NebulOuS

Open Call #1

1ST Q&A WEBINAR

5 MARCH 2024

12:00 CET

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Directorate-General for Communications Networks, Content and Technology. Neither the European Union nor the granting authority can be held responsible for them.

Webinar agenda

- Welcome
- Project presentation 20’
- NebulOuS FSTP 10’
  - Overview Open Call 1
  - How to apply
- Q&A 30’

Funded by
the European Union

NebulOuS

A META OPERATING SYSTEM FOR BROKERING HYPER-DISTRIBUTED APPLICATIONS ON CLOUD COMPUTING CONTINUUMS

Funded by
the European Union

NebulOuS

OUR VISION

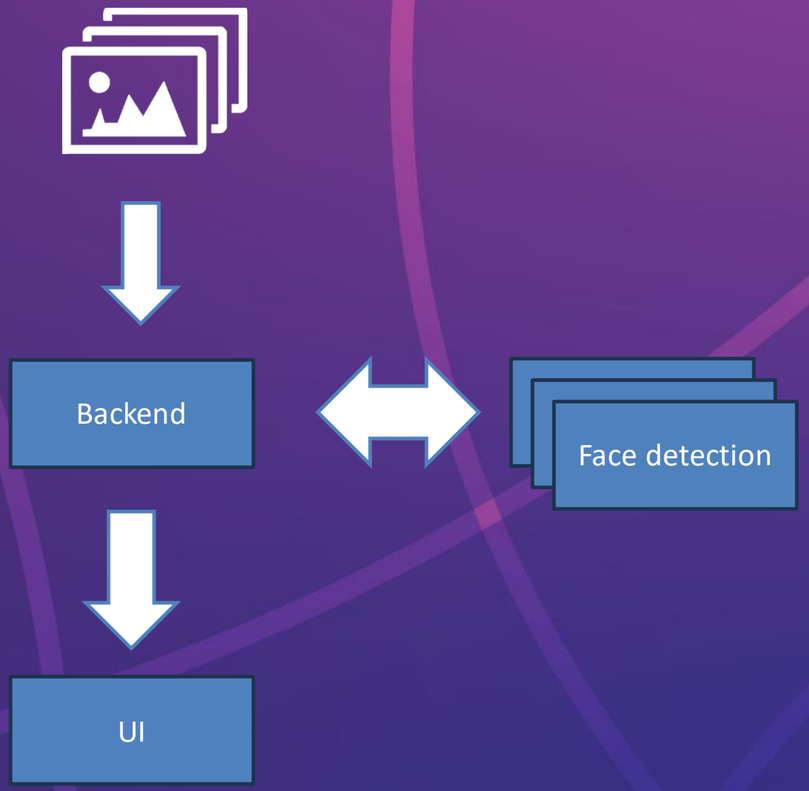
NebulOuS will develop a novel Meta Operating System and platform that seamlessly exploit edge and fog nodes, in conjunction with multi-cloud resources, to cope with the requirements posed by low latency applications.

Funded by
the European Union

Application modeling

NebulOuS

- Application modelling language based on OAM to express:
  - Application topology, requirements and scalability
  - Metrics and service level objectives
  - Optimization criteria
- Specialized semantics for expressing data-stream processing-oriented applications and workflow-oriented applications.



Face detection application architecture

Funded by
the European Union

Application modeling

NebulOuS

Application topology, requirements and scalability

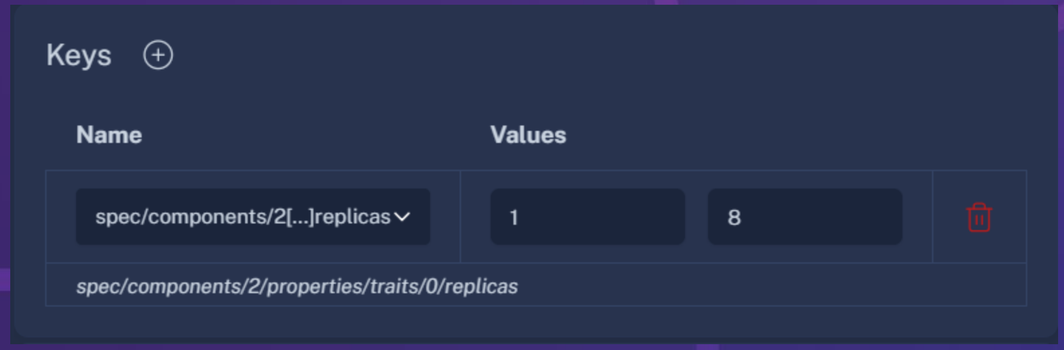
```yaml
apiVersion: core.oam.dev/v1beta1
kind: Application
metadata:
  name: surveillance-demo
  namespace: default
spec:
  components:
    - name: app-backend
      type: webservice
      properties:
        image: dummyapp/backend
        cpu: "2"
        memory: "2000Mi"

    - name: app-ui
      type: webservice
      properties:
        image: dummyapp/ui
        cpu: "0.3"
        memory: "512Mi"

    - name: face-detection
      type: webservice
      properties:
        image: dummyapp/face-detection
        traits:
          - type: scaler
            properties:
              replicas: 1
```

