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(71) Applicant: **THOMSON LICENSING** [FR/FR]; 1-5 rue Jeanne d'Arc, F-92130 Issy-les-Moulineaux (FR).

(72) Inventors: **LE GARJAN, Bruno**; c/o Technicolor R&D France, 975 Avenue des Champs Blancs, CS 17616, F-35576 Cesson-Sévigné (FR). **CHERON, Bruno**; c/o Technicolor R&D France, 975 Avenue des Champs Blancs, CS 17616, F-35576 Cesson-Sévigné (FR). **LIANG, Ying**; c/o Technicolor, 8/F, Bld. A, Technology Fortune Center, N°8, Xue Qing Road, Hai Dian District, Beijing (CN).

(74) Agents: **HUCHET, Anne** et al.; TECHNICOLOR, 1-5 rue Jeanne D'Arc, F-92130 Issy-Les-Moulineaux Cedex (FR).

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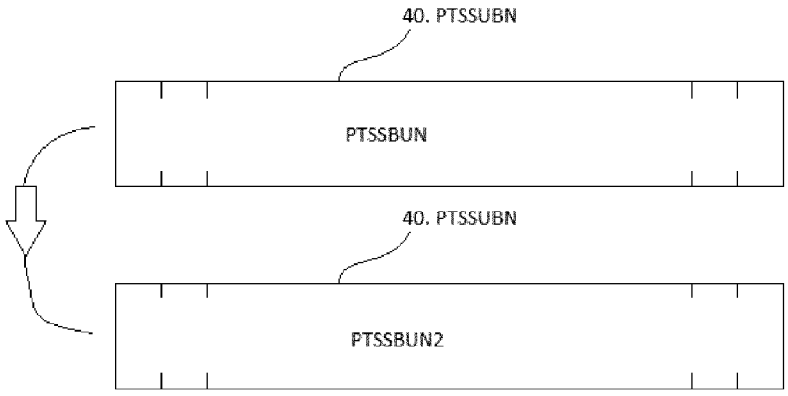

Figure 3

(57) Abstract: The present disclosure relates to a method, in an audiovisual program receiver-decoder device (7) comprising sub-titles intended to be displayed during a restitution step, in a synchronized way with an audio and/or video component of audiovisual programs, the method being characterized in that it comprises reception (S0) of a time stamp (PTSSUBN) corresponding to sub-titling data, analysis (S1) of the time stamp with respect to a reference clock and at least one time interval and determination (S2) of a replacement value of the time stamp (PTSSUBN2) with respect to the clock (PCR) and at least one time interval. The present disclosure also relates to the receiver-decoder device (7) implementing the method.

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METHOD FOR DETERMINING A TIME STAMP RELATING TO SYNCHRONIZATION AND ASSOCIATED DEVICE

1. Field of the present disclosure.

The present disclosure relates to the field of digital television receiver-decoders and more specifically to the restitution of subtitling data with audio/video content.

2. Prior Art.

Digital television receiver-decoder devices enable, in addition to the reception and restitution of components of audio and video type, the reception of related data, such as for example data coding subtitles to be displayed during a restitution step.

During restitution, the displaying of the subtitles is synchronized with the audio and/or video content.

The synchronization of the subtitles does not always require great precision, and most often a subtitle is displayed during the restitution of the corresponding part of the audio component, itself synchronized with the corresponding part of the video component.

For example, when a subject speaks and the video component makes it possible to see this subject speaking, the audio component is synchronized with a level of precision such that the user perceives little of no labial time delay. Subtitles enabling the user to read the corresponding words (the words of the character speaking which appear in this part of the video component) are displayed while the character is expressing himself. The user can then read, for example, as subtitles, the words of the character in the same language or translated to another language. Other times subtitling comprises commentary in correlation with the audio and/or video component, for example for karaoke, or as captions superimposed on images.

The synchronization of the subtitles is done, as for the synchronization of the audio and the video, with reference to a main clock and by the analysis of time stamps comprised in a data stream. The main clock is called the PCR (program clock reference) and the time stamps are called PTSs (presentation time stamps). There are PTS time stamps useful for the synchronization of the audio component, PTS time stamps useful for the synchronization of the video component and PTS time stamps useful for the synchronization of the subtitles. These items of information are respectively called audio PTSs, video PTSs and subtitle PTSs. The acronyms "PTS", "audio PTS", "video PTS", "subtitle PTS" and "PCR" appear in the MPEG2 compression and transport standard (ISO/IEC 13818-1-2-3) and more generally in the DVB digital broadcasting standard used in Europe for the broadcasting of audiovisual content. Their use commonly extends more widely and retains an identical meaning for any broadcasting and restitution system which comprises a synchronization clock (PCR) transmitted in a transport stream and time stamps (PTSs) linked to the restitution of the transmitted audio, video and subtitling components.

In order to optimize the restitution of the subtitles, their content is sometimes transmitted in advance with respect to the corresponding parts of the audio and/or video components. This enables, among other things, the processing of data coding subtitles in advance and guarantees the availability of the data useful for their display at moments defined by the associated time stamps (as a reference with respect to the PCR clock). Generally, the subtitles are restituted at a speed corresponding to a factor of x 1, but sometimes the "display speed" is different as the subtitles are also used during the use of "trick modes", such as slow motion or freeze frame or the use of an accelerated restitution.

Sometimes the time stamps relating to the subtitling are not correctly set up or are corrupted by the data processing and/or transmission chain or are absent at moments when they should have been received with a

view to synchronizing the restitution of a subtitle in a synchronized way with another component of the received stream, such as the video or the audio. The term "restitution" in the following paragraphs designates the delivery of baseband signals enabling the displaying of the decoded data by a display device. Thus, and more generally, the application of decoded audio and/or video to an output interface of a device, with a view to their subsequent processing for audio restitution or display is part of the restitution step implemented by the device.

The restitution errors linked to the absence of a time stamp relating to subtitling data or to an incorrect value may not be systematic and may occur only at certain moments.

Nevertheless, these result in "artefacts" as the subtitles concerned are restituted at the wrong moment or sometimes cannot be restituted.

