**SA WG2 Meeting #154 S2-220xxxx**

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**Source:**

**Title: Company views on conclusions of FS\_eNS\_Ph3**

**Document for:**

**Agenda Item: 9.14 Study on Network Slicing Phase 3**

**Work Item / Release: FS\_eNS\_Ph3 / Rel-18**

*Abstract of the contribution:*

# Discussion

## 1. Introduction and background

The interim conclusions on several key issues were agreed in TR23.700 41 v1.1.0. There are several open issues remaining in the conclusion. This paper is to collect company views on each open issue. Based on the company views, this paper propose resolutions on the remaining issues of the key issue.

In addition, during SA2#152e meeting, SA2 sent LS in S2-2207435 to RAN2 and RAN3 to request feedback on several solutions for key issue 3 and key issue 5. RAN2 has sent the feedback in R2-2210827 and RAN3 has sent the feedback is in R3-226083. See more details in Annex 2 and Annex 3.

## 2. Polling Question and company views

NOTE: one company can select multiple options on each topic.

### 2.1 Polling Question for KI#3

#### Q1: For support of limited AoS slices not matching deployed TAs, which option(s) should be concluded for normative phase?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Company name** | **Option 1** | **Option 2** | **Option 3** | **Option 4** | **Other/Comment** |
| Apple | No | No | Yes | Yes | Option 4: simple set of new policy  Option 3: network configuration based  Option 1: should not be considered due to RAN2 and RAN3 feedback.  Option 2: URSP-based solution is not acceptable because UE needs to apply the Route Selection Validation Criteria for already established PDU Sessions |
| LGE | No | Yes | Yes | Yes | There are too many impacts for option 1 according to RAN feedback. |
| Huawei | No | Yes | Yes | No | Based on RAN2/3 feedback, Option 1 has big RAN and UE AS layer impact. Furthermore, Option 1 cannot avoid re-allocating of secondary TAIs or introduction of new third TAIs (or even more) whenever new slices are deployed.  The purpose of Option 4 is the same as Option 2, i.e. to let the UE know the area of service but there is no need to introduce new parameters.  Option 3 is pure network configuration. It is possible to have some optimization on slice configuration. |
| Google |  |  |  | X | Simple solution |
| Ericsson | No | OK, see comments | Yes, see comments | Ok, see comments | The basis should be option 3, in addition, as to limit signaling from UE then additions from option 2 and 4 can be considered.  RAN2 and RAN3 replies clearly shows that we should not progress option 1. |
| Nokia | YES | NO | NO | NO | Note: the feedback from RAN says this can be done. in RAN2 LS it is also incorrect when they say "the broadcast TAI(s) are associated with NSAG not S-NSSAI(s)." as NSAG concept (optional to be used in a PLMN and also not applicable to all S-NSSAIs but just to those for which slice aware cell reselection or random access applies) did not even exist till rel-17 and TAIs support of S-NSSAI is a foundation of our system. it is true we want to apply this for the case where control of UE population is possible (e.g. enterprise customers, IIoT) but for the other cases we think the best course of action is actually to reconfigure the TAs as the behaviour end to end is deterministic and no need to introduce complex enhancements arises. in the long run however the secondary TA approach is the way to go rather than any temporary fix.  For RAN3 comments:   * The solution adds complexity on the handling of mobility restriction list . It remains to be studied whether this can be addressed by means of new solutions.   [NOKIA] this can be based on the most considering only the TAs where a slice is supported in MRL (i.e. if UE is only using slices in secondary TAs but primary TAs are restricted, then the UE can use the slices). Otherwise, if this is at UE level independent of used slices, the most stringent restriction applies based on the TAIs in the cell. it is not a big issue, can be addressed in normative phase. Overall, it is not a big deal. And can be discussed in normative phase.   * For UEs supporting this feature, this solution increases the UE/network signaling overhead and possibly the RRC state transitions when the UE moves in/outside of secondary TAIs to update its registration area.   [NOKIA] This is actually the same as if the TAs were reconfigured appropriately so it should be not an issue as it is needed to operate the system properly as established by existing specifications.   * The solution may also require reconfiguration of secondary TAIs or introduction of new third TAIs (or even more) whenever new slices are deployed.   [NOKIA] this assumes that the slices are unrelated to physical location of served customers reasons... in practice it is extremely rare that we would have in a cell a nesting of many TACs as this radiates on physical locations where it is unlikely e.g. that inside a Nokia campus we have a smaller slice for Ericsson that has inside the area for Ericsson a slice of Huawei. In any case, it is possible to nest up to 12 TACs in a cell but we do not expect this is needed and in rare case we should provision a third TAC on a cell. in short this is a not frequent occurrence and proper planning can avoid issues.  On the other hand RAN3 very clearly excludes to go for a cell-based granularity.  Any URSP based approach to location restrictions is also not adequate as this means relying on all UEs that support this feature to re-evaluate the URSP at every cell change so it is no better than a solution like option 1 from UE support requirement standpoint. also this is probably unacceptable from a UE performance standpoint. lastly this restriction for MO cannot resolve the MT issue (the network does not know where the UE is in TA in idle mode).  Option 4 is more tailored for KI#5 |
| Samsung |  |  | Yes | Yes | We prefer option 4 but OK with option 3 as well. |
| ZTE | NO | OK, see comments | YES | YES | The AMF provides the S-NSSAI availability policy of the serving PLMN to the UE, so the UE can know the time.  The URSP rule may also be possible to deliver the location and time information of slice in home PLMN. |
| NEC |  |  |  | YES | Option 4 is simple with minimum RAN impact. |
| Qualcomm | NO | OK, see comments | YES | YES | Although the feedback from RAN indicates that option 1 could be feasible, it is clear the impact on AS in UE and RAN is considerable.  URSP-based solution is acceptable only if it does not mandate UEs to implement the application of the Route Selection Validation Criteria also for already established PDU Sessions and their traffic. |
| vivo | No | Yes | Yes | Yes | Option 2 and 3 require UE to be aware of AoS, the UE impact need to be minimized. |
| CATT | No | Yes | Yes | Ok |  |
| InterDigital | Yes | OK | OK | NO | Option 1 is a complete solution. If the RAN impact is not acceptable, it can be made optional. |

