The Standards People

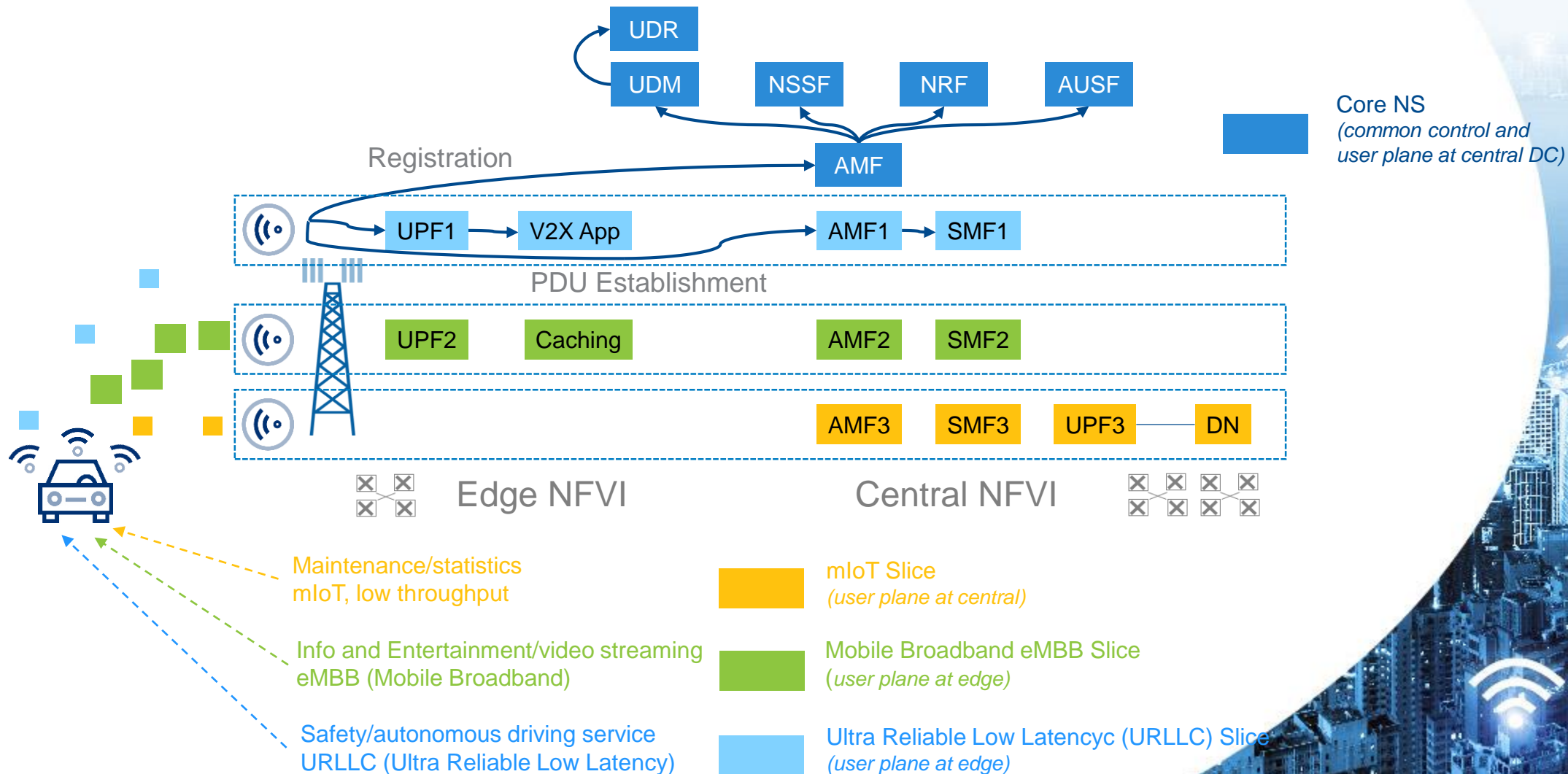# ZSM - Means of Automation

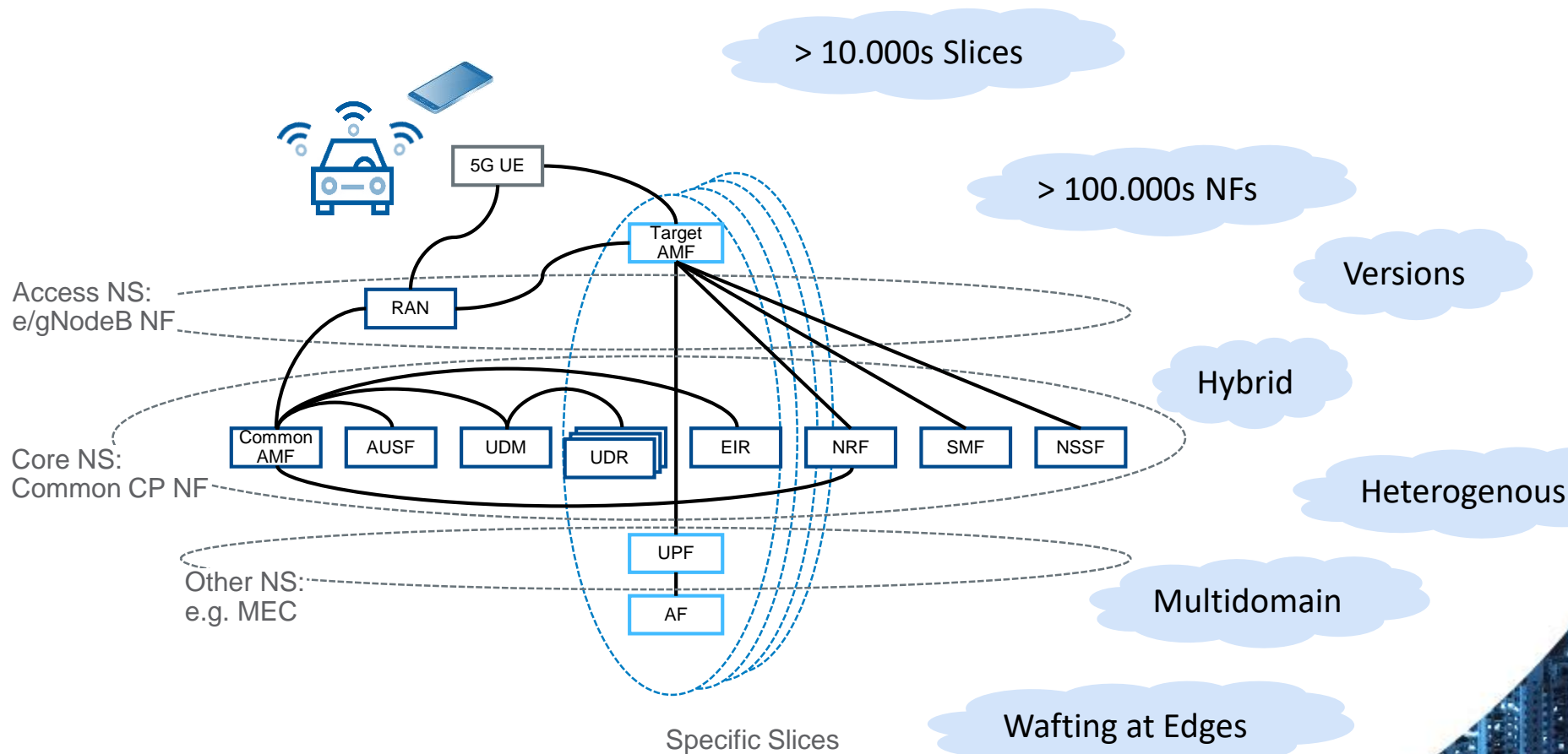Presented by: **Andreas Krichel**   For: **Layer123/ZTA congress, Madrid**

27.3.2019

Example: a 5G Slicing Use case

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2

How do you want to manage this?

