Cloud Native Applications in a Telco World

How Micro Do You Go?

Azhar Sayeed
Chief Architect
Red Hat, Inc.

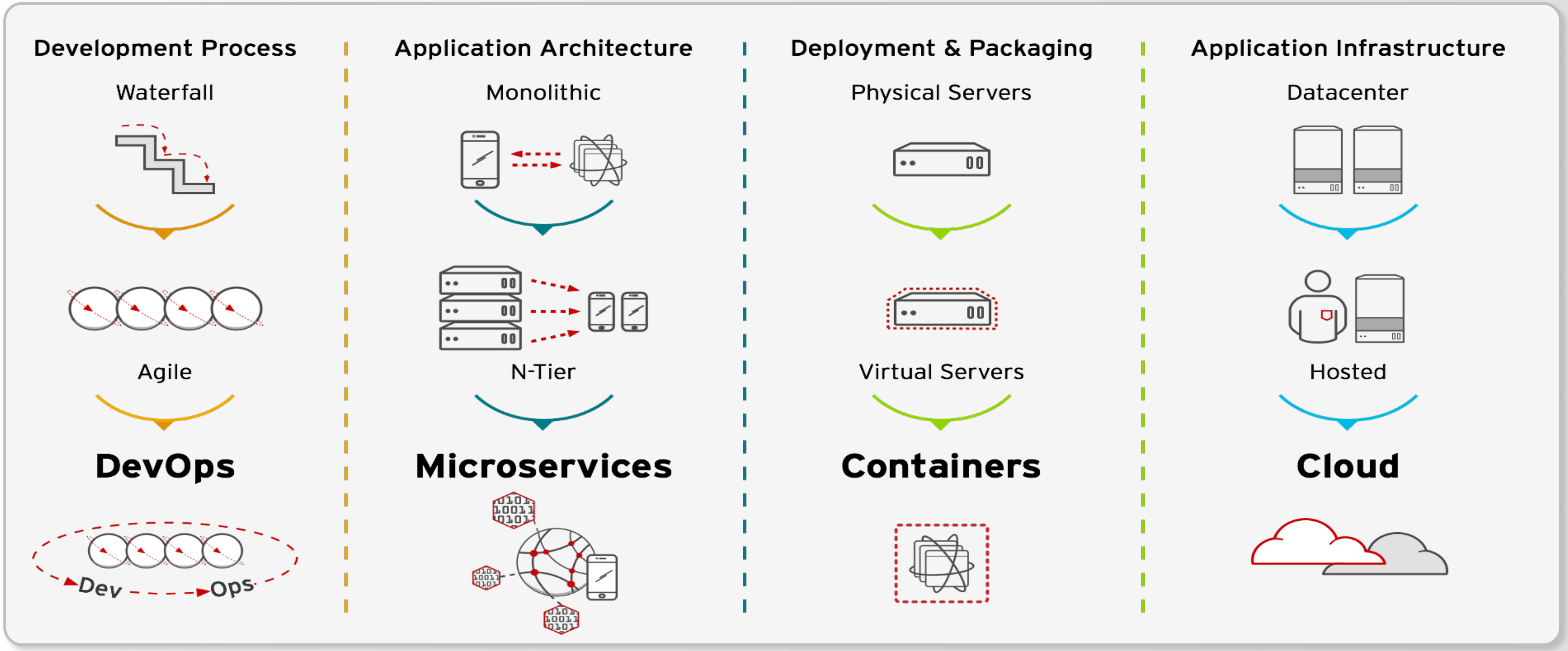
Dejan Leskaroski
Director, Product Management
Affirmed Networks

The industry leader in virtualized mobile networks.

Agenda

- Microservices – definition and benefits
- Why Containers ?
- 5G – driver for cloud native approach
- Application decomposition
    - Network functions – design choices
    - Orchestration
- Summary

