**3GPP TSG RAN WG2 Meeting #127 R2-24xxxxx**

Maastricht, Netherlands, Aug 19th– 23rd, 2024

Agenda Item: 8.1.2.2

Source: Intel Corporation

Title: Report of [POST126][032][AI/ML PHY] LCM (Intel/Samsung)\_Phase 2

Document for: Discussion and Decision

# Introduction

This report provides a summary for the following post-meeting email discussion:

* [POST126][032][AI/ML PHY] LCM (Intel/Samsung)

Intended outcome:

Phase 1: Agreable definitions (Samsung)

Phase 2: Reach common understanding of reactive/proactive framework for applicable functionality.

Deadline: long

Deadline for providing initial comments for phase 2 is July 26th, 2024, 10:00 UTC.

Deadline for final comments based on rapporteur’s phase 2 summary is Aug 2nd, 2024, 10:00 UTC.

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

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# Phase 2 Discussion

During phase 1 discussion, following definitions of functionalities (with majority view) are summarized:

Supported functionalities refer to functionalities that UE can indicate by using UE capability signalling.

Applicable functionalities refer to functionalities that the UE is ready to apply for model inference.

Activated functionalities refer to functionalities already activated and performing inference.

In phase 2, we will mainly focus on the signaling framework for applicable functionality reporting. To facilitate the discussion, following assumptions are considered:

* The discussion in Section 2.1 and Section 2.2 first focuses on beam management use case. Whether the conclusion for beam management can also be applicable to positioning use cases will be discussed in Section 2.4.
* The applicability reporting is only focusing on model inference purpose first, according to the observation from companies’ feedback in phase 1 Q3.

Before discussing the signaling framework, rapporteur would like to first discuss the understanding of NW-side and UE-side additional condition.

As we discussed in NW-sided model, UE-side additional condition may refer to UE speed, scenario, hardware capabilities, etc. The understanding of UE-side additional condition for UE-sided model is the same as NW-sided model. However, it is not clear what is the exact meaning of NW-side additional condition.

RAN1 summarized NW-side additional conditions in summarized in R1-2405680 :

* Mapping relationship of Set A and Set B, including ordering to (a set of ID, or resource )
* Consistency of downlink spatial domain transmission filters corresponding to the beams in Set A and Set B.
* QCL assumption
* The order of model input and model output.
* between RS and Tx beams can be pre-defined.
* Transmission power
* UE distribution
* antenna height
* Deployment scenarios (e.g., ISD, Umi/Uma)
* ensure consistency across different cells.

Note that it’s not rapporteur’s intention to discuss what is considered as NW-side additional condition or the definition of NW-side additional condition in this discussion. However, considering RAN2 is focusing on signaling framework of proactive/reactive reporting, it’s good to understand how this information is reflected in RRC signaling, if NW-side additional condition needs to be signaled over the air interface.

Therefore, rapporteur would like to collect companies’ view on what is the NW-side additional condition first before discussing the signaling procedure.

#### Q0-1: What is the representative of NW-side additional condition of a functionality in RRC signaling (e.g. network supported functionalities, network supported AI/ML resource configurations of the supported functionality, etc)?

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| --- | --- |
| **Company** | **Comment** |
| OPPO | In our view, NW side resource configurations can be divided into two categories:  Category A1(specified configurations used by UE for specific functionality but needs alignment with NW): the configurations configured to UE via dedicated signaling or broadcast signaling or default manner, i.e. Category A1 resource configurations can be known by UE via 3GPP specified method. For instance, BWP configuration, RB configuration, gap configuration and so on.  Category A2(specified configurations used by NW for specific functionality without UE involvement): the configurations are not configured to UE but specified via some spec e.g. NG, Xn, F1 and E1 spec. For instance, load info, interference coordination info and so on.  Category B1(NW implementation-based configurations which can impact inference performance for UE sided model): the configurations are not configured to UE, i.e. Category B1 resource configurations cannot be known by UE via 3GPP specified method but such configuration can significantly impact the inference performance of UE sided model. For instance, beam and Tx port mapping relationship, NW antenna shape, Antenna dip angle, height of gNB and so on.  Category B2(NW implementation-based configurations which has no impact on inference performance for UE sided model): the configurations are not configured to UE, i.e. Category B2 resource configurations cannot be known by UE via 3GPP specified method and such configuration has no significant impact on the inference performance of UE sided model. For instance, the algorism configuration for HO decision and so on.  [Mediatek] To clarify, if the additional condition on the network side involves only implementation configuration and does not impact the inference process, we could exclude this category from consideration as it remains entirely transparent to both the UE and the air interface. Is that correct?  In our view, when we’re talking about NW-side additional condition, it’s in relation with Category B1 resource configurations above. Because for Category A1 resource configurations, based on UE capability reporting, NW usually knows which specified data can be workable from UE point of view. As for Category A2/B2 resource configurations, it has no impact on inference performance for UE sided model, which is not related to UE side applicable functionality judgement.  More specific, from UE perspective, NW configured inference configuration includes two parts:  Part 1: Category A1 configurations, i.e. Normal specified functionality configurations, e.g. set A and/or set B resources for BM inference.  Part 2: Category B1 configurations, based on RAN1 progress, RAN1 has intention to introduce associated ID to implement Category B1 configurations, which can address the privacy concerns from NW vendor.  Based on above, we have the following definition for NW-side additional condition:   * **NW implementation-based configurations which can impact the consistency between training and inference for UE sided model**;   OPPO2：Thanks Rapp to give more info from RAN1 for NW-side additional conditions, but I would like to clarify the bullets listed here has no consensus by RAN1, RAN1 just lists all the possibility raised up by companies, some bullets even only supported by one company, so the bullets here are just for information to know all the possibility raised up by companies.  I was a little confused by the clarification from Rapp adding later, if we don’t touch what is considered as NW-side additional condition, how can we justify that UE capability signalling is not enough, anyway we should clarify the relationship between UE capability and additional condition reporting. We understand UE capability reporting+ additional condition reporting can tell NW the information needed to configure UE properly. For instance, UE reports its supporting two beam prediction functionalities: 4(input)-to-8(output) prediction and 8-to-16, based on UE capability signalling, at this stage (NW only obtains UE AI functionality capability), NW already knows which RS resources can be configured to UE side based on UE capability signalling, there is no need for NW to ask for the applicability of a specific RS resources again based on UAI, this is also the logic we follow for legacy non-AI feature, what NW does not know is the NW-side additional condition associated with UE sided model, because UE can know the NW-side additional condition associated with UE sided model only when the corresponding model is available at UE side, NW cannot get this dynamic info in advance without UE reporting. So NW should ask for such info (NW-side additional condition) via non-UE capability signalling, after this step, all info is ready from NW point of view, NW can do the configuration properly. |
| Xiaomi | We agree NW side additional condition is necessary to determine the functionality applicability. But we understand the exact meaning of NW side additional condition is up to RAN1. It’s not clear whether 3GPP would define the exact meaning of NW side additional condition. One example of NW side additional condition can be antenna pattern.  The general definition of NW side additional condition is already specified in the TR as following,  For an AI/ML-enabled feature/FG, *additional conditions* refer to any aspects that are assumed for the training of the model but are not a part of UE capability for the AI/ML-enabled feature/FG. It does not imply that *additional conditions* are necessarily specified. *Additional conditions* can be divided into two categories: NW-side additional conditions and UE-side additional conditions. Note: whether specification impact is needed is a separate discussion. |
| Futurewei | It is not very clear to us what “representative” means. To our understanding, additional conditions are the configurations under which a model was trained. Note although we are talking about functionality-based LCM, we all understand a functionality is always supported by one or more models. Therefore, NW-side additional condition are not “network supported functionalities”. These additional conditions are provided to the UE to ensure the NW and the UE are aligned on the conditions the model(s) is trained so that the UE/functionality can pick the right model for inference, for the current environment and configurations. |
| NEC | For BM-Case1 and BM-Case2 with a UE-side AI/ML model, the necessity and potential BM-specific conditions/additional conditions for functionality(ies) and/or model(s) are considered at least from the following aspects:  - information regarding model inference  - Set A / Set B configuration  - performance monitoring  - data collection  - assistance information  Among the above aspects listed in the TR, we understand consistency of Set B beams and Set A beams across training and inference would be a valid NW-sided additional condition. Followings are some examples:  ・Set size consistency for Set B, Set A: consistency in number of beams and/or associated resources for Set B and Set A, across training and inference  ・periodicity consistency for Set B, Set A: consistency in periodicity of beams and/or associated resources for Set B and Set A, across training and inference  ・relationship of Set A/ Set B (Set B is a subset of Set A or not): consistency in relationship of beams and/or associated resources for Set B and Set A, i.e, whether Set B is a subset of Set A, across training and inference |
| vivo | Tending to agree with Rapp to have general understanding on the NW-side additional conditions in RAN2 to facilitate the discussion on signalling procedure. The detailed additional conditions can be left to RAN1 to decide.  From our understanding, the NW-side additional conditions can be categorized as two types:  - **Type 1**: Beam characteristics, e.g., beam boresight direction (azimuth and elevation), 3dB beamwidth. This information can be agnostic to UE, thus can be implicitly indicated to UE as associated ID.  - **Type 2**: Set A/Set B related info, e.g., the beam index of set B. This information should be explicitly sent to UE for model inference. |
| Apple | 1) First, we suggest **RAN2 not to discuss definition of NW-side additional condition and detailed metrics of NW-side additional condition (e.g. set A and set B config):**   * As Xiaomi mentioned, its definition was already agreed in RAN1 and captured in TR 38.864. Any new definition from RAN2 perspective will confuse RAN1. * The list of metrics of NW-side additional condition from Rapporteur are only RAN1 feature lead summary of company contributions. As far we know, RAN1 didn’t make agreement for any of them. At this stage, we see no need for RAN2 to have duplicated efforts.   2) Please note RAN1 had made agreement to support associated ID at least in single cell in RAN1#117:  Working Assumption  Regarding the associated ID for Rel-19, the UE assumes that NW-side additional conditions with the same associated ID are consistent at least within a cell   * FFS: whether/how UE assumption can be applicable for multiple cells (including the feasibility study)   Based on it, we illustrate our understanding on how one NW-sided additional condition is indicated in RRC message in below figure with the following explanation:   * One “NW-sided additional condition” is associated to one inference configuration (e.g. resource of CSI set A) and/or one training configuration (e.g. resource of CSI set B) identified by the same associated ID.   + The UE trains separate AI/ML models with different dataset collected via training configuration identified by its associated ID (i.e. one associated ID->one training configuration->one AI model). * For one NW-sided additional condition” identified by one associated ID, the UE determines it is met if it identifies the same associated ID is indicated in applicability reporting configuration (i.e. consistency between inference and training is ensured).   + Please note that the UE can determine whether it is met with only associated ID (i.e. inference config is optional). Specifically, if only associated ID is provided, it is proactive reporting; If both associated ID and its corresponding inference configuration is provided, it is reactive reporting. * One “Supported functionalities” includes one or multiple “NW-sided additional condition(s)” because NW can have different training/inference configurations for one supported functionality   + For example, beam prediction in temporal domain is one supported functionality. NW may provide the following 3 NW-sided additional conditions for it:   Associated ID=1 identifies configuration of Set A / Set B under 2TX\*2RX MIMO;  Associated ID=2 identifies configuration of Set A / Set B under 4TX\*2RX MIMO;  Associated ID=3 identifies configuration of Set A / Set B under 8TX\*2RX MIMO; |
| Huawei, HiSilicon | The network side additional conditions are needed to be known to the network as part of the functionality applicability reporting. However, the details of what needs to be considered for the NW-side additional conditions are currently discussed in RAN1, so there is no need to repeat this discussion in RAN2. It may just be an associated ID as currently assumed for the BM case as in RAN1 agreement below:  At RAN1#117, it was agreed:  Working Assumption  Regarding the associated ID for Rel-19, the UE assumes that NW-side additional conditions with the same associated ID are consistent at least within a cell   * FFS: whether/how UE assumption can be applicable for multiple cells (including the feasibility study)   At RAN1#116bis, it was agreed:  Agreement  Further study, for the consistency of NW-side additional condition across training and inference for UE-sided model for BM-Case 1 and BM Case 2, where the NW-side additional condition may at least impact UE assumption on beams of Set A/Set B:   * Opt1: Based on associated ID (Referring to AI 9.1.3.3)   + FFS on what can be assumed by UE with the same associated ID across training and inference   + FFS on how associated ID is introduced, e.g., within CSI framework, or outside of CSI framework |
| ZTE | The intention of NW additional conditions for the functionality is to ensure the scenario consistency between UE side model/functionality training and inference, which has been already discussed in RAN 1 for model identification and the following alternatives are provided:  1: Associated Id  2: Performance monitoring.  With above potential solutions, the consistency can be implied by either associated Id or reflected by the performance monitoring, and hence there is no need for RAN2 to discuss the detail NW additional conditions piece by piece from RRC signalling perspective, it is too complicated and time consuming for RAN2 to do that. Moreover, RAN2 is not the WG to do the simulation so that is not a good idea for RAN2 to discuss the NW additional condition in detail.  Instead of discussing the detail NW additional conditions, RAN2 need discuss how to determine one functionality as applicable based on the potential solution as shown below :   * Assuming the associated Id is used, UE and NW consider whether one functionality is applicable by comparing the UE additional conditions with the current UE status/settings and the NW additional conditions with the current NW settings.   Assuming the performance monitoring, UE and NW consider whether one functionality is applicable by evaluating the performance of the functionality. |
| Mediatek | As RAN2 discusses the signaling framework, we are specifically focusing on those NW-side additional conditions that are perceivable to the UE, either through explicit or implicit methods.   * Explicit Signaling: Here, NW-side conditions are clearly defined and communicated. This may encompass details like radio resource configurations, including sets A and B, and potentially the cell ID. * Implicit Signaling: In this approach, NW-side conditions are not directly described but are inferred. The concept of an associated ID, as discussed in RAN1, exemplifies this method. It serves as an indirect representation of NW-side conditions, facilitating consistency between training and inference phases without overtly signaling each condition.   Per the RAN1 agreement, the associated ID emerges as a tool for maintaining the consistency of NW-side conditions across the training and inference processes. It acts as a proxy for NW-side conditions, offering the advantages of safeguarding sensitive NW implementation details and minimizing signaling overhead on the air interface. In our understanding, at least the associated ID can be considered as one representative of the NW-side condition.  However, it remains to be clarified if associated IDs alone suffice to represent all NW-side conditions, thereby eliminating the need for explicit signaling of such conditions. This determination falls under the purview of RAN1. |
| Lenovo | Rapporteur has listed the options of NW side additional condition under RAN1 discussion, and RAN1 is considering using an “associated ID” to represent the NW side additional condition. When it comes to the possible RAN2 RRC signalling impact, it would be stage 3 details and we believe it will be easier to discuss after RAN1 conclusion on the definition of NW side additional condition. In addition, NW-side additional conditions (if exist) will be necessary to determine the applicability of the functionality to maintain consistency in training and inference. Whether and how it is signalled over the air interface would depend on who determines the applicability. |
| Ericsson | We agree with HW, Xiaomi that RAN2 does not need to discuss this topic at the moment. NW-side additional conditions are needed for determining the applicability of the AIML functionality. However, how to represent them, e.g. via associated IDs and the granularity of the IDs (e.g. per resource set), is under discussion in RAN1.  RAN2 only needs to focus on protocol-related aspects (i.e. proactive/reactive reporting, activation/deactivation of functionalities), we do not need to discuss at the moment the content of the RRC configuration for the AIML inference which can be left to RAN1.  We also would like to stress that the NW-side additional condition from RAN2 point of view can just represented by possible inference configurations that the gNB can provide to the UE, and that can be represented with the associated IDs. We do not need to spend further time on what are the details of such inference configurations. That is up to RAN1, and RAN2 can discuss at a later stage how to include all the necessary IEs into the RRC signalling. |
| Fujitsu | From the description part before the question, it seems that rapporteur would like to know companies’ views on the details of NW-side additional conditions before talking about signalling and procedure, while in the question, the focus seem to become the representative forms for these conditions in RRC messages/signalling.   1. For the details of NW-side additional conditions:   The original purpose of additional condition discussion (including the early stage “condition” discussion during SI) is to avoid training/inference inconsistency. The functionality inference may not be activated or may be activated but with low performance if the UE/NW-side additional conditions between training and inference are not aligned.  Technically speaking, the additional conditions can be understood as everything which affects the functionality, i.e., the inference configurations, the network implementation configurations or even performance monitoring. It is believed that RAN1 knows the exact details by simulation and analysis. Therefore, we agree that the detailed parameters of NW-side additional conditions should be decided by RAN1.   1. For the representative forms for carrying additional conditions in RRC signalling:   As stated above, the NW-side additional conditions are important for the determination of the functionality applicability. As illustrated in the background of Q1-2, there are three options for the applicable functionality decision. For opt 1, there is no need to deliver this information from NW to UE. If needed, we believe both explicit and implicit(associated ID) solutions can be considered in the initial phase.  Therefore, we prefer to wait for the conclusion of the Q1-2. |
| Qualcomm | Note that RAN1 already agreed to use associated ID to represent network side additional conditions. We agree with Ericsson, Huawei, Xiaomi, and others that RAN2 does not need to discuss the “definition or detailed metrics of the network-side additional conditions”. The network-side additional conditions are required at the UE to determine the applicable functionalities and achieve consistency between training and inference.  We believe RAN2 can start the discussion with protocol aspects (e.g., proactive or reactive reporting, network-side additional condition signalling and its impact on inference configuration, activation/deactivation based on additional conditions, etc). If needed further RAN2 can start discussing the granularity of additional conditions, as it may have some impact on RAN2 signalling. |
| CATT | We think the NW-side additional condition is associated to AI/ML model based on the description “*additional conditions* refer to any aspects that are assumed for the training of the model” captured in TR, a functionality can be associated to one or more NW-side additional conditions.  NW-side additional condition is supposed to be acquired by UE along with AI/ML model(e.g., as meta info), it can be used for UE to determine applicable functionality based on NW’s indication of current NW-side additional condition to UE. And RAN1 has agreed to use associated ID for NW-side additional condition indication (as a starting point, for intra-cell case).  RAN2 can discuss which signaling can be used for the delivery of associated ID from NW to UE, e.g., when/how this delivery is triggered. We agree the NW-side additional condition contents is up to RAN1 discussion, and RAN2 doesn’t need to perform duplicate discussion. |
| Samsung | We agree that RAN2 doesn’t need to discuss the details of NW-side additional conditions as it will be discussed in RAN1. Nevertheless, RAN2 would need to have high-level understanding of the characteristics of NW-side additional conditions.  The following is the basic understanding of NW-side additional condition.   * It is to ensure consistency between training and inference.   + In case of beam management use case, it is very important to use the same beam codebook and/or indexing/mapping of Set A and Set B. That is, if model is trained with a data set with a certain beam codebook and index/mapping of Set A/Set B, inference could be working for the same beam codebook and index/mapping of Set A/Set B. * As one option, gNB provides associated ID for NW-side additional condition.   + The underlying assumption is that both UE and gNB knows what information is associated the associated ID. For example, a certain associated ID could be linked to a certain beam codebook and/or index/mapping of Set A/Set B.   Based on the above understanding, our answer is that NW-sided additional conditions are network supported configurations that can be applied for training and inference. In addition, with associated ID option, each distinguishable configuration is associated with each associated ID. |
| Interdigital | Our understanding is that network side additional conditions signify network conditions under which the UE side model was trained on, and that are not normally specified or indicated to the UE (i.e., not known at the UE). All the UE needs is to get this information and determine whether the concerned functionality has a model that is trained under these conditions (i.e., ensure consistency between the conditions under which the model is trained for and current conditions that inference is to be performed).  The discussion of what the network side additional condition signifies and the exact representation of it (e.g., via associated ID) is under discussion in RAN1, and RAN2 should not do a parallel discussion regarding that. RAN2 can simply assume that a network side additional condition must be checked to determine whether a functionality is applicable or not and discuss the signalling aspect of that. |
| LGE | We agree with many companies that RAN2 does not need to discuss the "definition or detailed metrics of the network-side additional conditions,". As a starting point, it seems sufficient to assume that some network-side additional condition is configured with an "associated ID." Instead, it would be beneficial to clarify whether the scope of RAN2 discussions will be limited to the UE-sided model with the UE-trains model. |
| Nokia | From TR: “For an AI/ML-enabled feature/FG, additional conditions refer to any aspects that are assumed for the training of the model but are not a part of UE capability for the AI/ML-enabled feature/FG. It does not imply that additional conditions are necessarily specified. Additional conditions can be divided into two categories: NW-side additional conditions and UE-side additional conditions.”  If the discussion is about “Information and/or indication on NW-side additional conditions is provided to UE” to ensure consistency between training and inference regarding NW-side *additional conditions*, RAN1 is already discussing “associated ID” (please refer to the RAN1 agreements on this). RAN2 may discuss how these “Associated IDs” may be configured/indicated by the NW in the training & inference phases or whether there should be other information and/or indication on NW-side additional conditions. In our view, there may be other parameters (e.g., NCGI, PCI, PLMN) that can be configured by the NW to ensure the consistency.  If the NW configures/indicates associated IDs and other parameters (e.g., NCGI, PCI, PLMN) in both data collection and inference stages, such information may be used to determine applicable functionalities in the inference stage. |
| CMCC | We agree with Apple, Huawei and other companies that there is no need to discuss the details of NW-side additional conditions in RAN2 because they are under discussion in RAN1. The network-side additional conditions are used for UE to determine whether there is the consistency between training and inference, and further determine whether the functionality is applicable. RAN2 should focus on the signaling and protocol impacts. |
| Sharp | We agree with the companies above, we do not need to discuss this now. We should wait for RAN1 discussion outcome on how to identify and represent network side additional conditions, for example using associated IDs. The network side additional conditions help UE in determining the applicability of a functionality and training and inference consistency. RAN2 can discuss this in detail later based on RAN1 outcome. |
| CEWiT | As pointed out by some of the companies, associated ID is sufficient to represent the NW-side additional conditions. |

**Summary:**

Most companies think that RAN2 should not discuss the detailed metrics of NW-side additional condition, considering there’s a parallel discussion in RAN1. Regarding to the representative of NW-side additional condition over the RRC signaling, some companies comment an example of using “associated ID”, which was agreed by RAN1 as one option. However, there’s different understanding among companies of what detailed metrics are represented by using the same associated ID:

1) Inference configuration (e.g. resource of CSI, etc)

NEC, Apple, MTK, Fujitsu, Samsung (at least beam codebook)

2) NW implementation-based configurations, e.g., beam and Tx port mapping relationship, NW antenna shape/pattern, Antenna dip angle, height of gNB, etc. There’s also a list of assumptions summarized in RAN1 FL summary.

