**3GPP TSG-SA5 Meeting #162S5-25xxxx**

**Gothenburg, Sweeden, 25 - 29 August 2025**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  | **28.533** | **CR** | **0166** | **Rev** |  | **Current version:** | **19.2.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network | **x** |

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| ***Title:***  | Rel-19 CR TS 28.533: addition of summary descriptions for functions in support of architecture reference model for management and orchestration  |
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| ***Source to WG:*** | NEC, Intel, Huawei, AT&T, ZTE, CATT, MATRIXX Software, Deutsche Telekom, Verizon, China Unicom, China Mobile, Orange, NTT Docomo, TELECOM ITALIA, Vodafone |
| ***Source to TSG:*** | SA5 |
|  |  |
| ***Work item code:*** | SBMA\_Ph3 |  | ***Date:*** | 2025-08-08 |
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| ***Category:*** | C |  | ***Release:*** | Rel-19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | The current specification does not explicitly define logical Management Functions (MnFs) as producers or consumers of Management Services (MnSs). This lack of clarity creates architectural gaps that lead to ambiguity, inconsistent interpretation across 3GPP Working Groups, and increasing functional overlap, especially as advanced features such as AI/ML, data analytics, and automation expand in 5G Advanced and future 6G systems. The essential, streamlined reference architecture provides the minimum structure needed to ensure architectural traceability and cross-WG alignment while preserving flexibility. |
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| ***Summary of change:*** | The change introduces a new subclause that provides normative, high-level descriptions of MnFs defined in the SBMA reference architecture. The added text outlines the functional scope of MnFs.These descriptions complement the reference architectural and MnFs table by making explicit the management scope/responsibilities of each function, thereby enhancing architectural clarity and cross-specification alignment. |
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| ***Consequences if not approved:*** | Without this baseline, the architectural role of MnFs will remain unclear, leading to continued ambiguity and fragmentation across Working Groups. This could hinder coordination, result in overlapping or inconsistent functions, and undermine SA5’s ability to guide end-to-end management and orchestration standardisation for 5G Advanced and the transition towards 6G. |
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| ***Clauses affected:*** | New annex A.y |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | For further background including rational for the change request please check the discussion paper in S5-253320 and CR in S5-253322 submitted to this meeting. |
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| ***This CR's revision history:*** |  |

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| **1st change** |

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] Void

[3] 3GPP TS 28.530: "Management and orchestration of networks and network slicing; Concepts, use cases and requirements".

[4] 3GPP TS 28.541: "Management and orchestration of 5G networks; Network Resource Model (NRM); Stage 2 and stage 3".

[5] 3GPP TS 28.552: "Management and orchestration of 5G networks; Performance measurements".

[6] 3GPP TS 28.554: "Management and orchestration of 5G networks; 5G End to end Key Performance Indicators (KPI)".

[7] 3GPP TS 32.425: "Telecommunication management; Performance Management (PM); Performance measurements Evolved Universal Terrestrial Radio Access Network (E-UTRAN)".

[8] 3GPP TS 28.531: "Management and orchestration of 5G networks; Provisioning".

[9] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[10] 3GPP TS 28.500: "Telecommunication management; Management concept, architecture and requirements for mobile networks that include virtualized network functions"

[11] 3GPP TS 28.510: "Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Requirements".

[12] 3GPP TS 28.511: "Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Procedures".

[13] 3GPP TS 28.512: "Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Stage 2".

[14] 3GPP TS 28.513: "Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Stage 3".

[15] 3GPP TS 28.515: "Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Requirements".

[16] 3GPP TS 28.516: "Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Procedures".

[17] 3GPP TS 28.517: "Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Stage 2".

[18] 3GPP TS 28.518: "Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Stage 3".

[19] 3GPP TS 28.520: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Requirements".

[20] 3GPP TS 28.521: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Procedures".

[21] 3GPP TS 28.522: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 2".

[22] 3GPP TS 28.523: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 3".

[23] 3GPP TS 28.525: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Requirements".

[24] 3GPP TS 28.526: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Procedures".

