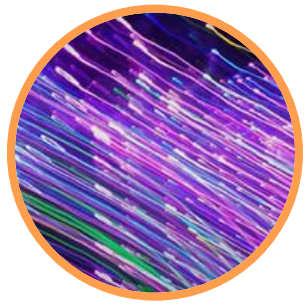
Step-by-Step Guide to Building a Truly Composable Infrastructure for 5G/Edge

Tejas Nevrekar, July 2019

Level Set: 5G Opportunities

Most Talked About 5G Services

IoT



Broadband Everywhere

Critical Remote Devices

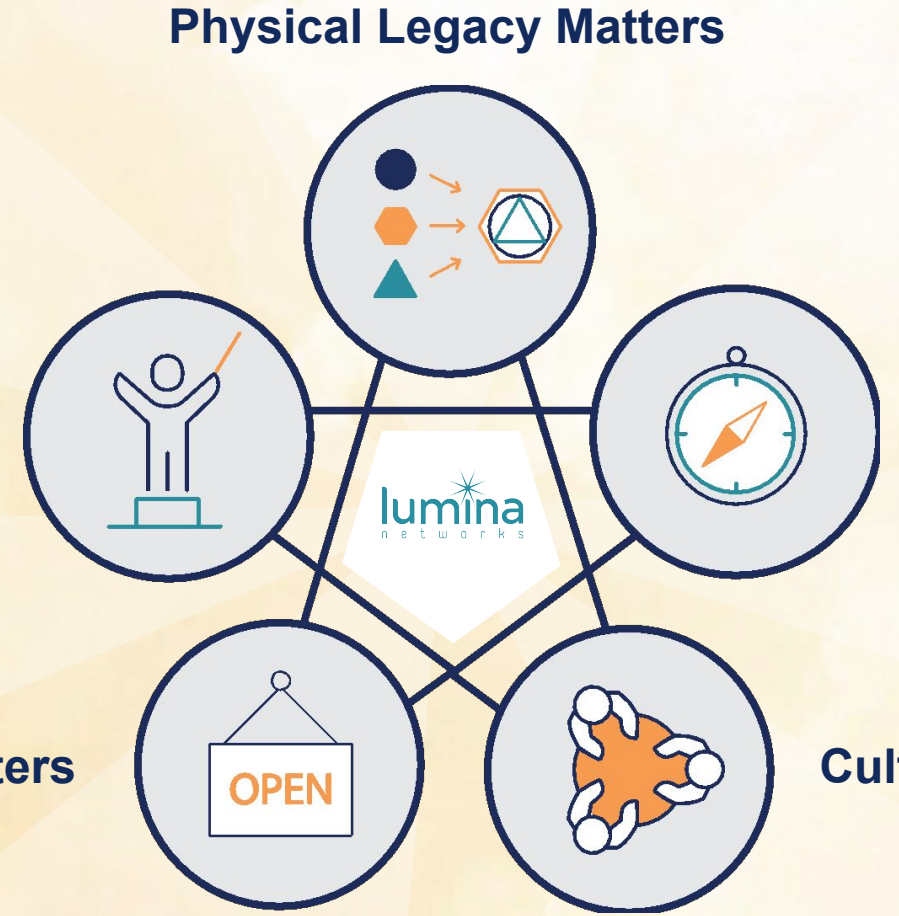
Smart Transportation

Media Everywhere

Customers want customized, context-driven, secure, on-demand experiences.

Trajectory

The 5 Factors of 5G



Transformation to Enable Opportunity

Service Innovation is changing in a 5G World

- Agile/DevOps will Create Services Faster
- Service Composition Needs will Increase in Variation
- Improve Service Delivery Times

Digital Transformation Requires Dynamism

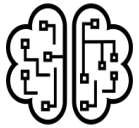
- Intent-based
- No Silos
- Reduce Complexity

Optimization Needed to Improve Bottomline

- Efficiencies
- Commoditize Resources
- Scale in Heterogeneous Environments

What are we working towards? 5G and the Future

Vehicular Telematics



Big Data Sensors for Machine Learning, AI

Internet of Things

Emergency Broadcast Services

Personalized & On-Demand Services

Drones

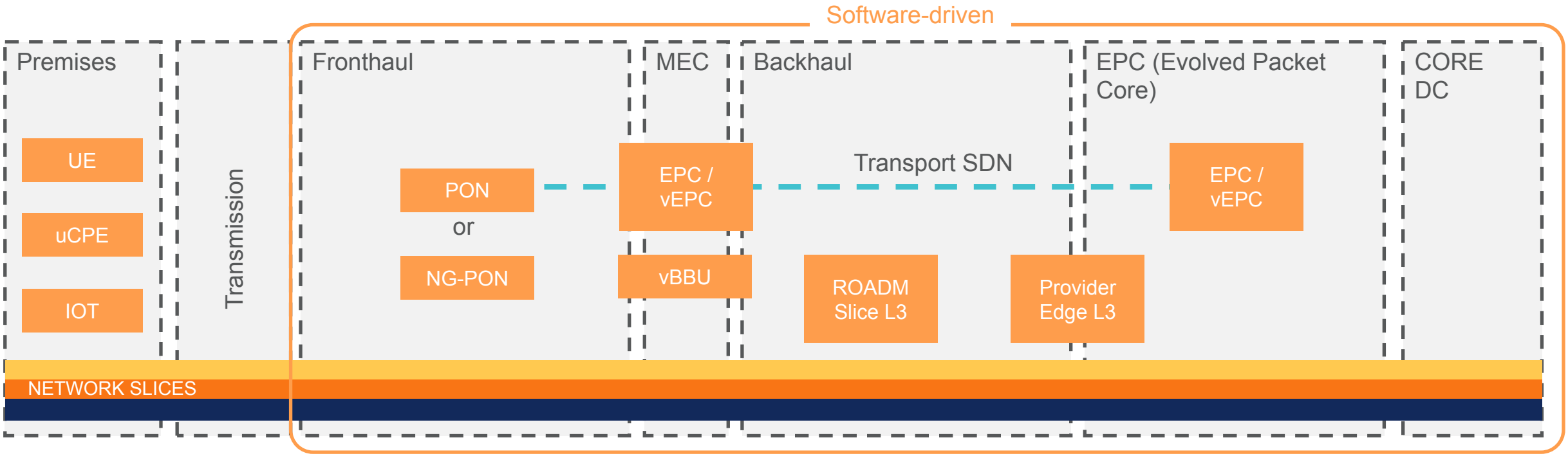
Ingredients

1. URLLC – ultrareliable low latency communication
2. EMBB – enhanced mobile broadband
3. mMTC – massive machine-type communications

