Standardization Overview of Autonomous Network
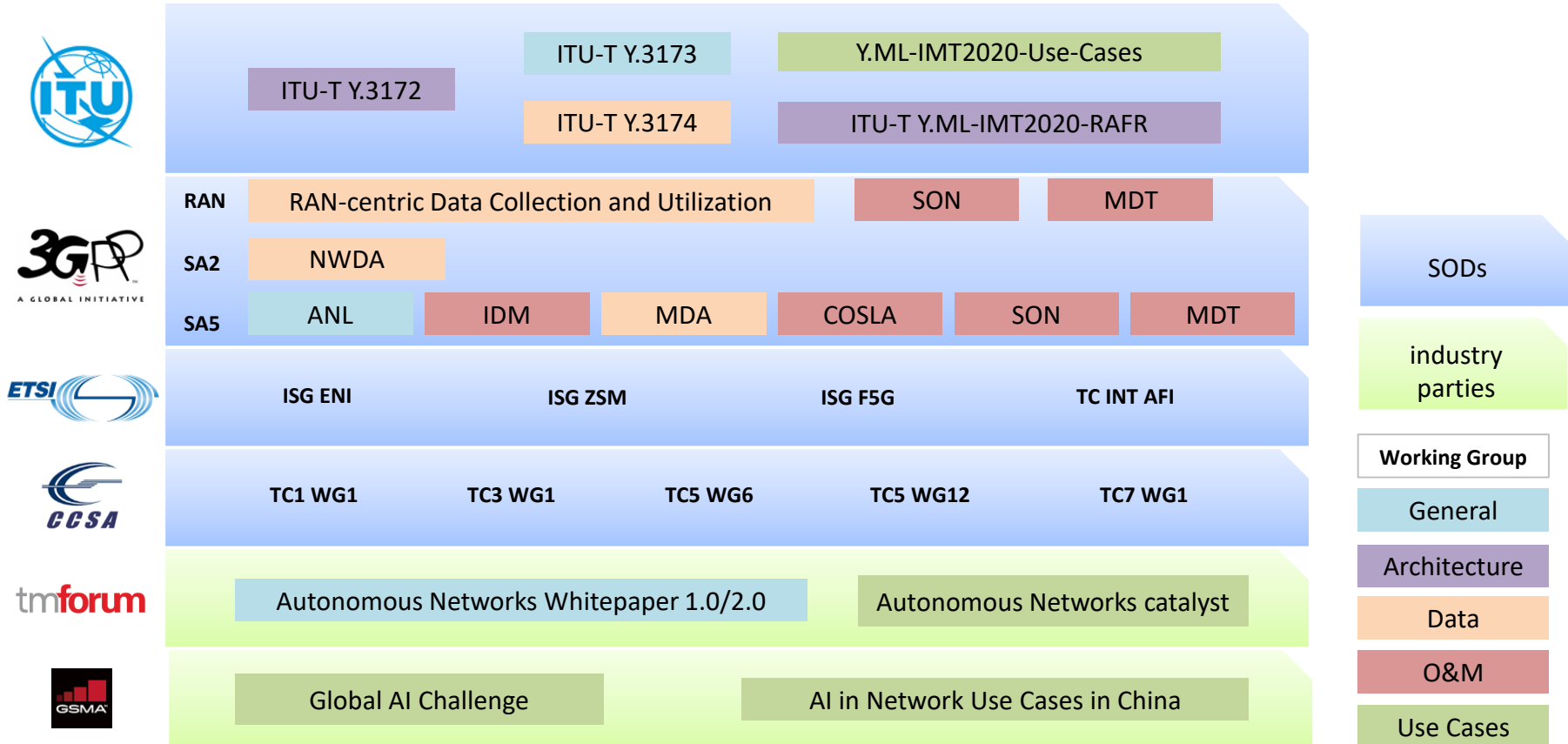
Dr. CAO Xi

