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▶ AUTOMATING TELCO CLOUD DEPLOYMENTS - WHY AND HOW

What is disruptive?

- Common belief- Market race
- New money - Extreme growth potential
- Strong value destroys current demands
- Significant social impact

5G Functionalities

Data Sovereignty

We are making the biggest investment ever to scale current market and exponential growth of new innovations!

Wave 1

Wave 2

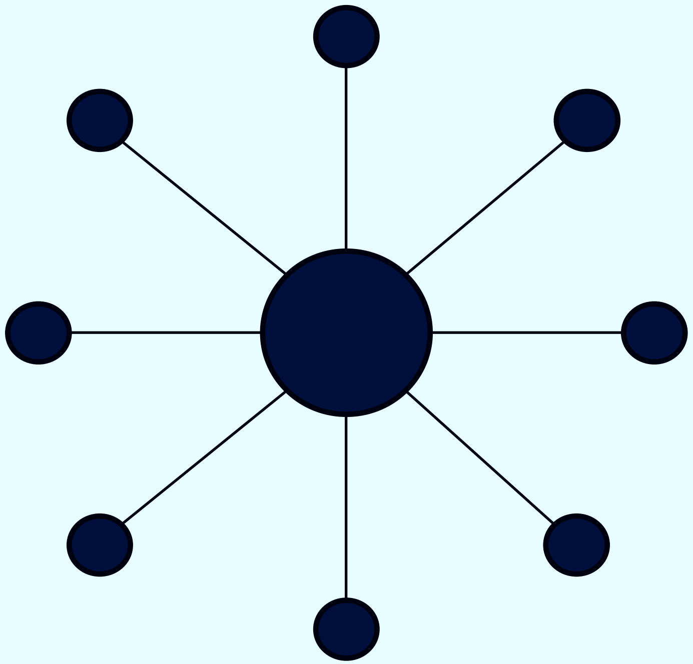
Wave 3

Wave 4

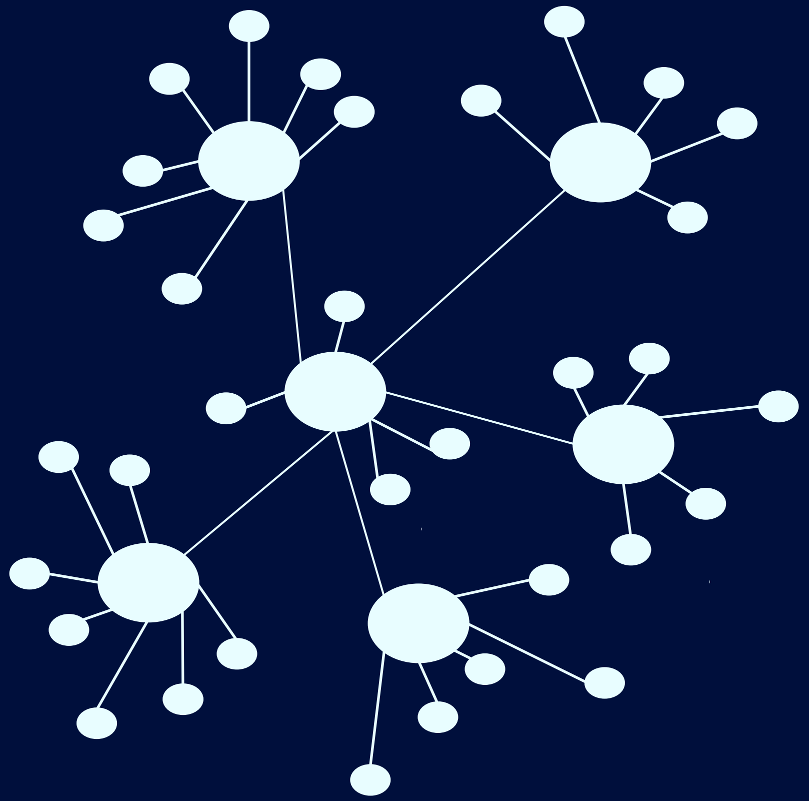
Wave 5

Vision vs reality!

Centralization



Decentralization



The scariest strategy in the world!

We are modernizing the network…

Innovation

… a future proofed platform to scale innovation…

Collaboration

… in partnership between research and businesses.

Innovation by experimenting is key

B2B offer growth opportunities for connectivity and new services, yet monetisation of 5G is slow. With new players entering the telco market, competition will be tough.

Those who will innovate fast, at scale and be trusted will be winning the customers.