One error commonly encountered is for example the inversion of the binary element of rank 33 of a subtitle PTS (bit 33) which has a value 1 when it should be 0 and vice versa, without, however, this error being systematic when it appears in an audiovisual program broadcasting system.

The error corresponding to a corruption of bit 33 of the subtitle PTS, the time subtitles synchronization time stamp, may be observed for instance on French broadcasting channels "France 2" and "France 3" and its probability of occurrence seems to be linked to software routines used for the generation and/or the management of subtitles in equipment.

"Corruption" is understood here to mean either an incorrect positioning of bit 33 during the creation of the data stream or the possibility of an accidental modification thereof during subsequent processing by an item of equipment.

Various artefacts result from this probable error of positioning of bit 33 of a subtitle PTS.

In fact, depending on the situation, the corresponding subtitle may not be displayed or may be displayed at an inopportune moment.

In addition, due to an incorrect value, it is possible that a time stamp relating to the subtitling is stored too long in a memory zone (circular

buffer) and ends up being overwritten or that memory is allocated for storing a subtitling time stamp and not then freed up, which can cause a problem of abnormal increase in the memory allocated for subtitling data processing.

3. Summary of the present disclosure.

The present disclosure makes it possible to improve the state of the art by proposing a method aiming to define, at reception of a time stamp relating to the restitution of subtitling data, whether the value of this subtitling time stamp is consistent with respect to other elements, and to correct it, by determination of a new value, if necessary (for example by correction of the state of bit 33).

To do this, the present disclosure relates to a method for correcting synchronization of the components of an audiovisual program, in an audiovisual program receiver-decoder device, said audiovisual program comprising a first component intended to be restituted in a synchronized way with at least one second component of said audiovisual program according to a time stamp of data of said first component.

According to an embodiment of the present disclosure, the method comprises:

- an analysis of said time stamp, comprising a first consistency verification of said time stamp with respect to a reference clock and to at least one first time interval,
- when said time stamp is inconsistent, a determination of a corrected value of said time stamp with respect to said reference clock and to at least one second time interval.
- a replacement of said time stamp with said corrected time stamp.

Thus, the method enables the use of the determined corrected value of the time stamp for the restitution of the data of said first component.

According to a particular embodiment, said second component is an audio and/or video component and said first component is a subtitling of said second component.

According to a particular embodiment of the present disclosure, the reference clock is a program clock reference of one of said audio and/or video components, or in other words, a program clock reference of one of the audio and/or video components transported by a transport stream comprising audio and/or video components.

According to a particular characteristic, said determination comprises an inversion of at least a binary element of determined rank of said time stamp.

According to a particular characteristic, said first consistency verification comprises a comparison:

- of a time interval taking account of a difference between said stamp and a stamp of an item of data, being restituted, of said second component,

- with a significant value.

Thus, the first time interval may for example be defined by the difference, modulo the maximum possible value of a stamp of the first component, between said stamp and the stamp of an item of data, being restituted, of said second component, converted to the same unit of time as the significant value.

According to an embodiment of the present disclosure, wherein the first component is an item of subtitling data of a second audio and/or video component, the first time interval is comprised in a list comprising:

- a maximum duration of storage of the audio and/or video data associated with said time stamp relating to the presentation of subtitles,

- a maximum value of anticipation between the reception of a subtitling time stamp and the instant of display of the video with which the subtitling element is associated.

- a maximum time difference between two successive subtitling time stamps.

The maximum duration of storage of the data depends on the size of the allocated memory zone, the maximum anticipation duration depends

on the transmission point of the transport stream comprising the data and the maximum duration between two successive subtitling time stamps depends on a configuration of the encoding equipment.

According to an embodiment of the present disclosure, the first time interval is an average value of anticipation between the reception of subtitling stamps and the restitution of the data with which it is associated or a storage time for data of an audio or video component in a storage memory.

According to a particular characteristic, the method comprises an evaluation of said corrected stamp, comprising a second consistency verification of said corrected value with respect to said reference clock and to said second time interval.

According to a particular characteristic, said second consistency verification comprises a comparison:

- of a time interval taking account of a difference between said corrected stamp and a stamp of an item of data, being restituted, of said second component,
- with a significant value.

Thus, the second time interval may for example be defined by the difference, modulo the maximum possible value of a stamp of the first component, between said corrected stamp and a stamp of an item of data, being restituted, of the second component, converted to the same unit of time as the significant value.

According to a particular characteristic, said significant value is a sum of:

- a maximum duration of storage of an item of data of said second component, by said receiver-decoder device, and
- a maximum so-called anticipation duration between an instant of reception of a stamp relating to an item of data of the first component and the instant of restitution associated with the value of the received stamp.

According to a particular characteristic, said corrected value takes account of:

- a stamp of an item of data, being restituted, of said second component;
- a duration of storage, by said receiver-decoder device, before restitution, of said item of data being restituted and;
- an average duration between an instant of reception of a stamp relating to an item of data of the first component and the instant of restitution associated with the value of the received stamp.

Said corrected value can for example be defined by the sum, modulo the maximum possible value of a stamp of the first component, of:

- the stamp of an item of data, being restituted, of said second component;
- a value corresponding to the sum of the duration of storage, by said receiver-decoder device, before restitution of said item of data being restituted and the average duration between an instant of reception of a stamp relating to an item of data of the first component and the instant of restitution associated with the value of the received stamp.

In some embodiments, wherein in particular the first component is a subtitling component of a second audio and/or video component, the determination of a corrected, replacement, value for the received time stamp determines the replacement value by addition of at least two time intervals from among:

- a value of the time stamp of the image being displayed,
- a time of storage of data of an audio or video component in a storage memory, and
- an average value of anticipation between the reception of subtitling stamps and the restitution of the data with which it is associated,

expressed with respect to a program clock reference,

then by division (modulo) of the sum obtained by a maximum value of a subtitling time stamp.

