**SA WG2 Meeting #143E S2-20xxxxx**

**24 February-09 March 2021, Elbonia (revision of S2-20xxxx)**

**Source: Ericsson (Rapporteur)**

**Title: FS\_eNPN moderated email discussion**

**Document for: Information**

**Agenda Item: TBD**

**Work Item / Release: FS\_eNPN / Rel-17**

*Abstract of the contribution: This contribution includes the moderated email discussions for the FS\_eNPN open issues.*

# 1. Introduction

More FS\_eNPN study time was requested to resolve the outstanding issues as listed in the TR cover sheet in S2-2009250.

To make the resolution of those open issues as smooth as possible and spend as little meeting time as possible on the study phase at SA#143E, this documents includes a request for companies to provide their opinion on the above mentioned open issues.

The result will be used as an input to a proposed conclusion at SA2#143E, and possibly we will target a working assumption at CC#1.

For each question the company should also include an opinion whether the eNPN WID should be updated with a resolution of the issue.

# 2. Issues

## KI#1-Q1: Additional SIB information for SNPN selection

TR conclusion in clause 8.1.4 includes an EN as:

Editor's note: Need for additional SIB information is FFS.

NOTE: There is already SIB information concluded for KI#1, se TR conclusion, i.e. EN is if there is any need for more SIB information beyond what is already concluded.

**Question**: Is there a need for additional SIB information for SNPN selection for UEs with an SNPN subscription of a Separate Entity?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | N | N | The conclusions already include enough SIB information. |
| Intel | N | N | Existing information in clause 23.700-07 8.1.4 is sufficient. |
| Nokia | N | N | Current conclusion is sufficient to address all use cases {open, closed, restricted} type of deployments thus we do not see the need for any new SIB information. |
| Orange | N | N | Current conclusions already include (more than) enough SIB information. |
| Qualcomm | N | N | We do not see a need for further SIB enhancements. |
| Deutsche Telekom | N | N | No additional SIB information is needed. |
| OPPO | N | N | There is no need to introduce additional SIB information for the SNPN selection. The SIB indications in the TR are sufficient for the assistance of the SNPN selection. |
| Alibaba | N | N | Current conclusion is sufficient and other functionalities can be achieved via NAS message. |
| Futurewei | Yes or No (depend on if considering onboarding) | No | If network selection clause including onboarding SNPN selection, that we should consider enhancement for onboarding which includes congestion control as indicated in the Note 3 of 8.4.1.  For network selection of the UE which already has subscription, no more SIB enhancement needed. |
| Huawei | N | N | The conclusions already include enough SIB information. |
| Charter | N | N | We do not see a need for further SIB enhancements. |
| CableLabs | N | N | Do not see a need for updating SIB enhancements further. |
| Philips | N | N |  |
| MediaTek | N | N | The existing SIB indication is sufficient |
| Lenovo | N | N | The currently agreed SIB enhancements seem to fulfil the objective. |
| ZTE | N | N | The conclusion on SIB is sufficient |
| Cisco | N | Y | There is no need for additional information. |
| Samsung | N | N |  |

## KI#1-Q2: Simultaneous connections for UEs with one subscription

The TR includes an empty conclusion clause "8.1.3 Conclusions for simultaneous data service from both V-SNPN and a separate entity owning the credentials (PLMN or SNPN)".

**Question**: Should simultaneous access, via separate PDU Sessions, to data services available via SNPN (LBO) and via Separate Entity (UPF in Separate Entity) be supported for UEs with one subscription?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | Y | Y | Both LBO and "HR" is supported by 5GS and no need to restrict this for the SNPN and Separate Entity architecture (and having a restriction will cause more work). |
| Intel | Y | Y | We think that access to services from the Separate Entity should be supported for UE with one subscription (via UPF in Separate Entity), the separate entity being an SNPN. The simultaneous access (via two PDU Sessions) is then a natural consequence. The WID should be updated with an objective pointing to the conclusions in 23.700-07 clause 8.1.3. |
| Nokia | Yes | Yes |  |
| Orange | N | N | There are no SA1 requirements for this. We have sent an LS to SA1 about this but even if SA1 would “find” such requirement, this is not in the scope of FS\_eNPN. |
| Qualcomm | Y | Y | This can easily be supported by the existing architecture. Therefore we do not see a need to artificially restrict the system. |
| Deutsche Telekom | No | No | There is no service requirement that supports this. This question should not even be asked!  There was an LS sent to SA1 and we have to wait for an answer. |
| OPPO | Y | Y | It is reasonable to support the PDU session connected to the home SP (UPF in the separate entity). |
| Alibaba | Y | Y | We think this feature is necessary as long as the subscription can be used for the access of SNPN and the Separate Entity. They should not be contradicted with each other. |
| Futurewei | Yes | yes |  |
| Huawei | Y | Y | The feature should be supported. Combination with KI#2, the UE with one subscription should also be able to receive data services from one network (e.g. NPN), and paging as well as data services from another network (e.g. PLMN) simultaneously. |
| Charter | Y | Y | This can easily be supported by the existing architecture. Therefore we do not see a need to artificially restrict the system. |
| CableLabs | Y | Y | Can be supported with existing architectures. |
| Philips | Y | Y | Agree with Ericsson and Qualcomm. |
| MediaTek | Y |  | It is similar to the condition when UE access SNPN via PLMN or vice versa, and the existing Rel-16 procedure can be used with necessary update for UE with one subscription |
| Lenovo | Y | Y | In general, we think if the Separate Entity is SNPN and implements SMF/UPF functionality, then the standard should support simultaneous LBO PDU Session and Home-Routed PDU Session.  If we understand this question correctly, it depends on the answer the **Question A** from the KI#1-Q3, i.e. whether service to the Home SNPN are supported (independent of service continuity). |
| ZTE | Y | Y | It seems the existing R16 mechanism can work. |
| Cisco | N | Y | The simple solution to this is use of VPNs to the separate entity. "home routed" solutions require a lot of coordination between home and visited networks which is OK for MNOs, but onerous for private network providers. SA2 should not waste time in specifying such a feature which has a very low probability of deployment. |
| Samsung | Y | Y |  |

