

MULTIMEDIA DATA SYNCHRONOUS PLAYING METHOD AND APPARATUS, AND DEVICE AND MEDIUM

APPLICATION OF PRIORITY

[0001] This patent application claims the priority of Chinese Patent Application No. CN118354132A filed on April 17, 2024 and entitled "MULTIMEDIA DATA SYNCHRONOUS PLAYING METHOD AND APPARATUS, AND DEVICE AND MEDIUM".

TECHNICAL FIELD

[0002] The present disclosure relates to the technical field of multimedia playing, and in particular, to a multimedia data synchronous playing method and apparatus, and a device and a medium.

BACKGROUND

[0003] With the decrease of display hardware costs and the increasing trend of advertisements demanding increasingly larger playing screens, synchronous video playing across a plurality of playing terminal displays is required in many scenarios.

[0004] For example, in some cases, all playing terminals need to process different videos or the same video to be played locally, and then start playing at a unified time. Alternatively, when a network video is played, the network video is downloaded by each playing terminal locally through the network, and then is decoded and played. In other scenarios, all playing terminals are controlled by a playing server. The target multimedia data is decoded by the server, and then the original audio and video data is transmitted.

[0005] In a first scenario described above, due to different hardware device performance differences and network differences, caching and decoding speeds of videos cannot keep the same, and a frame-level synchronous playing effect cannot be achieved. When screens are placed close to each other, playing differences are visible to a naked eye. In another scenario, the performance and the network bandwidth of the playing server are highly required, and the number of supported screens is limited, which is not applicable in complex scenarios such as inconvenient wiring.

SUMMARY

[0006] The present disclosure provides a multimedia data synchronous playing method and apparatus, and a device and a medium.

[0007] In a first aspect, the present disclosure provides a multimedia data synchronous playing method, including:

acquiring, by a first playing terminal, playlist information, where the playlist information is used for indicating target multimedia data to be played by each playing terminal of a playing terminal set, the playing terminal set includes two or more playing terminals, and the first playing terminal is any playing terminal of the playing terminal set; when the first playing terminal is a main playing terminal at a current moment, generating, by the first playing terminal, target playing signaling based on a playing progress of the target multimedia data at the current moment, where the target playing signaling instructs each playing terminal of the playing terminal set to execute a playing operation on the target multimedia data at a next moment; and sending, by the first playing terminal as the main playing terminal, the target playing signaling to other playing terminals of the playing terminal set except the first playing terminal, such that the other playing terminals execute the playing operation on the target multimedia data synchronously with the first playing terminal at the next moment in response to the target playing signaling, to cause the first playing terminal and the other playing terminals to cache decoded target multimedia data or display pre-decoded target multimedia data.

[0008] In a second aspect, the present disclosure provides a multimedia data synchronous playing apparatus, including:

an acquiring module, configured to acquire playlist information by a first playing terminal, where the playlist information is used for indicating target multimedia data to be played by each playing terminal of a playing terminal set, the playing terminal set includes two or more playing terminals, and the first playing terminal is any playing terminal of the playing terminal set; a generating module, configured to, when the first playing terminal is a main playing terminal at a current moment, generate, by the first playing terminal, target playing signaling based on a playing progress of the target multimedia data at the current moment, where the target playing signaling instructs each playing terminal of the playing terminal set to execute a playing operation on the target multimedia data at a next moment; and a sending module, configured to send, by the first playing terminal, the target playing signaling to other playing terminals of the playing terminal set except the first playing terminal, such that the other playing terminals execute the playing operation on the target multimedia data synchronously with the first playing terminal at the next moment in response to the target playing signaling, to cause the first playing terminal and the other playing terminals to store decoded target multimedia data or display the decoded target multimedia data stored.

[0009] In a third aspect, the present disclosure provides an electronic device, where the

electronic device includes a memory, a processor, and a computer program stored in the memory and executable on the processor, where the processor, when executing the program, implements the multimedia data synchronous playing method as described in the first aspect.

[0010] In a fourth aspect, the present disclosure provides a computer-readable storage medium having a computer program therein, where the computer program is configured to implement the multimedia data synchronous playing method as described in the first aspect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a schematic diagram of an architecture of a multimedia data synchronous playing system according to some embodiments of the present disclosure.

[0012] FIG. 2 is a flowchart of a multimedia data synchronous playing method according to some embodiments of the present disclosure.

[0013] FIG. 3 is a flowchart of a multimedia data synchronous playing method according to further embodiments of the present disclosure.

[0014] FIG. 4 is a structural schematic diagram of a multimedia data synchronous playing apparatus according to some embodiments of the present disclosure.

[0015] FIG. 5 is a structural schematic diagram of a processing device according to some embodiments of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0016] The present disclosure will be further described in detail with reference to the drawings and embodiments. It can be understood that the specific embodiments described here are only used to explain the present disclosure, but not to limit the present disclosure. In addition, it should be noted that, for the convenience of description, only the parts related to the present disclosure are shown in the drawings.

[0017] It should be noted that the embodiments in the present disclosure and the features in the embodiments can be combined with each other without conflict. The present disclosure will be described in detail with reference to the drawings and embodiments.

[0018] It can be understood that in places such as large conference rooms, gymnasiums, concerts, or rail vehicles, a plurality of playing terminals are usually configured to play multimedia data with different or the same contents, such as videos and pictures, synchronously to meet the needs of participants.

[0019] In a scenario formed by a plurality of playing terminals, due to various factors such as a performance difference of the playing terminal itself, a performance limitation of the playing

server, and a network difference, the plurality of playing terminals cannot achieve a frame-level synchronous playing effect when playing multimedia data.

[0020] For example, taking a video with 60 frames per second (fps) as an example, there are 60 frames per second, with an interval between frames of about 16 ms. Due to performance differences of the playing terminal or the network, a signaling delay is generated, such that a time difference for playing the same frame of data by adjacent playing terminals is more than 16 ms, resulting in playing differences visible to a naked eye.

