5G Security – What it means for Service Providers and their customers

Shain Singh
Cloud/5G Security Architect @ F5
shsingh@ieee.org

Agenda

Introduction to 5G

- Network Evolution
- Current Challenges

Industry Use Cases

- Private Enterprise and Edge Networks

5G Security

- Common Technology Components

Who am I?

Shain Singh

Cloud/5G Security Architect @F5

20+ years in carrier service providers and security

Social

https://linkedin.com/in/shsingh

shsingh@ieee.org

https://twitter.com/shainsingh

https://github.com/shsingh

https://shain.io

Professional Memberships

Introduction to 5G

Cellular Network Evolution

INCREASING COMPLEXITY / NEW BUSINESS MODELS / NEW COMPETITIVE LANDSCAPE

1G: Mobile Voice

First generation of wireless telephone technology (mobile telecommunications)

1979

1991

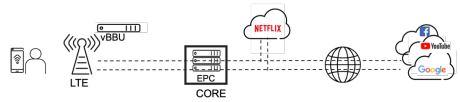
2G: + Texting

Commercially launched networks on the GSM standard

3G: + Internet

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

2001



2010

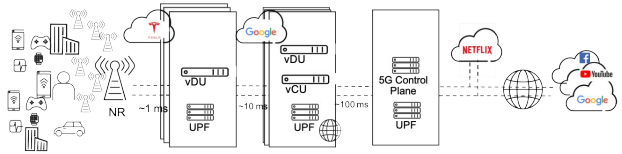
4G: +Mass Video

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

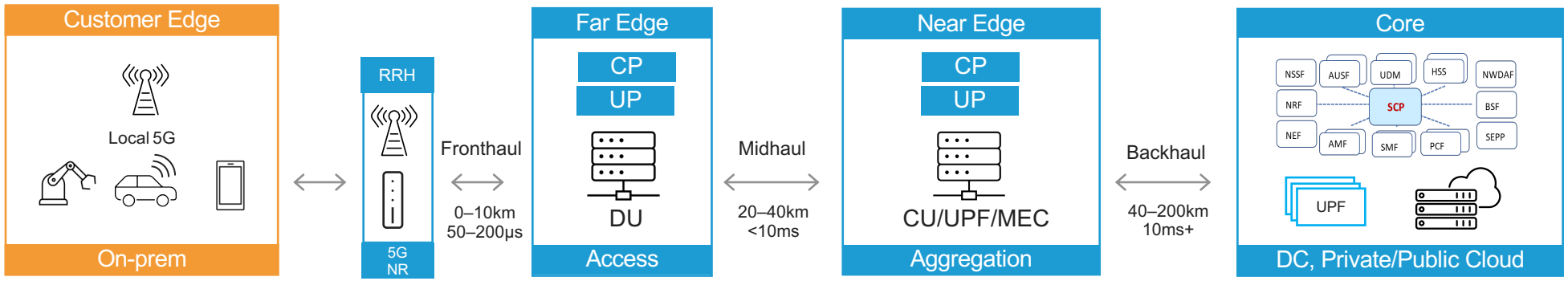
5G: + Network as a Business Platform

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

2020+



Consistent cloud-native operational model



Workload Type	VNF CNF APP Bare metal	VNF CNF Bare metal	VNF CNF APP Bare metal	VNF CNF APP Bare metal	**Types of Workloads** • Container, VM, Bare metal • Stateless and Stateful Apps • Distributed Data Store for Stateful apps
OS Requirement	RT, Near RT, Non RT	RT, Near RT	Non RT	Non RT	**OS support** • RTOS • Near RTOS • GPOS
Fleet Management	APP APP OS	APP APP OS	APP APP OS	APP APP OS	**LCM via Fleet management** • Apps • Firmware, OS • ZTP, ZTO
Network Stack	**Requirements** • Nomadic Edge & Fixed Edge • Large variety of form factors, I/O, CPU/GPU/FPGA, Wi-Fi/LTE/5G, • Cost/Perf sensitive, COTS HW • IPv4 & IPv6	**Requirements** • High performance network stack with Low Latency & High throughput • CPU pinning, NUMA aware scheduling, PCI passthrough, Guest TSC • SR-IOV, Multus, DPDK • GPU/FPGA Acceleration • RT/near-RT OS • IPv4 & IPv6	**Requirements** • Distributed resource allocation • Reliability and mobility • Hybrid cloud applications portability • Security and Data sovereignty • IPv4 & IPv6 • GPU/FPGA acceleration on MEC	**Requirements** • Gi/N6 NF – CGNAT, Gi-FW, DDoS, Secure DNS cache, TCP & Video Optimization, WAF • CDN, Anti-fraud, Anti-bot • Service Mesh, K8s Ingress/Egress, API mgmt • LI, Analytics, Logging • IPv4 & IPv6	**High Performance Network Stack**

