CLAIMS

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

decoding, by a video decoding device comprising one or more processors, a random access point (RAP) picture, wherein the RAP picture comprises one of a clean random access (CRA) picture or a broken link access (BLA) picture;

identifying, by the video decoding device comprising the one or more processors, one or more pictures of a first type associated with the RAP picture, wherein the one or more pictures of the first type precede the RAP picture in output order value and succeed the RAP picture in decoding order and refer to video data earlier than the RAP picture in the decoding order;

discarding the one or more pictures of the first type;

decoding, by the video decoding device comprising the one or more processors, one or more decodable leading pictures for the RAP picture in accordance with a restriction that causes a specified condition to be true, the specified condition requiring that all of the one or more pictures of the first type precede the one or more decodable leading pictures associated with the RAP picture in output order, wherein the one or more decodable leading pictures comprise one or more pictures having output order values that indicate an output order earlier than an output order value of the RAP picture, and wherein the one or more decodable leading pictures are decoded after decoding the RAP picture, and wherein the one or more decodable leading pictures do not refer to video data earlier than the RAP picture in decoding order; and

outputting, by the video decoding device comprising the one or more processors, the decoded RAP picture.

2. The method of claim 1, further comprising decoding, by the video decoding device comprising one or more processors, one or more leading pictures relative to the RAP picture in accordance with a restriction that all of the leading pictures for the RAP picture precede all trailing pictures for the RAP picture in decoding order, wherein the trailing pictures comprise pictures having output order values that are greater than an output order value of the RAP picture.

3. The method of claim 1, wherein any picture preceding the CRA picture or the BLA picture in decoding order precedes any decodable leading picture associated with the CRA picture or the BLA picture in output order.

4. The method of claim 1, the method further comprising:

decoding, by the video decoding device comprising one or more processors, one or more leading pictures associated with the RAP picture, wherein the leading pictures precede the RAP picture in output order value and succeed the RAP picture in decoding order; and

decoding, by the video decoding device comprising one or more processors, one or more trailing pictures associated with the RAP picture in accordance with a restriction that all of the leading pictures precede all the trailing pictures in decoding order, wherein the trailing pictures succeed the RAP picture both in output order value and in decoding order.

5. The method of claim 1, wherein decoding the one or more decodable leading pictures for the RAP picture comprises decoding the one or more decodable leading pictures associated with the RAP picture in accordance with the restriction that all the pictures of the first type precede the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in the decoding order and do not refer to video data earlier than the RAP picture in the decoding order.

6. The method of claim 1, the method further comprising:

decoding, by the video decoding device comprising one or more processors, one or more pictures that precede the RAP picture in a decoding order; and

wherein decoding the one or more decodable leading pictures comprises decoding the one or more decodable leading pictures associated with the RAP picture in accordance with a restriction that all pictures that precede the RAP picture in decoding order also precede all the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in decoding order and do not refer to video data earlier than the RAP picture in decoding order.

7. The method of claim 1, wherein decoding the RAP picture is performed as part of a video encoding process.

8. A device for decoding video data, the device comprising:

a memory configured to store the video data;

a video decoder comprising one or more processors configured to:

decode a random access point (RAP) picture, wherein the RAP picture comprises one of a clean random access (CRA) picture or a broken link access (BLA) picture;

identify one or more pictures of a first type associated with the RAP picture, wherein the one or more pictures of the first type precede the RAP picture in output order value and succeed the RAP picture in decoding order and refer to video data earlier than the RAP picture in the decoding order;

discard the one or more pictures of the first type;

decode one or more decodable leading pictures for the RAP picture in accordance with a restriction that causes a specified condition to be true, the specified condition requiring that all of the one or more pictures of the first type precede the one or more decodable leading pictures associated with the RAP picture in output order, wherein the one or more decodable leading pictures comprise one or more pictures having output order values that indicate an output order earlier than an output order value of the RAP picture, and wherein the one or more decodable

leading pictures are decoded after decoding the RAP picture, and wherein the one or more decodable leading pictures do not refer to video data earlier than the RAP picture in decoding order; and

output the decoded RAP picture.

