CLAIMS

What is claimed is:

1. A method implemented by a decoder, the method comprising:

receiving, by a receiver of the decoder, a bitstream comprising a picture parameter set (PPS) in a PPS network abstraction layer (NAL) unit and a coded picture comprising a set of video coding layer (VCL) NAL units, wherein a particular VCL NAL unit does not refer to the PPS NAL unit unless a value of a NAL unit header layer identifier (nuh_layer_id) of the PPS NAL unit is less than or equal to a value of a nuh_layer_id of the particular VCL NAL unit; and

decoding, by a processor of the decoder, the coded picture from the set of VCL NAL units based on the PPS in the PPS NAL unit to produce a decoded picture.

2. The method of claim 1, wherein the bitstream further comprises an adaptation parameter set (APS) in an APS NAL unit, and wherein the particular VCL NAL unit does not refer to the APS NAL unit unless a value of a nuh_layer_id of the APS NAL unit is less than or equal to the value of the nuh_layer_id of the particular VCL NAL unit.

3. The method of any of claims 1-2, wherein the particular VCL NAL unit comprises a slice of the coded picture and a header containing data elements pertaining to the slice, and wherein the header specifies an APS identifier (ID) of the APS.

4. The method of any of claims 1-3, wherein the particular VCL NAL unit comprises a slice of the coded picture, wherein the slice is associated with a header that contains syntax elements that apply to the slice of the coded picture, and wherein the header specifies a PPS ID of the PPS.

5. The method of any of claims 1-4, wherein the bitstream is a result of a sub-bitstream extraction process that removes NAL units from the bitstream based on nuh_layer_id value.

6. The method of any of claims 1-5, wherein the set of VCL NAL units are part of a layer when the set of VCL NAL units all have a particular value of nuh_layer_id.

7. The method of any of claims 1-6, wherein the layer includes non-VCL NAL units that are associated with the set of VCL NAL units that all have a particular value of nuh_layer_id.

8. The method of any of claims 1-7, further comprising:

receiving, by the decoder, a second bitstream comprising a second PPS in a second PPS NAL unit and second coded picture comprising a second set of VCL NAL units, wherein a second VCL NAL unit refers to the second PPS NAL unit with a value of a nuh_layer_id of the second PPS NAL unit is not less than or equal to a value of a nuh_layer_id of the second VCL NAL unit; and

in response to the receiving, taking some other corrective measures to ensure that a conforming bitstream corresponding to the second bitstream is received prior to decoding the coded picture from the second set of VCL NAL units.

9. A method implemented by an encoder, the method comprising:

encoding, by a processor of the encoder, a coded picture comprising a set of video coding layer (VCL) network abstraction layer (NAL) units in a bitstream;

encoding into the bitstream, by the processor, a picture parameter set (PPS) in a PPS NAL unit based on a constraint that a particular VCL NAL unit does not refer to the PPS NAL unit unless a value of a NAL unit header layer identifier (nuh_layer_id) of the PPS NAL unit is less than or equal to a value of a nuh_layer_id of the particular VCL NAL unit; and

storing, by a memory coupled to the processor, the bitstream for communication toward a decoder.

10. The method of claim 9, further comprising encoding into the bitstream, by the processor, an adaptation parameter set (APS) in an APS NAL unit based on a constraint that a particular VCL NAL unit does not refer to the APS NAL unit unless a value of a nuh_layer_id of the PPS NAL unit is less than or equal to a value of a nuh_layer_id of the particular VCL NAL unit.

11. The method of any of claims 9-10, wherein the particular VCL NAL unit comprises a slice of the coded picture and a header containing data elements pertaining to the slice, and wherein the header specifies an APS identifier (ID) of the APS.

12. The method of any of claims 9-11, wherein the particular VCL NAL unit comprises a slice of the coded picture, wherein the slice is associated with a header that contains syntax elements that apply to the slice of the coded picture, and wherein the header specifies a PPS ID of the PPS.

13. The method of any of claims 9-12, further comprising performing, by the processor, a sub-bitstream extraction process to remove NAL units from the bitstream based on nuh_layer_id value.

14. The method of any of claims 9-13, wherein the set of VCL NAL units are part of a layer when the set of VCL NAL units all have a particular value of nuh_layer_id.

15. The method of any of claims 9-14, wherein the layer includes non-VCL NAL units that are associated with the set of VCL NAL units that all have a particular value of nuh_layer_id.

16. A video coding device comprising:

a processor, a receiver coupled to the processor, a memory coupled to the processor, and a transmitter coupled to the processor, wherein the processor, receiver, memory, and transmitter are configured to perform the method of any of claims 1-15.

17. A non-transitory computer readable medium comprising a computer program product for use by a video coding device, the computer program product comprising computer executable instructions stored on the non-transitory computer readable medium such that when executed by a processor cause the video coding device to perform the method of any of claims 1-15.

18. A decoder comprising:

a receiving means for receiving a bitstream comprising a picture parameter set (PPS) in a PPS network abstraction layer (NAL) unit and a coded picture comprising a set of video coding layer (VCL) NAL units, wherein a particular VCL NAL unit does not refer to the PPS NAL unit unless a value of a NAL unit header layer identifier (nuh_layer_id) of the PPS NAL unit is less than or equal to a value of a nuh_layer_id of the particular VCL NAL unit;

a decoding means for decoding the coded picture from the set of VCL NAL units based on the PPS in the PPS NAL unit to produce a decoded picture; and

a forwarding means for forwarding the decoded picture for display as part of a decoded video sequence.

19. The decoder of claim 17, wherein the decoder is further configured to perform the method of any of claims 1-8.

20. An encoder comprising:

an encoding means for:

encoding a coded picture comprising a set of video coding layer (VCL) network abstraction layer (NAL) units in a bitstream; and

encoding into the bitstream a picture parameter set (PPS) in a PPS NAL unit based on a constraint that a particular VCL NAL unit does not refer to the PPS NAL unit unless a value of a NAL unit header layer identifier (nuh_layer_id) of the PPS NAL unit is less than or equal to a value of a nuh_layer_id of the particular VCL NAL unit; and

a storing means for storing the bitstream for communication toward a decoder.

21. The encoder of claim 19, wherein the encoder is further configured to perform the method of any of claims 9-15.

22. A method implemented by a decoder, the method comprising:

receiving, by a receiver of the decoder, a bitstream comprising a picture parameter set (PPS) in a PPS network abstraction layer (NAL) unit and a coded picture comprising a set of video coding layer (VCL) NAL units, wherein VCL NAL units that refer to the PPS are constrained to include a value of a NAL unit header layer identifier (nuh_layer_id) that is less than or equal to a value of a nuh_layer_id of the PPS NAL unit; and

decoding, by a processor of the decoder, the coded picture from the set of VCL NAL units based on the PPS in the PPS NAL unit to produce a decoded picture.

23. The method of claim 22, wherein the bitstream further comprises an adaptation parameter set (APS) in an APS NAL unit, and wherein VCL NAL units that refer to the APS

are constrained to include a value of nuh_layer_id that is less than or equal to a value of a nuh_layer_id of the APS NAL unit.

24. The method of any of claims 22-23, wherein each VCL NAL unit comprises a slice of the coded picture and a header containing data elements pertaining to the slice, and wherein the header specifies an APS identifier (ID) of the APS.

25. The method of any of claims 22-23, wherein each VCL NAL unit comprises a slice of the coded picture, wherein the slice is associated with a header that contains syntax elements that apply to the slice of the coded picture, and wherein the header specifies a PPS ID of the PPS.

26. The method of any of claims 22-24, wherein the bitstream is a result of a sub-bitstream extraction process that removes NAL units from the bitstream based on nuh_layer_id value.

27. The method of any of claims 22-25, wherein the set of VCL NAL units are part of a layer when the set of VCL NAL units all have a particular value of nuh_layer_id.

28. The method of any of claims 22-26, wherein the layer includes non-VCL NAL units that are associated with the set of VCL NAL units that all have a particular value of nuh_layer_id.

29. A method implemented by an encoder, the method comprising:

encoding, by a processor of the encoder, a coded picture comprising a set of video coding layer (VCL) network abstraction layer (NAL) units in a bitstream;

encoding into the bitstream, by the processor, a picture parameter set (PPS) in a PPS NAL unit based on a constraint that VCL NAL units that refer to the PPS are constrained to include a value of a NAL unit header layer identifier (nuh_layer_id) that is less than or equal to a value of a nuh_layer_id of the PPS NAL unit; and

storing, by a memory coupled to the processor, the bitstream for communication toward a decoder.

30. The method of claim 29, further comprising encoding into the bitstream, by the processor, an adaptation parameter set (APS) in an APS NAL unit based on a constraint that VCL NAL units that refer to the APS are constrained to include a value of nuh_layer_id that is less than or equal to a value of a nuh_layer_id of the APS NAL unit.

31. The method of any of claims 29-30, wherein each VCL NAL unit comprises a slice of the coded picture and a header containing data elements pertaining to the slice, and wherein the header specifies an APS identifier (ID) of the APS.

32. The method of any of claims 29-31, wherein each VCL NAL unit comprises a slice of the coded picture, wherein the slice is associated with a header that contains syntax elements that apply to the slice of the coded picture, and wherein the header specifies a PPS ID of the PPS.

33. The method of any of claims 29-32, further comprising performing, by the processor, a sub-bitstream extraction process to remove NAL units from the bitstream based on nuh_layer_id value.

34. The method of any of claims 29-33, wherein the set of VCL NAL units are part of a layer when the set of VCL NAL units all have a particular value of nuh_layer_id.

35. The method of any of claims 29-34, wherein the layer includes non-VCL NAL units that are associated with the set of VCL NAL units that all have a particular value of nuh_layer_id.