University of Pisa, Computer Science Department

Securing FaaS in the Fog

M. Pesaresi Seminar, 11/05/2020

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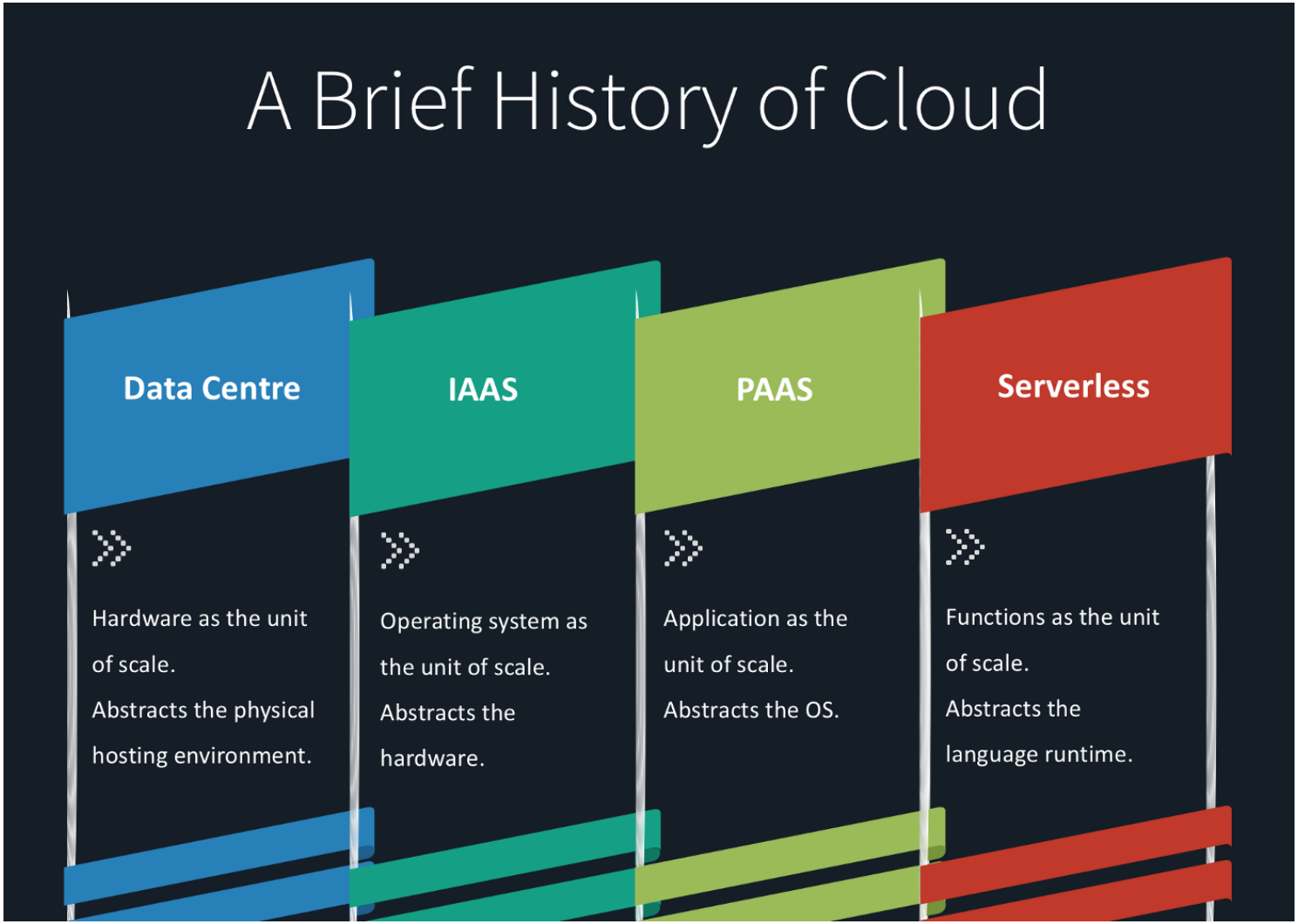
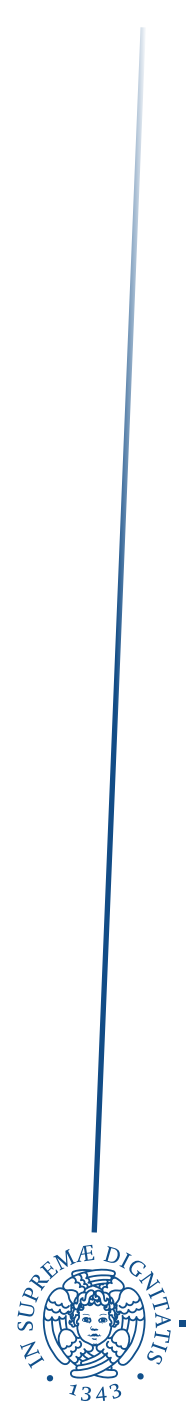
Outline

