

# General Trends on Testbeds for 5G & Beyond; Testbed Federation Use Cases

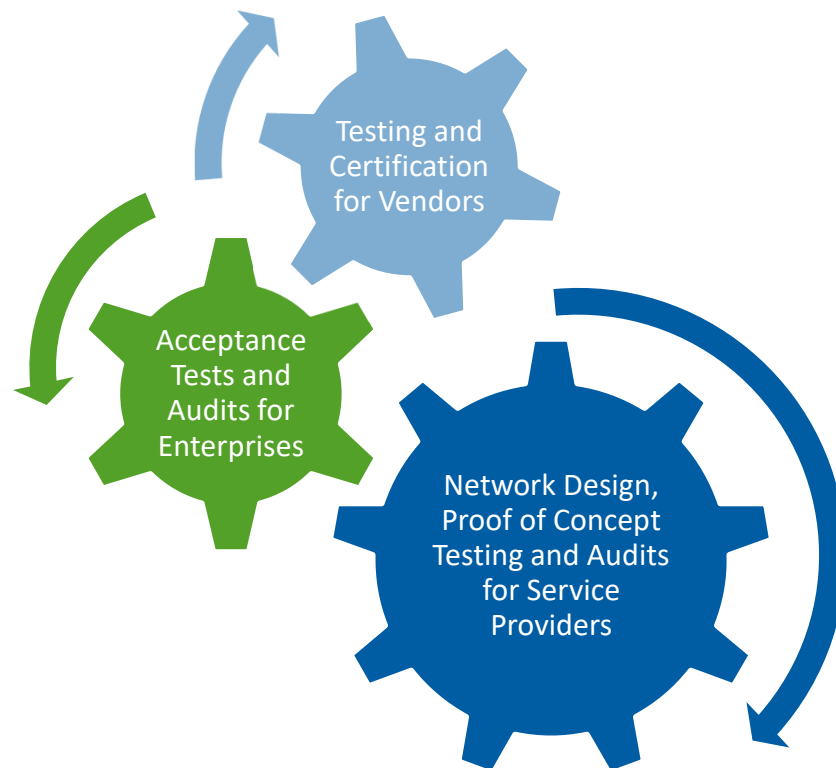
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# About the European Advanced Networking Test Center



- Independent and vendor-neutral test lab since 1991, commercial since 1999
- Covering fixed and mobile technologies, focusing innovations such as 5G, Open RAN, SDN, NFV, next-gen network security
- Emulating fully realistic large-scale scenarios representative for CSP / MNO deployments
- Adhering to highest quality standards and actively participating in test methods standardization

◆ *redefine the possible* log in. berlin.



# Telecom Testing Today

## Operator Requirements and Messages Voiced in Standardization Process

- Agile DevOps model
- Mastering QA process and content
- Coordinated test procedures
- Automated testing environments
- Continuous regression testing

-> All of these are preconditions for federated test beds

## Reality in CSPs and MNOs Engineering Departments (in many cases)

- Waterfall model both in procurement and implementation
- Outsourcing large parts of QA cycle; implicitly relying on large manufacturers' QA processes
- Almost always manual test sessions
- Infrequent testing cycles, mostly at RfI / RfP time

