SA2 Rel-19 23Q3 moderated discussion – Network Sharing enhancements - Version 0.0.3

SA2

https://nwm-trial.etsi.org/#/documents/8583

1 Introduction

The following information has been included to provide background information available as input to SA#100 workshop. They have not been verified for accuracy, agreement or endorsement by the moderator, but rather presented as is to facilitate understanding and discussion.

Certain aspects described in some of the input documents are more solutions than requirements, as such those assumptions/proposals have not been included in the WTs.

Moderator has made efforts to abstract the work tasks in a generic, solution independent manner.

" SWS-230033: China Unicom

Enabling new Network Sharing mechanism different from 5G MOCN (i.e. Indirect Network Sharing defined in SA1 3*GPP TS 22.851 Feasibility Study on Network Sharing Aspect (Release 19)*), which do not require the operators to maintain a large number of inter-PLMN interfaces, between hosting operator's NG-RAN and participating operator's 5GC (e.g. N2/N3).

• Roaming architecture can be reused as baseline for interactions between Hosting operator and Participating operator.

Enhanced E2E procedures for supporting 5G Indirect Network Sharing

• Defining high level principle for UEs to select appropriate operator when Indirect Network Sharing is enabled, and defining enhanced E2E procedures for supporting Indirect Network Sharing e.g. Registration, PDU Session Management, etc.

- Authorization mechanism specifically for the users subscribed to access or handover to a Hosting operator's shared network by 5G Indirect Network Sharing may need to be considered.

• Enhanced mobility management procedures (e.g. handover, idle mode mobility) for guaranteeing service continuity and/or minimizing the impact to user experience in different mobility situations (e.g. UE moving between a shared NG-RAN and a non-shared NG-RAN, or two shared NG-RANs belong to two different hosting operators respectively).

- For the scenario that the UE moving between shared NG-RANs belong to two different hosting operators, there may have no interfaces configured between these two hosting operators. \

Enhancements to NF Selection mechanism for inter-PLMN scenarios

• For inter-PLMN scenarios, by existing NF discovery and selection procedures, the consumer NF may discover a target NF without configured inter-PLMN interface. For example:

- At inter PLMN mobility, the source AMF selects an AMF instance(s) in the target PLMN by querying target PLMN level NRF via the source PLMN level NRF with target PLMN ID;
- In the home-routed roaming case, the SMF selection functionality selects an SMF in VPLMN based on the S-NSSAI of the VPLMN, as well as an SMF in HPLMN based on the S-NSSAI of the HPLMN. *Note: The descriptions above are quoted from 3GPP TS 23.501.

• Therefore how to enhance the NF selection mechanism to accurately select the optimal NFs in 5G Indirect Network Sharing scenario needs to be investigated.

Coordination between three operators

•Typical scenario: International roaming UE□belongs to OP3□roams into the coverage of local OP1, while:

- OP1 is the hosting operator whose 5G network can be shared by OP2 with Indirect Network Sharing mechanism.
- There is no roaming agreement between OP1 and OP3.
- There is a roaming agreement between OP2 and OP3.

•Potential enhancements for supporting roaming UEs to access the subscribed network using 5G Indirect Network Sharing provided needs to be investigated, e.g. OP2 acting as a relay network.

SWS-230055: China Telecom

Key Work Tasks includes defining

1. Investigate the potential enhancements to enable authorized UEs to access the

subscribed PLMN in 5G Indirect Network Sharing scenario, e.g. enhanced network

selection, identification of network sharing type, etc.

2. The roaming architecture enhancement of network sharing with indirect connection

between the shared access network and a participating operator's core network,

with transit SMF/NRF.

3. Investigate the potential enhancements for supporting roaming UE to access the

subscribed data network in 5G Indirect Network Sharing scenario, whereas the

subscribed operator has no roaming agreement with the hosting operator.

4. Investigate the potential enhancements of NF selection mechanism for selecting the

optimal NFs accurately in 5G Indirect Network Sharing scenario.

5. Investigate the potential enhancements to guarantee service continuity and/or

minimize the impact to the user experience for UEs that are moving between two

different PLMNs in 5G Indirect Network Sharing scenario (e.g. between a shared NGRAN

and a non-shared NG-RAN, or two shared NG-RANs belong to two different

hosting operators respectively).

SWS-230057: Charter Communications, Inc, Comcast, CableLabs

Background

Network sharing enables operators to maximize rollout and improve overall network quality. 3GPP system supports several types of network sharing since Rel-5, most of which are inherited by 5G

One of the challenges for the operators is the maintenance of the interconnections (e.g., number of network interfaces) between the shared NG-RAN and participating operators' core network

In TR 22.851, SA1 studied the feasibility of sharing when there is no direct interconnection between the shared NG-RAN and participating operators' core networks

Proposal

Study the architecture options including definition of new network functions and/or enhancements of existing network functions to enable Indirect Network Sharing

Note: The new network functions specified are to be part of the hosting operator network

Study the interfaces enhancements, if any, that are necessary between the hosting and participating operators network functions

SWS-230040: CableLabs

Support RAN sharing with reduced overhead/enhanced architecture compared to MOCN

Key Issue: architecture enhancements to support indirect network sharing via a host operator's network function

Justification:

Indirect RAN sharing via host operator's CN

- Enables network sharing without the need of interfacing the shared NG-RANs to individual participating operators CN
- Architecture enhancements to support inter-PLMN routing

Indirect RAN sharing via a host operator's network function (e.g., a gateway)

- No need to maintain individual interface (e.g., N2) from a shared NG-RAN to individual participating operator CN

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- Hosting operator gateway could aggregate/route traffic from shared NG-RANs before forwarding via individual interface to each participating operator's core network
- No impact on shared NG-RAN compared to MOCN

SWS-230002: GSMA MNOs

Table 1:

Definition	An NG-RAN is shared among multiple operators without necessarily assuming a direct connection between the shared radio access network and the Participating Operator's core network.
Justification	With the expanding of 5G deployments, more network-sharing scenarios may arise, depending on different operators' strategies, commercial agreements, and specific rules/legislation in different countries. Network sharing interest may extend also to existing 4G operators who intend to deploy a NG Radio Access Network to complement the existing E-UTRAN coverage. When developing network sharing (i.e. MOCN), one of the challenges for the partners' network operators is related with the maintenance generated by the interconnection (e.g. number of network interfaces) between the shared RAN and two or more core networks, especially for a very large number of shared base stations,
Usage scenario	Use cases including service continuity and QoS, access control and mobility, international roamers in shared network, hosted services, long-distance road transport are analyzed. This study provides alternatives for existing operators who intend to deploy a NG Radio Access Network to complement the existing market, taking into account of operators' business consideration, such as network planning, operation and other factors.

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2 Scoping

2.1 Work Tasks based on input to and outcome of the Workshop

The initial set of Work Tasks for discussion, based on the input to the workshop and SP-230759 are as follows:

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WT-1: Establish baseline understanding of network sharing for 5G, including any missing aspects for deployments that constitutes lack of support from baseline "MOCN network sharing". Note that "business consideration", "network planning" type aspects are not part of 3GPP standardization consideration as such relationships are outside of scope of public information and varies significantly depending on operators/service providers involved. Current assumption is that the study is for NR only.

