PHYSICS

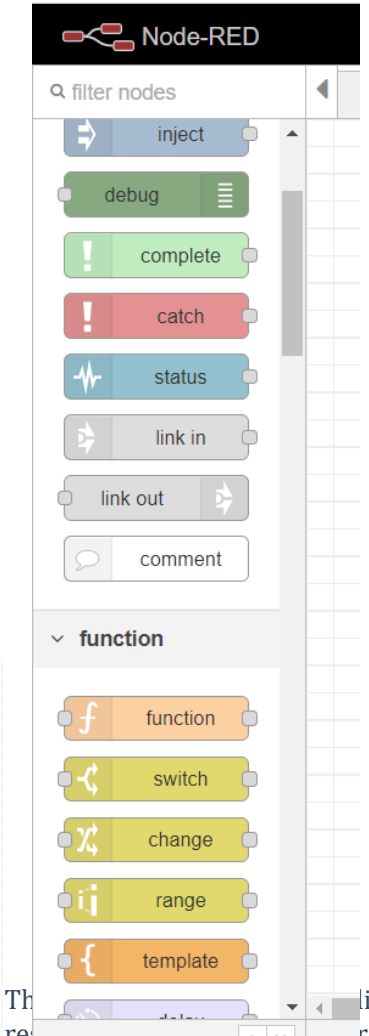
INTRO AND CHALLENGES

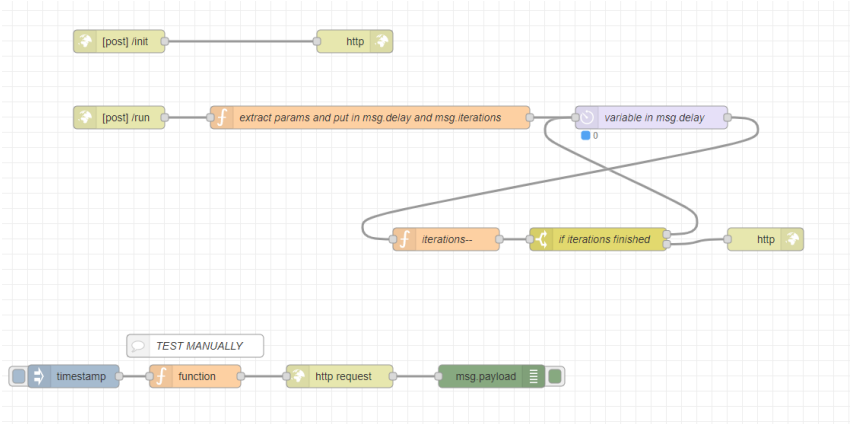
2nd PHYSICS Hackathon, 24/5/2023-7/6/2023

This project has received funding from the European Union's horizon 2020 research and innovation programme under grant agreement no 101017047

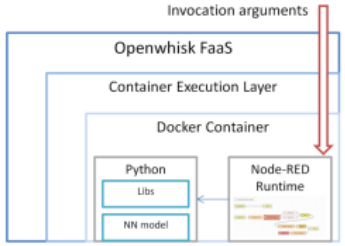
Baseline Technologies

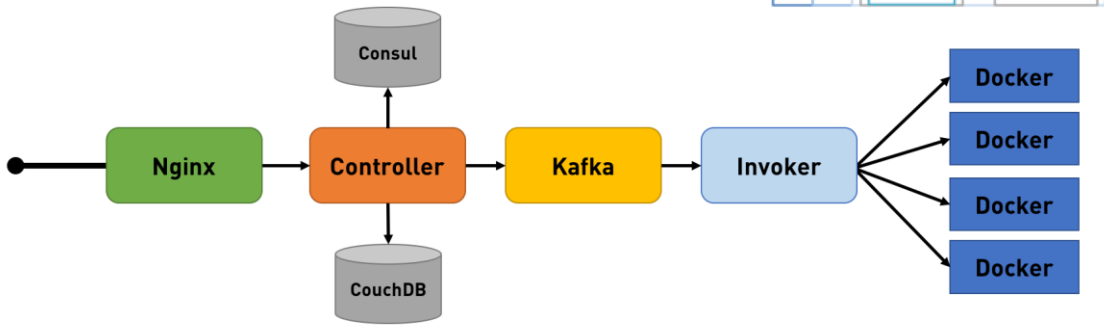
- Node-RED
  - Programming environment for event driven applications
    - Built-in nodes
    - NPM extension nodes
    - Subflows (groups of functions) as nodes
  - Combined workflow orchestration and function execution abilities
  - Used as the main execution **runtime** and function **choreographer** for PHYSICS functions





- Openwhisk
  - Open source FaaS platform
  - Supported by IBM
  - Main tool behind IBM Cloud Functions Service
  - Can execute functions based on custom container images





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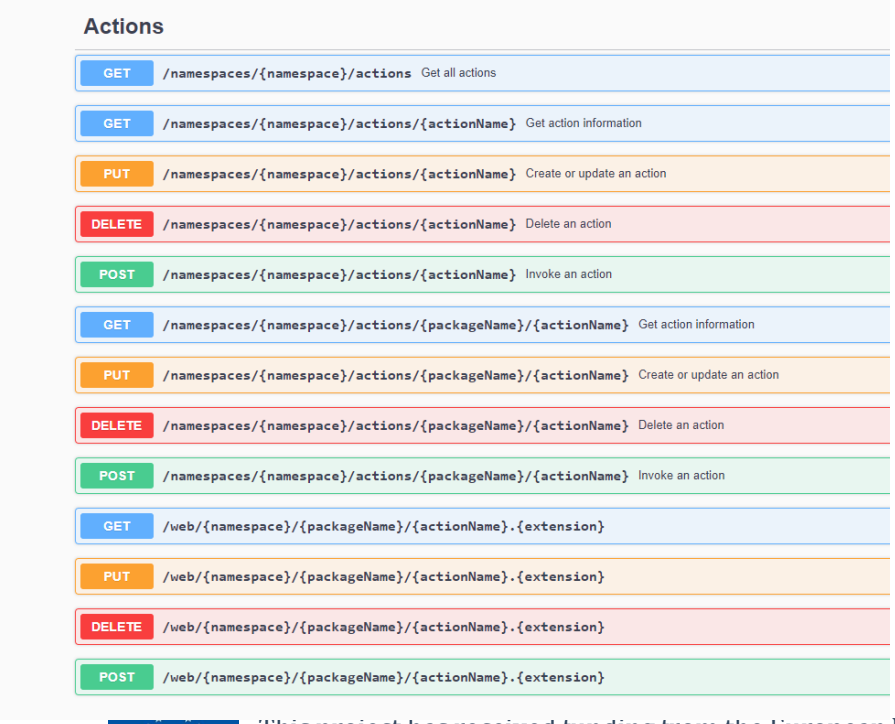
Openwhisk API

