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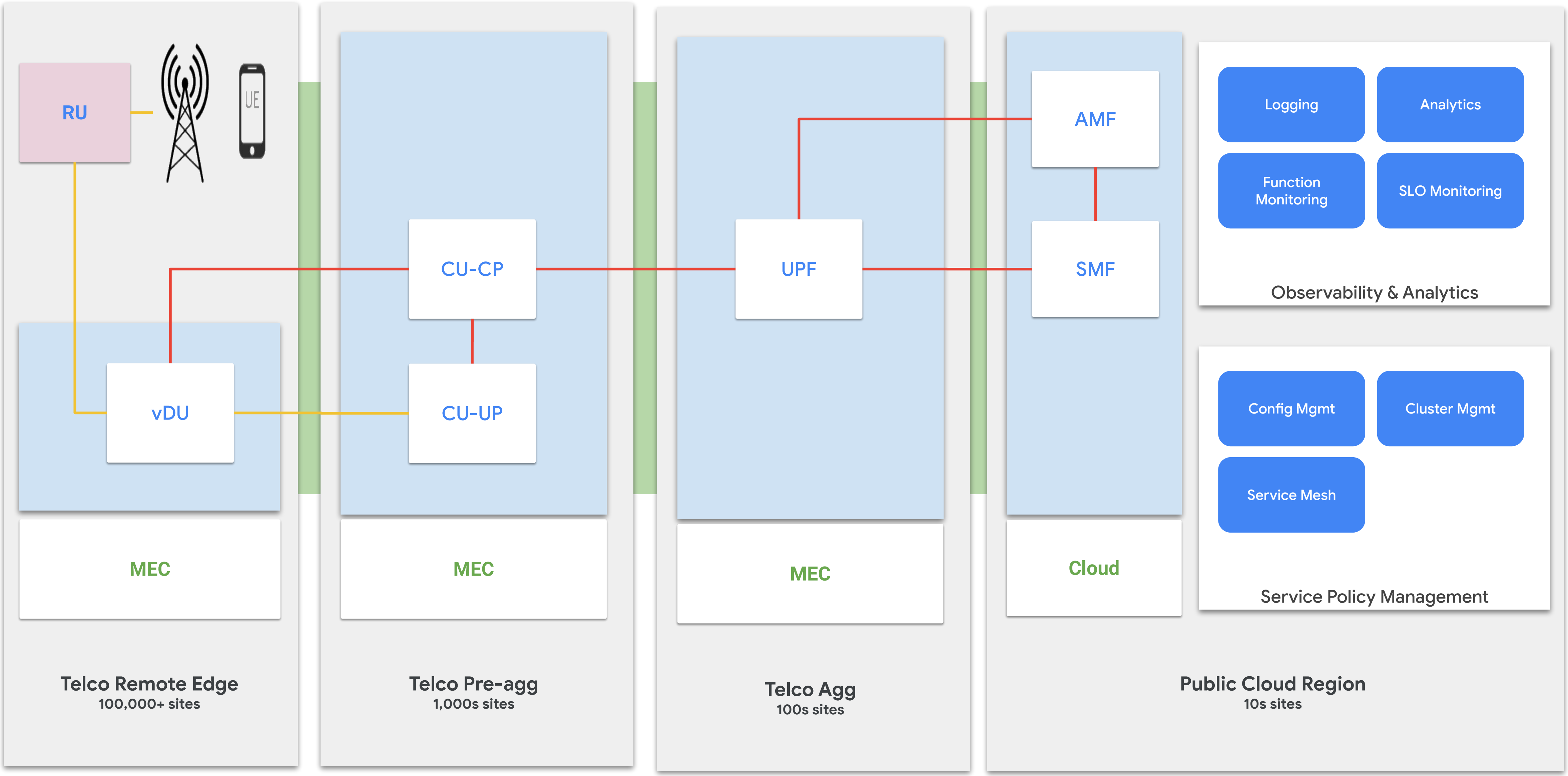
