



LF NETWORKING

Developer & Testing Forum

Nephio R1 & R2

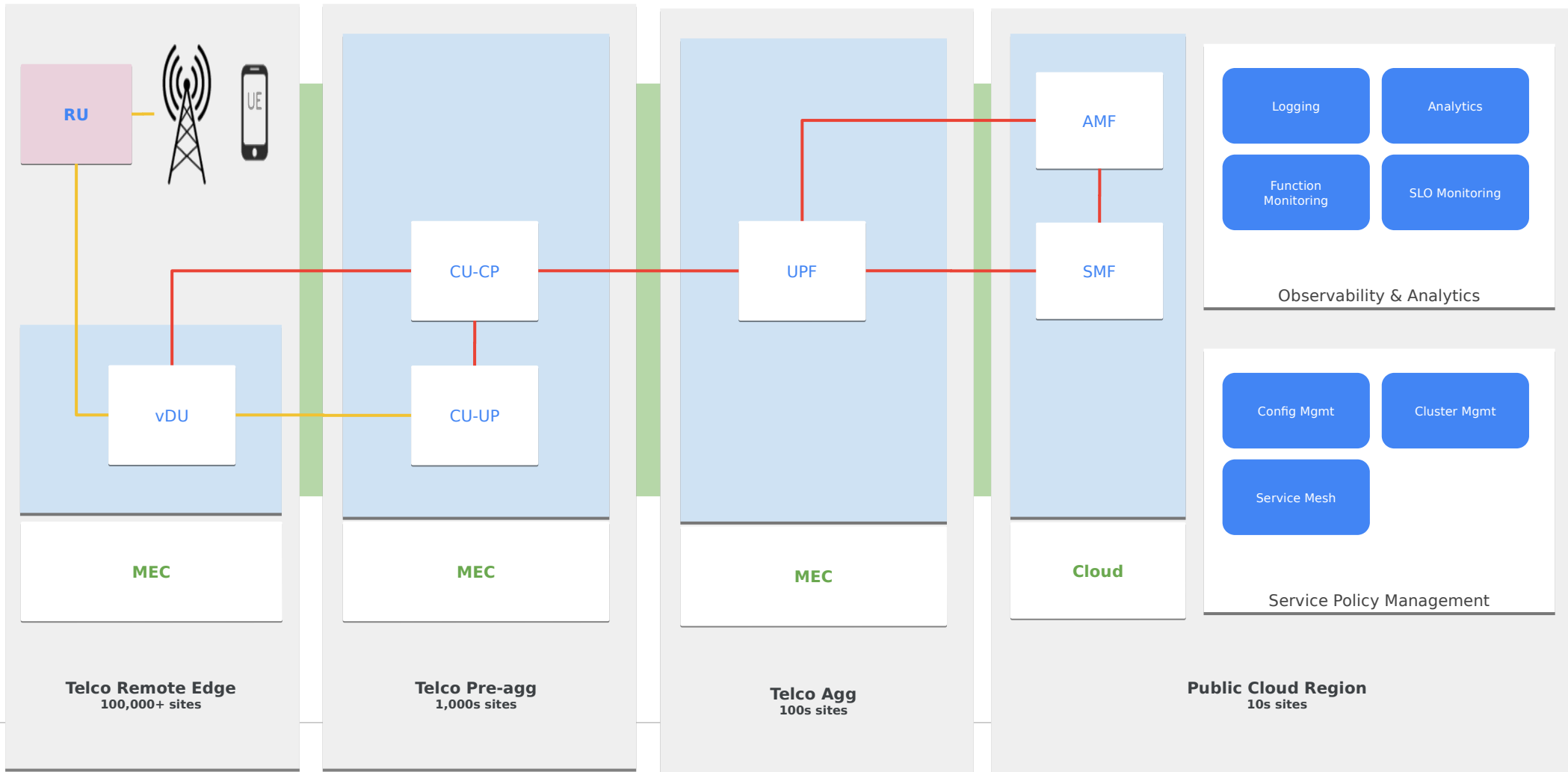
Prepared by John Belamaric (Google) and Wim Henderickx (Nokia)

Presented by Eric Debeau (Orange) & Timo Perala (Nokia)

