5G Opportunities And Challenges For Infrastructure Modernization

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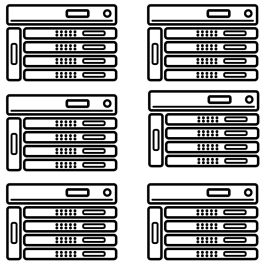
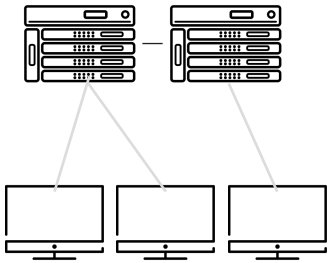
Network Evolutions

COMPUTING EVOLUTION TOWARD DISTRIBUTED ARCHITECTURES LEADS TO EXPONENTIAL GROWTH IN SOFTWARE COMPLEXITY

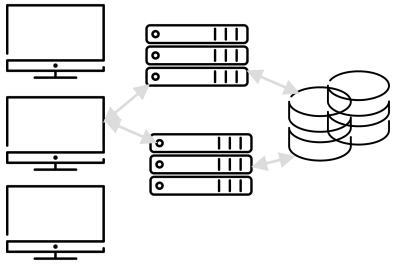
Mainframe



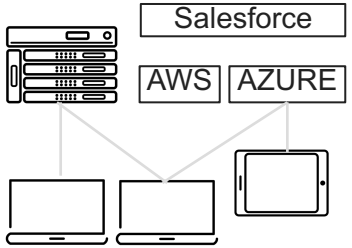
Client Server



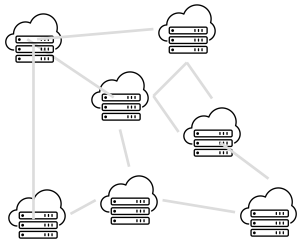
Three-Tier



Multi-Tenancy



Cloud-Edge Architectures



1970 1980 1990 2000 2010 2020

Cellular Network Evolution

INCREASING COMPLEXITY / NEW BUSINESS MODELS / NEW COMPETITIVE LANDSCAPE

1G: Mobile Voice

First generation of wireless telephone technology (mobile telecommunications)

1979

1991

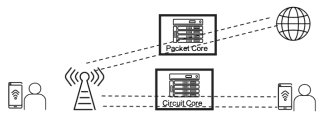
2G: + Texting

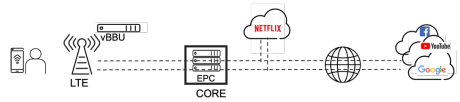
Commercially launched networks on the GSM standard

3G: + Internet

Use Cases include Voice, Video, Messaging. The Game Changer is the iPhone

2001





2010

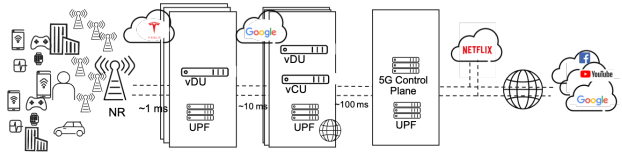
4G: +Mass Video

Use Cases include Voice, Video, Messaging, and Streaming. The Game changer application is Uber

