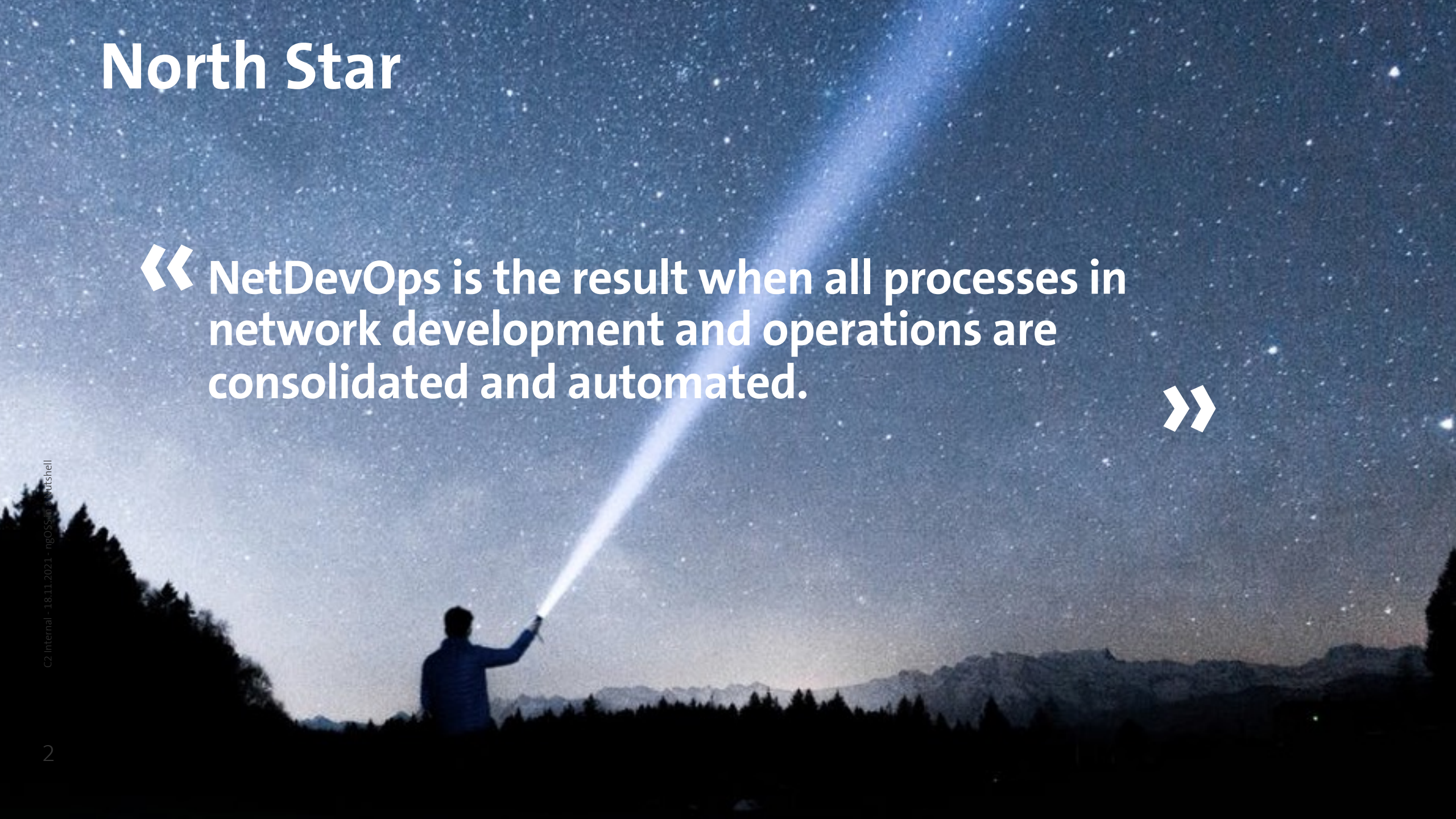
How Network Automation drives New Ways of Working

Martin Gysi, Rudolf Strijkers

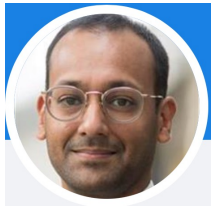
swisscom

North Star

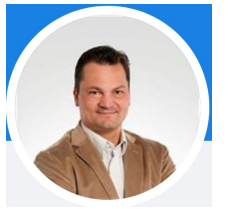


« NetDevOps is the result when all processes in network development and operations are consolidated and automated. »

Influences on our IP Transport ODM architecture



Martin
Development Engineer



API Gateway (Apigee)

Assurance
(closed loop assurance)

Service Assurance
Daisy
...