[25] 3GPP TS 28.527: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Stage 2".

[26] 3GPP TS 28.528: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Stage 3".

[27] ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV V1.3.1 (2018-01)".

[28] Void.

[29] ETSI GS ZSM 002: "Zero-touch Network and Service Management (ZSM); Reference Architecture V.1.1.1 (2019-08)".

[30] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[31] 3GPP TS 23.501: "System Architecture for the 5G system".

[32] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[33] IETF RFC 8446: "The Transport Layer Security (TLS) Protocol Version 1.3".

[34] IETF RFC 4253: "The Secure Shell (SSH) Transport Layer Protocol".

[35] 3GPP TS 28.100: "Management and orchestration; Levels of autonomous network".

[36] 3GPP TS 28.533: "Management and orchestration; Architecture framework".

[37] 3GPP TS 28.535: "Management services for communication service assurance; Requirements".

[38] 3GPP TS 28.536: "Management services for communication service assurance; Stage 2 and stage 3".

[39] 3GPP TS 28.537: "Management and orchestration; Management capabilities".

[40] 3GPP TS 28.538: "Management and orchestration; Edge Computing Management".

[41] 3GPP TS 28.540: "Management and orchestration; 5G Network Resource Model (NRM); Stage 1".

[42] 3GPP TS 28.550: "Management and orchestration; Performance assurance".

[43] 3GPP TS 32.421: "Telecommunication management; Subscriber and equipment trace; Trace concepts and requirements".

[44] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace; Trace control and configuration management".

[45] 3GPP TS 32.423: "Telecommunication management; Subscriber and equipment trace; Trace data definition and management".

[46] 3GPP TS 28.312: "Management and orchestration; Intent driven management services for mobile networks".

[47] 3GPP TS 28.557: "Management and orchestration; Management of Non-Public Networks (NPN); Stage 1 and stage 2".

[48] 3GPP TS 28.404: "Telecommunication management; Quality of Experience (QoE) measurement collection; Concepts, use cases and requirements".

[49] 3GPP TS 28.405: "Telecommunication management; Quality of Experience (QoE) measurement collection; Control and configuration".

[50] 3GPP TS 28.406: "Telecommunication management; Quality of Experience (QoE) measurement collection; Information definition and transport".

[51] 3GPP TS 28.631: "Telecommunication management; Inventory Management (IM) Network Resource Model (NRM) Integration Reference Point (IRP); Requirements".

[52] 3GPP TS 28.632: "Telecommunication management; Inventory Management (IM) Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[53] 3GPP TS 28.633: "Telecommunication management; Inventory Management (IM) Network Resource Model (NRM) Integration Reference Point (IRP); Solution Set (SS) definitions".

[54] 3GPP TS 28.623: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Solution Set (SS) definitions".

[55] 3GPP TS 32.130: "Telecommunication management; Network sharing; Concepts and requirements".

[56] 3GPP TS 28.310: "Management and orchestration; Energy efficiency of 5G".

[57] 3GPP TS 28.104: "Management and orchestration; Management Data Analytics (MDA)".

[58] 3GPP TS 28.313: "Management and orchestration; Self-Organizing Networks (SON) for 5G networks".

[59] 3GPP TS 28.314: "Management and orchestration; Plug and Connect; Concepts and requirements".

[60] 3GPP TS 28.315: "Management and orchestration; Plug and Connect; Procedure flows".

[61] 3GPP TS 28.316: "Management and orchestration; Plug and Connect; Data formats".

[62] 3GPP TS 28.555: "Management and orchestration; Network policy management for 5G mobile networks; Stage 1".

[63] 3GPP TS 28.556: "Management and orchestration; Network policy management for 5G mobile networks; Stage 2 and stage 3".

[64] ETSI GS NFV-IFA 008 (V4.3.1): "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".

[65] ETSI GS NFV-IFA 013 (V4.3.1): "Network Function Virtualisation (NFV) Release 4; Management and Orchestration; Os-Ma-nfvo reference point - Interface and Information Model Specification".

