3GPP TSG-RAN WG2 Meeting #126 R2-24xxxxx

Fukuoka, Japan, May 20th -24th, 2024

Agenda Item: 8.1.4

Source: Mediatek Inc.

Title: Report of [POST125bis][020][AI/ML PHY] UE side data collection

Document for: Discussion, Decision

# Introduction

This contribution is aimed at reporting the discussion and results of the following post email discussion:

* [POST125bis][020][AI/ML PHY] UE side data collection (Mediatek)

Intended outcome: Discuss new table capturing solution details and discussion fon control and visibility, privacy.

Deadline: two weeks (Deadline May 3rd, 10:00 UTC)

Companies providing input to this email discussion are requested to leave contact information below.

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# 2 Discussion

The following proposals were identified during the Rel-18 SI on AI/ML for NR Air Interface:

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| --- | --- |
| 1. UE collects and directly transfers training data to the Over-The-Top (OTT) server;   1a) OTT (3GPP transparent)  1b) OTT (non-3GPP transparent)   1. UE collects training data and transfers it to Core Network. Core Network transfers the training data to the OTT server. 2. UE collects training data and transfers it to OAM. OAM transfers the needed data to the OTT server.   RAN2 did not study or analyse these proposals and did not agree to requirements or recommendations. | |
| 1a) | 1b) |
| 2. Data collection via CN | 3. Data collection via OAM |

According to the consensus made during the online discussion in RAN2#125bis meeting,

=> need to better define what is control of data collection in MNO and visibility of data content in MNO.

=> understanding is that OTT is outside of MNO

We will clarify these methods in the following aspects:

* Inside/outside MNO’s network
* Termination Entity
* Controllability of data collection in MNO
* Visibility of data content in MNO
* Protocol layer for data transfer
* Privacy concerns

## 2.1 Terminology

According to the common understanding made in RAN2 that OTT is outside of MNO, it is inappropriate to refer to the term OTT in the context of solutions 1b, 2, and 3. To avoid confusion and enhance clarity, we propose replacing the term ' OTT server' with 'server for UE-side data collection' in these solutions. The term "UE-side data collection" refers to the data collection intended for use in UE-side model training. Please note that the term 'training' is omitted from the terminology to prevent confusion or debate regarding whether the locations for data storage and model training are identical or separate.

Q1: Do companies agree to replace the term ‘OTT server’ with ‘server for UE-side data collection’ in the definitions/descriptions of different solutions?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | Yes for solution 1b/2/3 with comments:  As this is new terminology created by RAN2, we are still confused with whether it is:   1. a server owned by UE vendor, or 2. a server owned by MNO, or 3. a neutral server   Since **the privacy requirements for the 3 possible options are different**, we think it needs separate discussion. One may argue it is out of RAN2 scope, but please note that RAN1 has agreed and discussed extensively on different model transfer solutions (y and z1-z5) depending on whether training is UE-sided, NW-sided or neutral site.    Thus, similarly, we think it is one important aspect RAN2 should discuss. Meanwhile, it is also part of “solution details” which are explicitly included as scope of this email discussion.  [Rapp1] This definition is very general and doesn’t imply any ownership of the server. The ownership is intended to be clarified whether it’s inside or outside MNO’s network. |
| Nokia | Yes, but maybe to be even clearer, we could use the term “server for training data collection for UE-side models”. |
| Ericsson | Yes, however the terminology “OTT server” is used to define a node outside the MNO premises. Hence (similar to Huawei comment below) for solution 1a) we should refer the server for UE-side data collection outside the MNO. Whereas for the solutions 1b), 2, 3 the server for UE-side data collection can be inside or outside the MNO premises.  [Rapp1] Yes, with the change of the terminology, the general description of solution 1a, 1b, 2, and 3 needs to be updated accordingly.  OK with Nokia clarification as well “server for training data collection for UE-side models outside the MNO”. |
| Huawei, HiSilicon | Yes with comments.  In our understanding, if we keep the original text in TR 38.843, the termination is OTT server. If we introduce another terminology for the server, we would like the email rapporteur to confirm whether our understanding is correct or not:  If this "server for UE-side data collection" is inside MNO, the server still needs to transfer the collected data to UE server outside MNO (for training purpose).  [Rapp1] As I emphasized initially, my goal was to avoid any ambiguity or debate concerning whether the sites for data storage and model training are the same or separate. This issue seems to be a subsequent inquiry. In my view, if we're discussing a 'server for UE-side data collection,' inside MNO, it should be understood that the data gathered is retained within the MNO's network for training purposes as well. This arrangement would typically involve the UE vendor renting server space from the MNO, or the MNO buying a server from the UE vendor and setting it up within their own network.  **[Huawei2, HiSilicon]** We think the whole question should be about the ownership of the server and also the collected data.If we only discuss the ownership of the server, it will be hard for companies to check other aspects (e.g. controllability, privacy concerns), and this is why we think the newly added Question2.0 is useful.  Then we need to look into the typical cases for UE server inside MNO.  (1) For your case "the UE vendor renting server space from the MNO", we understand that the ownership of the server should be the UE vendor (while the MNO should be like a cloud server provider), and the collected data should be also owned by the UE vendor. We do not see a difference between this case and the case "the UE vendor sets up its own OTTserver, i.e. server outside MNO".  (2) For your case "the MNO buying a server from the UE vendor and setting it up within their own network", we would like to understand what does it mean, and why does the MNO need to buy a server from the UE vendor. |
| OPPO | For solution 1a, we still can use OTT server, while for the other three solutions, i.e. 1b, 2,3, we can use ‘server for UE-sided data collection’. |
| Mediatek | Yes. The terminology proposed by Nokia is more precise but is somewhat lengthy and potentially cumbersome for ongoing discussions. Perhaps we could use the abbreviated term 'server for UE-side data collection' for the time being. It would be beneficial if the TR rapporteur could furnish a definition for this term, aligning with Nokia's suggestion, to ensure clear understanding |
| vivo | Yes for solutions 1b, 2, and 3. |
| CATT | Yes. We understand the intention, i.e., since OTT server is outside of MNO (as agreed by RAN2), we need another term (e.g., server for UE-side data collection) to refer to a server that can be either inside or outside of MNO. |
| Spreadtrum | Yes |
| ZTE | Agree with rapporteur’s intention. Just one question, assuming that the server for UE side data collection can be inside and outside of the MNO as shown in below table. What is difference between the server for UE side data collection outside of the MNO and OTT server. |
| China Unicom | Yes, prefer Nokia’s suggested term with slight modification, we could use the term “**server for UE-side training data collection**”. |
| Xiaomi | Yes for solution 1b, 2, and 3. |
| Samsung | No  The use of two different terminologies for 'OTT server' and 'server for UE-side data collection' is confusing, considering the following reasons:   1. The term "server" is used for UE-side model training and is managed by the UE-side vendor in all options/solutions. 2. The term is “OTT” is important to indicate that model transfer/delivery is transparent to the network. |
| Lenovo | Yes for solution 1b/2/3, and agree with Nokia to emphasize “training”. |
| Qualcomm | Yes.  In RAN2#125bis, the RAN2 chair note explicitly mentioned that the OTT server cannot be inside the MNO network. However, in solutions 1b, 2, and 3, the server for UE-side data collection ‘**server for UE-side data collection’** can be within or outside the MNO network. For terminology coherency, we can replace the OTT server with ‘**server for UE-side data collection’**. With the proposed change by the rapp., the solution 1a can be modified as   * Server for UE-side data collection (outside MNO network) (e.g., OTT server).   For 1b, 2, and 3, the OTT server can be replaced with  Server for UE-side data collection (within/outside MNO network). |
| Sharp | Yes, with comments: The term ‘OTT’ maybe helpful to clarify that the server is responsible for handling functions (be it for data collection, model training, transfer/delivery etc.) related to the OTT applications and not related any MNO services/functions. The terminology should clearly define/indicate when a UE-side server is inside or outside the MNO network. |
| CMCC | Yes for solutions 1b, 2, and 3.  But we still feel confusion with solution 1b, if the server is deployed outside of MNO, solution 1b is the same with solution 1a. While, if the server is deployed inside of MNO, solution 1b is the same with solution 2 and 3. |
| Intel | In general, we agree with Nokia on using the term “server for training data collection for UE-side models”, since the main goal of this data collection is to support model training.  Regarding to Apple’s comment, though we share the sympathy that the ownership of the server could be further clarified (e.g. owned by UE vendor, owned by MNO, owned by 3rd party (i.e. neutral server), etc), at this stage, we think identifying whether the server is inside or outside of MNO network is enough (i.e. difference between solution 1a) and 1b/2/3). Even a server is inside of MNO network, this does not preclude this server is owned by any 3rd party or UE-vendor. |
| Fujitsu | Yes for solutions 1b, 2, and 3. And we prefer the suggestion from Nokia. |
| Interdigital | OTT server seems appropriate for solution 1a, as for this case everyone seems to agree the server is outside of the MNO. For 1b, 2 and 3, “server for UE side data collection” or the more concrete definition by Nokia “server for training data collection for UE-side models” can be used |
| Futurewei | OK to replace the term ‘OTT server’ with ‘server for UE-side data collection’. However, because after the changes the term, “server for UE-side data collection”, is not an OTT server anymore, we also need to change the description of Solution 1. The following is a proposed change.   1. UE collects and directly transfers training data to the ~~Over-The-Top (OTT)~~ corresponding servers;   1a) OTT (3GPP transparent)  1b) ~~OTT~~ server for UE-side data collection (non-3GPP transparent)  However, as we discussed in the questions below, we prefer to remove Solution 1b). |
| DISH | Yes. The differentiation of terminology for 1a and other alternative solution is necessary to understand the difference of each solution.   * “OTT server” refers to server for UE-sided model training for solution 1a, which is clearly outside the MNO network, the data transfer to it is done transparently to the MNO network, and is outside MNO control and policy. * “Server for UE side training data collection” terminology for solution 1b, 2, 3 is fine, it can be hosted inside or outside MNO network, but the main point is that the server (and the data) is controllable and visible by the MNO. |

## 2.2 Inside/outside MNO’s network

One point that requires clarification is the location of the server for UE-side data collection relative to the MNO’s network. In solution 1a, the UE directly communicates with the server for UE-side model collection, typically via the application layer, without any interaction with the MNO's network infrastructure. Consequently, in this scenario, the server for UE-side data collection operates outside of the MNO's network, functioning as an OTT server. However, for solutions 1b, 2, and 3, the server for UE-side data collection has the flexibility to be positioned either inside or outside the MNO's network. It is noted that in solution 2, the server for UE-side data collection can be a NF in CN.

Reflecting on the feedback received, there's a need to clarify the intention and meaning on whether the server is located inside or outside the MNO's network. The core of this clarification is to determine server ownership, as this directly influences who is responsible for adhering to privacy laws, regulations, and so forth. If the server resides inside the MNO's network, it is considered to be owned by the MNO. Conversely, if it is located outside the MNO's network, ownership falls to the UE vendor or another external party, but not the MNO. So, I add one more question to align companies’ understanding.

Q2.0: Do companies agree that a server located within the MNO's network is deemed to be MNO-owned, whereas one located outside is not under MNO ownership?

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| --- | --- |
| Company | Yes/No (Comment) |
| Mediatek | Yes |
| vivo | Yes |
| CATT | Yes |
| Huawei, HiSilicon | [Huawei2, HiSilicon]  Yes, it is also our understanding that the server inside MNO should be seen as a MNO-owned server, and in this case, we think the collected data is also owned by the MNO. But companies may have different understanding on this aspect.  For the case server inside MNO’s network, rapporteur’s reply to our comments in Q1 was that “This arrangement would typically involve the UE vendor renting server space from the MNO, or the MNO buying a server from the UE vendor and setting it up within their own network.” We have more comments:  (1) For your case "the UE vendor renting server space from the MNO", we understand that the ownership of the server should be the UE vendor (while the MNO should be like a cloud server provider), and the collected data should be also owned by the UE vendor. We do not see a difference between this case and the case "the UE vendor sets up its own OTTserver, i.e. server outside MNO".  (2) For your case "the MNO buying a server from the UE vendor and setting it up within their own network", we would like to understand what does it mean, and why does the MNO need to buy a server from the UE vendor. |
| Spreadtrum | Yes |
| ZTE | The ownership shall be MNO , We also have some sympathies with HW, it need to be clarified as well. |
| Apple | Yes for first part with comments:  We agree that “a server located within the MNO's network is deemed to be MNO-owned”. On Huawei’s questions, we think it needs clarification and our understanding is:   1. The case "the UE vendor renting server space from the MNO"   In this case, we think if UE privacy exposure, both UE vendor and MNO take responsibility of exposure because MNO just rent its server to UE vendor (i.e. server still owned by MNO). On Huawei and ZTE’s question, we think that this is the key difference from the case "the UE vendor sets up its own OTTserver”.   1. The case "the MNO buying a server from the UE vendor and setting it up within their own network "   In this case, we think if UE privacy exposure, it should be MNO to take the responsibility of exposure.  On 2nd half: “whereas one located outside is not under MNO ownership”, it is true, but we think it is necessary to discuss 2 cases of “**UE vendor owned server**” and “**neutral server**” respectively because their privacy requirements are different and the privacy concern is only to MNO but also to other UE vendors and unknown 3rd party. |
| Xiaomi | Yes |
| Samsung | In our view, it would be useful to clarify the meaning of the server being inside or outside the MNO’s network, for solution 1b, 2, and 3. For example, the following are possible interpretations of (inside/outside) in terms of MNO’s controllability of the data:   * **Interpretation#1**: MNO owns and/or manages the server and has access to its content * **Interpretation#2:** MNO owns and/or manages the server but does not have access to its content * **Interpretation#3:** MNO just know the IP address and can transfer the data [efficiently] with some [control]. |
| Qualcomm | Definition of MNO-owned network entities are well-defined terminology in SA2 WG. Further, we agree with Samsung’s interpretations and believe that there is precedence for all three interpretations in SA2.  Furthermore, we are wondering about the scope of the discussion.  If the scope is about controllability:  For solutions 1b, 2, and 3, irrespective of whether the server is within/outside the MNO network, the data collection procedure is controlled by the MNO.  If the scope is about visibility:  For solution 1b, there can exist no, partial, or full visibility, irrespective of whether the server is within/outside MNO. The degree of visibility depends on the SLA between the vendor and MNO.  For solutions 2 and 3, if the CP-based solution (where each collected parameter is defined in the standard), the MNO will have full visibility irrespective of whether the server is within or outside the MNO. Otherwise, in any other MNO can have partial or full visibility depending upon the MNO and vendor SLA. |
| Sharp | Yes |
| CMCC | Yes. We share the similar view with Apple on the first part. |
| Intel | Not sure. In our understanding, even a server owned by 3rd party can also located inside of MNO network, though the server inside of MNO side work is assumed to be monitored by MNO. There’s no need from standard point of view to restrict any deployment/ownership scenarios. Our understanding is that the key point of this question is to clarify who will be responsible for the data and adhering to regulations, which is not entirely equals to ownership. As long as the server is monitored/managed by MNO following the required regulations, deployment options, the server can also be owned by 3rd party.  Therefore, we suggest to clarify the terminology as below:  MNO owned the responsibility for data collection (e.g. to adhering the privacy laws, regulations, etc) to the server within MNO network or the server using MNO network. |
| Fujitsu | Yes |
| Interdigital | Yes |
| Futurewei | Not sure (maybe not).  We think the key here is the definition of “ownership”. In the case "the UE vendor renting server space from the MNO", our understanding aligns with Huawei; the ownership of the server should be the UE vendor (while the MNO should be like a cloud server provider), and the collected data should be also owned by the UE vendor. It is like even though I rent the apartment from the landlord, I have ownership of my personal stuff inside the apartment. Note when we talk about ownership here, the collected data (the content) is more important than the device that stores it. |
| DISH | Maybe rather than addressing the “server ownership”, in the context of designing and clarifying solution(s), it would be better to clarify to what extent MNO can enforce their policy (controllability and visibility) to the server and to the data transferred to and stored in the server.  This is also relates to the “data ownership” that we discuss in Q7. |

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| --- | --- |
| Solutions | Inside/outside MNO’s network |
| 1a | OTT server, i.e., outside MNO’s network |
| 1b | Inside/outside MNO’s network |
| 2 | Inside/outside MNO’s network  Note: The server for UE-side data collection can be a NF in CN. |
| 3 | Inside/outside MNO’s network |

Q2.1: Do companies agree that for solution 1a the server for UE-side data collection is outside of MNO’s network and is therefore classified as an OTT server?

