

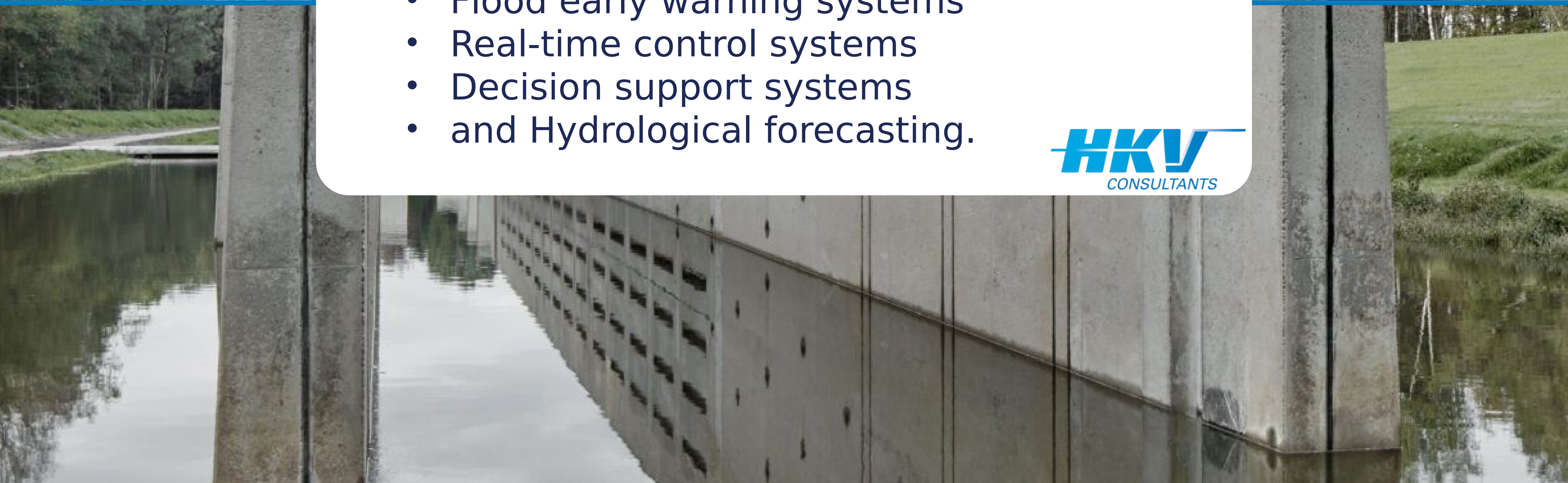
# Cloud-based horizontal scaling of queue-driven FSS

- Presented by Job Verkaik and Mattijn van Hoek (HKV)



We provide Consultancy and Services for:

- Flood early warning systems
- Real-time control systems
- Decision support systems
- and Hydrological forecasting.







We have in-depth knowledge of:

Hydrology, Hydraulics, Morphology  
Mathematics & AI, Remote sensing  
and **IT**.



## **Maintenance Burden**

Tired of updates? Security patches?

Having DBAs available?

Rebuilding indexes? Maintaining drives?

## **Computational Imbalance**

Resource waste? Cloud thrashing?

## **Organizational Costs**

Reduce your spending?

Reduce your energy & carbon footprint?





# Summary

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- **We can help** so *you can focus on your core business.*
- Make use of **horizontal scalability** and **elasticity** in the cloud.
- Scale FSS up, but especially scale **down**; Exhaling clouds. **In Production.**
- **Create synergy** between your database, Admin Interface API and K8s.
- **Reduce spending, reduce energy.**
- We **love** to cooperate.



# What we want

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Can we **control** the number of Forecasting Shell Services (**FSS**) within a **cloud-based** Delft-FEWS setup?

Especially, can we **scale down** resources when **not needed**?

