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5G programmability and development of Network Applications (NetApps)

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Project Approach

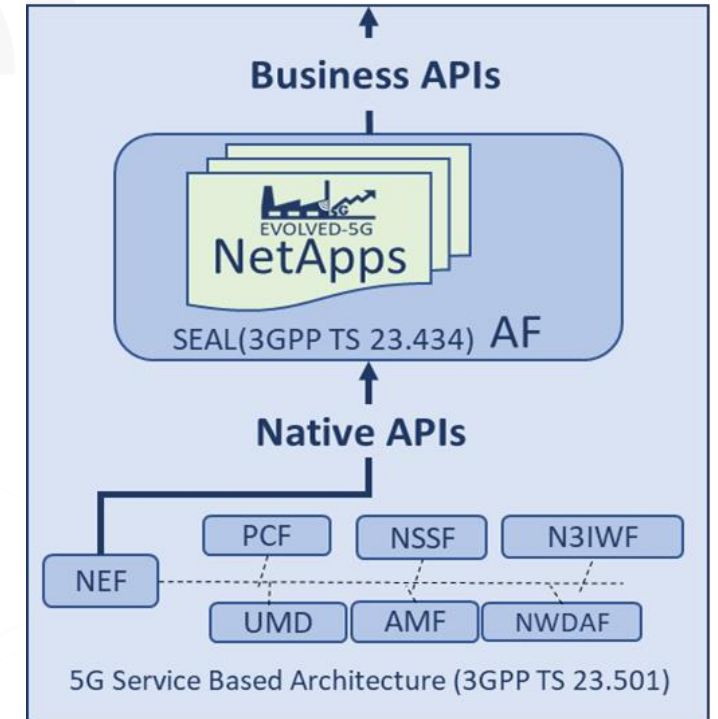


NetApp Definition

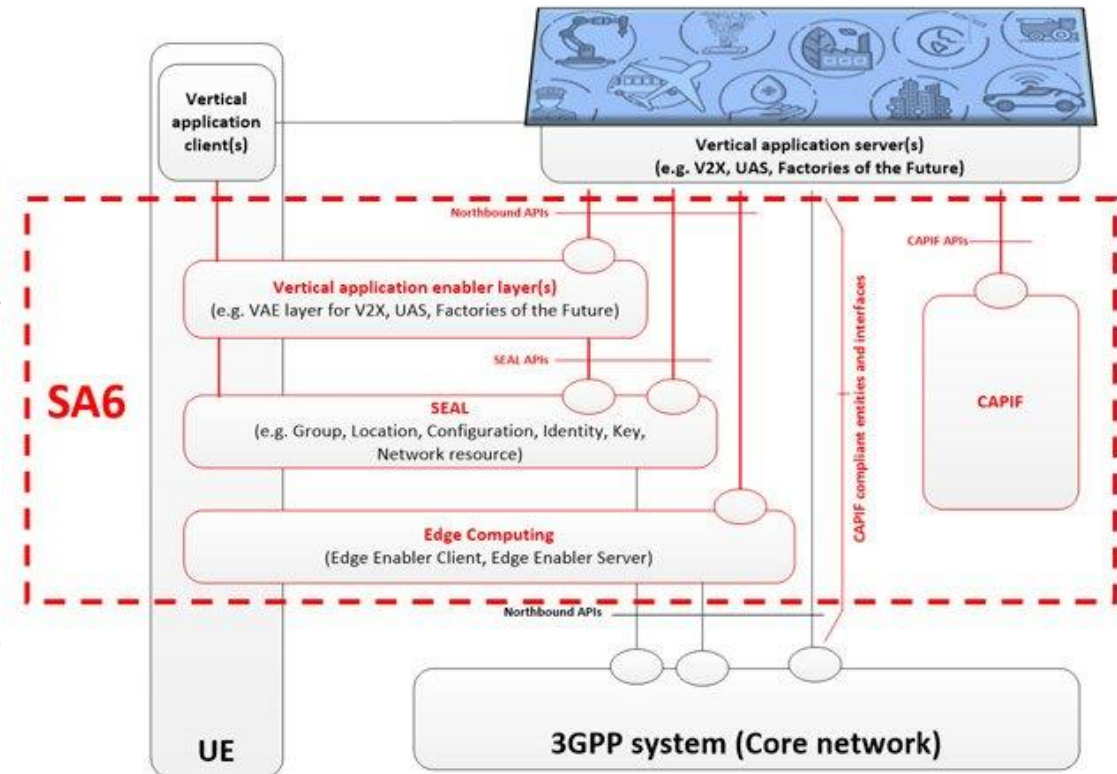
- **NetApp is a microservice that “consumes” 3GPP core network APIs (e.g., native APIs NEF/SEAL/CAPIF) or other telco APIs (e.g. MEC APIs, resource management APIs).**
 - For example, a NetApp could consume APIs that provide monitoring events and network slice configuration analysis to compose a service that guarantees quality of experience for latency-sensitive applications.