Resource Assurance
Netcool
...

Service Orchestration
CP Broker
Thor

Inventories
(Service Instance & Resource)
Netsense (resource)
Service inventory
...

Service Catalog
CP Broker
Thor

Resource Fulfilment (Infrastructure Management)
NSO

Rollout
Process Workflow Engine (ngBOB)

Network Resources
Access SE
Metro SE
Datacenter SE
...
...

Life Cycle
Delivery Process
(Engineering, Testing, Change, Problem, Defect)
Test Automation
CI/CD Pipeline (delivery stages)
Dev
Int.
e2e
Pre-prod
Prod
Infra as Code

Message bus

Error & Event Management

Simplify and streamline the network development process

We eliminate manual steps and error prone handovers. We introduce DevOps to networking.

Martin
Development Engineer
„Our development process is too slow, inflexibel and expensive“!

today

Step 1

Network engineer:
- develops router config
- writes engineering manual

Network element, Word

Step 2

Software engineer:
- reads engineering manual
- writes config template and IT spec

Word, Excel

Step 3

External Software developer:
- writes code and delivers to Swisscom

FUF tool

Step 4

Software and Network engineer:
- manually test code in lab

FUF tool , network element

Step 5

Software engineer:
- deploys code

Network Engineer:
- triggers network update

FUF tool , network element

---

tomorrow

Step 1

DevOps Engineer:
- develops router config
- adapts templates and writes glue code

Network element, NSO

Step 2

DevOps Engineer:
- commits code
- Automated tests are run

NSO, git, jenkins

Step 3

DevOps Engineer:
- deploys code
- live network is updated

NSO, Network element

Influences on our IP Transport ODM architecture

Vince
Head of Operations & SRE

API Gateway (Apigee)

Assurance
(closed loop assurance)

Service Assurance
Daisy
...

Resource Assurance
Netcool
...

Service Orchestration
CP Broker
Thor

Inventories
(Service Instance & Resource)
Netsense (resource)
Service inventory
...

Service Catalog
CP Broker
Thor

Resource Fulfilment (Infrastructure Management)
NSO

Rollout
Process Workflow Engine (ngBOB)

Network Resources
Access SE
Metro SE
Datacenter SE
...
...

Life Cycle
Delivery Process
(Engineering, Testing, Change, Problem, Defect)
Test Automation
CI/CD Pipeline (delivery stages)
Dev
Int.
e2e
Pre-prod
Prod
Infra as Code

Message bus

Error & Event Management

Improve and automate network operations
Our journey to NetDevOps

Vince
Head of Operations & SRE
„Too many incidents after change!“
"What is the status of my customer services?"
"If you automate a mess, you have an automated mess"

1

Manual Ops
- **Ad-hoc scripting**
- Operations at the device level
- Silo knowledge
- Low standardization

2

Automated Workflow
- **Focus on troubleshooting**
- Lots of preparations before change needed
- HW / SW homologation
- Some tests are automated

3

Automated tests and network as code
- **Infrastructure as code (git)**
- Test driven Ops
- Rethink troubleshooting as testing
- Implementation of telemetry and analytics
- Automated capacity mgmt.
- Network service model

4

CI/CD Ops
- **NetDevOps model**
- Pipeline for accuracy and agility
- Feedback/fail loop, small changes and frequent deployments
- Observability (metrics, tracing, logging) is the new monitoring
- Starting to automate Root Cause Analysis

5

Outcome driven
- **Business process orchestration**
- Network Reliability Engineering with Service Level Indicators, Objectives, and Agreements (SLO,SLI, SLA)
- Effective usage of error and toil budget
- Manage dependencies, separation of concerns
- Automated Root Cause Analysis
- Integrate Customer Care trends as a feedback loop

Foundation

People
Focus on reliability and value for the customers.

