WP02
Operational Use Cases

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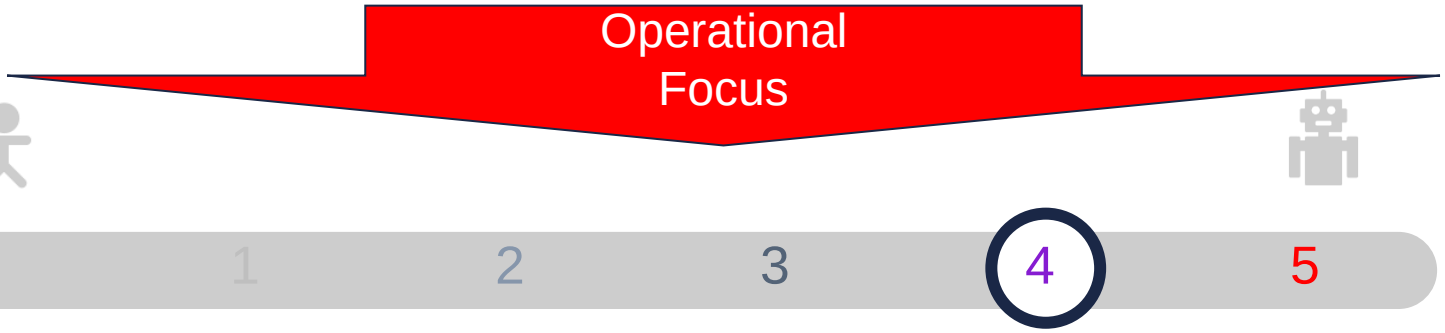
The three operational challenges

1. Introduction of new Intelligent application to AN
2. Transition from current Automation/ Autonomous Level to a higher level
3. Operational maintenance of a current Automation Level

The 6 Levels of Autonomous Networks

‘The HOW supervised’



‘The HOW Implemented’

Implementation Focus

Level Definition	L0: Manual Operation & Maintenance	L1: Assisted Operation & Maintenance	L2: Partial Autonomous Network	L3: Conditional Autonomous Network	L4: High Autonomous Network	L5: Full Autonomous Network
Execution	P	P/S	S	S	S	S
Awareness	P	P	P/S	S	S	S
Analysis	P	P	P	P/S	S	S
Decision	P	P	P	P/S	S	S
Intent/Experience	P	P	P	P	P/S	S
Applicability	N/A	Select scenarios				All scenarios

P: Personnel, **S:** Systems

The 6 Levels of Autonomous Networks

‘The HOW supervised’

Intent Users, Scope, Types, and Lifecycle

Operational Focus

‘The What’

0 1 2 3 4 5

‘The HOW Implemented’