9. The device of claim 8, wherein the video decoder is further configured to decode one or more leading pictures relative to the RAP picture in accordance with a restriction that all of the leading pictures for the RAP picture precede all trailing pictures for the RAP picture in decoding order, wherein the trailing pictures comprise pictures having output order values that are greater than a output order value of the RAP picture.

10. The device of claim 8, wherein any picture preceding the CRA picture or the BLA picture in decoding order precedes any decodable leading picture associated with the CRA picture or the BLA picture in output order.

11. The device of claim 8, wherein the video decoder is further configured to decode one or more leading pictures associated with the RAP picture, wherein the leading pictures precede the RAP picture in output order value and succeed the RAP picture in decoding order; and decode one or more trailing pictures associated with the RAP picture in accordance with a restriction that all of the leading pictures precede all the trailing pictures in decoding order, wherein the trailing pictures succeed the RAP picture both in output order value and in decoding order.

12. The device of claim 8, wherein the video decoder is configured to decode the one or more decodable leading pictures for the RAP picture by decoding the one or more decodable leading pictures associated with the RAP picture in accordance with the restriction that all the pictures of the first type precede the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in the decoding order and do not refer to video data earlier than the RAP picture in the decoding order.

13. The device of claim 8, wherein the video decoder is further configured to decode one or more pictures that precede the RAP picture in a decoding order; and wherein the video decoder is configured to decode the one or more decodable leading pictures by decoding the one or more decodable leading pictures associated with the RAP picture in accordance with the restriction that all pictures that precede the RAP picture in decoding order also precede all the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in decoding order and do not refer to video data earlier than the RAP picture in decoding order.

14. The device of claim 8, wherein the device comprises at least one of:
an integrated circuit;
a microprocessor; or
a wireless communication device that includes the video decoder.

15. An apparatus for decoding video data, the apparatus comprising:
means for decoding a random access point (RAP) picture, wherein the RAP picture comprises one of a clean random access (CRA) picture or a broken link access (BLA) picture;
means for identifying one or more pictures of a first type associated with the RAP picture, wherein the one or more pictures of the first type precede the RAP picture in output order value and succeed the RAP picture in decoding order and refer to video data earlier than the RAP picture in the decoding order;
means for discard the one or more pictures of the first type;
means for decoding one or more decodable leading pictures for the RAP picture in accordance with a restriction that causes a specified condition to be true, the specified condition requiring that all of the one or more pictures of the first type precede the one or more decodable leading pictures associated with the RAP picture in output order, wherein the one or more decodable leading pictures comprise one or more pictures having output order values that indicate an output order earlier than an output order value of the RAP picture, and wherein the one

or more decodable leading pictures are decoded after decoding the RAP picture, and wherein the one or more decodable leading pictures do not refer to video data earlier than the RAP picture in decoding order; and

means for outputting the decoded RAP picture.

16. The apparatus of claim 15, further comprising means for decoding one or more leading pictures relative to the RAP picture in accordance with a restriction that all of the leading pictures for the RAP picture precede all trailing pictures for the RAP picture in decoding order, wherein the trailing pictures comprise pictures having output order values that are greater than a output order value of the RAP picture.

17. The apparatus of claim 15, wherein any picture preceding the CRA picture or the BLA picture in decoding order precedes any decodable leading picture associated with the CRA picture or the BLA picture in output order.

18. The apparatus of claim 15, the apparatus further comprising:

means for decoding one or more leading pictures associated with the RAP picture, wherein the leading pictures precede the RAP picture in output order value and succeed the RAP picture in decoding order; and

means for decoding one or more trailing pictures associated with the RAP picture in accordance with a restriction that all of the leading pictures precede all the trailing pictures in decoding order, wherein the trailing pictures succeed the RAP picture both in output order value and in decoding order.

19. The apparatus of claim 15, wherein the means for decoding the one or more decodable leading pictures for the RAP picture comprises means for decoding the one or more decodable leading pictures associated with the RAP picture in accordance with the restriction that all the pictures of the first type precede the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in the decoding order and do not refer to video data earlier than the RAP picture in the decoding order.

20. The apparatus of claim 15, the apparatus further comprising:

means for decoding one or more pictures that precede the RAP picture in a decoding order; and

wherein the means for decoding the one or more decodable leading pictures comprises means for decoding the one or more decodable leading pictures associated with the RAP picture in accordance with a restriction that all pictures that precede the RAP picture in decoding order also precede all the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in decoding order and do not refer to video data earlier than the RAP picture in decoding order.