[0021] Therefore, in the present disclosure, in order to overcome the above defects, a signaling control mechanism of the main playing terminal is arranged, so that the arranged main playing terminal sends control signaling to other playing devices as slave playing terminals, and then so that each slave playing terminal pre-caches the decoded target multimedia data in response to the control signaling sent by the main playing terminal, and then in actual playing, executes the playing operation of the cached data frame synchronously with the main playing terminal in response to the playing signaling of the main playing terminal, thereby minimizing the time difference, for example, within 16 ms, and finally, achieving the frame-level synchronous playing effect of multimedia data.

[0022] FIG. 1 is a schematic diagram of a system architecture of a playing terminal set according to the present disclosure. As shown in FIG. 1, the system may include a playing terminal set, that is, a plurality of players as playing terminals.

[0023] Alternatively, in other embodiments, the system may further include a background server, that is, in a scenario of a network video stream, the background server is configured to provide a target multimedia data video stream. In addition, the background server may send the created playlist information to each playing terminal.

[0024] In a process of playing multimedia data by the playing terminal set, the main playing terminal, that is, a main player, sends playing signaling to other playing terminals of the playing terminal set as slave players, thereby controlling other slave players to follow the playing progress of the main player, and finally achieving synchronous playing of multimedia data.

[0025] It can also be understood that in the embodiment of the present disclosure, in order to enable each slave playing terminal to quickly respond to the playing signaling of the main playing terminal, thereby achieving frame-level synchronous playing of the multimedia content by a plurality of playing terminals, a local area network of a plurality of playing terminals can be arranged, such that the plurality of playing terminals are in the same local area network.

[0026] For example, a local area network can be constructed, such that the plurality of playing terminals are in the constructed local area network. Alternatively, a public network may be used

to ensure that the performance is sufficient to meet a rapid response of the control signaling.

[0027] It can also be understood that in the scenario where each playing terminal needs to play different multimedia contents synchronously, position information of each playing terminal may also be configured, so that respective multimedia contents can be played correspondingly according to the position information of each playing terminal.

[0028] In order to better understand the multimedia data synchronous playing method provided by the present disclosure, the following is described in detail with reference to the drawings.

[0029] FIG. 2 is a flowchart of the multimedia data synchronous playing method according to some embodiments of the present disclosure, as shown in FIG. 2.

[0030] The method may be specifically applied to any playing terminal of the playing terminal set shown in FIG. 1, such as a first playing terminal. The method specifically includes the following steps.

[0031] In S110, the playlist information is acquired by the first playing terminal. The playlist information is used for indicating target multimedia data to be played by each playing terminal of a playing terminal set, the playing terminal set includes two or more playing terminals, and the first playing terminal is any playing terminal of the playing terminal set.

[0032] In S120, when the first playing terminal is a main playing terminal at a current moment, the target playing signaling is generated by the first playing terminal based on a playing progress of the target multimedia data at the current moment. The target playing signaling instructs each playing terminal of the playing terminal set to execute a playing operation on the target multimedia data at a next moment.

[0033] In S130, the target playing signaling is sent by the first playing terminal as the main playing terminal to other playing terminals of the playing terminal set except the first playing terminal, such that the other playing terminals execute the playing operation on the target multimedia data synchronously with the first playing terminal at the next moment in response to the target playing signaling, to cause the first playing terminal and the other playing terminals to cache the decoded target multimedia data or display the pre-decoded target multimedia data.

[0034] Specifically, in some embodiments of the present disclosure, the playing terminal set as shown in FIG. 1 can create a playlist first, that is, the playlist information of the target multimedia data is configured for each playing terminal.

[0035] The playlist information may be a directory to be played, that is, indicating target multimedia data to be played by each playing terminal of the playing terminal set, specifically including identification information and playing time information of the target multimedia data, such as the name of each target multimedia data and the corresponding playing time information.

[0036] For example, the playlist information includes the names of a plurality of target multimedia data and the corresponding playing time, or for a network video, the playlist information may include an access address of the target multimedia data and the corresponding time.

[0037] The target multimedia data may include data such as a video, an image, a text, and a voice.

[0038] In addition, when different playing terminals play different multimedia contents, the playlist information further includes position information. The position information indicates an identifier of the playing terminal that plays the target multimedia data.

[0039] The playlist information may be pre-generated according to content information and time information of the target multimedia data and stored in each playing terminal, and for example, may be stored on a background server and then distributed to all playing terminals.

[0040] Further, when any playing terminal of the playing terminal set is the main playing terminal at the current moment, the first playing terminal may generate the target playing signaling based on the playing progress of the target multimedia data at the current moment. For example, based on the fact that the target multimedia data is currently in the non-playing process or in the playing process, a target playing instruction is generated.

[0041] The generated target playing signaling is used to control other playing terminals of the playing terminal set except the main playing terminal, that is, instruct the playing terminals of the playing terminal set to perform the playing operation on the target multimedia data at the next moment.

[0042] For example, the target playing signaling instructs to start playing the downloading and decoding operations of the target multimedia data in the playlist information at the next moment; or start playing a specific data frame in the target multimedia data at the next moment.

[0043] The main playing terminal at the current moment may be a pre-configured fixed playing terminal. For example, any playing terminal of the playing terminal set can be pre-configured as the main playing terminal, such as the first playing terminal.

[0044] Alternatively, the main playing terminal at the current moment may be the playing terminal determined by a real-time election mechanism, which is determined, for example, according to the hardware performance (such as performance parameters such as the remaining storage space or the processing speed at the current moment) of each playing terminal in real time. Alternatively, the main playing terminal may be determined according to a predetermined election mechanism. For example, each playing terminal is encoded, and then the terminal which is encoded early is determined as the main playing terminal according to an encoding order.

[0045] Finally, the first playing terminal may send the target playing signaling to other playing terminals of the playing terminal set, such that the playing terminal receiving the target playing signaling follows the main playing terminal at the current moment to execute the playing operation of the target content in the target multimedia data indicated by the target playing signaling, thereby keeping synchronous playing with the main playing terminal.