CLOUD & VIRTUALIZATION JOURNEY
DIGITAL TRANSFORMATION FOR TELCO & IT



Development Process

Waterfall

Agile

DevOps

Application Architecture

Monolithic

N-Tier

Microservices

Deployment & Packaging

Physical Servers

Virtual Servers

Containers

Application Infrastructure

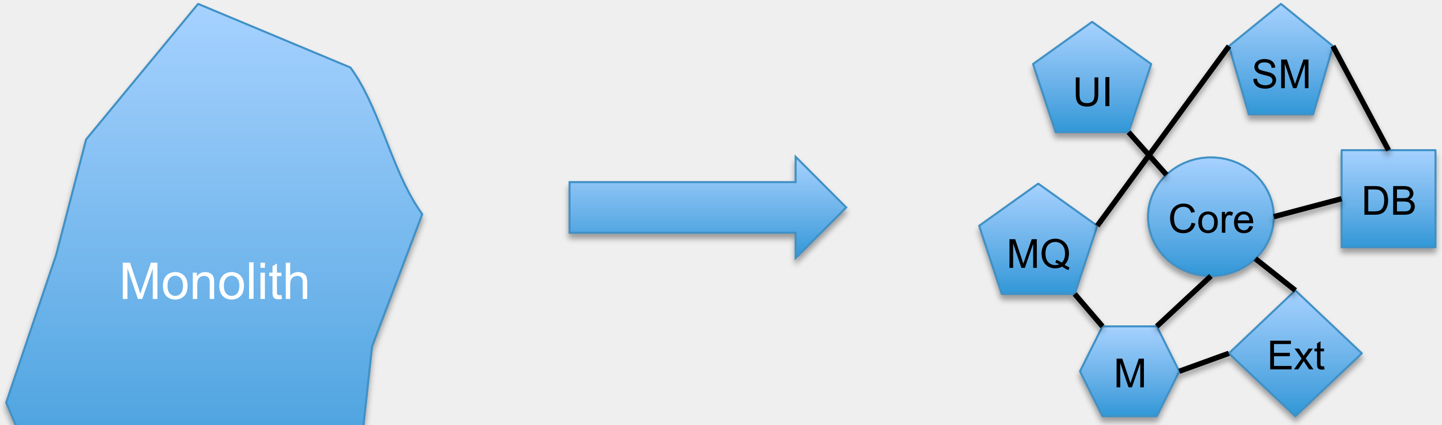
Datacenter

Hosted

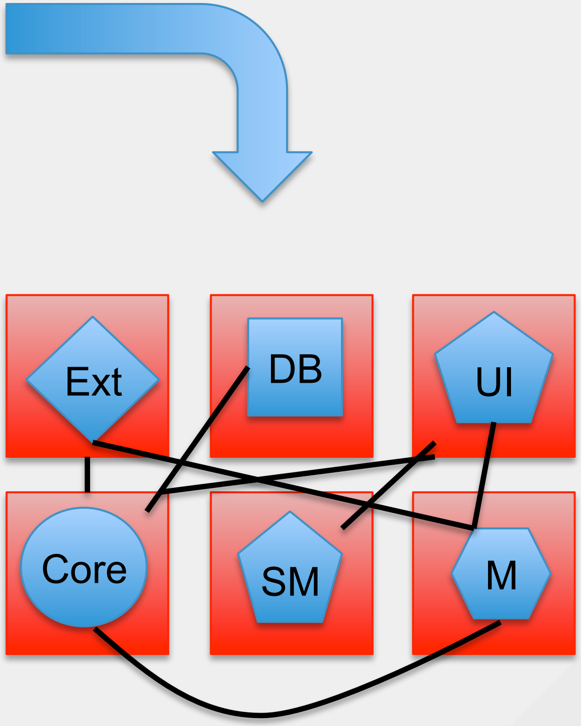
Cloud

Why Micro-services? – Micro-services & Containers

Microservices Architecture is independent from containers



Refactoring of application
Into components (micro-services)



Containers – Encapsulating
micro services

- Microservices architecture is about writing applications so that components can be independently updated and delivered to complete the product
  - May use containers for each of the components
  - Monolith vs componentized
  - Each component can evolve independently
- Network Functions can also be re-factored

VALUES OF MICROSERVICES

FAST TIME TO MARKET

Small autonomous services can be developed and delivered faster

EFFICIENCY

Automating delivery and monitoring of small services is easier

SCALABILITY

Fine grained scalability is easier and uses less resources

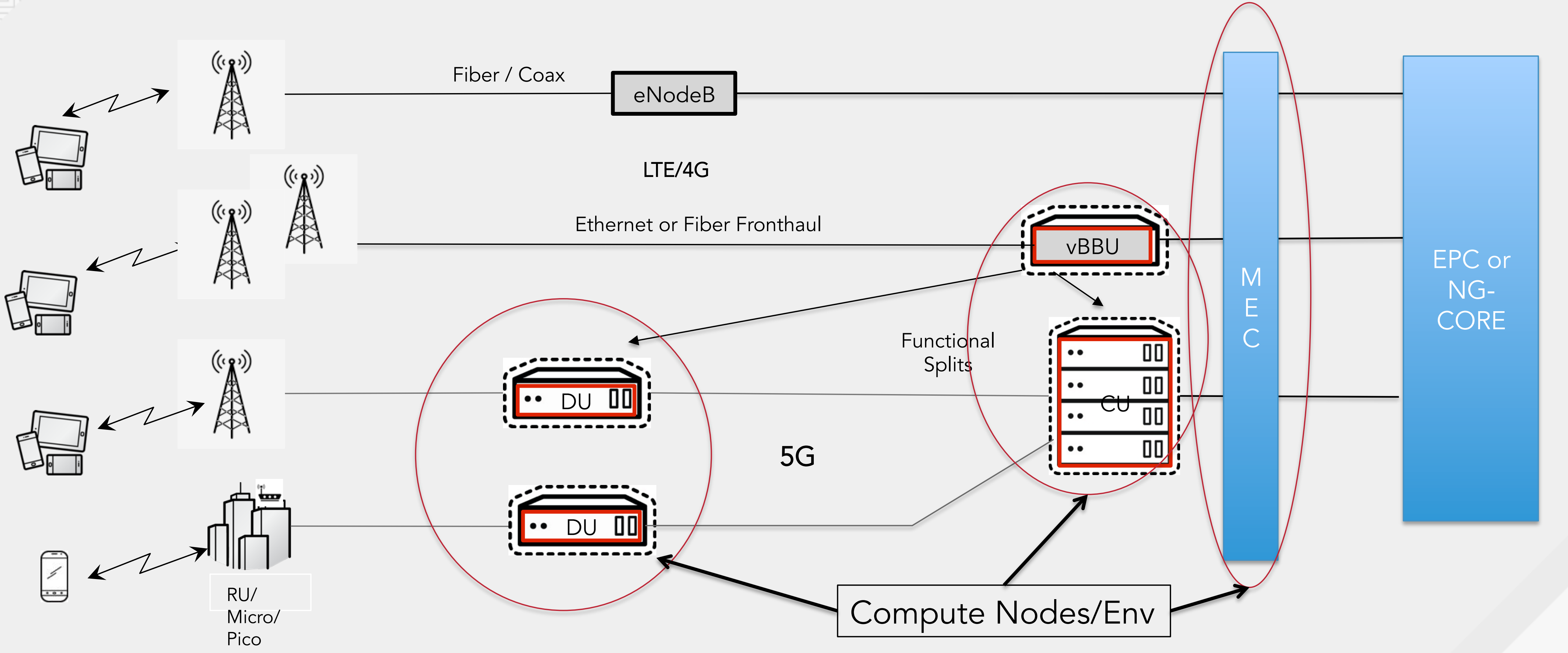
Containers - An Evolution in Application Deployment

Definition: Software packaging concept that typically includes an application and all of its runtime dependencies. Where hypervisors provide a logical abstraction of a full system (hardware, BIOS, OS), Containers provide an abstraction of the user space and share the same OS, services, and hardware.