Towards a NetApp ecosystem

- It refers to the request for a separated middleware layer that will
 - Simplify the implementation and deployment of vertical systems at large scale (vertical friendly interaction with 5G)
 - Provide the required adaptation for enabling vertical apps on Non-Public 5G Networks
- It responds to the same request that triggered the development of Vertical Application Enablers (VAE) by 3GPP SA6



- Incorporation of standard exposure capabilities of 5G networks
 - NEF
 - CaPIF (3GPP TS 22.261)
 - SEAL (3GPP TS 23.434)
 -



EVOLVED-5G embraces the potential of the emerging NetApp ecosystem for NPN-5G by developing..

- An open 5G experimentation facility that exposes standardized APIs to verticals and allows for NetApp validation (*Objective 1*)
- A DEVOPS pipeline for third-party programmers to design and develop NetApps (*Objective 2*)
- A NetApp Certification process and a related Marketplace where certified NetApp are published. (*Objective 3*)

..the ecosystem will allow for

- The development, validation, and publication of innovative NetApps related to the Industry 4.0 solutions of the onboard SMEs (*Objective 4*)
- Quantifying the performance and the flexibility that 5G provides (*Objective 5*)
- Maximising the technological fingerprint and the business potential expected from the integration of 5G in manufacturing, through targeted actions (*Objective 6*)