5G: + Network as a Business Platform

Use cases are categorized as eMBB, mMTC, uRLLC. The Game Changer is Automation

2020+



Moving to a Edge-Cloud Ecosystem

KEY MARKET DRIVERS FOR EDGE COMPUTING, BRINGING RESOURCES CLOSER TO WHERE THEY ARE NEEDED

End user experience – Application performance

Real-time decision making

Security

Hybrid cloud migration strategy

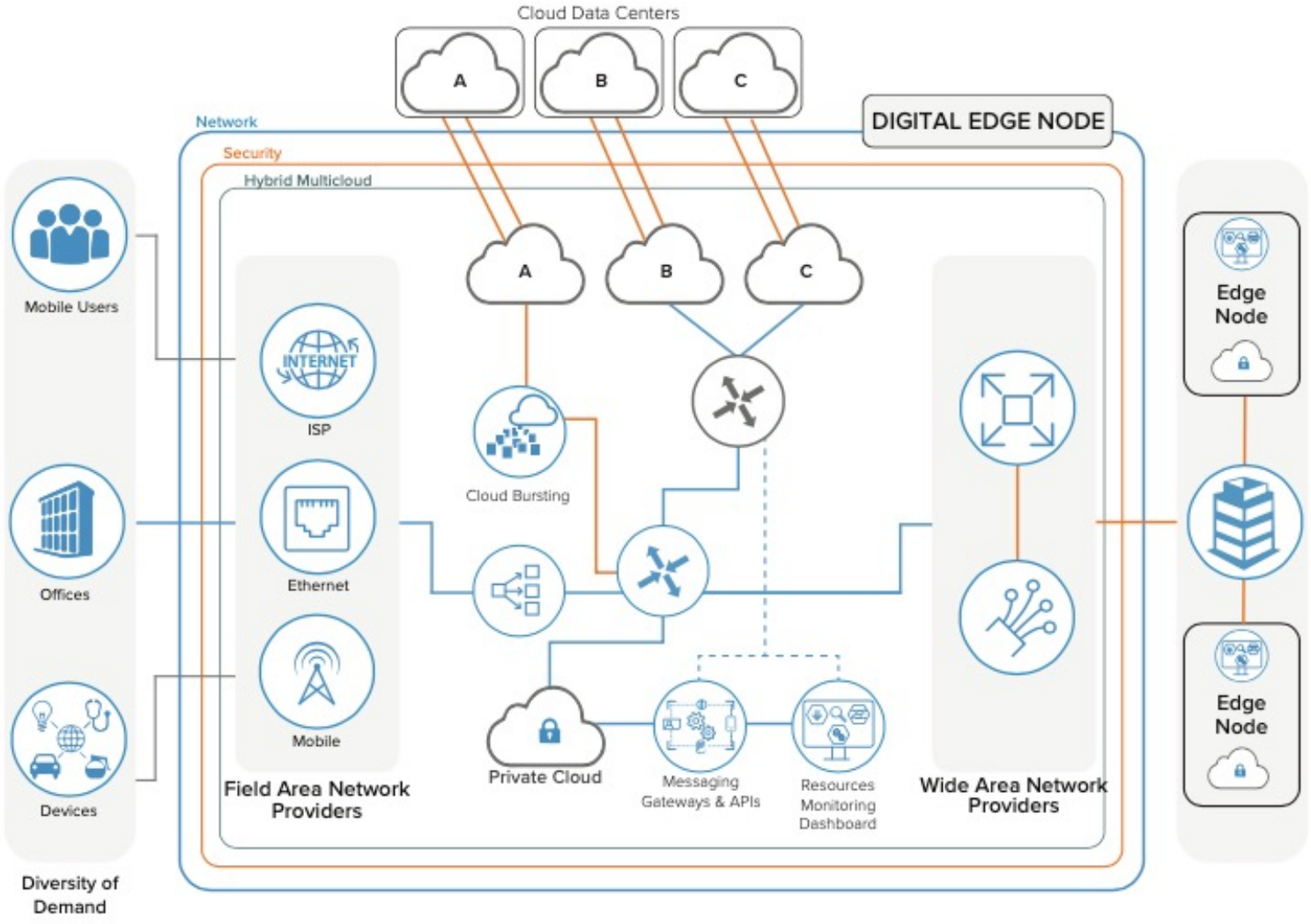
Application trends

Lifecycle management

Enabling a Digital Twin

Digital Transformation

What is the Edge?