Open Application Model (OAM) of the application with:

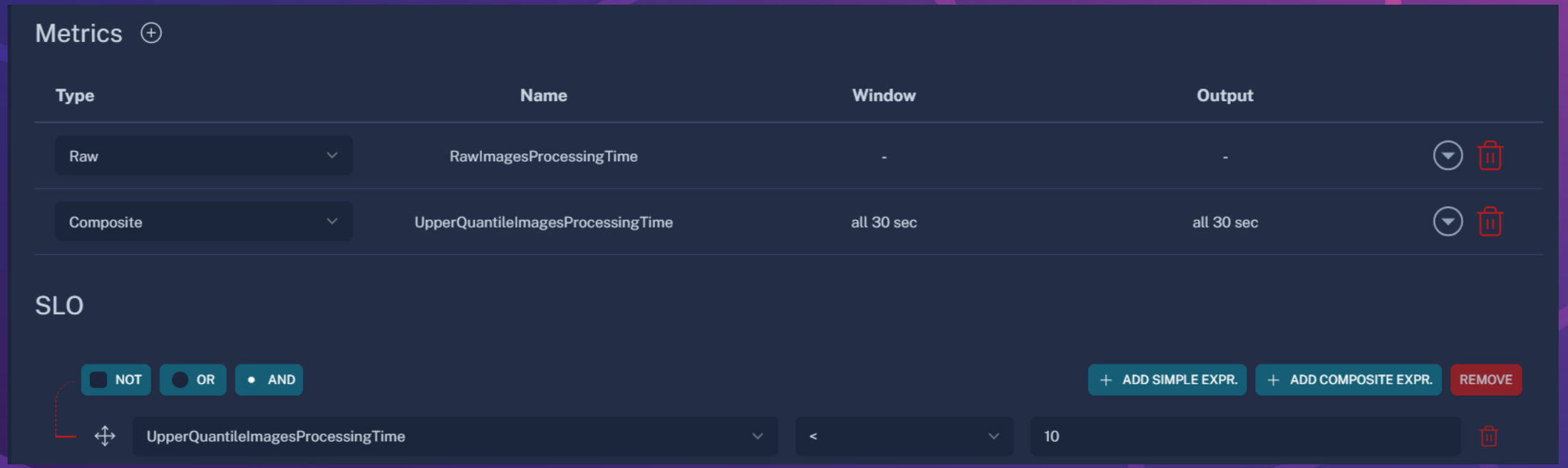
- Components
- Requirements
- Variable ranges for optimization



Application modeling

NebulOuS

Metrics and service level objectives



System metrics: CPU usage, RAM usage, Disk I/O....

Application specific metrics: Time to process a request, number of pending requests, etc.. Collected by OpenMetrics/Prometheus or PUSH using STOMP.