**Summary:**

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| --- | --- | --- |
| Option1 | Secondary TAs per cell based solution: | This option has 2 YES, 8 NO and 3 Empty. The main comment is that this option has big RAN and UE impacts based on RAN2/RAN3 feedback |
| Option 2 | reuse existing URSP rules with per cell level granularity: | This option has 8 YES, 2 NO and 3 Emtpy. The main comment is that UE needs to re-evaluate the URSP rule for already established PDU Sessions, and re-evaluate the URSP at every cell change. |
| Option 3 | Reconfiguration of TAs: | This option has 10 YES, 1 NO and 2 Emtpy. Network reconfiguration of TA can be default mechanism. |
| Option 4 | AMF is configured with S-NSSAI availability policies that the AMF sends to the UE | This option has 10 YES, 3 NO. The comment is whether there is need to introduce the new parameter if option 2 can be used. And this option may also relate with KI#5. |

**Proposal 1: It is propose to further work on option 2, option 3 and option 4.**

#### Q2: For improved support of temporary network slices, which option(s) should be concluded for normative phase?

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| --- | --- | --- | --- | --- | --- |
| **Company name** | **Option 1** | **Option 2** | **Option 3** | **Option 4** | **Other/Comment** |
| Apple | No | No | No | Yes | Option 4: Assuming option 4 is chosen for Q1, then same policy can be applied for both temporary network slices and limited AoS slices  Option 1: Similar to option 4 but timing information should not be configured in the RAN. We prefer no RAN impact.  Option 2: Not acceptable for the UE to apply the Route Selection Validation Criteria for already established PDU Sessions. Continuous re-evaluation of URSP rules is not acceptable for UE implementation.  Option 3: it’s unclear how the UE behaves when the validity timer expires, how UE and network are synched on Allowed NSSAI, etc. |
| LGE | No | No | Yes | Yes | For Option 1, it is not clear whether timing information is configured in the RAN. We support solutions without RAN impact.  For Option2, URSP re-evaluation had been discussed in previous releases but it was not agreed. |
| Huawei | No | Yes | Yes | No | The purpose of Option 1 and 4 are the same as Option 2 and Option 3, i.e. to let the UE know the validity time window of the service （then the UE can release the related PDU Session (s) gracefully with its own flexibility） but there is no need to introduce new parameters. |
| Google |  |  |  | X | Simple solution. We like to support using same handling for both temporary network slice and limited AoS slices |
| Ericsson | No | OK, partly | OK, partly | Yes, partly | It should be a policy, but the policy can even be handled within the CN by existing procedures. For examples the CN ensures the S-NSSAIs are not added to Allowed NSSAI when outside validity. S-NSSAI can be rejected for RA, as then UE will not request it again while in the RA and then if CN determines the S-NSSAI is valid again then AMF triggers a UCU adding the S-NSSAI to the Allowed NSSAI. In general the logic can be informatively described.  It should be noted that the SID does not include objective for slice with periodic availability. |
