Cloud-centric AIOps for network management

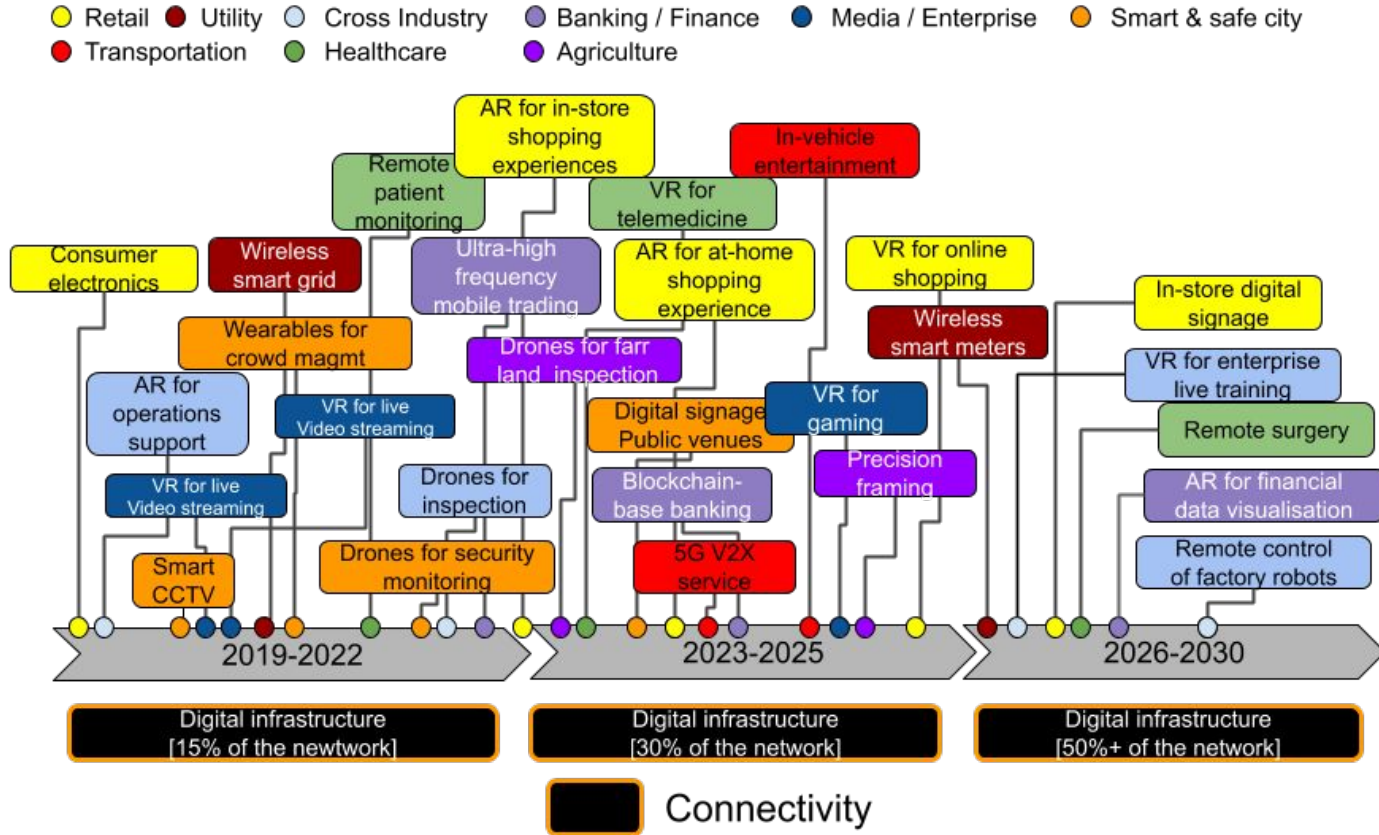22nd Annual Conference
Net-Centric
SDN/MPLS/NFV
2 0 2 0