WT-2: Indirect network sharing may include the following:

WT-2.1: Investigate high level principle for UEs to select appropriate operator when Indirect Network Sharing is enabled, and necessary implications for the overall system and procedures.

WT-2.2: Investigate potential for additional authorization of the users/UEs by the enabling operators, roles of these enabling operators to be determined during the course of the study.

WT-2.3: Investigate potential impacts on Mobility and Handover procedures, based on the scenarios to be supported as identified by WT 1.

WT-2.4: Investigate potential impacts on NF selection, in case of Inter-PLMN operations arising from the scenarios identified by WT 1.

WT-2.5: Investigate whether the interfaces and interconnections need to be reduced amongst the participating operators' network entities and if so, investigate potentially reusing existing functionality/protocols/SBIs or whether there is a need for new/modified mechanisms would be justified.

WT-3: Investigate potential enhancements and scenarios for supporting roaming UEs to access the subscribed network using 5G Indirect Network Sharing, in cases where certain roaming agreements/interconnections may or may not exist.

Feedback Form 1: Which of the above Work Tasks should be in scope of Rel-19?

1 – China Unicom

Firstly, thank Shabnam for your hard work!

In my view, I hope the WT-1 can be removed based on my clarification below. The WT-2.5 needs to be further clarified. And the other WTs should be in scope of R19 based on the necessary merging and rewording.

I give some clarification from my side for WT-1. Indirect Network sharing defined in SA1 is a type of NG-RAN Sharing in which the communication between the Shared NG-RAN and the Participating Operator's core network is routed through the Hosting NG-RAN Operator's core network as specified in TS 22.261. The main motivations are that the Indirect Network Sharing can avoid maintain number of network interfaces between the shared NG-RAN and Participating Operators' core networks (e.g., N2/N3), especially in the case of a large number of the shared base stations in 5G MOCN type. And compared with the 5G MOCN, the 5G Indirect Network Sharing enable the Hosting NG-RAN Operator to have the control of the UE, e.g., access control in AMF. It is reasonable to make 5G MOCN and 5G Indirect Network Sharing as two options for network sharing due to these characters. So we hope to continue to analyze and solve the gap between the identified potential requirements and existing 5GS functionalities in 5G Indirect Network Sharing scenario. I think this WT can be removed based on this clarification.

For WT-2.5, I don't understand this WT fully and I am wondering where this WT coming from?

For other WTs, I will give the corrected WTs in corresponding feedback forms.

2 – China Unicom

I would like to add that the concepts, use cases and requirements of Indirect Network Sharing are described in 3GPP TR 22.851 and TS 22.261. Hosting NG-RAN Operator is the operator that has operational control of a Shared NG-RAN. Participating NG-RAN Operator is the authorized operator that is using Shared NG-RAN resources provided by a Hosting NG-RAN Operator.

3 – VODAFONE Group Plc

I agree that WT 1 should not be part of the R19 package. However **what WT 1 describesneeds to be completed in order to agree whether anything or nothing needs to be done by SA2 a**nd other working groups!

Shabnam: perhaps you could you update the introductory text to include the requirements and pictures in Annex I of TS 22.261, please?

As was commented during the SA R19 workshop, the scenarios in TS 22.261 seem to be able to be supported by Rel 15 MOCN network sharing and/or configuring the hosting operator network with multiple PLMN IDs and/or "Rel 8 GateWay Core Network concepts implemented using R15 network slicing of AMF, UPF and SMF" and/or national roaming.

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With regard to Annex 1, **Figure I-1 in TS 22.261**:

- the Rel 15 NG-RAN of OP 1 can broadcast PLMN IDs of OP 1, 2, 3, 4, and once the UE of OP 2 has selected OP 2, the UE will display OP 2's name.

- existing Rel 15 MOCN allows the NG RAN of OP 1 to connect to OP 4 and OP 1 Core Network.

- Rel 15 TS 23.501 and 38.413 allow the OP 1 Core Network to configure the NG-RAN of OP 1 with the PLMN IDs of OP 1, 2 and 3. (See the PLMN Support List IE in the NG SETUP RESPONSE in clause 9.2.6.2 of TS 36.413. AND TS 23.501, clause 5.18.1 "*NOTE 3: Different PLMN IDs ...can also point to the same 5GC*".)

- To support an AMF using multiple PLMN IDs, TS 38.413, clause 8.6.1.2 states "*In case of network sharing, the selected PLMN is indicated by the PLMN Identity IE within the TAI IE included in the INITIAL UE MESSAGE message.*"

Considering e.g. S2-123075, **what is missing from Release 15** is the inclusion of the "selected PLMN ID" in the signalling from the AMF to the vSMF (and perhaps to the vUPF?) and hSMF. This information is needed for CDR generation and inter-operator accounting (in both VPLMN and HPLMN) in the vSMF, and perhaps for functionality in the vUPF. **However, adding this IE would seem to be TEI-19.**

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Referring to Annex 1, **Figure I-2 in TS 22.261**:

This appears to be supported by the above features.

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In summary, my understanding from the above work on WT 1 indicates that **neither WT 1 nor WT 2 need a "full SID/WID"** but instead the "selected PLMN ID" should be added to the signalling from AMF to vSMF/vUPF to hSMF/hUPF **as TEI-19**.

I may well be missing things, so please do explain what is not supported by rel 15.

4 – China Unicom

[To Vodafone]

I think this topic is necessary to start a study item in Rel-19 based on the clarification below:

Firstly, I want to clarify the Indirect Network Sharing specified in TS 22.261 does not a simple combination of the network selection mechanism of 5G MOCN, GWCN concept and the architecture of roaming.

For network architecture, roaming architecture can be reused as baseline for interactions between hosting operator and participating operator. However, it is determined based on follow-up discussion.

For network selection, if the network selection mechanism of 5G MOCN as described in TS 23.501 clause 5.18.3 is used in the scenario of Indirect Network Sharing, **the AMF of hosting operator may misjudge that the Indirect Network Sharing UE belongs to the subscribed UE of hosting operator, and the corresponding registration procedure will be failed because of the erroneous routing of the registration message.** For instance,a UE that has a subscription to one of the sharing core network operators will send the initial registration message which includes the PLMN ID of this sharing core network operator to the AMF of hosting operator when the UE is in the coverage of Shared NG-RAN, however the current mechanism to determine the roaming UE is for the AMF to judge whether the selected PLMN ID sent by the UE in the registration request and the HPLMN ID carried in the USIM card of the UE are same, if they are same then the AMF determines that the UE is a subscribed UE of hosting operator, otherwise the AMF determines that the UE is a roaming UE or an Indirect Network Sharing UE. **Accordingly, based on this gap, the potential enhancement of network selection should be studied in Indirect Network Sharing.**

For authorization, in Indirect Network Sharing case, the UE can be authored to access the Shared NG-RAN by enabling operator, e.g., based on the UE subscription of Indirect Network Sharing. **Therefore this aspect of authorization needs to be investigated.**

For mobility, the Indirect Network Sharing involves different inter PLMN mobility scenarios. Comparison with existing specification, **the inter PLMN handover procedure may need to be enhanced**, e.g., adding the authorization procedure about whether the UE can be authorized to access the shared NG-RAN and then continuing the HO procedure. And then it is difficult for the RAN side of the handover to configure the neighboring cell information and target base station information in source base station dynamically in inter PLMN case, **some other mobility solutions different from handover can also be investigated.**

In summary, it is reasonable to have a study item of supporting 5G Indirect Network Sharing to investigate the related WTs.