| Nokia | YES | NO | NO | Is similar to Option 1 in some respects | Providing explicit timing helps UE and network elements/functions involved to prepare for the local termination of sessions and also local deregistration of slices without further signalling (energy efficient approach). The system is left in a consistent state by distribution the timing info across the affected entities e.g. if the timing was not due to decommissioning as per UE based policies can also be applied if timing is provided by UDM (so it can also cover the case where the termination is not due to removal of a slice from deployment but just for a service based criterion, like temporary subscription)  EXISTING URSP based solutions do not work as there is no predictability of UE behaviour. the definition of time-based support requires new UE behaviour, especially to support the necessary information to propagate to the application layer for the apps that are associated with slices that are about to be disconnected. Also the allowed NSSAI is not changed and the network still has to update the UE so there is no point to use this as the slice-based validity criteria can suffice to terminate the sessions (if this was supported by existing UEs but this is not clear)  New URSP make behaviour more predictable but then it does not support the case of decommissioning and also it does not update the allowed NSSAI in the UE so the network still has to intervene to update the allowed NSSAI and therefore it is unclear why this is beneficial or an optimization.  Option 4 is similar to option 1 but it should be also possible to indicate the timing information in the Configured NSSAI, so the UE does not attempt to request the slice in the first place. so to us the option to provide the timing info also in configured NSSAI is necessary to avoid needless registrations with no longer available slices and needless UE configuration updates when a slice is no longer usable. this is covered fully by Option 1 and there is no need to consider Option 4 additionally as the per UE policies can be provide to AMF by UDM in option 1 and this be provided in Configured/Allowed NSSAI and if required to the RAN/SMF so the DRBs and essions for the slice are removed) |
| Samsung | Yes | No | No | Yes | Option 1 and Option 4 is same with only difference that apart from timing information the slice availability area/location (TAIs) will be shared to UE for the temporary slice. This is given in existing configured NSSAI.  Providing timing info/validity timer/validity condition using URSP rules will enforce UEs to continuously evaluate URSP which is a huge burden for UEs implementation. At present as per TS 23.503 6.6.2.3 UE revaluate only when PCF updates the URSP or some certain events is triggered. |
| ZTE | NO | NO | YES | YES |  |
| NEC | YES |  |  | YES | Option 1 also is OK in simplified version to avoid RAN impact. |
| Qualcomm | NO | NO | YES | YES |  |
| vivo |  |  | Yes | Yes | Option 1 and 2 introduce more UE complexity. |
| CATT | No | Yes | Yes | Ok |  |
| InterDigital | Yes | NO | NO | OK |  |

Summary:

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| --- | --- | --- |
| Option1 | Sending “Timing Information” about the configured/allowed slices to the UE | This option has 4 YES, 7 NO and 2 Empty. The main comment is that this option has RAN impact |
| Option 2 | URSP rule is enhanced with indication to request the UE to re-evaluation the URSP rules | This option has 3 Yes, 7 NO and 3 empty. The main concern is that UE need to re-evaluate the URSP rule for already established PDU Sessions. Another comments are that it does not support the case of decommissioning and also it does not update the allowed NSSAI in the UE |
| Option 3 | Reusing existing URSP rule | This option has 7 YES(including 1 partial YES), 4 NO and 2 Empty. The main concerns are the high burden of UESP revaluation in UE implementation and it is unclear how UE and network are synched on Allowed NSSAI. |
| Option 4 | AMF is configured with S-NSSAI availability policies that the AMF sends to the UE | This option has 12 YES(including 1 partial YES), 1 NO. The comment is whether there is need to introduce the new parameter |

Proposal 2: It is propose to further work on option 4.

