Open Source MANO by ETSI

OCI-Registries for OSM xNFs

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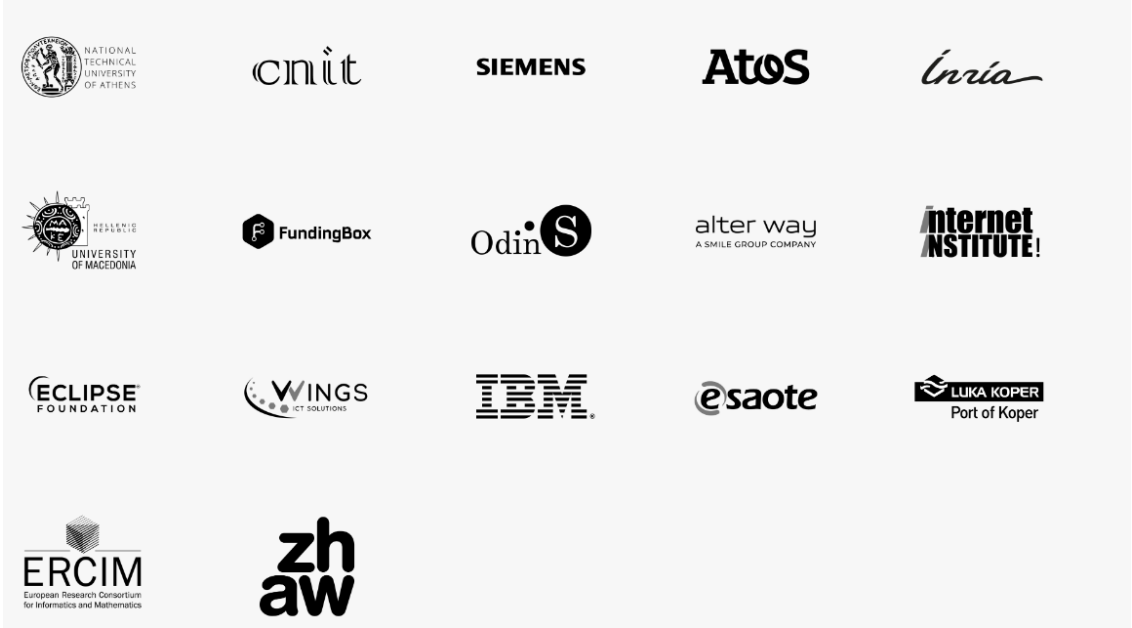
Agenda

- Nephele Project
- Motivation & Objectives
- Technologies
- Demo implementation
- Demo
- Conclusions and next steps

Nephele Project

- **Research and Innovation Action for "Future European platforms for the Edge: Meta Operating Systems".**
- Enable the efficient, reliable and secure end-to-end orchestration of **hyper-distributed applications (HDAs)** over programmable infrastructure that is spanning across the **compute continuum from Cloud-to-Edge-to-IoT**, **removing existing openness and interoperability barriers** in the convergence of IoT technologies against cloud and edge computing orchestration platforms, and introducing automation and decentralized intelligence **mechanisms powered by 5G** and distributed AI technologies.



