
# AI/ML as an Enabler for Autonomous Network Management

5G-CLARITY Vision and Use Cases

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5GPPP, TB meeting, 27/05/2020

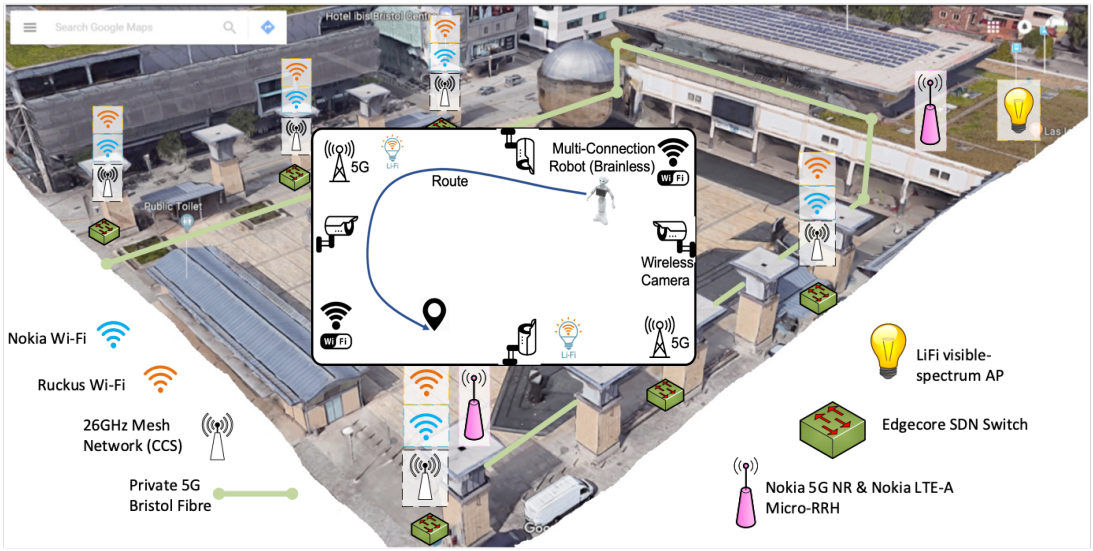
# 5G-CLARITY Project Overview

- 5G-CLARITY: Beyond 5G multi-tenant private networks integrating Cellular, WiFi, and LiFi, Powered by Artificial Intelligence and Intent Based PolicY
  - Public-private network integration
  - Multiple WAT
  - AI/ML for autonomous network management
  - Intent-based policies

- Partners
  - Coordinators
  - Operators
  - Vendors
  - 5G SMEs
  - Verticals
  - Universities

# 5G-CLARITY Use Cases

- Museum Pilot (Uni Bristol)
  - Enabling enhanced human-robot interaction



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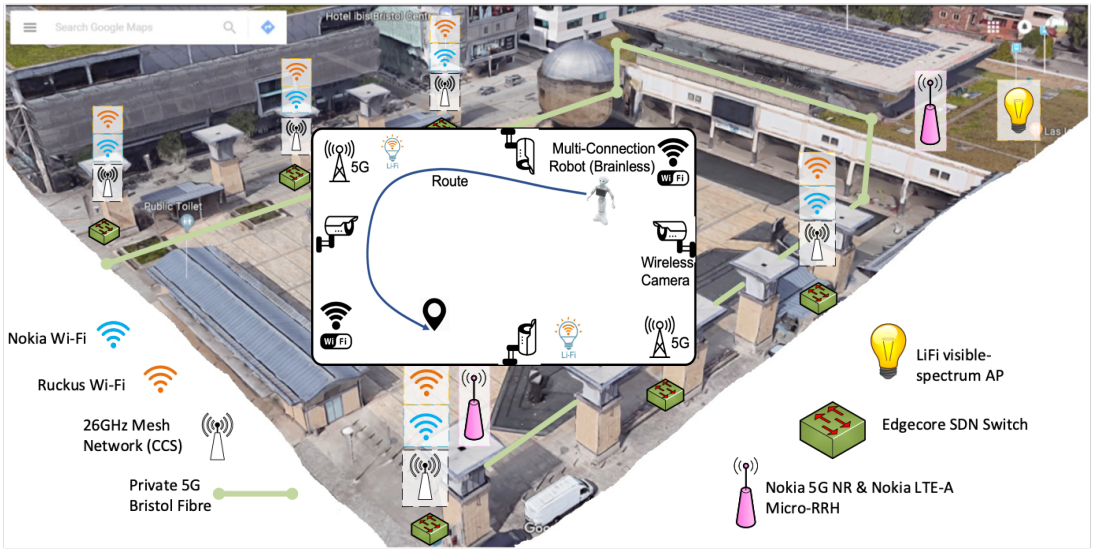
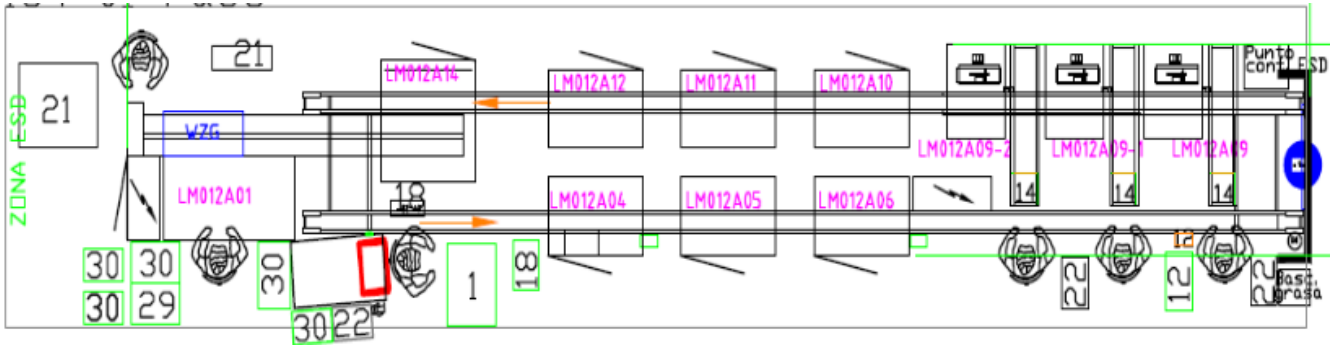
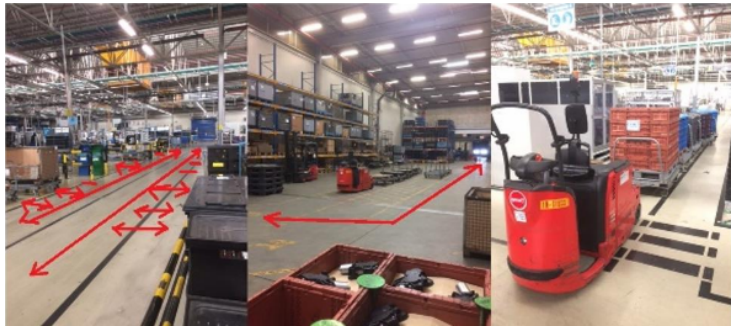