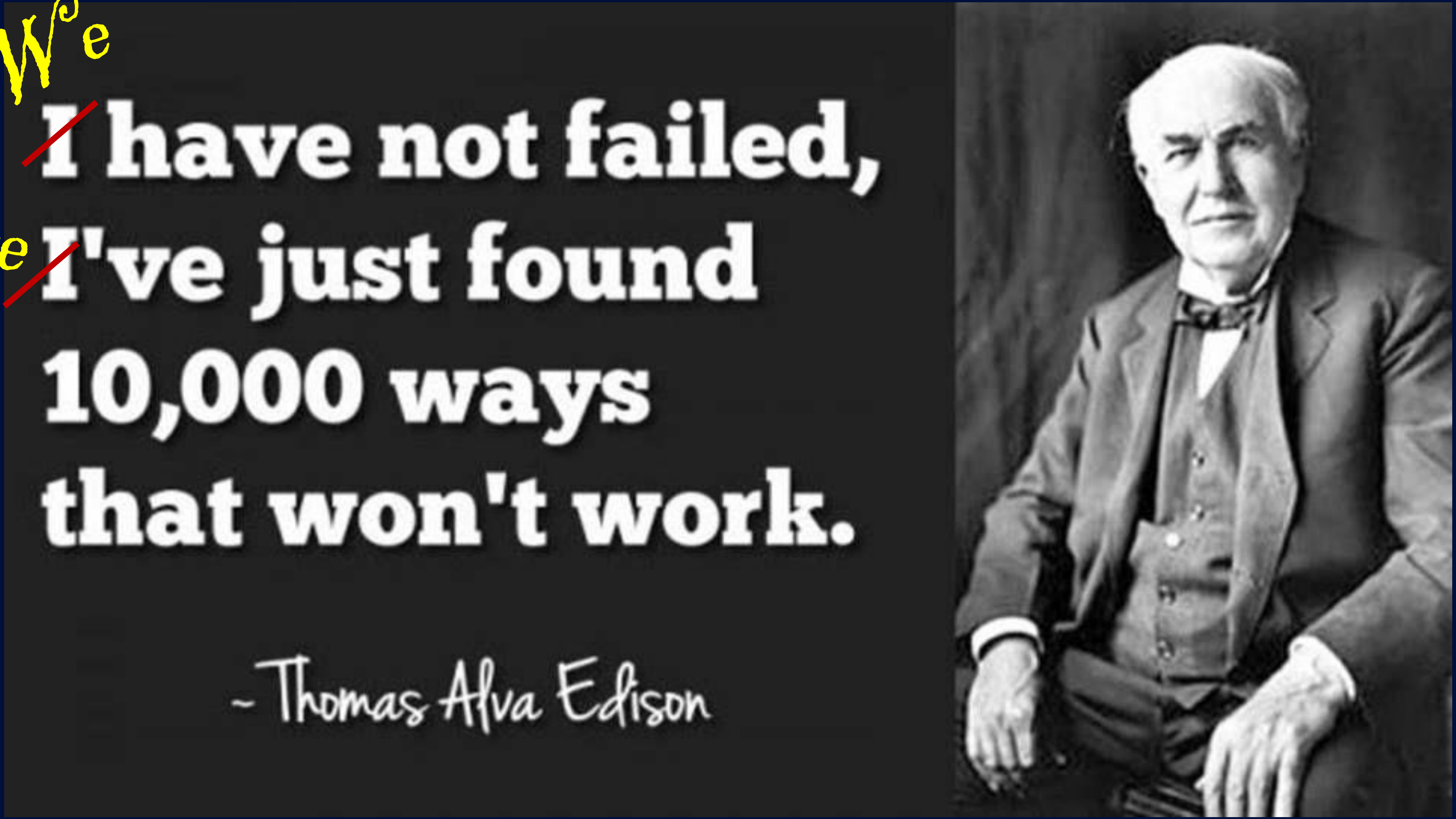
Energy

Defense & PPDR

Health

Industry

Transport



We ~~I~~ have not failed,
we ~~I~~'ve just found
10,000 ways
that won't work.

- Thomas Alva Edison

Innovation tool:

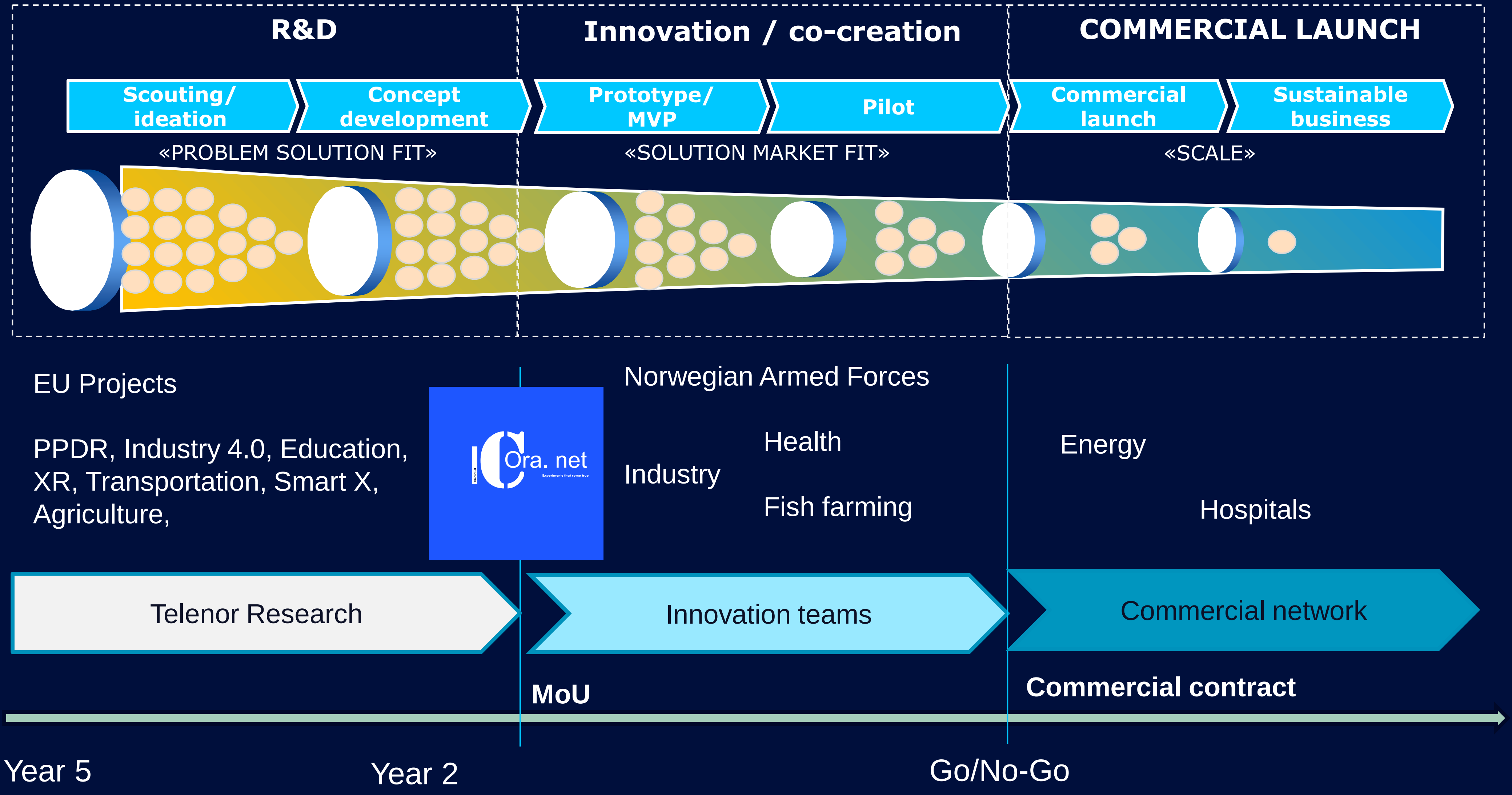
Telenor R&I

ICOra. net

Experiments that come true

i – innovative
C – Cloud-native
O – Open
R – Resilient
A – Automated

Successful innovation and co-creation with enterprise customers is a path for commercialization



