a method which creates a synthesized stream by multiplexing two transport streams, transmits and receives the synthesized stream to and from a security mechanism executing descrambling, and distributes transport packets of the received synthesized stream based on stream identification information.

CITATION LIST

PATENT DOCUMENT

[0005]

Patent Document 1: US Patent No. 7,508,454

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006]

Embodiments of the present invention synthesize plural streams into one stream, and realize preferable transmission and reception of the synthesized stream to and from an external device.

SOLUTIONS TO PROBLEMS

[0007]

According to a first aspect of the preset invention, there is provided an electronic device including: a synthesized stream creating unit that synthesizes transport stream packets of plural transport streams to create a synthesized stream; a stream transmitting unit that transmits the created synthesized stream to an external device; a processing information retaining unit that retains processing information for a certain period, the processing information being output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets; a count information adding unit that brings a count information adding area provided in each of the transport stream packets into a state to which a particular count value is added for each of the transport stream packets of the synthesized stream transmitted to the external device; a stream receiving unit that receives the synthesized stream

from the external device; and a processing unit that processes the respective transport stream packets of the received synthesized stream based on the processing information corresponding to the respective transport stream packets and sequentially output from the processing information retaining unit.

[0008]

According to embodiments of the present invention, the synthesized stream creating unit synthesizes transport stream packets of plural transport streams to create a synthesized stream. Then, the stream transmitting unit transmits the synthesized stream to the external device. For example, the stream transmitting unit and the stream receiving unit may transmit and receive the synthesized stream to and from the external device via a DVB-CI common interface, or a CI+ common interface, and the external device may be a conditional access module (CAM module) that executes descrambling.

[0009]

The processing information retaining unit retains processing information for a certain period, which information is output at the transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets. The processing information retaining unit is constituted by a FIFO (first in first out) memory, for example.

[0010]

The count information adding unit brings a count information adding area provided in each of the transport stream packets into a state to which a particular count value is added for each of the transport stream packets of the synthesized stream transmitted to the external device. For example, the count information adding area may be constituted by a partial area of a synchronous byte area within a header of each of the transport stream packets.

[0011]

In this case, the partial area may be a predetermined-number bit area having 1 as a bit value of a synchronous signal. In this case, bit values corresponding to a synchronous signal can be used

without change when the particular count value is set to a value containing 1 for all the bit values. In this state, rewriting is not required.

[0012]

The stream receiving unit receives the synthesized stream from the external device. For example, the external device equalizes the order of the respective transport stream packets of the transmitted synthesized stream with the order of the respective transport stream packets of the received synthesized stream based on the fact that the count information added to the count information adding area provided in each of the transport stream packets is the particular count value. Then, the processing unit processes the respective transport stream packets of the received synthesized stream based on the processing information sequentially output from the processing information and corresponding to the respective transport stream packets.

[0013]

According to embodiments of the present invention, therefore, the count information adding area provided in each of the transport stream packets is brought into the state to which the particular count value is added for each of the transport stream packets of the synthesized stream transmitted to the external device.

Accordingly, this configuration notifies the external device that a function for handling the packet order switching based on count information is not provided, and receives the synthesized stream containing the respective transport stream packets arranged in the same order as the order of the transport stream packets at the time of transmission.

[0014]

According to embodiments of the present invention, the processing information for processing the respective transport stream packets may contain time information indicating time positions of the respective transport stream packets in original transport streams, and the processing unit may locate, in respective streams to which the respective transport stream packets of the

received synthesized stream are distributed, the respective transport stream packets at time positions in accordance with the time information corresponding to the respective transport stream packets so as to reconstitute the plural transport streams, for example.

[0015]

In this case, there may be further provided a stream identification information adding unit that adds stream identification information for identifying original transport streams to the respective transport stream packets of the synthesized stream transmitted to the external device, and a stream identification information obtaining unit that obtains the stream identification information from the respective transport stream packets of the received synthesized stream. The processing unit may distribute the respective transport stream packets of the received synthesized stream to the respective streams in accordance with the stream identification information obtained from the respective transport stream packets.