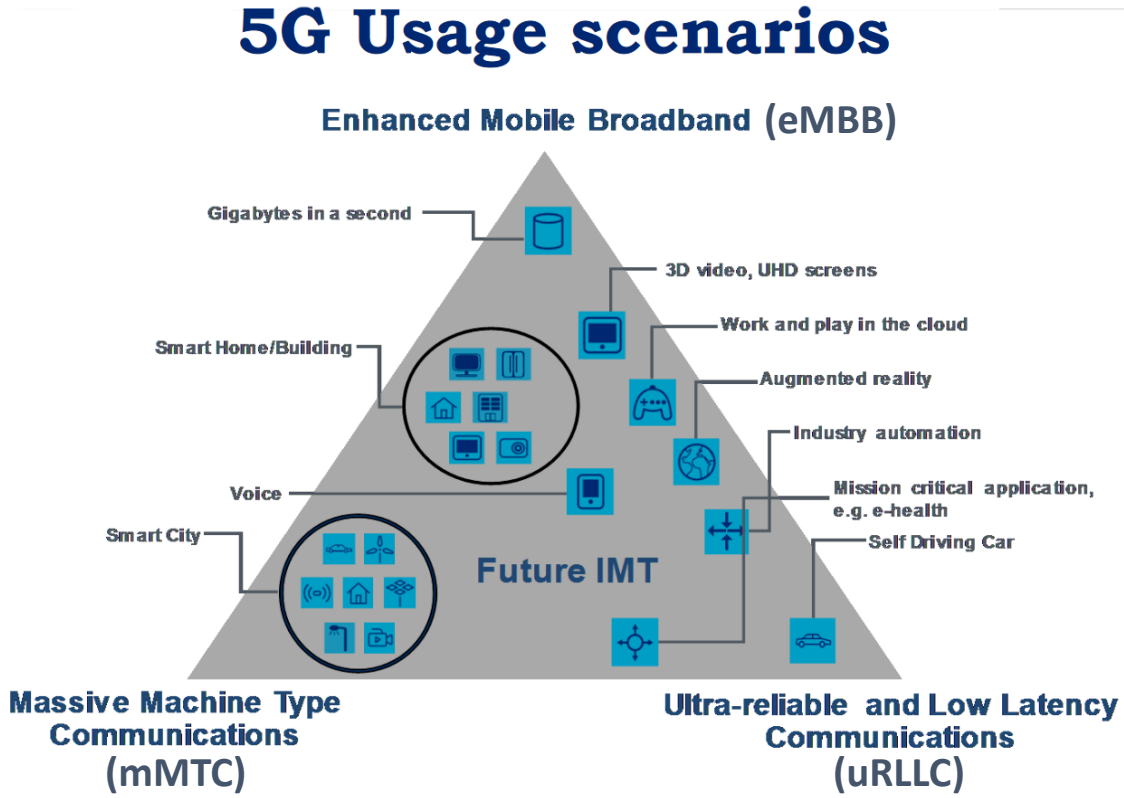

- Industry 4.0 Pilot (Bosch)
  - Wireless multi-service support in Industry 4.0
    - Alternative network to exchange production data
    - Enhanced positioning for AGVs used to move Bosch containers