- What is FaaS?
- What is Fog?
- When FaaS meets Fog
- Securing FaaS in the Fog

Introduction





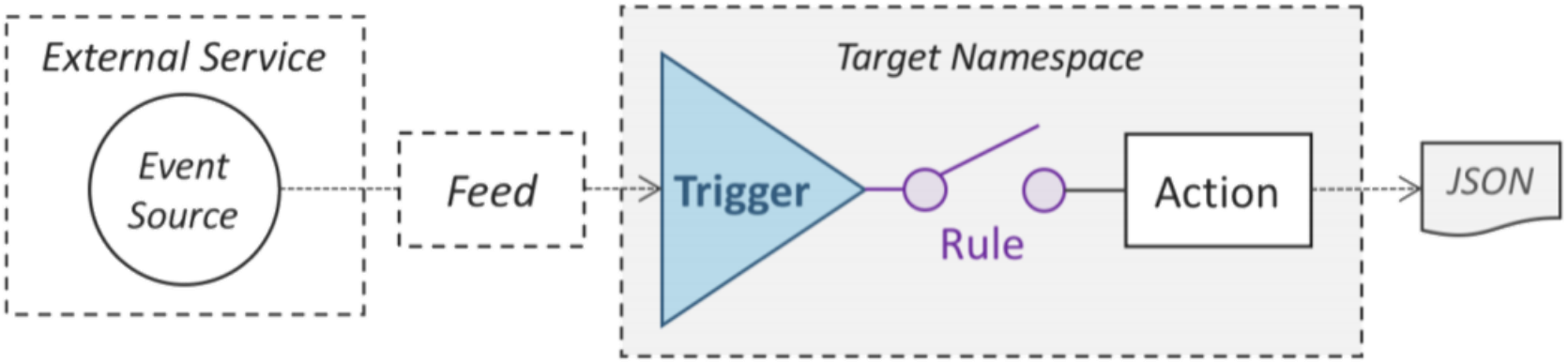
Serverless and FaaS

- The *function* is the core element
- Users provide the code of the function, the trigger and what to do with the results
- Event-driven
- No concern about infrastructure
- Business logic centred