## KI#1-Q3: Credentials for SNPN service continuity

SA2 asked SA1 the following questions (in LS S2-2007828):

*Q1: support for access to (and related service continuity) for services provided by an SNPN separate from the serving SNPN (i.e. services provided by the SNPN that issued the UE's subscription). One example could be access to voice services provided by the SNPN.*

*In case these, or other service continuity requirements for SNPNs exists, SA2 would like to ask SA1 the following additional questions:*

*Q2: whether only PLMN credentials (and respective authentication methods) can be used to register to a target network (i.e. which may be an SNPN with or without credentials being owned by separate entities, or a PLMN), given the various service continuity scenarios.*

*Q3: whether in addition to PLMN credentials, also non-3GPP identities and credentials (and respective alternative authentication methods) can be used to register to a target network, given the various service continuity scenarios.*

NOTE: SA1 has not yet replied.

**Question A**: Should the standard support access to (and related service continuity for) services provided by an SNPN separate from the serving SNPN?

**Question B**: If answer to A is yes, what type of credentials should be supported e.g. PLMN only, or both PLMN and non-3GPP identities and credentials?

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| **Company name** | **Answer question A**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | See comment | See comment | SA2 will need to wait for SA1 to answer, and meanwhile SA2 should complete the work without support for service continuity. |
| Intel | Y | Y | **A**: In our opinion access to services provided by an SNPN separate from the serving SNPN should be supported for UE with one subscription, as per our answer to KI#1-Q2.  **B**: If access to services provided by an SNPN separate from the serving SNPN is supported for UE with one subscription, then there the following two cases to consider:  **Case 1**: UE moves from one serving SNPN (SNPN1) to another serving SNPN (SNPN3), while the service is anchored in SNPN2. UE uses only the credentials of SNPN2.  **Case 2**: UE moves from a serving SNPN (SNPN1) to a serving PLMN, while the service is anchored in SNPN2. In this cases UE uses PLMN credentials to register with the PLMN, and then uses the Rel-16 OTT approach to resume service continuity with SNPN2 using SNPN2 credentials. |
| Nokia | Yes | Yes | 1) Mobility between serving SNPNs with service continuity should be supported.  2) Mobility between serving SNPNs should be supported even with separate entity holding UE’s subscription.  Service continuity should be supported for at least when using SNPN and/or separate credentials. (No view on the PLMN credential scenario). |
| Orange | N | N | There are no SA1 requirements for this. |
| Qualcomm |  |  | SA2 needs to wait for the reply from SA1 before taking a decision on these questions. |
| Deutsche Telekom | No | No | There is no service requirement that supports service access between SNPNs, only access authentication for that.  This question should not even be asked!  There was an LS sent to SA1 and we have to wait for an answer. |
| OPPO |  |  | Depending on the reply LS from SA1. |
| Alibaba | Y | Y | The answer for Question A is yes.  Service continuity should be supported when UE decides to get access to a SNPN that is separate from the serving SNPN.  The answer for Question B is also yes. Both 3GPP and non-3GPP credentials should be supported. |
| Futurewei | Yes | Yes | Both credentials can be supported. |
| Huawei | See comment | See comment | We believe service continuity should be supported.  In case the separate entity is PLMN, only PLMN credentials should be supported;  In case the separate entity is SNPN, non-3GPP identities and credentials can be supported. |
| Charter | Y |  | Service continuity should be supported with both PLMN and non-3GPP identities and credentials. |
| CableLabs | Y | Y | Access to (and related service continuity for) services provided by an SNPN separate from the serving SNPN should be supported with both PLMN and non-3GPP identities and credentials. |
| Philips | Y | Y | On Q1: No need to artificially restrict the functionality of NPNs.  On Q2: Both types need to be supported. Of course it depends on the target network and the deployment. By default, to register to a PLMN as target network, PLMN credentials (and respective authentication methods) need to be used. To register to a non-public network, both PLMN credential and non-3GPP identities and credentials may be used. |
| MediaTek | See comment | See comment | Wait until SA1 responds |
| Lenovo | See comments | See comments | Similar to KI#1-Q2, if the Separate Entity is SNPN implementing SMF/UPF functionality, then the standard should support services provided by the Home SNPN, i.e. Home-Routed PDU Session.  Regarding service continuity: we do not see requirements to support it. |
| ZTE |  |  | Service continuity should be supported. But we should wait for the reply from SA1 before move forward |
| Cisco | N | Y | For SNPN, support for home-services, eg. voice require very high quality support from the serving SNPN. Also, most such home services are provided via OTT means. |
| Samsung | See comments |  | SA2 needs to wait the answer from SA1 |

