KubeCon | CloudNativeCon

North America 2022

BUILDING FOR THE ROAD AHEAD

DETROIT 2022

Edge-Native Application Principles: Taking Your App Beyond the Cloud

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Agenda

1. What is edge?
2. Cloud native vs edge native
3. Edge native application principles
4. Case studies
5. Get involved with the working group and white paper

What is Edge?

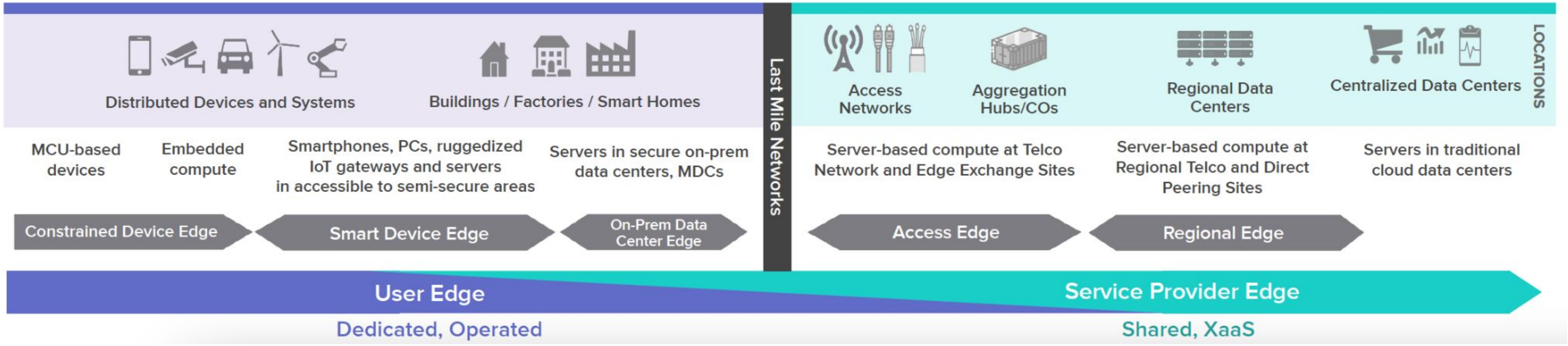
Edge computing is a paradigm which brings data processing closer to the source, for example, robot control in a factory

BENEFITS OF EDGE COMPUTING

- Reduced latency
- Bandwidth Management
- Increased Privacy
- Uninterrupted Operations

Edge Classification

Edge classification based on geography depends on the distance from the user or data source



Distributed Devices and Systems

Buildings / Factories / Smart Homes

Last Mile Networks

Access Networks

Aggregation Hubs/COs

Regional Data Centers

Centralized Data Centers

LOCATIONS

MCU-based devices

Embedded compute

Smartphones, PCs, ruggedized IoT gateways and servers in accessible to semi-secure areas

Servers in secure on-prem data centers, MDCs

Server-based compute at Telco Network and Edge Exchange Sites

Server-based compute at Regional Telco and Direct Peering Sites

Servers in traditional cloud data centers

Constrained Device Edge

Smart Device Edge

On-Prem Data Center Edge

Access Edge

Regional Edge

User Edge

Service Provider Edge

Dedicated, Operated

Shared, XaaS

Source: Linux Foundation Edge

Cloud Native Definition

*“Cloud native technologies empower organizations to build and run **scalable applications** in modern, dynamic environments such as public, private, and hybrid clouds. Containers, service meshes, microservices, immutable infrastructure, and declarative APIs exemplify this approach.*

*These techniques enable **loosely coupled systems that are resilient, manageable, and observable**. Combined with robust automation, they allow engineers to make **high-impact changes frequently and predictably with minimal toil**.”*

Cloud native technologies, as defined by the Cloud Native Computing Foundation

Edge Native Application Definition

“An application built natively to leverage edge computing capabilities, which would be impractical or undesirable to operate in a centralized data center. ***Edge-native applications leverage cloud-native principles while taking into account the unique characteristics of the edge in areas such as resource constraints, security, latency and autonomy****. Edge native applications are developed in ways that leverage the cloud and work in concert with upstream resources. Edge applications that don’t comprehend centralized cloud compute resources, remote management and orchestration or leverage CI/CD aren’t truly “edge native”, rather they more closely resemble traditional on-premises applications.”*