December 4th

Hyde SUGIYAMA

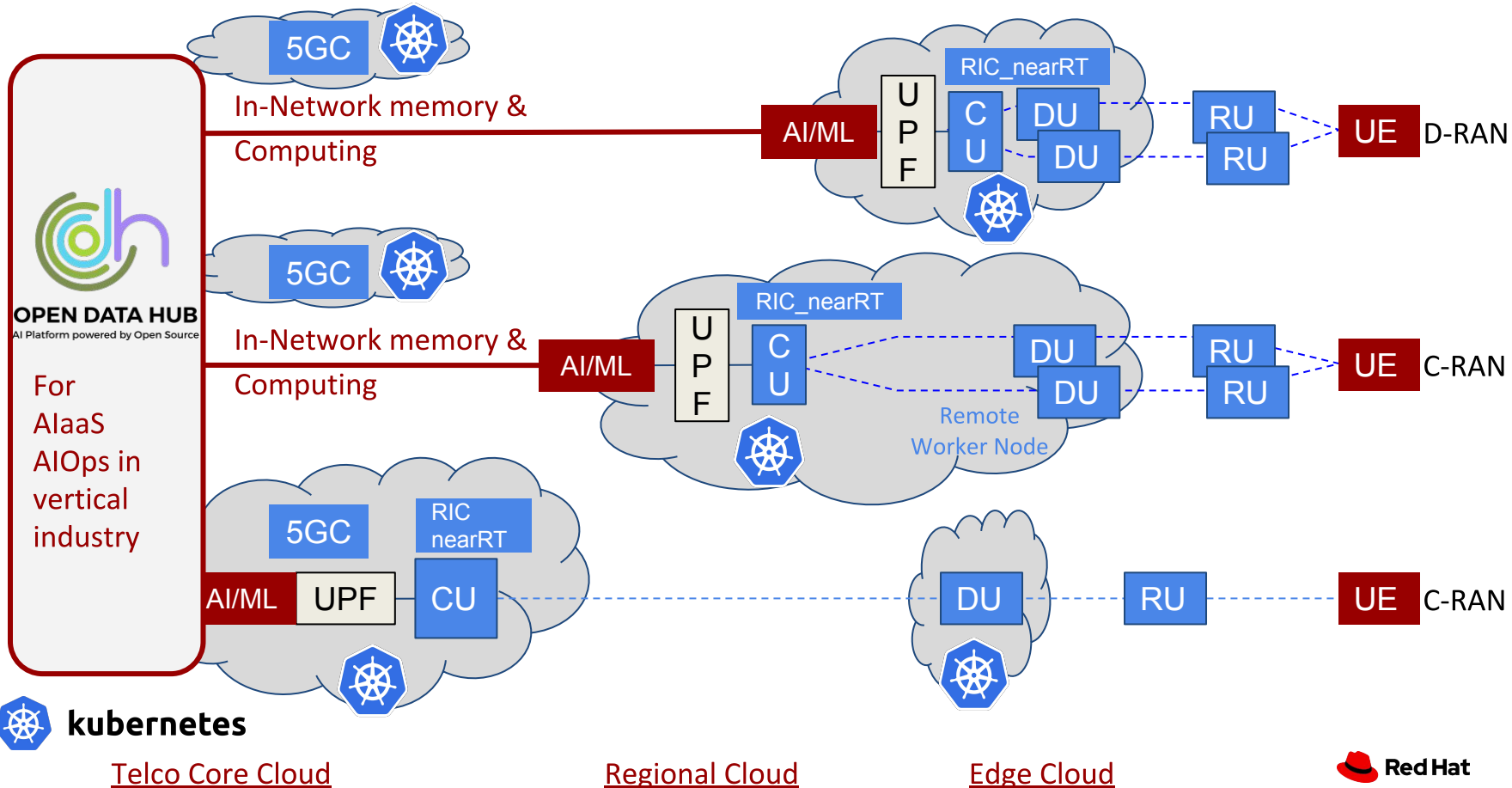Chief Architect, Red Hat Japan

https://www.isocore.com/2020/

Key challenge in next decade
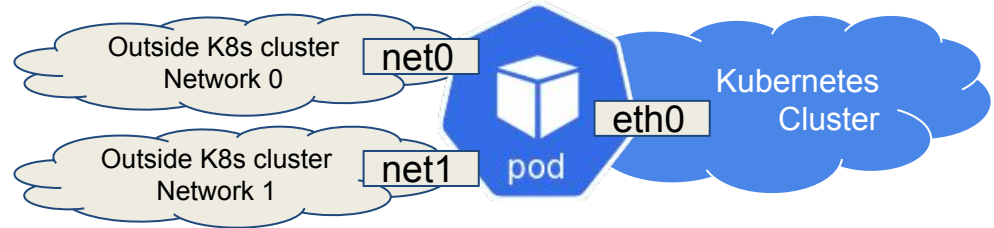## - unlike 4G, 5G & Beyond 5G use cases are diverse and each requires different connectivity