Who Owns the Infrastructure?

HURDLES TO OVERCOME IN ORGANISATIONAL CULTURE

The Laws which Rule over Us

Moore's Law	Computing power doubles every 18-24 months
Metcalf's Law	Network becomes more useful the more devices are connected to it
Conway's Law	Organizations design systems which copy the organization
Brook's Law	Adding more people to a late project makes it later
Goodhart's Law	Making a target from a measure changes the measure

Infrastructure / Platform Group

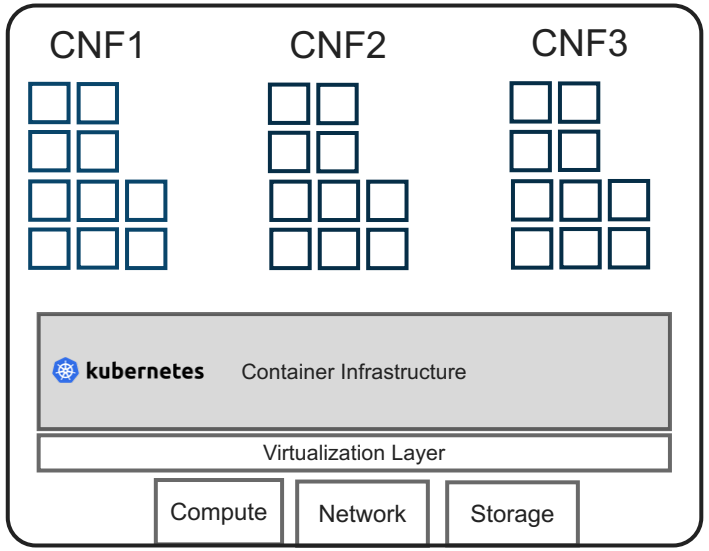
Goals: Consistent architecture across IT and 5G environments supporting multiple use cases