Application modeling

NebulOuS

Optimization model

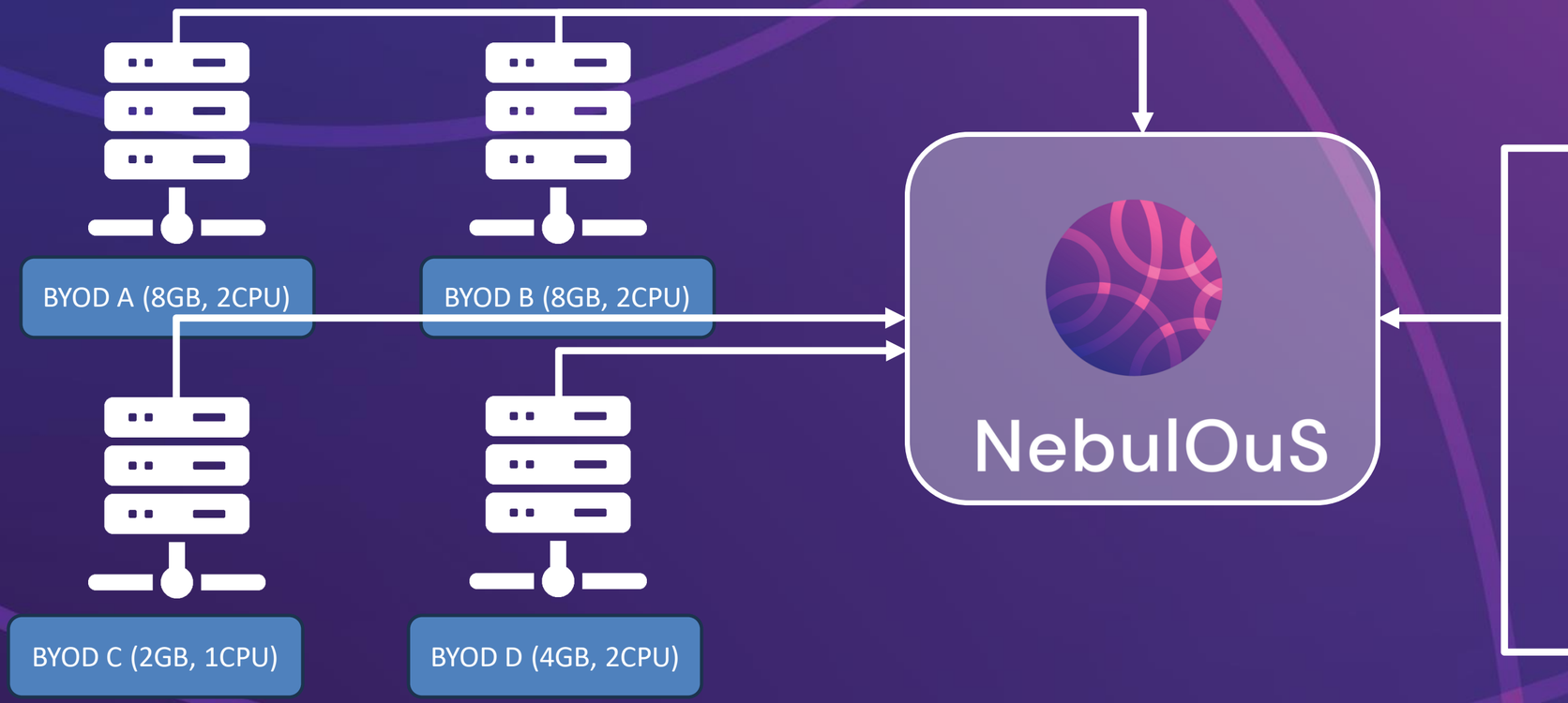
```
# There will be two utility objectives for this deployment:
# The first objective aims at minimising the total cost of the deployment.
minimize Cost:
    TotalCloudCost + TotalEdgeCost;
# The second objective aims to provide enough facial detection components to be
# able to process the queued number of images.
param ImagesToProcess;
param UpperQuantileImagesProcessingTime;
param TimeIntervalLength = 60s;
param UpperQuantileNoImagesPerComponent = TimeIntervalLength /
    UpperQuantileImagesProcessingTime;
maximize Performance:
    1/exp( (ImagesToProcess - UpperQuantileNoImagesPerComponent
        * faceDetection.workers_count )^2 );
```

AMPL file describing:

- Problem constraints
- Objective function

Resource brokerage

NebulOuS



Cloud provider A (AWS)

- Instance type A (8GB, 2CPU)
- Instance type B (16GB, 4CPU)
- Instance type C (8GB, 2CPU, 2GPU)