Serverless and FaaS

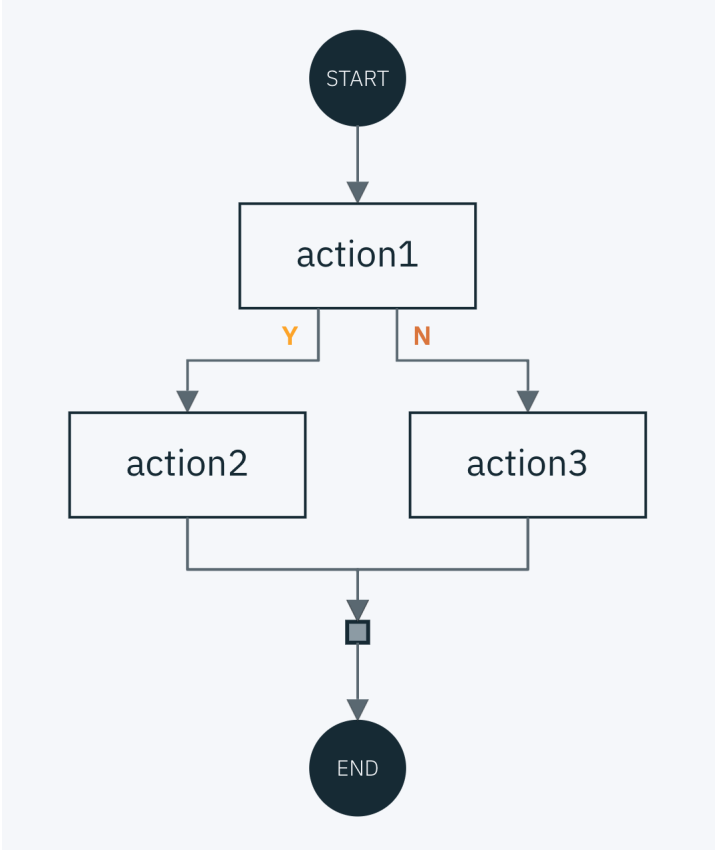
- Pro
  - Costs
  - Scalability
  - Productivity
  - Avg. latency
- Cons
  - No persistent state
  - Non concurrency controls
  - Cold starts