[66] 3GPP TS 28.105: "Management and orchestration; Artificial Intelligence / Machine Learning (AI/ML) management".

[67] 3GPP TS 28.317: "Management and orchestration; Self-configuration of Radio Access Network Entities (RAN NEs)".

[68] 3GPP TS 28.111: "Management and orchestration; Fault management (FM)".

[69] 3GPP TS 28.318: "Management and Orchestration; Network and services operations for energy utilities".

[70] 3GPP TS 28.319: "Management and orchestration; Access Control for Management services".

[71] 3GPP TS 26.247 "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)"

[x1] 3GPP TS 28.558: “Management and Orchestration UE level measurements for 5G system”.

[x2] 3GPP TS 28.561 “Management and orchestration; Management aspects of Network Digital Twins”

[x3] 3GPP TS 28.567 “Management and orchestration; Management aspects of closed control loops”

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| **Next change** |

## A.y Summary and capabilities of the architecture reference model for management and orchestration

### ML Training Function (MLTRF)

The ML Training Function (MLTRF) provides capabilities for initial training and re-training of machine learning models. It manages the collection and preparation of training data, executes training processes, validates trained models, and may coordinate joint training of multiple ML models when required. It produces training performance reports and enables authorised consumers to configure training thresholds, select training data sources, and manage the training lifecycle.

*Capabilities:*

- Initial training and re-training of ML models.

- Training data collection and preparation.

- Model validation.

- Model joint training.

- Training performance reporting.

- Training threshold configuration.

(Reference: TS 28.105 [66]).

### ML Testing Function (MLTEF)

The ML Testing Function (MLTEF) is responsible for evaluating the performance of trained ML models using independent testing datasets. It provides capabilities for selecting and applying performance indicators, comparing results against requirements, and enabling re-training if test results do not meet expectations. The function allows authorised consumers to request model testing and receive detailed test reports.

*Capabilities:*

- Model testing.

- Performance indicator selection and reporting.

- Model joint testing.

- Re-training triggering.

- Test report delivery.

(Reference: TS 28.105 [66]).

### ML Emulation Function (MLEMF)

The ML Emulation Function (MLEMF) provides the capability to emulate AI/ML inference processes in a controlled environment before deployment to the live network or system. It enables the evaluation of ML model inference performance under representative conditions and ensures that models meet operational performance targets without adverse effects on other network functions.

*Capabilities:*

- Inference emulation in test environments.

- Performance evaluation under lifelike conditions.

- Verification of non-impact on live systems.

- Inference emulation report delivery.

(Reference: TS 28.105 [66]).

### Management Data Analytics Function (MDAF)

The Management Data Analytics Function (MDAF) enables the processing and analysis of management, service, and network data to generate actionable analytics output. It supports diverse analytics capabilities such as performance assessment, prediction, anomaly detection, and root cause analysis across network domains (RAN, CN, and cross-domain). MDAF may utilize AI/ML inference for specific analytics types and interact with various data sources including PM/KPIs, QoE, alarms, traces, configuration, and external inputs (e.g. NWDAF, LMF, AFs). It offers its output via the Management Data Analytics Service (MDAS), allowing authorised consumers to request, control, and retrieve analytics reports. MDAF also enables service assurance, mobility optimisation, fault prediction, energy saving, and cross-domain orchestration by providing analytics tailored to use case-specific data inputs.

*Capabilities:*

- Cross-domain analytics processing.

- AI/ML inference for analytics.

- Performance prediction and anomaly detection.

- Integration with PM/KPI, trace, QoE, and external data.

- Use case-specific analytics support (e.g., assurance, energy saving).

(Reference: TS 28.104 [57]).

### Intent Handling Function (IHF)

The Intent Handling Function (IHF) enables high-level management of network and service behaviours by allowing authorised consumers to express desired outcomes intents without detailing how to achieve them. It translates these intents into concrete/executable actions, policies, and configurations, and manages their fulfilment using rule-based logic, closed-loop automation, or AI/ML mechanisms. IHF supports negotiation, feasibility checks, conflict resolution, and reporting throughout the intent lifecycle. It simplifies operations by abstracting complexity and supports a wide range of use cases, including service provisioning, assurance, energy saving, and end-to-end optimisation.

