



July 2021

A Practical Application of Monitoring data and AI for Network Management in an Industrial Environment

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5G-Enabled Growth in Vertical Industries



Industrial Applications

Digital Twin
Critical IoT

Telemetry & Monitoring
Massive IoT

Remote Support
Broadband IoT

5G End-to-End Infrastructure
(Radio, Transport, Cloud)



RADIO, TRANSPORT, CLOUD EQUIPMENT



Data center
(hosting cloud)

PLANT
MONITORING

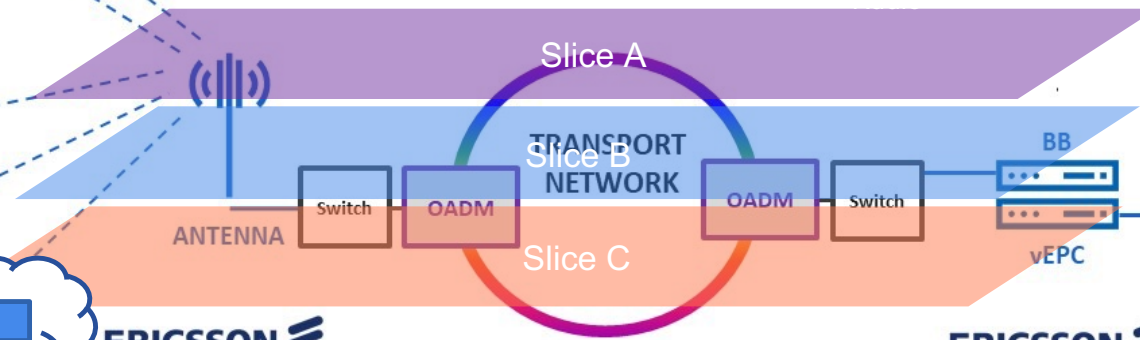
ROBOT CONTROL

Cloud
Radio
Transport

Orchestrator



Edge data center
(hosting edge cloud)



Mission of the Project: Automatically build, deploy and manage different vertical industrial services over a shared End-to-End 5G system (incl. Application Domain, Infrastructure Domain, Orchestration Domain), and perform real field trials validation and demonstrations

Pilots

- 5Growth aims to perform **real field trials** involving customer sites of **four vertical locations in Portugal, Spain and Italy**
- This requires the development, installation, validation and testing of **commercial 5G radio, transport and core technologies in vertical sites, connected with the ICT-17 platforms**