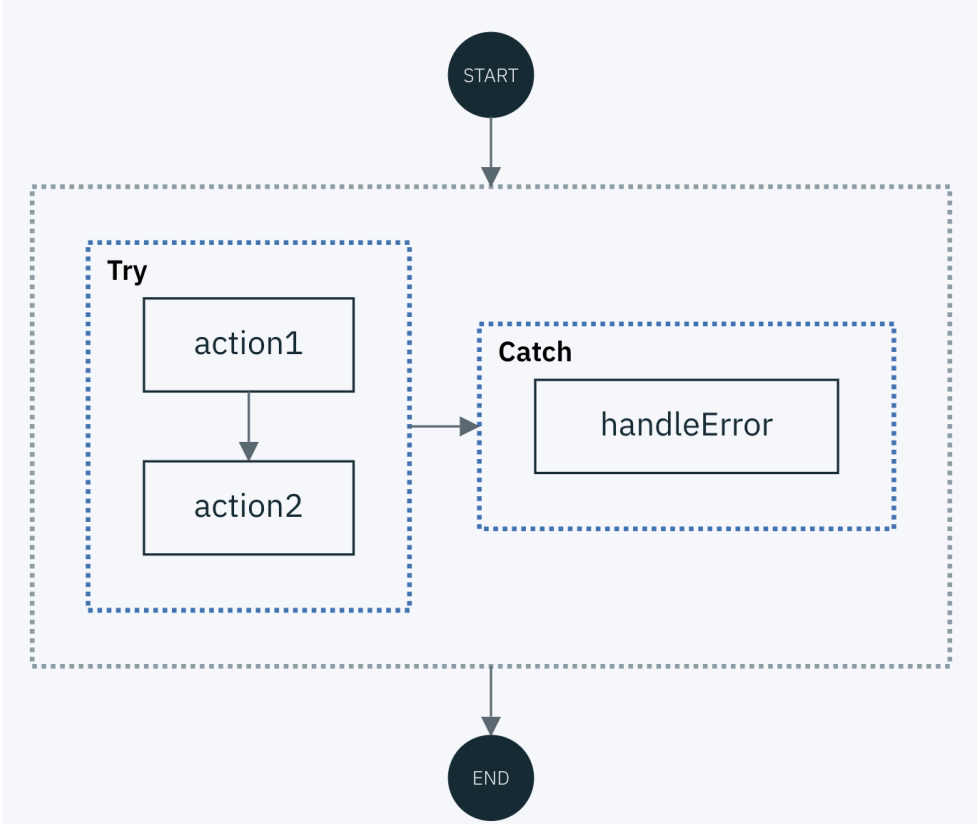
Programming model



Functions Composition

- Set of functions and chain of calls





Functions Orchestration

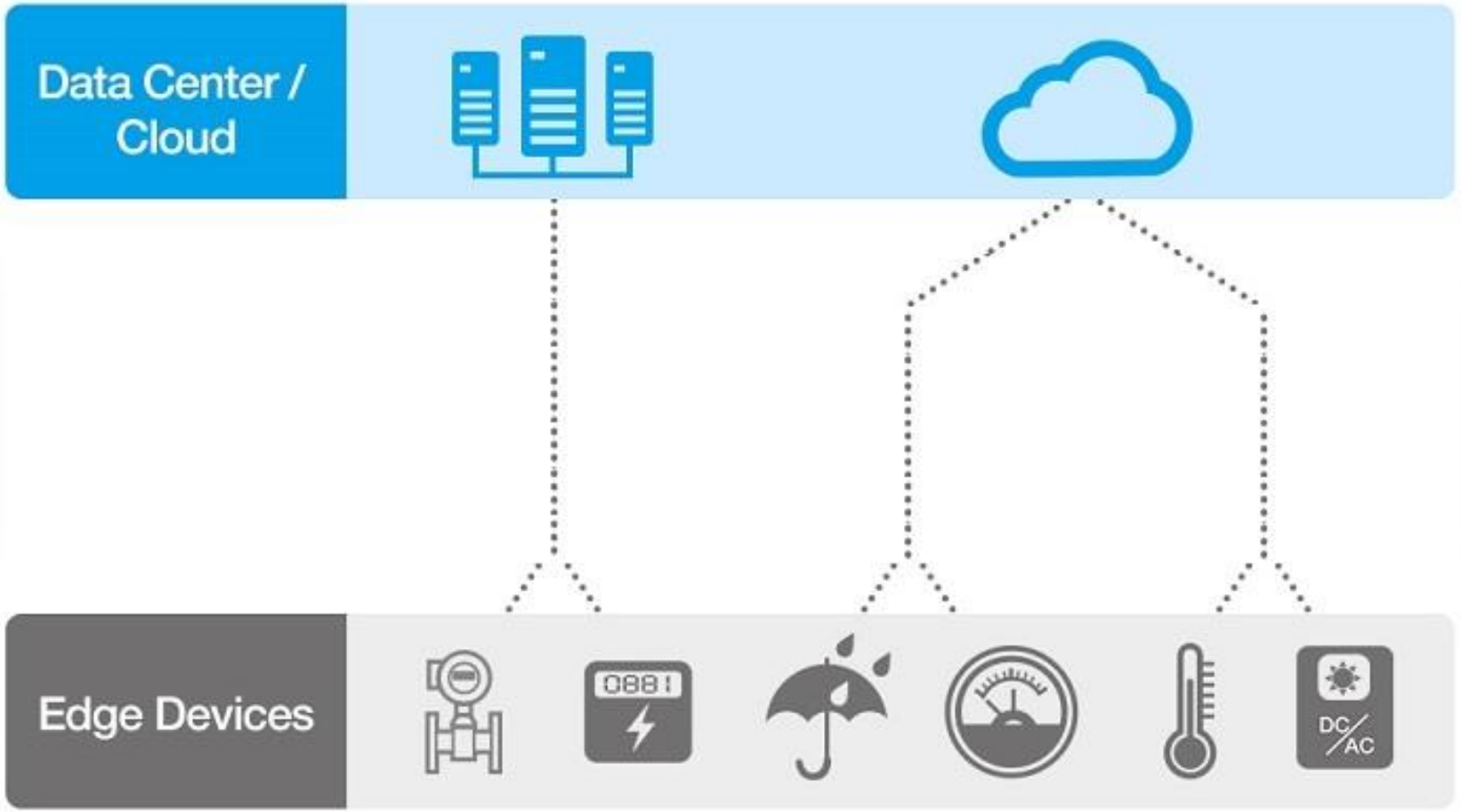
- Where the functions are deployed (node)
- Scheduling of functions
- Scaling