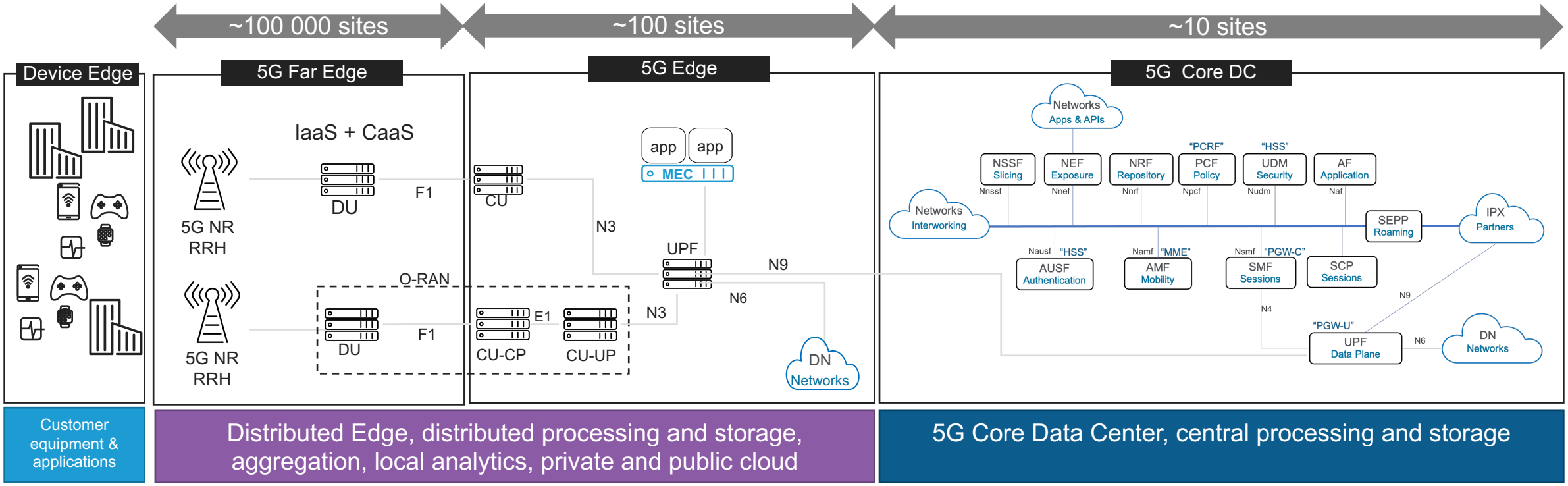


Source: ioakb.com

Distributed 5G Mobile Cloud Architecture – Key Challenges

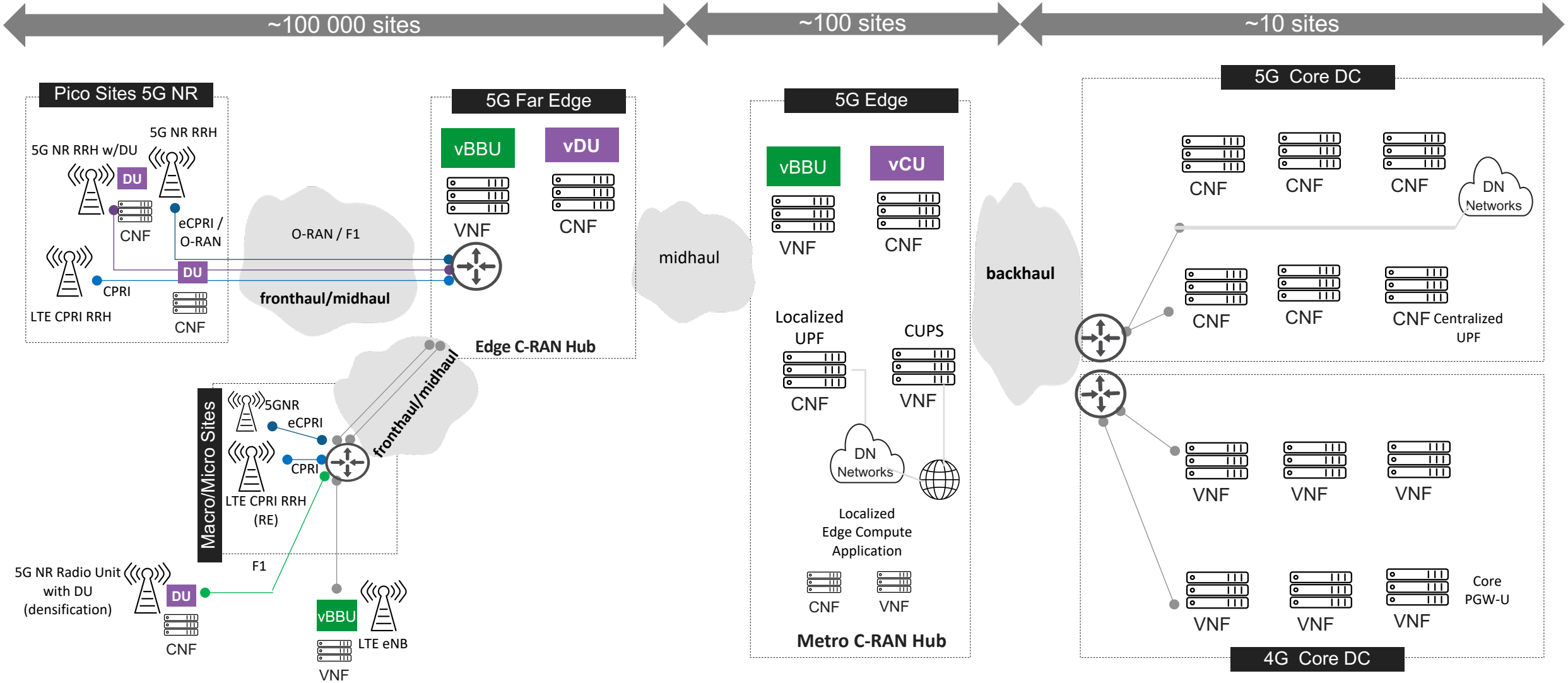
MERGING MULTI-CLOUD, HYBRID CLOUD AND ENTERPRISE IT WITH A COMMON PLATFORM

- Service Providers are moving from deploying and managing ~10 POPs to 250 POPs
- RAN and Small Cell densification leads to 10s of thousands of site deployments.
- Managing a hybrid network with CNFs and VNFs where initial deployments will have both VNFs with a Kubernetes wrapper (Kubevirt) (IaaS) along with pure Kubernetes Pods (CaaS)