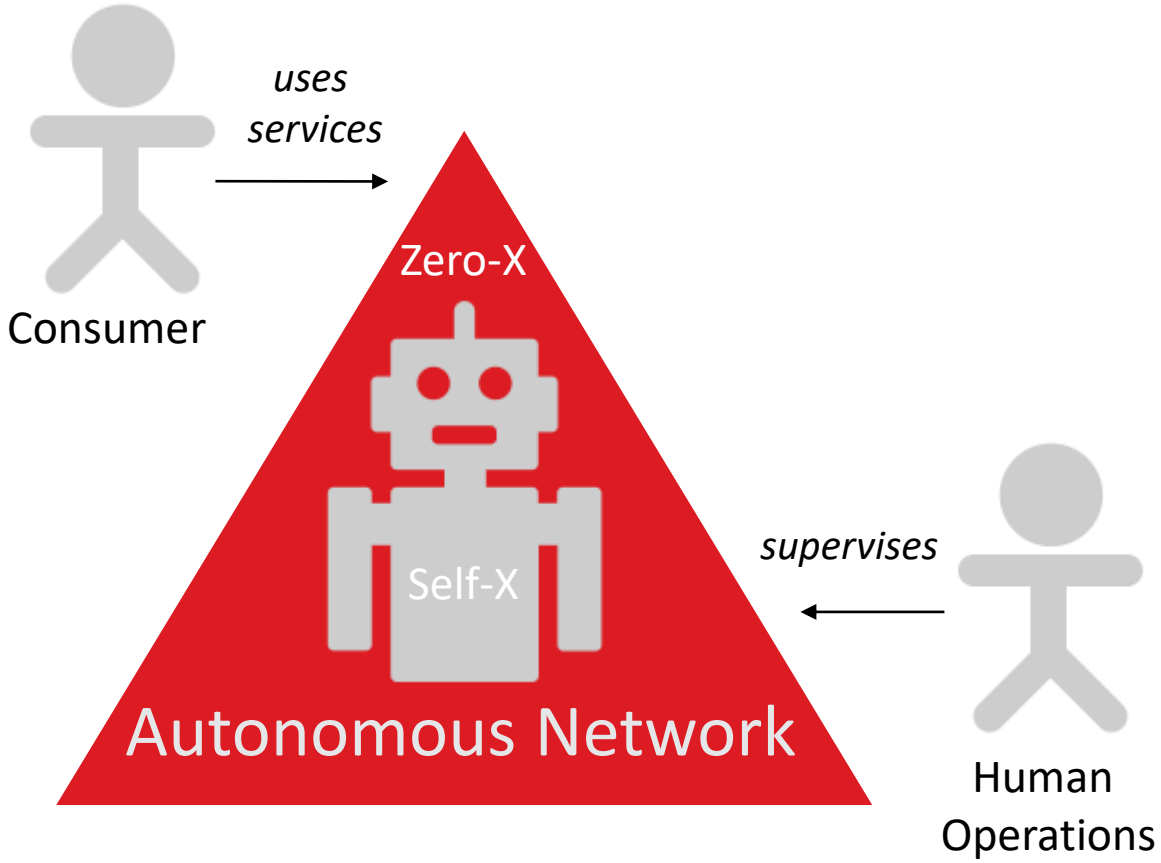
Solutions

Implementation Focus

Level Definition	L0: Manual Operation & Maintenance	L1: Assisted Operation & Maintenance	L2: Partial Autonomous Network	L3: Conditional Autonomous Network	L4: High Autonomous Network	L5: Full Autonomous Network
Execution	P	P/S	S	S	S	S
Awareness	P	P	P/S	S	S	S
Analysis	P	P	P	P/S	S	S
Decision	P	P	P	P/S	S	S
Intent/Experience	P	P	P	P	P/S	S
Applicability	N/A	Select scenarios				All scenarios

P: Personnel, **S:** Systems

Humans are part of the AN

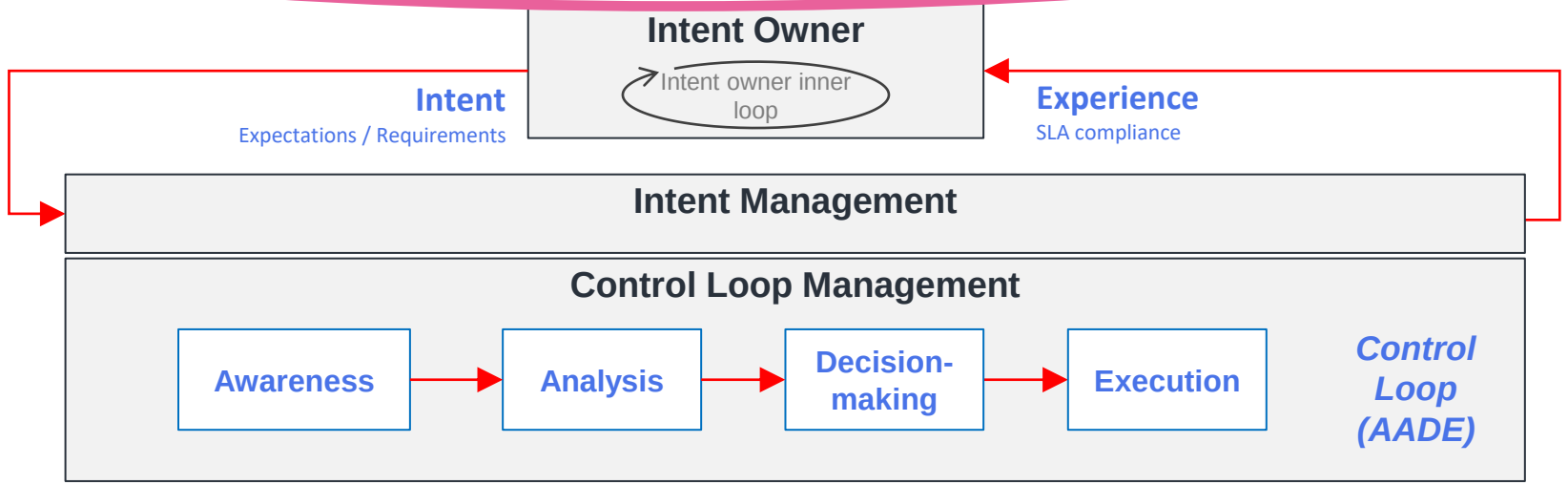


Closed Loop Mechanism of Autonomous Network

Level Definition

- Execution
- Awareness
- Analysis
- Decision
- Intent/Experience
- Applicability

P: Personnel, S: Systems



Alternate Implementation 'Models'

OODA	Observe	Orientate	Decision-making	Execution
MAPE	Monitor	Analysis	Plan	Execution