Enabling Capabilities

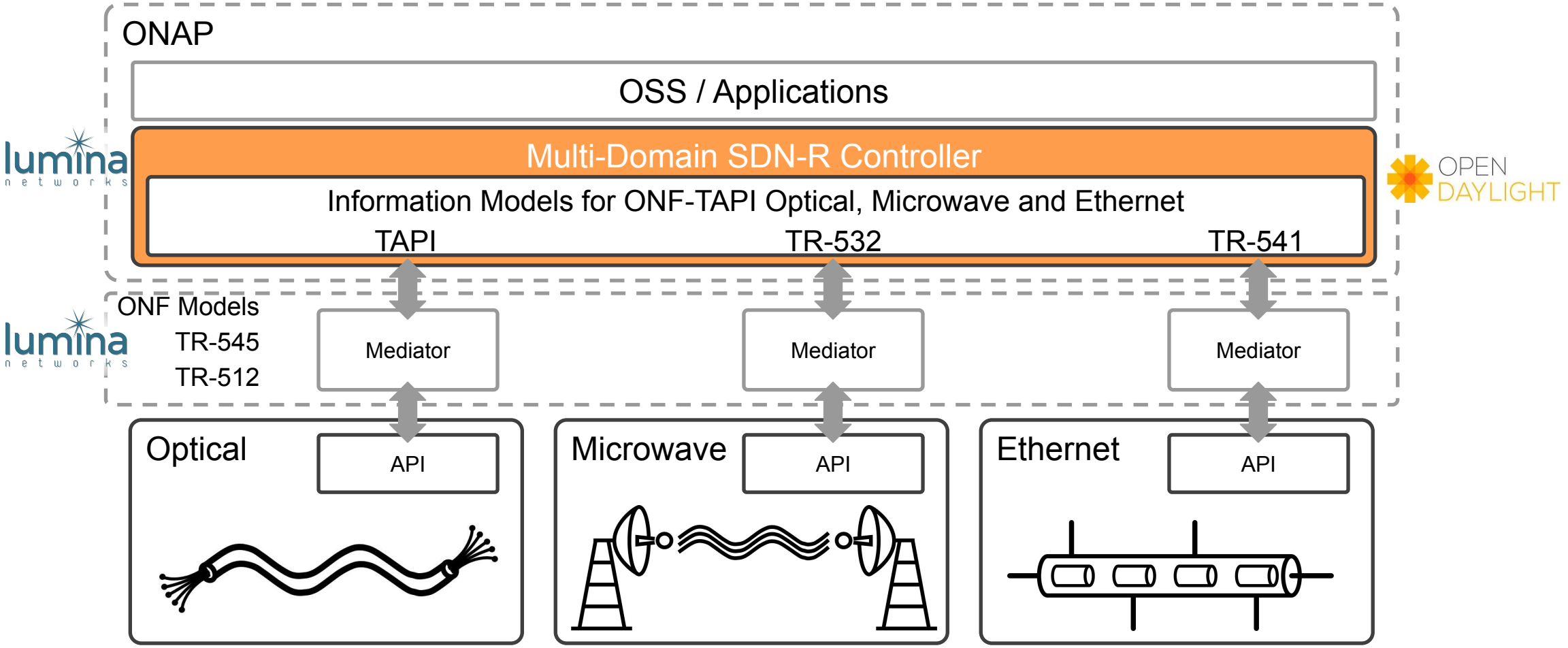
1. Network will have to be composable based on the intent
2. Intent requires software architecture which is cloud-enabled and microservices based

What will a Next Generation Network Look Like?

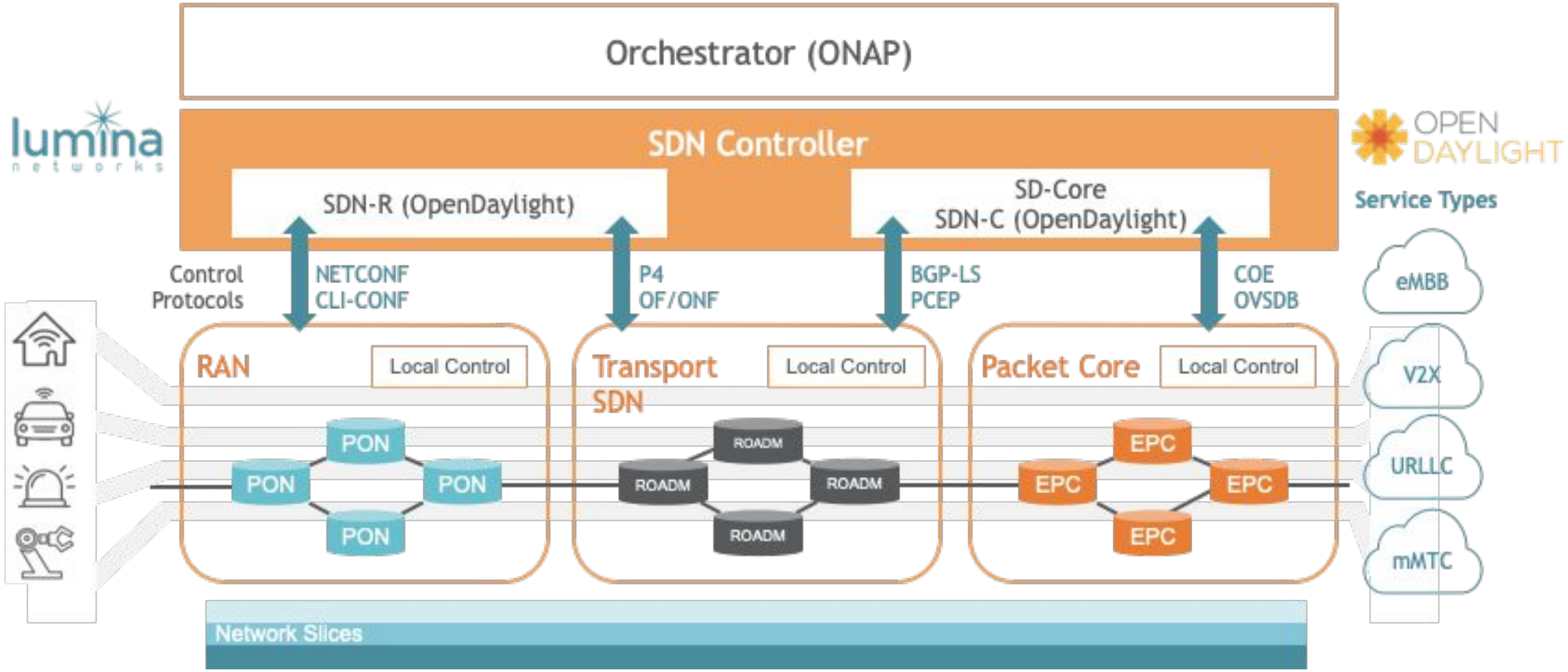


- ✓ Adaptable
- ✓ Mass Scale-Ready
- ✓ Open, vendor-agnostic
- ✓ Programmable
- ✓ Cloud-Ready
- ✓ Self-Organizing and Intent-Based
- ✓ RESTful interfaces & Data Models
- ✓ Agile Development-Enabled
- ✓ Standardized north & southbound interfaces