5 – VODAFONE Group Plc

Thanks for the reply. I'm sorry, but I'm still not understanding where the scenario(s) and/or issues differ from GWCN.

On the radio interface, the UE cannot tell the difference between MOCN and GWCN.

In my understanding, the NAS Registration Request from the UE to the AMF does not carry the "selected PLMN ID". Instead the UE's PLMN selection process causes (a pointer to) the selected PLMN to be sent in RRC signalling to the gNB, and the gNB sends the selected PLMN ID to the AMF in an NGAP information element. The AMF uses the routeing information sent in NAS with the UE's "encrypted IMSI"

to retrieve the UE's authorisation information -> neither the "selected PLMN ID" nor the identity of the AMF's operator plays any part in that routeing to the UE's authentication centre.

You mention "*based on the UE subscription of Indirect Network Sharing*". Are you meaning that some UEs (of HPLMN=x) would be allowed to access the shared NG-RAN and some UEs (of HPLMN=x) would not be allowed to access the shared NG-RAN? If so, then this can be achieved by regional subscription based on Tracking Areas. (But TS 22.261 does not seem to have *this requirement*?)

From my memory (which may be wrong), control of mobility from a non-shared area to a shared area is already supported by use of the information sent within the Handover Restriction List (HRL) from the AMF to the gNB. And the HRL can be controlled by the HPLMN using regional subscription information.

6 – MediaTek Inc.

WT-2.1 should be removed or reworded without UE impact. For UE, it should perform normal PLMN selection no matter this PLMN is indirect network sharing or using 5G MOCN network sharing.

7 – VODAFONE Group Plc

with regard to WT-2.1, I agree with Mediatek. TS 22.261 refers to TS 21.101 which in clause 4.9 states "Network sharing shall be transparent to the user."

8 – Qualcomm Korea

We have several comments for all the proposed WTs.

It is not clear the spec impact for WT-1, it should be discussed in SA1 but not SA2 for the baseline understanding of network sharing for 5G.

For WT-2, the conclusion in SA1 is that there will be no UE impact, so WT-2.1 should be removed.

A roaming UE can register to the VPLMN's network based on roaming agreement, from our point view, the use case of this indirect network sharing looks like a UE registers in a roaming PLMN in the same country but it displays the HPLMN is registered in the cell phone. We do not think there is any architecture enhancement is required but just reuse the roaming architecture, the registered AMF can send the displayed PLMN to UE via NAS message. We do not think WT2.2-2.5 are required to be studied.

For WT-3, it depends on the roaming agreement configuration in the served PLMN, we do not see the standard impact for the scenario.

9 – Comcast

Many thanks to Vodafone for your detailed assessment and even proposing a preliminary solution for the identified problem, :-).

With respect to the roaming architecture as a potential solution for network sharing, it seems that following may have to be further studied:

CALEA - Current roaming architecture does not support AMF to AMF interface. Per LI architecture, AMF may have to be configured when required per the information requested in the warrant. Today, for network sharing solution there is no need for the participating operator to provide any warrant related information to the shared NG-RAN operator.

Network based location - In the current roaming architecture, since home AMF is not involved, it is unclear how it can retrieve the location information with the necessary accuracy to meet the regulatory requirement for emergency calls.

CBC - There is no concept of distributing PWS messages for roaming UEs. Again, it is not clear how the current roaming architecture would support delivery of PWS messages from the participating operator to be broadcast over shared NG-RAN

Inbound Roamers of participating operator - It is unclear how inbound roamers to a participating operator can get access to the shared NG-RAN when the shared NG-RAN operator does not have a relationship with the home operator of the roamer or it self has a relationship with the home operator. What would be the implications of having requests for AUSF coming over an N32 via a SEPP not belonging to participating operator.

There are probably other aspects that we might be overlooking.

Note - if roaming interfaces as solution is ultimately concluded, we do agree with your comment about inclusion of TAI in the PDUSession_Create message; it is included in PDUSession_CreateSMContext optionally, but not in PDUSession_Create message. Inclusion of TAI in PDUSession_Create could be beneficial so that the H_SMF can do an optimal selection of the PSA UPF in the home network.

Also, you seem to be concluding roaming interfaces is adequate as a solution (which in our opinion is premature to conclude) to solve the operational complexity of managing N2/N3 interfaces by reducing the interfaces between individual gNBs of shared NG-RAN operator and the 5G cores of the participating operator.

There could be alternative solutions that might be less complex than enabling multiple different roaming reference interfaces that might be worth assessing. One example (not the only one) could be by introducing a N2/N3 aggregation function (an evolution of NNSF in 3G, HeNBGW in 4G).

We are not suggesting that roaming architecture cannot be used/enhanced, but it will also be good to study/e-valuate alternative solutions on how to best solve problem of (minimizing the complexity of managing interfaces between shared NG-RAN and participating operating's core) that can be deployed by all types of operators globally (e.g., shared NG-RAN operators, participating core operators, etc.).

We feel that a more comprehensive study rather than under the umbrella of TEI19 is required to make sure that the **service delivery from the perspective of the participating operators** does not deviate from the 5G MOCN approach to shared NG-RAN, and that the participating operators have control over the service delivery for end-user and regulators.

10 – Comcast

Following WTs should be in scope:

WT-2.2 to 2.5

WT-Comcast-2.5 to 2.10 (2.6 to 2.10 could be potentially be merged into a single WT)

WT-Nokia-2.N1 and N2 - other Nokia proposals seem to be captured in WT-Comcast 2.6 to 2.10 and could be merged with them

11 – Comcast

My apologies but I inadvertently didn't include WT-3 in the above list and should be included.

12 – Ericsson LM

Ericsson (not moderator :)): WT#1 is important to understand architectural aspects of the SA1 requirements as it is unclear to us what is needed, similar to Vodafone analysis. As there are diverging views, if the work is to proceed, clear baseline understanding of the use cases and definitions are needed.

13 – Ericsson LM

Moderator comment: I strongly suggest we separate the difference between User and UE, end user/user should not see/understand network sharing but potential UE impacts are different issue. And at least my understanding of the details provided within the supporting material does not rule out UE impacts.

Chris, your analysis is one conclusion, and I can see that is a scenario but reaching such conclusion needs agreement/consensus. That is why WT#1 tried to get to that point, one potential outcome can be further details and discussion during August.

14 – China Unicom

Thank you for your comments.

For network architecture, roaming architecture can be optional baseline for interactions between hosting operator and participating operator. However some enhancements as below compared with roaming still needs to be investigated in this SID.

I give the clarifications from four aspects based on other companies comments:

1. The indirect network sharing is different from roaming, e.g., the enhancement of NF selection mechanism.

The PLMN ID broadcasted by shared NR should include the PLMN ID related to participating operator. The UE will consider to access the HPLMN in indirect network sharing scenario. When the registration procedure is triggered in the indirect network sharing scenario, the AMF selection by 5G-AN in the hosting operator may needs to be enhanced. And different from roaming scenario, the impact of user experience

(delay, data rate) needs to be minimized in indirect network sharing scenario, therefore the traffic related to indirect network sharing should be routed to the subscribed DN nearby the shared area. Therefore when the PDU session establishment procedure is triggered in the indirect network sharing scenario, the H-SMF selection may need to be enhanced, e.g., considering UE location.

