PLEDGER

Resource optimisation on the edge: progress and challenges

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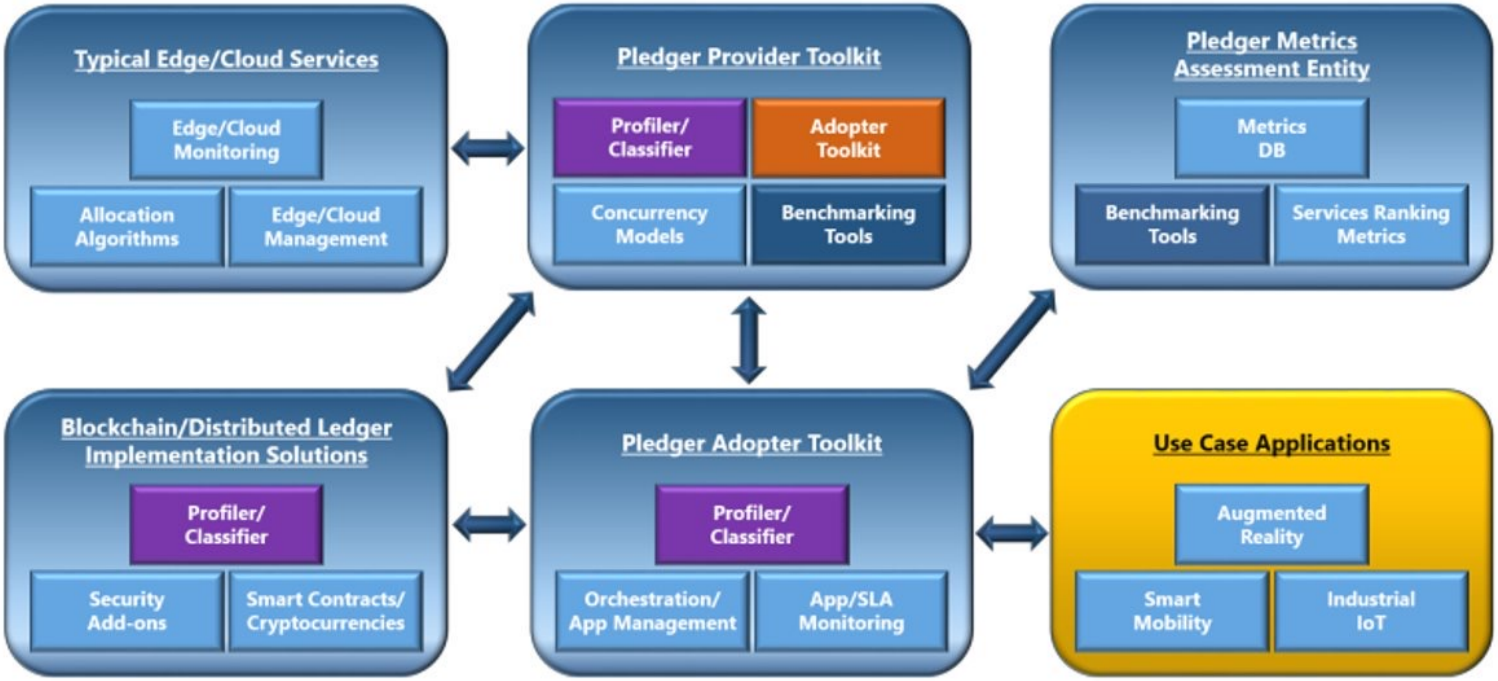
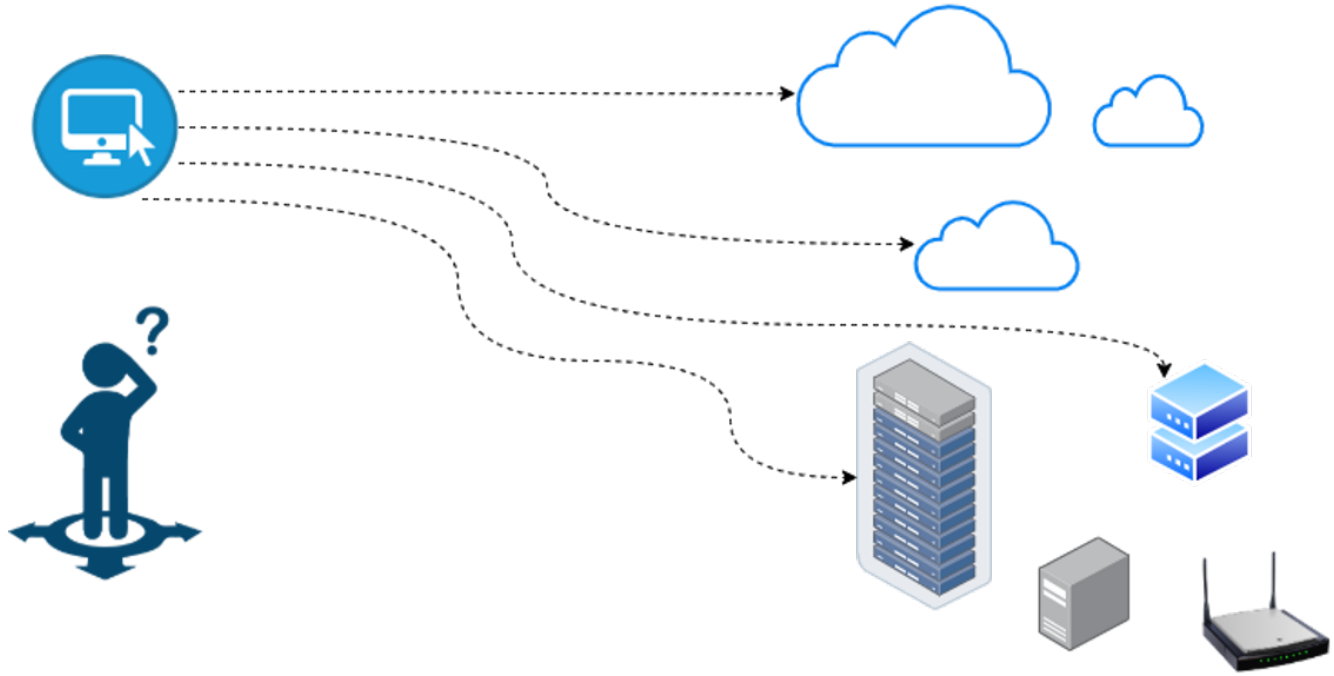
Pledger project