[0015a]

According to a second aspect of the present invention, there is provided a synthesized stream transmitting method including: in transmitting a synthesized stream created by synthesizing transport stream packets of plural transport streams to an external device, retaining processing information for a certain period, said processing information being used for processing the respective transport stream packets, wherein the processing information is outputted at transmission timing of the respective transport stream packets of the synthesized stream, and bringing a count information adding area provided in each of the transport stream packets into a state to which a particular count value is added for each of the transport stream packets of the synthesized stream.

According to a ~~second~~ third aspect of the present invention, there is provided a program under which a computer provides the functions of: synthesized stream creating means that synthesizes transport stream packets of plural transport streams to create a

synthesized stream; stream transmitting means that transmits the created synthesized stream to an external device; processing information retaining means that retains processing information for a certain period, the processing information being output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets; count information adding means that brings a count information adding area provided in each of the transport stream packets into a state to which a particular count value is added for each of the transport stream packets of the synthesized stream transmitted to the external device; stream receiving means that receives the synthesized stream from the external device; and processing means that processes the respective transport stream packets of the received synthesized stream based on the processing information corresponding to the respective transport stream packets sequentially output from the processing information retaining means.

[0016]

According to a ~~third~~ fourth aspect of the present invention, there is provided an electronic device including: a synthesized stream creating unit that synthesizes transport stream packets of plural transport streams to create a synthesized stream; a stream transmitting unit that transmits the created synthesized stream to an external device; a processing information retaining unit that retains processing information for a certain period, the processing information being output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets; a count information adding unit that adds count information sequentially counted while skipping a particular count value to both a count information adding area provided in each of the transport stream packets, and processing information output in correspondence with the transport stream packets for each of the transport stream packets of the synthesized stream transmitted to the external device; a stream receiving unit that receives the synthesized stream

from the external device; and a processing unit that processes the respective transport stream packets of the received synthesized stream based on the processing information extracted from the processing information retaining unit and containing count information having the same value as the value of count information added to each of the transport stream packets.

[0017]

According to embodiments of the present invention, the synthesized stream creating unit synthesizes transport stream packets of plural transport streams to create a synthesized stream. Then, the stream transmitting unit transmits the synthesized stream to the external device. For example, the stream transmitting unit and the stream receiving unit may transmit and receive the synthesized stream to and from the external device via a DVB-CI common interface, or a CI+ common interface, and the external device may be a conditional access module (CAM module) that executes descrambling.

[0018]

The processing information retaining unit retains the processing information for a certain period, which information is output at the transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets. The processing information retaining unit is constituted by a FIFO (first in first out) memory, for example.

[0019]

The count information adding unit adds the count information sequentially counted while skipping a particular count value to both the count information adding area provided in each of the transport stream packets, and the processing information output in correspondence with the transport stream packets for each of the transport stream packets of the synthesized stream transmitted to the external device. For example, the count information adding area may be constituted by a partial area of a synchronous byte area within a header of each of the transport stream packets. In

this case, the partial area may be a low-order 4-bit area or a low-order 3-bit area, for example.

[0020]

The stream receiving unit receives the synthesized stream from the external device. Then, the processing unit processes the respective transport stream packets of the received synthesized stream based on the processing information extracted from the processing information retaining unit and containing count information having the same count value as the count value of count information added to each of the transport stream packets.

[0021]

According to embodiments of the present invention, therefore, the count information sequentially counted while skipping a particular count value is added to both the count information adding area provided in each of the transport stream packets, and the processing information output in correspondence with the transport stream packets for each of the transport stream packets of the synthesized stream transmitted to the external device.

Accordingly, this configuration notifies the external device that the function for handling packet order switching based on count information is provided. In this case, the respective transport stream packets of the received synthesized stream can be appropriately processed based on the corresponding processing information even when the respective transport stream packets received from the external device are arranged in an order different from the order of the transport stream packet at the time of transmission.

[0022]

According to embodiments of the present invention, for example, the processing information for processing the respective transport stream packets of the received synthesized stream may contain time information indicating time positions of the respective transport stream packets in original transport streams, and the processing unit may locate, in respective streams to which the respective transport stream packets of the received synthesized

stream are distributed, the respective transport stream packets at time positions in accordance with the time information corresponding to the respective transport stream packets so as to reconstitute the plural transport streams.