## KI#1-Q4: AAA-S providing subscription information

TR conclusion in clause 8.1.1 includes an EN as:

Editor's note: It is FFS if the AAA server supports providing the subscription information needed for registration and session management procedure.

**Question**: Should it be possible for AAA-S to provide subscription information to SNPN?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | N | N | Main scenario for using AAA-S is to re-use off-the-shelf AAA infrastructure and while some information can be provided by an AAA-S it is not suitable for providing subscription information.  It is not realistic to consider that an external AAA-S would be provisioned with 5GS subscription data (e.g., Access and Mobility, Session management data as defined in 3GPP TS 23.502). It would not make sense either that 3GPP allows an external entity to play the same role as the one defined for UDM and require AMF to interact with AAA-S instead of with UDM for Subscription management purposes as some solutions propose. |
| Nokia | No | No | Subscriber data and session management services shall be provided by the UDM as defined in Rel16.  Necessary information in the UDM can be provisioned by other means.  Strongly against this approach as this introduces significant and unnecessary impact to 5G system procedures and invalidates (or duplicates) UDM functionalities. |
| Orange | N | N | This is not needed. |
| Qualcomm | N | N | We do not see a strong need to enable this scenario. |
| Deutsche Telekom | No | No | Subscriber data and session management services shall be provided by the UDM as defined in Rel16.  Necessary information in the UDM can be provisioned by other means. |
| Alibaba | Y | Y | For SNPN, it should be possible to use AAA-S to provide subscription information for registration and session management procedure for the purpose of flexible deployment. |
| Futurewei | No | N |  |
| Huawei | Y | Y | For the scenario that separate entity offers the AAA server, there should have SLA between the SNPN and separate entity. The 3GPP aware AAA server is trusted by the SNPN and can provide the individual subscription data (e.g., Access and Mobility, Session management data) dynamically to the SNPN to assist the SNPN to complete the registration and session management procedures for the UE. This can help differentiate the access and mobility management and session management for UEs per AAA server request.  If common subscription data is required for a group of UEs, i.e., no differentiated handling for UEs with credential owned by AAA server, then it is enough to statically configure this common subscription at UDM of SNPN. |
| Charter | N | N | We do not see a strong need to enable AAA to carry 5GS subscription data. |
| CableLabs | N | N | Do not see a need to enable AAA to carry 5GS subscription data. |
| Philips | N | N |  |
| Lenovo | See comments | See comments | As baseline for Rel-17, we consider that the SNPN's UDM/UDR can be pre-configured to store the Subscription Data (e.g. applicable to all or a group of UEs from the Separate Entity).  However, for individual Subscription Data per UE, the SNPN's UDM/UDR may pull the subscription data from the AAA-S on demand. |
| ZTE |  |  | Neutral |
| Cisco | N | N | While the AAA-S may provide subscription information, it will be difficult to specify/standardize the exact subscription information provided. Hence, it is best not to get into such details. |
| Samsung | N | N |  |

## KI#1-Q5: Other UE ID than SUPI towards AAA

TR conclusion in clause 8.1.1 includes an EN as:

Editor's note: Need for and details of using a UE ID other than the SUPI are FFS.

**Question**: Is there a need to support other UE ID than SUPI towards AAA?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | N | N | The SUPI should be enough.  If SA3 determines that there is a need for another UE ID, then SA2 can handle that addition during normative phase without any WID update. |
| Nokia | No | No | It is sufficient to use SUPI/SUCI as identifier also for AAA based primary authentication. |
| Orange | N | N |  |
| Qualcomm | N | N | SUPI is sufficient |
| Deutsche Telekom | N | N | The SUPI should be enough. |
| OPPO | See comments | See comments | If SA3 raises the security concern sending the SUPI to the AAA, then a UE ID other than the SUPI is required. |
| Alibaba | Y | Y | We think it should be possible to use other UE ID than SUPI, because for certain AAA provided by 3rd party, the authentication can be conducted via using other UE ID. |
| Huawei | Y | Y | Traditionally, legacy AAA server used user credential based on use MAC@, IP@ or username, certificate as UE ID. So the SUPI from 5G is a parameter identifying the UE ID (IMSI, NAI, Line ID) hence for NPN application shall be extended to other ID and stage 3 shall support also this ID format. For example in industrial scenario after provisioning the UE identifier is the Static IP address or the MAC@ which is also use for OAM and other industry usage. |
| Charter | N | N | SUPI is sufficient |
| CableLabs | N | N | Do not see a need to support other UE ID than SUPI |
| Philips | N | N | Agree with Ericsson. |
| MediaTek | N | N | SUPI/SUCI is sufficient |
| Lenovo | See comments | See comments | The question seems misleading. Assuming that the UE is provisioned with a NAI (used as SUPI) by the Separate Entity, then only this SUPI is to be used for the primary authentication towards the AAA-S.  However, whether the same SUPI used for the primary authentication is also used as UE-ID within the serving SNPNs should be answered by SA3. Depending on the SA3 answer, another UE-ID (without UE aware of it) may be used in a serving SNPN. |
| ZTE | N | N | SUPI is sufficient |
| Cisco | N | Y | SUPI allows NAI. There is no need for additional UE ID. |
| Samsung | Y | N | NAI can be used for new UE ID |