Oppo, Xiaomi, Vivo (including beam index), Interdigital (not normally specified or indicated to UE),

3) up to RAN1

Huawei

Considering the metrics of NW-side additional condition is under RAN1 discussion, in below summary, rapporteur will use NW-side additional condition by using associated ID as an example. Furthermore, since there’s also no consensus among companies whether associated ID can also represent full inference configuration or not, according to RAN1 listed candidates, following assumptions are considered during this email discussion:

**Rapporteur Summary 1: In this email discussion and summaries, rapporteur assumes NW-side additional condition as associated ID (which is referred by majority of companies), and full inference configuration (e.g. CSI-RS resource configuration, etc) is considered separately from NW-side additional condition, i.e. it is not considered as part of NW-side additional condition in below summaries/proposals.**

Furthermore, based on how the UE trains each functionality, different functionalities may have their corresponding different NW-side additional conditions.

#### Q0-2: Do you think 1) NW-side additional condition of the functionality supported by the UE needs to be signalled to the network? 2) If it is signalled to network, is it include as part of UE capability, or as part of other RRC signaling (other than UE capability)? 3) If it is not signalled to network, what is the expectation from companies?

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| Company | **1) Yes/No** | **2) UE cap/other RRC signaling** | **3) Behavior if it’s not signalled to network** |
| OPPO | Yes with comments  This can be achieved via explicit or implicit way.  For explicit way, UE report info associated to NW-side additional condition if NW does not indicate filtering info associated to NW-side additional condition;  For implicit way, UE report Yes/No info associated to NW-side additional condition if NW indicates filtering info associated to NW-side additional condition. | Other RRC signaling (other than UE capability) is better.  Based on RAN2 previous agreement, UE should report functionality applicability only when the corresponding model(s) is available, but the model availability status can be changed in a short time, e.g. serving cell change, in this case, UE may need to update the reported functionality applicability based on the latest NW side additional condition. UE capability signaling is not suitable for such dynamic reporting procedure, so other RRC signaling (other than UE capability) is better for NW-side additional condition reporting. |  |
| Xiaomi | Yes,  We understand it’s essential for NW to know the NW-side additional condition of the functionality in following scenarios,  1) if NW is the node to determine functionality applicability,  2) if NW would like to modify the NW side additional condition to enable certain functionality applicable. | If the model/functionality is trained by UE, the associated NW-side additional condition is reported by UE.  If the model/functionality is trained by NW, the associated NW-side additional condition doesn’t need to be reported by UE.  If we focus on the first case, other signalling is preferred.  As defined in the TR, the additional condition is determined by the training data. If UE collects more training data, the associated NW-side additional condition may change. Therefore, legacy capability signalling is not applicable to carry such information. |  |
| Futurewei | Yes (in general) | Because some of the conditions may change dynamically, they should not be included in UE capability. In addition, they are called “additional” conditions for a reason; they are not part of UE capabilities. |  |
| NEC | Yes | We think it is reasonable to allow the UE to report its supported NW-side additional condition of the functionality.  We understand different cells may have different NW-side additional condition. However, from UE perspective, some “UE supported NW-side additional condition”  (for example, Set A and Set B configurations used for UE-side model training) could be static. We think such static “UE supported NW-side additional condition” can be included as a part of UE capability.  Moreover, including static “UE supported NW-side additional condition” as a part of capability can reduce AI/ML configuration latency and configuration overhead. |  |
| vivo | Yes, for Type 2 additional condition i.e., Set A/Set B related info. For example, NW may have to further assess the additional condition applicability. | Other RRC signaling |  |
| Apple | **No:**  It is sufficient for UE to **only reports applicable functionalities** **which meet all below 3 conditions**:  1) NW-side additional condition (i.e. inference config and training config have same associated ID).  2) UE-side additional condition (e.g. current left memory/battery resource is sufficient to do inference).  3) UE completes model training and model is available in device.  Because 2) and 3) can only be left to UE implementation, we don’t think NW can do anything with UE reporting only 1) as intermediate result. Thus, we think it is **not necessary to report NW-side additional condition.** | **No need to report NW-sided condition, only need to report applicable functionality**:  1) See our response in Q0-1. According to latest RAN1 agreement, the UE determines whether one NW-sided condition is met via NW indicated associated ID. Thus, NW already knows NW-side conditions, and it doesn’t make sense for UE to report the info which the NW already knows (and provided by NW).  2) Since model availability and UE-side condition are also needed to determine applicable, it is meaningless for UE to report this intermediate result (i.e. only NW-side condition) to NW because NW can’t derive UE-side additional condition and whether model training is complete. | According to latest RAN1 agreement, the UE behaviour: it determines whether NW-sided condition is met via checking whether same associated ID indicated by NW. |
| Huawei, HiSilicon | Yes.  The network needs such conditions to align the training and the inference, and then to decide whether it is applicable from the network side. | We think 2) depends on the training, and this may not be the same from one cell to antoher cell (for local associated ID), and hence it cannot be part of UE capability. |  |
| ZTE | It depends on RAN1 discussion on NW additional conditions. | As we mentioned in Q 0-1, in RAN1 discussion for model identification, the NW additional conditions consistency can be either realized by an associated Id or implicitly evaluated by performance monitoring.  Assuming that associated Id is adopt by RAN1:  The answer maybe YES , besides it is not precluded that the signalling including NW additional conditions (e.g. associated Id) from the NW to UE is also possible.  Assuming the performance monitoring is adopt:  It means the NW additional condition would never be exchanged between UE and NW, the consistency between training and inference can be potentially reflected by the performance monitoring of each functionality, then the answer is NO | Assuming the associated ID is adopt:  If there is no any associated Id related to one functionality is reported to the NW, NW then consider such functionality can not be configured for the inference. |
| Mediatek | **No for AI/ML functionality applicability report**:  Before we can address the question at hand, it is essential to clarify several key points:   1. Purpose of UE reporting NW-side conditions:  * One potential purpose could be to signal the availability of AI/ML functionality, potentially initiating a model transfer procedure from the network to the UE. However, this scenario appears to be outside the scope of the current question.  1. AI/ML Functionality Applicability:  * Another reason for reporting could be to assist in determining the applicability of AI/ML functionality. * This leads to the subsequent question: Who bears the responsibility for deciding the applicability of UE-side AI/ML functionality?   Upon review, we concur with Apple's perspective that the UE is tasked with deciding the applicability of AI/ML functionality. This decision is based on a combination of factors, including the UE's additional conditions, the availability of AI/ML models for the functionality, and the NW-side additional conditions.  This understanding implies that the network must first signal NW-side additional conditions, such as associated IDs, to the UE.  If the network-side conditions are indeed signaled using IDs, it stands no reason that the UE should provide these IDs to the NW in advance. Providing NW-side additional condition to UE would enable to make a more informed and accurate decision regarding the applicability of AI/ML functionality. | Agree with Apple.  The key issue to address is determining who is responsible for deciding the applicability of UE-side AI/ML functionality. Based on our analysis, it is more appropriate for the UE to make this decision. This is because the UE's additional (internal) conditions are more dynamic, and the availability of AI/ML functionality on the UE side must also be taken into account.  The method by which the UE communicates the applicability of AI/ML functionality to the network side needs further discussion. This could potentially be conveyed through a functionality ID, if necessary, or perhaps through a combination of the associated ID and other relevant information. | The network provides the NW-side additional condition to the UE. Then UE determines the AI/ML functionality applicability. |
| Lenovo | Yes with comment  We have agreed last meeting to take UE determining the applicability as the baseline. In this scenario, it could be beneficial for UE to report the supported NW-side additional condition for each applicable UE-sided functionality to NW, such that NW may consider the NW-side additional condition to make sure the functionality is applicable from NW side.  If companies agree supporting the scenario wherein NW determines the applicability for a UE-sided functionality, then probably UE will need to. | In phase 1, majority companies think UE may not have AIML model available yet when reporting the supported AIML functionality via UE Capability signalling. In this case, not sure how the UE could report any information related to the applicability of the AIML functionality, including the NW-side additional condition. Therefore, it seems more reasonable to report the supported NW-side additional condition later on after the AIML model is available. Also, if we consider more flexible scenario that UE could further download a new AIML model for the same functionality, the associated NW-side additional condition could change as well. Considering above, maybe UAI is more suitable to convey those “applicability related information” to NW. |  |
| Ericsson | We agree with Apple. RAN2 should just focus on the applicability reporting for an AIML functionality, and the applicability reporting may or may not contain the NW-side additional conditions, and potentially also other info (depending on RAN1 progress).  Hence, the UE might not always need to report the NW-side additional condition to the gNB. For example, the gNB as part of the inference configuration can provide one or more Set A/B and then the UE can just reply by indicating that the AIML functionality is applicable according to one of such indicated set A/B. No need to indicate further info.  Whether to provide or not the NW-side additional condition depends also on whether proactive or reactive reporting is adopted. So we suggest RAN2 focusing on the applicability reporting (proactive/reactive) and discuss instead related protocol aspects. | Other RRC signalling.  This information should be exchanged as part of the applicability reporting, for which we have already discussed at length (since the SI) that capability signalling cannot be used, because the NW-side additional conditions are possible radio configurations that can change dynamically depending on the network/gNB to which the UE is connected. |  |
| Fujitsu | It depends.  It is dependent on the entity to determine the applicability of the functionality, referring to Q1-2. If the network contributes to the final decision/selection of the applicable functionalities, the NW should be aware of *functionality/model related* NW-side additional condition. One solution is to signal this information to the NW from the UE. The other solution may depend on implementation to obtain this information by NW.  If the UE decides the applicable functionalities itself(opt 2), this information is unnecessary to report to the NW. | If needed, we prefer other signaling, e.g., UAI or new procedure.  In our understanding, this is kind of information related with the functionality applicability, other than UE capability. The UE can signal this information via explicit or implicit ways. | If needed, we are open for the solutions.  The NW can retrieve the *NW-side additional condition of the functionality supported by the UE* from OAM based on the reported functionality information or by implementation in this Release. |
| Qualcomm | No.  We agree with Apple and MediaTek that applicable functionalities should be determined by the UE instead of the gNB, as UE may consider several other factors (e.g., availability of the models for the functionality, UE side additional condition) to determine applicable functionalities. Therefore, we do not think there is a need for UE to dynamically report supported network-side additional conditions. Furthermore, if the intention of such reporting is to facilitate configuration that can be immediately used at the UE, then supported network-side addition conditions are not sufficient information.  We believe that although an AI/ML functionality cannot be activated without it being applicable, the network may still be able to configure a supported AI/ML functionality that may not be applicable. However, for facilitating inference configurations without the knowledge of supported AI/ML functionalities information in UE capability is sufficient.  With the above, we believe that:  **Supported functionalities are determined by the network**, based on supported AI/ML functionality reported in the UE capability. This facilitates AI/ML inference configuration at the UE.  **Applicable functionalities are determined by the UE,** based ontheavailability of the models for the functionality, UE side additional condition. This facilitates the activation/deactivation/switching/fallback procedures. | No need for UE to report supported network-side additional conditions, as the network cannot determine applicable functionalities based on the information of supported network-side additional conditions. UEs-side additional conditions are implementation specific, and cannot be exposed to the network. |  |
| CATT | No.  Agree with Apple, it is not necessary to report supported NW-side additional condition, the UE only needs to report the applicable functionality to network. |  | Same view as Apple |
| Samsung | No  Although it is not under beam management use case, RAN1 has the following agreement under model identification, which RAN1 refers for associated ID. RAN1 assume NW signals the data collection related configurations and associated IDs.  Agreement  From RAN1 perspective, for UE-sided model(s) developed (e.g., trained, updated) at UE side, following procedure is an example (noted as **AI-Example1**) of MI-Option1 for further study (including the feasibility/necessity)   * A: For data collection, NW signals the data collection related configuration(s) and it/their associated ID(s)   + Associated IDs for each sub use case in relation with NW-sided additional conditions |  | gNB provides NW-side additional conditions. And UE provides applicable functionalities. |
| Interdigital | Not necessarily, as the applicability reporting could be sufficient (i.e. UE indicates whether the functionality is applicable based on the indicated network side additional condition).  Also, in a functionality-based LCM, even if the UE reports the network side additional conditions for a given functionality, the network still must indicate the current network side additional condition for the UE to select the proper model for that functionality. For example, assume the UE has indicated that a functionality is applicable for network side additional conditions x and y, and current network condition is x. If the network tries to activate the functionality without informing the network side additional condition, then there is no guarantee that the UE will activate the model that is trained for condition x. |  | *The UE being provided with the network side additional condition, and using that to determine functionality applicability,* can be considered as a baseline. |
| LGE | We agree with Apple, Ericsson, and Qualcomm.  According to TR 38.843, *additional conditions* refer to any aspects that are assumed for the training of the model but are not a part of UE capability for the AI/ML-enabled feature/FG. It does not imply that *additional conditions* are necessarily specified.  Since it is difficult to specify all conditions, conveying the "applicability" information can be the simplest starting point. The UE can determine whether it can perform the inference for a specific functionality based on network additional conditions, UE status, and other factors.  Further discussions can explore whether/how the "applicability" information includes   * associated ID associated with specific network additional conditions; and/or * configuration preferred by the UE that can be specified; | Other RRC signalling.  It is a part of the "applicability-related information," which can change dynamically and therefore does not align with the basic premise of the UE capability scheme. |  |
| Nokia | No – agree with Apple, Ericsson, Mediatek, Qualcomm, CATT, Samsung, Interdigital, and LGE.  The question is unclear due to the similar reasons we mentioned in Q0-1.  Also, RAN1 is having ongoing discussion on solving “consistency between training and inference regarding NW-side *additional conditions”* and there is no solution identified (also in TR 38.843) that the UE reports any additional conditions to the NW*.*  RAN2 should focus on applicable functionality reporting.  *From TR:* For inference for UE-side models, to ensure consistency between training and inference regarding NW-side *additional conditions* (if identified), the following options can be taken as potential approaches (when feasible and necessary):  - Model identification to achieve alignment on the NW-side additional condition between NW-side and UE-side  - Model training at NW and transfer to UE, where the model has been trained under the additional condition  - **Information and/or indication on NW-side additional conditions is provided to UE**  - Consistency assisted by monitoring (by UE and/or NW, the performance of UE-side candidate models/functionalities to select a model/functionality) | Answer to the previous question is No.  Assuming that the question is related to the signaling of applicable functionalities, the UE cannot indicate applicability through capability signaling since capability signaling has been agreed to be static. Because the capabilities are static, a requirement to signal applicability through capability signaling, it would mean that models could neither be replaced, deleted, or added, since to do so would require an update to the UE’s capabilities.  Therefore, other signaling is required to signal applicability. | Take an associated ID, which is being discussed in RAN1, for example. An associated ID could be signalled from the NW to the UE for evaluation of applicability. The UE could transmit to the NW a different ID, such as an ID associated with a configuration. To align on applicability, the UE needs to signal something that is inherently tied to the NW-side associated ID. At a minimum, the signaling of applicable functionalities is required. |
| CMCC | No.  We agree with Apple and MTK that the UE only needs to report the applicable functionality to network. We also think it is appropriate for the UE to determine the applicable functionalities since other conditions (e.g. UE-side additional conditions) may be considered by the UE. |  | Agree with Apple. |
| Sharp | No, with comments | We agree with the apple statement above,  The UE only needs to report applicable functionalities that fulfill all of the following conditions:  NW-side additional condition (i.e., the inference and training configurations have the same associated ID).  UE-side additional condition (e.g., sufficient current memory/battery resources to perform inference).  However, we understand that the conditions are dynamic and may change. Therefore, if the conditions change and the additional conditions are no longer met then the UE may report it to the network or request network to provide for e.g., a new configuration. Therefore if it is needed and motivation is clear it can be discussed at a later stage.  Other RRC signalling.  We also share the same understanding as some companies above, given that certain conditions may change dynamically, they should not be incorporated into the UE capability. The conditions are termed as "additional" conditions because they are not integral to the UE capabilities. |  |
| CEWiT | No.  We don’t think the UE needs to signal NW-side additional conditions of the functionality supported by the UE to the network. For the UE-side model, UE determining the applicable functionality based on NW-side and UE-side additional conditions is preferable. | No need. | Agree with Apple. |

**Summary:**

Majority companies think that the NW-side additional condition is first provided by network to UE for applicable functionality decision at UE side. The summary of how to signal NW-side additional condition from network to UE can be found in below discussion and proposals.

## Proactive Reporting

It was agreed in RAN2 #125bis and #126 meeting that supported functionalities (may or may not have available models) are reported in UE capability, while the existing UE assistance information (UAI) procedure is used for applicable functionality reporting in proactive reporting.

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| **RAN2 #125bis meeting:**   1. Which AI/ML-enabled Features/FGs and functionalities are supported should be standardized. The details wait for RAN1’s progress. “supported” means that the UE is capable of supporting the functionality and doesn’t mean neccesarily that the UE has the model available. FFS what functionality refers to. 2. Supported AI/ML-enabled Features/FGs and supported functionalities are included in UE capability. 3. Support proactive reporting of UE-sided applicable functionality, e.g., the UE reports its applicable AI/ML functionalities via UAI message/LPP message.   **RAN2 #126 meeting:**   1. For BM use case, As a baseline the UE determines whether a functionality is applicable. Existing UAI framework is used at least for proactive reporting of applicable functionality. FFS reactive |

According to the above agreements and companies’ inputs to RAN2 #126 meeting, rapporteur summarizes below signaling framework as an example of proactive reporting for discussion:



**Step 1**: Network sends *UECapabilityEnqiry* message to initiate the procedure to a UE reporting its AI/ML supported functionalities.

**Step 2**: UE sends *UECapablityInformation* message to network, containing supported functionalities at the UE side.

**Step 3**: Network configures UE that it is allowed to provide its applicable functionalities.

**Step 4**: UE sends applicable functionalities to network upon change of applicable functionality/condition.

**Step 5**: Network sends inference configuration for the applicable functionalities to the UE.

**Step 6**: Start inference/monitoring based on network/UE activation/deactivation.

In rapporteur’s understanding, in existing UAI framework, UE can only send UAI if configured to do (basic behaviour with UAI). Hence, the network shall at least configure the UE to provide assistance information, i.e. configure UE whether it is allowed to do UAI reporting or not.

#### Q1-1. Do you agree network shall at least configure the UE via *OtherConfig* whether it is allowed to do UAI reporting before applicable functionality reporting?