#### Q3: For the graceful and gradual termination aspect, which options should be concluded for normative phase?

|  |  |  |  |
| --- | --- | --- | --- |
| **Company name** | **Option 1** | **Option 2** | **Other/Comment** |
| Apple | No | Yes | As indicated for Q2, option 3, it’s unclear how the UE behaves when the validity timer expires and continuous re-evaluation of URSP rules is not acceptable  For non-supporting UEs, we need network-controlled behaviour. |
| LGE | Yes | No | Timing information can be provided via validity condition of URSP. There is no need to introduce separate mechanism to provide timing information. In case of roaming, serving PLMN can update mapping information without providing validity condition. |
| Huawei | Yes | No | See above. The UE should be able to make its own decision based on the application layer/OS Layer (traffic status) and release the PDU Sessions by itself also considering the validation criteria. |
| Google | X |  |  |
| Ericsson | Yes, but without UE receiving timer | No | SA5 specs already support graceful termination which is proposed to be re-used. |
| NOKIA | NO | YES | The timing information in Q3 is sufficient also to provide graceful termination (for supporting UEs)  Option 1 however is not possible with existing URSPs without assuming certain implementation behaviour and the same considerations apply as described for Q2 |
| ZTE | NO | YES | The AMF can send timing information to UE so the UE can release the PDU session gracefully. |
| Samsung |  | Yes | Based on the received timing information as part Q2 scenario the UEs can gracefully release the PDUs before the temporary slice gets decommissioned. But for those UEs not supporting the feature network based approach is fine like AMF may do the operation but the exact steps will be handled during normative as the present solution need to fine-tuned.  Option 1 again enforcing UEs to revaluate URSPs for existing PDU sessions continuously which is not OK as per our comments in Q2. |
| Qualcomm | YES | NO |  |
| vivo | Yes |  |  |
| CATT | Yes | No |  |
| InterDigital | NO | YES |  |

Summary:

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| --- | --- | --- |
| Option1 | OAM triggers the PDU session release.  The UE uses URSP rule to trigger the PDU session release. | This option has 7 YES, 4 NO and 1 Empty. The main comment is that continuous re-evaluation of URSP rule is a burden of UE implementation. |
| Option 2 | OAM triggers the PDU session release.  The UE uses slice related timing information to trigger the PDU session release. | This option has 5 Yes, 5 NO and 2 empty. The main comment is whether slice related timing information is needed in the UE. |

**Proposal 3: Agree that OAM can trigger the PDU session release as the basis. Decide whether the slicing related timing information is provided to the UE in Q3.**