Overview of standards from AN Level perspective

Main documents

- IETF – Focus on intent and Level 5
  - draft-irtf-nmrg-ibn-concepts-definitions-03.pdf
  - draft-irtf-nmrg-ibn-intent-classification-04.pdf
- 3GPP Levels with implementation focus
  - TS 28.100 V0.6.0 Levels of autonomous network
  - Focused on Reference Arch (and 28.533)
  - Taks performed and split between human and System for each Autonomous Level
- IEEE tba

- ETSI ZSM management services for Closed Loop
  - ETSI GS ZSM 009-1 Closed-Loop Automation; Part 1: Enablers
    - Management Services CL Coordination Management Services Governance
  - ETSI GR ZSM-011 V0.0.7 Draft
    - Intent federation and MD interactions/APIs
- ETSI ENI
  - ETSI GR ENI 007 V1.1.1 ENI Definition of Categories for AI Application to Networks
    - Network autonomicity Levels
  - ETSI GR ENI 010 V1.1.1 Evaluation of categories for AI application to Networks
- TM Forum
  - IG1218 Autonomous Networks – Business requirements & framework v2.0.0
  - IG1230 Autonomous Networks Technical Architecture v1.1
  - IG1251 Autonomous Networks Reference Architecture
  - IG1252 Autonomous Networks Levels Guide
  - IG1253 Intent in Autonomous Networks
  - IG1254 Control Loop Mechanism Guide
  - TMF921 Intent Management API Suite

Comparison of AN Level Definitions

Autonomous levels / categoreis	3GPP 28.100 v0.60 V0.6.0	ETSI GS ZSM 009-1 V1.1.1 tba	ETSI ENI GR ENI 007 v010101	TMF IG1218 Autonomous Network Busenss nd Framework
Level 0	**manual operating network**: No categorization of the tasks is accomplished by telecom system itself.		**Manual O&M:** O&M operators manually control the network through traditional interfaces and check network alarms and logs	**Level 0 - manual management:** The system delivers assisted monitoring capabilities, which means all dynamic tasks have to be executed manually.
Level 1	**assisted operating network**: A part of the execution and awareness tasks are accomplished automatically by telecom system itself based on human defined rules. At this level, telecom system can assist human to improve the execution and awareness efficiency.		**Assisted O&M:** Automated scripts are used in service provisioning, network function deployment, configuration and maintenance	**Level 1 - assisted management:** The system executes a certain repetitive sub-task based on pre-configured to increase execution efficiency.
Level 2	**preliminary autonomous network**: All the execution tasks are accomplished automatically by telecom system itself.		**Partial automation:** Most of the service provisioning is automated, as well as network deployment and maintenance. The AI system	**Level 2 - partial Autonomous Networks:** The system enables partial automatic O&M for certain units based on predefined rule/policy under certain external environments.
Level 3	**intermediate autonomous network**: All the execution and awareness tasks are accomplished automatically by telecom system itself. A part of the analysis and decision tasks are accomplished automatically by telecom system itself based on human defined policies		**Conditional automation:** Building on Category 2 capabilities, the AI system can sense real-time environmental changes, and in certain domains, optimize and adjust the network configuration thanks to the implementation of closed-loop management	**Level 3 - conditional Autonomous Networks:** Building on L2 capabilities, the system with awareness can sense real-time environmental changes, and in certain network domains, optimize and adjust itself to the external environment
Level 4	**advanced autonomous network**: All the execution, awareness, analysis and decision tasks are accomplished automatically by telecom system itself. And intent handling tasks can be partly accomplished automatically by telecom system itself based on human defined intent handling policies		**High automation:** Building on Category 3 capabilities, the AI system enables, in a cross-domain environment, customer experience-driven predictive or pro-active closed-loop management of networks and services.	**Level 4 - high Autonomous Networks:** Building on L3 capabilities, the system enables, in a more complicated cross-domain environment, analyze and make decision based on predictive or active closed-loop management of service and customer experience-driven networks.
Level 5	The entire network autonomy workflow is accomplished automatically by telecom system without human intervention.		**Fully autonomic system:** This category is the ultimate goal for telecom network evolution. The system is implemented with full closed-loop automation across multiple services,	**Level 5 - full Autonomous Networks:** This level is the goal for telecom network evolution. The system possesses closed-loop automation capabilities across multiple services, multiple domains, and the entire lifecycle, achieving Autonomous Networks.