In FaaS orchestration is offered by the providers

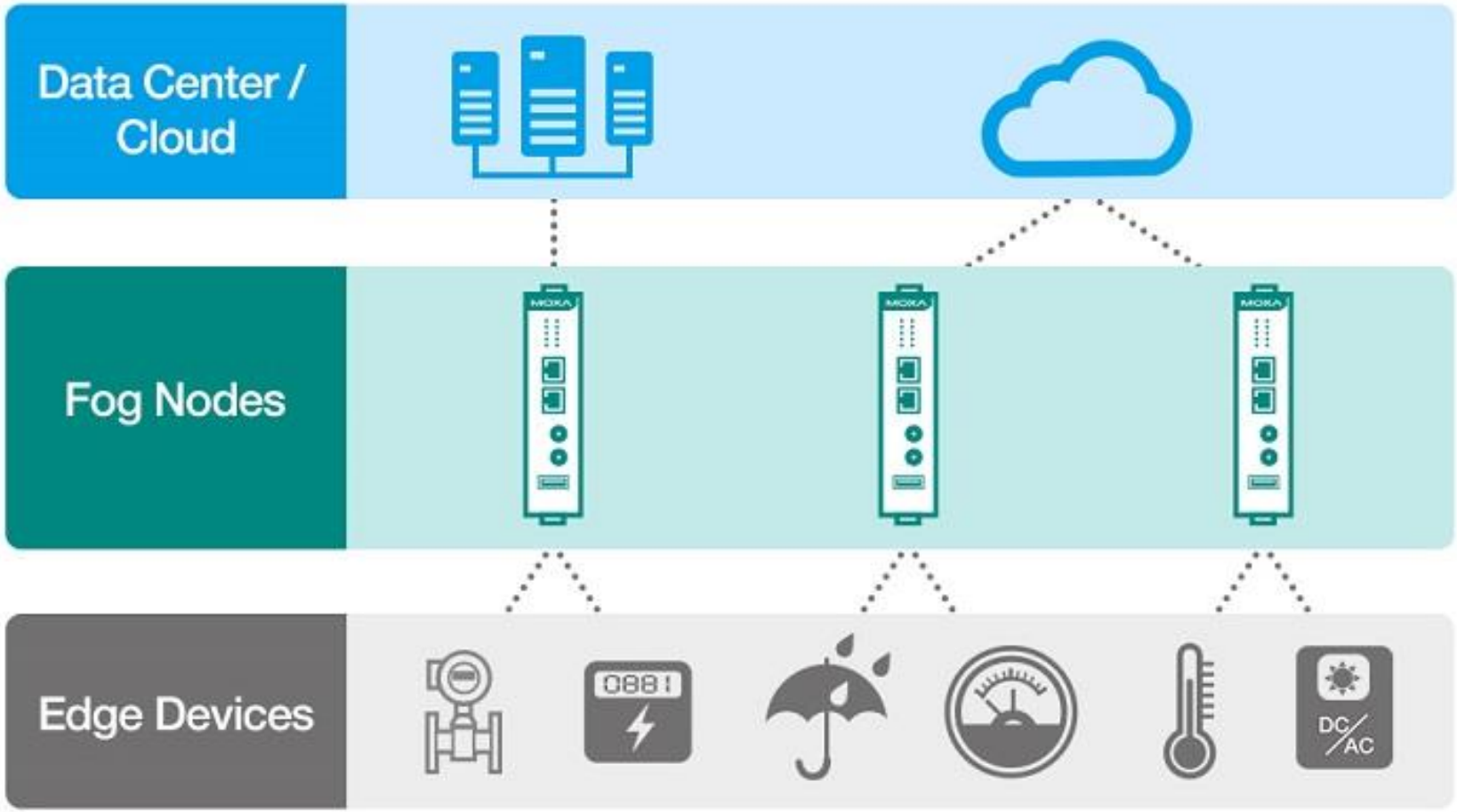
Recap FaaS

- Code the functions and give the composition
- Deploy them
- Use them
- Pay only the use