AI and Intelligent Operation Center, China Mobile Research Institute

3rd November 2020

Landscape of activities in SDOs and industry parties

ITU
- ITU-T Y.3172
- ITU-T Y.3173
- Y.ML-IMT2020-Use-Cases
- ITU-T Y.3174
- ITU-T Y.ML-IMT2020-RAFR

3GPP
RAN	RAN-centric Data Collection and Utilization	SON	MDT
SA2	NWDA		
SA5	ANL	IDM	MDA	COSLA	SON	MDT

ETSI
- ISG ENI
- ISG ZSM
- ISG F5G
- TC INT AFI

CCSA
- TC1 WG1
- TC3 WG1
- TC5 WG6
- TC5 WG12
- TC7 WG1

tmforum
- Autonomous Networks Whitepaper 1.0/2.0
- Autonomous Networks catalyst

GSMA
- Global AI Challenge
- AI in Network Use Cases in China

Legend:
- SODs
- industry parties
- Working Group
- General
- Architecture
- Data
- O&M
- Use Cases

2

SON: Self-Organizing Networks

TR 37.816 V16.0.0 Study on RAN-centric data collection and utilization for LTE and NR (Release 16)

TS 28.313 V16.0.0 Management and orchestration; Self-Organizing Networks (SON) for 5G networks (Release 16)

5 Use cases and solutions for RAN-centric data collection and utilization

- ▷ 5.1 Capacity and Coverage Optimization
- ▷ 5.2 PCI selection
- ▷ 5.3 Mobility optimization
- ▷ 5.4 Load Sharing and Load Balancing Optimization
- ▷ 5.5 RACH Optimization
- ▷ 5.6 Energy Saving
- ▷ 5.7 Minimization of Drive Test (MDT) Use Cases
- ▷ 5.8 UE energy saving
- ▷ 5.9 Active Antenna System (AAS) Optimization
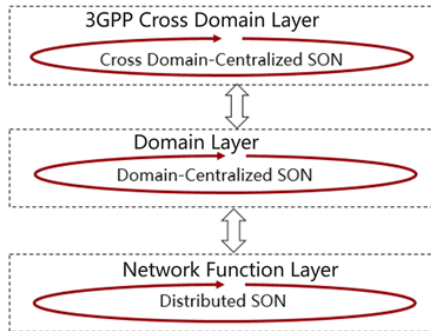
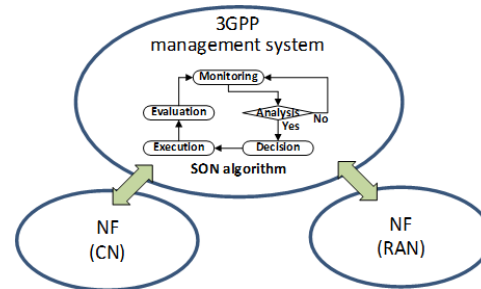**Figure 4.1.1-1 Overview of SON Framework**
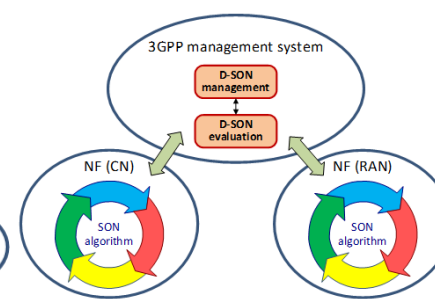
Figure 4.1.2-1 C-SON process

Figure 4.1.3-1 D-SON process

Figure 4.1.4-1 H-SON process

3

NWDAF: Network Data Analytics Function
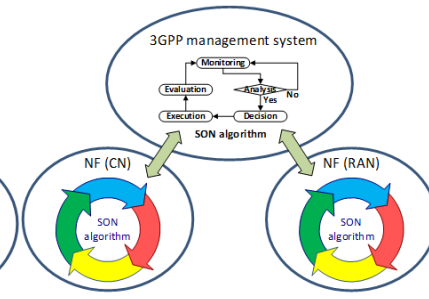
TS 23.501 V16.0.2 System Architecture for the 5G System; Stage 2 (Release 16)

6.2.18 Network Data Analytics Function (NWDAF)

NWDAF represents operator managed network analytics logical function. The NWDAF includes the following functionality:

- Support data collection from NFs and AFs;
- Support data collection from OAM;
- NWDAF service registration and metadata exposure to NFs/AFs;
- Support analytics information provisioning to NFs, AF.