- Pilots



Industry 4.0

- INNOVALIA
- COMAU



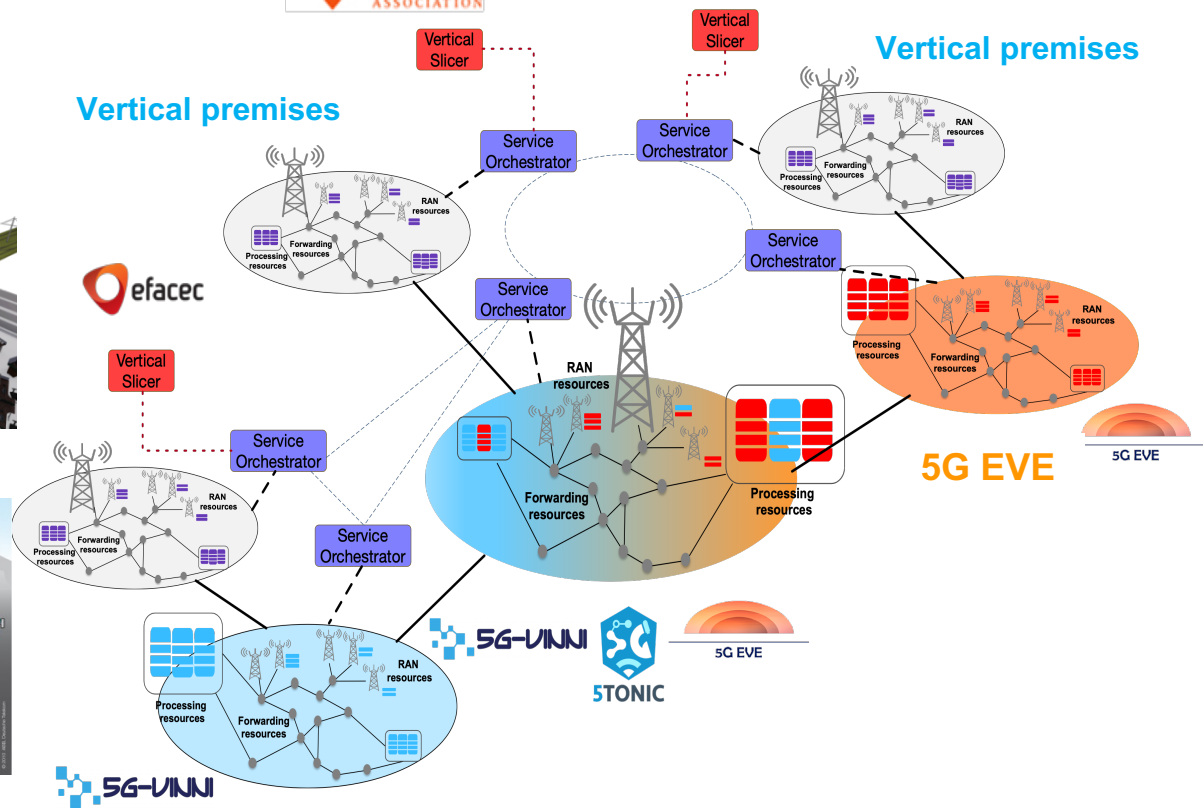
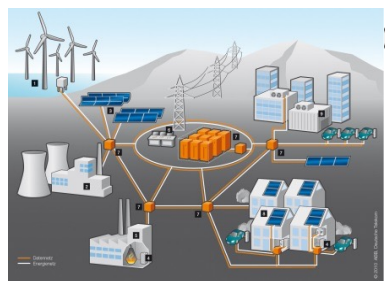
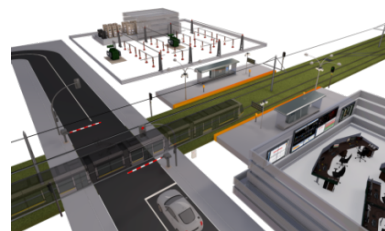
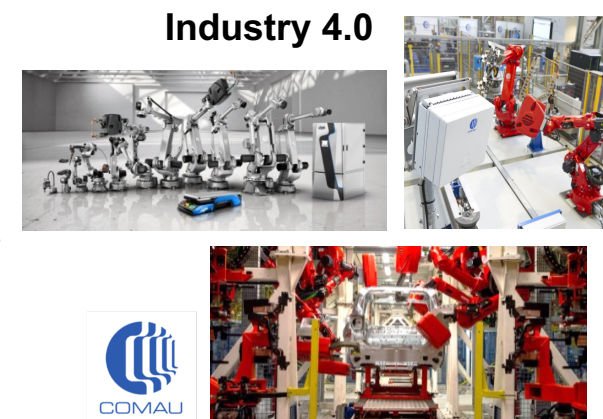
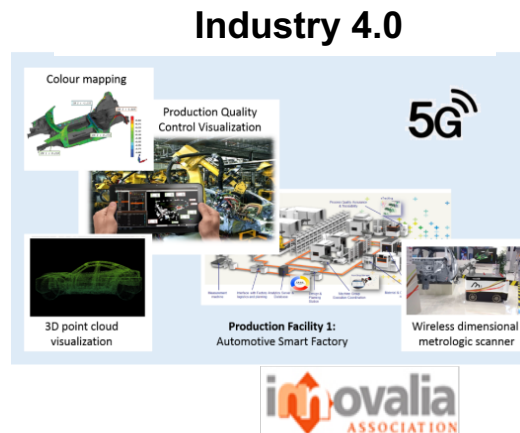
Energy

- EFACEC_E



Transportation

- EFACEC_S



5Growth Innovation Focus

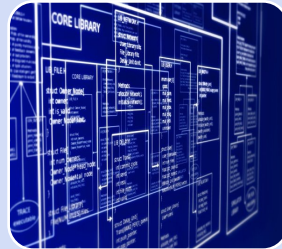
- ✓ Smartness
- ✓ Flexibility
- ✓ Efficiency
- ✓ Automation
- ✓ Performance
- ✓ Security

Framework



Security
CI/CD
Containerization

Architecture



Vertical Support
Monitoring Orchestration
Data Infrastructure
Control & Management
(Closed-loop, AI/ML)
End-to-end orchestration