ETSI ZSM; Closed-Loop Automation

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ETSI GS ZSM 009-1 (ZSM); Closed-Loop Automation; Part 1: Enablers

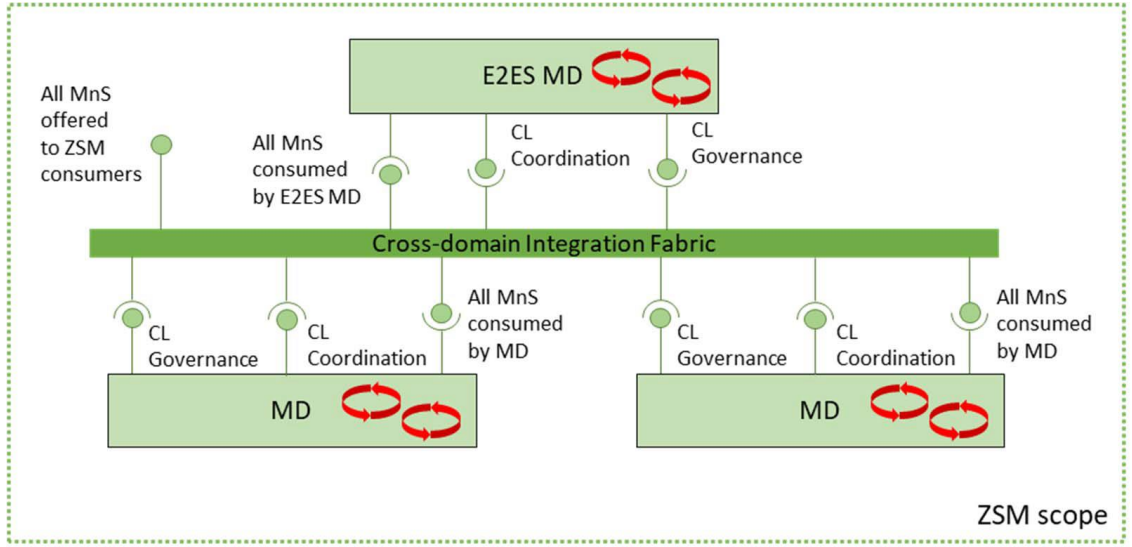