TS 23.288 V16.3.0 Architecture enhancements for 5G System (5GS) to support network data analytics services (Release 16)
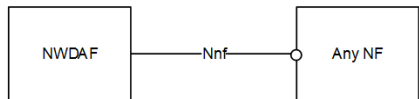

Figure 4.2-1: Data Collection architecture from any 5GC NF
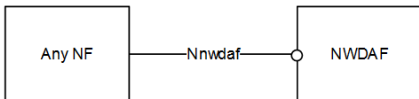

Figure 4.2-2: Network Data Analytics Exposure architecture

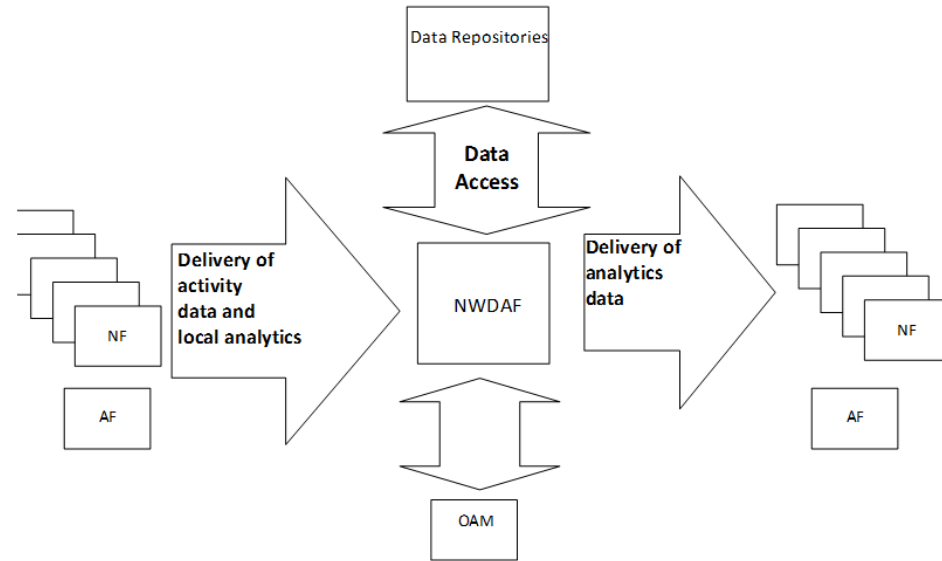## TR 23.791 V16.2.0 Study of Enablers for Network Automation for 5G (Release 16)

Figure 4.2-1: general framework for 5G network automation

TS 28.100 V0.1.0 Levels of autonomous network (Release 17)

Autonomous Network: telecommunication system (including management system and network) with autonomy capabilities which is able to be governed by itself with minimal to no human intervention.

Autonomous Network Level: describes the level of autonomy capabilities in the autonomous network.

TR 28.810 V17.0.0 Study on concept, requirements and solutions for levels of autonomous network (Release 17)

Figure 4.4.2-1: General workflow for network autonomy

Table 6.1.2-1: Framework approach for classification of autonomous network level

Network autonomy level		Task categories				
		Execution	Awareness	Analysis	Decision	Intent translation
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.