Combine IT & networking skills

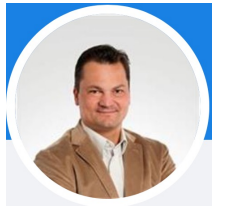
Process
NetDevOps and NRE

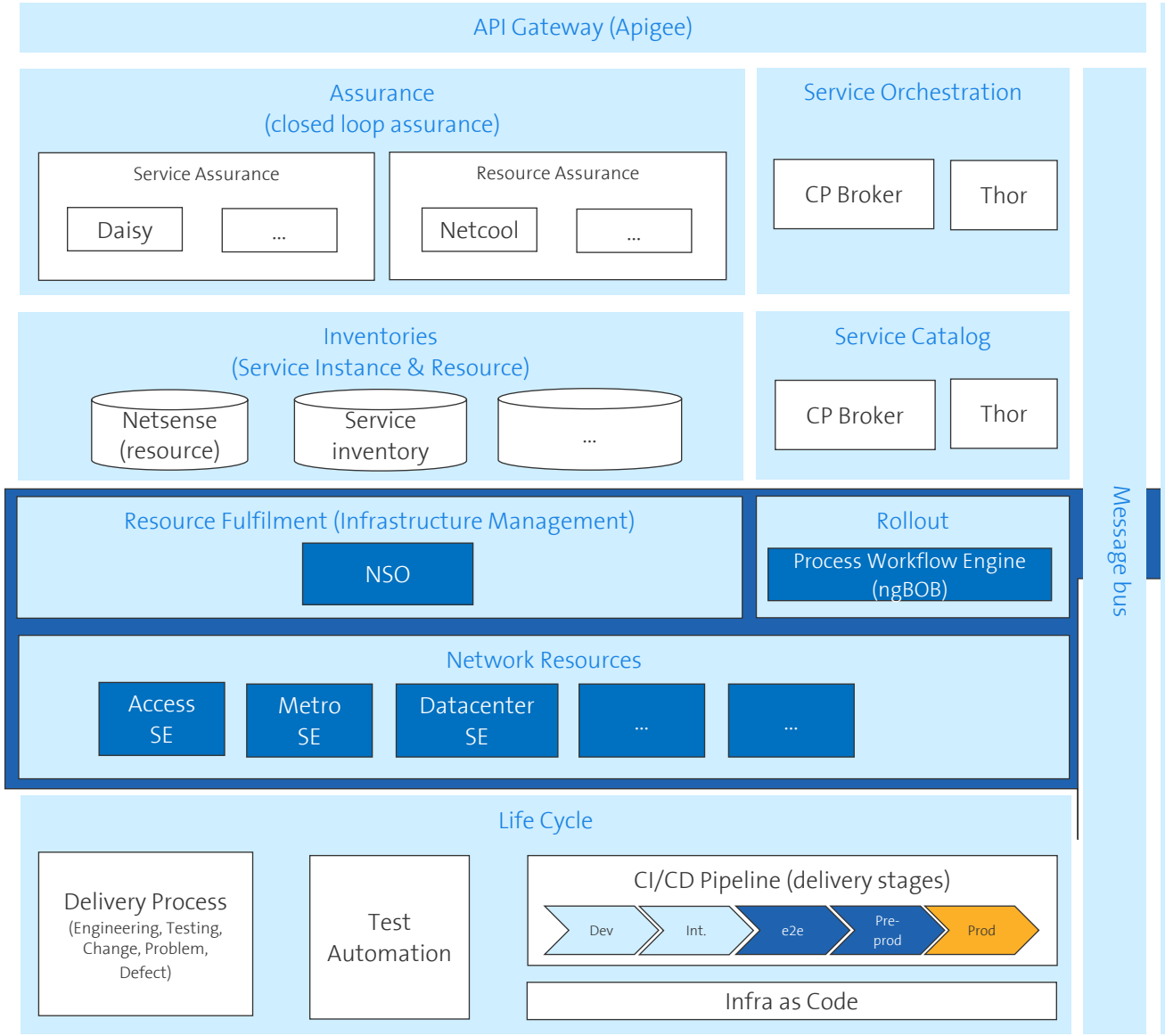
Technology
Test automation & CI/CD pipelines

Service modelling (NaaS)

Influences on our IP Transport ODM architecture

Panos
System Architect





„We would like to design a rollout process that is applicable and generic enough for the whole network“

- Simplify and automate the rollout process to avoid human errors
- Reduce the on-site engineering work by Field Service
- Decouple the work of the FS from the “back-office” engineers as this has high cost and complexity