**Reflection  
on cloud  
services &  
auto scaling**

**What we did**

**Benefits &  
Limitations**

**Way  
Forward**

# Reflection on **Cloud Services & Auto-Scaling**

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From **on-premise** to **cloud**  
- Lift and shift. Still **static**

- Reduce Maintenance Burden
- Reduce Organizational Costs
- Reduce Computational Imbalance



# Reflection on Cloud Services & Auto-Scaling



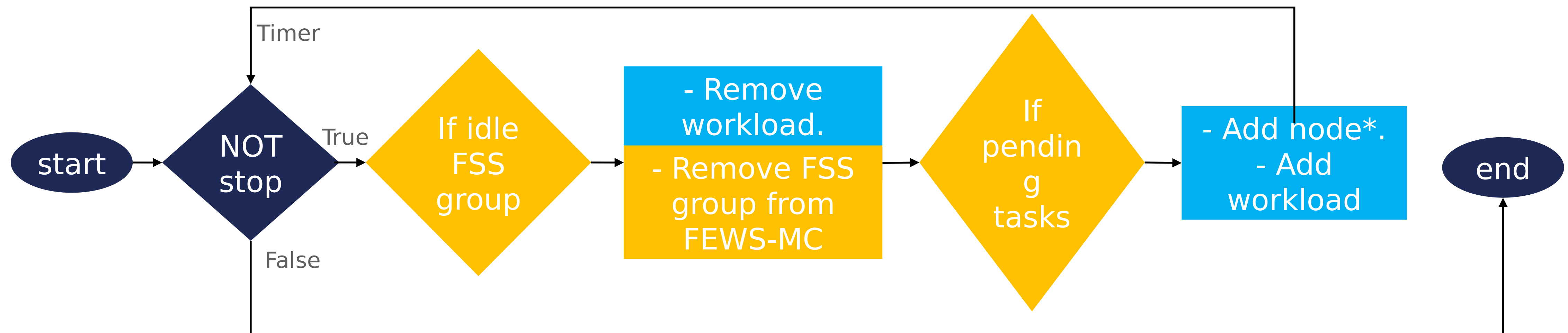
## Auto-scaling?

- Vertical Scaling ( $\updownarrow$  size)
  - Horizontal Scaling ( $\leftrightarrow$  instances)
- Scale FSS by CPU, memory or as workload. Cloud thrashing.
  - Scale FSS by tasks in FEWS queue