21. A non-transitory computer readable storage medium storing instructions that when executed by one or more processors cause the one or more processors to:

decode a random access point (RAP) picture, wherein the RAP picture comprises one of a clean random access (CRA) picture or a broken link access (BLA) picture;

identify one or more pictures of a first type associated with the RAP picture, wherein the one or more pictures of the first type precede the RAP picture in output order value and succeed the RAP picture in decoding order and refer to video data earlier than the RAP picture in the decoding order;

discard the one or more pictures of the first type;

decode one or more decodable leading pictures for the RAP picture in accordance with a restriction that causes a specified condition to be true, the specified condition requiring that all of the one or more pictures of the first type precede the one or more decodable leading pictures associated with the RAP picture in output play order, wherein the one or more decodable leading pictures comprise one or more pictures having output order values that indicate an output order earlier than an output order value of the RAP picture, and wherein the one or more decodable leading pictures are decoded after decoding the RAP picture, and wherein the one

or more decodable leading pictures do not refer to video data earlier than the RAP picture in decoding order; and

output the decoded RAP picture.

22. A method of encoding video data, the method comprising:

encoding, by a video encoding device comprising one or more processors, a random access point (RAP) picture, wherein the RAP picture comprises one of a clean random access (CRA) picture or a broken link access (BLA) picture;

encoding, by the video encoding device comprising the one or more processors, one or more pictures of a first type associated with the RAP picture, wherein the one or more pictures of the first type precede the RAP picture in output order value and succeed the RAP picture in decoding order and refer to video data earlier than the RAP picture in the decoding order;

encoding, by the video encoding device comprising the one or more processors, one or more decodable leading pictures for the RAP picture in accordance with a restriction that causes a specified condition to be true, the specified condition requiring that all pictures of the first type precede the one or more decodable leading pictures associated with the RAP picture in output order, wherein the one or more decodable leading pictures comprise one or more pictures having output order values that indicate an output order earlier than an output order value of the RAP picture, and wherein the one or more decodable leading pictures are decoded after decoding the RAP picture, and wherein the one or more decodable leading pictures do not refer to video data earlier than the RAP picture in decoding order; and

outputting, by the video encoding device comprising the one or more processors, the RAP picture.

23. The method of claim 22, further comprising encoding one or more leading pictures relative to the RAP picture in accordance with a restriction that all of the leading pictures for the RAP picture precede all trailing pictures for the RAP picture in decoding order, wherein the trailing pictures comprise pictures having output order values that are greater than a output order value of the RAP picture.

24. The method of claim 22, wherein any picture preceding the CRA picture or the BLA picture in decoding order precedes any decodable leading picture associated with the CRA picture or the BLA picture in output order.

25. The method of claim 22, the method further comprising:

encoding, by the video encoding device comprising the one or more processors, one or more leading pictures associated with the RAP picture, wherein the leading pictures precede the RAP picture in output order value and succeed the RAP picture in decoding order; and

encoding, by the video encoding device comprising the one or more processors, one or more trailing pictures associated with the RAP picture in accordance with a restriction that all of the leading pictures precede all the trailing pictures in decoding order, wherein the trailing pictures succeed the RAP picture both in output order value and in decoding order.

26. The method of claim 21, wherein encoding the one or more decodable leading pictures for the RAP picture comprises encoding the one or more decodable leading pictures associated with the RAP picture in accordance with the restriction that all the pictures of the first type precede the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in the decoding order and do not refer to video data earlier than the RAP picture in the decoding order.

27. The method of claim 22, the method further comprising:

encoding, by the video encoding device comprising the one or more processors, one or more pictures that precede the RAP picture in a decoding order; and

wherein encoding the one or more decodable leading pictures comprises encoding the one or more decodable leading pictures associated with the RAP picture in accordance with a restriction that all pictures that precede the RAP picture in decoding order also precede all the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in decoding order and do not refer to video data earlier than the RAP picture in decoding order.