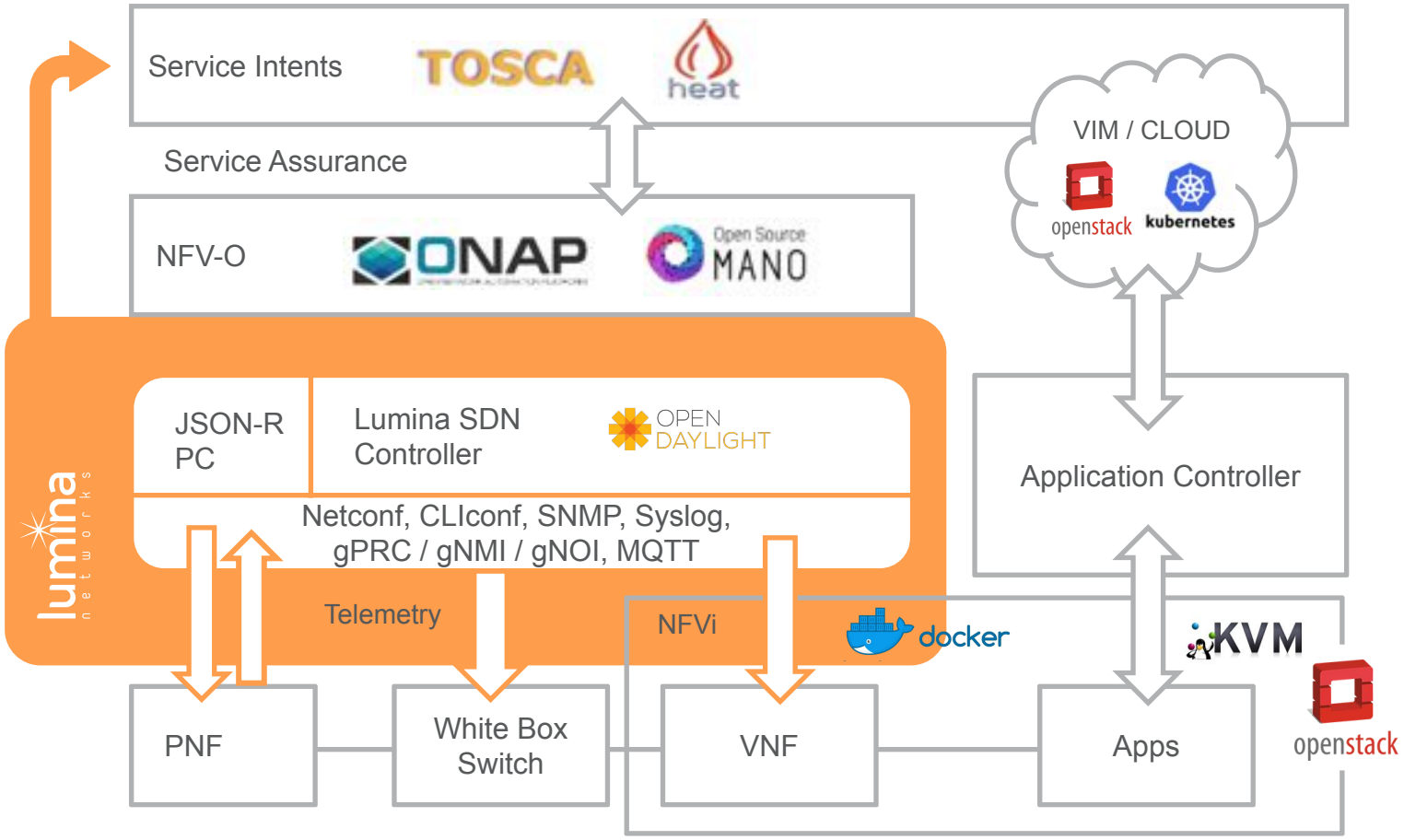
SDN-R


ONAP
OSS / Applications
Multi-Domain SDN-R Controller
Information Models for ONF-TAPI Optical, Microwave and Ethernet
TAPI
TR-532
TR-541
OPEN DAYLIGHT
ONF Models
TR-545
TR-512
Mediator
Mediator
Mediator
Optical
API
Microwave
API
Ethernet
API

Network Slicing



Intent Driven Architecture

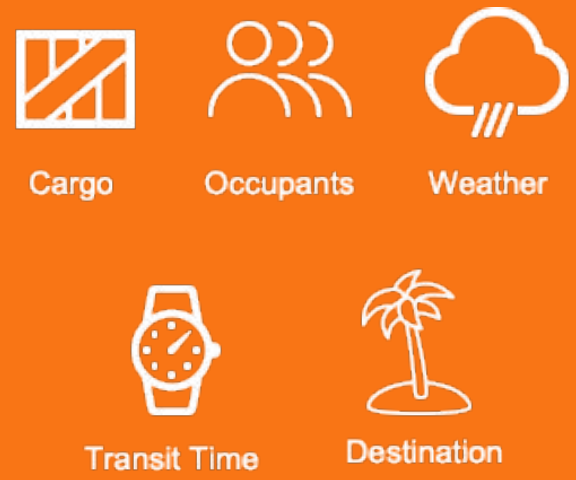


Current Infrastructure Operations

Static Investment

1 Decision
Multiple Intended Uses

Dynamic Use Cases



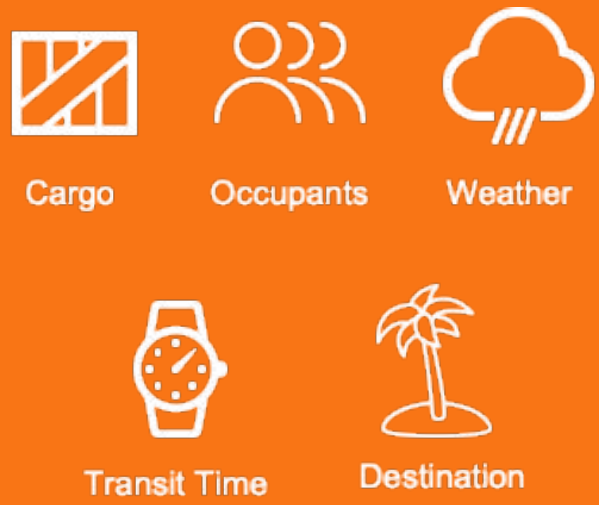
Future Infrastructure Operations

lumina networks

Flexible Investment

Composition Based on Intent

Dynamic Use Cases

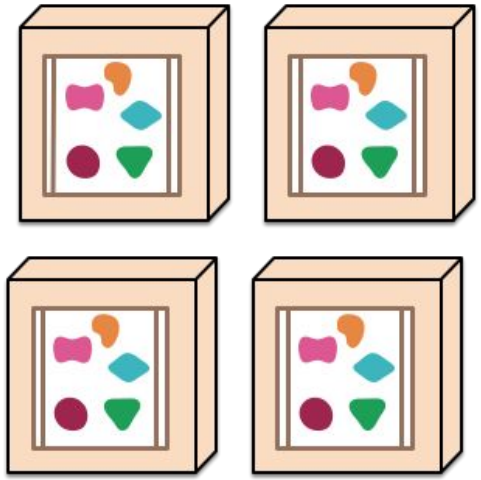


Custom Built for Custom Experiences

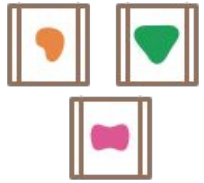
Microservices

A monolithic application puts all its functionality into a single process...