5G and Beyond 5G - Cloudfy 5GC SBA and UPF & CU location flexibility

OPEN DATA HUB
AI Platform powered by Open Source

For AIaaS AIOps in vertical industry

5GC

In-Network memory & Computing

AI/ML

RIC_nearRT

U P F

C U

DU

DU

RU

RU

UE D-RAN

5GC

In-Network memory & Computing

AI/ML

RIC_nearRT

U P F

C U

DU

DU

RU

RU

UE C-RAN

Remote Worker Node

5GC

RIC nearRT

AI/ML UPF

CU

DU

RU

UE C-RAN

kubernetes

Telco Core Cloud

Regional Cloud

Edge Cloud

Red Hat

Kubernetes Pod Networks

Pod Networks outside a Kubernetes Cluster

Outside K8s cluster Network 0

net0

Outside K8s cluster Network 1

net1

eth0

pod

Kubernetes Cluster

Pod Networks inside a Kubernetes Cluster

pod   pod

WORKER NODE1

IP Network

pod   pod

WORKER NODE2

A Kubernetes Cluster(including EndPoint slice)
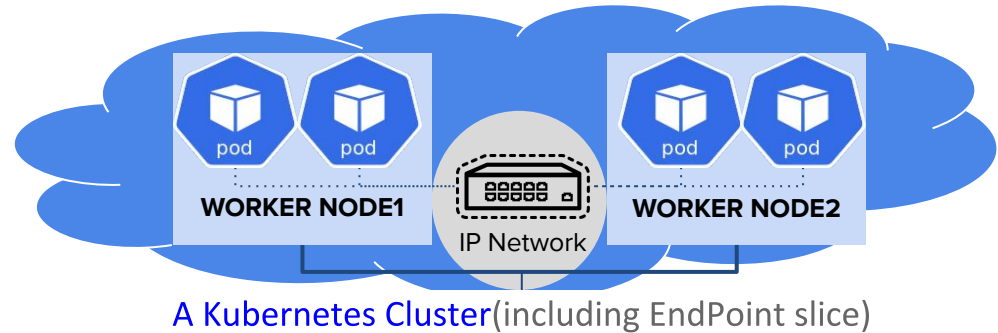
Kubernetes Multi-cluster service network discovery

Skupper: https://skupper.io/docs/overview.html

Submariner: https://github.com/submariner-io/submariner-operator

GLB: https://github.com/redhat-cop/global-load-balancer-operator

etc

Kubernetes Cluster 2

Kubernetes Cluster 1

Kubernetes Cluster 3

4

Red Hat
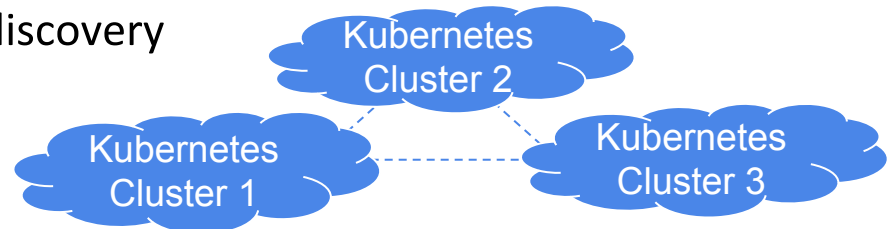
O-RAN SMO + Kubernetes Operator + AIOps w/ OpenData Hub

