Multi-cluster orchestration at the Edge

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orange™

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Overview of the Related Orchestration Solutions

Kubernetes clusters Federations:

KubeFed (Sig Multicluster) and Karmada (Huawei)

Fleet (Rancher)

EMCO (Intel/OpenNESS)

Kubernetes Clusters with geo-distributed nodes:

KubeEdge (Huawei)

OpenYurt (Alibaba Cloud)

Closed source solutions:

Anthos (Google)

Volterra (F5)

Red Hat Advanced Cluster Management for Kubernetes

EMCO (Edge Multi-Cluster Orchestrator)

Incubated as a subproject, ONAP4k8S, under ONAP since 2019, with the initial goal to replace ONAP MultiCloud Kubernetes Plugin

Moved under the Intel OpenNESS umbrella/repo in late 2020

Allows management of applications on Kubernetes Clusters at the Edge, for Telco Providers

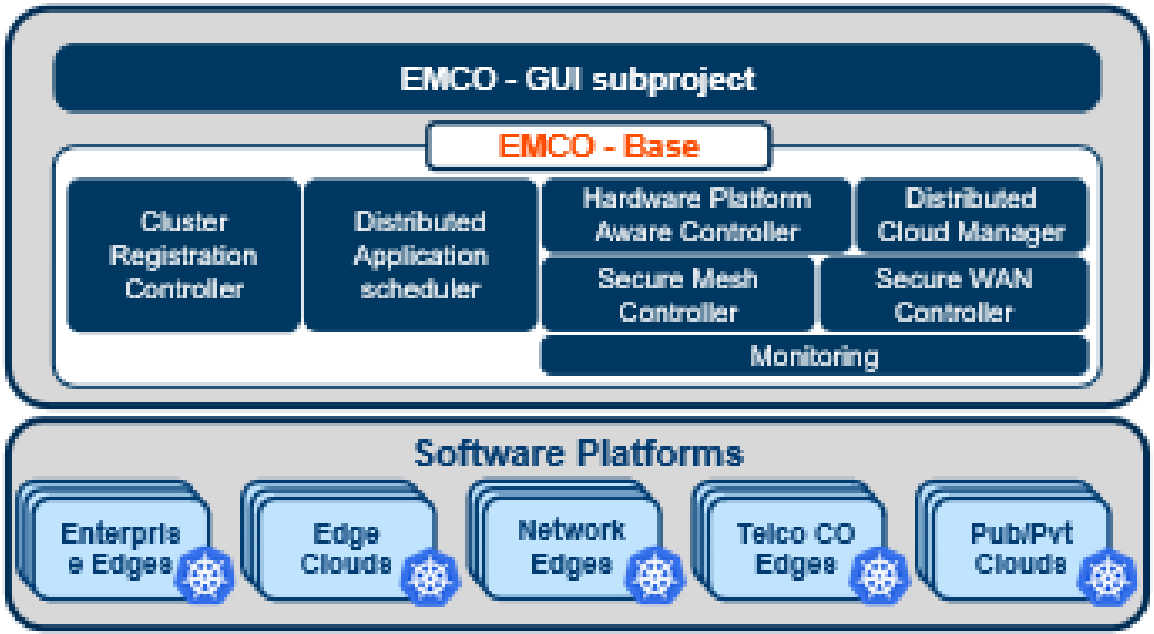
Can handle complex configuration and placements needs through a system of controllers and intents:

Each deployment is packaged with Intents, interpreted by EMCO's controllers to address a specific deployment need (WAN, Service Mesh, Placement, Day-2 configuration,…)

Micro-service architecture, with the possibility to add controllers and intents to resolve a specific need.

Very young project (first release December 2020), it is licensed as an sandbox LFN project in September 2021

EMCO : Architecture



*Cluster Registration Controller registers clusters by cluster owners

* Distributed Application Scheduler provides simplified, and extensible placement

*Hardware Platform Aware Controller enables scheduling with auto-discovery of platform features/ capabilities

*Distributed Cloud Manager presents a single logical cloud from multiple edges

*Secure Mesh Controller auto-configures both service mesh (ISTIO) and security policy (NAT, firewall)