TR 28.812 V17.0.0 Study on scenarios for Intent driven management services for mobile networks (Release 17)

Intent: A desire to reach a certain state/position for a specific entity for instance for a service assurance or network deployment task.
NOTE: An intent does not define the necessary steps to get to the wanted state.
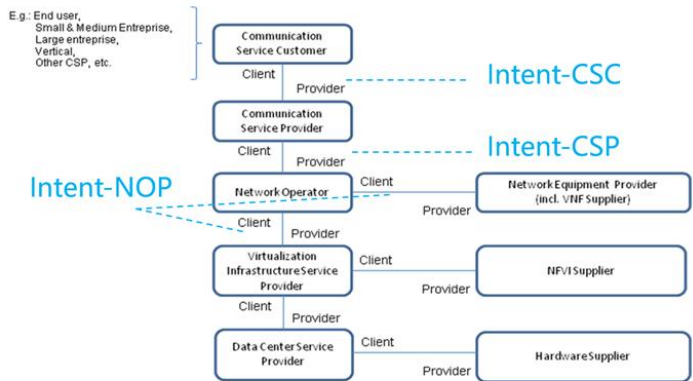**Intent driven MnS:** A management service that allows its consumer to express an Intent.

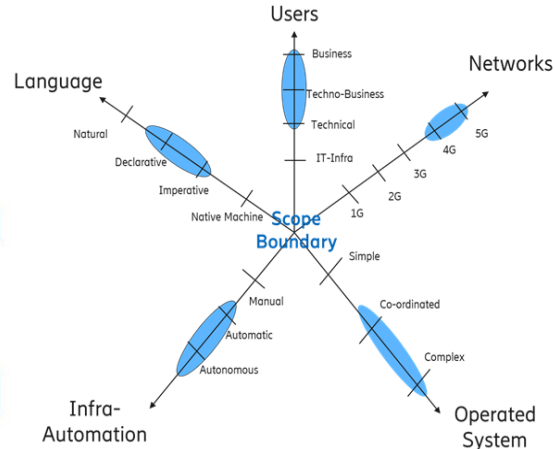Figure 4.1.2.4-1: Concept for utilization of intent
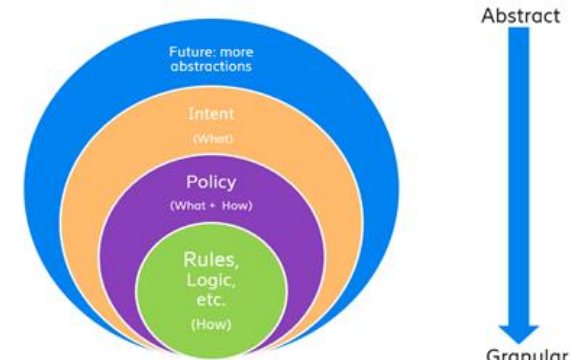
Figure 4.2.1-1: Dimension of intent

Figure 4.4-1: Intent driven management vs Policy driven management

Note: the normative work for intent driven management has been started in 3GPP SA5 (Corresponding contents will be captured in TS 28.312)

MDA: Management Data Analytics

Figure 4.2-1: Functional overview of MDA

TR 28.809 V1.0.2 Study on enhancement of Management Data Analytics (MDA) (Release 17)

4.1   Overview

The MDA provides a capability of processing and analysing the raw data related to network and service events and status to provide analytics report (including recommended actions) to enable the necessary actions for network and service operations.

The MDA, in conjunction with AI and ML techniques, brings intelligence and automation to the network service management & orchestration.
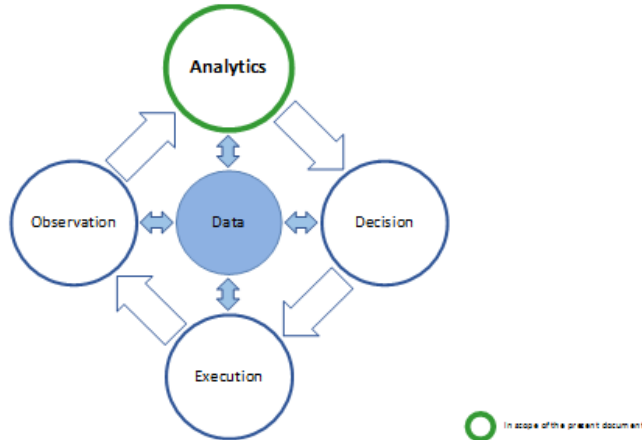