IHF can interact with other functions, including Closed Control Loop Functions (CCLF), to fulfil intents that require continuous assurance or dynamic adaptation.

*Capabilities:*

- Intent expression and processing.

- Policy and configuration translation.

- Closed-loop and AI/ML-based fulfilment.

- Negotiation and feasibility checks.

- Conflict detection and resolution.

- Intent lifecycle reporting and monitoring.

- Use case support: assurance, energy efficiency, etc.

(Reference: TS 28.312 [46]).

### 5.1b.x6 UE Data Handling Function (UDHF)

The UE Data Handling Function (UDHF) enables detailed per-UE data collection across the 5G system. Its capabilities include mechanisms for trace, MDT, QoE, and UE-level measurements. Together, they support fine-grained performance monitoring, troubleshooting, and analytics at the individual UE level, complementing traditional aggregated performance data.

UDHF supports the collection of trace data, MDT measurements, RLF and RRC failure reports, QoE information, and 5GC UE-level measurements. Data collection can be triggered on-demand or through management-based or signalling-based activation procedures. It enables authorised consumers to configure collection policies, manage activation and deactivation, and retrieve per-UE metrics such as delay, throughput, packet loss, and QoE indicators across both RAN and 5GC domains.

*Capabilities:*

- Per-UE trace and measurement collection.

- RLF/RRC failure report capture.

- QoE and 5GC measurement support.

- On-demand and policy-triggered collection.

- Per-UE KPI retrieval and analysis.

(References: TS 32.422 [44], TS 28.405 [49], TS 28.558 [x1]).

### 5.1b.x7 Performance Management Function (PMF)

The Performance Management Function (PMF) enables the collection, control, and reporting of performance measurements across 5G networks, including network slice instances (NSIs), network slice subnet instances (NSSIs), and network functions (NFs). PMF supports both file-based and streaming-based reporting of performance data and allows authorized consumers to create, query, and terminate measurement jobs. It includes services for threshold monitoring and KPI job control, enabling proactive performance assurance and analytics. PMF supports multi-tenant scenarios by enabling performance data collection per S-NSSAI, facilitating Network Slice as a Service (NSaaS). It interacts with various management services and data sources to provide timely and granular performance insights for assurance, optimization, and SLA compliance.

*Capabilities:*

- Performance measurement job control.

- File/stream-based data reporting.

- KPI threshold monitoring.

- Support for per-S-NSSAI collection.

- SLA compliance and assurance enablement.

(Reference: TS 28.550 [42]).

### 5.1b.x8 Fault Management Function (FMF)

The Fault Management Function (FMF) enables the detection, reporting, and management of faults across 5G network resources. These capabilities described in 3GPP TS 28.111 and conceptually framed in TS 28.530 enable the representation of faults, errors, and failures as alarms, facilitating timely awareness and resolution by operators or automated systems.

FMF provides mechanisms for generating, notifying, acknowledging, clearing, and correlating alarms. It supports both automatically and manually cleared alarms, alarm list reliability tracking, and alarm correlation to root causes. Alarms are modelled using a standardized structure and can be filtered, retrieved, and annotated by authorized consumers. Notifications are delivered via a service-based interface, supporting real-time and historical fault visibility.

*Capabilities:*

- Fault/alarm generation and clearance.

- Alarm correlation and root cause indication.

- Alarm annotation and filtering.

- Alarm acknowledgement.

- Real-time and historical alarm visibility.

- Multi-domain and multi-generation applicability.

(References: TS 28.111 [68], TS 28.530 [3]).

### 5.1b.x9 Data Management Function (DMF)

The Data Management Function (DMF) provides the management capabilities for the lifecycle of management data across network and management domains. As defined in TS 28.537, DMF facilitates the production, coordination, discovery, storage, delivery secure destruction of data at end-of-life of both 3GPP-specified and external management data, ensuring that authorized consumers can access the information they need for assurance, optimization, and automation.