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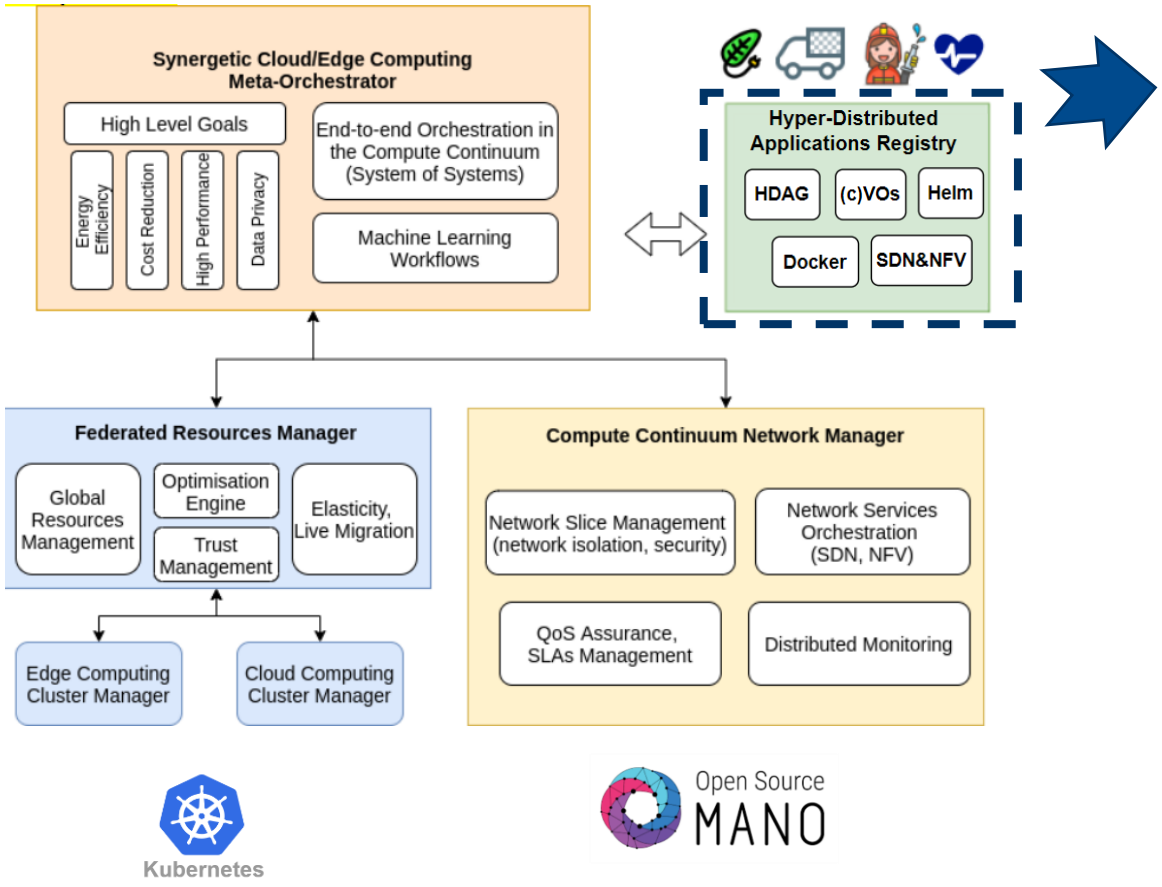
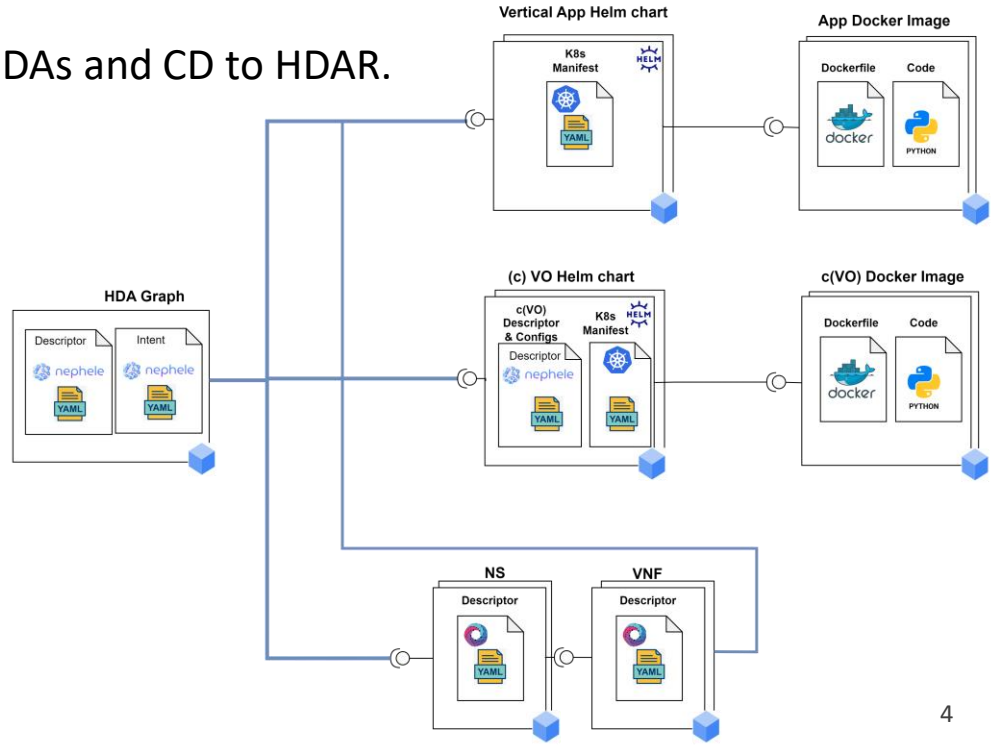
Nephele Project

- **Synergetic Meta-Orchestration Framework for the Compute Continuum.**



- **Hyper-Distributed Applications Registry**.
  - HDA: App distributed across the continuum (extremeEdge to Cloud)
  - R: Storage & Distribution System for all artifacts involved in the deployment of a HDA.
- **Development Environment for HDAs**
  - CI of HDAs and CD to HDAR.

