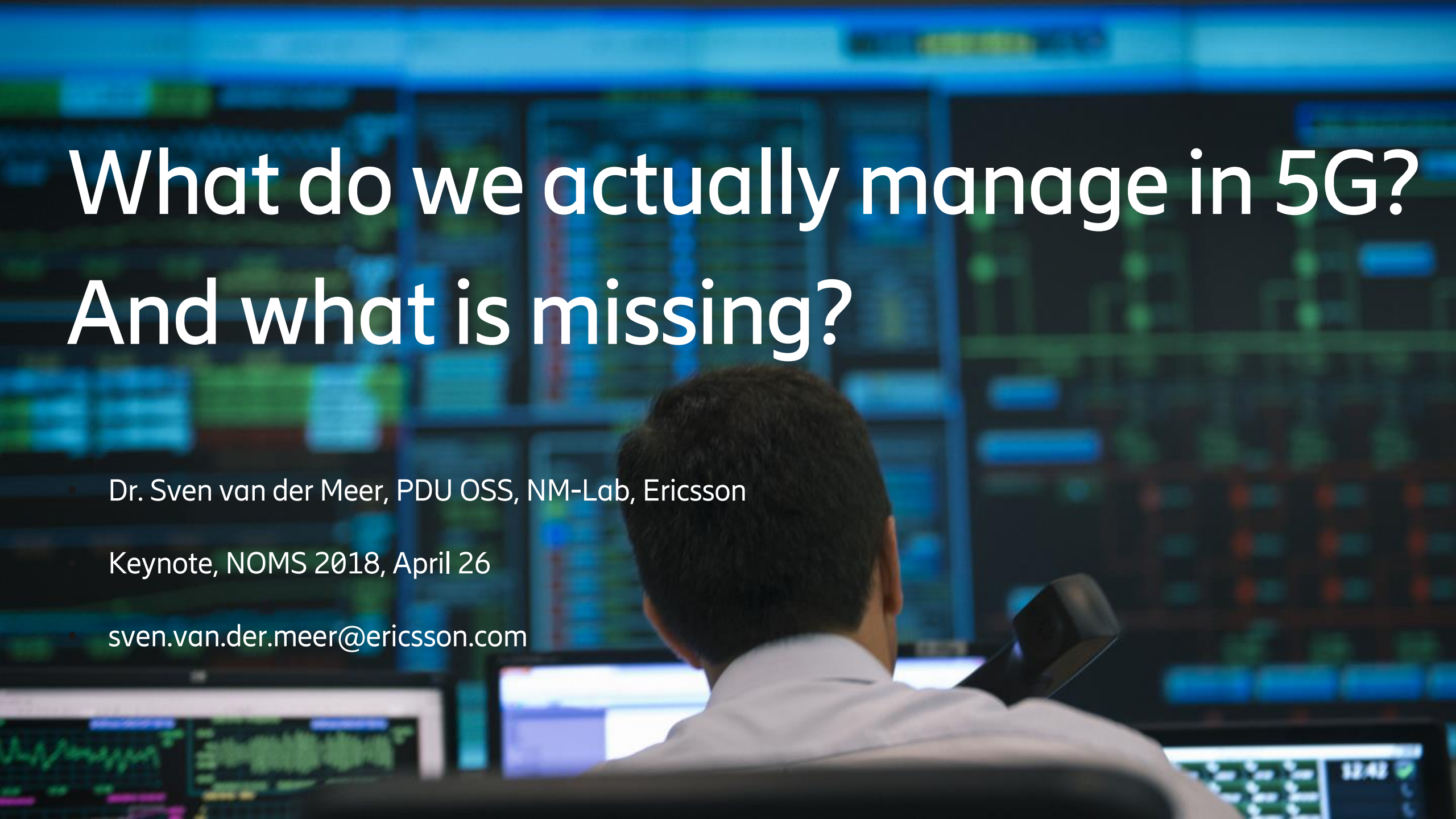
What do we actually manage in 5G? And what is missing?



- Dr. Sven van der Meer, PDU OSS, NM-Lab, Ericsson

- Keynote, NOMS 2018, April 26

- sven.van.der.meer@ericsson.com

For this Talk (and imho)

Management is

— First initial configuration
— Then monitoring and repair

— Everything else is control, …

Term and activities of management

— Are contextual, i.e. relative
— One's management is some one else's control
— More a continuum than a block or component

Managed components are

— Ideally autonomous, autonomic
— Expose interfaces for governing behavior

— Today: mix of control and management, this causes confusion

5G is an eco-system of many (and many more)

— Technologies/Protocols: access, core, cloud
— Devices and boxes: with varying ownership
— Horizontal services: communication
— Vertical solutions: for businesses

What do we manage in 5G?

What do we actually manage in 5G?

What is missing?

What do we manage in 5G?

New situations and challenges
Network evolution
A latency challenge
Network slicing on distributed cloud
Network slice evolution to 5G

In summary:

— A lot of complexity
— A lot of different technologies
— From a lot of different vendors
— Overall: a lot of variance(!)

