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| *Title:* | **Detection of a CDR for random access** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

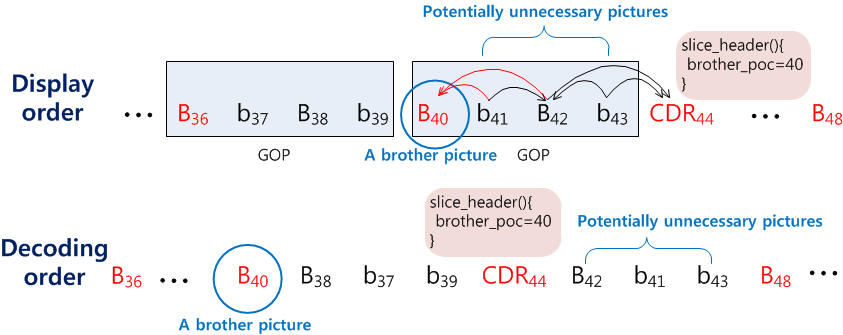
The clean decoding refresh (CDR) picture as a new type of random access points was introduced to HEVC and the discussion related to CDR was proposed in JCTVC-E400. In this proposal, the specific method to find the current status whether is random access or normal play is proposed when a CDR picture is decoded.

# Introduction

As discussed in JCTVC-E400, to make the decoder more effective, it is required that the detection of a CDR is used for random access or normal play. If decoder can detect the status of CDR decoding and the current status is random access, the following two functions could be operated in decoder side.

* The *potentially unnecessary pictures* could be skipped in decoding process.
* All reference pictures could be marked as “unused for reference” in the DPB that is similar to the implicit reference picture marking for IDR picture or a picture with MMCO equal to 5

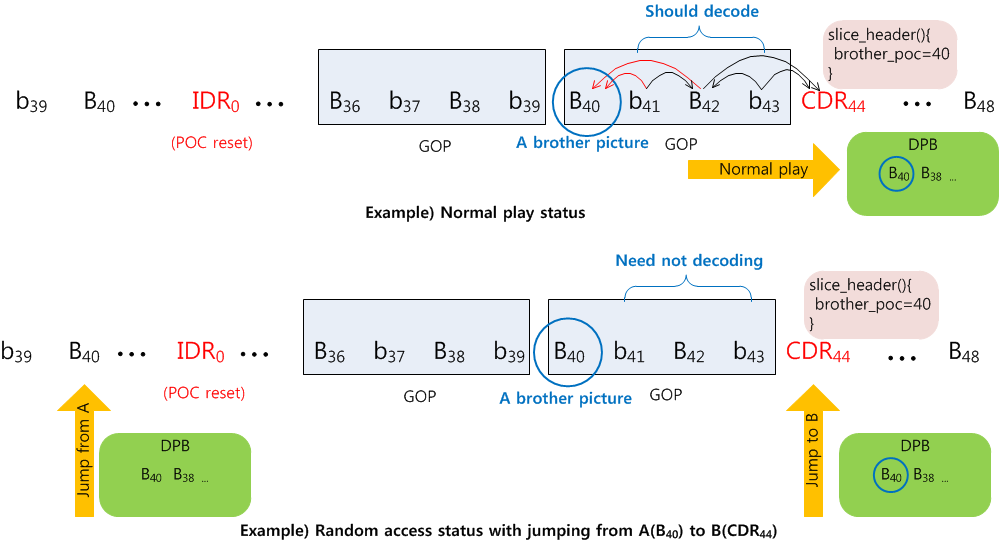
To detect the CDR status in JCTVC-E400, *a brother picture* which is the closest picture that precedes the CDR in decoding order and has a temporal level equal to 0 was introduced and the insertion of the POC or frame\_num of the brother picture in the slice header of the CDR picture was proposed. The Figure 1 below shows the example of the potentially unnecessary pictures and the brother picture. Each frame is denoted by the symbol *Bi*or *bi* with a subscript i that indicates its position in display order and a capital letter means referenced frame and a lower case means unreferenced frame. The fact that the POC number of a brother picture (40) is included in the slice header of CDR44 is also described.



**Figure 1. The example of the potentially unnecessary pictures and a brother picture described in JCTVC-E400**

# Problems

We think that the brining up a topic related to the needs for signaling of the brother picture in JCTVC-E400 is a useful point of view and that should be considered in the decoder implementation side as well as the specification. However, it is not sufficient just to signal the POC or frame\_num in the slice header in order to find the brother picture in the DPB. The frame\_num should be wrap-around in the unit of MaxFrameNum which is derived by the syntax **log2\_max\_frame\_num\_minus4** in the SPS. The POC also can be reset when it meets the IDR picture. The Figure 2 shows the example of this problem if the POC of the brother picture is signaled. When decoding the CDR44 in normal play, the POC of the brother picture (40) is signaled and the DPB has the “used for reference” picture which POC is equal to 40. So the decoder can infer current decoding status is normal play. On the other hand, when decoding the CDR44 in random access and suppose that the position of decoding is changed from A which position precedes the IDR to B which position is for CDR44 decoding, the DPB can have the “used for reference” picture which POC is equal to 40 too. In this case, there is no way to distinguish the decoding status is normal play or random access more.



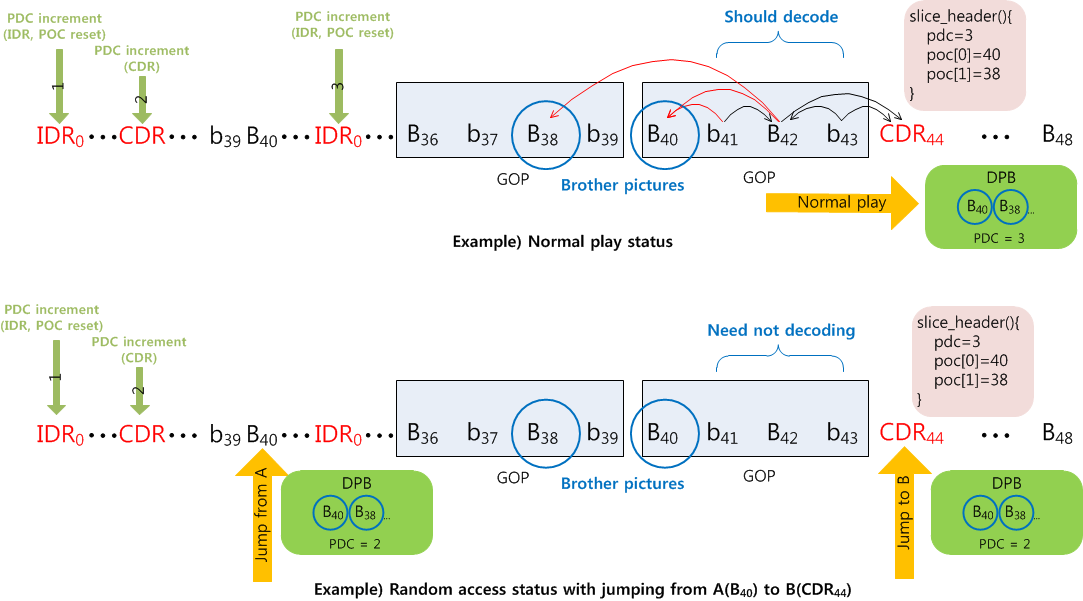
**Figure 2 The example for normal play and random access when the DPB status is same.**

# Algorithm Details

In this proposal, the distinct method for detection of CDR decoding status, i.e., normal play or random access is proposed. The redefinition of *brother pictures* which are came from the concept of a brother picture and the new definition of *POC discontinuity count (PDC)* are proposed as following:

* Brother pictures
  + The pictures that precede the CDR in decoding order and are used for referencing of potentially unnecessary pictures
  + The reason for brother pictures not a brother picture is that the random access could be occurred inside the GOP which precedes the brother picture in display order and can be used for referenced pictures by potentially unnecessary pictures.
* PDC (POC discontinuity count)
  + The PDC increases whenever the POC is reset, i.e., the IDR picture is presented.
  + The PDC increases whenever the CDR picture is received.

The Figure 3 illustrates the example for the brother pictures and PDC. When random access is happened like as the Figure 2 the fact that the signaled PDC (3) in the slice header is different from the PDC (2) in the DPB can let the decoder know current CDR decoding status is not normal play but random access. This is because the PDC could not increase by skipping the decoding of IDR picture.



**Figure 3 The example of the brother pictures and PDC (POC discontinuity count).**

# Syntax

The proposed syntax is described in Table 1 and Table 2 which include the brother picture and PDC related information.

## Sequence Parameter Set

|  |  |
| --- | --- |
| seq\_parameter\_set\_rbsp( ) { | Descriptor |
| <snip> |  |
| **log2\_max\_pic\_discontinuity\_cnt\_minus1** | ue(v) |
| } |  |

**Table 1 The proposed syntax for sequence parameter set.**

## Slice Header

|  |  |
| --- | --- |
| slice\_header( ) { | Descriptor |
| <snip> |  |
| if(nal\_unit\_type == 4) { |  |
| **pic\_discontinuity\_cnt** | u(v) |
| **num\_brother\_frames** | ue(v) |
| if(num\_brother\_frames > 0) { |  |
| **log2\_max\_brother\_pic\_order\_cnt\_minus1** | ue(v) |
| for(i=0; i<num\_brother\_frames; i++) |  |
| **brother\_frame\_poc[i]** | u(v) |
| } |  |
| } |  |
| } |  |

**Table 2 The proposed syntax for slice header.**

# Conclusion

In this proposal, the distinct method for detection of CDR decoding status, i.e., normal play or random access is proposed by using redefined brother pictures and newly defined PDC (POC discontinuity count). We also request the handling of potentially unnecessary pictures and the DPB operation should be well defined in the specification and deeply studied for consideration of the decoder implementation for the industrial world.

# Patent rights declaration(s)

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