Edge native applications, as defined by the The Open Glossary of Edge Computing

Cloud & Edge Native Applications - Similarities

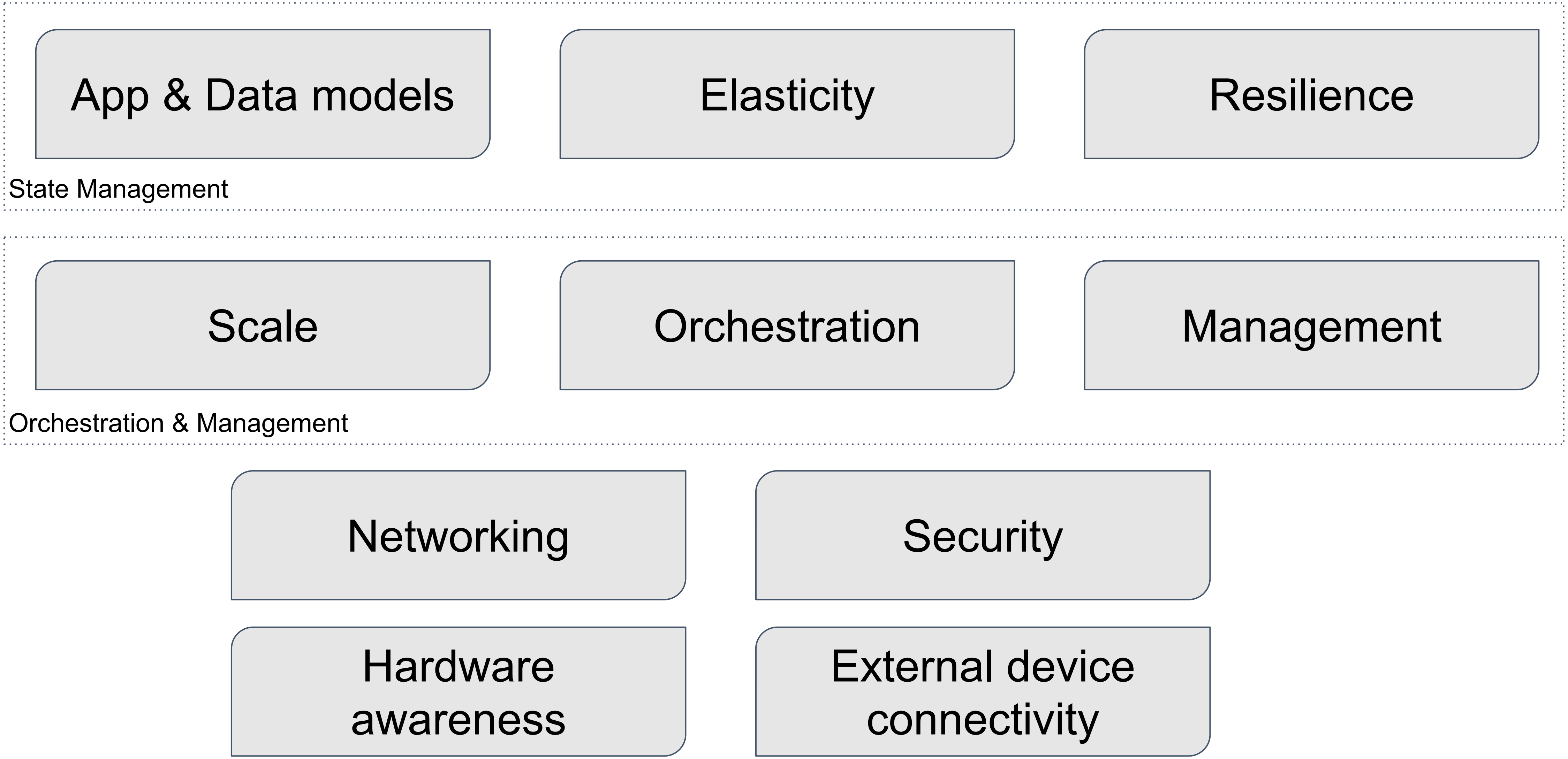
Apps and services portability

Observability

Manageability

Agnostic language and framework support

Cloud & Edge Native Applications - Differences



App & Data models

Elasticity

Resilience

State Management

Scale

Orchestration

Management

Orchestration & Management

Networking

Security

Hardware awareness

External device connectivity

Edge Native Application Principles

- Hardware Aware
- External Device Connectivity
- Aware of Variable Connectivity (and Network)

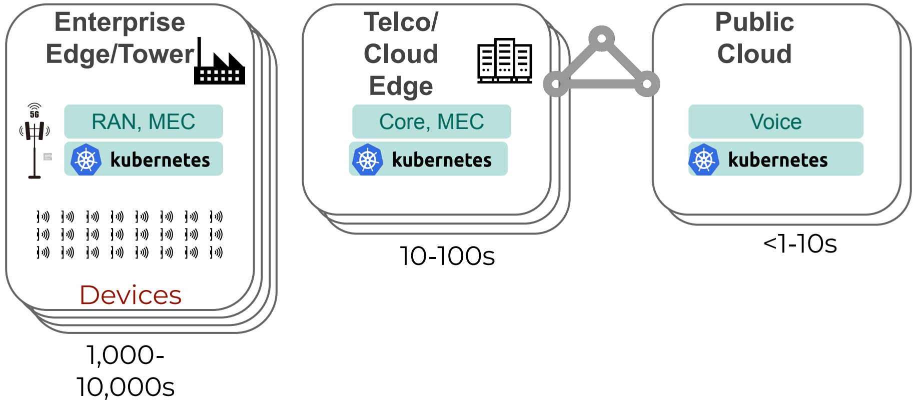
Resource & Device Aware

- Centrally Observable
- Infra & Platform Management at Scale
- Application Management at Scale