New situations and challenges

New Use Cases

With Radically Different Requirements

New deployment options

Enabled by SDN and NFV

Evolved Tools

Analytics

Policy

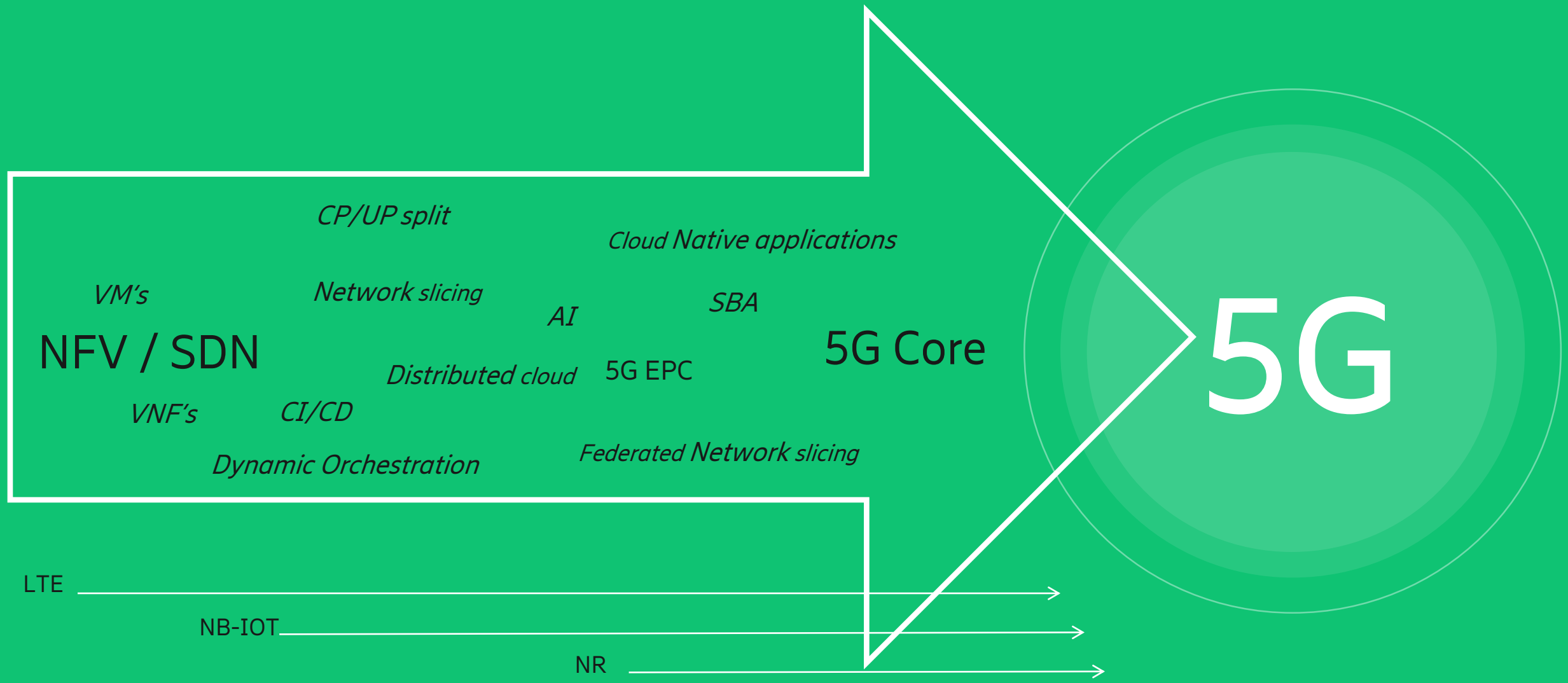
Orchestration
Control

High Expectations

Speed

Costs

Network evolution to 5G



The Latency Challenge

100 ms

Improved network Dimensioning, address the tail

60 ms

Wide area core network and transport planning

25 ms

Local area core

20 ms

Local breakout

18 ms

Instant uplink access H1 2018

11 ms

Short TTI H2 2019

4 ms

40%

35%

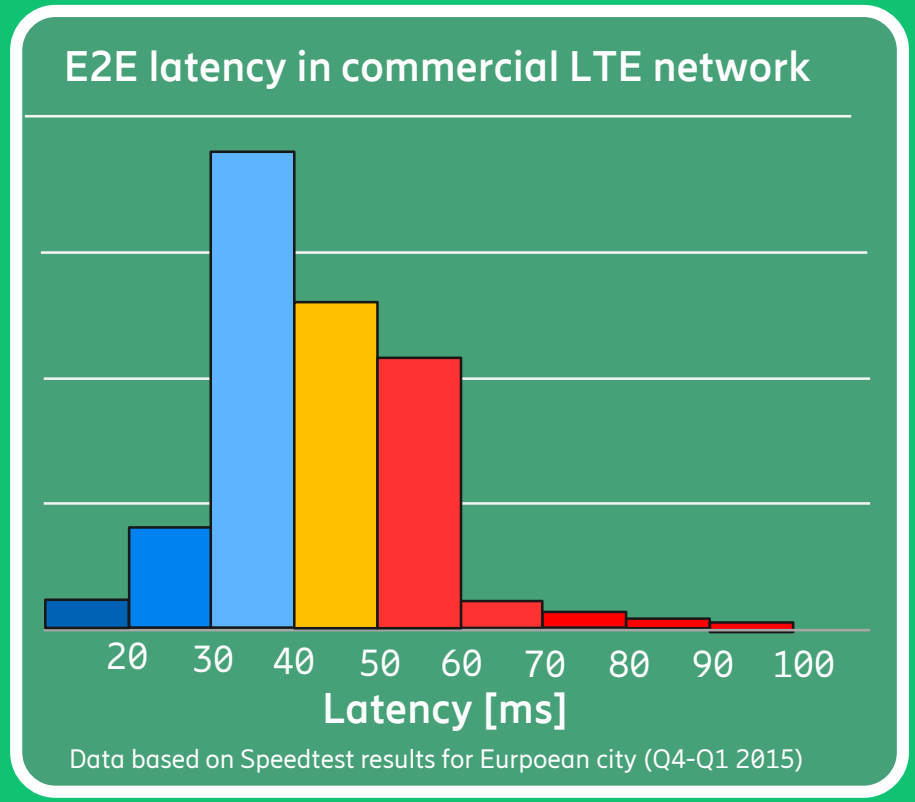
5%

2%

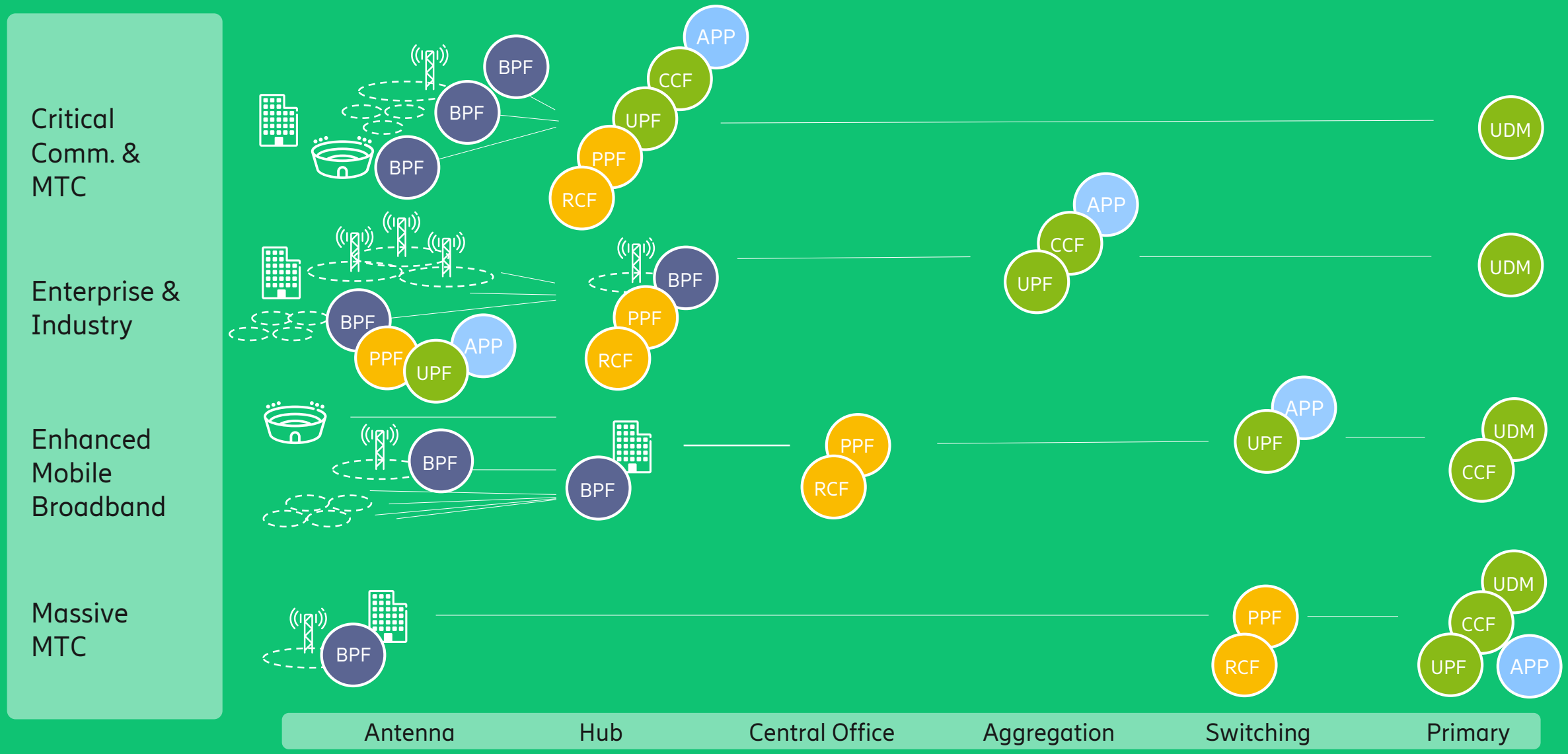
7%

7%

2 ms RAN + 2ms Core => 4 ms e-2-e RTT

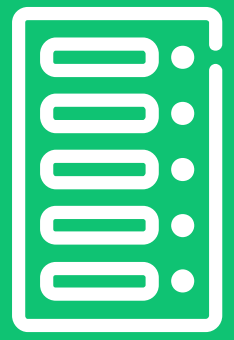


Network Slicing on distributed cloud



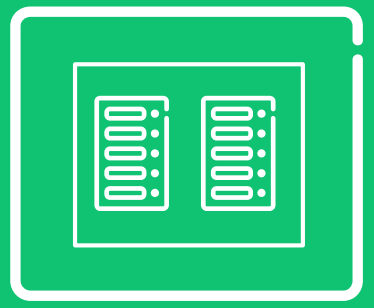
Network Function Evolution to 5G

Integrated nodes



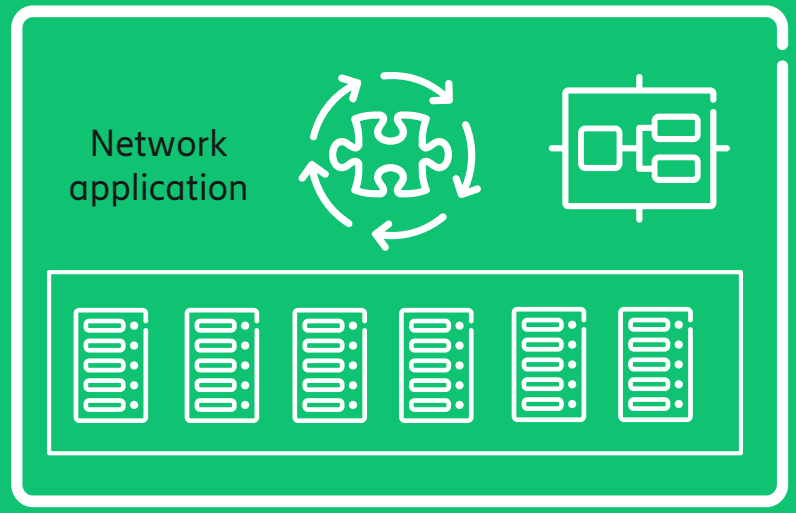
- Dedicated HW/SW
- Static capacity
- Element management