Networks / Mobility Group

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

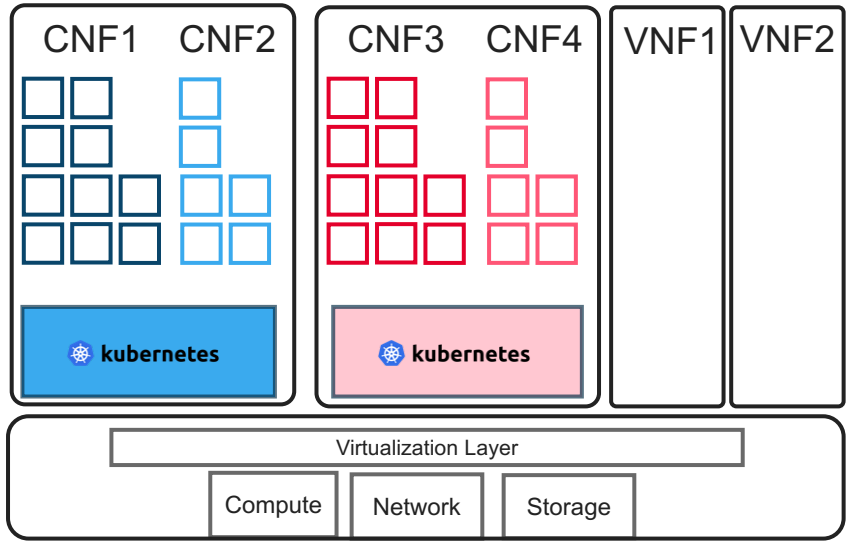
Infrastructure deployment strategies

COMMON DEPLOYMENT MODES



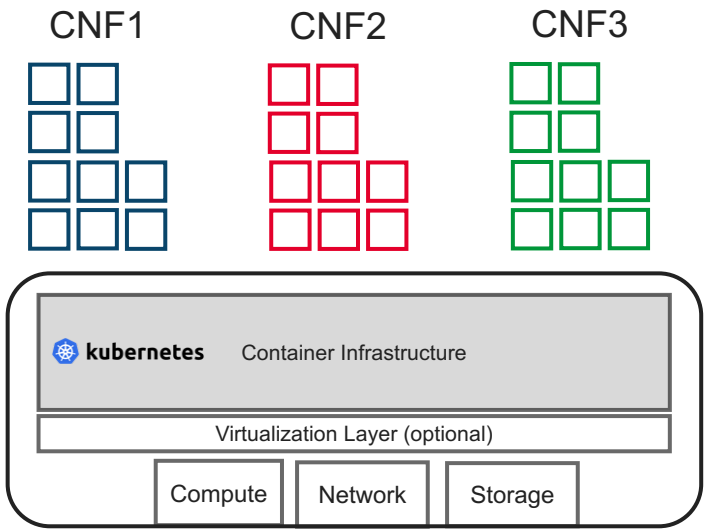
Mode 1

Everything provided by one vendor



Mode 2

Different (4G and) 5G Vendors bringing their container runtime layer



