Colder Than the Warm Start and Warmer Than the Cold Start! Experience the Spawn Start in FaaS Providers," in *ApPLIED ’*22). Salerno, Italy, 35–39, 2022.
  - M. Gusev, **S. Ristov**, et al. „CardioHPC: Serverless Approaches for Real-Time Heart Monitoring of Thousands of Patients“, *WORKS’*22 Workshop (Supercomputing) , Dallas, USA, Nov. 2022

Serafin Plattner

- Bachelor student
- Bachelor thesis in serverless
- pyfOps: A pipeline for one-touch FaaSification, deployment, and testing of Python serverless functions
- On demand, we can show his pipeline, which integrates FaaSification and tests

Organization (Social)

- Show agenda on WEB
- Refreshments
- Two Breaks

Organization (Technical)

- FaaS familiarity?!
- Fork the repository `https://github.com/FaaSTools/faas-tutorial`
- Install Terraform
- AWS Account

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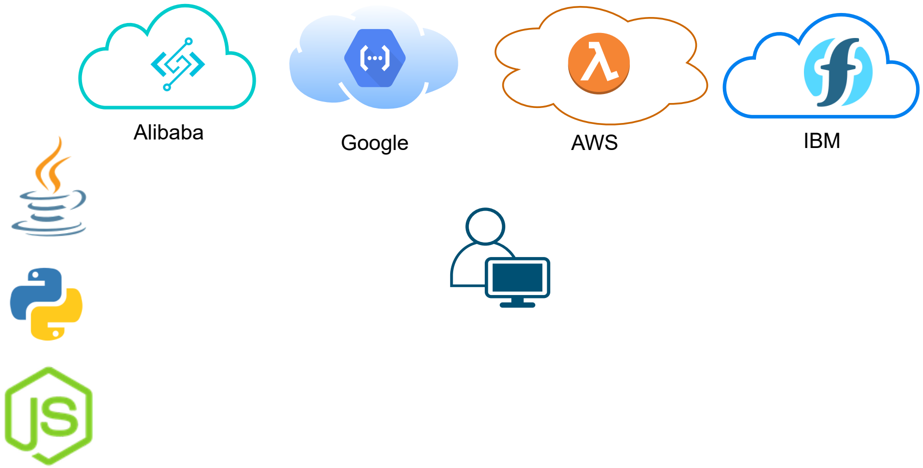
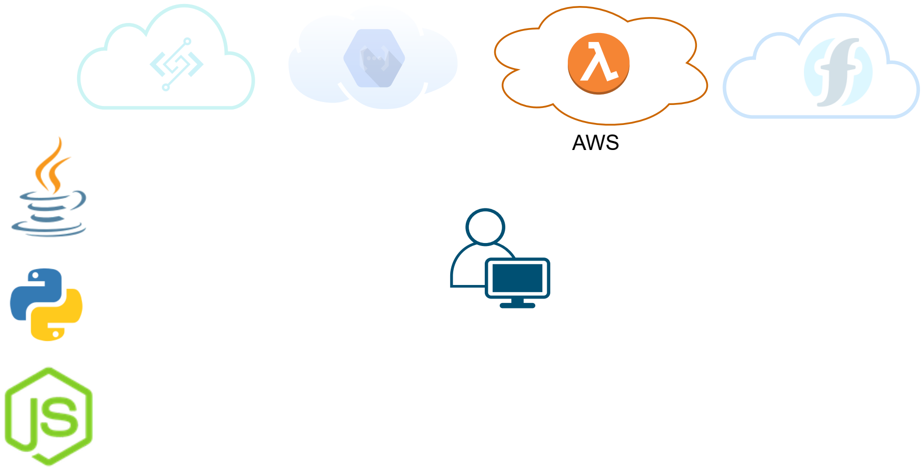
FaaS Options