*Secure WAN Controller automates secure overlays across edge groups

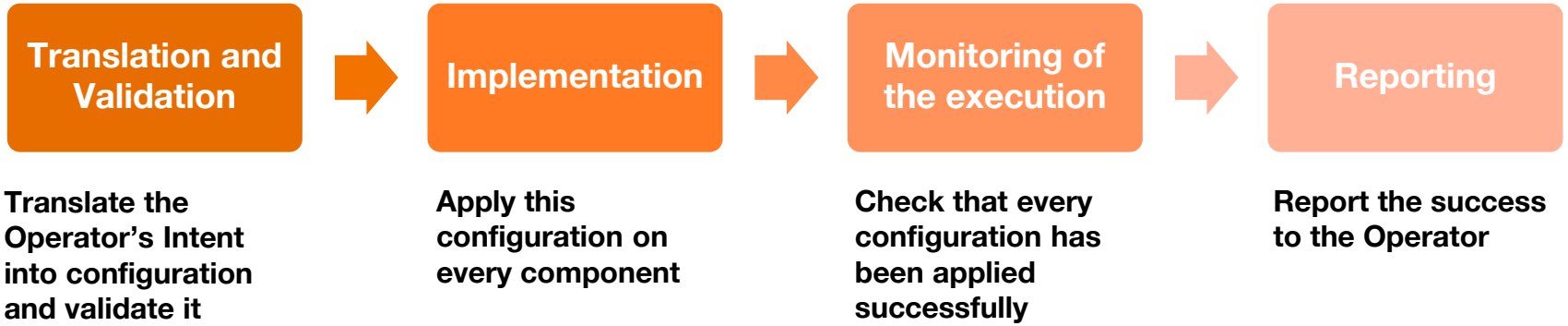
* Monitoring covers distributed application performance, and accesses

Intent based orchestration

Intent: Set of specifications in natural language or technical language of high-level policies for automated orchestrations

e.g., a **Placement Intent**: “I want to run my workload in a particular set of clusters, with a GPU available, and it needs at least x amount of CPU/Memory available”

e.g., an **Action Intent**: “I want my workload A, to be able to communicate with my workload B”



→ With EMCO’s architecture, new intents can be added through new controllers

EMCO's Controllers

When a deployment is instantiated, the controllers are sequentially called by the orchestrator

Each controller manages a set of intents (either placement or action) and takes appropriate actions

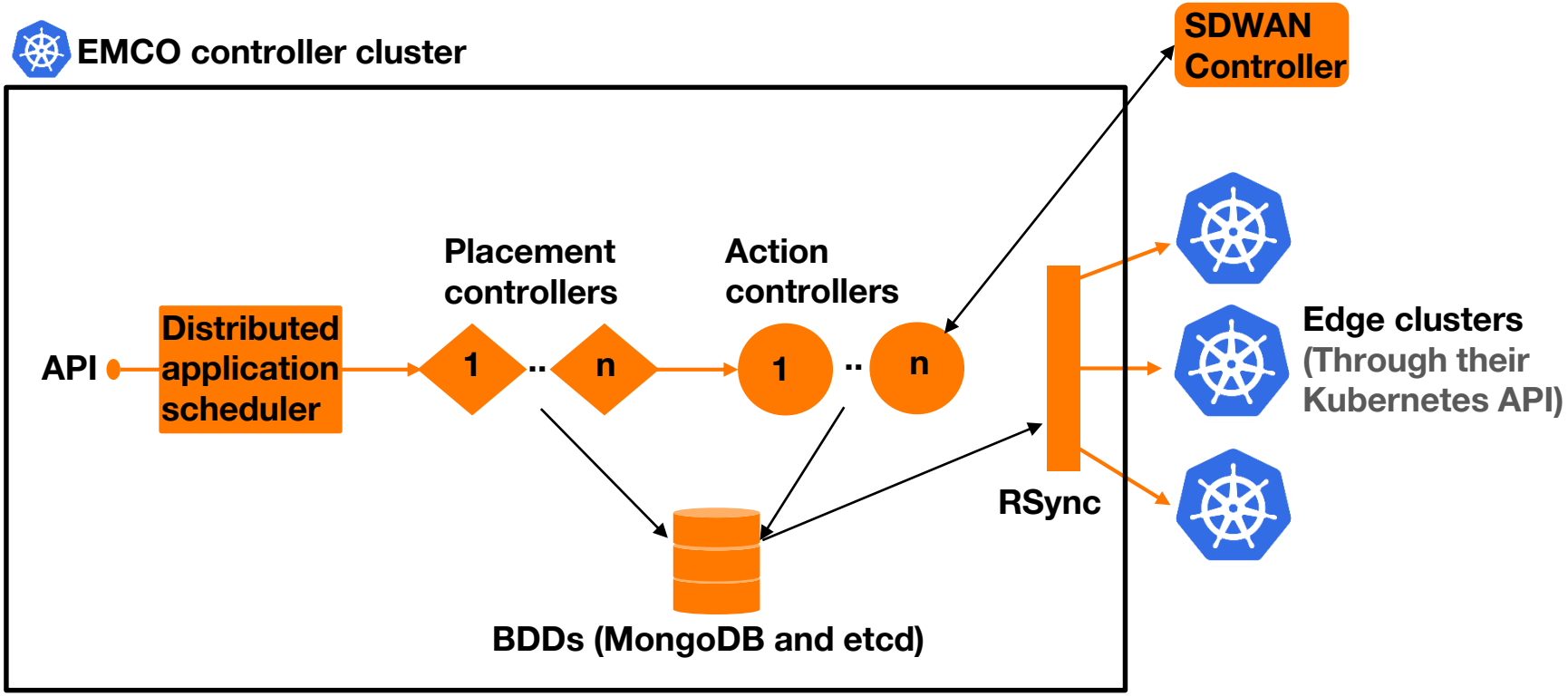
Controllers can be added to the orchestrator to support new intents (e.g. AI-powered placement controller)