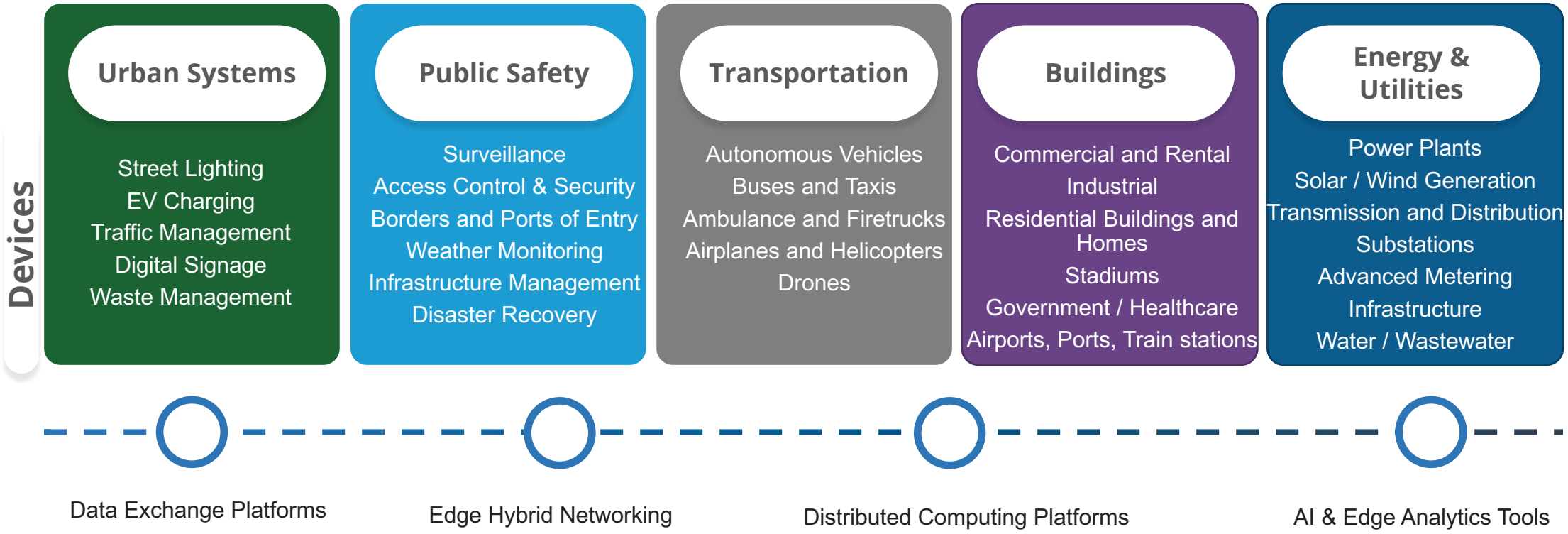
Mode 3

Separated Container infrastructure

Industry Use Cases

Vertical Industries are undergoing digital transformation

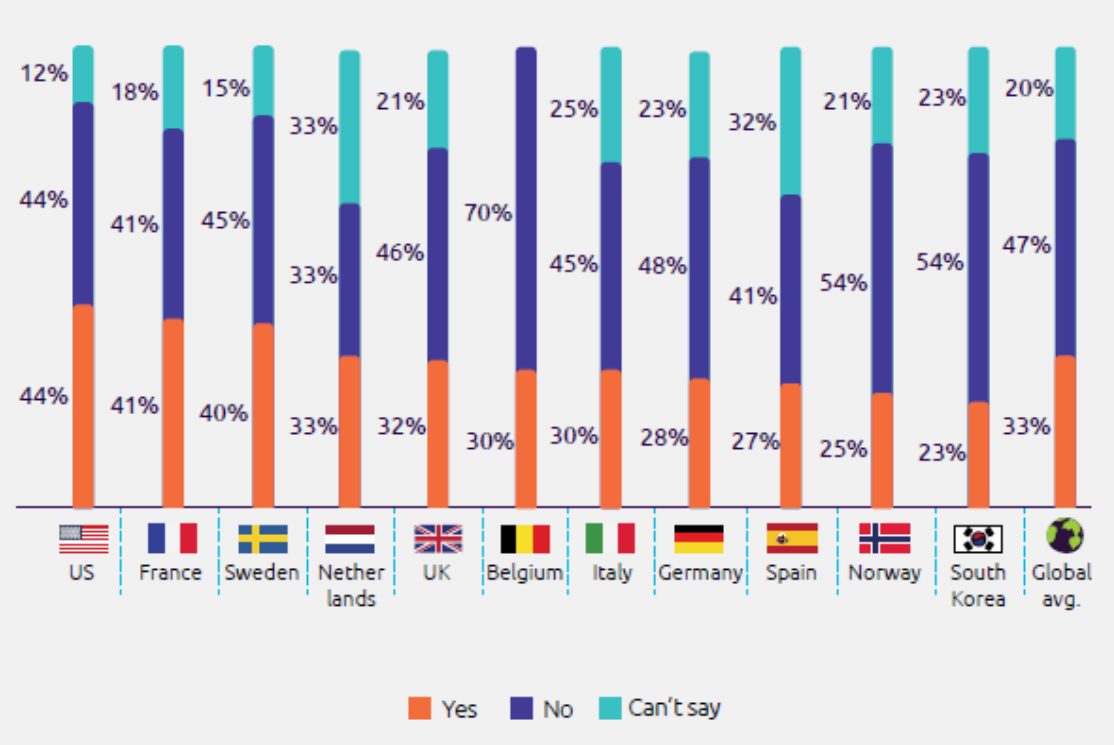
5G FOR ENTERPRISE SOLUTIONS – ENABLING A MULTI TENANT, MULTI CLOUD AND END-2-END NETWORK