The present disclosure also relates to an audiovisual program receiver-decoder device, said audiovisual program comprising a first component intended to be restituted in a synchronized way with at least one second component of said audiovisual component according to a time stamp of data of said first component.

According to a particular embodiment of the present disclosure, said device comprises:

- a reception module, able to receive at least one time stamp corresponding to data of said first component;
- an analysis module, able to perform an analysis of said time stamp, said analysis comprising a first consistency verification of said stamp with respect to a reference clock and to at least one first time interval,
- a determination module, able to determine a corrected value of said time stamp with respect to said clock and to at least one second time interval, when said stamp is inconsistent;
- A replacement module, able to replace said time stamp with said corrected time stamp.

According to a particular embodiment of said device, said second component is an audio and/or video component and said first component is a subtitling of said second component.

According to a particular embodiment of said device, said reference clock is a program clock reference of one of said audio and/or video components.

According to a particular characteristic, said device further comprises an input-output module, able to enable the definition of an item of information representative of a bringing-forward of and/or delay in restitution to be brought about for said first component and said corrected value is calculated with respect to said defined item of information.

According to a particular characteristic, said device further comprises a module for restitution of said audiovisual program.

According to an embodiment of the device of the present disclosure, the first time interval is comprised in a list comprising:

- a maximum duration of storage of the audio and/or video data associated with the time stamp relating to the presentation of subtitles,

- a maximum value of anticipation between the reception of a subtitling time stamp and the instant of display of the video with which the subtitling element is associated.

- a maximum time difference between two successive subtitling time stamps.

Advantageously, the first time interval is an average value of anticipation between the reception of subtitling stamps and the restitution of the data with which it is associated or a storage time for data of an audio or video component in a storage memory.

According to at least one particular embodiment of the device of the present disclosure, wherein notably the first component is a subtitling component of a second audio and/or video component, the device determines the corrected, replacement, value by addition of at least two time intervals from among:

- a value of the time stamp of the image being displayed,

- a time of storage of data of an audio or video component in a storage memory, and

- an average value of anticipation between the reception of a subtitling stamp and the restitution of the data with which it is associated,

expressed with respect to a program clock reference,
then by division of the sum thus obtained by a maximum value of a subtitling time stamp.

While not explicitly described, the receiver-decoder device of the present disclosure may be adapted to perform the method of the present disclosure in any of its embodiments.

While not explicitly described, the present embodiments related to a method for correcting synchronization and/or to the corresponding audiovisual program receiver-decoder device may be employed in any combination or sub-combination.

The present disclosure also relates to a computer program product comprising program code instructions for executing the method described above when the program is executed on a computer.

Notably, it relates to a non-transitory program storage device, readable by a computer, tangibly embodying a program of instructions executable by a computer to perform method described above, in any of its embodiments.

According to another aspect, the present disclosure relates to a computer readable storage medium carrying a software program comprising program code instructions for performing the method for monitoring of the present disclosure, in any of its embodiments, when said non transitory software program is executed by a computer.

As will be appreciated by one skilled in the art, aspects of the present principles can be embodied as a system, method, or computer readable medium. Accordingly, aspects of the present principles can take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, resident software, micro-code, and so forth), or an embodiment combining software and hardware aspects that can all generally be referred to herein as a “circuit”, module” or “system”. Furthermore, aspects of the present principles can take the form of a computer readable storage medium. Any combination of one or more computer readable storage medium(s) may be utilized.

A computer readable storage medium can take the form of a computer readable program product embodied in one or more computer readable medium(s) and having computer readable program code embodied thereon

that is executable by a computer. A computer readable storage medium as used herein is considered a non-transitory storage medium given the inherent capability to store the information therein as well as the inherent capability to provide retrieval of the information therefrom. A computer readable storage medium can be, for example, but is not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. It is to be appreciated that the following, while providing more specific examples of computer readable storage mediums to which the present principles can be applied, is merely an illustrative and not exhaustive listing as is readily appreciated by one of ordinary skill in the art: a portable computer diskette: a hard disk, a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing.

Thus, for example, it will be appreciated by those skilled in the art that the block diagrams presented herein represent conceptual views of illustrative system components and/o circuitry embodying the principles of the present disclosure. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable storage media and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

4. List of figures.

The present disclosure will be better understood, and other specific features and advantages will emerge upon reading the following description, the description making reference to the annexed drawings wherein:

- **Figure 1** shows an audiovisual program receiver-decoder connected to a broadcasting network and to a restitution device according to a non-restrictive embodiment of the present disclosure.

- **Figure 2** shows a module for extraction, analysis and processing of time stamps relating to subtitles according to a non-restrictive embodiment of the present disclosure.
- **Figure 3** shows a time stamp relating to the subtitle modified by determination of a new value according to a non-restrictive embodiment of the present disclosure.
- **Figure 4** is a functional diagram showing the method for correcting, if necessary, the stamp according to a non-restrictive embodiment of the present disclosure.

5. Detailed description of embodiments of the present disclosure.

In **figures 1 to 2**, the modules shown are functional units that may or may not correspond to physically distinguishable units. For example, these modules or some of them are grouped together in a single component, or constituted of functions of the same software. On the contrary, according to other embodiments, some modules are composed of separate physical entities.

Figure 1 shows an audiovisual program receiver-decoder 7 configured to receive audiovisual programs according to a non-restrictive embodiment of the present disclosure. The receiver-decoder 7 is connected by means of an antenna 1 to a network for broadcasting programs by digital terrestrial television (DTT). The programs comprise audio and video components and a component comprising subtitling data intended to be restituted after reception and decoding. The restitution of the components is done via the intermediary of the restitution device 6, connected to the receiver-decoder 7 via the intermediary of a link 5. The link 5 is for example a digital audio/video connection cable compatible with an HDMI (High Definition Multimedia Interface) audio/video communication interface. The receiver-decoder 7 is connected to the DTT network via the intermediary of an input module 2 which comprises a tuner module and a digital demodulation module suitable for the demodulation of data transmitted over

a DTT network. The restitution device 6 comprises a screen and is preferably a television set, connected to the audiovisual program receiver-decoder 6 via the intermediary of an output interface 4 comprising an HDMI interface and a connector compatible with the HDMI standard to which is connected the link 5. The restitution device 6 may also be a tablet, a smartphone or any other item of equipment commonly used for the restitution of audiovisual content.