28. The method of claim 22, wherein encoding the RAP picture is performed as part of a video encoding process.

29. A device for encoding video data, the device comprising:

a memory configured to store the video data;

a video encoder comprising one or more processors configured to:

encode a random access point (RAP) picture, wherein the RAP picture comprises one of a clean random access (CRA) picture or a broken link access (BLA) picture;

encode one or more pictures of a first type associated with the RAP picture, wherein the one or more pictures of the first type precede the RAP picture in output order value and succeed the RAP picture in decoding order and refer to video data earlier than the RAP picture in the decoding order;

encode one or more decodable leading pictures for the RAP picture in accordance with a restriction that causes a specified condition to be true, the specified condition requiring that all pictures of the first type precede the one or more decodable leading pictures associated with the RAP picture in output order, wherein the one or more decodable leading pictures comprise one or more pictures having output order values that indicate an output order earlier than an output order value of the RAP picture, and wherein the one or more decodable leading pictures are decoded after decoding the RAP picture, and wherein the one or more decodable leading

pictures do not refer to video data earlier than the RAP picture in decoding order; and

output the RAP picture.

30. The device of claim 29, wherein the video encoder is further configured to encode one or more leading pictures relative to the RAP picture in accordance with a restriction that all of the leading pictures for the RAP picture precede all trailing pictures for the RAP picture in decoding order, wherein the trailing pictures comprise pictures having output order values that are greater than a output order value of the RAP picture.

31. The device of claim 29, wherein any picture preceding the CRA picture or the BLA picture in decoding order precedes any decodable leading picture associated with the CRA picture or the BLA picture in output order.

32. The device of claim 29, wherein the video encoder is further configured to encode one or more leading pictures associated with the RAP picture, wherein the leading pictures precede the RAP picture in output order value and succeed the RAP picture in decoding order; and encode one or more trailing pictures associated with the RAP picture in accordance with a restriction that all of the leading pictures precede all the trailing pictures in decoding order, wherein the trailing pictures succeed the RAP picture both in output order value and in decoding order.

33. The device of claim 29, wherein the video encoder is configured to encode the one or more decodable leading pictures for the RAP picture comprises encoding the one or more decodable leading pictures associated with the RAP picture in accordance with the restriction that all the pictures of the first type precede the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in the decoding order and do not refer to video data earlier than the RAP picture in the decoding order.

34. The device of claim 29, wherein the video encoder is further configured to encode one or more pictures that precede the RAP picture in a decoding order; and wherein the video encoder is configured to encode the one or more decodable leading pictures by encoding the one or more decodable leading pictures associated with the RAP picture in accordance with a restriction that all pictures that precede the RAP picture in decoding order also precede all the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in decoding order and do not refer to video data earlier than the RAP picture in decoding order.

35. The device of claim 29, wherein the device comprises at least one of:
an integrated circuit;
a microprocessor; or
a wireless communication device that includes the video encoder.

36. An apparatus for encoding video data, the apparatus comprising:

means for encoding a random access point (RAP) picture, wherein the RAP picture comprises one of a clean random access (CRA) picture or a broken link access (BLA) picture;

means for encoding one or more pictures of a first type associated with the RAP picture, wherein the one or more pictures of the first type precede the RAP picture in output order value and succeed the RAP picture in decoding order and refer to video data earlier than the RAP picture in the decoding order;

means for encoding one or more decodable leading pictures for the RAP picture in accordance with a restriction that causes a specified condition to be true, the specified condition requiring that all pictures of the first type precede the one or more decodable leading pictures associated with the RAP picture in output order, wherein the one or more decodable leading pictures comprise one or more pictures having output order values that indicate an output order earlier than an output order value of the RAP picture, and wherein the one or more decodable leading pictures are decoded after decoding the RAP picture, and wherein the one or more decodable leading pictures do not refer to video data earlier than the RAP picture in decoding order; and

outputting, by the video encoding device comprising the one or more processors, the RAP picture.

37. The apparatus of claim 36, further comprising means for encoding one or more leading pictures relative to the RAP picture in accordance with a restriction that all of the leading pictures for the RAP picture precede all trailing pictures for the RAP picture in decoding order, wherein the trailing pictures comprise pictures having output order values that are greater than a output order value of the RAP picture.

38. The apparatus of claim 36, wherein any picture preceding the CRA picture or the BLA picture in decoding order precedes any decodable leading picture associated with the CRA picture or the BLA picture in output order.