Goal: deliver a new **architectural paradigm** and a **toolset** for edge computing **providers** and **adopters**, by coupling the benefits of low latencies on the edge, with the robustness and resilience of cloud infrastructures.

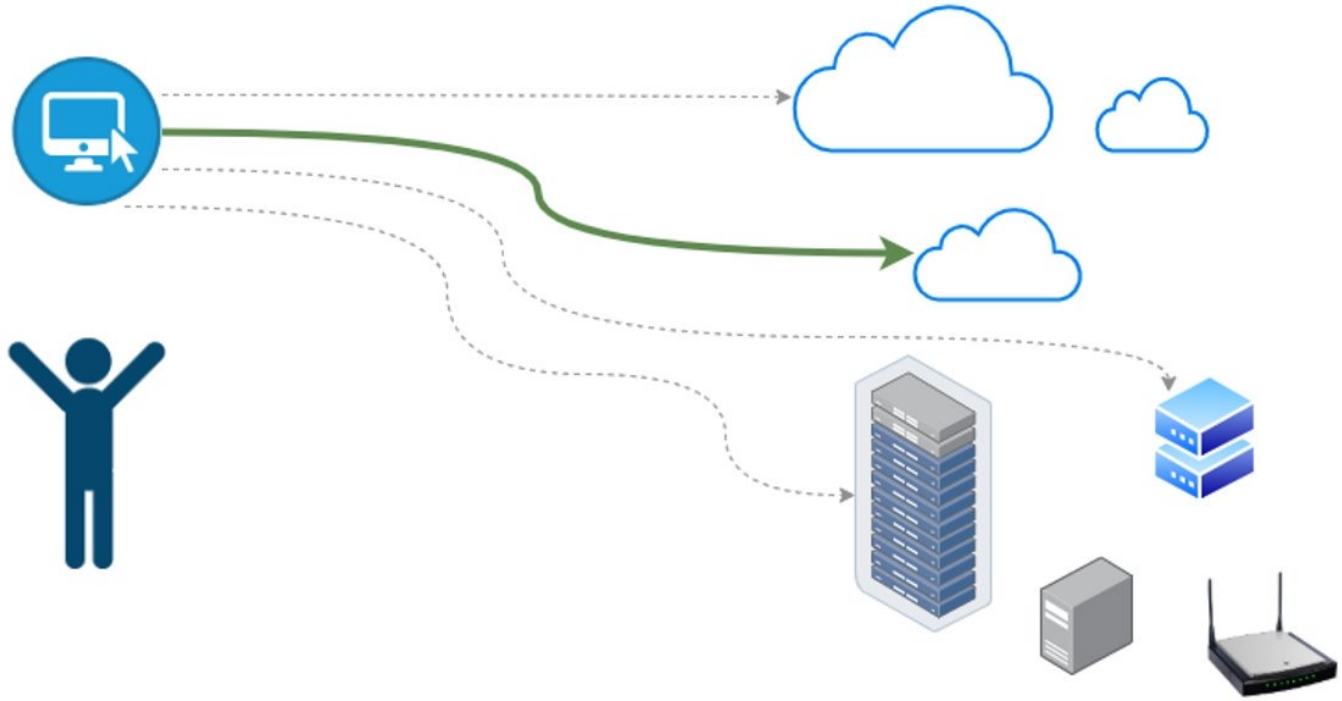


Cloud/Edge infrastructure/nodes selection and QoS/QoE



What actions should I take to make sure my Application fulfills some QoS/QoE in a cloud/edge infrastructure?