**NOTE: Whether the UDM need to signal anything to AMF can be concluded separately**.

### 2.2 Polling Question for KI#5

#### Q4: Whether partially Allowed S-NSSAI should be concluded for normative work?

|  |  |  |  |
| --- | --- | --- | --- |
| **Company name** | **Yes** | **No** | **Other/Comment** |
| Apple |  | X | No RAN impact was foreseen for KI#5 but based on RAN3 feedback there is RAN impact. |
| LGE |  | O | Based on RAN2/3 feedback, RAN impact is expected while there should be no RAN impact according to SID. |
| Huawei |  | V | Based on RAN2/3 feedback, partly Allowed S-NSSAI approach will have RAN impact. KI#5 shall not have RAN impact.  Partly Allowed S-NSSAI approach has impact on the existing slicing feature, e.g. NSAC. |
| Google |  | X | We can only support partly allowed S-NSSAI without RAN impacts. |
| Ericsson | Yes |  | The NG-RAN can be kept agnostic i.e. there is no need to impact the NGAP if the AMF includes the partly allowed S-NSSAIs into the Allowed NSSAI IE sent to the NG-RAN via NGAP. The NG-RAN knows already the S-NSSAI support per TA e.g. from Xn information. |
| Nokia | X |  | Partially Allowed NSSAI enables a complementary behaviour that can be used when the UE registers in a TA that was earlier marked as a TA where a Rejected S-NSSAIs is partially supported in RA. Without this we must restrict RA to apply to only the TAs where the Allowed NSSAI is supported.  The RAN impacts for RAN3 are protocol level adjustments (the addition of Partially Allowed NSSAI in UE context and its handling seems the only impact). we also have some comments on the comments provided by some companies in RAN3:   * To RAN3´s understanding, the solution is assumed to trigger handover not during but just after state transition from idle to connected procedure, which increases signalling.   [NOKIA] Nokia assumes this is the same as for target NSSAI , so since this was acceptable for target NSSAI it should not be a problem. also, the increase in signaling here is not clear as it is at most a redirection (if needed) and the increase should be relative to a base scenario that allows the same benefit and we are not aware of this base scenario alternative.   * Potential issue on propagation of Allowed NSSAI via Xn interface for Xn based handover needs to be discussed further.   [NOKIA] Nokia understands that the Allowed NSSAI is already passed to target gNB during handover in the Path switch request ACK. the partially Allowed NSSAI can be passed at the same time.   * Handing over a UE to a target cell/frequency, because that mobility target supports the partially allowed S-NSSAIs (i.e. without any active UP connection for the partially allowed S-NSSAIs) needs to take into account the radio performance.   [NOKIA] As usual the handover to a target cell will need to take into account the "feasibility" from a radio standpoint. Again: Same considerations apply as with the case of the Target NSSAI. |
| Samsung |  | Yes | 1. RAN impact 2. Solving a problem should not lead to another problem. If we allow this solution then it will lead to KI#6 problem where UEs already being registered but obviously it can’t use in the present TA which means after some time it will fall down to slice inactive issue. 3. Also without getting using this slice because of NSAC feature interaction NSACF will count it. This leads to a situation where both these features can’t be used together and for operator it will be unnecessary restriction. |
| ZTE | YES |  | RAN can further study the impact on partially allowed NSSAI. |
| NEC | YES |  |  |
| Qualcomm | YES |  | We consider the RAN impacts to be minimal and restricted to RAN3. |
| vivo | Yes |  | Maybe this question will also influence some solutions for KI#6 |
| CATT | Yes |  |  |
| InterDigital | YES |  |  |

Summary:

YES: 8, NO: 5

**Proposal 4: Partially Allowed S-NSSAI is concluded for normative work. RAN3 can continue the work on the RAN impacts.**

# 3. Proposal

**For support of limited AoS slices not matching deployed TAs**

**Proposal 1: It is propose to further work on option 2, option 3 and option 4.**

**For improved support of temporary network slices:**

**Proposal 2: It is propose to further work on option 4**

**For the graceful and gradual termination aspect:**

**Proposal 3: Agree that OAM can trigger the PDU session release as the basis, and decide whether the slicing related timing information is provided to the UE in Q3.**

**NOTE: Whether the UDM need to signal anything to AMF can be concluded separately.**

**On whether partially Allowed S-NSSAI should be concluded for normative work**

**Proposal 4: Partially Allowed S-NSSAI is concluded for normative work. RAN3 can continue the work on the RAN impacts.**