# Telecom Technology Challenges for Quality Assurance

## Network disaggregation

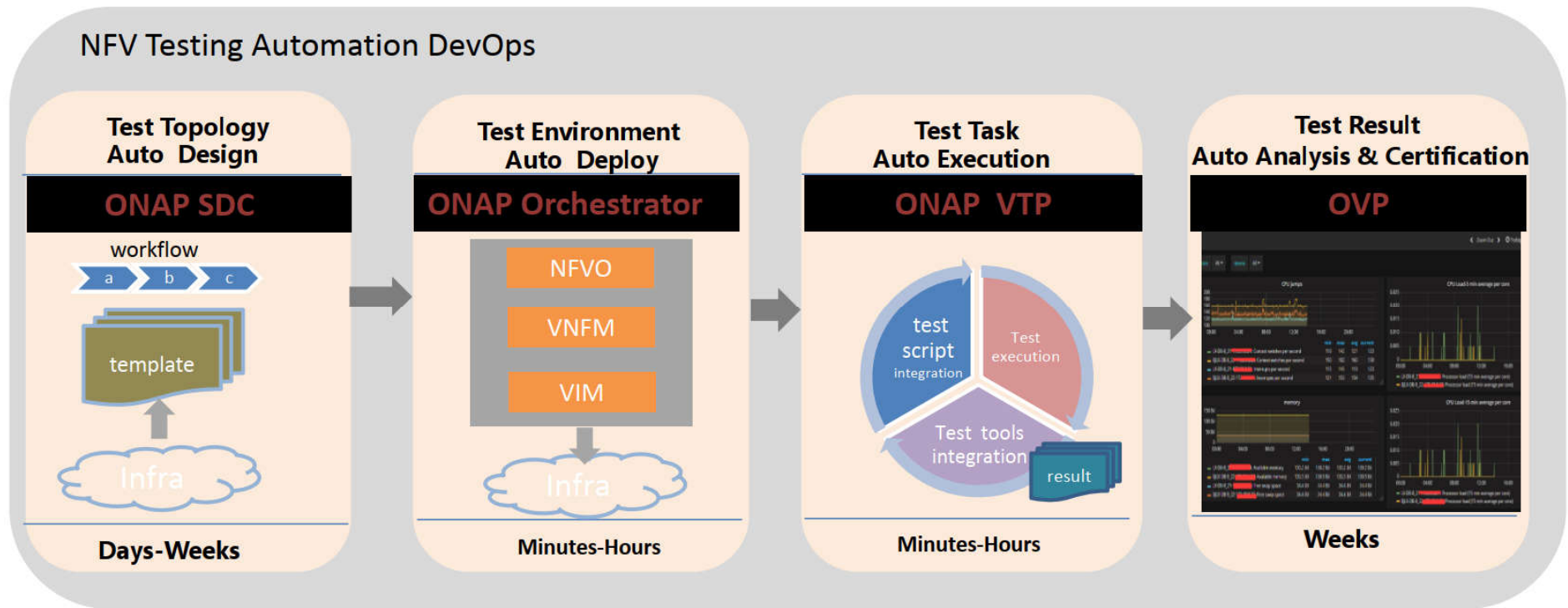
- 5G Service-based architecture
- Network functions virtualization (NFV)
- Multi-layer management of Software-Defined Networks (SDN)
- Open RAN: Radio network disaggregation
- Broadband access: Control and user plane separation
- Cloud and Edge computing: distributed workload placement

## Network application (NetApp) integration

- 5G NetApps require tight integration with network layer
- Extremely diverse application space, domain-specific QA

What is Possible Today?