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| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | Yes, as captured in Chair Note. |
| BT | Yes but for us, solution 1a is totally outside 3GPP scope. Consequently, it should be taken away from the WI phase. No need to discuss option 1a. |
| Nokia | Yes. We would also like to know if the following figure, an excerpt from TS26.531, Figure 4.2-1 is the intended representation of solution 1a.    Additionally, the following note is provided in the same specification: “NOTE 5: Interactions at reference point R8 are beyond the scope of 3GPP standardisation.” |
| Ericsson | Yes |
| Huawei, HiSilicon | Yes with comments.  The wording could be improved, i.e. suggest to use outside-MNO server. |
| OPPO | Yes |
| vivo | Yes |
| CATT | Yes. And 1a means no impact on 3GPP standardization. |
| Spreadtrum | Yes |
| Xiaomi | Yes |
| Samsung | Not necessarily (see comment)   * According to TR 38.843 (7.2.1.3.2 Data collection for UE-side model training), all solutions (1a, 1b, 2, and 3) transfer the UE data to the OTT server. * The OTT server is an application server that can be accessed via IP protocol, so it could reside inside or outside 3GPP network. * Consequently, for solution 1a, the server for UE-side data collection (i.e. OTT server) can operates inside or outside the MNO's network. |
| Lenovo | Yes |
| Qualcomm | Yes. Do not agree with Huawei's suggestion. |
| Sharp | Yes, with comments.  Since the OTT server for UE side model may also reside within MNO, it should be clarified that the OTT server in this case is outside the MNO. |
| CMCC | Yes. Solution 1a) is out of 3GPP. |
| Intel | Yes, Agree with BT’s comment that solution 1a) is an implementation option that outside 3GPP scope, i.e. no impact to 3GPP at all. |
| Fujitsu | Yes, and 1a has no impact on 3GPP |
| Interdigital | Yes |
| Futurewei | Yes. |
| DISH | Yes. As stated in as comment for Q1. This understanding is necessary to clearly differentiate 1a and 1b.  We also share Nokia’s question and would like to know companies’ understanding on whether Figure 4.2-1 in TS26.531 is the intended representation of solution 1a. |

Q2.2: Do companies agree that for solutions 1b, 2 and 3, the server for UE-side data collection can be either inside or outside MNO’s network?

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| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Solution 2, Yes. But,  My understanding is that solution 1b) should still be sub-option of the solution 1 group (i.e. UE directly transfers data to server), so the difference from the solution 1a) is the server is “inside” MNO’s network and solution 1b is that the server is “outside” MNO’s network. We propose to preclude “outside” from 1b).  In addition, for solution-3, it is a bit unclear if the UE-side data collection should be inside or outside MNO’s network. |
| Apple | No for solution 1b, Yes for solution 2 with comments, not sure for solution 3.  On solution 1b, we are not sure how the server can be inside MNO’s network. As we commented in Q1, we think two solutions can be:   * a) UE vendor can deploy its owned server in MNO network or   + In this case, which Network entity UE vendor can deploy its server (e.g. in CN or RAN)? * b) MNO deploy some servers (i.e. owned by MNO) which are rent to UE vendor for data collection?   Note that in case of understanding a), it may have 3GPP impact and cross-WG impact. Thus, RAN2 should make it clear. Before this issue is concluded, we think “inside” should be precluded from solution 1b).  For solution 2, we agree it can be inside or outside MNO network. Meanwhile, we appreciate that Rapporteur provides example of “a NF”, but we are not whether it means “a NF” performs model training on behalf of UE vendor or it is just an intermedium entity for further forwarding dataset? Please clarify.  [Rapp1] As I emphasized initially, my goal was to avoid any ambiguity or debate concerning whether the sites for data storage and model training are the same or separate. This issue seems to be a subsequent inquiry. In my view, it’s just an intermedium entity for further data forwarding.  [Apple] Thanks. I think the confusion is because NWDAF can perform training. We have same view: it’s just an intermedium entity for further data forwarding.  For solution 3, we agree with NEC it is not clear. We noticed Rapporteur doesn’t provide example. We are wondering whether anyone can give a concrete example that the final UE server is within MNO network (e.g., if it is an entity in RAN, is it within DU or CU)?  [Rapp1] Please check my example provided below in Mediatek’s comment  [Apple] Thanks. TCE is a good example. |
| BT | No.  From our understanding, the server for UE-side collected data on options 1a, 2 and 3 are inside the MNO and the ownership is for the MNO.  A different discussion is where the algorithms for training, management and inference are allocated but we consider this is not asked here. |
| Jerediah [Nokia] | Maybe, but we first need to clarify what “outside” the network means, and whether that server could have, e.g., a VPN or N3IWF interface to the NW to communicate with NFs that are involved in DC. And it should be clarified whether there is any other difference in the interface between the server for UE-side data collection whether it is located inside or outside of the network. |
| Ericsson | Yes. For all solutions (except 1a), depending on the deployment and specific SLA agreement, the server for UE-side data collection can be inside or outside the MNO network. In case the server for UE-side data collection is outside the MNO, then it should be discussed for all the cases (except 1a)), what is the involvement of 3GPP network nodes. |
| Huawei, HiSilicon | No.  Firstly, we have the same comments as for Q1, and we would like to confirm our understanding as below.  If this "server for UE-side data collection" is inside MNO, the server still needs to transfer the collected data to UE server outside MNO (for training purpose).  [Rapp1] Regardless of the server's location, whether within or outside the MNO's network, the interface connecting the server to entities within the MNO may either be standardized or non-standardized interface. I believe that assessing the implications on specifications solely from a RAN2 perspective is challenging. My suggestion is that we delve into the solutions' details as thoroughly as possible from the RAN2 standpoint and then engage other WGs to assess the impacts on specifications. We should pose the question once we have a clearer understanding of each solution's specifics.  **[Huawei2, HiSilicon]** We do not quite understand the above responses. We still have some reservations about them, but we can move on to other questions first.  Secondly, we suggest to clarify the impacts if UE server is deployed inside MNO, and also to clarify differences between inside and outside MNO from a standard point of view.  Thirdly, we suggest to clarify the following: if the training data (from UE side) is transferred to a UE-side server inside MNO, does it mean that MNO can directly use the data for training purpose?  [Rapp1] The data is accessible to MNO, and MNO can use data for training if it has interest. But the MNO’s effort would be huge if MNO takes the training responsibilities for different UE vendors/chipsets with different hardware/firmware requirements. In practice, it may involve the UE vendor renting server space from the MNO, or the MNO buying a server from the UE vendor and setting it up within their own network. (This part can be commented by operators).  **[Huawei2, HiSilicon]** We are still confused by the above responses. For the server-inside-MNO case, with “MNO can use data for training if it has interest”, the assumption seems to be: the data can be used by both MNO and UE vendors. Then who is the owner of the data in this case?  We already commented on the two cases you mentioned in previous questions, “the UE vendor renting server space from the MNO”, and “the MNO buying a server from the UE vendor and setting it up within their own network”, which is copied/pasted below:  (1) For your case "the UE vendor renting server space from the MNO", we understand that the ownership of the server should be the UE vendor (while the MNO should be like a cloud server provider), and the collected data should be also owned by the UE vendor. We do not see a difference between this case and the case "the UE vendor sets up its own OTTserver, i.e. server outside MNO".  (2) For your case "the MNO buying a server from the UE vendor and setting it up within their own network", we would like to understand what does it mean, and why does the MNO need to buy a server from the UE vendor. |
| OPPO | Yes for solution 2 and solution 3, some concern for solution 1b.  For solution 2 and solution 3, OPPO understanding is that usually specified data type will be used to collect UE side data, in this case, both operator and UE can decode the collected data, so it makes sense that the server for UE-side data collection can be either inside or outside MNO’s network as both operator and UE server can use the data without extra offline engineering work.  When it comes to solution 1b, we understand that usually unspecified data type will be used to collect UE side data, in this case, only UE vendor can decode the collected data, so it doesn’t make sense that the server for UE-side data collection is inside MNO’s network as operator can not use the collected data without extra offline engineering work. It makes more sense that for solution 1b, server for UE-side data collection is outside MNO’s network. |
| Mediatek | Yes.  For solution2, the server can be a NF if it is inside MNO’s network. If the server is outside MNO’s network, there may be an interface between the server and CN.  For solution 3. If the server is outside of MNO’s network, there may be an API between the server and OAM. If the server is inside of MNO’s network, it may be similar as TCE, which may be even within OAM domain.  For all solutions, the interface connecting the server to entities of the MNO may either be standardized or non-standardized interface. We should figure out the solutions' details as thoroughly as possible from the RAN2 standpoint and then engage other WGs to assess the impacts on specifications. |
| vivo | The boundary between inside and outside MNO’s network should be further clarified. Besides, inside or outside MNO’s network is up to SA.  From RAN2 perspective, the key characteristic of option 1b/2/3 is that the server for UE-side data collection is known by a specific MNO entity, and the MNO entity is involved in the data exchange between UE and the server. |
| CATT | Yes. But we also need to clearly define the detail of option 1b, and clarify the difference between option 1b (user plane delivery?) and option 2 (control plane delivery?). |
| Spreadtrum | Yes for solution 2 and solution 3.  As for solution 1b, it should be outside MNO. Because we are discussing the way UE directly transfer data to server. |
| ZTE | please see the below comments.  Firstly:  It is really confusing for us about the UE server for UE sided data collection outside of MNO and the OTT server. It is better that rapporteur can clarify what is difference between those two entities. If they are the same thing, we hope to use the OTT server to replace the UE server for UE side data collection outside of MNO.  Secondly:  If the UE server for UE side data collection can be either inside MNO or outside MNO for all of option 1b, option 2, option 3, our discussion will get more complex since the 4 options (1a, 1b, 2, 3) become 7 options (e.g. 1a, 1b(e.g inside or outside), 2(e.g. inside or outside), 3 (e.g. inside or outside)  In this sense, we suggest that we can always assume，for option 1b, option 2, and option 3， the UE sever for UE sided data collection is within the MNO, and the case of the UE server outside of the MNO shall not be taken into account since we do not see any necessities that the NW shall be involved when the transfer path terminated between UE and a UE server that is outside of the MNO. |
| China Unicom | No. For solution 1b, 2, and 3, it’s illustrated that UE collects and directly transfers training data to the OTT server in a non-3GPP transparent way, in which “non-3GPP transparent” means a 3GPP entities (e.g. NG-RAN, OAM, or CN) are able to control and read all the data flowing through itself. Under this premise, the OTT server (server for UE-side training data collection) must be inside of the MNO in case of any incontrollable data leak. |
| Xiaomi | Yes for solution 2 and 3. For solution 1b, our understanding is that the server for UE-side data collection is located outside MNO, just as in solution 1a.  Our understanding of inside MNO is that MNO has the full control (including data visibility) of the server for UE-side data collection. |
| Samsung | See comments   * Refer to answers to Q 1 and Q 2.1. * Moreover, it is not clear, how solution 1b, 2 and 3, can support the two cases for the server being inside and outside the MNO network. |
| Lenovo | In principle yes, upon deployment server owner can deploy it outside MNO or inside MNO (e.g., with SLA). We can consider them possible for the theoretical analysis for now. |
| Qualcomm | Yes.  controllability:  For solution 1b, regardless of whether the server is within/outside the MNO network, the data collection procedure is controlled by the MNO.  Visibility:  For solution 1b, there can exist no, partial, or full visibility, regardless of whether the server is within/outside MNO. The degree of visibility depends on the SLA between the vendor and MNO.  SA2 has previously designed solutions where the MNO can have **controllability and visibility regardless** **of when the server is within/outside the MNO.** Therefore, the arguments from some companies that for **controllability and visibility** the server must be inside the MNO network seems unreasonable. Furthermore, we believe that it is not within RAN2's scope to determine/justify whether **the server is within/outside the MNO for controllability and visibility.**  Similar arguments hold for solutions 2 and 3. |
| Sharp | Yes, for solution 2 and 3, for solution 1b further clarity is needed. |
| CMCC | Yes for solution 2 and 3.  In our understanding, if the server is outside of MNO, solution 1b) is the same as solution 1a). If the server is inside of MNO, solution 1b) can be reflected in solution 2 and 3.  For solution 2 and 3, we share the similar view with MTK. |
| Intel | As we commented in Q2.0, the key aspect of option 1b/2/3 is whether the MNO can monitor/manage the data collection to adhering the privacy laws, regulations.  For solution 1b, in our understanding, the server can either be inside or outside MNO’s network. It is noted from TS 23.288 that SA2 also has a similar solution to support AF gets UE data via user plane connection with UE. In such solution, AF can either be in the MNO domain or external to MNO domain over user plane via a PDU session. Hence, at least for solution 1b), we think server either inside or outside MNO network is possible, where SLA can be established between operator and application service provider (server) to adhering to the regulations. By using SLA, the MNO still owns the responsibility for managing data.  For solution 2/3, since the data is first collected by CN or OAM, the MNO anyway owns right to adjust data collection to adhering regulations through CN and OAM. Hence, either server is inside or outside of MNO can be up to implementation.  Furthermore, we don’t think the NOTE in solution 2 is needed. It is up to SA2 design how to collect data in CN. |
| Fujitsu | Yes, the same view as CMCC |
| Interdigital | For solution 1b: No.  Our understanding is that for solution 1b, the server is an OTT server like in solution 1a. Otherwise, solution 1b overlaps with solution 2 or 3.  For solutions 2 and 3: Yes |
| Futurewei | We think the confusion comes with the definition of “the server”; should it be the initial/intermediate server for data collection or the final/termination server where the training is conducted. If it is the initial server, the answer for 1b/2/3 will all be “inside the MNO’s network”. If it is the final/termination server, the answer for 1b will be “inside the MNO’s network” and the answer for 2/3 will be “outside the MNO’s network”. |
| DISH | See our view on Q2.0.  The main point is not whether the server is hosted inside/outside MNO network, but more on the point that MNO should be able to enforce their policy (controllability and visibility) to the server and to the data transferred to and stored in the server.  And then after this clarified, we can address the above discussion between Huawei and Rapporteur (Mediatek) on how UE vendor can perform AIML training in such server. |

## 2.3 Termination Entity

The "(First)termination entity" refers to the entity that receives and stores data transmitted from the UE, **which possesses the authority to oversee the subsequent handling of this data**, such as data cleaning, forwarding, sharing, and analysis, among others, in compliance with privacy policies, security protocols, and any regulatory compliance requirements. The purpose of introducing the term ‘(first) termination entity’ is to emphasize the entity’s role in management and possession of the collected data.