> 10.000s Slices

> 100.000s NFs

Versions

Hybrid

Heterogenous

Multidomain

Wafting at Edges

Access NS:
e/gNodeB NF

Core NS:
Common CP NF

Other NS:
e.g. MEC

5G UE

Target AMF

RAN

Common AMF

AUSF

UDM

UDR

EIR

NRF

SMF

NSSF

UPF

AF

Specific Slices
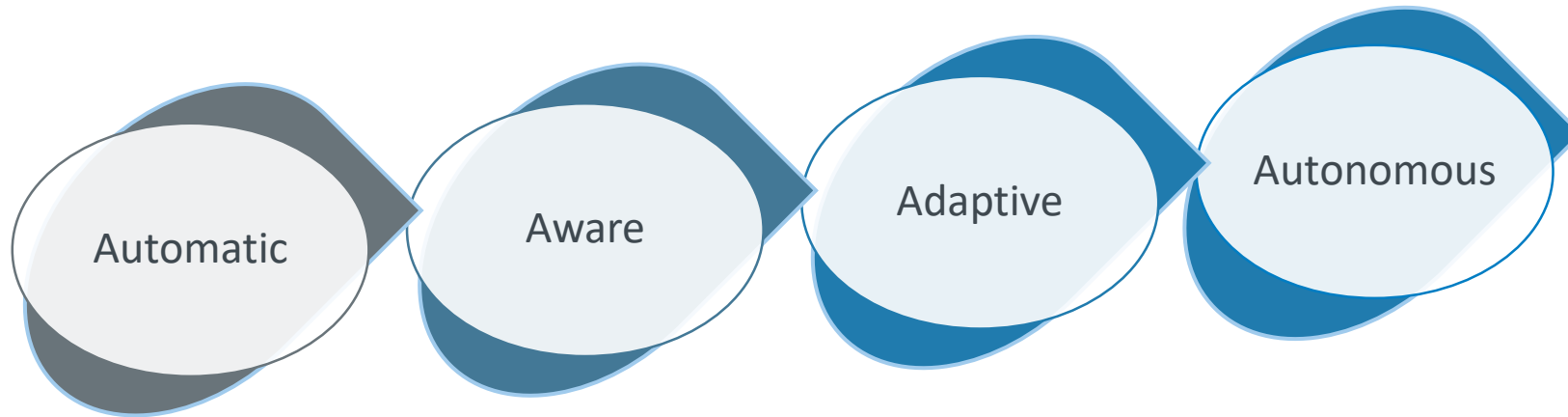
How to achieve Autonomy ?

Automation replaces manual functions with automation artifacts - is that all ?

Automation alone can only adapt within the pre-defined scope and context.
Higher levels of autonomy can be reached by combining the automatic, aware and adaptive properties in a end-to-end management approach.

Automatic	programs provide proficiency to execute systematic and exhaustive tasks
Aware	anomalies and attacks are constantly detected
Adaptive	agnostic coordination across heterogeneous environment
Autonomy	each perceived inconsistencies translate into (specific) actions achieving consistency

Comprehensive Automation

A comprehensive automation solution consists in chaining automated functions, with the following properties:

- Vertically end-to-end, i.e. across the protocol stack or from the service-layer to the physical-layer

- Horizontally end-to-end, i.e. across different technologies or administrative domains

- Repeatable and reusable in different contexts, i.e. relies on standardized or best current practices for interfaces and models

- Provision dynamically, customizable "control or touch points" in the end-to-end automation – closed loop – allows for human supervision

Therefore, a comprehensive automation provides an approach for combining function automation with process automation.

Areas* with the highest impact for automation

- Autonomies within Networks

- Network Governance

- Operations Automation

- Time to Market

*Today contributed in ZSM005
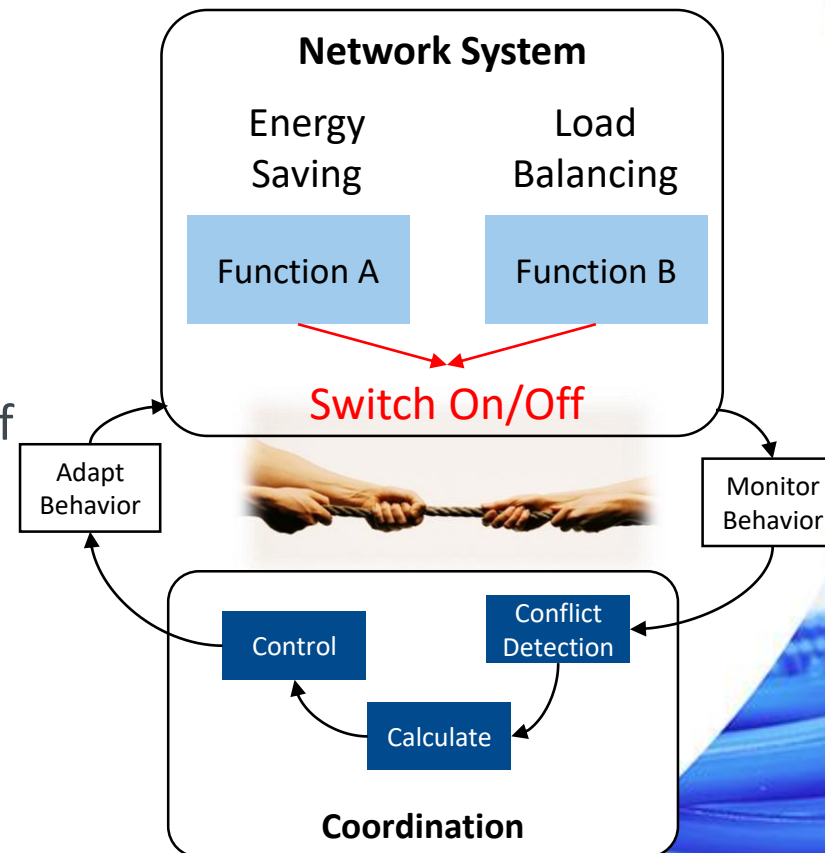
Service Stability and Governance