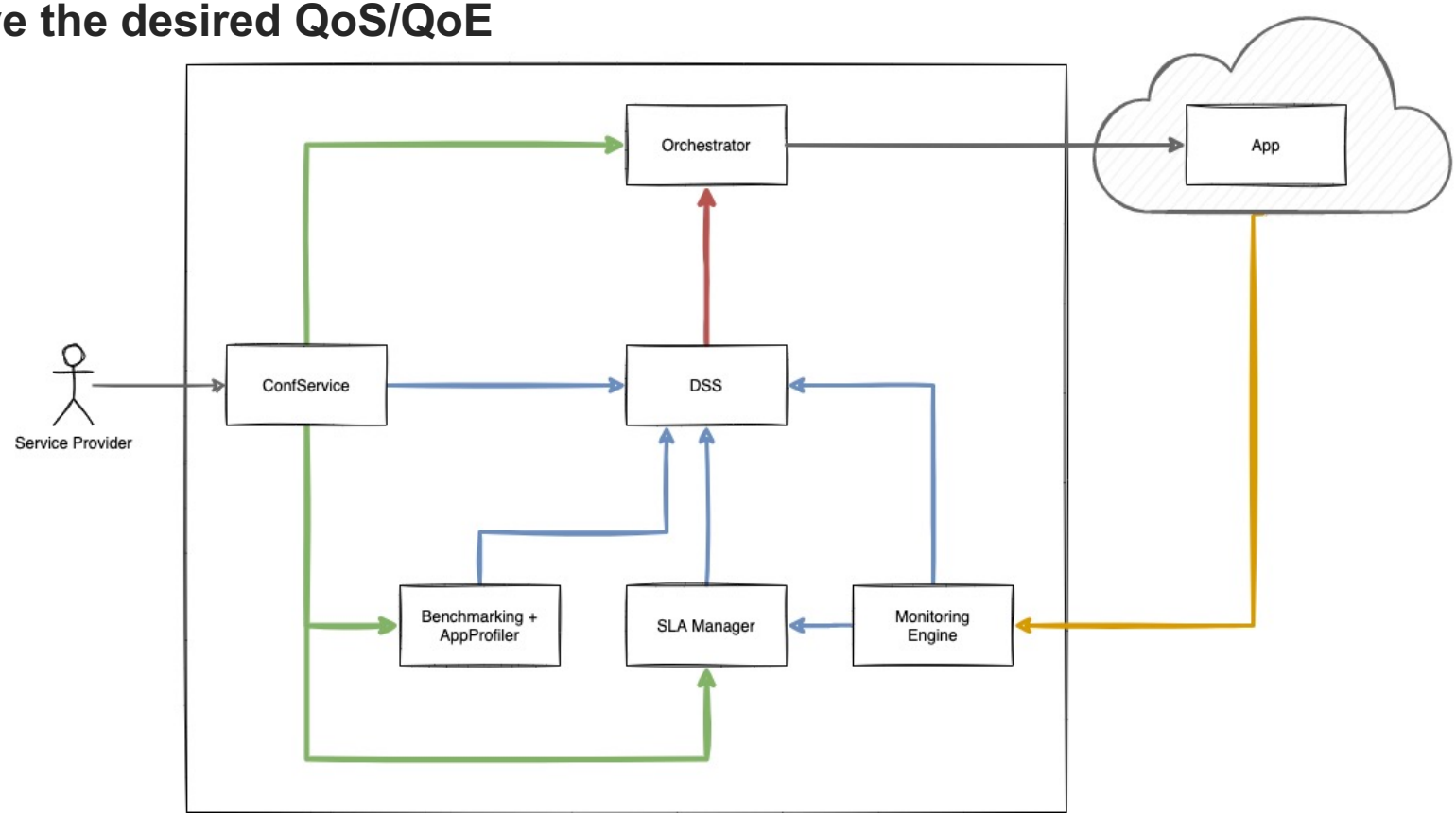
The Pledger workflow



- **Identify** metrics that define the QoS/QoE of the App
- **Measure** the metrics on different providers
- **Monitor** SLA violations and warnings
- **Rank** deployment options managing infrastructures variety
- **Choose** the best infrastructure/nodes for a given App

The DSS and the core components in Pledger

Goal: produce **optimal decisions** for the **resource management/offloading** to **achieve the desired QoS/QoE**



DSS optimisations

The scenarios explored by the DSS are with **private**, **scarce** and **diverse** edge resources