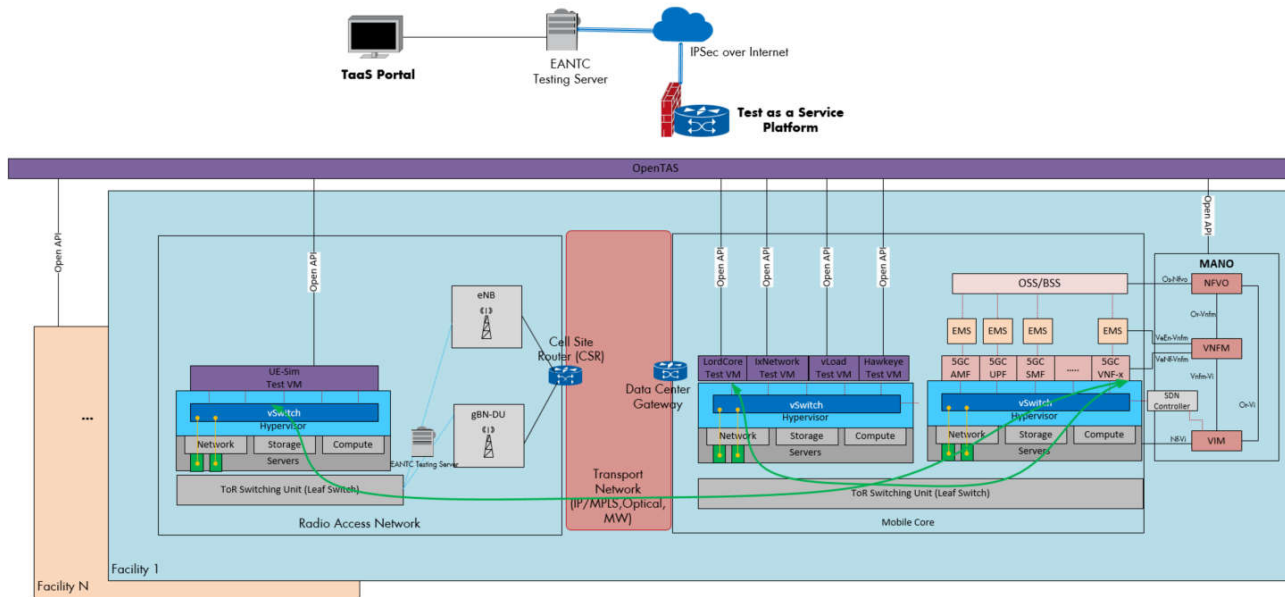
# Network Virtualization Layer Automation



Source: Test Automation DevOps and CI/CD, China Mobile, LFN April 2020 Virtual Technical Event

## What is Possible Today?

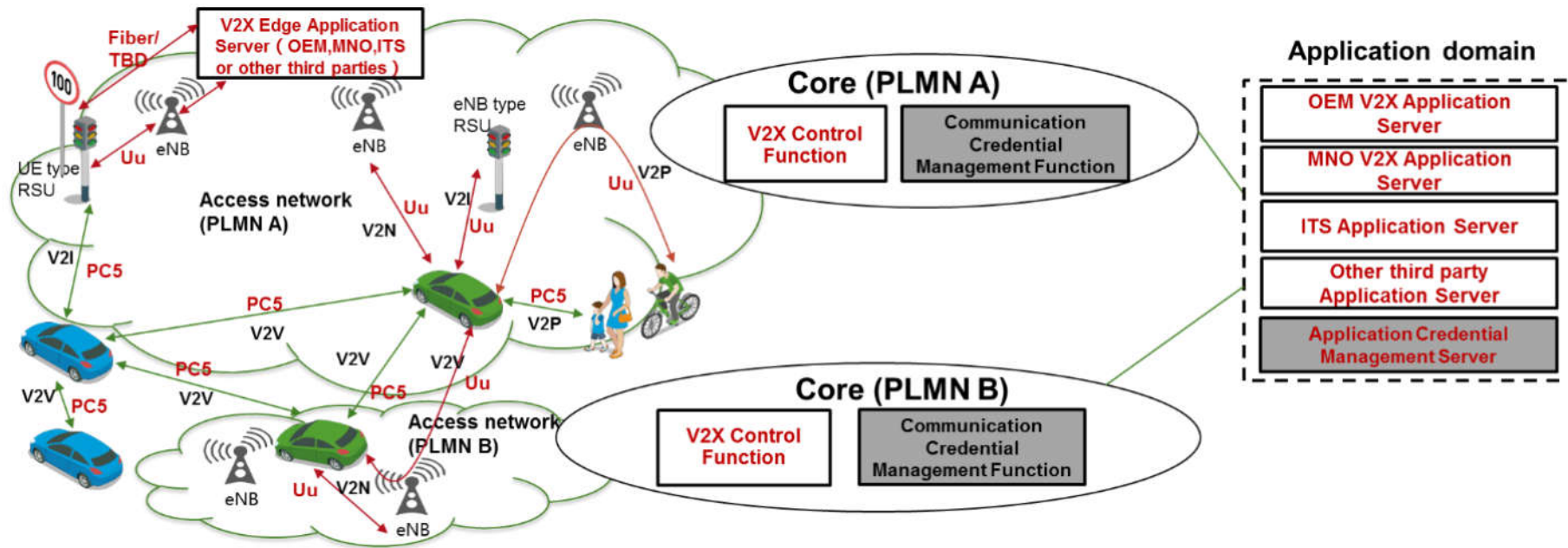
# 5GVINNI: Example of 5G Network Layer TaaS