According to the responsibility of the termination entity as define above, the termination entity for solution 1a) is the OTT server. The termination entity for solution 1b is the server for UE-side data collection. The termination entity for solution 2 is the CN. The termination entity for solution 3 is the OAM.

Q3.1: Do companies agree that for solutions 1a the termination entity of UE-side data collection is the OTT server?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | Yes |
| BT | Yes but as it was mention before, no need to discuss 1a |
| Nokia | Yes. |
| Ericsson | Yes. By the definition given above by the rapporteur, the termination entity is inside the MNO. We propose clarifying that, and use instead the terminology “termination entity inside the MNO”, rather than “first termination point”. This is because as per what captured in the TR, in all the approaches the data are ultimately transferred/terminated to the server for UE-side data collection (previously named OTT server) which could be outside the MNO. So it would be good to clarify that in all the approaches (except 1a), there might be a termination entity inside the MNO, and one outside (i.e. the training entity). Whereas for option 1a), the termination entity is only outside the MNO.  [Rapp1] Tend to agree. It means for solution 1a, there is no termination entity inside the MNO. Let’s check whether there are any other suggestions. |
| Huawei, HiSilicon | Yes |
| OPPO | Yes, better to add the term ‘first’ before termination entity to remove ambiguity. So does for the following questions. |
| Mediatek | Yes |
| vivo | Yes |
| CATT | Yes |
| Spreadtrum | Yes |
| ZTE | Yes |
| China Unicom | Yes, but we don’t need not to discuss 1a. We concur with OPPO’s suggestion to use term “the first termination entity” for the following solutions discussion. |
| Xiaomi | Yes |
| Samsung | Yes |
| Lenovo | Yes, the first and only termination entity. |
| Qualcomm | Yes |
| Sharp | Yes |
| CMCC | Yes |
| Intel | Yes  Regarding to Ericsson’s comment, ok for solution 2/3 that the termination entity is inside the MNO. However, for solution 1b, since the server can either be inside or outside of the MNO and MNO network only provides a tunnel for data collection transmission, the termination then depends on whether the server is inside or outside of MNO network. It is not precise to say the termination is inside MNO network for solution 1b. |
| Fujitsu | Yes |
| Interdigital | Yes |
| Futurewei | Yes. But to remove ambiguity, we may need to define “termination entity”. In our understanding, the termination entity is where collected data is used for model training. |

Q3.2: Do companies agree that for solutions 1b the termination entity is the server for UE-side data collection?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | Yes |
| BT | Q2.2 indicates “for solutions 1b, 2 and 3, the server for UE-side data collection can be either inside or outside MNO’s network”.  We do not consider “outside” the MNO as an option for that reason, we propose to clarify the sentence:  Do companies agree that for solution 1a, the termination entity of UE-side data collection is inside the MNO?  Using our proposed sentence, the answer is yes. |
| Nokia | Yes. We would also like to know if the following figure, an excerpt from TS26.531, Figure 4.2-1 is the intended representation of solution 1b, wherein the first termination entity is actually in the CN. Otherwise, we would like to discuss what is the difference between what is depicted in the figure vs. solution 1b as depicted in the diagram (shown in the introduction of Section 2, top-right) for solution 1b provided in this Email Discussion. |
| Ericsson | Yes, but the terminology “termination entity” might be a bit ambiguous (as per the previous comment). Propose to clarify “termination entity inside the MNO is the server for UE-side data collection”.  As commented above, in all the approaches there might be always a “second” termination entity (former OTT server in charge of training) which is outside the MNO. Hence it should be clarified that the “first” termination entity discussed in this section is inside the MNO. |
| Huawei, HiSilicon | Yes with comments.  For Solution 1b, the terminology “termination entity” is a bit confusing. As we asked in Q1, whether there is one UE server or more than one UE server should be clarified. |
| OPPO | Yes |
| Mediatek | Yes |
| vivo | Yes |
| CATT | Yes |
| Spreadtrum | Yes with comments.  The “**the server for UE-side data collection**” should also be outside MNO and equals to OTT server. |
| ZTE | Yes with comments  As our comments in Q2.2, the terminated point shall be the UE server inside of the MNO. |
| China Unicom | Share the same view with BT. We agree with that for solutions 1b the first termination entity is the server (inside the MNO) for UE-side data collection. |
| Xiaomi | Yes |
| Samsung | Yes (but with comment).  Refer to answer to Q 1 and Q 2.1. |
| Lenovo | Yes, the first and only termination entity. |
| Qualcomm | Yes. As mentioned above for the controllability and visibility, the server being within the MNO is not required. Therefore, we do not agree with the companies arguments that it should be inside MNO. |
| Sharp | Yes |
| CMCC | In our understanding, if the server is outside of MNO, solution 1b) is the same as solution 1a), i.e. the termination entity is OTT server. If the server is inside of MNO, solution 1b) can be reflected in solution 2 and 3, i.e. the first termination entity is the server (inside the MNO) for UE-side data collection. |
| Intel | Yes |
| Fujitsu | Yes |
| Interdigital | Yes |
| Futurewei | Agree with CMCC. Solution 1b) should be inside the MNO otherwise it can be covered by 1a). However, when it is inside the MNO, it can be covered by Option 2 or 3. Propose to remove Solution 1b). |
| DISH | Yes.  Share Nokia question to clarify if the Figure 4.2-1 from TS26.531 is the intended representation of 1b, or just one of the way to realize 1b. |

Q3.3: Do companies agree that for solutions 2 the termination entity of UE-side data collection is the CN?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | No.  According to the nice figure provided by Rapporteur, only the first termination point is CN in Solution 2 (i.e. final termination entity is still “server for UE-side data collection”). Thus, we suggest below rewording:  for solutions 2 the first termination entity of UE-side data collection is the CN |
| BT | For clarification, we propose the following sentence  Do companies agree that for solutions 2 the termination entity of UE-side data collection is inside the CN?  Yes. That was the proposal done on [R2-2403492](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403492.zip) |
| Nokia | Yes, however it is unclear which CN entity is the termination entity. We would also clarify that the termination in the CN is not the UPF. |
| Ericsson | Yes, but the terminology “termination entity” might be a bit ambiguous (as per the previous comment). Propose to clarify “termination entity inside the MNO is a CN node”.  In all the approaches there might be always a “second” termination entity (former OTT server in charge of training) which is outside the MNO. Hence it should be clarified that the “first” termination entity discussed in this section is inside the MNO. |
| Huawei, HiSilicon | Yes with comments.  We agreed with Apple that first termination entity should be used in order to avoid confusions. |
| OPPO | Yes |
| Mediatek | Yes. Tend to agree with Ericsson to clarify that the termination entity inside the MNO is a CN node. |
| vivo | Yes |
| CATT | Yes |
| Spreadtrum | Yes, and we agree with the above companies that “**the first termination entity**” should be emphasized. |
| ZTE | Yes with comments  In option 2, the CN is considered as a first termination node, the question itself may cause the some ambiguities between the CN and the UE server for UE side data collection, which one is referred in the question. In this sense, we echo apple’s comments:  In solution 2, the first termination entity of UE-side data collection is the CN. |
| China Unicom | Same view as Q3.3. We agree with that for solutions 2 the first termination entity is the server (inside the CN) for UE-side data collection. |
| Xiaomi | Yes |
| Samsung | No (See comments).   * Refer to answer to Q 1 and Q 2.1. * According to the definition of solution 2 the termination entity for data collection is not the CN:   + UE collects training data and transfers it to Core Network. Core Network transfers the training data to the OTT server. |
| Lenovo | Yes, the first termination entity. |
| Qualcomm | Yes, but CN is just forwarding the collected data to the server.  Based on the definition of the definition of the "(First)termination entity"   * the entity that receives and stores data transmitted from the UE, **which possesses the authority to oversee the subsequent handling of this data**, such as data cleaning, forwarding, sharing, and analysis, among others.   Our understanding is that CN should handle only forwarding of the data. It should not perform data cleaning, analysis, and others. |
| Sharp | Yes, we agree with the companies above, clarification is needed that it’s a ‘first’ termination entity and that it is a node within CN. |
| CMCC | Yes with comments that the **first** termination entity of UE-side data collection inside the MNO is a CN node. |
| Intel | Yes. Apple’s suggestion to add “first” looks good to us. |
| Fujitsu | Yes, CN node is the first termination entity at least. |
| Interdigital | Yes (with similar comments as Apple/Ericsson/Spreadtrum/ZTE that it should be the “first termination entity”) |
| Futurewei | No. CN is just the **initial** entity for data collection. Based on the agreement, CN can transfer further the collected data to the OTT server. Therefore, the termination entity of UE-side data collection is the OTT server. |
| DISH | First termination is (inside) CN.  But we think when discussing termination entity (final and intermediate), it’s beneficial to lay out the whole data transfer path and at the same time and clarify the protocol in mind.  E.g. for solution 2: UE -> CN-> UE-side training data collection Server, and clarify the protocol layer accordingly. This is also to understand the level of data visibility in the intermediate terminating nodes. |

Q3.4: Do companies agree that for solutions 3 the termination entity of UE-side data collection is the OAM?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | No.  Similar to Q3.3, we suggest below rewording:  for solutions 3 the first termination entity of UE-side data collection is the OAM |
| BT | Similar to Q3.3, we propose:  Do companies agree that for solutions 3 the termination entity of UE-side data collection is inside the OAM?  Yes. The UE-side data collected is still under MNO control. |
| Nokia | Yes. |
| Ericsson | Yes, but the terminology “termination entity” might be a bit ambiguous (as per the previous comment). Propose to clarify “termination entity inside the MNO is the OAM”.  In all the approaches there might be always a “second” termination entity (former OTT server in charge of training) which is outside the MNO. Hence it should be clarified that the “first” termination entity discussed in this section is inside the MNO. |
| Huawei, HiSilicon | Yes with comments.  We agreed with Apple that first termination entity should be used in order to avoid confusions. |
| OPPO | Yes |
| vivo | Yes |
| CATT | Yes |
| Spreadtrum | Yes |
| ZTE | Yes with comments:  In option 3, the OAM is considered as a first termination node, the question itself may cause the some ambiguities between the OAM and the UE server for UE side data collection, which one is referred in the question. In this sense, we echo apple’s comments:  In solution 3, the first termination entity of UE-side data collection is the OAM. |
| China Unicom | Same view as Q3.3. We agree with that for solutions 3 the first termination entity is the server (inside the OAM) for UE-side data collection. |
| Xiaomi | Yes |
| Samsung | No (See comments).   * Refer to answer to Q 1 and Q 2.1. * According to the definition of solution 3 the termination entity for data collection is not OAM:   + UE collects training data and transfers it to OAM. OAM transfers the needed data to the OTT server. |
| Lenovo | Yes, the first termination entity. |
| Qualcomm | Yes, but OAM is just forwarding the collected data to the server.  Based on the definition of the definition of the "(First)termination entity"   * the entity that receives and stores data transmitted from the UE, **which possesses the authority to oversee the subsequent handling of this data**, such as data cleaning, forwarding, sharing, and analysis, among others.   Our understanding is that OAM should handle only forwarding of the data. It should not perform data cleaning, analysis, and others. |
| Sharp | Yes |
| CMCC | Yes with comments that the **first** termination entity of UE-side data collection inside the MNO is OAM. |
| Intel | Yes. Apple’s suggestion to add “first” looks good to us. |
| Fujitsu | Yes, OAM is the first termination entity at least. |
| Interdigital | Yes (with similar comments as previous question that it should be the “first termination entity”) |
| Futurewei | No. OAM is just the **initial** entity for data collection. Based on the agreement, OAM can transfer further the collected data to the OTT server. Therefore, the termination entity of UE-side data collection is the OTT server. |
| DISH | Similar comment as response for Q3.3.  For solution 3: UE->OAM->UE-side data collection server?  Or the UE-side data collection server in this case is OAM? |

## 2.4 Controllability for transfer of the collected data in MNO

To begin, we focus on the aspect of data transfer to address controllability.  Once these aspects are clearly understood, we can delve into more intricate details, such as how the MNO might configure measurement and reporting for the UE, among other considerations.

We define the controllability of data transfer for UE-side data collection within an MNO in the following dimensions:

* The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, etc.) the data transfer to and from the server for UE-side data collection.

The specific entity within the MNO to control the data transfer to and from the server for UE-side data collection.

* The protocols and methods utilized by the MNO to control the data transfer to and from the server for UE-side data collection.

’Companies are invited to discussion on whether it is appropriate to start discussions on the controllability of data transfer, as outlined in the preceding four bullet points. Additionally, companies are requested to provide any definitions of controllability that may encompass critical aspects not already covered.

Q4.1 Do companies agree to start controllability discussion on data transfer as defined with the above four bullets? Please provide/clarify the definition on controllability if there are any important aspects missing.