2. Enabling the authorized UE to access the shared network to use service in indirect network sharing scenario needs to be studied.

This case to be addressed is that some UEs of participating operator can be authorized to access the shared NR and the other UEs cannot, e.g., based on UE subscription. The potential requirement is that the charging using indirect network sharing may be specific based on the network sharing agreement. Because the 4G coverage of participating operator may be extensive in the country, the UE can continue to use the 4G of participating operator when the UE moves into the shared NR area. The shared 5G can be seemed as value-added business per UE in some case. And in the other case, some UEs of participating operator may be limited to access other operator network based on the regulatory policy. Therefore enabling the authorized UE to access the shared network is reasonable.

3. Clarification for handover restriction list

Firstly, the handover restriction list applies to the case of interworking between 5GC and EPC in TS 23.501 and TS 23.502. The indirect network sharing involves the case between two different 5G networks belong to different PLMNs. Even though this HRL can be used in 5G, if the hosting operator changes (add or remove) based on the network sharing agreement between the hosting operator and participating operator dynamically, the mobility restriction list in the UE subscription will be adjusted dynamically, this is a challenge. Therefore, in my opinion, the other solution should be investigated.

4. Clarification of the UE impact

It is beneficial and reasonable to investigate the solution of indirect network sharing **without UE impact** because of considering the large amount of the legacy UEs. This is my position. However the network selection solution of core network assisting may need to be studied in indirect network sharing scenario. The WT 2.1 and WT 2.2 can be merged as described in the second feedback form based on my proposal.

In summary, this is a gap analysis from my view, other operators may stand to analyze network sharing from other perspectives. This also needs to reach some consensuses. Therefore this SID is needed to investigate above issues and other potential gaps in detail.

15 – China Telecommunications

First of all, thanks for all the questions and comments, I give the clarifications according to these comments. We agree that the baseline structure of the indirect network sharing can be roaming.

Currently, GWCN is supported in both 3 and 4G, but not in 5G. According to the original statement in TS 23.501 in R16: In this Release of the specification, only the 5G Multi-Operator Core Network (5G MOCN) network sharing architecture, in which only the RAN is shared in the 5G System, is supported. Therefore, further research is needed to meet the requirements of indirect network sharing.

Then, in terms of roaming, the latest standard supports the participant operator's partner only roaming to the participant operator's network, but cannot roam to the hosting partner's network. Therefore, how to support this use case needs to be investigated.

Based on the above description, we think further research is needed to enhance existing standards to support indirect network sharing.

16 – ZTE Corporation.

We believe WT#1 should not be included in the study because it is not possible to start WT#2 before we conclude WT#1. I think WT#1 are mainly for SA1 discussion. From SA2 POV we just study how to meet the SA1 requirements. Of course people can propose solution without any standard impact and do evaluation as usual.

Therefore we think this study should include WT#2 only. However we can add ”whether and how” at the begining of the WT.

WT#2.5 can be removed and one NOTE can be added to clarify that existing interface should be reused as much as possible.

WT#3 can be included under WT#2 as China Telecom suggested below.

17 – HuaWei Technologies Co.

We are OK to capture the WTs in R19 related to indirect network sharing with the recording we suggested below.

18 – Cisco Systems Belgium

Annex I in 22.261, Figure-1-2 is very much GWCN Sharing in 23.251. Not sure why we should create new wording for architecture that already exist in 3GPP. (also seems to be reflected by China Telecom in their comments).

- we should state that this is for NR only

- we should state that no UE impacts

WT-1 may be removed because Fig I-2 in 22.261 is not MOCN but GWCN.

WT-2 is OK

WT-3 should be removed (”roaming UE” is not right since this is network sharing).

We should not consider ”relay roaming”, i.e Op-1 <=> Op-2 <=> Op-3 in this release.

Also, the goal should be to re-use existing 5GC architecture, eg. roaming architecture, to support the 5G GWCN architecture.

19 – Beijing Xiaomi Mobile Software

WT2.1 should be reworded or removed as suggested it should be without UE impact

20 – China Unicom

Based on above clarification and other company discussion, the different solutions may be involved and studied in this topic. And consolidated requirements of Indirect Network Sharing will be completed in the normative work in TS 22.261. In order to delve into solutions to meet SA1 requirements, it is reasonable to start a SID of indirect network sharing and WT 2 which considers the merging and rewording provided by China Unicom in form 2 and form 3 can be included in this SID.

Reply to Cisco, GWCN specified in clause 4.1 of TS 23.251 (take 4G for example) is specific solution involving the shared MME and shared eNB, Indirect Network Sharing defined in ongoing SA1 R19 Netshare item does not limit which NFs can be involved in hosting operator core network. I prefer to reuse Indirect Network Sharing.

Reply To Xiaomi, considering the concern about UE impact, the NOTE of no UE impact can be added in the SID paper and the WT 2.1 and WT 2.2 can be merged as described in form 2 comment #3. The clarification is provided in form 1 comment #14.

21 – China Telecommunications

We think the WT related to indirect network sharing can be included in this study item.

Reply to Cisco, the current standard does not support that VPLMN interconnects indirectly with HPLMN through the shared party network (hosting operator) and we need to investigate the potential enhancement. And this requirement of WT 3 has been discussed in SA1. A study on related WT 3 (which can be included under WT2) is necessary for the SID of 5G indirect network sharing.

22 – CICT

[From CATT]

Indirect Network Sharing is a new option of network sharing as studied in SA1. For the whole network sharing topic, a study on whether and how to adapt 5G system to additional network sharing option is necessary. So we propose to focus more on supporting Indirect Network Sharing option in 5G system within R19.

For the detailed work task, we have the following comments.

WT-1

We believe an analysis to the understanding of network sharing in 5G is needed, but not need to limit MOCN as the baseline since roaming architecture could be candidate for Indirect Network Sharing as stated by China Unicom, China Telecom, etc.

If still plan to keep WT-1 in scope, it is suggested to reword it to a generic task for investigating the architecture adaption to different options of sharing arrangement, including MOCN, Indirect Network Sharing. and coexistence. And identify potential enhancement aspects.

WT-2

If WT-1 is not taken in or not reworded as the above, the impact investigation on the architecture and functionalities is needed(Comcast and China Unicom have provided example wording). Then WT-2.4 could be merged in or treated as a sub-task.

WT-2.1&2.2: support to be merged for network access control including enhanced network selection, authorization, access rules etc.

WT-2.3 can be included as it is.

WT-2.5: not clearly understand why to reduce the interfaces and interconnection. But if this is about the architecture adaption, it could be merged to ”revised WT-1” or architecture related WT-2.X.

WT-3

The impact investigation should be taken under Indirect Network Sharing, so it is suggested to be merged to WT-2.

23 – Nokia France

We can assume 2 kinds of solution

1. Solutions based on a GW that aggregates N2/N3 interfaces from the gnb(s) of the Hosting operator and presents an unique N2/N3 interface to each Participating operator. This has the merit of both keeping the same functional interface than in MOCN (only N2/N3 interfaces between Hosting operator and Participating operator) and of having a very limited number of interfaces between Hosting operator and Participating operator.