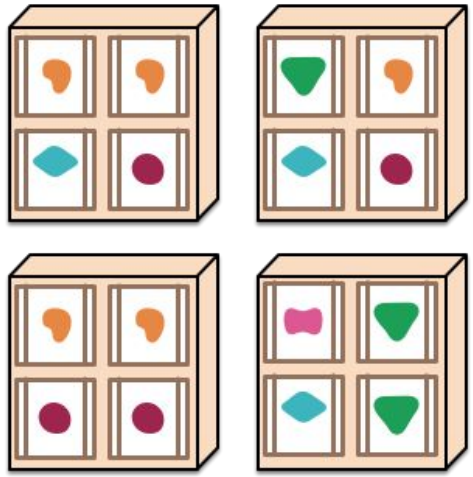
... and scales by replicating the monolith on multiple servers



A microservices architecture puts each element of functionality into a separate service...



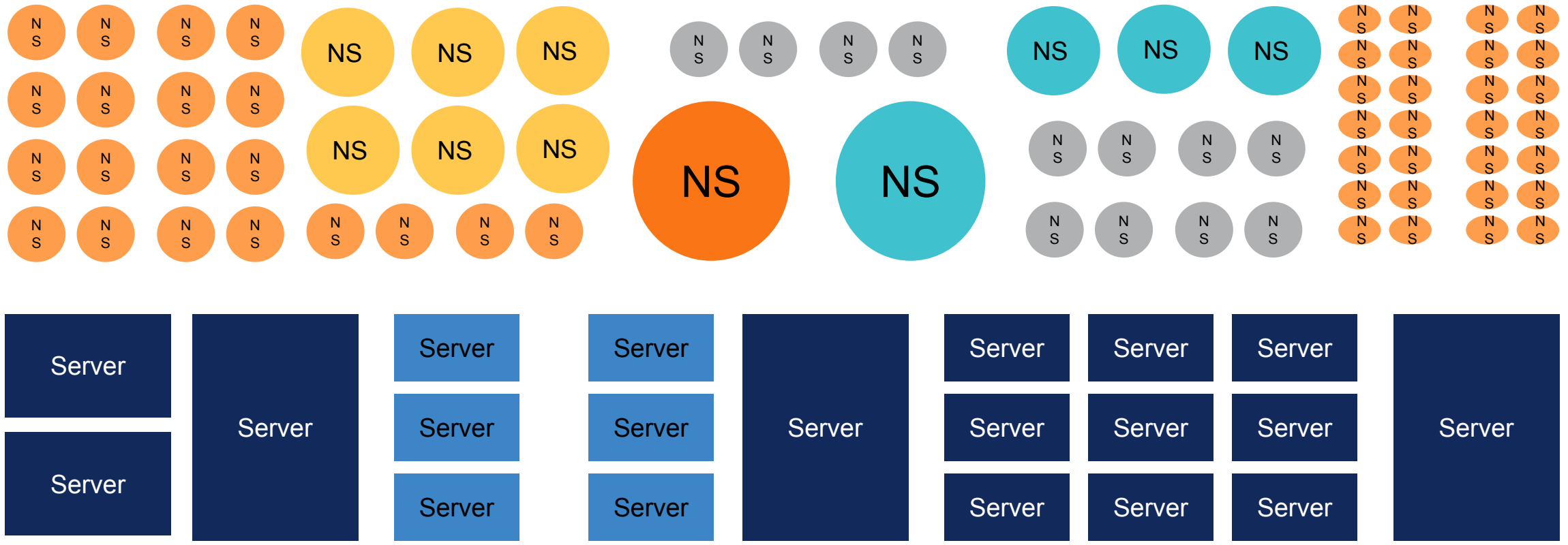
... and scales by distributing these services across servers, replicating as needed.



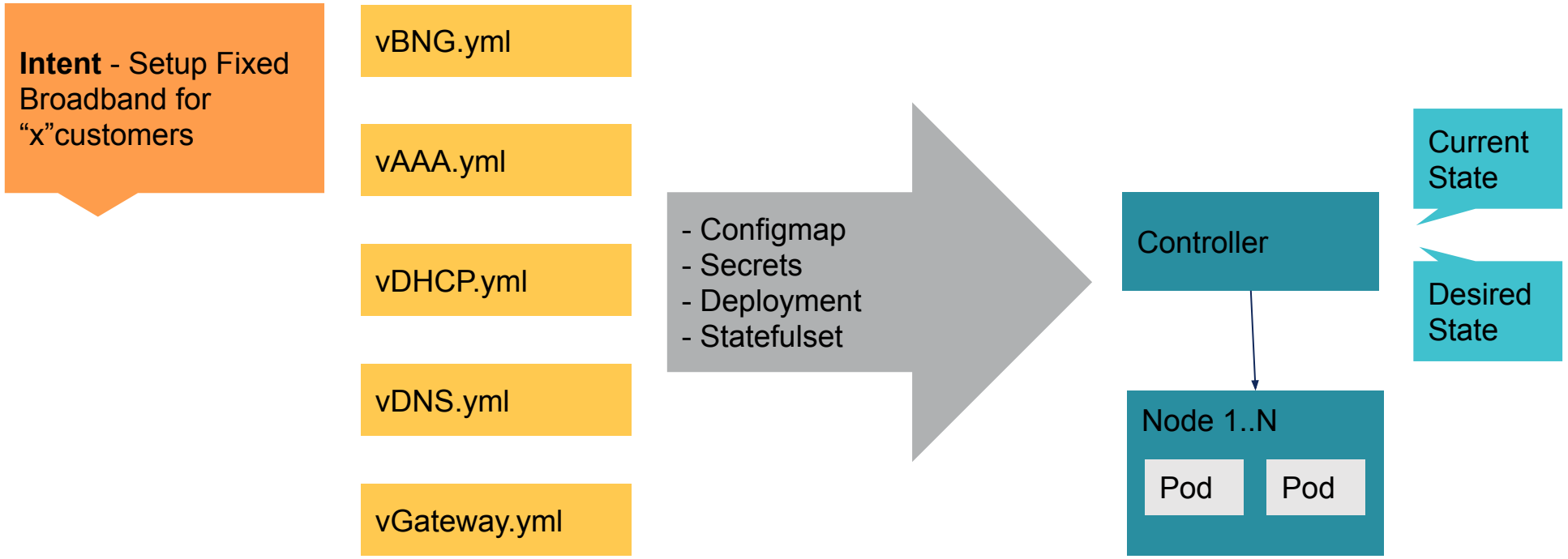
- Componentization via Services
- Organized around Business Capabilities
- Products not Projects
- Smart endpoints and dumb pipes
- Decentralized Governance
- Decentralized Data Management
- Infrastructure Automation
- Design for failure
- Evolutionary Design