39. The apparatus of claim 36, the apparatus further comprising:

means for encoding one or more leading pictures associated with the RAP picture, wherein the leading pictures precede the RAP picture in output order value and succeed the RAP picture in decoding order; and

means for encoding one or more trailing pictures associated with the RAP picture in accordance with a restriction that all of the leading pictures precede all the trailing pictures in decoding order, wherein the trailing pictures succeed the RAP picture both in output order value and in decoding order.

40. The apparatus of claim 36, wherein the means for encoding the one or more decodable leading pictures for the RAP picture comprises means for encoding the one or more decodable leading pictures associated with the RAP picture in accordance with the restriction that all the pictures of the first type precede the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in the decoding order and do not refer to video data earlier than the RAP picture in the decoding order.

41. The apparatus of claim 36, the apparatus further comprising:

means for encoding one or more pictures that precede the RAP picture in a decoding order; and

wherein the means for encoding the one or more decodable leading pictures comprises means for encoding the one or more decodable leading pictures associated with the RAP picture in accordance with a restriction that all pictures that precede the RAP picture in decoding order also precede all the one or more decodable leading pictures in output order, wherein the one or more decodable leading pictures precede the RAP picture in output order and succeed the RAP picture in decoding order and do not refer to video data earlier than the RAP picture in decoding order.

42. A non-transitory computer readable storage medium storing instructions that when executed by one or more processors cause the one or more processors to:

encode a random access point (RAP) picture, wherein the RAP picture comprises one of a clean random access (CRA) picture or a broken link access (BLA) picture;

encode one or more pictures of a first type associated with the RAP picture, wherein the one or more pictures of the first type precede the RAP picture in output order value and succeed the RAP picture in decoding order and refer to video data earlier than the RAP picture in the decoding order;

encode one or more decodable leading pictures for the RAP picture in accordance with a restriction that causes a specified condition to be true, the specified condition requiring that all pictures of the first type precede the one or more decodable leading pictures associated with the RAP picture in output order, wherein the one or more decodable leading pictures comprise one or more pictures having output order values that indicate an output order earlier than an output order value of the RAP picture, and wherein the one or more decodable leading pictures are decoded after decoding the RAP picture, and wherein the one or more decodable leading pictures do not refer to video data earlier than the RAP picture in decoding order; and

output the RAP picture.

43. The method of claim 1, wherein the one or more pictures of the first type comprise one or more random access skipped leading pictures.

44. The method of claim 1, wherein the one or more decodable leading pictures comprise one or more random access decodable leading pictures.

45. The method of claim 1, wherein the one or more pictures of the first type comprise one or more pictures that depend on data from one or more pictures occurring earlier, in decoding order, than the RAP picture.

46. The device of claim 8, wherein the one or more pictures of the first type comprise one or

more random access skipped leading pictures.

47. The device of claim 8, wherein the one or more decodable leading pictures comprise one or more random access decodable leading pictures.

48. The device of claim 8, wherein the one or more pictures of the first type comprise one or more pictures that depend on data from one or more pictures occurring earlier, in decoding order, than the RAP picture.

49. The method of claim 22, wherein the one or more pictures of the first type comprise one or more random access skipped leading pictures.

50. The method of claim 22, wherein the one or more decodable leading pictures comprise one or more random access decodable leading pictures.

51. The method of claim 22, wherein the one or more pictures of the first type comprise one or more pictures that depend on data from one or more pictures occurring earlier, in decoding order, than the RAP picture.

52. The device of claim 29, wherein the one or more pictures of the first type comprise one or more random access skipped leading pictures.

53. The device of claim 29, wherein the one or more decodable leading pictures comprise one or more random access decodable leading pictures.

54. The device of claim 29, wherein the one or more pictures of the first type comprise one or more pictures that depend on data from one or more pictures occurring earlier, in decoding order, than the RAP picture.

55. The apparatus of claim 36, wherein the one or more pictures of the first type comprise one or more random access skipped leading pictures.

56. The apparatus of claim 36, wherein the one or more decodable leading pictures comprise one or more random access decodable leading pictures.

57. The apparatus of claim 36, wherein the one or more pictures of the first type comprise one or more pictures that depend on data from one or more pictures occurring earlier, in decoding order, than the RAP picture.