Virtualized deployment



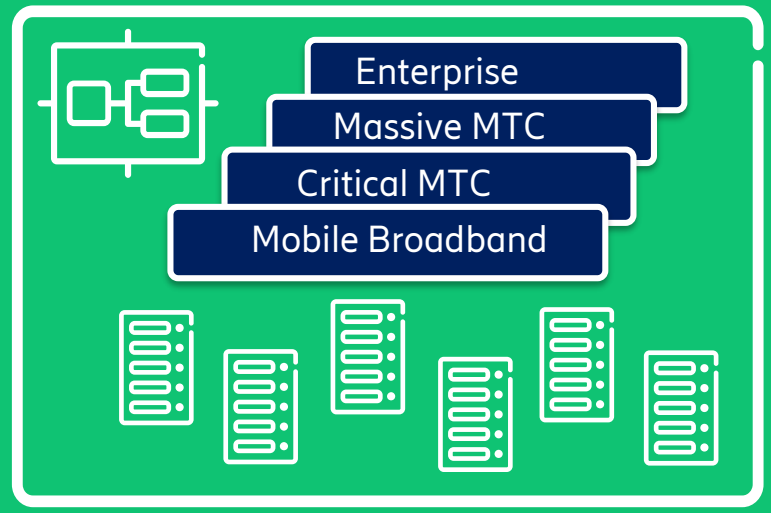
- COTS server hardware
- Manual life-cycle management
- VNF management

Cloud deployment



- Software defined infrastructure
- Orchestrated applications and network services
- Automated life-cycle management
- Cloud optimized performance

5G



- Distributed cloud infrastructure
- Network slice orchestration
- Cloud optimized applications
- 5G core architecture

What do we actually manage in 5G?

Broad mix of services and verticals
Broad mix of technologies
Industry transformation
Continuous Integration / Development
Open Source (and standards)
More automation than networks

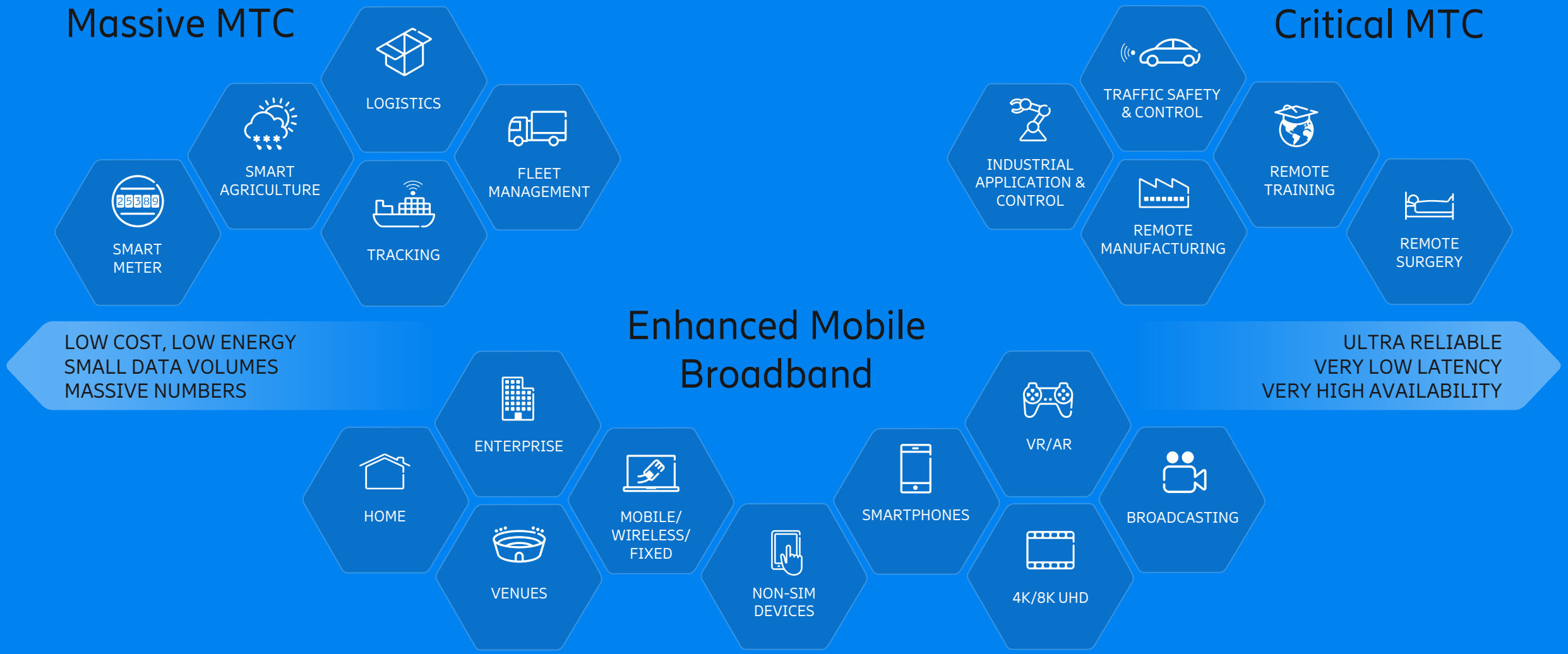
In summary:

— Features and capabilities
— For a reason (e.g. business goal, vertical)
— Mostly contextual, in a domain (DDD)
— An eco-system of n-dimensions
— It's all about automation