https://martinfowler.com/articles/microservices.html

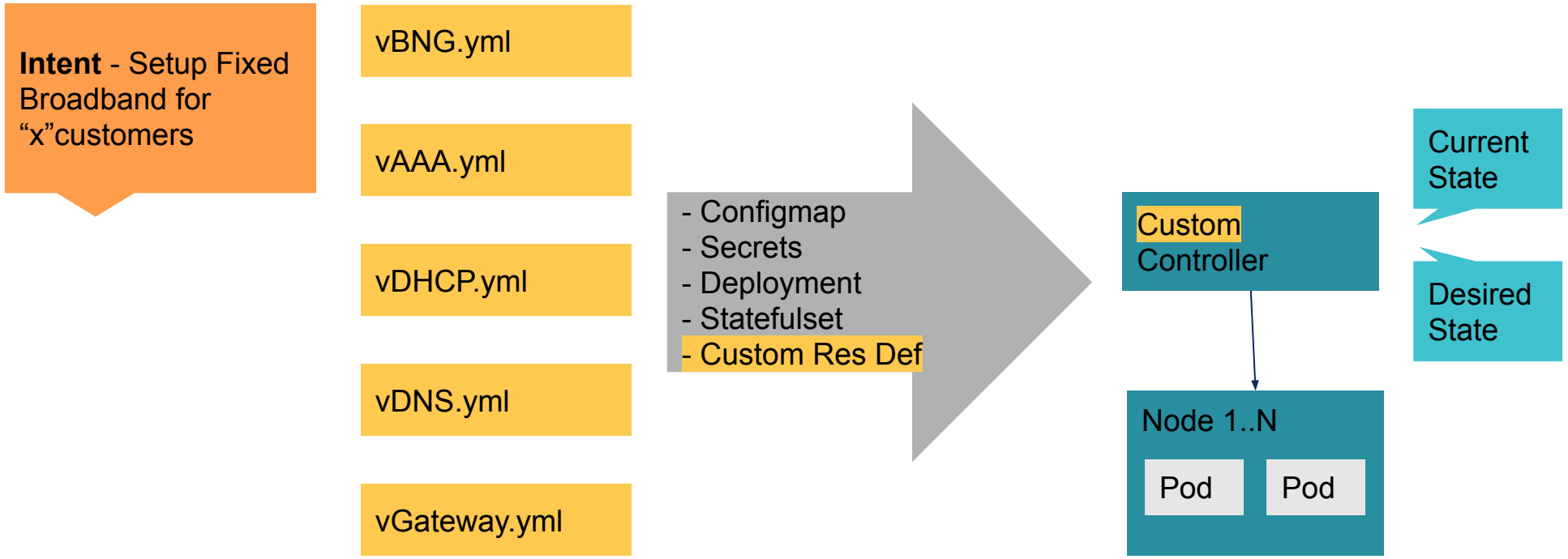
Composable components



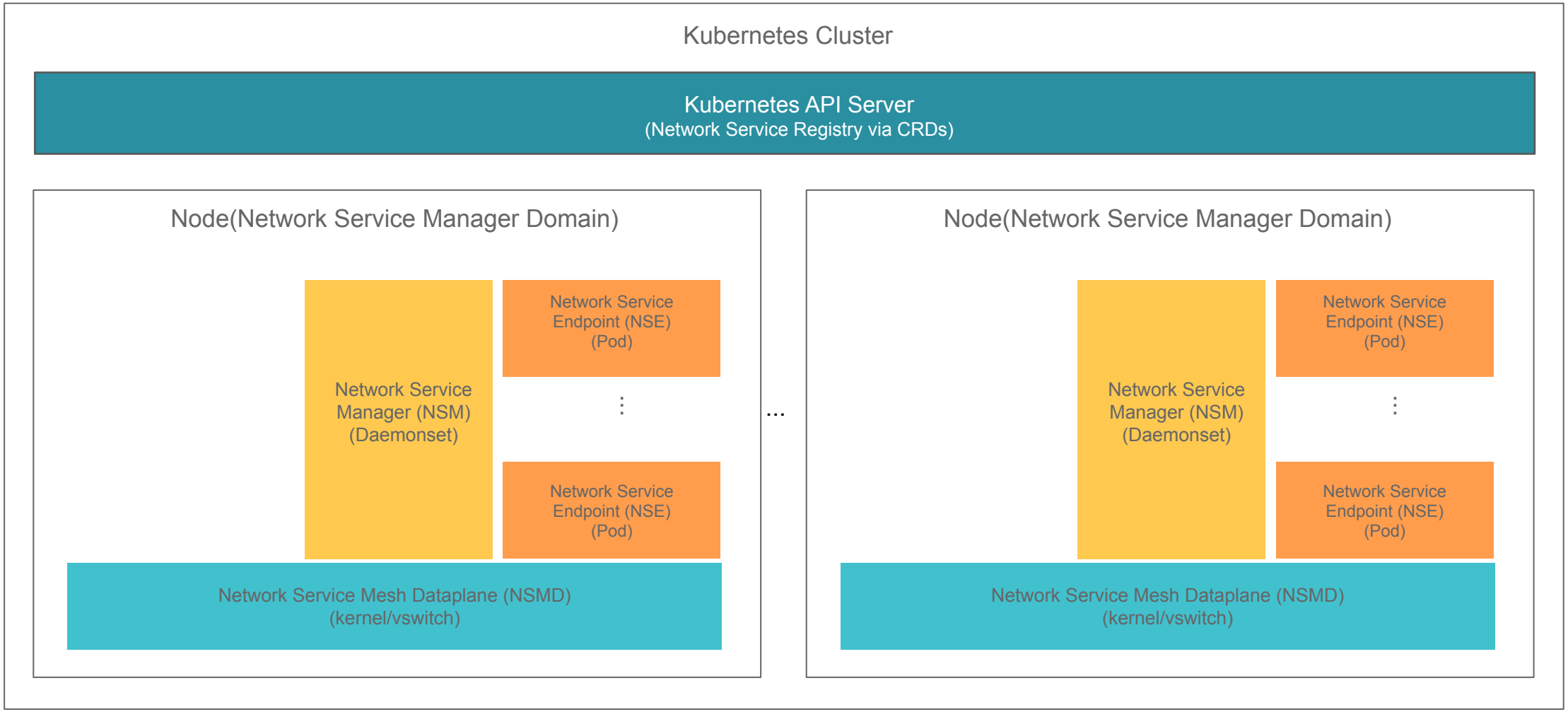
Kubernetes Service Deployment - CRD



Kubernetes Service Deployment - CRD

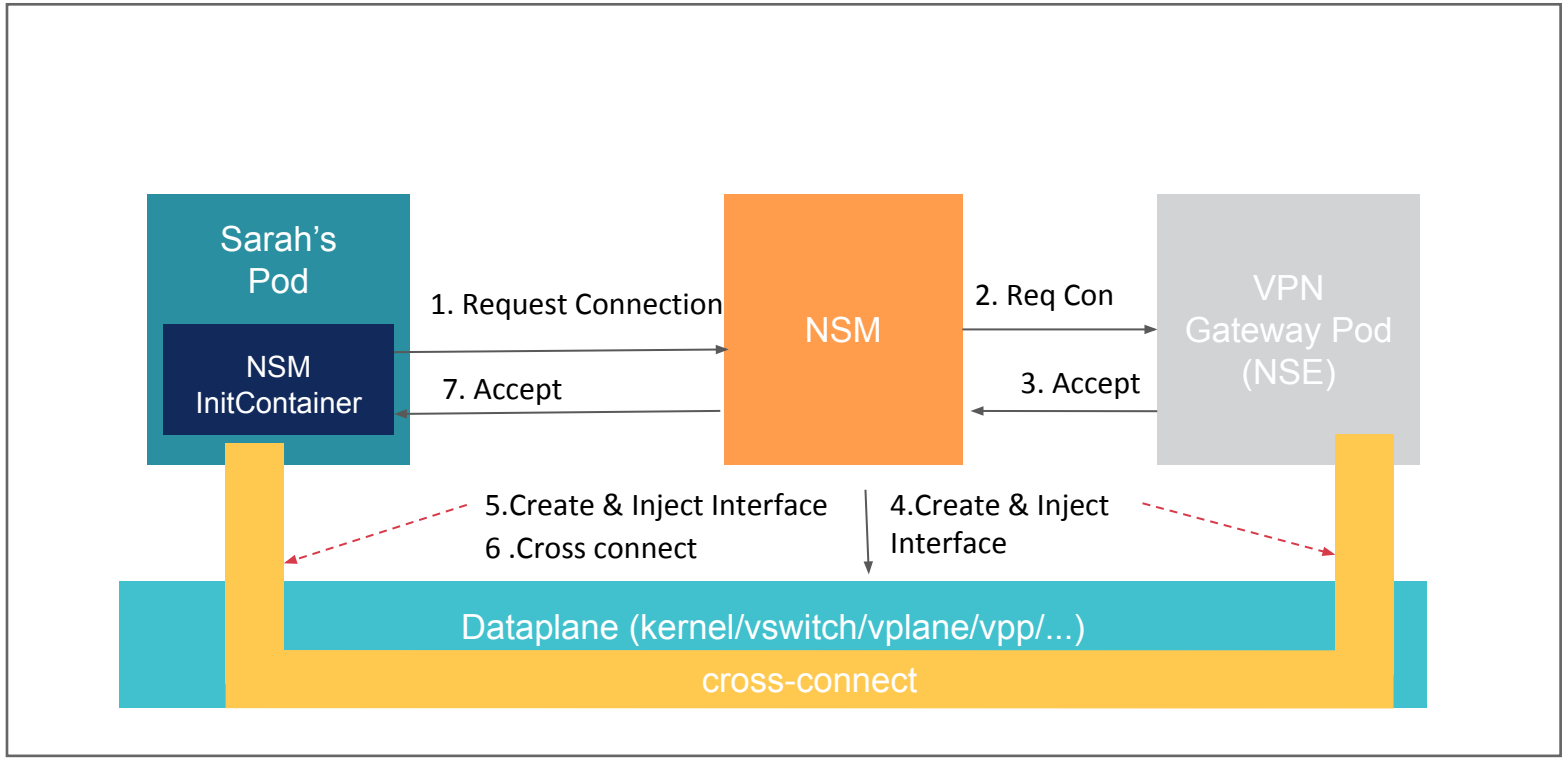


Kubernetes and Network Service Mesh



Network Service Mesh CRD

```
kind: NetworkService
apiVersion: V1
metadata:
      name: my-cnf