The receiver-decoder 7 further comprises a control unit module 3 of SoC (system on chip) type. The control unit 3 comprises a TS (transport stream) data stream de-multiplexing module, a memory associated with the de-multiplexing module, a decoding module, a memory associated with the decoding module and a management module for the presentation of data (or their restitution) during the restitution step which aims to present the data received and decoded on the output interface 4.

The term "transport stream" here designates the coded incident data stream received by the receiver-decoder 7, compatible with a transport stream as defined, for example, in the MPEG-2 standard. But transport stream is more generally understood to mean any data stream comprising data packets coding audio and/or video and subtitling components (program), and further comprising a synchronization clock common to these components and time stamps relating to the restitution of the components.

The control unit 3 further comprises an embedded microcontroller associated with a non-volatile memory useful for the storage of data and software code (for instructions forming software routines to be executed by the microcontroller), a volatile working memory and the set of circuits participating in a standard architecture of a control unit, such as, for example and in a non-exhaustive way, clock circuits, a reset circuit and control ports of input-output type.

Figure 2 shows architectural details of the control unit 3 of the receiver-decoder 7. The input of the circuit 3, which receives data from the input module 2 of the receiver-decoder 7, via the bus IN 31 is connected to the de-multiplexing module DX 32. The de-multiplexing data are successively sent to the decoding module BDEC 390, then to the restitution (or

presentation management) module BR 391. The data from the restitution module are transmitted to the output interface 4 of the receiver-decoder 7 via the intermediary of the data bus OUT 38. The modules are interconnected to a volatile memory MEM 36 which comprises storage spaces respectively used by the de-multiplexer module DX 32, decoder module BDEC 390 and restitution module BR391, and by the microcontroller CU 37 comprising a processor 371 and a non-volatile memory FM 372.

Advantageously, the de-multiplexing module DX 32 extracts the data corresponding respectively to the audio, video and subtitling components of the incoming data stream in TS format. The components thus extracted are stored in the volatile memory MEM 36, in buffer memory zones, and can be read by the decoding module BDEC 390. The components decoded by the module BDEC 390 are also stored in a buffer memory zone of the memory 36 and can be read by the restitution (presentation) module BR391. The set of modules DX 32, BDEC 390 and BR 391 are configured at initialization, or dynamically during the nominal operation of the receiver-decoder 7, by the control unit CU 37 which comprises the processor CPU 371, which executes software routines whose instructions are stored in the non-volatile memory FM 372, which is of FLASH memory type, for example.

The control unit 3 is a digital core comprising the elements known to those skilled in the art and useful for the reception, the decoding and the restitution of the data comprising audiovisual and subtitling components.

Advantageously, the control unit is configured for the processing of a data stream coded according to the MPEG-2 data compression standard. According to a variant embodiment, the incoming data stream is coded according to the MPEG-4 standard or a revision of this standard.

According to the embodiment of the present disclosure, the PTSs (presentation time stamps) and the DTSs (decoding time stamps) are readable in the memory MEM 36, after being extracted from the data stream at the same time as the useful data of the audiovisual components of the incoming data stream. The PTS stamps specific to the subtitling data, also called "subtitle PTSs" are also readable in the memory MEM 36, both by the

modules DX 32, BDEC 390 and BR 391 and by the processor CPU 371, suitable for processing them, under software control.

The processor CPU 371 reads and modifies data of subtitle PTS type, directly in the memory and according to results of analyses resulting from the execution of software routines suitable for their processing and for the standard operations for restitution of subtitling data. The processor CPU 371 is thus able to modify the binary elements which code a time stamp making it possible to know the precise instant of display of subtitling data. The time stamp being referenced with respect to the PCR reference clock transmitted in the data stream received at the input of the receiver-decoder 7.

Figure 3 is a graphical representation of an item of data of time stamp type PTSSUBN 40 relating to subtitling data, the stamp and the corresponding data being transmitted in the incident stream received by the receiver-decoder 7. Advantageously the time stamp is comprised in an n^{th} data packet transporting subtitling data, also called data packet of the subtitling components, in the same way as the time stamps specific to the video components are comprised in data packets of the video component and as the time stamps specific to the audio are comprised in data packets of the audio component. Thus, it is easy during the processing of data at the receiver-decoder 7, and notably in the buffer memory zones of the volatile memory MEM 36, to manage a correspondence between the time stamps and the data which are attached thereto, including in terms of storage zone.

Advantageously, at reception of each of the time stamps relating to the processing of subtitling data, the processor CPU 371 performs steps of analysis of the value of the stamp with respect to the maximum duration of storage of the (audio or video) data in the buffer memory zone reserved for this storage and to the existing anticipation between the instant of reception and the instant of processing in restitution. In other words, the anticipation corresponds to the time interval between the reception of a time stamp and the instant which it codes which is also the instant of restitution of the data which are associated therewith during the restitution step. According to the embodiment of the present disclosure, if the value of the time stamp received

is not consistent with respect to the reference clock and its maximum duration of storage (or the maximum duration of storage of data of another component which are associated therewith), during an analysis AN1, a determination DET2 of a PTS value is carried out. The analysis AN1 and determination DET2 of a substitution value PTSSUBN2 appear in figure 4.

Thus, if the value of the time stamp appears inconsistent with respect to maximum duration of storage of the (audio or video) data in the buffer memory zone reserved for this storage and the existing anticipation between the instant of reception and the instant of processing in restitution, the processor determines a new value and replaces the received value with the value determined during the step DET2.

In some embodiments, the value determined can for example consist of an inverse value of a determined bit, for example of bit 33. The processor CPU 371 can thus invert the logical element of rank 33 (also called bit 33 or bit33), which logical element sometimes appears incorrectly positioned or corrupted at reception by a receiver-decoder due to previous processing carried out at the transmission point or at any place in the transport chain preceding the receiver-decoder 7. Thus, if the value of the time stamp appears inconsistent with respect to the values stated above and if bit33 is positioned at logical state 1, the processor modifies bit33 so that it becomes 0 and vice versa.