- https://petstore.swagger.io/?url=https://raw.githubusercontent.com/openwhisk/openwhisk/master/core/controller/src/main/resources/apiv1swagger.json#/



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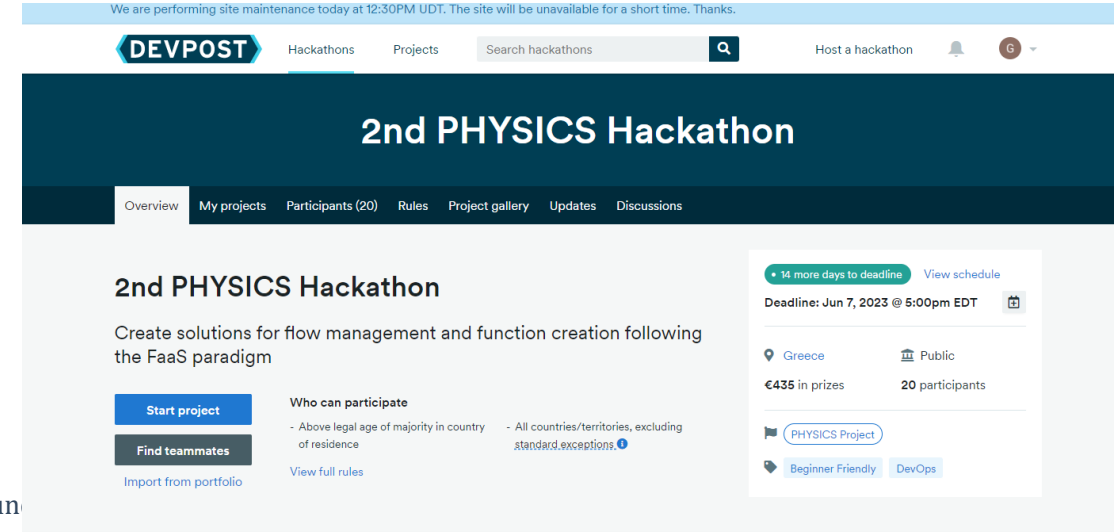
Submission process

- Individual or team participation
- Submission through the DevPost form including
  - Link to a github repo with the outputs or relevant (e.g. Docker image in dockerhub, subflow file in Node-RED repo: https://flows.nodered.org/)
  - Small presentation and/or video with the produced results and screenshots/demo
- Submission deadline
  - 7/6/2023
- Decisions
  - 8-9/6/2023



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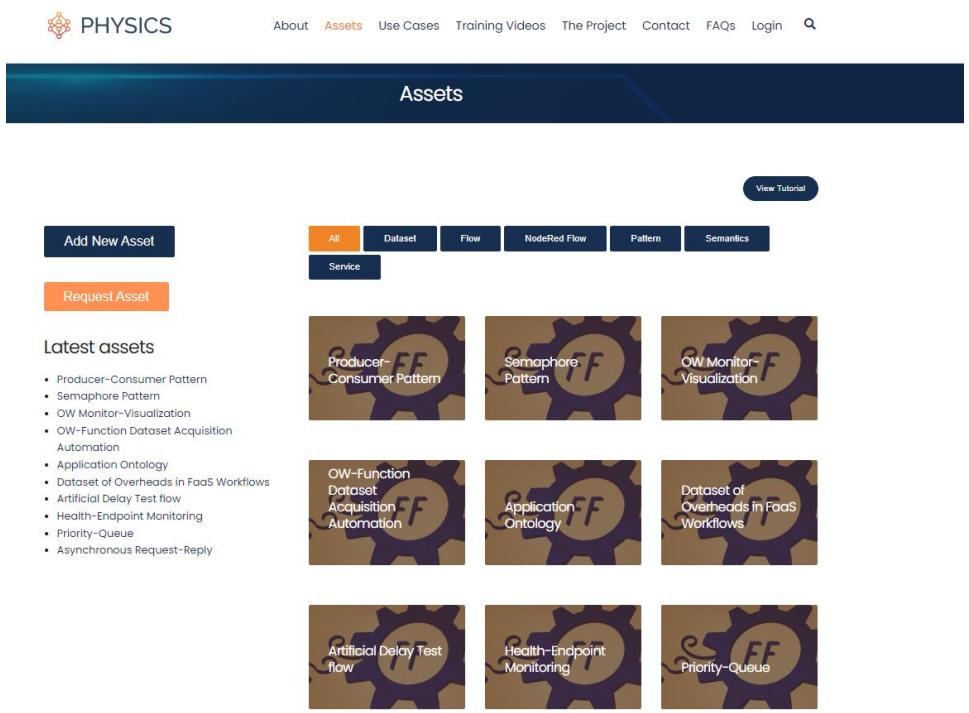
Prizes

- 4 amazon gift card prizes for succesfully submitted and substantial artefacts/completed challenges
  - 1st place: 140
  - 2nd place: 130
  - 3rd place: 75
  - 4th place: 70
- Certificate of participation for all submissions
- Working artefacts can also be uploaded in the project marketplace for better visibility
  - https://marketplace.physics-faas.eu/assets