Algorithms

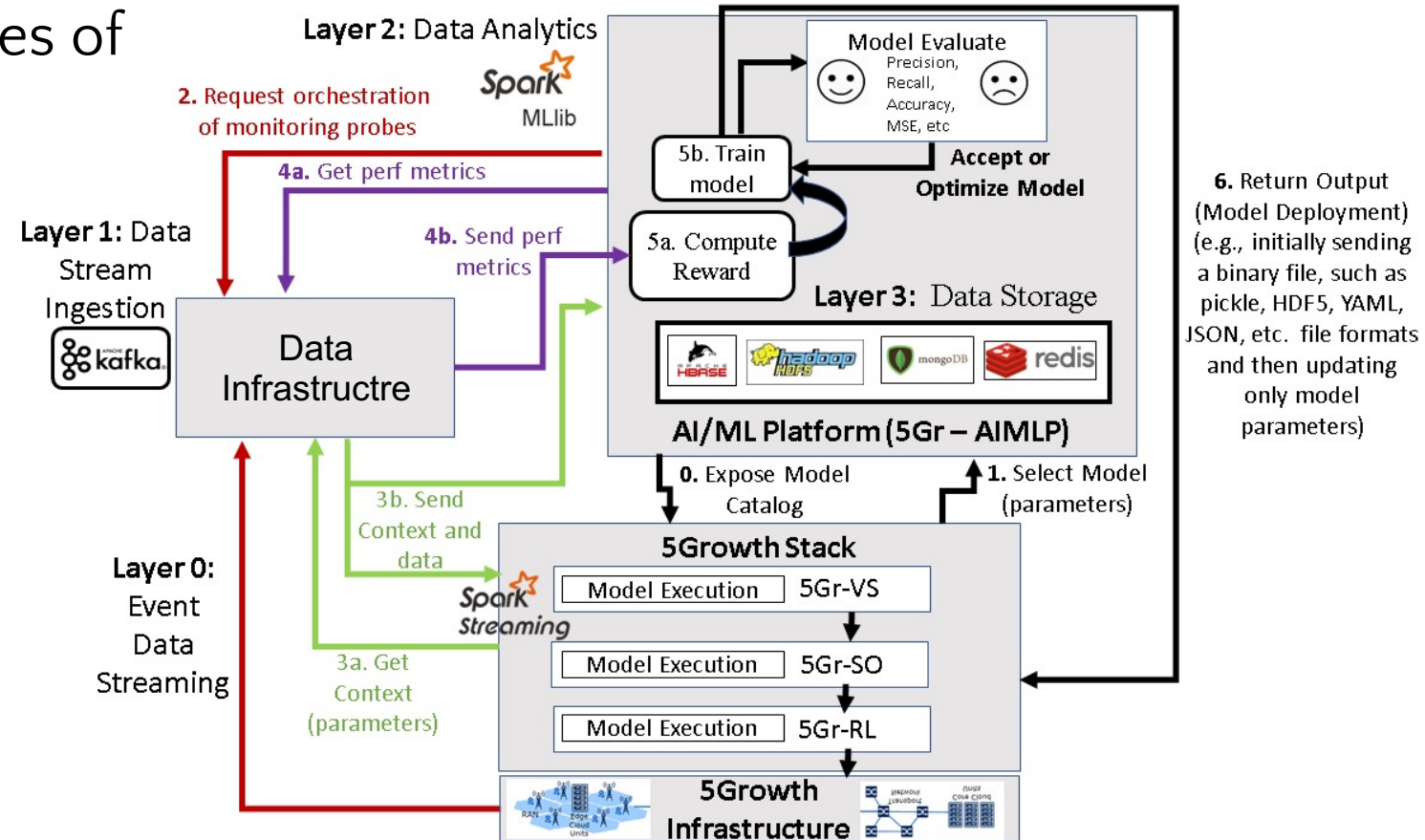


Smart
Orchestration &
Control
Anomaly
Detection
Forecasting and
Inference

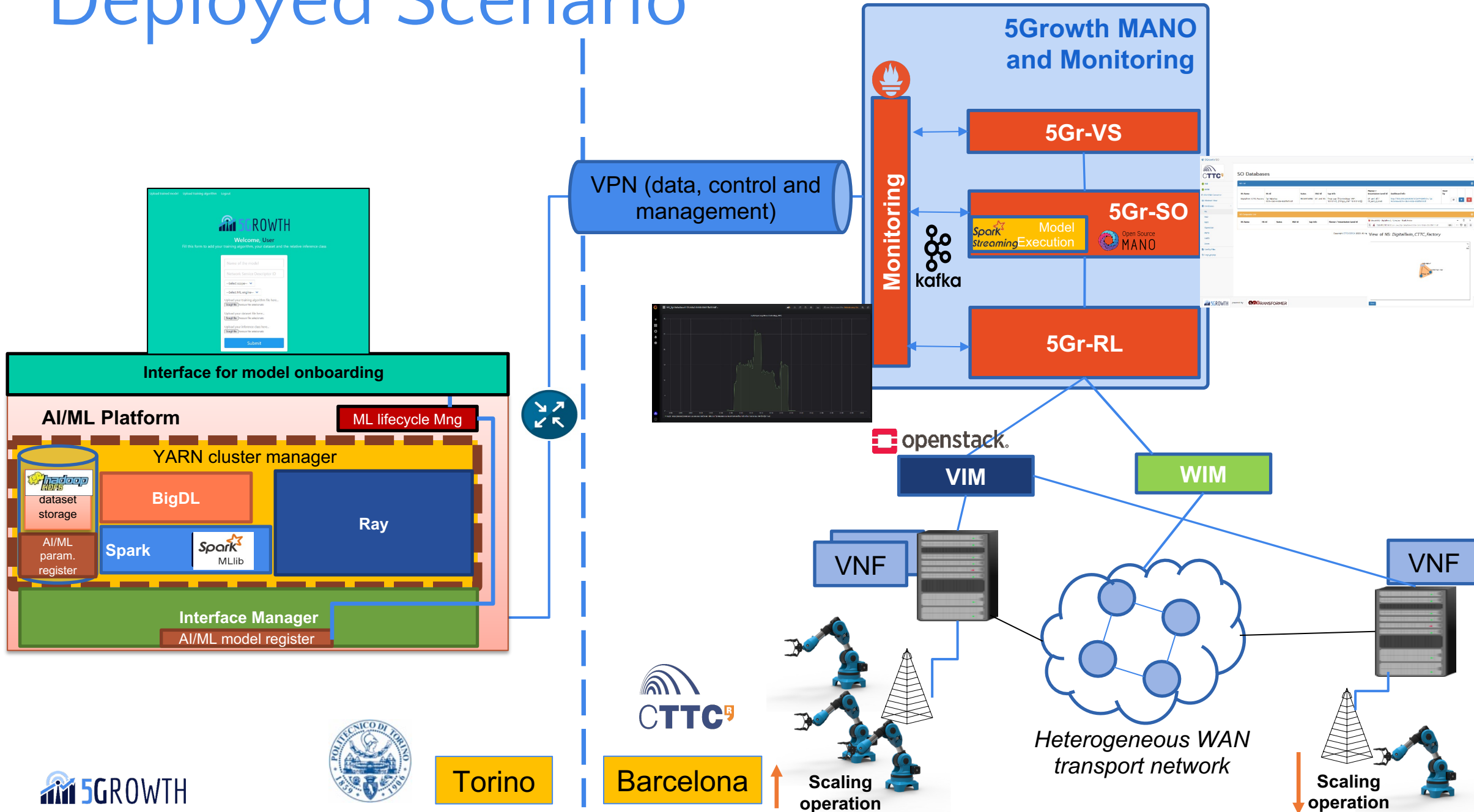