the DSS receives:

- ✓ **deployment option rankings** based on **SP preferences** to leverage on edge **variety**
- ✓ **monitoring data, classification data and SLA violations/warnings**

…then it:

- ✓ creates a **resource allocation model** based on **thresholds** (request/limit) for Apps
- ✓ **changes resource allocation/thresholds** to reduce resource waste and SLA violations
- ✓ **offloads** (when needed) Apps using the **deployment option rankings**

DSS optimisations – some details (1/4)

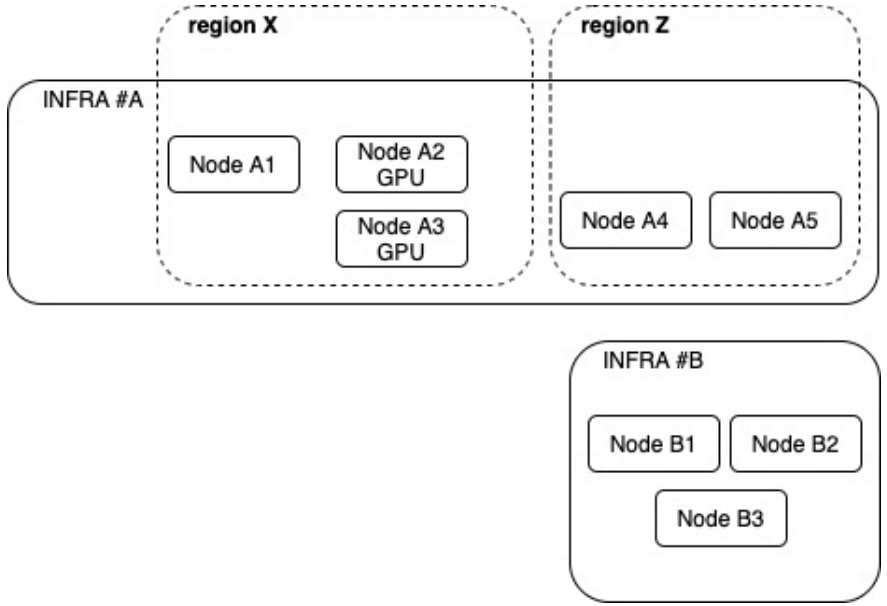
How to manage **edge resources variety**?

