**3GPP TSG-SA5 Meeting #156S5-243541**

**19 - 23 August 2024, Maastricht, Netherlands**

**Source: Nokia**

**Title: Rel-19 pCR TR28.867 Solution for goal-targets conflicts**

**Document for: Approval**

**Agenda Item: 6.19.4**

# 1 Decision/action requested

***The group is asked to discuss and agree on the proposal.***

# 2 References

[1] 3GPP TR 28.867: “Closed control loop management” v0.3.0

# 3 Rationale

The use cases on CCL conflicts management describes goal targets conflicts as one of the conflicts that need to be managed. This pCR is to add a solution for managing goal targets conflicts

# 4 Detailed proposal

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| **First Change** |

5.6 Use case 6: CCL conflicts management

5.6.1 Description

Multiple CCLs could co-exist and concurrently act within the same environment. The CCLs can affect one another, in the worst cases leading to conflicts. The different kinds of conflicts are summarized by Table 5.6.1-1.

5.6.1-1: Types of potential conflicts among CCL instances for goals g1, g2 and g3

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| Conflict Type | Description | CCL-A | CCL-B | Comments |
| Target Conflict | For CCLs C1 and C2, when same at least 1 target of a goal is present in both CCL asking for different outcomes on that target on same controlled entity (ME1). | Control Scope: ME1  Goal targets:   * Load > 90% (to maximize resource utilization) * latency < 10ms | Control Scope: ME1  Goal target:   * Load < 90% (to avoid congestion) | Conflict among the targets within the goals - due to different required target outcomes |
| Action Conflict | For CCLs C1 and C2, when both C1 and C2 is trying to configure the same characteristics of same target entity (gNB-g1) in contradiction. | **Example 1** | | Conflict due to configuration actions at execution step because both CCL want different contradicting value for a particular characteristic of gNB-g1.  Effect: even when executed at different times, the value may ping-pong continuously. |
| Goals target:   * Throughput > 10gbps   Actions:   * Target Entity: gNB-g1 * Target Change: scale-out virtual resource | Goals target:   * EC is < 10KVA   Actions:   * Target Entity: gNB-g1 * Target Change: scale-in virtual resource |
| **Example 2** | |
| Goal target:   * HO failure is < 2%   Actions:   * Target Entity: gNB-g1 * Target Change: set CIO to a small **positive** value{to guarantee HOs with low chances of HO failure} | Goal target:   * Load < 80%   Actions:   * Target Entity: gNB-g1 * Target Change: set CIO to a small negative value [to advance HOs and move load to other cells] |
| Indirect target conflict | For CCLs C1 and C2, when C1 [optimize handover] and C2 [minimize interference] have different goals but the actions of C1 affect the goals of C2 | Goal target:   * HO failure is < 2%   Actions:   * Target Entity: gNB-g1 * Target Change: reduce CIO {to reduce chances of HO failure} | Goal target:   * SINR > 10dB   Actions:   * Target Entity: gNB-g1 * Target Change: lower antenna tilt | By reducing antenna tilt to minimize interference C2 affect the HO goal target of C1 |
| Action Execution Time Conflict | For CCLs C1 and C2, when both C1 and C2 are trying to configure the same characteristics of same target entity (gNB-g1) in contradiction. | Goals:   * Throughput > 10gbps   Actions:   * Target Entity: gNB-g1 * Target Change: scale-out * Target Time: 04:00 | Goals:   * EC is < 10KVA   Actions:   * Target Entity: gNB-g1 * Target Change: scale-in * Target Time: 04:00 | Conflict due to the time of executing the configuration actions at the execution step |
| Scope conflict | For CCLs C1 and C2, C1 and C2 have different goals and actions but their scopes are overlapping – e.g. C1’s control scope (i.e. the controlled entities in the network) is part of C2’s measurement scope (i.e. the measured entities in the network) | Measurement scope: cells g1  Control Scope: g1  Goal targets:   * EC/bit is < 1WA   Actions:   * Target Entity: gNB-g2 * Target Change: switch off g2 | Measurement scope: cells g1, g2, g3, g4  Control Scope: g2  Goals:   * Load < 80%   Actions:   * Target Entity: gNB-g2 * Target Change: change CIO | By switching off g2, C1 affects the scope which C2 reads for its load distribution measurements |

The CCL may detect or observe events that identify the possibility of any one of the above conflicts. The conflict can be avoided using some information or the policies (e.g., priority) provided by the consumer. If the conflict actually occurs, the CCL MnS producer should support services to inform MnS consumers the confirmed detected conflicts. This may also include informing MnS consumer about the potential conflict.

5.6.2 Potential Requirements

REQ-CCL-CONFLICT-1: The MnS Producer for CCL management should support a capability to detect a potential or actual conflict.

Note: A potential conflict is where some events are observed that indicate that there may be a conflict, but the CCL MnS Producer cannot conclude that it is a conflict. So, the CCL can indicate this so that some other entity e.g. the MnS consumer takes responsibility to confirm the conflict.

REQ-CCL-CONFLICT-2: The MnS Producer for CCL management should support a capability to inform an authorized MnS consumer about a potential conflict that has been detected.