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| OPPO | Yes | This is the basic logic as in legacy, we support this.  One more thing is that whether NW can configure something more, e.g. filtering info, to limit the reporting overhead in UL. Of course, this can be evaluated as the second step. |
| Xiaomi | Yes | Aligned with current UAI procedure. |
| Futurewei | Yes | Reasonable. |
| NEC | Yes | Follow current UAI framework. |
| vivo | Yes |  |
| Apple | Yes as baseline with comments | We are fine to use current UAI procedure as baseline of proactive reporting.  However, please note that existing UAI framework can only report UE’s **condition/information changes** **on serving cell (i.e. the UE is only required to monitor condition changes in serving cell in existing UAI framework)**. We are not sure whether existing UAI procedure can work for **proactive reporting of neighbour cells’ applicable functionalities reporting which requires the UE to monitor condition change in neighbour cells**. Please note that reporting applicable functionalities of neighbour cells need to be supported for Rel-19 AI/ML, at least including:   * Beam prediction for neighbour TRPs (within Rel-19 AI/ML based BM) * L3 measurement prediction for neighbour cells (within Rel-19 AI/ML based mobility).   To resolve the issue, we think RAN2 can:   * Either extend UAI framework to neighbour cell reporting (and it needs to put a new UE requirement to monitor condition change in neighbour cells). * or leave neighbour cell reporting to reactive reporting with different RRC message framework.   [Rapp]  Rapporteur suggests to focus on serving cell first in this email discussion, neighbouring cell’s applicable functionality reporting and monitoring can be further studied. |
| Huawei, HiSilicon | Yes | For Step 3, we think RAN2 can discuss whether the NW can also indicate some configurations to the UE, e.g. all/some functionalities within UE capability information, some associated IDs. However, this discussion is not urgent for now, and can be further discussed.  [Rapp]  Rapporteur understands this depends on whether proactive reporting also needs to provide additional configuration in Step 3 (which was agreed to be supported in reactive reporting), which can be further discussed based on companies understanding on the difference between proactive/reactive reporting. |
| ZTE | It depends on RAN1 discussion regarding NW additional conditions | As we mentioned in Q 0-1, in RAN1 discussion for model identification, the NW additional conditions consistency can be either realized by an associated Id or implicitly evaluated by performance monitoring.  Assuming the performance monitoring is adopt:  Then proactive applicability reporting is not needed since UE need to do the performance monitoring to determine the applicability of each functionality.  Assuming the associated Id is adopt:  It can be a candidate procedure for proactive applicability reporting, in addition to the UAI, there can be another alternative, e.g. the RRCReconfiguation/RRCReconfiguationComplete also can be taken into account for the proactive applicability reporting.  [Rapp]  Rapporteur understands that RAN2 has already agreed to use UAI framework as baseline for proactive reporting. Hence, there’s no dependency with RAN1 decision on how to achieve consistency between training and inference in terms of what signaling is used for proactive reporting. |
| Mediatek | Yes as baseline. | In step 3, the network can provide the NW-side additional condition in *RRCReconfiguration* message.  Another possibility is that UE can response the AI/ML functionality applicability directly in the *RRCReconfigurationComplete* message.  [Rapp]  Rapporteur understands this depends on whether proactive reporting also needs to provide additional configuration in Step 3 (which was agreed to be supported in reactive reporting), which can be further discussed based on companies understanding on the difference between proactive/reactive reporting. |
| Lenovo | Yes | As in legacy |
| Ericsson | Yes | If UAI is used otherConfig should be configured as legacy. However, the content of otherConfig should be discussed, e.g. for which AIML functionality/ies the applicability reporting is requested, the radio configurations that the gNB can give to the UE.  [Rapp]  Rapporteur understands this depends on whether proactive reporting also needs to provide additional configuration in Step 3 (which was agreed to be supported in reactive reporting), which can be further discussed based on companies understanding on the difference between proactive/reactive reporting. |
| Fujitsu | Yes | It is natural to follow the legacy mechanism. |
| Qualcomm | Maybe, with comments  (do not agree with the sequence of steps) | We agree that one method of reporting applicable functionality can be where the configuration is provided by RRCReconfiguration/otherconfig/RRCResume/RRCRelease, and UE provides applicable functionality information in UAI/RRCReconfigurationComplete/RRCResumeComplete/RRCEstablishmentComplete. We believe that by providing the configuration in RRCRelease, the UE can report applicable functionality in the RRCEstablishmentComplete when UE comes to RRC Connected state.  Furthermore, we believe in another method, the configuration can be provided by the system information, as the configuration is not unique to the UE, but applies to all UEs in the cell. Therefore, before selecting a solution RAN2 should check if a dedicated configuration is required.  Therefore, we believe that proactive and reactive approaches should be combined instead of standardized separately. We can have a common framework for applicable functionality reporting, where:   * Configuration is performed using RRCReconfiguration (or otherconfig) / RRCResume / System information /RRCRelease * Reporting is done using RRCReconfigurationComplete / RRCResumeComplete / RRCEstablishmentComplete / UAI   We do not agree with the sequence of steps:   * RAN2 did not agree that only applicable functions can be configured for the inference. In our understanding, this requires two steps of the inference configurations, i.e., first for determining what functionalities are applicable, then second for inference configuration. We believe this can be avoided, as the network can perform activation, separately (after the configuration) [which is different from a legacy where configuration implies activation]. Therefore, we believe, steps 3 and step 5 can happen together.   [Rapp]  Rapporteur understands this depends on whether proactive reporting also needs to provide additional configuration in Step 3 (which was agreed to be supported in reactive reporting), which can be further discussed based on companies understanding on the difference between proactive/reactive reporting.  On the other hand, we agree with Apple that applicable function reporting should not be only supported for the serving cell, but also for the neighboring cells. In our understanding, otherconfig and UAI should be enhanced to support applicable function reporting not only for the serving cell, but also for the neighboring cells.  [Rapp]  Rapporteur suggests to focus on serving cell first in this email discussion, neighbouring cell’s applicable functionality reporting and monitoring can be further studied. |
| CATT | Yes | Align with legacy UAI mechanism. |
| Samsung | Yes | The exact signalling (implicit or explicit) can be discussed after all required configurations are sorted out. |
| Interdigital | Yes | Can be agreed as a baseline, and it can be reconsidered once we have progressed regarding the contents of the applicability determination signalling/reporting and any further/relevant progress in RAN1 on the consistency and model identification discussion. |
| LGE | Yes | Can be a baseline |
| Nokia | Yes, with comments. | The mechanism for configuration and activating a UE-side functionality has not yet been agreed, but we can evaluate an option as an example.  If a UE is “configured” with a UE-side AI/ML functionality, then it should be implicit that the UE needs to report which of the “configured” UE-side AI/ML functionalities are applicable. Without being able to report whether a functionality is applicable, the NW would have to guess which one of the provided configurations to activate. Therefore, we think that the UE should be immediately allowed to report applicability in reaction to a configuration, which could also be done through the transmission of UAI. Applicability reporting that follows the initial report, such as updates to applicability, could be limited through *OtherConfig*. Whether we decide to apply constraints to how often a UE may proactively update its applicable functionalities could be further discussed.  [Rapp] To rapporteur’s understanding, the method of UE replies applicability based on network provided configuration is reactive reporting, which are discussed in Section 2.2. That depends on whether we use the same signaling for proactive and reactive reporting. |
| CMCC | Yes | Agree to follow the legacy UAI procedure. |
| Sharp | Yes | Following existing UAI procedure. |
| CEWiT | Yes | Legacy framework is sufficient. |

**Summary:**

All companies agree current UAI procedure is reused as baseline, i.e. network shall at least configure UE via *OtherConfig* whether it is allowed to do UAI reporting before applicable functionality reporting.

There are also some companies think that inference configurations should also be provided to UE in proactive reporting step 3, e.g. supported functionalities/associated IDs by network [HW], radio configurations that gNB can provide [Ericsson, QC]. According to RAN2 agreements, configurations are provided by network in reactive reporting.

|  |
| --- |
| Support reactive reporting of UE-sided applicable functionality. The NW configures AI/ML functionalities via RRC/LPP message. |

Regarding to whether network also provides radio configurations in Step 3 of proactive reporting, rapporteur postponed the conclusion to later questions. No conclusion in this question.

Furthermore, Apple and QC further raised a question that whether UE needs to monitor and report neighbour cells’ applicable functionality. Since this was not discussed before, rapporteur suggests to focus on serving cell in this post email discussion, whether extend UAI framework to support neighbouring cell applicable functionality reporting can be further discussed based on companies’ contribution.

Rapporteur Summary 2: In proactive reporting, network shall at least configure UE via *OtherConfig* whether it is allowed to do UAI reporting before applicable functionality reporting, i.e. same as current UAI framework.

As agreed in RAN2 #126 meeting, applicable functionality is determined by UE as baseline.

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| --- |
| For BM use case, As a baseline the UE determines whether a functionality is applicable. |

After the UE is configured to provide applicable functionality information, the UE first needs to decide which applicable functionalities should be included in UAI and report to the network. Furthermore, as discussed in [6] and [12], the network may also be able to determine whether a functionality is applicable or not, according to NW-side additional conditions (i.e. without sending NW-side additional conditions to UE).

According to companies’ inputs to RAN2 #126 meeting, rapporteur summarizes below options on how UE/network decide the applicable functionalities:

* **Option 1: Joint decision by UE and NW**

In this option, UE-side additional conditions are known by UE internally, and NW-side additional conditions are known at network-side internally. First of all, UE decides UE-considered applicable functionalities based on UE-side additional conditions (e.g. UE speed, scenario, hardware capabilities, model availability, etc). UE reports **UE-considered** applicable functionalities to network. Network further checks its NW-side additional conditions by implementation and decides the **final** applicable functionalities by providing the corresponding configuration in Step 5.

However, the UE may also need to include NW-side additional condition of the corresponding reported UE-considered applicable functionalities in Step 4. Example of Step 3-5 of Option 1 is shown as below:



* **Option 2: UE decision**

**UE decides** the applicable functionalities based on UE-side additional conditions (internally known by UE) and NW-side additional conditions. This option seems to be a special case for Option 1 where network sends NW-side additional conditions to UE in Step 3 in advance for applicable functionality determination. Example of Step 3-5 of Option 2 is shown as below:



* **Option 3: NW decision**

**NW decides** the applicable functionalities based on UE-side additional conditions and NW-side additional conditions. In this option, the UE needs to report its UE-side additional conditions to NW via UAI. In rapporteur’s understanding, for proactive reporting, network only needs to provide network configurations to functionalities with available models at the UE side. Therefore, in this option, rapporteur assumes UE only needs to report UE-side additional conditions of available models in Step 3, while the network doesn’t need to know the exact model used by the UE. However, the UE may also need to include NW-side additional condition of the corresponding reported UE-considered applicable functionalities in Step 4. Example of Step 3-5 of Option 3 is shown as below:



#### Q1-2. Regarding to applicable functionalities determination, which option do you agree? Please also list any missing information that you think needs to be transferred to UE or reported to NW in Step 3/4 for applicable functionality determination.

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1/2/3** | **Comment (Is there any other information needed? why it’s essential?)** |
| OPPO | Option1/2 | For Option1, functionality filtering info may also be optionally included in step3, i.e. other config, to limit the reporting scope from UE side. This filtering info is supported by many UAI features in legacy, better to keep the door open for now.  For Option2, we’re wondering whether the NW-side additional condition included in step3 is configured per functionality or per cell, this may impact the reporting format in UAI from UE side. Of course, this may somehow touch stage3.  Both Option1 and Option2 can be workable. For Option1, the scalability may be better than Option2 considering mobility scenario, for Option2, NW may configure the latest NW-side additional condition in other config again to trigger UE reporting updated UAI while Option1 may still survive after serving cell change as all supported NW-side additional reporting reported from UE will transfer to target cell during HO.  For Option2, the Yes/No info in UAI may save some overhead compared to Option1.  Option3 is not workable from our side unless UE reports both UE side and NW-side additional condition and then NW make the decision. If UE only reports UE side additional condition, we don’t know how NW can know NW-side additional condition associated with UE side functionality. |
| Xiaomi | Comments | Option 3 is not preferred since it’s difficult to standardize and report all UE side additional condition. Many factors are up to implementation.  The key difference of option 1 and 2 is whether UE can obtain the NW side additional condition. It’s still under RAN1 discussion whether NW should provide NW side additional condition to UE.  We understand UE shall determine functionality applicability at least based on UE side additional condition. If UE can obtain the NW side additional condition, UE shall also consider the NW side additional condition. It’s unnecessary for UE to ignore the available NW side additional condition.  In short, UE shall determine the functionality applicability based on UE side additional condition and NW side additional condition if available. Option 1 and 2 can be merged. |
| Futurewei | Comments | We think it is important to separate the discussions for NW-side functionality and UE-side functionality; each may prefer different options. For example, for UE-side functionality/model, Option 2 may be preferred while for NW-side functionality/model, Option 3 may be preferred.  [Rapp]  Note that applicable functionality reporting is for UE-sided model. Rapp considers this comment as preferring Option 2. |
| NEC | Option 2 | Phase 1 has the agreement that “Applicable functionalities refer to functionalities that the UE is ready to apply for model inference.”, therefore we think Option 2 is a straightforward solution.  Option 1: Regarding the NW-side additional conditions, if there are no information from NW side, seems the UE shall report UE-considered applicable functionalities and all corresponding UE-considered NW-side additional conditions which may not match with the current gNB additional conditions at all.  [Rapp]  Agree that this may results in a possibility that reported UE-considered applicable functionality are not applicable after checking NW-side additional condition at NW-side. However, then network doesn’t need to provide any radio configuration for any functionalities. From procedure pov, it also workable. Also, for proactive reporting, in rapporteur’s understanding, functionalities reported by UE may or may not need to meet both UE/NW-side additional condition, depends on whether NW-side additional condition is sent to UE or not in Step 3. Similarly, the same logic can also be applicable for Option 2, that no applicable functionalities can be reported after UE checking both UE-side and NW-side additional condition.  Option 3: This option against the baseline we agreed at RAN2#126,  As a baseline the UE determines whether a functionality is applicable.  Moreover, it is not clear that whether NW has full knowledge on the UE-side additional conditions to make a proper determination of applicable functionalities. |
| vivo | Option 1/2 | For step 3, the NW-side additional conditions can be broadcast as system information, e.g., associated ID |
| Apple | Option 2 | According to latest RAN1#117 agreement, NW indicates NW-side additional condition(s) to the NW via associated ID as we illustrated in Q0-1, and the UE determines whether it is met via whether identifying inference config and training config with same associated ID. This is aligned with option 2, and we don’t think option 1 and option 3 can work:  [Rapp]  Rapporteur understands both NW-side additional condition (e.g. associated ID) and AIML inference configuration are transmitted as associated ID in RRC Signaling in above comment.   * Option 1:   + We fail to understand why “NW-side additional conditions” are explicitly reported in step 4. Please note that NW-sided additional condition is notified by NW to the UE in forms of associated ID. So, NW already knows such info. Then, why does the UE need to report the information which the NW already knows (and provided by NW)?   + Because UE-sided additional condition is not reported to NW in option 1, we don’t think NW can determine whether one functionality is applicable or not. Thus, option 1 is incomplete solution.   [Rapp] Note that rapporteur clarified UE reports “UE-considered” applicable functionalities in Step 4. UE may or may not report NW-side additional conditions of the reported functionality (depends on whether it knows according to prior knowledge).   * Option 3:   + **This solution can work only if the UE is specified to report UE-sided additional condition to NW.** However, as they may include privacy information and UE proprietary implementation, we strongly object to specify reporting of UE-sided additional conditions to NW.   + As NEC mentioned, this option is against the baseline we agreed at RAN2#126 (i.e. the UE determines whether a functionality is applicable). Considering Rel-19 AI/ML discussion is controversial, we should focus on baseline at this stage.   + Please note that reporting UE-side additional information is not in scope of Rel-19 WID, and RAN1 don’t study the detailed metrics of UE-side additional information. |
| Huawei, HiSilicon | Option 1, 2 | For option 1, UE just checks applicability by UE-side additional conditions, and then report the applicable functionalities to NW. NW will check this input with its associated ID information, and do the functionality management decision. This option is reasonable.  For option 2, NW can provide some functionalities/associated IDs to UE, so that the UE will use this information to check. Compared with option 1, the UE has more information (i.e. associated ID), and thus it can do the filtering. This option is also reasonable, as it could reduce some signalling in Uu. For example, if the UE has functionality for associated ID #1, #2, and #3, but the current NW only supports ID#2, then option 2 could let UE report #2.  [Rapp]  Rapporteur understands NW-side additional condition is transmitted as associated ID in RRC Signaling in above comment.  For option 3, we do not see the usefulness. For UE-side additional conditions, the NW does not need to know the details, and instead they are just used by UE side. In other words, the necessity of UE reporting UE-side additional conditions to NW side for UE sided model should be clarified first. |
| ZTE | Comments | For option 1, it is too early to decide the contents of each procedure step since, in the Question 0-2, rapporteur asks what kind of RRC signalling could be used for reporting NW additional conditions from UE to NW (e.g. UE capability or RRC signalling other than the UE capability). Assuming the UE capability would be used for carrying the NW additional conditions (e.g. associated ID), then in option 1, there is no need to carry the NW additional conditions in the UAI, it is because, in this case, NW can filter the functionality reported in the UE capability by considering the respective NW additional conditions, and then make UE report the applicability of the **interested functionalities**(e.g. the NW additional conditions of those functionalities is considered as apt to the current NW settings) , in this sense, there is no need to have the NW additional conditions again in the UAI message.  For option 2, it illustrates that the NW additional conditions shall be reported from NW to the UE which has not been discussed in the above questions (e.g. above questions only mention the case that the NW additional conditions reported from UE to NW, and the NW additional conditions reported from NW to UE is NOT mentioned).  Regarding the option 3, it is as similar as the option 1 if the NW can do the filter according to the UE capability and the NW additional conditions are reported in UE capability, then NW can make the decision according to the received UE additional conditions, but whether or what kind of the UE additional conditions are needed shall be discussed in RAN1 not RAN2, in this sense, the option 3 shall be pending until RAN1 has confirmed the UE additional conditions is needed for NW to identify the UE side functionality. |
| Mediatek | Option 2 | Just as commented in Q0-2, UE is responsible for deciding the applicability of AI/ML functionality. This decision is based on a combination of factors, including the UE's additional conditions/internal conditions, the availability of AI/ML models for the functionality, and the NW-side additional conditions.  Under Option 3, the UE is expected to report both UE-side additional conditions/ internal conditions and the availability of AI/ML functionality. However, the UE-side additional conditions/internal conditions relevant to model training and inference are largely tied to the UE's proprietary implementation. Specifying these conditions would be impractical due to concerns over proprietary information, competitive differentiation, product strategy, and the potential complexity it would add to standardization efforts.  In the case of Option 1, it remains unclear how the UE would ascertain the applicability of AI/ML functionality without any preliminary information from the network. If the decision is based solely on the UE's internal conditions and the availability of AI/ML models, there is a high likelihood that the UE would deem all available AI/ML functionalities as applicable. Therefore, the usefulness of such information for the network to make a final determination on the applicability of AI/ML functionality is questionable.  Option 2 facilitates a more informed and precise decision-making process regarding the applicability of AI/ML functionality by the UE, assuming network provides the NW-side additional conditions to the UE. |
| Lenovo | Option 2 as baseline agreed last time  Option 1/3 are also possible | In the last RAN2 meeting, RAN2 agreed to support UE determining the functionality applicability as the baseline, which is Option 2.  In the meanwhile, we believe Option 1 or 3 are also possible. Eventually it will depend on the required input (e.g., NW/UE side additional condition) and if the value of them can be transferred over air interface. |
| Ericsson | Option 1 as baseline  Option 2 to be discussed together with the reactive approach | All the options are in fact the same thing, and we do not need to distinguish about UE decision vs joint UE-NW decision. In all the options, it is always the network that decides the configuration, and it is always the UE that checks its own applicability conditions. The issue is more the content of the messages in the various steps.  Additionally, we note that the proactive and reactive approach should coexist, and they should not be considered necessarily as alternative approaches, i.e. the NW can provide both a reactive configuration and a proactive configuration. In such a case, the proactive approach based on UAI can be used to inform the NW about changes in the applicability conditions considering the reactive configuration. This aspect should be considered when evaluating the signalling details of the proactive options, since the inference configurations (including the NW-side additional conditions) do not need necessarily to be conveyed via the OtherConfig.  Option 1 is more aligned with the current UAI framework. In the current UAI framework, the otherConfig carries minimum set of information just to enable the UE to report its preferred/recommended configurations to the gNB. Hence, option 1 is more aligned with this framework, i.e. the gNB enables the UE in the otherConfig to send UAI for one or more AIML functionalities, and in the step 4, the UE responds with the applicable functionalities and related NW-side additional conditions. Then in step-5 the gNB provides the needed AIML inference radio configuration. Option 2 can also be considered, but in that case we are not sure that the inference configurations including the NW-side additional conditions should be signalled as part of the otherConfig. The NW can just configure the UE according to the reactive approach and then the UE can use the UAI to inform the NW about the changes in the applicability considering the configurations included in the reactive configuration.  [Rapp]  If rapporteur understands correctly, both network-side additional condition (assuming it’s associated ID) and AIML inference radio configuration needs to be signalled in Step 3 (but not in OtherConfig). |
| Fujitsu | Option1/2 | Option 1 can be the baseline that both UE and NW check its own status and make the decision of applicability jointly.  Option 2 is also OK, since the model is at UE side, UE can collect all related information and make the decision on its side. |
| Qualcomm | Option 2 | Same view as Apple. We also prefer to reduce the signalling required for inference configuration at the UE. The network provides the inference configuration and network-side additional conditions in the RRCReconfiguration/RRCResume/RRCRelease. UE responds in the RRCReconfigurationComplete/RRCEstablishmentComplete/RRCResumeComplete/ UAI on the functionalities that can be activated. |
| CATT | Option 2 | Option 3 needs UE to report UE-side additional condition to network, which is still under the discussion in RAN1 whether to support UE-side additional condition. Therefore, at least in current stage, Option 3 is not a suitable solution.  For Option 1 and Option 2, we understand both can work. But we prefer Option 2 considering the following reasons:   1. In RAN2#126 meeting, RAN2 has agreed that as a baseline the UE determines whether a functionality is applicable, and for NW-side additional conditions, RAN2 assumes that RRC signaling **from gNB to UE** can be designed for consistency between inference and training. 2. NW-side additional condition is associated with AI model, and a functionality can have multiple NW-side additional conditions (each for different model). If we go with Option 1, NW selects functionality according to current NW-side additional condition and configure to UE, as the functionality has multiple models with different NW-side additional conditions, UE still has no idea how to select a model for inference. To avoid the risk that UE selects multiple unsuitable models, it is better that network sends the NW-side additional condition to UE for providing more information for functionality-based LCM. |
| Samsung | Option 2 as a baseline | Given that NW provides NW side additional conditions which should be used to identify applicable functionalities (having available models trained with corresponding additional conditions), option 2 should be straightforward.  Nevertheless, since RAN1 has not completed NW side additional conditions and related details, we could be open for option 1. |
| Interdigital | Option 2 as a baseline, Option 1 may be considered | The AIML models reside at the UE, and thus the UE knows the UE side and network side conditions under which the models are trained in. Since the UE knows its own conditions, if it is provided with information about current network side additional conditions, it can determine whether it has a functionality that has a model that is applicable at the moment. This is Option 2, and as indicated by the rapporteur, agreed in RAN2 for the BM case.  Option 1 may also be considered.  However, we think option 3 is not a suitable option for a UE side model, as it requires the signalling of UE side additional conditions to the network (which may need to be done frequently whenever the UE side additional condition changes). |
| LGE | Option 2 | The associated ID-based reporting we are considering aligns better with Option 2. |
| Nokia | Option 2 with modificatons | **Option 1**: In Step 3, it isn’t clear what is being transmitted to the UE such that the UE knows for which features and/or functionalities it needs to determine applicability.  TR38.843 states the following regarding functionalities: “functionality refers to an AI/ML-enabled Feature/FG enabled by configuration(s), where configuration(s) is(are) supported based on conditions indicated by UE capability. Correspondingly, functionality-based LCM operates based on, at least, one configuration of AI/ML-enabled Feature/FG or specific configurations of an AI/ML-enabled Feature/FG.”  The underlined portion of the definition shows that a functionality is enabled by a configuration. If we are to use this definition, then does it imply that the UE needs to transmit to the gNB every combination of parameter values for each AI/ML-enabled feature it supports? If not, what subset of configuration would the UE send to the NW? We think the NW should be in control of configuring the UE, and therefore, the NW should provide the UE a configuration to evaluate.  **Option 2**: In this option, the UE has all of the information it needs to determine applicability. However, as in Option 1, it isn’t clear the extent of information provided by the NW to the UE. It seems that here, the UE is still creating configurations, the number of combinations of which could be quite large. We think again that the NW should determine the configurations (functionalities) and provide them to the UE for evaluation.  [Rapp] To clarify, this option doesn’t mean UE will create configurations on its own. The configuration of the functionality will be provided by NW in Step 5 after NW knows the applicable functionality.  Step 3: We agree that *otherConfig* can be provided in the RRCReconfiguration to enable the UE to report through UAI the applicable functionalities. However, we do not agree that **NW-side additional conditions** are transmitted in that way. We need to first understand what the associated ID will represent and then where the associated ID(s) will go. However, assuming that the UE was provided the associated ID(s) through a different stage of the configuration or through different IEs as part of the *RRCReconfiguration* message, we could agree.  Unlabelled Step: We think that the UE would know the associated ID(s), but there is no agreement that the NW will have provided “NW-side additional condition”. Therefore, we can agree to this block if NW-side additional condition is changed to associated ID.  [Rapp] According to RAN1 discussion, associated ID is one of the options how to represent NW-side additional condition. RAN2 had some discussion during RAN2 #126 meeting, while agreed whether to use associated ID or not it up to RAN1. Therefore, rapporteur suggests to wait for RAN1 conclusion, but we could use associated ID as an example.  Step 4: We agree with this step.  Step 5: We can agree with this step if we remove monitoring, and change “inference configuration” to “functionality activation”. It is not our intention to keep that working in the specification, but rather to use the terms we have been using throughout the past year and during the study item.  [Rapp] there’s a question, i.e. Q3-2, whether the configuration provided in Step 5 means the functionality is activated or not. Rapporteur will conclude there.  **Option 3**: We do not think that the UE should signal its additional conditions to the NW. The examples given, such as velocity and hardware constraints are better evaluated internally to the UE with respect to its own models. Otherwise, the UE needs to tell the NW that it has a model that supports velocities < 30kph and it needs to report its velocity so that the NW can perform the comparison. The procedure should be faster with the UE evaluating its own additional conditions. |
| CMCC | Prefer option 2 | Same view as CATT. |
| Sharp | Option 1/2 | Option 2 may be useful in mobility scenarios, but all the options, including Option 3, should be further discussed to evaluate their benefits and necessity. |
| CEWiT | Option 2 | For UE-side model, option 2 fits better. |