FaaS Options



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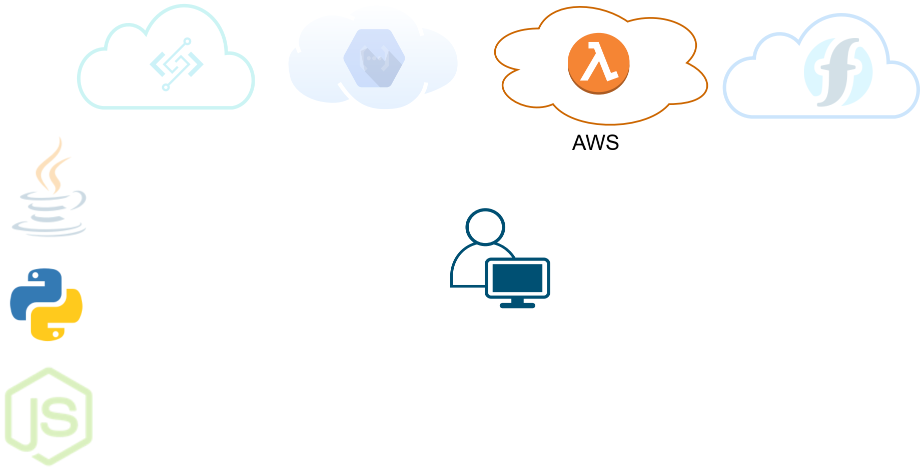

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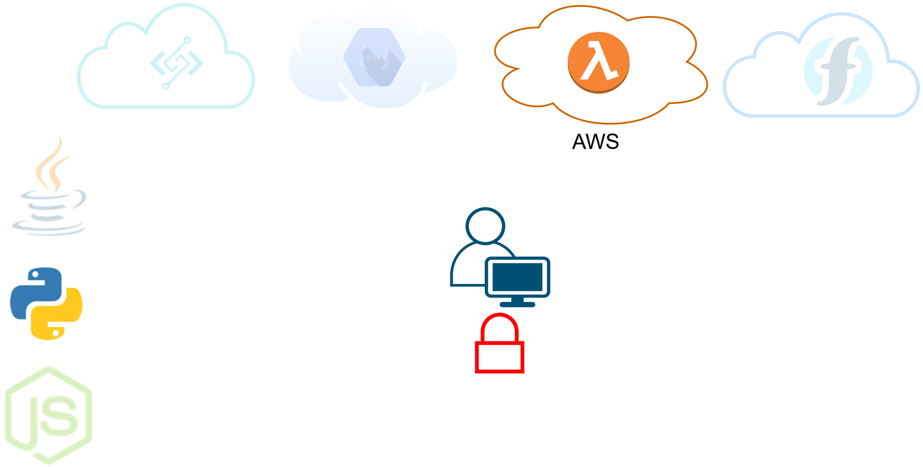

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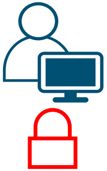
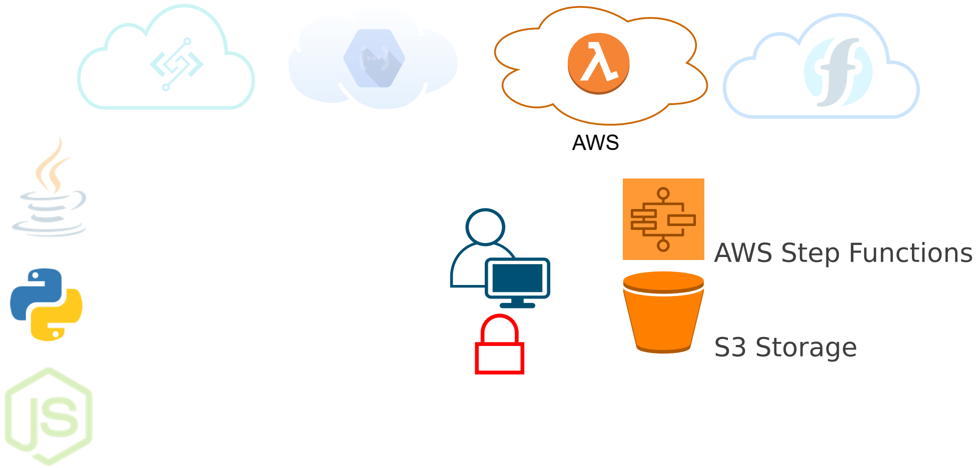