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes, but it would be important to clarify which entity within the MNO that should be responsible for the control of the data transfer for each solution if any. |
| Apple | Yes with comments:  We understand the 1st dimension is covered by the 4th one. So, suggest to remove 1st dimension. |
| BT | Current proposals are ambiguous as they may have different understandings. We propose:   * The capability of the MNO to control the data transfer to the server for UE-side data collection. * The capability of the MNO to control the data transfer from the server for UE-side data collection. * The specific entity within the MNO to control the data transfer to and from the server for UE-side data collection. * The protocols ~~or~~ and methods utilized by the MNO to control the data transfer to and from the server for UE-side data collection. * The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, etc.) the data transfer to and from the server for UE-side data collection. |
| Nokia | Yes, but it seems that the fourth bullet is a more descriptive version of the first bullet. The list could be consolidated by deleting the first bullet.  It should also be noted that there may be multiple protocols, e.g., for solution 3, there is an interface between OAM and the gNB, and between the gNB and the UE, each with a very different protocol. Furthermore, there would be an interface between the OAM and the server for UE-side data collection, which we need to determine to be proprietary or 3GPP-based. |
| Ericsson | Yes. At this stage we do not need to discuss which NW node is in charge of handling those 4 bullets. That is beyond RAN2 scope.  However, we believe that we should not only focus on controllability/management of the data transfer. Also whether the UE is allowed to start the data collection for the purpose of UE-side training is something that should be controlled and managed by the MNO/NW, i.e. the UE should start the data collection only if that is allowed by the MNO/NW.  So we propose adding the following bullet:   * The MNO's ability to manage/control the initiation/termination of the data collection for UE-side model training.   [Rapp1] is it covered by the bullet “The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, etc.) the data transfer to and from the server for UE-side data collection”? |
| Huawei, HiSilicon | Yes with comments.  We have a high level question for clarification:  At RAN2#125bis, it was agreed to defined what is control of data collection and waht is visibility of data content, and the necessity of controllability was not discussed before. Perhaps the email rapporteur could clarify whether/how we discuss the necessity of controllability in this email.  For dimension discussions, we think the scope should be: capability of control and what to control.  1st bullet and 4th bullet should be about the capability of the MNO, so we suggest to merge them into a single bullet. In addition, regarding "ability to manage the data transfer", our view is that MNO should firstly be aware of the collected data, and then it can be able to control the data collection. So we think the discussion here is also relevant to section 2.5. **Our suggetion is: 1st/4th bullet is replaced by the following:**  The capability of the MNO to control and manage the data transfer process, by considering the visibility of data content.  for 2nd and 3rd bullet, we think they are not part of dimensions, and they are about details of controllability. **So we prefer to not list both bullets here.** If needed, we could address them later. |
| OPPO | Yes with comments  Basically, we agree the intention in general, but would like to further clarify the boundary between bullet 1 and bullet 4. My understanding is that bullet 4 is discussing how MNO can control the data collection task before the data is collected to the first termination entity while bullet 1 is trying to address the aspect how MNO can control the data sharing procedure after the data is collected to the first termination entity. If that is the case, the following revision suggestion can make it more clear:   * The capability of the MNO to control the data sharing procedure after the data is collected to the first termination entity, e.g. data sharing from the first termination entity to the server for UE-side data collection. * The specific entity within the MNO to control the data collection. * The protocols or methods utilized by the MNO to control the data collection. * The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, etc.) the data collection task before the data is collected to the first termination entity. |
| Mediatek | I revised the bullets based on the comments received so far. We agree to discuss the above three bullets for controllability. |
| vivo | Beside above controllability aspects, It is essential to clarify the controllability for data collection at the server. We think the following aspects of controllability should be considered:   * Maintenance of user consent; * Selection of desired UEs to enable the server only collects data from specific UE(s); * Management of the session/connection between UE and termination entity;   Awareness of data content; |
| CATT | In our view, the controllability discussion refers to how to control a UE to transfer training data to “the termination entity”. But the training data delivery from “the termination entity” to server for UE-side data collection is not in RAN2 scope. |
| Spreadtrum | Yes with comments.  We are OK with the modified three bullets. And we suggest to discuss the detailed controllability per solution after identifying the preferred solution.  Besides, there are some description that is unclear to us:  For bullet 1, what is “prioritize/de-prioritize” in e.g. part.  For all the three bullets, “the data transfer **to and from the server** for UE-side data collection” is mentioned. We wonder in which cases we will collect data from the server. |
| ZTE | We are wondering what kind of data need to be transferred from the UE server for UE side data collection to the NW entity? In all options on the table, the data transfer direction is from UE, via NW entity (gNB , OAM or CN) to OTT server/UE server.  In addition, it is only mentioned that NW controllability on the data transfer between the NW and OTT server. The data transfer path between UE device and NW is missing.  In this sense, we suggest to have the following modification:   * The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, etc.) the data transfer to the server for UE-side data collection and from the UE device. * The specific entity within the MNO to control the data transfer to the server for UE-side data collection and from the UE device. * The protocols and methods utilized by the MNO to control the data transfer to the server for UE-side data collection and from the UE device. |
| China Unicom | Firstly, we understand the controllability means the data can be read simultaneously and wrote, so we propose to revise the first bullet as below:   * The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, real-time read, write, etc.) the data transfer to and from the server for UE-side data collection.   The second and third bullets can be agreed only the server for UE-side data collection is inside the MNO. |
| Xiaomi | Agree with the updated bullets. |
| Samsung | No (postpone the discussion).  Regarding the first (updated) bullet point, considering that there is no latency requirement for data collection for model training, we do not expect any prioritization/de-prioritization specific for AI/ML data for UE sided model training.  More importantly, in our view, the discussion on MNO controllability of the data, should be postponed pending conclusion on following open points:   1. RAN1 agreement/outcome of discussion on contents of transferred/collected data [[RP-240774](http://ftp.3gpp.org/tsg_ran/TSG_RAN/TSGR_103/Docs/RP-240774.zip)]:  * CN/OAM/OTT collection of UE-sided model training data [RAN2/RAN1]:   + For the FS\_NR\_AIML\_Air study use cases, identify the corresponding contents of UE data collection  1. Clarification of the following questions in relation to MNO controllability of data:  * The use case(s) that would require MNO specific controllability of data collection. * Whether(why) the MNO would require controllability of all collected data (e.g., including proprietary implementation data) specifically. * Whether(why) the MNO would require controllability of the data itself and/or the data collection process (e.g. start, end, etc.). * Whether(why) the MNO would be differentiating AI/ML data from non-AI/ML data? |
| Lenovo | Yes to the 1st bullet after modification.  For 2nd and 3rd bullet, they seem in the expertise domain of SA2/SA5 instead. Not sure if RAN2 can discuss next level details. Maybe RAN2 can just assume it is doable without diving into detailed options?  And it is only about training data collection. |
| Qualcomm | We agree with Rapp. Summary. We believe further discussion can be postponed or handled by relevant WGs. |
| Sharp | Agree to discuss the updated bullets but it needs to be clarified that since the latency requirement is not considered, then under what conditions (de)prioritization is done. Secondly, as mentioned in the first bullet ‘the data transfer to and from the server for UE-side data collection’, it needs to be clarified when the data is collected from the server and by which entity. |
| CMCC | We understand the first bullet only means the data collection procedure is controllable by MNO, but from the perspective of operator, **the data content should also be controllable**.  Therefore, we share the similar view with China Unicom on the revision of the first bullet. |
| Intel | Yes with comment.  For bullet 2/3, it would be good to clarify that this does not preclude the server itself is within MNO network. |
| Fujitsu | Yes for the revised bullets.  And we also prefer that the controllability is not only for the data transfer but also for the data content collection. |
| Interdigital | We think the most important aspect in this email discussion is the first question. Which entity in the network does the controlling and what protocol is used to do so can be discussed once we have progressed regarding the first question. |
| DISH | Agree to the revised bullets of controllability aspect.  In addition to that it would be beneficial if we can include the ability to schedule the timing of the transfer in to first bullet:   * The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, schedule data transfer, etc.) the data transfer to and from the server for UE-side data collection. |

Based on the feedback received so far, it seems necessary to clarify the level of controllability. As an initial step, we define the levels of controllability of MNO over data transfer to and from the server for UE-side data collection as follows:

* Full Control: The MNO has the capability to manage data transfer to the server for UE-side data collection. This includes initiating, terminating, and fully managing the volume of data. For example, the UE should start the data transfer only if that is allowed by the MNO/NW.
* Partial Control: The MNO has some degree of control over the data transfer but may be limited by certain factors such as agreements with third parties. For example, the UE can start the data transfer without involvement of MNO/NW as long as the tunnel is available.
* No Control: The MNO has no capability to influence or manage the data transfer.

For solution 1a), the MNO has no specific controllability for transfer of the collected data for UE-side data collection. For example, the collected data might be transferred together with other UE traffic without differentiation.

Q4.2: Do companies agree that in solution 1a) MNO has no specific controllability for transfer of the collected data for UE-side data collection? Otherwise, please clarify any controllability that the MNOs have.

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| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | We agree its intention, but we think the term “specific controllability” is not clear:   1. We think NW implementation can already achieve NW controllability, e.g., by assigning a dedicated PDU session only for UE sided data collection. In this case, since the UE can’t mix other type of traffics with training dataset, it is at cost of radio resource inefficiency. 2. To alleviate the issue of radio resource inefficiency in 1), the controllability can be enhanced by limited spec change, e.g. SA2 introduce a new 5QI for dataset transfer of training. With it, the UE can mix other type of traffics with training dataset in one PDU session, and NW can differentiate it.   To make it clear, we suggest below rewording:  in solution 1a) although it may not fully optimize system performance, MNO can already have ~~has no specific~~ controllability for transfer of the collected data for UE-side data collection via NW implementation.  [vivo] with such rewording, we are confused the boundary of 1a) and 1b) may not be very clear. We prefer to avoid such approach. |
| BT | Yes, but as mentioned before, 1a is a solution totally outside 3GPP. No need to discuss 1a |
| Nokia | Maybe. If the MNO knows the IP addresses of the OTT servers, traffic to the servers could be throttled. But there is, otherwise, no specific control over aspects of the data collection procedures. |
| Ericsson | Yes, if there is no SLA between MNO and the OTT server application.  However, if an SLA is present between MNO and OTT server, then the control is also possible and needed with 1a), i.e. the data stream destined to the IP address associated to the OTT server can be controlled/managed by the MNO as any other traffic.  So it should be either clarified that solution 1a) implies no SLA, or if with solution 1a) it is possible to have SLA, then the controllability is always possible. |
| Huawei, HiSilicon | Yes.  Solution 1a) can work without specific controllability. |
| OPPO | Yes |
| Mediatek | Yes. No control from MNO over the data transfer from UE to the server. |
| vivo | Yes |
| CATT | Yes |
| Spreadtrum | Yes |
| ZTE | Yes |
| China Unicom | Yes, due to 3GPP doesn’t need to discuss 1a. |
| Xiaomi | Yes |
| Samsung | No (see comment).  In Solution 1a, the MNO can use existing service management/QoS framework for controllability of the transfer of the collected data.  Moreover, it is beneficial before discussing whether Solution 1a have no specific controllability on data collection, RAN2 need to first clarify the following open points:   * The use case(s) that would require MNO specific controllability of data collection. * Whether(why) the MNO would require controllability of all collected data (e.g., including proprietary implementation data) specifically. * Whether(why) the MNO would require controllability of the data itself and/or the data collection process (e.g. start, end, etc.). * Whether the MNO would be differentiating AI/ML data from non-AI/ML data, and if yes, for what reason? |
| Lenovo | Yes |
| Qualcomm | Yes (with comments)  Solution 1a is the over-the-top solution, outside 3GPP. The MNO controllability can be potentially achieved outside 3GPP. |
| Sharp | Yes |
| CMCC | Yes. The solution 1a) is totally out of 3GPP scope. |
| Intel | We think level “No control” is also not clear, e.g. whether MNO has no control because of the transport tunnel is not via MNO network or the transport itself is not awared by network.  In our understanding, solution 1a means the data collection transfer does not use MNO 3GPP network, the transfer of data collection can either use IP tunnel or WLAN, etc.  To further clarify, in our understanding, solution 1a does not include using UP to collect data from UE to the server.  With this, we suggest further clarify “no control” as below:  The MNO has no capability to influence or manage the data transfer since the data transfer tunnel is outside of 3GPP (e.g. WLAN, IP tunnel). |
| Fujitsu | Yes, solution 1a works without any controllability of MNO. |
| Interdigital | Yes. |
| Futurewei | Yes. |
| DISH | Yes. To clearly differentiate the solutions, we should clarify that solution 1a is the one with no controllability nor visibility of the MNO. Hence does not need to be discussed in 3GPP. |

In solution 1b, it is recognized that the MNO retains a certain level of control over the data transfer to the server for UE-side data collection. The entity within the MNO responsible for this control might be a NF in the CN, such as the DCAF. The MNO exercises this control at the granularity of the PDU session, as governed by the SLA. However, since the initiation of the data collection procedure is triggered by the server as specific types of services, the MNO may not have the authority to directly control and manage the data transfer process.

Q4.3: Related to solution 1b, can the MNO have control/management over the data collection for UE-side data collection, given that it may be managed by a NF within the CN, with control granularity at the level of the PDU session per SLA? Please clarify any other controllability that the MNOs might have in solution 1b.