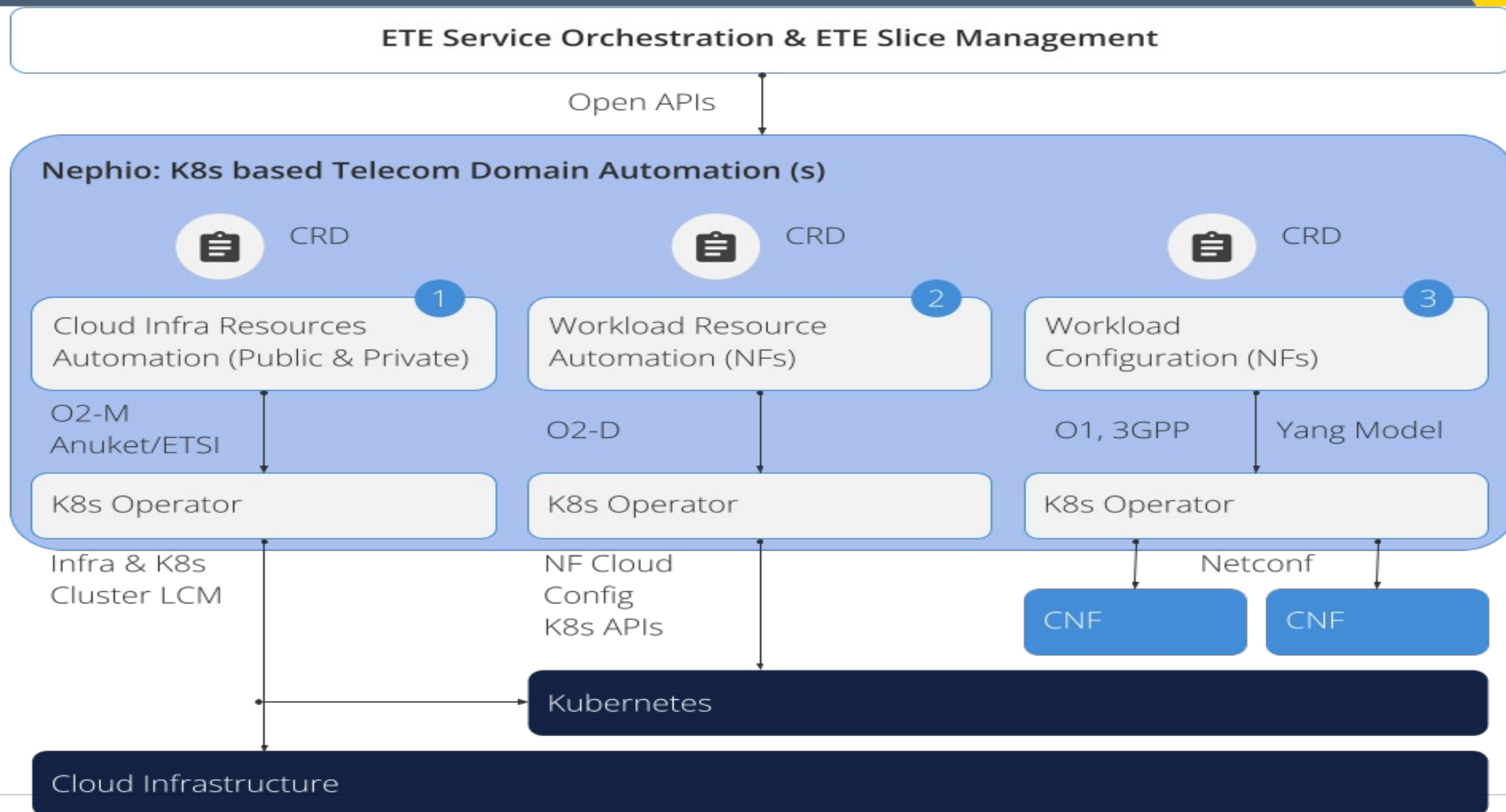
<https://lfnetworking.org>



The telco landscape



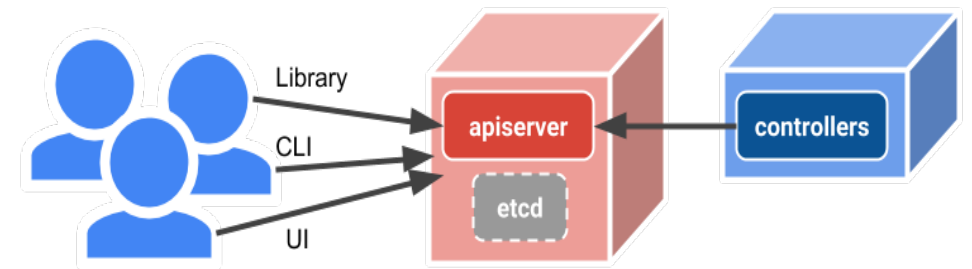
Introducing Nephio



KRM: Kubernetes Resource Model



- API centric
- Declarative control
 - desired state
 - observed state
- Standard metadata (indexing)
- Extendable (CRD)
- Event driven (Watch)
- Resource Semantics and lifecycle
- Eventual consistency
- Huge eco-system