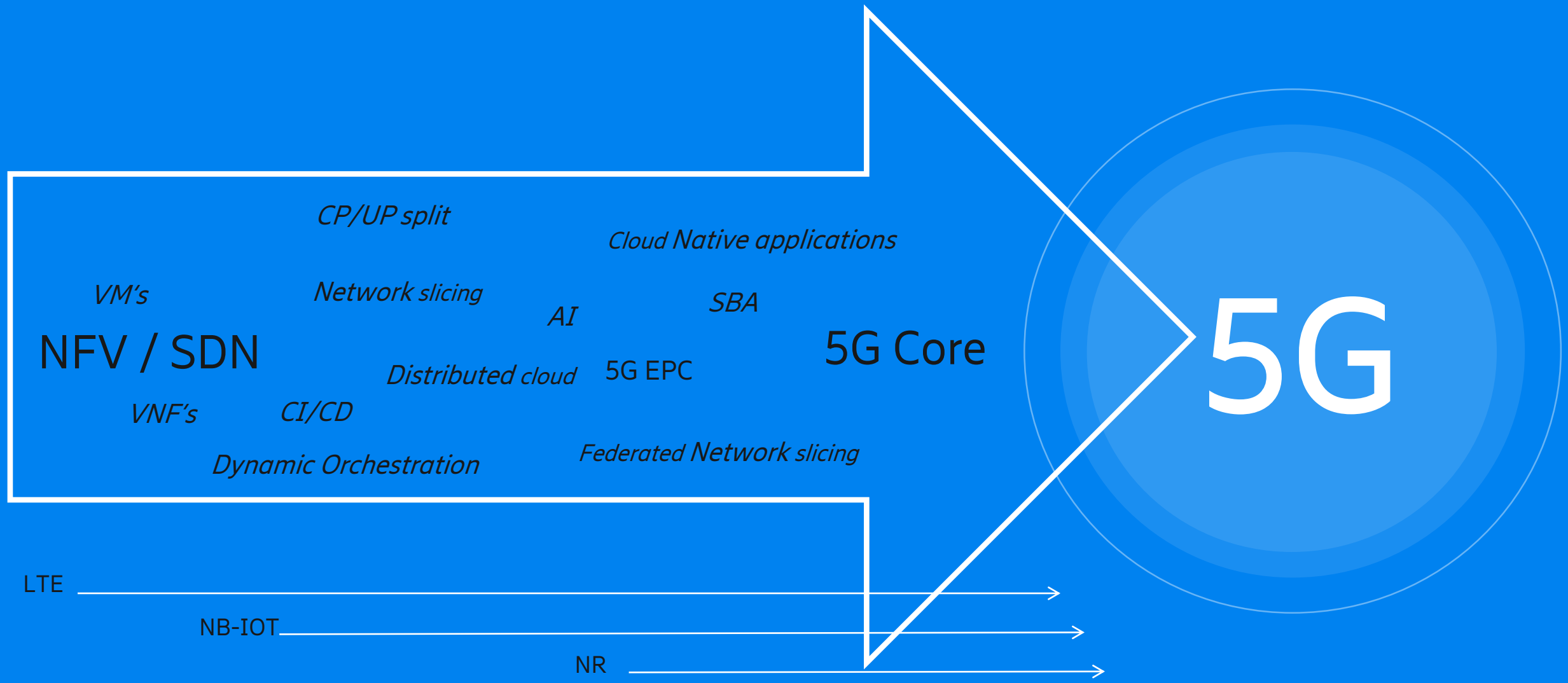
We don’t want to end here

Source: gapingvoid, link

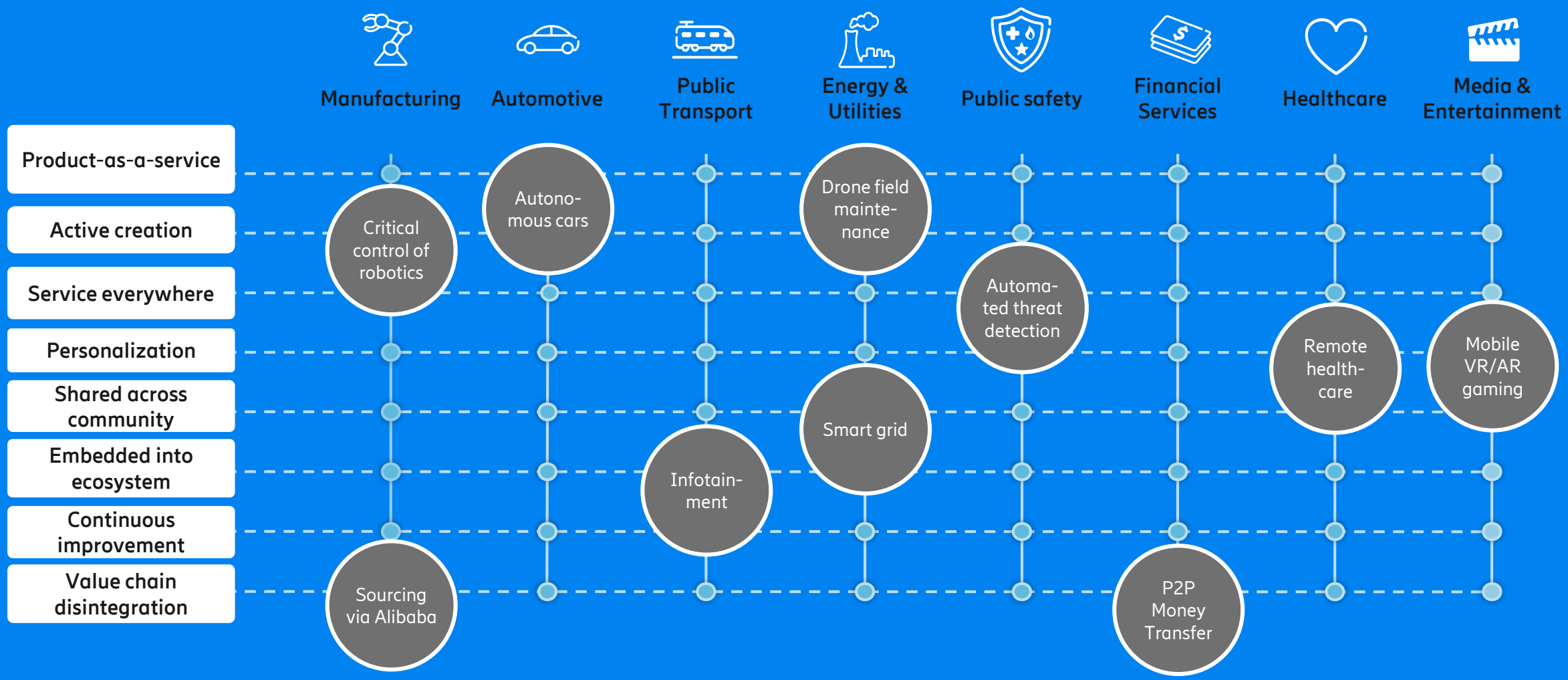
Broad mix of services and verticals



Broad mix of technologies



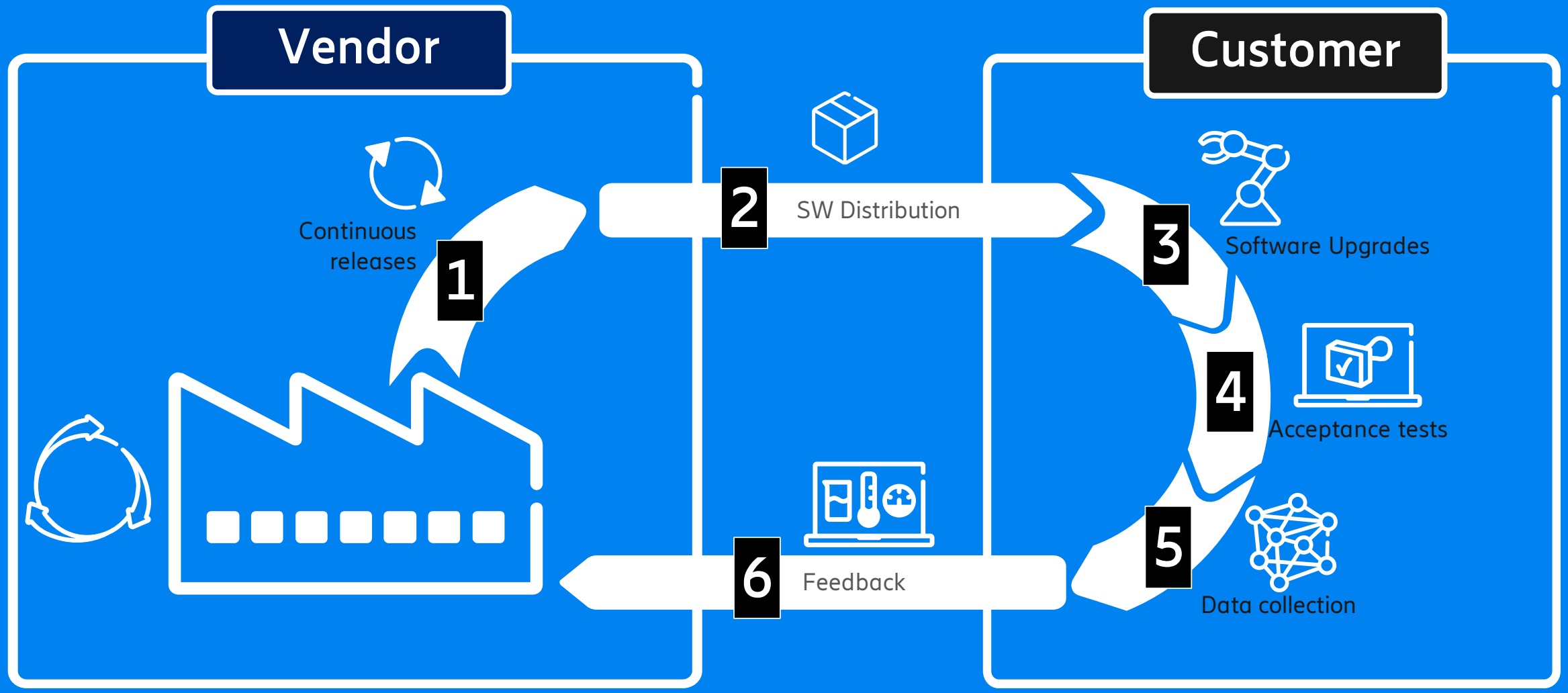
Industry transformation (it's a matrix)