REQ-CCL-CONFLICT-3: The MnS Producer for CCL management should support a capability to confirm a detected potential goal, action, indirect target, action execution time, scope conflict.

REQ-CCL-CONFLICT-4: The MnS Producer for CCL management should support a capability to resolve a goal, action, indirect target, action execution time, scope conflict that has been detected.

REQ-CCL-CONFLICT-5: The MnS Producer for CCL management should enable authorized MnS consumers to provide information that can be used to avoid the conflict.

REQ-CCL-CONFLICT-6: The MnS Producer for CCL management should enable authorized MnS consumers to provide information that can be used to resolve the conflict.

5.6.3 Potential Solutions

5.6.3.x Potential Solution x: Goal targets coordinationNote: This solution focusses on the requirement on

* detection and avoidance of potential goal targets conflicts
* detection and resolution of actual goal targets conflicts

5.6.3.x.1 Required capabilities and interactions.

CCL instances will be responsible for related, adjacent or in some cases overlapping scopes. In such cases it is good to ensure that the goals of two CCLs are not contradictory or conflicting or leading to contradictory or conflicting outcomes. The goal may be seen as a set of network measurements and KPIs (i.e. targets) to be concurrently achieved by the CCL. A coordination layer, say a coordination CCL, may have a goal management capability responsible for managing and optimizing the goals of the CCLs based on general objectives for the network scope, where the general objective describe the priorities among the different target values on the specific KPIs. For example, as illustrated by Figure 1, the input network scope objectives may simply require ensuring, for KPI K1, that with priorities, p1, p2, p3, the value of K1 should respectively be less than values V1, V2, V3. This may be provided for different KPIs on a network level (e.g., by the operator). Then, the goal management functionality compares these objectives to choose the appropriate KPI targets for each CCL. In the example, the CCL goals are set as K1<0.1 and K2>85%.

A graph with red line

Description automatically generated

Figure 5.6.3.x.1-1: Example prioritized goal targets on a set of KPIs that need to be coordinated among a group of CCL instances.Note: this solution assumes that the scopes are prefixed but the outcomes of the solution may a recommendation to adjust the scopes.

To support detection and avoidance of potential goal targets conflicts

* The CCL may register its goal targets with the coordinationCCL which triggers an evaluation of potential conflict, i.e., whether those targets are likely to conflict with the targets of another CCL
* In case of a potential conflict, the goal management functionality of coordination CCL sends the selected new or revised goal targets to each CCL ensuring to minimize contradictions or conflicts among the targets in the different goals of different CCLs, for example, that for a given scope a specific target is assigned to only one CCL.

To support detection and resolution of actual goal targets conflicts

* The CCLs attempt to fulfil its set targets, and where they ae unable to, the CCL sends feedback to the goal management functionality in the coordinationCCL indicating which targets cannot be fulfilled. A CCL may for example indicate that there are ping-pong effects on a target, i.e., whenever the target is pushed in a given direction, it flips back to a previous state. The flipflop is an indication of a potential goal conflict which the CCL should notify to the goal management.
* Based on the feedback, the goal management functionality acting as CCL MnS producer can then confirm the existence of goal-target conflict and may revise the targets by setting new target values.

5.6.3.x.2 Information objects to realize required capabilities and interactions

* The coordinationCCL should be extended with the capability to for coordinating CCLs goal .
  + Introduce an attribute on the coordinationCCL to capture the goal set of a CCL instance. A CCL that requires its goals to be evaluated for conflicts can add its goal set into the list of goal sets.
    - For each introduced goal set, introduce a Boolean attribute to indicate if a potential conflict is observed for the goal set
  + Introduce a datatype and corresponding attribute on the coordinationCCL to represent the the full set of goal-targets and their priorities for a given scope from which individual CCLs may be assigned their goal targets. This set may be called networkScopeObjectives and are used by the coordinationCCL to identify instances in which 2 CCLs have goals or goal targets that are conflicting
  + It can also be used to decide how to reallocate the goal targets in away that avoids or minimizes conflicts
* Extend the assuranceGoal dataType with information to support goal coordination.
  + Add for each target in the goal target list an attribute to reflect the value of achievement of the target.
  + Add for each target in the goal target list a Boolean attribute, say called flipFlopNoted to indicate if flipflops are observed on the target. The flipFlopNoted can be notifiable which provides a way for the CCL to indicate to the coordinationCCL that there are flip flops observed on the goal target.

5.6.4 Evaluation of solutions

The potential solution described in clause 5.6.3.x is a fully NRM-based approach that extends the existing NRM to realise coordination of CCL Goal targets. The solution allows the MnS consumer to directly configure the goals of a group of CCL instances by defining the targets and their priorities on a coordination CCL. It also enables the coordination CCL to configure the targets of each CCL instance to coordinate the goals among the multiple CCL instances. Then in case of a conflict for a goal target, the CCL instance can provide information on the detected conflict which triggers the coordination CCL to reconfigure the targets of the CCL instance. Therefore, the solution described in clause 5.6.3 is a feasible solution for coordination of goals assignment to CCLs.

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| **Next Change** |

# 6. Conclusions and Recommendations

It is recommended to move on to the normative specification development phase for the use case on

* coordination of CCL Goal targets, the normative specification development should follow the solution outlined in clause 5.8.3.X