AI/ML
Continuous training, tuning, deployment

OPEN DATA HUB
AI Platform powered by Open Source

telco AIOps
Intent Based Networking
Predictive Maintenance

Data Lake

Service Management and Orchestration Framework

Non-Real Time RIC

Remote center site

| O1 | O1 | O1 | A1 | | O1 | | O1 |

Local edge site

Near-Real Time RIC

CNFs in a Cloud RAN

X2-c
Xn-c
NG-c

E2 E2 E2

O-CU-CP

E1

X2-u
Xn-u
NG-u

O-CU-UP
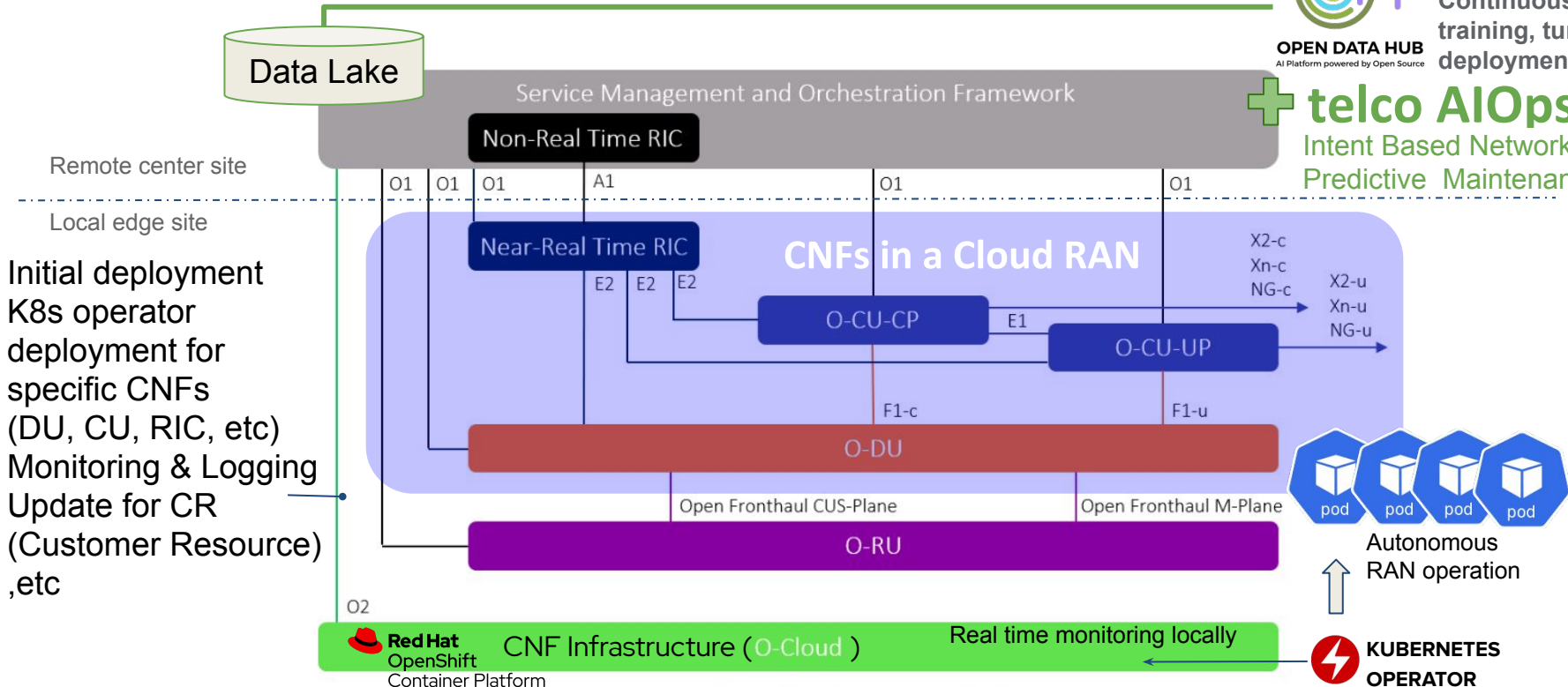
Initial deployment
K8s operator
deployment for
specific CNFs
(DU, CU, RIC, etc)
Monitoring & Logging
Update for CR
(Customer Resource)
,etc

F1-c

F1-u

O-DU

Open Fronthaul CUS-Plane

Open Fronthaul M-Plane

pod pod pod pod

O-RU

Autonomous
RAN operation

O2

Red Hat
OpenShift
Container Platform

CNF Infrastructure (O-Cloud)