Source: Arthur D. Little Digital Transformation Study 2015

Examples

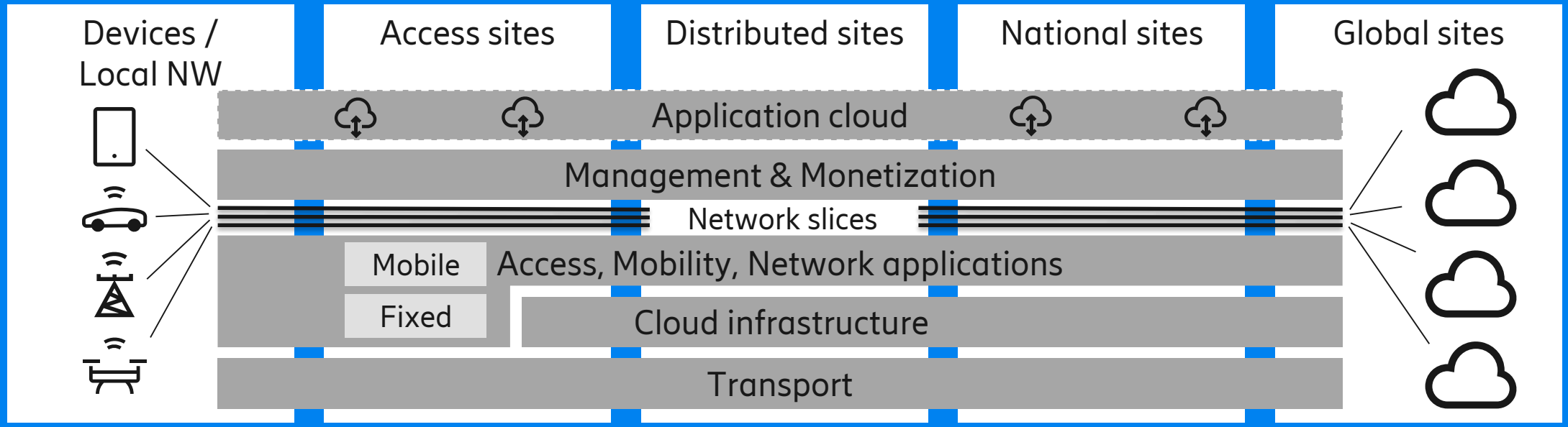
Continues Integration / Deployment



Continued update of the network resources → continued update of the management models

Open Source & Standards …

… everywhere …


Devices / Local NW
Access sites
Distributed sites
National sites
Global sites
Application cloud
Management & Monetization
Network slices
Mobile
Fixed
Access, Mobility, Network applications
Cloud infrastructure
Transport

Cloud Native Landscape

v2.1

See the interactive landscape at landscape.cncf.io

Greyed logos are not open source

App Definition & Development

Database & Data Warehouse

Vitess (CNCF Incubating)

Streaming

NATS (CNCF Incubating)

Source Code Management

Application Definition

Continuous Integration / Continuous Delivery (CI/CD)

Orchestration & Management

Scheduling & Orchestration

kubernetes (CNCF Graduated)

Coordination & Service Discovery

CoreDNS (CNCF Incubating)

Service Management

GRPC (CNCF Incubating)

envoy (CNCF Incubating)

LINKERD (CNCF Sandbox)

Runtime

Cloud-Native Storage

ROOK (CNCF Sandbox)

Container Runtime

containerd (CNCF Incubating)

rkt (CNCF Incubating)

Cloud-Native Network

CNI (CNCF Incubating)

Provisioning

Host Management / Tooling

Infrastructure Automation

Container Registries

Secure Images

Key Management

Notary (CNCF Incubating)

TUF (CNCF Incubating)

Cloud

Public

Private

Platforms

Certified Kubernetes - Distribution

Certified Kubernetes - Platform

Non-Certified Kubernetes

PaaS/Container Service

Observability & Analysis

Monitoring

Prometheus (CNCF Incubating)

Logging

fluentd (CNCF Incubating)

Tracing

OPENTRACING (CNCF Incubating)

JAEGER (CNCF Incubating)

Serverless

See the separate serverless landscape

Special

Kubernetes Certified Service Provider

github.com/cncf/landscape

This landscape is intended as a map through the previously uncharted terrain of cloud native technologies. There are many routes to deploying a cloud native application, with CNCF Projects representing a particularly well-traveled path.

CLOUD NATIVE Landscape

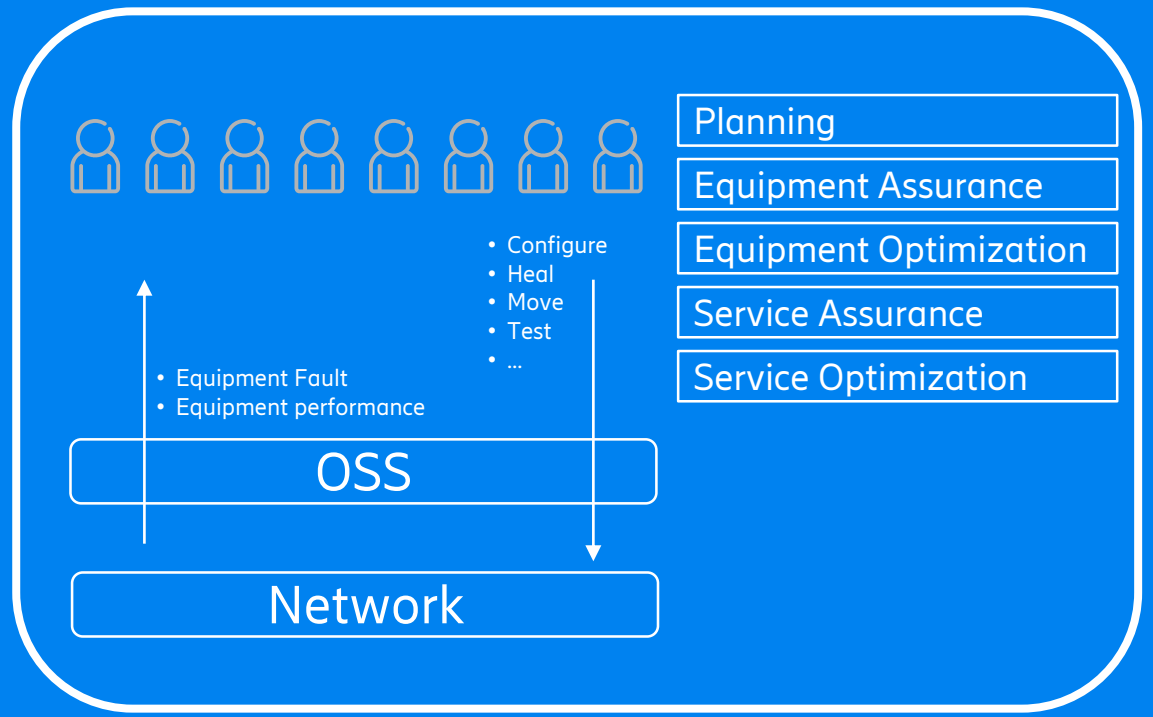
CLOUD NATIVE COMPUTING FOUNDATION

Redpoint Amplify PARTNERS

Automation, not networks
(automation, automation, automation)

