

Title: Transferring of List of candidate SCells
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Agenda Item: 7.1.2.2
Document for: Discussion and Decision

1. Introduction

In RAN2#70bis, it was agreed that a list of candidate SCell will be transferred from source eNB to target eNB. The next thing is to decide whether this information is transferred in the RRC Container HandoverPreparationInformation or in the X2 or S1 message. There is also a further point to discuss whether the SCell should be part of the reestablishmentInfo as well or a separate IE should be used.

2. Discussion

2.1 Where should the candidate SCells be sent

In X2 handover, the target cell identifier (ECGI) of the target serving cell is sent in the X2AP Handover Request message

In S1 handover, the target cell identifier (ECGI) of the target serving cell is sent in the transparent container of the S1AP Handover Request message.

It seems quite natural to send the candidate SCells in the same way as the target serving cell (which is the PCell for Rel-10) in Rel-8/9. However, the target only really needs the PCell info from backwards compatibility point of view and this allows the flexibility to use either X2-AP or RRC container to carry the SCell details. It is proposed that they are kept in the RRC Container to reduce the interaction between RAN 2 and RAN 3 and to minimise the impact on RAN3. It also allows a uniform handling irrespective of S1 or X2 HO.

Proposal#1: The list of candidate SCells are sent in the RRC Container (i.e. HandoverPreparationInfo message)

2.2 How should the list of candidate SCells be structured

In Rel-8/9, there is also the reestablishInfo IE in the HandoverPreparationInfo message and it contains additionalReestabInfoList IE which contains a list of cells under the control of the same target eNB for re-establishment. Also contained for each cell in the additionalReestabInfoList IE is the KeNB* and shortMAC-I. KeNB* will be needed if the target eNB wants to perform PCell reselection (i.e. choose another PCell instead of the PCell selected by the source eNB). While shortMAC-I IE is only required for re-establishment case and hence not essential for the candidate SCells for handover, it is most likely that the candidate SCells for handover are also cells for re-establishment. However, the converse may not be true (i.e., (all re-establishment cells may not be potential SCells). Hence there are the following options to structure the list of candidate SCells:

Option 1: List of candidate SCells is contained in another structure in the HandoverPreparationInformation message

Option 2: Reuse the re-establishmentInfo IE and indicates the cells that are also candidate SCell

In Option 1, a simple structure is as follows (like the re-establishmentInfo IE) can be used. As agreed, it will contain the frequency numbers and the PCI. KeNB* is only needed for possible PCell reselection. Unfortunately, this cannot be added at the level of AS-Context IE as there is no extension marker. Hence the only logical place is to add it in the non-critical extension in HandoverPreparationInformation-vaxx as follows:

HandoverPreparationInformation message

-- ASN1START

```

HandoverPreparationInformation ::= SEQUENCE {
    criticalExtensions          CHOICE {
        c1                     CHOICE{
            handoverPreparationInformation-r8    HandoverPreparationInformation-r8-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture          SEQUENCE {}
    }
}

HandoverPreparationInformation-r8-IEs ::= SEQUENCE {
    ue-RadioAccessCapabilityInfo    UE-CapabilityRAT-ContainerList,
    as-Config                        AS-Config                      OPTIONAL,      -- Cond HO
    rrm-Config                       RRM-Config                     OPTIONAL,
    as-Context                       AS-Context                     OPTIONAL,      -- Cond HO
    nonCriticalExtension             HandoverPreparationInformation-v920-IEs    OPTIONAL
}

HandoverPreparationInformation-v920-IEs ::= SEQUENCE {
    ue-ConfigRelease-r9             ENUMERATED {
        rel9, spare7, spare6, spare5, spare4, spare3,
        spare2, spare1, ...}        OPTIONAL,      -- Cond HO2
    nonCriticalExtension             HandoverPreparationInformation-vaxx-IEs    OPTIONAL
}

HandoverPreparationInformation-vaxx-IEs ::= SEQUENCE {
    secondaryCellInfoList           SecondaryCellInfoList          OPTIONAL,      -- Cond HO2
    nonCriticalExtension             SEQUENCE {}                    OPTIONAL
}

SecondaryCellInfoList ::= SEQUENCE ( SIZE (1..maxSCell) ) OF SecondaryCellInfo

SecondaryCellInfo ::= SEQUENCE{
    carrierFreq                     ARFCN-ValueEUTRA,
    physCellIdEUTRA                 PhysCellId,
    key-eNodeB-Star                 Key-eNodeB-Star,
}

Key-eNodeB-Star ::= BIT STRING (SIZE (256)) -- Note: May require to make this global

-- ASN1STOP