R&D

Innovation / co-creation

COMMERCIAL LAUNCH

Scouting/ ideation

Concept development

Prototype/ MVP

Pilot

Commercial launch

Sustainable business

«PROBLEM SOLUTION FIT»

«SOLUTION MARKET FIT»

«SCALE»

EU Projects

PPDR, Industry 4.0, Education, XR, Transportation, Smart X, Agriculture,

Ora. net

Norwegian Armed Forces

Industry

Health

Fish farming

Energy

Hospitals

Telenor Research

Innovation teams

Commercial network

MoU

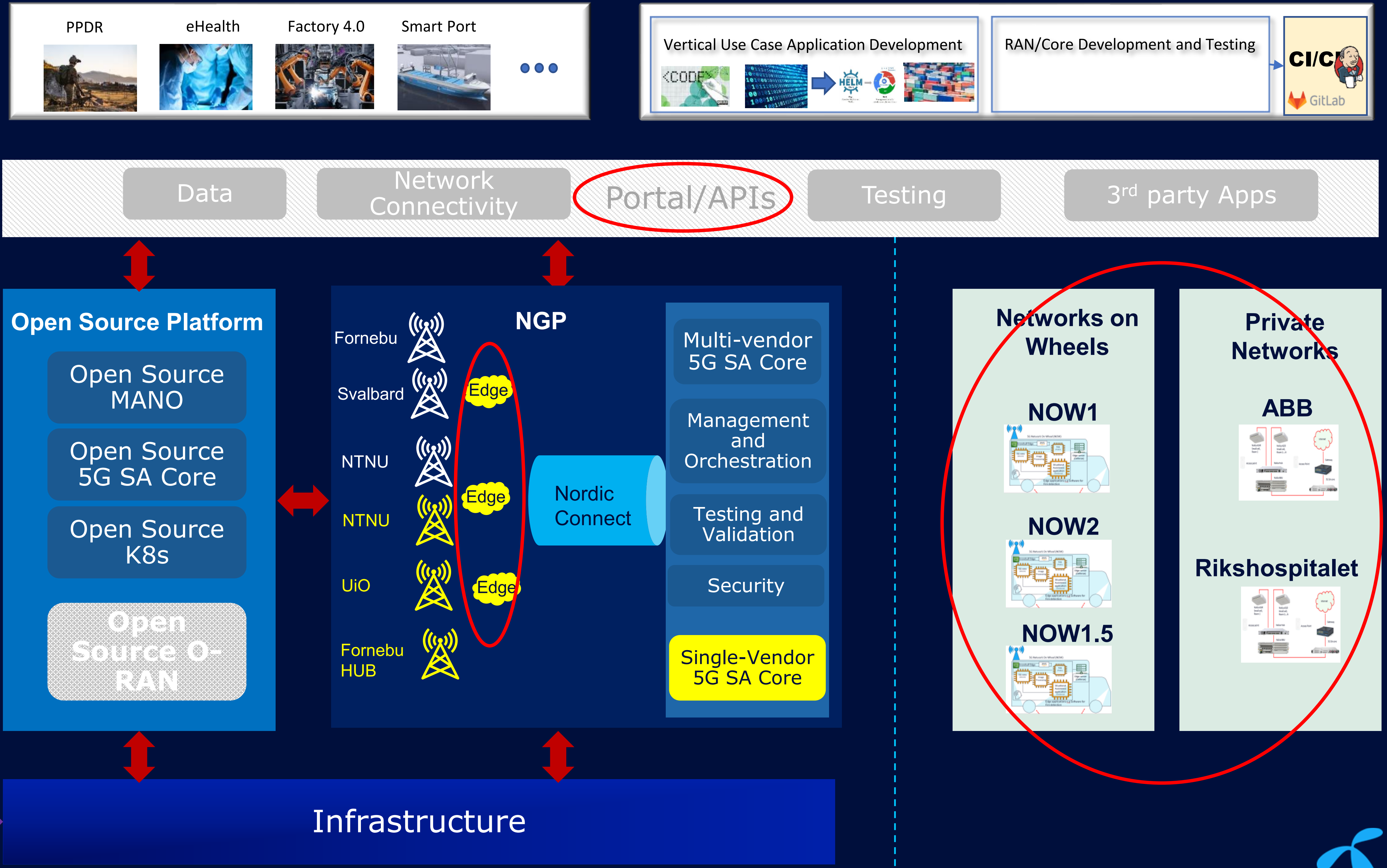
Commercial contract

Year 5

Year 2

Go/No-Go

iCORA Platform

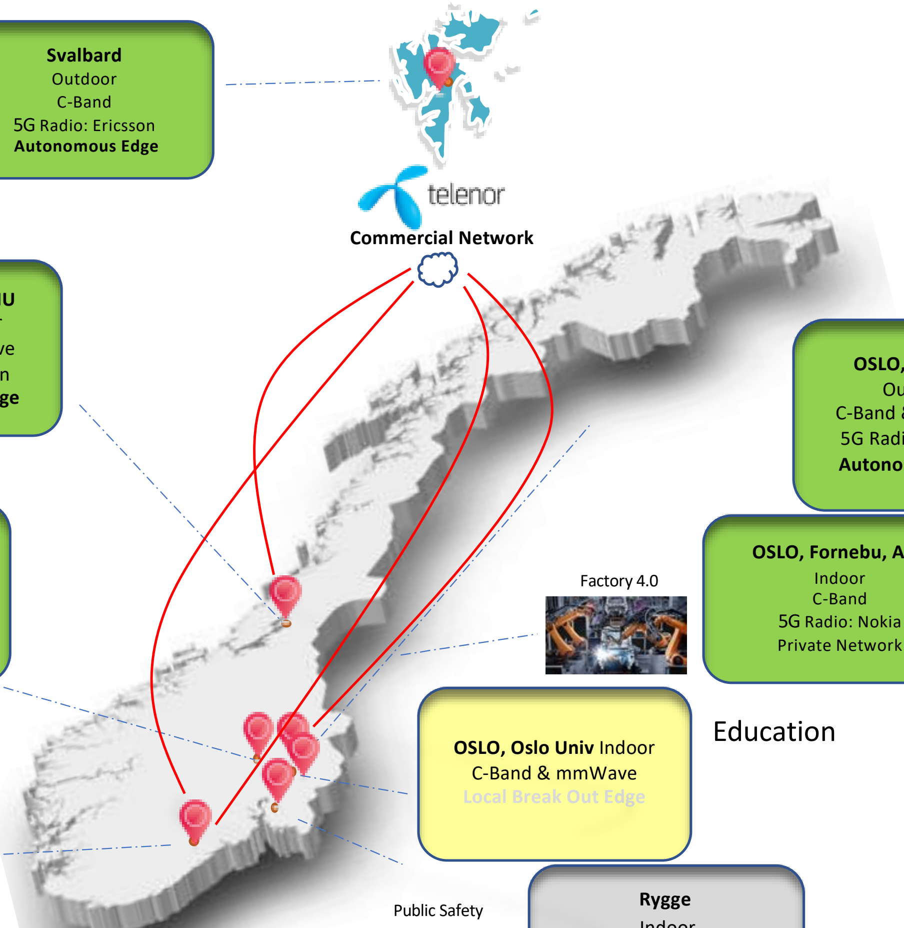

PPDR
eHealth
Factory 4.0
Smart Port
Vertical Use Case Application Development
<CODE>
HELM
RAN/Core Development and Testing
CI/CD
GitLab
Data
Network Connectivity
Portal/APIs
Testing
3rd party Apps
Open Source Platform
Open Source MANO
Open Source 5G SA Core
Open Source K8s
Open Source O-RAN
NGP
Fornebu
Svalbard
NTNU
NTNU
UiO
Fornebu HUB
Edge
Edge
Edge
Nordic Connect
Multi-vendor 5G SA Core
Management and Orchestration
