Amended Set of Claims 1 to 45

1. A method for decoding video data, the method comprising:

decoding a buffering period supplemental enhancement information (SEI) message associated with an access unit (AU), wherein the AU has a TemporalId equal to 0;

decoding one of a picture timing SEI message or a sub-picture timing SEI message associated with the AU;

decoding a duration between coded picture buffer (CPB) removal time of a first decoding unit (DU) in the AU and CPB removal time of a second DU from the said one of a picture timing SEI message or a sub-picture timing SEI message;

determining a removal time of the first DU based at least in part on the decoded duration; and

decoding video data of the first DU based at least in part on the removal time.

2. The method of claim 1, wherein the second DU is subsequent to the first DU in decoding order and in the same AU as the first DU.

3. The method of claim 2, wherein the second DU is immediately subsequent to the first DU in the AU in decoding order or a last DU in the AU in decoding order.

4. The method of claim 1, further comprising:

decoding one or more sub-picture level CPB parameters, wherein determining the removal time of the first DU comprises determining the removal time of the first DU based at least in part on the decoded duration and the sub-picture level CPB parameters.

5. The method of claim 4, wherein decoding one or more sub-picture level CPB parameters comprises:

decoding a sub-picture timing supplemental enhancement information (SEI) message that is associated with the first DU.

6. The method of claim 5, wherein the second DU is a last DU in the AU in decoding order, and wherein decoding the sub-picture SEI message comprises:

decoding the duration between a removal time of the last DU and the removal time of the first DU in the sub-picture timing SEI message.

7. The method of claim 4, further comprising:

decoding a sequence level flag to determine presence of the sub-picture level CPB parameters either in picture timing SEI messages or in sub-picture timing SEI messages.

8. The method of claim 1, wherein the first DU comprises a non-video coding layer (VCL) network abstraction layer (NAL) unit with nal_unit_type equal to UNSPEC0, EOS_NUT, EOB_NUT, in the range of RSV_NVCL44 to RSV_NVCL47 or in the range of UNSPEC48 to UNSPEC63.

9. The method of claim 1, further comprising:

deriving at least one of a CPB arrival time and a CPB nominal removal time for the AU at both an access unit level and a sub-picture level regardless of a value of a syntax element that defines whether the first DU is the AU.

10. A video decoding device comprising a video decoder configured to:

decode a buffering period supplemental enhancement information (SEI) message associated with an access unit (AU), wherein the AU has a TemporalId equal to 0;

decode one of a picture timing SEI message or a sub-picture timing SEI message associated with the AU;

decode a duration between coded picture buffer (CPB) removal time of a first decoding unit (DU) in the AU and CPB removal time of a second DU from the said one of a picture timing SEI message or a sub-picture timing SEI message;

determine a removal time of the first DU based at least in part on the decoded duration; and

decode video data of the first DU based at least in part on the removal time.

11. The video decoding device of claim 10, wherein the second DU is subsequent to the first DU in decoding order and in the same AU as the first DU.

12. The video decoding device of claim 11, wherein the second DU is immediately subsequent to the first DU in the AU in decoding order or a last DU in the AU in decoding order.

13. The video decoding device of claim 10, the video decoder further configured to decode one or more sub-picture level CPB parameters, wherein determine the removal time of the first DU comprises determine the removal time of the first DU based at least in part on the decoded duration and the sub-picture level CPB parameters.

14. The video decoding device of claim 13, wherein the video decoder is further configured to decode one or more sub-picture level CPB parameters by decoding a sub-picture timing supplemental enhancement information (SEI) message that is associated with the first DU.

15. The video decoding device of claim 14, wherein the second DU is a last DU in the AU in decoding order, and wherein decode the sub-picture SEI message comprises decode the duration between a removal time of the last DU and the removal time of the first DU in the sub-picture timing SEI message.

16. The video decoding device of claim 13, the video decoder further configured to decode a sequence level flag to determine presence of the sub-picture level CPB parameters either in picture timing SEI messages or in sub-picture timing SEI messages.

17. The video decoding device of claim 10, wherein the first DU comprises a non-video coding layer (VCL) network abstraction layer (NAL) unit with nal_unit_type equal to UNSPEC0, EOS_NUT, EOB_NUT, in the range of RSV_NVCL44 to RSV_NVCL47 or in the range of UNSPEC48 to UNSPEC63.

18. The video decoding device of claim 10, the video decoder further configured to derive at least one of a CPB arrival time and a CPB nominal removal time for the AU at both an access unit level and a sub-picture level regardless of a value of a syntax element that defines whether the first DU is the AU.

19. A computer-readable storage medium having stored thereon instructions that, when executed, cause a processor of a device for decoding video data to:

decode a buffering period supplemental enhancement information (SEI) message associated with an access unit (AU), wherein the AU has a TemporalId equal to 0;

decode one of a picture timing SEI message or a sub-picture timing SEI message associated with the AU;

decode a duration between coded picture buffer (CPB) removal time of a first decoding unit (DU) in the AU and CPB removal time of a second DU from the said one of a picture timing SEI message or a sub-picture timing SEI message;

determine a removal time of the first DU based at least in part on the decoded duration; and

decode video data of the first DU based at least in part on the removal time.

20. The computer-readable storage medium of claim 19, wherein the second DU is subsequent to the first DU in decoding order and in the same AU as the first DU.

21. The computer-readable storage medium of claim 19, wherein the second DU is immediately subsequent to the first DU in the AU in decoding order or a last DU in the AU in decoding order.

22. A video decoding device comprising:

means for decoding a buffering period supplemental enhancement information (SEI) message associated with an access unit (AU), wherein the AU has a TemporalId equal to 0;

means for decoding one of a picture timing SEI message or a sub-picture timing SEI message associated with the AU;

means for decoding a duration between coded picture buffer (CPB) removal time of a first decoding unit (DU) in the AU and CPB removal time of a second DU from the said one of a picture timing SEI message or a sub-picture timing SEI message;

means for determining a removal time of the first DU based at least in part on the decoded duration; and

means for decoding video data of the first DU based at least in part on the removal time.

23. The video decoding device of claim 22, wherein the second DU is subsequent to the first DU in decoding order and in the same AU as the first DU.

24. The video decoding device of claim 22, wherein the second DU is immediately subsequent to the first DU in the AU in decoding order or a last DU in the AU in decoding order.

25. A method for encoding video data, the method comprising:

determining a duration between coded picture buffer (CPB) removal time of a first decoding unit (DU) in an access unit (AU) and CPB removal time of a second DU in the AU, wherein the AU has a TemporalId equal to 0; and

encoding the duration within one of a picture timing SEI message or a sub-picture timing SEI message associated with the AU.

26. The method of claim 25, wherein the second DU is subsequent to the first DU in decoding order and in the same AU as the first DU.

27. The method of claim 26, wherein the second DU is immediately subsequent to the first DU in the AU in decoding order or a last DU in the AU in decoding order.

28. The method of claim 25, further comprising:

encoding one or more sub-picture level CPB parameters, wherein determining the duration comprises determining the removal time of the first DU based at least in part on the sub-picture level CPB parameters.

29. The method of claim 28, wherein encoding one or more sub-picture level CPB parameters comprises:

encoding a sub-picture timing supplemental enhancement information (SEI) message that is associated with the first DU, wherein the sub-picture timing SEI message includes the one or more sub-picture level CPB parameters.

30. The method of claim 29, wherein the second DU is a last DU in the AU in decoding order, and wherein encoding the sub-picture SEI message comprises:

encoding the duration in the sub-picture timing SEI message.

31. The method of claim 28, further comprising:

encoding a sequence level flag to indicate presence of the sub-picture level CPB parameters either in picture timing SEI messages or in sub-picture timing SEI messages.

32. The method of claim 25, wherein the first DU comprises a non-video coding layer (VCL) network abstraction layer (NAL) unit with nal_unit_type equal to UNSPEC0, EOS_NUT, EOB_NUT, in the range of RSV_NVCL44 to RSV_NVCL47 or in the range of UNSPEC48 to UNSPEC63.

33. The method of claim 25, further comprising:

deriving at least one of a CPB arrival time and a CPB nominal removal time for the AU at both an access unit level and a sub-picture level regardless of a value of a syntax element that defines whether the first DU is the AU.

34. A video encoding device comprising a video encoder configured to:

determine a duration between coded picture buffer (CPB) removal time of a first decoding unit (DU) in an access unit (AU) and CPB removal time of a second DU in the AU, wherein the AU has a TemporalId equal to 0; and

encode the duration within one of a picture timing SEI message or a sub-picture timing SEI message associated with the AU.

35. The video encoding device of claim 34, wherein the second DU is subsequent to the first DU in decoding order and in the same AU as the first DU.

36. The video encoding device of claim 35, wherein the second DU is immediately subsequent to the first DU in the AU in decoding order or a last DU in the AU in decoding order.

37. The video encoding device of claim 34, wherein the video encoder is further configured to encode one or more sub-picture level CPB parameters, wherein determining the duration comprises determining the removal time of the first DU based at least in part on the sub-picture level CPB parameters.

38. The video encoding device of claim 37, wherein the video encoder is further configured to encode one or more sub-picture level CPB parameters by encoding a sub-picture timing supplemental enhancement information (SEI) message that is associated with the first DU.

39. The video encoding device of claim 38, wherein the second DU is a last DU in the AU in decoding order, and wherein encode the sub-picture SEI message comprises encode the duration in the sub-picture timing SEI message.

40. The video encoding device of claim 37, wherein the video encoder is further configured to encode a sequence level flag to indicate presence of the sub-picture level CPB parameters either in picture timing SEI messages or in sub-picture timing SEI messages.

41. The video encoding device of claim 34, wherein the first DU comprises a non-video coding layer (VCL) network abstraction layer (NAL) unit with nal_unit_type equal to UNSPEC0, EOS_NUT, EOB_NUT, in the range of RSV_NVCL44 to RSV_NVCL47 or in the range of UNSPEC48 to UNSPEC63.

42. The video encoding device of claim 34, wherein the video encoder is further configured to derive at least one of a CPB arrival time and a CPB nominal removal time for the AU at both an access unit level and a sub-picture level regardless of a value of a syntax element that defines whether the first DU is the AU.

43. A computer-readable storage medium having stored thereon instructions that, when executed, cause a processor of a device for decoding video data to:

determine a duration between coded picture buffer (CPB) removal time of a first decoding unit (DU) in an access unit (AU) and CPB removal time of a second DU in the AU, wherein the AU has a TemporalId equal to 0; and

encode the duration within one of a picture timing SEI message or a sub-picture timing SEI message associated with the AU.

44. The computer-readable storage medium of claim 43, wherein the second DU is subsequent to the first DU in decoding order and in the same AU as the first DU.

45. The computer-readable storage medium of claim 43, wherein the second DU is immediately subsequent to the first DU in the AU in decoding order or a last DU in the AU in decoding order.

CLAIMS

1. A method for determining bitstream conformance, the method comprising:

receiving an encoded video bitstream that includes a buffering period supplemental enhancement information (SEI) message, wherein buffering period SEI messages are subject to a restriction that no buffering period SEI message in the bitstream can be associated with an access unit (AU) with a TemporalId greater than 0,

the buffering period SEI message providing information of an initial Coded Picture Buffer (CPB) removal delay and an initial CPB removal delay offset,

the buffering period SEI message comprising an initial CPB removal delay syntax element for a schedule selection index, the initial CPB removal delay syntax element is an initial alternative CPB removal delay syntax element for the schedule selection index,

a Hypothetical Reference Decoder (HRD) including a buffering model of a coded picture buffer (CPB) and a decoded picture buffer (DPB), bitstream conformance being specified as part of a specification of the HRD, the HRD relying on the buffering period SEI message, a picture timing SEI message, and HRD parameters provided in the bitstream in an hrd_parameters( )syntax structure in a video parameter set (VPS) or a sequence parameter set (SPS),

the bitstream representing video blocks of an encoded video slice of a picture and associated syntax elements, the picture having a TemporalId equal to 1; and

setting a value of an initial CPB removal delay variable for the schedule selection index to the initial CPB removal delay syntax element for the schedule selection index when DefaultInitCpbParamsFlag is equal to 0.

2. A device for determining bitstream conformance, the device comprising:

a coded picture buffer (CPB); and

one or more processors configured to:

receive an encoded video bitstream that includes a buffering period supplemental enhancement information (SEI) message, wherein buffering period SEI messages are subject to a restriction that no buffering period SEI message in the bitstream can be associated with an access unit (AU) with a TemporalId greater than 0,

the buffering period SEI message providing information of an initial CPB removal delay and an initial CPB removal delay offset,

the buffering period SEI message comprising an initial CPB removal delay syntax element for a schedule selection index, the initial CPB removal delay syntax element is an initial alternative CPB removal delay syntax element for the schedule selection index,

a Hypothetical Reference Decoder (HRD) including a buffering model of the CPB and a decoded picture buffer (DPB), bitstream conformance being specified as part of a specification of the HRD, the HRD relying on the buffering period SEI message, a picture timing SEI message, and HRD parameters provided in the bitstream in an hrd_parameters( ) syntax structure in a video parameter set (VPS) or a sequence parameter set (SPS),

the bitstream representing video blocks of an encoded video slice of a picture and associated syntax elements, the picture having a TemporalId equal to 1; and

set a value of an initial CPB removal delay variable for the schedule selection index to the initial CPB removal delay syntax element for the schedule selection index when DefaultInitCpbParamsFlag is equal to 0.

3. A non-transitory computer-readable storage medium having stored thereon instructions that, when executed, cause one or more processors of a device to:

receive an encoded video bitstream that includes a buffering period supplemental enhancement information (SEI) message, wherein buffering period SEI messages are subject to a restriction that no buffering period SEI message in the bitstream can be associated with an access unit (AU) with a TemporalId greater than 0,

the buffering period SEI message providing information of an initial Coded Picture Buffer (CPB) removal delay and an initial CPB removal delay offset,

the buffering period SEI message comprising an initial CPB removal delay syntax element for a schedule selection index, the initial CPB removal delay syntax element is an initial alternative CPB removal delay syntax element for the schedule selection index, a Hypothetical Reference Decoder (HRD) including a buffering model of a coded picture buffer (CPB) and a decoded picture buffer (DPB), bitstream conformance being specified as part of a specification of the HRD, the HRD relying on the buffering period SEI message, a picture timing SEI message, and HRD parameters provided in the bitstream in an hrd_parameters( )syntax structure in a video parameter set (VPS) or a sequence parameter set (SPS),

the bitstream representing video blocks of an encoded video slice of a picture and associated syntax elements, the picture having a TemporalId equal to 1; and

set a value of an initial CPB removal delay variable for the schedule selection index to the initial CPB removal delay syntax element for the schedule selection index when DefaultInitCpbParamsFlag is equal to 0.

4. A device for determining bitstream conformance, the device comprising:

means for receiving an encoded video bitstream that includes a buffering period supplemental enhancement information (SEI) message, wherein buffering period SEI messages are subject to a restriction that no buffering period SEI message in the bitstream can be associated with an access unit (AU) with a TemporalId greater than 0,

the buffering period SEI message providing information of an initial Coded Picture Buffer (CPB) removal delay and an initial CPB removal delay offset,

the buffering period SEI message comprising an initial CPB removal delay syntax element for a schedule selection index, the initial CPB removal delay syntax element is an initial alternative CPB removal delay syntax element for the schedule selection index,

a Hypothetical Reference Decoder (HRD) including a buffering model of a coded picture buffer (CPB) and a decoded picture buffer (DPB), bitstream conformance being specified as part of a specification of the HRD, the HRD relying on the buffering period SEI message, a picture timing SEI message, and HRD parameters provided in the bitstream in an hrd_parameters( )syntax structure in a video parameter set (VPS) or a sequence parameter set (SPS),

the bitstream representing video blocks of an encoded video slice of a picture and associated syntax elements, the picture having a TemporalId equal to 1; and

means for setting a value of an initial CPB removal delay variable for the schedule selection index to the initial CPB removal delay syntax element for the schedule selection index when DefaultInitCpbParamsFlag is equal to 0.

5. The method of claim **1**, wherein an access unit associated with the buffering period SEI message is referred to as access unit **0**, the method further comprising:

based on an access unit being access unit **0**, determining, based on the initial CPB removal delay for the schedule selection index, a nominal removal time of the access unit;

setting a CPB removal time equal to the nominal removal time of the access unit, wherein the access unit is a decoding unit (DU); and

at the determined CPB removal time, instantaneously decoding the DU.

6. The device of claim **2**, wherein an access unit associated with the buffering period SEI message is referred to as access unit **0**, the one or more processors further configured to:

based on an access unit being access unit **0**, determine, based on the initial CPB removal delay for the schedule selection index, a nominal removal time of the access unit;

set a CPB removal time equal to the nominal removal time of the access unit, wherein the access unit is a decoding unit (DU); and

at the determined CPB removal time, instantaneously decode the DU.

7. The non-transitory computer-readable storage medium of claim 3, wherein an access unit associated with the buffering period SEI message is referred to as access unit 0, the instructions, when executed, causing the one or more processors to:

based on an access unit being access unit 0, determine, based on the initial CPB removal delay for the schedule selection index, a nominal removal time of the access unit;

set a CPB removal time equal to the nominal removal time of the access unit, wherein the access unit is a decoding unit (DU); and

at the determined CPB removal time, instantaneously decode the DU.

8. The device of claim 4, wherein an access unit associated with the buffering period SEI message is referred to as access unit 0, the device further comprising:

means for determining, based on an access unit being access unit 0 and based on the initial CPB removal delay for the schedule selection index, a nominal removal time of the access unit;

means for setting a CPB removal time equal to the nominal removal time of the access unit, wherein the access unit is a decoding unit (DU); and

means for instantaneously decoding, at the determined CPB removal time, the DU.