The Three-Dimensional Closed-Loop

Closed-loops for the processes of

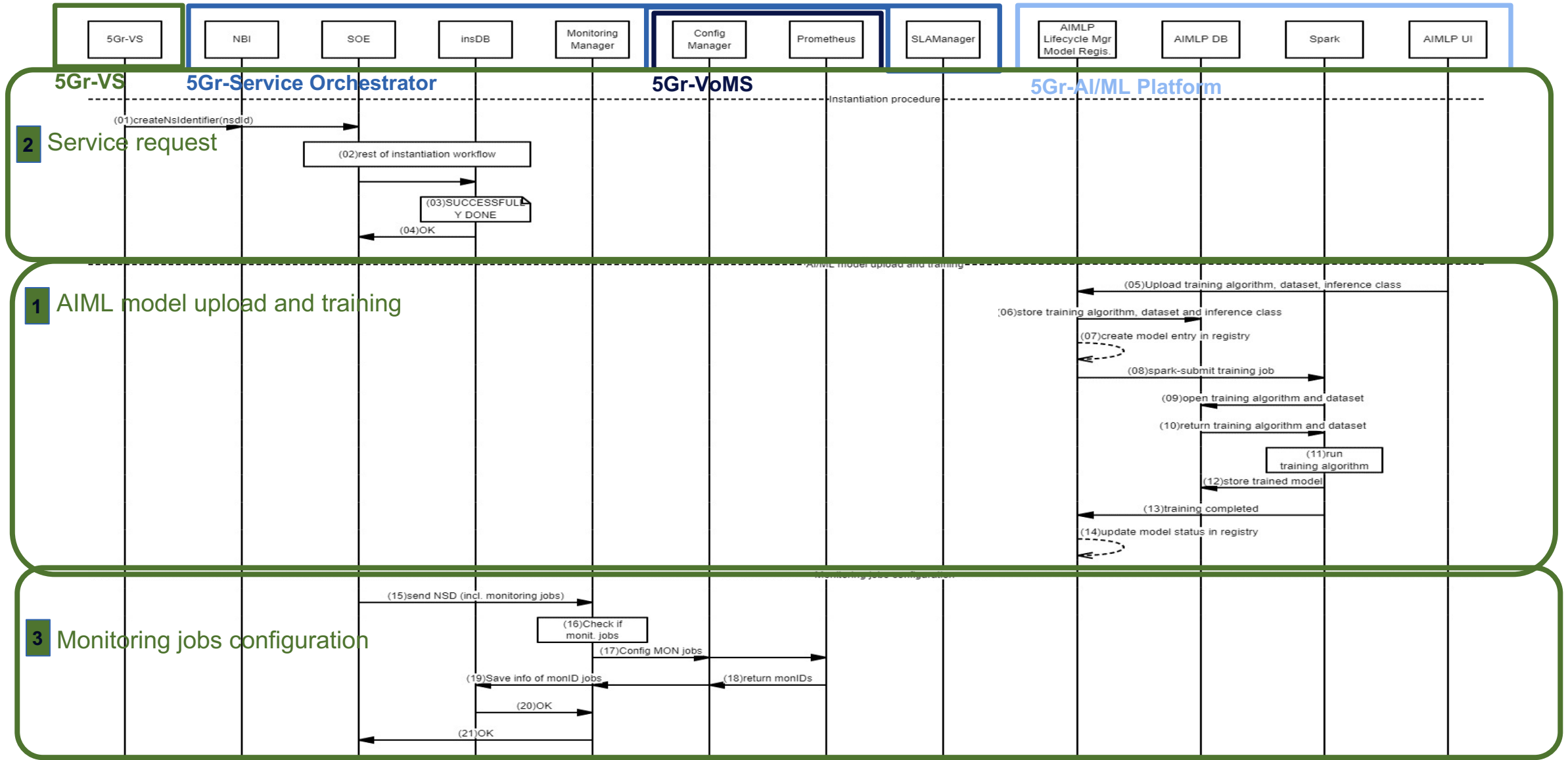
- Collecting monitoring data from the services and networks
- Performing real-time data analytics for identifying events to handle
- Making orchestration decisions for optimization and/or reconfiguration of the system.