- 4 Main Facilities
- Common test orchestration
- End-to-end tests 5GC, RAN, NFV platform, services
- Automation of functional and performance tests

## NetApp Integration Challenges

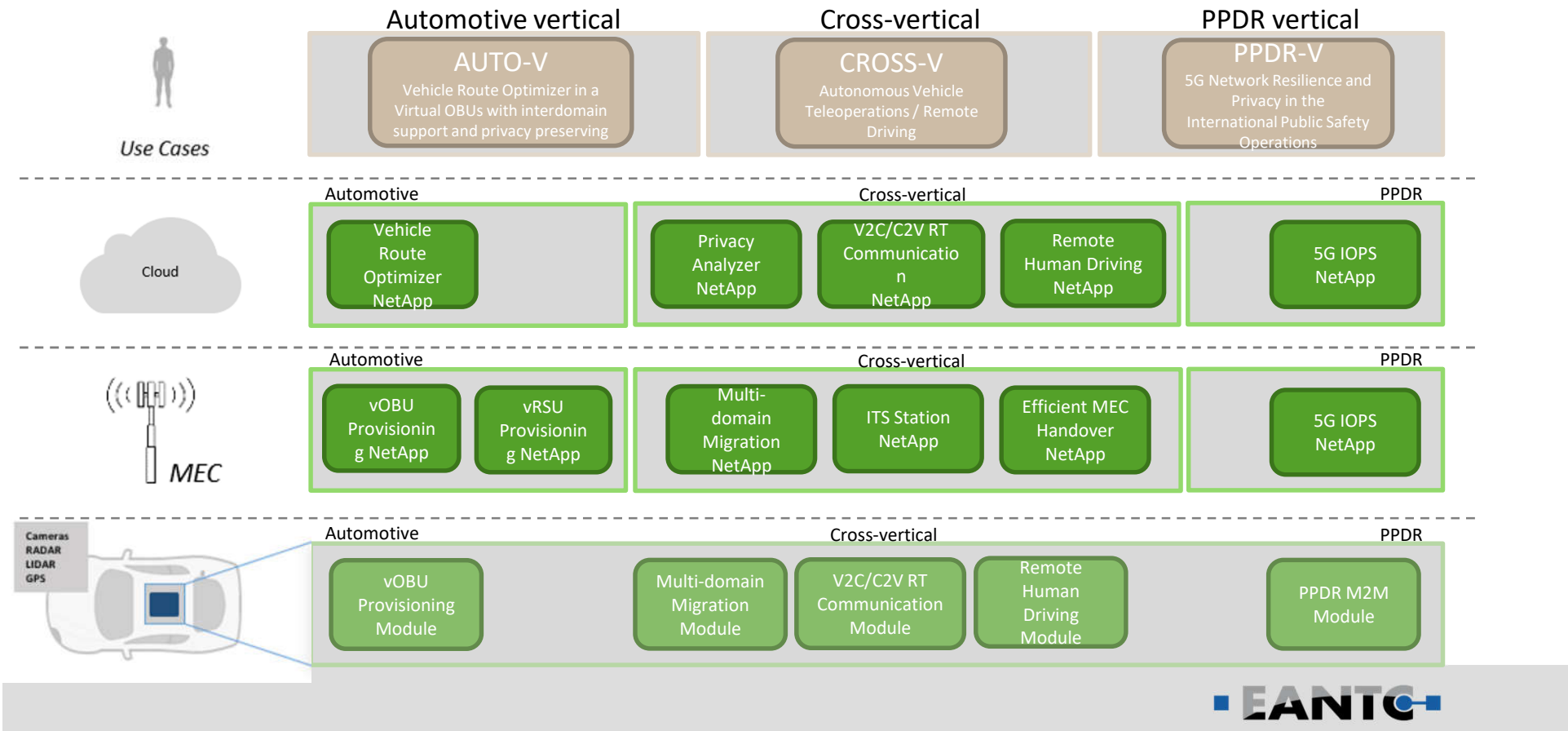
# V2X – Example of NetApp Architecture



Source: NGMN V2X White Paper v1.0, 17-06-2018