Figure 7.1-1: CL related management capabilities introduced in the present document

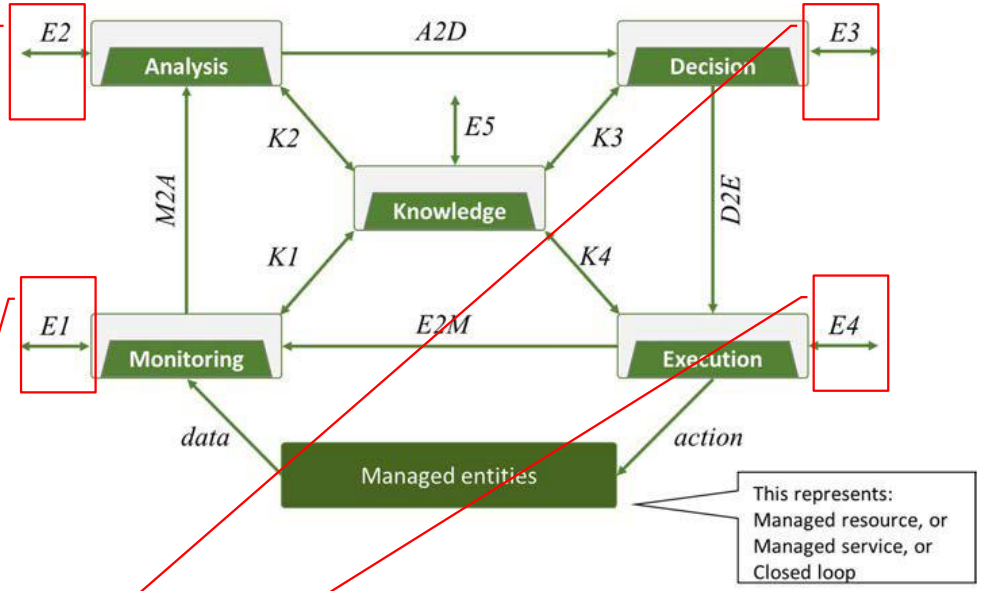
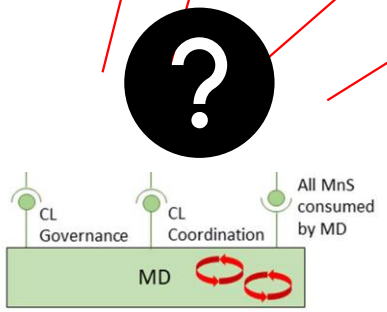
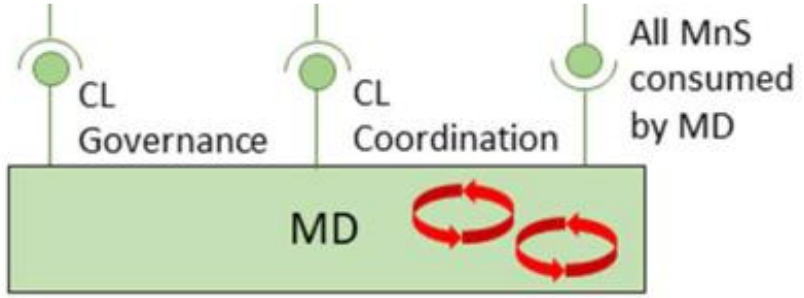
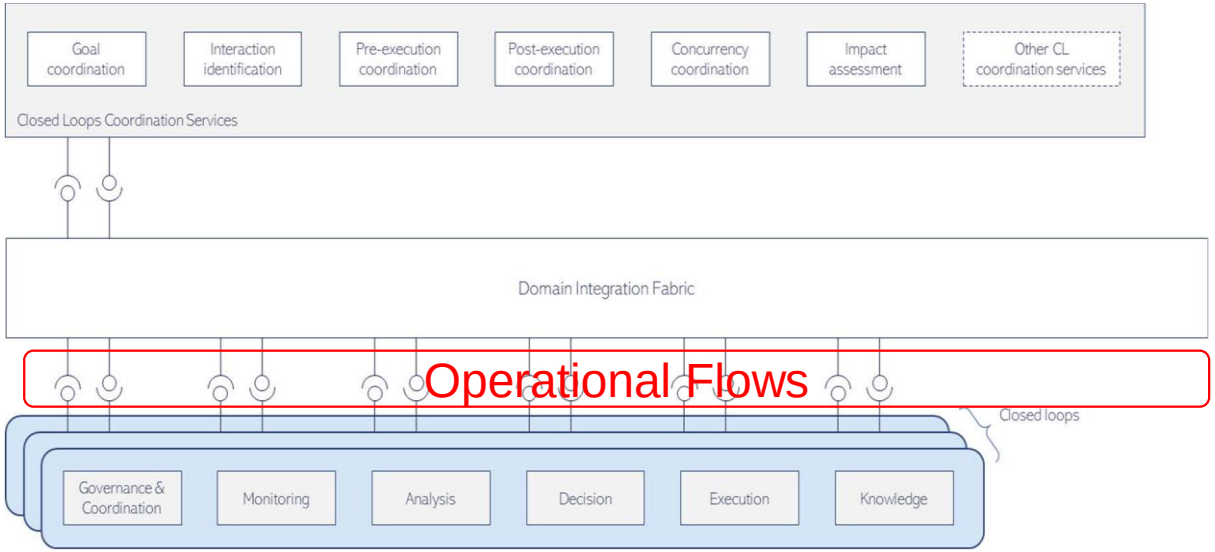