Panos
System Architect

Day-2:
Plan and outline

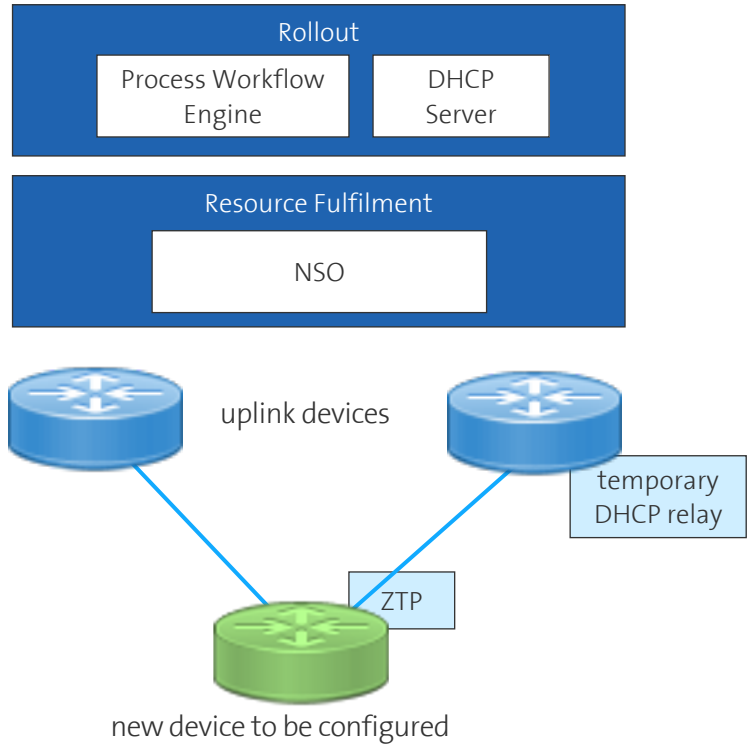
Day-1 (device preconfiguration):
Not necessary, we’ll use ZTP

Day-0 (connectivity):
Use ZTP to establish mgmt connectivity

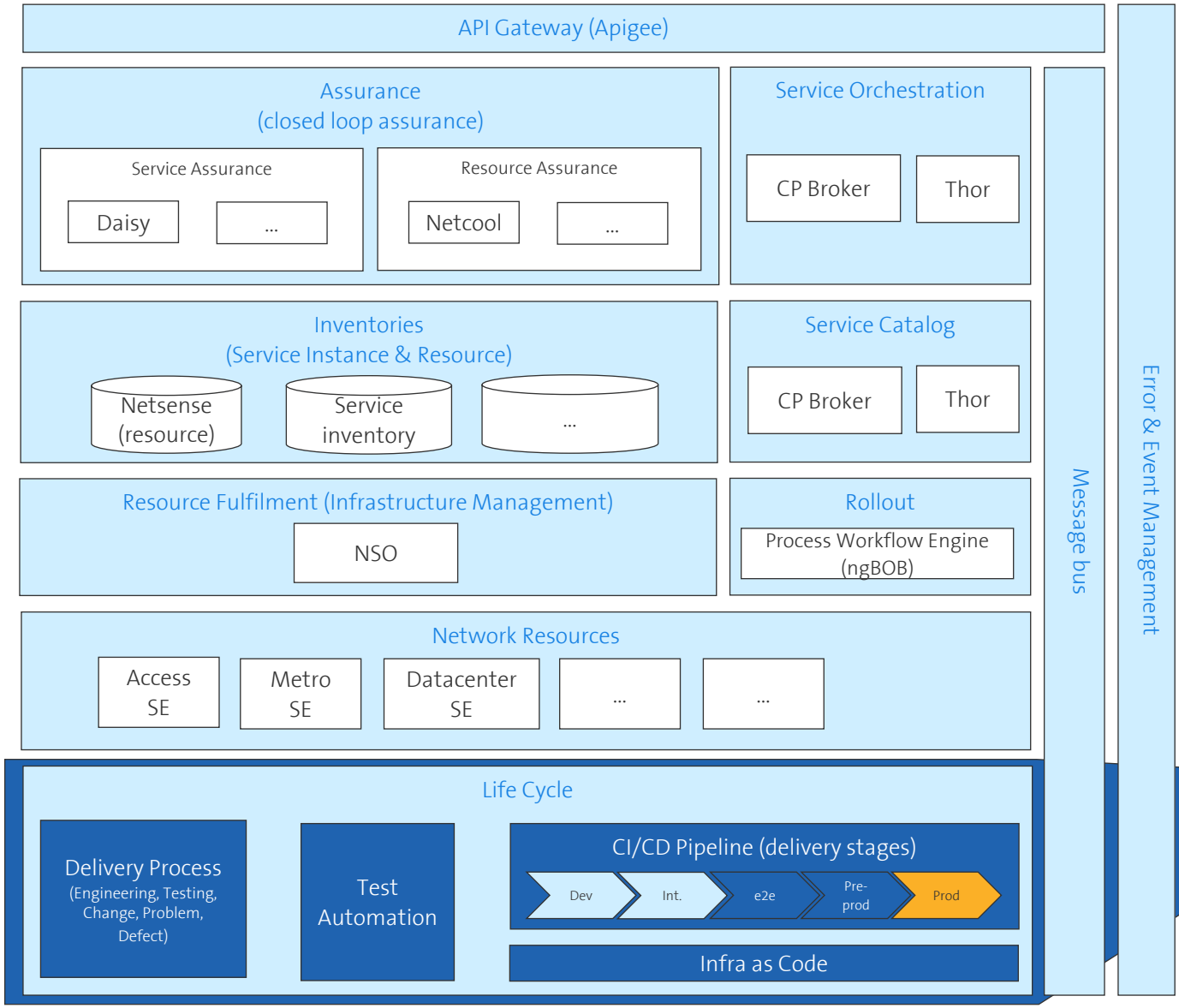
1. NSO configures uplink nodes for ZTP
2. New device is connected, receives temporary IP to be accessed by NSO
3. Firmware upgrade