2. Solutions based on GWCN, where the AMF belongs to the Hosting operator and where the interface between Hosting operator and Participating operator would at laest contain N8, N10 and N11 but would not need to scale with the number of gnb(s)

Both solutions above require little study (if any) and specification work

We can of course invent *plenty* of other solutions BUT are we going to spend a lot of time discussing fancy solutions and comparing their merits while we already have 2 simple solutions that meet the requirements. I’d have *strong reservation* with SA2 spending time in a late 5G release and short release to make beauty contests while we already have 2 simple solutions that meet the requirements.

In short WT1 needs to be reworded into

- only following 2 mechanisms will be studied:

· Solutions based on a GW that aggregates N2/N3 interfaces from the gnb(s) of the Hosting operator and presents an unique N2/N3 interface to each Participating operator

· Solutions based on GWCN,

- only NR access is in scope

- the work shall have no UE impacts

24 – CableLabs

WT-comcast-2.5 (WT-2.5 is revised to WT-comcast-2.5), WT-2.3, WT-2.4, WT-3,. We also are supportive on including WT related to services related to regulatory services (e.g., WT-comcast-2.6-10, WT-Nokia-N3, WT-CATT-2.6, etc). We also are supportive of Nokia proposal on GW solution based on N2/N3 aggregation.

For WT-2.5, we like to echo comcast feedback on potential solutions to achieve indirect network sharing e.g., architecture enhancement based on roaming architecture, architecture enhancements with N2/N3 aggregation via a network function. We need to evaluate different options which in our view would involve a gap analysis. In that sense, we do not see a strong need of a separate WT-1. For WT-2.5, it can be revised as WT-comcast-2.5 which is for studying potential architecture solutions. We consider WT-comcast-2.5 captures the scope more clearly than the suggested updates on WT-comcast-2.5 from China Unicom.

For WT-2.1 and WT-2.2, we prefer rewording to capture no UE impact if included.

25 – China Unicom

Disagree with Nokia comment about limited two solution (solution based on a new NF and solution based on GWCN).

In this stage before studying, it is unpersuasive to exclude roaming based network sharing solution. I strongly suggest that solution based on the roaming architecture needs to be considered in this study item.

26 – Nokia France

WT2.1 shall have no UE impact, I am not sure it is needed

WT2.2: network sharing is not a subscribed service, it is a way for operators to save money by sharing RAN resources. I do not oppose to it, but I don't see what we should do in this domain, especially what we should do in this domain that would be different from MOCN; and an operator can always use so, regional subscription based as VF is suggesting

on Tracking Areas.

WT1: About the remark on GWCN versus roaming, let's assume CT is the hosting operator and CU the participating operator for a CU user, wouldn't what is displayed on the phone be "CU" with GWCN and "CT" with roaming approach. I'd think that we would want to display CU as in MOCN case. whether with 5G GWCN we use an ISMF/VSMF is another story

My proposal is a bit crude but would allow to avoid spending time for beauty contests while we have existing solutions that just need small updates.

WT2.5: we don't see the need for this WT

WT-3: it depends on the roaming agreement configuration in the served PLMN, could you clarify the expected kind of standard impact

NR only means that the shared RAN is a collection of gnb(s) but also that participating and hosting operators are 5GS operators

27 – VODAFONE Group Plc

Thank for the discussion (and sorry that I have not read everything).

Replying a bit to Comcast #9 comment - this is a national roaming type of architecture, so I'm not sure that there are really CALEA issues (but please do educate me) -> e.g. I expect that the the LI target list on a Verizon-USA AMF should (shall) be identical to the LI target list on an ATT-USA AMF.

On PWS (Comcast#9), I think that this also ought to work OK as I don't think that ATT customers should receive different PWS message to those for Verizon?

I tend to support Nokia in focussing any study on those two approaches, or even just on ”GWCN”.

One extra detail/TEI-19 part relates to emergency calls and handover out of the shared core to the non shared core.... For this I think that it would be good if the shared AMF/MME could be configured to select the IMS-emergency system of the selected PLMN, and not the IMS emergency system of the hosting operator.

Feedback Form 2: Can any of the Work Tasks above be combined/merged?

1 – China Unicom

I think that the WT-2.1 and WT-2.2 can be merged, because the network access control defined in TS 23.501 includes the network selection (corresponding to WT-2.1) and authorization (corresponding to WT-2.2). The merged WT from my side is: Investigate the potential enhancements to enable authorized UEs to access the subscribed PLMN to use voice call and data service in 5G Indirect Network Sharing scenario, e.g. enhanced network selection, identification of network sharing type, authorization of the UEs by the enabling operators, etc.

2 – Nokia Corporation

Could you please clarify why in the proposed merged WT, the mention is specific to only voice and data services. This shall be generic services as we need to include SMS too ?

3 – China Unicom

To Nokia: you are correct, the 5G Indirect Network Sharing should include generic services.

The merged WT based on the Nokia comment: Investigate the potential enhancements to enable authorized UEs to access the subscribed PLMN to use service in 5G Indirect Network Sharing scenario, e.g. enhanced network selection, identification of network sharing type, authorization of the UEs by the enabling operators, etc.

4 – Comcast

WT-2.1/2 could be combined into WT-2.2

5 – VODAFONE Group Plc

As explained above, further justification for a SID/WID is needed

6 – China Unicom

[To Vodafone]

It is reasonable to have a study item of supporting 5G Indirect Network Sharing to investigate the related WTs. Please see the above clarification in the first feedback.

7 – VODAFONE Group Plc

Please see the second response in feedback form 1.

8 – Qualcomm Korea

No

9 – China Unicom

Please see the 14th response in the first feedback form.

10 – CableLabs

WT-2.5 is merged/revised to WT-comst-2.5,

WT-2.1 and WT-2.2 with no UE impact

Feedback Form 3: Should any of the Work Tasks above be reworded? If so, propose the required rewording.

1 – China Unicom

For WT-2.3, I think it needs to be refined. Because the 5G Indirect Network Sharing involves the inter PLMN mobility scenarios, we hope when the UE moves between two different PLMNs (e.g. between a shared NG-RAN and a non-shared NG-RAN, or two shared NG-RANs belong to two different Hosting NG-RAN Operators respectively), the mobility procedures can guarantee the service continuity and/or minimize the impact to the user experience. The content of WT-2.3 needs to be refined to express this requirement exactly. The rewording WT from my side is: Investigate the potential enhancements to guarantee service continuity and/or minimize the impact to the user experience for UEs that are moving between two different PLMNs in 5G Indirect Network Sharing scenario (e.g. between a shared NG-RAN and a non-shared NG-RAN, or two shared NG-RANs belong to two different Hosting NG-RAN Operators respectively).

2 – China Unicom

For WT-2.4, if the WT-1 is excluded, the WT-2.4 should be reworded. The rewording WT from my side is: Investigate the potential enhancements of NF selection mechanism for selecting the optimal NFs accurately in case of Inter-PLMN operations arising from 5G Indirect Network Sharing scenario.

3 – Comcast

Proposed rewording of WT-1: Establish baseline understanding of network sharing enhancements for 5G, including aspects for deployments that constitute evolution of baseline “MOCN network sharing”. Alternatively as suggested by China Unicom, if this is clear then can be skipped.