**Summary:**

Option 1 (8/21): Oppo, Xiaomi (can be merged with Option 2, NW-side additional condition may or may not be available), Vivo (associated ID broadcasted in SIB), Huawei, Lenovo, Ericsson (as baseline), Fujitsu (as baseline), Samsung (open for option 1)

Option 2 (18/21): Oppo, Xiaomi (can be merged with Option 1, NW-side additional condition may or may not be available), Futurewei, NEC, Apple, Huawei, MTK, Lenovo, Ericsson (NW-side additional conditions not signaled as part of OtherConfig, but considering it together with reactive reporting), Fujitsu, QC, CATT, Samsung (as baseline), Interdigital

Option 3 (1/21): Lenovo

For Option 3, companies [Oppo, Xiaomi, Apple, Huawei, MTK] explains Option 3 is not preferred considering following aspects:

1. It’s difficult to standardize all UE-side additional condition and may expose UE privacy information/proprietary implementation

2. No need for network to know UE-side additional condition

Hence, rapporteur suggests to deprioritize Option 3 during the discussion.

Furthermore, in Option 2, according to companies’ comment above, rapporteur summarizes following information needs to be signaled in Step 3 for UE to decide applicable functionalities:

1) associated ID (Vivo, Apple, HW, MTK, QC, Nokia, LG)

2) AIML inference radio configuration (including NW-side additional condition) (Ericsson, Apple, QC)

According to rapporteur’s understanding of RAN2 agreement, there’s no agreed motivation to let network also provide AIML inference radio configuration in proactive reporting Step 3. However, supporting proactive/reactive reporting simultaneously are not precluded. Therefore, rapporteur postpone the conclusion of related to inference configuration in Step 3 to Section 2.2.

Rapporteur Summary 3: In proactive reporting, UE decides the applicable functionalities based on UE-side additional conditions (internally known by UE) and reports to network upon change of applicable functionality as baseline.

Rapporteur Summary 4: In proactive reporting, it is optional for network to provide NW-side additional condition (e.g associated ID) to UE before applicable functionality reporting (i.e. Step 3). UE may also use NW-side additional condition (e.g. associated ID) for UE’s applicable functionality decision if available. The detail of NW-side additional condition is up to RAN1.

#### Q1-3. Any other comment on the above signaling flow of proactive reporting?

|  |  |
| --- | --- |
| **Company** | **Comment** |
| OPPO | See answer in Q1-2. |
| Xiaomi | Option 1 and 2 can be merged. UE shall first determine the functionality applicability based on UE side additional condition and NW side additional condition if available. After report, NW can further choose the functionality based on NW side additional condition, which is not provided to UE. |
| NEC | For activating UE-sided model, at least two RRCReconfig are needed, the first one for applicable functionality UAI report and the second one for full AI/ML configuration. Not sure are there any concerns on latency. |
| vivo | Option 1 and 2 can be merged, for example in case NW side additional conditions are available and NW can include them in step 3 of Option 1, i.e., along the configuration to allow UE performing UAI reporting. |
| Huawei, HiSilicon | Agree with Xiaomi that Option 1 and 2 can be captured in one procedure. For example, if the NW indicate associated ID to UE, the UE checks both UE-side additional conditions and the indicated associated ID for generating applicable functionalities; otherwise, the UE only checks UE-side additional conditions for generating applicable functionalities and reports them together with the supported associated IDs (here it is assumed that the UE has not reported associated ID via UE capability signalling). |
| Ericsson | As commented above, we agree that option 1 and 2 are in principle the same thing, but the network actions might be different. Additionally, the reactive approach should be also considered when evaluating UAI-related signalling. For example, in option 2, the step 5 might not be needed, i.e. if the UE was already provided in the reactive configuration with the possible AIML inference configurations (including the NW side additional conditions), then in step 4 the UE can just signal the AIML inference configuration that is applicable, and then in step-5 the gNB can just activate the model without any further configuration. So at this stage we do not need to merge them, we just need to better clarify the signalling needed.  [Rapp] Rapporteur understands that is reactive reporting, which is not considered in the discussion of this Section of proactive. But, rapporteur doesn’t preclude the scenario where both proactive and reactive are supported simultaneously.  Further comments:  Option 1/2 – step 3: It should be clarified that the otherConfig may include the AIML functionality for which the applicability conditions should be evaluated by the UE (and for which UAI should be reported)  Option 1/2 – first box: it should be clarified that the checking of the applicability functionalities should be done on the basis of the OtherConfig configured by the gNB  Option 1 – step 3. It should be further discussed whether OtherConfig should be used. As commented above, UAI is typically used by the UE just to provide its recommendation/preference without specific inputs from the gNB. Here instead, it seems that the otherConfig should provide extra radio configuration information, that could be provided also via the reactive approach. We suggest further evaluating the option 2 together with the reactive approach progress  [Rapp] The raised question is about how to combine proactive and reactive reporting from signaling pov. Reusing UAI framework for proactive reporting is already agreed, i.e. OtherConfig in Step 3. For reactive approach where radio configuration is provided to UE in advance, rapporteur suggest to discuss in next section. |
| Samsung | It may be a bit early to assume that UE provides applicable functionalities in proactive reporting although there is a benefit to have a common format with reactive reporting. Anyway, it is not clear whether UE can provide actual functionality or functionality related information (e.g. supported associated IDs) in case of proactive reporting. It would depend on what is the exact definition of functionality which is still FFS in RAN1.  [Rapp] As concluded above, if UE knows the NW-side additional condition (e.g. associated ID), the applicable functionality can be provided by UE even in proactive reporting. |
| Nokia | **Option X**: Our view is that the NW will likely have significant control over the data collection procedure for the beam management use case. Therefore, we do not envision that the NW will create configurations so specific that the NW would need to provide a UE an excessive number of functionalities to evaluate. In the beam management case, it isn’t likely that the gNB’s beam characteristics would change frequently, nor would it be in its best interest to provide too many different options for Set B configurations.  We propose that the UE provides in its UECapabilityInformation the supported functionalities, which are every valid combination of the parameters of an AI/ML-enabled feature, and that the NW provides the UE configurations corresponding to those supported functionalities. The configurations from the NW would include information sufficient to determine applicability, which could at least include an associated ID.  [Rapp] This option described above seems the reactive reporting. Rapporteur will consider it in Section 2.2. |

**Summary:**

The above comments are considered in the summaries of other questions.

## Reactive Reporting

According to companies’ inputs to RAN2 #126 meeting, it seems companies’ understanding on reactive reporting is whether the applicable functionality reporting is considered as a response to network configuration. The network can either provide AI/ML resource configuration for multiple functionalities or some initial query (with some initial configuration) of applicable functions to UE. UE then reports applicable functionalities in response, either indicating acceptance of certain configurations or request for detailed network configurations for applicable functionalities.

From signaling procedure point of view, rapporteur summarizes below example for reactive reporting. The overall signaling procedure is similar to proactive reporting. However, there are some differences in terms of signaling content and detailed information, for example, the network needs to provide configurations to UE before UE reports applicable functionalities.



**Step 1**: Network sends UECapabilityEnquiry message to initiate the procedure to a UE reporting its AI/ML supported functionalities.

**Step 2**: UE sends *UECapablityInformation* message to network, containing supported functionalities at the UE side.

**Step 3**: Network provides network configurations and initiates UE to report its applicable functionalities.

**Step 4**: UE sends applicable functionalities to network.

**Step 5**: Network sends updated inference configuration for applicable functionalities reported in Step 4 to the UE. (see Q2-6)

**Step 6**: Start inference/monitoring based on network/UE activation/deactivation.

Following agreement was reached in RAN2 #125bis meeting:

1. Support reactive reporting of UE-sided applicable functionality. The NW configures AI/ML functionalities via RRC/LPP message. FFS what the configuration contains. FFS how to report applicable functionality and what is applicable functionality

In rapporteur’s understanding, network can provide configurations (e.g. beam resource configuration of Set A and Set B) for supported functionalities in Step 3.

#### Q2-1. In Step 3 of reactive reporting, do you agree that network can provide some configurations (e.g. AI/ML beam resource configuration of Set A and Set B) for functionalities? Please also provide an example of configuration for functionalities other than AI/ML beam resource configuration, if applicable.

NOTE: NW-side additional condition will be discussed in Q2-2.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| OPPO | No | As analysed in Q0-1, NW will definitely know which specified configuration, i.e. Category A1 resource configurations in Q0-1, is or is not applicable to UE side based on UE capability reporting, this is the logic we always follow in legacy, what is the strong motivation to break this principle for AIML? why NW should ask again when already known via UE capability reporting? What NW does not know is the NW side additional condition associated to UE side functionality, that’s why we need NW side additional condition reporting from UE to NW.  Based on above, we don’t think this kind of reacting method is workable.  From our side, reacting method have another understanding, like proactive method listed above, NW configure other config via RRCReconfiguration message, UE responses with RRCReconfigurationcomplete message including applicable functionality, the three options introduced for proactive method above is also valid for this reacting method. |
| Xiaomi | Yes with comments | This is related to the granularity of functionality, which is under RAN1’s discussion. It’s up to RAN1 whether the beam resource configuration of set A and B can identify a functionality. If functionality is agnostic to configuration of set A and B, there is no need to provide such configuration to trigger reactive report.  NW can already obtain the supported functionality via UE capability signalling, as concluded in phase 1. NW may just indicate the ID of the supported functionality. And UE response with the applicability of the indicated functionality. |
| Futurewei | Yes. | NW-side additional conditions/configurations will help the UE to determine its available functionality. |
| NEC | Maybe Yes | We understand the rapporteur intention here is to provide some configurations related to NW-side addition conditions. If Set A / Set B configurations can be considered/defined as NW-side additional conditions, then “AI/ML beam resource configuration of Set A and Set B” can be used to present NW-side additional condition related information. Based on this understanding, we think the answer may be “Yes”.  Basically, we think Step 3 can only include configurations related to NW-additional condition (e.g., configurations which used to present NW-additional conditions). Full configuration of the AI/ML, e.g., configuration for inference and/or performance monitoring, etc. of the applicable functionality should be provided after receiving UE applicable functionality reporting (i.e., Step 5). |
| vivo | Yes, with Type 1 i.e., Beam characteristics, no for type 2 i.e., Set A/Set B related info | - Type 1: Beam characteristics, e.g., beam boresight direction (azimuth and elevation), 3dB beamwidth. This information can be agnostic to UE, thus can be implicitly indicated to UE as associated ID.  - Type 2: Set A/Set B related info, e.g., the beam index of set B. This information should be explicitly sent to UE for model inference. |
| Apple | Yes with comments | In our understanding, whether inference configuration is provided together with associated ID in same *RRCReconfiguraiton* is one of the key differences between proactive reporting and reactive reporting:   * Proactive reporting:   + **Only associated ID(s)** are included *OtherConfig* of *RRCReconfiguration* (i.e. its corresponding inference configuration like set A configuration is not provided)*.*   + Since inference configuration is not provided, the UE can perform inference only after NW provides inference configuration with another message (i.e. inference config is provided **after** applicable functionality reporting). * Reactive reporting:   + **Both associated ID(s) and their corresponding inference configuration** are included *RRCReconfiguration.*   + Since inference configuration is already provided, the UE can **perform inference immediately for the functionalities which are determined as “applicable”**, without need to wait another message from NW (i.e. inference config is provided **before** applicable functionality reporting). |
| Huawei, HiSilicon | See comments | We are open to discuss "some configurations".  Firstly, we think there should be at least some examples for the configurations. Secondly, we suggest to also discuss the UE behaviours upon getting such configurations from NW side. As mentioned by some companies, if NW can include configurations related to NW-side additional conditions (e.g. associated IDs), the intention should be let UE do the filtering. Then we think it is one example.  And then, we could discuss the necessity of such configurations. |
| ZTE | May be No, it depends, see the comments | As we mentioned in Q 0-1, in RAN1 discussion for model identification, the NW additional conditions consistency can be either realized by an associated Id or implicitly evaluated by performance monitoring.  Assuming the associated Id is adopt:  In this assumption, We think it is not a valid case for which the UE send the applicability reporting reactive to the RRCReconfiguration including the functionality configuration(e.g. Set A and/or Set B), in our understanding, NW shall be aware of the applicability of each functionality via associated Id before configuring it to UE (e.g. via proactive applicability reporting), otherwise, the RRC signalling to configure the useless AI/ML functionality would be waste due to such blind manner which seems not necessary.  Assuming the performance monitoring is adopt:  In this assumption, we think it is a valid case for which the UE send the applicability reporting reactive to the RRCReconfiguration including the functionality configuration(e.g. Set A and Set B beam resource configuration), and UE start executing the performance monitoring for those preconfigured functionalities and report the applicability of each functionality to NW after a time period of performance monitoring. |
| Mediatek | Yes with comment | The difference between proactive and reactive reporting lies in the timing of coordinating AI/ML functionality applicability relative to the inference configuration. In reactive reporting, the network provides the inference configuration to the UE before the coordination of AI/ML functionality applicability.  However, given that proactive reporting allows the UE to precisely indicate AI/ML functionality applicability before the inference configuration is set, the necessity for reactive reporting needs to be clearly justified.  One potential reason for having reactive reporting is its ability to accommodate dynamic changes in the UE's internal conditions, which may influence the applicability of AI/ML functionalities after the initial setup.  Another potential reason for having reactive reporting is to report the availability of the AI/ML functionality, which may trigger model transfer from the network to the UE if model transfer is supported. |
| Lenovo | No? see comments | First, it would be helpful to clarify the scenario, is it about UE determining the applicability (Option 2 in Q1-2).  If the intention of this question is asking if NW should provide some configuration for functionality before UE determines the applicability, then the answer would be yes. And example of the configurations would be those useful and related to applicability determination, e.g., related to NW side additional condition such as the Set A and Set B association discussed by RAN1.  But if the intention of this question is asking if the related configuration must be provided in the same request message that triggers the UE applicability report, the answer would be no. In our view, it can be provided in any regular *RRCReconfiguration* message beforehand, and not necessarily coupled with the trigger of UE applicability report.  [Rapp] Rapporteur assume the answer to the question is Yes. The detailed signaling is discussed in below question. |
| Ericsson | Yes | The Step 3 in the reactive reporting can include one or more candidate radio inference configurations including the associated IDs that the UE can use for the inference and also the AIML functionalities that are requested by the gNB. Then in step 4, the UE can respond indicating which (if any) of these indicated radio configurations make the AIML functionality applicable, or it can also indicate other radio configurations (including the NW side additional conditions), e.g. if none of the inference configurations indicated by the gNB in step 3 are applicable. Related to step-5, we believe that it is optional. For example, if in step-4, the UE indicates that a certain inference configuration is applicable, then step-5 can just be an activation command, or simply the UE can activate/apply straight away the inference configuration if that is applicable for the AIML functionality (no need in this case for any activation)  Related to the question from the rapporteur to “provide an example of configuration for functionalities other than AI/ML beam resource configuration”, we believe that this is left to RAN1, and RAN2 should just discuss protocol related aspects, without digging into the content of the “inference configuration”. |
| Fujitsu | Yes, with comments | We agree that the NW can provide some configurations to assist the reactive reporting of the applicable functionality at UE side.  This can work as kind of filtering of the reported applicable functionality. For this purpose, the configurations can be inference configurations, e.g., beam resource configuration of Set A and Set B, associated IDs (if introduced), network implementation configurations, performance KPIs or other configurations. As a response, the UE will then report the applicable functionalities which can meet the above configurations. |
| Qualcomm | Wait for RAN1 progress.  (do not agree with the sequence of steps) | RAN2 should wait for the definition of functionality and representation. If functionality is represented by the set A and set B configuration, then maybe the resource config (set A and Set B) configuration is used for inference configuration.  For both proactive and reactive approaches inference configuration can be provided together with the configuration for applicable functionality reporting. For both proactive and reactive approaches steps 3 and step 5 should be combined. Furthermore, as discussed in the response to q1-1, proactive and reactive approaches should be combined instead of standardized separately. We can have a common framework for applicable functionality reporting, where:   * Configuration is performed using RRCReconfiguration (or otherconfig) / RRCResume / System information /RRCRelease   Reporting is done using RRCReconfigurationComplete / RRCResumeComplete / RRCEstablishmentComplete / UAI |
| CATT | No with comments | We don’t see big differences between proactive and reactive reporting procedures. In our view, the inference configuration should be provided after UE reports the applicable functionality, the network only needs to provide the inference configuration for applicable functionality. Providing the inference configuration before the applicable functionality reporting will cause unnecessary signalling overhead.  If the network configuration refers to **NW-side additional condition**, e.g., associated ID, as UE needs also consider UE-side additional condition and whether there is available model, NW-side additional condition is not the only condition for UE to report applicable functionality. The UE-side additional condition changes or model available situation changes can also trigger applicable functionality reporting. It is better to define a separable procedure for NW-side additional condition. This will be similar to proactive reporting. |
| Samsung | Yes | It seems reasonable assumption that NW can provide applicable functionalities in reactive reporting. In case of associated ID, it may not be necessary to include as long as gNB configured functionalities are already associated to the associated IDs.  Whether further information is needed would be based on RAN1 conclusion on functionality. |
| Interdigital | See comments | RAN1 is still discussing the details of network side additional conditions and associated IDs. For example, it is still not clear if the associated ID implies a certain inference configuration (e.g., set A/B configuration). Thus, we propose to wait for RAN1 progress before we can decide on this (i.e., whether inference configuration is provided in step 3 or step 5). |
| LGE | Yes | The main difference between reactive reporting and proactive reporting is that reactive reporting immediately informs whether the inference can be performed based on the current given configuration. |
| Nokia | Yes | We think that the NW could also alternatively provide a CSI-ReportConfig, which includes NZP-CSI-ResourceSetConfig(s), which would allow the UE to evaluate the full configuration of a functionality, including the inputs and outputs. |
| CMCC | See comments | Based on the previous online discussion, we think the majority view is that on of the key differences between proactive reporting and reactive reporting is whether inference configuration is provided with NW-side additional condition in the same RRCReconfiguraiton. However, we also think that the inference configuration should be provided after UE reports the applicable functionality, otherwise, it will cause unnecessary signaling overhead.  If the network configuration refers to NW-side additional condition, we share the similar view as OPPO that the reactive reporting has another understanding,i.e. NW configure via RRCReconfiguration message, UE responses the applicable functionality in RRCReconfigurationcomplete message.  [Rapp] It is not clear to rapporteur whether the answer is agree or not the full inference configuration should be provided to UE before applicable functionality or not. It seems the answer is contradicting with itself. |
| Sharp | Yes, with comments | Network-side additional conditions/configurations provide essential context and parameters that help the UE determine which functionalities it can support and activate. These configurations may include details such as beam resource mappings, transmission power settings, and other network-specific parameters that are not inherently part of the UE's capabilities but are critical for the proper functioning of certain features. |
| CEWiT | Yes | Same view as Ericsson. |

**Summary:**

Yes: 15/21 companies reply some configuration of functionalities needs to be provided to UE before reporting applicable functionalities. Among companies who agree the configuration of functionalities needs to be provided, here’s some examples of configurations that can be provided in Step 3 for reactive reporting:

1) NW-side additional condition (e.g. associated ID): Xiaomi (if granularity of functionality can indicate relationship between Set A and B of beams, and assume it is gNB implementation information according to reply in Q0-2), NEC (configuration is defined as NW-side additional condition, not full inference configuration), Vivo (associated IDs representing beam characteristics and beam info with explicit signaling, not full inference configuration according to reply in Q0-2), Lenovo, Fujitsu (assume its full inference configuration according to reply in Q0-2)

2) Beam related information (e.g. beam index) of Set A and Set B: Vivo, Sharp. Rapporteur understands this information anyway needs to be provided together with other information. However, this also depends on the definition of NW-side additional condition, which is up to RAN1.