# Flowchart

## What we did



\* Using clever bookkeeping

 FEWS Admin Interface API  KubeCTL/Azure API



# Screencast

## What we did

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Left panel will show

- **Delft FEWS Operator Client**

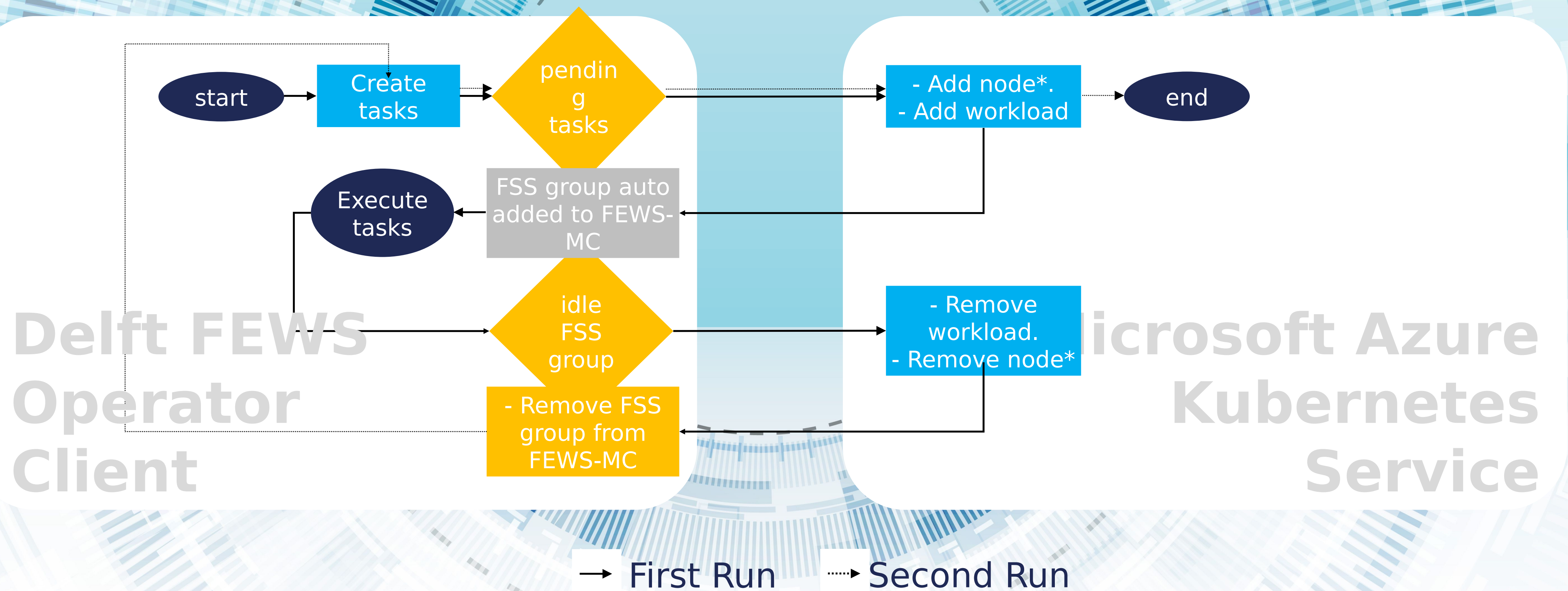
Right panel will show

- Few seconds Delft FEWS MC
- **Microsoft Azure Kubernetes Service**
- Few seconds Delft FEWS MC



