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Agenda Item: 11.2

Source: ZTE Corporation, Qualcomm, China Unicom, Lenovo, Nokia, Ericsson

Title: (TP to 38.423) AI/ML assisted Network Slicing

Document for: Text Proposal

# Text Proposal

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### 8.4.13 Data Collection Reporting Initiation

#### 8.4.13.1 General

This procedure is used by an NG-RAN node to request from another NG-RAN node the reporting of information to support, e.g., AI/ML in NG-RAN.

The procedure uses non UE-associated signalling.

#### 8.4.13.2 Successful Operation



Figure 8.4.13.2-1: Data Collection Reporting Initiation, successful operation

NG-RAN node1 initiates the procedure by sending the DATA COLLECTION REQUEST message to NG-RAN node2 to start information reporting or to stop information reporting. Upon receipt, NG-RAN node2:

- shall initiate the requested information reporting according to the parameters given in the request in case the *Registration Request for Data Collection* IE is set to "start"; or

- shall stop all measurements and predictions and terminate the reporting in case the *Registration Request for Data Collection* IE is set to "stop".

If the *Registration Request for Data Collection* IE is set to "start" in the DATA COLLECTION REQUEST message and the *Report Characteristics for Data Collection* IE indicates cell-specific information reporting, the *Cell To Report List for Data Collection* IE shall be included.

If the *Registration Request for Data Collection* IE is set to "start" in the DATA COLLECTION REQUEST message and the slice-specific information reporting is requested, the *Slice To Report for Data Collection List* IE shall be included.

If NG-RAN node2 is capable of providing all of the requested information, it shall initiate the information reporting as requested by NG-RAN node1 and respond with the DATA COLLECTION RESPONSE message.

If NG-RAN node2 is capable of providing some but not all of the requested information, it shall initiate the information reporting for the admitted requested information and include the *Node* *Measurement Initiation Result List* IE or the *Cell* *Measurement Initiation Result List* IE or both in the DATA COLLECTION RESPONSE message.

If the *Reporting Periodicity for Data Collection* IE in the DATA COLLECTION REQUEST message is present, this indicates the periodicity for the reporting of configured measurement objects. The NG-RAN node2 shall report only once, unless otherwise requested within the *Reporting Periodicity for Data Collection* IE.

If the *Requested Prediction Time* IE in the DATA COLLECTION REQUEST message is present, it indicates the specific point in time to which the prediction of the requested information applies. The NG-RAN node2 shall take it into account when generating the requested predicted information.

If the *UE Trajectory Collection Configuration* IE is present in the DATA COLLECTION REQUEST message, the NG-RAN node2 shall take it into account for the configuration of UE trajectory collection and reporting. NG-RAN node2 shall report the UE trajectory only once. NG-RAN node2 shall terminate the collection when at least one of the following conditions is fulfilled:

- the time since UE was successfully handed over to NG-RAN node2 is equal to the value of the *Collection Time Duration for UE Trajectory* IE;

- the number of visited cells within NG-RAN node2 is equal to the value of the *Number of Visited Cells* IE, if included;

- UE moves to RRC\_INACTIVE or RRC\_IDLE state;

- UE is handed over to a cell belonging to an NG-RAN node different from NG-RAN node2.

The result of the UE trajectory collection is reported at the next available DATA COLLECTION UPDATE message.

If the *UE Performance Collection Configuration* IE is present in the DATA COLLECTION REQUEST message, the NG-RAN node2 shall take it into account for the configuration of UE performance collection and reporting. NG-RAN node2 shall terminate the collection when at least one of the following conditions is fulfilled:

- the time since UE was successfully handed over to NG-RAN node2 is equal to the value of the *Collection Time Duration for UE Performance* IE;

- the time since S-NG-RAN node addition successfully completed is equal to the value of the *Collection Time Duration for UE Performance* IE;

- UE moves to RRC\_INACTIVE or RRC\_IDLE state;

- UE is handed over to another cell;

- the NR-DC with the S-NG-RAN node for the UE is released.

The result of the UE performance collection is reported at the next available DATA COLLECTION UPDATE message.