In some embodiments, the processor carries out, during the step of determination DET2, a new evaluation of the value of the time stamp thus determined with respect to the values mentioned in order to verify that the inconsistency identified during the step of analysis AN1 no longer exists. Such an adjustment of the value of the time stamp, which in fact constitutes an error correction, enables for example a better restitution of the subtitling data which are attached thereto. That is to say, a restitution of subtitling data associated with a for example more opportune moment than that corresponding to the received value. In the case of a corruption of the value of a time stamp linked to an element of the coding or transport chain, and advantageously using the determination method, the corresponding subtitle

or subtitles are displayed with a better synchronization (with the audio or video components), even though this does not correspond to what would have been achieved in the presence of an item of subtitle PTS data normally defined by the equipment at the source of the data stream. The set of components being synchronized with respect to a same PCR reference clock comprised in the stream of the packets of the transport stream.

Audio and video synchronization is understood to mean a level of synchronization of the audio and video components as commonly accepted: when a character speaks and when the video component makes it possible to see the character speaking, the audio component is restituted with a time delay such that the user perceives little or no labial time delay. This corresponds to a synchronization of within a few tens of milliseconds. With regard to the synchronization of restituted subtitling data, synchronized restitution is understood to mean a restitution of the subtitling data enabling the user to read the corresponding words (the words of the character speaking which appear in this part of the video component) when the character is expressing himself.

Here this involves a synchronization resulting in a delay in the order of one to two seconds, for example.

The user can then read, for example, as subtitles, the words of a character shown, in the same language or translated to another language.

Figure 4 is a functional diagram which shows the method for determining the time stamp according to a first particular and non-restrictive embodiment of the present disclosure.

Step **S0** corresponds to the initialization of the receiver-decoder 7 and more generally of the whole of the reception system. This step results in a nominal operation of the receiver-decoder 7, at the end of which it is configured in reception to a transmission channel of the DTT network to which it is connected. At the end of step **S0**, the receiver-decoder receives and stores data coding a video component, an audio component and a subtitling component of a same audiovisual program. The receiver thus receives useful data and related data, among which are the data useful for

the synchronization of the components with each other and for the reference clock, itself received in the stream and to which is slaved a local clock of the receiver-decoder 7. In step **S0**, the receiver-decoder 7 has received an n^{th} time stamp denoted PTSSUBN and shown in FIG.3.

In step **S1**, the receiver-decoder carries out a first analysis of the time stamp PTSSUBN, using the processor CPU 371.

According to the embodiment of the present disclosure, the processor 371 reads the last time stamp processed relating to the video component, that is to say the time stamp attached to a video element being displayed (restituted). The processor thus defines a MAX_ANTICIPATION value defined as being the maximum anticipation between the reception of a subtitling PTS and the instant of display of the video with which the subtitling element is associated.

The processor CPU 371 then calculates a maximum value PTS_MAX of the subtitling PTS, PTSSUBN, with respect to the number of binary elements which compose it (and therefore to its resolution) and thus calculates a time difference value DELTA_PTS between two time stamps according to the following formula:

DELTA_PTS = (PTSSUBN + PTS_MAX – PTS_VIDEO) Modulo PTS_MAX,

Where PTS_VIDEO is the value of the time stamp of the image being displayed by the reception system.

According to a non-restrictive embodiment of the present disclosure, a step of analysis AN1 is carried out in step S1 of the method, consisting in determining whether the value DELTA_PTS is greater than the sum of the values MAX_ANTICIPATION and MAX_BUFFER_DURATION, where MAX_BUFFER_DURATION is the maximum storage time for data of an audio or video component associated with the subtitling data, themselves associated with the time stamp PTSSUBN, in the buffer memory zone concerned of the memory MEM 36.

If the value DELTA_PTS is greater than the sum of the values MAX_ANTICIPATION and MAX_BUFFER_DURATION, this means that the

value of the stamp PTSSUBN is erroneous and that this subtitling stamp cannot be used for a correct synchronization.

The time stamp value error can for example result from the absence of positioning of the value during the creation of the stream, thus resulting in a random value or a value dependent on the circuits or means used, that is to say from a corruption caused by an item of equipment following the setting up of the value during the creation of the stream.

In the particular embodiment of figure 4, the processor CPU 371 carries out a determination DET2 of a (replacement) value for the time stamp PTSSUBN, during step**S2** of the correction method.

The replacement value for the initial value PTSSUBN is denoted PTSSUBN2.

5.1 Calculation of a corrected stamp according to a first embodiment

According to a first embodiment, in order to do this the processor CPU 371 determines a current storage time CURRENT_VIDEO_BUFFER_DURATION for the data of the video component in the storage memory, converted to "PTS units" (a PTS unit having a value of for example 1/90000 of a second).

The processor CPU 371 also determines an average value of anticipation SUBTITLE_ANTICIPATION_AVG between the reception of subtitling stamps and the restitution of the data with which they are respectively associated.

The processor CPU 371 then determines a value PTSSUBN2 according to the formula:

PTSSUBN2 =
(PTS-VIDEO+
PTS(CURRENT_VIDEO_BUFFER_DURATION) +
SUBTITLE_ANTICIPATION_AVG) Modulo PTS_MAX.

The value PTSSUBN2 thus calculated can be used as a corrected value of the previously received time stamp PTSSUBN.

5 .2 Calculation of a corrected stamp according to a second embodiment

In a second particular embodiment of figure 4, the processor CPU 371 calculates, during step **S2** of the correction method, a second value of the time stamp PTSSUBN, denoted PTSSUBN2, by inversion of the logical element bit33.

The processor CPU 371 then determines a value DELTA_PTS2 according to the formula:

DELTA_PTS2 = (PTSSUBN2 + PTS_MAX – PTS_VIDEO) Modulo PTS_MAX,

and carries out a comparison of the value DELTA_PTS2 with the sum MAX_ANTICIPATION + MAX_BUFFER_DURATION.