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Helper Material&Channels

- https://github.com/gkousiouris/2ndPHYSICSHackathon

- Hello world function available in the existing Openwhisk installation
  - guest/helloLab
    - Parameters: name
  - guest/clustering
    - Input according to:
      - https://flows.nodered.org/flow/4e1fc62b3b7040e2d5b07f3b25297c73/in/HXSkA2JJLcGA

- Slack channel
  - https://join.slack.com/t/2ndphysicshackathon/shared_invite/zt-1vscl9myd-mq~h5WmQwPj2cnU3lvfiHQ

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EXAMPLE CHALLENGES

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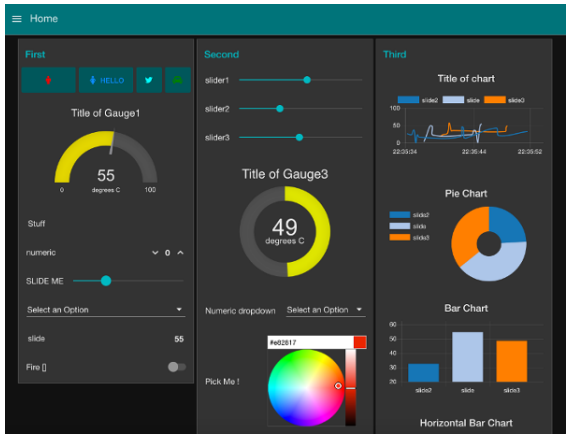
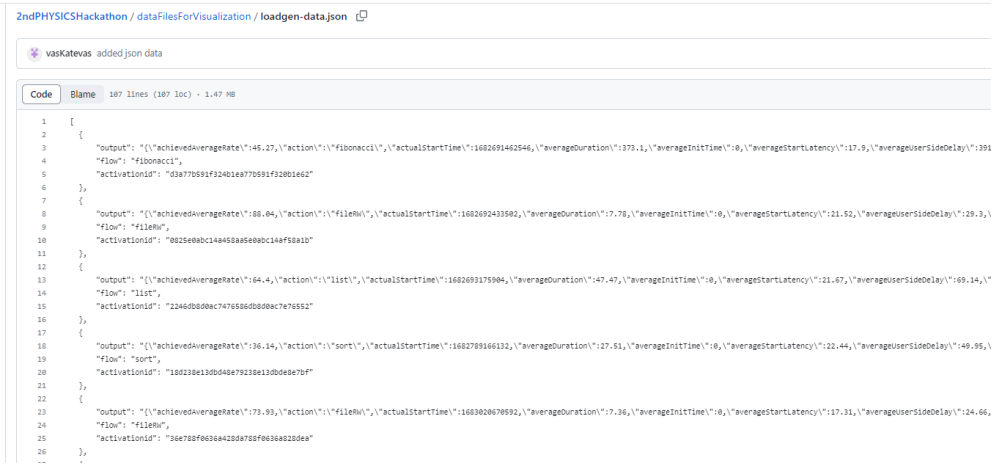
Visualization of Performance Data

- By using the node-red dashboard node (https://flows.nodered.org/node/node-red-dashboard) create suitable visualizations that portray a number of performance data files



- Examples of data inputs are given in the hackathon material
  - https://github.com/gkousiouris/2ndPHYSICSHackathon/tree/main/dataFilesForVisualization



- Ideally we should have different tabs for each category as well as filters based on the data fields (e.g. function name or needed information)

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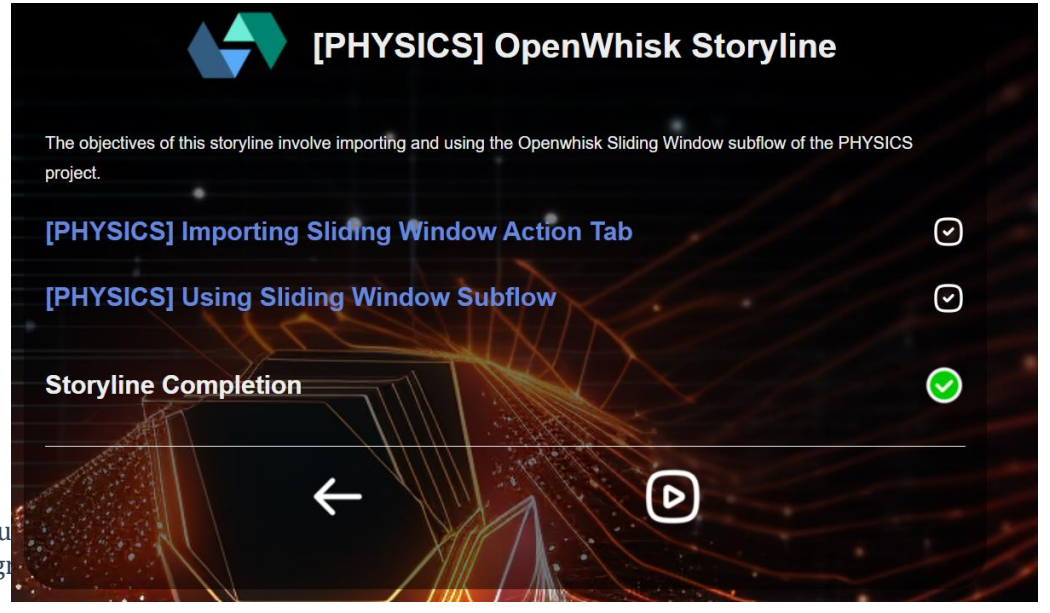
Gamification Server

- Challenge
  - Download the Game Server
    - https://hub.docker.com/r/captainflin/game-blue
  - Run the Game Server
    - Go to Browser: http://localhost:3000
  - Complete the scenarios listed in the Game Server