Configuration service:

- extracts HW infrastructure **features** (eg. GPU)
- allows SP to **label** Infrastructure Nodes with domain specific information (eg. location etc.)
- allows SP to define deployment **constraints**, for example to privilege edge over cloud

DSS:

- works within such constraints depending on resource requests and availability



example of SP deployment constraints:

1) prefer deployment on Infra #A on region #Z
2) if no resources prefer region #X but only with GPU
3) if no resources prefer Infra #B

default: get back when resources are available again

DSS optimisations – some details (2/4)

How to manage **edge resources allocation**?

DSS inspires to Kubernetes QoS model, based on resource thresholds (min/max)

min («request») represents what an App is guaranteed to get if requested.

- impact: which Apps will be hosted on a resource-limited infrastructure (eg. edge)

max («limit») avoid an App to take too many resources.

- impact: which App will be evicted, that would lead to SLA violations

Thresholds need to be carefully chosen to use edge as much as possible and avoid violations

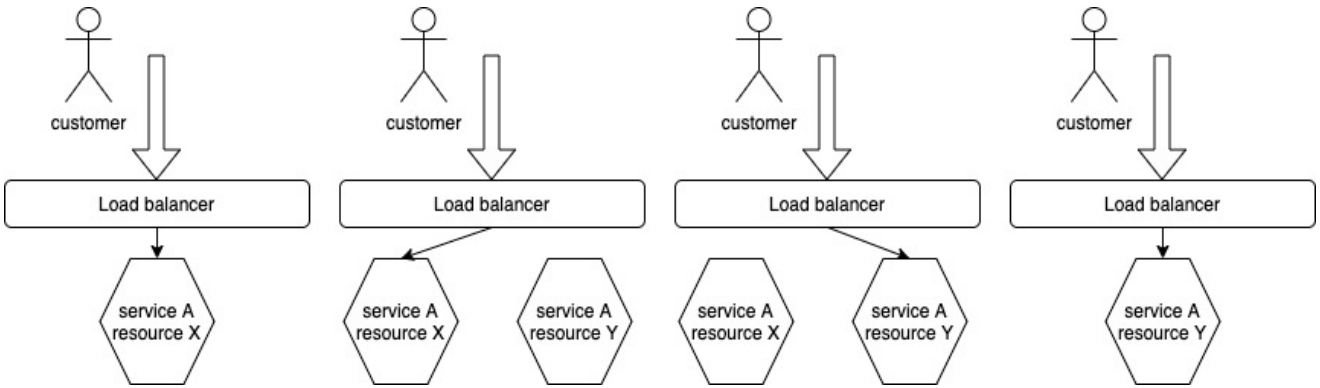
DSS uses **SLA warnings** to **increase/decrease** the **resources** (cpu/memory)
If no resources are available, it **offloads** using the rankings (edge/cloud-to-edge/cloud)

DSS optimisations – some details (3/4)

How to choose **which** App to **optimise resource** first?

The DSS uses SP ”weights” to compute App critical score based on SLA violations

Also, in case of **scale up/down,** load-balancer is used to avoid service disruption and the DSS monitors the Apps **time to boot** to prioritise those that are faster



DSS optimisations – some details (4/4)

How to choose among multiple deployment options (Nodes) with the **same ranking**?
The DSS uses

- **Benchmarking** based on **App profile**, to prioritise Nodes which better fits an App

How to choose among different edge nodes?
The DSS uses

- **edge nodes latency,** to prioritise Nodes with lower values (**edge-to-edge** offloading)

What if a **custom** automation is needed?
The DSS integrates with **NodeRed** to allow custom rules through an easy UI

Next steps and challenges

- ✓ Finalize the integration with the use cases and validate the algorithm with i2CAT
- ✓ Include far-edge devices to support edge-to-edge offloading based on edge node latency
- ✓ Include energy benchmarks on edge devices to optimize service allocation
- ✓ Experiment distributed load-balancing in multi-clusters (eg. for weighted load distribution)

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