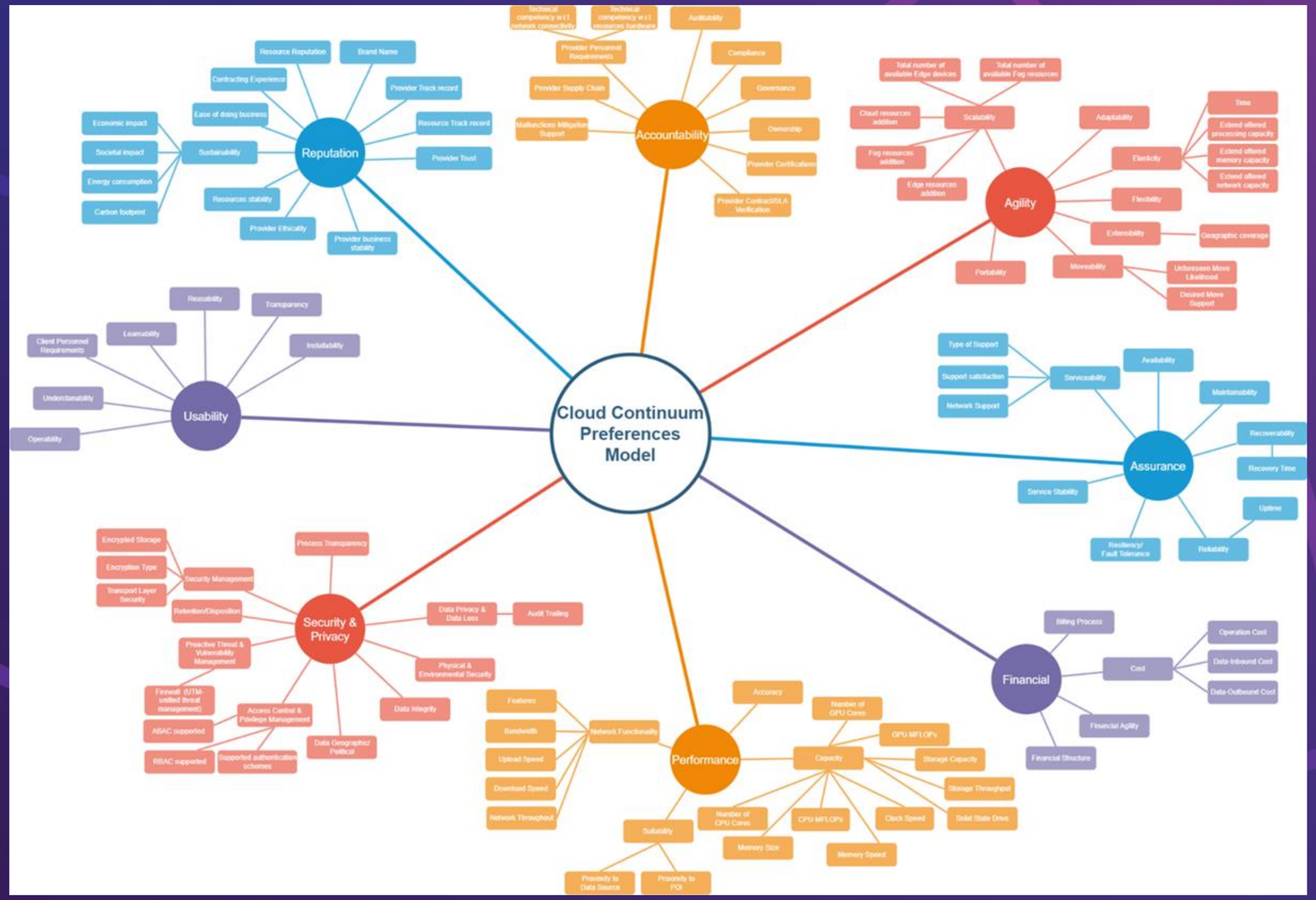
Cloud provider B (OpenStack)

- Instance type A (8GB, 2CPU)
- Instance type B (16GB, 4CPU)
- Instance type C (8GB, 2CPU, 2GPU)