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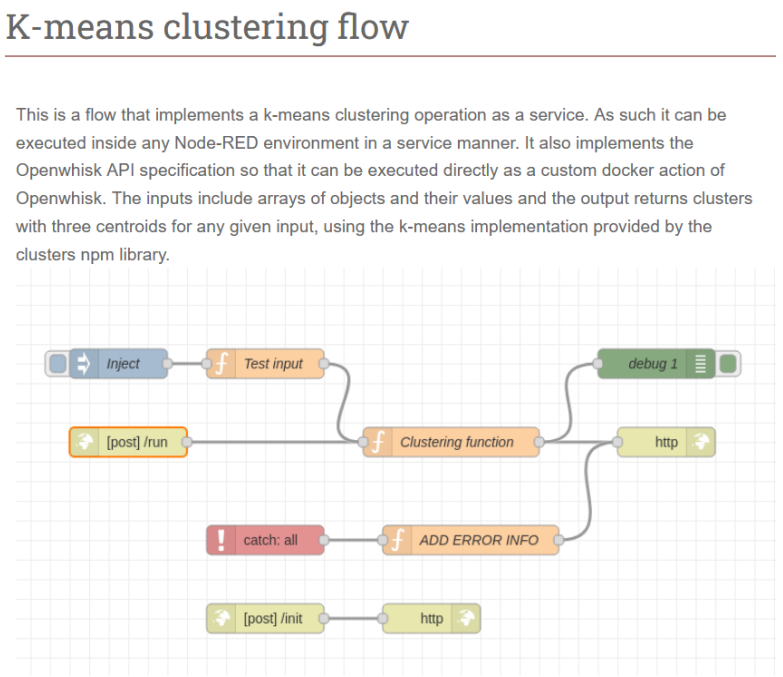
Import of common algorithms as function implementations

- Example: k-means clustering algorithm
  - Node-RED flow: https://flows.nodered.org/flow/4e1fc62b3b7040e2d5b07f3b25297c73/in/HXSkA2JJLcGA
  - Docker Image: https://hub.docker.com/r/vkatevas/node-red_data_clustering

- Challenge: Create according images for other common algorithms
  - Able to be run as Openwhisk functions
  - Taking data as input parameters
    - And potentially algorithm choice



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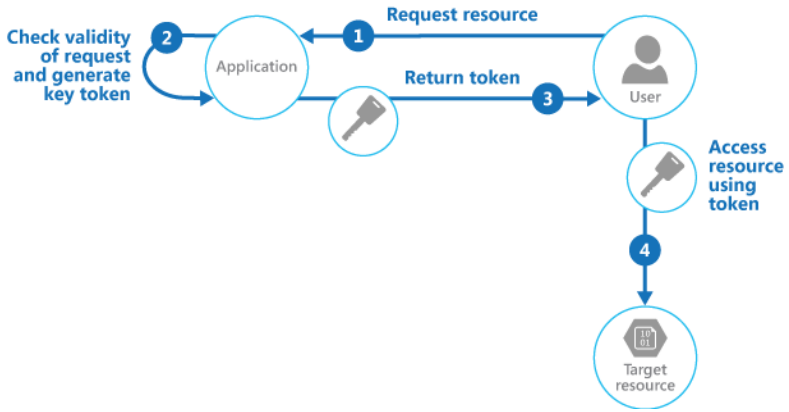
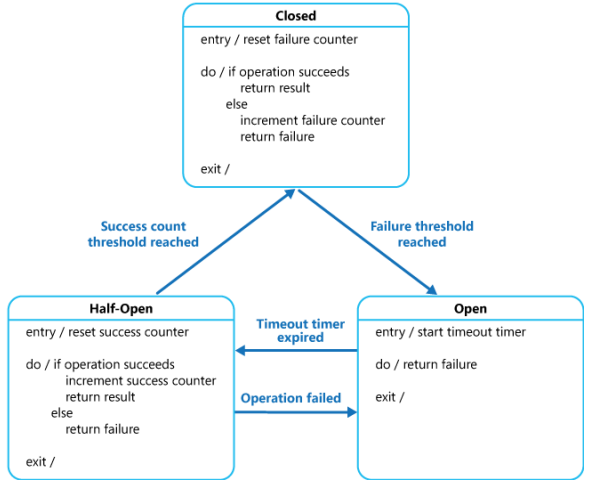
Cloud Design Patterns

- Cloud Design Patterns are a way to define strategies that are suitable for cloud environments. Example documentation:
  - https://learn.microsoft.com/en-us/azure/architecture/patterns/



- Patterns are a parametric/reusable way to solve a particular problem
  - Design considerations need to take various trade-offs in mind
    - When to use them or not
  - How to set the parameters



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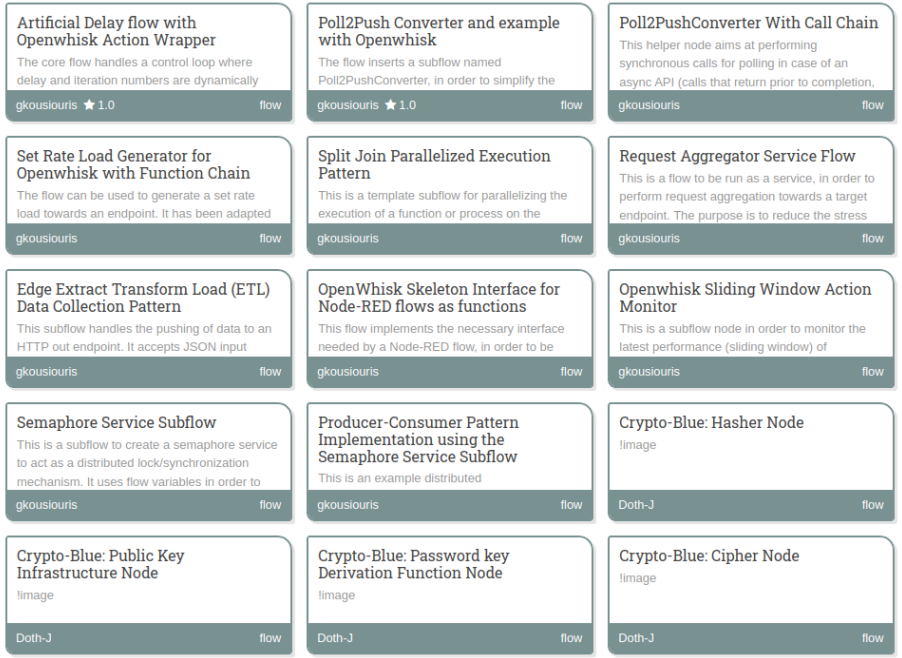
Combination/extension of PHYSICS Pattern flows