**Interaction with the Data Collection Reporting procedure**

When starting a measurement, the *Report Characteristics* *for Data Collection* IE in the DATA COLLECTION REQUEST message indicates the type of objects NG-RAN node2 performs measurements or predictions on. NG-RAN node2 shall include in the DATA COLLECTION UPDATE message:

- the *SSB Area Radio Resource Status List* IE, excluding the *DL scheduling PDCCH CCE usage* IE and *UL scheduling PDCCH CCE usage* IE, included inthe *Predicted Radio* *Resource Status* IE, if the first bit, "Predicted Radio Resource Status" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2. If the *Slice To Report List for Data Collection* IE is included for a cell, the *Predicted Radio* *Resource Status* IE for such cell shall, if supported, include the *Slice Radio Resource Status Item* IE.

- the *Predicted* *Number of Active UEs* IE, if the second bit, "Predicted Number of Active UEs" of the *Report Characteristics* *for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Predicted* *RRC Connections* IE, if the third bit, "Predicted RRC Connections" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Average UE Throughput DL* IE, if the fourth bit, "Average UE Throughput DL" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Average UE Throughput UL* IE, if the fifth bit, "Average UE Throughput UL" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Average Packet Delay* IE, if the sixth bit, "Average Packet Delay" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Average Packet Loss DL* IE, if the seventh bit, "Average Packet Loss DL" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Energy Cost* IE, if the eighth bit, "Energy Cost" of the *Report Characteristics* *for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Measured UE Trajectory* IE, if the ninth bit, "Measured UE Trajectory" of the *Report Characteristic*s *for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Predicted* *Slice Available Capacity Group* IE, if the tenth bit, "Predicted Slice Available Capacity" of the *Report Characteristics* *for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1"and if

- the *Slice To Report List for Data Collection* IE is included for the cell, and

- the measurement object is admitted by NG-RAN node2.

If the Cell Capacity Class Value Uplink IE and the Cell Capacity Class Value Downlink IE are included within the Predicted Slice Available Capacity Group IE for the cell for which the Predicted Slice Available Capacity IE is reported, these IEs are used to assign weights to the available capacity indicated in the requested predicted Slice Available Capacity Value Uplink IE and predicted Slice Available Capacity Value Downlink IE respectively.

- the *Slice Average UE Throughput DL* IE, if the eleventh bit, "Slice Average UE Throughput DL" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2

- the *Slice Average UE Throughput UL* IE, if the twelfth bit, "Slice Average UE Throughput UL" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Slice Average Packet Delay* IE, if the thirteenth bit, "Slice Average Packet Delay" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Slice Average Packet Loss DL* IE, if the fourteenth bit, "Slice Average Packet Loss DL" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

- the *Slice Average Packet Loss UL* IE, if the fifth bit, "Slice Average Packet Loss UL" of the *Report Characteristics for Data Collection* IE included in the DATA COLLECTION REQUEST message is set to "1" and if the measurement object is admitted by NG-RAN node2.

#### 8.4.13.3 Unsuccessful Operation



Figure 8.4.13.3-1: Data Collection Reporting Initiation, unsuccessful operation

If none of the requested information can be initiated, NG-RAN node2 shall send the DATA COLLECTION FAILURE message with an appropriate cause value.

#### 8.4.13.4 Abnormal Conditions

For the same Measurement ID, if the initiating NG-RAN node1 does not receive either the DATA COLLECTION RESPONSE message or the DATA COLLECTION FAILURE message, the NG-RAN node1 may reinitiate the Data Collection Reporting Initiation procedure towards the same NG-RAN node, provided that the content of the new DATA COLLECTION REQUEST message is identical to the content of the previously unacknowledged DATA COLLECTION REQUEST message.

If the NG-RAN node2 receives a DATA COLLECTION REQUEST message which includes the *Registration Request for Data Collection* IE set to "stop" and if the NG-RAN node2 Measurement ID value received in the DATA COLLECTION REQUEST message is not used, the NG-RAN node2 shall initiate DATA COLLECTION FAILURE message with an appropriate cause value.