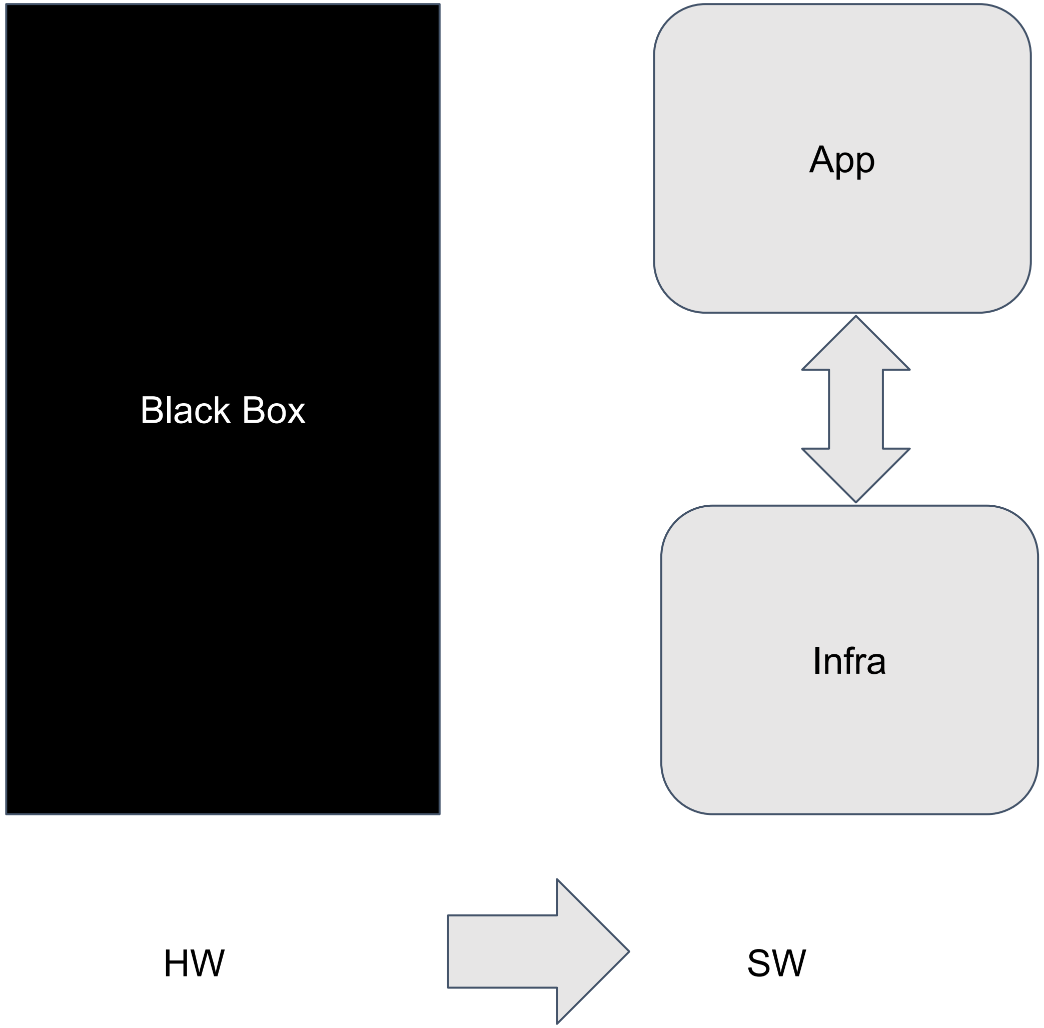
Collaboratively building app manifests at scale in complex organizations