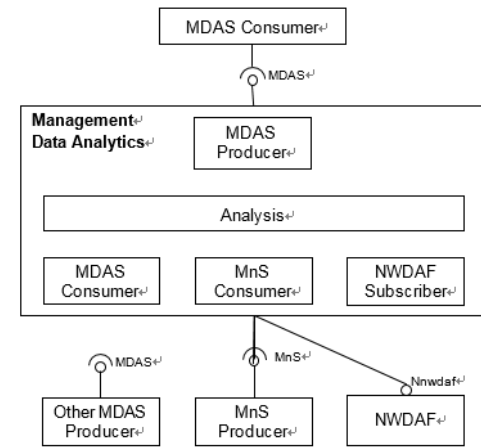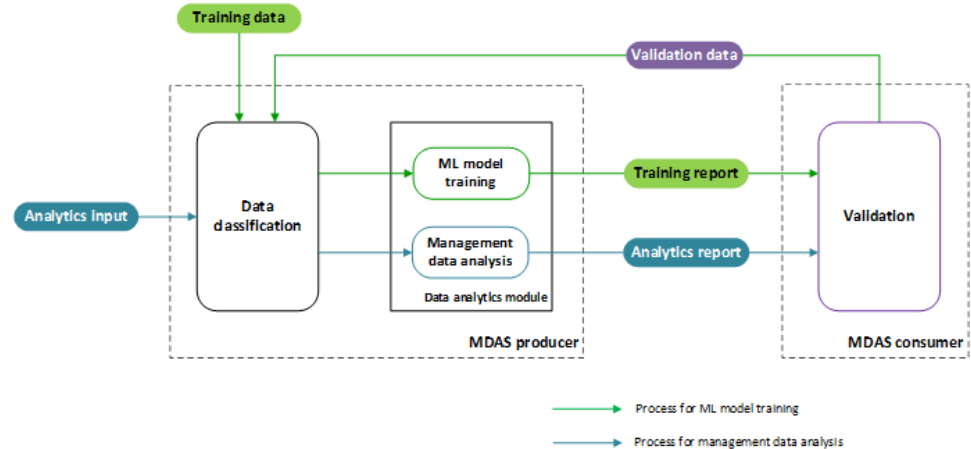Figure 5.1-1: Analytics in management loop

Figure 5.3-1: MDA process

COSLA: Closed Loop Communication Service Assurance

TS 28.535 V16.1.0 Management services for communication service assurance; Requirements (Release 17)

1   Scope

Concepts and background, and specifies use cases and requirements for closed loop communication service assurance solution that adjusts and optimizes the services provided by NG-RAN and 5GC.
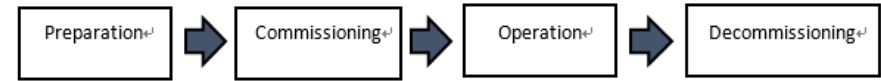

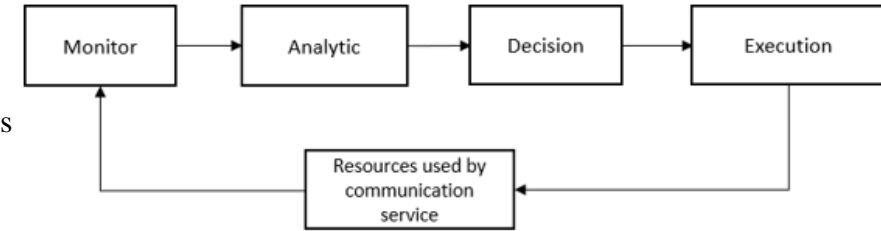Figure 4.1.1: Lifecycle of a communication service