Funded by
the European Union

Resource brokerage

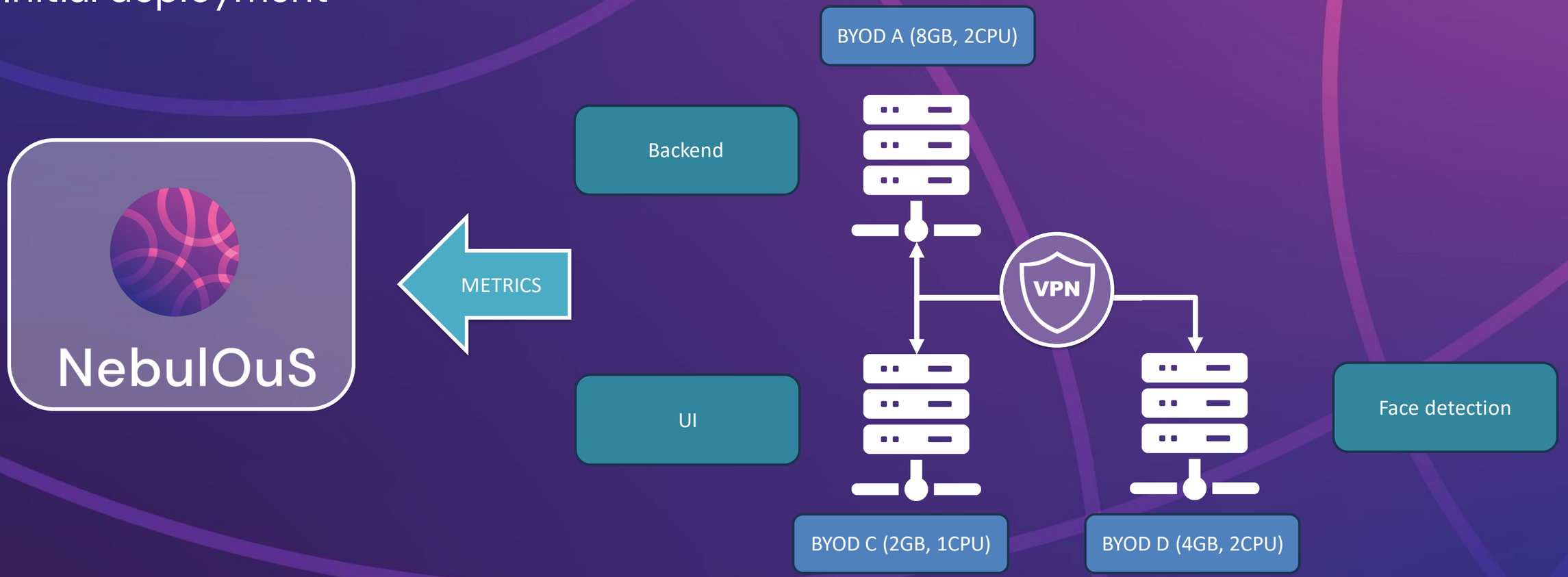
NebulOuS



Application lifecycle

NebulOuS

Initial deployment

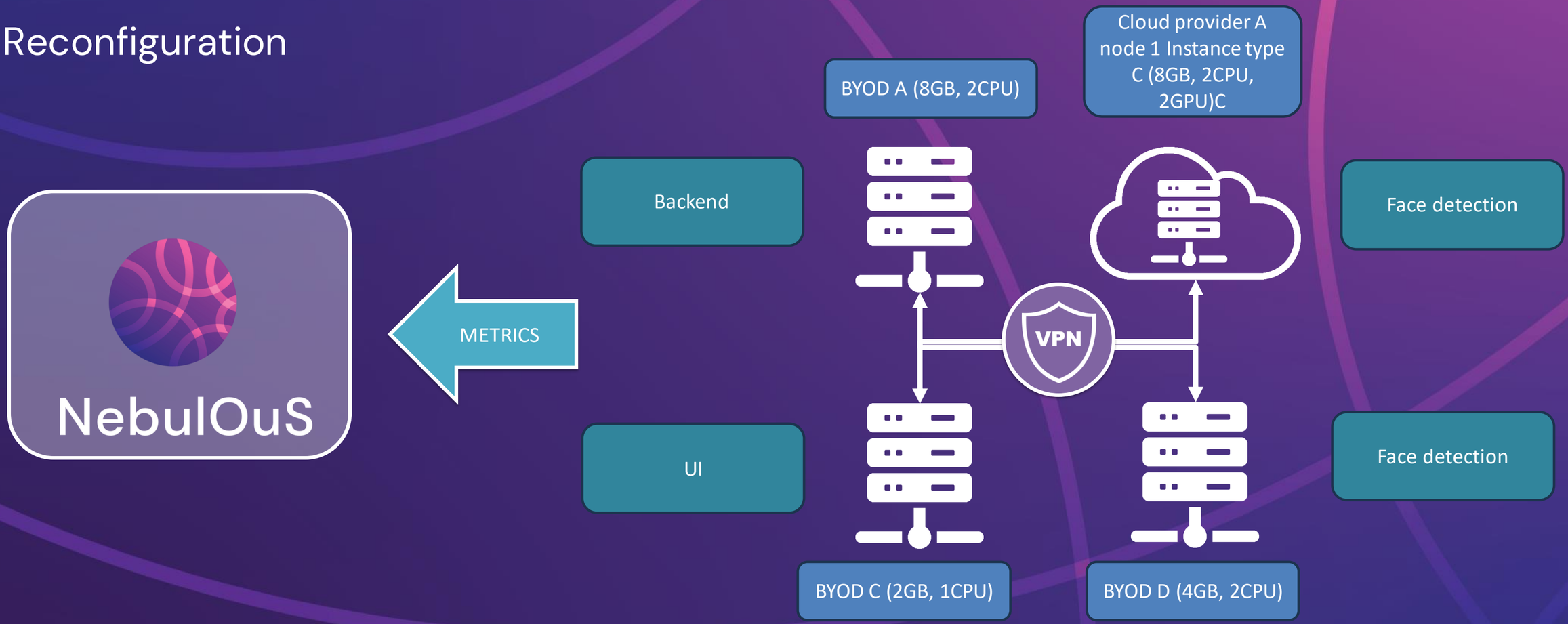


Funded by
the European Union

Application lifecycle

NebulOuS

Reconfiguration

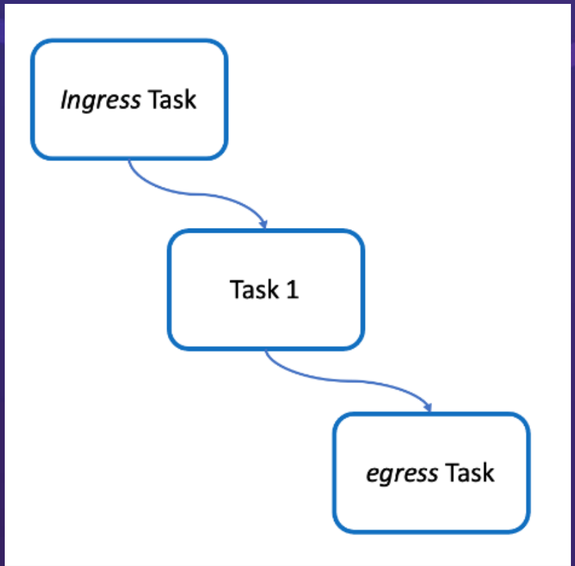


Funded by
the European Union

Application modeling

NebulOuS

Workflow applications



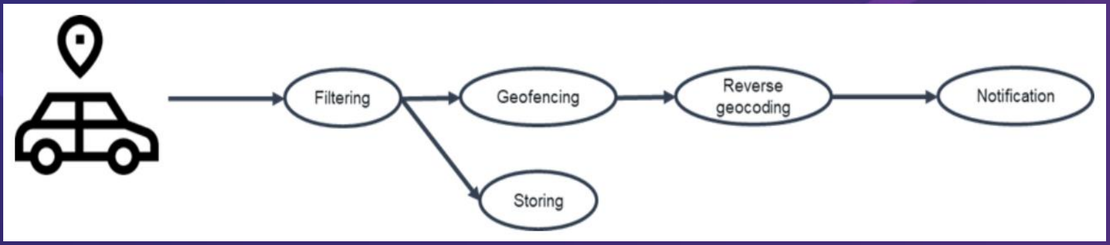
A directed graph of tasks operates sequentially, with each task waiting for its predecessors to finish before starting. Resources are freed after each task completes. Workflows end at an egress task, delivering results to the user. Workflows can run iteratively with multiple instances executing concurrently.

Funded by
the European Union

Application modeling

NebulOuS

Data-stream processing-oriented applications



Specialized semantics for modeling data processing pipelines. These pipelines, represented as directed acyclic graphs of steps. Users can specify parallel instances and message grouping conditions, enabling efficient resource allocation based on workload fluctuations. NebulOuS orchestrates these pipelines, managing computational resources dynamically to match current demand.

