**3GPP TSG-RAN2 #121bis-e R2-230xxxx**

**Electronic meeting, April 17 – April 26, 2023**

**Agenda item:** **7.2.2 (Sidelink positioning)**

**Source:** Samsung (Rapporteur)

**Title:** Report of **[AT121bis-e][429][POS] Session-based SLPP (Samsung)**.

**Document for:** Discussion and Decision

1. Introduction

 **[AT121bis-e][429][POS] Session-based SLPP (Samsung)**

    Scope: Discuss the proposals from section 2.1 of R2-2304005 and progress towards agreements.

    Intended outcome: Report to CB session

    Deadline: Monday 2023-04-24 2359 UTC

Response deadline for collecting comments: Friday 2023-04-21 2359 UTC

2 Contact Information

|  |  |
| --- | --- |
| **Company** | **Contact: Name (E-mail)** |
| Fraunhofer  | Birendra Ghimire (birendra.ghimire@iis.fraunhofer.de)  |
| ZTE | Yu Pan(pan.yu24@zte.com.cn) |
| Nokia | stepan.kucera@nokia.com |
| LG | Jonggil Nam (jonggil.nam@lge.com) |
| Qualcomm | Dan Vassilovski (dvassilo@qti.qualcomm.com) |
| Intel | Ansab Ali (ansab.ali@intel.com) |
| CATT | Jianxiang Li (lijianxiang@catt.cn) |
| Spreadtrum | Huifang Fan (Huifang.fan@unisoc.com) |

3. Discussion

We introduced session based SLPP, and session-less SLPP in the last R2#120 meeting. However, in this email discussion, we only handle the session-based SLPP operation since there is not much time in this meeting to be concluded, and as requested by the chair. The questionnaires in this email discussion are based on Tdoc [1].

In R2 meeting (R2#120), there were the agreements regarding session-based SLPP as below:

Agreement:

Sidelink positioning supports a session-based concept in SLPP, in which signalling messages within a session can be associated with one another by the involved UEs. The relationship to upper-layer designs from SA2 can be discussed during normative work.

FFS if there is also sessionless operation and what aspects of session-based operation would not be included.

In R2#121, there was some discussions on the session-based SLPP designing but, we couldn’t make an agreement.

There was no specific definition of the session in the SLPP perspective even though the discussion was held with some implicit background among companies. By defining the exact terminology, it is easy to find the new consideration points.

In our understanding, the core concept regarding the session of SLPP is that the session is associated with a single location service request regardless of which entity has instigated that, and the signaling/messages are all related to that purpose. The definition of LPP session can be used as the reference for defining the session of the SLPP, and cropped from 37.355 as below:

|  |
| --- |
| **4.1.2 LPP Sessions and Transactions**An LPP session is used between a Location Server and the target device in order to obtain location related measurements or a location estimate or to transfer assistance data. A single LPP session is used to support a single location request (e.g., for a single MT-LR, MO-LR or NI-LR). Multiple LPP sessions can be used between the same endpoints to support multiple different location requests (as required by TS 23.271 [3]). Each LPP session comprises one or more LPP transactions, with each LPP transaction performing a single operation (capability exchange, assistance data transfer, or location information transfer). In E-UTRAN and NG-RAN, the LPP transactions are realized as LPP procedures. The instigator of an LPP session will always instigate the first LPP transaction, but subsequent transactions may be instigated by either end. LPP transactions within a session may occur serially or in parallel. LPP transactions are indicated at the LPP protocol level with a transaction ID in order to associate messages with one another (e.g., request and response).Messages within a transaction are linked by a common transaction identifier. |

We can take this text of LPP’s session and related transaction definitions as a reference for the SLPP’s counterparts, and agree on each, further discuss and tailor them on SLPP specific aspects if needed step-by-step.

## 3.1 End points used in a session

The yellow highlighted part above, that is also applicable to the SLPP session, except that the one of the end points is not only location server, but another UE. Moreover, we consider that SLPP is also used for IC/PC which can be encapsulated. However, in this IC/PC case, there should be further discussion on how SLPP session can be handled with respect to LPP. Therefore, for defining session-based SLPP operation in at least PC5-only case, we propose to discuss the following statements.