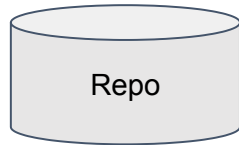


<https://github.com/kubernetes/design-proposals-archive/blob/main/architecture/resource-management.md>

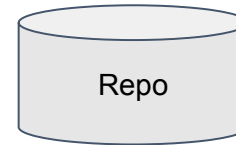
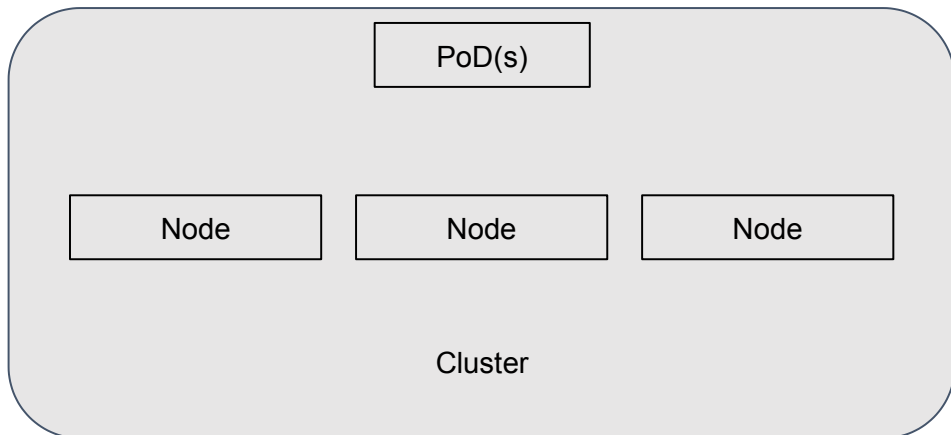
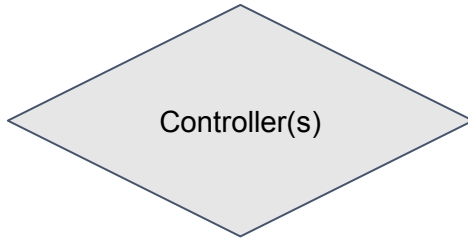
Configuration as data

- A new approach to configuration management
 - Represent config in a well-defined, structured data model (KRM!)
 - Configuration lives in versioned storage, separate from the live state
 - Tools operate on the config - do not intermingle code and configuration
 - Clients interact with config via APIs, not directly on storage
- Machine manageable configurations
- Enables iterative, multi-actor mutation and validation
- Automated changes, bulk operations, and human-initiated modifications co-exist peacefully
- Automatic system validation of configuration before applying to live state
- Reusable, well-tested functions operate on configuration rather than embedding code inside the configuration

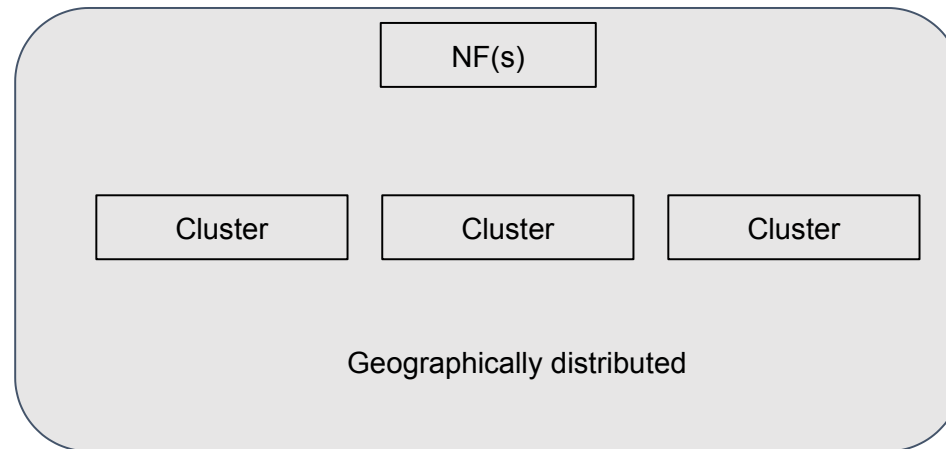
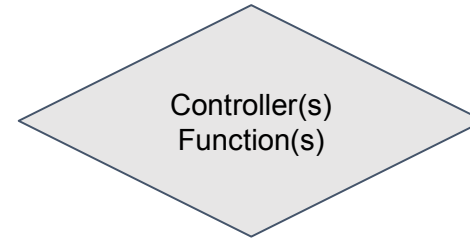
Analogy



