CLAIMS

1. A computer-implemented method for hosting online applications or video games, performing video compression, and transmitting compressed video over a network comprising:

receiving a request from a user for playing a low latency video game or executing an application;

generating control signals from a client in response to an input device of the client being actuated by the user as the user is playing the low latency video game or using the application;

receiving the control signals at a server, the control signals transmitted over a network at least a portion of which comprises a public network, as the user is playing the video game or using the application and responsively executing the video game or application on the server to generate video output comprising a plurality of video frames of the video game or application;

encoding the plurality of video frames using low latency encoding to generate low latency encoded video frames, wherein the low latency encoding comprises:

subdividing each video frame of the plurality into a first set of one or more frame portions and a second set of one or more frame portions;

encoding frame portions in the first set using a first type of encoding;

encoding frame portions in the second set using a second type of encoding;

wherein subdividing each video frame into frame portions and encoding the first set of frame portions using the first encoding format and the second set of frame portions using the second encoding format produces a more consistent bitrate for the video frames and lower latency for the end user than if entire video frames were compressed using the first type of encoding and the second type of encoding;

transmitting the plurality of low latency encoded video frames to a client device over the network;

receiving feedback information from the client device over the network, the feedback information usable to determine whether data contained in the low latency encoded video frames or frame portions has not been successfully received and/or decoded;

in response to detecting that one or more low latency encoded video frames or frame portions thereof have not been successfully received and/or decoded, then adjusting the encoding of the low latency encoded video frames while maintaining a latency such that the user has the perception that the selected video game or application is responding instantly to the signals, wherein adjusting the encoding comprises adjusting the ratio of frame portions compressed using the first type of encoding to the frame portions compressed with the second type of encoding in each frame;

decoding the low latency encoded video frames on the client device and rendering the resulting decoded video frames on a display of the client device;

wherein the operations of generating the control signals, receiving the control signals transmitted over the network, executing the video game or application, encoding the plurality of video frames using low latency encoding, transmitting the low latency encoded video frames, decoding the low latency encoded video frames, and rendering the resulting decoded video frames on a display are performed with a latency such that the user has the perception that the selected video game or application is responding instantly to the signals.

2. The method as in claim 1 wherein each video frame portion encoded according to the second type of encoding is dependent on a prior video frame portion, respectively, and wherein each video frame portion encoded according to the first encoding format is not dependent on a prior video frame or portion, respectively.

3. The method as in claim 2 wherein the first type of encoding format comprises intra-frame-portion coding and wherein the second encoding format comprises inter-frame-portion coding.

4. The method as in claim 3 wherein the frame portions selected to be included in the first set in a first video frame are selected to be included in the second set in one or more successive video frames following the first video frame.

5. The method as in claim 1 wherein the feedback information comprises an indication that the frames or frame portions have not been successfully received and/or decoded at the client device.

6. The method as in claim 1 wherein the frame portions are selected to be in the first set or the second set based, at least in part, on characteristics of video content contained in the frame portions.

7. The method as in claim 6 wherein the characteristics of the video content includes an amount of change in the video content between successive video frames.

8. A system for hosting online applications or video games comprising a memory for storing program code and a processor for processing the program code to perform the operations of:

receiving a request from a user for playing a low latency video game or executing an application;

generating control signals from a client in response to an input device of the client being actuated by the user as the user is playing the low latency video game or using the application;

receiving the control signals at a server, the control signals transmitted over a network at least a portion of which comprises a public network, as the user is playing the video game or using the application and responsively executing the video game or application on the server to generate video output comprising a plurality of video frames of the video game or application;

encoding the plurality of video frames using low latency encoding to generate low latency encoded video frames, wherein the low latency encoding comprises:

subdividing each video frame of the plurality into a first set of one or more frame portions and a second set of one or more frame portions;

encoding frame portions in the first set using a first type of encoding;

encoding frame portions in the second set using a second type of encoding;

wherein subdividing each video frame into frame portions and encoding the first set of frame portions using the first encoding format and the second set of frame

portions using the second encoding format produces a more consistent bitrate for the video frames and lower latency for the end user than if entire video frames were compressed using the first type of encoding and the second type of encoding;

transmitting the plurality of low latency encoded video frames to a client device over the network;

receiving feedback information from the client device over the network, the feedback information usable to determine whether data contained in the low latency encoded video frames or frame portions has not been successfully received and/or decoded;

in response to detecting that one or more low latency encoded video frames or frame portions thereof have not been successfully received and/or decoded, then adjusting the encoding of the low latency encoded video frames while maintaining a latency such that the user has the perception that the selected video game or application is responding instantly to the signals, wherein adjusting the encoding comprises adjusting the ratio of frame portions compressed using the first type of encoding to the frame portions compressed with the second type of encoding in each frame;

decoding the low latency encoded video frames on the client device and rendering the resulting decoded video frames on a display of the client device;

wherein the operations of generating the control signals, receiving the control signals transmitted over the network, executing the video game or application, encoding the plurality of video frames using low latency encoding, transmitting the low latency encoded video frames, decoding the low latency encoded video frames, and rendering the resulting decoded video frames on a display are performed with a latency such that the user has the perception that the selected video game or application is responding instantly to the signals.