In **S2**, if the value DELTA_PTS2 is less than the sum of the time values MAX_ANTICIPATION and MAX_BUFFER_DURATION, this means that the value PTSSUBN2 of the subtitling time stamp is consistent after inversion of its binary element bit33, of rank 33, and that the value PTSSUBN2 can be used as a corrected value of the previously received time stamp PTSSUBN.

It should be noted that, in the particular embodiment shown, the inversion of the binary element of rank 33 is carried out by considering that the logic word which codes the time stamp has a low order bit of rank 1.

Naturally, in variant embodiments, a correction of a subtitling stamp, such as PTSSUBN, can be performed by inversion of binary elements of rank other than that of bit 33.

In the two embodiments described above, in **S3**, the processor replaces the value of the stamp PTSSUBN with the value PTSSUBN2 in the memory MEM 36. The value PTSSUBN2 thus enables a better restitution of the data (of the subtitle) which are associated therewith and the subtitling is then carried out with a correct, though sometimes approximate, synchronization.

In other words, the method for correcting the time stamp PTSSUBN is applied in the audiovisual program receiver-decoder device 7,

the audiovisual programs comprising subtitles intended to be restituted, in a synchronized way with an audio and/or video component of audiovisual programs; the correction method comprises:

- reception of the time stamp PTSSUBN corresponding to subtitling data,

- analysis AN1 of the value of the time stamp PTSSUBN with respect to the values MAX_VIDEO_PTS, MAX_ANTICIPATION, MAX_BUFFER_DURATION, the time values being expressed with respect to the PCR reference clock of the system.

- determination DET2 of the time stamp PTSSUBN2 with respect to the values PTS_VIDEO, CURRENT_VIDEO_BUFFER_DURATION, SUBTITLE_ANTICIPATION_AVG, the time values being expressed with respect to the PCR reference clock of the system.

- Use of the time stamp of value PTSSUBN2 after its determination for the restitution of subtitling data.

The reference clock is a clock of program clock reference type (commonly called PCR) of one of the audio and/or video components of the stream of programs received, serving as a reference for synchronization according to the techniques well known to those skilled in the art.

The audiovisual program receiver-decoder device 7 therefore comprises:

- a module for reception of at least one time stamp PTSSUBN corresponding to subtitling data, constituted of the input module 2 and the de-multiplexing module DX 32,

- a module for analysis of the time stamp PTSSUBN with respect to the PCR reference clock and at least one time interval, constituted of the processor CPU 371 associated with the memory MEM 36 and executing

software routines using instructions stored in the program memory FM 372 of the control unit CU 37,

a module for determination of a corrected, replacement value PTSSUBN2 for the time stamp PTSSUBN, also constituted of the processor CPU 371 associated with the memory MEM 36 and executing software routines using instructions stored in the program memory FM 372 of the control unit CU 37.

According to a first non-restrictive variant embodiment of the present disclosure, the substitution value PTSSUBN2 is defined by an item of information entered by the user by mean of a man-machine interface tool, such as, for example, a specific menu which appears after pressing and holding a "Subtitling" key of a remote control of the receiver-decoder 7. Thus, the user can, for example, move a cursor along a graphic object representing a time scale, which object comprises a so-called neutral position symbolizing neither a bringing-forward, nor a delay in terms of synchronization of the display of subtitling data with respect to at least one associated (audio and/or video) component. According to this first variant, a sliding to the right of a cursor on the graphic object defines a delay in restitution of subtitling data with respect to the theoretical value of the stamp PSTSUBN which is or which should be present in the stream. A sliding to the left causes a bringing-forward of restitution with respect to the associated audio and/or video component or components. The determined substitution value PTSSUBN2 is thus calculated according to an item of information representative of the position of the cursor on the graphic object (that is to say a bringing-forward, a neutral position or a delay).

The graphic object is for example a horizontal bar whose limits correspond respectively to a bringing-forward of a few seconds and a delay of a few seconds for the display of the subtitling data with respect to the display of the corresponding audio and/or video data.

The total amplitude of the bar corresponds, for example, to about ten seconds, that is to say a bringing-forward or a delay being able to be defined

with a maximum amplitude of 5 seconds for the restitution of subtitling data with respect to the component with which these data are synchronized.

The value of the replacement time stamp is calculated by the processor CPU 371 from the item of information representative of the position of the cursor, then is stored in a non-volatile memory to be able to be re-used subsequently. The calculation is carried out by addition or subtraction of a time interval to or from the value PTS_VIDEO, for example. PTS_VIDEO being the presentation time stamp of the image being displayed.

Advantageously, a value thus determined is associated with an audiovisual program being received by the receiver-decoder 7, which makes it possible to benefit from a different setting for each of the programs available in reception.

According to another variant, the storage of a value representing a bringing-forward or a delay and which will be used for the determination of a substitution value PTSSUBN2 will be stored for all the channels where this type of manual presetting has not yet been stored specifically for a given channel.

It should be noted that the precision of a synchronization thus done by observation of a user is all the more stable as the relative anticipation at reception of the data also is.

Naturally the invention is not limited to subtitling time stamps but can also be applied to the correction of time stamps associated with other components of the received flux, such as for example, audio or video time stamps, by analyzing their respective consistencies with respect to a stamp of a component having a relationship therewith in terms of synchronization at restitution, and with respect to the maximum storage time provided for in a memory zone (circular buffer, for example) and the maximum anticipation; the maximum anticipation corresponding to the difference between the instant of reception and the instant of restitution.

According to a variant embodiment, the audiovisual program receiver-decoder 7 comprises, between the input module 2 and the control unit 3, a storage unit useful for the implementation of tricks mode, such as pause and

deferred resumption, freeze frame, slow motion or fast playback from the storage unit. This storage unit in this case being controlled by the control unit module 3.

The invention can of course be implemented by means of a processor module different from that of the embodiment described above, such as for example, a software processor module executed in a computer configured for the reception, decoding and restitution of audiovisual programs comprising, for example, one or more graphic processor units (GPUs).