# Screencast

## What we did









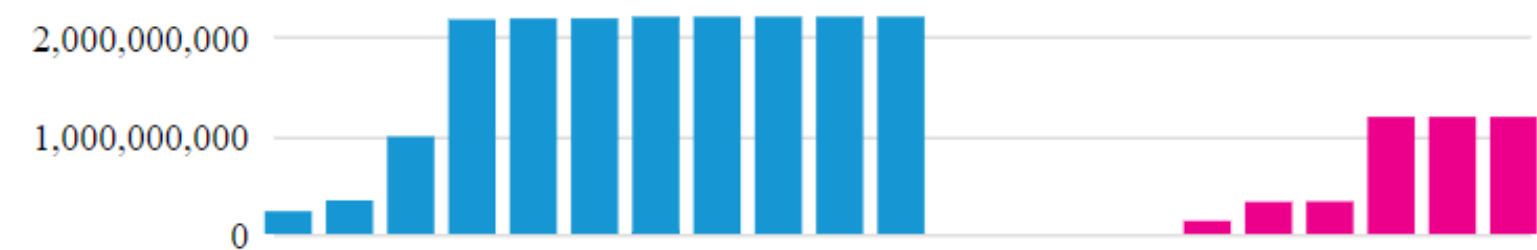
# Stats

## What we did

CPU Usage Percentage



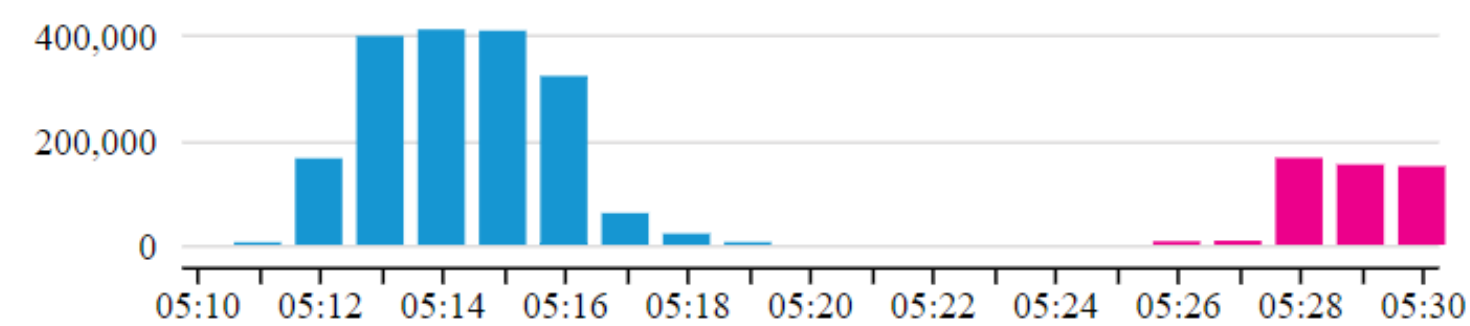
Memory RSS Bytes



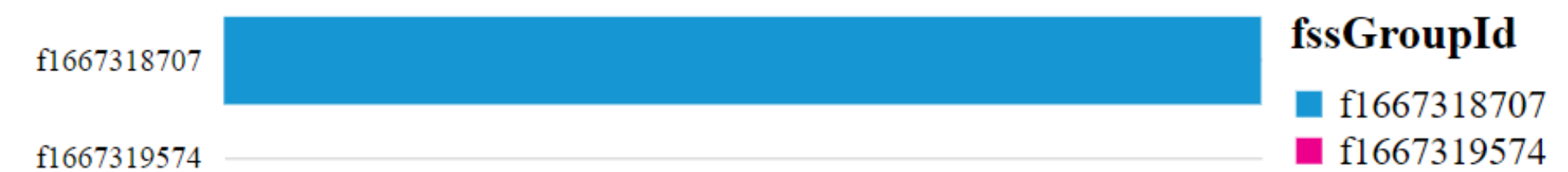
Network In Bytes



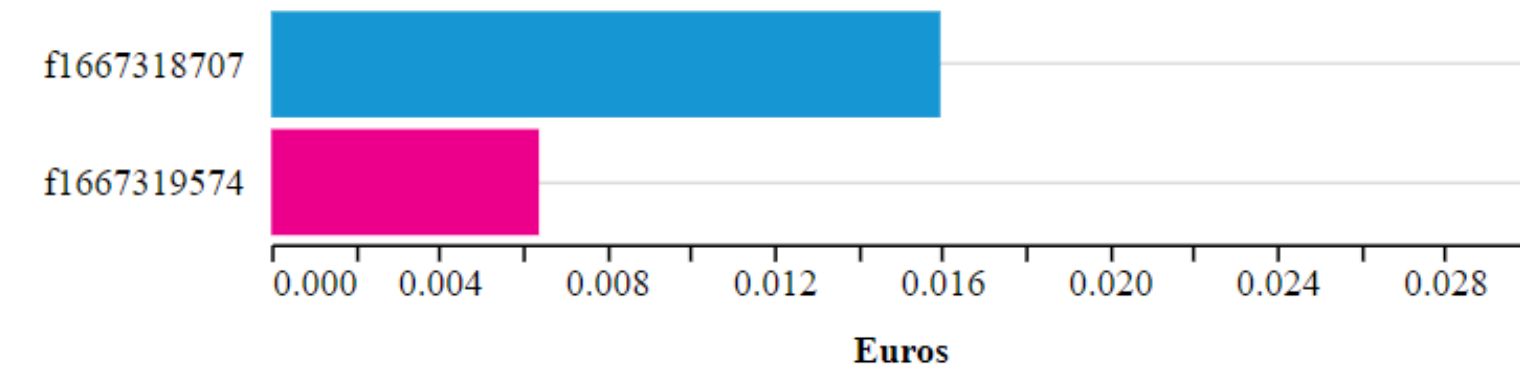
Network Out Bytes



Costs disk1 Euros



Costs vmss Euros





# Benefits & Limitations

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- ☐ **No resource waste**

No cloud thrashing

- ☐ **Reduction of cloud costs**

Lower Carbon Footprint

Utilized no. nodes.

Utilized no. pods.

Utilized I/O & memory





# Benefits & Limitations

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## Latencies

Time to add FSS: 5 minutes

Time to remove FSS: 3 minutes

## Type Tasks

Suitable for heavy tasks in parallel

- Short tasks can result in interference.
- Once FSS is up, queue is empty



# Way Forward



## Get ahead of the curve We invite you to discuss

- Reduce Maintenance Burden
- Reduce Organizational Costs
- Reduce Computational Imbalance

## Make FEWS WorkFlows Cloud Native

Can it?

## Proactive vs Reactive scaling

Wrt latencies: listen to queue or



# Meet the team

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We believe in the synergy between Delft-FEWS systems and Cloud Infrastructure. You too?



Job Verkaik  
[verkaik@hkv.nl](mailto:verkaik@hkv.nl)



Mattijn van Hoek  
[hoek@hkv.nl](mailto:hoek@hkv.nl)



Rolf Waterman



Marc Jansen



A high-speed photograph of a butterfly emerging from a large splash of water. The butterfly is in the center, with its wings spread, surrounded by numerous water droplets and splashes. The background is a soft, warm yellow-orange gradient. The text 'Join Us' is in the top left, and a quote is in a red box on the right. The HKV CONSULTANTS logo is in the bottom right.

Join Us

Just when the  
caterpillar thought the  
**world was over**, it  
became a **butterfly**.