**3GPP TSG SA WG5 Meeting #143e S5-223210**

**Online, , 9th May 2022 - 17th May 2022**

**Source: Samsung, Nokia, Huawei**

**Title: pCR 28.104 Handover Optimization**

**Document for: Approval**

**Agenda Item: 6.6.5**

# 1 Decision/action requested

***The group is asked to discuss and approve the proposals.***

# 2 References

[1] ETSI GS NFV-IFA 011 Network Functions Virtualisation (NFV) Release 4; Management and Orchestration;VNF Descriptor and Packaging Specification

# 3 Rationale

Current handover procedures are mainly based on radio conditions for selecting the target cell for a handover. The target cell accepts or rejects the handover (HO) request depending on various conditions. In virtualized environment, the HO may be rejected due to inadequate available resources within the target gNB. The notion of resources may include virtual resources (e.g., compute, memory) and/or radio resources (e.g., PRB, RRC connected users). Several target cell can be tried until the request is successfully accepted. This process can result in wastage of UE and network resources, while it may also introduce service disruption due to increased latency and radio link failures (RLFs). It also introduces inefficiency in the HO or other network procedures.

The solution proposed enables analytics report stating when the target cell is optimal for handover. This address the following requirements from section 7.2.5.2.3

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| --- | --- | --- |
| **REQ-MOB\_MDA-01** | MDA capability for handover optimization shall be able to provide the analytics output related to current statistics and future predictions of virtual resource consumption of gNB. | Handover optimization |
| **REQ-MOB\_MDA-02** | MDA capability for handover optimization shall be able to provide the analytics output related to current statistics and future predictions of radio resource consumption of cell. | Handover optimization |
| **REQ-MOB\_MDA-07** | MDA capability for handover optimization shall be able to provide the analytics output including the following information that can be used to optimize handover decisions:  - Indication on whether the target cell is optimal for handover.  - Recommended action to optimize the target cell for handover. | Handover optimization |

# 4 Detailed proposal

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| **First modification** |

# 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] 3GPP TS 32.500: "Telecommunication management; Self-Organizing Networks (SON); Concepts and requirements".

[3] 3GPP TS28.535: “Management services for communication service assurance; Requirements”.

[4] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[5] 3GPP TS 28.554: "5G end to end Key Performance Indicators (KPI)".

[6] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace; Trace control and configuration management".

[7] 3GPP TS 32.423: "Telecommunication management; Subscriber and equipment trace; Trace data definition and management".

[8] 3GPP TS 28.405: "Telecommunication management, Quality of Experience (QoE) measurement collection; Control and configuration".

[9] 3GPP TS 28.406: "Telecommunication management; Quality of Experience (QoE) measurement collection; Information definition and transport".

[10] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[11] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[12] 3GPP TS 32.425: "Telecommunication management; Performance Management (PM); Performance measurements Evolved Universal Terrestrial Radio Access Network (E-UTRAN)".

[13] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".

[14] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

[15] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[16] 3GPP TS 28.658: "Telecommunication management; Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[17] 3GPP TS 28.662: "Telecommunication management; Generic Radio Access Network (RAN) Network Resource Model (NRM); Information Service (IS)".

[18] 3GPP TS 32.156: "Telecommunication management; Fixed Mobile Convergence (FMC) Model Repertoire".

[19] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[20] 3GPP TS 28.511: "Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Procedures".

[21] 3GPP TS 28.531: "Management and Orchestration; Provisioning".

[22] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".

[23] 3GPP TS 26.114: "IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

[24] 3GPP TS 28.105: "Management and orchestration; Artificial Intelligence / Machine Learning (AI/ML) management".

[X] ETSI GS NFV-IFA 011 (V3.3.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; VNF Descriptor and Packaging Specification".

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| **Next modification** |

### 8.4.x Mobility management analytics

#### 8.4.x.1 Handover Optimization analysis

##### 8.4.x.1.1 MDA type

The MDA type for handover optimization is: Mobility.Management.HandoverOptimization.

##### 8.4.x.1.2 Enabling data

The enabling data for handover optimization analysis are provided in table 8.4.x.1.2-1.

For general information about enabling data, see clause 8.2.1.

Table 8.4.x.1.2-1: Enabling data for handover optimization analysis

|  |  |  |
| --- | --- | --- |
| Data category | Description | References |
| Performance Measurements | Consumed virtual resources of target gNB | Virtualised resource usage measurement (clause 6.2 of TS 28.552[4]) |
| The physical radio resource utilization of each target cells. | Physical radio resource utilization of the target gNB, see clause 5.1.1.2 of TS 28.552 [4]; |
| PDCP Data Volume of NR cells | Clause 5.1.2.1 and 5.1.3.6 of TS 28.552 [4]. |
| MDT Data | UE measurements related to RSRP, RSRQ, SINR (serving cell and neighbour cells) and UE location information | RSRPs, RSRQs and UE location of M1 measurements for NR in TS 32.422 [6] and TS 32.423 [7]. |

##### 8.4.x.1.3 Analytics output

The specific information elements of the analytics output for handover optimization analysis, in addition to the common information elements of the analytics outputs (see clause 8.3), are provided in table 8.4.x.1.3-1.