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| Company | Yes/No (Comment) |
| NEC | Yes, what RAN2 can clarify is the CN control, but the details of CN implementation can be discussed by SA2. |
| Apple | Yes with comments:  It is our understanding that from controllability perspective, the main difference of solution 1b from solution 1a is that it has one more control in CN via a NF (e.g. NWDAF, DCAF). However, the issue of radio resource inefficiency is same as solution 1, and the deployment of NF for data analysis (e.g. DCAF or NWDAF) in practical network is not successful so far.  Thus, to reflect above issue, we suggest below rewording:  Related to solution 1b, although it may not fully optimize system performance, MNO can have control/management over the data collection for UE-side data collection, given that it may be managed by a NF within the CN, with control granularity at the level of the PDU session per SLA. |
| BT | No. Considering Q3.2, our understanding is that UE-side data collected is inside the MNO. That means, the UE-side data collection belongs to the MNO. Therefore, it has control and awareness over collected data. |
| Nokia | Maybe. Depending on whether our interpretation of solution 1b matches what we have shown in our answer to Q3.2, the level of control could be considered to be more than just at the PDU session level.  However, if 1b is simply a server attached to a UPF and has an IP address internal to the network or specific to a DN for data collection, then we would agree with the PDU session level of granularity. |
| Ericsson | Yes.  The MNO can control and manage the entire data collection procedure via the UPF, and the gNB, as it would do for any other service injected into the 3GPP network. For example, the operator can configure a gNB/UPF with criteria to allow/disallow the transfer of data, it can control the amount of data transferred, it can control and manage the QoS of the data collection traffic, and the related overhead.  Based on SLA, the MNO can also control, e.g. by assigning different QoS flows, which data should terminated inside the MNO (i.e. the data that should be visible) and outside the MNO (i.e. the data that should not be visible). |
| Huawei, HiSilicon | No.  How MNO in involved in Solution 1b) is unclear to us. This is related to our comments in Q2.2 (inside MNO), and also related to the dimension discussion in Q4.1. |
| OPPO | Yes with comments  In general, we have the similar sense that a NF within the CN, e.g. DCAF, may be involved to control the data collection task at the level of the PDU session per SLA. But which node will generate/manage the data collection configuration is still unclear, in our view, at least the NF mentioned above can generate/manage the data collection configuration, which should be clarified further to better understand how solution 1b works in a whole picture. |
| Mediatek | Yes. We assume it’s partial control. The NW/MNO may not be able to start/stop the data transfer between UE and the server as long as the data tunnel is established. |
| vivo | Yes, but for solution 1b, the following controllability can be considered:   * Maintenance of user consent; * Selection of desired UEs to enable the server only collects data from specific UE(s); * Management of the session/connection between UE and the server; |
| CATT | We agree for option 1b it’s partial control. But it’s not clear to us what the overall procedure of option 1b is, and which MNO entities are involved. Maybe we could also take a chance to clarify the details of option 1b in this email discussion. |
| Spreadtrum | Yes with partial control.  NW (e.g., gNB or NF) can indicate data collection configuration to UE including allow/dis-allow data reporting, the collected data type etc.  But NW cannot control when UE should transfer data to server, UE will log those data until triggered by server.  From our side, server is outside MNO for the solution 1b, thus UE can only transfer data to server via UP way. In this case, if the IP address of server is known by MNO, the SLA or QoS requirement can be optimized. |
| ZTE | In our understanding, it mainly depends on whether the UE server for UE side data collection is inside or outside of the MNO, if the UE server for UE side data collection is inside of the MNO, the NW have a full or partial controllability over the data transfer. Otherwise, NW have no any controllability on the data collection since the option 1b is as similar as option 1a. |
| China Unicom | No, as we answered in Q3.2, the server of data collection for UE-side data collection must be inside of the MNO, so the MNO is always controllable and awareness of the data collection. |
| Xiaomi | Yes with comments. Our understanding is that in option 1b, MNO has partial control, e.g. the control over the PDU session used between UE and the server for UE-side data collection. |
| Samsung | Yes (to some extent, see comment)  In our understanding of Solution 1b, the MNO may have partial control over the data collection. Considering that the data collection entity (or NF) may not expose the actual data to the CN, e.g. only analytics or reports about the data to assist the MNO in planning network resources for transferring the collected data via the MNO network.  Regarding the “control granularity at the level of the PDU session per SLA”, this is discussion is not within RAN2 scope. |
| Lenovo | Yes. Since the data is transferred over user plane, and CN is not expected to store the data (compared to solution 2), controlling per PDU session level (e.g., based on IP address) is a reasonable option. |
| Qualcomm | Yes. We have same understanding Ericsson that MNO can enforce SLA using existing means. |
| Sharp | Yes, with partial control. |
| CMCC | If the termination entity is outside of MNO, solution 1b) is the same as solution 1a), i.e. solution 1b) is no control.  If the termination entity is within MNO, solution 1b) can be reflected in solution 2 and 3, i.e. solution 1b) is full control. |
| Intel | Yes, but not only for PDU session management.  According to TS 23.288, MNO can at least have the controllability of data collection via SLA in following aspects:  - The AF for the UE Application to connect to (e.g. based on an FQDN).  - The information that the UE Application shares with the AF, subject to user consent.  - Possible Data Anonymization, Aggregation or Normalization algorithms (if used).  - The authentication information that enable the AF to verify the authenticity of the UE's Application that provides data.  Furthermore, according to TS 23.288, MNO can further send data collection request to the server for UE side data collection. This gives MNO “full controllability” (i.e. following the definition provided above) of data transfer. |
| Fujitsu | It depends.  If the UE server is outside of the MNO, it is kind of 1a. the MNO has no controllability. If the UE server is inside the MNO, it depends on the solutions. For UP-based data transfer, the MNO only has partial controllability, e.g., the QoS control. |
| Interdigital | Our understanding is the control here is partial control or maybe even limited to just awareness (i.e., MNO is aware data collection is happening) |
| Futurewei | For 1b), the argument we heard during the last meeting was that the NMO will need to have certain control of the data collection, making it non-3GPP-transparent and different from 1a). Given this, the MNO MUST have control/management over the data collection for UE-side data collection as otherwise it has no reason to be an option. However, as we and other companies mentioned above, this case can be covered by Solution 2.  Suggest removing Solution 1b). |
| DISH | Our understanding of 1b is more like V2X or ProSe servers, which may not be within the operator’s network but are recognized by MNO and have SLA association/agreement and hence MNO can can set priority/QoS to the sessions between those servers and a certain UE. Full controllability and visibility can be achieved. Granularity per PDU session would be a good start. |

For solution 2, it is recognized that the MNO has full level of control over the data collection process. The entity within the MNO responsible for this control is a NF in the CN, such as NWDAF, LMF (for positioning), or other relevant NFs. There are two potential control methods:

* Option 1: The MNO may manage data collection through NAS signaling (or LPP for positioning).
* Option 2: Alternatively, the MNO may manage the data collection process from the CN to the UE via RAN nodes, utilizing RRC signaling.

This level of control enables the MNO to directly manage the data collection process as required.

Q4.4: Do the companies agree that in solution 2, the MNO’s control over the data collection for UE-side data collection is characterized by full controllability? Please clarify whether it is managed by a NF within the CN through NAS signaling directly (option 1) or through RRC signaling via RAN node (option 2), or others?

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| Company | Yes/No (Comment) |
| NEC | Yes, what RAN2 can clarify is the CN control for this solution, but the details of CN implementation can be discussed by SA2.  In addition , we think the potential control methods for solution-2 can be also appliable to solution-1b.  From signaling perspective, we believe the NAS layer signalling should be prioritized. |
| Apple | Yes but we have below question for clarification for option 2:   * On RRC signaling, to help understanding, is it signaling like QoE (i.e. a transparent container in RRC message)?   [Rapp 1] It’s possible that there is certain interaction between CN and RAN, and it is RAN which controls the data collection process through RRC message. If it is a transparent container in RRC message, it is considered as a variation of option 1 via NAS signaling?  [Apple] Thanks for response. So, option 2 means CN (e.g. a NF) sends Radio configuration to RAN via N2 interface, and then RAN decode it and generate a RRC message. |
| BT | Yes to "the MNOs have full control over data collection configuration and collected data for UE-side model training, management and inference on the CN”.  It is too early to decide the concrete signaling. |
| Nokia | Option 1: Maybe. It isn’t clear how the CN could provide detailed configurations to the gNB, though.  If the approach is CN-based, then the initial 3GPP-based control mechanism for DC for BM could come from the CN over NAS. NAS messages would be required to configure the UE for data collection for BM and NAS messages would be required to transport the measurements to the AMF and then further through the CN.  For positioning data collection, we agree that LPP would be the mechanism used to manage data collection from the UE.  Option 2: No. Currently, there is a mechanism to pass a signaling-based MDT Trace Activation from OAM to the gNB through the AMF, but we do not think that is the intention of this solution 2. We see this as a RAN-based or OAM approach. And for this option, the CN would still need to configure the RAN node for physical layer data collection. |
| Ericsson | Yes, but we would like however to clarify that the level of controllability is the same as in solution 1b, i.e. not clear why the term “full” controllability is used here. The only difference between the controllability of option 1b, and option 2, is that in option 1b the controllability is at UP level, whereas in option 2 it could be at CP level. Related to whether to use NAS or RRC signalling, we are concerned in general about CP solutions. NAS is the natural candidate for CN-centric approach, however that is not designed to carry large amount of data. Hence, the feasibility of using NAS for option 2 should assessed by SA2. |
| Huawei, HiSilicon | No.  The terminology "full controllability" is to be clarified. There has not been definitions for it.  We think it is too early to discuss the signaling details. In our understanding, we could discuss whether MNO has controllability over data collection process and data content at a high level.  For controllability over data collection process, if solution 2 is to use control plane for data collection, MNO should to able to have controllability of data collection process.  However, as we commented for Q4.1, for dimension discussions, we suggest to consider controlling data collection process and the visibility of data content together. For the data content aspect, we provide comments in section 2.7, and we do think discussion of controllability is inseparable from discussion of visiblity of data content. |
| OPPO | Comments  Actually, we don’t quite understand the meaning of ‘**full controllability’** mentioned in this question. My understanding is that Q4.2~Q4.5 should be answered on top of Q4.1, to differentiate the real controllability level among 4 solutions on the table, we should touch the specific aspects addressed in Q4.1; otherwise, any generic question does not make much sense for our discussion as we may still back to the beginning.  As for Option 1 and Option 2, we also don’t know what ‘manage’ refers to, does it refer to data collection configuration control or data collection reporting control or both? The answer can be totally different if we focus on different use cases, for BM use case, we think Option2, i.e. RRC visible signaling, should be the baseline no matter we’re talking about data collection configuration and data collection reporting; for positioning use case, for data collection configuration part, Option2, i.e. RRC visible signaling, may be possible while for data collection reporting part, Option 1, i.e. NAS signaling (LPP message) should be the baseline. |
| Mediatek | Yes, but  For solution 2, the MNO/NW can have full control of the data transfer to and from UE and the server for UE-side data collection if option 2 is considered. It requires coordination between CN and RAN to manage the data transfer procedure.  Same level of controllability, e.g., partial control as solution 1b is also possible for solution 2. |
| vivo | See comment:  We tend to focus on positioning for solution 2, i.e., CN collects data from UE/PRU via LPP procedures and further transfers of the data to the server.  In this case, the CN has full controllability over the data collection, including:   * Maintenance of user consent; * Selection of desired UEs to enable the server only collects data from specific UE(s); * Management of the session/connection between UE and termination entity; * Awareness of data content.   The LPP procedures can be categorized as Option 1. |
| CATT | Yes. In our view, full control of the data transfer means separate data tunnel and specific mechanism to transfer training data from UE to termination entity. |
| Spreadtrum | Yes for “MNO has full controllability”. But what the meaning of “full controllability” still needs further discussion.  As for signaling part, it may be discussed case by case. Yet the identified use cases are RAN dependent. And CN may not know the specific RAN data needed to be collected. Thus RRC signaling can be starting point. |
| ZTE | Yes for the first part, NW have a full controllability over the data transfer between UE and CN.  For the signaling aspect, we think both options (e.g. CP based solution) may be possible, but we also share the same view with HW, it is too early to discuss the signaling aspect. |
| China Unicom | Yes for the “full controllability”. We understand term “full controllability” means as below:   * The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, real-time read, write, etc.) the data transfer to and from the server for UE-side data collection.   For the signalling details, it’s suggested to put potential options on the table accompanied by a comprehensive comparison of their pros and cons, e.g. NAS signalling, QoE-like mechanisms. |
| Xiaomi | Yes. Our understanding is that from UE perspective, NAS signalling (option 1) is used. |
| Samsung | Yes (see comment).  Clearly in the case of Solution 2, the use of NAS or RRC signaling to transfer the collected data would have similar impacts to those identified for model transfer via CP, in TR 38.843 (refer to Table 7.3.1.4-1 and Table 7.3.1.4-2). |
| Lenovo | Yes, both Option 1 via NAS or Option 2 via RRC are possible for CN/gNB to control the transfer of collected training data. |
| Qualcomm | Yes (please see additional comments)  The CP-based solution may cause significant overhead over the control plane, irrespective of whether it is NAS-based or RRC signaling. Furthermore, note that defining all the parameters to be collected is infeasible, as training for target UE device has more offline engineering aspects. |
| Sharp | Yes, but it needs to be defined what is meant by ‘Full’ controllability. |
| CMCC | Yes with comments.  We agree that solution 2 should be full control by MNO. However, we think the definition of full control is not sufficient. As we comment in Q4.1, we understand that full control means that not only the procedure should be controllable, but the data content also should to be controllable. The definition is suggested to be revised as follows:   * Full Control: The MNO has the capability to manage data transfer to the server for UE-side data collection. This includes initiating, terminating, and fully managing the volume of data and data content. For example, the UE should start the data transfer only if that is allowed by the MNO/NW. |
| Intel | Similar comment as above companies, definition of “full controllability” is not clear, e.g. whether this also includes the data content is configured by CN or not? |
| Fujitsu | Yes,  for solution 2, the MNO/NW can control the collection of the data content and the transfer of the data to the UE server. For the definition of “full controllability”, we prefer to modify it to cover the control of data content.  For opt 1 vs. opt 2, it depends on the use cases. For BM, we prefer opt 2. In this way, RAN2 can try to design the common framework for gNB-/CN-/OAM-centric training data collection. |
| Interdigital | Yes (regarding full controllability over the data transfer between the UE and CN). As we commented above, the protocol and actual entity that does the controlling can be discussed once we have progressed with the controllability aspect first. |
| Futurewei | Agree that “***the MNO’s control over the data collection for UE-side data collection is characterized by full controllability***”, with “full control” defined in Q4.1.  It is too early to decide whether opt 1 or opt 2 should be used and it may be use case dependent. |
| DISH | For option 2, 3, MNO has full controllability and full visibility. |

For solution 3, it is recognized that the MNO has full level of control over the data collection process. The entity within the MNO responsible for this control is OAM. The MNO controls the data collection process through RRC signaling via RAN node. This level of control enables the MNO to directly initiate and terminate the data collection process as required.

Q4.5: Do the companies agree that in solution 3, the MNO’s control over the data collection for UE-side data collection is characterized by full controllability, managed by OAM through RRC signaling via RAN node?

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| Company | Yes/No (Comment) |
| NEC | Yes, what RAN2 can clarify is the OAM control for this solution, but the details of OAM implementation can be discussed by SA5. Meanwhile, it should be noted that the interface between OAM and RAN is non standardized interface.  It would be helpful to clarify how the OAM manage the data collection procedure through RRC signaling via RAN node.  We assume the OAM management can reuse the MDT framework. The OAM triggers the UE-side data collection via RAN (RRC signalling). The detail is different from MDT but the triggering and request the RAN node to do/signal something to the UE will be similar. We may consider this as baseline, then can discuss further, e.g. whether new framework is needed or not. |
| Apple | Yes |
| BT | Yes to "the MNOs have full control over data collection configuration and collected data for UE-side model training, management and inference on the OAM”. |
| Nokia | Yes. |
| Ericsson | Yes. We would like however to clarify that the level of controllability is the same as in solution 1b and 2, i.e. not clear why the term “full” controllability is used here. The only difference between the controllability of option 1b, and option 2/3, is that in option 1b the controllability is at UP level, whereas the in option 2/3 it is at CP level.  [Rapp1] I clarified the level of the full control. Please check. Similarly, we would also like to clarify the terminology “directly manage”. In option 1b, 2 and 3, there is a 3GPP network involvement, so in all these options there should be the possibility for the MNO to manage the data collection procedure. In option 1b, the management is done e.g. by an NF, in option 2 by a CN node, in option 3 by the OAM.  [Rapp1] This part is not important, so I removed it. In particular for the option 3, it should be clarified how the OAM can interact with the server for UE-side data collection (former OTT server) both for the case in which that is inside and outside the MN. That is important because the need for initiating/terminating a data collection session comes from the training entity. |
| Huawei, HiSilicon | No.  The terminology "full controllability" is to be clarified. There has not been definitions for it.  We think it is too early to discuss the signaling details. In our understanding, we could discuss whether MNO has controllability over data collection process and data content at a high level.  For controllability over data collection process, if solution 3 is to use control plane for data collection, MNO should to able to have controllability of data collection process.  However, as we commented for Q4.1, for dimension discussions, we suggest to consider controlling data collection process and the visibility of data content together. For the data content aspect, we provide comments in section 2.7, and we do think discussion of controllability is inseparable from discussion of visiblity of data content. |
| OPPO | Comments  Actually, we don’t quite understand the meaning of ‘**full controllability’** mentioned in this question. My understanding is that Q4.2~Q4.5 should be answered on top of Q4.1, to differentiate the real controllability level among 4 solutions on the table, we should touch the specific aspects addressed in Q4.1; otherwise, any generic question does not make much sense for our discussion as we may still back to the beginning.  More addition, we’d like to clarify that solution 3 is not suitable for positioning use case compared to solution 2. My understanding is that solution 3 and solution 2 can aim for different use cases. |
| vivo | See comments:  We tend to focus on beam management for solution 3 and reuse MDT framework for NW side data collection, i.e., OAM collects data from UE via MDT and further transfers the data to the server.  In this case, the OAM and gNB have full controllability over the data collection, including:   * Maintenance of user consent; * Selection of desired UEs to enable the server only collects data from specific UE(s); * Management of the session/connection between UE and OAM; * Awareness of data content. |
| CATT | Yes. MDT mechanism can be baseline. |
| Spreadtrum | Yes |
| ZTE | Yes |
| China Unicom | Yes for the “full controllability”. We understand term “full controllability” means as below:   * The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, real-time read, write, etc.) the data transfer to and from the server for UE-side data collection.   MDT mechanism can be baseline. |
| Xiaomi | Yes. |
| Samsung | Yes (see comment).  Clearly in the case of Solution 3, the use of RRC signaling to transfer the collected data would have similar impacts to those identified for model transfer via CP, in TR 38.843 (refer to Table 7.3.1.4-1). |
| Lenovo | Yes, RRC can be used similar as for MDT configuration. |
| Qualcomm | Yes.  The CP-based solution may cause significant overhead over the control plane. Furthermore, note that defining all the parameters to be collected is infeasible, as training for target UE devices has more offline engineering aspects. |
| Sharp | Yes, but it needs to be defined what is meant by ‘Full’ controllability. |
| CMCC | Yes with similar comments to Q4.4.  We understand that full control means that not only the procedure should be controllable, but also the data content should also be controllable. The definition is suggested to be revised as follows:   * Full Control: The MNO has the capability to manage data transfer to the server for UE-side data collection. This includes initiating, terminating, and fully managing the volume of data and data content. For example, the UE should start the data transfer only if that is allowed by the MNO/NW. |
| Intel | Similar comment as above companies, definition of “full controllability” is not clear, e.g. whether this also includes the data content is configured by OAM or not? |
| Fujitsu | Yes. |
| Interdigital | Yes (with similar comments as in previous question) |
| Futurewei | Yes. |