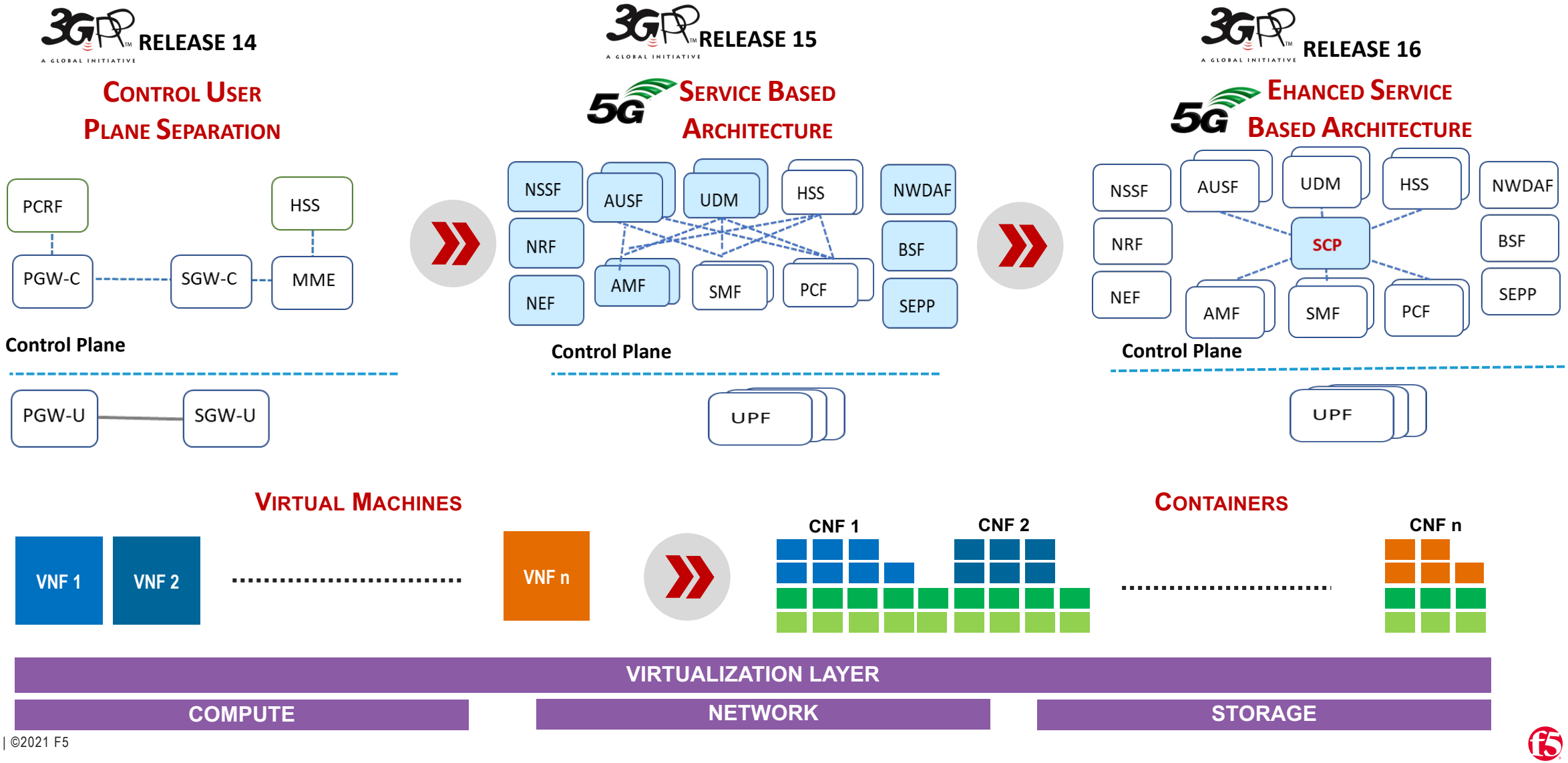


Complexity with Distributed 5G Mobile Cloud Architecture

MERGING MULTI-CLOUD, HYBRID CLOUD AND ENTERPRISE IT WITH A COMMON PLATFORM

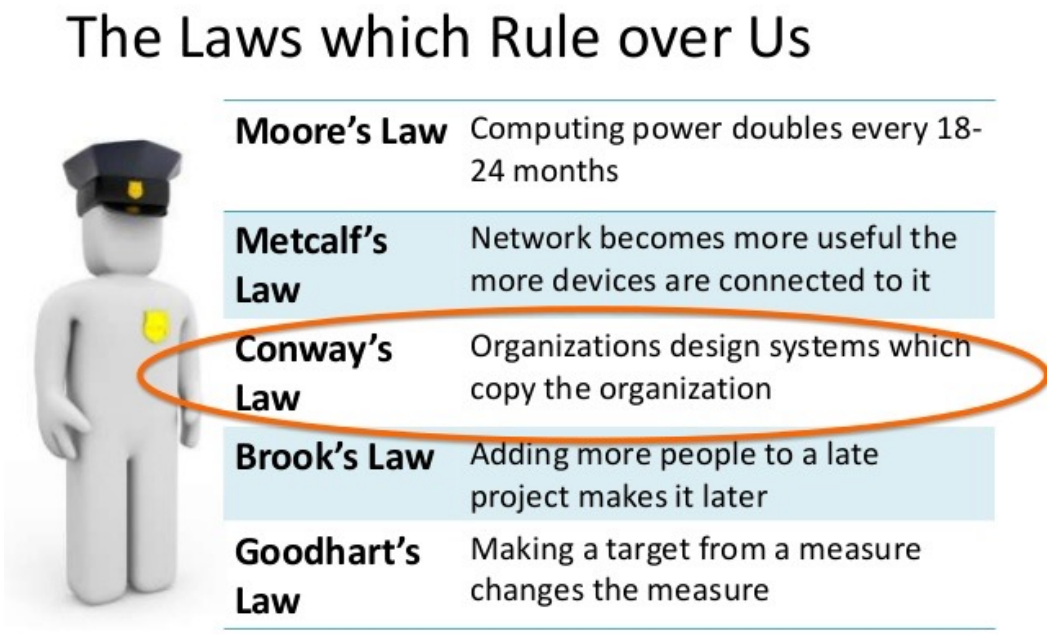


Digital Transformation within Service Providers



Who Owns the Infrastructure?