EVOLVED-5G Overall concept

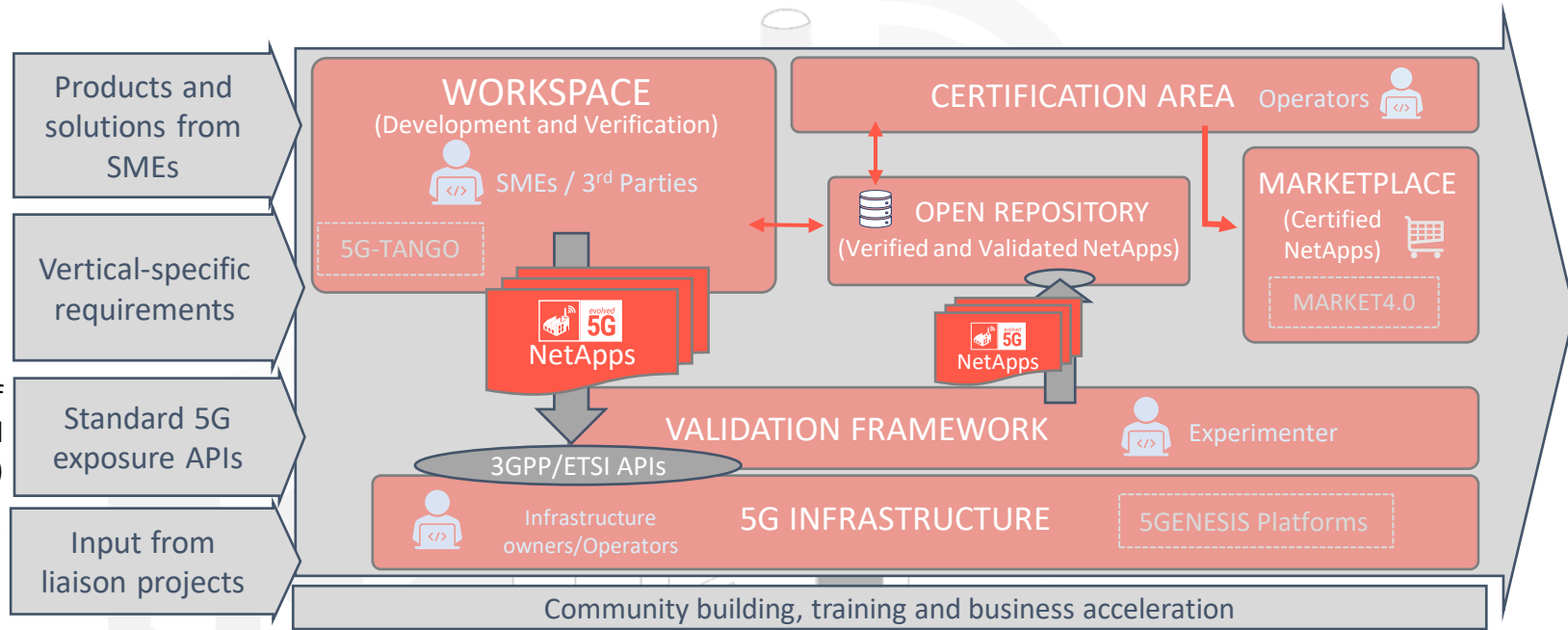


11 SMEs grouped in 4 **Industry 4.0 – related pillars** bring their vertical apps

The Project targets **5G NPN** for the **Industry 4.0** sector with FF-specific use cases

5G-Enabled vertical apps with the aid of **NetApps** that consume 5G core Northbound APIs (and MEC APIs from the edge)

NetApp development environment from 5G TANGO, validation framework from 5GENESIS and Marketplace design from MARKET 4.0



IEA (EVOLVE Global) and supporting organizations: Code.Hub, MIT Enterprise Forum, Lefkippos Technology Park, Eurada.