We are also suggesting the following updates to WT-2.5 and bringing it at top of the list:

WT-Comcast-2.5 (“new” WT-2.1): Investigate overall architecture along with functional and procedural enhancements, if any, to reduce interconnections between shared NG-RAN and participating operator’s core networks.

With respect to WT-2.3 and 2.4, replace “WT1 with “WT1 and “new” WT-2.1 (i.e., WT-Comcast-2.5)”.

4 – China Unicom

The related definition and requirement of Indirect Network Sharing has been discussed and specified in SA1 R19 Network Sharing item. Therefore the WT-1 can be removed by adding some clarification in the justification part as I clarified in the first feedback form.

To Comcast, I correct the WT-Comcast-2.5 (“new” WT-2.1) to ‘*Investigate potential impact to existing architecture, if any, to satisfy the definition and requirement of Indirect Network Sharing specified in TS 22.261*.’ in order to make a more general WT.

For WT-2.3 and WT-2.4, in my opinion, the rewording provided by China Unicom are clearer. But we can have the further discussion about this if we can reach a consensus to remove WT-1.

5 – China Unicom

The related definition and requirement of Indirect Network Sharing has been discussed and specified in SA1 R19 Network Sharing item. Therefore the WT-1 can be removed by adding some clarification in the justification part as I clarified in the first feedback form.

To Comcast, I correct the WT-Comcast-2.5 (“new” WT-2.1) to ‘*Investigate potential impact to existing architecture, if any, to satisfy the definition and requirement of Indirect Network Sharing specified in TS 22.261*.’ in order to make a more general WT.

For WT-2.3 and WT-2.4, in my opinion, the rewording provided by China Unicom are clearer. But we can have the further discussion about this if we can reach a consensus to remove WT-1.

6 – Nokia Corporation

WT1

We warmly support that this work is only for NR. Thus the sentence in WT1 ”Current assumption is that the study is for NR only.” could be reworded as “The study is for NR only”.

7 – China Unicom

I want to ask the clarification about ‘The study is for NR only’. Does the NR only limit that the shared RAN is NR or limit that both the Hosting Operator network and the Participating Operator network should be 5G network in this study?

8 – Comcast

We prefer our proposed WT-Comcast-2.5 (new WT-2.1) instead of the modified version proposed by China Unicom as it identifies the work task without delving into a specific solution. Whether existing architecture is sufficient or not can determined during the study phase.

9 – VODAFONE Group Plc

As explained above, further justification for a SID/WID is needed

10 – China Unicom

[To Vodafone]

It is reasonable to have a study item of supporting 5G Indirect Network Sharing to investigate the related WTs. Please see the above clarification in the first feedback.

11 – VODAFONE Group Plc

To China Unicom. No. Please explain why the existing architecture and specifications do not support what you want -> then we might be able to change the SA1 requirements to document these requirements.

For example, please explain what extra is needed in the HRL and/or point to requirement(s) beyond those in TS 22.261 as the only requirement I've noticed in TS 22.261 says :

The 5G system shall be able to support Indirect Network Sharing between the Shared NG-RAN and one or more Participating NG-RAN Operators' core networks, by means of the connection being routed through the Hosting NG-RAN Operator's core network.

which, in my understanding is supported in Rel 15 (see my first response in feedback form 1).

12 – Qualcomm Korea

No, we have concern for all the WTs, we do not see any need for the rewording.

13 – Ericsson LM

no, rather we need better understanding of what is missing, having SA1 requirement only does not imply study needed

14 – China Unicom

Please see the 14th response in the first feedback form.

15 – HuaWei Technologies Co.

WT 1:

Agree with the intention to do gap analysis, but no need to limit MOCN as baseline, e.g. the roaming architecture mentioned by Chris could also be considered as baseline. Suggest to only say "gap analysis with existing functionalities". Besides, "NR only" is a little bit open-ended. Suggest to limit the Hosting Operator with "Option 2 only", i.e. NR+5GC. It is easier to converge on the scenarios then.

WT 2:

Suggest to add "It is assumed there is no UE impact." as general description to align with SA1 requirement (TR 22.851). This can also avoid some concerns on the UEimpact.

16 – Comcast

We disagree with using any proposed solution as a baseline even before the work has begun.

We are ok with adding a note that the solution shall be transparent to the UE, i.., no UE impact.

17 – CICT

If need one generic WT, WT-1 could be revised to

Establish baseline understanding of network sharing for 5G, including a gap analysis on whether the current architecture can be adapt to different options of sharing arrangement, e.g. MOCN, Indirect Network Sharing, or both, and identify any potential enhancement aspects.

18 – CableLabs

WT-2.4 with no dependency on WT-1 (in case WT-1 is removed)

WT-1, if included, is reworded to be more generic (e.g., as suggested by comcast or clause 5.18 in TS 23.501 as the baseline)

2.2 Additional Work Tasks

As well as the initial set of Work Tasks in section 2.1 companies can request to add additional Work Tasks. The naming of these additional Work Tasks should follow the format: WT-company name-# (eg WT-Samsung-1) so that other participants can reference them.

Feedback Form 4: Are there any additional Work Tasks that should be part of Rel-19?

1 – Comcast

In addition to voice/data/SMS services, mobility, access control and QoS the following should also be included individually or together as new WTs:

WT-Comcast-2.6: Investigate potential impact functional and procedural aspects to support PWS service

WT-Comcast-2.7: Investigate potential impact on functional and procedural aspects to support emergency services (voice, SMS) and associated location update procedures

WT-Comcast-2.8: Investigate potential impact on functional and procedural aspects to support WPS and MPS services

WT-Comcast-2.9: Investigate potential impact on functional and procedural aspects to support location services

WT-Comcast-2.10 (TBD based on scope of mobility): Investigate impact on mobility between shared NG-RAN and LTE of participating operator

2 – CICT

[From CATT]

Yes.

For indirect network sharing, the study on the applicability of potential architecture and mechanisms for regulatory services is not included now.

3 – Nokia Corporation

We propose the following WT to be part of the study.

WT-Nokia-2.N1

Investigate potential charging information that may be collected to enable the charging system to be able to monetize various actors in the 5GC indirect Network Sharing ecosystem.

WT-Nokia-2.N2

Investigate potential mechanisms that enable the Hosting Operator to extend indirect sharing to the Participating Operator dynamically. The mechanisms could be pertaining to a time period during which the Hosting Operator would extend indirect sharing to a particular Participating Operator, load factors that influence the indirect sharing, etc.

WT-Nokia-2.N3

Investigate potential impacts with respect to functional and procedural aspects to enable Emergency services and corresponding regulatory aspects while implementing Indirect Network Sharing.

WT-Nokia-2.N4

Investigate potential impacts on the functional and procedural aspects with respect to PWS services while implementing Indirect Network Sharing.

4 – VODAFONE Group Plc

As explained above, further justification for a SID/WID is needed

5 – Qualcomm Korea

We also seek for the justification for the SID/WID.

6 – Ericsson LM

We also believe further discussion needed to reach common understanding before progressing the SI or potential TEI19 WI

Feedback Form 5: If there are any additional Work Tasks required, describe them

1 – Comcast

The additional work task encompass service requirements related to regulatory services (e.g., PWS, WPS/MPS, etc.). In general, the finalized architecture should be able to support all of the existing services supported by the 5GC in 3GPP release 18.