Current existing controllers:

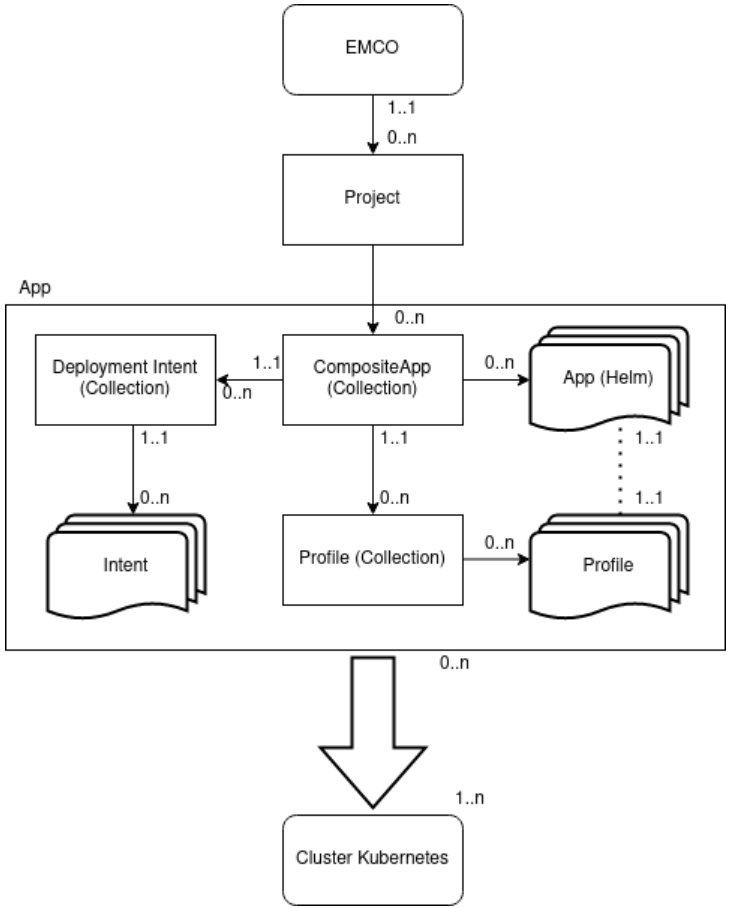
- OVN Action controller: Manage network interface annotations to attach network interfaces
- Traffic controller: Create network policy resources
- Generic Action Controller: Create or modify Kubernetes Objects

And (hopefully) soon more to come ! (SDWAN, Service Mesh, better placement capabilities)

Deploying an App with EMCO



Structure of a deployment with EMCO



SWOT Analysis of EMCO

Strengths:

- Management of distributed applications at the Edge
- Tailored for Telco use cases
- Modular architecture
- Works with Kubernetes Vanilla
- LFN Sandbox Project

Opportunities:

- Need in the ONAP community and Telco ecosystem for a solutions like EMCO
- The only open-source solution targeting Telco