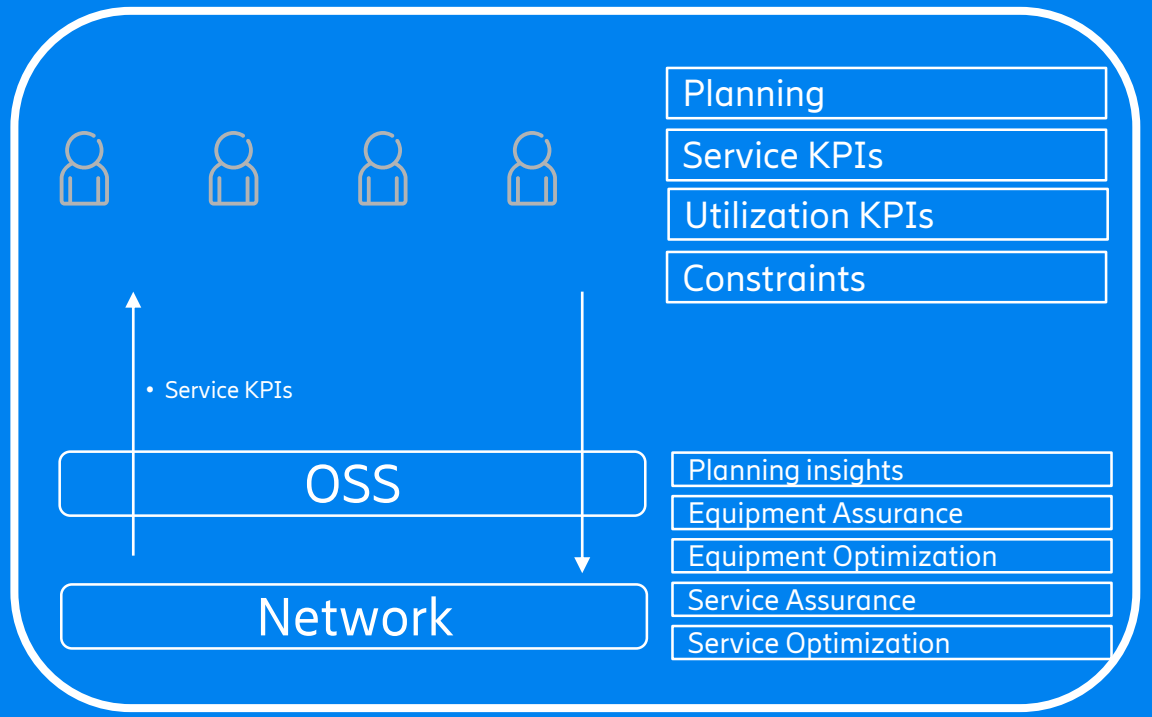
Today

Focus on equipment to meet the service



Tomorrow

Focus on service KPIs, efficiency, constraints
Focus on features & capabilities



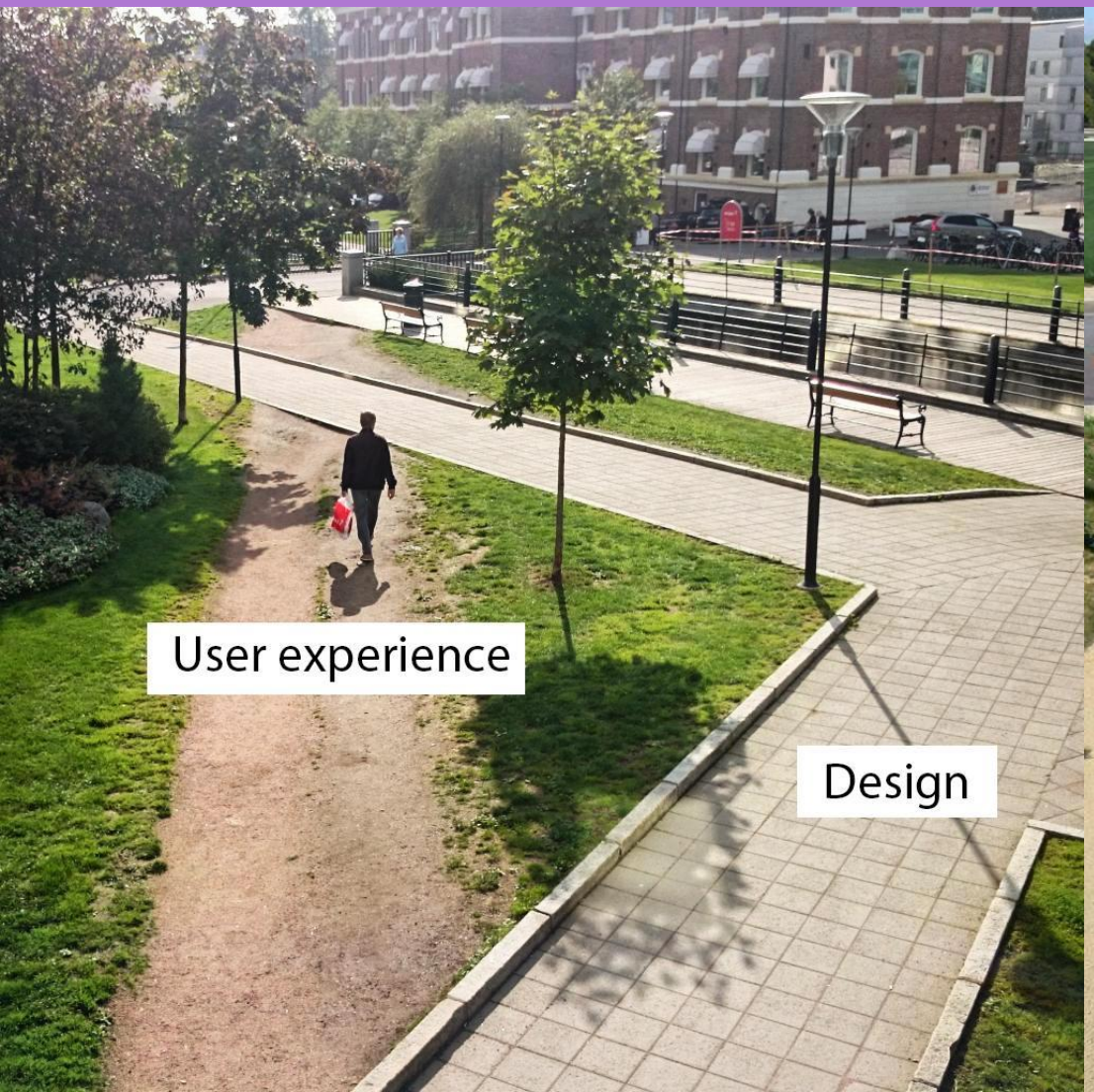
What is Missing?

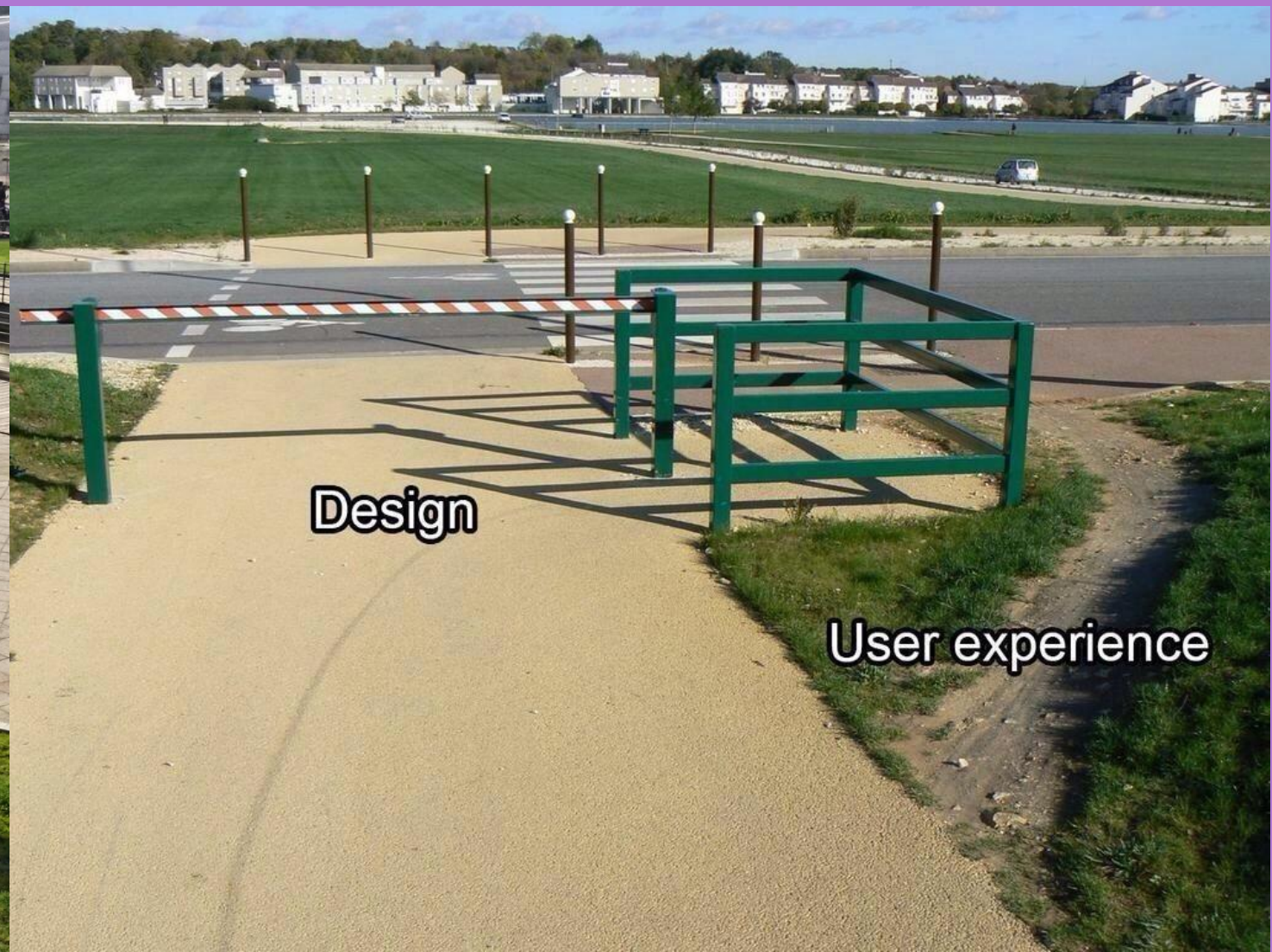
Deal with extreme modification
Deal with intelligent networks
Models for automation
Move from automatic to autonomic
Machine intelligence

In summary, we need:

— Models (resource, network, coordination, semantics)
— Network intelligence (and distribution)
— Federation (of domains and capabilities)

Design and build for purpose (domain)
think DDD / DSL





Deal with unexpected situations

anywhere, anytime

Source: Storyful, link

Extreme Modification
(in user facing parts of 5G)