2 – CICT

[From CATT]

For WT-2 indirect network sharing, a dedicated study on how to support regulatory services, especially emergency call and associated positioning procedures shall be taken into account. To make it generic, a proposal for this work task could be as below,

WT-CATT-2.6: Investigate potential impacts and enhancements, if any, to support regulatory services(e.g. emergency call, PWS, etc).

3 – VODAFONE Group Plc

re WT-CATT-2.6 -> with the AMF and vSMF/vUPF in the hosting PLMN, then I think that the AMF can handle these services in the REL 15 manner (e.g. resolving the emergency IMS APN to a local emergency IMS system)

4 – CICT

Many thanks to VODAFONE to provide a potential solution for the support to regulatory services in such an early stage :-)

We share the similar understanding with Comcast as they explained in the feedback about TEL19. It's a little too rush to conclude the legacy roaming architecture would be the one solution and fully suitable for all the identified use cases.

3 Dependencies

These feedback forms will help define the dependencies between Work Tasks, dependencies of Work Tasks on other Working Groups (SA, RAN or CT), and dependencies on other potential SA2 Rel-19 SIDs and WIDs. The Work Tasks can be from the list in section 2.1, or any additional Work Tasks identified in the feedback in section 2.2.

Feedback Form 6: Describe the dependencies that any of the Work Tasks have on other 3GPP Working Groups

1 – China Unicom

In indirect network sharing scenario, considering UE mobility (WT 2.3 proposed by China Unicom in

form 3), N14 interface between the hosting operator and participating operator which does not involve in the roaming architecture figure needs to be considered and the corresponding security aspects may need to be studied in SA3.

Charging aspects (WT-Nokia-2.N1) need to be studied in SA5.

2 – Cisco Systems Belgium

LI aspects need to be considered by SA3-LI

3 – Nokia France

if we opt for a N2/N3 gateway appraoch this may have (small) impacts to RAN3. so if there is a study RAN should be ticked as yes (only RAN3)

Feedback Form 7: Describe dependencies between the Work Tasks

1 – ZTE Corporation.

WT#3 may have dependency on WT#1 and WT#2. We expect same architecture will be used for all WTs.

2 – China Telecommunications

To ZTE□

We agree with your point. It is indeed possible to merge WT3 into WT2 and become a subgroup of WT2.

3 – Qualcomm Korea

WT2 and WT3 have dependency on WT1.

4 – Ericsson LM

WT#2 & WT#3 are dependent on WT#1 to establish baseline understanding of the work. Potentially some aspects of WT#1 can also be addressed before proceeding with any study work agreement which may help define scope etc.

Feedback Form 8: Describe any dependencies on potential work/study items that might be created as a result of the other Q3 moderated discussions.

4 Partitioning

These questions will help determine whether there is one, or more than one, Study Item, Work Item or TEI-19 item to be created from these Work Tasks.

Feedback Form 9: Should there be more than one SID, WID or TEI-19 item created based on the Work Tasks?

1 – Ericsson LM

Further discussion needed with proponents of the study to better understand if SI/WI or TEI19 approach to be taken

2 – China Unicom

One SID is fine.

3 – China Telecommunications

One SID

4 – Nokia France

see our comment on WT1: a SID is possible starting by WT1 reworded into

- only following 2 mechanisms will be studied:

· Solutions based on a GW that aggregates N2/N3 interfaces from the gnb(s) of the Hosting operator and presents an unique N2/N3 interface to each Participating operator

· Solutions based on GWCN,

- only NR access is in scope

- the work shall have no UE impacts

(Solutions based on GWCN actually don't require a study and could be specified via a TEI19)

5 – China Unicom

Form 1 comment #25: Disagree with Nokia comment about limited two solution (solution based on a new NF and solution based on GWCN).

Feedback Form 10: If the answer to the above question is yes, describe how the Work Tasks should be partitioned into different items.

5 Summary from the Q3 discussions

Total 14 companies provided feedbacks (listed in alphabetical order) :

CableLabs, China Telecommunications, China Unicom, CICT (CATT), Cisco, Comcast, Ericsson, HuaWei, MediaTek, Nokia, Qualcomm, Vodafone, Xiaomi, ZTE.

5.1 Summary from section 2.1

Table 2:

Q#1: Which of the above Work Tasks should be in scope of Rel-19?	
Work Task	#14 of companies that provided feedback on: China Unicom, Vodafone, Comcast, MediaTek, Qualcomm, Ericsson, China Telecommunications, ZTE, HuaWei, Cisco, Xiaomi, CICT/CATT, Nokia, CableLabs.

WT#1 : Establish baseline understanding & scope of the architecture (i.e. NR/5GS only, NR/5GS and other 3GPP RATs, NR/5GS and other 3GPP RATs (3G?, 4G) and EPS)	Comments from China Unicom and Vodafone. Support/no concerns from Ericsson, HuaWei, Xiaomi and to some extent Nokia and; Vodafone, CICT/CATT support analysis and scenarios to better understand the need and if agreed, define scope of the work properly without the WT. Rewording of WT will be needed if maintained. Qualcomm/ZTE/Cisco believe it is in scope of SA1 to discuss this area and since SA1 has details in their spec, we focus on that. No support: Comcast, China Unicom, Qualcomm, ZTE, Cisco CableLabs proposes to include in other WTs the architecture options. Majority of NO Support companies either assume there is no need to better understand the issue or assumes that it is GWCN and then question is why we need a study to begin with. **Moderator comment:** WT#1 is NOT about architecture options for solutions but rather understanding the stage 1 requirements as well as input material on the issues to frame the scope of any stage 2 work. Further analysis/discussion is recommended first before progressing with any study discussion or any technical work, such as TEI19, in SA2. This is supported based on detailed input and discussion (documented in sections 2, 3 and 4) from Vodafone, Nokia, Comcast, China Unicom, Cisco, Ericsson. NR only scope support(Nokia: means that the shared RAN is a collection of gnb(s) but also that participating and hosting operators are 5GS operators): Ericsson, Nokia, Cisco. China Unicom: Ask clarification if NR only means no other 3GPP Radio access then not ok.
WT#2 (subtasks): What is Indirect network sharing & associated requirements	High level, the sub tasks are providing the details
2.1: selection of appropriate operator when Indirect Network Sharing is enabled, and necessary implications for the overall system and procedures	Companies support but propose to remove UE/User impact: MediaTek, Vodafone, China Unicom, Xiaomi, CableLabs, Nokia Support: ZTE, HuaWei, Cisco, CICT/CATT Propose to remove: Qualcomm, Comcast Support: Ericsson (UE impacts can be identified as Undefined but don't agree to remove, since we are not clear on the requirements)
2.2: Investigate potential for additional authorization of the users/UEs by the enabling operators	Support: Cisco, CICT/CATT, CableLabs, HuaWei Merge: China Unicom (with WT 2.1) Remove: Nokia

2.3: Investigate potential impacts on Mobility and Handover procedures, where and if applicable	Support: ZTE, CICT/CATT, HuaWei, CableLabs
2.4: Investigate potential impacts on NF selection, in case of Inter-PLMN operations arising from the scenarios to be investigated	Support: ZTE, CICT/CATT, HuaWei, CableLabs
2.5: investigate whether the interfaces and interconnections & relationship between participating operators & potential impacts	Remove: ZTE, Support: CICT/CATT, CableLabs, HuaWei
WT#3: Investigate potential enhancements and scenarios for supporting roaming UEs to access the allowed 5G Indirect Network Sharing	Support: CICT/CATT, HuaWei, CableLabs Remove: Cisco, Nokia (or clarify standards impact)
Moderator Remark:	Extensive technical discussions have been included under Form Q#1. Recommend/encourage interested companies provide input materials to aid discussion.