Real time monitoring locally

O-RAN Logical Architecture Diagram
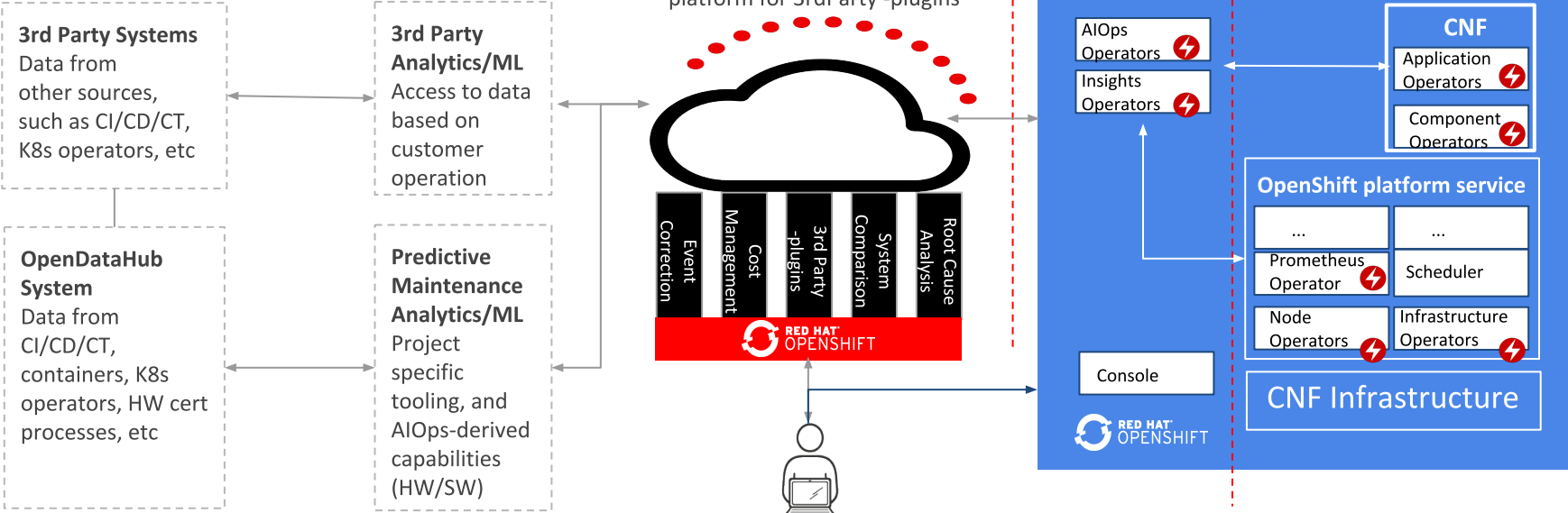
**KUBERNETES
OPERATOR**

Red Hat

Telco AIOps

CI/CD & Continuous Training
Guided by ML & Inference
engine from real deployed
environments.

Analyze aggregated data
Derive recommendations
Train decision models
Implement / Update
K8s operators and Applications

Telco-wide data aggregation
Telco-wide Decisions
Global Data Aggregation
Global Decisions
Aggregate representation
platform for 3rdParty -plugins

K8s cluster-wide
Data aggregation
Filtering
K8s cluster-wide
Representation

Telco's Data Sources
Application/Near RT
Local decisions & action
Providers

3rd Party Systems
Data from
other sources,
such as CI/CD/CT,
K8s operators, etc

OpenDataHub System
Data from
CI/CD/CT,
containers, K8s
operators, HW cert
processes, etc

3rd Party Analytics/ML
Access to data
based on
customer
operation

Predictive Maintenance Analytics/ML
Project
specific
tooling, and
AIOps-derived
capabilities
(HW/SW)

Event Correction

Cost Management

3rd Party -plugins

System Comparison

Root Cause Analysis

RED HAT OPENSHIFT

Service Providers or
Community Users(Admin/Ops)

AIOps Operators

Insights Operators

Console

RED HAT OPENSHIFT

CNF

Application Operators

Component Operators

OpenShift platform service

...

...