Figure 7.2.1-1: Functional view of a Closed Loop and its stages within the ZSM framework



ETSI GS ZSM 009-1 (ZSM); Closed-Loop Automation; Part 1: Enablers





- Closed Loop Coordination services
  - Pre-execution coordination service
  - Post-execution coordination service
- Management services -Closed Loop Governance
  - Closed Loop Governance service
  - Closed loop information reporting service
  - Closed loop execution management service
  - Closed loop usage statistics management service
- Pause points?

3GPP 28.100 Levels of Autonomous Network

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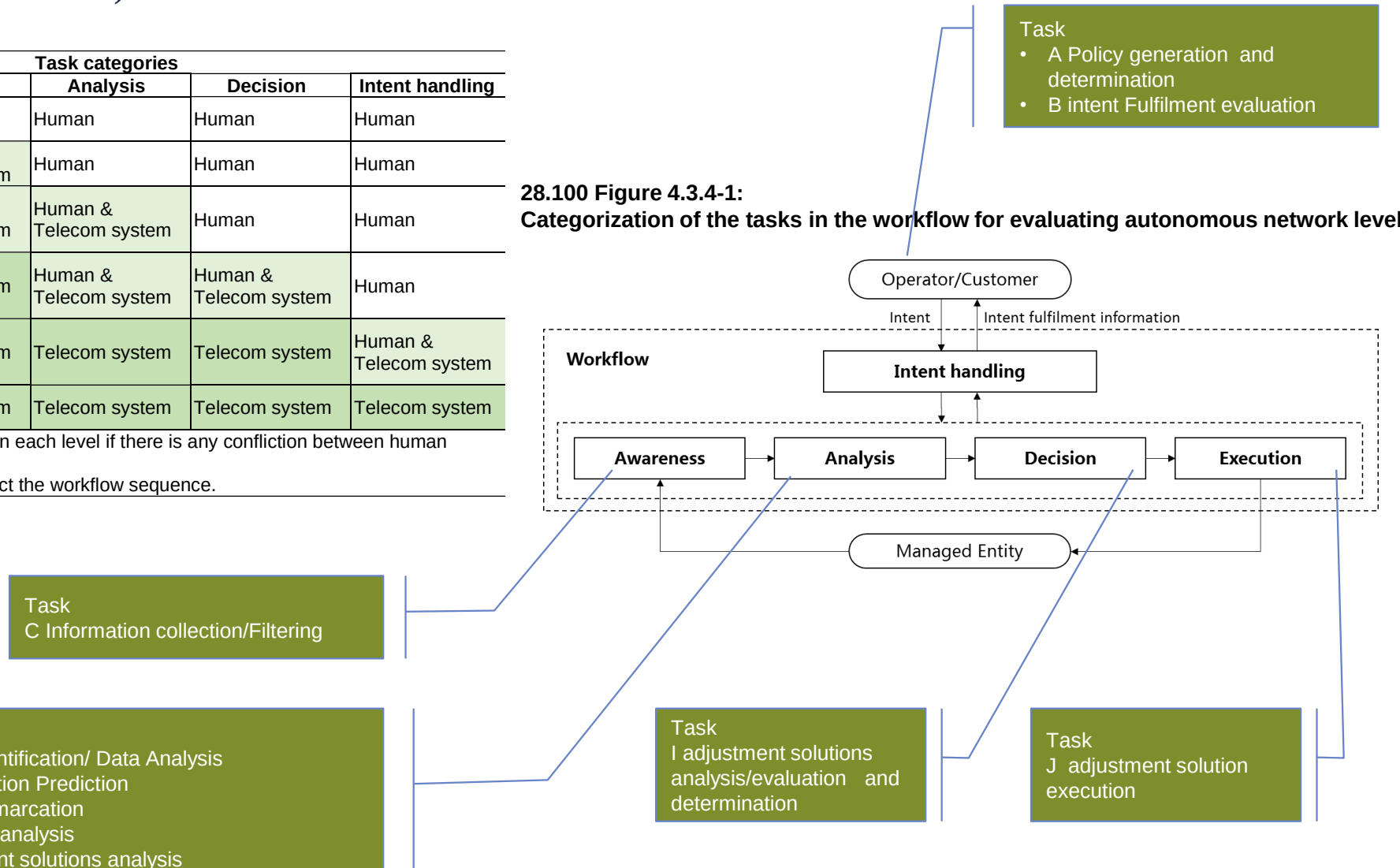
3GPP 28.100 Levels of Autonomous Network

3GPP TS 28.100 V0.6.0 (2021-09)

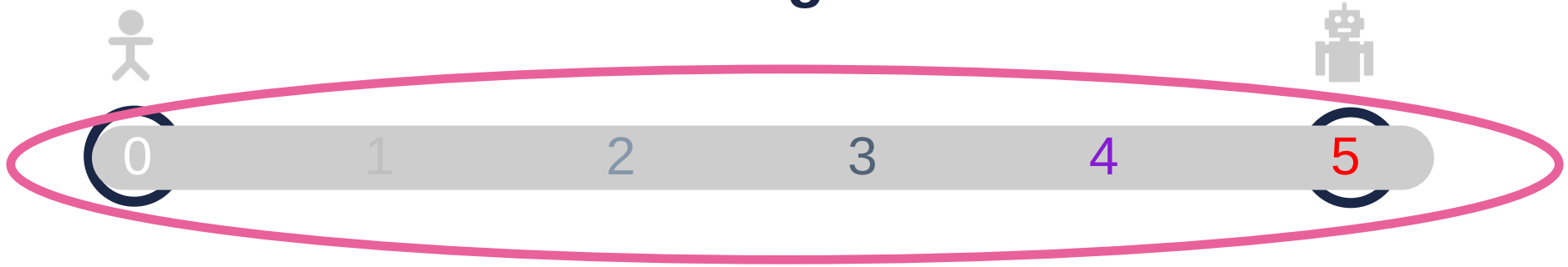
Network autonomy level		Task categories				
		Execution	Awareness	Analysis	Decision	Intent handling
L0	Manual operating network	Human	Human	Human	Human	Human
L1	Assisted operating network	Human & Telecom system	Human & Telecom system	Human	Human	Human
L2	Preliminary autonomous network	Telecom system	Human & Telecom system	Human & Telecom system	Human	Human
L3	Intermediate autonomous network	Telecom system	Telecom system	Human & Telecom system	Human & Telecom system	Human
L4	Advanced autonomous network	Telecom system	Telecom system	Telecom system	Telecom system	Human & Telecom system
L5	Full autonomous network	Telecom system	Telecom system	Telecom system	Telecom system	Telecom system

Note 1: Human reviewed decision have the highest authority in each level if there is any confliction between human reviewed decision and telecom system generated decision.
Note 2: The order of above five task categories does not reflect the workflow sequence.