Testing and Validation
Security
Single-Vendor 5G SA Core
Networks on Wheels
NOW1
NOW2
NOW1.5
Private Networks
ABB
Rikshospitalet
Infrastructure
To TNOR labs
To Clouds
To EU platforms

NGP Overview – RAN, Edge, NPN

- ● Functional
- ● In-Progress/To be
- ● Decommissioned

PPDR

Svalbard
Outdoor
C-Band
5G Radio: Ericsson
Autonomous Edge



Factory 4.0

Trondheim – NTNU
Indoor/Outdoor
C-Band & mmWave
5G Radio: Ericsson
Local Breakout Edge

eHealth

OSLO, Rikshospitalet
Indoor
C-Band
5G Radio: Nokia
Private Network

Smart Port

Herøya,
Outdoor
C-Band
5G Radio – Ericsson
Local Break Out Edge

OSLO, Fornebu
Outdoor
C-Band & mmWave
5G Radio: Ericsson
Autonomous Edge

OSLO, Fornebu, ABB
Indoor
C-Band
5G Radio: Nokia
Private Network

Education

OSLO, Oslo Univ Indoor
C-Band & mmWave
Local Break Out Edge

Public Safety

Rygge
Indoor
C-Band & mmWave
5G Radio: Nokia
Autonomous Edge

Public Safety

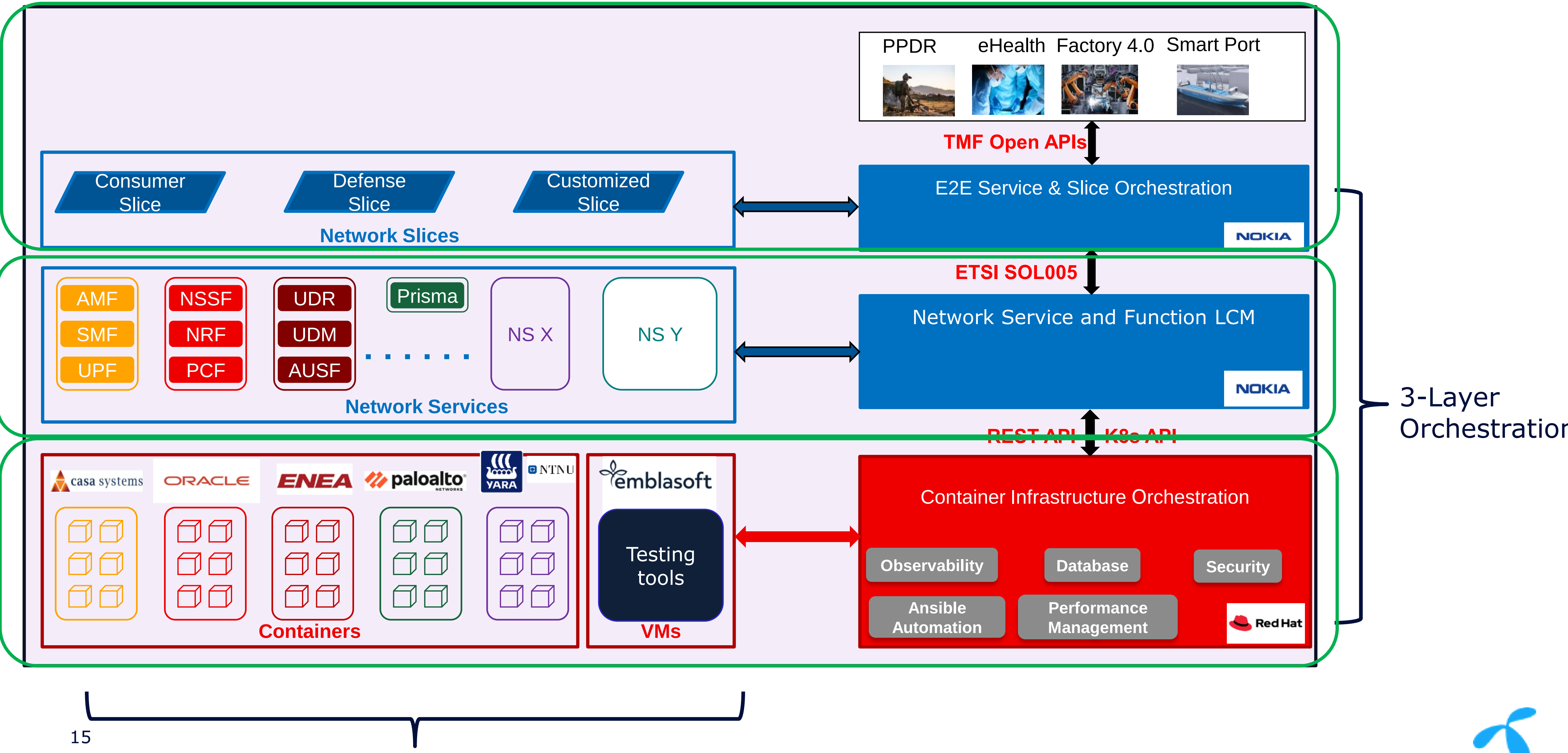
Network on Wheels
Mobile
C-Band
5G Radio: Nokia
Private Network