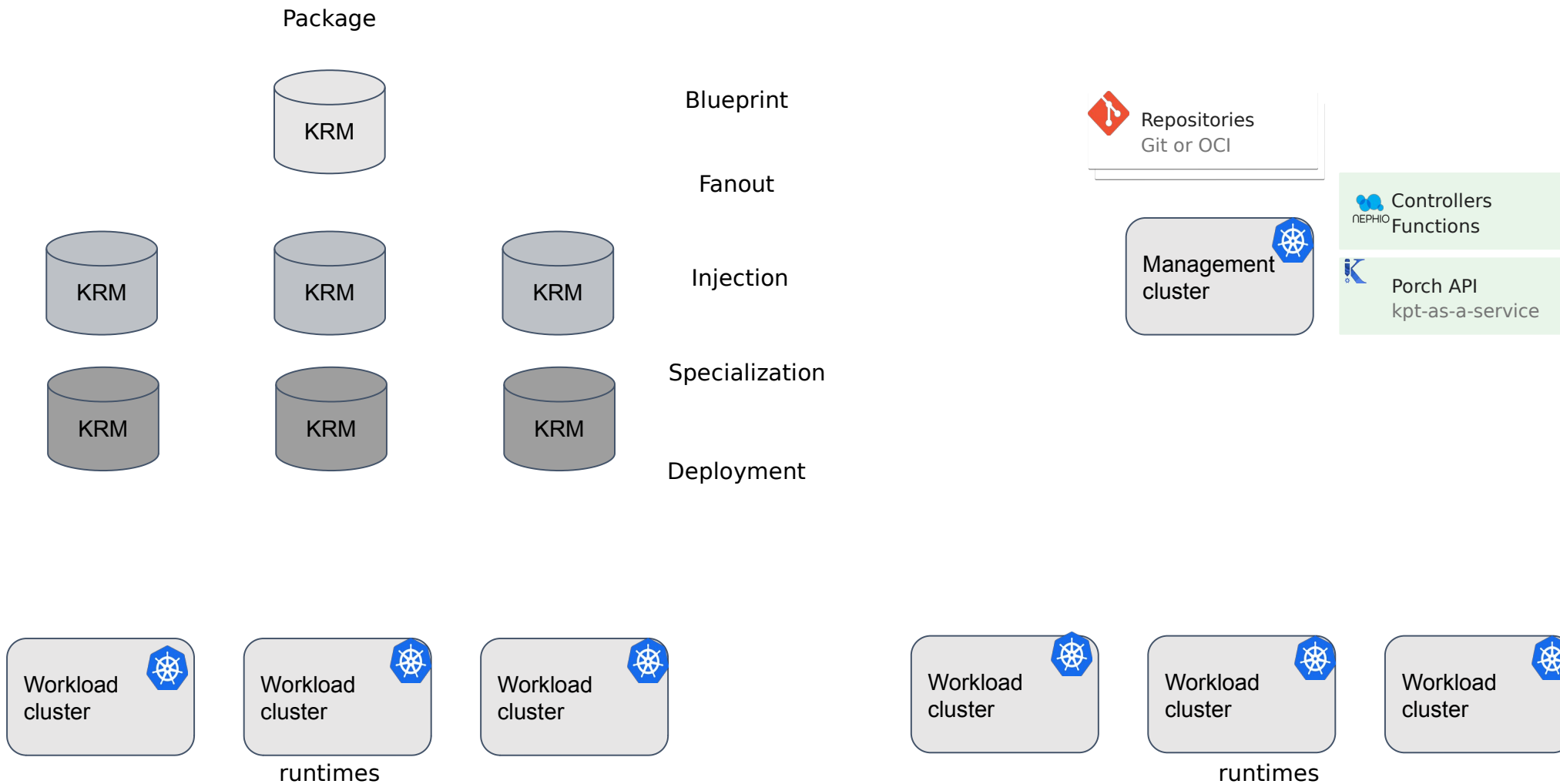
Deployment, Daemonset, StatefulSet



Package Variant Set



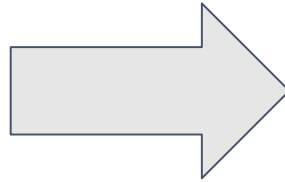
High level architecture



Example

```
apiVersion: kpt.dev/v1
kind: Kptfile
metadata:
  name: pkg-upf
  annotations:
    config.kubernetes.io/local-config: "true"
info:
  description: upf package example
Pipeline:
- fn-A
- fn-B
```