John Belamaric Google
Wim Henderickx Nokia

The Telco landscape



Tightly coupled



- High Performance
- Mission critical
- Closed systems
- Different culture/mindset
- Organizational dependencies
- Roles and responsibility challenges
- …

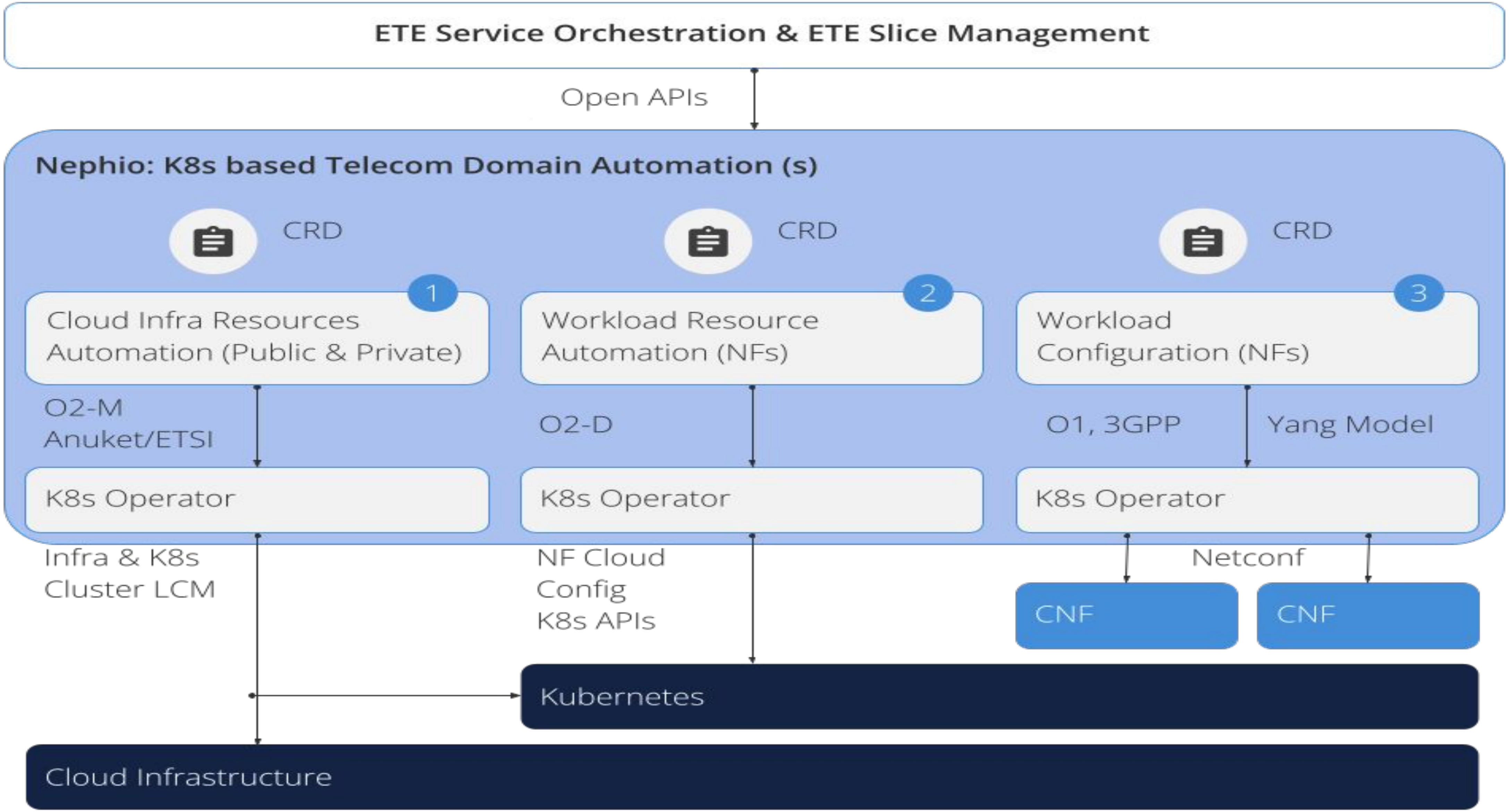
Specialization versus generalization

Domain A

Domain B

Domain C

Introducing Nephio



ETE Service Orchestration & ETE Slice Management

Open APIs

Nephio: K8s based Telecom Domain Automation (s)

CRD

1 Cloud Infra Resources Automation (Public & Private)

O2-M Anuket/ETSI

K8s Operator

Infra & K8s Cluster LCM

CRD

2 Workload Resource Automation (NFs)

O2-D

K8s Operator

NF Cloud Config K8s APIs

CRD

3 Workload Configuration (NFs)

O1, 3GPP

Yang Model

K8s Operator

Netconf

CNF

CNF

Kubernetes

Cloud Infrastructure

Goal

Intent Driven

Continuously reconciling systems are more robust at scale than imperative, fire-and-forget tools.