## KI#1-Q6: Additional mechanisms to update list of preferred SNPNs

TR conclusion in clause 8.1.7 includes an EN as:

Editor's note: Need for additional mechanisms (e.g. URSP or new policy using UPU) to update the separate entity controlled prioritized list of preferred SNPNs in the UE is FFS.

**Question**: Should it be possible to use additional mechanisms (e.g. URSP or new policy using UPU) to update the separate entity controlled prioritized list of preferred SNPNs in the UE?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | N | N | Enabling a more dynamic update of network selection lists would require more study and such enhancements can be added in a later release. |
| Intel | N | N | We don’t see the need for any additional mechanisms to update the prioritized lists on top of those defined in 23.700-07 clause 8.1.7. |
| Nokia | No | No | No additional mechanism besides UPU or SoR is needed. |
| Orange | N | N |  |
| Qualcomm | N | N | No additional mechanisms needed on top of UPU/SoR. |
| Deutsche Telekom | No | No | No additional mechanism is needed. |
| OPPO | N | N | The SoR or the UPU mechanism is sufficient to update separate entity controlled preferred list.  But if the new mechanism is introduced, then the updated listed shall be protected by the key in the separate entity. |
| Alibaba | Y | Y | We think there is a need to have additional mechanism to update list of preferred SNPNs because if other information such as UE policy has list of preferred SNPN, it can be used to update the list of preferred SNPNs. |
| Futurewei | Y | N | How the updated list can be delivered with integrity  protection for the SNPN when non-3GPP credential being  used for primary authentication need input from SA3. This  may lead to new or enhancement of existing mechanism.  Also how to trigger UE for re-selection after receiving the updated list can also be considered as additional enhancement of priority list update. |
| Huawei | N | N | SoR or UPU is enough to enable update of network selection lists |
| Charter | N | N |  |
| CableLabs | N | N |  |
| Philips | N | N | Agree with Ericsson |
| MediaTek | N | N | The current solutions in TR are all based on SoR or UPU. The EN can be removed. |
| Lenovo | N | N | SoR or UPU are available and can be re-used to update the lists of SNPN IDs. |
| ZTE | N | N | SoR or UPU is enough to update network selection lists |
| Cisco | N | Y | UPU is sufficient. Also most Enterprises will use an OTT MDM scheme which will provide the mechanism of updating these lists. |
| Samsung | N | N |  |

## KI#2-Q1: Continuity for single radio UE using N3IWF

In SA2#141E, a conclusion is agreed that single radio UE is able to achieve PDU session continuity by using the existing handover procedure between 3GPP access and non-3GPP access. Such conclusion is aligned with the statement in clause 5.30.2.7 and 5.30.2.8 in TS 23.501.

In SA2#142E, there was a debate regarding whether single radio UE is sufficient to fulfill the service continuity when using N3IWF. But no conclusion is agreed.

Service continuity defined in TS 23.501 is quoted as below:

**Service Continuity:** The uninterrupted user experience of a service, including the cases where the IP address and/or anchoring point change.