# 4. Annex

## Annex 1 Interim conclusion on KI#3 in TR 23.700-41 v1.1.0

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| **For support of limited AoS slices not matching deployed TAs it is proposed that:**  **Option1: Secondary TAs per cell based solution:**  - If the access to the network slice can be limited to only supporting devices (i.e. the slice customer can control the UE population): to retain the same behaviour as in current system (homogenous support in TA) a new feature is introduced in the system to handle secondary TAs for supporting UEs and networks.  Editor's note: The above bullet is FFS and subject of feedback from RAN WGs.  **Option 2: reuse existing URSP rules with per cell level granularity:**  - Clarify that URSP rules allows a per cell level granularity that the UE is required to validate before using a URSP including an S-NSSAI, and also that the UE to apply the Route Selection Validation Criteria also for already established PDU Sessions and their traffic. This would then ensure cell level granularity of service availability without any protocol impacts, unless URSP rules is to be explicitly enhanced with new indication that the UE is to apply the Route Selection Validation Criteria also for already established PDU Sessions and their traffic. If the UE does not support enhancement of URSP to apply the Route Selection Validation Criteria also for already established PDU Sessions and their traffic, SM policies are enhanced to release the PDU Sessions for the concerned S-NSSAI when the UE moves out of the AoS.  NOTE: How the handover can be optimized to prevent the UE from leaving the slice service area (or entering into the slice service area) will be considered during normative phase based on RAN WG feedback.  **Option 3: Reconfiguration of TAs:**  - Reconfiguration of TAs to keep the end-to-end significance of slice unchanged, but an operator configures the cells of a TA that are outside AoS to have no or limited resources using existing NG-RAN OAM configuration. The solution can be combined with a mechanism that limited the SM signalling for slices when the UE is outside the AoS e.g. Option 2.  **Option 4: AMF is configured with S-NSSAI availability policies that the AMF sends to the UE:**  - Availability validity can be time and location. The UE uses the policies and when the availability are not valid, the UE considers the S-NSSAI to be 1) not registered or 2) registered while no UP are allowed to be activated based on information in the received policy.  Editor's note: It is FFS which option(s) are adopted for normative work (option 3 is already supported by current specifications).  **For improved support of temporary network slices:**  **Option 1: Sending “Timing Information” about the configured/allowed slices to the UE:**  - "Timing Information" as described in Solution #24 can be used to track the start time, end time, and periodicity of the availability of the network slice, including any related temporary TA. A solution will be standardized that enabled the UE to be updated with timing information related to the availability of the configured/allowed slices. It is proposed to specify that the UE can be updated with timing information about the configured/allowed slices and this same timing information can also be provided from the RAN to the AMF when the serving PLMN RAN is configured with the timing information. The timing information can be associated to TAs, S-NSSAIs for temporary slices that also require deployment/support of temporary TAs. If the termination of a network slice is HPLMN initiated, then this information is passed to UE and RAN UE context in addition to AMF and SMF. If both VPLMN and HPLMN timing information applies the most constraining timing determines a slice availability.  - When the timer associated with a S-NSSAI expires, then the UE and network removes the S-NSSAI locally from the allowed NSSAI if the S-NSSAI present in the allowed NSSAI.  - When a slice is periodically available/unavailable, the principles of Solution #24 can be followed so that the associated PDU session can be retained and restored.  - The UE sends capability that it supports timing information to the network. The network provides timing information to the supported UE.  **Option 2: URSP rule is enhanced with indication to request the UE to re-evaluation the URSP rules:**  - For timing restriction of the use of a network slice, URSP rules are enhanced with the requirement for the UE to re-evaluate the URSP rules periodically as per a standardized value or according to a value indicated by the PCF, and for the UE to apply the Route Selection Validation Criteria also for already established PDU Sessions and their traffic. As to enable enforcement in the network, the SMF enforces the UP of PDU Sessions and deactivates the UP according to the timing information that the SMF receives from PCF as part of the SM Policy.  **Option 3: Reusing existing URSP rule:**  - The PCF should generate URSP based on Temporary network slices related information stored in the UDR. UE can be aware of the validity timer of the slice or applicable area of the service in the validation criteria in URSP and manage the PDU Sessions for the related S-NSSAI accordingly based on the current design as described in clause 6.6.2.3 of TS 23.503 [12].  **Option 4: AMF is configured with S-NSSAI availability policies that the AMF sends to the UE:**  - Availability validity can be time and location. The UE uses the policies and when the availability are not valid, the UE considers the S-NSSAI to be 1) not registered or 2) registered while no UP are allowed to be activated based on information in the received policy.  Editor's note: It is FFS which option are adopted for normative work.  NOTE: Temporary network slices does not mean that the network slices are decommissions and created as per the timing information, but the network slices are not meant to be available for use by the UE.  **For the graceful and gradual termination aspect:**  **Option 1:**  - For decommission of a network slice, OAM and NF implementation (e.g. by updating URSP rules and to deregister not used S-NSSAIs) can handle the functionality without further standardization. Whether OAM provides timing information to an NF as to allow the NF to apply a change of resource utilization in advance, e.g. a time for how long time a Shutting Down state is to be valid, would be up to SA WG5.  - UE can be aware of the validity timer of the slice or applicable area of the service in the validation criteria in existing URSP and release the PDU Sessions for the related S-NSSAI gracefully based on the current design as described in clause 6.6.2.3 of TS 23.503 [12].  **Option 2:**  - When a slice is decommissioned, the PDU Sessions of the slice should be gracefully (for supporting UEs of the timing information) and gradually released (for no supporting UEs of the timing information):  - If the UE supports the timing information indicating time of network slice availability, the network may provide the timing information to the UEs so the UE knows in advance when a network slice ceases to be supported. In this case, the UE can take the necessary actions to prepare for the slice not becoming available.  - In addition, the AMF, for non-supporting UEs and for the case of UE not performing any actions despite of the timing information provided by the network, may be triggered by the OAM to start gradually terminating PDU Session(s) associated with S-NSSAI subject to be terminated. The AMF releases PDU Session(s), associated with the S-NSSAI subject to be terminated, based on operator’s policy available at the AMF.  Editor's note: Whether UDM need to signal anything to AMF is FFS.  Editor's note: The above bullet is FFS and depends on the conclusion of temporary network slices.  Editor's note: It is FFS which option are adopted for normative work. |