spec:
      selector:
            app: my-cnf
      channels:
            - name: my-ip-channel
                payload: IP
            - name:
   my-ethernet-channel
                payload: ethernet
            - name:
   my-mpls-channel
                  payload: mpls
```



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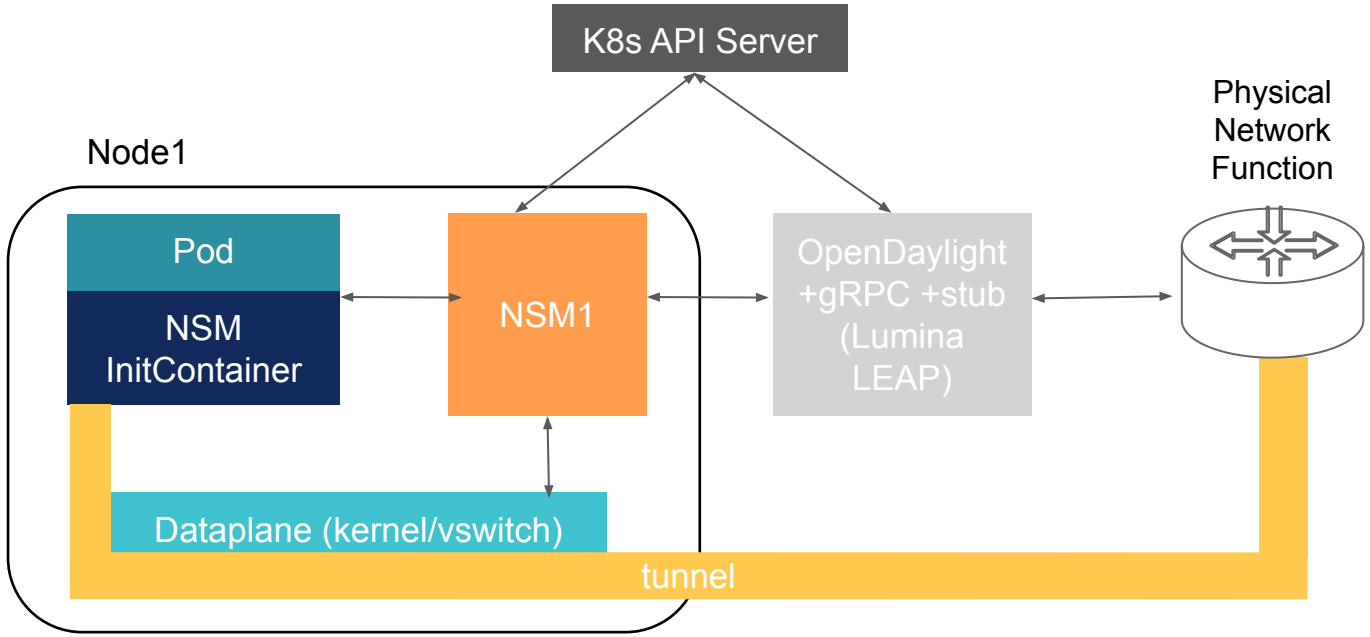
Network Service Mesh for ODL