- Enable efficiency and automation for microservices, but also support traditional applications
- Enable faster and more consistent deployments from Development to Production
- Enable application portability across 4 infrastructure footprints: Physical, Virtual, Private & Public Cloud

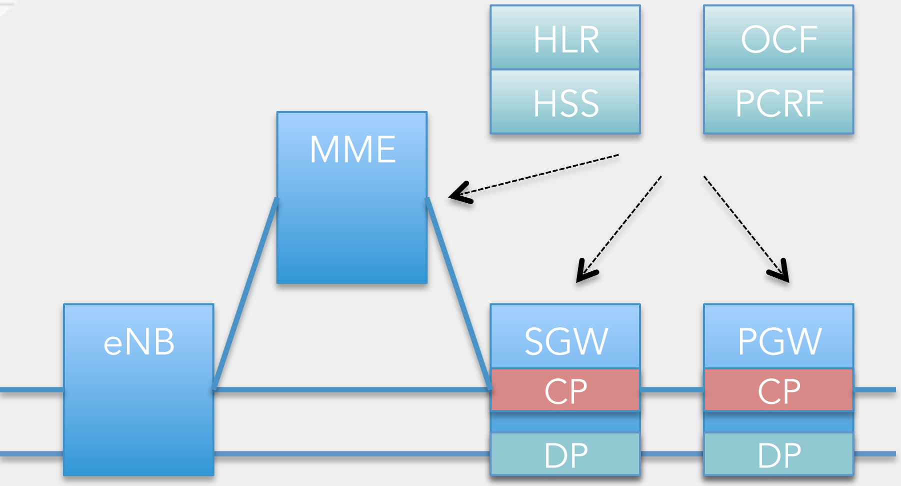
A Word About 5G

RAN Evolution

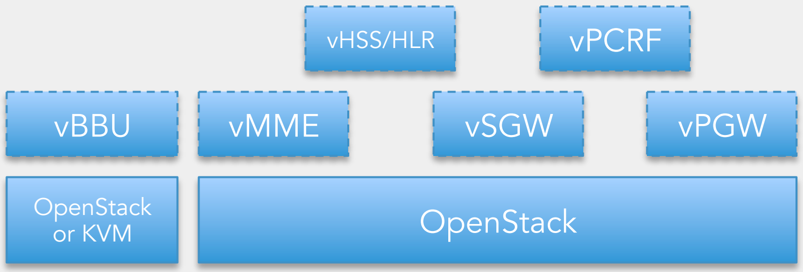


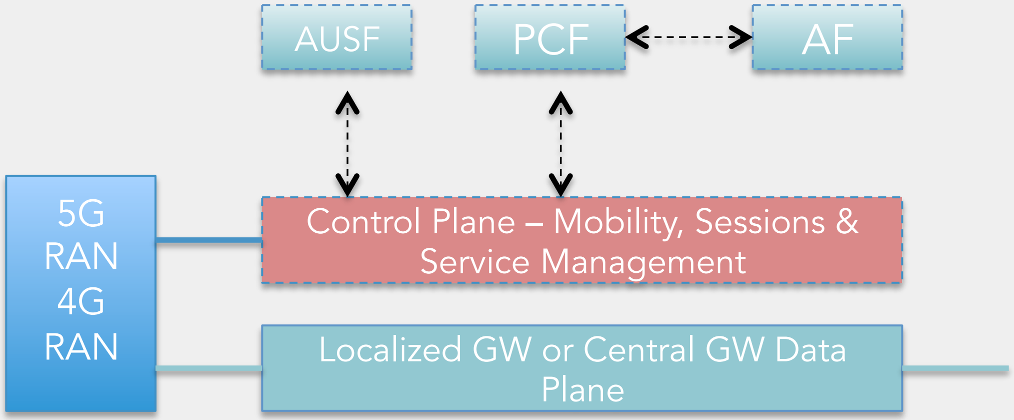
Virtualized RAN: Virtualized BBU (LTE/4G), CU/DU (5G)

PACKET CORE EVOLUTION



Box / Device centric
LTE/4G

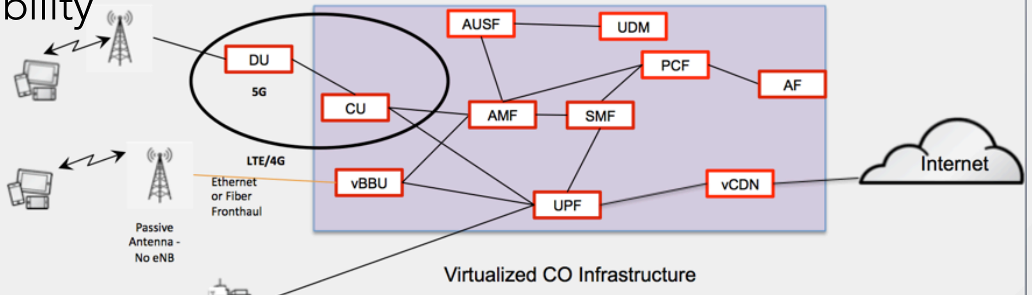



AUSF
PCF
AF
5G RAN 4G RAN
Control Plane – Mobility, Sessions & Service Management
Localized GW or Central GW Data Plane

- CP-DP Separation
- UPF is controlled by AMF and SMF
- Data plane extensibility

5G - Cloud Based

NG - Core



Virtualized RAN: Virtualized BBU (LTE/4G), CU/DU (5G)
NG-CORE with UPF and NGSF, AMF etc

NG-Core and cRAN – require micro services models

- DU, CU and vBBU – Containers attractive to deliver control and data plane functions
- 5G NG-Core - Separate Control and User Plane allows flexible deployment of functions
    - => Orchestration models needed to place functions - Kubernetes
    - => Granularity functions or services for flexibility – Micoservices and re-usability
- Support for Edge computing and efficient UPF re-selection/redirection
    - => Common orchestration of core and other functions
    - => Re-usability of components
- Support Network Slicing based on modular design and multi slice connectivity from UEs
    - => Resource partitioning from edge to core
- Stateless functions – compute decoupled from storage

What does Cloud-Native mean?