Day-1 (base configuration):
Deploy final configuration and remove ZTP again

1. NSO deploys base config to new device and uplink nodes
2. NSO changes management IP from temporary to fixed inband management loopback
3. NSO removes temporary configuration on uplink nodes and new device



Influences on our IP Transport ODM architecture



René
Delivery Methodology Evangelist

Delivery & Release Process Definition

Stages and Automation support the overall process

René
Delivery Methodology Evangelist

Delivery Process

Solution Backlog → Solution / Domain / Platform Development → Stakeholder Acceptance Testing → Production Rollout Preparation → Production Pilot / All Production Sites

- Solution / Domain / Platform Development: Release Backlog → Sprint Backlog → In Development → Unit Tests → Automated Acceptance Tests (AT) → Demo
- Stakeholder Acceptance Testing: Autom. AT → Stakeholder Testing
- Production Rollout Preparation: Autom. AT → Operation Testing
- Production Pilot / All Production Sites: Autom. Sanity Tests

High frequency, requires high automation

Environments & Delivery Automation

Environment Stage	Dev	Dev Test Labs	Integration Labs	E2E Labs	Pre-Production Labs	Production
	GIT Checkins	Automated	Environment Manager	Environment Manager	Change Board	
	Development Virtual	Development Constant Automatic Updates Virtual Unit Tests	Development Constant Automatic Updates Production Like Setup Viable Acceptance Tests	NEW Release Candidate Updated at the end of a Sprint or PI Production Like Setup Acceptance Tests	PRODUCTION Release Updated before Production Rollout Production Like Setup Acceptance Tests	PRODUCTION Release Updated upon Rollout Production Non impacting Sanity Tests

IP Transport (Sample Domains)

- Fulfilment Stack (NSO) Pipeline
- Assurance Stack Pipeline
- Transport Network Pipeline

Integration Lab "Integration" Pipeline → Execute Acceptance Tests

E2E Lab "E2E" Pipeline → Execute Acceptance Tests

Pre-Production Lab "PreProd" Pipeline → Execute Acceptance Tests

Production "Prod-All-Sites" Pipeline → Execute Non Service affecting Acceptance Tests

Other domains are simulated / stubbed / mocked if required

Connectivity

Acceptance Tests against "real" remote platforms

Connectivity

B2C Services (Sample Domains)

- Fulfilment Stack (NSO) Pipeline
- Assurance Stack Pipeline
- BNG Pipeline

Integration Lab "Integration" Pipeline → Execute Acceptance Tests

E2E Lab "E2E" Pipeline → Execute Acceptance Tests

Pre-Production Lab "PreProd" Pipeline → Execute Acceptance Tests

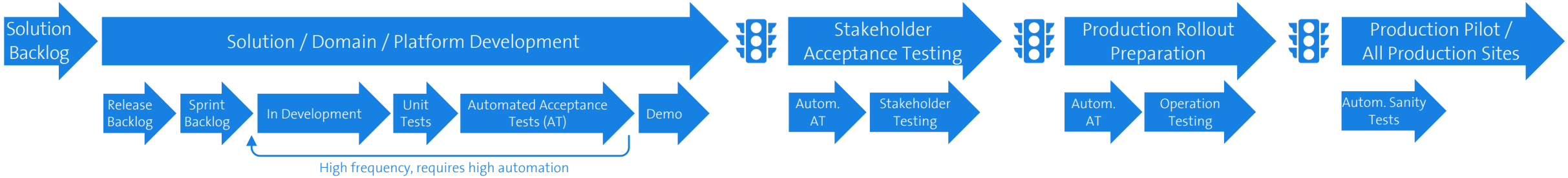
Other domains are simulated / stubbed / mocked if required