AWS

AWS Step Functions

FaaS Options



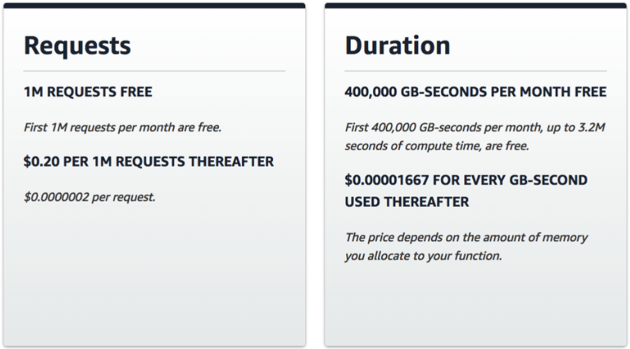
Pay as you go

- **Upload** a function **in any language**
- NodeJS, Swift, Java, Go, Scala, Python, PHP, Ruby
- **Other** programming languages
  - Prepare your **own container**

Charging?

- Fuel
  - Up to the 1/1000 (third digit after the "comma")

Charges for AWS Lambda



Requests

1M REQUESTS FREE

First 1M requests per month are free.

$0.20 PER 1M REQUESTS THEREAFTER

$0.0000002 per request.

Duration

400,000 GB-SECONDS PER MONTH FREE

First 400,000 GB-seconds per month, up to 3.2M seconds of compute time, are free.

$0.00001667 FOR EVERY GB-SECOND USED THEREAFTER

The price depends on the amount of memory you allocate to your function.

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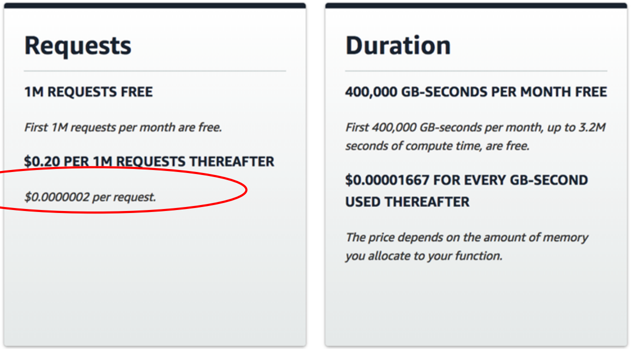

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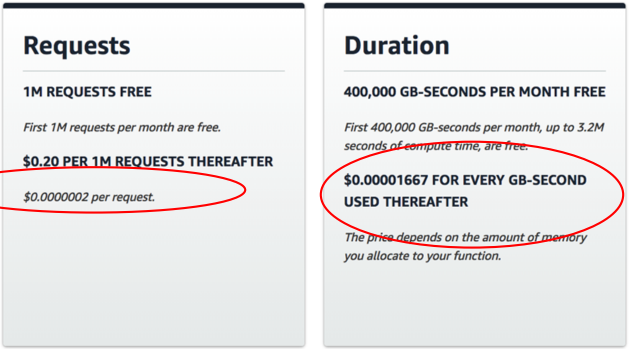