Figure 4.2.1.2: Management Control Loop
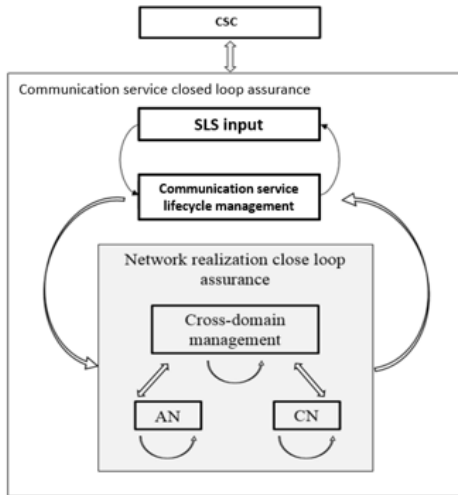
Figure 4.2.1.1: Communication service closed loop assurance
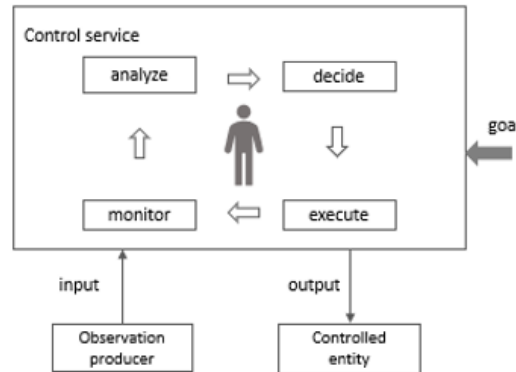
Figure 4.2.3.1: Open control loop entities
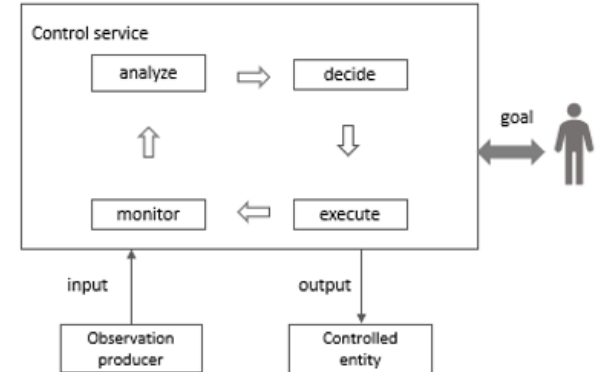
Figure 4.2.4.1: Closed control loop entities

8

ETSI ISG ENI founded at 17Q1, Release 1 (2017-2019), Extended at 19Q1 into Release 2(2019-2021)
Core idea: Network perception analysis, data-driven policy, AI based closed-loop control

ETSI GS ENI 005 V1.1.1 (2019-09) Experiential Networked Intelligence (ENI); System Architecture

ENI High-Level Functional Architecture
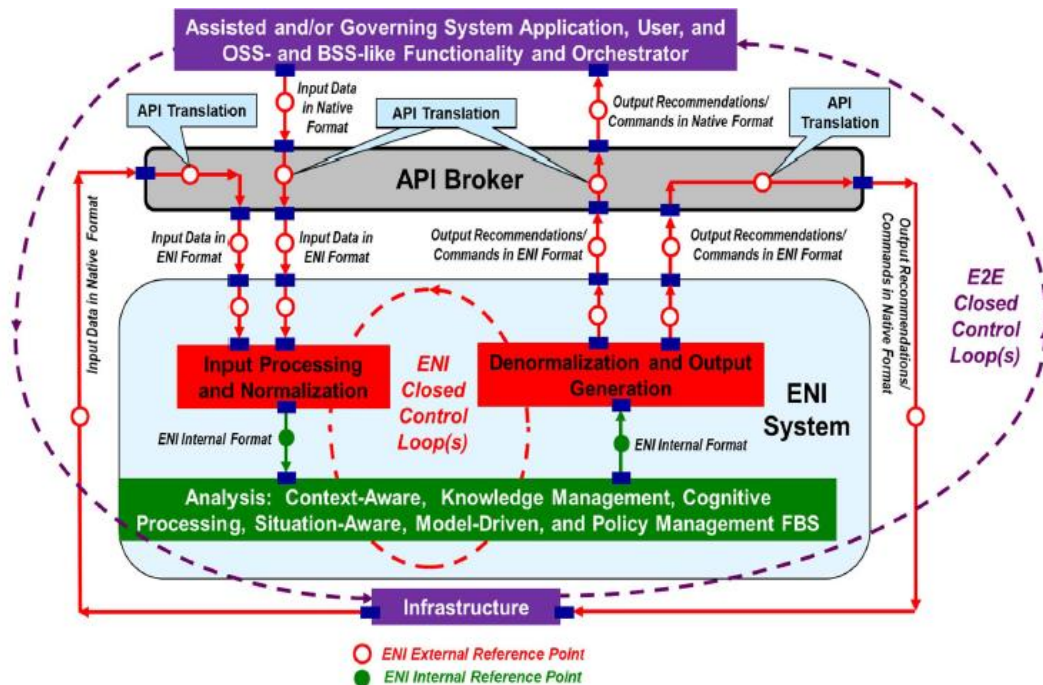
Figure 4-5: High-Level Functional Architecture of ENI When an API Broker Is Used