Service and Network Stability thru Coordination

Within a network, autonomic functions (AF) are likely to compete with one another, either to control same network parameters or to influence different metrics.

Coordination protects the network from instabilities and effects due to the presence of multiple AFs running concurrently. It ensures the proper triggering sequence of AFs and guarantees their stable operation.

Coordination provides

- Conflicts detections
- Algorithms to Insure Coordination
- Mechanisms to Control AFs

Network System

Energy Saving	Load Balancing
Function A	Function B

Switch On/Off

Adapt Behavior

Monitor Behavior

Control — Conflict Detection — Calculate

Coordination
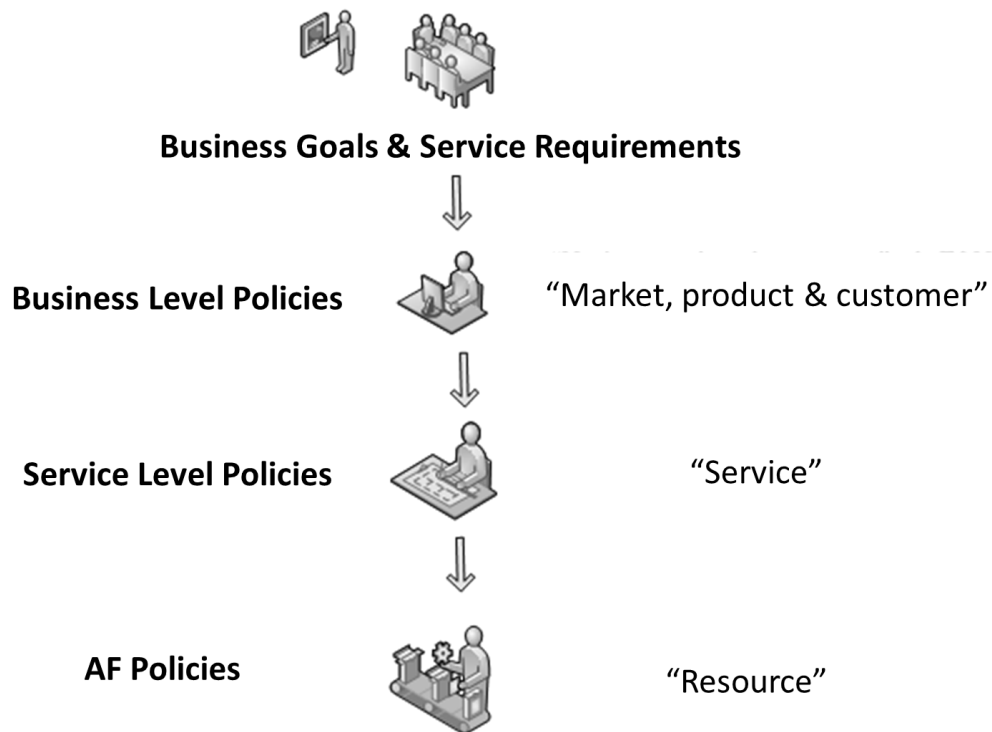
Service and Network Governance

The introduction of closed control loop and autonomic capabilities generate a re-assignment of tasks previously carried out by humans, which will now rather focus on future network operation and planning, rather than continuously monitoring the behaviour of individual components.