If in the *Report Characteristics for Data Collection* IE bitmap all bits are set to "0" in the DATA COLLECTION REQUEST message, then NG-RAN node2 shall initiate a DATA COLLECTION FAILURE message with an appropriate cause value.

If the NG-RAN node2 receives a DATA COLLECTION REQUEST message which includes the *Registration Request for Data Collection* IE set to "start" and the *NG-RAN node1 Measurement ID* IE corresponding to an existing on-going Data Collection reporting, then NG-RAN node2 shall initiate a DATA COLLECTION FAILURE message with an appropriate cause value.

### 8.4.14 Data Collection Reporting

#### 8.4.14.1 General

This procedure is initiated by an NG-RAN node to report information accepted by the NG-RAN node following a successful Data Collection Reporting Initiation procedure for the purpose of, e.g., AI/ML in NG-RAN.

The procedure uses non UE-associated signalling.

#### 8.4.14.2 Successful Operation



Figure 8.4.14.2-1: Data Collection Reporting, successful operation

NG-RAN node2 shall report the accepted information in DATA COLLECTION UPDATE message. The accepted information is the information that was successfully initiated during the preceding Data Collection Reporting Initiation procedure.

If some results of the admitted measurements in DATA COLLECTION UPDATE message are missing, NG-RAN node1 shall consider that these results were not available at NG-RAN node2.

#### 8.4.14.3 Unsuccessful Operation

Not applicable.

#### 8.4.14.4 Abnormal Conditions

Void.

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#### 9.1.3.26 DATA COLLECTION REQUEST

This message is sent by NG-RAN node1 to NG-RAN node2 to initiate the requested information reporting according to the parameters given in the message.

Direction: NG-RAN node1 → NG-RAN node2.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
| --- | --- | --- | --- | --- | --- | --- |
| Message Type | M |  | 9.2.3.1 |  | YES | reject |
| NG-RAN node1 Measurement ID | M |  | INTEGER (1..4095,...) | Allocated by NG-RAN node1 | YES | reject |
| NG-RAN node2 Measurement ID | C-ifRegistrationRequestForDataCollectionStop |  | INTEGER (1..4095,...) | Allocated by NG-RAN node2 | YES | ignore |
| Registration Request for Data Collection | M |  | ENUMERATED(start, stop, …) | Type of request for which the information is required. | YES | reject |
| Report Characteristics for Data Collection | C-ifRegistrationRequestForDataCollectionStart |  | BITSTRING  (SIZE(32)) | Each position in the bitmap indicates the object the NG-RAN node2 is requested to report.  First Bit = Predicted Radio Resource Status,  Second Bit = Predicted Number of Active UEs,  Third Bit = Predicted RRC Connections  Fourth Bit = Average UE Throughput DL,  Fifth Bit = Average UE Throughput UL,  Sixth Bit = Average Packet Delay,  Seventh Bit = Average Packet Loss DL  Eighth Bit = Energy Cost  Ninth Bit = Measured UE Trajectory  Tenth Bit = Predicted Slice Available Capacity  Eleventh Bit = Slice Average UE Throughput DL  Twelfth Bit = Slice Average UE Throughput UL  Thirteenth Bit = Slice Average Packet Delay  Fourteenth Bit = Slice Average Packet Loss DL  Fifth Bit = Slice Average Packet Loss UL  Other bits are ignored by the NG-RAN node2. | YES | reject |
| **Cell To Report List for Data Collection** |  | *0..1* |  | Cell ID list to which the request applies. | YES | ignore |
| >**Cell To Report Item for Data Collection** |  | *1 .. <maxnoofCellsinNG-RANnode>* |  |  | – |  |
| >>Cell ID | M |  | Global NG-RAN Cell Identity  9.2.2.27 | Indicates an NR Cell Identity. | – |  |
| **>>Slice To Report List for Data Collection** |  | *0..1* |  | S-NSSAI list to which the request applies. | YES | ignore |
| **>>>Slice To Report Item for Data Collection** |  | *1 .. < maxnoofBPLMNs >* |  |  | – |  |
| >>>>PLMN Identity | M |  | 9.2.2.4 | Broadcast PLMN | – |  |
| **>>>>S-NSSAI List** |  | *1* |  |  | – |  |
| **>>>>>S-NSSAI Item** |  | *1 .. < maxnoofSliceItems>* |  |  | – |  |
| >>>>>>S-NSSAI | M |  | 9.2.3.21 |  | – |  |
| Reporting Periodicity for Data Collection | O |  | ENUMERATED(500ms, 1000ms, 2000ms, 5000ms, 10000ms, …) | Periodicity that can be used for reporting of requested objects. Also used as the averaging window length for all objects if supported. | YES | ignore |
| Requested Prediction Time | O |  | INTEGER (1..60, ...) | For one time reporting, it indicates the point in time, measured from reception of the DATA COLLECTION REQUEST message, for which predictions are provided. In periodic reporting, for each subsequent DATA COLLECTION UPDATE message, the point in time is shifted by the reporting periodicity. (unit: second) | YES | ignore |
| UE Trajectory Collection Configuration | O |  | 9.2.3.185 |  | YES | ignore |
| UE Performance Collection Configuration | O |  | 9.2.3.186 |  | YES | ignore |