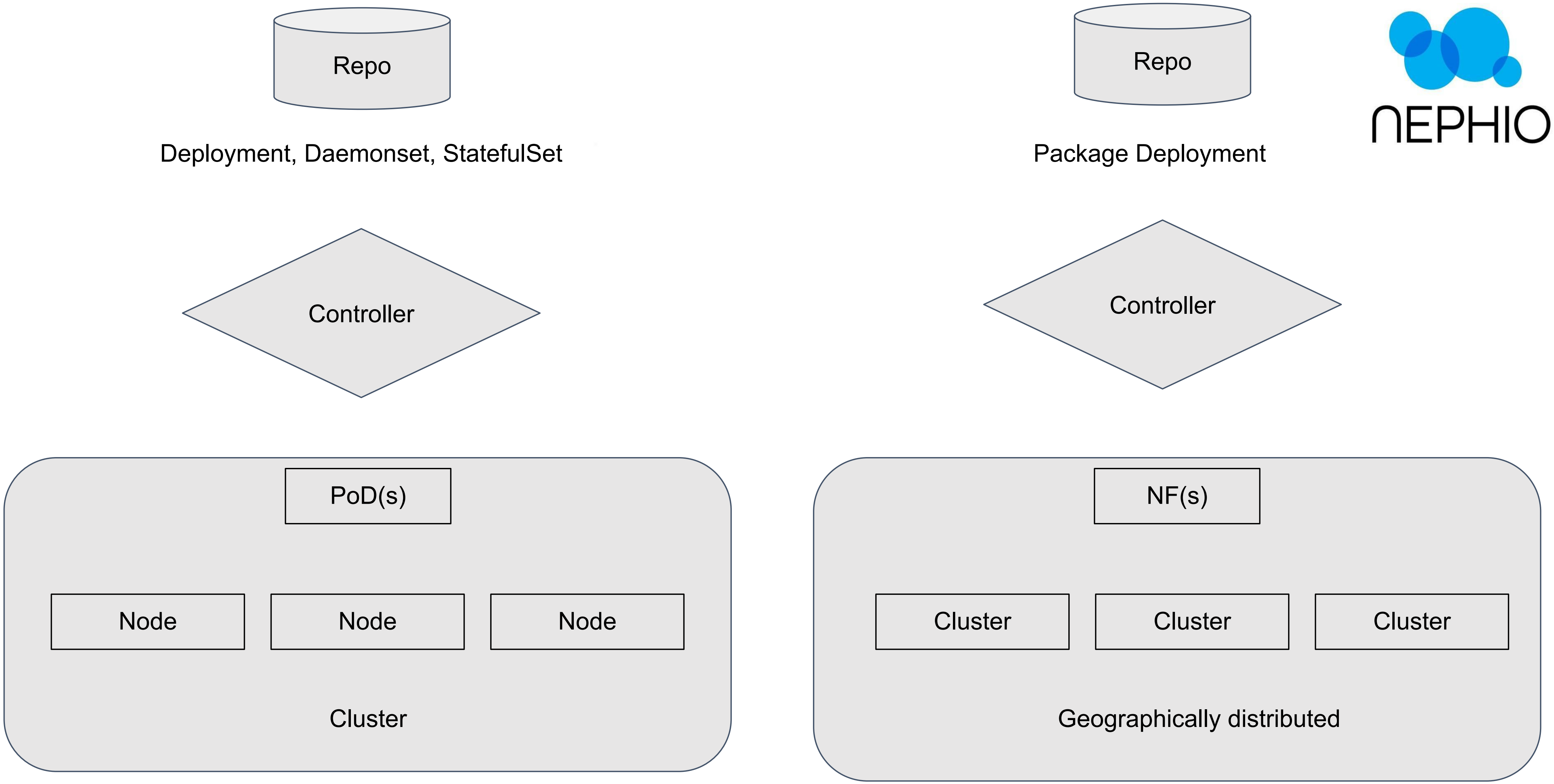
Distributed Actuation

A must for large-scale edge deployments. Triggering all actions from a centralized location is not reliable and does not scale, especially for edge deployments.

Uniformity in systems

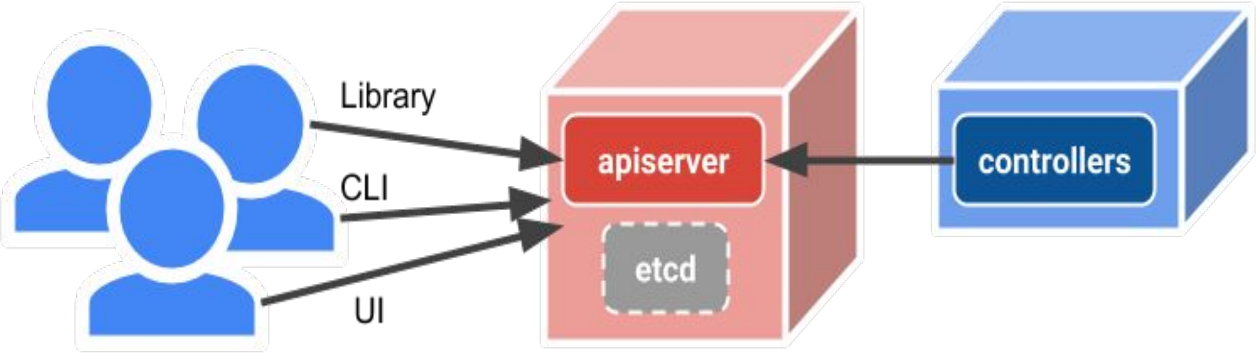
Reduce human errors, easier to maintain and allow for pre-validation at scale