At Scale Management

- Portable and Reusable (with Limits)
- Resource Usage Optimization
- Spanning

Case study: 5G

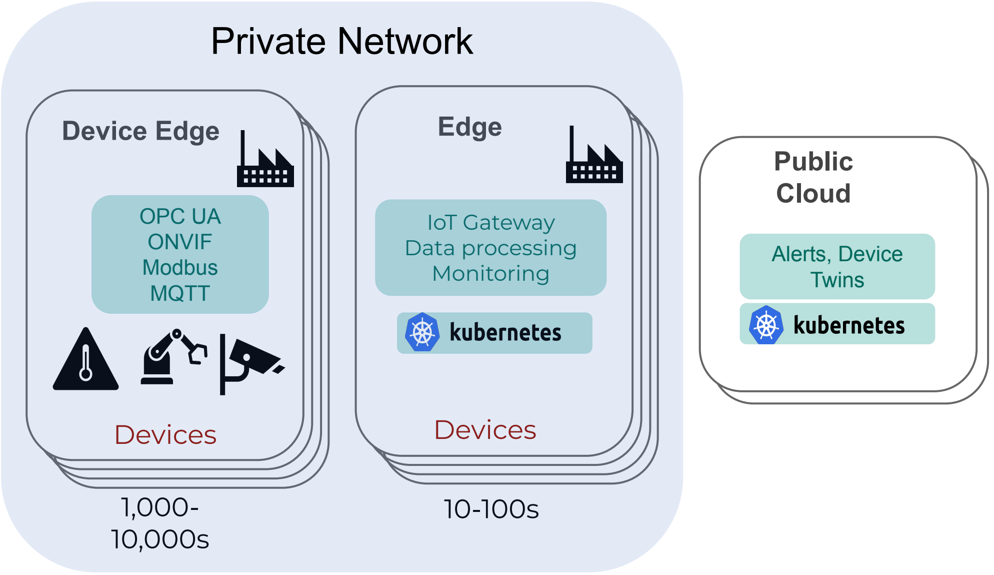


Example of 5G Architecture

Other than the radio, the entire network will be software driven

Grouping	Implementation
Resource & device aware	RAN interfaces with the physical Radio and is aware of acceleration such as GPU, DPU
At scale management	10s of thousands of RAN sites have to be centrally managed; no staff available on-site
Spanning	RAN: tower, Core: cloud edge, Voice: public cloud
Resource usage optimization	RAN has to be very efficient in resource consumption as it can be 65% of the cost of a 5G network
Portable and reusable — within limits	RAN can run on multiple edge implementations (hyperscaler or private)

Case study: Factory



Example of Factory Floor Architecture

Grouping	Implementation
Resource & device aware	Device registry and digital twins. Handling device credentials. Network connect apps with OT devices.
At scale management	Remote manage & configure services. Configure edge applications to use devices. Diagnostics visible from the cloud.
Spanning	Data and processing stays on the factory floor but aggregate data (about device state, alerts, health, logs, etc.) sent up to cloud.
Resource usage optimization	Event driven services. Data pipelines. Proper management of OT and IoT devices so no down time.
Portable and reusable — within limits	Apps may be tightly tied to OT; however, data aggregation and processing workloads can be portable across factory locations.

Open Source Projects (by Principle)

- CNCF IoT Edge WG is gathering a list of open source projects that enable app developers to achieve these edge native principles
- Add your project to the list
- Tell us about it at the working group meetings

https://docs.google.com/spreadsheets/d/1dfa3lUvLuCrzmTH1w1TLeXxU-gy6QfbsE_ZXd1h4zTI/edit?usp=sharing

Get involved with the working group!

Edge Native Application Principles White Paper

#wg-iot-edge on K8s Slack

Meetings 9AM PT bi-weekly

https://www.cncf.io/calendar/

Runtime TAG GitHub

https://github.com/cncf/tag-runtime/blob/master/wg/iot-edge.md

We’d love your feedback! Please scan the QR Codes.

Leave feedback for the Session

Leave feedback for the IoT Edge Working Group

https://forms.gle/uXyT4cxpWvVKDMo96