HURDLES TO OVERCOME IN ORGANISATIONS



Infrastructure / Platform Group

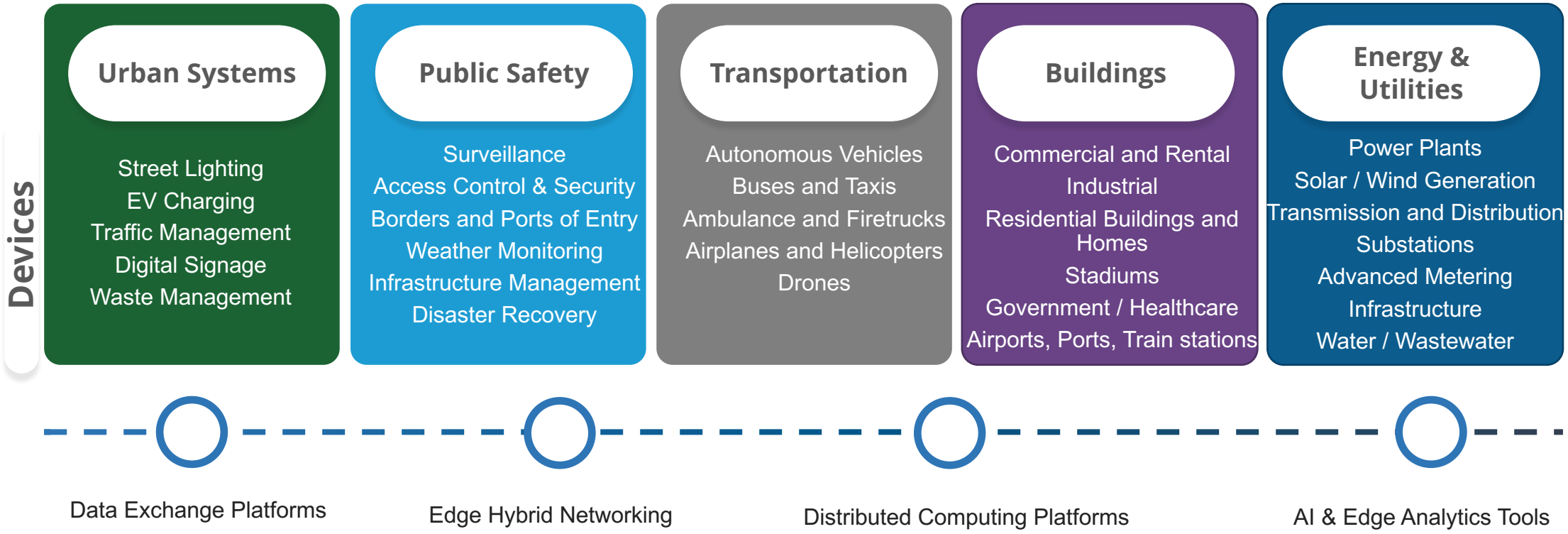
Goals: Consistent architecture across IT and 5G environments supporting multiple use cases

Networks / Mobility Group

Goals: Deployment of 5G components without too much focus on IT and enterprise applications

Vertical Industries are undergoing digital transformation

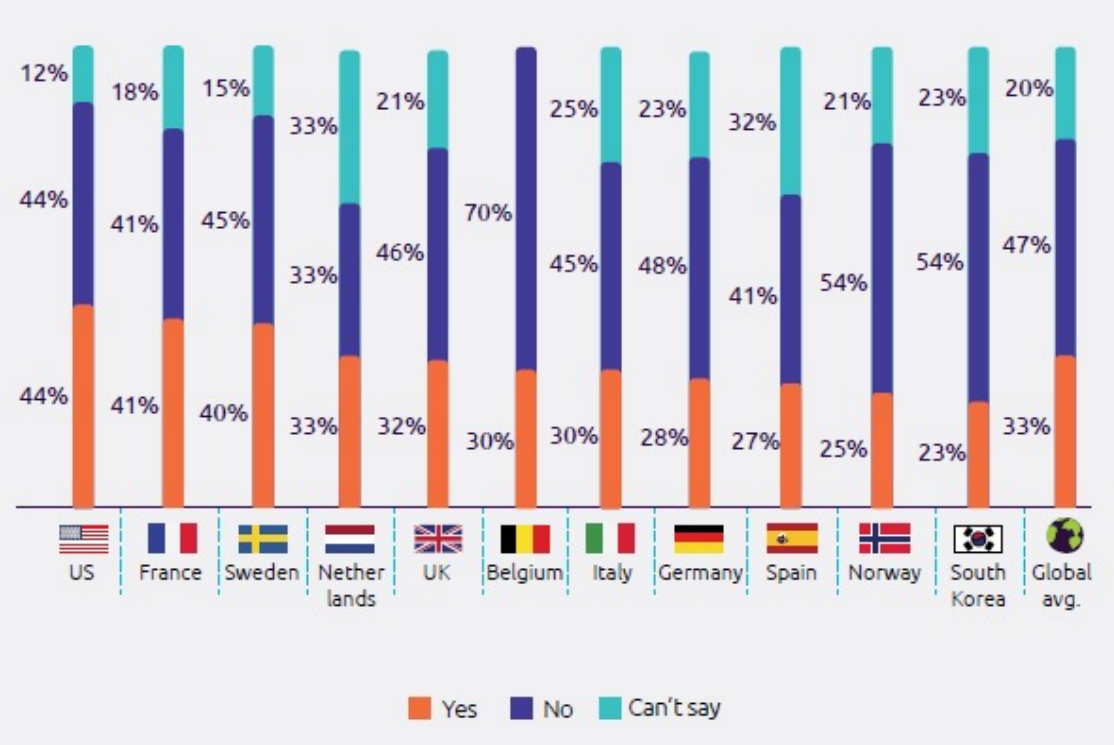
5G FOR ENTERPRISE SOLUTIONS – ENABLING A MULTI TENANT, MULTI CLOUD AND END-2-END NETWORK