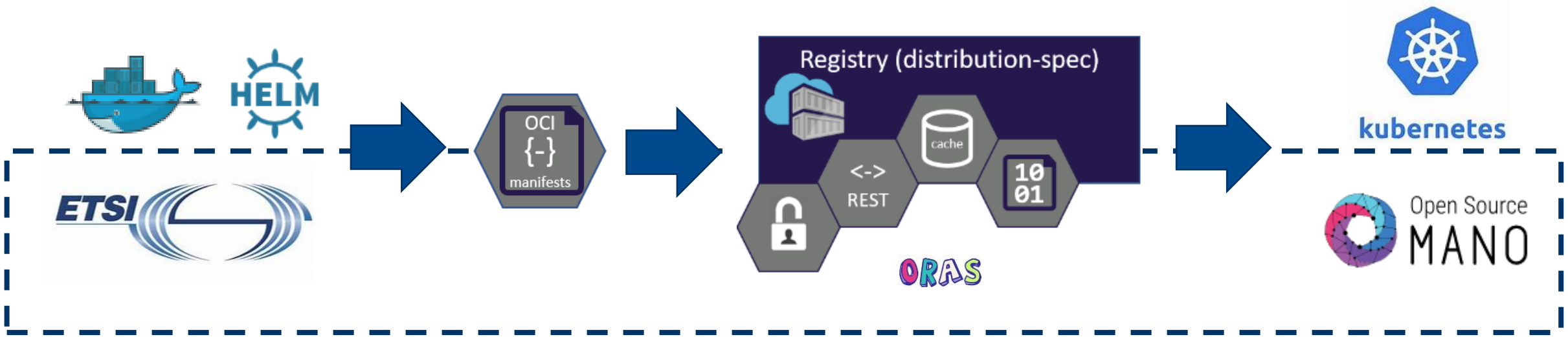


Motivation & Objective

Motivation: Simplify and improve the development and management (storage and distribution) of xNFs artifacts (NS, VNFs, Slices) in simple and complex scenarios by **leveraging commercial-grade technologies from the CN ecosystem.**

- Simplify and unify artifact management in OpenSource codebase.
- Contribute to the **ETSI & CNCF alignment**: ETSI & CNCF agreement renewal, OCI registry for Helm OCI registries for helm (#10997) · Issues · osm / Features · GitLab (etsi.org)

Objective: To demonstrate how we can **harmonize the storage and distribution mechanisms used for artifacts** in the Telco and CN industries **significantly improving both, the developer and the stakeholder experience and interoperability**.

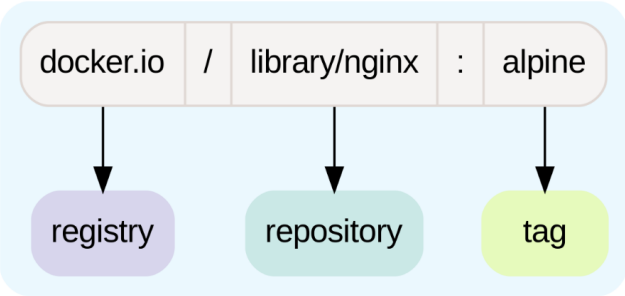


Demo

Technologies

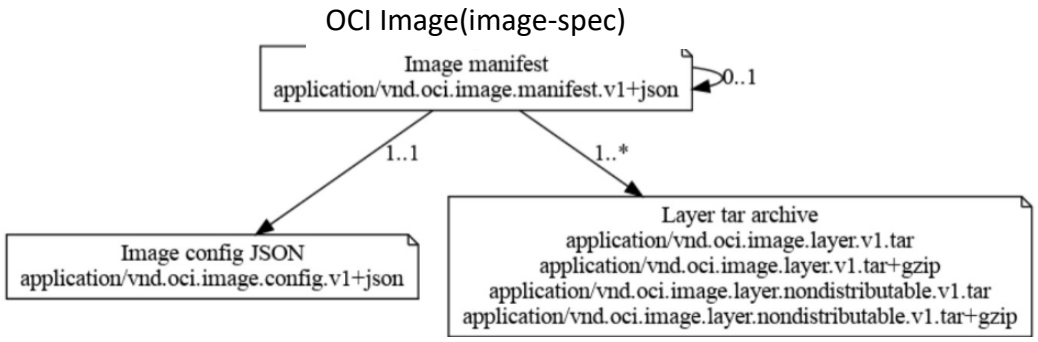
Background:

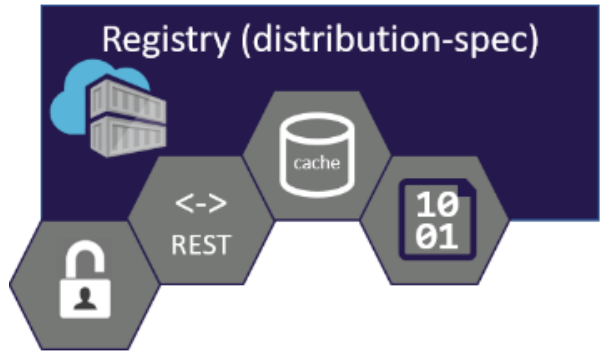
- **Artifact**: Distributable outcome of a software development in the form of a filesystem bundle, essentially, anything that a system or user might need to successfully run a software.
- **Registry**: A registry is a storage and distribution system for those artifacts
- **Repository**: A registry is organized into repositories, where a repository holds all the versions of a specific artifact



OCI Specifications:

- The Runtime Specification (**runtime-spec**) details how to run a "filesystem bundle" that is unpacked on disk.
- The Image Specification (**image-spec**) outlines how to build and process the "filesystem bundle" which results in the creation of an OCI Image.
  - The **image manifest** structure and mediaType is fixed to be compatible with the distribution-spec implementers
  - The **image config manifest** and mediaType is what enables the runtime-spec implementers to know if the image is meant for their system and how to process the filesystem bundle. → This is what needs to be standardize for NFV artifacts.
- The Distribution Specification (**distribution-spec**) defines an API protocol to facilitate and standardize the distribution of OCI images.





Demo implementation

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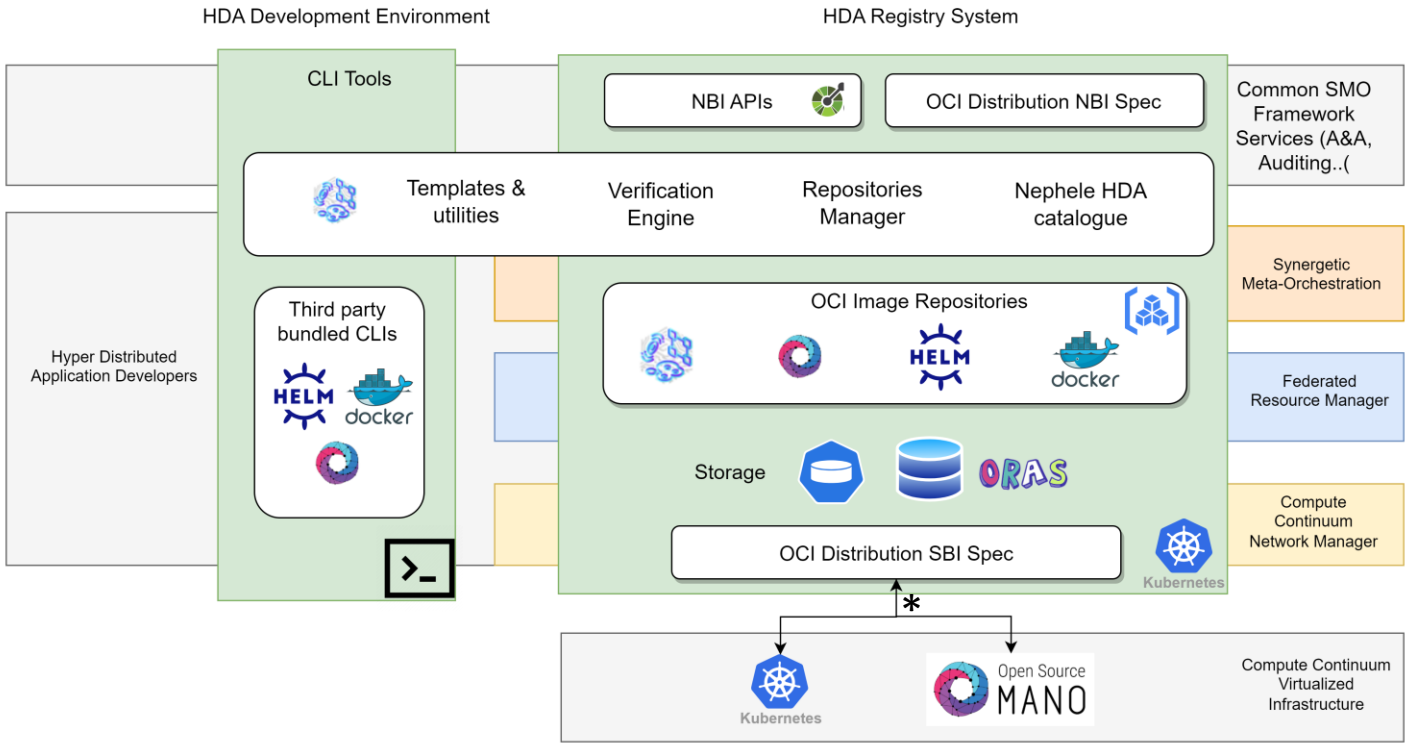
The HDAR CLI (inspired in Helm CLI) implements the custom image-spec for NEPHELE and OSM artifacts to Pull&Push them to the OCI-Registry. Supports