## Annex 2 RAN2 feedback in R2-2210827

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| RAN2 has discussed the 3 questions for Key Issue #3: Network Slice Area of Service for services not mapping to existing TAs boundaries, and Temporary network slices and would like to share the following understanding with SA2 and RAN3.   1. *Whether NG-RAN can broadcast one or more Secondary TAIs (up to a number RAN2 agrees, we note that for NTN is already possible to broadcast TWO TACs) via an updated SIB or new SIB, and report them to the CN and between gNBs as per existing Tracking Area related information exchange procedures but with indication they are secondary. The additional TAIs are associated with specific S-NSSAI(s) like the existing TAs and will be treated by UEs supporting secondary TAs as a normal Tracking area from RM standpoint (as described in solution#9)*   **[RAN2 answer]**  The NG-RAN can now broadcast more than one TACs per PLMN per cell (the limitation is 12 TACs per cell identity) but it is only for NTN, not for TN, and the broadcast TAI(s) are associated with NSAG not S-NSSAI(s).  Currently there is no concept of differentiating which is the primary TAI and which are the secondary TAI(s). The introduction of secondary TAI(s) has clear RAN2 impact.  The secondary TAIs will have limited applicability as legacy UEs do not benefit from the mechanism. And the applicability of legacy slicing features may also be impacted.  Whether NG-RAN can report them to the CN and between gNBs as per existing Tracking Area related information exchange procedures but with indication they are secondary is out of RAN2 scope and can be left to RAN3 decision.   1. *Whether the NG-RAN can be configured with a slice availability on a per-cell basis and*    1. *inform AMF and other gNBs in NGAP messages (as described in solution#11 and others)*    2. *Whether in Constrained Service Area the network slice is still supported but since no dedicated resources are allocated for the network slice the SLA of the network slice is not guaranteed.(as described in solution#45).*   **[RAN2 answer]**  Changing the uniform support of slices within a TA, e.g. configuring NG-RAN with a slice availability on a per-cell basis, may have RAN2 impacts and thus this change requires investigations in RAN2.  Communication between NG-RAN nodes and the CN, between NG-RAN nodes for slice availability on a per-cell basis is out of RAN2 scope and can be left to RAN3 decision.  RAN2 understand that in case the slice service area (i.e. the area where the operator guarantees the SLA of the slice to Ues) is smaller than a TA that supports the slice, it is up to NW implementation what resources a slice may access outside this slice service area.   1. *The NG-RAN receives in solution 29 (but conceivably this would be needed for similar solutions) the partially allowed S-NSSAIs in addition to the Allowed NSSAI. Can the NG-RAN in principle trigger handover procedure to a supporting TAI of the partially allowed S-NSSAIs when it is possible to do so? this can happen while in connected mode or when the UE is engaged in transition from Idle to connected mode. The reason is to enable the support of the maximum number of S-NSSAIs in the Allowed and partly allowed S-NSSAIs lists.*   **[RAN2 answer]**  RAN2 impact is foreseen to support NG-RAN triggering handover procedure to a supporting TAI of the partially allowed S-NSSAIs and RAN2 understand the feasibility should also be evaluated by RAN3. |

