**3GPP TSG RAN WG1 Meeting #100bis-E R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

**Source: Moderator (Intel Corporation)**

**Title: Email Discussion #2 [100b-e-NR-5G\_V2X\_NRSL-Mode-2-02]**

**Agenda item: 7.2.4.2.2**

**Document for:** **Discussion and Decision**

Introduction

This document provides discussion on issues in the second email discussion on V2X Mode-2 during RAN1#100bis-e.

[100b-e-NR-5G\_V2X\_NRSL-Mode-2-02] Email discussion/approval w.r.t. pre-emption including aspects:

* Finalization of the RRC parameter for pre-emption configuration per resource pool (still TBD in the RRC list)
* Relation of pre-emption RSRP threshold and Step 1 checking
* Which resources can be re-selected after pre-emption condition – only ones to be transmitted or to be signalled

till 4/27, with potential TPs till 4/30 (Intel, Sergey)

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| Agreements**:**   * Support a resource pre-emption mechanism for Mode-2   + A UE triggers reselection of already signaled resource(s) as a resource reservation in case of overlap with resource(s) of a higher priority reservation from a different UE and, SL-RSRP measurement associated with the resource reserved by that different UE is larger than an associated SL-RSRP threshold     - Only the overlapped resource(s) is/are reselected     - FFS       * the timeline for reselection       * other details     - FFS whether or not to support other potential UE behaviour (e.g, power boosting/reduction)   + This mechanism can be enabled or disabled, per resource pool     - FFS details   Agreements:   * For pre-emption, both full and partial frequency domain overlap in the same slot are considered as the overlapping condition to trigger resource reselection, wherein the whole resource is reselected even if the partial overlap happened * (Re-)selection procedure for an already reserved but pre-empted resource to be used for transmission in a slot ‘m’ is not required to be triggered at moment > ‘m – T3’   + T3 here is identical to T3 introduced for the re-evaluation * FFS whether re-selection of the already-reserved, but pre-empted resource applies only to the resource transmitted in slot ‘m’ or to other already-reserved and pre-empted resource(s) signaled in the SCI in slot ’m’ as well |

Discussion

The first aspect relates to the open question of RRC configuration. The agreement says that pre-emption can be enabled or disabled, per resource pool, and FFS details. In the last meeting, no consensus was reached to conclude whether the activation in the pool applies to any priority level or to a sub-set of priorities.

There are different options observed in contributions:

* The per resource pool pre-emption configuration is priority unaware, i.e. it is a flag {enabled, disabled/not provided}. Companies in favour of this option usually refer to sufficiency of such configuration option and allow any higher priority transmission to pre-empt any lower priority transmission.
* The per resource pool pre-emption configuration is priority aware, a scalar priority value {0…7} controls activation of pre-emption. Companies in favour of this option refer to better controlled pre-emption rate, also can realize the scenarios where only the highest priority can pre-empt other transmissions. There are two contributions showing pre-emption SLS evaluations [13][27] motivating to introduce priority dependent activation for pre-emption rate control.

**Q1: Which of the following options is preferred?**

* Option 1
  + Finalize the RRC parameter for pre-emption activation per resource pool by confirming that it is {enabled, disabled}, and no separate priority value provided
* Option 2
  + Finalize the RRC parameter for pre-emption activation per resource pool by introducing a priority level p\_preemption {0…7}, and if priority p\_SCI associated with the resource indicated in SCI is higher than p\_preemption and prioTX, then pre-emption can be triggered

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| Source | Option | Comment |  |
| Ericsson | 2 | We think it is important to limit the use of pre-emption to those cases when it really makes sense to use it. ON/OFF configuration is not sufficient. Nonetheless, it should be possible to prevent pre-emption between some priority pairs. |  |
| Intel | 2 | Pre-emption is more important for high priority transmissions. Other mechanisms can be used for medium/low priorities |  |
| Futurewei | 2 | It is important that the highest priority traffic can always sent. |  |
| NTT DOCOMO | 1 | Traffic with higher priority should always be prioritized than the one with lower priority |  |
| Apple | 2 | Pre-emption is triggered only for very high priority traffic. This avoids the frequent pre-emption scenario in a system. |  |

The second aspect is the open question which RSRP threshold is used to decide about pre-emption triggering when priority condition is met. There are the following alternatives:

* RSRP threshold is one the used for resource identification in Step 1 including all increments
  + In one alternative, this is the threshold in current resource selection window when checking for pre-emption is triggered. This option is very similar to re-evaluation and can be considered with higher priority to ensure same mechanism between features.
  + In another alternative, this is the threshold in the resource selection window when the resource was selected previously. In this case, the RSRP threshold may not reflect changed loading.
* RSRP threshold is the one configured per-priority for resource identification, before any increments during Step 1
* RSRP threshold is separately configured for pre-emption purpose, it is not subject to increments