**Q1. Do company agree on that “For session-based SLPP, a SLPP session is used among UEs in at least PC5-only case in order to obtain location related measurements or a location estimate or to transfer assistance data.”?**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comments**  |
| Fraunhofer | Yes | We agree that a SLPP session is associated with location related measurements of a single target UE. |
| OPPO | Yes |  |
| ZTE | Yes  | Agree to adopt this general description for SLPP, since the session (no matter LPP and SLPP) is designed with the purpose of yellow part.  |
| Nokia | Yes |  |
| Huawei, HiSilicon | Yes, but | Not sure what does it mean by for “at least PC5-only case”. For hybrid Uu-PC5 case, do we need a SLPP session? |
| LG | Yes |  |
| Qualcomm | Yes, with comment | We agree that an SLPP session can be used to at least transfer assistance data, location-related measurements and location estimates. In addition, an SLPP session should be used for exchange of capabilities, session creation, session termination and session modification. |
| Intel | Yes |  |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| vivo | Yes |  |

## 3.2 The definition of session

Also, regarding green part, single SLPP session is used to support a single location request, which also is the majority company view. Therefore, we also propose to discuss on the following.

**Q2. Do company agree on that “For session-based SLPP, a single SLPP session is used to support a single location request for sidelink positioning.”?**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comments**  |
| Fraunhofer | Partially yes | We agree that a location request for a target UE shall be supported within a single session. However, our view is that setup and maintaining UEs within a session has its own overhead and induces latency. Therefore, we have a different view to the proposal that a single SLPP session is used to support a **single** location request for sidelink positioning. One of the use cases is tracking of devices, and this can be associated with one or more deferred location requests. If they all belong to one target UE then the location requests can be grouped together to form a session. By this we avoid having to setup a session for each position fix.Our proposed variant would be:**For session-based SLPP, a single SLPP session is used to support a single immediate LR or a a group of deferred LRs for a target UE for sidelink positioning.**  |
| OPPO | Yes | Location request can come from external clients, UE itself at the different time. They could have different QoS requirement such as accuracy, response time, QoS class, etc, so it is hard to co-ordinate between them and group them into one SLPP session. |
| ZTE | Yes | We support ‘a single SLPP session is associated with a single location request’ to make the procedure simple. Regarding to Fraunhofer’s comment, we think a single service request can be enhanced to include multiple target UEs service request, or LMF can make the multiple service requests into one then forward to the RAN side. |
| Nokia | Yes | Agree with the ZTE concept but would reformulate as:**For session-based SLPP, a single SLPP session is created to support a single location request. FFS if and how additional / subsequent requests (eg, of same QoS) can be mapped to an existing session.** |
| Huawei, HiSilicon | Yes | Agree with the comment from ZTE and Nokia, similar to LCS, a SLPP session corresponds to a single location request |
| LG | Partially yes | Session-based and session-less operation can be used for sidelink positioning. In addition, we think multiple sessions can be used between different endpoints for a single location request, by considering UEs various capabilities and dynamic situation.**A single SLPP session can be used to support a single location request for sidelink positioning** |
| Qualcomm | Yes with comment | We support LG’s proposed change, and further note that a single location request can be for Triggered, Periodic or Aperiodic measurements. |
| Intel | Yes | We think this is the most feasible way to associate a session with a specific session request. This also implies that explicit session management shall not be needed since the involved UEs and the positioning signaling are all implicitly associated with a single location request. Therefore, we do not see compelling reason to differ from LPP design |
| CATT | Yes |  |
| Spreadtrum | Yes | Agree with the Intel views. A single SLPP session is used to support a single location request is simple way to handle SLPP session. And this implies that explicit session management shall not necessary.  |
| vivo | Partially yes | Agree with LG that multiple sessions can be used between different endpoints for a single location request, e.g., LMF receives a location request for the ranging between UE1 and UE2. But UE1 is too far to directly communicate with UE2. The LMF can find an intermediate UE3. The LMF can initiate two SLPP sessions: one is for the ranging between UE1 and UE3, the other is for the ranging between UE2 and UE3. The LMF obtains the ranging between UE1 and UE2 based on the result of UE1 and UE3 and the one of UE2 and UE3. |

However, for that “a single location request” in the **Q2**, it is not known that legacy LCS service request cases (i.e., MT-LR, MO-LR or NI-LR) can be applied to sidelink positioning cases as it is. Obviously, the whole call flow of sidelink positioning and related service request must be different with the legacy LCS request cases due to that the involved CN/RAN entity would be changed. And this needs SA2 confirm. Therefore, we propose to consult SA2 on this.