“Cloud native computing uses an open source software stack to deploy applications as microservices, packaging each part into its own container, and dynamically orchestrating those containers to optimize resource utilization. Cloud native technologies enable software developers to build great products faster”

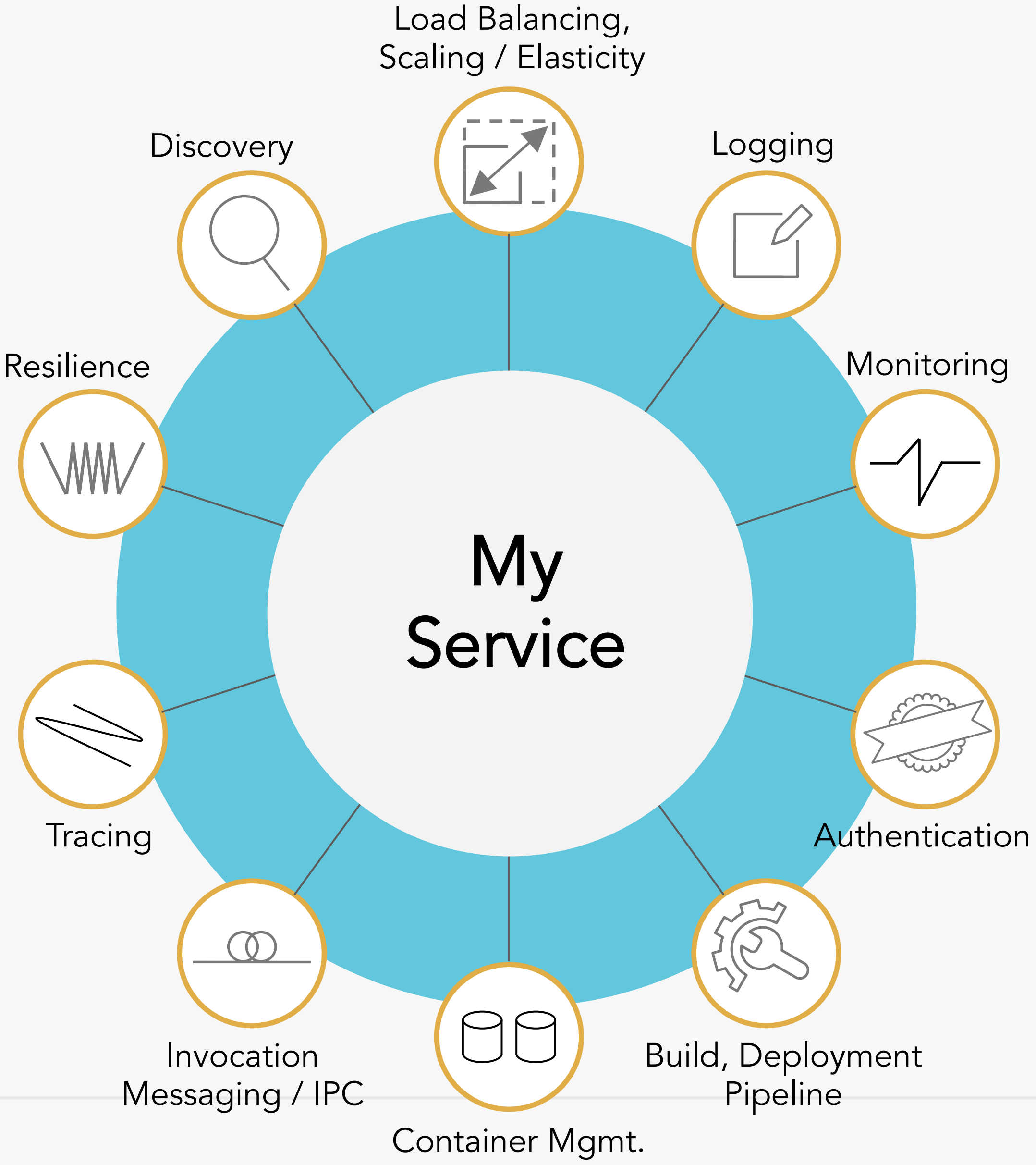
CLOUD NATIVE
COMPUTING FOUNDATION

https://www.cncf.io/

- Scale elastically
- Resilient to failures
- Instrumented to provide insights

- Repeatable
- Automated
- Utilize – cloud storage, queuing, caching, messaging etc

Platform for delivery of Microservices



PaaS (cloud-based)

Middleware services

Application lifecycle management

Mobile

Cloud Native Enablers - Recap

Orchestration

- Externalized clustering, load balancing, and connectivity management

Platform-as-a-Service (PaaS)

- Logging, Tracing, Performance Monitoring, API Management and much more

HTTP APIs

- Standardized integration technology; Publishable (OpenAPI 3.0 / Swagger)