iCORA Platform Overview

Scale is the Key

Site	Type	Services	Use Cases	Stakeholders
Fornebu Outdoor	Public	Network Slicing PNI-NPN	All	
Fornebu Indoor	Public/MPN	Network Slicing PNI-NPN		5GMediaHUB
Svalbard outdoor	Public	Network slicing & Autonomous EDGE	PPDR, forestry	COMMECT
Trondheim indoor	Public	Network slicing & LBO EDGE	Media	fidal field trials beyond 5G 5 Imagine B5G
Trondheim outdoor	Public	Network slicing & LBO EDGE	Media	fidal field trials beyond 5G
UiO indoor	Public	Network slicing & LBO EDGE	Education, XR	UiO
ABB indoor	NPN	Network slicing & PNI-NPN; I-NPN	Industry 4.0	ABB
Rikshospitalet	NPN	MPN, PNI-NPN	Healthcare	OSLO UNIVERSITETSSYKEHUS
Network on Wheels	NPN	MPN; PNI-NPN; I-NPN	PPDR; Media	NORWEGIAN DEFENCE MATERIEL AGENCY NRK COMMECT

Method – Multi-Layer Orchestration Architecture



PPDR

eHealth

Factory 4.0

Smart Port

TMF Open APIs

Consumer Slice

Defense Slice

Customized Slice

Network Slices

E2E Service & Slice Orchestration

NOKIA

ETSI SOL005

AMF
SMF
UPF

NSSF
NRF
PCF

UDR
UDM
AUSF

Prisma

NS X

NS Y

Network Services

Network Service and Function LCM

NOKIA

REST API K8s API

casa systems
ORACLE
ENEA
paloalto NETWORKS
YARA
NTNU

Containers

emblasoft

Testing tools

VMs

Container Infrastructure Orchestration

Observability

Database

Security

Ansible Automation

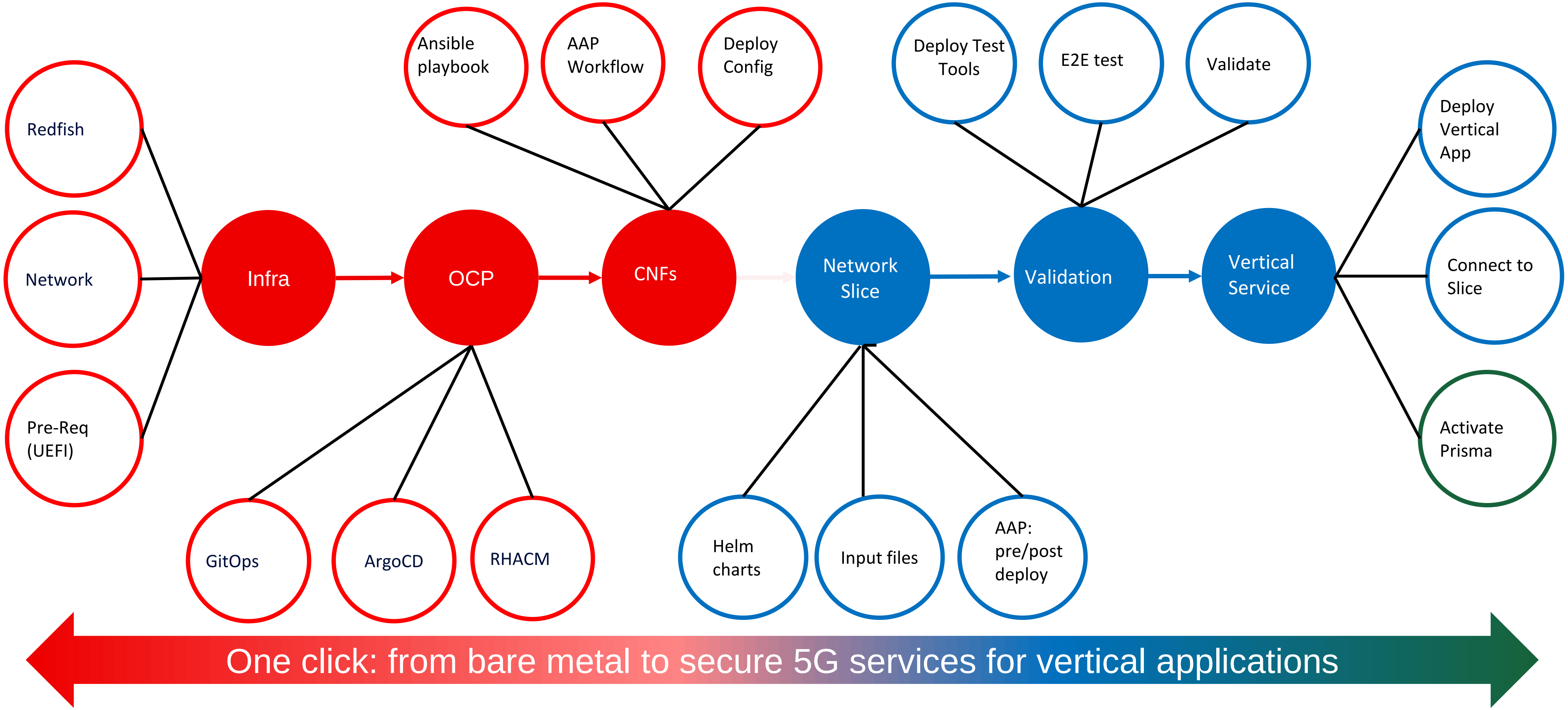
Performance Management

Red Hat

3-Layer
Orchestratio