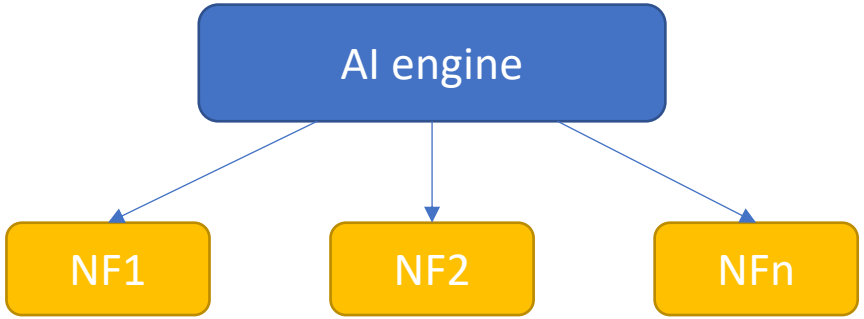
# Complexity of Network Management in 5G

- Different 5G use cases exist in the same network
  - Different requirements and configurations for each use case
- Need for fast changing network
  - Flexibly reacting to demand
  - Scalability
- Need for ease-of-use
  - Reducing OPEX
- AI-supported network management needed to tackle 5G requirements



# Role of AI/ML and Intent in 5G-CLARITY

- AI-supported network management
  - Slice setup and provisioning
  - Resource scheduling
  - SLA violations
  - ATSSS
  - Positioning



# Role of AI/ML and Intent in 5G-CLARITY

## ❑ AI-supported network management

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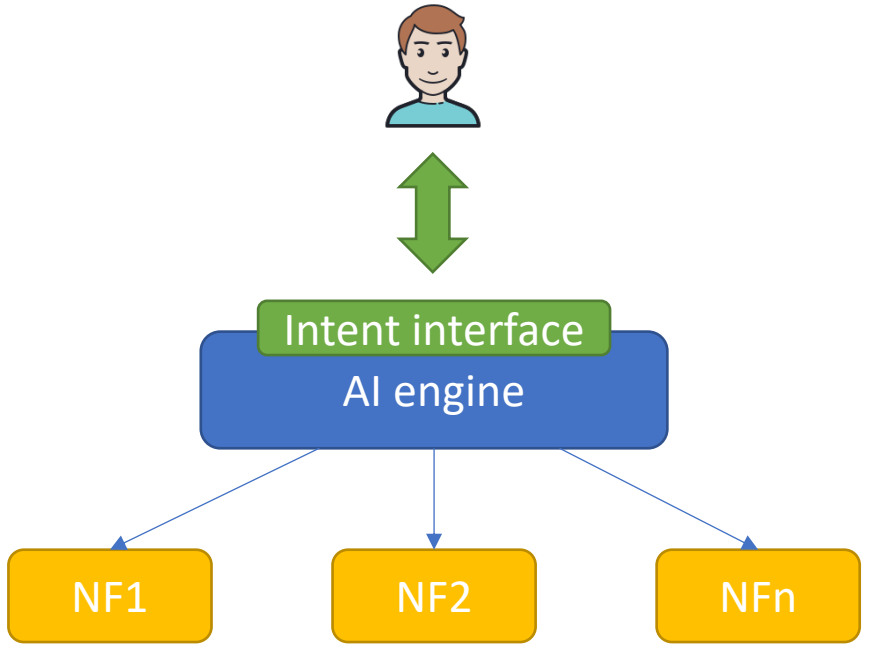
## ❑ Intent-based policies

- Operator tells the AI what they want, AI takes care of the rest
- Using intent engine to determine who/what can fulfil the request