Private 5G networks and the Edge

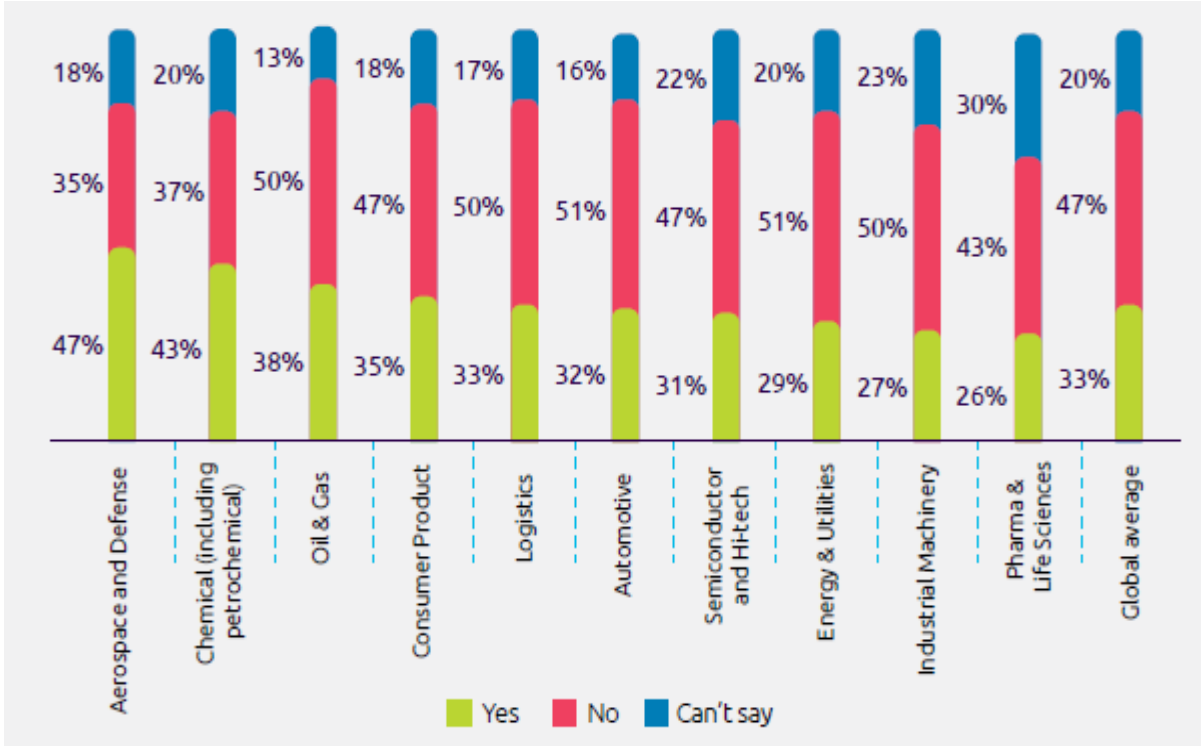
IS 5G A CATALYST FOR PRIVATE 5G ENTERPRISE?