Fog Computing



Fog Computing



Fog Computing

- Pro
  - Improvement of QoS (i.e. latency and bandwidth)
  - It permits local computations and storage
  - Green energy
- Cons
  - Heterogenous devices
  - Less powerful devices

When FaaS meets Fog

Key idea: deploy functions on fog nodes

- Improve QoS of FaaS
- Event-driven programming
- Resources management

Challenges

- Orchestration on fog nodes
- Security and privacy
- Middleware support
- …

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Securing FaaS in the Fog

- Heterogenous devices bring a larger attack surface
- Data of functions used
- Information flow
- …

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Information flow security 101

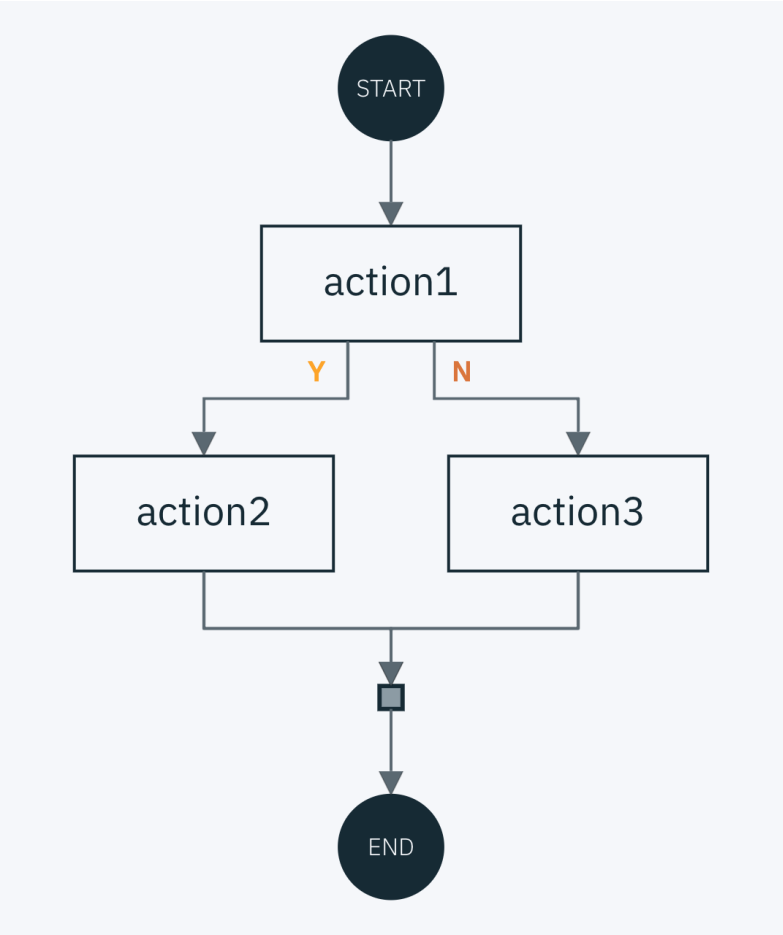
- Information are classified in secrecy levels
- Observing low levels information can disclose the higher level ones