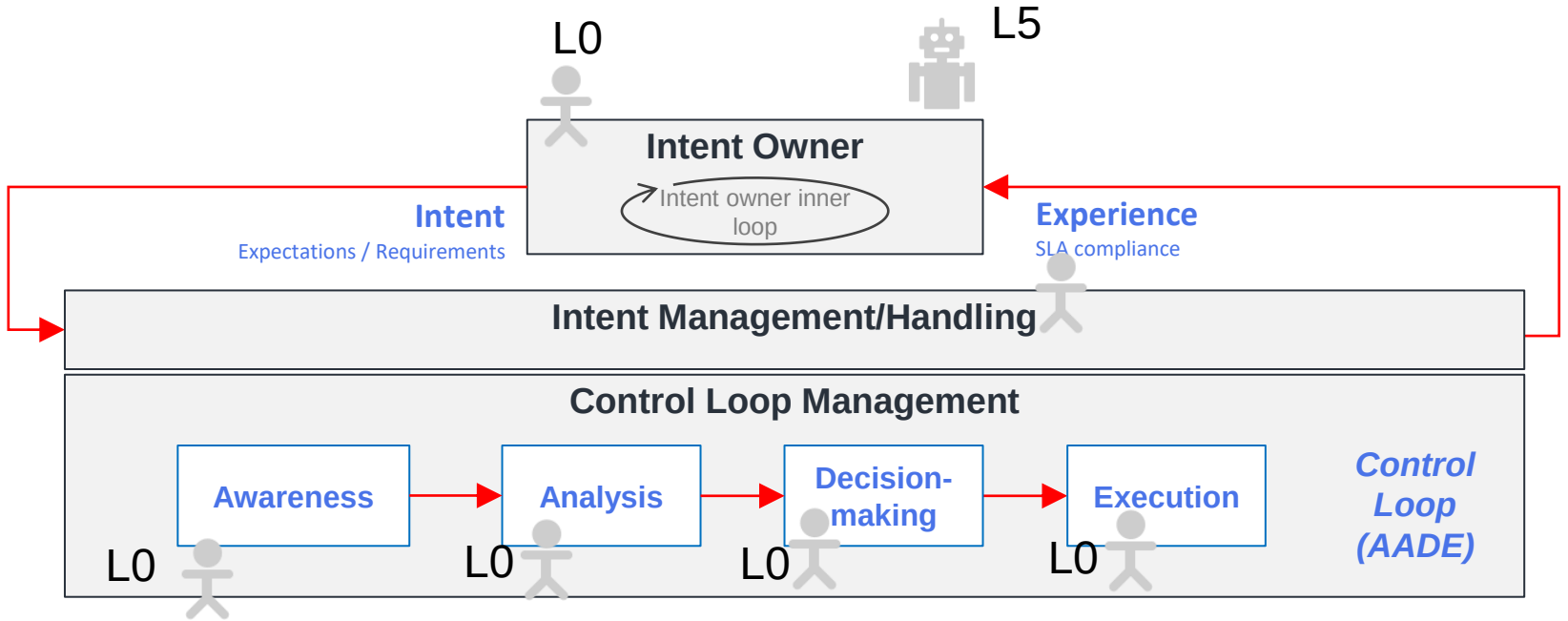
28.100 Figure 4.3.4-1:
Categorization of the tasks in the workflow for evaluating autonomous network levels



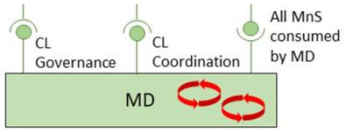
Autonomous Network Levels –using 3GPP 28.100 Definitions