## 2.5 Visibility of data content in MNO

As a preliminary measure, the nature of the data content can be described by its format, type, value and others. Visibility refers to the extent to which the MNO is able to be aware, access or even comprehend this data content.

Companies are invited to provide the definition on visibility and to what extent (aware, access or comprehend) the visibility is preferred.

Q5.1 Companies are invited to clarify their understanding of data content visibility and specify their preferred level of visibility.

|  |  |
| --- | --- |
| Company | Comment |
| NEC | In our understanding, the data content should be only visible by the termination point. |
| Apple | First, it is not clear whether the “data content visibility” could comply with regulations in different countries, e.g. GDPR. It is beyond 3GPP scope to define those requirements/mechanisms closely related based on legal grounds.  Second, assuming 3GPP is going to work on this requirement, we believe it is in remit of SA1 instead of RAN2. So, RAN2 should not define any requirement on behalf of SA1.  Third, regarding partial and fully data content visibility, SA3 should be consulted as there is potential impact on UE privacy and security and potential contradict with regional regulations.  Just to facilitate RAN2 discussion on clarifying solution details, we can compromise to start discussion on solution details based on **assumption of Rapporteur’s suggested 3 levels “visibility”**. However, we have strong concern that this assumption may be misused as requirement of “visibility”. Thus, **when capturing solution details, we requested to clearly clarify below points:**   1. This is just an assumption for RAN2 study purpose, and the definition of “visibility” and the category of visibility should be discussed and defined in SA1. 2. RAN2 should not agree any definition and requirements on “visibility”. 3. Without proper definition and requirements from SA1 and guidance from SA3, RAN2 shall not conclude any solutions as it may contradict with regulations. |
| BT | visibility for us mean awareness, access, and comprehend |
| Nokia | Visibility has at least two characteristics: knowledge that a certain type of data is being transmitted from the UE (e.g., by knowing that traffic to a certain IP address is always for training data collection); or knowledge about the contents of the data, e.g., the format of the data, or what a string of bits represents in terms of type and value.  We think that both characteristics are necessary to enable full visibility from the MNO. |
| Ericsson | OK with the definition given by the rapporteur. |
| Huawei, HiSilicon | In our understanding, visiblity of data content means each data to be collected should be standardized in relevant signalling level. It means that MNO should be able to see from the collected data what has been collected from UEs/users. |
| OPPO | My understanding of full data visibility has two levels of meanings:  Level 1: all collected data metrics are specified with open format, which means the data format is clearly defined in the spec.  Level 2: no vendor can get more info from the specified data.  For instance, RSRP metric collected via RRC, this data type is specified and the physically meaning is the same no matter which vendor gets this data.  My understanding of Partial data visibility has two levels of meanings:  Level 1: all collected data metrics are specified with open format, which means the data format is clearly defined in the spec.  Level 2: some vendor can get more info from the specified data.  For instance, some ID metric, e.g. *systemInformationAreaID*, broadcast via SIB1, this data type is specified but the physically meaning, e.g. which area this *systemInformationAreaID* serves for, is maintained by Operator or NW vendor itself, which is usually unknown by the UE vendor. From UE vendor point of view, *systemInformationAreaID* is not fully understood although this ID is logically used by the UE vendor to judge the validity of a SI message.  My understanding of no data visibility has one level of meanings:  Level 1: collected data metric is unspecified with proprietary format, which means the data format is not defined in the spec, something like a container. |
| vivo | Level 0: MNO entity is not aware of data collection procedure;  Level 1: MNO entity is aware of data collection procedure, and the collected data may be in string format as a container;  Level 2: MNO entity is aware of the type and value of collected data, that is, the data is with specified format and value.  From our perspective, Level 2 is preferred for solutions 1b/2/3. |
| CATT | OK with the definition given by the rapporteur. |
| Spreadtrum | Our understanding of data visibility:  Level 1: MNO is unaware of data collection procedure;  Level 2: MNO is aware of data collection procedure but unaware of what type of data is transferred.  Level 3: MNO is aware of data collection procedure and what type of data is transferred, but unaware of the specific content/value of the data.  Level 4: MNO is aware of data collection procedure, what type of data is transferred, and aware of the specific content/value of the data.  We prefer to apply Level 1 for option 1a, Level 2 or 3 for option 1b, and Level 4 for option 2/3. |
| ZTE | Generally okay with the rapporteur’s suggestion. |
| China Unicom | Visibility for us mean the data content can be readable in real time and wrote by MNO at least. |
| Xiaomi | Our understanding is that “data visible to MNO” means that MNO can access and comprehend the data content, e.g. when the data format is specified. “Data invisible to MNO” is related to cases that data is transferred in a container or there is end-to-end encryption between UE and server for data collection which is outside MNO. |
| Samsung | The discussion on data content visibility and granularity/level of content visibility will require clear understanding of the data content for UE-side model training, which is an objective of this WI and currently under discussion in RAN1 [[RP-240774](http://ftp.3gpp.org/tsg_ran/TSG_RAN/TSGR_103/Docs/RP-240774.zip)]:   * CN/OAM/OTT collection of UE-sided model training data [RAN2/RAN1]:   + For the FS\_NR\_AIML\_Air study use cases, identify the corresponding contents of UE data collection |
| Lenovo | Not sure about “aware” of data content, does it mean MNO is “aware” of the collected data transfer? Or it means MNO is “aware” of the data type transferred?  Not sure about the difference between “access” and “comprehend”. How can one have access to the data but cannot comprehend, or vice versa?  Maybe there is no finer granularity for “visibility” of collected data. Of course, partial visibility or full visibility can be discussed. |
| Qualcomm | Okay with the rapporteur’s definition.  Companies arguing for real-time read/write, in our understanding is that even MDT solutions do not support real-time read/write. Real-time read/write for data that are used for UE-side model training is not justifiable in our view. |
| Sharp | OK, as a generic definition provided by the rapporteur. |
| CMCC | In our understanding, visibility means awareness, access, **and** comprehend. Furthermore, MNO should be able to write the collected data, e.g. anonymize the subscriber information. |
| Intel | We share similar understanding with vivo on the level of visibility.  In our understanding, solution 1a is level 0, since the transportation of data collection is outside of 3GPP network. Solution 1b/2/3 is level 2, considering the data type and procedure management can either be controlled by MNO via SLA or specified procedures. |
| Fujitsu | Ok with the definition provided by the rapporteur |
| Interdigital | Our understanding is that visibility is related to the data content and we shouldn’t mix visibility with controllability. For example, whether the MNO is aware of the data collection process or not should be discussed under “controllability” (previous section) and not here. |
| Futurewei | It really depends on how the MNO wants to manage/control the data collection. From our perspective, some aspects of the visibility of the data content, depending on the level of visibility, may include   * What use case the data is collected for. * What data is collected. * The way of interpreting the data. |
| DISH | Agree with BT on visibility scope: awareness, access, and comprehend. |

As an initial step, we define the levels of data content visibility within the MNO as follows:

* No visibility: MNO is not aware of the collected data and cannot access the data content.
* Partial visibility: The MNO is aware of the collected data, has limited access/comprehension to some elements of the data content, allowing for limited access.
* Full visibility: The MNO is aware of the collected data, has complete access to all aspects of the data content, enabling thorough comprehension.

For solution 1a), the MNO has no visibility of data content. For solution 1b), the MNO has no or partial visibility of data content depending on the SLA. For solution 2 and 3, the MNO is able to have full visibility of the data content.

Q5.2: Do companies agree that in solution 1a) MNO has no visibility of data content for UE-side data collection?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | No.  In solution 1a), it is still possible that part of data content compliance with regulations can be visible to MNO via offline engineering between particular pair of MNO and UE vendor. Thus, we suggest below change:  in solution 1a) MNO has no or partial visibility of data content compliant with regulations for UE-side data collection depending on offline engineering.  [vivo] I agree we should be careful with the wording, but we do not think RAN2 is the right WG to make assessment on “compliance with regulations”. |
| BT | visibility for us mean awareness, access, and comprehend |
| Nokia | Yes. While the MNO might be able to infer something about traffic to a certain IP address, the contents of the data would be unknown to the MNO. |
| Ericsson | Yes |
| Huawei, HiSilicon | Yes with comments.  For full visibility, it means complete access to data content, without any conditions, so the wording "if needed" is unclear to us. In addition, with this wording "if needed", the boundary between partial visiblity and full visibility is unclear.  So we suggest to remove "if needed". |
| OPPO | Yes |
| Mediatek | Yes. |
| vivo | Yes |
| CATT | Yes |
| Spreadtrum | Yes |
| ZTE | Yes with comments  just one question for clarification on the definition of different levels of visibility, what’s the meaning of access to the data content, we observe that rapporteur using ‘/’ to connect ‘access’ and ‘comprehension’, does it mean they have the same meaning , if so, we can remove the ‘access’. |
| China Unicom | It’s out of 3GPP scope. |
| Xiaomi | Yes |
| Samsung | No.  What is the meaning of “limited access/comprehension”? In our view, it should be “comprehend” or “not comprehend”, i.e., only two levels.  Additionally, it should be clear that the term “visibility of data” refers to “standardized data format”. |
| Lenovo | Yes |
| Qualcomm | Not required but can be provided if an SLA exists between MNO and vendor.  Although there is no requirement of SLA for solution 1a). However, an SLA can exist between MNO and vendor, and based on the SLA there can be “Full visibility”, “Partial visibility”, or “No Visibility” as defined by rapp. |
| Sharp | Yes |
| CMCC | Yes, it is totally out of 3GPP scope. |
| Intel | Yes. Solution 1a in our understanding is transferred outside of 3GPP network (i.e. IP, WLAN, etc), hence, MNO has no visibility of data content. |
| Fujitsu | Yes |
| Interdigital | Yes |
| Futurewei | Yes |

Q5.3: Do companies agree that in solution 1b) MNO has no or partial visibility of data content for UE-side data collection depending on SLA?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | No, we think the data content should be visible to the CN entity as solution 2.  [Rapp] This question is for solution 1b, not solution2. |
| Apple | Yes with comments:   1. We think the difference between solution 1a) and solution 1b) is just whether the offline agreement has 3GPP impact or not (i.e., offline engineering in solution 1a vs SLA in solution 1b). Please note that both solutions need offline negotiation between particular pair of MNO and UE vendor. And the efforts of offline negotiation should be equal for solution 1a) and solution 1b). 2. In the case of “MNO has partial visibility of data content”, which part of the data content can be visible to MNOs should be left to SA3 to decide, as it is impacting UE security and privacy.   And similar to Q5.3, we think the partial visibility of data content should also fulfill compliance with regulations. Thus, we suggest below change:  in solution 1b) MNO has no or partial visibility of data content compliant with regulations for UE-side data collection depending on SLA  [vivo] I agree we should be careful with the wording, but we do not think RAN2 is the right WG to make assessment on “compliance with regulations”. |
| BT | No. We consider UE-side data collector is inside the MNO network. Consequently, MNO has full visibility |
| Nokia | No. We think that no visibility, partial visibility, and full visibility are all options for solution 1b data collection. We think that partial visibility should also be defined.  We think that partial visibility means that some fields are decodable by the MNO and others are not decodable, e.g., proprietary measurement types. Additionally, we do not think that discussion about SLAs is in RAN2 scope, and we should instead discuss what type of access could be enabled from a third party. |
| Ericsson | No, visibility (full or partial) can be achieved for option 1b, as in the other solutions. The data that should be visible (e.g. based on an SLA agreement) can be first terminated within a termination entity inside the MNO (as per Q3.2), whereas data that should not be visible can be encrypted by the UE and not made visible. For example, upon receiving a service request from the UE for data collection, the operator can configure the network to setup different QoS flows, i.e. a QoS flow for the data that should be visible to the MNO, and a QoS flow for data that should not be visible. With the same approach, all data can be made visible, if needed. The UE will then encrypt data accordingly to ensure that certain data can be visible to the operator. |
| Huawei, HiSilicon | No.  In Solution 1b), how MNO can access the data content is unclear to us. |
| OPPO | No  We think for solution 1b, MNO has no visibility of data content for UE-side data collection from 3GPP perspective. If companies think some types of data are visible to MNO within 3GPP, please clarify what metric is visible to MNO and how MNO can be visible from spec perspective. We understand the SLA is for PDU session not for data content, please clarify. |
| Mediatek | Yes.  If the server for UE-side data collection is outside of MNO, MNO has no visibility of data content, since the data is transferred directly to the server of the MNO without stopping in the MNO network. If the server for UE-side data collection is inside of MNO, MNO is able to have partial visibility or full visibility of the data content according to the SLA. |
| vivo | For solution 1b, the MNO should be able to have full control of the data content/type exchanged between UE and server. |
| CATT | We tend to keep all options open for now, so visibility (full or partial) can be achieved for option 1b, as in the other solutions. |
| Spreadtrum | No, we think MNO cannot access to the data content. Maybe MNO can control/know what type of data is reported but cannot know the details of data content. |
| ZTE | Agree with MTK. |
| China Unicom | No, share the same view with BT. |
| Xiaomi | No. In option 1b, MNO has no visibility of data content as the server for UE side data collection is outside MNO. |
| Samsung | The level or granularity of data visibility for solution 1b) is not clear.  Regarding the “data visibility depending on SLA”, this is discussion is not within RAN2 scope. |
| Lenovo | Partially  Yes, to no visibility, wherein MNO only has controllability on the data transfer as in Q4.3.  Maybe to partial/full visibility. Both are theoretically possible as commented by some companies. But then not sure what is the difference compared to solution 2. |
| Qualcomm | Yes. SLA between MNO and vendor is required.  The MNO can have “Full visibility”, “Partial Visibility” or “No Visibility” (as defined by rapp.) based on SLA between the MNO and vendor, regardless of whether server is inside/outside MNO. |
| Sharp | It depends if the sever for UE-side data collection is inside or outside the MNO. At this point it should not be limited and all (full, partial, or no) visibility options can be considered. |
| CMCC | If the termination entity is outside of MNO, solution 1b) is the same as solution 1a), i.e. solution 1b) is no visibility.  If the termination entity is within MNO, solution 1b) can be reflected in solution 2 and 3, so the comment is similar to Q5.4. That is, solution 1b) is no, or partial or full visibility depending on whether/how the data content is 3GPP specified. |
| Intel | In our understanding, SLA between operator and server can include the information that the UE shares with the server, subject to user consent. A certain data anonymization, aggregation or normalization algorithms may be applied to the collected data. Hence, MNO or the server may have the visibility of the post-processing (i.e. anonymization, aggregation, normalization, subject to user consent, etc) of the collected data. |
| Fujitsu | No.  Currently, for 1b, MNO has no visibility of data content no matter whether the UE server is inside or outside of the MNO. |
| Interdigital | We think the difference from solution 1a is controllability (i.e., also no visibility of content of data in case 1b) |
| Futurewei | As we mentioned earlier, suggest removing Solution 1b) as it can be covered by Solution 2 and 3 (CMCC has a good explanation). |
| DISH | No. We think 1b can be made to have full visibility as what described by Ericsson. |