Prometheus Operator

Scheduler

Node Operators

Infrastructure Operators

CNF Infrastructure

KUBERNETES OPERATOR

Red Hat

6

AIOps for network management in Telco horizontal clouds
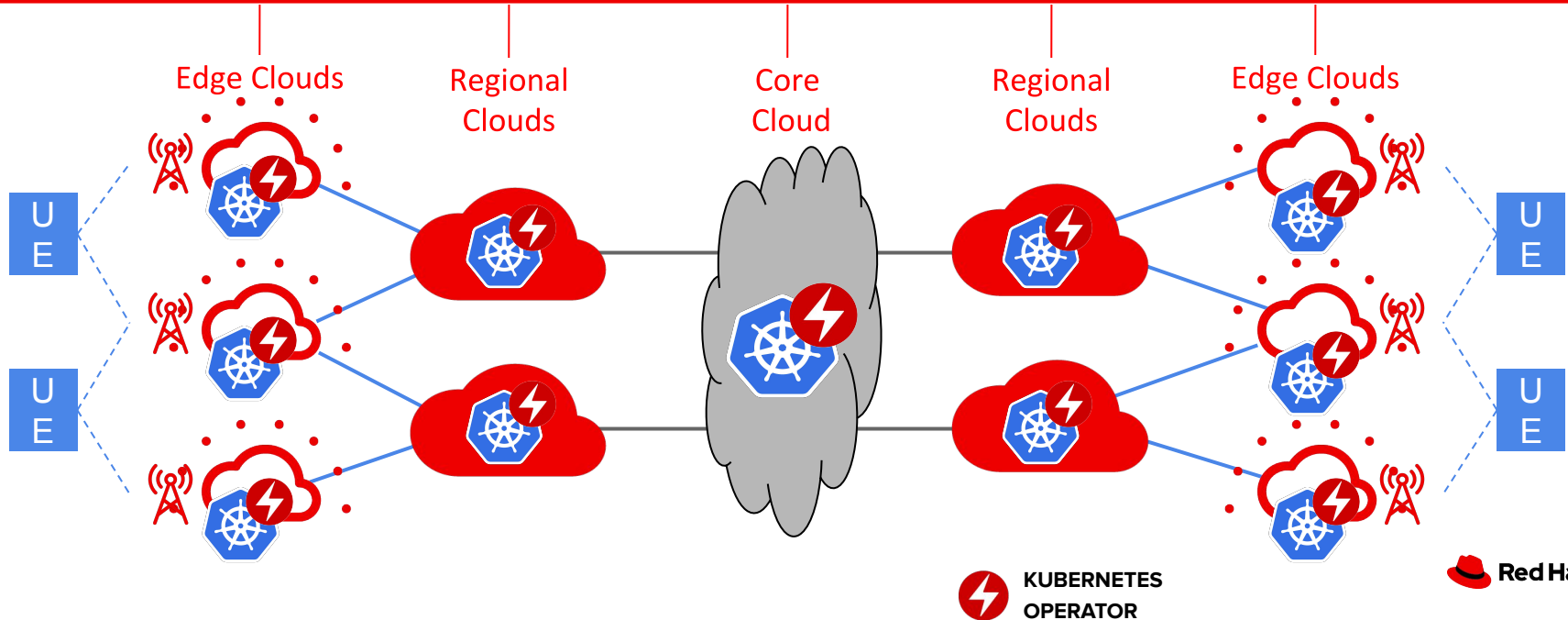
Advanced Cluster Management for kubernetes multi-clouds environment ✚ **AIOps**

CNF and Kubernetes network Predictive Maintenance & Analysis Intent Based Networking
- Multi kubernetes cluster connectivity
- Offloaded network connectivity outside Kubernetes cluster

Cloud Native App **Development** | Cloud Native App **Portability**   **|**   Common **CI/CD**, automation, and support models | Nearly **autonomous operations**