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

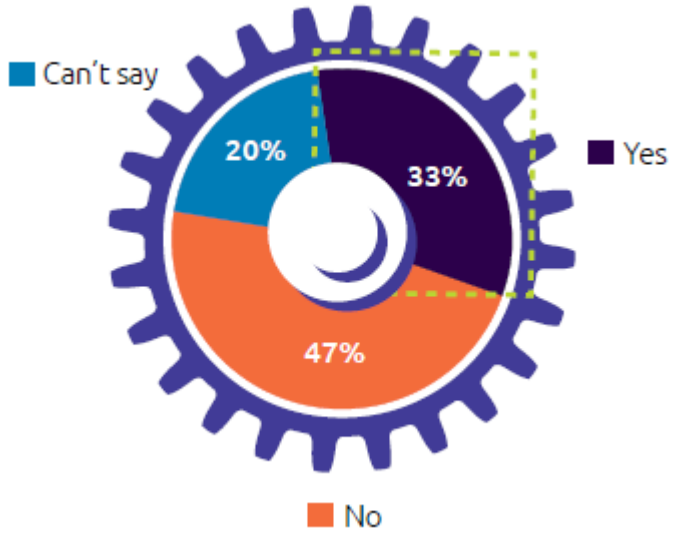


Source: Cap Gemini, Industrial Companies' Survey of 313 Companies Mar-Apr, 2019

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

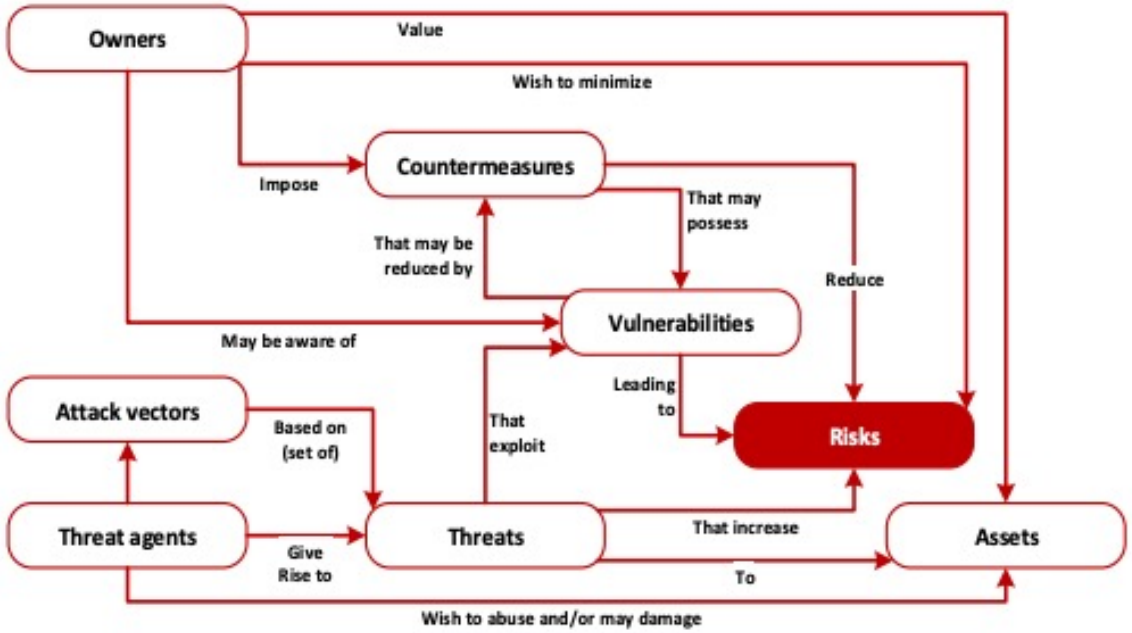
"We cannot wait for the network operators to be ready – we are in the midst of Industry 4.0"

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

Security

Many moving parts for security

SECURITY OF 5G NETWORKS INVOLVES MORE THAN SECURITY COMPONENTS IN 5GC

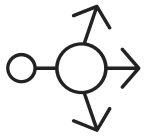


To better understand the cyber-threats affecting 5G Networks, it is essential to know the vulnerabilities and weaknesses of assets, assessing thus their attack surface and how it can be exploited by malicious actors.

https://www.enisa.europa.eu/publications/enisa-threat-landscape-report-for-5g-networks

Common Technology Components for 5G Security

5G IS A USE CASE OF MODERN APPLICATION DEPLOYMENT ENVIRONMENTS



Ingress Control

Scenarios:

- Traffic Steering and Control to workloads
- AuthN/AuthZ for workloads
- Application Security and DDoS (flood protection aka signaling storm)

API Gateway

Scenarios:

- Traffic Steering and Control to endpoints
- AuthN/AuthZ for endpoints
- Application Security and DDoS (automated threat/bot mitigation)

Service Mesh

Scenarios:

- Fine grained control between workloads (E-W and in-cluster traffic)
- Egress control to external services
- Workload visibility and analytics