**Q2: Which option of RSRP threshold for pre-emption checking is preferred**

* Option 1
  + The RSRP threshold after Step 1 checking, i.e. including any 3 dB increments
    - Option 1a
      * The threshold after Step 1 checking on a current resource selection window (triggered specifically for pre-emption)
    - Option 1b
      * The threshold after Step 1 checking on the resource selection window during latest re-evaluation for this resource
* Option 2
  + The RSRP threshold (pre-)configured for regular Step 1 checking, before any increments
* Option 3
  + A separately configured per priority pair RSRP threshold

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| Source | Option | Comment |  |
| Ericsson | 2 | The configuration must be based on some fixed parameters. Not on something internal to the UE |  |
| Intel | Option 1a | UE executes Step-1 and checks if pre-empted resource is within candidate resource set |  |
| Futurewei | 3 or 2 | Agree with Ericsson that a UE-internal value cannot be used. Option 3 provides a little bit more flexibility than option 2, thus is slightly preferred to 2 |  |
| NTT DOCOMO | 1a | RSRP threshold specific to pre-emption is not necessary. Similar to re-evaluation is sufficient. |  |
| Apple | Similar to Option 1a | Only configure the maximum RSRP threshold per priority pair. If the maximum RSRP threshold is reached and less than X% of candidate resources are identified, then pre-emption is triggered. |  |

The third aspect in this discussion is related to the FFS whether re-selection of the already-reserved, but pre-empted resource applies only to the resource transmitted in slot ‘m’ or to other already-reserved and pre-empted resource(s) signalled in the SCI in slot ’m’ as well.

Based on the discussion, the following options were identified:

* Re-selection is performed only for the upcoming resource to be used for transmission
* Re-selection is performed for any resource to be used for transmission or signaled, if those fulfil pre-emption triggering condition
* Re-selection is performed for all resources to be used for transmission or signaled, if at least one of these resources fulfil the pre-emption triggering condition
  + Note, this may violate prior RAN1 agreement that only overlapped resource(s) are reselected

**Q3.1: Which option for resource re-selection due to pre-emption is preferred**

* Option 1
  + Re-selection is performed only for the upcoming resource to be used for transmission
* Option 2
  + Re-selection is performed for any resource to be used for transmission or signaled, if those fulfil pre-emption triggering condition
* Option 3
  + Re-selection is performed for all resources to be used for transmission or signaled, if at least one of these resources fulfil the pre-emption triggering condition

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| Source | Option | Comment |  |
| Ericsson | Option 2 | Option 3 unnecessarily reselects resources that have no issue. Option 1 is not justified, as it does not reselect resources for which the pre-emption condition holds, even if these are further apart in time. The earlier resources are re-selected and reserved, the better. |  |
| Intel | Option 2 is preferred | Option 3 - there may be no need to reselect all resources. Option 1 – it is better to reselect resource signalled in slot ‘m’ as well |  |
| Futurewei | 2 | Reselect only for the resource affected |  |
| NTT DOCOMO | 2 | Agree with Ericsson |  |
| Apple | Option 2 | Reselect the resources to be transmitted or to be signaled |  |

There is one more sub-aspect, where like re-evaluation, the reselection of a pre-empted resource may need to fulfil any introduced timing restrictions.

**Q3.2: When re-selection of the pre-empted resource(s) is performed, whether to allow violation of timing restrictions?**

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| Source | Comment |  |
| Ericsson | No. Timing restrictions cannot be violated. They reflect considerations on processing times, etc. that cannot be altered. |  |
| Intel | In our view at least HARQ RTT should be ensured, while SCI chain integrity(signaling window) may not be ensured. |  |
| Futurewei | No |  |
| NTT DOCOMO | No |  |
| Apple | No. Timing restriction should be kept. |  |

Summary of proposals on the relevant issues

1. Finalization of the RRC parameter for pre-emption configuration per resource pool (still TBD in the RRC list)
   * Priority dependent configuration: [3][13][20][27]
     + [13][27] show SLS evaluation in support of it
   * Not priority dependent configuration: [6][10][12][15][16][24]
2. Relation of pre-emption RSRP threshold and Step 1 checking
   * [13][16][27]
3. Which resources can be re-selected – only ones to be transmitted or to be signalled
   * [2][5][7][9][13][16][17][21][22]

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