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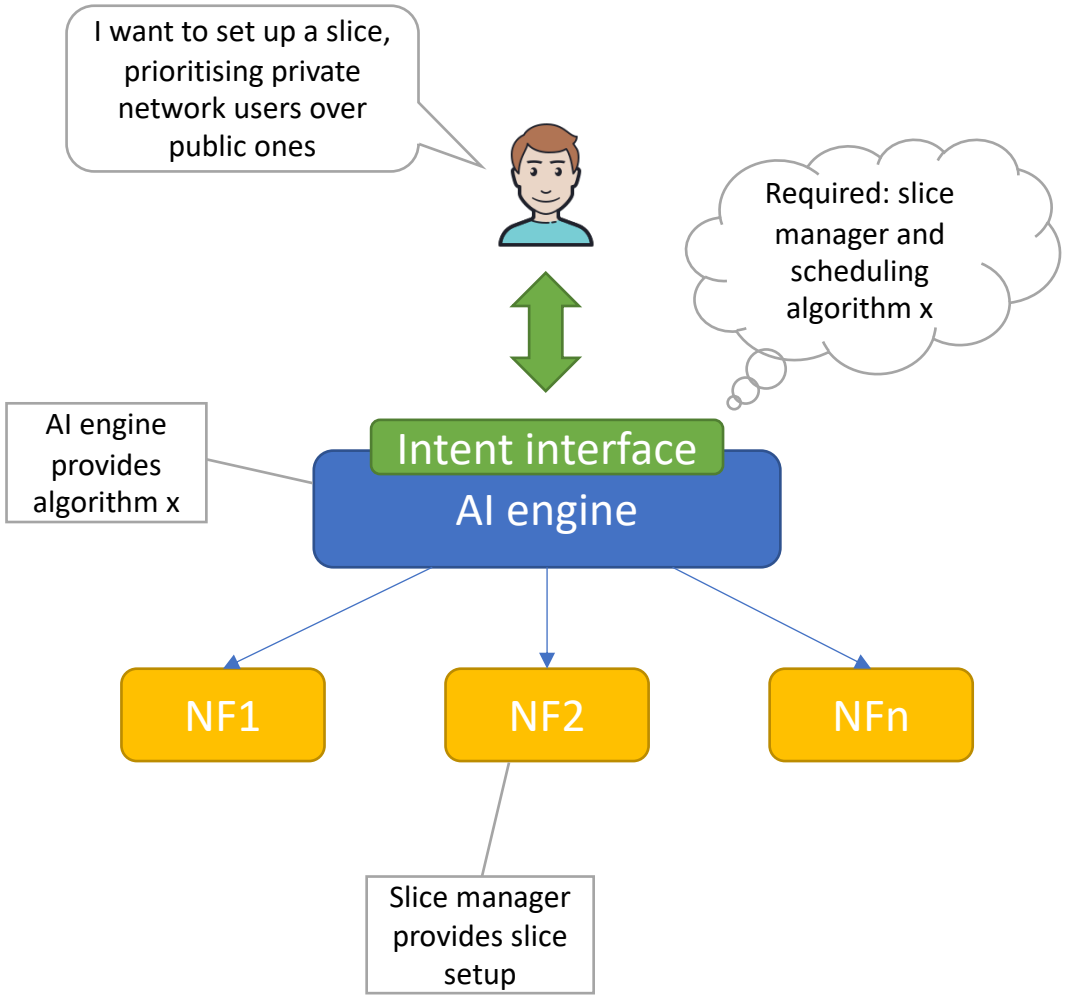
