**3GPP TSG-SA5 Meeting #156S5-243543**

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

**Source: Nokia**

**Title: Rel-19 pCR TR28.867 solution for indirect targets conflict detection**

**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 indirect action conflicts as one of the conflicts that need to be managed. This pCR is to add a solution for managing indirect action 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

Note: This solution focusses on the requirement on

* detection of potential indirect targets conflicts
* Avoidance of indirect targets conflicts
* detection of actual indirect targets conflicts

#### 5.6.3.x Potential Solution x: Detecting potential and actual indirect targets conflicts

5.6.3.x.1 Required capabilities and interactions.

Two CCLs (CCL1 and CCL2) may optimize 2 target metrics Y1 and Y2, e.g. one intending to ensure “HO failure is < 2%” while the other wants “SINR > 10dB”. Due to coupling between Y1 and Y2, actions to optimize these by CCLs may lead to correlated oscillations/degradations in Y1 or Y2. The correlated oscillations indicate a potential conflict, but the CCLs may not see the oscillations in the metric that is not of their interest. The coordinator CCL may analyse the behavior of Y1 and Y2 to see if there are correlated oscillations as result of actions by CCL1 and CCL2 which then indicates potential conflict between CCL1 and CCL2. When the oscillations are observed, the coordination CCL MnS producer should be able to inform the related MnS Consumer(s) (i.e., CCL1 and CCL2) about the detected potential conflict represented by the correlated oscillations.

For detected potential conflict the CCL coordination service producer needs to confirm that it is an actual harmful conflict. This can be determined based on the severity of degradation in the performance metrics of the related CCLs. The threshold to determine the severity may be defined by the MnS consumer (e.g. the operator or coordinator CCL). If the degree of degradation is higher than the threshold then it is a confirmed conflict that requires resolution. Otherwise, no action is needed.

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

* To provide information on potential conflicts, introduce a datatype and corresponding attribute on the CCL (specifically on the coordination CCL) representing a detected potential conflict. It may be called detectedPotentialConflict and includes a list of targets which have been detected to have correlated oscillations and thus likely to be conflicting.
  + The detectedPotentialConflict is a list that is notifiable; when an entry is added, a notification is sent to the CCLs who metrics are monitored by the respective coordination CCL.
* To support confirmation of potential conflicts as actual conflicts, introduce an attribute for each goal target on the CCL that represents the threshold for the severity of degradation in the performance metrics at which a real conflict is declared by the CCL. The threshold is the percentage by which the performance metrics have to change form their desired value for the CCL to declare that the change is due to another CCL affecting the target, but not other “normal” changes.

#### 5.6.3.x Potential Solution x: Avoiding indirect targets conflicts

For a detected indirect targets conflict, the coordinator CCL can trigger one or more CCLs to respond to the detected potential conflict. If the CCLs that has been requested to resolve potential conflict is unable to resolve that conflict, the CCL should inform the coordination CCL MnS producer about the failure to resolve the problem.

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 support capabilities for detecting potential and actual metric conflicts. The solution enables the CCL MnS producer to inform the related Mns Consumer(s) (CCLs) about detected potential conflict (e.g., those detected from correlated oscillations of CCL goal targets). It also enables the MnS consumer to configure the threshold used to confirm that a detected potential conflicts is actually a true conflict. It then enables an MnS consumer to trigger resolution of the conflict on a specific CCL. Therefore, the solution described in clause 5.6.3.x is a feasible solution for Detecting potential and actual CCL metric conflicts.

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| **Next Change** |

# 6. Conclusions and Recommendations