Funded by
the European Union

```
kind: Application
metadata:
  name: vehicle-fleet-monitoring
spec:
  components:
    - name: pub-sub-master
      type: webservice
      properties:
        image: activemq/artemis

    - name: filtering-step
      type: webservice
      properties:
        image: vehicle-fleet-monitoring/filtering-step

    - name: geofencing-step
      type: webservice
      properties:
        image: vehicle-fleet-monitoring/geofencing-step

    - name: reverse-geocoding-step
      type: webservice
      properties:
        image: vehicle-fleet-monitoring/reverse-
geocoding-step
…
```

OAM

```
{
  "filtering_step": {
    "input_stream": "raw_data",
    "grouping_key_accessor": {
      "source": "body_json",
      "expression": "vehicle_id"
    }
  },
  "geofencing_step": {
    "input_stream": "filtering_step_output",
    "grouping_key_accessor": {
      "source": "body_json",
      "expression": "vehicle_id"
    }
  },
  "reverse_geocoding_step": {
    "input_stream": "geofencing_step_output"
  }
}
```

Data processing pipeline config

Application modeling

NebulOuS

Serverless

NebulOuS can deploy serverless functions implemented with Knative.
https://knative.dev/docs/

Funded by
the European Union

Demonstrators

NebulOuS

Windmill maintenance

Energy and utilities

Computer vision for city maintenance

Smart City

Precision agriculture

Agriculture

Fresh food supply

Transport and logistics

Crisis management

Environment

Funded by
the European Union

NebulOuS

NebulOuS FSTP

We plan to engage 9 more SMEs to work with the NebulOuS platform and demonstrate its benefits through 2 open calls

Funded by
the European Union

OPEN CALL 1

From 14 February to 17 April 2024 17:00 CET

NebulOuS

MORE INFO

Call objective: validation of basic aspects of the platform by showcasing new use cases in different domains than those covered already by the project, addressing one of the challenges

- Challenge 1 — Workflow application
- Challenge 2 — IoT application with variability
- Challenge 3 — Serverless application
- Challenge 4 — Open challenge

Available funding: **up to €600.000 to fund 4 projects**
150K equitity-free funding

Eligible applicants: Industry – SMEs, start-ups and Research organisations
Teams of 1 or 2 organisations

Applications handled via F6S platform https://www.f6s.com/nebulous-open-call-1

Funded by
the European Union

OPEN CALL 1

NebulOuS

From 14 February to 17 April 2024 17:00 CET

Challenges

- **Challenge 1 — Workflow application**

  A workflow orchestrator component for managing multiple parallel instances of a directed graph-based workflow a application efficiently, ensuring user-defined SLOs are met by optimizing resource usage.

- **Challenge 2 — IoT application with variability**

  NebulOuS simplifies IoT application deployment by providing specific semantics for modelling data processing pipelines, allowing users to express data transformations and manage computational resources dynamically based on workload fluctuations.

- **Challenge 3 — Serverless application**

  NebulOuS deploys applications across the Cloud-to-Edge Continuum, offering support for diverse resources including containers, VMs, and serverless execution through its Meta-OS integration.

- **Challenge 4 — Open challenge**

Funded by
the European Union

OPEN CALL 1

Deadline April, 17th 2024 @17CET

NebulOuS

Launch
of the OC through NebulOuS network and channels

14th February – 17th April 2024

Evaluation
Eligibility check & external evaluation

April – May 2024

Selection

4 awarded projects

June 2024

Mentoring
monitoring and validating the selected pilots

June 2024

2025

January

Funded by the European Union

OPEN CALL 1

NebulOuS

How to apply?