3) Inference configuration (full configuration): Xiaomi (if granularity of functionality can indicate relationship between Set A and B of beams), Apple, MTK (reactive reporting is used to accommodate dynamic changes and/or trigger model transfer), Ericsson (can be one/more candidate inference configurations), Fujitsu, Samsung? Nokia, LG, Sharp

4) others: performance KPIs, network implementation configuration, other network-specific parameters, etc

No: Oppo, ZTE (depends how RAN1 decides NW-side additional condition, but not blindly provides full inference configuration, according to response to Q3-1), CATT

Open to discuss: HW

Wait for RAN1: QC, Interdigital. It is not clear if the associated ID can imply a certain configuration.

Considering companies with the answer ‘Yes’ has different interpretations on configuration provided in Step 3, rapporteur understands that there’s no consensus on whether other inference configuration (full configuration) needs to be provided to UE before applicable functionality reporting. Also, this also depends on how RAN1’s understanding of UE assumption of using the same associated ID. Therefore, rapporteur feels it might be better to wait for further RAN1 progress on this.

Rapporteur Summary 5: Wait for further RAN1 progress and further study whether other inference configuration of functionalities separately is provided in Step 3. Providing NW-side additional condition in Step 3 is discussed in Q2-2. Summary can be found under Q2-2.

According to UE capability reported by the UE, network can provide network configuration (discussed in Q2-1) to all/subset of supported functionalities.

Based on current NW-side additional conditions, network can filter a list of functionalities from supported functionalities according to network implementation, and then provide configurations for those NW-considered applicable functionalities. Alternatively, similar as proactive reporting, in addition to network configuration (discussed in Q2-1), network can provide NW-side additional condition explicitly in Step 3, and let UE decide applicable functionality based on both NW-side and UE-side additional condition.

In the end, considering this configuration is provided by network based on UE supported functionalities, in rapporteur’s understanding, all of the functionalities configured by network in Step 3 may or may not have an available model, and may or may not be applicable at the UE side.

#### Q2-2. In Step 3 of reactive reporting,

**1) is there any other information (e.g. NW-sided additional condition) you think the network can provide except AI/ML resource configuration of NW-considered applicable functionalities (i.e. subset of supported functionalities based on NW-side additional condition)**

**2) those functionalities may or may not have an available model, and may or may not be applicable at the UE side?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | **1) Yes/No** | **2) Yes/No** | **Comment** |
| OPPO |  |  | See answer in Q2-1 |
| Xiaomi | Yes | Yes | We agree with rapp NW may provide the NW side additional condition to UE. UE can response with the applicable functionality under the corresponding NW side additional condition. Such information is useful for NW to decide the appropriate NW configuration and activated functionality. |
| NEC | Maybe No | Yes | We are a bit confused with the relationship between “AI/ML beam resource configuration of Set A and Set B” in Q2-1 and “AI/ML resource configuration of NW-considered applicable functionalities” here.  If the former one is just an example of the latter wording, we have no idea on any other information besides “AI/ML resource configuration of NW-considered applicable functionalities”.  Step 3 only provides NW-sided additional condition, therefore, those functionalities may or may not have an available model, and may or may not be applicable at the UE side. |
| vivo | Left to RAN1 | Yes | [Rapp] based on response to Q2-1, it seems at least NW-side additional condition is needed? |
| Apple | Yes (associated ID) | Yes | As we responded in Q2-1, NW-sided additional conditions are always provided to the UE in the form of associated IDs, irrespective of proactive reporting or reactive reporting. Thus, we think associated ID are needed to be provided. |
| Huawei, HiSilicon | Yes | Yes | For 1), as we commented for proactive reporting, the UE may only report the functionalities for NW-side additional conditions requested by NW. |
| ZTE |  |  | See our answer in Q2-1. |
| Mediatek | Yes. (i.e., NW-side additional condition, details left to RAN1) | Yes with more clarification |  |
| Lenovo | Need clarification | No, there may be problematic if the model is not available at that moment | 1) need to clarify the scenario of applicability determination it sounds like a variation of Option 1 in Q1-2. Maybe we should discuss first is Option 1 or any variation of Option 1 can be agreeable, then the same solution can work for both proactive and reactive.  2) as we raised in phase 1 discussion, if we consider the case that the model is not available at the moment NW triggers the applicability report from UE, it is difficult for NW to provide proper configurations/information that is related to the applicability of a functionality. |
| Ericsson | Yes | Yes | Question 1): The gNB when providing the inference configurations it should include the necessary associated IDs (NW-side additional conditions) to aid the UE to determine the applicability. From RAN2 pov, at least the following info should be included in step 3:   * Inference configurations (including the associated IDs/NW side additional conditions) * The AIML functionalities of interest for the NW.   Question 2): The AIML functionalities requested by the gNB in step 3 may or may not be available at the UE, because the NW cannot know beforehand (e.g. from capabilities) whether the UE really has a trained model for the request functionality |
| Fujitsu | Yes | Yes | For 1), pls see our reply in Q2-1;  For 2), we agree with Ericsson. |
| Qualcomm | Yes (associated ID) | Yes | Agree with Apple that network-side additional conditions should be provided to the UE irrespective of proactive or reactive approach. Furthermore, we should combine proactive and reactive approaches. |
| CATT |  |  | See our comment in Q2-1.  [Rapp] Rapporteur understands the comment in Q2-1 indicates that the NW-side additional condition should be configured to the UE. |
| Samsung | Yes | Yes | For 1), it seems reasonable to assume that gNB also provides associated ID linked to supported functionalities unless it is already identified by proactive reporting.  For 2), there could be two cases. The first case is where associated ID is not provided in advance so that gNB doesn’t know whether a certain functionality has trained model. The second case is where UE’s condition (processing capability or other constraints) has changed so that model may become invalid. |
| Interdigital | Yes (e.g., network side condition such as associated ID(s)) | Yes |  |
| LGE | Yes (details left to RAN1) | Yes |  |
| Nokia | Yes + comments | Yes + comment. | 1. When a functionality is configured to the UE, it is expected to provide more configuration parameters than the resource configurations (e.g., CSI reporting configuration is an example used in RAN1 for BM use case). In addition to the parameters provided in the functionality (inference configuration such as CSI-ReportConfig), the NW could provide an associated ID which links inference configuration to training data collection configurations.  We aren’t sure what a NW-considered applicable functionality is. Although the procedures for configuration are standardized, the NW configures the UE in a proprietary manner based on the UE’s capabilities, thus the term does not add to the discussion since it seems to simply mean “configuration”.   We do not think that availability of a model is relevant since applicability implies availability. It isn’t useful to know if a UE has a model available which wouldn’t perform well at the cell requesting the applicability report. |
| CMCC | Yes for NW-sided additional condition | Yes for applicable functionalities | For 2), we understand the question is that the NW indicates the UE to report whether those functionalities have an available model, and/or whether they are applicable at the UE side. However, we think only applicable functionalities need to be reported, because the functionality maybe not applicable even if there is an available model for it. |
| CEWiT | Yes | Yes |  |

**Summary:**

Combining companies’ feedback from Q2-1 and Q2-2, most of companies (16/19) think that NW-side additional condition (e.g. associated ID) needs to be sent to UE in Step 3 of reactive reporting.

Yes for NW-side additional condition (e.g. associated ID) of supported functionalities: Xiaomi, NEC, Vivo, Apple, HW, MTK, Ericsson (also other inference configurations), Fujitsu, QC, Samsung, Interdigital, CATT

Besides, only one company (Lenovo) thinks the functionality indicated in Step 3 needs to have an available model. However, RAN2 agreed that the supported functionalities reported in UE capability reporting may or may not have available model.

|  |
| --- |
| Which AI/ML-enabled Features/FGs and functionalities are supported should be standardized. The details wait for RAN1’s progress.   “supported” means that the UE is capable of supporting the functionality and doesn’t mean neccesarily that the UE has the model available. |

Rapporteur suggests to continue follow RAN2 agreement during the discussion.

Rapporteur Summary 6: In reactive reporting, network provides NW-side additional condition (e.g. associated ID) of supported functionalities before UE reports appliable functionalities (i.e. in Step 3). The detail of NW-side additional condition is up to RAN1. FFS on whether network can provide other inference configurations for functionalities before UE reports appliable functionalities (i.e. in Step 3) depending on RAN1 progress.

Then UE can decide the final applicable functionalities based on its UE-side additional condition:



#### Q2-3. Do you agree UE reports final applicable functionalities (applicable based on both UE and NW side additional condition) in Step 4, as a response to Step 3?

NOTE: Non-applicable functionality with available model reporting in Step 4 will be discussed in Q2-7.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| OPPO |  | See answer in Q2-1 |
| Xiaomi | Yes with comments | We suggest to remove the ‘final’. Because NW may further determine the applicable functionality based on NW side additional condition or other implementation factors. UE just need to reports the applicable functionalities from UE point of view. |
| Futurewei | Yes. |  |
| NEC | Yes |  |
| vivo | No | Agree with Xiaomi to remove “final” as “~~final~~ applicable functionalities”  [Rapp] rapporteur considers this as “Yes” after removing “final” in the proposal. |
| Apple | Partially Yes | Besides UE-side and NW-side additional condition, the model availability in device (i.e. the UE completes model training and downloading) also need to be met. Otherwise, the NW can’t know whether the functionalities are applicable and when they can be activated.  Thus, we suggest below change on Rapporteur’s proposal:  UE reports final applicable functionalities (applicable based on **~~both~~ model availability in device,** UE **side additional condition** and NW side additional condition) in Step 4, as a response to Step 3 |
| Huawei, HiSilicon | Yes with comments | Agree with Xiaomi to remove the wording "final" in the last step. |
| ZTE |  | See answer in Q2-1 |
| Mediatek | Agree with Apple | We agree with the Rapporteur's view that the UE should determine the final applicability of the AI/ML functionality, provided that the network-side condition, e.g., represented by the associated ID, is supplied alongside the inference configuration. This approach minimizes the need for additional handshaking, signaling, and potential latency that would result if the network were to make the final decision. |
| Lenovo | See comment | As commented in Q2-2, it seems similar approach as Option 1 in Q1-2. In Option 1 of Q1-2, it is upon UE to do filtering and NW makes the final determination. Here, it is upon NW to do filtering and UE makes the final determination. Not sure if we need different approaches supported, prefer to have one principle solution, even though we may have different variation in terms of proactive and reactive (if agreed).  [Rapp] Rapporteur understands the preference is Option 2 (i.e. yes to this question), and Option 1/3 for further consideration? |
| Ericsson | Yes, but “final” not needed | Suggested changes to the figure:   * In the RRC Reconfiguration signalling just include “RRCReconfiguration (inference configurations including NW-side additional conditions, AIML functionalities for applicability reporting)”…..i.e. remove “NW-considered applicable”, because the NW cannot know at this stage whether a function is applicable or not. * First box: add “based on the received RRCReconfiguration” * We cannot preclude the case that the “applicability functionality reporting” can also include here other inference configurations/NW-side additional conditions, e.g if none of the inference configurations are ok, or simply if the gNB wants to use the RRCReconfiguration to inquire the UE about its applicabilities and needed inference configurations/NW-side additional conditions |
| Fujitsu | Yes | Agree with Apple, it is necessary to confirm that in step 3, all applicability related information has been sent to UE for final decision. |
| Qualcomm | Agree with Apple. |  |
| CATT | Partially Agree with Apple | Based on Apple’s revision, we further suggest to remove “as a response to Step 3”, or change it to “after step 3”. As “a response” seems to imply this is a RRCxxxComplete message, but we are not sure whether there is a time delay requirement for this applicable functionality checking.  And in our view, no matter proactive or reactive way, UE determines whether functionality is applicable. |
| Samsung | Yes | We are ok to remove “final”. |
| Interdigital. | See comments | We think this question is overlapping with Q1-2. For example, with option 2 in Q1-2, the UE determine the “final” applicable functionalities, while with options 1/3, it is the network that determines the “final” applicable functionalities.  [Rapp] following comments in Q1-2, rapporteur assumes your preference is Option 2 as baseline (i.e. yes to this question) and Option 1 for further discussion? |
| LGE | Yes | Agree to remove “final” |
| Nokia | Yes + comments | We agree that UE reports applicable functionalities, but we don’t understand why they are regarded as “final”, since the applicable functionalities can be updated. However, the mentioning of NW/UE-additional conditions is not accurate and not reflected correctly in the diagram provided by the moderator.  For example, the first step should be focused on NW sending associated-ID(s) and functionality configurations towards the UE. Mentioning of NW-additional conditions and NW-considered applicable functionalities seems not well aligned with the terminologies or discussions in RAN1. Also, UE checking its UE-additional conditions looked like an incorrect way of referring UE-additional conditions. Based on the TR, both NW and UE additional conditions are related to model training aspects and known at the UE. A selection of a model or a model applicability shall be determined at the UE based on the associated ID(s). UE additional conditions and what is their impact is not related to this discussion. |
| CMCC | Yes with comments | Agree with Apple. |
| CEWiT | Yes | Agree with Apple. |

**Summary:**

Most companies (18/20) agree that UE decides its applicable based on UE-side additional condition and NW-side additional condition.

Furthermore, model availability in device can also considered according to companies’ feedback.

There’s also one proposal from one company to consider signaling for “applicability functionality reporting” can also include other inference configurations/NW-side additional conditions” preferred by UE. This will be further discussed/concluded in Q2-7.

Rapporteur Summary 7: In reactive reporting, UE reports applicable functionalities (applicable based on model availability in device, UE side additional condition and NW side additional condition) (in Step 4) after receiving *RRCReconfiguration* from network (i.e. Step 3). Whether it is UAI or *RRCReconfigurationComplete* will be summarized in Q2-4.

In below sections, let’s have some initial discussion on candidate RRC signalings used for Step 3-4. According to the contributions submitted RAN2#126 meeting. There are mainly two options proposed by companies:

**Option 1:** RRCReconfiguration/ RRCReconfigurationComplete (including RRCResume /RRCResumeComplete, etc) [1][9][15][18][21]

In this option, *RRCReconfigurationComplete* message is directly used to report the applicable functionalities in response to *RRCReconfiguration* in Step 3. Furthermore, [9][18][21] also mentioned that complete messages can be used when synchronization is lost between UE and NW, RRC state transition, etc.

**Option 2:** UAI (i.e. same as Approach #1 (proactive reporting), OtherConfig in RRCReconfiguration and UAI) [2][5][10][19][25]

In this option, UAI message can also be used in response to configurations received by UE in Step 3, indicating the applicable functionalities, i.e. reuse the same signaling as proactive reporting. By using UAI framework for reactive reporting, it also means network also needs at least configure the UE whether it is allowed to do applicable functionality reporting in Step 3.

#### Q2-4. Which option do you agree as signalings for Step 3 and Step 4?

**Option 1: RRCReconfiguration/ RRCReconfigurationComplete (including RRCResume /RRCResumeComplete, etc)**

**Option 2: UAI (i.e. same as Approach #1 (proactive reporting), OtherConfig in RRCReconfiguration and UAI)**

**Option 3: Others (please list the signaling message)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1/2/3** | **Comment** |
| OPPO | Option1 | See answer in Q2-1, only Option1 is applicable for reactive method. |
| Xiaomi | 1/2 | No strong view. Both options are feasible. |
| Futurewei | 2 | Option 2 can work for both proactive and reactive cases. Option 1 works too. But we have agreed to use Option 2 for the proactive case. We should use the same approach for both cases. |
| NEC | - | Option 1: On the top of reporting UE supported NW-side additional conditions via UE capability signalling and proactive applicable functionality reporting, we don’t see motivations to introduce this reactive reporting via RRCReconfiguration/ RRCReconfigurationComplete (including RRCResume /RRCResumeComplete, etc).  Option 2, we are OK with Option 2, however, it is the same as proactive reporting.  See answer in Q0-2, we think it would be good to use UE capability signalling to reduce AI/ML configuration latency and configuration overhead. |
| vivo | Option2/3 | Prefer to have unified procedure for reactive and proactive reporting, specifically, A UE have applicable functionalities may initiate the UAI procedure if it was configured to do so, upon it was configured to provide applicable functionalities, or upon change of applicable functionalities.  The former case (initial report) can be regarded as reactive reporting and the latter ones (upon change) can be regarded as proactive reporting.  We are also OK for the separate procedures. But we do not think Option 1, is appropriate for applicable functionality reporting. *UEInformationRequest /response* can be considered, which is used by the network to request the UE to report information. |
| Apple | Option 1 | 1. As we responded in Q2-1, in reactive reporting, associated ID and corresponding inference config are provided to the UE together in same *RRCReconfiguraiton* message, and the UE can immediately perform inference for applicable functionality. Thus, the UE can naturally include which functionalities are applicable in the response RRC message (i.e. *RRCReconfiguraitonComplete).* **It is unnecessary and redundant to use another RRC message (e.g. UAI) to report them as the UE already performs inference.** 2. We don’t think option 2 (i.e. UAI) can work for reactive reporting of neighbour cells. Existing UAI framework can only report UE’s **condition/information changes** **on serving cell, but it can’t work for reactive reporting of neighbour cells.** For example, in L3 measurement prediction for neighbour cells, the existing UAI framework can’t report applicable functionalities corresponding to the NW-side additional conditions of neighbour cells. So, if option 2 is adopted, we need to enhance existing UAI framework. 3. In Handover, option 2 (i.e. UAI) also can’t work for reactive reporting. In legacy, target cell configuration is included in HO command and the UE response *RRCReconfiguraitonComplete* message to target cell. It is straight forward that associated ID and inference configuration of target cell are also included in HO command, and the UE includes applicable functionalities in the response *RRCReconfiguraitonComplete* message towards target cell. As UAI message can’t be sent directly to target cell, it means existing UAI framework can’t work for handover case.   If RAN2 can extend existing UAI framework to support above neighbour cell and Handover case, we are also fine. But we assume that it will introduce significant spec change as it changes the fundamental assumption of UAI framework and put a new UE requirement (i.e. the UE needs to monitor condition/info change of both serving cell and neighbour cells). |
| Huawei, HiSilicon | Option 2 | We prefer to have a unified solution for both proactive and reactive approaches as it is sufficient and has less specification impacts. For Option 1, we wonder about the necessity.  The applicable functionality reporting means the applicability status may change dynamically, and then Option 1 may be inefficient in some cases. For example, at T0, the UE uses Option 1 for reporting and then the NW immediately knows that the UE has no applicable functionalities, but just after a short time, the UE has applicable functionalities (and vice versa). In this case, the NW does not know the change, and it will lead to inefficient signalling procedure between UE and NW.  In order to solve this issue, the NW may initiate multiple RRCReconfiguration procedures, and the UE could be able to send applicable functionalities via complete messages correspondingly. However, this may cause significant signalling overhead and NW resources. |
| ZTE | Either Option 1 or Option 2 ,not both | See our answer in Q2-1.  If the associated Id is adopt, we think the one unified solution is enough no matter the applicability reporting is reactive or proactive. |
| Mediatek | Option 1/2 | Even for proactive reporting, we think option 1 is possible. For example, the NW provides the associated ID in the *RRCReconfiguration* message, and UE can respond directly in the *RRCReconfigurationComplete* message whether/which AI/ML functionality is applicable.  But we are open to consider both option 1 and 2 for reactive reporting. |
| Lenovo | Option 2 | We tend to believe UAI based solution would be sufficient. The UAI can be triggered by UE anyway in case of any change of NW side additional condition e.g., via *RRCReconfiguration*. The motivation of using Option 1 *RRCReoconfigurationComplete* message seems be because of the latency consideration, but not sure if it is really necessary. |
| Ericsson | Option 1 | The reactive approach is used whenever we want the UE to react to specific inference configurations. It does not make sense to use UAI for it. The proactive approach has to be used mainly for the cases in which the UE wants to signal a change in its applicability conditions (due to UE conditions, or other received NW configurations). One benefit of reactive approach is that the UE can consider the applicable AIML configuration active straight away, without further NW configurations. If UAI is only UAI this cannot be achieved, as also Apple pointed out. However option 2, which is the proactive approach, should be integrated with the option 1, e.g. the network provides an inference configuration reactive approach, i.e. via classical RRCReconfiguration signalling (step 3), the UE applies it and starts doing AIML (step 4). Then at a later point in time the UE can signal changes in its applicability, e.g. the applied inference configuration is not applicable anymore. |
| Fujitsu | Option 2 preferred.  Option 1 also OK. | From unified framework for both proactive and reactive reporting’s point of view, option 2 is slightly preferred due to it is more dynamic.  Option 1 can be kept for further discussion. |
| Qualcomm | See comment | As discussed in the response to q1-1, proactive and reactive approaches should be combined instead of standardized separately. We can have a common framework for applicable functionality reporting, where:   * Configuration is performed using RRCReconfiguration (or otherconfig) / RRCResume / System information /RRCRelease * Reporting is done using RRCReconfigurationComplete / RRCResumeComplete / RRCEstablishmentComplete / UAI |
| CATT | Option 2 | Similar to our comment in Q2-1, the network only needs to send the inference configuration to UE for the final activated functionality, so UAI for proactive reporting is sufficient, inference configuration in step 3 is not needed. |
| Samsung | Option 2 | If we consider that UE decide applicability based on current UE and NW additional conditions upon RRC reconfiguration, option1 would be sufficient.  However, we see a need for UE to update applicable functionalities due to change of UE additional conditions e.g. UE mobility, UE processing/resource capability. In this case, there should be a way for UE to indicate update of applicable functionality by using UAI.  If we go with only one option, UAI should be more suitable. |
| Interdigital | No strong opinion | Both options are viable. It is natural to consider RRC complete messages for the reactive approach. However, a unified solution via UAI for both reactive and proactive reporting could reduce the standardization work. |
| LGE | Option 1/2 | If the UE determines and informs the applicability immediately after receiving configuration with functionality-related settings, then Option 1 is reasonable to avoid the need for an additional report. However, if the UE’s situation changes and applicability needs to be updated later, then Option 2 may be necessary. |
| Nokia | Option 2, Option 3 | A single IE could be defined to support signaling of the applicable functionalities in either the RRCReconfigurationComplete message or in a UAI message, however, we should consider UAI as the baseline. We also think the question is combines our answers for step 3 and step 4, but UAI couldn’t be used for Step 3.  For BM use cases, as the functionality may be referred by the CSI-ReportConfig, it is also feasible to introduce new MAC-CE (or any other L2) signalling to indicate applicable CSI-ReportConfigIDs in a more flexible manner. We think this, option 3, is necessary because the configuration and reporting of applicability aren’t a monolithic step.  [Rapp] Based on the reply, it seems the preference is using RRCReconfiguration in Step 3, and UAI in Step 4. Rapporteur count it as preferring Option 2 (as a response to configuration), but will consider Step 3 with different signaling. |
| CMCC | Option 1 | See our answer in Q2-1.  In addition, we agree with Ericsson and Apple that the reactive approach is used whenever the network wants the UE to react to specific configurations or specific scenario (e.g. handover), which cannot be achieved by UAI. |
| Sharp | 1 and 2 | Both options are feasible |
| CEWiT | Option 1 | Option 1 is the best option for reactive method. If unified solution is preferred for proactive and reactive methods, okay to go with the majority. |