KptFile (Package + pipeline
- functions/controllers)



```
apiVersion: req.nephio.org/v1alpha1
kind: DataNetwork
metadata:
  name: internet
  annotations:
```

```
conf
pref
spec:
  metadata:
    name: 3
```

```
networ
name
pools:
- na
pr
```

```
apiVersion: req.nephio.org/v1alpha1
kind: Interface
metadata:
  name: 3
  annotations:
    con
spec:
  metadata:
    name: 3
```

```
apiVersion: infra.nephio.org/v1alpha1
kind: ClusterContext
metadata:
  name: cluster-context
  annotations:
    config.kubernetes.io/local-config: "true"
spec:
  network:
    name:
  cniType:
  attach
```

Blueprint Package

```
apiVersion: k8s.cni.cncf.io/v1
kind: NetworkAttachmentDefinition
meta
```

```
cre
na
kind: NetworkAttachmentDefinition
```

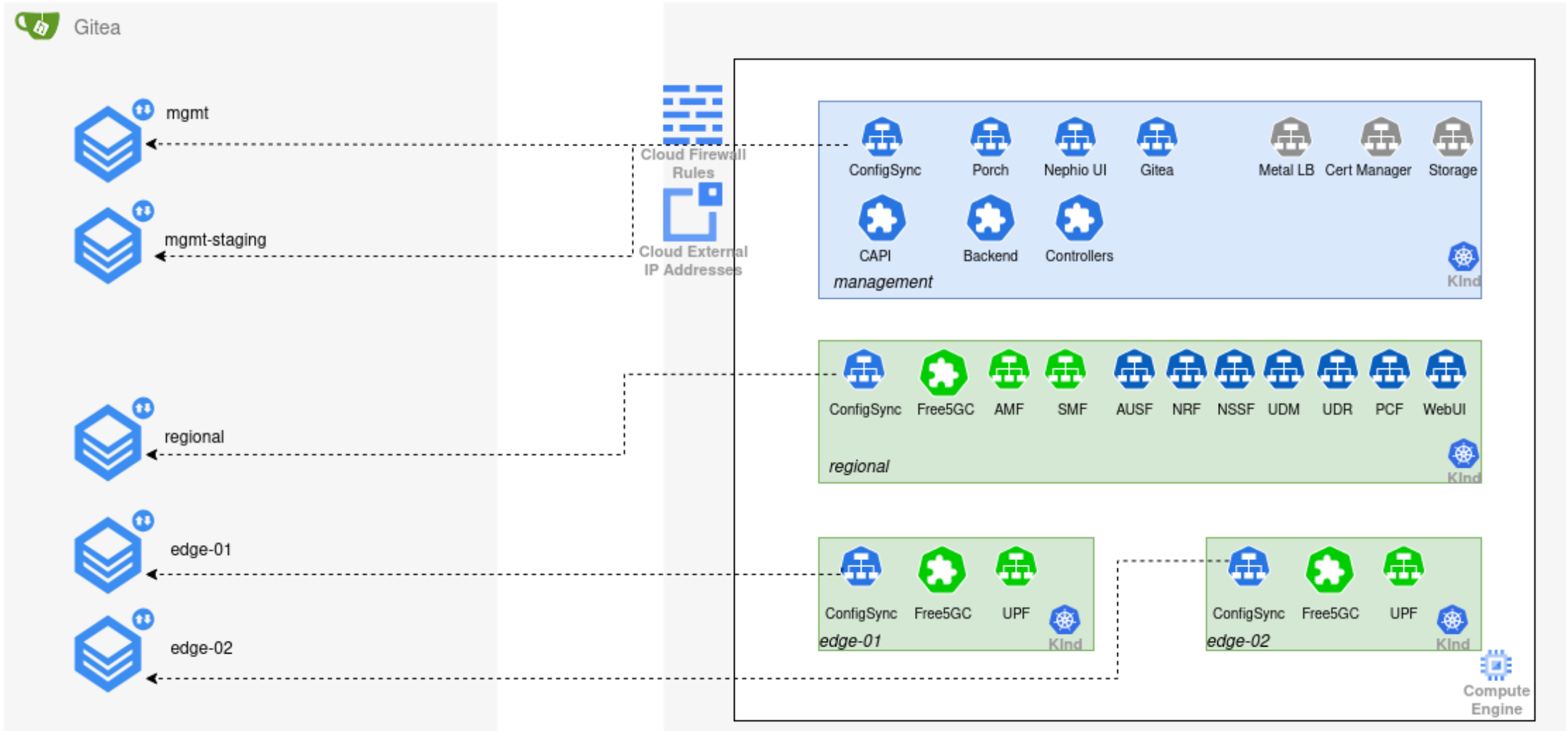
```
meta
cre
name
apiVersion: nf.nephio.org/v1alpha1
kind: UPFDeployment
metadata:
  name: upf
spec:
  networkInstance:
    name: vpc-internal
  interface:
    - n3: 10.0.0.1
    - N4: 192.168.0.1
```