Stateless Applications

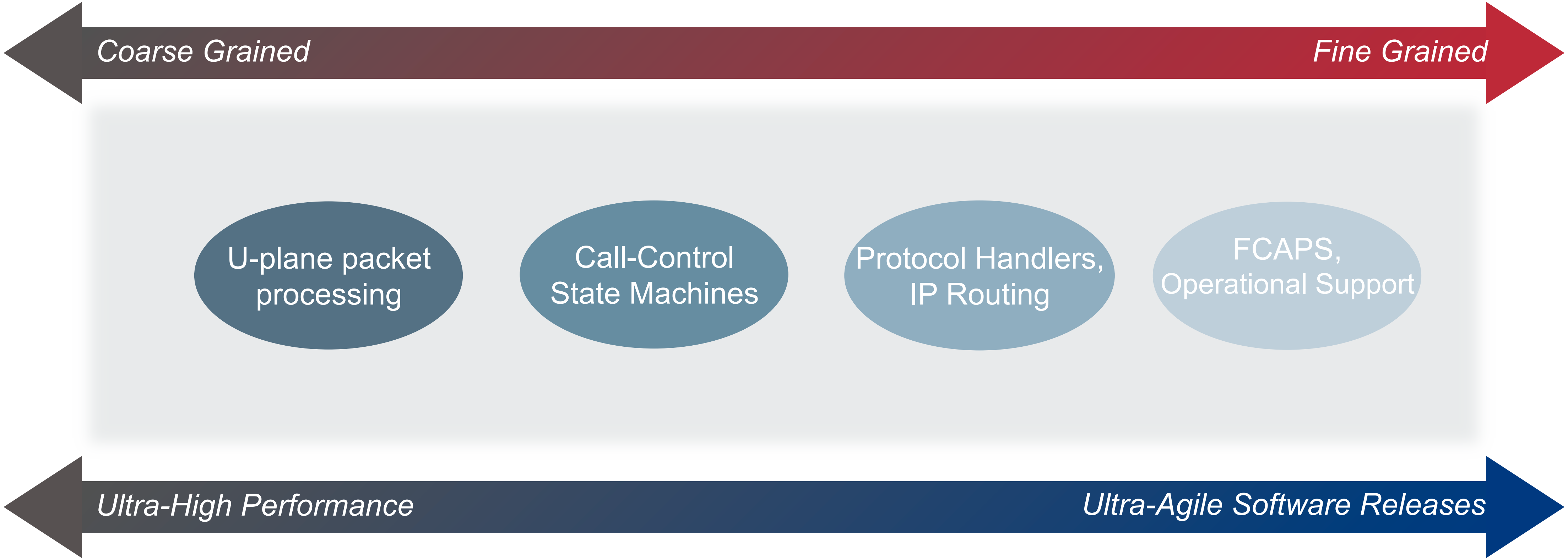
- Ease of Life Cycle Management – “Cattle not Pets”