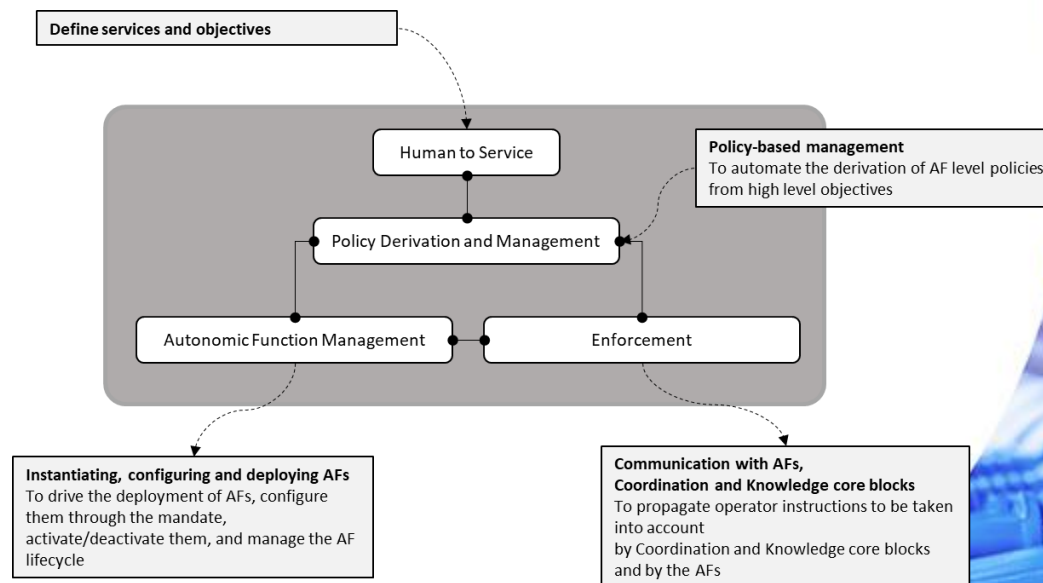Building a network governance framework also faces technical challenges in five main functional areas:

business language, translation, reasoning, policies, and configuration enforcement.

Service and Network Governance

"Business Translation"

Business Goals & Service Requirements

⬇

Business Level Policies   "Market, product & customer"

⬇

Service Level Policies   "Service"

⬇

AF Policies   "Resource"

"Governance Framework"

Define services and objectives

Human to Service

Policy Derivation and Management

Policy-based management
To automate the derivation of AF level policies from high level objectives

Autonomic Function Management   Enforcement

Instantiating, configuring and deploying AFs
To drive the deployment of AFs, configure them through the mandate, activate/deactivate them, and manage the AF lifecycle

Communication with AFs,
Coordination and Knowledge core blocks
To propagate operator instructions to be taken into account
by Coordination and Knowledge core blocks
and by the AFs

Customer Service

Service Composition

Resource

Network

Physical System

Virtual System

Function

Quality Indicators

Everything is a Service

The Business Goals of a Digital Service Provider

▽ Self Service with Zero Touch Automation

▽ Composability of new Offerings

▽ Agility to achieve shortest Time to Market

A technical means to achieve above:

- Intent based modelling, networking and orchestration is a new approach, to cope with complexity e.g. of 5G networks. Future management systems shall support service evolution and incremental growth, without breaking existing systems. This can be achieved by composition of small autonomous service components, structured using declarative policy descriptors.

- Intent based Service Orchestration provides a comprehensive automation solution, combining function automation with process automation in one approach.

Definition (by J.Strassner, IETF 95, 2016)

Policy

- "Policies are rules governing the choices in behavior of a system" – Sloman, 1994

- "Policy is a set of rules that are used to manage and control the changing and/or maintaining of the state of one or more managed objects." – Strassner, 2003

Policy-based management is an administrative approach that is used to simplify the management of a given endeavor by establishing policies to deal with situations that are likely to occur.

Why We Care ?

- Devices (i.e. network functions) will not, in general, be autonomic – but with appropriate management and orchestration, the overall system can appear to be autonomic (→ autonomic functions)

The History of "Intent"

- M.Sloman 1994: "Policies are rules governing the choices in behavior of a system"

- J.Strassner 2003: "Policy is a set of rules that are used to manage and control the changing and/or maintaining of the state of one or more managed objects."

- A.Bandara, E.Lupu et al 2004: "Goal-based approach to Policy refinement"

- J.Strassner 2016: "Policy Management is HARD. People want simpler Solutions."