**Q3. Do companies agree to send LS to SA2 to inform the agreed session-based SLPP definition in this meeting and ask for the procedure on how a single SLPP session is invoked by the LCS service request for sidelink positioning including the case of OOC and IC/PC” ?**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comments**  |
| Fraunhofer | Yes | We see the need to have working assumptions in RAN2 about session initiation (and in general about the definition of session) and consult with SA2.  |
| OPPO | Yes | SA2 should be also consulted with the possibility of LMF to trigger a SLPP session to make calibration the Uu-based positioning measurement results obtained from a ongoing Uu-based positioning task |
| ZTE | Yes | TS23.586 has captured the following description:

|  |
| --- |
| 5.5.2 Network assisted SL Positioning of UE with NAS connectionA UE with a NAS signalling connection is in CM-Connected state. The UE enters CM-Connected state by performing UE triggered Service Request for 5GC-MO-LR or performing Network triggered Service Request for 5GC-NI-LR or 5GC-MT-LR. As the Target UE can establish a NAS signalling connection with the AMF, the functionality specified in TS 23.273 [8] for location services can be reused including e.g. 5GC-MO-LR, 5GC-MT-LR and 5GC-NI-LR with the additional functionality captured in this clause.- The Location Service is triggered via the AMF serving the Target UE. The location request comes either from an AF/external client via the GMLC, a 5G NF, or the Target UE.- The LTE positioning protocol (LPP) as specified in TS 37.355 [9] is used between the Target UE and the LMF. When LCS procedures are used to estimate the location of the Located UE, LPP is used between Located UE and LMF.Editor's note: RAN WGs will determine whether and what enhancements and the subset functionalities of LPP are needed to support Network assisted SL positioning including an 5GC-MT-LR, 5GC-MO-LR and 5GC-NI-LR.- Either the Target UE or LMF determines if network assisted SL positioning will be applied. When LMF determines that network assisted SL positioning is used, LMF may trigger the Target UE to perform the discovery of Located UE(s).5.5.3 Network assisted SL positioning without NAS connectionWhen Target UE cannot establish the NAS connection with AMF due to the Target UE being out of coverage, for 5GC-MO-LR or pending 5GC-MT-LR (e.g. deferred 5GC-MT-LR), the following principles are applied:- The Target UE performs the Located UE's discovery and selection. |