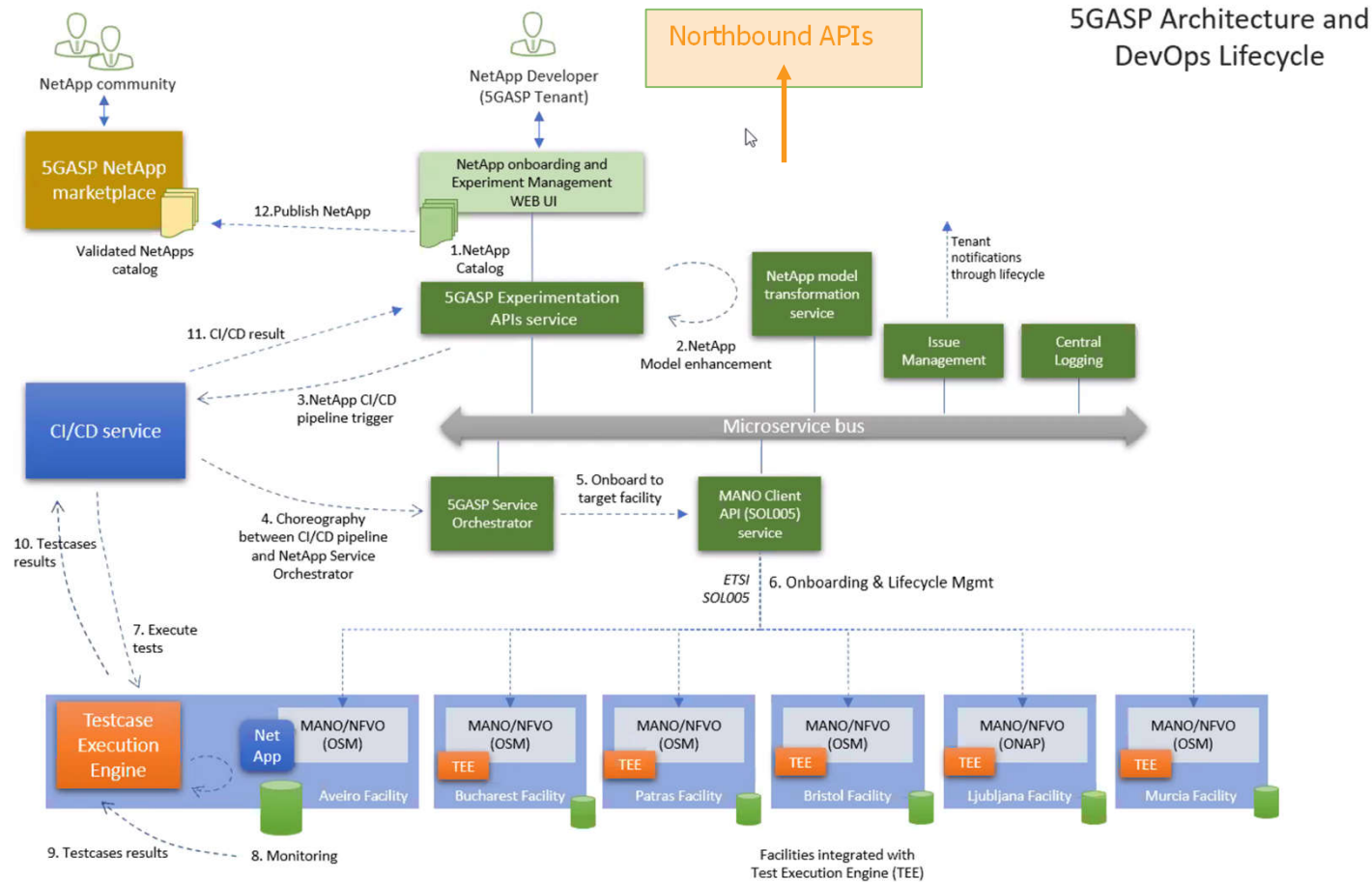
# NetApp Integration Challenges

## 5GASP NetApp Deployment Architecture