Edge Clouds   Regional Clouds   Core Cloud   Regional Clouds   Edge Clouds

UE   UE   UE   UE

KUBERNETES OPERATOR

Red Hat

7

AIOps for multi layer connectivity management

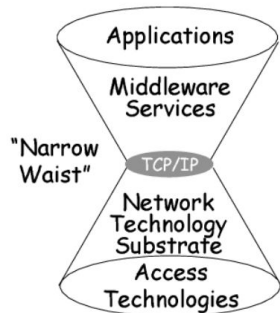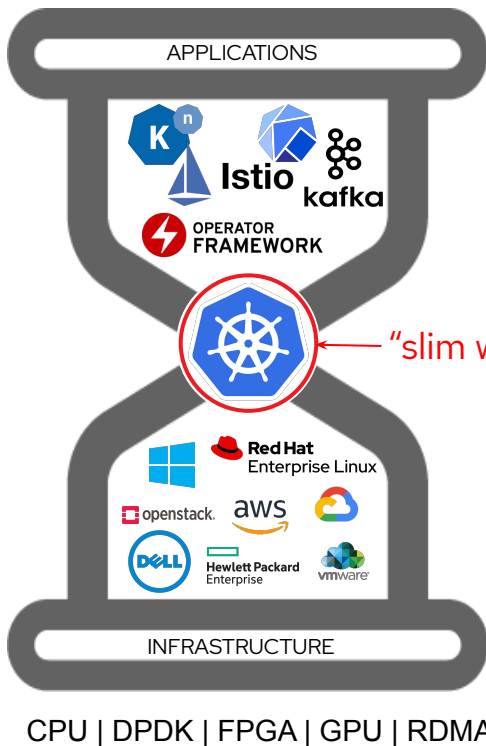ACM: Advanced Cluster Management for Kubernetes multi-clouds environment

Summary

- More than 50% of Digital services will utilize persistent network connectivity in next decade…. Online merges Offline world.
  - Use cases are diverse and each requires different connectivity.
- Network Functions need portability and location agnostic/flexibility deployment for Digital services meeting each use case requirement. … CNF is mandatory.
- AIOps is needed for
  - Predictive maintenance & analysis to each type of Network and Cloud.
  - Intent Based Networking across multi types of connectivity.
- Data foundation across Telco horizontal clouds is important for AIOps.
  - Data centric communication and computing
  - Service Telemetry Framework
  - Open Data Hub

Red Hat

Why Kubernetes: Cloud Innovation standard

APPLICATIONS

OPERATOR FRAMEWORK

"slim waist"

Red Hat Enterprise Linux

INFRASTRUCTURE

CPU | DPDK | FPGA | GPU | RDMA

Slim waist
(Narrow waist like a TCP/IP in Internet era)

- Kubernetes is to cloud what IP was to networking.

Industry agnostic & Cloud innovation standard

- Provides heterogeneous cluster - COTS server, P4 programmable switch, WDM transpodor(TIP)

- Provides container orchestration on top of an infrastructure abstraction (CPU, DPDK, GPU, FPGA, RDMA, etc).

- Foundation for higher–level abstractions (such as KubeFlow, Knative serverless, service mesh, kafka, etc).

Red Hat

Reference

Multicluster-service-discovery-in-openshift
https://www.openshift.com/blog/multicluster-service-discovery-in-openshift

Submariner
https://github.com/operator-framework/community-operators/tree/master/community-operators/submariner

Skupper
https://skupper.io/docs/overview.html

Open Cluster Management
https://github.com/open-cluster-management

Open Data Hub
https://opendatahub.io/

Operator Framework
https://github.com/operator-framework

Red Hat

Thank you!

 linkedin.com/company/Red-Hat

 facebook.com/RedHatinc

 youtube.com/user/RedHatVideos

 twitter.com/RedHat

Upstream/Community Projects in the AI/ML Space

NVIDIA NGC
GPU optimized
and curated

Kubeflow
ML toolkit for
Kube

ML lifecycle

OPEN DATA HUB
AI Platform powered by Open Source

The registry for
Kubernetes Operators

Integration & Delivery
Logging & Trac

OperatorHub.io

Home for k8s community to share operators for various apps/tools

Open Data Hub: Projects not products

Prometheus *

- Monitoring and alerting toolkit
- Used to diagnose problems

Grafana *

- Analytics platform for all metrics
- Query, visualize and alert on metrics

SELDON

- Deploying machine learning models as micro-services
- Full model lifecycle management