| Condition | Explanation |
| --- | --- |
| ifRegistrationRequestForDataCollectionStop | This IE shall be present if the *Registration Request for Data Collection* IE is set to the value “stop”. |
| ifRegistrationRequestForDataCollectionStart | This IE shall be present if the *Registration Request* *for Data Collection* IE is set to the value “start”. |

| Range bound | Explanation |
| --- | --- |
| maxnoofCellsinNG-RANnode | Maximum no. cells that can be served by a NG-RAN node. Value is 16384. |
| maxnoofBPLMNs | Maximum no. of broadcast PLMNs by a cell. Value is 12. |
| maxnoofSliceItems | Maximum no. of signalled slice support items. Value is 1024. |

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#### 9.1.3.27 DATA COLLECTION RESPONSE

This message is sent by NG-RAN node2 to NG-RAN node1 to indicate that the requested information, for all or part of the measurement objects included in the reporting, is successfully initiated.

Direction: NG-RAN node2 → NG-RAN node1.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
| --- | --- | --- | --- | --- | --- | --- |
| Message Type | M |  | 9.2.3.1 |  | YES | reject |
| NG-RAN node1 Measurement ID | M |  | INTEGER (1..4095,...) | Allocated by NG-RAN node1 | YES | reject |
| NG-RAN node2 Measurement ID | M |  | INTEGER (1..4095,...) | Allocated by NG-RAN node2 | YES | reject |
| **Node Measurement Initiation Result List** |  | *0..1* |  | List of measurement objects that failed to be initiated in the node. | YES | reject |
| **>Node Measurement Initiation Result Item** |  | *1 .. <maxFailedMeasPerNode>* |  |  | – |  |
| >>Node Measurement Failed Report Characteristics | M |  | BITSTRING  (SIZE(32)) | Each position in the bitmap indicates measurement objects that failed to be initiated in the NG-RAN node2.  First Bit = Energy Cost, Second Bit = Average UE Throughput DL,  Third Bit = Average UE Throughput UL,  Fourth Bit = Average Packet Delay,  Fifth Bit = Average Packet Loss DL,  Sixth Bit = Measured UE Trajectory  Seventh Bit = Slice Average UE Throughput DL,  Eighth Bit = Slice Average UE Throughput UL,  Ninth Bit = Slice Average Packet Delay  Tenth Bit = Slice Average Packet Loss DL.  Eleventh Bit = Slice Average Packet Loss UL  Other bits are ignored by the NG-RAN node1. | – |  |
| >>Cause | M |  | 9.2.3.2 | Failure cause for measurement objects for which the measurement cannot be initiated. | – |  |
| **Cell Measurement Initiation Result List** |  | *0..1* |  | List of measurement objects that failed to be initiated per cell. | YES | reject |
| **>Cell Measurement Initiation Result Item** |  | *1 .. <maxnoofCellsinNG-RANnode>* |  |  | – |  |
| >>Cell ID | M |  | Global NG-RAN Cell Identity  9.2.2.27 | Indicates an NR Cell Identity. | – |  |
| **>>Cell Measurement Failure Cause List** |  | *0..1* |  | Indicates that NG-RAN node2 could not initiate the measurement for at least one of the requested measurement objects in the cell. | – |  |
| **>>>Cell Measurement Failure Cause Item** |  | *1 .. <maxFailedCellMeasObjects>* |  |  | – |  |
| >>>>Cell Measurement Failed Report Characteristics | M |  | BITSTRING  (SIZE(32)) | Each position in the bitmap indicates measurement objects that failed to be initiated in the NG-RAN node2.  First Bit = Predicted Radio Resource Status,  Second Bit = Predicted Number of Active UEs,  Third Bit = Predicted RRC Connections.  Other bits are ignored by the NG-RAN node1. | – |  |
| >>>>Cause | M |  | 9.2.3.2 | Failure cause for measurement objects for which the measurement cannot be initiated. | – |  |
| **>>Slice Measurement Initiation Result** | O |  | 9.2.3.x1 | List of measurement objects that failed to be initiated per slice. | YES | reject |
| Criticality Diagnostics | O |  | 9.2.3.3 |  | YES | ignore |