Deployment Manifests

Nephio R1 User Stories

- User Story 1: Deploy 5G core network functions (free5gc)
- User Story 2: Upgrade user plane capacity
 - Upgrade the resources (vertical scaling) of an existing UPF
 - Deploy a new edge cluster and deploy UPF (horizontal scaling)
- User Story 3: Upgrade control plane capacity
 - Upgrade the resources (vertical scaling) of an existing SMF
- Provision all free5gc NFs
- Provision workload clusters and join them to Nephio management
- UI viewers and editors for PackageVariant(Set) resources
- Provision Networking
- Make a call via UERANSIM

Nephio R1 Free5GC use case



Nephio R1 Free5GC Operator

- A single K8S Operator for AMF, UPF, SMF
 - Generates ConfigMap, Service, Deployment
 - Resource limits depends on CRD capacity

AMFDeployment workload.nephio.org v1alpha1

Kind Group Version

```
apiVersion: workload.nephio.org/v1alpha1
kind: AMFDeployment
```

No Description Provided.

- collapse all + expand all

spec object

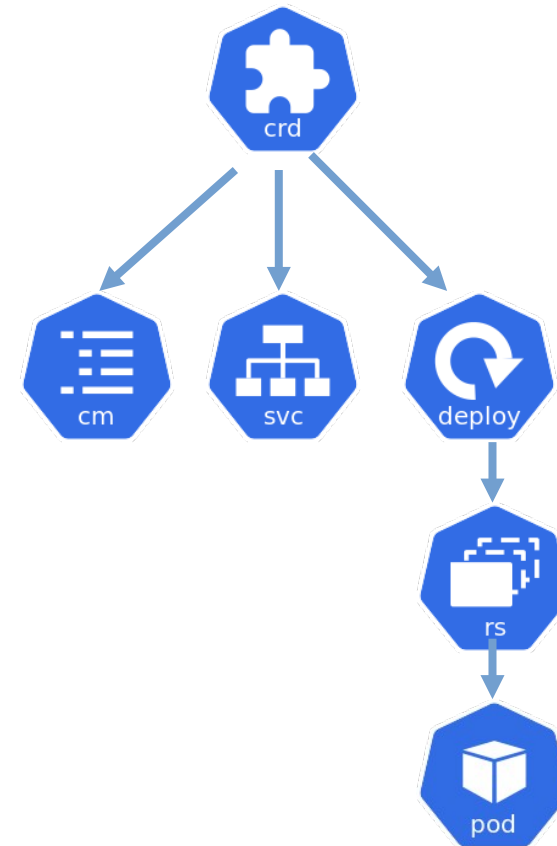
No Description Provided.

- capacity object
- configRefs []object
- interfaces []object
- networkInstances []object