CLAIMS

1. Method for correcting synchronization of components of an audiovisual program, in an audiovisual programs receiver-decoder device (7), said audiovisual program comprising a first component intended to be restituted in a synchronized way with at least one second component of said audiovisual program according to a time stamp (PTSSUBN) of data of said first component, said method being characterized in that it comprises:

- An analysis (S1) of said time stamp (PTSSUBN), comprising a first consistency verification of said time stamp with respect to a reference clock and to at least one first time interval,

- When said time stamp is inconsistent, a determination (S2) of a corrected value (PTSSUBN2) of said time stamp (PTSSUBN) with respect to said reference clock (PCR) and to at least one second time interval.

- A replacement (S3) of said time stamp with said corrected time stamp (PTSSUBN2).

2. Method according to claim 1 characterized in that said second component is an audio and/or video component and in that said first component is a subtitling of said second component.

3. Method according to claim 2, characterized in that said reference clock (PCR) is a program clock reference of one of said audio and/or video components.

4. Method according to any one of claims 1 to 3 characterized in that said determination comprises an inversion of a binary element of a determined rank (bit33) of said time stamp (PTSSUBN).

5. Method according to any one of claims 1 to 4 characterized in that said first consistency verification comprises a comparison:

- of a time interval taking account of a difference between said stamp (PTSSUBN) and a stamp of an item of data, being restituted, of said second component,

- with a significant value.

6. Method according to any one of claims 1 to 5 characterized in that said determination comprises an evaluation (S2) of said corrected stamp (PTSSUBN2), comprising a second consistency verification of said corrected value with respect to said reference clock (PCR) and to said second time interval.

7. Method according to claim 6 characterized in that said second consistency verification comprises a comparison:

- of a time interval taking account of a difference between said corrected stamp (PTSSUBN2) and a stamp of an item of data, being restituted, of said second component,

- with a significant value.

8. Method according to claim 5 or 7 characterized in that said significant value is a sum of:

- a maximum duration of storage (MAX_BUFFER_DURATION) of an item of data of said second component, by said receiver-decoder device, and
- a maximum so-called anticipation duration between an instant of reception of a stamp relating to an item of data of the first component and the instant of restitution associated with the value of the received stamp.

9. Method according to any one of claims 1 to 8, characterized in that said corrected value (PTSSUBN2) takes account of:

- a stamp of an item of data, being restituted, of said second component;

- a duration (CURRENT_VIDEO_BUFFER_DURATION) of storage, by said receiver-decoder device, before restitution, of said item of data being restituted and;

- an average duration between an instant of reception of a stamp relating to an item of data of the first component and the instant of restitution associated with the value of the received stamp.

10. Audiovisual program receiver-decoder device (7), said audiovisual program comprising a first component intended to be restituted in a synchronized way with at least one second component of said audiovisual program according to a time stamp (PTSSUBN) of data of said first component, said device being characterized in that it comprises:
- a reception module (2, 32), able to receive at least one time stamp (PTSSUBN) corresponding to data of said first component;

- an analysis module (371, 372, 36), able to perform an analysis of said time stamp (PTSSUBN), said analysis comprising a first consistency verification of said time stamp with respect to a reference clock (PCR) and to at least one first time interval,

- a determination (S2) module (371, 372, 36), able to determine a corrected value of said time stamp (PTSSUBN) with respect to said reference clock (PCR) and to at least one second time interval, when said stamp is inconsistent;

- A replacement module, able to replace said time stamp with said corrected time stamp (PTSSUBN2).

11. Device according to claim 10, characterized in that said reference clock (PCR) is a program clock reference of one of said audio and/or video components.

12. Device according to one of claims 10 to 11, characterized in that it further comprises an input-output module, able to enable the definition of an item of information representative of a bringing-forward of and/or a delay in

restitution to be brought about for said first component and said corrected value is calculated with respect to said defined item of information.

13. Device according to one of claims 10 to 12 characterized in that it further comprises a module for restitution of said audiovisual program.

14. Computer program product, characterized in that it comprises program code instructions for executing the method according to any one of claims 1 to 9, when said program is executed on a computer.

15. Computer readable storage medium carrying a software program comprising program code instructions for performing the method of any of claims 1 to 9, when said non transitory software program is executed by a computer.