- ODL participates in gRPC
- All ODL networks/devices/services can be defined as endpoints
- End-users can point from their containers to these services



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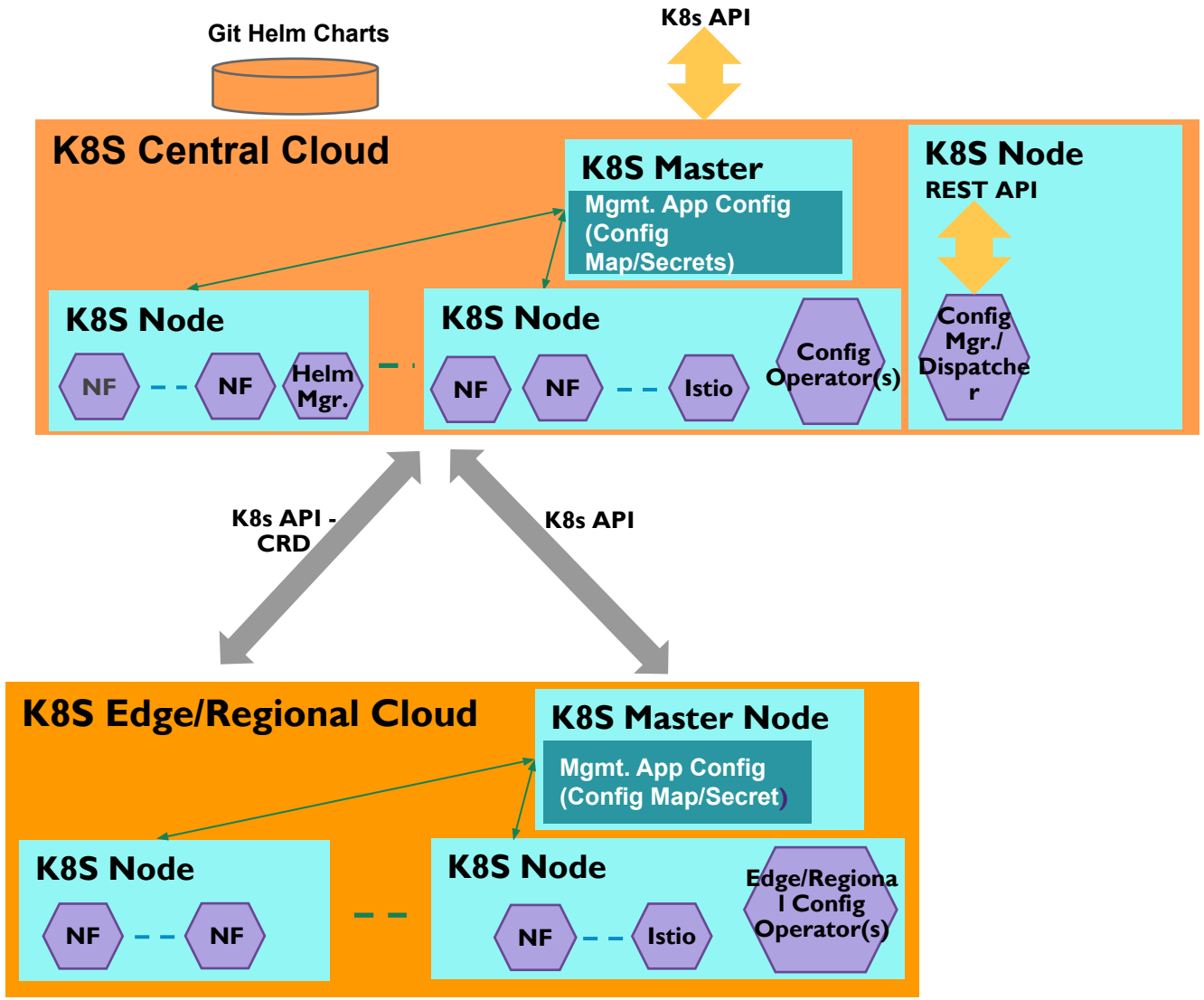
Kubernetes as Network Service Orchestrator



Design

Network Service Versioning/Upgrade/Rollback

- K8S Ecosystem Helm Charts/Manager

Deploy

Initial NF Configuration

- Helm Charts for initial configuration

NF Config Store

- K8S Config Map/Secret in Central/Edge/Regional Cloud(s)

NF Placement

- K8S RM/QoS for performance-aware NF placement in K8S Central/Edge/Regional Cloud

Multi-Cloud Support

- K8S Ecosystem KubeVirt etc. - VMs besides Containers

Operate

NF Monitoring

- K8S Ecosystem Prometheus etc.