- D.Lenrow 2015: "Intent is WHAT – not HOW"

- ONF 2016: "Intent NBI – Definition and Principles"

- Various Vendors 2015-2019: Intent-based Networking and Orchestration
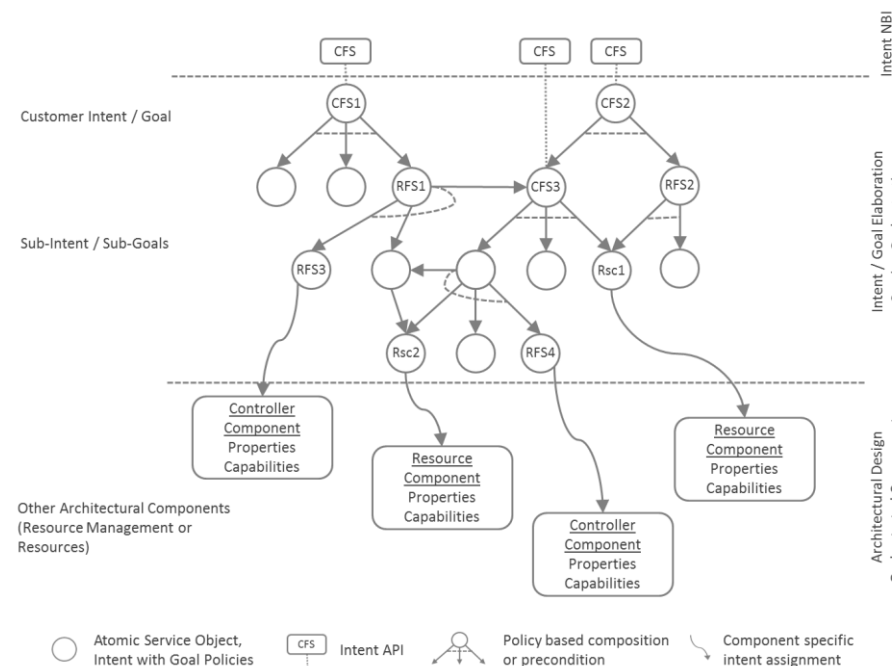
# Dave Lenrow 2015: Intent is WHAT – not HOW

Intent is What – not How

- Intelligent software determines how to translate the Intent into an infrastructure-specific "prescription" that causes the network to behave in the desired manner.

Intent is...

- Intent is **invariant** – it stays valid, independent from the network behavior

- Intent is **portable** – it is independent, what it is made of such as protocols or vendors

- Intent is **composable** – any combination of intent driven services can be used concurrently

- Intent **scales** – it allows scaling as needed, taking context into account, and as systems allow

- Intent **provides context** and dissolves conflicts – intent-oriented description conveys the WHY, rather than the HOW, so it is possible to determine conflicts and find ways to fulfill the cumulative intent of the multiple-client services