[0046] It can be understood that in the embodiment of the present disclosure, in a multimedia playing process, after each playing terminal of the playing terminal set receives the playlist information, the playing terminal, as the main playing terminal at the current moment, generates target playing signaling instructing each playing terminal to execute a playing operation on the target multimedia data at a next moment, according to the playlist information based on the playing progress of the target multimedia data to be played which is indicated in the playlist information, and sends the target playing signaling to other playing terminals of the playing terminal set. After receiving the target playing signaling, other playing terminals of the playing terminal set execute the playing operation indicated by the target playing signaling on the target multimedia data synchronously with the main playing terminal at the next moment in response to the target playing signaling, such that each playing terminal can pre-cache the decoded target multimedia data or directly display the pre-cached decoded target multimedia data. In this way, on the basis of pre-storing the decoded multimedia data, each playing terminal can achieve synchronous playing of all playing terminals of the playing terminal set based on control of the main playing terminal, thereby avoiding a time difference when the multimedia content is played on each playing terminal due to differences in device performance and network performance of each playing terminal, avoiding restrictions on the number of accessed playing terminals, wiring networks and servers when the multimedia content is transmitted to each playing terminal after being uniformly decoded by the same server, resulting in the reduced device cost, and improved user experience.

[0047] That is, when the main playing terminal sends playing signaling to other playing terminals as slave players to control other playing terminals, the time difference is controlled to be minimized, for example, within 16 ms, so that the frame-level synchronous playing effect of multimedia data can be achieved.

[0048] Optionally, in some embodiments of the present disclosure, in order to avoid a slow multimedia data playing rate or even a playing failure caused by a failure of the main playing terminal or a performance limitation in the case of the main playing terminal being fixedly arranged, a real-time election mechanism of the main playing terminal is arranged, so that other main playing terminals can be elected as the main playing terminal at the current moment in time

after the main playing terminal is disconnected.

[0049] That is, after each playing terminal acquires the playlist information, an execution process of the method may further include an operation step of determining the main playing terminal at the current time, specifically including the following steps.

[0050] In S115, the first playing terminal acquires quasi-playing signaling sent by other playing terminals. The quasi-playing signaling is generated based on the playing progress of the target multimedia data at the current moment, and the quasi-playing signaling includes priority information.

[0051] In S116, the first playing terminal determines the main playing terminal of the playing terminal set at the current moment according to the configured priority information and the priority information in the quasi-playing signaling. The quasi-playing signaling sent by the determined main playing terminal at the current moment is the target playing signaling.

[0052] Specifically, in order to achieve autonomous election of the main playing terminal, the priority information may be set in the playing terminal, and when each playing terminal generates quasi-playing signaling, the quasi-playing signaling carries its own priority information, so that each playing terminal device can automatically identify the main playing terminal with the highest priority according to the configured priority information and the priority information of a sending terminal included in the received quasi-playing signaling sent by other playing terminals.

[0053] It can be understood that when a certain playing terminal is determined as the main playing terminal at the current moment, the quasi-playing signaling sent by the playing terminal is used as the target playing signaling for control of synchronous playing.

[0054] For example, for setting of the priority information, the priorities of all the playing terminals may be ranked according to the device performance of all playing terminals, and the playing terminal with better device performance is defined as the highest priority, that is, when multimedia data synchronous playing is performed, the playing terminal as the main playing terminal sends the control signaling to other slave playing terminals.

[0055] Alternatively, when the device performance of all playing terminals is consistent, the priorities of all playing terminals may be directly defined. For example, an identification code of each playing terminal is configured, and the priority is defined according to the identification code, such as an order from the smallest identification code to the largest identification code, as the priority order of each playing terminal.

[0056] In the embodiment, when the first playing terminal receives playing signaling including the priority information, a current main playing terminal priority and a locally set priority are

compared. If the current main playing terminal priority is less than the locally set priority, a main machine signaling of a local machine is sent, and the local machine is set as the main machine. If the current main playing terminal priority is greater than the locally set priority, the terminal receiving the sent signaling is set as the main machine.

[0057] For example, after the first playing terminal receives the quasi-playing signaling of each playing terminal, the main playing terminal of the playing terminal set at the current time can be determined according to the priority information in the quasi-playing signaling and its own priority information.

[0058] If the received priority information in each of all quasi-playing signaling is lower than the priority information of the first playing terminal itself, such as the priority number, the first playing terminal may determine itself as the main playing terminal of the playing terminal set at the current moment.

[0059] Otherwise, the playing terminal with the highest level in the priority information is determined as the main playing terminal at the current moment. If the second playing terminal of the playing terminal set is determined as the main playing terminal, it indicates that all playing terminals of the playing terminal set follow the second playing terminal to execute a playing operation on the target multimedia data at the next moment.

[0060] It can be understood that in the present disclosure, in a process of playing multimedia data synchronously by the playing terminal set, the main playing terminal is set to be automatically elected, so that the main playing terminal determined at the last moment can still be automatically restored when being disconnected without affecting synchronous playing.

[0061] Optionally, in some embodiments of the present disclosure, after the second playing terminal is determined as the main playing terminal at the current moment, other playing terminals may follow playing signaling of the second playing terminal to execute the playing operation on the target multimedia data.

[0062] That is, when the second quasi-playing signaling instructs each playing terminal of the playing terminal set to execute the playing operation on the target multimedia data at a next moment, and when the determined main playing terminal at the current moment is a second playing terminal of the playing terminal set, the method further includes the following steps.

[0063] In S140, the first playing terminal uses the quasi-playing signaling sent by the second playing terminal as the target playing signaling, and executes the playing operation on the target multimedia data at the next moment.

[0064] Specifically, in the embodiment of the present disclosure, when the second playing terminal is determined to be the main playing terminal at the current moment according to the

priority information, the other playing terminals, such as the first playing terminal, can first use the received quasi-playing signaling sent by the second playing terminal as the target playing signaling when following the second playing terminal to execute the playing operation on the target multimedia data, and then execute the playing operation on the target multimedia data in response to the quasi-playing signaling sent by the second playing terminal as the target playing signaling.

[0065] It can be understood that in the embodiment of the present disclosure, any playing terminal of the playing terminal set can be determined as the main playing terminal through its own election mechanism, thereby achieving synchronous playing of the target multimedia data.

[0066] It can also be understood that in the embodiment of the present disclosure, after each playing terminal acquires the playlist information, if the target multimedia data indicated by the playlist information is a local file, each playing terminal can acquire the target multimedia data in advance. Otherwise, only the playing terminal as the main playing terminal acquires the target multimedia data of the non-local file, and then caches the target multimedia data after decoding the target multimedia data. However, other playing terminals as slave playing terminals wait for the data frame of the decoded target multimedia data distributed by the main playing terminal. That is, when the target multimedia data is a non-local file, such as a network video stream, each slave playing terminal does not need to download and decode the target multimedia data, but the main playing terminal directly distributes the target multimedia data after decoding the target multimedia data.