**Question**: With existing mechanism, is single radio UE sufficient to support service continuity of VIAPA service when using N3IWF?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | N | Y | The resolution is to include a statement in specification that single radio UE is not an option when using N3IWF for service continuity. |
| Intel | Depends on the direction | N | According to 22.263 clause 5.5: “*The 5G system shall be able securely reconnect within a short period of time (<1s) from UE starting first network reconnection attempt after the UE has detected a UE network connection loss.*”  Assuming the following cases:  **Case 1**: UE is initially connected directly to SNPN. After losing SNPN coverage, UE registers directly with PLMN and then OTT with the SNPN, to resume service continuity. We think in this direction it will be **difficult** to achieve a service break lower than 1s.  **Case 2**: UE is initially connected directly to PLMN and then OTT with the SNPN. After losing PLMN coverage, UE registers directly with SNPN and resumes service continuity. We think in this direction it is **possible** to achieve a service break lower than 1s. |
| Nokia | No | No | With N3IWF solution, some service disruption is inevitable as there is no HO prep phase or data forwarding supported between source and target. Dual radio is beneficial to avoid disruption but not mandatory for UE to support. 3GPP can highlight the constraints and leave it up to the market to decide based on the desired use case and the service offering expected. |
| Orange | Depends on the service | No | If the service cannot cope to the connectivity interruption, it is up to the implementation to use dual radio, but no additional functionality needs to be specified. |
| Qualcomm | Y | N | Servince continuity (IP address preservation) can be supported. |
| Deutsche Telekom | Yes | No | Requirement quoted by Intel is not related to service continuity. It is about reconnection after a connection loss (on the same link).  No additional service requirements for VIAPA service continuity were introduced in Rel17 in SA1 because Rel16 mechanism should be good enough. No additional functionality needs to be specified (any improvements to be left for implementation) |
| OPPO | N | N | - Informative guideline for how to use existing Rel-16 mechanisms and information to support VIAPA services  The above bullet can be used to address this requirement if needed. |
| Alibaba | Y | Y | We think single radio UE can support service continuity of VIAPA service as long as the application layer relocation and the network layer relocation can be supported. |
| Futurewei | Yes | No | Existing solution should be enough for session continuity. Seamless service continuity for single radio doesn’t need to be supported in this release. |
| Huawei | See comment | See comment | This question is not that clear.  We can’t say DR UE or SR UE would be sufficient to support service continuity of VIAPA service when using N3IWF. Because service continuity depends on specific network, specific service and even user experience.  What we can do is to list the potential mechanism which could help to improve service continuity using N3IWF, such as MA-PDU session and dual connectivity to both networks using different radio interfaces in DR UE case, and trigger a dual registration/connectivity to target network using N3IWF in SR UE case. |
| Charter | Y | N | Service continuity based on existing mechanism should be supported (IP address preservation). |
| CableLabs | Y | N | Should be able to support service continuity based on existing mechanisms |
| Philips | Depends on the service | N | The mechanism supports IP address preservation, but with single radio it will likely lead to some interruptions for many VIAPA services. Some improvements are needed to fully support service continuity, but these could be added in future release given that the study phase will finish soon. |
| LGE | Depends on service / application | N | With help of application layer, short interruption may be tolerable. |
| MediaTek | N | The decision should be documented. | Single radio UE by its capability cannot support the seamless service continuity. |
| ZTE | Y | N |  |
| Samsung | Y | Y |  |

## KI#2-Q2: Network trigger for UE to register to N3IWF

TR conclusion in clause 8.2 includes an EN as:

Editor's note: Whether the network trigger the UE register to the target network via N3IWF before it lose the radio coverage is FFS.

To shorten the time spent during the mobility procedure, it has been proposed to let network to indicate the UE to register to the target network via N3IWF, assuming the service subject to the mobility is accessible from DN of both source and target network.

**Question**: Should the standard support a network trigger for the UE to register to the target network via N3IWF before UE lose radio coverage?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | N | N | The proposed solution still has unsolved open issue. Details are missing to be evaluated and concluded. |
| Intel | N | N | We think that the trigger for initiating registration with an N3IWF should be determined by the UE itself e.g. based on deterioration of radio link quality. |
| Nokia | Yes | Yes | To reduce service disruption time (especially for single radio UE(s)), network trigger and network assistance for UE to move earlier and register with the target network will be beneficial. (However, I believe the Question should be corrected to remove “via N3IWF” as the registration in the target network need not be via N3IWF rather it can register directly via 3GPP access/NR gNB.) |
| Orange | N | N |  |
| Qualcomm | N | N | We do not see a need for a network trigger; this should be left to UE decision. |
| Deutsche Telekom | N | N | We think that the trigger for initiating registration with an N3IWF should be determined by the UE itself. |
| OPPO | N | N | It is very difficult for the network to foresee the path of the UE. Additionally this can cost some additional signaling for the measurement. |
| Alibaba | Y | Y | We think that network may have some knowledge that can be used to persuade the UE to register to a target network via N3IWF. |
| Futurewei | Yes | Yes | This can help to achieve service continuity for dual radio UE. |
| Huawei | Y | Y | It is a general feature to improve the mobility procedure when moving between 2 networks and especially helpful for SR UE case. Would be good to keep this feature if the existing procedure could be reused with minimal changes.  @Peter: may we know what is the unsolved open issue in the proposed solution? |
| Charter | N | N | This can be left to UE implementation. |
| CableLabs | N | N | Can be left to UE implementation. |
| Philips | Y | Y | This will improve service continuity. |
| LGE | N | N | This up to UE implementation or application layer. |
| MediaTek | N | N | If it is single radio , See KI#2-Q1  If it is dual radio UE, it is implementation dependent |
| ZTE | N | N | It is quite similar with 5GS-EPS interworking without N26 case, whether the UE register in another network is implementation. |
| Samsung | N | N |  |

## KI#2-Q3: Latency to resume a service provided by the overlay network

TR conclusion in clause 8.2 includes an EN as follows in relation to statement about improving the latency to resume a service provided by the overlay network:

Editor's note: Further details of the indication and the conditions for the 5GC sending the indication to NG-RAN is FFS, and whether existing QoS flow information can be used to derive whether it is preferred to release a UE to RRC-Inactive is FFS.