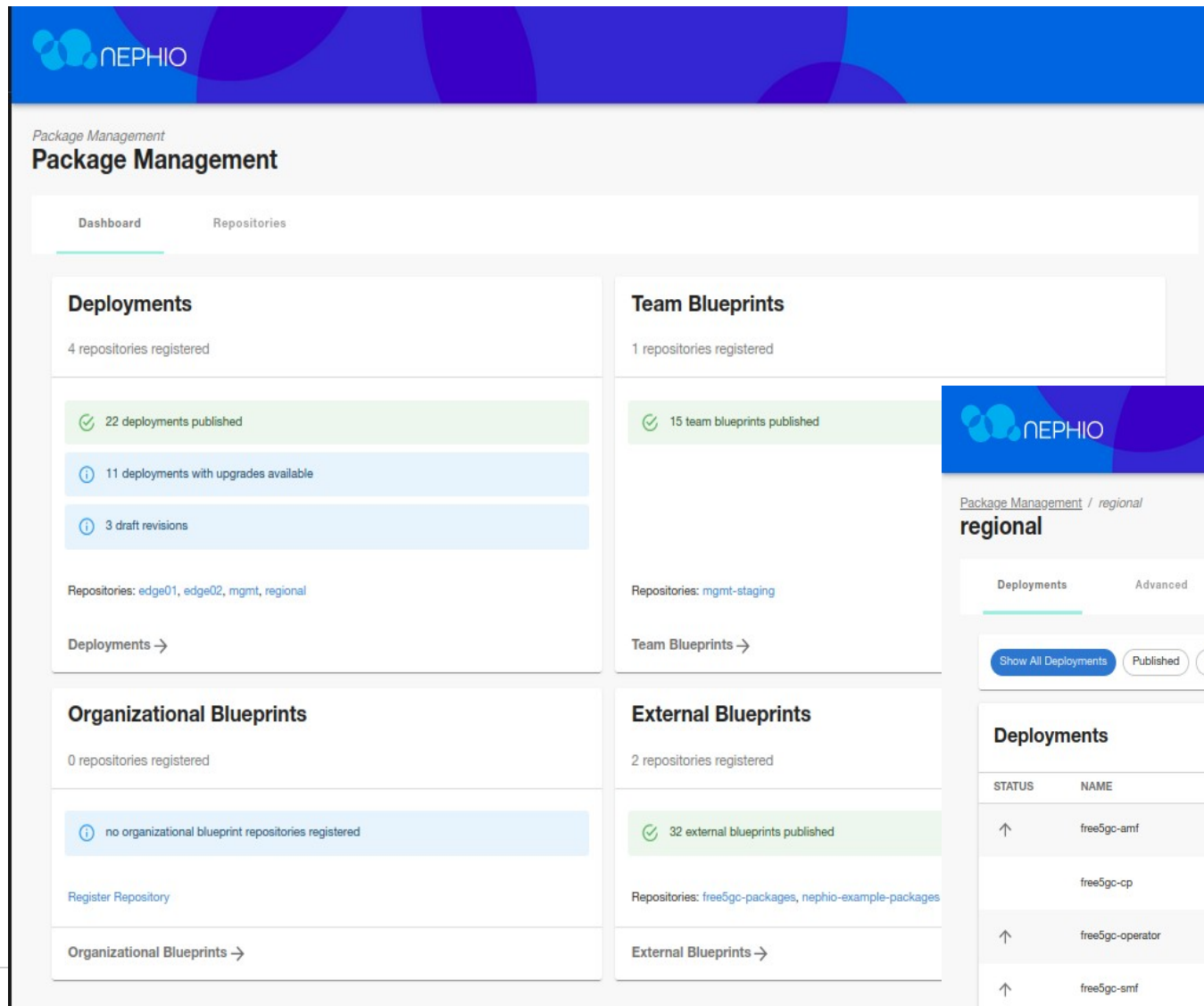
status object

No Description Provided.

- conditions []object
- observedGeneration integer required



Nephio R1 UI



Package Management

Dashboard | Repositories

Deployments
4 repositories registered

- 22 deployments published
- 11 deployments with upgrades available
- 3 draft revisions