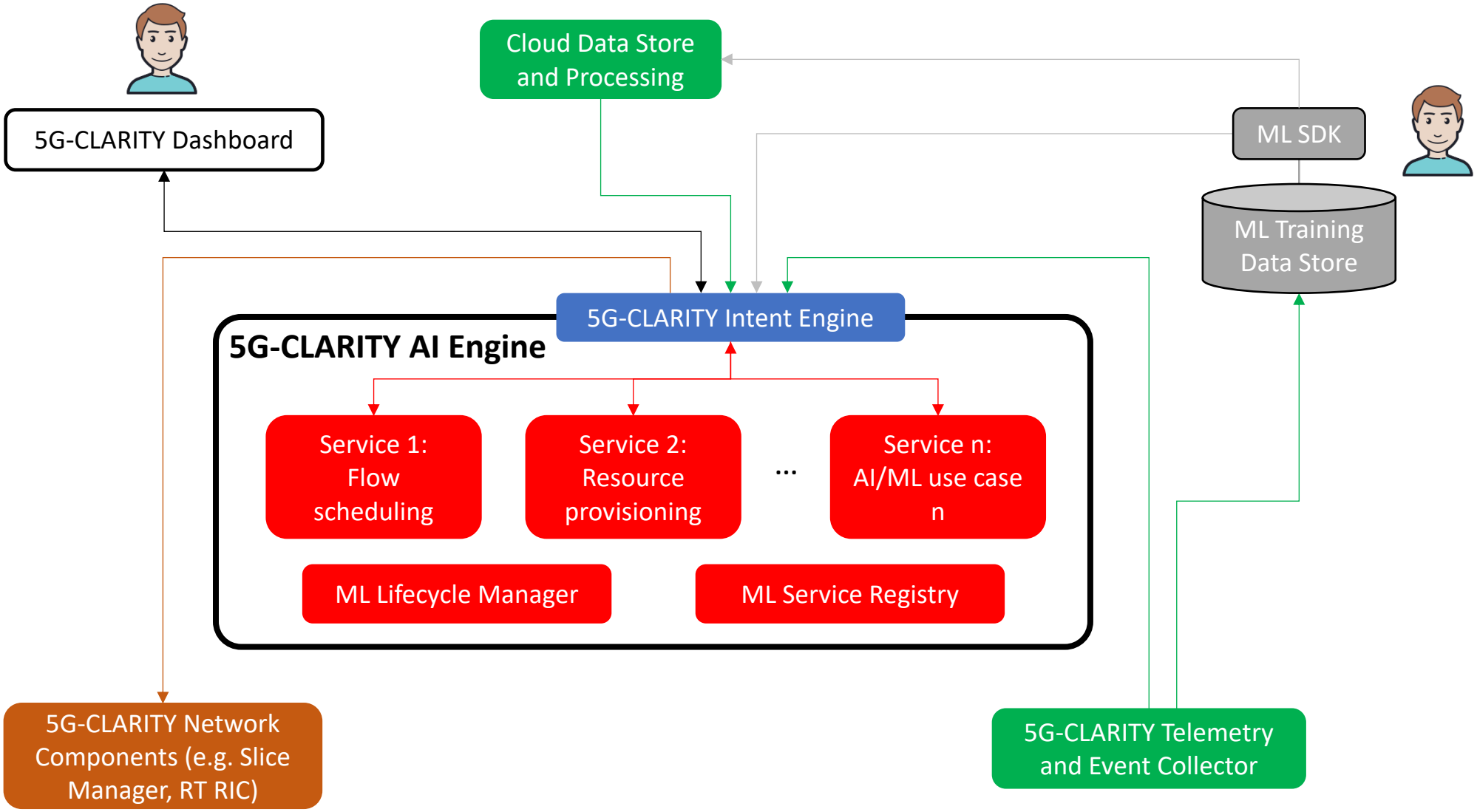
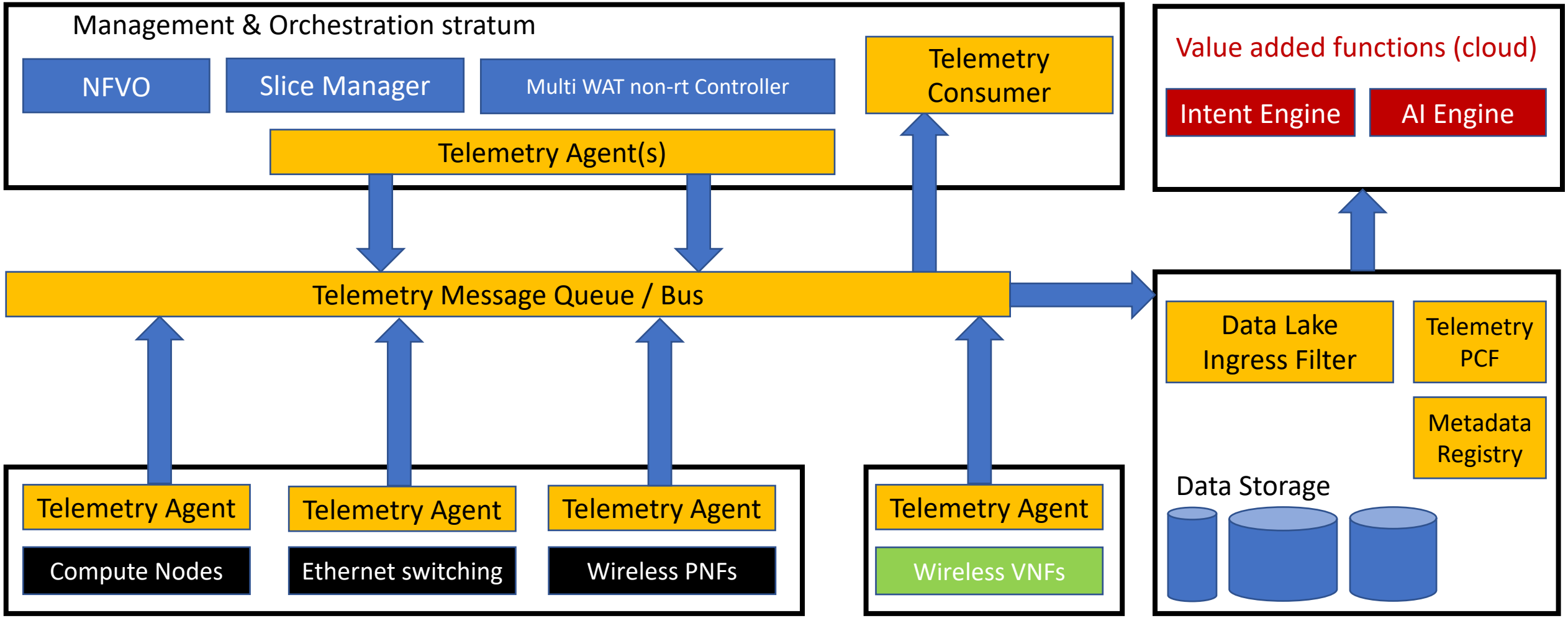