A new approach for Intent Based Modeling

Dynamic Service Descriptors*

Catalog of Descriptors

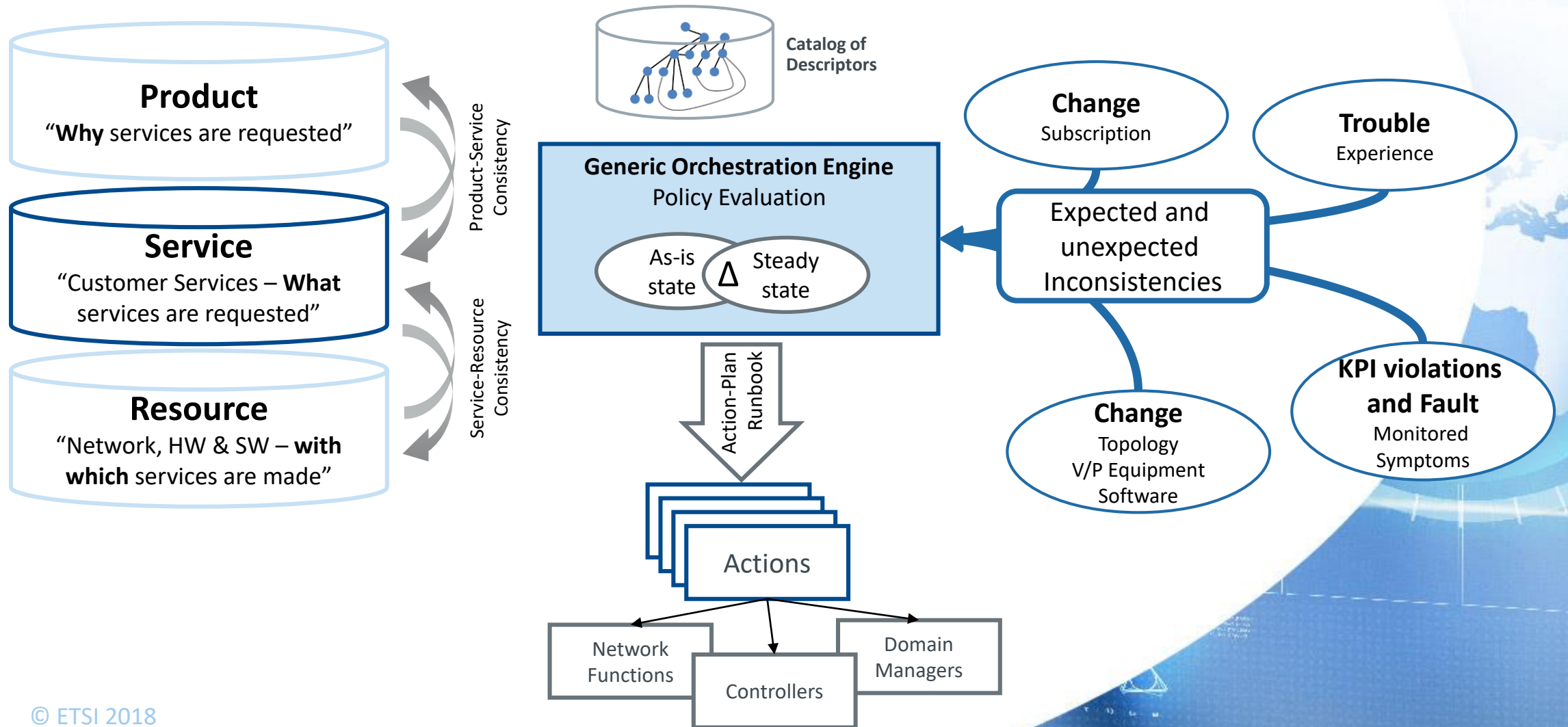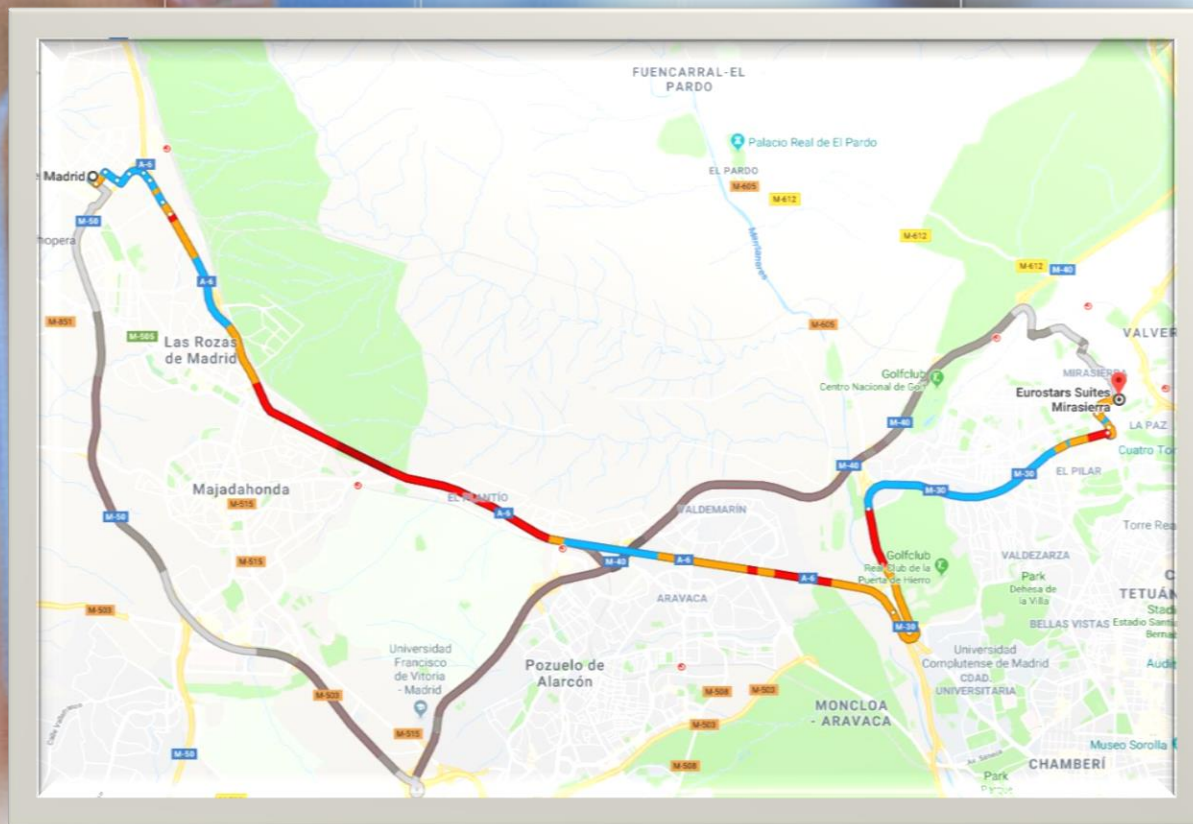**Service Descriptor**