- PHYSICS Pattern Flows
  - Includes a number of produced flows
  - https://flows.nodered.org/collection/HXSkA2JJLcGA
- Challenge goal is to
  - Extend the collection with other common functionalities as Node-RED subflows
  - Combine and enrich current patterns to solve a particular problem
  - Create prototypes of a selected design pattern from:
    - https://learn.microsoft.com/en-us/azure/architecture/patterns/



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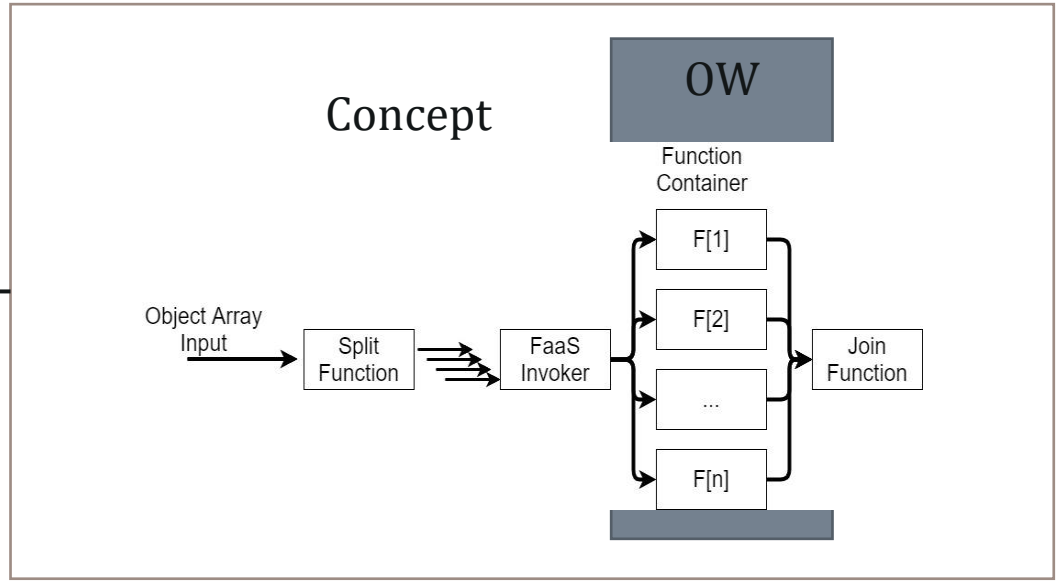
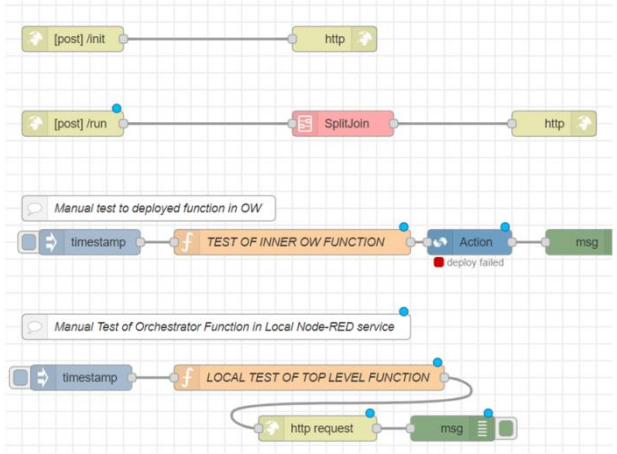
Example of Fork-Join parallelization pattern