**Summary:**

Option 1 (*RRCReconfigurationComplete*, etc) (10/21): Oppo, Xiaomi, Apple, ZTE, MTK, Ericsson, LG, CMCC, Sharp, CEWiT (ok with majority)

1) NW-side additional condition and/or inference configuration are provided over *RRCReconfiguration* message, where UE can response immediately.

2) UAI cannot support reporting of neighbouring cells and handover scenario.

3) Avoid additional reporting

Option 2 (UAI) (12/21): Xiaomi, NEC (ok with Option 2), Vivo, Huawei, ZTE, MTK (open to consider), Lenovo, Fujitsu, CATT, Samsung, LG (for update), Nokia (configuration not in *OtherConfig*), Sharp

1) No motivation to introduce immediate response to *RRCReconfiguration* (some companies assume inference configuration doesn’t need to be provided to UE before applicable functionality reporting, also NW-side additional condition (e.g. associated ID) can be transmitted via *OtherConfig*)

2) considering UE mobility, change of processing/resource capability, UAI is more suitable for unified solution of proactive/reactive.

It seems companies supporting Option 1 assumes inference configuration should be provided to UE in Step 3 via *RRCReconfiguration* message. According to the discussion and summary above, whether network can provide other inference configurations for functionalities before UE reports appliable functionalities (i.e. in Step 3) depends on RAN1 progress, which can be further discussed.

Moreover, as commented by companies, it is also possible that the inference configuration is provided in *RRCReconfiguration* message (i.e. Step 3), while the applicable functionality is provided in UAI (i.e. Step 4).

With the above consideration, rapporteur suggests to make following assumptions on the signaling used for reactive reporting:

Rapporteur Summary 8: Reactive reporting considers the following options for applicable functionality reporting:

Option 1: *RRCReconfigurationComplete* (etc)

Option 2: UAI

#### Q2-5. Please also list any missing information that you think needs to be transferred to UE or reported to NW in Step 3/4. If none, please skip this question.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Apple | * + - 1. As we responded in Q2-1, NW-sided additional conditions are always provided to the UE in the form of associated IDs, irrespective of proactive reporting or reactive reporting. Thus, we think **associated ID** are needed to be provided by NW.       2. Since inference configuration is already provided before applicable functionality reporting, we think it is sufficient for the UE to report whether they are applicable or not (e.g. the associated IDs whose corresponding inference configuration are applicable). |
| Ericsson | In step-4 we should not preclude the UE to report to the NW, the associated IDs/inference configurations, even if these associated IDs/inference configurations are not included in step-3. The step-3 can just be used by the gNB to require the UE to transmit its applicable functionalities and the related associated IDs, and then the gNB can use step-5 to configure, if interested, the needed inference configuration.  So the step 4 could:   * Include the applicable functionality/ies and the inference configurations/NW-side additional conditions selected by the UE for the inference (among the inference configurations/NW-side additional conditions included in the step 3). * Include other possible inference configurations/NW-side additional conditions that the gNB can configure to the UE (not included in the step 3).   Related to Apple comment 1: We agree that the NW-side additional conditions are part of the possible inference configurations in the reactive approach that the NW can provide to the UE. However, RAN2 does not need to discuss the details of this inference configuration. What to include there should be decided by RAN1. |
| Nokia | Step 3 may need to provide associated IDs and other parameters (CGI, PCI, etc..). However, what exactly that information is related to the ongoing RAN1 discussion on ensuring consistency in training and inference. |
|  |  |
|  |  |
|  |  |

**Summary:**

The above comments are considered in the summaries above.

After Step 4 and determination of applicable functionalities, it is not clear whether the network needs to provide an update of network configurations or not.

The update of network configuration may not be needed, considering the UE itself knows the applicable functionalities and can directly use the network configuration in Step 3 without further update from network. On the other hand, the network may not have provided the full AIML resource configuration in Step 3 and may need to provide an updated configuration to UE according to the final applicable functionalities reported by the UE.

#### Q2-6. Do you think Step 5 is needed in reactive reporting? if yes, please comment on what is the difference with Step 3.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| OPPO |  | See answer in Q2-1 |
| Xiaomi | Up to NW | NW may send *RRCReconfiguration* to update the NW configuration or other configuration. We don’t need to restrict NW implementation. |
| Futurewei | No | Does not seem necessary; does it provide any new information that the UE does not know? And how the UE is going to use it? |
| NEC | Yes | Step3 only configures NW-side additional condition related configurations (e.g., AI/ML beam resource configuration of Set A and Set B) whereas Step 5 should provide a full configuration for the activated functionality, for example, inference and/or performance monitoring related configurations, etc. |
| vivo | Yes | Especially for the type 2 conditions.  - Type 2: Set A/Set B related info, e.g., the beam index of set B. This information should be explicitly sent to UE for model inference. |
| Apple | Up to NW | Same view as Xiaomi, it is legacy behaviour that it is up to NW implementation whether/when to send another *RRCReconfiguration* to update the NW configuration or other configuration. It doesn’t make sense to restrict NW implementation. |
| Huawei, HiSilicon | Yes | For the difference between Step 3 and Step 5, our understanding is as below:  Step 3 is ‘otherConfig’ for the UAI containing additional configuration such as the assocaitedID and functionalities;  Step 5 contains the inference configuration that the network chooses for the UE inference operation. |
| ZTE |  | See answer in Q2-1 |
| Mediatek | Up to NW |  |
| Lenovo | Yes? | The inference related configuration should be provided to UE before the activation of AIML functionality.  From another aspect, it would be reasonable if NW provides functionality-specific configuration for inference after an AIML model being available at UE. Otherwise, it may be a waste of effort, as the AIML model may be never available.  If companies believe the availability is indicated by the applicability report, then the answer would be yes.  The same issue applies to proactive reporting scenario. |
| Ericsson | Up to NW | The step-5 can be used if for example the UE indicates in step-4 that the UE needs a different inference configuration (NW-side additional conditions) to make an AIML functionality applicable. Then the gNB can use step-5 can be used by the gNB to configure, if interested, the UE with the needed inference configuration. |
| Fujitsu | Yes | The same step as in proactive reporting.  In step 5, the NW can send the *RRCReconfiguation* to inform the activated functionalities. In addition, it may also include the inference configuration for the UE to perform the inference. |
| Qualcomm | Up to NW  With comment | For both reactive and proactive approaches, step 3 and step 5 can be combined. However, we also agree that for both approaches network can update any configuration, if needed. |
| CATT | Up to NW | It’s up to NW whether to update configurations. But our view is it should be the network to finally activate a functionality (not UE automatic activation). |
| Samsung | Yes | NW may update applicable functionalities based on UE’s reporting or any other factors. |
| Interdigital |  | Please see our comments to Q2-1. |
| LGE | Up to NW |  |
| Nokia | Yes | Even in reactive reporting, the UE needs to report which functionalities are applicable or non-applicable. If the NW provides more than one configuration option and the UE determines that more than one configuration is applicable, then the NW will still need to select the preferred applicable functionality which the UE should activate.  Because it cannot be known at the time of the first RRCReconfiguration which functionalities are applicable, the UE cannot directly activate anything anyway since the NW would need to configure itself to support the applicable functionality once it is reported by the UE. |
| CMCC | It depends | If the inference configuration is provided in step 3, then step 5 is optional and up to NW.  If the inference configuration is not provided in step 3, then step 5 is needed.  [Rapp] According to the feedback from company above, rapp understands the preference is not provide configuration in Step 3? |
| Sharp | Upto NW | The network may update any configuration when needed. |
| CEWiT | Yes | As an optional step, in case the network needs to update the configuration. |

**Summary**:

Yes (8/21): NEC, Huawei, Vivo, Lenovo, Fujitsu, Samsung, Nokia, CEWiT (optional step), CMCC?

Among above companies, NEC and Huawei assumes only NW-side additional condition (e.g. associated ID) is provided in Step 3, where further inference configuration is provided in Step 5 after applicable functionality reporting. On the other hand, Samsung thinks Step 5 may provide potential update to Step 3, by assuming inference configuration is provided in Step 3.

No (1/21): Futurewei

Up to network to provide updated inference configuration (8/21): Xiaomi, Apple, MTK, Ericsson, QC, CATT, LG, Sharp

Among above companies, some companies assume inference configuration is provided in Step 3, then Step 5 is not mandatorily needed; one company assumes UE may indicate to network a new configuration is needed for its non-applicable functionality, hence Step 5 is used to send new configurations for those non-applicable functionalities.

Similar as the signaling used for reactive reporting, since there’s no consensus whether other inference configuration (except NW-side additional condition) can be provided to UE before applicable functionality reporting. Therefore, rapporteur summarize below two options:

Rapporteur Summary 9: RAN2 considers the below approaches of providing inference configuration (except NW-side additional condition) to UE:

Option 1: Network provides full inference configuration of applicable functionality to UE after applicable functionality reporting (i.e. Step 5), i.e. full inference configuration is not provided in Step 3.

Option 2: Network provides full inference configuration of supported functionality to UE before applicable functionality reporting (i.e. Step 3). Updates to the configuration of applicable functionality may be provided after applicable functionality reporting, which is up to network (i.e. Step 5).

During RAN2 #126 meeting, it was agreed that, for a functionality to be applicable, it should have at least one model available within it. It is straightforward to conclude that applicable functionalities reported in Step 4 has an available model. During phase 1 discussion, companies have different understanding on whether to define available functionalities separately from applicable functionalities. Then, the question is whether a UE can report its non-applicable functionalities but with an available model via the same message used for applicable functionality reporting or not.

#### Q2-7. For reactive reporting, do you think UE can also include non-applicable functionalities with an available model in Step 4?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| OPPO | Yes if reactive method definition is based on our understanding in Q2-1 | See answer in Q2-1 |
| Xiaomi | Comment | In current procedure, UE reports the applicable functionality or non-applicable functionality. Does rapp intend to introduce a new type of functionality? We don’t see the need to introduce more types of non-applicable functionality. |
| Futurewei | Comment | We don’t quite understand the question; why we want to report a non-applicable functionality with an available model? |
| NEC | No | Both proactive and reactive reporting are limited to applicable functionalities. |
| vivo | no |  |
| Apple | No | For both proactive and reactive reporting, we think the UE determines applicable functionaries **when all below conditions are met**:   * NW-side additional condition (i.e. the UE detects inference config and training config with same associated ID). * UE-side additional condition (e.g. current left memory/battery resource is sufficient to do inference). * Model is available in device.   It seems this question is whether we need to introduce another type of functionality which only meet above condition 3). If the understanding is correct, we think it is not necessary: at least 2) is up to UE implementation. Then, with this new functionality reporting, the NW can’t derive whether condition 2) is met in the UE side, and thereby can’t determine applicable functionalities. So, it is not useful. |
| Huawei, HiSilicon | See comments | If the question is on whether the UE should report the functionalities for which it does not have a model, then we should further understand whether there is anything the NW can do about it, e.g. configure model training etc. |
| ZTE | Too early to discuss | Too early to discuss, it is not sure why we need to take such information. |
| Mediatek | No | For the determination and reporting of AI/ML functionality applicability, the UE already considers the availability of the AI/ML model when determining applicability. Therefore, the necessity of additionally indicating the availability remains unclear. |
| Lenovo | See comment | Does it mean only applicable/non-applicable info of available models will be reported to NW, and for those not available, UE will not indicate anything? It seems to be a way of implying unavailability. |
| Ericsson | Yes, but question not clear | In all the options discussed above (proactive/reactive) one of the main objectives is for the UE to inform the network about the configurations that are needed to make an available AIML functionality applicable, so that the gNB can provide the necessary configuration to make such AIML functionality applicable. If the AIML functionality is already applicable, given the current configuration, then the UE just needs to report that the AIML functionality is applicable without signalling further info, e.g NW-side additional conditions, and the NW can just activate it. So the question in its current formulation appears unclear given the discussion on the previous sections about all the options for proactive/reactive.  The question should be instead what is the UE behaviour related to step-4 when the AIML functionality requested by the NW in step-3 is not available/trained. Should the UE use the step-4 to ask for training? Should the UE leave the applicable functionality reporting empty for such AIML functionality? Should the UE indicate that the AIML model is not available? We suggest discussing this issue. |
| Fujitsu | postpone | We prefer to first check whether this information will be helpful for functionality management at NW side.  For the solutions, it is a bit early to touch the detailed solutions before we confirm the question. |
| Qualcomm | No | Same view as Apple and Mediatek. |
| CATT | No | Same view as Apple |
| Samsung | No | We don’t see any motivation for UE to report non-applicable functionalities at this moment. |
| Interdigital | Postpone | We agree with Fujitsu |
| LGE | Maybe Yes | If rapporteur is considering the case where a functionality was initially applicable but later becomes non-applicable due to changes in the UE's situation (such as issues with battery or memory), then notifying the network of this change would be a reasonable action.  [Rapp] The intention of the question is whether the non-applicable functionality of UE at current state will be reported or not. The later changes can be reported in an update message later. Hence, rapporteur thinks the answer of this comment is ‘No’ as it referring to future change of current applicable functionalities. |
| Nokia | See comments. | Reactive and proactive reporting should use the same IE structure. Therefore, the UE should be able to report which functionalities are applicable, and/or which are not. Depending on the mechanism of reporting, there could be no difference in optimality between reporting or not reporting non-applicable functionalities.  We do not understand what non-applicable functionality with an available model is. It seems that a model could be available at the feature level, but that isn’t useful for applicable functionality reporting. |
| CMCC | No | Agree with Apple. |
| Sharp | See comments | In step 4 of the reactive reporting, the UE reports applicable functionalities. We do not see the benefit or reason to indicate non-applicable functionalities with available model. |
| CEWiT | Maybe Yes | Since the applicability conditions can change over time, indicating non-applicable functionality with available model maybe useful. |

**Summary:**

Majority of companies don’t think Step 4 can be used to report non-applicable functionalities or prefer to postpone the discussion.

Rapporteur Summary 10: Postpone the discussion on whether UE can include non-applicable functionalities in Step 4 after the basic procedure of applicable functionality reporting is clear.

#### Q2-8. Any other comment on the above signaling flow of reactive reporting?

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Nokia | We should try to implement the same mechanisms for proactive and reactive reporting of applicable functionalities. When it comes to implementation in stage 2 and stage 3, we should support different orderings of messages to support signaling of applicability immediately after configuration, and sometime after configuration as an update to functionality applicability. |
|  |  |
|  |  |
|  |  |
|  |  |

**Summary:**

The above comment is considered in the summaries below Q3-2.

## Others

proactive vs. reactive

After discussing the above signaling, hope companies now have a clear understanding of what is proactive and reactive reporting. Based on above assumptions, the key differences between proactive and reactive reporting can be summarized as below:

|  |  |  |
| --- | --- | --- |
|  | **What is the trigger applicable functionality reporting?** | **Sequence between configuration and applicable functionality reporting** |
| **Proactive reporting** | Upon a change of condition(s) | Applicable functionality reporting -> Configuration |
| **Reactive reporting** | As a response to network configuration | Configuration -> Applicable functionality reporting |