Table 8.4.x.1.3-1: Analytics output for handover optimization analysis

|  |  |  |  |
| --- | --- | --- | --- |
| Information element | Definition | Support qualifier | Properties |
| hOTarget | This provides analytics report for each target cell, of a target gNB, for handover optimization. | M | type: Target  multiplicity: 1…\*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: False |
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| **Next modification** |

## 8.5 Data type definitions

### 8.5.x Target <<dataType>>

#### 8.5.x.1 Definition

This data type specifies the information about the target cell and gNB for handover.

The attribute isOptimal specify if the cell (served by GNB) is optimal for handover considering the current virtual and physical resource consumption by the gNB and the cell respectively. The value TRUE imply that the target is not resource deprived at present and can be selected for handover

The attribute futureOptimal specify if the cell (served by the gNB) will be optimal for handover at a future point(s) of time considering the future virtual and physical resource consumption by the gNB and the cell respectively. This will also provide projection of future virtual and physical resource consumptions.

#### 8.5.x.2 Information elements

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Definition | Support qualifier | Properties |
| gNBId | See clause 4.4.1 of [15]. | M | type: Integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| cellLocalId | See clause 4.4.1 of [15]. | M | type: Integer  multiplicity: 1  isOrdered: N/A  isUnique: TRUE  defaultValue: NULL  isNullable: False |
| isOptimal | This specifies if the cell (served by the gNB) is optimal for handover with respect to the virtual resource consumption of its gNB and its own physical resource consumption. The value TRUE indicates that the gNB is optimal at present.  Allowed Values: TRUE and FALSE. | M | type: Boolean  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: TRUE  isNullable: False |
| isFutureOptimal | This specifies if the cell (served by the gNB) is optimal for handover at a future point of time with respect to the virtual resource consumption of its gNB and its own physical resource consumption. | O | type: Boolean  multiplicity: 1  isOrdered: False  isUnique: True  defaultValue: TRUE  isNullable: False |
| futureOptimalInfo | This specifies additional information when isFutureOptimal is TRUE.  It will be present only if the isFutureOptimal = TRUE. | CM | type: FutureOptimal  multiplicity: 1  isOrdered: False  isUnique: True  defaultValue: TRUE  isNullable: False |
| PredictedQoE | The predicted QoE value of UE (e.g., PDCP Data Volume, MOS value, etc) in the target cell before the time point indicated by the FutureOptimalTime.  The QoE prediction can be based on (not limited to) resource information, cell traffic, measurement results. A trained prediction model can also be used. | M | type: Integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |

### 8.5.e FutureOptimal <<dataType>>

#### 8.5.e.1 Definition

This data type specifies the time duration for which the gNB is optimal for upgrade.

#### 8.5.e.2 Information elements

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Definition | Support qualifier | Properties |
| FutureOptimalTime | This specifies the time duration during which the cell is optimal for handover. | CM | type: ProjectionDuration  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| ProjectedVResCon | This specifies the projected virtual resource consumption of the gNB | M | type: VirRes  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| ProjectedPResCon | This specifies the projected physical resource consumption of the cell | M | type: PhyRes  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
|  |  |  |  |

### 8.5.y VirRes <<dataType>>

#### 8.5.y.1 Definition

This data type specifies the virtual resource consumption.

#### 8.5.y.2 Information elements

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Definition | Support qualifier | Properties |
| virtualCPU | It indicates the average number of virtual CPU (see definition of numVirtualCpu in clause 7.1.9.2.3.2 of [X]) usage over the time duration indicated by FutureOptimalTime attribute. | M | type: Integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| virtualMemory | It indicates the average virtual memory size (see definition of virtualMemSize in clause 7.1.9.2.3.2 of [X]) usage over the time duration indicated by FutureOptimalTime attribute. | M | type: Integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| virtualDisk | It indicates the average virtual storage size (see definition of sizeOfStorage in clause 7.1.9.2.3.2 of [X]) usage over the time duration indicated by FutureOptimalTime attribute. | M | type: Integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
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### 8.5.a PhyRes <<dataType>>

#### 8.5.a.1 Definition

This data type specifies the physical resource consumption.

#### 8.5.a.2 Information elements

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Definition | Support qualifier | Properties |
| DLPRBUsage | This specifies the average total usage (in percentage) of physical resource blocks (PRBs) on the downlink for any purpose, over the time duration indicated by projectionTime attribute. | M | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| ULPRBUsage | This specifies the average total usage (in percentage) of physical resource blocks (PRBs) on the uplink for any purpose, over the time duration indicated by projectionTime attribute. | M | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
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### 8.5.s ProjectionDuration <<dataType>>

#### 8.5.s.1 Definition

This data type specifies the time duration for which the projections are made.

#### 8.5.s.2 Information elements

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Definition | Support qualifier | Properties |
| FromTime | This specifies the timestamp from when the projection are made | M | type: DateTime  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| ToTime | This specifies the timestamp till when the projection are made | M | type: DateTime  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |