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| *Title:* | **On APS partial update** | | |
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# Abstract

This document proposes to a solution for the APS partial update problem, wherein redundant transmission would occur if only a part of an APS needs to be updated. The proposed solution involves a new parameter set, referred to as group parameter set (GPS), which groups multiple parameter sets of different types, and the GPS ID is referred in the slice header.

The GPS concept is also included in JCTVC-H0388 on high-level syntax hooks for future HEVC scalable and 3DV extensions.

# Proposal

The syntax and semantics for GPS as well as changes to the APS and slice header are provided below. Two slightly approaches are included. In the first approach, an APS type is added into the APS syntax, and each APS NAL unit can only contain one type of APS parameters. In the second approach, the APS syntax remain unchanged as in the latest WD, thus one APS NAL unit may contain one or more than one type of APS parameters. We slightly prefer the second approach, which provides more flexibility for the encoder to decide whether to include multiple types of APS parameters or just one type of APS parameters into one APS NAL unit.

## The first approach

### APS

|  |  |
| --- | --- |
| aps\_rbsp( ) { | Descriptor |
| **aps\_type** | ue(v) |
| **aps\_id** | ue(v) |
| **~~aps\_scaling\_list\_data\_present\_flag~~** | ~~u(1)~~ |
| **~~aps\_sample\_adaptive\_offset\_flag~~** | ~~u(1)~~ |
| **~~aps\_adaptive\_loop\_filter\_flag~~** | ~~u(1)~~ |
| **~~aps\_deblocking\_filter\_flag~~** | ~~u(1)~~ |
| if( aps\_type = = 0 ~~aps\_scaling\_list\_data\_present\_flag~~ ) |  |
| scaling\_list\_param( ) |  |
| if( aps\_type = = 1 ~~aps\_sample\_adaptive\_offset\_flag~~ ) |  |
| sao\_param( ) |  |
| if( aps\_type = = 2 ~~aps\_adaptive\_loop\_filter\_flag~~ ) |  |
| alf\_param( ) |  |
| if( aps\_type = = 3 ~~aps\_deblocking\_filter\_flag~~ ) |  |
| dbl\_param() |  |
| **aps\_extension\_flag** | u(1) |
| if( aps\_extension\_flag ) |  |
| while( more\_rbsp\_data( ) ) |  |
| **aps\_extension\_data\_flag** | u(1) |
| rbsp\_trailing\_bits( ) |  |
| } |  |

**aps\_type** specifies the type of the adaption parameter set RBSP. aps\_type equal to 0 specifies that the adaptation parameter set is a scaling list adaptation parameter set. aps\_type equal to 1 specifies that the adaptation parameter set is an SAO adaptation parameter set, aps\_type equal to 2 specifies that the adaptation parameter set is an ALF adaptation parameter set, aps\_type equal to 3 specifies that the adaptation parameter set is a deblocking filter adaptation parameter set. The value of aps\_type shall be in the range of 0 to 3, inclusive.

### Group parameter set

A Group Parameter Set (GPS) includes a PPS ID, and zero or more APS IDs. At most one GPS may be active at any moment during the decoding process. A GPS is activated for if it is not already the active GPS and it is referred by a coded slice NAL unit being decoded.

|  |  |
| --- | --- |
| group\_parameter\_set\_rbsp( ) { | Descriptor |
| **group\_parameter\_set\_id** | ue(v) |
| **pps\_id** | ue(v) |
| **num\_aps\_ids** | ue(v) |
| for( i = 0; i < num\_aps\_ids; i++ ) |  |
| **aps\_id[** i **]** | ue(v) |
| **gps\_extension\_flag** | u(1) |
| if( gps\_extension\_flag ) |  |
| while( more\_rbsp\_data( ) ) |  |
| **gps\_extension\_data\_flag** | u(1) |
| rbsp\_trailing\_bits( ) |  |
| } |  |

**group\_parameter\_set\_id** identifies a group parameter set. The value of group\_parameter\_set\_id shall be in the range of 0 to 255, inclusive.

**pps\_id** identifies the picture parameter set referred by the group parameter set. The value of pps\_id shall be in the range of 0 to 255, inclusive.

**num\_aps\_ids** specifies the number of different types of adaptation parameter sets refered by the group parameter set. The value of num\_aps\_ids shall be in the range of 0 to 4, inclusive.

**aps\_id[** i **]** identifies the i-th adaptaion parameter set refered by the group parameter set. The value of aps\_id[ i ] shall be in the range of 0 to 255, inclusive. For any two different values of i and j less than num\_aps\_ids, the two adaptaion parameter sets identified by aps\_id[ i ] and aps\_id[ j ] shall have different values of aps\_type.

**gps\_extension\_flag** equal to 0 specifies that no gps\_extension\_data\_flag syntax elements are present in the sequence parameter set RBSP syntax structure. gps\_extension\_flag shall be equal to 0 in bitstreams conforming to this Recommendation | International Standard. The value of 1 for gps\_extension\_flag is reserved for future use by ITU-T | ISO/IEC. Decoders shall ignore all data that follow the value 1 for gps\_extension\_flag in a grouping parameter set NAL unit.