"The IoT should be designed for a generation that is not only hungry for content and services…

… but also for extreme modification and personalization of the tools to use to sculpt their identity"

Pier Luigi Capucci, Open World Forum, Paris, September 2011 – link

Think about that for a moment…

Intelligence in Networks
(it's coming with 5G)

"The Carriers are stuck in the innovator's dilemma"

Jeff Lawson, 20-Feb-2012, link

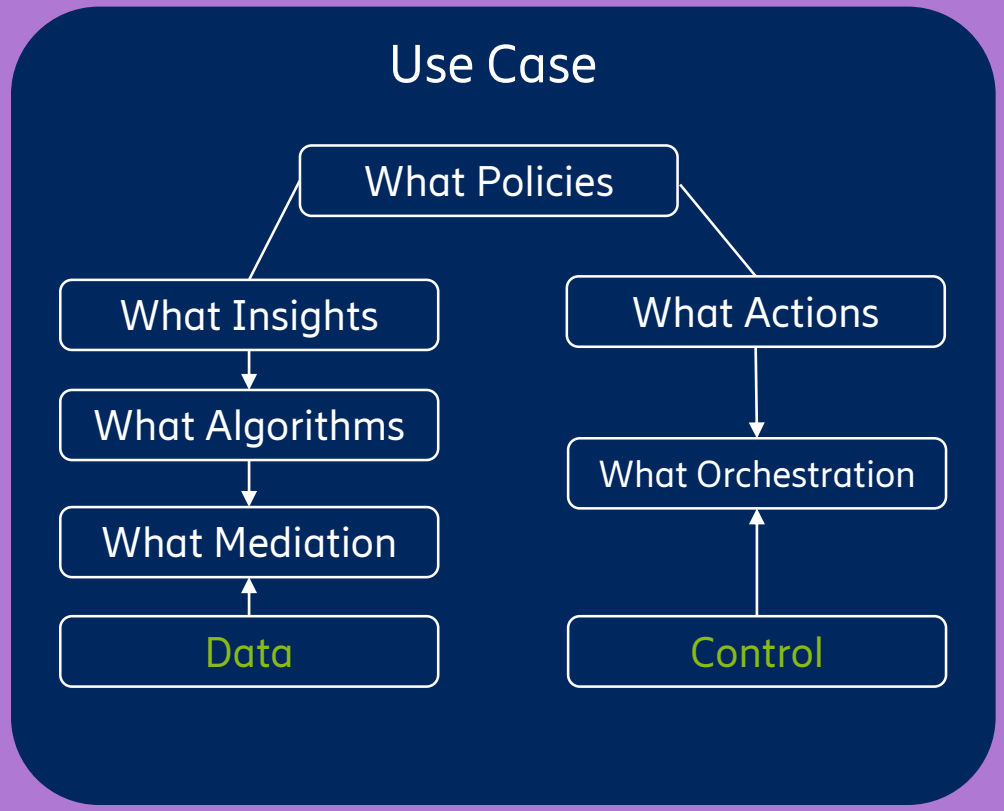
— Based on the Innovator's Dilemma by Clayton Christensen
— To survive, telecoms "need to increase the intelligence of their networks and open them up for innovation"

** (psst: if they do, and they started(!), then our NMS, OSS, BSS is next!)

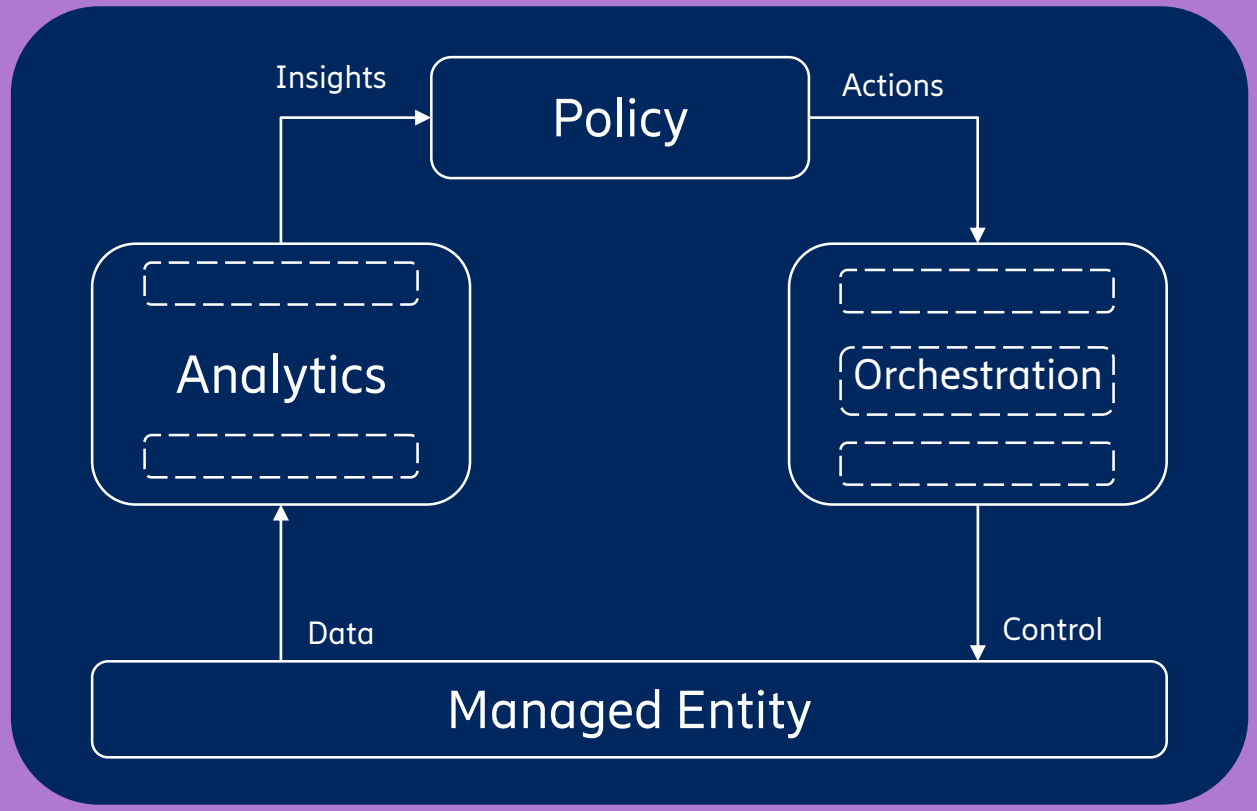
Models for Automation

(simple, dynamic, recursive, network, federation, semantic, coordination)

Design Time



Run Time



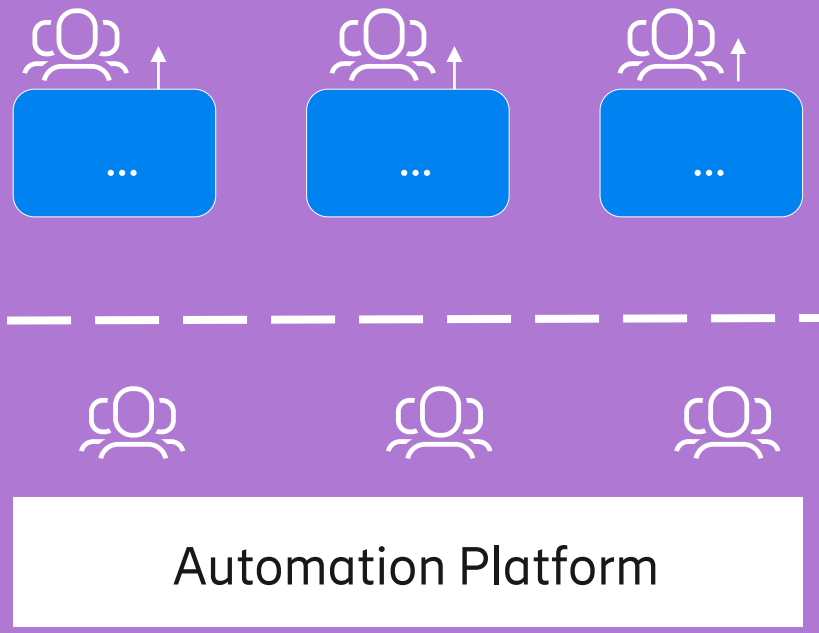
Separation of concerns

- Radio Network
- Core Network
- Transport Network
- Data Centre
- E2E Service
- Enterprise
- Devices

Business and technical questions are specific to the domain

Enable specialized competence per concern

Each concern abstracts its services offered



- Different concerns treat services from others as resources
- Concerns have their own space
- Deployment per concern possible