Analogy


Repo
Deployment, Daemonset, StatefulSet
Controller
PoD(s)
Node
Node
Node
Cluster
Repo
Package Deployment
Controller
NF(s)
Cluster
Cluster
Cluster
Geographically distributed

KRM

- 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

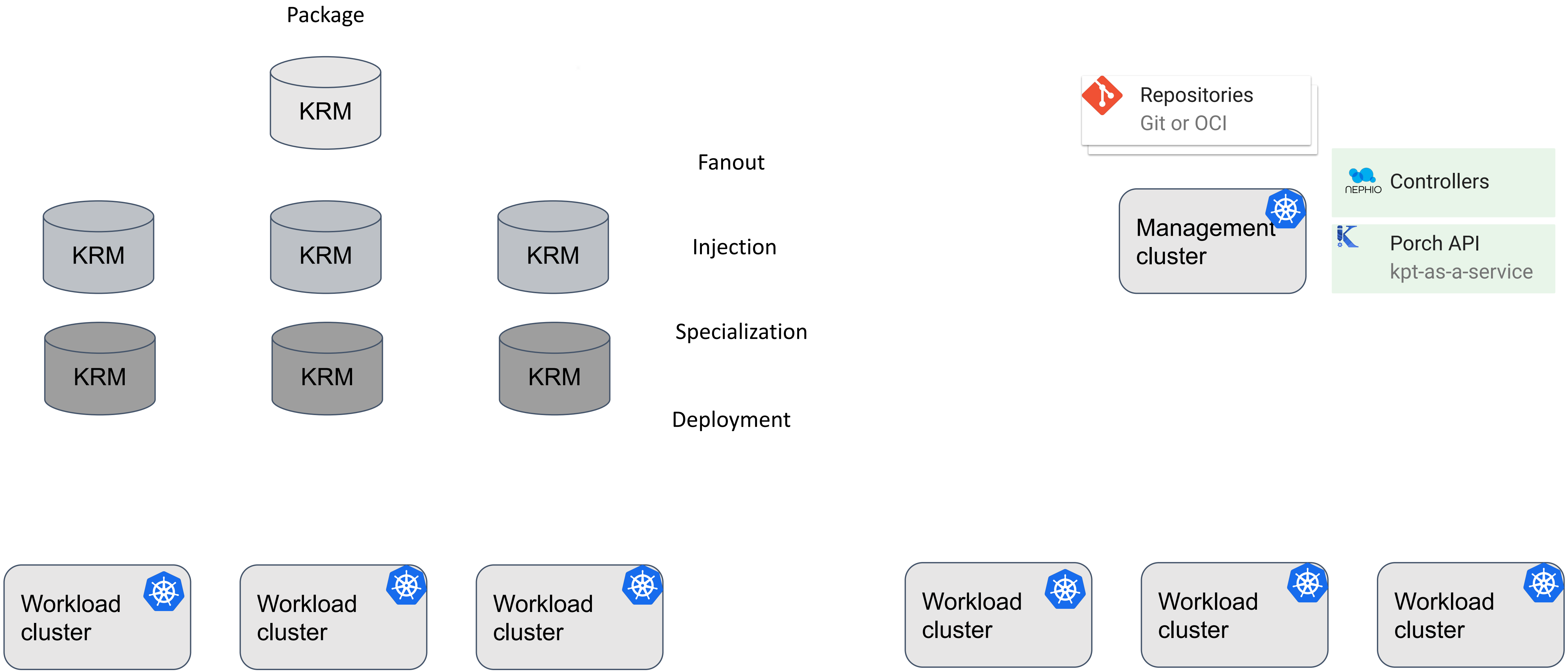


https://github.com/kubernetes/design-proposals-archive/blob/main/architecture/resource-management.md