NF Auto Healing

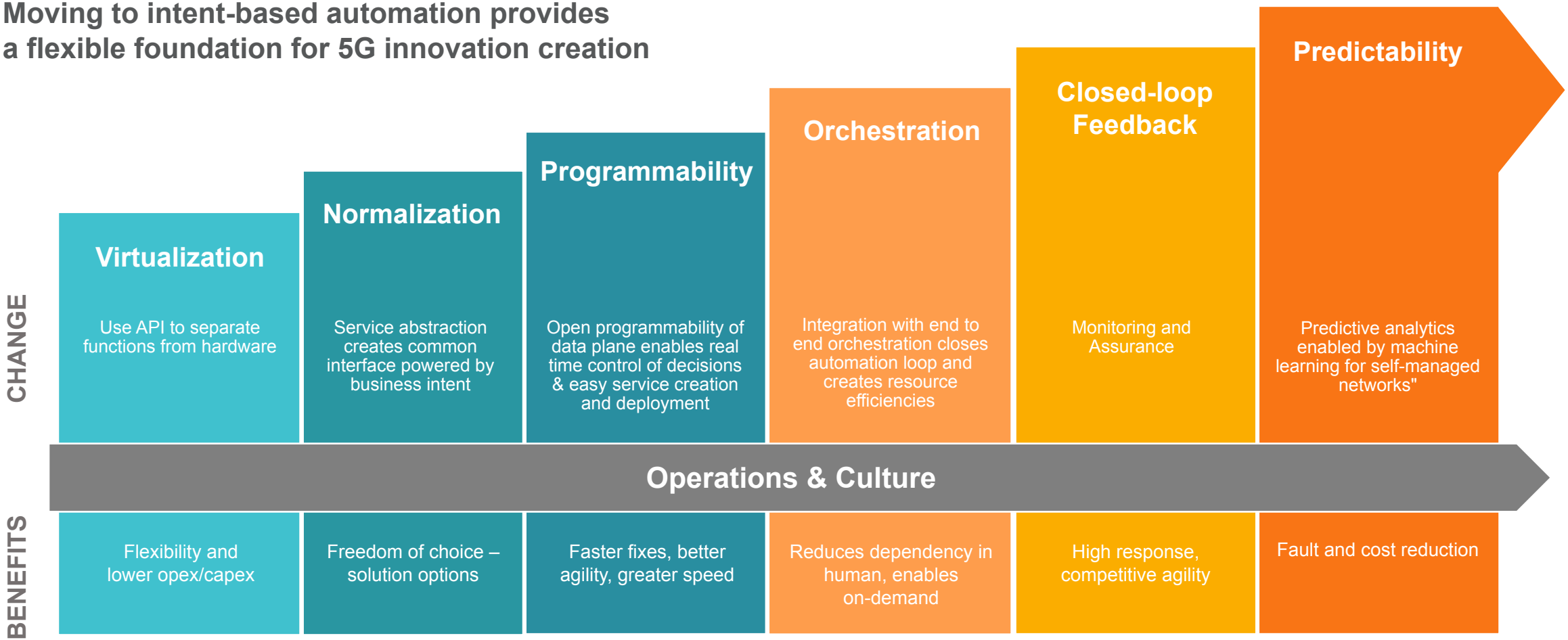
- K8S Replica Set

Incremental NF Configuration - Config Mgr./Dispatcher

- Track app config changes; dispatch changes using K8S API CRD; use app specific config operators to effect app config change

Network Transformation Enables a New Tomorrow

Moving to intent-based automation provides a flexible foundation for 5G innovation creation



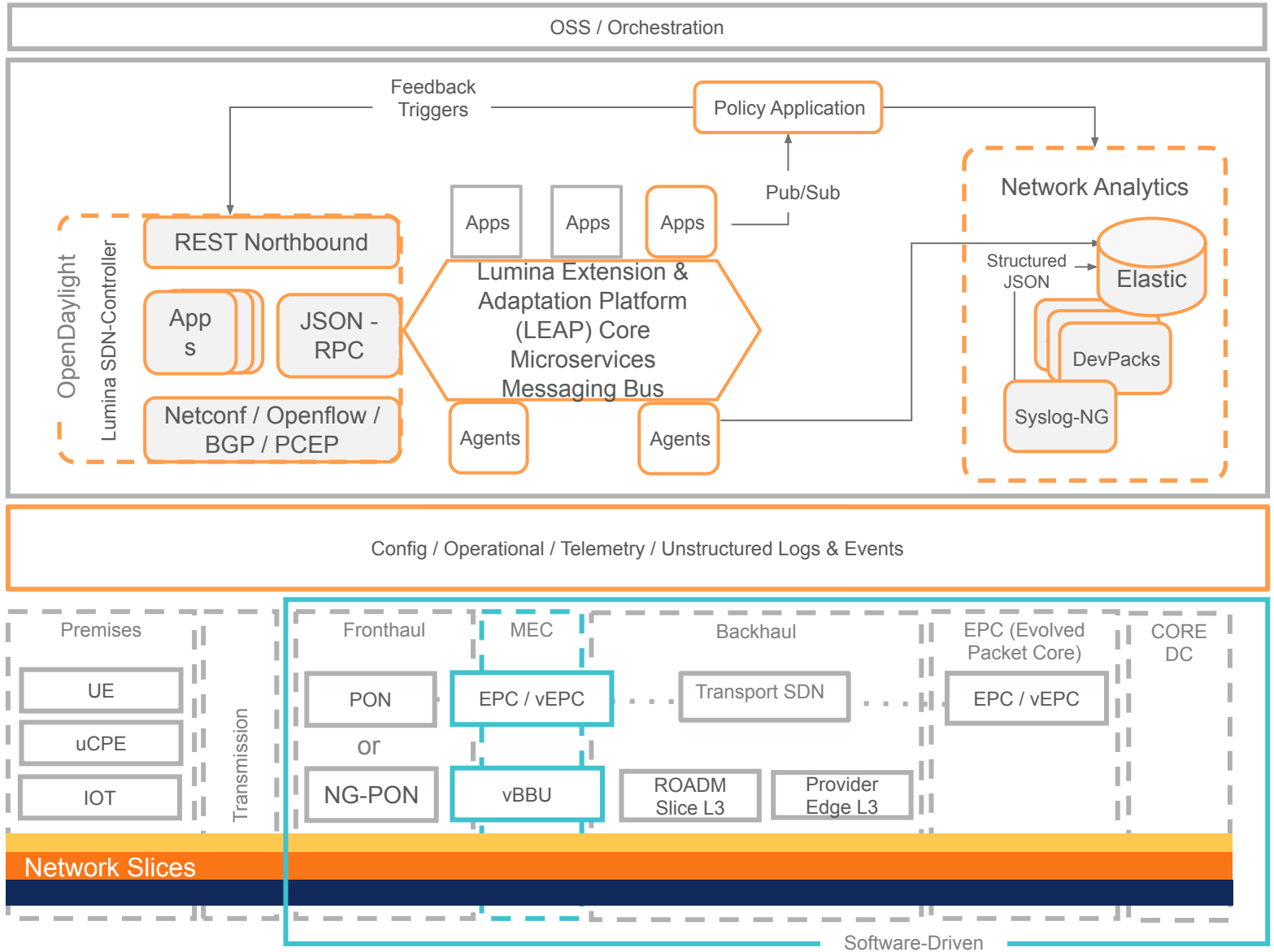
LEAP Enables Next Generation Networks

Lumina Solutions / Functions

Partner / Customer Devices / Apps

New to 5G

1. Microservices Architecture
2. Makes network applications aware and cloud-ready
3. Enable one-click service provisioning
4. Industry proven large scale production deployments
5. Wide array of standardized southbound & Northbound interfaces
6. Pure Play Open Source-based with No Vendor Lock-in



Take Action

Service Providers

- Implement agile software practices
  - Shorten the process between trial and production deployment
- Move to PoCs with open source software
  - Include brownfield components
- Reduce or eliminate slow legacy paperwork processes
  - e.g. RFIs, RFPs,…

Vendors

- Embrace open source platforms
  - Work toward interoperability especially for existing widely-deployed equipment
- Increase contribution toward open source projects
  - Intellectual property, time, money, and people

Developers

- Simplify architectures
  - Make 5G and related technologies easier to deploy
- Increase focus on scale, stability, and interoperability testing
  - Automation and document key