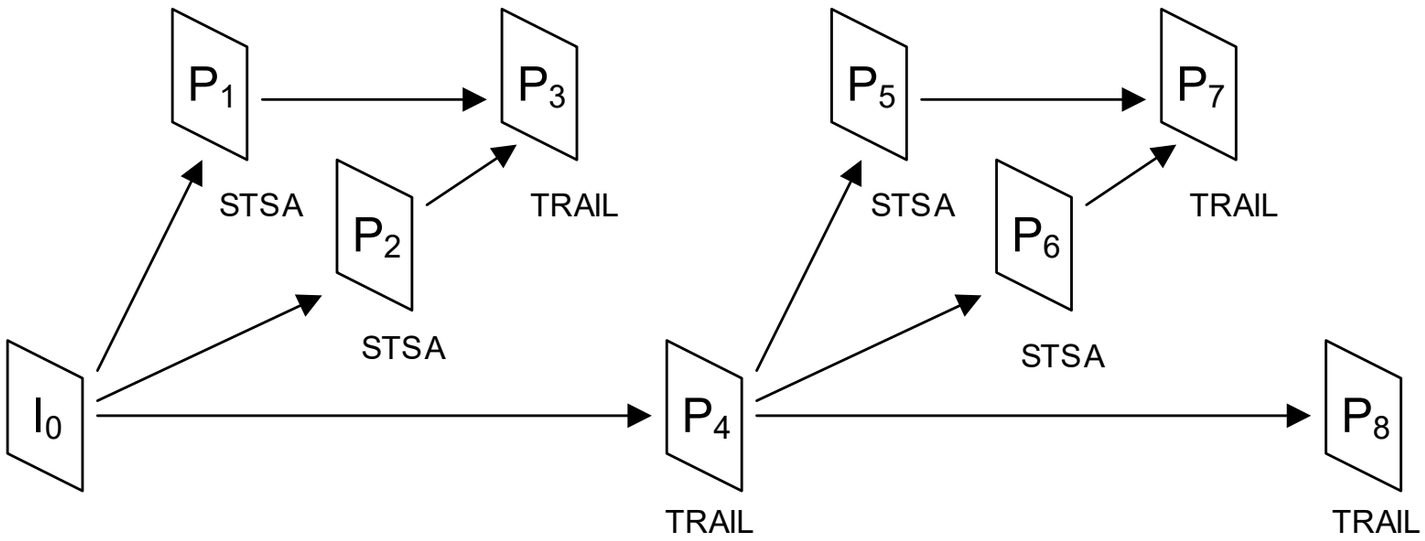
JVET-O0235
AHG17: Ensuring temporal switching with STSA pictures

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The STSA picture



- The STSA_NUT in VVC indicates pictures to which temporal sub-layer up-switching is possible
- Assume you are decoding temporal sub-layer n and lower
  - If there is an STSA picture belonging to temporal sub-layer (n+1) you can start decoding sub-layers (n+1) and lower

STSA in JVET-N1001-v8

— In JVET-N1001-v8, there is text in the definition of the STSA picture but no corresponding restrictions

— We therefore propose four restrictions related to the STSA picture
1. Disallow Temporal ID equal to 0 for STSA pictures
2. Require VCL NAL units in one access unit to have the same type
3. Add RPL restrictions for STSA pictures
4. Add parameter set restrictions for STSA pictures

3.120 step-wise temporal sub-layer access (STSA) picture: A *coded picture* for which each *VCL NAL unit* has NalUnitType equal to STSA_NUT.

NOTE – An STSA picture does not use pictures with the same TemporalId as the STSA picture for inter prediction reference. Pictures following an STSA picture in decoding order with the same TemporalId as the STSA picture do not use pictures prior to the STSA picture in decoding order with the same TemporalId as the STSA picture for inter prediction reference. An STSA picture enables up-switching, at the STSA picture, to the sub-layer containing the STSA picture, from the immediately lower sub-layer. STSA pictures must have TemporalId greater than 0.

1: Disallow Temporal ID equal to 0 for STSA pictures



- VVC STSA pictures indicate pictures that are possible to switch up to temporally
- The lowest temporal layer that makes sense for an STSA picture is layer 1
- A layer 0 STSA picture could logically be an IRAP picture
  - But VVC use separate NAL unit types for IRAP

- We therefore propose that the following restriction is added:
  - When NalUnitType is equal to STSA_NUT, TemporalId shall not be equal to 0

- HEVC v5 contains the following corresponding restriction:
  - When nuh_layer_id is equal to 0 and nal_unit_type is equal to STSA_R or STSA_N, TemporalId shall not be equal to 0

2: Require VCL NAL units in one AU to have same type

- The VVC draft doesn't seem to restrict slice NAL units in one AU to have the same type
  - HEVC v5 includes such a restriction

- This makes the VVC draft ambiguous
  - What if a picture includes one STSA_NUT and one TRAIL_NUT
  - Then the picture is both an "STSA picture" and a "non-STSA trailing picture" according to the draft

- We therefore propose that the following restriction is copied from HEVC, with the illustrated modifications:
  - All coded slice ~~segment~~ NAL units of an access unit shall have the same value of NalUnitType. A picture or an access unit is also referred to as having a NalUnitType equal to the NalUnitType of the coded slice ~~segment~~ NAL units of the picture or the access unit.