Funded by
the European Union

NebulOuS Open Call #1:
Step no. 1 Read Open Call 1 Guidelines

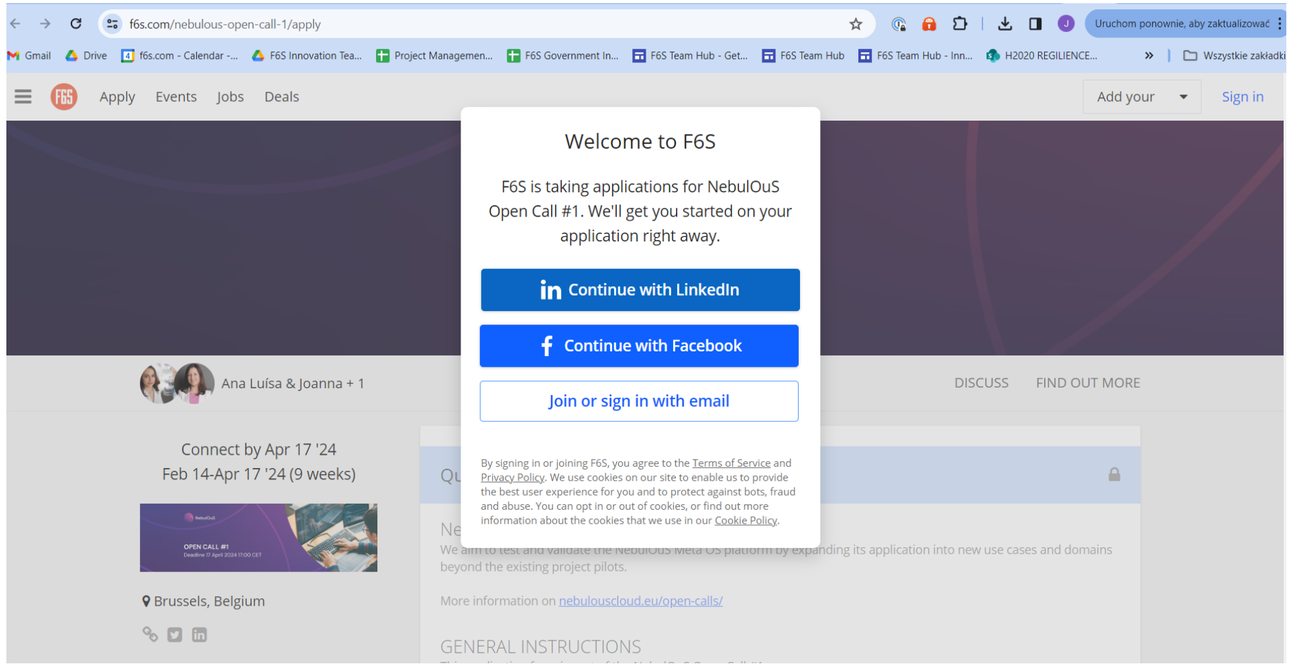
- Check Annex 1 – **NebulOuS Guidelines for applicants** for full terms and conditions

- Available on the project website:

https://nebulouscloud.eu/open-calls/

NebulOuS Open Call #1:
Step no. 2 prepare your application

- Create a page for your company at the F6S platform
- Go to NebulOuS Open Call #1 page
- Start your application by inserting your proposal info, SME Legal Data and accepting the requirements to join NebulOuS funding programme



NebulOuS Open Call #1:
Step no. 3 submit your application

- Describe your project following Proposal Template
  Download Annex 2.1 Proposal Template

- Upload a completed PDF of your project as part of your online application form at F6S platform

https://www.f6s.com/nebulous-open-call-1/apply

- submit your application

Are you done? Click below to finalize

Apply to NebulOuS Open Call #1

NebulOuS Open Call #1 documents to read

Please find all important documents on the open call website page:

- Annex 1 – NebulOuS Guidelines for Applicants
- Annex 2 – Application Form
- Annex 2.1 – Proposal Template
- Annex 3 – Sub-grant agreement
- Annex 4/5 – Declaration of Honour
- Annex 6 – SME status
- Annex 7 – Bank account information

Check if you comply with **SME Qualification Criteria** (for more info, please read the European Commission Recommendation 2003/361/EC and the SME qualification guide)

Need more info?

- You can find all Open Call #1 Terms and Conditions on the project website: **https://nebulouscloud.eu/open-calls/**
- For further questions please write to us at: **opencall@nebulouscloud.eu**
- Ask questions directly in the F6S Discussion Pannel: **https://www.f6s.com/nebulous-open-call-1/discuss**
- F6S support team (for platform issues during the application): **support@f6s.com**

Q & A session

Funded by
the European Union

NebulOuS

Supported by

eurecat

SOUTH-EAST EUROPEAN RESEARCH CENTRE

7bulls.com

Activeeon SCALE BEYOND LIMITS

AUGMENTA PRECISION AGRICULTURE · REDEFINED

ubiwhere SUITING THE FUTURE

UBITECH ubiquitous solutions

mercabarna

UNIVERSITAS OSLOENSIS MDCCCXI

ICCS ΕΠΙΣΕΥ

existanze #connectingdots

F6S

TTAnalysis

@fire

Telefónica

BIBA

Funded by
the European Union

NebulOuS

Follow us

nebulouscloud.eu

/company/nebulouscloud

@nebulous_cloud

info@nebulouscloud.eu

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Directorate-General for Communications Networks, Content and Technology. Neither the European Union nor the granting authority can be held responsible for them.