9. The system as in claim 8 wherein each video frame portion encoded according to the second type of encoding is dependent on a prior video frame portion, respectively, and wherein each video frame portion encoded according to the first encoding format is not dependent on a prior video frame or portion, respectively.

10. The system as in claim 9 wherein the first type of encoding format comprises intra-frame-portion coding and wherein the second encoding format comprises inter-frame-portion coding.

11. The system as in claim 10 wherein the frame portions selected to be included in the first set in a first video frame are selected to be included in the second set in one or more successive video frames following the first video frame.

12. The system as in claim 8 wherein the feedback information comprises an indication that the frames or frame portions have not been successfully received and/or decoded at the client device.

13. The system as in claim 8 wherein the frame portions are selected to be in the first set or the second set based, at least in part, on characteristics of video content contained in the frame portions.

14. The system as in claim 13 wherein the characteristics of the video content includes an amount of change in the video content between successive video frames.

15. A non-transitory machine-readable medium having program code stored thereon which, when executed by a machine, causes the machine to perform the operations of:

receiving a request from a user for playing a low latency video game or executing an application;

generating control signals from a client in response to an input device of the client being actuated by the user as the user is playing the low latency video game or using the application;

receiving the control signals at a server, the control signals transmitted over a network at least a portion of which comprises a public network, as the user is playing the video game or using the application and responsively executing the video game or application on the server to generate video output comprising a plurality of video frames of the video game or application;

encoding the plurality of video frames using low latency encoding to generate low latency encoded video frames, wherein the low latency encoding comprises:

subdividing each video frame of the plurality into a first set of one or more frame portions and a second set of one or more frame portions;

encoding frame portions in the first set using a first type of encoding;

encoding frame portions in the second set using a second type of encoding;

wherein subdividing each video frame into frame portions and encoding the first set of frame portions using the first encoding format and the second set of frame portions using the second encoding format produces a more consistent bitrate for the video frames and lower latency for the end user than if entire video frames were compressed using the first type of encoding and the second type of encoding;

transmitting the plurality of low latency encoded video frames to a client device over the network;

receiving feedback information from the client device over the network, the feedback information usable to determine whether data contained in the low latency encoded video frames or frame portions has not been successfully received and/or decoded;

in response to detecting that one or more low latency encoded video frames or frame portions thereof have not been successfully received and/or decoded, then adjusting the encoding of the low latency encoded video frames while maintaining a latency such that the user has the perception that the selected video game or application is responding instantly to the signals, wherein adjusting the encoding comprises adjusting the ratio of frame portions compressed using the first type of encoding to the frame portions compressed with the second type of encoding in each frame;

decoding the low latency encoded video frames on the client device and rendering the resulting decoded video frames on a display of the client device;

wherein the operations of generating the control signals, receiving the control signals transmitted over the network, executing the video game or application, encoding the plurality of video frames using low latency encoding, transmitting the low latency encoded video frames, decoding the low latency encoded video frames, and rendering the resulting decoded video frames on a display are performed with a

latency such that the user has the perception that the selected video game or application is responding instantly to the signals.

16. The non-transitory machine-readable medium as in claim 15 wherein each video frame portion encoded according to the second type of encoding is dependent on a prior video frame portion, respectively, and wherein each video frame portion encoded according to the first encoding format is not dependent on a prior video frame or portion, respectively.

17. The non-transitory machine-readable medium as in claim 16 wherein the first type of encoding format comprises intra-frame-portion coding and wherein the second encoding format comprises inter-frame-portion coding.

18. The non-transitory machine-readable medium as in claim 17 wherein the frame portions selected to be included in the first set in a first video frame are selected to be included in the second set in one or more successive video frames following the first video frame.

19. The non-transitory machine-readable medium as in claim 15 wherein the feedback information comprises an indication that the frames or frame portions have not been successfully received and/or decoded at the client device.

20. The non-transitory machine-readable medium as in claim 15 wherein the frame portions are selected to be in the first set or the second set based, at least in part, on characteristics of video content contained in the frame portions.

21. The non-transitory machine-readable medium as in claim 20 wherein the characteristics of the video content includes an amount of change in the video content between successive video frames.