**gps\_extension\_data\_flag** may have any value. It shall not affect the conformance to profiles specified in this Recommendation | International Standard.

### Slice header

|  |  |
| --- | --- |
| slice\_header( ) { | Descriptor |
| **…** |  |
| **gps\_id** | ue(v) |
| **~~pic\_parameter\_set\_id~~** | ue(v) |
| ~~if( sample\_adaptive\_offset\_enabled\_flag || adaptive\_loop\_filter\_enabled\_flag )~~ |  |
| **~~aps\_id~~** | ~~ue(v)~~ |
| **…** |  |

**gps\_id** identifies the group parameter set refered by the slice header. The value of gps\_id shall be in the range of 0 to 255, inclusive.

## The second approach

### APS

In this approach, the APS syntax remains unchanged as in the latest WD, as follows:

|  |  |
| --- | --- |
| aps\_rbsp( ) { | Descriptor |
| **aps\_id** | ue(v) |
| **aps\_scaling\_list\_data\_present\_flag** | u(1) |
| **aps\_sample\_adaptive\_offset\_flag** | u(1) |
| **aps\_adaptive\_loop\_filter\_flag** | u(1) |
| **aps\_deblocking\_filter\_flag** | u(1) |
| if( aps\_scaling\_list\_data\_present\_flag ) |  |
| scaling\_list\_param( ) |  |
| if( aps\_sample\_adaptive\_offset\_flag ) |  |
| sao\_param( ) |  |
| if( aps\_adaptive\_loop\_filter\_flag ) |  |
| alf\_param( ) |  |
| if( aps\_deblocking\_filter\_flag ) |  |
| dbl\_param() |  |
| **aps\_extension\_flag** | u(1) |
| if( aps\_extension\_flag ) |  |
| while( more\_rbsp\_data( ) ) |  |
| **aps\_extension\_data\_flag** | u(1) |
| rbsp\_trailing\_bits( ) |  |
| } |  |

### Group parameter set

Same as in the first approach, at most one GPS may be active at any moment during the decoding process. A GPS is activated for if it is not already the active GPS and it is referred by a coded slice NAL unit being decoded. The GPS syntax in the second approach is as follows:

|  |  |
| --- | --- |
| group\_parameter\_set\_rbsp( ) { | Descriptor |
| **group\_parameter\_set\_id** | ue(v) |
| **pps\_id** | ue(v) |
| **num\_ref\_aps\_ids** | ue(v) |
| for( i = 0; i < num\_ref\_aps\_ids; i++ ) { |  |
| **ref\_aps\_id[** i **]** | ue(v) |
| **ref\_aps\_param\_type[** i **]** | ue(v) |
| } |  |
| **gps\_extension\_flag** | u(1) |
| if( gps\_extension\_flag ) |  |
| while( more\_rbsp\_data( ) ) |  |
| **gps\_extension\_data\_flag** | u(1) |
| rbsp\_trailing\_bits( ) |  |
| } |  |

**group\_parameter\_set\_id** identifies a group parameter set. The value of group\_parameter\_set\_id shall be in the range of 0 to 255, inclusive.

**pps\_id** identifies the picture parameter set referred by the group parameter set. The value of pps\_id shall be in the range of 0 to 255, inclusive.

**num\_ref\_aps\_ids** specifies the number of the following ref\_aps\_id[ i ] syntax elements. The value of num\_ref\_aps\_ids shall be in the range of 0 to 4, inclusive.

**ref\_aps\_id[** i **]** identifies the i-th adaptaion parameter set referred by the group parameter set. The value of ref\_aps\_id[ i ] shall be in the range of 0 to 255, inclusive.

NOTE – The same value of the ref\_aps\_id may be present in the loop more than once, thus more than one type of APS parameters from the same APS can be referenced by the same GPS and applies to coded slices referring to the GPS.

**ref\_aps\_param\_type[** i **]** specifies the type of the APS parameters included in the i-th adaptaion parameter set referred by the group parameter set. The value of ref\_aps\_parame\_type[ i ] shall be in the range of 0 to 3, inclusive. The values of 0 to 3 for ref\_aps\_parame\_type[ i ] correspond to scaling list, SAO, ALF, and deblocking filter APS parameters, respectively. The values of ref\_aps\_parame\_type[ i ] for different values of i shall be different.

**gps\_extension\_flag** equal to 0 specifies that no gps\_extension\_data\_flag syntax elements are present in the sequence parameter set RBSP syntax structure. gps\_extension\_flag shall be equal to 0 in bitstreams conforming to this Recommendation | International Standard. The value of 1 for gps\_extension\_flag is reserved for future use by ITU-T | ISO/IEC. Decoders shall ignore all data that follow the value 1 for gps\_extension\_flag in a grouping parameter set NAL unit.

**gps\_extension\_data\_flag** may have any value. It shall not affect the conformance to profiles specified in this Recommendation | International Standard.

### Slice header

The slice header syntax in the second approach is the same as in the first approach.

# Patent rights declaration(s)

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