## Annex 3 RAN3 feedback in R3-226083

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| RAN3 thanks for SA2’s information related to Rel-18 study FS\_eNS\_Ph3. After discussion, RAN3 achieved consensus on SA2’s following questions   1. Whether NG-RAN can broadcast one or more Secondary TAIs (up to a number RAN2 agrees, we note that for NTN is already possible to broadcast TWO TACs) via an updated SIB or new SIB, and report them to the CN and between gNBs as per existing Tracking Area related information exchange procedures but with indication they are secondary. The additional TAIs are associated with specific S-NSSAI(s) like the existing TAs and will be treated by UEs supporting secondary TAs as a normal Tracking area from RM standpoint (as described in solution#9)   **RAN3 answer:**  The secondary TAI broadcast is within RAN2 remit. Depending on the resulting functionality impacts, it may be possible for NG-RAN node to report over NG to CN and also exchange over Xn additional TAIs with indication on secondary TAIs.  However, companies in RAN3 raised the following technical comments:   * The solution adds complexity on the handling of mobility restriction list . It remains to be studied whether this can be addressed by means of new solutions. * For UEs supporting this feature, this solution increases the UE/network signaling overhead and possibly the RRC state transitions when the UE moves in/outside of secondary TAIs to update its registration area. * The solution may also require reconfiguration of secondary TAIs or introduction of new third TAIs (or even more) whenever new slices are deployed.  1. Whether the NG-RAN can be configured with a slice availability on a per-cell basis and    1. inform AMF and other gNBs in NGAP messages (as described in solution#11 and others)    2. Whether in Constrained Service Area the network slice is still supported but since no dedicated resources are allocated for the network slice the SLA of the network slice is not guaranteed.(as described in solution#45).   **RAN3 answer to 2a):**  RAN3 does not prefer to report cell level configuration to Core network due to increased NGAP signaling and due to a well-established principle that AMF shall remain cell agnostic.  **RAN3 answer to 2b):**  RAN3 considers the solution has no signalling impacts on RAN specifications. Whether and how a slice should be served within its constrained service area is left to operator’s policies, which can be enabled by means of RRM Policies. For slices that have no resources allocated outside their availability area, the slice Composite Available Capacity (CAC) will be zero, which can prevent active mode mobility to occur.  Companies in RAN3 raised the following technical comments:   * The mobility constraint may be different from the current assumption that handovers are allowed regardless of the slice support of the target NG-RAN node. This means that, if the NG-RAN node disregards the per-slice CAC, the NG-RAN node may handover UE to a target NG-RAN node where a slice used by the UE has no allocated resources. * This solution may increase the network signaling. The network may make UE register to a slice and/or trigger service request for a slice at some point while the network knows that it will not serve it with any resource (if zero resources) in the cell where the UE moved to RRC\_Connected. * It is unclear how GBR bearers are handled when zero resources are allocated and whether non-GBR bearers packets would be dropped by the NG-RAN node. * This solution may require study charging issue to be studied in other groups.  1. The NG-RAN receives in solution 29 (but conceivably this would be needed for similar solutions) the partially allowed S-NSSAIs in addition to the Allowed NSSAI. Can the NG-RAN in principle trigger handover procedure to a supporting TAI of the partially allowed S-NSSAIs when it is possible to do so? this can happen while in connected mode or when the UE is engaged in transition from Idle to connected mode. The reason is to enable the support of the maximum number of S-NSSAIs in the Allowed and partly allowed S-NSSAIs lists.   **RAN3’s answer:**  Depending on the resulting functionality, it it may be possible for NG-RAN to receive the S-NSSAIs included in the partially allowed NSSAI and trigger connected mode handover procedure to a suitable target cell.  Companies in RAN3 raised the following technical comments:   * To RAN3´s understanding, the solution is assumed to trigger handover not during but just after state transition from idle to connected procedure, which increases signalling. * Potential issue on propagation of Allowed NSSAI via Xn interface for Xn based handover needs to be discussed further. * Handing over a UE to a target cell/frequency,because that mobility target supports the partially allowed S-NSSAIs (i.e. without any active UP connection for the partially allowed S-NSSAIs) needs to take into account the radio performance. |