Table 3:

Q#2: Can any of the Work Tasks above be combined/merged?	
# of companies that provided feedback on Q#2	Moderator feedback: most companies did not fill in Q2 and has given feedback/analysis under Q1, but if not clearly identified in Q#2, they have not been taken into account here. Direct comments from China Unicom, Qualcomm, Comcast, CableLabs Vodafone general comment that no SI/WI can be agreed without further discussion/clarification. Nokia commented on rescoping by China Unicom proposal
No Merger/combined needed	Qualcomm, Ericsson
WT#1	To WT# 2: Vodafone, China Unicom (other comments in Q#1 with detailed technical discussions that cannot be concluded without further work)
WT#2 (subtasks)	
2.1	To 2.2: With no UE impact: China Unicom, Comcast, CableLabs
2.2	See WT# 2.1

2.3	No feedback
2.4	No feedback
2.5	Comcast revised/new WT proposal: CableLabs, Comcast
WT#3	No direct feedback (Comments under Q1 about incorporating within other WTs mentioned by ZTE, Cisco propose to remove, Nokia asks clarification what to be done)

Table 4:

Q#3: Should any of the Work Tasks above be reworded? If so, propose the required rewording.	
# of companies that provided feedback on Q#3	9: China Unicom, Comcast, Nokia, Vodafone, Ericsson, Qualcomm, HuaWei, CICT, CableLabs Vodafone general comment is that we are not ready to have a SI, further discussion needed. What is missing/why can't existing architecture work? Qualcomm, Ericsson also have concerns and lack of understanding and prefer further discussion. Nokia proposes to restrict scope to two cases, China Unicom disagrees.
WT#1	To be reworded: China Unicom, Comcast, Ericsson, Nokia, HuaWei (Gap analysis only), CICT, CableLabs (more generic) Support for NR with 5GS only: Ericsson, HuaWei, Nokia, Cisco
WT#2 (subtasks)	HuaWei: No UE impacts can help progress avoid deadlock.
2.1	To 2.2: With no UE impact: China Unicom, Comcast, CableLabs
2.2	See WT# 2.1
2.3	To be reworded: China Unicom, Comcast (remove dependency to WT#1)

2.4	To be reworded if WT#1 excluded: China Unicom, Comcast (WT#1 dependency),
2.5	Comcast (revised to new proposal), CableLabs (prefers wording of Comcast as new WT)
WT#3	No direct feedback, Nokia asks question on the need for standards.

Table 5:

Moderator Proposal for each WT by considering all feedbacks in section 2.1 **Each WT is categorized as IN, IN* or OUT** **IN : including the WT in the draft SID is proposed.** **IN* : including the WT in the draft SID is proposed for further discussion and final decision on whether including it or not.** **OUT: NOT including the WT in the draft SID is proposed because other "IN" WT(s) can cover it or due to insufficientsupport.**		

Moderator General Remark		**There are quite diverging and contradictory views on actual problem statements/requirements from stage 1 and how to interpret them. In order to make progress, recommend that interested parties read the detailed input from different companies and provide input papers towards SA2#158 and subsequent SA2 meetings to reach common understanding and decide way forward. As such moderator proposal is to leave all options open and continue discussion to reach consensus. Expect most of the WTs will need to be revised and new WTs may be added or potential TEI19 if scenarios and what is lacking can be agreed.**
Moderator Proposal#1	WT#1	**IN***
Moderator Proposal#2	WT#2 (subtasks)	**IN***
Moderator Proposal#3	2.1	**IN***
Moderator Proposal#4	2.2	**IN***
Moderator Proposal#5	2.3	**IN***
Moderator Proposal#6	2.4	**IN***
Moderator Proposal#7	2.5	**IN***
Moderator Proposal#8	WT#3	**IN***

5.2 Summary from section 2.2

Table 6:

Q#4: Are there any additional Work Tasks that should be part of Rel-19?	

Summary	Comcast (5 new WTs), CICT (Yes, generalized large item), Nokia (4 new WTs some of which are in view not in SA2 scope) propose multiple additional WTs. Vodafone, Qualcomm, Ericsson require further discussion/clarification before proceeding with any SI/WI.
Moderator Proposal#9: Proposed Interim Conclusion	**Some WTs are not in SA2 scope or requires other WGs to take lead. In addition, without reaching consensus on the scope and architectural requirements of what to work on, it is not feasible to conclude on the additional WTs yet.**

Table 7:

Q#5: If there are any additional Work Tasks required, describe them	
Summary	See Form for Q#4 for details. Additional WTs include regulatory, emergency (voice, SMS etc.), PWS, MPS, WPS, location services, mobility across different 3GPP RATs, charging, roaming, dynamic sharing partner aspects including load etc.
Moderator Proposal#10	Pending conclusion on how to proceed, encourage discussion on consensus

5.3 Summary from section 3

Table 8:

Q#6: Describe the dependencies that any of the Work Tasks have on other 3GPP Working Groups	
# of companies that provided feedback on Q#6	3: China Unicom, Nokia, Cisco

Summary	Potential dependency with RAN WG(s) depending on outcome. Potential dependency or actually work for other WGs like SA5-CH, SA3-LI
Moderator Proposal#11: Proposed Conclusion	**It is proposed to decide the dependencies on other 3GPP WGs when discussing the SID once the scope is agreed.**

Table 9:

Q#7: Describe dependencies between the Work Tasks	
# of companies that provided feedback on Q#7	4: ZTE, China Unicom, Qualcomm, Ericsson
Summary	WT#1 with WT#2 and WT#3, depending on how WT#1 and associated work is scoped. Requires further discussion and consensus.

Table 10:

Q#8: Describe any dependencies on potential work/study items that might be created as a result of the other Q3 moderated discussions.	
# of companies that provided feedback on Q#8	No feedback/input.

5.4 Summary from section 4

Table 11:

Q#9: Should there be more than one SID, WID or TEI-19 item created based on the Work Tasks?	

Summary	Companies provided feedback: Ericsson, Nokia, China Unicom, China telecommunications. Support: China Unicom, China Telecommunications, Nokia Other companies have expressed views in other Q's that further discussion needed: Vodafone, Qualcomm Some have expressed support for a SI in other Q's responses: Comcast, Cisco, Cablelabs, ZTE, HuaWei
Moderator Proposal#12: Proposed Conclusion	**There are disagreements on the scope, requirements and interpretations on how to proceed. At this point any SI will not result in agreement, draft maybe provided including proposed new WTs for discussion in the meeting in an attempt to revise and reach consensus.**

Table 12:

Q#10: If the answer to the above question is yes, describe how the Work Tasks should be partitioned into different items.	
Summary	No feedback.