CNF Security

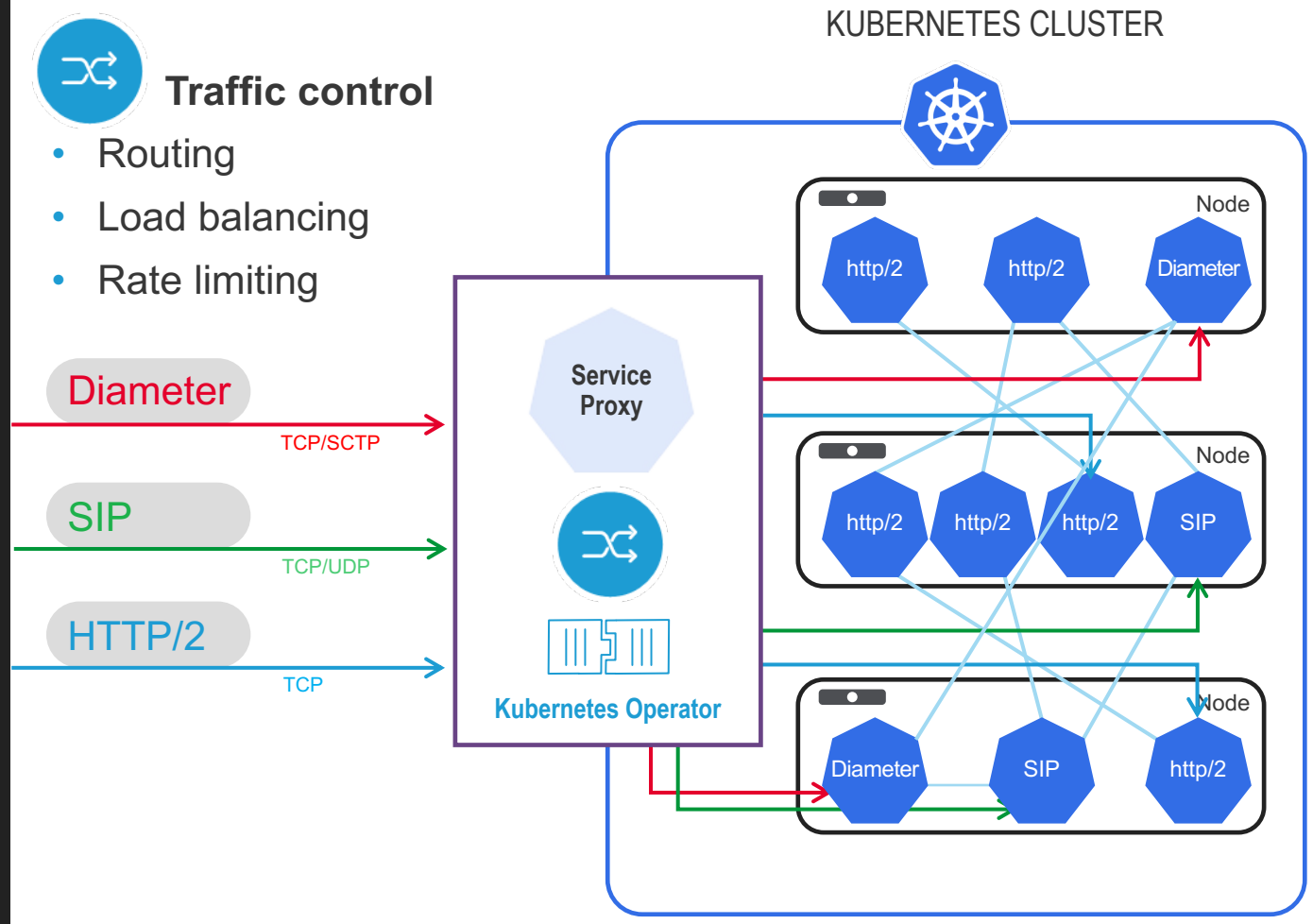
Scenarios:

- Container-native security controls for common services typically found in carrier control plane (Gi/N6 services)

Ingress/Egress scenarios

Security
Encrypt/Decrypt
Traffic steering
Multi-protocol support

Multi-protocol *ingress* as well as *egress* controls are needed



Summarising it all

Key Takeaways

- 5G is more than an incremental evolution of carrier networks
- Infrastructure rollout heavily influenced by organisation culture
- Private 5G and Edge Networks is likely to increase over time
- 5G Security benefits from enterprise modern app learnings
- Container environments need scrutiny for enterprise app workloads