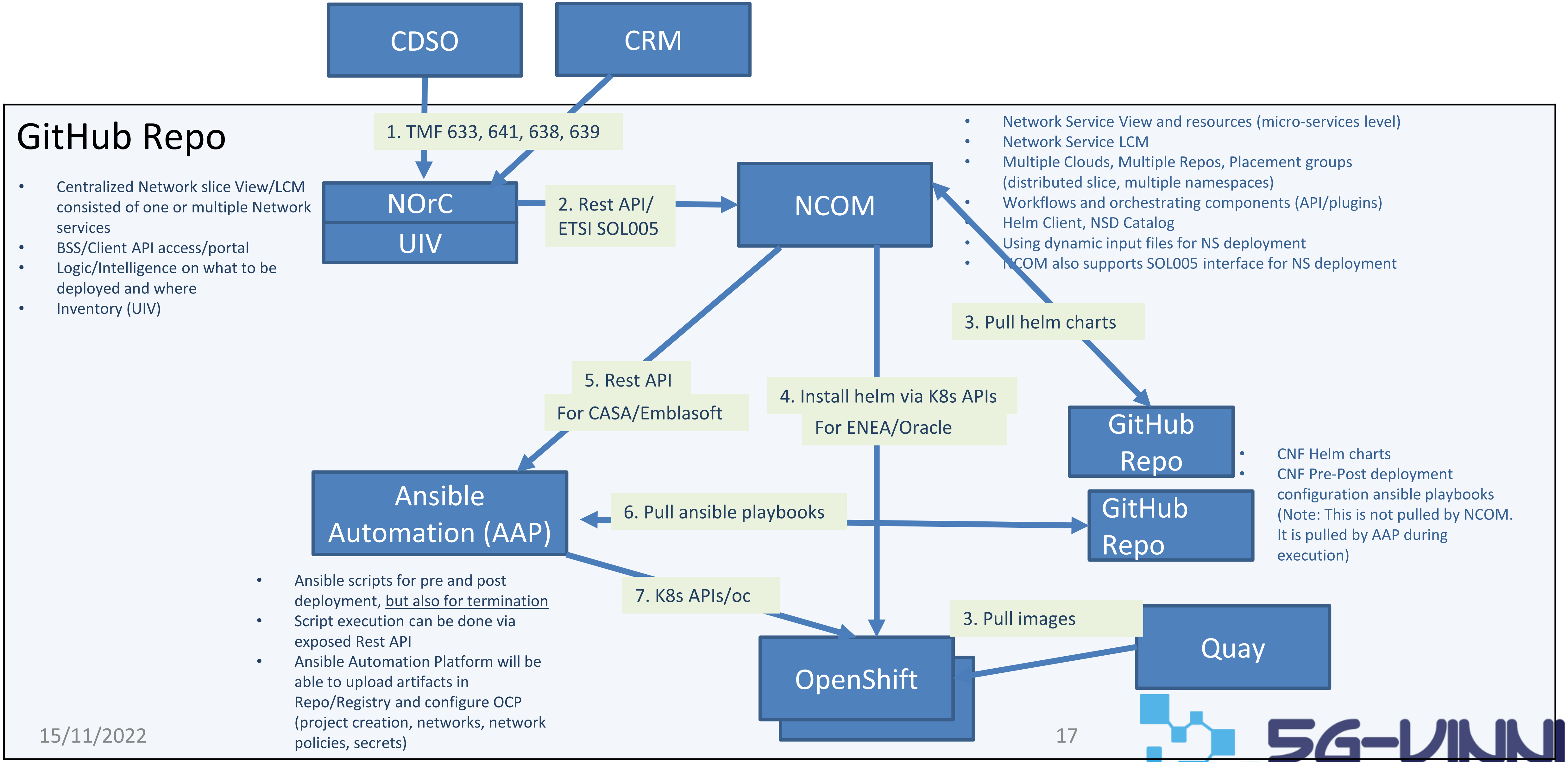
Hybrid deployment

Automation Workflows


Redfish
Network
Pre-Req (UEFI)
Infra
OCP
GitOps
ArgoCD
RHACM
CNFs
Ansible playbook
AAP Workflow
Deploy Config
Network Slice
Helm charts
Input files
AAP: pre/post deploy
Validation
Deploy Test Tools
E2E test
Validate
Vertical Service
Deploy Vertical App
Connect to Slice
Activate Prisma

One click: from bare metal to secure 5G services for vertical applications

5G Network Service Lifecycle Management Automation



CDSO

CRM

GitHub Repo

- Centralized Network slice View/LCM consisted of one or multiple Network services
- BSS/Client API access/portal
- Logic/Intelligence on what to be deployed and where
- Inventory (UIV)

1. TMF 633, 641, 638, 639

NOrC

UIV

2. Rest API/ ETSI SOL005

NCOM

- Network Service View and resources (micro-services level)
- Network Service LCM
- Multiple Clouds, Multiple Repos, Placement groups (distributed slice, multiple namespaces)
- Workflows and orchestrating components (API/plugins)
- Helm Client, NSD Catalog
- Using dynamic input files for NS deployment
- NCOM also supports SOL005 interface for NS deployment

3. Pull helm charts

GitHub Repo

- CNF Helm charts
- CNF Pre-Post deployment configuration ansible playbooks (Note: This is not pulled by NCOM. It is pulled by AAP during execution)

5. Rest API

For CASA/Emblasoft

4. Install helm via K8s APIs

For ENEA/Oracle

Ansible Automation (AAP)