[0067] Optionally, in some embodiments of the present disclosure, in a process of controlling the playing progress of the target multimedia data by using the main playing terminal, the target playing signaling generated by the main playing terminal or the received quasi-playing signaling may be start signaling, frame data signaling or playing frame signaling.

[0068] That is, when the first playing terminal is used as the main playing terminal, various types of playing signaling may be generated specifically according to the current playing progress of the target multimedia data and the source of the target multimedia data when achieving a controlling operation on other slave playing terminals.

[0069] As shown in FIG. 3, the following steps are specifically included.

[0070] When the target multimedia data is not played, the first playing terminal generates start signaling according to the playlist information. The start signaling is used for instructing each playing terminal to execute a preparation playing operation on the target multimedia data.

[0071] When the target multimedia data is in the playing process, the first playing terminal generates playing frame signaling according to a frame to be played at the next moment in the

target multimedia data. The playing frame signaling is used for instructing each playing terminal to execute a displaying operation on the frame to be played at the next moment.

[0072] Specifically, after each playing terminal receives the generated playlist information, when a specific target multimedia data needs to be played synchronously, the start signaling may be generated according to the playlist information, such as the identifier and the playing time of the target multimedia data, based on the playing progress of the target multimedia data.

[0073] For example, in a manner of timing, when a set duration of the playing time approaches, the playing terminal is triggered to execute an election operation of the main playing terminal, that is, the start signaling for the target multimedia data content is generated and sent to the other playing terminals of the playing terminal set.

[0074] That is, when the target multimedia data is not played, the quasi-playing signaling may be start signaling, which may include identification information of the target multimedia data and priority information of the playing terminal. The identification information may be information such as the name or the access address. Alternatively, when a part of the target multimedia data is played by different playing terminals, the quasi-playing signaling further includes position information.

[0075] It can be understood that after the first playing terminal generates the start signaling, the start signaling may be further sent to other playing terminals to indicate the other playing terminals to decode and cache the target multimedia data in response to the start signaling.

[0076] Further, when the target multimedia data is in the playing process, the first playing terminal, as the main playing terminal at the current moment, may generate playing frame signaling according to the playing process at the current moment, that is, according to the frame to be played at the next moment in the target multimedia data. The playing frame signaling is used for instructing each playing terminal of the playing terminal set to play the data frame at the next moment.

[0077] That is, when the target multimedia data is in the playing process, the first playing terminal, as the main playing terminal at the current moment, may generate the playing frame signaling according to the playlist information and the playing progress of the target multimedia data when playing signaling is sent so that the target multimedia data is played synchronously by all the playing terminals of the playing terminal set. The playing frame signaling may include an identifier of the target multimedia data and the frame to be played at the next moment, that is, a Presentation Time Stamp (PTS) of the target frame.

[0078] In some embodiments of the present disclosure, when the first playing terminal is still the main playing terminal at the current moment, after the first playing terminal sends the start

signaling to other playing terminals, playing frame signaling or frame data signaling may be generated according to the type of the target multimedia data.

[0079] For example, when the target multimedia data is a non-local file, that is, a network file, after the first playing terminal sends the start signaling to other playing terminals, the playing content of the target multimedia data may be acquired from the server. After the acquired playing content is decoded, frame data signaling may be generated based on the decoded playing content, thereby distributing the decoded playing content to each playing terminal.

[0080] For another example, when the target multimedia data is a local file, after the first playing terminal sends the start signaling to the other playing terminals, the first playing terminal may further enter a waiting state, and wait for each playing terminal to execute a decoding operation on the target multimedia data. Further, when the waiting duration is up to the set time, such as 10 ms, the target multimedia data may be played, that is, the target multimedia data can be sent to each playing terminal according to the playing frame signaling of a data frame in the target multimedia data and the playlist information.

[0081] That is, the main playing terminal determines the type of the current target multimedia data, such as video resources. If the current target multimedia data is a local file, the main playing terminal waits for a period of time (for example, according to the size of the local file, the period of time is generally set about 1 to 200 ms), and starts playing after all terminals have preloaded the corresponding video resource frames, that is, generating playing frame signaling.

[0082] It can be understood that in the above embodiment, for the target multimedia data, the first playing terminal as the main playing terminal, can first generate start signaling according to the playlist information, so as to indicate each playing terminal to prepare for playing the target multimedia data. That is, when the target multimedia data is a local file, each playing terminal can start the decoding operation of the target multimedia data in response to the start signaling. When the target multimedia data is a non-local file, each playing terminal can enter a waiting state to wait for frame data signaling sent (including the decoded content of the target multimedia data) by the main playing terminal in response to the start signaling. Further, the playing process of the target multimedia data can start. That is, after the first playing terminal finishes the set waiting duration or sends the frame data signaling to each playing terminal, the first playing terminal can send playing frame signaling for each data frame in the target multimedia data to each playing terminal, so that each playing terminal can execute a frame playing operation synchronized with the main playing terminal according to the indication of the playing frame signaling, and finally achieve a goal of frame-level synchronous playing, thereby avoiding an image difference during playing of a plurality of playing terminals and a limitation

that the server performs unified decoding.

[0083] Optionally, in some embodiments of the present disclosure, when it is determined that the main playing terminal at the current moment is the second playing terminal of the playing terminal set, the first playing terminal, as a slave playing terminal, can follow the second playing terminal to execute the playing operation on the target multimedia data.

[0084] That is, as shown in FIG. 3, in this scenario, when the first playing terminal plays the target multimedia data in response to the quasi-playing signaling sent by the second playing terminal, the playing operation is executed on the target multimedia data specifically according to the type of the quasi-playing signaling.

[0085] If the quasi-playing signaling sent by the second playing terminal is start signaling, when the target multimedia data is a local file, the first playing terminal decodes the target multimedia data and caches the decoded target multimedia data in response to the start signaling sent by the second playing terminal.

[0086] If the quasi-playing signaling sent by the second playing terminal is playing frame signaling, the first playing terminal executes a displaying operation on the frame to be played which is indicated in the playing frame signaling in response to the playing frame signaling sent by the second playing terminal.

[0087] If the quasi-playing signaling sent by the second playing terminal is frame data signaling, the first playing terminal caches the decoded target multimedia data in the received frame data signaling in response to the frame data signaling sent by the second playing terminal.

[0088] Specifically, when the first playing terminal determines that the main playing terminal at the current moment is the second playing terminal, that is, when the first playing terminal at the current moment is used as a slave playing terminal, after the quasi-playing signaling sent by the second playing terminal is received, the type of the quasi-playing signaling can be determined first, and then the corresponding playing operation is executed according to the determined type and the content carried in the quasi-playing signaling.

[0089] For example, as shown in FIG. 3, in some embodiments, when the quasi-playing signaling is start signaling, the first playing terminal further determines whether the target multimedia data is a local file.

[0090] If the target multimedia data is a local file, the first playing terminal acquires the target multimedia data, decodes the content of the target multimedia data after acquiring the target multimedia data, and finally caches the decoded target multimedia data.

[0091] Otherwise, the first playing terminal enters a waiting state. That is, if the target multimedia data is a non-local file, the first playing terminal waits to acquire the frame data

signaling (including the playing content of the target multimedia data) sent by the main playing terminal, that is, the second playing terminal.

[0092] That is, according to the start signaling, the resource information and the currently played PTS are acquired. The video resources are analyzed. The key frames closest to the PTS are located to start decoding, and the video frames are stored in the cache queue, waiting for the playing frame signaling to play the video.

[0093] For another example, as shown in FIG. 3, if the received quasi-playing signaling is not start signaling, it is further determined whether the received quasi-playing signaling is playing frame signaling.

[0094] If the quasi-playing signaling is playing frame signaling, after the first playing terminal receives the playing frame signaling, the first playing terminal executes a displaying operation on the frame to be played that is indicated in the playing frame signaling in response to the playing frame signaling sent by the second playing terminal.

[0095] That is, the first playing terminal compares identification information in the received playing frame signaling with identification information of the frame to be played at the next moment in a cache queue, and time information in the received playing frame signaling with time information of the frame to be played at the next moment in the cache queue.

[0096] If the identification information of the above both are the same, and the time information in the playing frame signaling is earlier than or equal to the time information of the frame to be played at the next moment in the cache queue, the first playing terminal executes the displaying operation on the frame to be played at the next moment in the target multimedia data.

[0097] Otherwise, the first playing terminal deletes the frame to be played at the next moment in the cache queue.

[0098] For example, the first playing terminal can first compare identification information of the frame to be played at the next moment in the received frame to be played with identification information of the frame to be played at the next moment in the cache queue, and time information of the frame to be played at the next moment in the received frame to be played with time information of the frame to be played at the next moment in the cache queue.

[0099] Further, if the identification information of the frame to be played at the next moment in the received frame to be played is the same as the identification information of the frame to be played at the next moment in the cache queue, and the time information of the received frame to be played at the next moment is earlier than or equal to the time information of the frame to be played at the next moment in the cache queue, the displaying operation is executed on the frame to be played at the next moment in the target multimedia data. Otherwise, the frame to be played

at the next moment in the cache queue is deleted.

[0100] That is, the first playing terminal may determine whether the current cache resource is consistent with the signaling resource according to the data information (that is, identification information) and the time information of the frame to be played in the playing frame signaling, and compare the PTS in the signaling with the PTS of the frame in the cache queue. If the received PTS is greater than or equal to the PTS of the cache frame, the current frame is immediately played and moved out of the cache queue. If the resources are inconsistent or the PTS in the cache queue does not meet the requirements, the cache queue can be emptied, and target multimedia data, such as video resources, can be reloaded according to the type of resources.

[0101] Further, as shown in FIG. 3, if the received quasi-playing signaling is not the start signaling or the playing frame signaling, but the frame data signaling, it indicates that the decoded content to be played sent by the main playing terminal (that is, the second playing terminal) to the non-local file is received. At this time, the first playing terminal can cache the content to be played in the frame data signaling, thereby taking out the corresponding data frame from the cache queue and executing the playing operation after receiving the playing frame signaling in the later stage.

[0102] In addition, as shown in FIG. 3, in some embodiments of the present disclosure, a dynamic real-time election mechanism is implemented for the main playing terminal. That is, in the scenario where the second playing terminal is the main playing terminal, when the playing signaling of the second playing terminal is not received within a predetermined duration, for example, after the start signaling sent by the second playing terminal is received, the frame data signaling or the playing frame signaling sent by the second playing terminal is not received within a predetermined duration, and it indicates that the main playing terminal at the current moment, that is, the second playing terminal, is disconnected.

[0103] In this case, a main playing terminal election mechanism of each playing terminal may be triggered. That is, each playing terminal may generate quasi-playing signaling, such as frame data signaling or playing frame signaling, according to the playlist information and the playing progress of the target multimedia data, and broadcast the quasi-playing signaling to other playing terminals to re-determine the main playing terminal at the current moment, thereby ensuring normal playing of the target multimedia data.

[0104] It can be understood that in the embodiment of the present disclosure, in a multimedia playing process, after each playing terminal of the playing terminal set receives the playlist information, the playing terminal as the main playing terminal at the current moment, according

to the playlist information, generates target playing signaling that indicates a playing operation at a next moment, and sends the target playing signaling to other playing terminals of the playing terminal set, so that after receiving the target playing signaling, other playing terminals may execute the playing operation indicated by the target playing signaling on the target multimedia data synchronously with the main playing terminal at the next moment in response to the target playing signaling. In this way, synchronous playing of all playing terminals in the playing terminal set is achieved, thereby avoiding a time difference when the multimedia content is played on each playing terminal due to differences in device performance and network performance of each playing terminal, and avoiding restrictions on the number of accessed playing terminals, wiring networks and servers when the multimedia content is transmitted to each playing terminal for playing after being uniformly decoded by the same server. That is, in the present disclosure, a control mechanism of the main playing terminal is arranged, so that one of the playing terminals is used as the main playing terminal to control other playing terminals to execute a synchronous playing operation, thereby achieving frame-level synchronous playing of each playing terminal, reducing the device cost, and improving user experience.