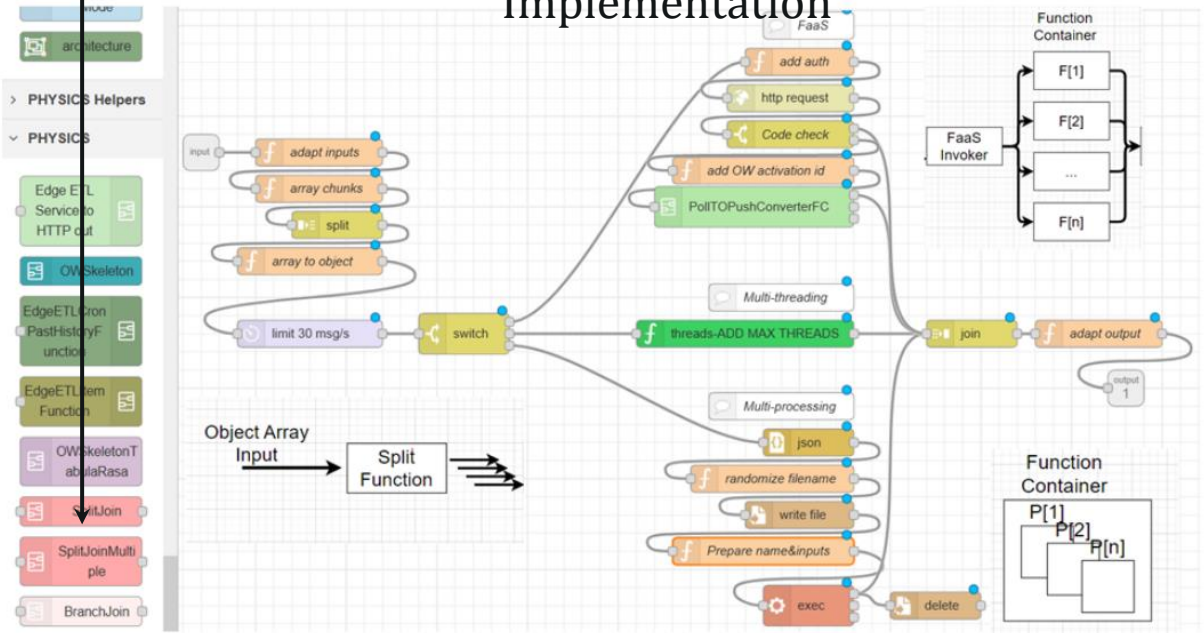
Concept



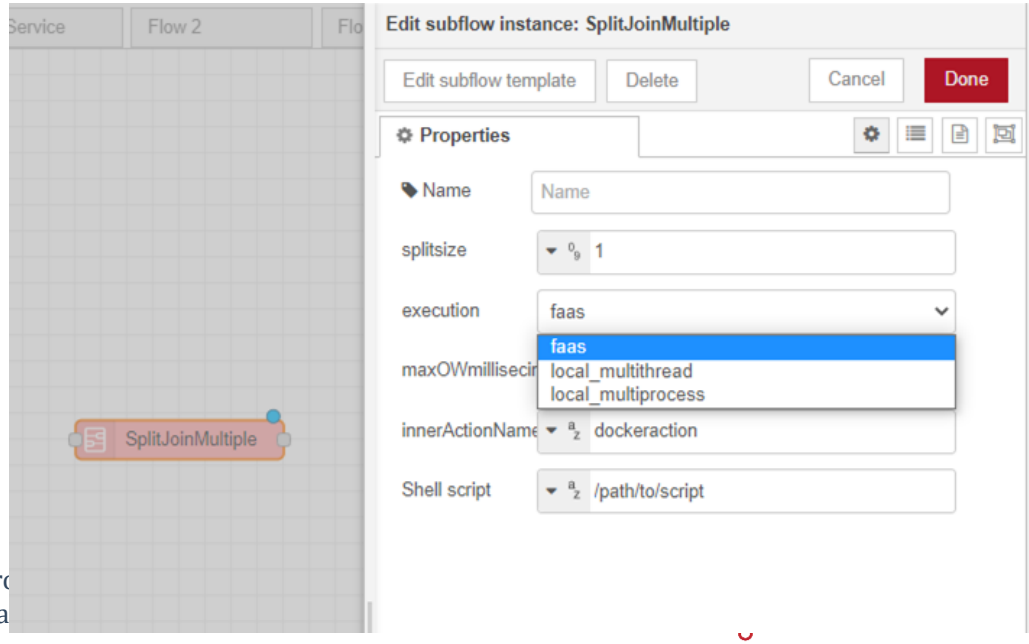
Usage in an Orchestrator Function



Implementation



Parameterization



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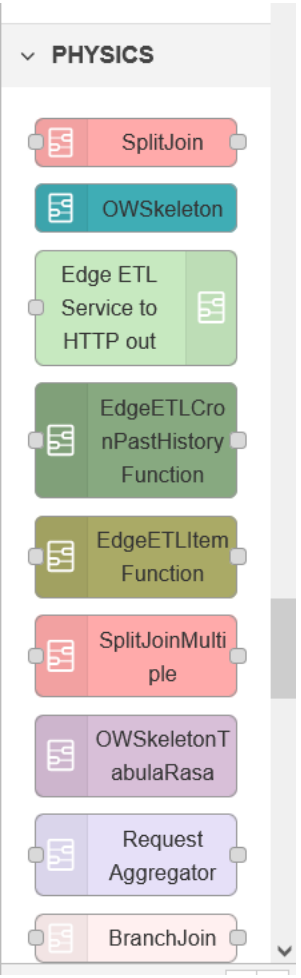
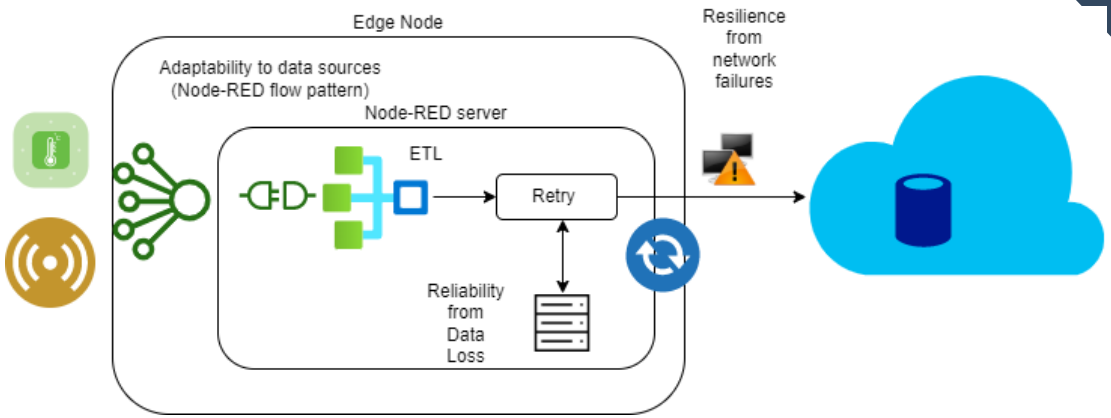
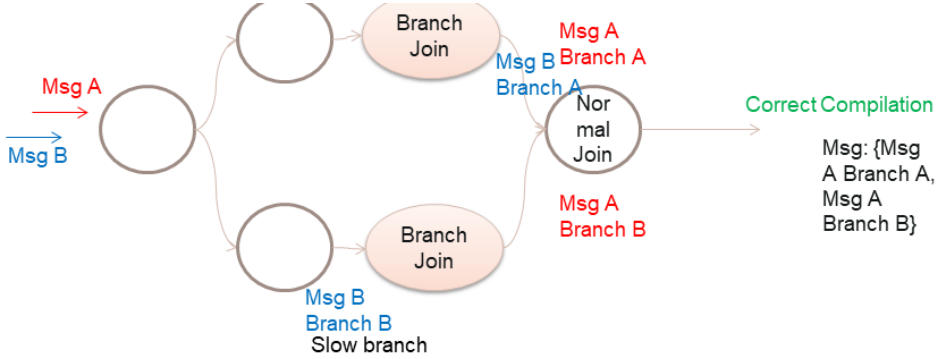
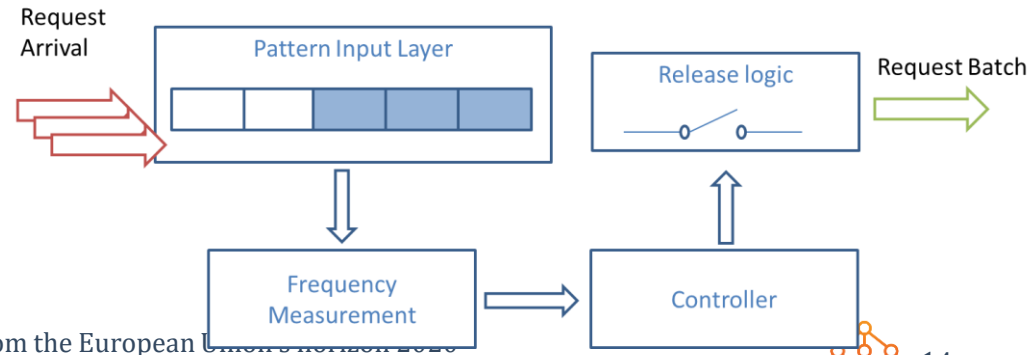
Pattern flow examples