We think the above briefly describes how MT-LR in IC/PC and MO-LR in IC/OOC are worked to trigger SLPP session, and we should ask the details. |
| Nokia | Yes | Given the agreed existence on both session-based and session-less SL positioning, we generally see the need to define these concepts for SA2’s understanding as well as indicate our views when these are to be used so that they can provide more concrete constructive feedback.We analyse this issue in more detail in R2-2300586 and propose the following definitions:**Proposal 1: Session-based SL positioning ensures service continuity, timely signalling, satisfactory resource provisioning with the goal to obtain predictable and reliable positioning outcomes / performance.****Proposal 3: Session-less sidelink positioning primarily focuses on minimization of overhead and latency, and offers only best-effort positioning services.**These could be used when drafting the LS. Prior to sending any LS to SA2, we also see a need to clarify the following issue from RAN2 perspective:**Proposal 5: RAN2 to study mandatory and optional conditions for selecting session-based and session-less positioning, as well as the decision-making node represented by****- Alternative 1: LMF or the server UE****- Alternative 2: target UE.** |
| Huawei, HiSilicon | Yes, but | We wonder is session-less SL positioning equivalent to autonomous self location? We should be clear about the definition of session-based/session-less before asking SA2 questions |
| LG | Yes | We think LMF and target/server UE can trigger SL positioning in IC/PC(target UE inside of network coverage) and OOC/PC(target UE outside of network coverage), respectively. Herein, SL positioning can be worked as PC5-only-based or joint Uu+PC5 mode. But, it is still not clear who manages SLPP session, i.e. whether target UE or server UE. If server UE works for SLPP session management, we believe server UE should be at least either target UE or one of anchor UEs, but target UE is preferred. If not, discovery and SLPP procedures could be very complicated. Target UE should find server UE in overlapped PC5 coverage with all anchor UEs.  |
| Qualcomm | Yes | We support sharing RAN2 conclusions with SA2. Our view is the LCS service request can be intra-UE, inter-UE, UE-to-LMF or LMF to UE. The LS could suggest this and allow SA2 to further elaborate.  |
| Intel | Yes | We agree with LG that one piece of the puzzle is indeed the role of the server UE, at least for the OOC case. RAN2 can discuss whether the anchor or target UE may perform the functionality of the server UE and inform SA2 when asking them about the overall session based SLPP procedure invocation. |
| CATT | No | RAN2 already sent the LS (R2-2302285) to SA2 in the last meeting to ask SA2 the triggering event. We assume that SA2 will answer how the event to trigger an SLPP session.Question 2: Regarding the step 1 trigger event, RAN2 would like to understand whether SA2 will specify the triggering event for an SLPP session? |
| Spreadtrum | Yes | We think for IC/PC coverage, server UE/LMF can trigger SL positioning and for OOC, only server UE can trigger SL positioning. There is also a possibility that LMF triggers a SLPP session to make calibration the Uu-based positioning measurement results when the Uu positioning cannot meet location requirements. Thus SL positioning can be standlone or joint Uu and SL positioning. We look forward to SA2 to further elaborate. |
| vivo | No | Same view with CATT. Besides, maybe we need to ask SA2 to confirm that multiple sessions can be used between different endpoints for a single location request. |

Beside of SA2’s confirmation, if there is no connectivity of the CN/RAN entity in OOC case, the upper layer e.g., the application layer or V2X/ProSe layer can trigger the service with the necessary information such as the target UE, QoS level, etc. Anyhow, this triggers SLPP layer to start/setup the corresponding procedures. In this case, a single SLPP session can be invoked by the upper layer’s request for the sidelink positioning.

**Q4. Do company agree that “For session-based SLPP, once service request indicated by the upper layer, SLPP can initiate the session start”?**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comments**  |
| Fraunhofer | Needs discussion | In general, we think the session should be created at the UE that is handling the server functionality. This may be another UE acting as a server, one or the anchor UEs or the target UE itself. The session could start if the target UE also performs the functionality of server UE (i.e. resource coordination / positioning computation). Otherwise, the target UE should request the server UE to create and maintain a positioning session. |
| OPPO |  | Agree with Fraunhofer. A SLPP session should at least start with a target UE and a location server UE |
| ZTE | Yes | In Uu positioning, it is LPP that indicate LPP session start in 37.355: ‘An LPP session is used between a Location Server and the target device in order to obtain location related measurements or a location estimate or to transfer assistance data. ... The instigator of an LPP session will always instigate the first LPP transaction, but subsequent transactions may be instigated by either end.’So we think SLPP can also trigger session start |
| Nokia | See comments | We understand this proposal in the sense that SLPP may be used to setup a positioning session once a positioning requests is received. This would be agreeable to us. When and who exactly uses SLPP to trigger the session needs to be discussed (similar view as Frauenhofer). |
| Huawei, HiSilicon | Yes |  |
| LG | Yes |  |
| Qualcomm | Yes |  |
| Intel | Yes with comment | For the OOC case, service request initiated by the upper layer shall be handled by the Positioning server UE (which may be the same as the anchor UE) or it may be triggered and sent to the server UE by the target UE. This can serve as the trigger for the initiation of the session start by the SLPP |
| CATT | No | We need to discuss what steps are included in a SLPP session at first. Is a discovery procedure included in the SLPP session? The discovery procedure is not supposed in a SLPP session in our view. SLPP session can be created after all of participant UEs are determined. So s SLPP session should be initiated after all anchor UEs are selected.LCS request -> discovery procedure -> SLPP session setupThe wording can be updated as **For session-based SLPP, after service request indicated by the upper layer and all participant UEs are** **determined, SLPP can initiate the session start.**  |
| Spreadtrum | Yes |  |
| vivo |  | Agree with Fraunhofer. If target UE is not server UE, the app of target UE will send location request (which is app level message) to the server UE. Upon receiving the request, the app layer of server UE notifies the SLPP layer of server UE. Then the SLPP layer of sever UE will setup the SLPP session.  |