*Capabilities:*

- Request- and subscription-based data production.

- Time-/condition-based reporting.

- Discovery of available data and metadata.

- Support for 3GPP and external data types.

- Coordination across multiple consumers.

- Storage for reuse (e.g., ML training).

(Reference: TS 28.537 [39], TS 28.622 [32], TS 28.623 [54]).

### 5.1b.x10 Provisioning Function (PRF)

The Provisioning Function (PRF) provides the capabilities required to instantiate, configure, modify, and retire managed entities within the 5G network, including network slice instances (NSIs), network slice subnet instances (NSSIs), network functions (NFs), and sub-networks. As specified in TS 28.531, PRF supports the full lifecycle of provisioning operations, from feasibility checks and resource reservation to activation and deactivation, across both physical and virtualized infrastructure.

*Capabilities:*

- Lifecycle management (instantiation, configuration, and termination) of NSIs, NSSIs, NFs.

- Support for feasibility checks and resource reservation.

- Activation/deactivation of managed entities including physical and virtualised network functions.

- Slice template customization (standard/private).

- Coordination with NFV MANO and transport orchestration.

- Priority-based and location-aware provisioning.

- Support for IAB-node specific configuration.

(Reference: TS 28.531 [8]).

### 5.1b.x11 Network Digital Twin Function (NDTF)

The Network Digital Twin Function (NDTF) provides management capabilities to create and operate virtual replicas of a mobile network or part of it, capturing its attributes, behaviour, and interactions to support management and orchestration. The NDTF enables simulation and/or emulation of network scenarios to evaluate configurations, predict outcomes, verify automation functions, and generate synthetic data without impacting the live network. It interacts with other t functions such as MDAF, AIML Functions, and the Intent Handling Function, and may coordinate with other NDTF instances to enhance simulation fidelity. The NDTF exposes its capabilities through the NDT Management Service (NDT MnS), allowing authorized consumers to configure, control, and retrieve simulation or emulation results.

Capabilities:

- Control and life cycle management of NDT instances including creation, configuration, execution, synchronization, and termination.

- Support for network automation by evaluating high-risk operations, failure scenarios, and issue inducement such as signalling storms and coverage problems.

- Support for verification of network scenarios, configurations, events, and automation-function configurations, providing reports on simulation or emulation outcomes.

- Support for data generation by producing synthetic network data, ML training datasets, and user experience data under simulated conditions.

- Advanced capabilities enabling collaboration between multiple NDT instances, coordinated simulations, and enhanced situational awareness through information exchange.

- Applicability across RAN, Core, and cross-domain management contexts to support both domain-specific and cross-domain use cases.

(Reference: TS 28.561 [x2]).

### 5.1b.x12 Closed Control Loop Function (CCLF)

The Closed Control Loop Function (CCLF) provides management capabilities to monitor, analyze, decide, and execute control actions over managed entities, aiming to achieve defined goals autonomously. CCLF supports the dynamic composition, coordination, performance monitoring, conflict management, and escalation of closed control loops across various network contexts. The function enables interactions with other t functions and services, leveraging historical data, triggers, and feedback mechanisms to optimize loop behaviour.

CCLF exposes its capabilities through standardized management services, allowing authorized MnS consumers to configure, control, and retrieve information related to closed control loops. It supports both open-box and closed-box CCL realizations, enabling flexible composition from discrete functions or services.

*Capabilities:*

- Instantiate or compose CCLs dynamically from templates or components.

- Utilize historical CCL profiles to configure and optimize new loops.

- Evaluate and monitor the performance of CCLs, including feedback on executed actions and impact assessment.

- Apply CCLs for fault management and network performance problem recovery.

- Instantiate or execute CCLs based on specified conditions.

- Detect, confirm, and resolve conflicts among goals, scopes, actions, and metrics of CCLs.

- Escalate decision-making to higher-level entities under predefined conditions.

- Coordinate CCL operations with other functions to ensure consistent actions and avoid conflicts.

(Reference: TS 28.567 [x3]).

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| **End of changes** |