22. The method as in claim 1 wherein adjusting the encoding comprises:

if no forward error correction (FEC) coding is initially used to transmit the plurality of video frames or frame portions, then encoding a new video frame or frame portion thereof using FEC coding; or

if a first FEC coding is initially used to transmit the plurality of encoded video frames or frame portions, then encoding a new video frame or frame portion thereof using a second FEC coding, the second FEC coding being a relatively stronger FEC coding than the first FEC coding; and

transmitting the new video frame or frame portion thereof to the client device.

23. The method as in claim 1 wherein the operations of generating the control signals, receiving the control signals transmitted over the network, executing the video game or application, encoding the plurality of video frames using low latency encoding, transmitting the low latency encoded video frames, decoding the low latency encoded video frames, and rendering the resulting decoded video frames on a display are performed with a finite latency of 80 ms or less.

24. The method as in claim 1 wherein the operations of generating the control signals, receiving the control signals transmitted over the network, executing the video game or application, encoding the plurality of video frames using low latency encoding, transmitting the low latency encoded video frames, decoding the low latency encoded video frames, and rendering the resulting decoded video frames on a display are performed with a finite latency of 150 ms or less.

25. The system as in claim 8 wherein adjusting the encoding comprises:

if no forward error correction (FEC) coding is initially used to transmit the plurality of video frames or frame portions, then encoding a new video frame or frame portion thereof using FEC coding; or

if a first FEC coding is initially used to transmit the plurality of encoded video frames or frame portions, then encoding a new video frame or frame portion thereof using a second FEC coding, the second FEC coding being a relatively stronger FEC coding than the first FEC coding; and

transmitting the new video frame or frame portion thereof to the client device.

26. The system as in claim 8 wherein the operations of generating the control signals, receiving the control signals transmitted over the network, executing the video game or application, encoding the plurality of video frames using low latency encoding, transmitting the low latency encoded video frames, decoding the low latency encoded video frames, and rendering the resulting decoded video frames on a display are performed with a finite latency of 80 ms or less.

27. The system as in claim 8 wherein the operations of generating the control signals, receiving the control signals transmitted over the network, executing the video game or application, encoding the plurality of video frames using low latency encoding, transmitting the low latency encoded video frames, decoding the low latency encoded video frames, and rendering the resulting decoded video frames on a display are performed with a finite latency of 150 ms or less.

28. The non-transitory machine-readable medium as in claim 15 wherein adjusting the encoding comprises:

if no forward error correction (FEC) coding is initially used to transmit the plurality of video frames or frame portions, then encoding a new video frame or frame portion thereof using FEC coding; or

if a first FEC coding is initially used to transmit the plurality of encoded video frames or frame portions, then encoding a new video frame or frame portion thereof using a second FEC coding, the second FEC coding being a relatively stronger FEC coding than the first FEC coding; and

transmitting the new video frame or frame portion thereof to the client device.

29. The non-transitory machine-readable medium as in claim 15 wherein the operations of generating the control signals, receiving the control signals transmitted over the network, executing the video game or application, encoding the plurality of video frames using low latency encoding, transmitting the low latency encoded video frames, decoding the low latency encoded video frames, and rendering the resulting decoded video frames on a display are performed with a finite latency of 80 ms or less.

30. The non-transitory machine-readable medium as in claim 15 wherein the operations of generating the control signals, receiving the control signals transmitted over the network, executing the video game or application, encoding the plurality of video frames using low latency encoding, transmitting the low latency encoded video frames, decoding the low latency encoded video frames, and rendering the resulting decoded video frames on a display are performed with a finite latency of 150 ms or less.

31. The method as in claim 7 wherein frame portions having an amount of change in the video content above a specified threshold are included in the first set of frame portions and encoded using the first type of encoding.

32. The method as in claim 31 wherein one or more video frames are subdivided into frame portions having different sizes.

33. The method as in claim 32 wherein the different sizes of the frame portions are selected based on the amount of change detected in video content contained in the frame portions.

34. The method as in claim 33 wherein frame portions having an amount of change in the video content above a specified threshold are given a relatively smaller size than frame portions having an amount of change below the specified threshold.

35. The system as in claim 14 wherein frame portions having an amount of change in the video content above a specified threshold are included in the first set of frame portions and encoded using the first type of encoding.

36. The system as in claim 35 wherein one or more video frames are subdivided into frame portions having different sizes.

37. The system as in claim 36 wherein the different sizes of the frame portions are selected based on the amount of change detected in video content contained in the frame portions.

38. The system as in claim 37 wherein frame portions having an amount of change in the video content above a specified threshold are given a relatively smaller size than frame portions having an amount of change below the specified threshold.