Delivery & Release Process Definition

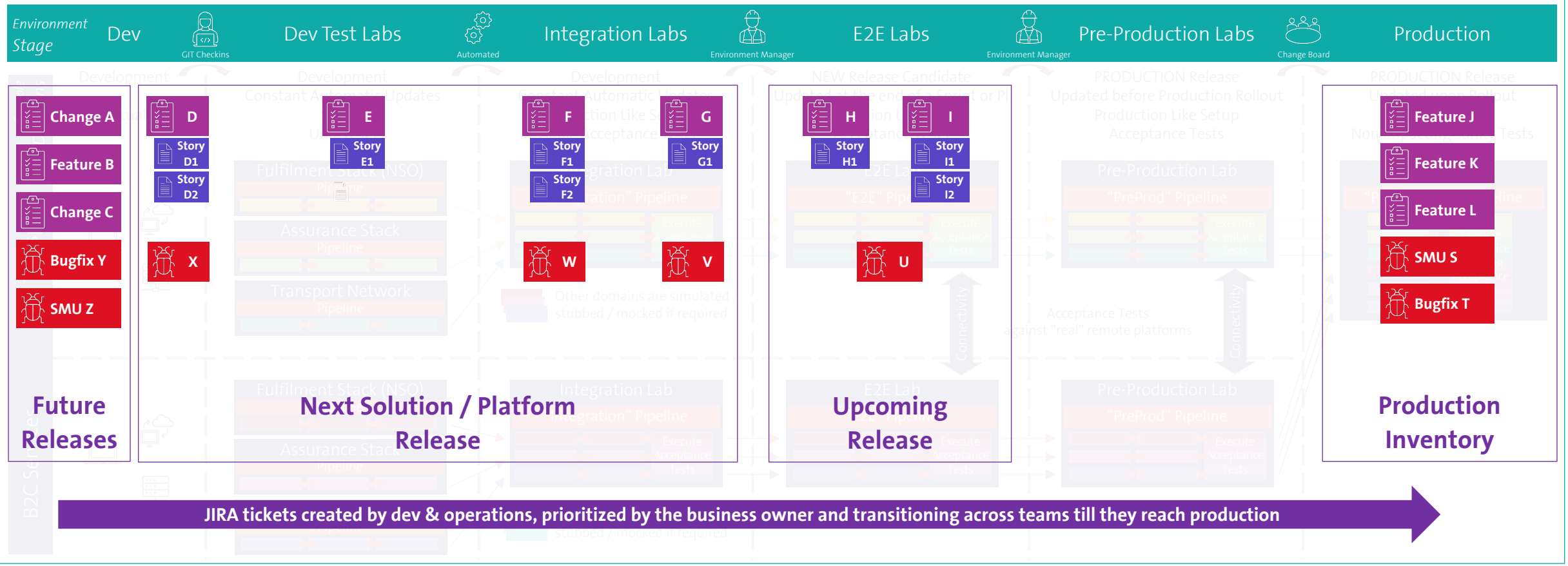
Stages and Automation support the overall process

