**3GPP TSG-SA5 Meeting #156S5-243546**

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

**Source: Nokia**

**Title: Rel-19 pCR TR28.867 Evaluating impact of planned actions**

**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 action conflicts as one of the conflicts that need to be managed. One approach is to always evaluate any planned actions prior to execution. This pCR is to add a solution to track the impact of any planned actions

# 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 Solutions6.6.3.C Potential Solution x: Avoiding indirect target conflicts - Evaluating likely-impact of planned actions

Note: This solution focusses on the requirement on

* Avoidance of potential indirect targets conflicts

5.6.3.C.1 Required capabilities and interactions.

For any CCL, large and frequent changes to network parameters may affect network stability since they increase the probability of occurrence of conflicts, i.e., avoiding making unnecessary configuration changes to the managed objects guarantees network stability and minimize the probability of conflicts between CCLs. This may then imply that executing large changes, e.g., to quickly improve the performance, in case of a poor decision, may also result in significant degradation. So, it is preferred to take small smooth changes in the case where the impact is not so clear, and only make the large changes when the CCL is sure that the impact is positive.

For any planned action, the CCL sends to the coordinator CCL the planned change, its claimed/predicted performance improvement and reliability/confidence in that action/decision. The coordinator CCL evaluates the claimed performance improvement and reliability/confidence to determine if the action should be allowed or not. This ensures to avoid counter-productive actions - if the CCL demands to make large changes, it must prove high reliability/ confidence and significant improvement in performance. The criteria applied by the coordinator CCL to match acceptance/rejection of a planned action to the reliability and performance may be implementation-specific or defined by the operator.

The coordinator CCL then sends the decision and possibly the failed criteria to the CCL – to either be executed or to be used to compute better decisions. It is assumed that based on feedback on the quality of its decisions, the CCL updates it decision-making engine and repeats the decision evaluation process. Then if the CCL has consistently made good large action-decisions, the coordinator CCL can consider the CCL as trusted to make such large decisions. The coordinator CCL informs the CCL that the CCL has consistently made good decisions and achieved its ultimate trust.

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

To support avoidance of indirect target conflicts by evaluating likely-impact of planned actions,

* Re-use the attribute for planned action, say called CMPlan. A CCL can request a coordinator CCL for an evaluation of the CMPlan,
  + The CMPlan includes information on the desired change, the predicted impact/effect of the decision on the related metrics as well as the CCL’s confidence in that decision.
* Introduce an attribute representing the coordinator CCL’s evaluation of the CM plan, say called CMPlanReport. The CMPlanReportinforms the CCL of whether the decision is acceptable or not.
  + A positive decision may indicate that the CCL can use/reuse that CMPlan.
  + In case the decision is unacceptable, the response may include criteria on why the decision is bad/untrustworthy, e.g. how far the CCL predicted impact/effect on the network metrics is from the true value or what is the maximum change (in the current network parameters) that is allowed.
  + the decision trust report may include in an indication for when the CCL has consistently made good decisions and achieved ultimate trust. The report may include an indication for how the CCL may behave thereafter – e.g. that the CCLs decisions will go without checking via the coordinator or that the CCL may directly execute its decisions on to the network.sthe CMPlanReport may include in an indication to pause or unpause the CCL, where the “pause” indicates that the CCL may cease to propose new actions until it is unpaused.

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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

* evaluating likely-impact of planned actions, the normative specification development should follow the solution outlined in clause 5.8.3.C