x : top secret, y: low secret

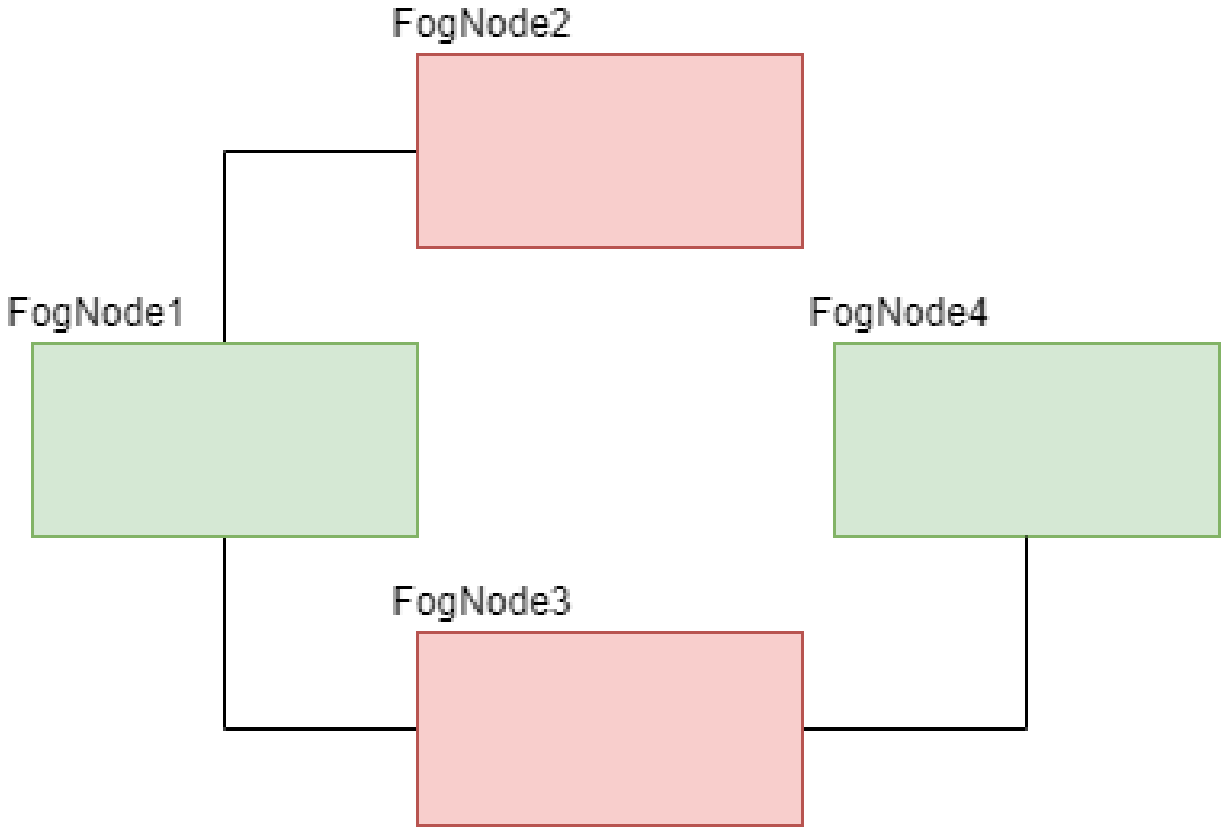
```
1  if (x == true)
2    y = true;
3  else
4    y = false;
5  // Since y == x, the label of y should be
6  // at least as restrictive than the label of x
```

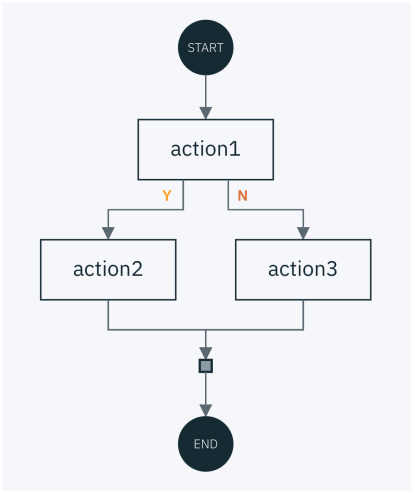
Information flow in FaaS & Fog Example 1