# 5G-CLARITY AI Engine with Intent Interface

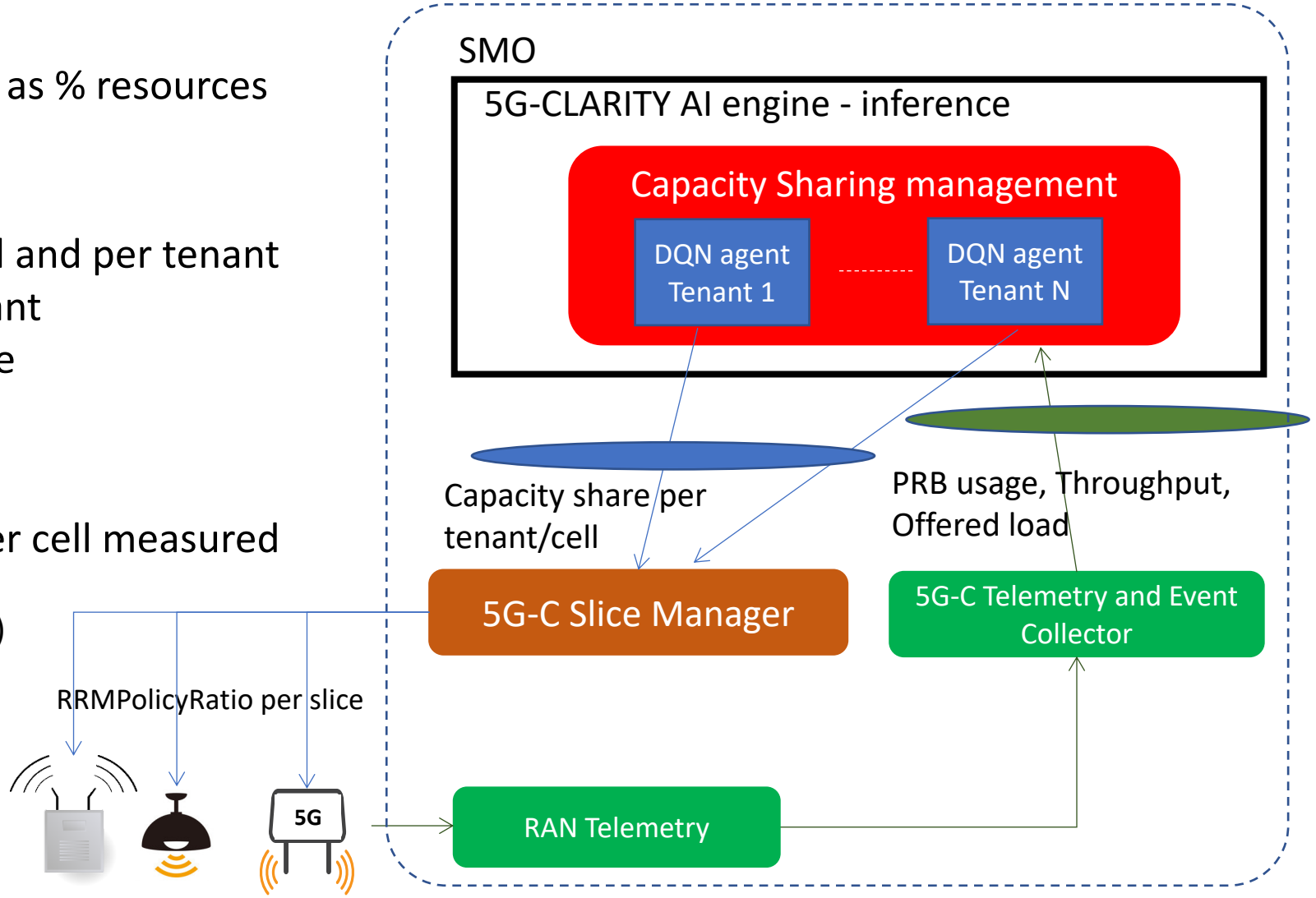


# 5G-CLARITY Telemetry Framework



# Use Case 1: Non RT Slice Resource Control

- Problem:
  - Maintain per-tenant SLA defined as % resources over geographic area
- Inputs
  - PRBs used for data traffic per cell and per tenant
  - Throughput per cell and per tenant
  - Offered load per cell and per slice
  - SLA terms
- Outputs
  - Capacity share per tenant and per cell measured as the % of resources in the cell
    - PRBs (5GNR), air time (WiFi), λ (LiFi)
- Periodicity:
  - Minutes (Non RT)
  - Location: AI engine