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 workflows to operate and validate configurations
- 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
- Implemented in open source projects kpt, Porch, and Config Sync

High Level architecture



Organization complexities

Network Function

Infrastructure

Security

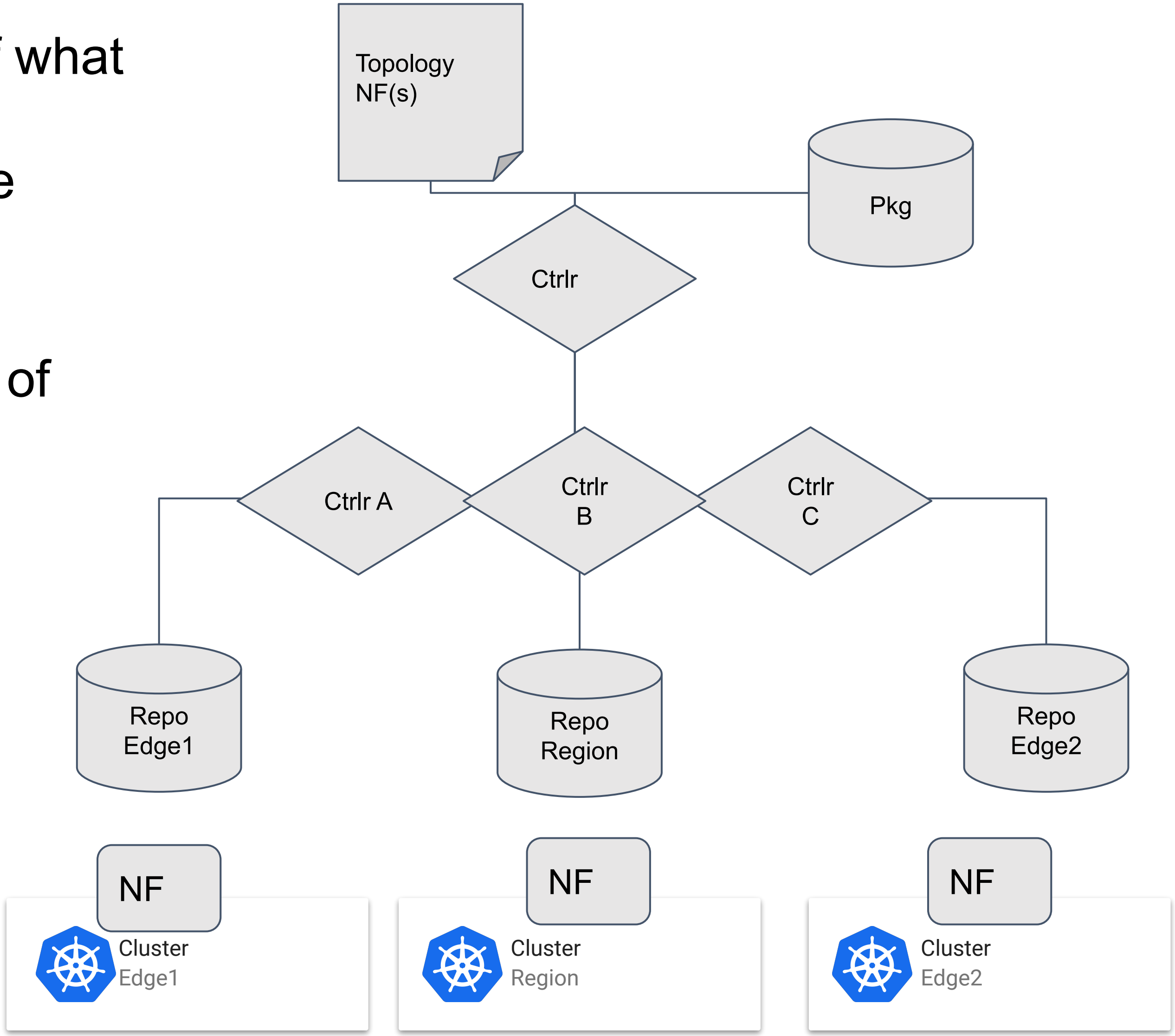
Consumer
+
provider

Loose Coupling

CRD Ownership

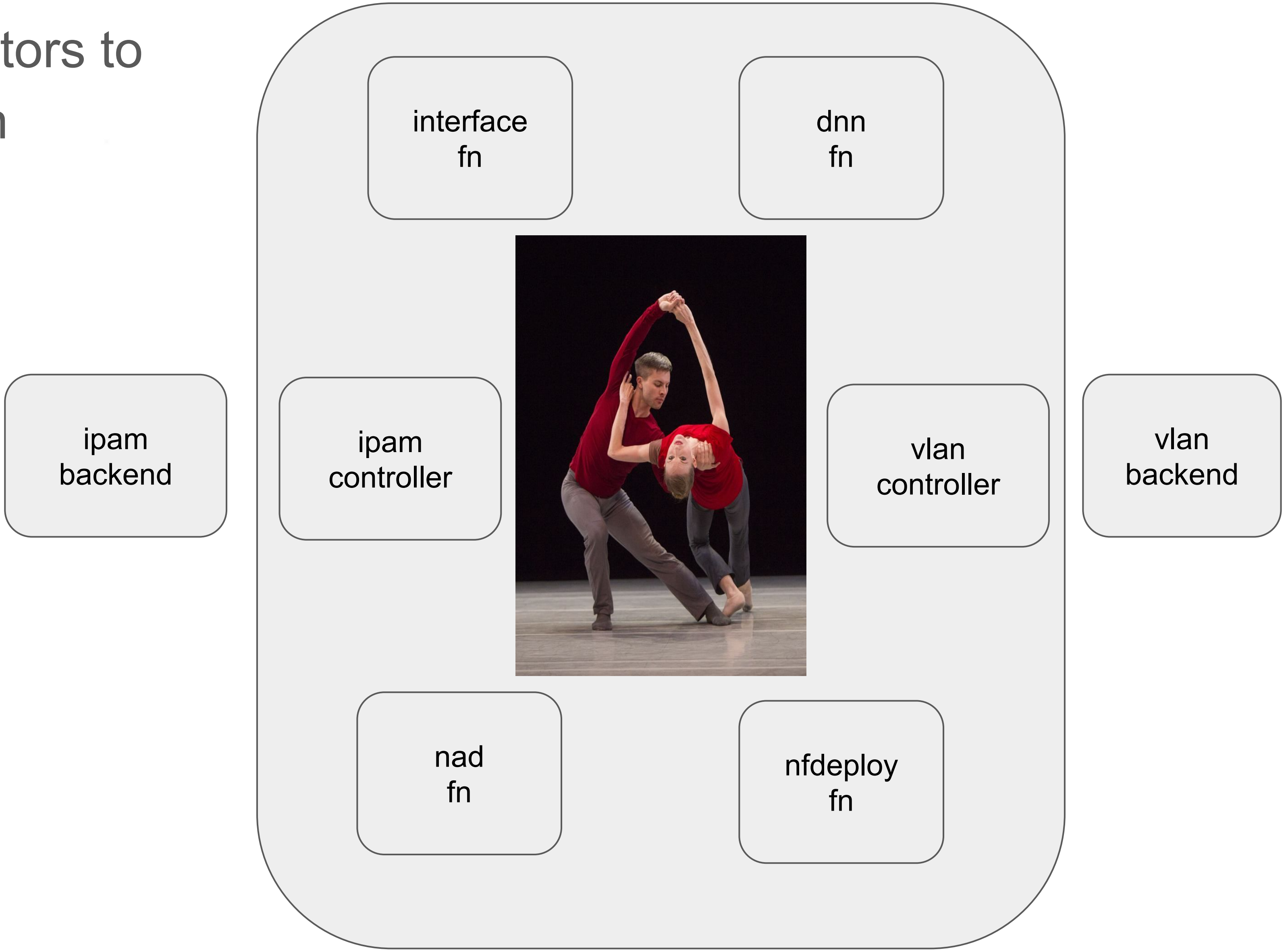
Decoupling/hydration

- Business intent (abstract definition of what we want to achieve)
  - E.g i wants a set of NF(s) on all edge clusters
- Result:
  - A set of NF(s) get deployed on a set of selected clusters
- How?
  - Controllers, Functions
  - Hydration
  - Loose coupling
  - Reusable components
  - Late binding
  - Event driven



Conditional dance/choreography

- a set of independent actors to reach together a certain outcome
- actors have roles in the choreography
- Lots of analogy to a controller
  - lifecycle handling
  - parent resource
  - child resources
  - adjacent resources



interface fn

dnn fn

ipam backend

ipam controller

vlan controller

vlan backend

nad fn

nfdeploy fn

Join us

Project Resources

- 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

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