Only action1 is top secret



Information flow in FaaS & Fog Example 2





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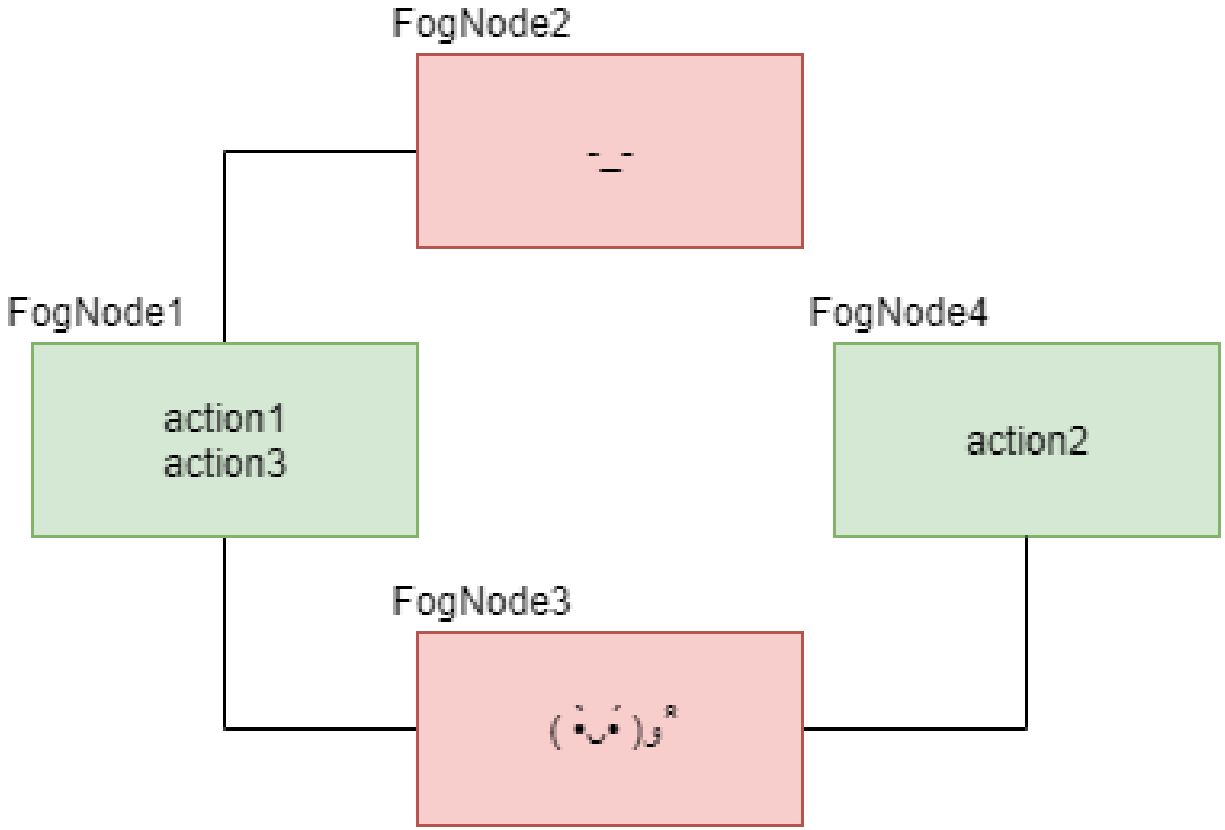

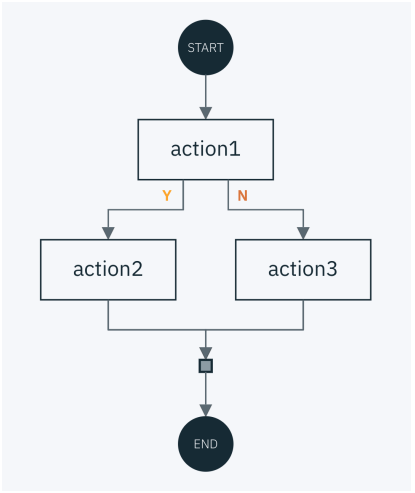

Conclusions

- FaaS on Fog is a green field
- Orchestration of functions
- Security and privacy

Thanks for your attention!

Questions?