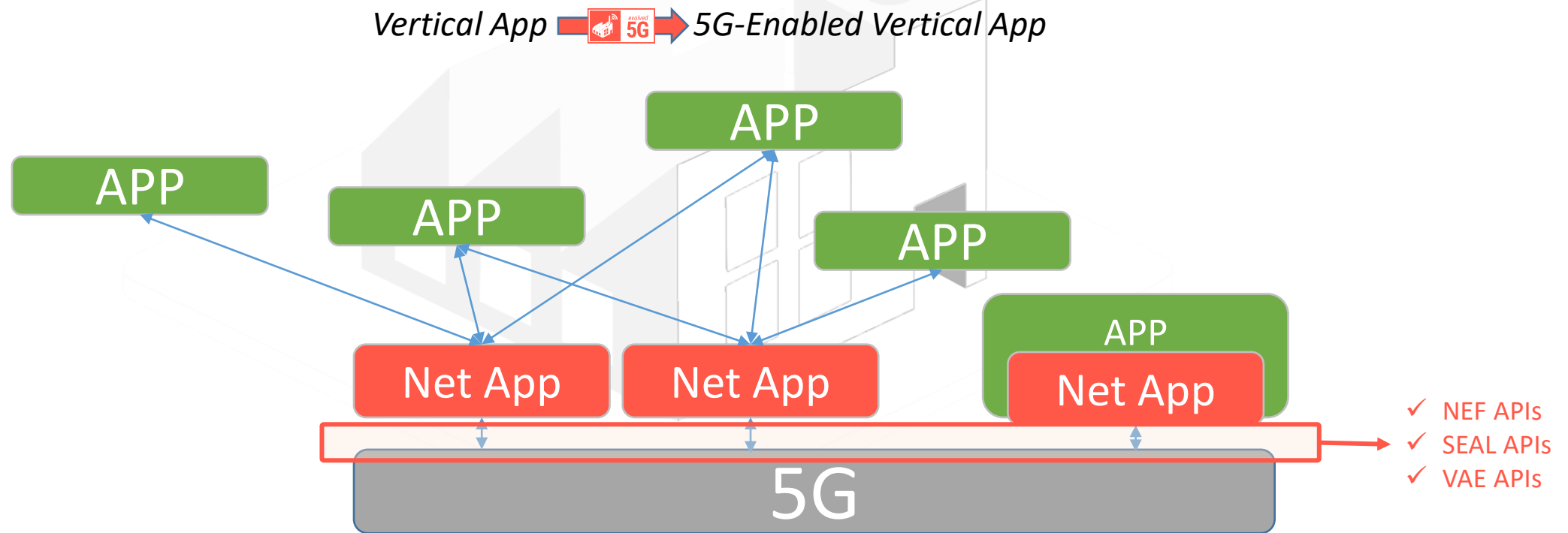
EVOLVED-5G NetApp and FoF applications



| FoF Pillar | FoF Applications | 5G Core APIs consumed by FoF NetApps (3GPP TS 29.122) |
|---|--|---|
| Innovation in the interaction of employees and machines | IMM: Mixed Reality (MR) assisted manufacturing INF: Intent-driven Chatbots for precise maintenance GMI: Haptic-driven console for industrial surface repairing | Monitoring Event Configuration Device Triggering Group Message Delivery Network Parameter Configuration Application Server (AS) session setup with required QoS |
| Efficiency in FoF operations | ININ: IoT/M2M-based remote monitoring platform CAF: AI based video analyzer for industrial and robotics safety QCOM: ML-driven anomaly detection for Industrial Processes | Monitoring Event Configuration Resource management of Background Data Transfer Non-IP Data Delivery Reporting of Network Status Communication Pattern Parameters Provisioning Network Parameter Configuration Application Server (AS) session setup with required QoS |
| Security guarantees and risk analysis | 8BELLS: L7-aware Whitebox Switch with Dynamic SFC and TSN Support FOGUS: Security information and event management system IQBT: Blockchain broker | Monitoring Event Configuration Reporting of Network Status Communication Pattern Parameters Provisioning Packet Flow Description Management Network Parameter Configuration Application Server (AS) session setup with required QoS |
| Agility in the production line infrastructure | PAL: AI-driven Humanoid robot UNM: AI-driven logistics robotic fleets | Monitoring Event Configuration Resource management of Background Data Transfer Non-IP Data Delivery Device Triggering Group Message Delivery Reporting of Network Status Communication Pattern Parameters Provisioning Application Server (AS) session setup with required QoS |