In order to address the paging aspect of the key issue, it has been proposed to keep UE stay in CM-CONNECTED in both underlay network and overlay network. The method to keep UE in CM-CONNECTED state in overlay network is agreed to use existing Rel-16 mechanisms. The method to keep UE in CM-CONNECTED state in underlay network is proposed to always release a UE to RRC-Inactive in the underlay network, if the UE has a connection to an overlay network via the user plane of the underlay network. But it is FFS regarding if it is necessary to keep UE in CM-CONNECTED state in underlay network for addressing the paging aspect of the key issue.

Further details of the indication and the conditions for the 5GC sending the indication to NG-RAN to decide whether it is preferred to release a UE to RRC-Inactive is FFS, and whether existing QoS flow information can be used to derive whether it is preferred to release a UE to RRC-Inactive is FFS.

**Question**: Is there a need to support additional mechanisms to improve the latency to resume a service provided by the overlay network?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | N | N | NG-RAN has enough information to decide upon a suitable RRC state for the UE, and it is not necessary to keep UE in CM-CONNECTED state in underlay network to address the paging aspect of the key issue |
| Intel | N | N | We think that the use of keepalive packets in the overlay networks (e.g. for NAT traversal) will also keep the underlying network in CM-CONNECTED state. |
| Nokia | No | No | Strongly against this approach. RRC state transition shall be managed by RAN locally and not by overlay network. |
| Orange | N | N |  |
| Qualcomm | N | N |  |
| Deutsche Telekom | No | No | No need for additional mechanism |
| Alibaba | Y | Y | We think that the overlay network can have impact to the NG-RAN for the management of UE RRC status in order to improve the latency. |
| Futurewei | No | No |  |
| Huawei | N | N | This can be done by NG-RAN implementation per current R16 specification. |
| Philips | N | N |  |
| LGE | N | N | Existing information such as QoS parameters provided to RAN should be sufficient. |
| ZTE | N | N | Can depend on the RAN implementation. |
| Samsung | N | N |  |

## KI#2-Q4: New QoS notification information between NPN and PLMN

TR conclusion in clause 8.2 includes an EN as:

Editor's note: It is FFS if any new information is needed or not for the QoS notification between NPN and PLMN

Overlay network can act as an AF to subscribe "QoS Sustainability Analytics" provided by the NWDAF of the underlay network via NEF. So the overlay network is able to be notified if there is QoS degradation in the underlay network and take actions accordingly. The opposite way is also possible that the underlay network to subscriber "QoS Sustainability Analytics" from the overlay network.

**Question**: Is there a need to standardize new QoS notification information to enable VIAPA services between SNPN and PLMN?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | N | N | QoS Sustainability Analytics in 23.288 Rel-16 enables the consumer to subscribe to notifications on QoS degradation per 5QI in a certain area. Then, the AF may decide to provide a new QoS reference id if multiple application requirements exist, the PCF may change the QoS profile for the application if needed, e.g. change PDB or the priority level 5QI. |
| Intel | N | N | We don’t see the need for standardizing a new QoS notification. |
| Nokia | No | No |  |
| Orange | N | N |  |
| Qualcomm | N | N |  |
| Deutsche Telekom | No | No | We don’t see the need for standardizing a new QoS notification. |
| Alibaba | Y | Y | We think the QoS notification from overlay network can improve the VIAPA services. |
| Futurewei | NO | NO. | Can use this existing QoS notification mechanism. But additional report parameters for underlay or overlay network using existing notification mechanism may be introduced during the normative phase if needed. |
| Huawei | PotentialY | Potential Y | The new information can potentially be used to support QoS differentiation.  From our side, R16 mechanism for QoS differentiation is not good enough since DSCP can be changed by transport network.  Since we introduce QoS notification between overlay network and underlay network via control plane in R17. Similar mechanism can be used to support QoS differentiation. |
| Philips | N | N | Agree with Futurewei |
| LGE | N | N |  |
| ZTE | N | N |  |
| Samsung | N | N |  |

## KI#3-Q1: Support for IMS deployment scenarios – with IMS in Separate Entity

KI#1 architecture supports UEs accessing an SNPN by using credentials from a Separate Entity. IMS deployment scenarios when KI#1 architecture with credentials from a Separate Entity is supported by an SNPN needs to be understood, e.g. whether the Separate Entity can also support IMS.