Private 5G networks and the Edge

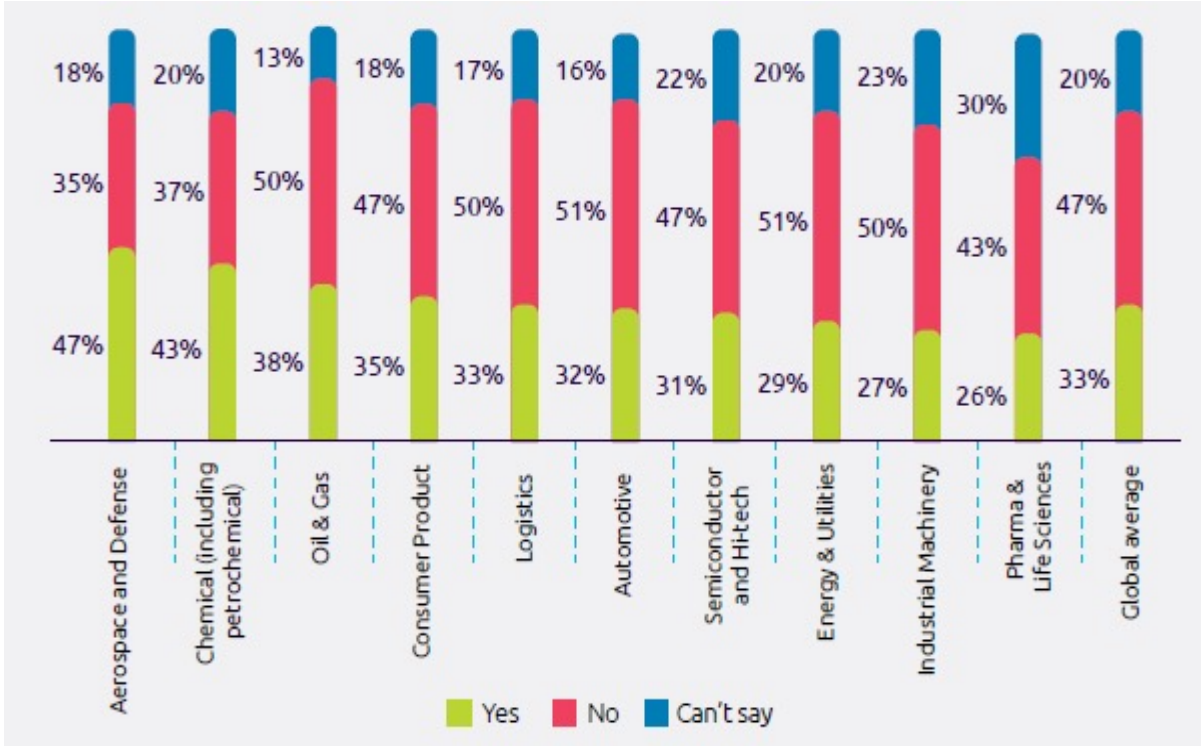
IS 5G A CATALYST FOR PRIVATE 5G ENTERPRISE?

Industrial companies keen on applying for 5G licenses



Source: Cap Gemini, Industrial Companies' Survey of 313 Companies Mar-Apr, 2019

Interest in applying for licenses by sub-sector

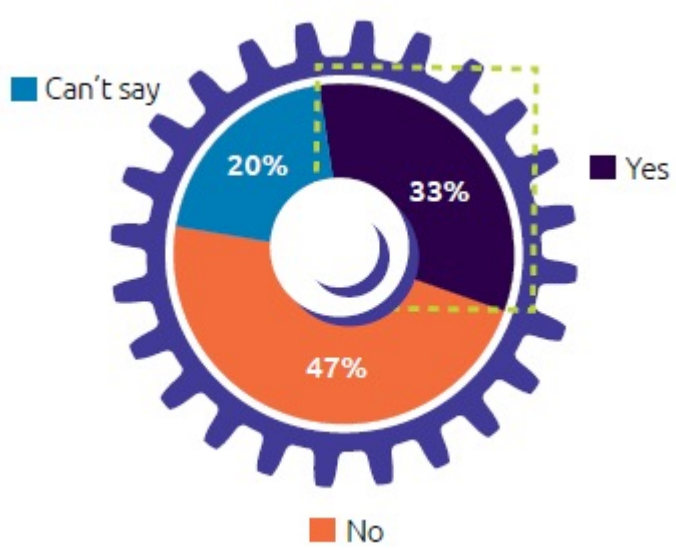


Source: Cap Gemini, Industrial Companies' Survey of 313 Companies Mar-Apr, 2019

Private Enterprise Networks

ONE THIRD OF LARGE ENTERPRISES WOULD CONSIDER THEIR OWN LICENSE

Has your organization applied for 5G license in your country of operation (or has it been considering to do so)?



Source: Cap Gemini, Industrial Companies' Survey of 313 Companies Mar-Apr, 2019

"We think having our own license is very beneficial because this gives us the freedom to either deploy the network alone or with a telecom operator"

- Gunther May, Head of Technology and Innovation, Business Unit Automation and Electrification, Bosch Rexroth AG

Volkswagen

BOSCH

SIEMENS
Ingenuity for life

DAIMLER

"We cannot wait for the network operators to be ready – we are in the midst of Industry 4.0"

- Spokeman for Siemens, one of the companies planning to bid for a local license in Germany