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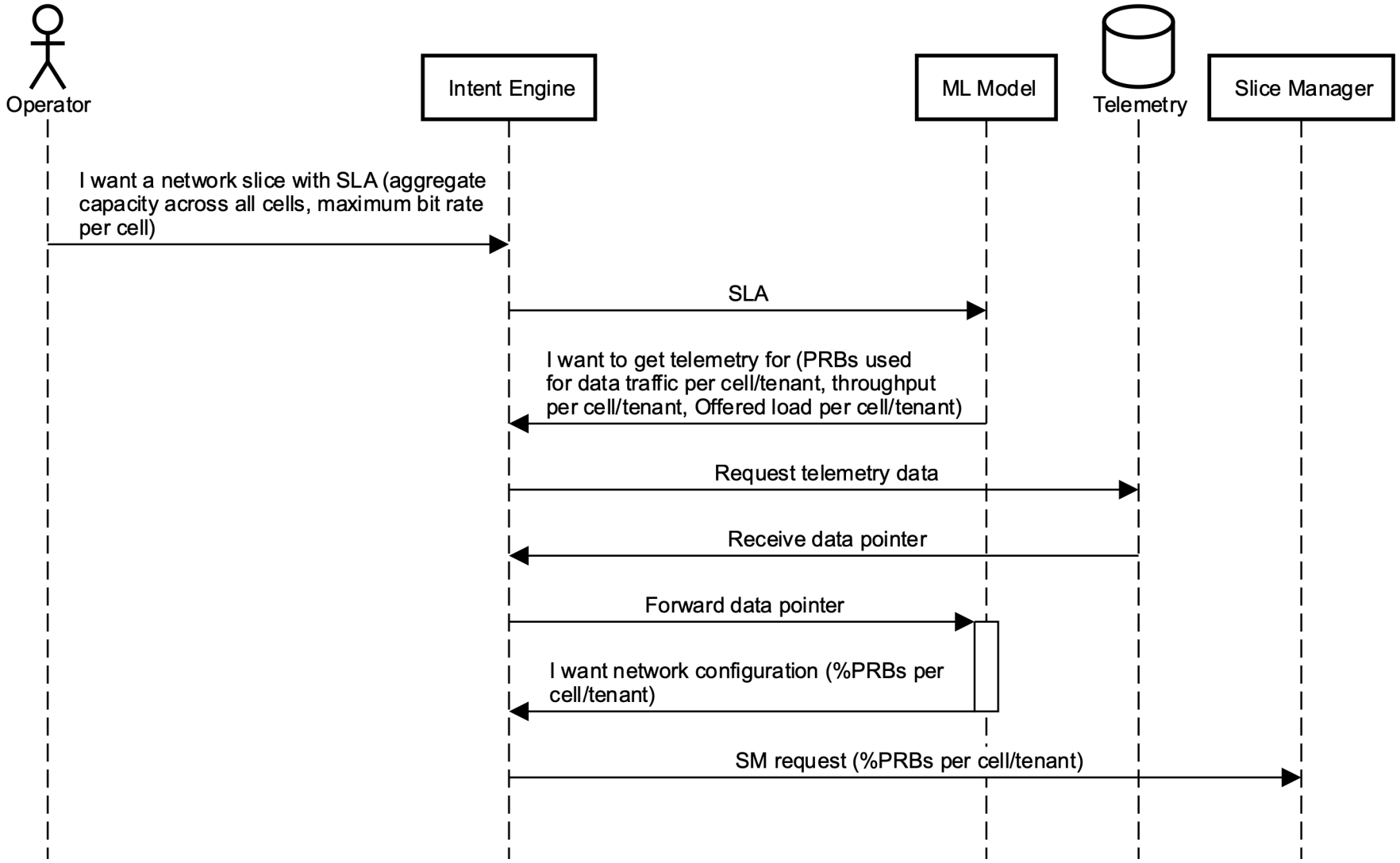
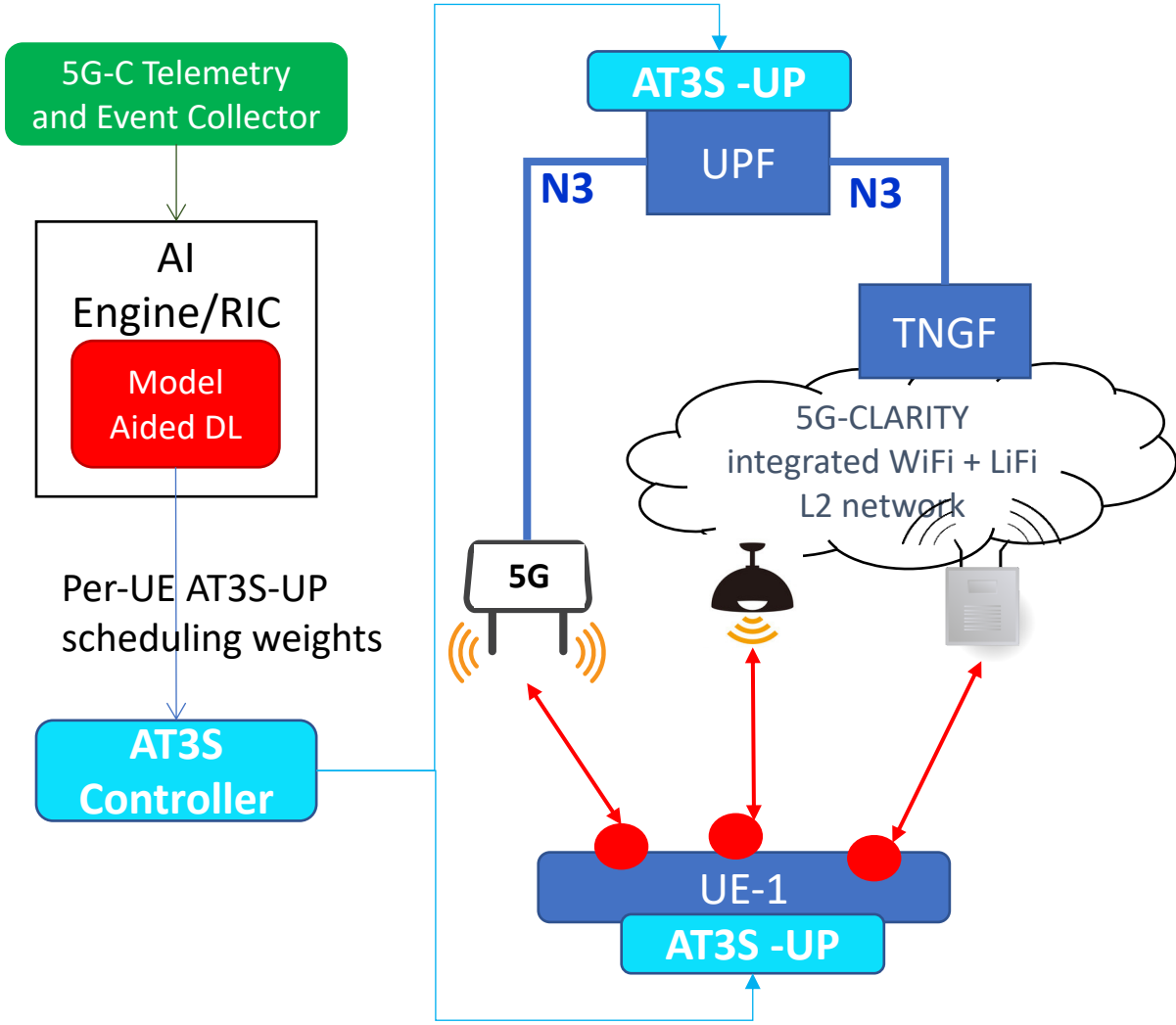