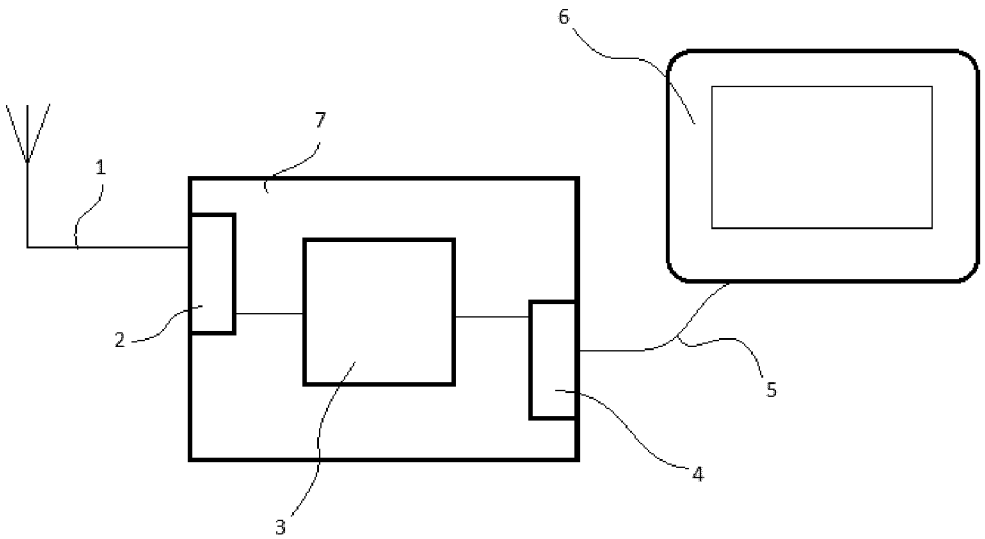

Figure 1

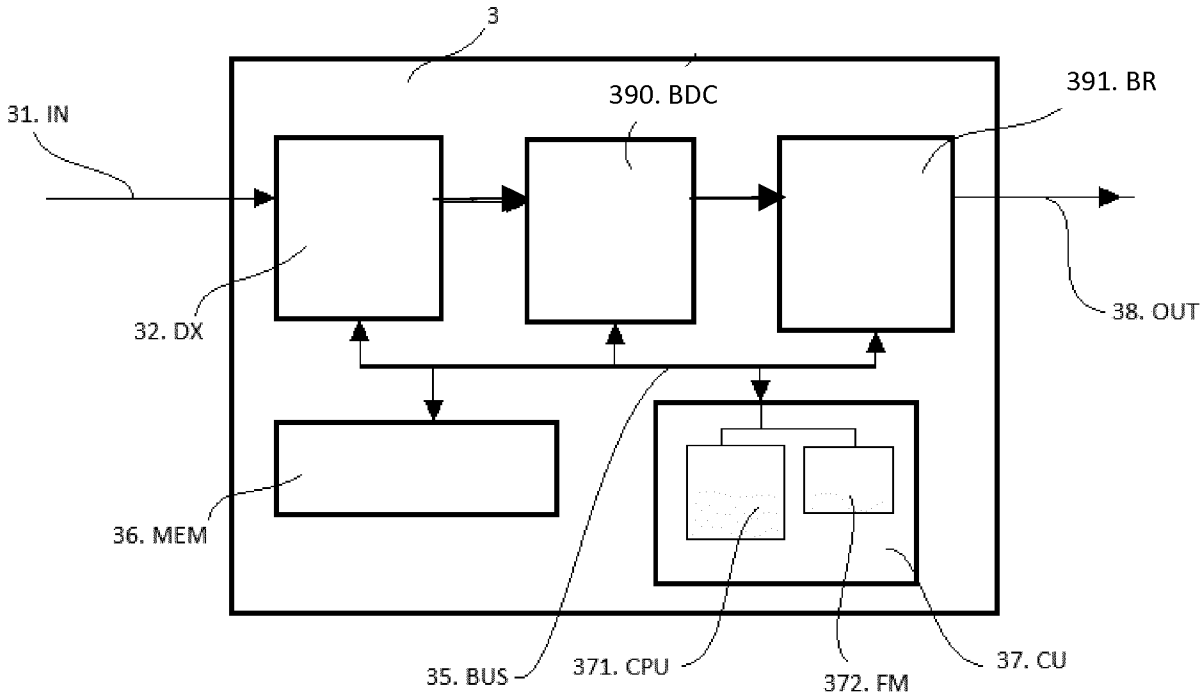

Figure 2

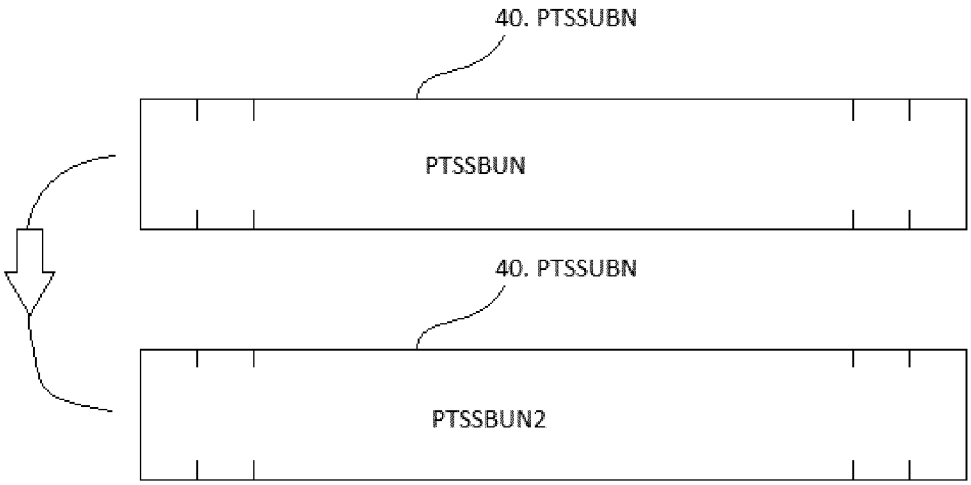

Figure 3

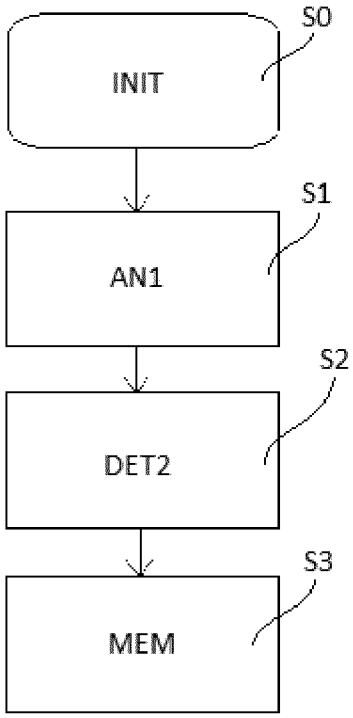

Figure 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/069002

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N21/43 H04N21/488
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/219444 A1 (KITAZATO NAOHISA [JP] ET AL) 22 August 2013 (2013-08-22) paragraphs [0026] - [0046], [0061] - [0062], [0095] - [0100]; figures 3,4	1-7, 10-15
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X	US 2008/279272 A1 (SAITO TATSUNORI [JP] ET AL) 13 November 2008 (2008-11-13) paragraphs [0035], [0044] - [0045]	1-5, 10-15
A	JP 2007 324872 A (TV ASAHI DATA VISION CORP; LSI JAPAN KK) 13 December 2007 (2007-12-13) paragraphs [0019], [0024], [0038] - [0041], [0052]; figure 2	1-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 November 2014	02/12/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Rolet, Etienne

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2014/069002

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