[0105] That is, a plurality of terminals can achieve a frame-level synchronous playing effect without a server. In addition, the main playing terminal is automatically elected, and the machine is automatically restored when being disconnected without affecting synchronous playing. Moreover, a decoding operation is dispersed to each terminal, which can support a large-scale multi-screen synchronous playing, synchronous playing of network video streams, and synchronous playing of a live video by a plurality of terminals.

[0106] In another aspect, the embodiment of the present disclosure further provides a multimedia data synchronous playing apparatus, as shown in FIG. 4. The apparatus includes as follow.

[0107] A first acquiring module 210 is configured to acquire playlist information by a first playing terminal. The playlist information is used for indicating target multimedia data to be played by each playing terminal of a playing terminal set, the playing terminal set includes two or more playing terminals, and the first playing terminal is any playing terminal of the playing terminal set.

[0108] A generating module 220 is configured to, when the first playing terminal is a main playing terminal at a current moment, generate, by the first playing terminal, target playing signaling based on a playing progress of the target multimedia data at the current moment. The target playing signaling instructs each playing terminal of the playing terminal set to execute a playing operation on the target multimedia data at a next moment.

[0109] A sending module 230 is configured to send, by the first playing terminal as the main playing terminal, the target playing signaling to other playing terminals of the playing terminal set except the first playing terminal, such that the other playing terminals execute the playing operation on the target multimedia data synchronously with the first playing terminal at the next moment in response to the target playing signaling, to cause the first playing terminal and the other playing terminals to cache the decoded target multimedia data or display the pre-decoded target multimedia data.

[0110] Optionally, after the first playing terminal acquires the playlist information, the multimedia data synchronous playing apparatus provided by the present disclosure further includes as follow.

[0111] A second acquiring module 240 is configured to acquire, by the first playing terminal, quasi-playing signaling sent by other playing terminals. The quasi-playing signaling is generated based on the playing progress of the target multimedia data at the current moment, and the quasi-playing signaling includes priority information.

[0112] A determining module 250 is configured to determine, by the first playing terminal, the main playing terminal of the playing terminal set at the current moment according to the configured priority information and the priority information in the quasi-playing signaling. The quasi-playing signaling sent by the determined main playing terminal at the current moment is the target playing signaling.

[0113] Optionally, when the determined main playing terminal at the current moment is a second playing terminal, the second playing terminal is any playing terminal of the playing terminal set except the first playing terminal, and the multimedia data synchronous playing apparatus provided by the present disclosure further includes as follow.

[0114] A playing module 260 is configured to use, by the first playing terminal, the quasi-playing signaling sent by the second playing terminal as the target playing signaling, and execute the playing operation on the target multimedia data at the next moment.

[0115] Optionally, when the first playing terminal is the main playing terminal at the current moment, the generating module of the multimedia data synchronous playing apparatus provided by the present disclosure is specifically configured to:

when the target multimedia data is not played, generate, by the first playing terminal, start signaling according to the playlist information, where the start signaling is used for instructing each playing terminal to execute a preparation playing operation on the target multimedia data; and when the target multimedia data is in the playing process, generate, by the first playing terminal, playing frame signaling according to a frame to be played at the next moment in the

target multimedia data, where the playing frame signaling is used for instructing each playing terminal to execute a displaying operation on the frame to be played at the next moment.

[0116] Optionally, when the first playing terminal is the main playing terminal at the current moment, and the content to be played of the target multimedia data is a non-local file, the generating module of the multimedia data synchronous playing apparatus provided by the present disclosure is further configured to: if the target multimedia data is not played, acquire the target multimedia data, and decode the target multimedia data by the first playing terminal; and generate frame data signaling according to the decoded target multimedia data, where the frame data signaling includes the decoded target multimedia data.

[0117] Optionally, if the second playing terminal is the main playing terminal at the current moment, the playing module of the multimedia data synchronous playing apparatus provided by the present disclosure is specifically configured to: if the quasi-playing signaling sent by the second playing terminal is start signaling, when the target multimedia data is a local file, decode the target multimedia data and cache the decoded target multimedia data by the first playing terminal in response to the start signaling sent by the second playing terminal; if the quasi-playing signaling sent by the second playing terminal is playing frame signaling, execute a displaying operation on the frame to be played that is indicated in the playing frame signaling by the first playing terminal in response to the playing frame signaling sent by the second playing terminal; and if the quasi-playing signaling sent by the second playing terminal is frame data signaling, cache the decoded target multimedia data in the received frame data signaling by the first playing terminal in response to the frame data signaling sent by the second playing terminal.

[0118] Optionally, the playing frame signaling includes identification information and time information of the frame to be played at the current moment, the playing module of the multimedia data synchronous playing apparatus provided by the present disclosure is specifically configured to: compare identification information in the received playing frame signaling with identification information of the frame to be played at the next moment in a cache queue, and time information in the received playing frame signaling with time information of the frame to be played at the next moment in the cache queue by the first playing terminal; if the identification information of the above both are the same, and the time information in the playing frame signaling is earlier than or equal to the time information of the frame to be played at the next moment in the cache queue, execute the displaying operation on the frame to be played at the next moment in the target multimedia data by the first playing terminal; and otherwise, delete the frame to be played at the next moment in the cache queue by the first playing terminal.

[0119] In another aspect, a processing device provided by the embodiment of the present disclosure further includes a memory, a processor, and a computer program stored in the memory and executable on the processor, where the processor, when executing the program, implements an operation and maintenance method of an energy storage power station device as described above.

[0120] Next, reference is made to FIG. 5. FIG. 5 is a structural schematic diagram of a processing device according to an embodiment of the present disclosure.