#### Q3-1. Do you agree the key differences between proactive and reactive reporting are:

1. **trigger of applicable functionality reporting: upon a change of condition(s) (proactive) or as a response to network configuration (reactive)**
2. **whether the configuration of functionalities is provided after applicable functionality reporting (proactive) or before (reactive)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| OPPO | No | See answer in Q2-1 |
| Xiaomi | Comment on the proactive trigger | We understand the trigger of proactive reporting upon a change of functionality applicability, rather than the condition. Because the condition change may not necessarily result in functionality applicability change. Upon condition change, UE shall first determine whether functionality applicability changes. If yes, trigger proactive report. If no, no need to trigger proactive report.  We are fine with other parts.  [Rapp] Just to clarify, ‘condition’ is a general terminology when discussing UAI. For this AI/ML case, conditions may mean different conditions at UE side and finally lead to the change of functionality applicability. |
| NEC | Partially Yes | For reactive reporting, sequence should be  NW-side additional condition related configuration -> Applicable functionality reporting -> full configuration |
| vivo | Yes for 1,  No for 2 |  |
| Apple | Yes with comments | We agree with the intention of Rapporteur, but we think “**the configuration of functionalities”** in 2nd bullet is not clear. To avoid misunderstanding, we suggest to make it clear that it is inference configuration. For example, we provide below suggested wording:   1. **trigger of applicable functionality reporting: upon a change of condition(s) (proactive) or as a response to network inference configuration (reactive)** 2. **whether the inference configuration of functionalities is provided after applicable functionality reporting (proactive) or before (reactive)**   [Rapp] based on above discussion and summary, it seems companies have different interpretation on the configuration provided in Step 3. Please see rapporteur’s updated summary below with two understandings. |
| Huawei, HiSilicon | No | In our opinion, there are two differences:  (1) the reponse messages are different  (2) even if the response messages can be the same, the usages are different. In reactive reporting, the UE reports the functionalities upon being configured with applicable functionalities reporting. While in proactive reporting, the UE additionally reports the applicable functionalities when the applicable functionalities change.  [Rapp] The exact response message may not be the key difference based on above discussion and summary. As for the comment 2), rapporteur understand it is aligned with understanding of the sequence between configuration and applicable functionality reporting? |
| ZTE | No for 1  Yes for 2 | For triggering proactive reporting :  In the example of proactive reporting, it is straight forward that UAI (applicability reporting) is triggered by otherconfig of RRCReconfiguraion which does not match what the table says triggered upon condition change.  For triggering reactive reporting：  We do not agree the blindly configuring of the functionality is a rational implementation at NW side. |
| Mediatek | Yes with comment | Just as commented in Q2-1, the difference between proactive and reactive reporting lies in the timing of coordinating AI/ML functionality applicability relative to the inference configuration.   * In proactive reporting, the network provides the inference configuration to the UE after the coordination of the AI/ML functionality applicability. * In reactive reporting, the network provides the inference configuration to the UE before the coordination of the AI/ML functionality applicability.   For proactive reporting, one possible trigger is the availability of a new AI/ML model for a functionality.  [Rapp] This is included in “upon change of functionality applicability”? (considering we agree applicable functionality needs to have an available model, and this is also concluded in Q2-3) |
| Lenovo | See comment | Not sure if 1) and 2) are combined.  The fundamental difference of proactive and reactive would be if it is   * UE report triggered by UE (proactive) * UE report triggered by NW based on NW request/configuration (reactive)   In the case of UE determines the functionality applicability, in both proactive and reactive cases, UE needs to know enough info (NW configuration, additional condition) to determine the applicability of a functionality.  In addition, we believe the UAI based framework can serve the purpose of reporting the applicability, which can be considered as proactive/reactive depending on the interpretation. |
| Ericsson | 1. Yes 2. Changes needed | 1. Those are the fundamental scopes of the two approaches, which as mentioned above should coexist. The proactive is used for the UE to signal any change in the applicability (due to a number of reasons such as UE-side conditions), whereas the reactive is for the gNB to quickly/efficiently configure AIML 2. That is a direct consequence of 1). However, it cannot be precluded that also for the reactive approach there is a further reconfiguration after the applicability reporting (i.e. step-5 in the reactive reporting). The UE may be allowed by the network to signal in the reactive approach its recommended configurations/NW-side additional conditions, and then the gNB can configure it in a following message. So we suggest rewording 2) as follows: **the configuration of functionalities is provided after applicable functionality reporting (proactive) or before (reactive) and optionally after (reactive)**   [Rapp] based on above discussion and summary, it seems companies have different interpretations on the configuration provided in Step 3. Please see rapporteur’s updated summary below with two understandings. |
| Fujitsu | No for 1)  Maybe for 2) | For 1) Similar view with Xiaomi, first of all, the proactive reporting is triggered by UAI configuration (otherConfig), UE cannot do the reporting without configuration even if the condition changed. Second, the reporting should be triggered only if the applicability changed, rather than condition changed, if the applicability can be maintained, UE should not do additional reporting even if the condition changed.  For 2) for reactive reporting, it depends on the contents of configuration in step 3 as discussed in Q2-1. |
| Qualcomm | No for 2.  Yes for 1. | While we agree with “**What is the trigger applicable functionality reporting?”** but not with “**Sequence between configuration and applicable functionality reporting”.**  We believe that key difference between proactive and reactive approaches are:   * proactive procedures are needed all the time, as the conditions at the UE can change at any time. Therefore, it needs to be supported (even during the configuration time). * Reactive procedure, if defined, will only be applicable at the reconfiguration time. Note that UAI can be used after step 4 to update any updated applicability information before activation.   Therefore, we believe that there is no need for two separate procedure definitions. As we have highlighted previously, they should be combined. We believe the only thing matters is configuration for applicability functionalities reporting and reporting from the UE.  Our understanding is that for both reactive and proactive approaches step 3 and step 5 indicated in the figure can happen together. |
| CATT | Yes with comment | For 2), agree with Apple that the “configuration” should be clarified to be “inference configuration”. |
| Samsung | See comment for 1)  Yes for 2) | For 1), it is not clear what “condition” means. Is it for NW-side additional conditions or UE side addition conditions? In case of UE side additional condition, it can be also changed in the middle of connection and hence, reactive reporting would be applicable.  [Rapp] rapporteur changes it into change of functionality applicability, which can be decided based on UE-side additional condition and/or NW-side additional condition (if available).  For 2), it seems a reasonable starting point. In this case, we are wondering if the UE can report applicable functionality in proactive reporting i.e. UE may not provide all the details of functionality configurations as it may be too complicated without gNB configured functionality configuration.  In general, we think that whether proactive or reactive can be assumed based on whether there are configured functionalities. That is, once functionalities are configured, UE can send “updated” functionalities whenever their applicability is updated.  [Rapp] Please see understanding #2 in the table below. |
| Interdigital | See comments | These questions are not very clear. For example, we think there is a common understanding what reactive and proactive reporting are based on the descriptions of the two before Q1-1 and Q2-1, respectively. But the way the questions are written here may cause confusion. For example, in the first question, it is stated “upon a change of condition(s) (proactive) or as a response to network configuration (reactive)”. Even proactive reporting is in response to network configuration (though the response may come later when/if the functionality becomes applicable).  Also, the second question is overlapping with questions regarding steps 3/5 (e.g., Q 2-1, 2-6). |
| LGE | Yes with 1) and 2) | As a baseline, we agree with the rapporteur's opinion. Scenarios such as (1) where the UE reports after the network updates the settings and (2) where the UE updates applicability can be discussed further once the basic scenario is established. Rather than categorizing all cases as reactive or proactive, it would be better to list the necessary scenarios and discuss them in addition. |
| Nokia | Yes to 1, No to 2, and comments. | 1) The word “condition” is already used in RAN1 to mean what is signalled by capabilities. We think we can simply define that proactive reporting is triggered by a change in applicability of one or more functionalities. We agree with this point if the word “conditions(s)” is replaced with “additional conditions”.  2) It isn’t clear how either the reactive or proactive case could react with which functionalities are applicable prior to receiving the functionality configurations. We agree on this point with Fujitsu and Interdigital. |
| CMCC | See comments | For 1), we share the same view as Fujitsu that the proactive reporting is triggered by UAI configuration (otherConfig) and the reporting should be triggered only if the applicability changed rather than condition changed.  For 2) for reactive reporting, it depends on the contents of configuration in step 3 as discussed in Q2-1, i.e. yes for 2) if the inference configuration is provided in step 3, no for 2) if the inference configuration is not provided in step 3. |
| Sharp | See comments | We understand the intention. However, it is not clear and we would like to clarify the following.  The question for clarification is that does it mean that in proactive reporting, the network inference configuration is provided after the UE reports applicable functionalities whereas in reactive reporting, the inference configuration is provided before the UE reports applicable functionalities? |
| CEWiT | Yes for 1) and 2) | Okay with the rapporteur’s view. |

**Summary:**

Based on companies’ feedback above and in Section 2.1/2.2, an updated table is provided below. Considering we have concrete conclusions for different approaches in sections above, the below table is provided just for information.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **What is the trigger applicable functionality reporting?** | **Sequence between configuration and applicable functionality reporting** | **How UE decides its applicable functionality** |
| **Proactive reporting** | Upon a change of functionality applicability | Applicable functionality reporting -> Inference Configuration | NW-side additional condition (if available), UE-side additional condition (internal available at UE side), model availability |
| **Reactive reporting** | As a response to network configuration | Understanding #1: NW-side additional condition -> Applicable functionality reporting -> Full Inference configuration  Understanding #2: Full Inference Configuration -> Applicable functionality reporting (update of inference configuration provided later is up to network) | NW-side additional condition, UE-side additional condition (internal available at UE side), model availability, FFS on full inference configuration |

However, according to companies’ comments to above questions and rapporteur’s summary, there are some commonalities between two approaches, for instance, as concluded in Rapporteur Summary 4/6, network may provide NW-side additional condition optionally for UE to decide applicable functionality in both proactive and reactive reporting (i.e. may or may not be needed for proactive reporting, needed for reactive reporting). Another example is UE may report its applicable functionalities to network either upon change of functionality applicability or as a response to network. From RRC signaling point of view, it seems the only difference between two approaches is what and how the content will be signalled over the air interface. It seems discussing/defining two approaches separately may lead to more confusion and is not that helpful to RAN2 work.

Furthermore, RAN2 also agreed that both proactive and reactive reporting will be supported and further study whether two approaches can be combined together.

**Agreements for positioning and beam management**

1. Support proactive reporting of UE-sided applicable functionality, e.g., the UE reports its applicable AI/ML functionalities via UAI message/LPP message.
2. Support reactive reporting of UE-sided applicable functionality. The NW configures AI/ML functionalities via RRC/LPP message. FFS what the configuration contains. FFS how to report applicable functionality and what is applicable functionality

3 FFS how the two approaches will be specified and whether we can combine them into one procedure. FFS how to report applicable functionality, what is applicable functionality, how the UE determines which function is applicable or not (if it is needed)

Therefore, instead of discussing the difference and understanding of proactive and reactive reporting separately, rapporteur suggests to just focus on the specification impacts and what/how will be signalled/reported over the RRC signaling for applicable functionality reporting.

The related proposals to applicable functionality reporting can be found after Q3-2.

Rapporteur Summary 11: Considering there are commonalities between proactive and reactive reporting in RRC signaling, the proposals for specification/signaling impact of applicable functionality reporting (proactive and reactive) can be found after Q3-2.

Initial Activation/Deactivation

During RAN2 #126 meeting discussion, following agreements are captured on applicable functionalities and activated functionalities:

|  |
| --- |
| RAN2 will support functionality activation/deactivation after inference configuration. FFS initial state of configuration and how activation/deactivation is achieved. |

After applicable functionality reporting, it is not clear what is the initial state (active/deactive) of the functionality after Step 5, and how an applicable functionality becomes an activated functionality. There are three options:

**Option 1**: The applicable functionality is activated by receiving configuration for applicable functionalities in Step 5 (if needed). If configuration is not provided by the network, it means the functionality is not activated.

**Option 2**: The applicable functionality is automatically activated if it is included in applicable functionality reporting (assuming the network configuration received in Step 3 is directly applied and the functionality is activated).

**Option 3:** A functionality is activated based on a field in RRCReconfiguration in Step 3 or Step 5 (indicating the functionality activation status), and additionally via L1/L2 based activation/deactivation signaling. L1/L2 based activation/deactivation signaling is up to RAN1.

#### Q3-2. Which option do you agree that an applicable functionality initially becomes an activated functionality after receiving configuration in Step 5?

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Proactive reporting:**  **Option 1/2/3** | **Reactive reporting:**  **Option 1/2/3** | **Comment** |
| OPPO | Option1/3 | Option1/3 | Option1 should be the baseline. Option3 can be considered for model switching/deactivation/activation. |
| Xiaomi | 1 | 1 | Option 1 is used for initial activation. Option 3 is used for subsequent activation/deactivation.  Although the same RRC message may be used in step 3 and 5, e.g. *RRCReconfiguration*, different IEs would be used to indicate the functionality in step 3 and 5. In step 3, the purpose is not to activate the functionality. |
| NEC | Option 3 | Option 3 | Should be in Step 5. |
| vivo | 1 or 3 | 1 or 3 |  |
| Apple | Option 1 as baseline | Option 1 as baseline | Option 1 obviously can work.  Whether Option 3 is needed depends on whether RAN1 agree to introduce L1/L2 activation signalling, which further depends on whether RAN1 identify requirement for dynamic activation, deactivation and switching. As usual, it is RAN1 decision and RAN2 can just wait for RAN1 conclusion. |
| Huawei, HiSilicon | Option 1 | Option 1 | Option 1 is reasonable. |
| ZTE | Waiting for RAN1 | Waiting for RAN1 | In our understanding, which option to go is depending on RRC signalling structure and granularity of functionality. At the current stage, RAN2 is not clear about either the detail RRC signalling structure (ASN.1) or the granularity of functionality, which needs to be firstly designed by RAN1. In this sense, we suggest to postpone the discussion until sufficient progress is made by RAN1. |
| Mediatek | Option 1 | Option 1 | Option 1 is the baseline. |
| Lenovo | 3/1 | 3/1 | RAN2 agreed before the following  1 For UE-sided model, for the functionality management, the “network decision, network-initiated” AI/ML management is supported as a baseline. The following can be considered further “UE autonomous, decision reported to the network”, “Network decision, UE-initiated” (i.e. proactive approach).  Since the applicability of AIML functionality could vary depending on the UE/NW side condition, performance etc. It would be good to support dynamic activation/deactivation of AIML functionality as in Option 3 or Option 1.  Besides, we don’t think L2 MAC CE based activation/deactivation solution would depend on RAN1. |
| Ericsson | Option 1 | Option 1 (baseline)  2 and 3 (possible for more efficiency) | Proactive: The legacy framework of UAI is used by the UE to signal its recommendation/preference to the gNB at any point in time, and then the gNB can decide whether to accept this recommendation and configure the UE accordingly. We need to follow here the same mindset, the UE cannot activate a functionality without previously informing the NW, since the NW does not know the point in time in which the UAI will be transmitted, and it is not guaranteed that the gNB can now accept the UE recommendation/preference.  Hence, only option 1 should be considered for proactive approach, followed potentially by explicit L1/L2 signalling for the actual activation.  Reactive: Unlike the proactive approach, here the gNB can provide the candidate inference configurations/NW-side addition conditions already in step-3. Hence in theory, the UE can just select one of these configurations, report the selected configurations to the gNB, and apply it straight away, without the step-5. So option 2 can also be adopted to avoid extra signalling. In our understanding option 3 is a way to configure the UE to adopt option 2 or option 1 (with the only difference that in option 1 RRC is needed, whereas option 3 proposes L1/L2). Is that correct understanding? |
| Fujitsu | Option1/3 | Option1/3 | First, we prefer a common functionality activation solution for both proactive and reactive reporting.  If there is one functionality configured and activated at one time, opt 1 is enough.  If there are more than one functionality configured to the UE, opt 3 can also be considered to enable the fast functionality switching. |
| Qualcomm | Option 1/3, See comments | Option1/3, See comments. | Which signaling is used for configuration is used will depend on several factors:   1. Whether the applicable functionality report contains the applicable function information for source and neighboring cells or only source    1. If only source: then as we mentioned in our response to Q1-1 and Q2-1, step 3 and step 5 can happen together. Then, a functionality should be activated upon receiving the applicable functionality information. Therefore, the initiate state can be assumed deactivated and the network activates the functionality after inference configuration, i.e., option 3 for both proactive and reactive approaches.    2. If both for source and neighboring: Then, the target may have the latest applicable functionality information (via source cells) during handover configuration and inference configuration. Then, the configuration is assumed to be activated when the configuration is received at the UE, i.e., option 1. However, this assumes that a single functionality is configured for a feature/feature group by gNB, i.e., switching is not supported.   Therefore, we believe we need to first discuss   * Whether the applicable functionality information/report contains information only about the source cell or source and neighboring cells?   Whether the inference configuration contains configuration for a single functionality for a feature/feature group, i.e., whether switching is supported or not? |
| CATT | Option 1 | Option 1 |  |
| Samsung | Option1 as a baseline | Option 1 as a baseline | Option 1 should be a typical operation for NW enabled feature. We need more information from RAN1 for option 2 and option3. For example, for option2, whether we need to reduce delay by not waiting for gNB’s confirmation or for option 3, how L1/L2 based activation would work. |
| Interdigital | Option 1 | Options 1 | Option 1 to be considered as a baseline, and it applies to both reactive and proactive.  Option 2/3 are signalling/latency optimizations and may be considered based on RAN1 input regarding the need for that. |
| LGE | Option 1 as baseline | Option 1 as baseline | Options 2 and 3 have not been ruled out, but it would be better to wait for input from RAN1 before making a decision. |
| Nokia | 1 – with comments  3- with comments, to support L2 signaling  **No**  Option 2 | 1 – with comments  3 – with comments, to support L2 signalling  **No**  Option 2 | 1. We agree with Step 5 being an option to activate a functionality based on the applicable functionality report from Step 4. We disagree with the text “if needed”, since the activation would definitely be needed in this approach. This option would work for proactive and reactive in the same way. Proactive reports would come in the form of Step 4 and Step 5, while reactive would require Step 1 – Step 3 to receive the initial configuration. 2. Allowing for option 2 would make it difficult to consider the reactive and proactive approaches unified since option 2 only applies to reactive. We think that at this stage we should lay the foundation for a unified approach before making optimizations.   We think that the functionality could be activated through a field in step 5, but it isn’t clear how that is different from Option 1. We are open to exploring MAC signaling for activation as well, in place of Step 5. |
| CMCC | Option 1/3 | Option1/3 | Option 1 can be used for initial activation. Option 3 is used for subsequent activation/deactivation. |
| Sharp | Option 1/3 | Option 1/3 | Option 3 provides more flexibility in our opinion. |
| CEWiT | Option 1/3 | Option 1/3 | Option 1 and 3 seems fine. Okay to go with majority for this. |

**Summary:**

Option 1 (18/21): Oppo, Xiaomi, Vivo, Apple, Huawei, MTK, Lenovo, Ericsson (proactive/reactive baseline), Fujitsu (one functionality configured), QC, CATT, Samsung, Interdigital, LGE, Nokia, CMCC (initial activation), Sharp, CEWiT

Option 2 (1/21): Ericsson (reactive),

Option 3 (11/21): Oppo, NEC, Vivo, Lenovo, Ericsson (reactive), Fujitsu (more than one functionality configured), QC, Nokia (L2 signaling), CMCC (subsequent activation/deactivation), Sharp, CEWiT

Option 3 up to RAN1: Apple

Up to RAN1: ZTE

According to the discussion in Q2-6, the inference configuration in Step 5 will be provided either as mandatory signaling if such configuration is not provided in Step 5 or as optional signaling up to network implementation. Hence, rapporteur changes “if needed” into “if provided” to accommodate both options. Whether to introduce L1/L2 signaling for activation/deactivation can be further studied.

Rapporteur Summary 12: As baseline, the applicable functionality is initially activated by receiving configuration (either in Step 3 or 5) for the corresponding applicable functionalities. FFS on additional L1/L2 signaling for activation/deactivation.

In the end, as discussed in summary of Q3-1, rapporteur summarizes the following proposals for signaling and specification impacts of applicable functionality reporting. Furthermore, rapporteur also observes that there might be different preferences for signaling sequences in Step 3 and Step 4, in proposals below. Hence, rapporteur uses “” on top of Step 3 and 4, to indicate it may not directly reflect the actual sequence of the messages.

Proposal 1:

Step 1: Network sends *UECapabilityEnqiry* message to initiate the procedure to a UE reporting its AI/ML supported functionalities.

Step 2: UE sends *UECapablityInformation* message to network, containing supported functionalities at the UE side.

Proposal 2: “Step 3”: Following configurations are provided from NW to UE:

1) UE is allowed to do UAI reporting via *OtherConfig*.

2) It is optional for network to provide NW-side additional condition in *OtherConfig.* Check whether companies are ok to change it as mandatorily signalled.

3) FFS on other inference configuration of supported functionalities.

Proposal 3: UE decides the applicable functionalities based on NW-side additional conditions (if available), UE-side additional conditions (internally known by UE) and model availability in device.

Proposal 4: “Step 4”: UE considers to report applicable functionality in the following scenarios:

1) Upon change of applicable functionality change via UAI

2) As response to NW-side additional condition, FFS via UAI or *RRCReconfigurationComplete*, etc

Proposal 5: Step 5:

1) Network configures full inference configuration to UE after applicable functionality reporting, if inference configuration is not provided in Step 3 (i.e. full inference configuration is provided in Step 5).

2) If inference configuration is provided to Step 3, it is up to network implementation whether to provide an updated configuration or not.

Proposal 6: The applicable functionality is initially activated by receiving configuration (either Step 3 or 5) for the corresponding applicable functionalities. FFS on additional L1/L2 signaling for activation/deactivation.

Furthermore, according to companies’ comments above, rapporteur also provides a list of open questions which are not considered in above proposals. Companies are welcome to bring contributions to below open questions to RAN2 future meetings.

**Open questions for further discussion based on companies’ contribution:**

- Whether neighbouring cell’s applicability needs to be considered in applicable functionality reporting to serving cell?

- Whether UE can include non-applicable functionalities in Step 4 after the basic procedure of applicable functionality reporting is clear?

## Positioning

During RAN2 #126 meeting online discussion, following agreements on positioning Case 1 were made:

1. The LPP Capability Transfer procedures (RequestCapabilities/ProvideCapabilities messages) are used to indicate supported AI/ML positioning capabilities. FFS how to handle dynamic capabilities, depending on further RAN1 progress and understanding of the functionality.
2. wait for RAN1 for associate ID discussion

Considering the exact signaling needs further RAN1 inputs, rapporteur suggests to only focus on the **general principle** for positioning during this discussion, e.g. exact LPP signaling (whether existing signaling or new enhancement) and NW-side/UE-side additional condition will **not** be discussed in this email discussion.

It was agreed in RAN2 #125bis meeting that proactive reporting and reactive reporting are applicable for both beam management and positioning use cases.

**Agreements for positioning and beam management**

1. Support proactive reporting of UE-sided applicable functionality, e.g., the UE reports its applicable AI/ML functionalities via UAI message/LPP message.
2. Support reactive reporting of UE-sided applicable functionality. The NW configures AI/ML functionalities via RRC/LPP message. FFS what the configuration contains. FFS how to report applicable functionality and what is applicable functionality

Based on the discussion of beam management, it seems there are some commonalities between positioning and beam management in terms of proactive/reactive reporting. Following assumptions for beam managements are also applicable for positioning, except the protocol is LPP between UE and LMF:

* + - 1. The key difference between proactive and reactive reporting is the trigger of applicable functionality reporting, and whether the configuration of functionalities is provided after applicable functionality reporting or before. This seems can also be applicable for positioning Case 1: i.e.

1) in **proactive reporting**, UE can report a change in applicable functionality/condition by sending applicable functionalities upon change via LPP signaling, network provides configurations of functionalities via LPP signaling **after** NW knowing applicable functionalities

2) in **reactive reporting**, applicable functionality reporting is provided as **a response to** the network configuration, where network provides configurations of functionalities via LPP signaling **before** NW receiving applicable functionalities.