Containers

- Dynamic orchestration tools, fast instantiation, efficient deployment unit

Microservice Decomposition

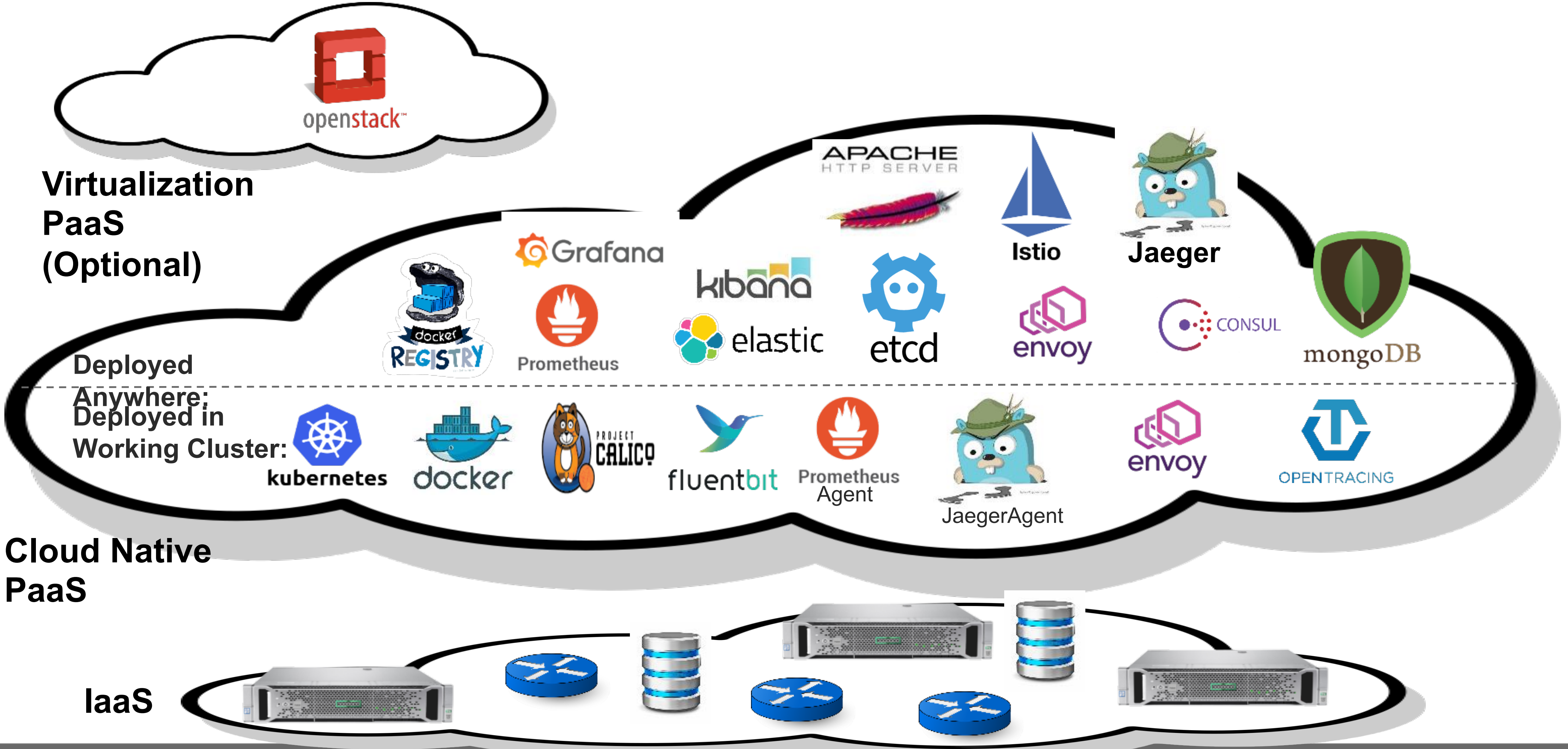
Balancing Performance & Flexibility



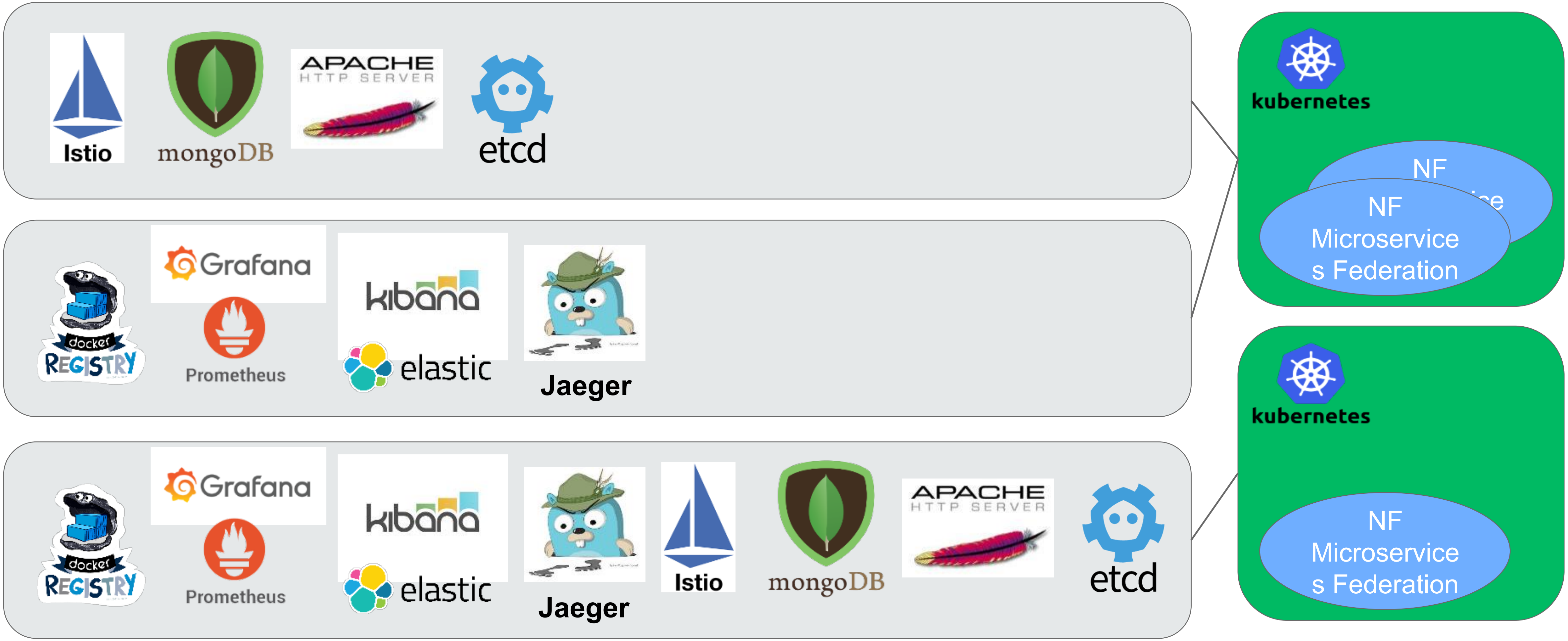
Coarse Grained
Fine Grained
U-plane packet processing
Call-Control State Machines
Protocol Handlers, IP Routing
FCAPS, Operational Support
Ultra-High Performance
Ultra-Agile Software Releases

✓ **Business Value:** Affirmed has the right architecture that strikes the right balance between performance and agility.