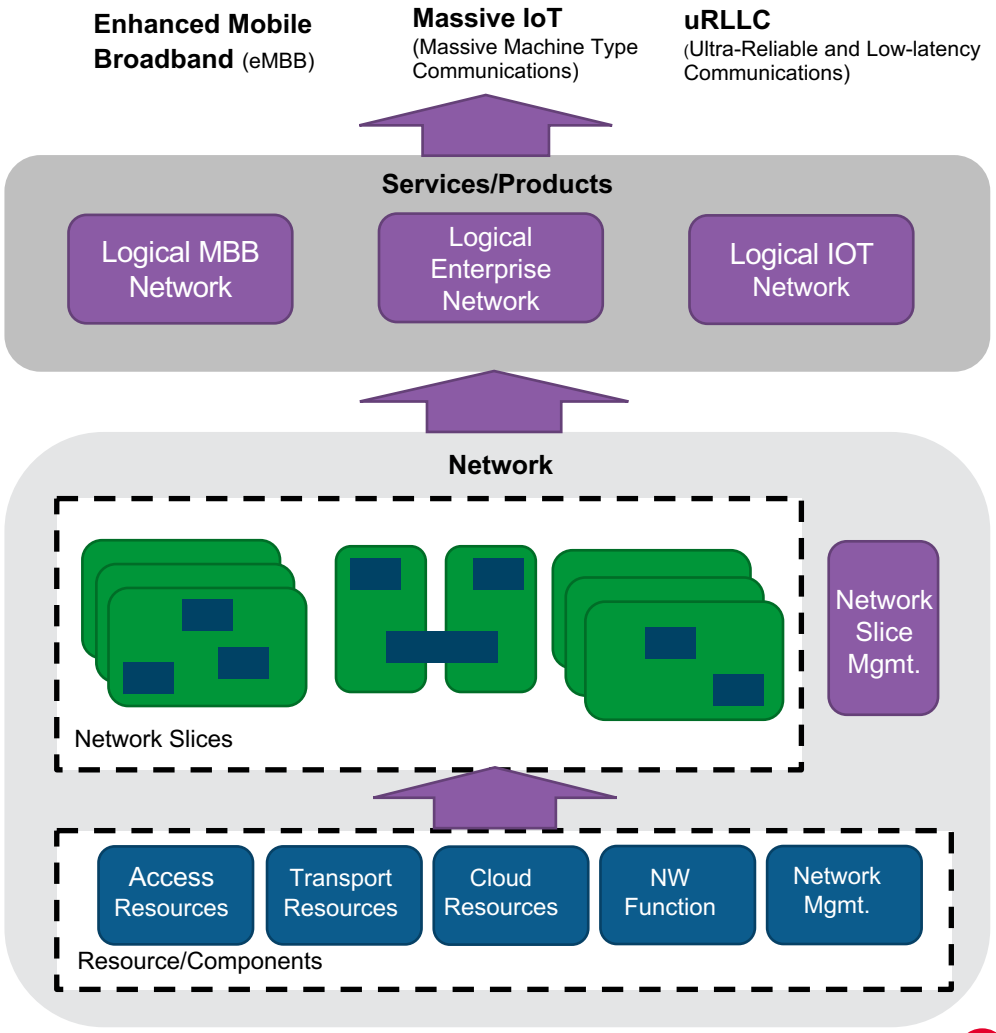
Network Slicing all the way to the edge

CREATING A LOGICAL NETWORK FROM THE CORE ALL THE WAY TO THE EDGE

Network Slicing enables Mobile network Operators to build customizable solutions/Offerings

Network Slicing contributes a level of isolation that allows MNOs to build and deploy solutions without impacting other network functions.

Creating Innovation Sandboxes increases the potential of network slicing



Network Slicing – Creating New Revenue Streams for Service and Industry

HIGHLIGHTING KEY CHALLENGES AND DESIRED OUTCOME

Challenges

- Increased Network Complexity
- Decrease Cost
- Increase Revenue
- Different industries and services require different SLAs.
- Multi-tenancy
- Multi Vendor 5G SA CORE

What is Needed

- Network Tailored to specific requirements
- Reduce TTM
- Increase network utilization
- Per slice security

Outcomes

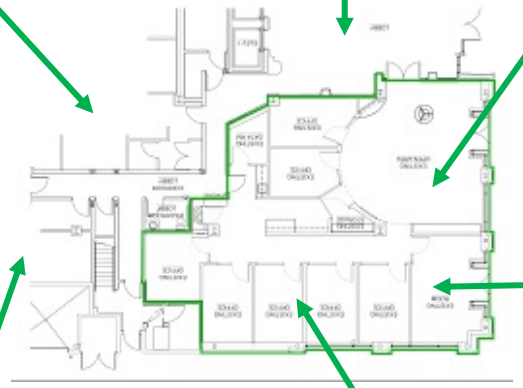
- Instantiation simplicity
- Increase network Agility
- Multi-tenant
- IaaS and CaaS per slice
- Unlock new revenue streams for Services and industry
- Slice lifecycle management