Apache Spark

- Unified analytics engine
- Large-scale data access

JupyterHub

- Multi-user Jupyter
- Used for data science and research

ceph
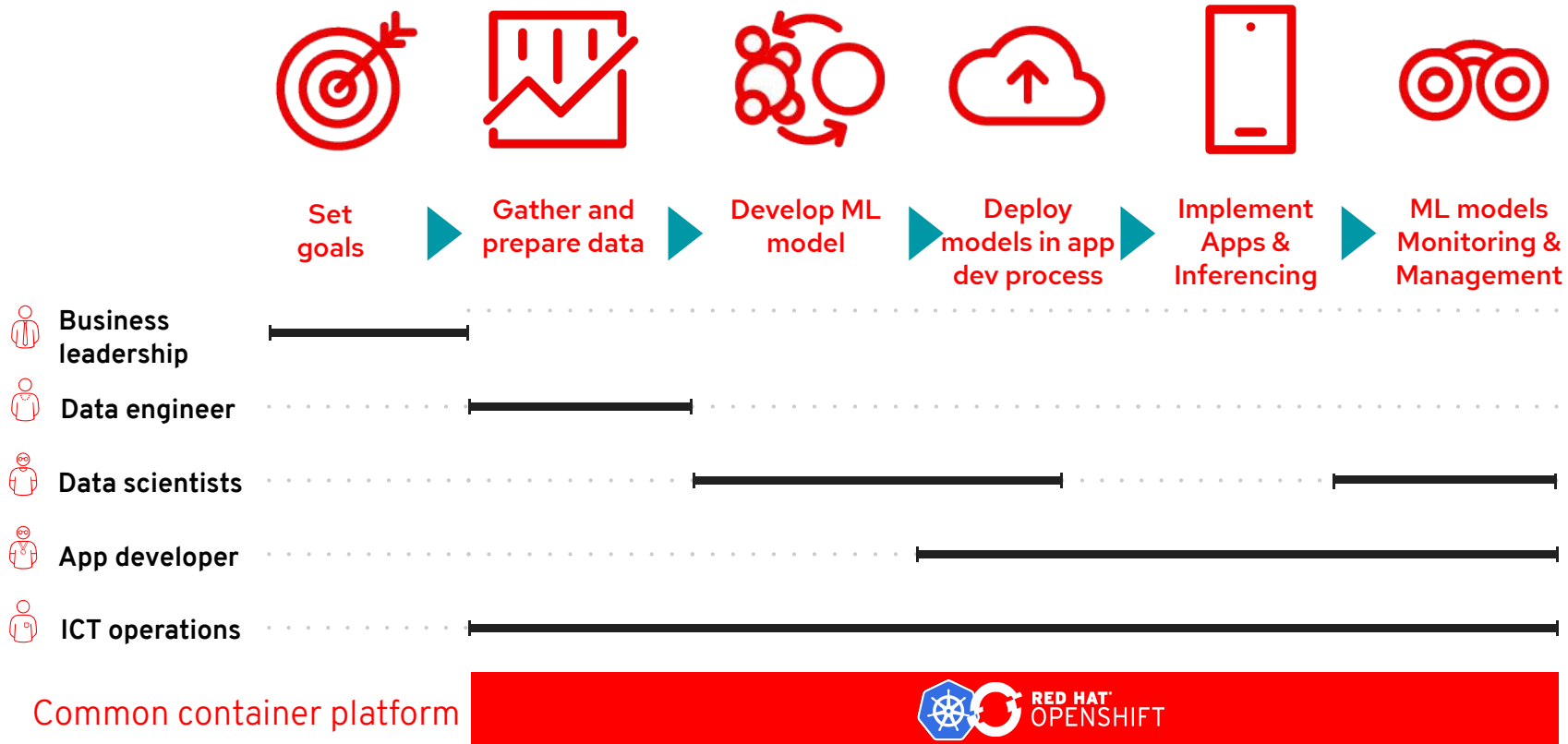
- Distributed Object Store
- S3 Interface

STRIMZI kafka

- Distributed event streaming
- Pub/Sub Messaging

argo

- Container-native workflow engine
- Declaratively deploy ML pipelines and models

Red Hat

The ML lifecycle and responsibilities

	Set goals	Gather and prepare data	Develop ML model	Deploy models in app dev process	Implement Apps & Inferencing	ML models Monitoring & Management
Business leadership	●━━━━━●					
Data engineer		●━━━━━●				
Data scientists			●━━━━━━━━━━●			●━━━●
App developer				●━━━━━━━━━━━━━━━━●		
ICT operations		●━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━●				

Common container platform — RED HAT OPENSHIFT

Red Hat

Q & A

Red Hat OpenShift

in linkedin.com/company/red-hat

▶ youtube.com/user/RedHatVideos

f facebook.com/redhatinc

🐦 twitter.com/RedHat

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