- Edge Extract-Transform-Load processes
  - Reliable data collection at the edge and pushing to a central storage
- Workflow primitives assistance
  - BranchJoin
- Request Aggregation
- Encryption and decryption
- Async read/writes
- Poll2Push Converters
  - For async APIs
- OW interface and Context Management
- Load Generation







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Scoring for challenges

- 1 completed scenario from gaming challenge
  - 20 points for generic intro scenarios
  - 40 points for PHYSICS related scenarios
- Visualization scenario
  - 30 points per data file
- Common algorithm as function
  - 100 points per function
- Creation of a subflow
  - Complex subflow: 100 points
  - Simple subflow: 25 points

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HELPER ENVIRONMENT

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Openwhisk Installation

- HUA students can use university's server
  - https://10.100.59.208
  - Namespace: guest
  - Credentials: 23bc46b1-71f6-4ed5-8c54-816aa4f8c502:123zO3xZCLrMN6v2BKK1dXYFpXlPkccOFqm12CdAsMgRU4VrNZ9lyGVCGuMDGIwP

- Non-HUA participants can install openwhisk themselves locally with kind or docker compose
  - install-requirements.sh and kind-setup.sh from here for the kind installation
  - *Docker compose:*
    - *https://github.com/apache/openwhisk-devtools/blob/master/docker-compose/README.md*

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Install Compose

- sudo curl -L "https://github.com/docker/compose/releases/download/1.28.6/docker-compose-$(uname -s)-$(uname -m)" -o /usr/local/bin/docker-compose
- sudo chmod +x /usr/local/bin/docker-compose
- sudo apt install zip
- git clone https://github.com/apache/openwhisk-devtools.git
- cd openwhisk-devtools/
- cd docker-compose
- make quick-start
  - Builds and deploys

- Stopping
  - docker-compose --project-name openwhisk stop
- Starting again
  - docker-compose --project-name openwhisk start

- Το μόνο πρόβλημα με αυτή τη προσέγγιση είναι ότι γράφει στο tmp file
- Αλλά αν δεν γίνει restart ο node τότε θα κρατηθούν τα διάφορα functions klp

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Install Openwhisk cli

- Download cli targz for platform
  - https://github.com/apache/openwhisk-cli/releases
- tar –zxvf <clifile>
- Instructions
  - https://github.com/apache/openwhisk/blob/master/docs/cli.md

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Cli configuration

- Compose installation on HUA:
- ./wsk property set --apihost https://10.100.59.208
- ./wsk property set --auth 23bc46b1-71f6-4ed5-8c54-816aa4f8c502:123zO3xZCLrMN6v2BKK1dXYFpXlPkccOFqm12CdAsMgRU4VrNZ9lyGVCGuMDGIwP

- Main instructions
  - wsk action create –i
  - wsk action invoke –i
  - wsk activation get -i

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CUSTOM FUNCTION BASED ON NODE-RED RUNTIME TUTORIAL

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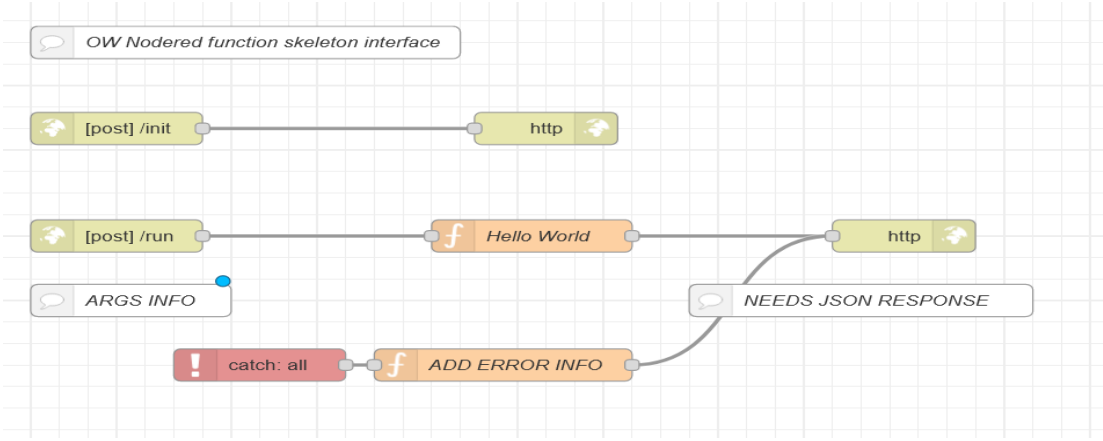
Openwhisk Custom Docker Image as Function-Template skeleton flow