| Range bound | Explanation |
| --- | --- |
| maxnoofCellsinNG-RANnode | Maximum no. cells that can be served by a NG-RAN node. Value is 16384. |
| maxFailedCellMeasObjects | Maximum number of measurement objects that can fail per cell. Value is 124. |
| maxFailedMeasPerNode | Maximum number of measurement objects that can fail per node. Value is 124. |

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#### 9.2.3.x2 Slice UE Performance

This IE indicates per Slice UE performance measurements metrics.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
| --- | --- | --- | --- | --- |
| PLMN Identity | M |  | 9.2.2.4 | Broadcast PLMN |
| **S-NSSAI UE Performance List** |  | *1* |  | Indicates the UE performance per network slice |
| **>S-NSSAI UE Performance Item** |  | *1 .. < maxnoofSliceItems>* |  |  |
| >>S-NSSAI | M |  | 9.2.3.21 |  |
| >>Slice Based UE Performance | M |  | 9.2.3.x4 |  |

|  |  |
| --- | --- |
| Range bound | Explanation |
| maxnoofSliceItems | Maximum no. of signalled slice support items. Value is 1024. |
| maxnoofBPLMNs | Maximum no. of PLMN Ids.broadcast in a cell. Value is 12. |

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#### 9.2.3.x4 Slice Based UE Performance

This IE represents UE performance metrics per S-NSSAI.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
| --- | --- | --- | --- | --- |
| Slice Average UE Throughput DL | O |  | Bit Rate  9.2.3.4 | Corresponds to Average UE Throughput DL per S-NSSAI as specified in TS 28.558 [58] clause 6.3.1.4.1. |
| Slice Average UE Throughput UL | O |  | Bit Rate  9.2.3.4 | Corresponds to Average UE Throughput UL per S-NSSAI as specified in TS 28.558 [58] clause 6.3.1.4.2. |
| Slice Average Packet Delay | O |  | Average Packet Delay  9.2.3.187 | Corresponds to the Average Packet Delay per S-NSSAI as specified in TS 28.558 [58], clause 6.3.1.1. |
| Slice Average Packet Loss DL | O |  | INTEGER (0..1000000, ...) | Corresponds to DL PDCP SDU Drop Rate per S-NSSAI. |
| Slice Average Packet Loss UL | O |  | INTEGER (0..1000000, ...) | Corresponds to • UL PDCP SDU Loss Rate per S-NSSAI. |

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### 9.3.5 Information Element definitions

SliceBasedUEPerformance ::= SEQUENCE {

averageSliceUEThroughputDL BitRate, OPTIONAL,

averageSliceUEThroughputUL BitRate, OPTIONAL,

averageSliceUEPacketDelay AveragePacketDelay, OPTIONAL,

averageSlicePacketLossDL INTERGER(0..1000000, ...), OPTIONAL,

averageSlicePacketLossUL INTERGER(0..1000000, ...), OPTIONAL,

iE-Extensions ProtocolExtensionContainer { { SliceBasedUEPerformance-ExtIEs} } OPTIONAL,

...

}

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