# Use Case 2: RT AT3S Control Plane

- Problem:
  - Optimize resource utilization for multi-connectivity UEs, s.t. per-UE policies (e.g. reliability, max. throughput, etc)
- Inputs
  - UE connected cell/AP/SSID – user mobility pattern
  - UE DL packet drop rate – handover failure
  - RSSI – link performance/blockage
  - Available Cell resources
  - End-to-end aggregation metrics (measured at AT3S UP function)
- Outputs
  - Scheduling weights in Multi-connectivity framework in UE and UPF
- Periodicity:
  - 100 – 500 ms
  - Location: O-RAN RIC in RAN Edge



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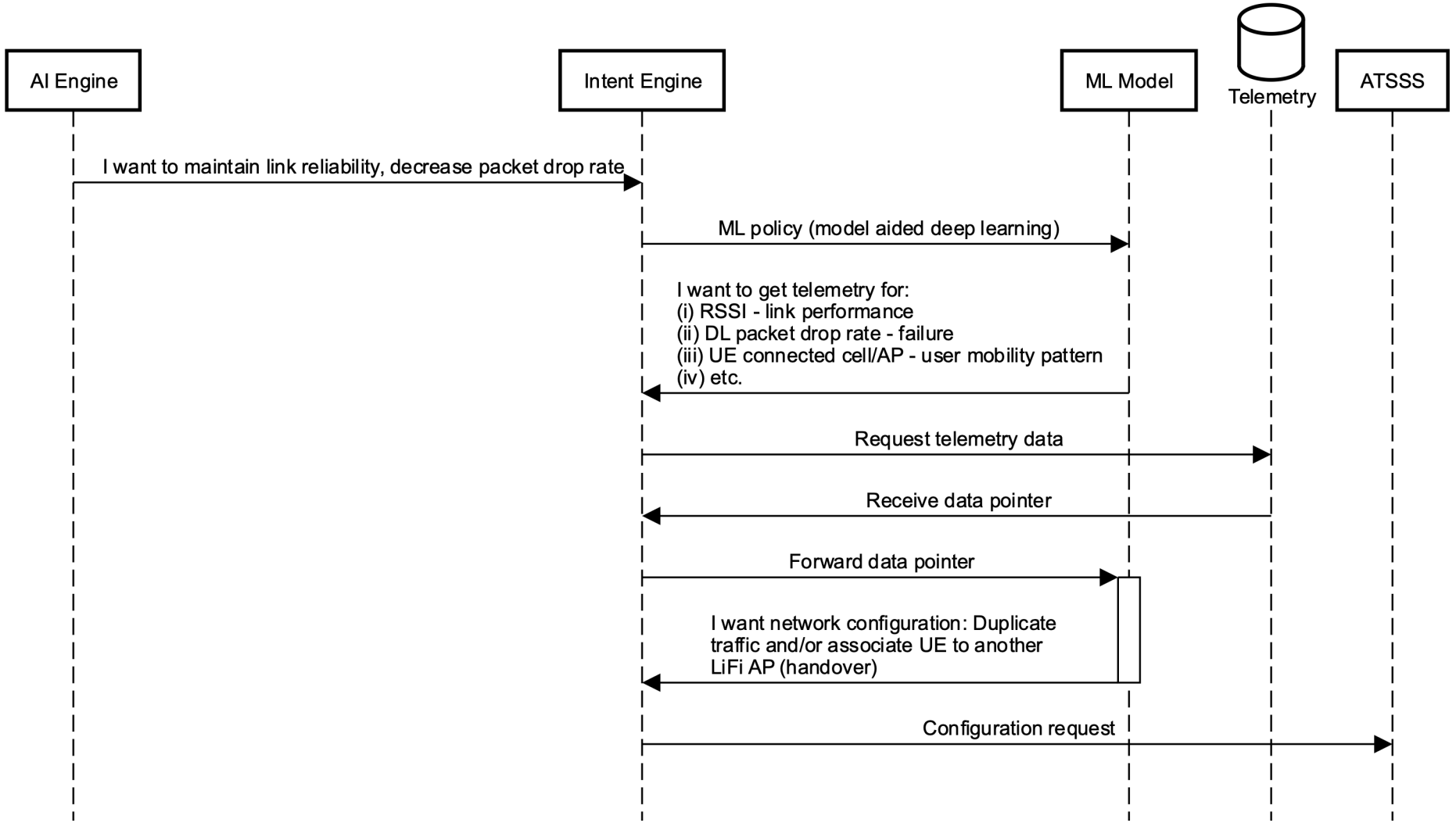

# Reference 5G-CLARITY documents

- D2.2: “Primary system architecture”
  - General Architecture. Introducing role of AI-Engine
  - **Due date**: October 31st, 2020
- D4.1: “Initial design of the SDN/NFV platform and identification of target 5G-CLARITY ML algorithms”
  - Initial AI Engine design. AI use case definitions
  - **Due date**: October 31st, 2020
- D4.2: “Validation of 5G-CLARITY SDN/NFV platform, interface design with 5G service platform, and initial definition of evaluation of ML algorithms”
  - Design and initial evaluation for AI engine and ML use cases
  - **Due date**: June 30th, 2021

# Summary

- AI/ML to support autonomous network management in 5G
  - Traditional network management can’t handle complexity
- AI/ML use cases in 5G-CLARITY
  - Slice setup and provisioning
  - Resource scheduling
  - SLA violations
  - ATSSS
  - Positioning
- AI engine as host for AI/ML algorithms
  - Covering each AI/ML use case
- Intent engine for communication to and from the AI engine
  - Enabling ease-of-use for network management