- **HDAG, (c)VOs, NS, VNF**
- Other CLIs support: **Helm, SBOM, Digital signatures, Provenance data, Attestations and Vulnerability reports [OCI artifacts on Docker Hub | Docker Docs]**

The HDAR System consist of (regarding OSM):

- An **OCI-Registry** (distribution-spec) which stores custom OCI images**, including OSM artifacts (NS and VNFs).**
- **NFV Config JSON proposal with supporting info for deployment and verification.**
- Integrated custom CLI and OSM CLI to onboard artifacts to OSM.



* Helm pull expected by OSM Rel15.

* OSM pull under development and to be proposed as feature.

Demo

OSM VNF image-spec image manifest JSON


```
{
    "schemaVersion": 2,
    "mediaType": "application/vnd.oci.image.manifest.v1+json",
    "config": {
        "mediaType": "application/vnd.etsi.nfv.config.v1+json",
        "digest": "sha256:c8afbc0b197e8d4f56374412b68bb823aa8179d909ceb6f492cba605f9ed89cd",
        "size": 421
    },
    "layers": [
        {
            "mediaType": "application/vnd.etsi.nfv.config.v1+json",
            "digest": "sha256:c0a70ca449b9c570280f750d9b9b4f87a934746b182d86be5021abfd186291b5",
            "size": 321,
            "annotations": {
                "org.opencontainers.image.title": "openldap_knf-1.0.tar.gz"
            }
        }
    ],
    "annotations": {
        "org.opencontainers.image.authors": "Telefonica",
        "org.opencontainers.image.created": "2023-11-21T11:34:50Z",
        "org.opencontainers.image.description": "KNF with single KDU using a helm-chart for openldap version 1.2.3",
        "org.opencontainers.image.title": "openldap_knf",
        "org.opencontainers.image.version": "1.0"
    }
}
```


OSM NFV image-spec image config JSON


```
{
    "schemaVersion": "1",
    "mediaType": "application/vnd.etsi.nfv.config.v1+json",
    "packageSpec": "SOL004",
    "dataModelSpec": "SOL006",
    "descriptorFile": "openldap_knf/openldap_vnfd.yaml",
    "descriptorType": "VNF",
    "descriptorId": "openldap_knf",
    "descriptorVersion": "1.0",
    "dependencies": [
        {
            "descriptorType": "HELM",
            "descriptorId": "stable/openldap",
            "location": "external",
            "mode": "soft"
        }
    ]
}
```

Conclusions and next steps

While most of the existing implementations for any of the three OCI specifications focus on containerized workloads in the context of Kubernetes. **The image-spec and the distribution-spec are by no means limited to K8s and has already been adopted by multiple projects** OCI artifacts on Docker Hub | Docker Docs.

Using an OCI-Registry to store OSM artifacts **simplifies the developers work and greatly contributes to the interoperability of xNF providers and MNOs**.

What could come next?

- Simplification of the OSM CLI codebase: **Unification of the K8s and OSM Repositories codebase.**
- Creation of a xNF Martketplace and **upgrade of the OSM Packages GitLab repository**.
- **Public and Private Registries**, externally and internally.
- Quick support for **xNF artifacts versioning.**
- OCI-Registry replication and proxies for multi-stakeholder environments.
- **OSM storage profile reduction**:
  - Offloading to specialized commercial-grade services.
  - Layer blob sharing, automated garbage collection.
  - Pull-based orchestration.

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Thank You!