ETSI ISG ZSM was established in January 2018. It is working on the definition of a new, future-proof, horizontal and vertical end-to-end operable framework and solutions to enable agile, efficient and qualitative management and automation of emerging and future networks and services.

ETSI GS ZSM 002 V1.1.1 (2019-08) Zero-touch network and Service Management (ZSM); Reference Architecture

ZSM framework reference architecture

Figure 6.2-1: ZSM framework reference architecture

Autonomous Networks: Empowering Digital Transformation For The Telecoms Industry
Autonomous Networks: Empowering digital transformation for smart societies and industries

Figure 8: Autonomous Networks framework

3-layers: Are common capabilities that can be utilized to support all scenarios and business need

- **Network resource layer**
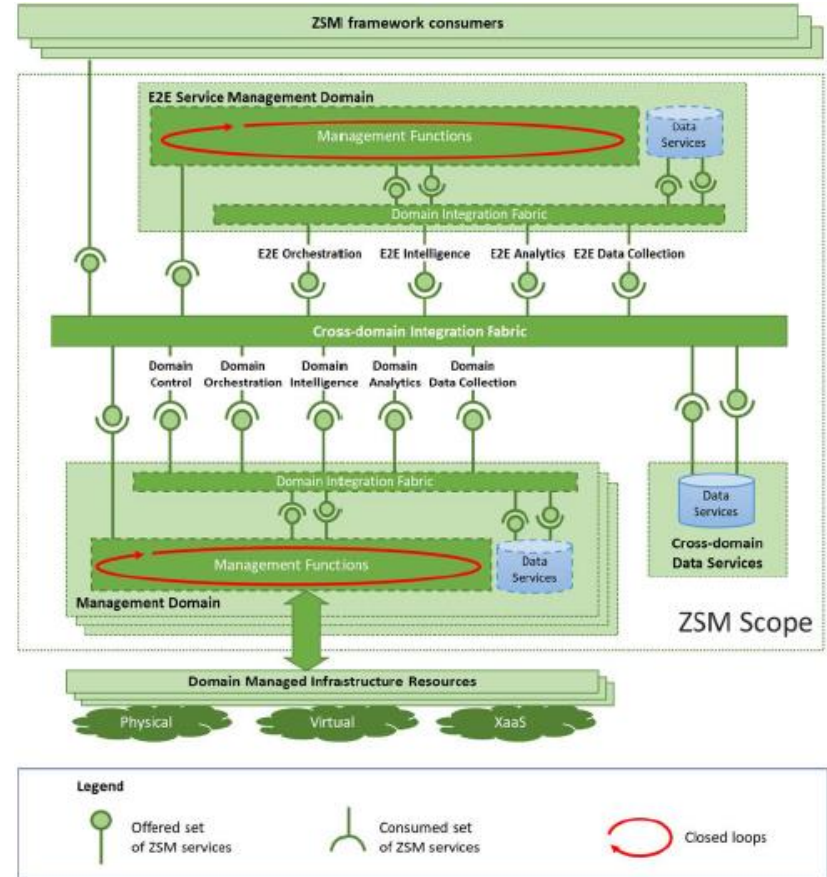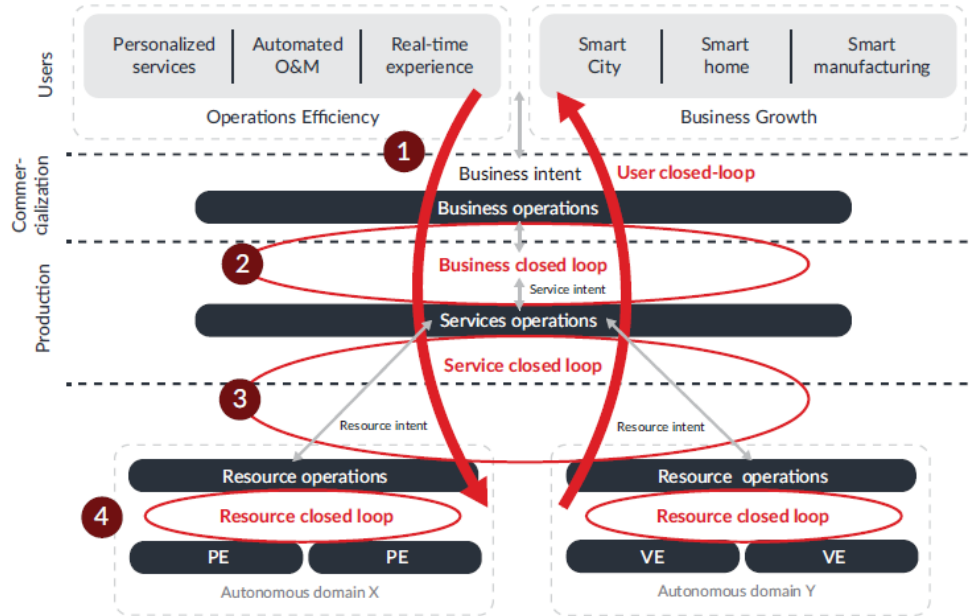- **Network operations layer**
- **Business operations layer**