Use Case: Multi-Tenant In-Building Private 5G Networks

Smart/Demo Factory

Lab / IoT Demo Hub

Atrium – Conference Events



Private Company

Car and Bicycle Parking Spaces

Offices
Smart Commercial Building

Use Case: On-Demand Infrastructure for Government

How the U.S. Air Force Deployed Kubernetes and Istio on an F-16 in 45 days

24 Dec 2019 8:19am, by Tom Krazit

Department of the Air Force

Integrity - Service - Excellence

DoD Enterprise DevSecOps Initiative & Platform One Keynote Presentation

Mr. Nicolas Chaillan

Chief Software Officer, U.S. Air Force

Co-Lead, DoD Enterprise DevSecOps Initiative

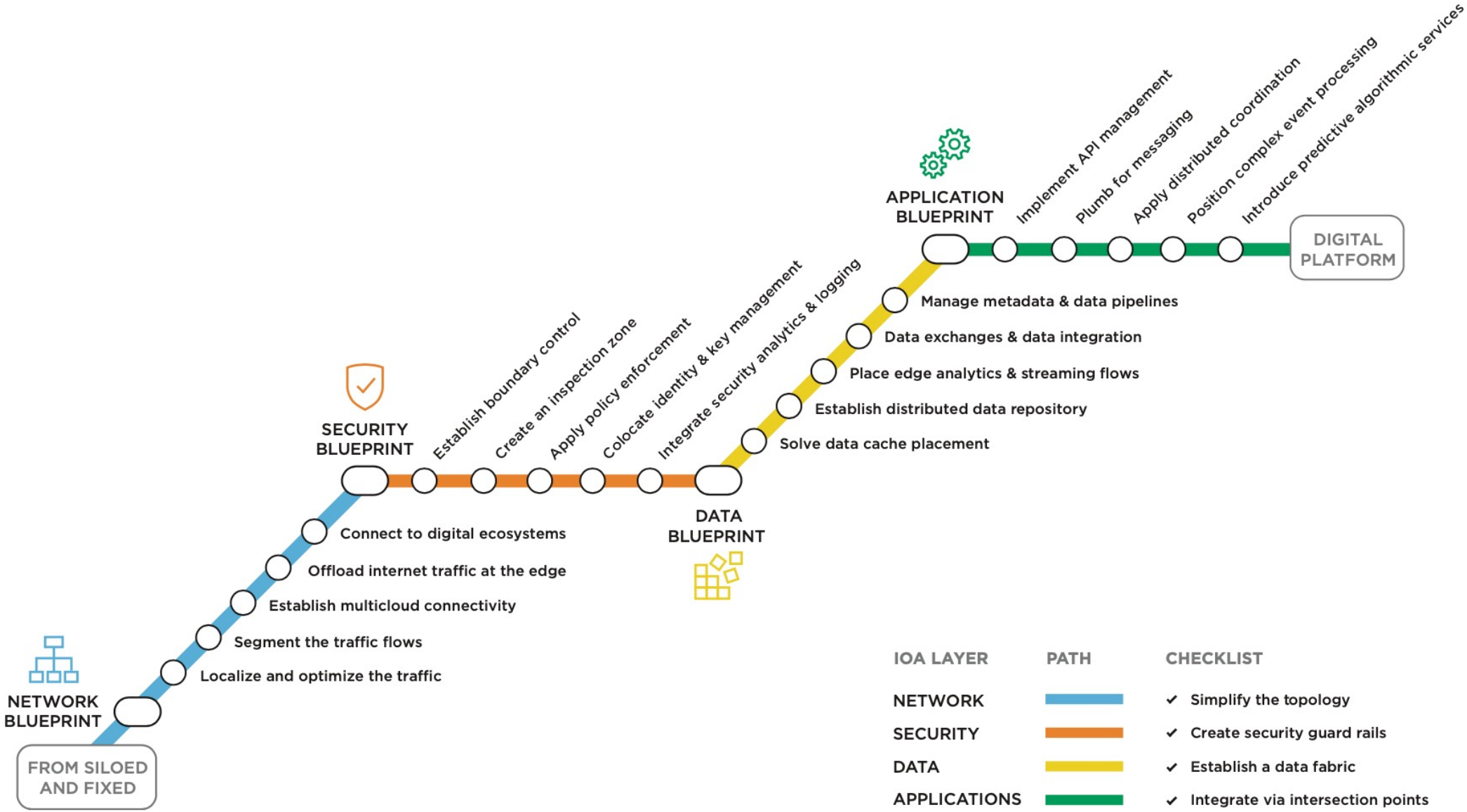
Chair, DSAWG DevSecOps Subgroup

V2.0 – UNCLASSIFIED

Why Kubernetes / Containers?

- One of the most critical aspect of the DevSecOps initiative is to ensure we **avoid any vendor lock-in** so the DoD mandated:
  - **Open Container Initiative (OCI) containers** (no lock-in to containers/container runtimes/builders)
  - **Cloud Native Computing Foundation (CNCF) Kubernetes compliant cluster** for container orchestration, no lock-in to orchestration options/networking/storage APIs.
- Containers are **immutable** and will allow the DoD to centrally accredit and harden containers (FOSS, COTS, GOTS) (think of a true gold disk concept but that actually scale and works).
- Continuous Monitoring is a critical piece of our Continuous ATO model and the Sidecar Container Security Stack (SCSS) brings those capabilities with Behavior, Zero Trust and CVE scanning.
- Kubernetes will provide:
  - **Resiliency**: Self-healing so containers that crash can automatically be restarted,
  - **Baked-in security**: thanks to **automatic injection** of our Sidecar Container Security Stack (SCSS) to any K8S cluster with Zero Trust,
  - **Adaptability**: containers are “Lego” blocks and can be swapped with no downtime thanks to load balancing and modern routing (A/B testing, canary release etc.),
  - **Automation**: thanks to our Infrastructure as Code (IaC) and GitOps model,
  - **Auto-scaling**: if load requires more of the same container, K8S will automatically scale based on compute/memory needs,
  - **Abstraction layer**: ensure we don’t get locked-in to Cloud APIs or to a specific platform as K8S is managed by CNCF and dozens of products are compliant with its requirements.

The Journey Ahead



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