Q5.4: Do companies agree that in solution 2 and 3 MNO is able to have full visibility of data content for UE-side data collection?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | No, we think the data content should be visible to the CN entity for solution 2.  It is FFS for Solution-3, which may be up to the discussion at SA5. |
| Apple | No, it depends on whether/how the data content is 3GPP specified:   * If whole data content is UE vendor’s proprietary format, MNO has no visibility because MNO can’t comprehend it and thereby can’t use the data. * If some part of data content is UE vendor’s proprietary format (e.g. a container in RRC message) and other part is 3GPP specified format, MNO may have partial visibility.   + In this case, which part of the data content can be visible to MNOs should be left to SA3 to decide, as it is impacting UE security and privacy. * If whole data content is 3GPP format (e.g. specified IE in RRC message), MNO may have full visibility.   Since RAN1 is still discussing specification of data/metric for data collection, RAN2 can’t assume all data contents are 3GPP specified. If necessary, we can send LS to RAN1 for confirmation.    And similar to Q5.3 and 5.4, we think the partial/full visibility of data content should also fulfill compliance with regulations. Thus, we suggest below change:  in solution 2 and 3 MNO ~~is able to have~~ has no, or partial, or full visibility of data content compliant with regulations for UE-side data collection depending on whether/how the data content is 3GPP specified.  [vivo] 1) I agree we should be careful with the wording, but we do not think RAN2 is the right WG to make assessment on “compliance with regulations”. 2) I Agree whether the data content is 3GPP specified may be critical |
| BT | No. We consider UE-side data collector is inside the MNO network. Consequently, MNO has full visibility  [Rapp1] So the answer is yes, i.e., the MNO has full visibility? |
| Nokia | Yes. However, a transparent container has been discussed in the past to enable a “partial visibility” solution, at least for solution 3. |
| Ericsson | No. Adopting solution 2 or 3 does not imply automatically that all data are visible by default. There might be also some data collected by the UE that are not standardized, and those data cannot be read, hence they are not practically visible. This should be always possible, irrespective of the solution adopted. |
| Huawei, HiSilicon | No.  It depends on what data MNO is to collect.  For Solution 2 and 3, if CP solution is considered and each data is standardized in relevant CP signalling, full visiblity can be achieved. For example, if MDT framework is used for solution 3, and L1 measurements can be collected via necessary enhancements in RAN2, then L1 measurements are full visible at OAM side and also at server side. |
| OPPO | Yes with comments  Based on our understanding in Q5.1, both full data visibility and Partial data visibility have full visibility of data content, i,e, specified data with open format, the difference is on whether all vendors can get the same info from the specified data. To protect UE proprietary info, UE may get more info from some specified data. We suggest to use the following revision to make it clear:  For solution 2 and solution 3, all collected data is specified with open format. |
| Mediatek | Yes. Standardization is not the sole method to achieve visibility of data content. Visibility can be granted to the MNO through business agreements, whereby the vendor discloses the data to the MNO that enters into such a business or cooperation contract.  [Apple] We are not sure why RAN2 has expertise to determine partial/full visibility of data content through business agreement rather than standardization. According to TS 33.501, the only one place on “visibility” is section 5.10.1 (“security visibility”) which only means the UE can see NW’s security configuration. We have concern this new concept will confuse SA3.  [vivo] Standardization can achieve a common understanding on visibility. So we think taking standardized data content as starting point is the simple and safe way |
| vivo | Yes |
| CATT | We tend to keep all options open for now, so visibility (none, full or partial) can be achieved for option 2 and 3, as in the other solutions. |
| Spreadtrum | Yes |
| ZTE | Yes. |
| China Unicom | Yes with comment. We agree that in solution 2 and 3 MNO ~~is able to~~ have full visibility of data content for UE-side data collection. |
| Xiaomi | It depends on the signalling format defined. With data format explicitly specified, full visibility can be achieved. If container is used, there could be partial visibility. |
| Samsung | No.  Refer to answer to Q5.1. The discussion on data visibility is pending/depends on RAN1 discussion on data content. |
| Lenovo | Yes. This can be taken as the starting point to distinguish from solution 1b. |
| Qualcomm | No.  Defining all the parameters to be collected is infeasible, as training for target UE devices has more offline engineering aspects. Therefore, full visibility is infeasible for solution 2 and 3. |
| Sharp | Yes (it maybe clarified what is the scope, meaning and definition of ‘Full’ visibility.) |
| CMCC | We agree with Apple that it depends on whether/how the data content is 3GPP specified. |
| Intel | We need to further clarify whether visibility means standardization.  Agree that with solution 2/3, it is possible to standardize data collected from UE over 3GPP signaling. If there’s non-standardized data collected via solution 2/3, can we clarify that those data are transferred via container using the same method as standardized data? otherwise, it is confusing how to interpret the solution for standardized data and non-standardized data in solution 2/3. |
| Fujitsu | Yes for solution 3;  Yes for solution 2 if CP solution is considered as said in Q4.4. |
| Interdigital | Not necessarily. For example, there may be some components of the data that is being collected that is proprietary to the UE vendor that should not be visible to the MNO. |
| Futurewei | We can agree if we change the statement from “**have full visibility**” to “**have full or partial visibility**”. |
| DISH | Yes. Full visibility in the last/final termination node.  Depending on the protocol used for data transfer, some clarifications is needed whether the data is visible in the intermediate nodes terminating each protocol. |

## 2.6 Protocol layer for Data Transfer

For solution 1a and 1b, the server for UE-side data collection receives data from the UE through the application layer, utilizing a UP tunnel for transmission. It should be noted that from user’s perspective, the data transfer from the UE to the server via UP tunnel is consider as traffic and is subject to data usage charges.

Q6.1: Do companies agree that in solution 1a) and 1b) the data transfer from the UE to the server for UE-side data collection is through the application layer, utilizing a UP tunnel for transmission?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | Yes |
|  |  |
| BT | Yes.  This data will be considered as user plane. Therefore, it is the end customer who must pay for it (perhaps without being aware of it). |
| Nokia | Yes. Is it further implied, then, that the protocol for data transmission is proprietary, or are there standardized solutions, e.g., in the case of solution 1b? |
| Ericsson | Yes |
| Huawei, HiSilicon | Yes |
| OPPO | Yes |
| Mediatek | Yes |
| vivo | Yes |
| CATT | Partially Yes. Option 1a can also refer to a training data delivery by WIFI or other approaches. |
| Spreadtrum | Yes |
| ZTE | * For option 1a, Yes. * For option 1b:   + In the case of the UE server for UE side data collection outside the MNO, we consider it shall be as same as option 1a, the IP network including normal UP tunnel can be applied for transmission.   + In the case of the UE server for UE side data collection inside the MNO, we consider it can be either UP tunnel (Non-IP Data delivery) or CP transmission. |
| China Unicom | Yes for 1b. 1a is out of the scope of 3GPP, whether the transmission is executed by utilizing a UP tunnel is implementation solutions. |
| Xiaomi | Yes. |
| Samsung | Yes |
| Lenovo | Yes |
| Qualcomm | Yes |
| Sharp | Yes |
| CMCC | Yes |
| Intel | In our understanding, solution 1a is outside of 3GPP, i.e. not using UP tunnel. Solution 1b can use UP for data transfer. |
| Fujitsu | Yes |
| Interdigital | Ok to consider as baseline, but as commented in some of the questions above, protocol aspects can be discussed once after companies have a common understanding of all the solutions. |
| Futurewei | Yes |

For solution 2, the UE collects training data and transfers it to the CN, which then forwards the data to the UE-side server. As a basic approach, the data transfer from the UE to the CN can be conducted through the NAS layer using CP tunnel. The necessity for a UP tunnel to facilitate data transfer from the UE to the CN depends on the data volume, which is based on the requirements provided by RAN1. The feasibility of support a UP tunnel falls under the purview of SA2.

Q6.2: Do companies agree that in solution 2, the baseline method for data transfer from the UE to the CN, is through the NAS layer, utilizing a CP tunnel for transmission?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes, the CP can be the baseline. On the other hand, RAN2 should keep the UP possibility on the table which is pending SA2 discussion. |
| Apple | Yes |
| BT | Not in a position to answer this question without knowing the data volume required for different AI/ML algorithms. |
| Nokia | Yes. To properly differentiate between solution 1b and 2, we think that it is necessary to restrict solution 2 to NAS signaling between the UE and AMF. It is FFS whether additional signaling would be required between the AMF and gNB. |
| Ericsson | No, agree with BT. Feasibility should be assessed in SA2. NAS is not designed today to carry large amount of data. Since data collection may imply the transfer of large amount of data, whether NAS is a feasible solution should be discussed in SA2. RAN2 cannot rule out non-NAS based solution. |
| Huawei, HiSilicon | Yes with comments.  We think Solution 2 can take CP for discussions first, but no need to discuss signalling details for now. |
| OPPO | Yes |
| Mediatek | Yes |
| vivo | We tend to focus on positioning for solution 2.  The data can be transferred from UE to LMF via LPP, which can utilize either CP or UP tunnel |
| CATT | Ok to consider this as baseline |
| Spreadtrum | Yes |
| ZTE | Yes, CP is baseline. |
| China Unicom | Yes for the CP solution, signalling design can be further discussed. |
| Xiaomi | Yes with comments. We think RAN2 can take CP solution as baseline, and may investigate UP solution if CP solution is not sufficient e.g. for large amount of data. |
| Samsung | Yes |
| Lenovo | Mostly Yes, except that for positioning LPP over UP is also supported now. We are open to discuss other UP based solution with SA2’s involvement. |
| Qualcomm | Yes. |
| Sharp | Yes |
| CMCC | Yes, CP solution can be baseline. |
| Intel | Whether to use CP or UP to collect data from UE to CN should be up to SA2. |
| Fujitsu | No,  CP solution is the baseline. For whether to use NAS layer or RRC layer can be further discussed. |
| Interdigital | Same answer as Q6.2 |
| Futurewei | Agree with Ericsson and Intel; this is up to SA to decide. |
| DISH | Depends on the data volume. |

For solution 3, the UE collects training data and transfers it to the OAM, which then forwards the data to the UE-side server. As a basic approach, the data transfer from the UE to the OAM via RAN node can be conducted through the RRC layer using CP tunnel. The necessity for a UP tunnel to facilitate data transfer from the UE to the OAM depends on the data volume, which is based on the requirements provided by RAN1. The feasibility of support a UP tunnel falls under the purview of SA5.

Q6.3: Do companies agree that in solution 3, the baseline method for data transfer from the UE to OAM via RAN node is through the RRC layer, utilizing a CP tunnel for transmission?

