

CLAIMS

What is claimed is:

1. A method of decoding implemented by a video decoder, comprising:
receiving, by the video decoder, a video bitstream including a video parameter set (VPS) and a plurality of layers, wherein no layer is neither an output layer of at least one output layer set (OLS) nor a direct reference layer of any other layer; and
decoding, by the video decoder, a picture from one of the plurality of layers.
2. The method of claim 1, wherein the picture is included in an output layer of the at least one OLS.
3. The method of any of claims 1 to 2, further comprising selecting an output layer from the at least one OLS prior to the decoding.
4. The method of any of claims 1 to 3, further comprising selecting the picture from the output layer after the output layer has been selected.
5. The method of any of claims 1 to 4, wherein each layer in the plurality of layers comprises a set of video coding layer (VCL) network abstraction layer (NAL) units that all have a particular value of a layer identifier (ID) and associated non-VCL NAL units.
6. The method of any of claims 1 to 5, wherein each layer of the at least one OLS comprises the output layer or the direct reference layer of the any other layer.
7. The method of claim 6, wherein the at least one OLS contains one or more output layers.
8. The method of any of claims 1 to 7, wherein the VPS includes a layer used as a reference flag and a layer used as an output layer flag, and wherein a value of the layer used as a reference flag and a value of the layer used as an output layer flag are not both zero.

9. The method of any of claims 1 to 8, further comprising displaying the decoded picture on a display of an electronic device.
10. The method of any of claims 1 to 9, further comprising:
receiving, by the video decoder, a second video bitstream including a second video parameter set (VPS) and a second plurality of layers, wherein at least one layer is neither an output layer of at least one output layer sets (OLS) nor a direct reference layer of any other layer;
and
in response to the receiving, taking some other corrective measures to ensure that a conforming bitstream corresponding to the second video bitstream is received prior to decoding a picture from one of the second plurality of layers.
11. A method of encoding implemented by a video encoder, the method comprising:
generating, by the video encoder, a plurality of layers and a video parameter set (VPS) specifying at least one output layer set (OLS), wherein the video encoder is constrained such that no layer is neither an output layer of the at least one OLS nor a direct reference layer of any other layer;
encoding, by the video encoder, the plurality of layers and the VPS into a video bitstream; and
storing, by the video encoder, the video bitstream for communication toward a video decoder.
12. The method of claim 11, wherein each of the one or more OLSs contains one or more output layers, and wherein each of the output layers comprises one or more pictures.
13. The method of any of claims 11 to 12, wherein each layer in the plurality of layers comprises a set of video coding layer (VCL) network abstraction layer (NAL) units that all have a particular value of a layer identifier (ID) and associated non-VCL NAL units.
14. The method of any of claims 11 to 13, wherein one of the OLSs comprises two output layers, and wherein one of the two output layers references another of the two output layers.

15. The method of any of claims 11 to 14, wherein the VPS includes a layer used as a reference flag and a layer used as an output layer flag, and wherein a value of the layer used as a reference flag and a value of the layer used as an output layer flag are not both zero.
16. A decoding device, comprising:
a receiver configured to receive a video bitstream including a video parameter set (VPS) and a plurality of layers, wherein no layer is neither an output layer of at least one OLS nor a direct reference layer of any other layer;
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 a picture from one of the plurality of layers to obtain a decoded picture.
17. The decoding device of claim 16, wherein the picture is included in an output layer of the at least one OLS.
18. The decoding device of any of claims 16 to 17, wherein the processor is further configured to select an output layer from the at least one OLS prior to the picture being decoded.
19. The decoding device of any of claims 16 to 18, wherein the processor is further configured to select the picture from the output layer after the output layer has been selected.
20. The decoding device of any of claims 16 to 19, wherein each layer in the plurality of layers comprises a set of video coding layer (VCL) network abstraction layer (NAL) units that all have a particular value of a layer identifier (ID) and associated non-VCL NAL units.
21. The decoding device of any of claims 16 to 20, wherein each layer of the at least one OLS comprises the output layer or the direct reference layer of the any other layer.
22. The decoding device of any of claims 16 to 21, wherein the at least one OLS contains one or more output layers.

23. The decoding device of any of claims 16 to 22, further comprising a display configured to display the decoded picture.
24. The decoding device of any of claims 16 to 23, wherein the processor is configured to execute the instructions to further cause the decoding device to:
- receive a second video bitstream including a second video parameter set (VPS) and a second plurality of layers, wherein at least one layer is neither an output layer of at least one output layer sets (OLS) nor a direct reference layer of any other layer; and
 - in response to the receipt of the second video bitstream, taking some other corrective measures to ensure that a conforming bitstream corresponding to the second video bitstream is received prior to decoding a picture from one of the second plurality of layers.
25. 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 plurality of layers and a video parameter set (VPS) specifying one or more output layer sets (OLSs), wherein the encoding device is constrained such that no layer is neither an output layer of at least one OLS nor a direct reference layer of any other layer;
 - encode the plurality of layers and the VPS into a video bitstream; and
 - a transmitter coupled to the processor, the transmitter configured to transmit the video bitstream toward a video decoder.
26. The encoding device of claim 25, wherein each of the one or more OLSs contains one or more output layers, and wherein each of the output layers comprises one or more pictures.
27. The encoding device of any of claims 25 to 26, wherein each layer in the plurality of layers comprises a set of video coding layer (VCL) network abstraction layer (NAL) units that all have a particular value of a layer identifier (ID) and associated non-VCL NAL units.

28. The encoding device of any of claims 25 to 27, wherein each layer of the at least one OLS comprises the output layer or the direct reference layer of the any other layer.
29. The encoding device of any of claims 25 to 28, wherein the VPS includes a layer used as a reference flag and a layer used as an output layer flag, and wherein a value of the layer used as a reference flag and a value of the layer used as an output layer flag are not both zero.
30. 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 10 and any of claims 11 to 15.
31. The coding apparatus of claim 28, further comprising a display configured to display a decoded picture.
32. 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 16 to 31.
33. 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 10 and any of claims 11 to 15.