```

In Option 2, instead of adding the agreed list of PCI and the frequency number, by exploiting the fact that Scells are also potential re-establishment cells, it is possible to reuse the reestablishmentInfo with Cell Identity by indicating which of the reestablishment cell is also candidate SCell. The structure can be done in either of the 2 ways below:

Option 2a: Indicate in the ReestablishmentInfo which is the candidate SCell
ReestablishmentInfo information element

```

-- ASN1START

ReestablishmentInfo ::= SEQUENCE {
    sourcePhysCellId              PhysCellId,
    targetCellShortMAC-I           ShortMAC-I,
    additionalReestabInfoList      AdditionalReestabInfoList          OPTIONAL,
    ...
    secondaryCellInfoList         SecondaryCellInfoList          OPTIONAL
}

AdditionalReestabInfoList ::= SEQUENCE ( SIZE (1..maxReestabInfo) ) OF AdditionalReestabInfo

AdditionalReestabInfo ::= SEQUENCE{
    cellIdentity                  CellIdentity,
    key-eNodeB-Star              Key-eNodeB-Star,
}

```

```

shortMAC-I                               ShortMAC-I
}
Key-eNodeB-Star ::=                      BIT STRING (SIZE (256))

SecondaryCellInfoList ::=                SEQUENCE ( SIZE (1..maxReestabInfo) ) OF BOOLEAN

-- ASN1STOP

```

Option 2b: Indicate in the HandoverPreparationInformation message
HandoverPreparationInformation message

```

-- ASN1START

HandoverPreparationInformation ::= SEQUENCE {
    criticalExtensions                CHOICE {
        c1                           CHOICE{
            handoverPreparationInformation-r8  HandoverPreparationInformation-r8-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture          SEQUENCE {}
    }
}

HandoverPreparationInformation-r8-IEs ::= SEQUENCE {
    ue-RadioAccessCapabilityInfo      UE-CapabilityRAT-ContainerList,
    as-Config                         AS-Config OPTIONAL, -- Cond HO
    rrm-Config                        RRM-Config OPTIONAL,
    as-Context                         AS-Context OPTIONAL, -- Cond HO
    nonCriticalExtension               HandoverPreparationInformation-v920-IEs OPTIONAL
}

HandoverPreparationInformation-v920-IEs ::= SEQUENCE {
    ue-ConfigRelease-r9               ENUMERATED {
        rel9, spare7, spare6, spare5, spare4, spare3,
        spare2, spare1, ...} OPTIONAL, -- Cond HO2
    nonCriticalExtension               HandoverPreparationInformation-vaxx-IEs OPTIONAL
}

}

HandoverPreparationInformation-vaxx-IEs ::= SEQUENCE {
    secondaryCellInfoList             SecondaryCellInfoList OPTIONAL, -- Cond HO2
    nonCriticalExtension               SEQUENCE {} OPTIONAL
}

}

SecondaryCellInfoList ::=                SEQUENCE ( SIZE (1..maxReestabInfo) ) OF BOOLEAN

-- ASN1STOP

```

Both options are backward compatible as a target Rel-8/9 eNB will ignore the extension while a Rel-10 CA-non-capable target eNB will not act upon the SCell list.

From the analysis above, Option 2b is preferred since it reuses the reestablishmentInfo structure and thus uses the least amount of bits if the source eNB is preparing target cells for reestablishment and list of candidate SCells at the same time.

Proposal#2: List of candidate SCell is based on the reestablishmentInfo IE and an extra IE is added to indicate which reestablishment cell is also a candidate SCell in the HandoverPreparationInformation message.

3. Conclusion

It is requested that RAN 2 discuss the following proposals:

Proposal#1: The list of candidate SCells are sent in the RRC Container (i.e. HandoverPreparationInfo message)

Proposal#2: List of candidate SCell is based on the reestablishmentInfo IE and an extra IE is added to indicate which reestablishment cell is also a candidate SCell in the HandoverPreparationInformation message.