René
Delivery Methodology Evangelist

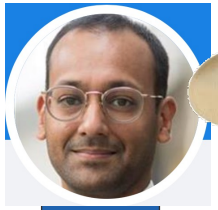
Delivery Process



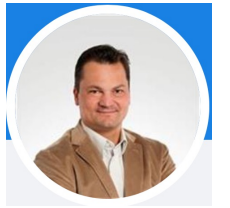
Environments & Delivery Automation

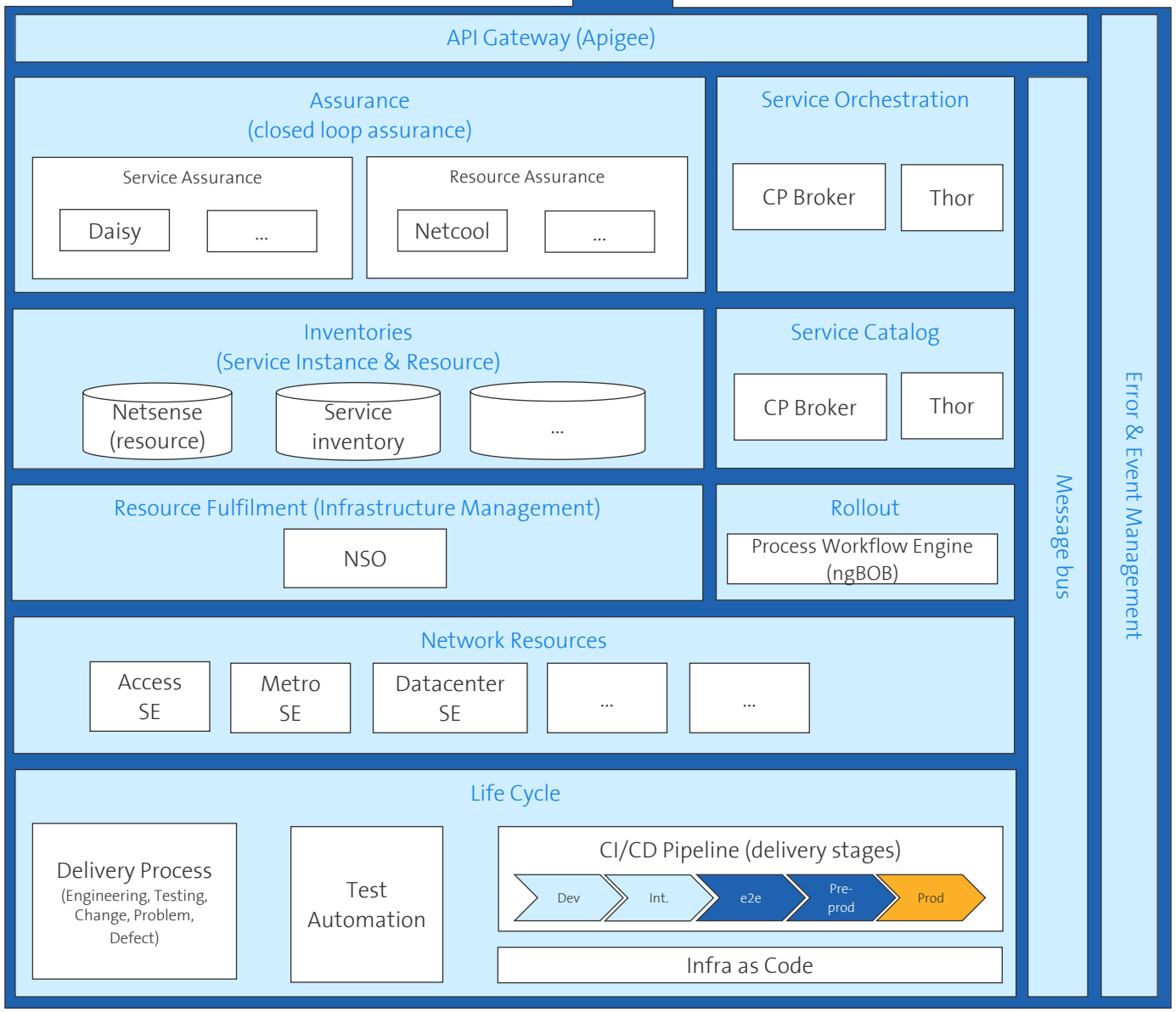


Influences on our IP Transport ODM architecture



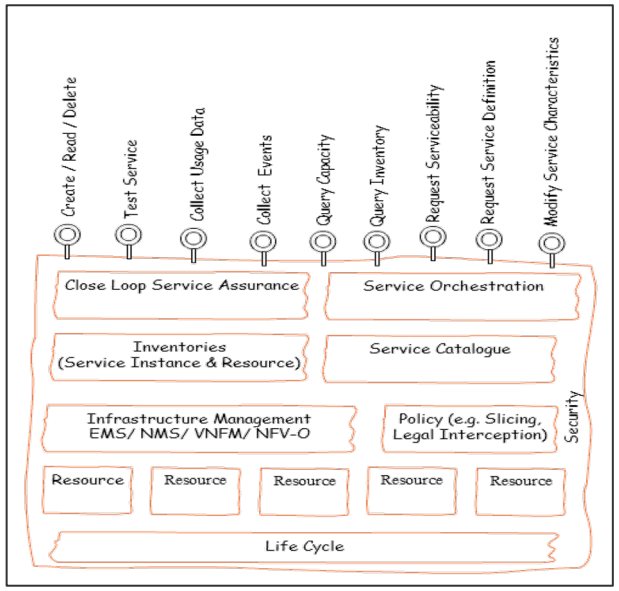
Rudolf
Solution Architect

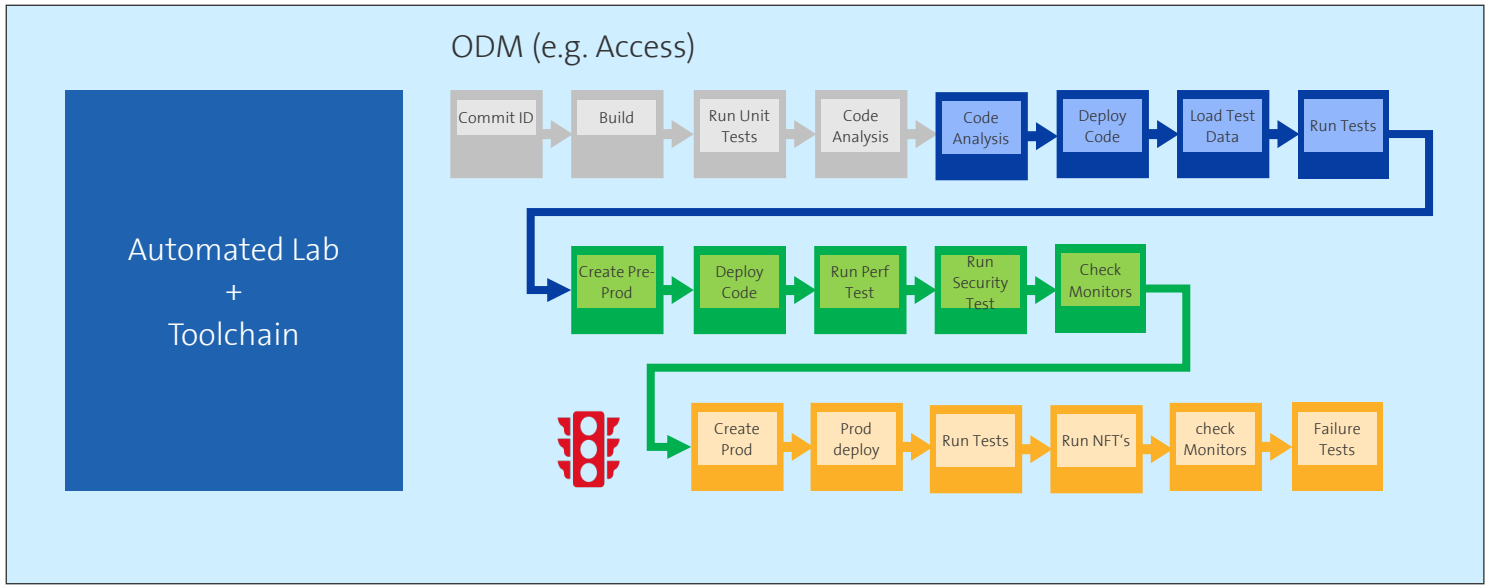




«We follow the TMF Definitions for structuring our domains (ODMs)»

Rudolf
Solution Architect





- DevOps expertise and responsibility per ODM
- CI/CD/CT per ODM
- Service and resource management, monitoring, etc. per ODM
- High cohesion / low coupling per ODM
- Separate release cycles of each element belonging to an ODM

Network as a Service (NaaS) manages the life-cycle and dependencies of capabilities managed by Operational Domains (ODMs)

Rudolf
Solution Architect

Products and services correlation / further integration in OSS / BSS

SLO, Network Service API, Service management

Here the service is exposed as a single integration point

NaaS (e.g. Basic Connectivity, Service Connect)

Automated Lab + Toolchain

Here the Domains capabilities are exposed as APIs

Life-cycle and dependency management of composite service

ODM (e.g. Access)

Automated Lab + Toolchain

ODM (e.g. Transport)

Automated Lab + Toolchain

ODM (e.g. Edge)

Automated Lab + Toolchain

North Star

« NetDevOps is the result when all processes in network development and operations are consolidated and automated.