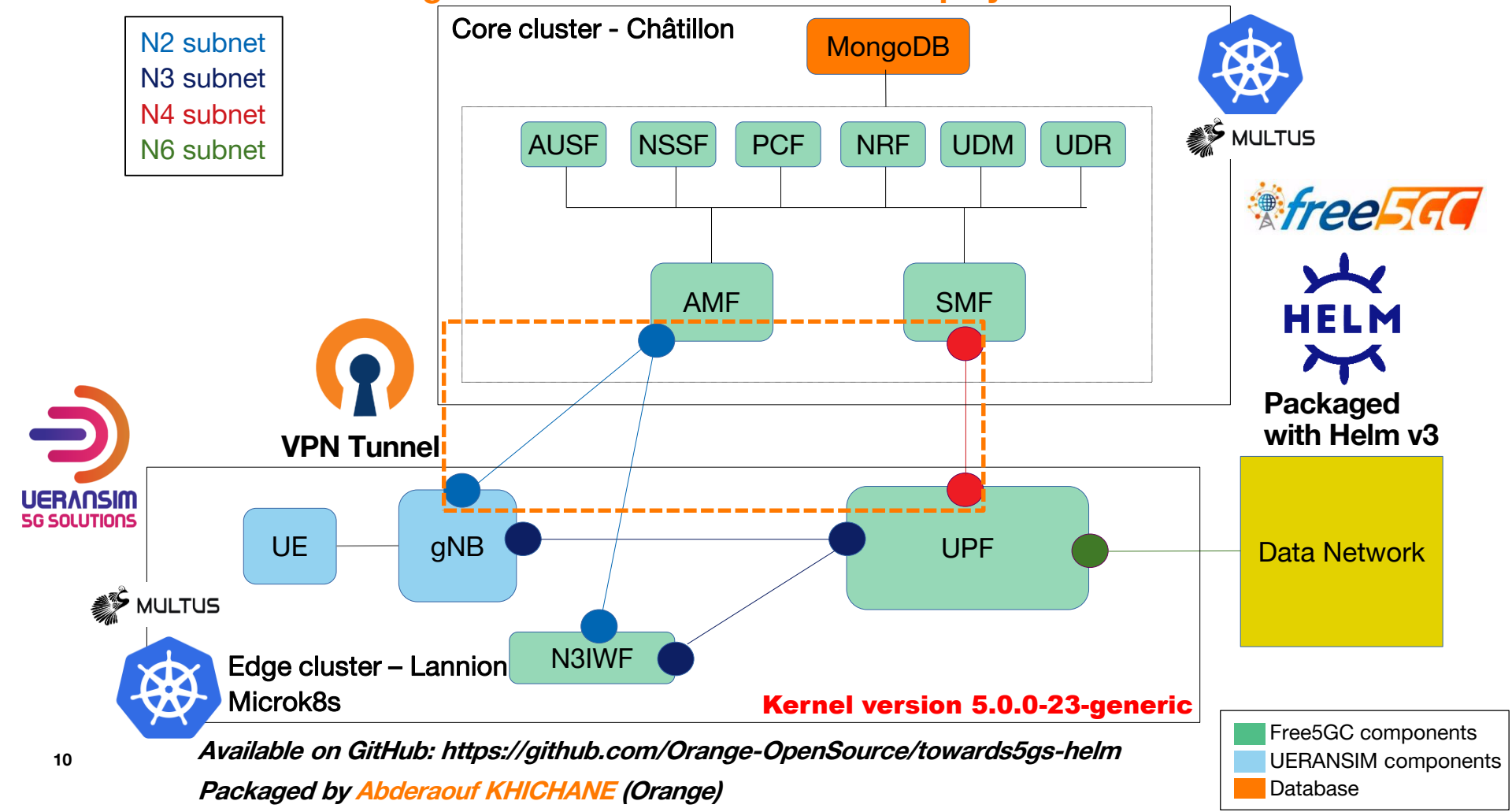
Weaknesses:

- Early stage
- Currently mainly backed by Intel
- Many core features are missing

Threats:

- Several emerging projects (e.g Baeytl, Open Horizon)
- With the LFN licensing, will have to grow a community in the next months

First Use Case: Provisioning of a Distributed 5G Network Deployment



Available on GitHub: https://github.com/Orange-OpenSource/towards5gs-helm

Packaged by Abderaouf KHICHANE (Orange)

EMCO : Community Status

- **TSC established August 24, 2021**
  - **Weekly TSC meeting established**
- **Technical Charter: Sept 02, 2021**
- **Seed code dropped September 21, 2021**
- **TAC Approved EMCO for LFN Induction Sept 22, 2021**
- **Next Step: LFN Board review and vote**
- **Website:** https://emco-project.io
- **Wiki:** https://wiki.lfnetworking.org/display/EMCO/Welcome+to+the+EMCO+Wiki
- **Mailing list:** https://lists.project-emco.io/g/main
- **Community size: 36 members (based on mailing list)**
- **11 companies/entities represented**
- **>200 commits by 10+ contributors from Intel and Aarna Networks in 6 months prior to seed code drop**
  - Repo: https://gitlab.com/project-emco/EMCO

Thank you for your attention

Any questions?