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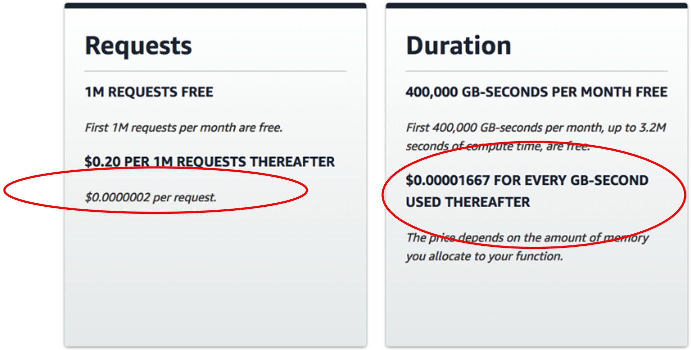

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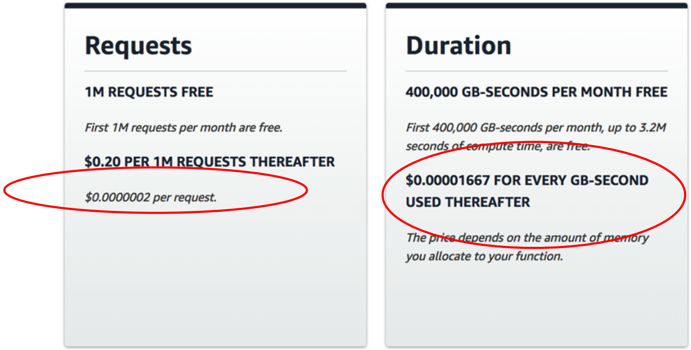
Free tiers both for requests and duration/resources

Charges for AWS Lambda



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Free tiers both for requests and duration/resources

Some FaaS providers do not charge invocations!

How to Code?

- Handler method
- Read keys from the JSON input data `event['key']`
- Code the functions
- Return the output `returnJSON`
- Show AWS Console

How to Deploy?

- Handler method format
- Region
- Memory
- Timeout
- Runtime Environment
- Role
- Show AWS Console

How to Run?

- Test input
- Cold/Warm start
- Timeout
- Runtime Environment
- Show AWS Console

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How to Code?

- Boto3 for Python
- `boto3.resource('s3')`
- `boto3.client('rekognition')`
- layers
- Deployment package is ZIP

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Infrastructure as a Code

- Automate and manage
  - infrastructures
  - platforms
  - services

Declarative vs. Imperative Approaches

- Declarative approach (IDEMPOTENT) - **Desired state** :
  - 20 servers
  - 2 FW
  - 3 VPCs

- Imperative approach - give **instructions**:
  - add 2 servers in AWS North Virginia
  - remove 2 servers in IBM Tokyo
  - add a FW
  - remove a security group

Infrastructure Provisioning / Coding Tools / Standard

- Terraform
- Open Tosca
- AWS Cloud Formation (provider specific)
- AWS SAM (provider specific)
- Serverless.com

Terraform

- tool for infrastructure provisioning, and platform and service deployment
- open source
- multi provider support

Terraform

- tool for infrastructure provisioning, and platform and service deployment
- open source
- multi provider support
- declarative approach

Terraform Use Cases

- Provision the environment
- Update the environment
- Replicate environment
  - From DEVELOPMENT to TESTING or PRODUCTION

Terraform Architecture

- Inputs
  - TF-config (.tf)
    - What to create / configure
  - TF-State

- Core (how to reach the desired state from the current one?)
  - compares the config and the state
  - what needs to be deployed / updated / destroyed

- Providers
  - IaaS (AWS, IBM, ...)
  - PaaS (Kubernetes)
  - Serverless (FaaS)

Terraform Actions

- `refresh`
  - query the provider about the current state
- create an execution plan (`init`)
  - which actions are necessary to be taken (no execution yet)
- `apply`
  - execute the plan
- `destroy`
  - destroy the infrastructure according to the plan (opposite from `apply`)

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GitHub Actions

- A pipeline to automatize actions after some push/pull on GitHub
- YAML-based script
- create `.github/workflows/main.yaml`
- https://docs.github.com/en/actions/using-workflows/workflow-syntax-for-github-actions

GitHub Actions Example

Open Actions -> Python application

QUESTIONS?

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