Affirmed Cloud Native Ecosystem



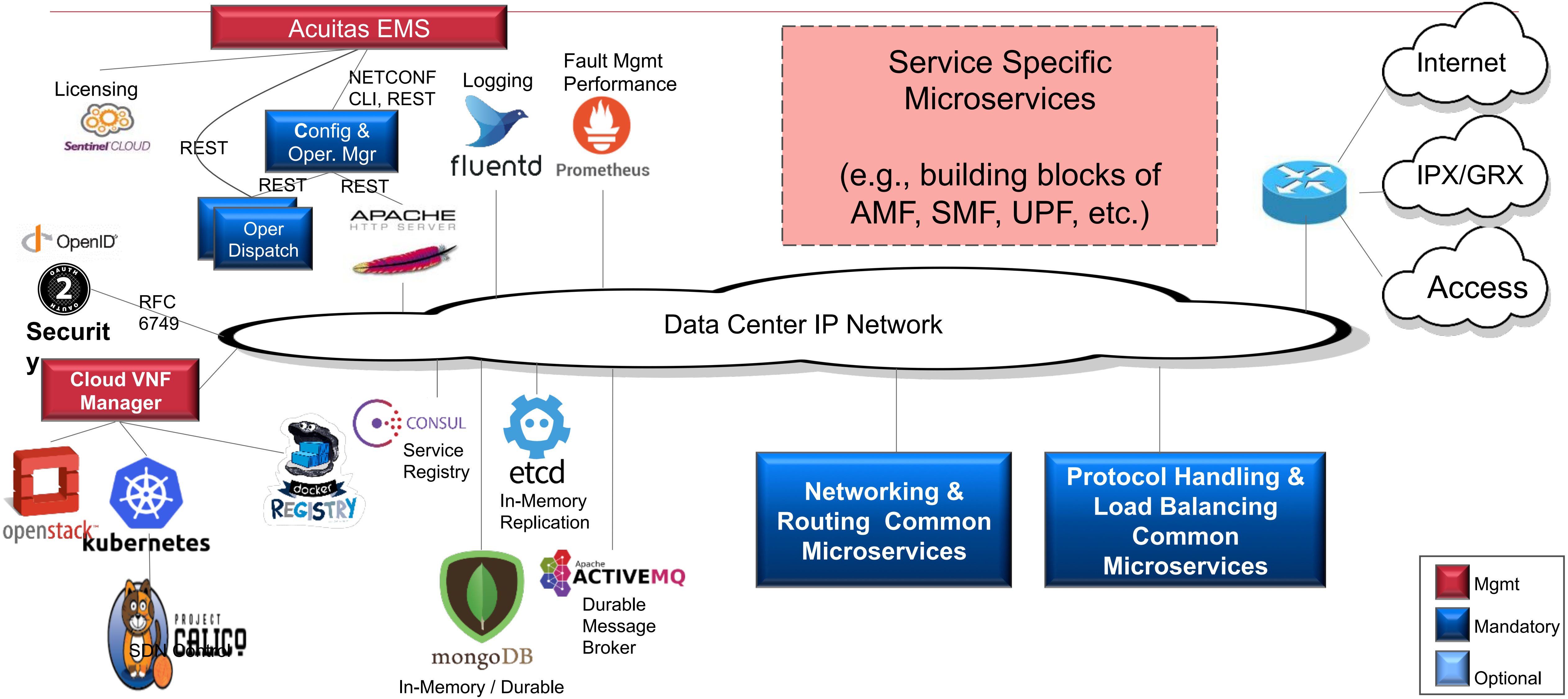
PaaS Slicing & Multi-Tenancy



Cloud Deployed PaaS Slices

K8s Clusters

Cloud Native Components & Common Microservices



Acuitas EMS

Licensing

REST

NETCONF
CLI, REST

Config &
Oper. Mgr

REST

REST

Oper
Dispatch

Logging

Fault Mgmt
Performance

Service Specific
Microservices

(e.g., building blocks of
AMF, SMF, UPF, etc.)

Internet

IPX/GRX

Access

RFC
6749

Securit
y

Data Center IP Network

Cloud VNF
Manager

Service
Registry

In-Memory
Replication

SDN Control

In-Memory / Durable

Durable
Message
Broker

Networking &
Routing Common
Microservices

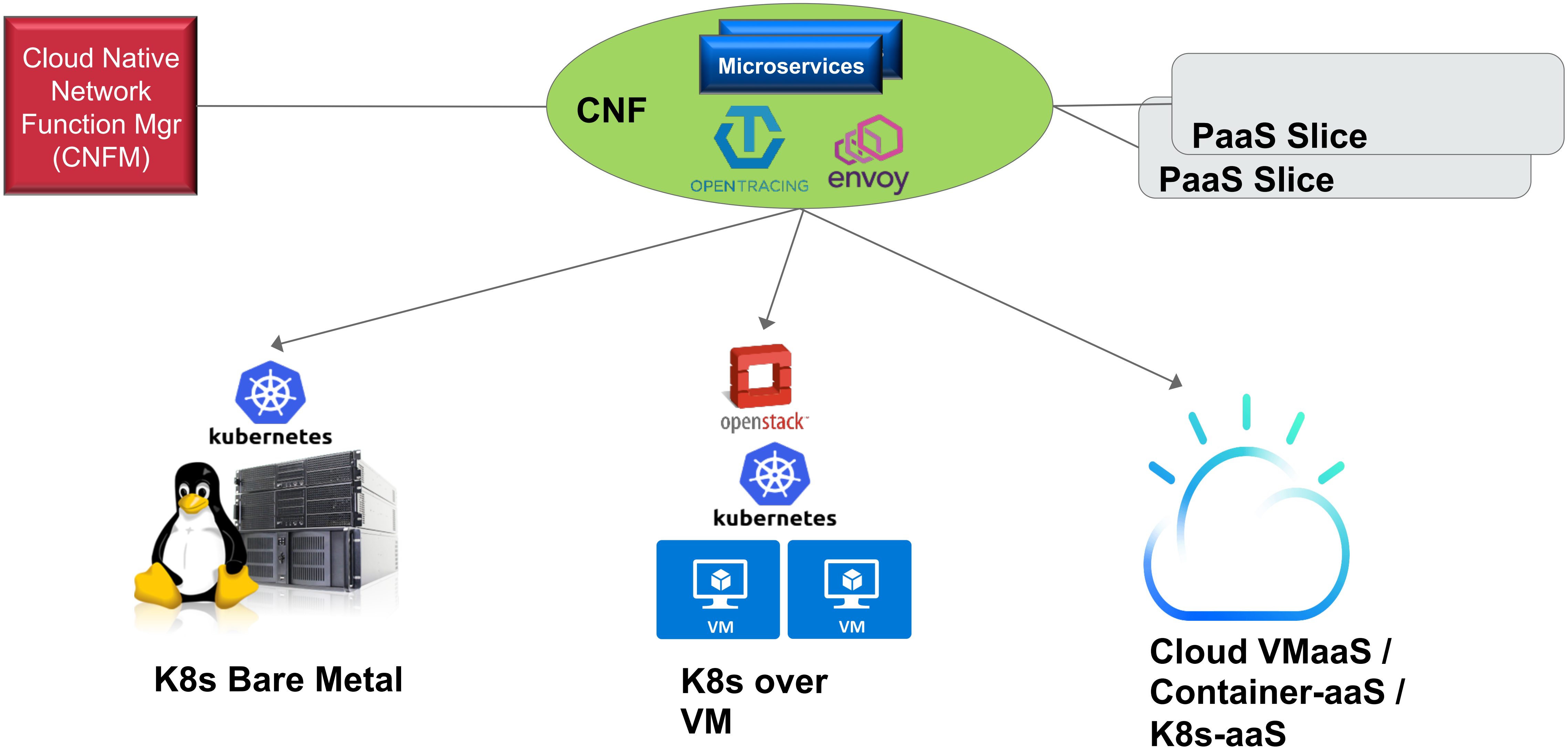
Protocol Handling &
Load Balancing
Common
Microservices