4-closed-loops: to fulfill the full lifecycle of the process

- **Resource closed loop**
- **Service closed loop**
- **Business closed loop**
- **User closed loop**

Autonomous Levels	L0: Manual operation & maintenance	L1: Assisted operation & maintenance	L2: Partial Autonomous Networks	L3: Conditional Autonomous Networks	L4: High Autonomous Networks	L5: Full Autonomous Networks
AN services (Zero X)	N/A	Individual AN case	Individual AN case	Select AN cases	Select AN services	Any AN services
Execution	P	P/S	S	S	S	S
Awareness	P	P	P/S	S	S	S
Analysis/ Decision	P	P	P	P/S	S	S
Intent/ Experience	P	P	P	P	P/S	S

Personnel (manual) ▢ Systems (autonomous) ▢

TM Forum 2020

Figure 9: Six levels of Autonomous Networks

Process Review of Autonomous Network Level Standardizing

		2018				2019				2020				2021
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	

ITU-T

FG-ML5G — 2018.4 Start new deliverable "Grading method for intelligent capability of mobile networks" — 2019.6 Consent "Method for evaluating mobile network intelligence level"

SG13 — 2019.6 New Draft Recommendation Y.ML-IMT2020-Intelligence-level — 2019.10 Y.3173 Consent — 2020.2 Y.3173 Approval

CCSA

TC5-WG6 — 2018.4 New SI on grading method for intelligent capability of mobile networks — 2019.8 Complete SI on grading method for intelligent capability of mobile networks

TC7-WG1 — 2020.1 Start WI on Technical Specification for Intelligent level of Mobile Network Management and Operation

3GPP

SA5 — 2019.8 New SI of FS_ANL — 2020.8 Complete SI of FS_ANL — 2020.6 New WI of ANL

Methodology phase
Achieve consensus on ANL concept, framework approach

Specification phase
Make ANL to be measurable, evaluable in real network

Thank You

caoxi@chinamoile.com