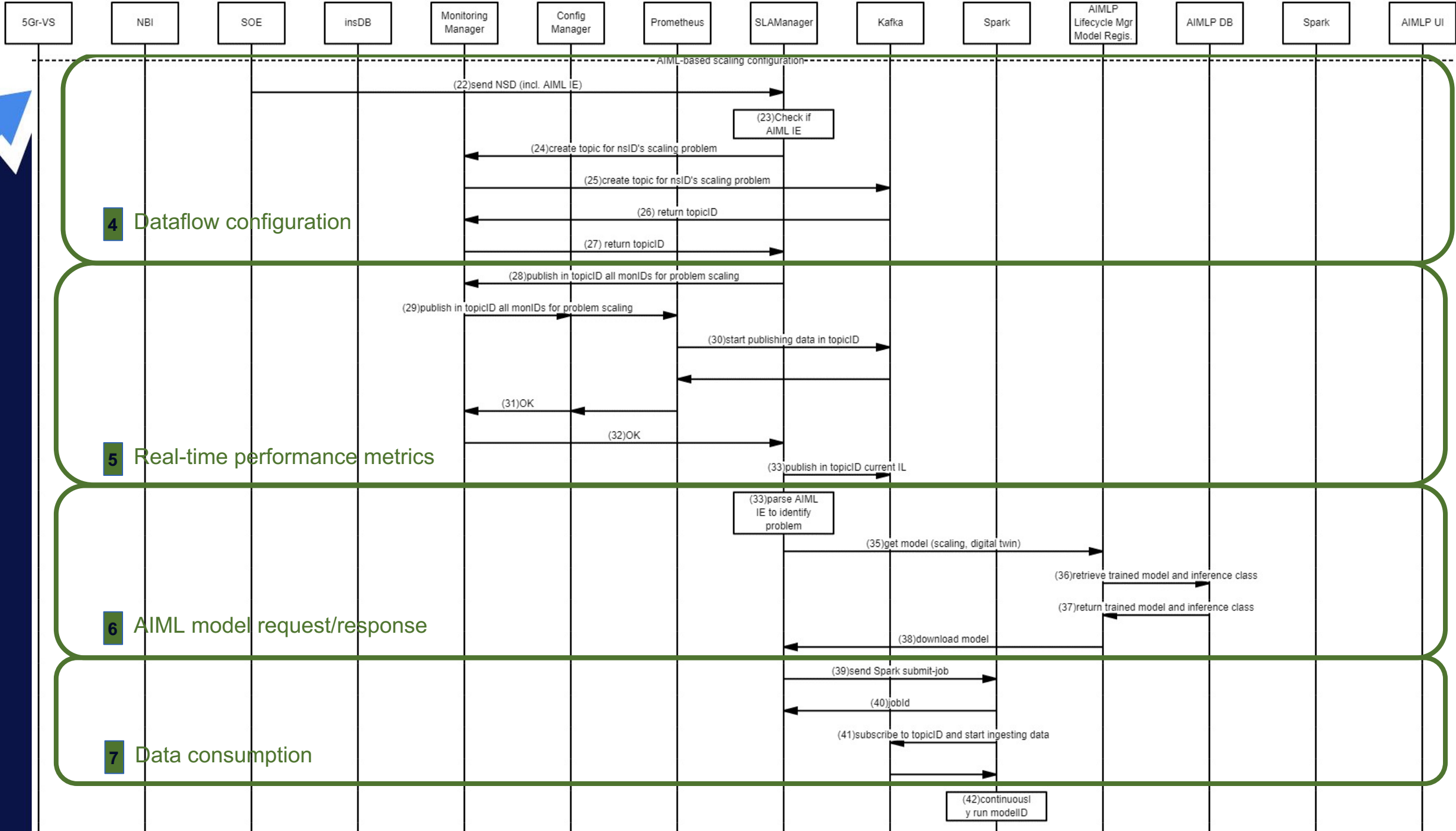


Deployed Scenario

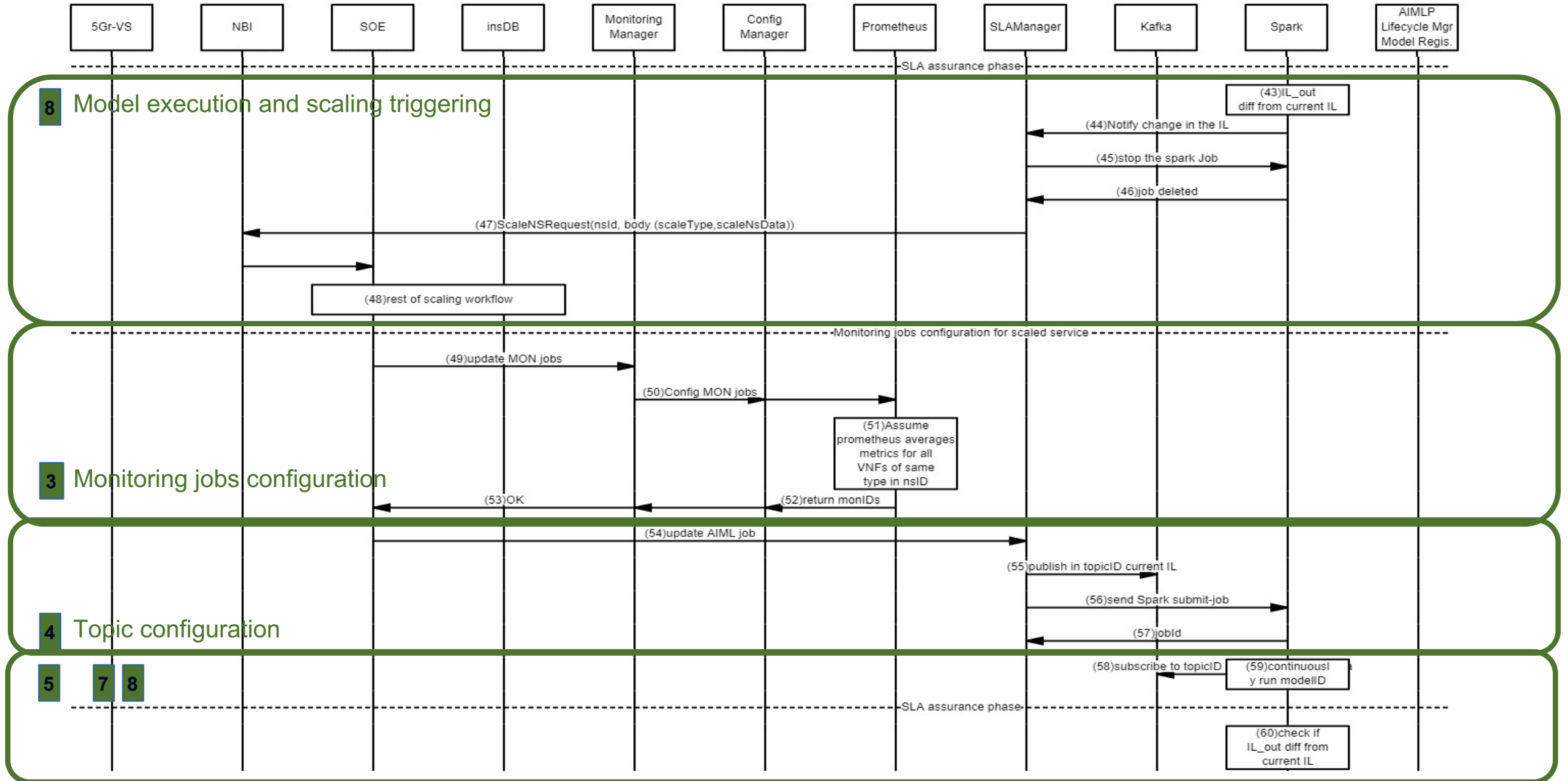


Deployment and Configuration





Scaling workflow





Concluding

- 5Growth addresses data-driven network management in a three-dimensional closed loop
 - The common double loop for learning and inference
 - An additional control loop for monitoring data flows
- Making use of the project data infrastructure
 - Data-driven requirements embedded in service descriptors
 - Monitoring orchestration
 - Model-based data flows
- Applied to a real industrial use case
 - A path to be explored for other classes of Digital Twins

More Can Be Found at...

- J. Baranda, J. Mangués, E. Zeydan, L. Vettori, R. Martínez, X. Li, A. García-Saavedra, C. Fabiana Chiasserini, C. Casetti, K. Tomakh, O. Kolodiazhnyi, C. Jesus Bernardos: *On the Integration of AI/ML-based scaling operations in the 5Growth platform*, in Proceedings of the 6th IEEE Conference on Network Functions Virtualization and Software Defined Networking (IEEE NFV-SDN 2020), 9-12 November 2020.
- J. Baranda, J. Mangués, E. Zeydan, C. Casetti, C. Fabiana Chiasserini, M. Malinverno, C. Puligheddu, M. Groshev, C. Guimarães, K. Tomakh, D. Kucherenko, O. Kolodiazhnyi, *Demo: AIML-as-a-Service for SLA management of a Digital Twin Virtual Network Service*, in Proceedings of the International Conference on Computer Communications (IEEE INFOCOM), 10-13 May 2021.
- The whole use case demo on YouTube:
 - <https://youtu.be/7V3AKSrWzzY> (short)
 - https://youtu.be/K5GyrAD7h_Q (long)