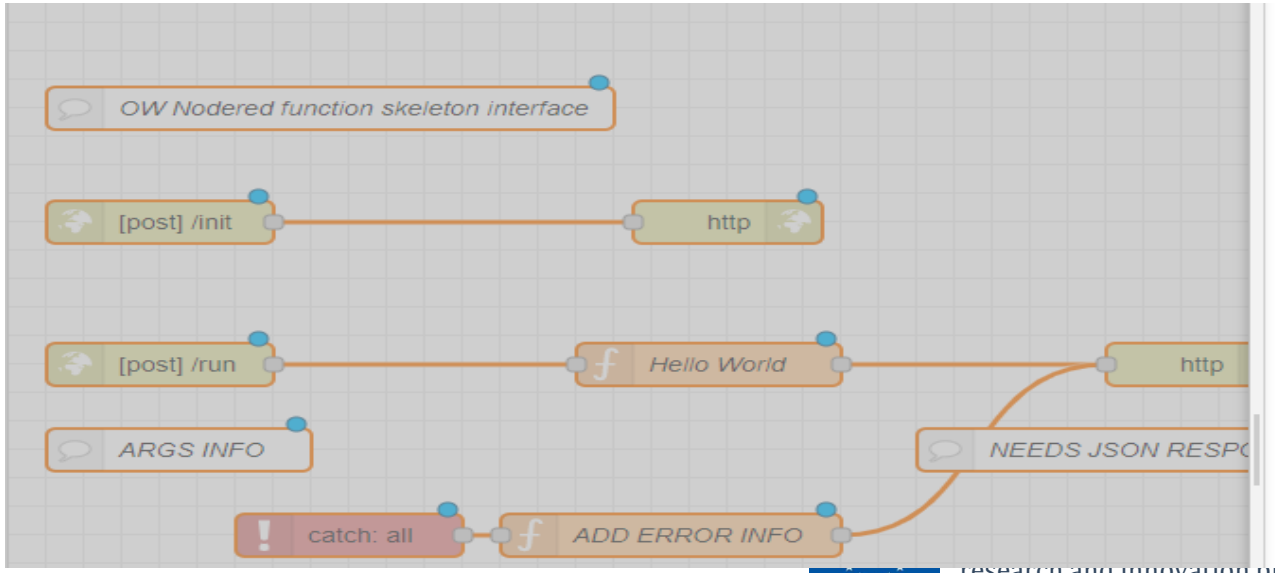
- https://flows.nodered.org/flow/d010a0a5af458e093342420349d63773/in/HXSkA2JJLcGA

- Includes instructions on image creation

```
FROM nodered/node-red
RUN npm install <any needed node-red packaged node for your flows from npm>
#move arbitrary flow from local dir
COPY myflow.json /data/flows.json
#optional: add a specific settings.js file
COPY settings.js /data/settings.js
#optional: add a specific flows_cred.js file with credentials. If used then the
#credentialSecret option should be set in the settings.js file during credential
#creation in the development Node-RED server so that credentials are transferable
#to the new image
COPY flows_cred.json /data/flows_cred.json
ENV PORT 8080
EXPOSE 8080:8080
```

Parameter passing considerations

- Openwhisk intervenes in the way our parameters in the request (or in the body of the POST HTTP call) get passed in the flow
  - It includes an extra field msg.payload.**value.**<param_name>
  - This needs to be considered in the follow-up nodes when we try to extract the parameters



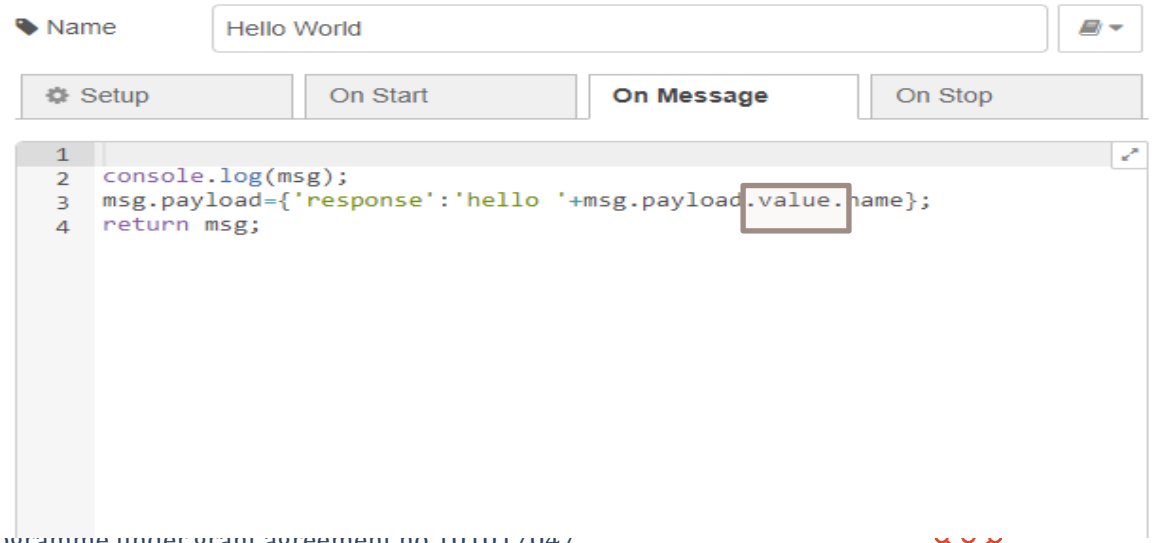


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Image building and Action Registration

Then the image can be built (in the same dir):

```
docker build -t <docker_registry_account>/<image_name> .
```

and pushed:

```
docker push <docker_registry_account>/<image_name>
```

Following the creation of the image and its pushing to a registry, it can be registered in Openwhisk as an action through the following command:

```
wsk action create <action_name> --docker <docker_registry_account>/<image_name>
```

and invoked through:

```
wsk action invoke <action_name> --param name george
```

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Practice

- Try to create the image based on the previous slides and the available skeleton flow

- Register the action in the Openwhisk testbed with a name like hello_<YOUR_IT>

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Thank you for the attention!
George Kousiouris, HUA

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