* + - 1. Depends on Q2-7 if agreed, UE also sends functionalities with available model, but not applicable via LPP signaling in the same message used for applicable functionality reporting.
      2. Depends on Q3-2, the configuration after NW receiving applicable functionality reporting may or may not means the functionality is activated.

#### Q4-1. For positioning Case 1, do you agree with the above assumptions?

NOTE: Exact LPP signaling (whether existing signaling or new enhancement) and NW-side/UE-side additional condition will **not** be discussed in this email discussion.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| OPPO | Yes for assumption 2 and 3 | For assumption 1, we have different view as commented in Q2-1 |
| Xiaomi | Comments for assumption 1  Yes for assumption 2 and 3 | We have the following understandings regarding the functionality reporting for positioning:   * The UE reports the applicable functionality, not the condition. * Proactive reporting implies that the reporting occurs without a network request, whereas reactive reporting is based on a network request. * The LPP is used between the UE and the LMF, we suggest using ‘LMF’ instead of ‘network’.   Therefore, we make some changes as below:  1) in **proactive reporting**, UE can report a change in applicable functionality/condition by sending applicable functionalities upon change via LPP signaling without LMF request, LMF network provides configurations of functionalities via LPP signaling **after** LMF NW knowing applicable functionalities  2) in **reactive reporting**, applicable functionality reporting is provided as **a response to** the network configuration LMF request, where LMF network provides configurations of functionalities via LPP signaling **before** LMF NW receiving applicable functionalities. |
| vivo | Yes for 1 with comments.  No for 2  Yes for 3 | For 1) and 2), We think the description can be simplified as:  1) in **proactive reporting**, UE can report a change in applicable functionality~~/condition~~ by sending applicable functionalities upon change via LPP signaling, ~~network provides configurations of functionalities via LPP signaling~~ **~~after~~** ~~NW knowing applicable functionalities~~  2) in **reactive reporting**, applicable functionality reporting is provided as **a response to** the network request ~~configuration, where network provides configurations of functionalities via LPP signaling~~ **~~before~~** ~~NW receiving applicable functionalities~~. |
| Apple | Comments to assumption 1,  Yes for assumption 2 and 3 | We agree with Xiaomi that “the UE reports the applicable functionality, not the condition”. The other part of assumption 1 is aligned with our understanding. Thus, we suggest below change:   * + - 1. The key difference between proactive and reactive reporting is the trigger of applicable functionality reporting, and whether the **inference** configuration of functionalities is provided after applicable functionality reporting or before. This seems can also be applicable for positioning Case 1: i.e.   1) in **proactive reporting**, UE can report a change in applicable functionality**~~/condition~~** by sending applicable functionalities upon change via LPP signaling, network provides **inference** configurations of functionalities via LPP signaling **after** NW knowing applicable functionalities  2) in **reactive reporting**, applicable functionality reporting is provided as **a response to** the network **inference** configuration, where network provides **inference** configurations of functionalities via LPP signaling **before** NW receiving applicable functionalities. |
| Huawei, HiSilicon | Yes for 2, 3  No for 1 | Xiaomi's revision can be considered.  Based on Xiaomi's revision, **we think 1) should remove "without LMF request"**, because as we discussed in section 2.1, the NW may still need to configure something to the UE. With the wording "without LMF request", the UE is freely to send the applicable functionality to LMF, which is out of LMF control and thus may lead to some negative imapcts to NW side. |
| ZTE | Comments for assumption 1  Comments for assumption 2/3 | To assumption 1,we think in AI positioning, reactive reporting is UE to report the capability in a solicited way (see TS37.355 section 5.1.1), and proactive reporting is UE to report the capability in a unsolicited way (see TS37.355 section 5.1.2). The spec will have no hard requirement on the time order of capability reporting(proactive or reactive) and configuration provision.  [Rapp] Tend to agree with above comment, but there’s also a recommend order provided in the spec. Please see the summary and updated assumption as below.    Figure 5.1.1-1: LPP Capability Transfer procedure    Figure 5.1.2-1: LPP Capability Indication procedure  For assumption 2, we think UE should only report the functionality that the UE currently supported.  For assumption 3, from RAN2 signaling structure perspective, AI/ML positioning functionality (usecase) can be managed as positioning method, i.e., activating a positioning method means activating the corresponding AI/ML positioning functionalities (usecases). usually LMF gives activation on a positioning method after UE reports it supports the positioning method. So we think assumption 3 for AI pos should be ‘ the configuration after NW receiving applicable functionality reporting ~~may or may not~~ means the functionality is activated’  [Rapp] As concluded in Q3-2, it seems the conclusion is aligned with the comment. |
| Mediatek | Yes for 1  No for 2  Yes for 3 | For assumption 1, Apple’s revision looks better. |
| Lenovo | Yes for assumption 2 and 3 | For assumption 1, we don’t think “whether the configuration of functionalities is provided after applicable functionality reporting or before” is the key difference for proactive/reactive.  The fundamental difference of proactive and reactive would be if it is   * UE report triggered by UE (proactive) * UE report triggered by NW based on NW request/configuration (reactive)   In the case of UE determines the functionality applicability, in both proactive and reactive cases, UE needs to know enough info (NW configuration, additional condition) to determine the applicability of a functionality. |
| Ericsson | Assumption 1: Yes, but changes need  Assumption 2: Yes, but the question should also be on what happens when the AIML functionality is not available  Assumption 3: Details can be further discussed after Q3-2 is addressed | Assumption 1: Related to 1) in assumption 1, we agree with Xiaomi rewording, but we also agree with HW, that similar to the UE also the LPP signalling should be configured by the LMF first. Related to 2) we do not need to preclude the possibility for the UE to signal in response to a NW configuration, the NW-side additional conditions to make the AIML model applicable, and then the gNB can provide the needed configuration  So we suggest the following rewording related to assumption 1:  Therefore, we suggest following changes below:  1) in **proactive reporting**, UE can report, upon LMF configuration, a change in applicable functionality/condition by sending applicable functionalities upon change via applicability functionality reporting in LPP signaling without LMF request, LMF network provides configurations of functionalities via LPP signaling **after** LMF NW receiving the applicability functionality reporting. ~~knowing applicable functionalities~~  2) in **reactive reporting**, applicable functionality reporting is provided as **a response to** the network configuration LMF request, where LMF network provides configurations of functionalities via LPP signaling **before** LMF NW receiving applicable functionality~~ies~~ reporting, and optionally after LMF receiving the applicability functionality reporting.  Assumption 2: As our reply to Q2-7, it is obvious for use that the UE should use the LPP signalling to inform the LMF about the NW-side condition to make the available functionality applicable. If the AIML functionality is already applicable, no extra info should be reported by the UE, rather the UE can just signal that the AIML functionality is applicable straight away. The question should instead be on what happens if the AIML functionality requested in the reactive configuration is not available. What the UE should report in this case in LPP?  Assumption 3: It is not critical to address this question at the moment. BM assumption does not need to be necessarily mapped to positioning protocols. We can address this after discussing Q3-2 |
| Fujitsu | No for 2)  Yes for 3) | For 1), Xiaomi’s wording can be referred. |
| Qualcomm | See comments | (1)  An LPP procedure may involve a request/response pairing of messages (solicited information transfer) or one or more unsolicited messages. Each LPP procedure has a single objective (e.g., transfer of assistance data, exchange of LPP related capabilities, or positioning of a target device). LPP procedures are not required to occur in any fixed order. A UE may request assistance data at any time in order to comply with a previous request for location measurements from an LMF; the target device may transfer capability information to the server at any time, etc.  Therefore, as also pointed out by ZTE, “reactive reporting” corresponds to solicited information transfer; “proactive reporting” corresponds to unsolicited information transfer as already defined in LPP.  (2)  The UE always provides its currently supported capabilities (functionality) in a LPP Provide Capabilities message, which however, may change during an LPP session.  (3)  We think a functionality is “activated” by the device when a request for location information has been received (that is in agreement with the UE supported functionality). |
| CATT | Comments to assumption 1,  Yes for assumption 2 and 3 | Agree with the change from Apple. |
| Samsung | Yes with changes for 1)  See comment for 2)  Yes for 3) | Agree with other companies to remove “condition” and remove “without LMF request”  For 2), we don’t support to indicate available model but not applicable because it is not clear what is the usage of such indication. If companies agreed on Q2-7, same principle could be applicable though. |
| Interdigital | See comments regarding assumptions 1 and 2  Yes for assumption 3 | Regarding Assumption 1, we agree with the following comments from Xiaomi;  “   * Proactive reporting implies that the reporting occurs without a network request (e.g., based on earlier configuration), whereas reactive reporting is based on a network request. * The LPP is used between the UE and the LMF, we suggest using ‘LMF’ instead of ‘network’.   “  Regarding the definition of proactive and reactive signaling, we prefer to keep “functionality/condition” as we have not defined explicitly what “functionality” or “condition” refers to. Once clarification is made, we can discuss whether one of the terms can be removed or not.  Regarding Assumption 2, our view is to postpone the discussion as described in Q2-7.  Regarding Assumption 3, we agree. |
| Nokia | No | 1. We have to think carefully about how the UE is configured with an applicable functionality. In legacy positioning, the configuration for measurement and reporting comes in the LPP RequestLocation message, to which the UE responds with its location. In addition, information such as the DL PRS configuration, timing of received signals, and SSB information of the TRPs are signaled to UE via LPP Provide Assistance Data. For AI/ML positioning, these two configurations could be interpreted as a “configuration of functionality”.  Further, in legacy, UE is typically provided with a configuration for a specific positioning method a positioning session, which it is expected to execute, thus configuration of *multiple* “functionalities” isn’t feasible as a solution for determination of applicable functionalities as it is in the BM use case.  Next, we need more thought into how applicability reporting would work for LPP. We do not agree on using the term “applicable condition” reporting, which may be interpreted as an additional dynamic reporting of UE capability. In the case of a reactive or proactive reporting (which as indicated earlier, we do not believe should be terms used in the specification), information must be provided to the UE, or else there is no basis for the UE’s evaluation of functionality applicability.  [Rapp] Rapp tends to agree we will not specify the word “reactive/proactive” in specification. That is only for discussion purpose.  2. We do not agree to use the concept of “available model”. This assumption requires further clarification, the wording is confusing and ambiguous. The purpose of indicating non-applicable functionalities, if applicable ones are indicated, is not clear.  3. This point is ambiguous, but the behaviour should be well defined. After the applicable functionality report, the NW can choose to activate the functionality or it can choose not to activate the functionality. RAN2 has agreed that LPP Request/Provide Location Information will be used for inference operation. In this case, Request Location Information can be interpreted as a request sent to UE for activating a functionality. It shouldn’t be left up to the UE to choose whether the functionality is activated.  [Rapp] Agree with the comment, according to summary in Q3-2, the proposal seems aligns with above statement, i.e. it’s not up to UE to choose its activation/deactivation. |
| CMCC | Yes for assumption 2 and 3  No for assumption 1 | For assumption 1, it depends on the discussion in Q2-1. |
| CEWiT | See comments | Assumption 1: Proactive reporting is equivalent to unsolicited message transfer and reactive is equivalent to solicited message transfer. Both are already supported by LPP signaling.  Assumption 2: Same response as Q2-7.  Assumption 3: Unsolicited and solicited location information transfer supported by LPP signaling is sufficient. |

**Summary:**

Assumption 1:

Most companies agree that this assumption is also applicable to positioning Case 1. There’s some companies comment that there’s no hard requirement on when network provides configuration of an applicable functionality in positioning use case. Rapporteur tends to agree with above observation, as in legacy positioning use case, following context can be found in TS 38.305:

|  |
| --- |
| 7.1.2.5            Sequence of procedures LPP procedures are not required to occur in any fixed order, in order to provide greater flexibility in positioning. Thus, a UE may request assistance data at any time in order to comply with a previous request for location measurements from the LMF; an LMF may instigate more than one request for location information (e.g., measurements or a location estimate) in case location results from a previous request were not adequate for the requested QoS; and the target device may transfer capability information to the server at any time if not already performed.  Despite the flexibility allowed by LPP, it is expected that procedures will normally occur in the following order:  1.   Capability Transfer;  2.   Assistance Data Transfer;  3.   Location Information Transfer (measurements and/or location estimate).  Specific examples for each positioning method are shown in clause 8. |

However, it was not discussed before whether the same principle should be followed by AI/ML based positioning use case. Rapporteur suggests to update Assumption 1 as below:

UE can report a change in applicable functionality by sending applicable functionalities upon change via LPP signaling (unsolicited information transfer). UE can also provide applicable functionality reporting as a response to LMF request (solicited information transfer). FFS on the order of inference configuration and applicable functionality reporting.

Assumption 2: According to the summary in Q2-7, this assumption is also postponed for positioning use case.

Assumption 3: All companies agree the proposal provided in Q3-2 can be re-used here:

As baseline, the applicable functionality is initially activated by receiving configuration for the corresponding applicable functionalities.FF**S** on additional L1/L2 signaling **f**or acti**v**ation/deactivation.

Proposal 7: For positioning Case 1, following understanding of applicable functionality reporting (proactive/reactive) is considered:

1) UE can report a change in applicable functionality by sending applicable functionalities upon change via LPP signaling (unsolicited information transfer). UE can also provide applicable functionality reporting as a response to LMF request (solicited information transfer). FFS on the order of inference configuration and applicable functionality reporting.

2) As baseline, the applicable functionality is initially activated by receiving configuration for the corresponding applicable functionalities. FFS on additional L1/L2 signaling for activation/deactivation.

#### Q4-2. For positioning Case 1, any other information needs to be considered during proactive/reactive reporting?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Apple | Yes | As we responded in Q2-1, NW-sided additional conditions are always provided to the UE in the form of associated IDs, irrespective of proactive reporting or reactive reporting. Thus, we think **associated ID** are needed to be provided by NW in positioning case 1. |
| Ericsson | Comments | Agree with Apple comment above. The NW-side additional conditions are part of the possible inference configurations in the reactive approach that the NW can provide to the UE. However, RAN2 does not need to discuss the details of this inference configuration. What to include there should be decided by RAN1. |
| Samsung | Comment | Regarding associated ID, RAN1 has not concluded (or discussed in detail) on the need of associated ID for positioning use case. We can wait for RAN1 progress. |
| Nokia | Yes | In assumption 1, the definition of proactive reporting requires further clarification. Is the intention to enable UE to change capabilities dynamically via LPP? If so, we need to align that with the prior agreement not to support dynamic capabilities for AI/ML functionalities.  In addition, for Positioning, how can we ensure that if the UE is capable to do a proactive reporting of a functionality A, the NW and the circumstances of the PRS allocation resources is available and feasible? In the worst case, if the UE is capable to use the proactive reporting, the final decision should be always in the LMF side. In other words, any applicable functionality that is reported to the LMF, it cannot be activated immediately. A pre-screening should be done by the LMF. |
|  |  |  |
|  |  |  |

**Summary:**

The above comments are considered in the summaries above.

# Conclusion

**NOTE: In this email discussion and summaries, rapporteur assumes NW-side additional condition as associated ID (which is referred by majority of companies), and full inference configuration (e.g. CSI-RS resource configuration, etc) is considered separately from NW-side additional condition, i.e. it is not considered as part of NW-side additional condition in below proposals.**

Proposal 1:

Step 1: Network sends *UECapabilityEnqiry* message to initiate the procedure to a UE reporting its AI/ML supported functionalities.

Step 2: UE sends *UECapablityInformation* message to network, containing supported functionalities at the UE side.

Proposal 2: “Step 3”: Following configurations are provided from NW to UE:

1) UE is allowed to do UAI reporting via *OtherConfig*.

2) It is optional for network to provide NW-side additional condition in *OtherConfig.* Check whether companies are ok to change it as mandatorily signalled.

3) FFS on other inference configuration of supported functionalities.

Proposal 3: UE decides the applicable functionalities based on NW-side additional conditions (if available), UE-side additional conditions (internally known by UE) and model availability in device.

Proposal 4: “Step 4”: UE considers to report applicable functionality in the following scenarios:

1) Upon change of applicable functionality change via UAI

2) As response to NW-side additional condition, FFS via UAI or *RRCReconfigurationComplete*, etc

Proposal 5: Step 5:

1) Network configures full inference configuration to UE after applicable functionality reporting, if inference configuration is not provided in Step 3 (i.e. full inference configuration is provided in Step 5).

2) If inference configuration is provided to Step 3, it is up to network implementation whether to provide an updated configuration or not.

Proposal 6: The applicable functionality is initially activated by receiving configuration (either Step 3 or 5) for the corresponding applicable functionalities. FFS on additional L1/L2 signaling for activation/deactivation.

**Proposal 7: For positioning Case 1, following understanding of applicable functionality reporting (proactive/reactive) is considered:**

**1) UE can report a change in applicable functionality by sending applicable functionalities upon change via LPP signaling (unsolicited information transfer). UE can also provide applicable functionality reporting as a response to LMF request (solicited information transfer). FFS on the order of inference configuration and applicable functionality reporting.**

2) As baseline, the applicable functionality is initially activated by receiving configuration for applicable functionalities.

# Reference

[1] R2-2404151 LCM for UE-sided model for Beam Management use case OPPO

[2] R2-2404185 Beam management UE-sided model LCM signaling Intel Corporation

[3] R2-2404275 On LCM for UE-sided model for Beam Management use case Qualcomm Incorporated

[4] R2-2404341 Discussion on the LCM for UE-sided model for Beam Management Fujitsu

[5] R2-2404370 LCM for UE-sided model for Beam Management use case TCL

[6] R2-2404390 Discussion on LCM for UE-sided model for Beam Management vivo

[7] R2-2404503 LCM for UE-sided model for Beam Management use case Interdigital Inc.

[8] R2-2404599 Discussion on LCM for UE-sided model for BM Xiaomi

[9] R2-2404637 LCM procedure of UE-sided model for AI/ML based beam management Apple

[10] R2-2404691 Discussion on LCM for UE-sided model for Beam Management use case CATT

[11] R2-2404816 LCM for AIML based beam management with UE-sided model Lenovo

[12] R2-2404817 Discussion on applicability-related information and additional condition Lenovo

[13] R2-2404902 UE side model functionality definition Sony

[14] R2-2404933 Discussion on LCM for UE-sided model Spreadtrum Communications

[15] R2-2404941 Functionality based LCM related to UE-side models for BM Nokia

[16] R2-2404957 Functionality identification and applicability related report LG Electronics

[17] R2-2404958 Functionality management for UE-sided model LG Electronics

[18] R2-2405025 Discussion on LCM for UE-sided model for BM CMCC

[19] R2-2405073 Discussion on LCM for UE-sided model NEC

[20] R2-2405180 Functionality-based LCM for UE sided model Samsung

[21] R2-2405184 Considerations on LCM for UE side Model for AIML Based BM ZTE Corporation

[22] R2-2405246 LCM Framework for UE-sided model SHARP Corporation

[23] R2-2405266 LCM for UE-side models for beam management Ericsson discussion

[24] R2-2405274 Discussion on LCM for UE-Side Models Futurewei Technologies

[25] R2-2405337 Discussion on functionality based LCM for UE-sided model for BM Huawei, HiSilicon

[26] R2-2405536 Considerations for moving forward with Functionality-based LCM Kyocera

[27] R2-2405665 Discussion on applicable functionality NTT DOCOMO, INC.

# Annex – RAN2 agreements on UE-sided model LCM

RAN2 #125bis meeting

**Agreements**

1. Which AI/ML-enabled Features/FGs and functionalities are supported should be standardized. The details wait for RAN1’s progress. “supported” means that the UE is capable of supporting the functionality and doesn’t mean neccesarily that the UE has the model available. FFS what functionality refers to.

2. Supported AI/ML-enabled Features/FGs and supported functionalities are included in UE capability.

**Agreements for positioning and beam management**

1. Support proactive reporting of UE-sided applicable functionality, e.g., the UE reports its applicable AI/ML functionalities via UAI message/LPP message.
2. Support reactive reporting of UE-sided applicable functionality. The NW configures AI/ML functionalities via RRC/LPP message. FFS what the configuration contains. FFS how to report applicable functionality and what is applicable functionality

3 FFS how the two approaches will be specified and whether we can combine them into one procedure. FFS how to report applicable functionality, what is applicable functionality, how the UE determines which function is applicable or not (if it is needed)

**Agreements:**

1 For UE-sided model, for the functionality management, the “network decision, network-initiated” AI/ML management is supported as a baseline. The following can be considered further “UE autonomous, decision reported to the network”, “Network decision, UE-initiated” (i.e. proactive approach).

2 “UE-autonomous, UE’s decision is not reported to the network” is not considered for Rel-19

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**Agreements**

1 RAN2 will support functionality activation/deactivation after inference configuration. FFS initial state of configuration and how activation/deactivation is achieved. FFS what Deactivation refers to: examples discussed: 1) fallback to legacy 2) switching, etc.

2 We will work offline on the definitions for functionality types and define what is availability.

3 The UE will indicate the gNB/LMF whether the AI/ML functionality is available/applicable. For a functionality to be applicable at least there should at least one model available within it. FFS other details on what is applicability/non-applicability.

4 For NW-side additional conditions, RAN2 assumes that RRC signaling from gNB to UE can be designed for consistency between inference and training. RAN2 will wait for RAN1 input for further details. FFS if the same applies to positioning

5 For BM use case, As a baseline the UE determines whether a functionality is applicable. Existing UAI framework is used at least for proactive reporting of applicable functionality. FFS reactive