Move from automatic to autonomic

Once per month

Once per millisecond

P **Policy:** Automated Recommendation and Decision

A **Analytics:** Automated analysis of the situation

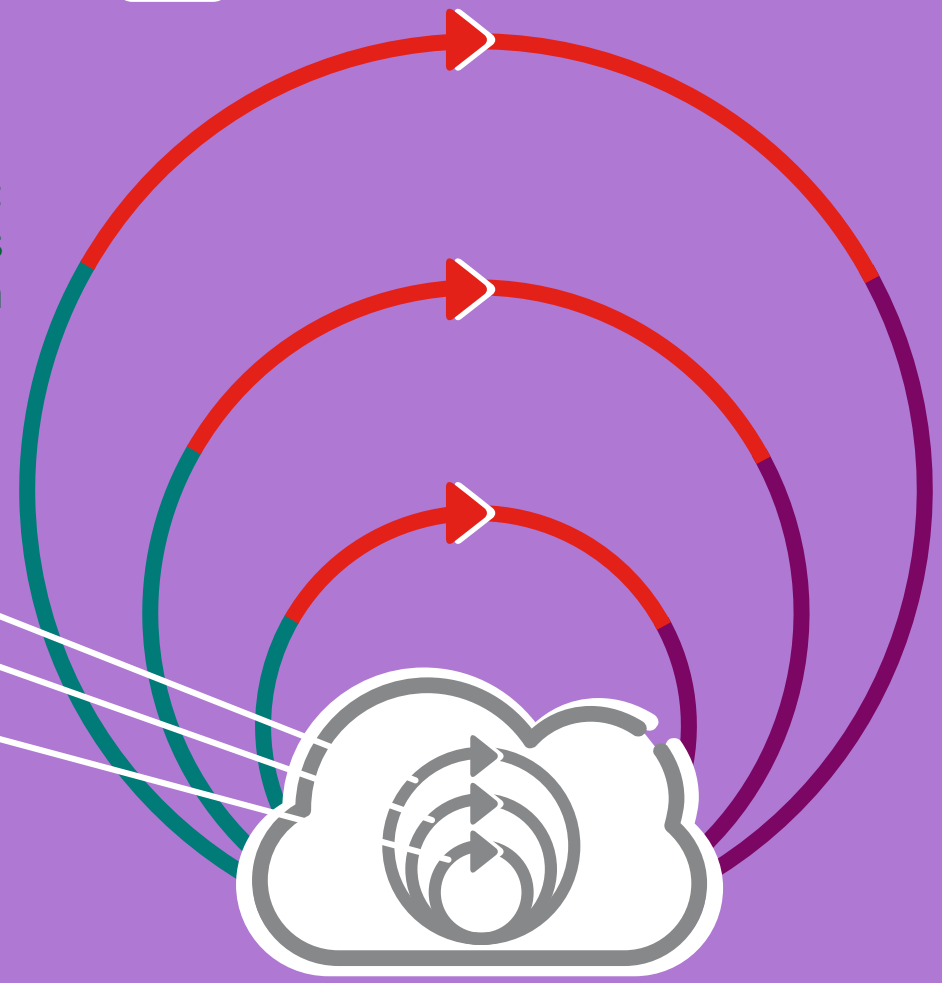
DISTRIBUTED AUTOMATION

Self-Configuration

Self-Optimization

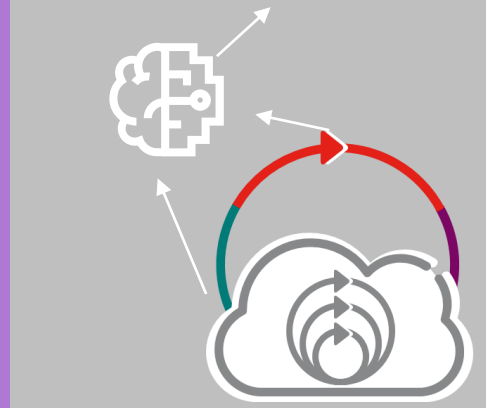
Self-Healing

Shorten response times and reduce system complexity by providing automation in the network itself when possible



Control, Orchestration and Management: Execution of requested changes

COM



Coordinate the control

Summary

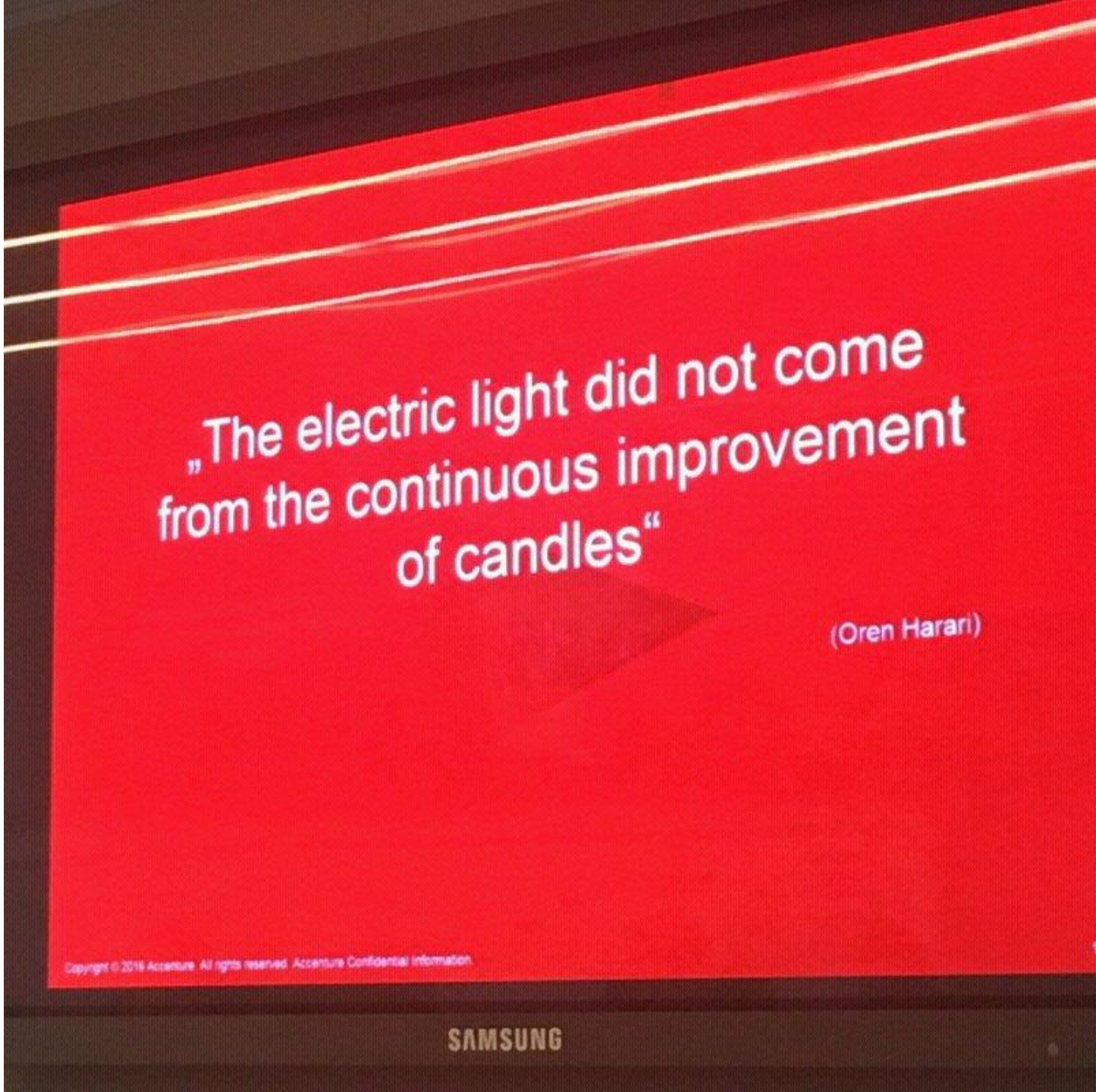
Managing 5G is about
- Huge complexity
- Endless technologies, devices, protocols
- From numerous vendors
- A lot of variance

Actual management of 5G is be about
- Eco-system of features and capabilities
- Understood reasons (e.g. business, verticals)
- Using domain-driven design concepts
- Automate everything you can (but not more)

Missing Parts
- More simplicity, more invariance, less variance
- Models (for automation)
- Machine intelligence for management
- Federation, coordination (of domains)
- Separation of concerns

Now over to YOU!

Be brave(!)



Sally Eaves, Tweet, 10-Dec-2016 – link

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