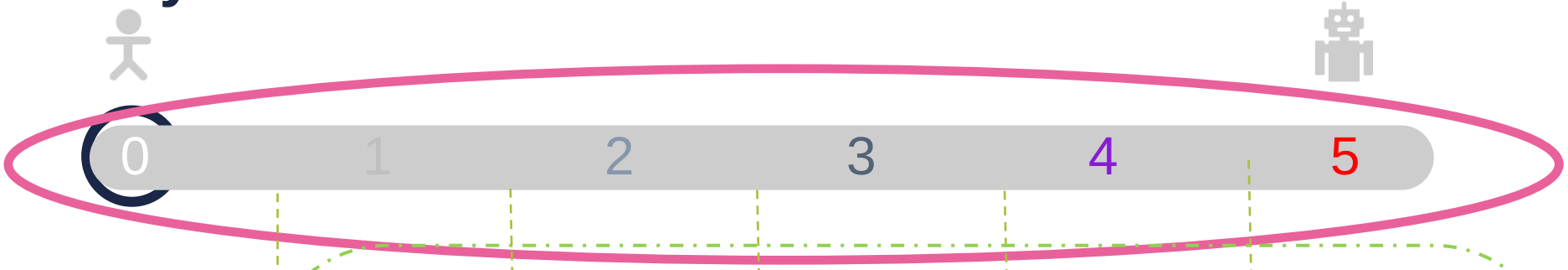


P: Personnel, S: Systems



Example analysis





TM Forum AI operations lifecycle

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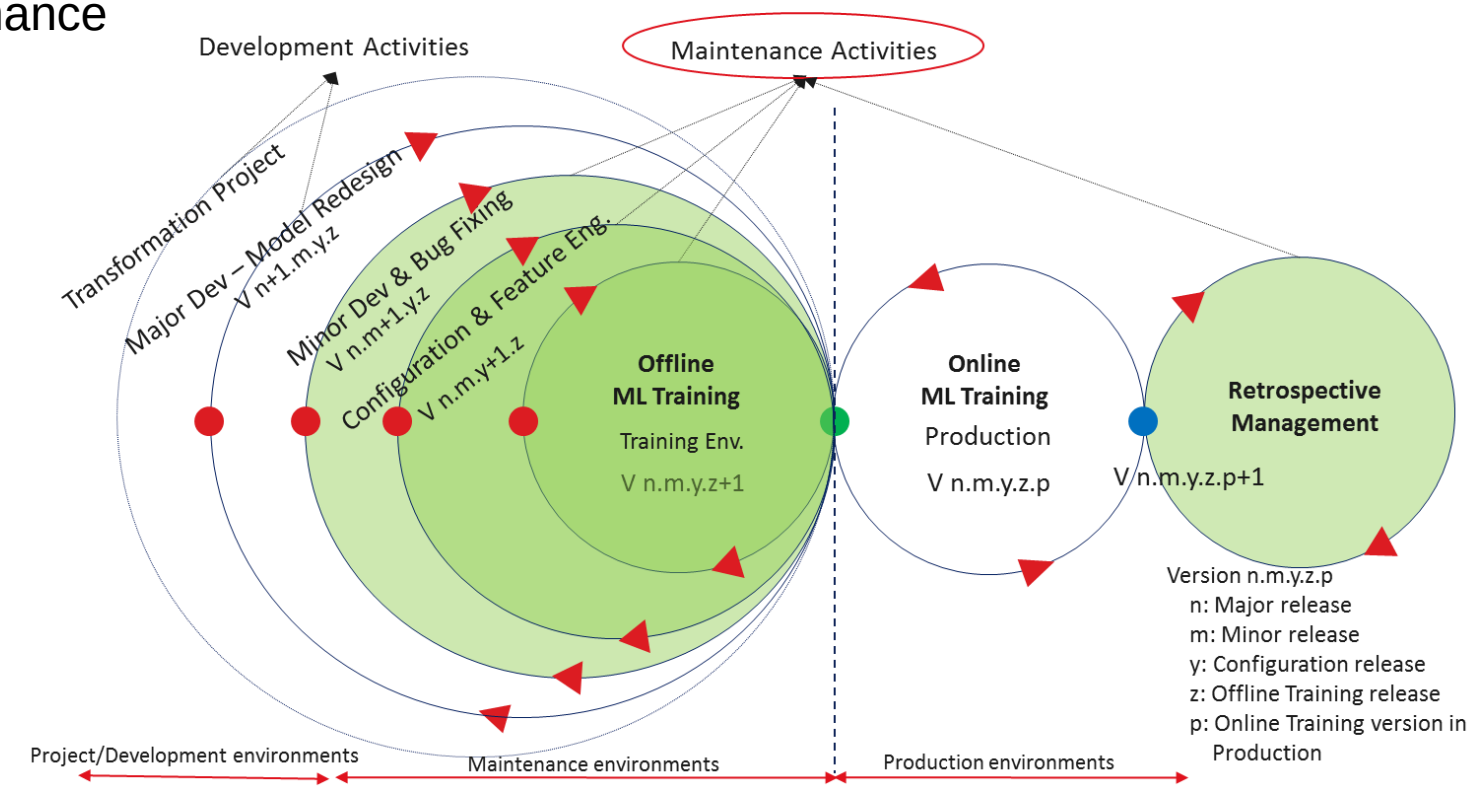
AI Operations Maintenance & Change/Version Management (example)

IG1190 App Maintenance



Summary /Questions

- Focus is on Operational flows at differ3nt
- At Level 0 we have legacy operations flows based on today's APIs
- At Level 5 we have intent abstraction and don't see anything about internal structure of Autonomous Domain or CL
- At Levels 1 -4 we see varying degrees of automation of:
  - Awareness
  - Analysis
  - Decision making
  - Execution
  - Each with different technology ptions and operational processes for pre and post execution
- From CSP Operational Perpsective this is a complex set of operation transformations adding cost and time
- Can we simplify the evolution of operational flows?