**Question**: Should a deployment with an SNPN supporting KI#1 functionality and the Separate Entity providing also IMS be supported?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | Y | Y | The IMS deployment scenarios described in solution 24, including the ability for PDU Sessions terminating in the Separate Entity, requires only a general description for their applicability to SNPNs e.g. in an annex to TS 23.228. SLA aspects are out of scope of 3GPP e.g. service continuity. |
| Intel | Y | Y | We think this should be supported. This is also linked to the services supported in the Separate Entity (via UPF in Separate Entity), the Separate Entity being SNPN as discussed in KI#1-Q2. |
| Nokia | Yes | No | This scenario has to be supported but we don’t see the need for additional specification work (beyond KI#1) to enable this. Existing IMS deployment scenarios should cover also this particular aspect. |
| Orange | Y | N | This will be supported with the outcome of KI#1 and Annex M.2 of TS 23.228. No additional work is needed and there are no service requirements for terminating PDU Sessions in the separate entity owning the credentials. |
| Qualcomm | Y | Y | As per the objectives of KI#1 it is possible that a separate entity “owns” the subscription of the UE. If the UE uses IMS services, this separate entity will provide the service to the UE |
| Deutsche Telekom | Y | N | No need for standardization beyond what is needed for KI#1 by accessing external IMS services from an SNPN by providing regular interfaces (N6, Gm) with no standard work and not HR roaming. |
| OPPO | Y | N | If the conclusion in the clause 8.3 is updated, then it implicitly includes this deployment. |
| Huawei | Y | Y | The case that IMS service is provided by separate entity like PLMN is valuable. |
| Charter | Y | Y |  |
| CableLabs | Y | Y | Separate Entity should be able to support IMS |
| Philips | Y | Y |  |
| MediaTek | Y | Y | This is same as addressed in the KI#1 that UE access V-SNPN using the credentials owned by separate entity. |
| ZTE | Y |  | The scenario is valuable, not sure what needs to be modified. |
| Samsung |  |  | Neutral |

## KI#3-Q2: Support for IMS deployment scenarios – separate IMS and access provider

SA1 answered in the LS in S2-2009531 the following to an SA2 question:

***For the question*** *if “The SNPN can have an SLA agreement with a third party (different Administrative Domain) IMS provider to provide IMS services”?*

***Answer:*** *Although there is no explicit SA1 requirement,* [*3GPP TS 22.228*](https://www.3gpp.org/DynaReport/22228.htm) *Annex B gives various examples how an IMS provider can have a relationship with Access Network Operator.*

The TS 22.228 Annex B states:

"*The IMS shall support at least the following operator's domain relationships:*

*…*

*a.2) Access network and the IMS it connects to, belong to different operators having an interconnection as shown in figure B.2.*

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"

**Question**: Should the IMS deployment scenario as described in TS 22.228 Annex B a.2 be described in TS 23.228?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | Y | Y | The IMS deployment scenarios described in solutions 19, and solution 26, requires only a general description for their applicability to SNPNs e.g. in an annex to TS 23.228. |
| Intel | Y | Y | Given this deployment scenario for non-roaming case is supported for PLMN, we support extending this scenario for SNPN in order to support additional flexible deployment options. |
| Nokia | N | Y | The WID can be updated with a reference to TS 22.228 Annex B a.2. Annex of TS 23.228 should be updated only, if it is clear what the delta and add-on to stage 1 description is. |
| Orange | N | N | This scenario is already supported with Annex M.2 of TS 23.228. |
| Qualcomm | N | N | Given the answer to KI#3-Q1, only if this separate entity is also the one owning the subscription of the UE and therefore the architecture for KI#1 is used |
| Deutsche Telekom | N | N | Isn’t this scenario already in 23.228?  This scenario shall not be described for the SNPN case (as this would be a HR scenario which would not be based on service requirements). |
| OPPO | Y | N | If the conclusion in the clause 8.3 is updated, then it implicitly includes this deployment. |
| Huawei | Y | Y | The case that IMS service is provided by third party like PLMN is valuable. |
| ZTE | Y | Y | The scenario is valuable. |
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## KI#4-Q1: CP provisioning

TR conclusion in clause 8.4.1 includes an EN as:

Editor's note: SA WG3 feedback will need to be taken into account for including of the CP based provisioning.

KI#4 conclusions for " **Remote provisioning for SNPN credentials (Component 2 of KI#4)**" includes support for remote provisioning via CP as well as UP. However, there is an Editor's note stating "SA WG3 feedback will need to be taken into account for including of the CP based provisioning".