Object

Relationships ← → Policies
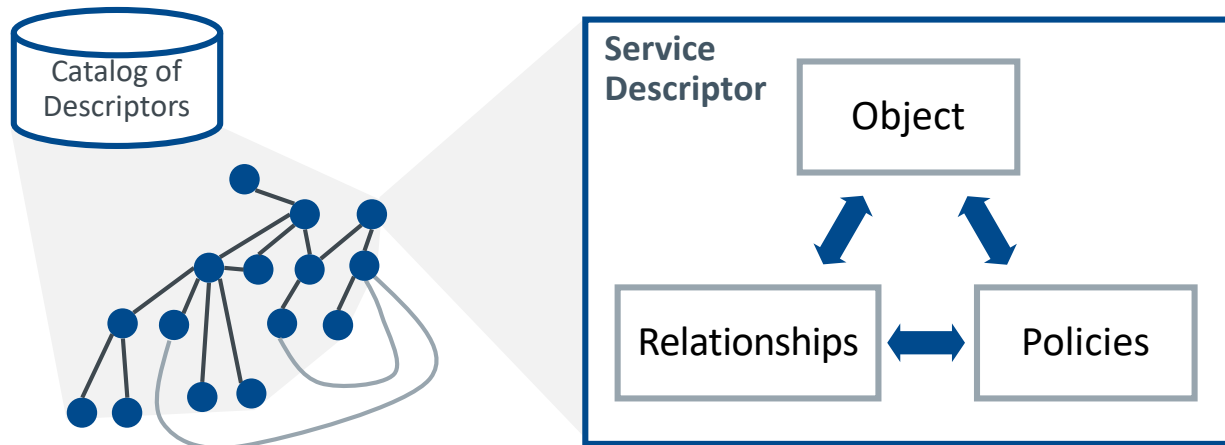
WHAT not just the HOW
Reason behind the Model
(not just its structure)
"Everything has a purpose"

No Monolithic Structures
Composable Objects

Behavior is part of the model
Expressed in Relationships
and Policies

*definition by HPE

Model-Design replaces workflows,
And enables a generic Engine

Product
"**Why** services are requested"

Service
"Customer Services – **What** services are requested"

Resource
"Network, HW & SW – **with which** services are made"

Product-Service Consistency

Service-Resource Consistency

Catalog of Descriptors

Generic Orchestration Engine
Policy Evaluation

As-is state   Δ   Steady state

Action-Plan Runbook

Actions

Network Functions

Controllers

Domain Managers

Expected and unexpected Inconsistencies

Change Subscription

Trouble Experience

Change Topology V/P Equipment Software

KPI violations and Fault Monitored Symptoms

5G requires to cope with more dynamics than ever. Intelligent software can do.

GR ZSM005 – Means of Automation

- Differentiates maturity levels of automation

- Addresses areas with the highest impact for automation:
    - network, operations, devops

- Reports about existing means of automation:
    - Business motivation, problems addressed, solution concepts, implications, and evidence of success

- Next steps:
    - Collect further contributions
    - Reach Stable Draft
    - Publication planned Sep 2019

Thank You !