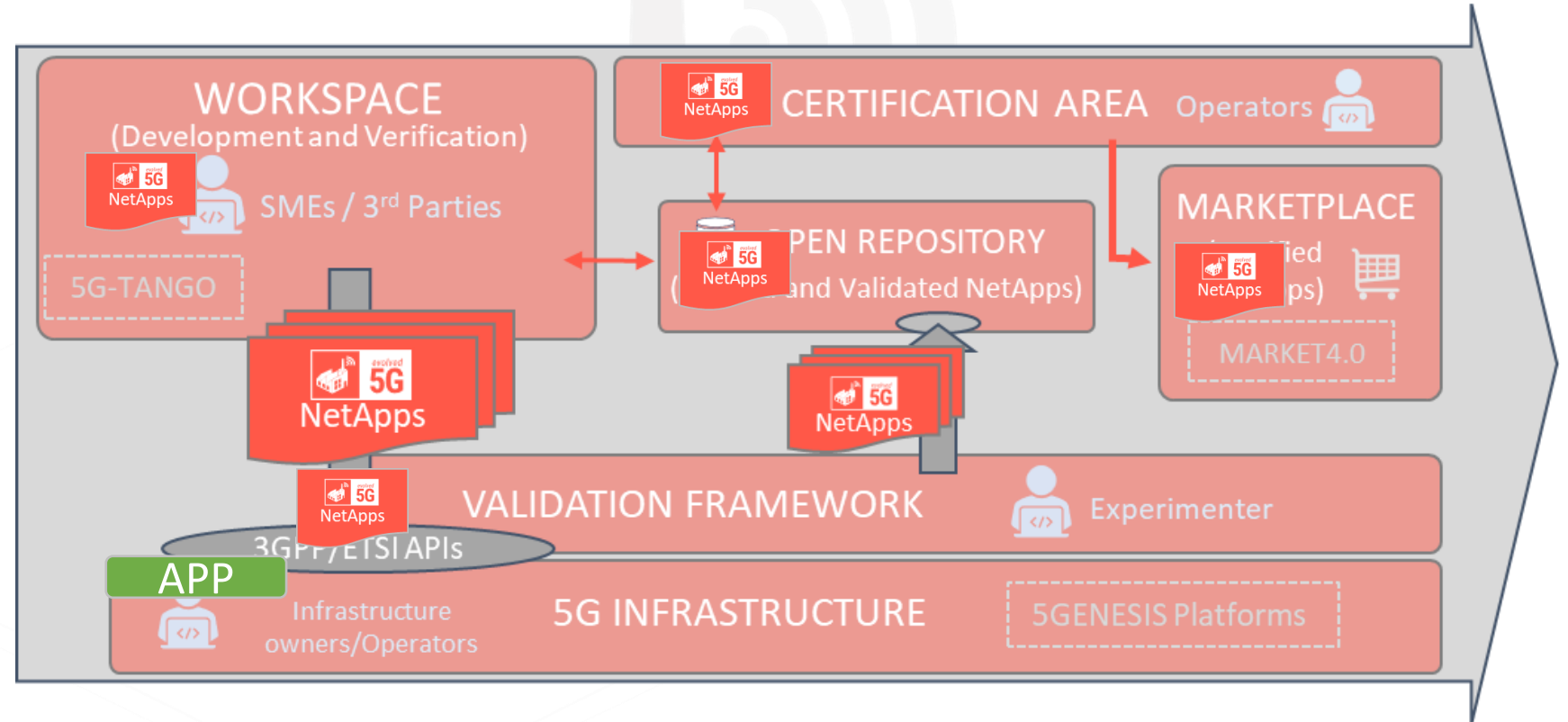
Vertical App – NetApp relation

- Each EVOLVED-5G SME will develop a companion NetApp to their respective App, which will be reused by other SMEs in the same field for making their applications 5G-aware.



NetApp lifecycle

- Development & Verification
 - *Any method that will ensure that a program will do exactly what it is supposed to do.*
- Validation
 - *Experimentation on top of 5G infrastructure of the App and Net-App proper interaction*
- Certification & Publication
 - NetApp evaluation process as pre-commercialization testing, and release at the Marketplace



Key Achievements



EVOLVED-5G Achievements (M1-M16)



- Clear approach regarding NetApps and NetApp ecosystem (well perceived in 5GPPP)
- Functional architecture completed – The implementation view is added
- Major tools that compose the EVOLVED-5G facility are now mature and some of them have been released
 - ✓ Release A of EVOLVED-5G workspace
 - ✓ Release A of EVOLVED-5G SDK
 - ✓ Release A of NEF emulator (Location and QoS Mon supported)
 - ✓ Release A of CAPIF emulator
 - ✓ Release A of EVOLVED-5G NetApps
 - ✓ Release A of automated framework
 - ✓ Evolution of 5GENESIS facilities and experimentation methodology
 - ✓ Release A of EVOLVED-5G Marketplace

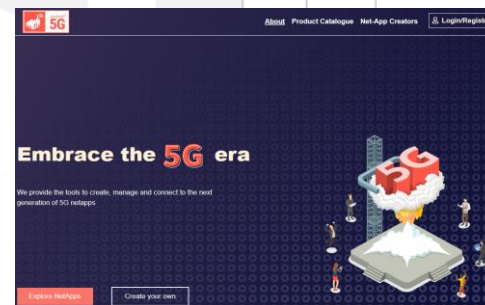
EVOLVED-5G Achievements (M1-M16)



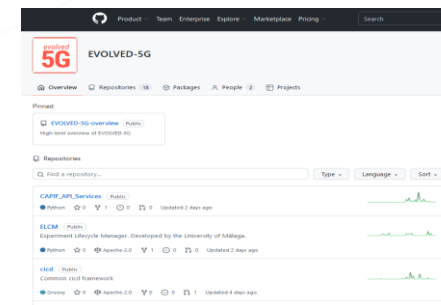
- The project-specific NetApps are being developed. A first version with all of them using the SDK is completed
- Training activities performed and hands-on training material is being prepared
- Community building strategy has been defined and relevant activities have been scheduled
- Dissemination and Communication activities are performed (active channels, EUCNC papers have been accepted)
- Standardization efforts are intense and have affect 3GPP SA6 work
- The engagements with other projects and 5GPPP is tight (e.g., WPs contributions to WG Arch and WG SoftNet, ICT41 Workshop proposal)