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| NEC | Yes |
| Apple | Yes |
| BT | Not in a position to answer this question without knowing the data volume required for different AI/ML algorithms. |
| Nokia | Yes. We should reuse the legacy approach. |
| Ericsson | Too early to say, agree with BT. For the reasons mentioned above related to NAS, the feasibility of other solutions should be assessed by SA2/SA5. |
| Huawei, HiSilicon | Yes with comments.  We think Solution 2 can take CP for discussions first, but no need to discuss signalling details for now. |
| OPPO | Yes |
| Mediatek | Yes |
| vivo | Yes, we tend to focus on beam management for solution 2 and reuse MDT. |
| CATT | Ok to consider this as baseline |
| Spreadtrum | Yes |
| ZTE | Yes, CP is baseline. |
| China Unicom | Yes. |
| Xiaomi | Yes with comments. Similar to Q6.2, we think RAN2 can take CP solution as baseline, and may investigate UP solution if CP solution is not sufficient e.g. for large amount of data. |
| Samsung | Yes |
| Lenovo | Yes as baseline. We are open to discuss other UP based solution with SA2’s involvement. |
| Qualcomm | Yes. |
| Sharp | Yes, as baseline |
| CMCC | Yes, CP solution can be baseline. |
| Intel | Yes |
| Fujitsu | Yes |
| Interdigital | Same comment as Q6.2 |
| Futurewei | Yes, can be the baseline. |
| DISH | Depends on data volume. |

Q6.4: For solution 2 and 3, interested company please share their view on solution details of UP tunnel solutions.

|  |  |
| --- | --- |
| Company | Yes/No (Comment) |
| Apple | We are open to discuss UP option for solution 2 and 3. However, we are not sure how it works for now. According to current NR definition of UP tunnel, it is between UE and UPF, i.e. **the terminated entity is UPF in UL**. It seems to be conflicted with option 2 (3GPP terminated entity is one NF in CN) and option 3 (3GPP terminated entity is OAM). We believe a new Network Architecture and new protocol stack is not in Rel-19 scope. |
| Nokia | With regard to Apple’s comment that for the CN approach, the UPF is the termination point of UP traffic, we think that the use of the UPF should not be considered a CN approach in particular. The CN approach should terminate in a CN entity other than a UPF prior to any data transfer to a server which trains UE-side models. |
| Ericsson | Solutions other than NAS/RRC can be taken into account and assessed by SA WGs. |
| Huawei, HiSilicon | For UP solutions for solution 2/3, the collected data is totally invisible to the intermediate node(s) (e.g. CN, OAM), then how to protect privacy is a big problem. |
| Mediatek | For UP solution for solution 3, maybe we can have UP tunnel between UE and OAM. The data can be transferred to from UE to OAM through UP tunnel with RAN control. |
| vivo | SA2 already introduced the UP solution for LPP procedure between UE and LMF. |
| Spreadtrum | It may depend on SA2 discussion.  Our understanding is we can mimic UP-based LPP procedure if it is necessary, i.e., to establish connection between UPF and data collection entity in CN. In this case, UPF can forward the data to the data collection entity. |
| ZTE | UP solution for option 2 have some kind of existing structure to do that in SA2, the NEF based non-IP data delivery. However, we agree with HW that the privacy protection is a big problem. |
| Xiaomi | This is similar to positioning over user plane connection between UE and LMF (TS 23.273 clause 5.10 and TS 24.572). |
| Qualcomm | Same view as Apple. |
| CMCC | We agree with HW that the privacy protection is a big problem for UP solution. |
| Intel | For solution 2, it is up to SA2 to decide how to support UP for data collection if needed. |
| Fujitsu | Agree with Apple and Huawei |

## 2.7 Privacy Concerns

Privacy concerns in the communications ecosystem can vary significantly among different stakeholders, such as MNOs, network vendors, OEMs, and chipset vendors. Each entity has its own set of sensitive information that needs to be protected from unauthorized disclosure. Here are more detailed examples of privacy concerns for each stakeholder:

MNO Privacy Concerns:

* Network Information Disclosure: MNOs may inadvertently disclose sensitive network information, such as deployment strategies, network configurations, and performance metrics, to servers outside their network.
* Data Transfer Risks: When transferring data to external servers, there is a risk that the data may contain undisclosed information about the network or its users/customers. This could include subscriber identities, locations, website visited, phone calls, etc and other proprietary information that MNOs are obligated to protect.

Network Vendor Privacy Concerns:

* Sensitive Information Leakage: Network vendors may possess proprietary algorithms, system designs, and other intellectual property that are integral to their competitive edge. Unintentional disclosure of such information to third parties could undermine their market position and lead to potential legal issues.
* Implementation Details Exposure: The specific details of how network equipment is implemented, including software and hardware design, are crucial for maintaining the security and integrity of the network. If such information is disclosed, it could be exploited for malicious purposes or used by competitors to gain insights into the vendor's technology.

Chipset Vendor Privacy Concerns:

* Proprietary Technology Exposure: Chipset vendors develop specialized hardware and software that may contain trade secrets or patented technologies. here is a risk that shared information could be unintentionally disclosed to unauthorized parties, leading to privacy breaches.

OEM Privacy Concerns:

* User Information Disclosure: OEMs handle a vast amount of user data, including personal information, usage habits, and location data. There is a significant privacy concern if this information is disclosed to external entities without user consent, potentially violating privacy laws and damaging the OEM's reputation.

For all stakeholders, it is essential to implement robust data protection measures, such as encryption, access controls, and privacy policies, to mitigate these privacy concerns. Additionally, compliance with regulations like the General Data Protection Regulation (GDPR) and other local privacy laws is crucial for maintaining trust and legal standing in the market.

Companies are encouraged to clearly define and express their privacy concerns, even if these concerns may not be the primary focus of RAN2. There is a prevailing sentiment that companies have underlying fears that they have not been able to precisely define. This ambiguity regarding the specific nature of their concerns is not conducive to advancing our collective work on data collection. A well-defined awareness of the privacy issues at stake is important for facilitating meaningful progress in our study.

Q7: What’s your privacy concerns on the data collection?

|  |  |
| --- | --- |
| Company | Comment |
| Apple | As both UE vendor and chipset vendor, we have strong concerns on privacy from below aspects:   1. Concerns on UE Privacy:    * As UE vendor, we have strong concern on exposure of UE privacy to unknown 3rd entity. We believe it is always most sensitive issue to all UE vendors, and it may violate privacy laws and damage the OEM's reputation.    * The UE privacy at least includes UE Identities (SUPI, IP address, etc.), personal information, UE location, and UE trajectory information, etc.    * Thus, explicit UE consent for data collection is a must. Furthermore, we don’t think existing 3GPP specified UE consent mechanism/requirements in TS 33.501 Annex V (e.g. consent of MDT) is applied in this case because we understand it only specifies whether and how NFs in MNO domain check the user consent before processing the data. User consent mechanism for the scenario of sharing data outside of MNO domain has not been discussed in 3GPP yet. Without a proper mechanism on collecting user consent for sharing data outside of MNO domain, any solution will be risky to violate the user privacy as well as the regional regulations. 2. Concern on exposure of proprietary implementation to other vendors:    * It is common understanding that chipset vendor can have some proprietary implementation on top of 3GPP specification. And UE differentiation is one of most important reasons why 3GPP can build successful ecosystem so far. We believe any challenging of this principle will challenge success of 3GPP.    * As chipset vendor, we have strong concern on exposure of our proprietary implementation to other vendors, including other chipset vendors, UE vendors, NW vendors, MNOs, and any 3rd entity.    * Thus, we do not agree any solution which has potential risk of exposure of proprietary implementation to other vendors. And we believe not exposure of proprietary implementation to other vendors should be one of the most important requirements for UE data collection design. |
| BT | It is the operator who is under regulatory restriction. The lack of control and knowledge over collected data may result on an undesired exposure of our customers personal data. Most likely, it will conclude on penalties for operators as we will break regional regulations. In consequence, MNOs requires tools to stop it.  Option 1a is the only one that exempts operators from any responsibility, but that solution is totally outside 3GPP. It cannot be even considered as baseline.  Collected data will expose our network design and network strategy. Any disclaim of that information will have a negative impact. |
| Nokia | An additional privacy concern on Network Vendor that is not covered here is that radio topology and radio specific settings can be disclosed, and standard should not enable this. |
| Ericsson | All the concerns above can be taken into account. Agree with Nokia, about adding NW vendor privacy concerns.  It is important also to stress that irrespective of the solution used for transferring the collected data, the parties involved in the data collection transfer should always ensure the above privacy principles. This means that also for 1a), the above principles should be respected by the involved parties. |
| Huawei, HiSilicon | For the above bullets, our comments are as below:  For Network Vendor Privacy Concerns:  Suggest to add the following bullet:  • Violation of user privacy regulation: The equipment of the network vendor may be used for collecting user’s data without getting approval/consent from the user in advance, and this behaviour may violate the local regulations and risks the sales of the equipment.  For Chipset Vendor Privacy Concerns:  Add more description for Proprietary Technology Exposure:  Another risk is that some sensitive data of a chipset vendor may be exposed to a second vendor without the knowledge of the chipset vendor.  For OEM Privacy Concerns:  Suggest to add the following bullet:  • Proprietary Technology Exposure: OEM vendors develop specialized hardware and software that may contain trade secrets or patented technologies. here is a risk that shared information could be unintentionally disclosed to unauthorized parties, leading to privacy breaches. Another risk is that some sensitive data of a OEM vendor may be exposed to a second vendor without the knowledge of the OEM vendor.  We have more comments for listed solutions:  For Solution 1a), if user consent is used via implementation, we understand that all the user data are delivered within the user itself, with the 3GPP entities involved as transparent path, so we observe no privacy issues.  For Solution 1b), as we commented in section 2.4 and 2.5, this solution can not achieve "full" controllability and visibility, so there may be privacy issues.  For Solution 2 and 3, as we commented above, some sensitive data of a chipset/OEM vendor may be exposed to a second vendor without the knowledge of the chipset/OEM vendor, so there may be privacy issues. |
| OPPO | From UE vendor, i.e. OEM, point of view, all data generated from UE internally naturally belongs to the customer, no matter the data is coming from modem or camera or other software/hardware. UE vendor should have full visibility of any data ported from UE side no matter the data collection termination entity, e.g. UE cloud/other server not belonging to UE vendor/NW entity within 3GPP; otherwise, there is high risk to violate privacy laws and damage the OEM's reputation. |
| vivo | 1. User data exposure without user consent. And user consent should guarantee specified data collection from UE.  2. UE vendor-specific info exposed to other vendors. |
| Spreadtrum | Rapporteur’s views on privacy concern make sense.  As chipset vendor, we hope our hardware design and associated algorithms can be protected and do not been exposed. |
| ZTE | The same view with Nokia, the radio related setting shall not be disclosed by the standards. |
| China Unicom | 1. Concerns on the network design and network strategy exposure. 2. Concerns on the private data leak, and user behavior exposure, which may violate the regulation and law. |
| Xiaomi | In general, all stakeholders’ privacy concerns should be respected. Specifically for UE side data collection, our understanding is that UE cannot collect data related to MNO privacy (e.g. deployment strategy) and network vendor privacy (e.g. hardware and software design). Therefore chipset vendor and OEM privacy concern are more relevant for UE side data collection. Data should be only accessible to MNO or third parties when there are user consent and SLA in place. |
| Samsung | As we explained in [R2-2402375](https://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN2/Docs/R2-2402375.zip), one of the major privacy concern is related to:  Disclosure of user data to a third party (Option 1b, 2 and 3):   * One of the major implication and limitation that RAN2 need to consider in the study of option 1b, 2, and 3, is the potential serious threat of exposing sensitive vendor information and/or user data security/privacy, due to disclosing data to a third party, e.g. without knowledge of UE vendor that holds a data protection legal agreement with the user. However, considering that option 1b, 2 and 3, have no clear framework/signalling that could address the threat to vendor information and/or user data, any study or detailed analyses to specify such signalling, will result in huge workload to RAN2 and other working groups, even for a feasibility study. In this purpose, we believe that option 1a is the only feasible solution that would avoid the threat of disclosing sensitive data without the need to trigger any cumbersome discussions in RAN2 and other WGs. * Moreover, the “Chipset Vendor Privacy Concerns”, should be modified to “UE vendor” to encompass both Chipset Vendor and UE vendor”. |
| Lenovo | Agree that all the concerns mentioned by rapporteur and other companies could be considered. |
| Qualcomm | As we mentioned, in our contribution paper [24], we have concerns with the sharing of UE proprietary information with other UE vendors, infra vendors, MNO (without SLA), and third parties.  We have similar understanding/concerns, as raised by Apple   * UE vendors can utilize proprietary implementation on top of 3GPP standardized parameters. This is not only useful for the UE differentiation but also required by the UE vendors, in the process of model development, such that they can test the coexistence of an AI/ML-enabled feature/FG with other AI/ML-enabled feature/FG and non-AI/ML-enabled feature/FG. * We have concerns about the exposure of our proprietary implementation to other vendors, including, other UE vendors, NW vendors, MNOs (without SLA), and any 3rd entity.   Therefore, from the UE vendor perspective, as we mentioned in our paper [24], the below should be the baseline requirement:  The data collected from/by one UE vendor cannot be shared with other UE vendors, network vendors, MNO (without SLA), or third parties. |
| CMCC | We share the same view with BT. |
| Interdigital | We think rapporteur’s summary have captured the major concerns. Specifically, the main privacy concerns are:   * exposure of data without UE consent (e.g., identity, location, etc.), * exposure of network deployment/configuration, * exposure of UE vendor’s proprietary information (e.g., implementation related, configuration related) |
| DISH | Agree that privacy concerns listed by the moderators need to be considered when in evaluating solutions. Solutions should be designed to satisfy those privacy aspects.  In addition, we would like to understand companies’ (RAN2) understanding with regard to the ownership of the data generated in/by the UE (device) and in this case, collected/transferred to a “server” for the purpose of AI/ML training.  Our understanding is that MNO owns and reserves the right to use those data for any network optimizations and/or device/user experience improvement effort (including by AI/ML with UE sided training, NW sided training or combination of the two). Therefore MNO is responsible to ensure that all the privacy/security aspects are enforced whenever this data is transferred from UE to a server. The legal agreement for this should be covered in user contract to use MNO’s network. (or different MNO may have different way of enforcing user policy agreement) But nonetheless, it seems that Samsung (and other UE vendors) may have different view that these data belongs to the UE vendor (and therefore thinks that only solution 1a can satisfy the privacy concern since it is assumed that the legal agreement is between user and UE vendor). Maybe clarifying this aspect may help to understand why MNOs think that it’s important to have solution with full controllability and visibility. |

# 3 Appendix

Table 1 Comparative analysis among different data collection approaches

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Aspects | 1a) OTT (3GPP Transparent) | 1b) OTT (Non-3GPP Transparent) | 2. Transfer via Core Network | 3. Transfer via OAM |
| Termination Entity | UE-side OTT server | UE-side OTT server | CN | OAM |
| Inside/outside MNO’s network | Outside | Inside/Outside | Inside/outside | Inside/outside |
| Transport Tunnel | UP tunnel (Note: data collection may be charged as normal traffic.) | UP tunnel (Note: data collection may be charged as normal traffic.) | CP tunnel (FFS: UP tunnel) | CP tunnel (FFS: UP tunnel) |
| Protocol layer for data transfer | Application layer | Application layer | NAS or RRC layer (FFS: transport layer of UP tunnel) | RRC layer (FFS: transport layer of UP tunnel) |
| Data Collection Controller | UE-side OTT server | CN (certain NF, e.g., DCAF) | CN | OAM/RAN |
| Control Granularity by NW | NA, the OTT server can directly request data from the UE. | Coarse e.g., based on SLA | Finer (e.g., per NAS procedure) | Finer (e.g., per RRC procedure) |
| RAN Intervene | No | No | Possible | Yes |
| Radio Resource Efficiency | Low, as the network cannot optimize radio resource usage for data transfer | Low, as the network cannot optimize radio resource usage for data transfer | Higher, due to the possibility of RAN intervene | Maximum |
| Data format | Non-standardized | Non-standardized | Standardized/non-standardized | Standardized/non-standardized |
| Network Awareness of the data Content | No | No | Yes, if the data content is standardized or disclosed to MNO. | Yes, if the data content is standardized or disclosed to MNO. |
| RAN configuration/condition acquisition | Unclear whether the RAN configuration/condition acquired by the UE can be transferred to the UE-side OTT server. | Unclear whether the RAN configuration/condition acquired by the UE can be transferred to the UE-side OTT server and how the CN can control it with limited intervene. | Controlled by MNO | Controlled by MNO |
| Spec Impact | No | Limited | High | High |
| Security and Privacy Risk | High, managed by the OTT application, with potential risks if not 3GPP compliant | Lower, managed by the OTT application and NF based on SLA. | Minimum, NW can enforce security and privacy protection. | Minimum, NW can enforce security and privacy protection. |
| Involved WGs | No | SA2 | RAN2, SA2 | RAN2, SA2, SA5 |

# 4 Conclusion



# 5 Reference

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