6. Pull ansible playbooks

GitHub Repo

7. K8s APIs/oc

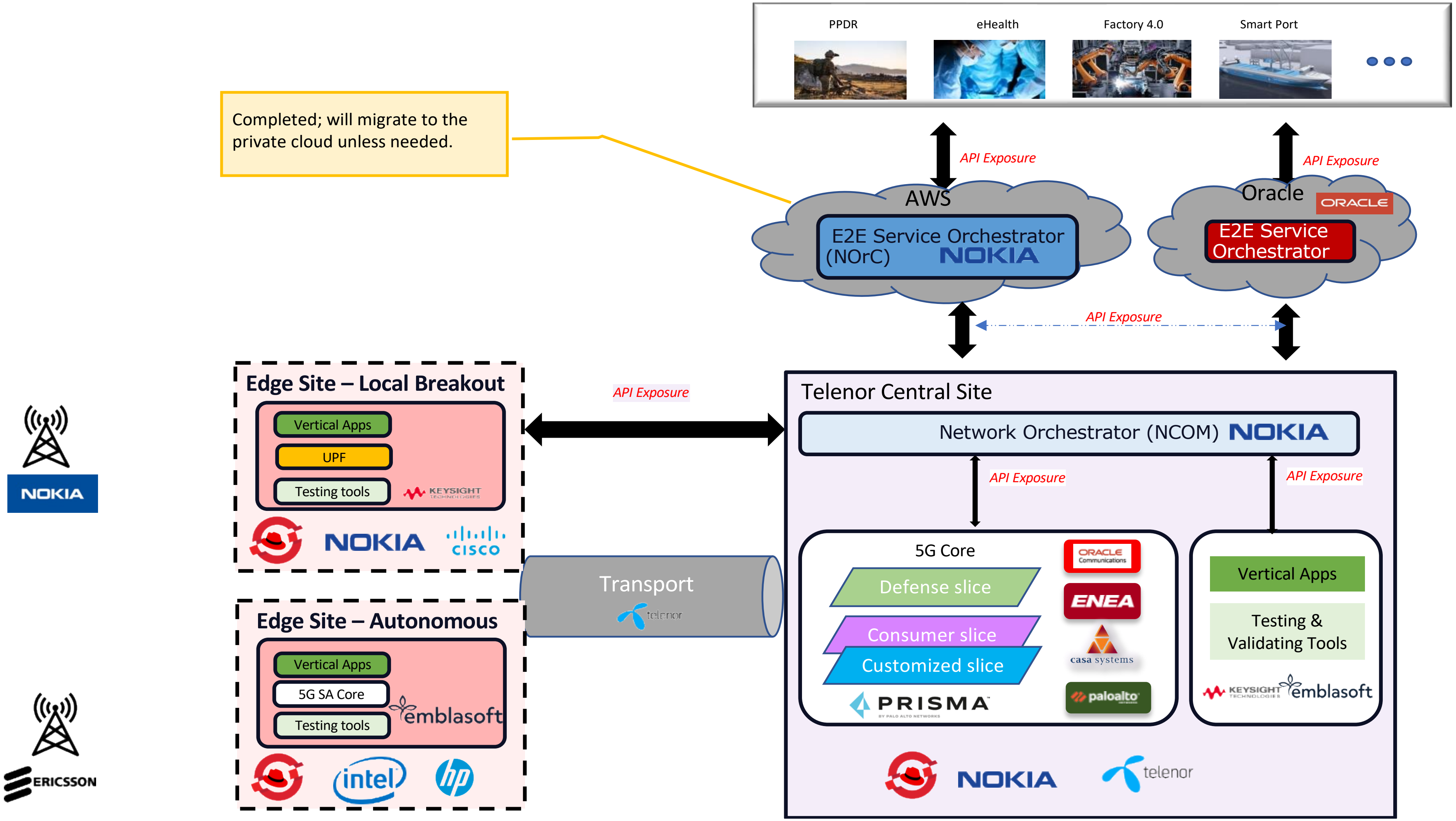
- Ansible scripts for pre and post deployment, but also for termination
- Script execution can be done via exposed Rest API
- Ansible Automation Platform will be able to upload artifacts in Repo/Registry and configure OCP (project creation, networks, network policies, secrets)

3. Pull images

Quay

OpenShift

Next Step - EDGE Deployment Automation



PPDR
eHealth
Factory 4.0
Smart Port

Completed; will migrate to the private cloud unless needed.

API Exposure

AWS
E2E Service Orchestrator (NOrC) NOKIA

API Exposure

Oracle
ORACLE
E2E Service Orchestrator

API Exposure

Edge Site – Local Breakout
Vertical Apps
UPF
Testing tools
KEYSIGHT TECHNOLOGIES
NOKIA
CISCO

API Exposure

Telenor Central Site
Network Orchestrator (NCOM) NOKIA
API Exposure
API Exposure
5G Core
Defense slice
Consumer slice
Customized slice
PRISMA
ORACLE Communications
ENEA
casa systems
paloalto
Vertical Apps
Testing & Validating Tools
KEYSIGHT TECHNOLOGIES
emblasoft
NOKIA
telenor

