

CLAIMS

What is claimed is:

1. A method implemented by a video decoder, comprising:
receiving, by the video decoder, a bitstream comprising a coded picture and a supplemental enhancement information (SEI) message, wherein the SEI message includes coded picture buffer (CPB) parameters corresponding to decoding unit (DU)-based hypothetical reference decoder (HRD) operations on sublayers; and
decoding, by the video decoder, the coded picture from the bitstream to obtain a decoded picture.
2. The method of claim 1, wherein the CPB parameters specify a duration between CPB removal times of two decoding units.
3. The method of any of claims 1 to 2, wherein the SEI message is a picture timing (PT) SEI message.
4. The method of any of claims 1 to 3, wherein the CPB parameters comprise a common CPB removal delay increment and a CPB removal delay increment for an access unit (AU) associated with the PT SEI message.
5. The method of any of claims 1 to 4, wherein the SEI message is a PT SEI message that specifies a number of decoding units in the AU associated with the PT SEI message.
6. The method of any of claims 1 to 5, wherein the SEI message is a PT SEI message that specifies a number of network abstraction layer (NAL) units in a decoding unit (DU) of the AU associated with the PT SEI message.
7. The method of claim 1, wherein the SEI message is a decoding unit information (DUI) SEI message that provides a temporal identifier (ID) of an SEI NAL unit containing the DUI SEI message.
8. The method of claim 7, wherein the temporal ID specifies a highest sublayer for which CPB removal delay information is contained in the DUI SEI message.

9. The method of any of claims 1 to 8, further comprising displaying the decoded picture on a display of an electronic device.
10. A method implemented by a video encoder, comprising:
generating, by the video encoder, a bitstream comprising a coded picture and a supplemental enhancement information (SEI) message, wherein the SEI message includes coded picture buffer (CPB) parameters corresponding to decoding unit (DU)-based hypothetical reference decoder (HRD) operations on sublayers;
performing, by the video encoder, the DU-based HRD operations on the sublayers using the CPB parameters to determine whether the bitstream is conforming; and
storing, by the video encoder, the bitstream for communication toward a video decoder when the bitstream is conforming based on performance of the DU-based HRD operations.
11. The method of claim 10, wherein the CPB parameters specify a duration between CPB removal times of two decoding units, and wherein the bitstream is conforming when the duration between the CPB removal times is not exceeded.
12. The method of any of claims 10 to 11, wherein the SEI message is a picture timing (PT) SEI message.
13. The method of any of claims 10 to 12, wherein the CPB parameters comprise a common CPB removal delay and a CPB removal delay for an access unit (AU) associated with the PT SEI message.
14. The method of claim 13, wherein the PT SEI message specifies a number of decoding units in the AU associated with the PT SEI message and a number of network abstraction layer (NAL) units in a decoding unit (DU) of the AU associated with the PT SEI message.
15. The method of claim 10, wherein the SEI message is a decoding unit information (DUI) SEI message that provides a temporal identifier (ID) of an SEI NAL unit containing the DUI SEI message.

16. The method of claim 15, wherein the DUI SEI message specifies the temporal ID of a highest sublayer for which CPB removal delay information is contained in the DUI SEI message.
17. A decoding device, comprising:
a receiver configured to receive a bitstream comprising a coded picture and a supplemental enhancement information (SEI) message, wherein the SEI message includes coded picture buffer (CPB) parameters corresponding to decoding unit (DU)-based hypothetical reference decoder (HRD) operations on sublayers;
a memory coupled to the receiver, the memory storing instructions; and
a processor coupled to the memory, the processor configured to execute the instructions to cause the decoding device to decode the coded picture from the bitstream to obtain a decoded picture.
18. The decoding device of claim 17, wherein the CPB parameters specify a duration between CPB removal times of two decoding units.
19. The decoding device of any of claims 17 to 18, wherein the SEI message is a PT SEI message that specifies a number of decoding units in an access unit (AU) associated with the PT SEI message, and wherein the CPB parameters comprise a common CPB removal delay and a CPB removal delay for the AU associated with the PT SEI message.
20. The decoding device of claim 17, wherein the SEI message is a decoding unit information (DUI) SEI message that provides a temporal identifier (ID) of an SEI NAL unit containing the DUI SEI message.
21. The decoding device of claim 20, wherein the temporal ID specifies a highest sublayer for which CPB removal delay information is contained in the DUI SEI message.
22. An encoding device, comprising:
a memory containing instructions;
a processor coupled to the memory, the processor configured to implement the instructions to cause the encoding device to:

generate a bitstream comprising a coded picture and a supplemental enhancement information (SEI) message, wherein the SEI message includes coded picture buffer (CPB) parameters corresponding to decoding unit (DU)-based HRD operations on sublayers;

perform the DU-based HRD operations on the sublayers using the CPB parameters to determine whether the bitstream is conforming; and

a transmitter coupled to the processor, the transmitter configured to transmit the video bitstream toward a video decoder when the bitstream is conforming based on performance of the DU-based HRD operations.

23. The encoding device of claim 22, wherein the CPB parameters specify a duration between CPB removal times of two decoding units, and wherein the bitstream is conforming when the duration between the CPB removal times is not exceeded.

24. The encoding device of any of claims 22 to 23, wherein the SEI message is a picture timing (PT) SEI message.

25. The encoding device of any of claims 22 to 24, wherein the CPB parameters comprise a common CPB removal delay and a CPB removal delay for an access unit (AU) associated with the PT SEI message.

26. The encoding device of any of claims 22 to 25, wherein the PT SEI message specifies a number of decoding units in the AU associated with the PT SEI message and a number of network abstraction layer (NAL) units in a decoding unit (DU) of the AU associated with the PT SEI message.

27. The encoding device of claim 22, wherein the SEI message is a decoding unit information (DUI) SEI message that provides a temporal identifier (ID) of an SEI network abstraction layer (NAL) unit containing the DUI SEI message.

28. The encoding device of claim 27, wherein the DUI SEI message specifies a temporal identifier (ID) of a highest sublayer for which CPB removal delay information is contained in the DUI SEI message.

29. A coding apparatus, comprising:
a receiver configured to receive a picture to encode or to receive a bitstream to decode;
a transmitter coupled to the receiver, the transmitter configured to transmit the bitstream to a decoder or to transmit a decoded image to a display;
a memory coupled to at least one of the receiver or the transmitter, the memory configured to store instructions; and
a processor coupled to the memory, the processor configured to execute the instructions stored in the memory to perform the method in any of claims 1 to 9 and any of claims 10 to 16.
30. The coding apparatus of claim 29, further comprising a display configured to display a decoded picture.
31. A system, comprising:
an encoder; and
a decoder in communication with the encoder, wherein the encoder or the decoder includes the decoding device, the encoding device, or the coding apparatus of any of claims 17 to 29.
32. A means for coding, comprising:
receiving means configured to receive a picture to encode or to receive a bitstream to decode;
transmission means coupled to the receiving means, the transmission means configured to transmit the bitstream to a decoding means or to transmit a decoded image to a display means;
storage means coupled to at least one of the receiving means or the transmission means, the storage means configured to store instructions; and
processing means coupled to the storage means, the processing means configured to execute the instructions stored in the storage means to perform the method in any of claims 1 to 9 and any of claims 10 to 16.