3: Add RPL restrictions for STSA pictures

We propose that the following restrictions are added, similar to the HEVC v5 restrictions for RPS:

HEVC v5 text

- When the current picture is a step-wise temporal sub-layer access (STSA) picture, there shall be no picture included in RefPicSetStCurrBefore, RefPicSetStCurrAfter or RefPicSetLtCurr that has TemporalId equal to that of the current picture.
- When the current picture is a picture that follows, in decoding order, an STSA picture that has TemporalId equal to that of the current picture, there shall be no picture that has TemporalId equal to that of the current picture included in RefPicSetStCurrBefore, RefPicSetStCurrAfter or RefPicSetLtCurr that precedes the STSA picture in decoding order.

Proposed VVC text

- When the current picture is a step-wise temporal sub-layer access (STSA) picture, there shall be no active entry in RefPicList[i] that has TemporalId equal to that of the current picture.
- When the current picture is a picture that follows, in decoding order, an STSA picture that has TemporalId equal to that of the current picture, there shall be no picture that has TemporalId equal to that of the current picture included as an active entry in RefPicList[i] that precedes the STSA picture in decoding order.

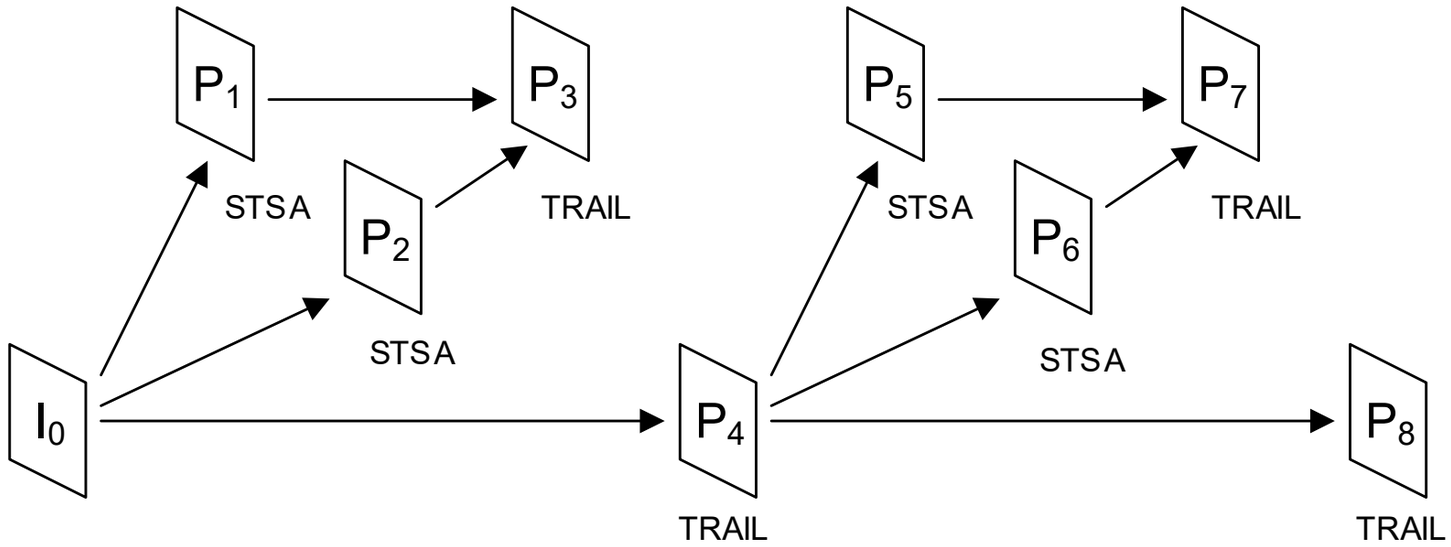
4: Add parameter set restrictions for STSA pictures



- An STSA picture should guarantee that only APSs and PPSs that are available if up-switching is done are referenced after the up-switch
  - This seems missing in the VVC draft

- We therefore propose that the following restriction is added:
  - When the current access unit has a NalUnitType equal to STSA_NUT, the following applies:
    - The current access unit shall not activate a PPS or use an APS that precedes the first NAL unit of the current access unit in decoding order and has TemporalId equal to the TemporalId of the current access unit.
    - For any following access unit that has TemporalId equal to that of the current access unit and follows the current access unit in decoding order, the following access unit shall not activate a PPS or use an APS that has TemporalId equal to that of the current access unit that precedes the first NAL unit of the current access unit in decoding order.

Summary



— We have proposed four restrictions related to the STSA picture
  1. Disallow Temporal ID equal to 0 for STSA pictures
  2. Require VCL NAL units in one access unit to have the same type
  3. Add RPL restrictions for STSA pictures
  4. Add parameter set restrictions for STSA pictures

— Text on top of JVET-N1001-v8 is attached with the proposal