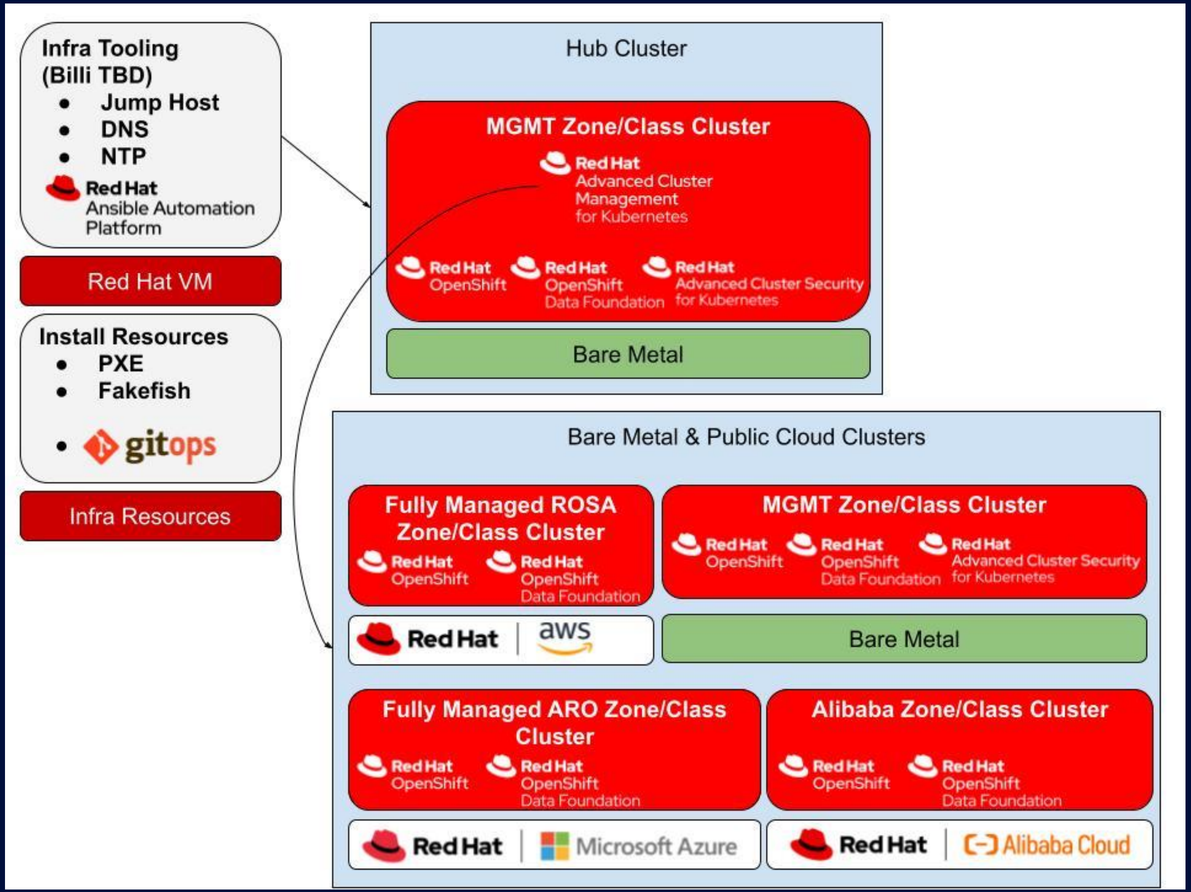
Transport
telenor

Edge Site – Autonomous
Vertical Apps
5G SA Core
Testing tools
emblasoft
intel
hp

NOKIA
ERICSSON

EDGE and NPN deployment automation

Step 1


Infra Tooling (Billi TBD)
- Jump Host
- DNS
- NTP

Red Hat Ansible Automation Platform

Red Hat VM

Install Resources
- PXE
- Fakefish
- gitops

Infra Resources

Hub Cluster

MGMT Zone/Class Cluster
Red Hat Advanced Cluster Management for Kubernetes
Red Hat OpenShift
Red Hat OpenShift Data Foundation
Red Hat Advanced Cluster Security for Kubernetes

Bare Metal

Bare Metal & Public Cloud Clusters

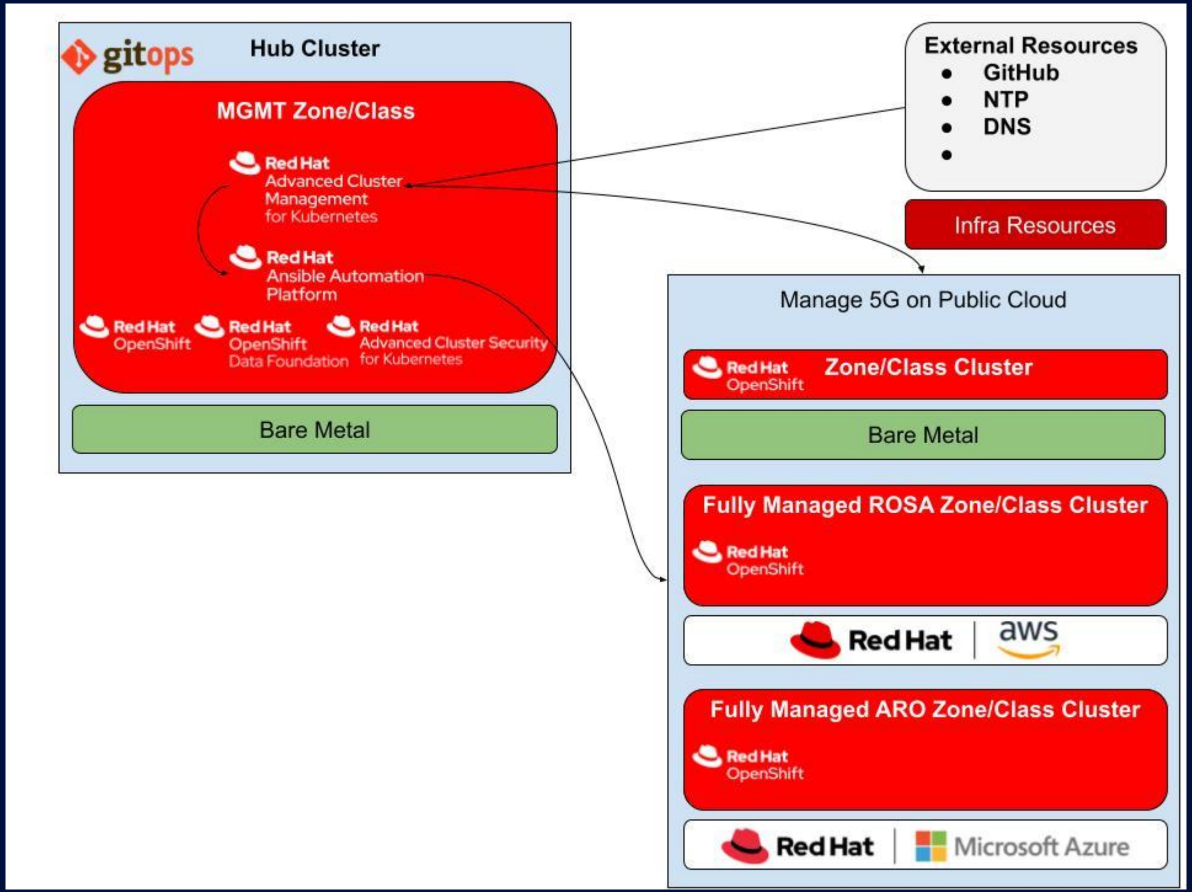
Fully Managed ROSA Zone/Class Cluster
Red Hat OpenShift
Red Hat OpenShift Data Foundation
Red Hat | aws

MGMT Zone/Class Cluster
Red Hat OpenShift
Red Hat OpenShift Data Foundation
Red Hat Advanced Cluster Security for Kubernetes
Bare Metal

Fully Managed ARO Zone/Class Cluster
Red Hat OpenShift
Red Hat OpenShift Data Foundation
Red Hat | Microsoft Azure

Alibaba Zone/Class Cluster
Red Hat OpenShift
Red Hat OpenShift Data Foundation
Red Hat | Alibaba Cloud

Step 2


gitops

Hub Cluster

MGMT Zone/Class
Red Hat Advanced Cluster Management for Kubernetes
Red Hat Ansible Automation Platform
Red Hat OpenShift
Red Hat OpenShift Data Foundation
Red Hat Advanced Cluster Security for Kubernetes

Bare Metal

External Resources
- GitHub
- NTP
- DNS
-

Infra Resources

Manage 5G on Public Cloud

Red Hat OpenShift
Zone/Class Cluster
Bare Metal

Fully Managed ROSA Zone/Class Cluster
Red Hat OpenShift
Red Hat | aws

Fully Managed ARO Zone/Class Cluster
Red Hat OpenShift
Red Hat | Microsoft Azure

Q&A

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