<https://evolved-5g.eu/>

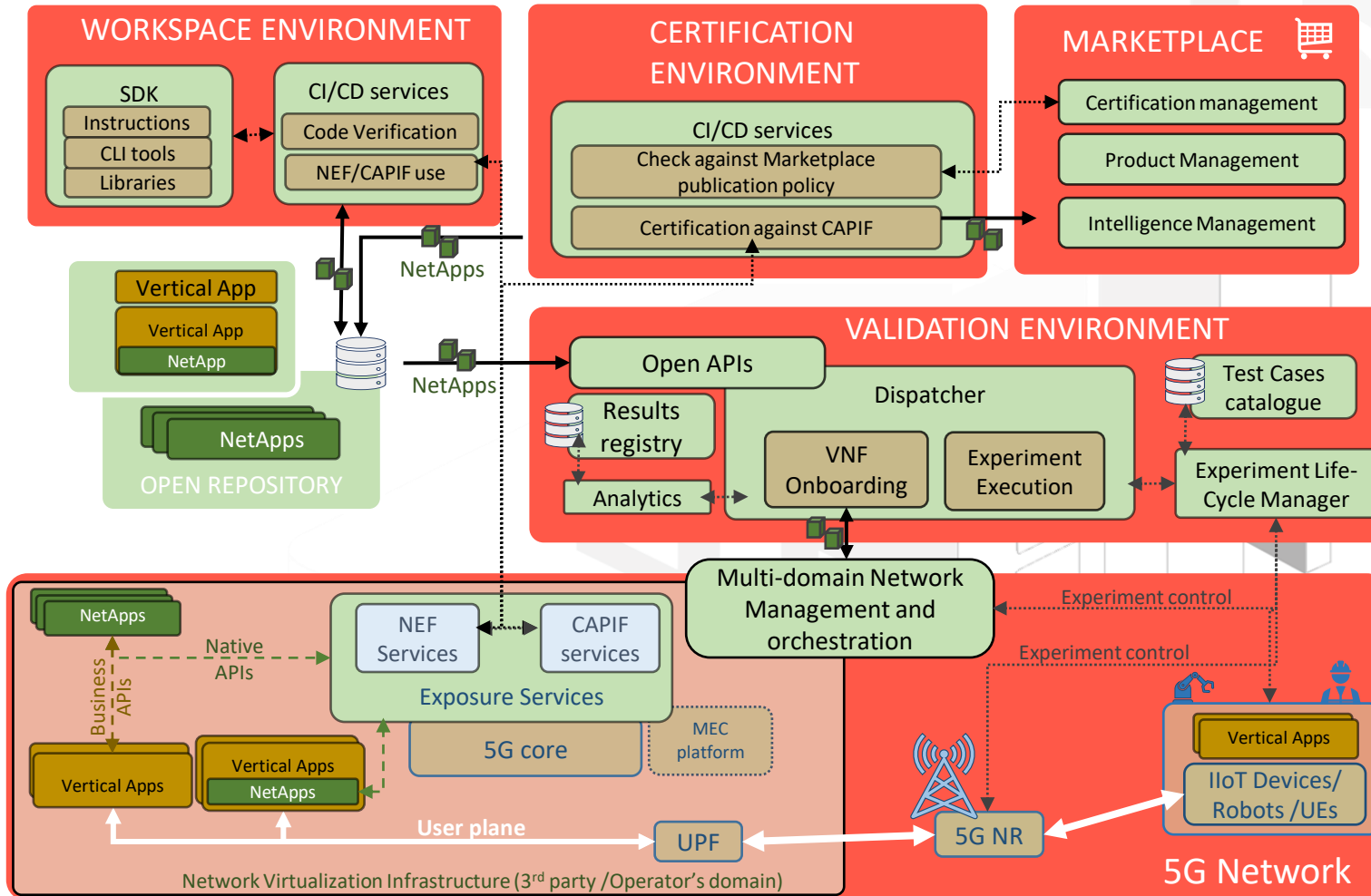


<http://evolved5g-marketplace.evolved-5g.gr/>



<https://github.com/EVOLVED-5G>

EVOLVED-5G Architecture



- **WP3** is about developing all the components of the reference architecture.
 - [T3.1] Workspace environment (SDK + CI/CD)
 - [T3.2] Validation environment
 - [T3.3] 5G-NPN (upgrades) + NEF/CAPIF Emulators
 - [T3.4] Certification tool and Marketplace
- **WP4** is about using the components of the reference architecture for developing and verifying NetApps. The Vertical apps are upgraded as well.
 - [T4.1] Exposure Capabilities and SMEs mentoring
 - [T4.2-5] NetApps /vApps development
- **WP5** is about using the components of the reference architecture and the verified NetApp to perform
 - [T5.1] 5G-NPN Infrastructure validations
 - [T5.2] NetApp+vAPP validations
 - [T5.3] NetApp certification and publishing