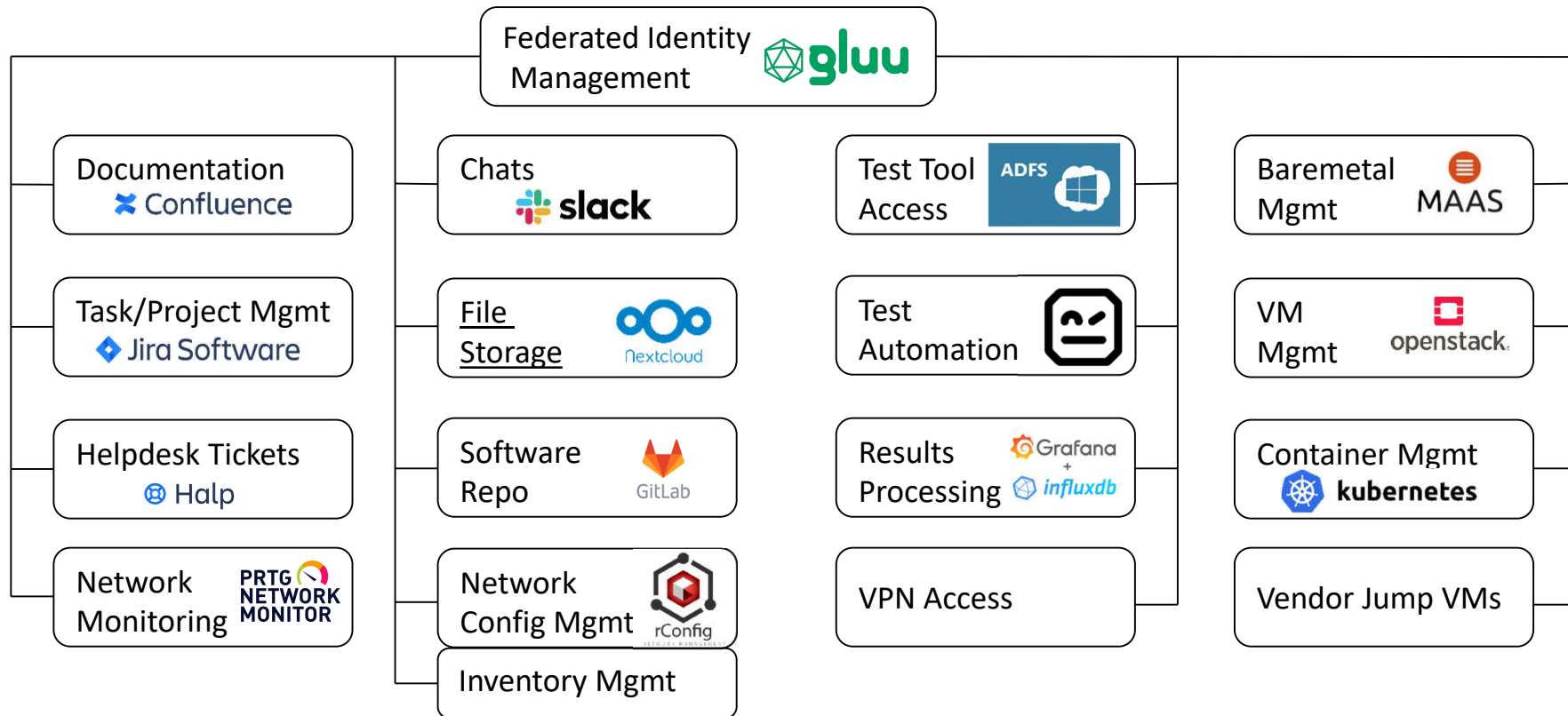


# 5GASP QA Architecture and DevOps Lifecycle



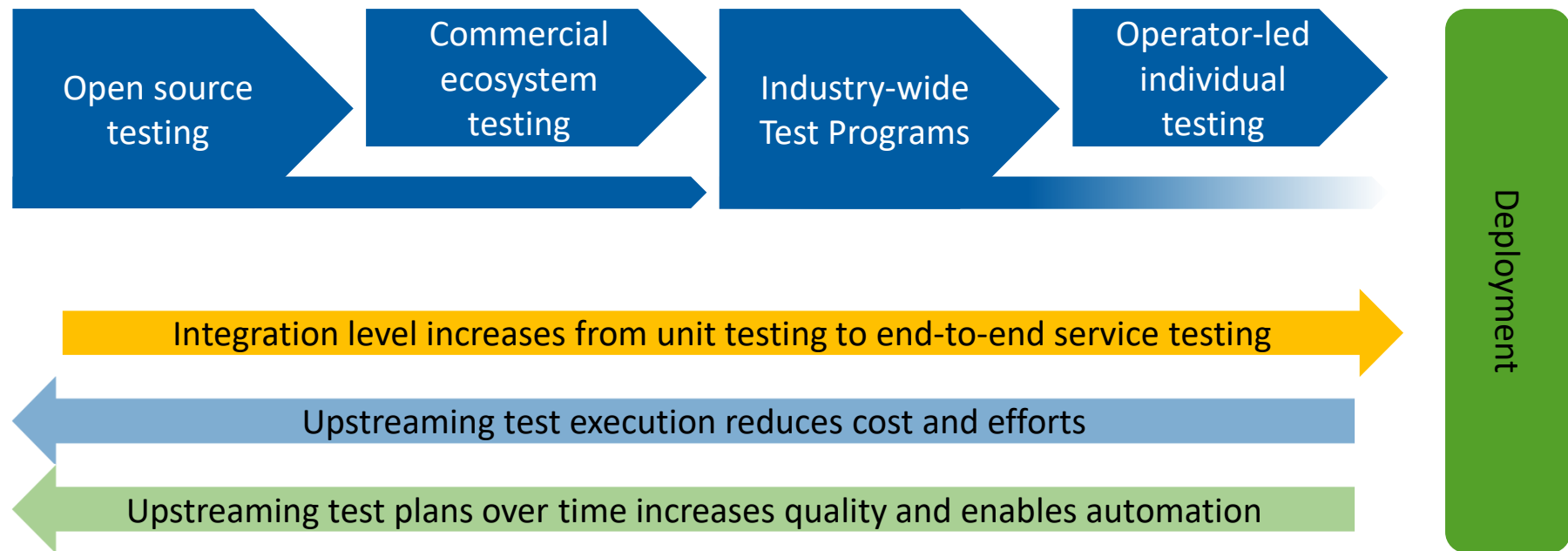
# What Makes Lab Testing Efficient?