🟥 Mgmt

🟦 Mandatory

🟦 Optional

Network Function Deployment Modes



Cloud Native Network Function Mgr (CNFM)

CNF

Microservices

PaaS Slice

PaaS Slice

K8s Bare Metal

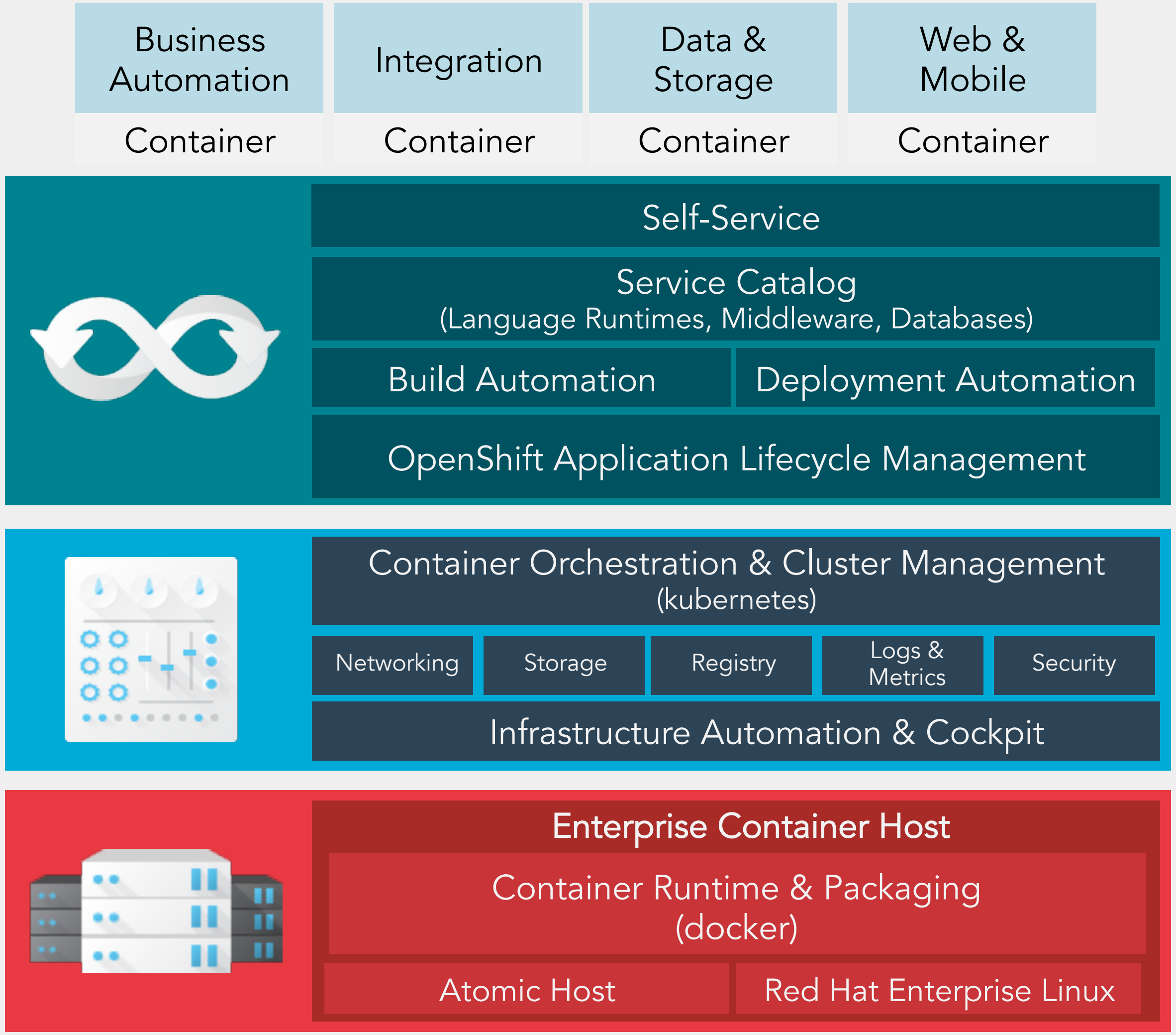
K8s over VM

Cloud VMaaS / Container-aaS / K8s-aaS

Principles of Microservices Development

- Model around a domain – In our case today packet core gateways - NG-Core
- Culture of Automation – Automated deployment, automated scale and monitoring
- Independent deployment of each microservice
- Active monitoring of services
- Isolation of failures
- Dependency management – declaration and isolation
- Concurrency – process model
- Disposability – fast startup and graceful shutdown
- Logs and monitoring metrics – Event streaming and Telemetry
- Build, Test, Release and Run – Full DevOps

OPENSHIFT A PLATFORM FOR MICROSERVICES



Business Automation — Container

Integration — Container

Data & Storage — Container

Web & Mobile — Container

Self-Service

Service Catalog
(Language Runtimes, Middleware, Databases)

Build Automation | Deployment Automation

OpenShift Application Lifecycle Management

Container Orchestration & Cluster Management
(kubernetes)

Networking | Storage | Registry | Logs & Metrics | Security

Infrastructure Automation & Cockpit

Enterprise Container Host

Container Runtime & Packaging
(docker)

Atomic Host | Red Hat Enterprise Linux

OPENSHIFT

Traditional, stateful, and cloud-native apps

Developer Experience

Enterprise Kubernetes++ container orchestration

Container Linux – provides Isolation and Security

Summary

- Refactoring a monolith necessary for building cloud native applications
- Leverage existing micro services to build new applications
- Containerization can provide isolation of microservices
- How micro do you go ?
  - Independence
  - Scale
  - Efficiency
  - Lifecycle management
- Microservices necessary for building next generation cloud native functions – Network functions and gateways for 5G
- Red Hat OpenShift has already built in capabilities and DevOps environment for delivering cloud native applications

THANK YOU