**Question**: Should CP provisioning be supported for SNPN?

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| **Company name** | **Answer**  **(Y/N)** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson | Y | Y (see comments) | If SA3 provides feedback indicating CP provisioning is feasible it should be supported. |
| Intel | Y | N | Preference for Rel-17 is to focus and support only UP provisioning. In addition, with a single provisioning mechanism there will be no need for selection (KI#4-Q2) between UP or CP (when both are supported) which avoids additional complexity. |
| Nokia | No | No | There are too many opens in CP provisioning (architecture, procedures, message encoding), furthermore, it is quite complex in terms of system security aspects, placement of functions etc. With UP provisioning we have already a solution for remote provisioning available. |
| Qualcomm | It depends on SA3 | If it is resolved in SA3 | As per the EN we should wait for SA3 feedback. In more detail there are three separate cases in order of technical complexity that need to be considered:   1. DCS is combining the functions of AUSF/UDM in which case Kausf key is readily available in DCS and can be used for UPU 2. DCS is AAA-S (legacy), eAUSF and UDM are in O-SNPN and DCS needs to share some key (MSK?) with the O-SNPN where the UDM is located in order to perform UPU   Could be relatively straight forward 2) has significant impacts in security architecture and SA3 needs to decide whether it is ok |
| Deutsche Telekom | No | No | Rel-17 to focus and support only UP provisioning. |
| OPPO | Y | Y | Depending on the input from SA3.  But as early discussion, the CP provisioning is limited to the UPU-based mechanism as specified in TS 23.502. |
| Alibaba | Y | N | We think CP based provisioning is necessary for light-weighted UE such as IoT UE. |
| Futurewei | Yes | Yes |  |
| Convida Wireless | Y | Y | Assuming SA3 feedback indicates that it is possible. |
| Huawei | Y | Y | Should wait for SA3 confirmation. But since existing procedures are reused and some IOT devices may only support data exchange over NAS, the CP provisioning should be supported. |
| Philips | Y | Y | Agree with Huawei |
| MediaTek | Y | See comment | Depending on the feedback from SA3 |
| Lenovo | Y  (see comments) | Y  (see comments) | It depends on the answers from SA3. |
| ZTE | Y? | Y? | Depend on SA3 response. Only if SA3 confirm this. |
| Cisco | N | Y | UP mechanism for provisioning of SNPN credentials is sufficient. IoT onboarding has several very mature and secure UP solutions and there is no need to create yet another 3GPP specific onboarding mechanism. |
| Samsung | Y | Y |  |

## KI#4-Q2: Selection of CP or UP

TR conclusion in clause 8.4.1 includes an EN as:

Editor's Note: How the network instructs the UE whether to use control plane or user plane provisioning is for FFS.

The logic of selecting either CP or UP provisioning for a specific UE, when both mechanisms are supported by the standard has not been concluded.

**Question**: If the standard support both CP and UP, how is a method selected?

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| **Company name** | **Answer**  **Not applicable** | **Should the WID be updated with a resolution of the issue?**  **(Y/N/)** | **Comments (optionally more details e.g. reasoning and what needs to be updated, if any)** |
| Ericsson |  | Y (see comments) | If provisioning over CP, see question KI#4-Q2, is supported by the standard then there is a need to agree how CP vs UP is selected.  UE should provide its capabilities to the network, and then the network provides the method to use to the UE. |
| Intel | Not applicable | N | As already indicated in comments for KI#4-Q1, our preference for Rel-17 is to focus and support only UP provisioning and hence do not see the need for selection. |
| Nokia | UP should be the default solution | No | In general, this is not needed if CP provisioning is not supported at all.  SNPN: CP provisioning shall not be supported in SNPN case.  PNI-NPN: if both UP and CP are supported, UP provisioning support should be enabled by default. CP provisioning is supported only, if support is indicated separately by the network. |
| Orange |  | Y | UE should provide its preference to the network. |
| Qualcomm |  | N | The EN is phrased incorrectly. CP provisioning (UPU) is not initiated by the UE it is initiated by the network (UDM). UP provisioning can only get initiated after the UE establish IP connectivity and can be UE or NW initiated. UP signaling can only happen after the UE establish PDU session (successfully) and therefore has completed (successfully) onboarding registration. So the two mechanisms do not clash and is possible to work in parallel. |
| Deutsche Telekom | Not applicable | No | Rel-17 to focus and support only UP provisioning. |
| OPPO |  | Y | Some mechanism is required.  And the same mechanism can be used for determination of the CP/UP for the provisioning of PNI-NPN. |
| Alibaba | Not applicable | Y | We think it is necessary for the network to instruct UE for the selection of UP or CP based provisioning due to the different SLA between Operator’s network and verticals. |
| Futurewei | Yes | Yes | Need to support both CP and UP, as well as how network and UE to coordinate regarding the selection. |
| Convida Wireless |  | Y | Assuming SA3 indicates that CP provisioning is possible, the network should select CP or UP based on network policy and UE capability. |
| Huawei |  | Neutral | The UE and the onboarding network should support CP provisioning. The onboarding network selects CP provisioning by default/local configuration. If the onboarding network doesn’t start CP provisioning over NAS during or after the registration for onboarding, then UE will trigger UP provisioning. |
| Philips |  | Y | Agree with Ericsson and Futurewei.  The selection will be primarily driven by the capabilities of the UE. Note that the PS may also need to take part in making the selection. |
| MediaTek |  | Y | The network decides which CP or UP is used based on what UE supports |
| Lenovo |  | Y  (see comments) | Assuming that provisioning via CP is confirmed by SA3, then a mechanism is required. It can be also based on pre-configuration. |
| ZTE |  | N | If both are supported (depend on the answer for KI#4 Q1), UP provisioning is default |
| Cisco |  | Y | UP provisioning should be the default. If UP provisioning is not supported for a particular private network, the UDM initiates UPU to provide onboarding credentials to the UE. |
| Samsung |  | Y |  |

# 3. Summary

## 3.1 KI#1

## 3.2 KI#2

## 3.3 KI#3

## 3.4 KI#4

# 4. Proposed Way Forward