## Sample Environment

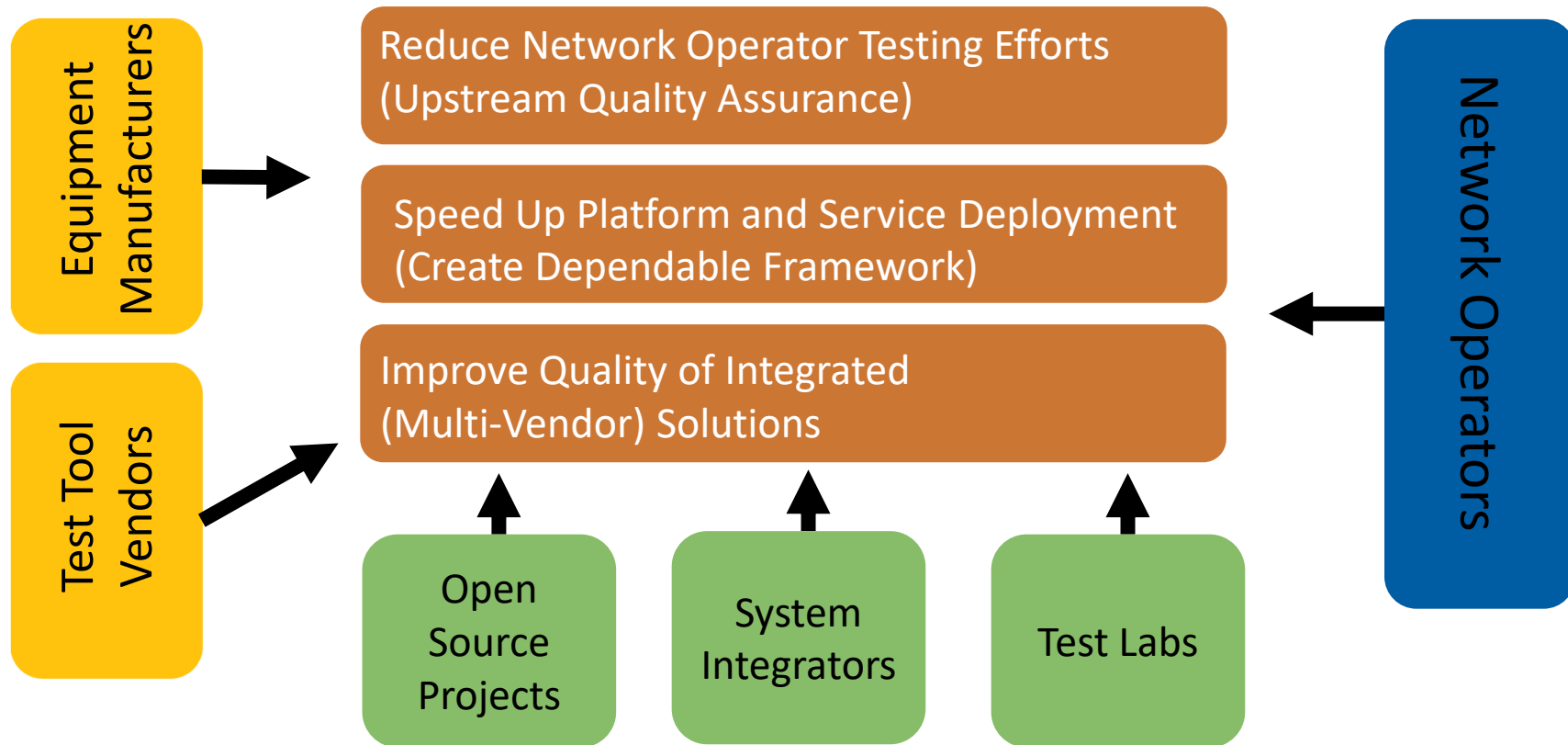


## Different View on Test Bed Federation: Testing Integration Pipeline

Collaboration of all stakeholders provides benefits to improve quality assurance



# Why Certification?



## Certification Programs – Goals of Industry Parties

- All of these are valid reasons; however, they are in conflict

Industry Group	Goals
Manufacturers	Recognize product quality as marketing differentiator Enable customer short-listing in RfP responses Keep requirements low and support self-certification to avoid barrier to sales
Network operators	Rely on certificates as an RfP selection criteria Offload internal testing efforts Buy off-the-shelf test tools implementing automated certification procedures
Test tool vendors	Implement certification test procedures as part of products Focus on test tool strengths as competitive differentiation
Test labs	Conduct certification testing as a service Keep requirements high to provide real benefit to operators Interest in 3rd party certification rather than self-certification

## Summary

- Network layer testing automation is progressing well
- Application layer (NetApp) integration is challenging
- Telco industry has not adopted standards for test automation and federation yet
- Some telco industry forums focus on certification or badging programs for marketing rather than technical reasons

EANTC suggestions for standards bodies and industry forums:

- Increase peer review and industry buy-in for important standardization efforts
- Lead and improve focus on technology-specific QA goals (quality awareness)

# Thank you for your interest!

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