Repositories: edge01, edge02, mgmt, regional

Deployments →

Team Blueprints
1 repositories registered

- 15 team blueprints published

Repositories: mgmt-staging

Team Blueprints →

Organizational Blueprints
0 repositories registered

- no organizational blueprint repositories registered

Register Repository

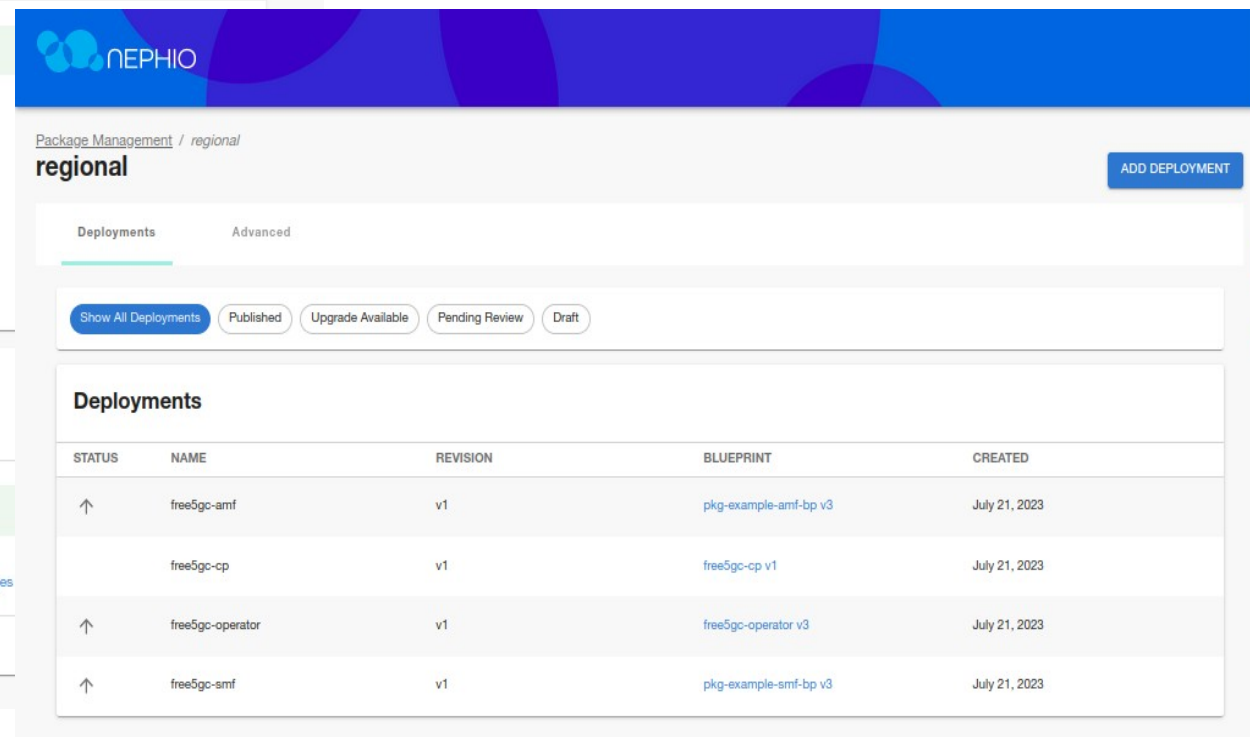
Organizational Blueprints →

External Blueprints
2 repositories registered

- 32 external blueprints published

Repositories: free5gc-packages, nephio-example-packages

External Blueprints →



Package Management / regional

regional ADD DEPLOYMENT

Deployments | Advanced

Show All Deployments | Published | Upgrade Available | Pending Review | Draft

Deployments

| STATUS | NAME | REVISION | BLUEPRINT | CREATED |
|--------|------------------|----------|-----------------------|---------------|
| ↑ | free5gc-amf | v1 | pkg-example-amf-bp v3 | July 21, 2023 |
| | free5gc-cp | v1 | free5gc-cp v1 | July 21, 2023 |
| ↑ | free5gc-operator | v1 | free5gc-operator v3 | July 21, 2023 |
| ↑ | free5gc-smf | v1 | pkg-example-smf-bp v3 | July 21, 2023 |

Nephio R2 and beyond

Release deliverables

- Features
 - Multi vendor support
 - OAI Core & OAI RAN
 - Topology Controller
 - Integration with new release of Porch
- Technical debt
- Documentation
- Installer

Exploration(Spikes & POCs)

- Nephio SDK
- Helm Support
- Observability
- Service Assurance
- Policy engine
- NF2Infra

Nephio working groups

- **SIG1 Architecture**

- WG1: Architecture & long-term roadmap
- WG2: use cases O-RAN
- WG3: Release scope & User Stories
- WG4: Experience & Modeling
- WG5: Service Assurance & Policy

- **SIG2 Automation**

- **SIG3 Release**
- **SIG4 Security**

Nephio resources

- Nephio: A New Approach for Automating Telco Workloads - Wim Henderickx & John Belamaric – YouTube
- Website - <https://nephio.org/> , <https://nephio.org/about/>
- Wiki - <https://wiki.nephio.org/>
- Blog Postings - <https://nephio.org/blog/>
- Project Github - <https://github.com/nephio-project> (Please note “nephio-project is right one”)
- More links at <https://github.com/nephio-project/docs>
- Project email distro - <https://lists.nephio.org>
- [nephio-tsc](#) (for TSC members and interested parties)
- [nephio-dev](#) (for all)
- SIG lists: [sig-netarch](#), [sig-automation](#), [sig-release](#), [sig-security](#)