[0121] As shown in FIG. 5, the processing device includes a Central Processing Unit (CPU) 301, which can perform various appropriate actions and processes according to a program stored in a Read-Only Memory (ROM) 302 or a program loaded into a Random Access Memory (RAM) 303 from a storage part 308. Various programs and data required for the operation of the electronic device 300 are also stored in the RAM 303. The CPU 301, the ROM 302, and the RAM 303 are connected to each other through a bus 304. An input/output (I/O) interface 305 is also connected to the bus 304. In some embodiments, the following components are connected to the I/O interface 305, including: an input part 306 such as a keyboard and a mouse; an output part 307 such as a Cathode Ray Tube (CRT), a Liquid Crystal Display (LCD), and a speaker; a storage part 308 such as a hard disk; and a communication part 309 including a network interface card such as a local area network (LAN) card and a modem. The communication part 309 performs communication processing via a network such as the Internet. A driver 310 is also connected to the I/O interface 305 as needed. A removable medium 311, such as a magnetic disk, an optical disk, a magneto-optical disk, and a semiconductor memory, is installed on the driver 310 as needed, so that a computer program read from the removable medium can be installed into the storage part 308 as needed. In particular, according to an embodiment of the present disclosure, a process described above with reference to the flowchart can be implemented as a computer software program. For example, an embodiment of the present disclosure includes a computer program product, which includes a computer program carried on a machine-readable medium. The computer program contains a program code for executing the method shown in the flowchart. In such an embodiment, the computer program can be downloaded and installed from the network through the communication part 309 and/or installed from the removable medium 311. When the computer program is executed by the Central Processing Unit (CPU) 301, the above functions defined in the electronic device of the present disclosure are performed.

[0122] It should be noted that the computer-readable medium shown in the present disclosure may be a computer-readable signal medium, or a computer-readable storage medium, or any combination of the computer-readable signal medium and the computer-readable storage

medium. The computer-readable storage medium may be, for example, but not limited to, an electronic device, apparatus or component based on electricity, magnetism, optics, electromagnetism, an infrared ray, or a semiconductor, or a combination of any of the above. More specific examples of the computer-readable storage medium may include, but are not limited to, an electrical connection with one or more wires, a portable computer disk, a hard disk, a Random Access Memory (RAM), a Read-Only Memory (ROM), an Erasable Programmable Read-Only Memory (EPROM or a flash memory), an optical fiber, a portable Compact Disk Read-Only Memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the above. In the present disclosure, the computer-readable storage medium may be any tangible medium containing or storing a program. The program may be used by or in combination with a signaling execution electronic device, apparatus or component. In the present disclosure, the computer-readable signal medium may include a data signal propagated in a baseband or as a part of a carrier wave, in which a computer-readable program code is carried. The propagated data signal may use many forms, including but not limited to electromagnetic signals, optical signals or any suitable combination of the above. The computer-readable signal medium may also be any computer-readable medium except the computer-readable storage medium. The computer-readable medium may send, propagate or transmit a program which is used by or in combination with the signaling execution electronic device, apparatus or component. The program code contained in the computer-readable medium may be transmitted by any suitable medium, including but not limited to: a wireless, a wire, an optical cable, a radio frequency (RF), and the like, or any suitable combination of the above.

[0123] The flowcharts and block diagrams in the drawings illustrate an architecture, a function, and an operation that may be possibly implemented by the processing device, the method, and the computer program product according to various embodiments of the present disclosure. In this regard, each block in the flowchart or the block diagram may represent a module, a program segment, or a part of the code. The module, the program segment, or a part of the code contains one or more executable signaling for implementing specified logical functions. It should also be noted that in some alternative implementations, the functions noted in the blocks may occur in a different order than those noted in the drawings. For example, two blocks shown in succession may actually be executed substantially in parallel, and may sometimes be executed in a reverse order, depending on the functions involved. It should also be noted that each block in the block diagram and/or flowchart, and the combination of blocks in the block diagram and/or flowchart, may be achieved by a dedicated hardware-based electronic device that executes specified functions or operations, or may be implemented by a combination of dedicated hardware and

computer signaling.

[0124] The units or modules described in the embodiment of the present disclosure may be implemented by software or hardware. The described unit or module may also be arranged in a processor, which may, for example, be described as a processor including an acquiring module, a generation module, and a sending module. The names of these units or modules do not constitute the limitation of the unit or module itself in some cases. For example, the sending module may also be described as "being configured to send, by the first playing terminal as the main playing terminal, the target playing signaling to playing terminals of the playing terminal set except the first playing terminal, such that the other playing terminals execute the playing operation on the target multimedia data synchronously with the first playing terminal at the next moment in response to the target playing signaling, and such that the first playing terminal and other playing terminals cache the decoded target multimedia data or display the pre-decoded target multimedia data".

[0125] In another aspect, the present disclosure further provides a computer-readable storage medium. The computer-readable storage medium may be included in the electronic device described in the above embodiment, or exist alone without being assembled into the electronic device. The computer-readable storage medium stores one or more computer programs. The one or more processors, when executing the computer program, implement the multimedia data synchronous playing method described in the present disclosure, which includes: acquiring, by a first playing terminal, playlist information, where the playlist information is used for indicating target multimedia data to be played by each playing terminal of a playing terminal set, the playing terminal set includes two or more playing terminals, and the first playing terminal is any playing terminal of the playing terminal set; when the first playing terminal is a main playing terminal at a current moment, generating, by the first playing terminal, target playing signaling based on a playing progress of the target multimedia data at the current moment, where the target playing signaling instructs each playing terminal of the playing terminal set to execute a playing operation on the target multimedia data at a next moment; and sending, by the first playing terminal as the main playing terminal, the target playing signaling to other playing terminals of the playing terminal set except the first playing terminal, such that the other playing terminals execute the playing operation on the target multimedia data synchronously with the first playing terminal at the next moment in response to the target playing signaling, and such that the first playing terminal and the other playing terminals cache the decoded target multimedia data or display the pre-decoded target multimedia data.

[0126] The above description is only the preferred embodiment of the present disclosure and the

explanation of the applied technical principles. It should be understood by those skilled in the art that the scope involved in the present disclosure is not limited to the technical solution formed by the specific combination of the above technical features, but also covers other technical solutions formed by any combination of the above technical features or the equivalent features without departing from the foregoing concept of the present disclosure. For example, the above features are replaced with (but not limited to) technical features with similar functions disclosed in the present disclosure.