## 3.3 Multiple sessions

Regarding cyan part, multiple SLPP sessions can be used between or among same UEs, which is a marginal difference between LPP and SLPP. So, except this, other part can be reused. Since the details on the reference spec still cannot be specified, we can remove them, which later can be updated.

**Q5. Do companies agree on the following TP for session-based SLPP? (please find the track marked changes):**

**Multiple SLPP sessions can be used between/among the same endpoints to support multiple different location requests. Each SLPP session comprises one or more SLPP transactions, with each SLPP transaction performing a single operation (capability exchange, assistance data transfer, or location information transfer). In NG-RAN, the SLPP transactions are realized as SLPP procedures. The instigator of an SLPP session will always instigate the first SLPP transaction, but subsequent transactions may be instigated by other end. SLPP transactions within a session may occur serially or in parallel.**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comments**  |
| Fraunhofer | Depends | As indicated in our above response to Q2, our preference is to have same session if it pertains to the same target UE (deferred LRs). This reduces latency and setup overhead.However, if there are use cases where different QoS are required for the target device then multiple SLPP sessions can be considered. |
| OPPO | Yes |  |
| ZTE | Too early to discuss the TP | Agree with the baseline to reuse the paragraph. But it is no hush to finalize the TP wording.In addition we think legacy wording ‘either end’ is correct |
| Nokia | Too early | In general we support the intention of the proposal but its concrete wording feels like a general terminology definition rather than a concrete technical contribution. For this reason, we think we should postpone this discussion, eg until key SLPP design issues are agreed (for example Q2).  |
| **Huwei, HiSilicon** |  | **Not clear what is multiple SLPP session in the first place and what is the use of it** |
| LG | Partially yes | In Q2, we provide our view on that multiple sessions can be used between different endpoints for a single location request. In addition, we think one and more sessions can be used between/among the same endpoints for a single location request. Additional session can be initiated by SLPP layer independent from a location request of upper/application layer. We do not need to have some restriction on number of session in specification, leave on implementation.  |
| Qualcomm | Partially yes | Since multiple UEs may participate in an SLPP session, a session may have multiple “other ends.” As such, we suggest the following clarification, “…but subsequent transactions may be instigated by ~~either~~ other UEs participating in the SLPP session ~~end~~.” |
| Intel | Yes | We can follow LPP design here, i.e. multiple SLPP sessions between same endpoints correspond to different location requests (independently) |
| CATT | **Yes with comment** | **A SLPP transaction corresponding to a transaction procedure between two endpoints. Suggest change to “(capability exchange, assistance data transfer, or location information transfer between two endpoints)”** |
| Spreadtrum | Yes with comment | We also have concern about the scenario of multiple SLPP sessions to support multiple different location requests between same endpoints. We think different location request may have different QoS requirement. As Q2 mentioned, anchor UEs may be different for different SLPP sessions. Thus the first sentence may be a corner case. |
| vivo | Too early | Same view with ZTE and Nokia |

## 3.4 Transaction ID in a session

Regarding pink part, as LPP, SLPP transactions are indicated at the SLPP protocol level with a transaction ID to associate messages with one another (e.t., request and response). We already have the agreed functions where the messages can be associated under, as already agreed in R2#120 as below:

Agreement:

With respect to the overall signaling procedure for PC5-only positioning (including at least IC and OOC; FFS if there are differences for PC), it is proposed to agree that the sidelink positioning procedure comprises the following series of steps as a baseline, between the LMF/positioning server UE/NG-RAN/candidate Anchor UE(s) and Target UE(s):

1. Triggering event
2. Sidelink positioning capability exchange

3. Sidelink positioning assistance data transfer

4. SL Positioning Request Location Information

5. Measurement of SL-PRS

6. Location calculation

7. SL Positioning Provide Location Information

Some steps may have dependencies on SA2 and can be revisited in this light. The order is subject to further discussion. FFS if discovery and selection of anchor UEs and/or server UE are part of the positioning layer in RAN2 scope.