Mapping the tools to Environments that support the NetApp lifecycle

Target

- Individual evolution plan per Tool
- Integration plan
- Usage of the tools in the testing activities

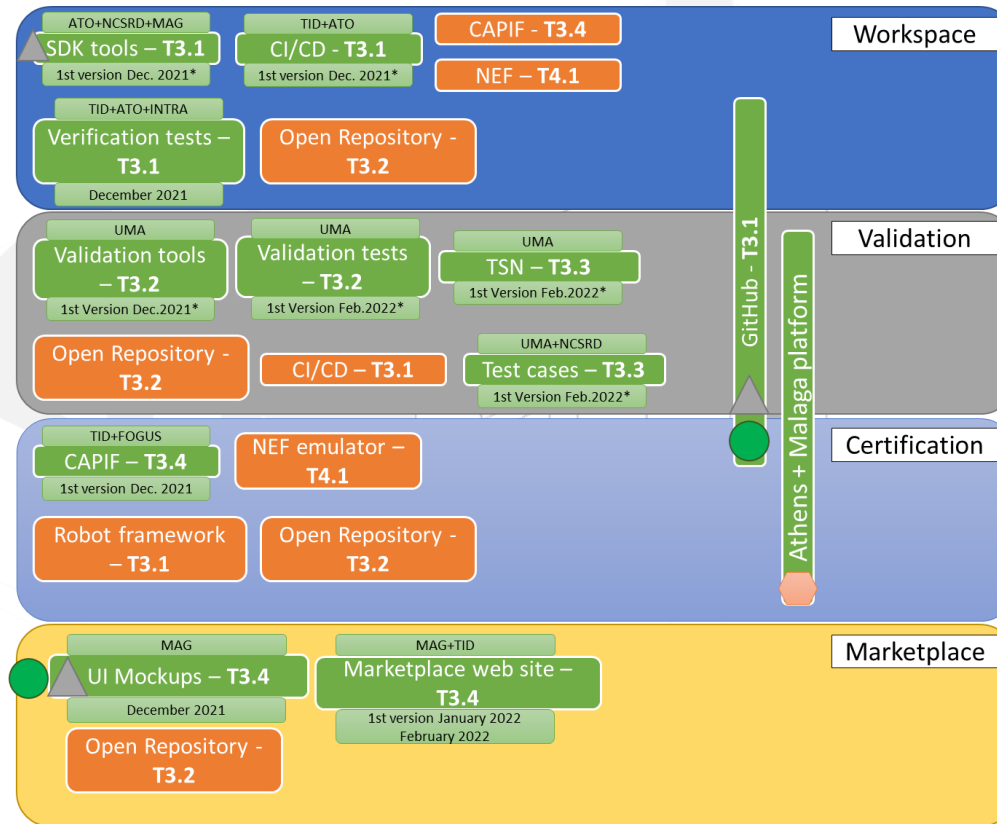
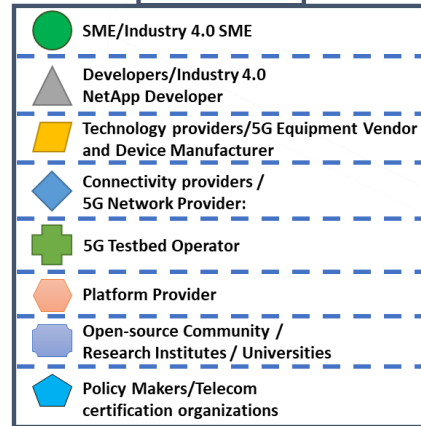
- SDK tools (template, libraries, CLI)
- CAPIF Core Functional Tool
- CI/CD (Jenkins)
- Time Sensitive Network (TSN)

- Tool implemented in the environment
- Tool usage in the environment

* A first version is intended to have it ready by the end of 2021, although there will be a continuous updating during the duration of the T3.1.

** Every partner related to WP3 will make use of GitHub by uploading its repository.

Stakeholders



NetApp SME Ecosystem



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5G



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Thank you

Any questions?