WHAT IS CLAIMED IS:

1. A multimedia data synchronous playing method, wherein the method comprises:

acquiring, by a first playing terminal, playlist information, wherein the playlist information is used for indicating target multimedia data to be played by each playing terminal of a playing terminal set, the playing terminal set comprises two or more playing terminals, and the first playing terminal is any playing terminal of the playing terminal set;

when the first playing terminal is a main playing terminal at a current moment, generating, by the first playing terminal, target playing signaling based on a playing progress of the target multimedia data at the current moment, wherein the target playing signaling instructs each playing terminal of the playing terminal set to execute a playing operation on the target multimedia data at a next moment; and

sending, by the first playing terminal as the main playing terminal, the target playing signaling to other playing terminals of the playing terminal set except the first playing terminal, such that the other playing terminals execute the playing operation on the target multimedia data synchronously with the first playing terminal at the next moment in response to the target playing signaling, to cause the first playing terminal and the other playing terminals to cache decoded target multimedia data or display pre-decoded target multimedia data.

2. The multimedia data synchronous playing method according to claim 1, wherein the method further comprises: after the playlist information is acquired by the first playing terminal, and before executing the playing operation on the target multimedia data,

acquiring, by the first playing terminal, quasi-playing signaling sent by the other playing terminals, wherein the quasi-playing signaling is generated based on the playing progress of the target multimedia data at the current moment, and the quasi-playing signaling comprises priority information; and

determining, by the first playing terminal, the main playing terminal of the playing terminal set at the current moment according to configured priority information and the priority information in the quasi-playing signaling, wherein the quasi-playing signaling sent by the determined main playing terminal at the current moment is the target playing signaling.

3. The multimedia data synchronous playing method according to claim 2, wherein when the determined main playing terminal at the current moment is a second playing terminal, the second playing terminal is any playing terminal of the playing terminal set except the first

playing terminal, and the method further comprises:

using, by the first playing terminal, the quasi-playing signaling sent by the second playing terminal as the target playing signaling, and executing the playing operation on the target multimedia data at the next moment.

4. The multimedia data synchronous playing method according to claim 3, wherein when the first playing terminal is the main playing terminal at the current moment, the first playing terminal generating the target playing signaling based on the playing progress of the target multimedia data at the current moment comprises:

when the target multimedia data is not played, generating, by the first playing terminal, start signaling according to the playlist information, wherein the start signaling is used for instructing each playing terminal to execute a preparation playing operation on the target multimedia data; and

when the target multimedia data is in a playing process, generating, by the first playing terminal, playing frame signaling according to a frame to be played at the next moment in the target multimedia data, wherein the playing frame signaling is used for instructing each playing terminal to execute a displaying operation on the frame to be played at the next moment.

5. The multimedia data synchronous playing method according to claim 4, wherein when the first playing terminal is the main playing terminal at the current moment and the target multimedia data is a non-local file, the first playing terminal generating the target playing signaling based on the playing progress of the target multimedia data at the current moment further comprises:

in a case that the target multimedia data is not played, acquiring, by the first playing terminal, the target multimedia data, and decoding the target multimedia data; and

generating frame data signaling according to the decoded target multimedia data, wherein the frame data signaling comprises the decoded target multimedia data.

6. The multimedia data synchronous playing method according to claim 5, wherein when the second playing terminal is the main playing terminal at the current moment, the first playing terminal using the quasi-playing signaling sent by the second playing terminal as the target playing signaling, and executing the playing operation on the target multimedia data at the next moment, comprises:

in a case that the quasi-playing signaling sent by the second playing terminal is the start

signaling, when the target multimedia data is a local file, decoding, by the first playing terminal, the target multimedia data and caching the decoded target multimedia data in response to the start signaling sent by the second playing terminal;

in a case that the quasi-playing signaling sent by the second playing terminal is the playing frame signaling, executing, by the first playing terminal, the displaying operation on a frame to be played that is indicated in the playing frame signaling in response to the playing frame signaling sent by the second playing terminal; and

in a case that the quasi-playing signaling sent by the second playing terminal is the frame data signaling, caching, by the first playing terminal, the decoded target multimedia data in the frame data signaling received, in response to the frame data signaling sent by the second playing terminal.

7. The multimedia data synchronous playing method according to claim 6, wherein the playing frame signaling comprises identification information and time information of the frame to be played at the next moment, and the first playing terminal executing the displaying operation on the frame to be played that is indicated in the playing frame signaling in response to the playing frame signaling sent by the second playing terminal comprises:

comparing, by the first playing terminal, the identification information in the playing frame signaling received with identification information of the frame to be played at the next moment in a cache queue, and the time information in the playing frame signaling received with time information of the frame to be played at the next moment in the cache queue;

in a case that the identification information in the playing frame signaling received is the same as the identification information of the frame to be played at the next moment in the cache queue, and the time information in the playing frame signaling is earlier than or equal to the time information of the frame to be played at the next moment in the cache queue, executing, by the first playing terminal, the displaying operation on the frame to be played at the next moment in the target multimedia data; and

otherwise, deleting, by the first playing terminal, the frame to be played at the next moment in the cache queue.

8. A multimedia data synchronous playing apparatus, wherein the apparatus comprises:

an acquiring module, configured to acquire playlist information by a first playing terminal, wherein the playlist information is used for indicating target multimedia data to be played by each playing terminal of a playing terminal set, the playing terminal set comprises two or more

playing terminals, and the first playing terminal is any playing terminal of the playing terminal set;

a generating module, configured to, when the first playing terminal is a main playing terminal at a current moment, generate, by the first playing terminal, target playing signaling based on a playing progress of the target multimedia data at the current moment, wherein the target playing signaling instructs each playing terminal of the playing terminal set to execute a playing operation on the target multimedia data at a next moment; and

a sending module, configured to send, by the first playing terminal, the target playing signaling to other playing terminals of the playing terminal set except the first playing terminal, such that the other playing terminals execute the playing operation on the target multimedia data synchronously with the first playing terminal at the next moment in response to the target playing signaling, to cause the first playing terminal and the other playing terminals to store decoded target multimedia data or display the decoded target multimedia data stored.

9. An electronic device, wherein the electronic device comprises: a memory, a processor, and a computer program stored in the memory and executable on the processor, wherein the processor, when executing the program, implements the multimedia data synchronous playing method according to any one of claims 1 to 7.

10. A computer-readable storage medium having a computer program stored therein, wherein the computer program is configured to implement the multimedia data synchronous playing method according to any one of claims 1 to 7.