LS to SA2 to ask for confirmation and guidance on the SA2 aspects.

Therefore, we propose the following:

**Q6. Do companies agree that “For session-based SLPP, SLPP transactions are indicated at the SLPP protocol level with a transaction ID in order to associate messages with one another (e.g., request and response)”?**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comments**  |
| Fraunhofer | Yes | No strong opinion. |
| OPPO | Yes | SLPP transaction ID is needed for the endpoints to know the relationship between incoming and transmitted msgs. |
| ZTE | Yes |  |
| Nokia | Yes |  |
| Huawei, HiSilicon | Yes | Still needed between the two entities communicating with SLPP since there can be multiple SLPP messages. |
| LG | Yes but | Agreed. But, unlike LPP, SLPP needs session ID at the SLPP level (Q8). For more clarification, SLPP transactions are indicated at the SLPP protocol level with a transaction ID and a session ID in order to associate messages with one another (e.g., request and response). |
| Qualcomm | Yes | Agree with LG’s comment that an SLPP Session ID (per Q8) is also required.  |
| Intel | Yes |  |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| vivo | Yes |  |

For the grey part, even we don’t know how the details of SLPP messages to be designed yet, it seems natural to reuse the transaction ID-based association among the SLPP messages which have relation with each other within a transaction.

**Q7. Do companies agree that “For session-based SLPP, messages within a transaction are linked by a common transaction identifier”?**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comments**  |
| Fraunhofer | Yes |  |
| OPPO | Yes |  |
| ZTE | Yes |  |
| Nokia | Yes |  |
| Huawei，Hislicon | Yes |  |
| LG | Yes |  |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| vivo | Yes |  |

## 3.5 Necessity of session ID for SLPP

In the SLPP case, there would be multiple sessions per the same end points, and those sessions might be different according to the intended target UE, and/or required service characteristics such as QoS level etc even the session is initiated by the same UE. Considering there are multiple on-going sessions, and an involved UE might have different session with different target UE at the same time, there should be a way to tell them at the UE to respond accordingly. This can be possible by using session ID. The straightforward way to realize this is to include session ID in the SLPP message. Therefore, rapporteur propose to discuss the following:

**Q8. Do company agree that “For the session based SLPP, there should be a session ID to distinguish the sessions at the involved UEs in SLPP messages”?**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comments**  |
| Fraunhofer | Yes |  |
| OPPO | Yes | Different session ID should be associated with different target UEs |
| ZTE | Yes |  |
| Nokia | Yes |  |
| Huawei, HiSIlicon | Not clear | Actually, the session ID in LPP is not that needed. Not sure if it is still needed in SLPP |
| LG | Yes | In Uu-based positioning, a single UE positioning session is used for a single location service at the LPP level, and multiple UE positioning sessions are used for multiple different location services at the higher (i.e. application layer) level. In sidelink positioning, a single anchor UE may support multiple target UEs to transmit/receive SL-PRS reference signals at the SLPP level, thus, a single anchor UE can be involved in multiple SLPP sessions. But anchor UE does not know the information of location service of target UE, so could not identify each SLPP session. To support multiple SLPP sessions between a single anchor UE and multiple target UEs, SLPP session ID should be assigned when an SLPP session is established.  |
| Qualcomm | Yes |  |
| Intel | See comment | We have similar question as Huawei, i.e. why would transaction ID not be sufficient |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| vivo | Yes |  |

References

[1] R2-2304005, Designing SLPP protocol in the session perspective, submitted R2#121bis, Samsung