[0023]

In this case, there may be further provided a stream identification information adding unit that adds stream identification information for identifying original transport streams to the respective transport stream packets of the synthesized stream transmitted to the external device, and a stream identification information obtaining unit that obtains the stream identification information from the respective transport stream packets of the received synthesized stream. The processing unit may distribute the respective transport stream packets of the received synthesized stream to the respective streams in accordance with the stream identification information obtained from the respective transport stream packets.

[0023a]

According to a ~~fourth~~ fifth aspect of the present invention, there is provided a synthesized stream transmitting method comprising: in transmitting a synthesized stream created by synthesizing transport stream packets of plural transport streams to an external device, retaining processing information for a certain period, said processing information being used for processing the respective transport stream packets, wherein the processing information is outputted at transmission timing of the respective transport stream packets of the synthesized stream, and adding predetermined-bit count information sequentially incremented except for a particular count value to a count information adding area provided in each of the transport stream packets for each of the transport stream packets of the synthesized stream.

[0023b]

According to a ~~fifth~~ sixth aspect of the present invention, there is provided a program under which a computer provides the

functions of: synthesized stream creating means that synthesizes transport stream packets of plural transport streams to create a synthesized stream; stream transmitting means that transmits the created synthesized stream to an external device; processing information retaining means that retains processing information for a certain period, the processing information being output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets; count information adding means that adds count information sequentially counted while skipping a particular count value to both a count information adding area provided in each of the transport stream packets, and processing information output in correspondence with the transport stream packets for each of the transport stream packets of the synthesized stream transmitted to the external device; stream receiving means that receives the synthesized stream from the external device; and processing means that processes the respective transport stream packets of the received synthesized stream based on the processing information extracted from the processing information retaining means and containing count information having the same value as the value of count information added to each of the transport stream packets.

[0024]

According to a ~~sixth~~ seventh aspect of the present invention, there is provided an electronic device including: a stream receiving unit that receives a synthesized stream created by synthesizing transport stream packets of plural transport streams from an external device; a processing unit that separates the respective transport stream packets of the received synthesized stream, decrypts the respective separated transport stream packets, and synthesizes the respective decrypted transport stream packets to create a synthesized stream; a stream transmitting unit that transmits the created synthesized stream to the external device; a processing information retaining unit that retains processing information for a certain period, the processing information being

output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets; and a control unit that controls the processing unit based on count information added to a count information adding area provided in each of the transport stream packets of the received synthesized stream.

[0025]

According to embodiments of the present invention, the stream receiving unit receives the synthesized stream created by synthesizing the transport stream packets of the plural transport streams from the external device. The processing unit separates the respective transport stream packets of the received synthesized stream, decrypts the respective separated transport stream packets, and synthesizes the respective decrypted transport stream packets to create a synthesized stream. Then, the stream transmitting unit transmits the created synthesized stream to the external device.

[0026]

The control unit controls the processing unit based on count information added to the count information adding area provided in each of the transport stream packets of the received synthesized stream. For example, the count information adding area may be constituted by a partial area of a synchronous byte area within a header of each of the transport stream packets.

[0027]

For example, the control unit may control such that the order of the respective transport stream packets of the created synthesized stream becomes the same order as the order of the respective transport stream packets of the received synthesized stream when the count information has a particular count value. In this case, the control unit may raise the speed of decrypting operation. By raising the operation speed, the power consumption increases. However, reduction of the delay amount is achievable.

[0028]

According to embodiments of the present invention, therefore, the processing unit is controlled based on the count information

added to the count information adding area provided in each of the transport stream packets of the received synthesized stream. This configuration easily notifies the external device that the function for handling packet order switching based on count information is not provided, and transmits to the external device a synthesized stream containing the respective transport stream packets arranged in the same order as the order of the transport stream packets at the time of transmission.

EFFECTS OF THE INVENTION

[0029]

According to embodiments of the present invention, plural streams are synthesized into one stream, and preferable transmission and reception of the synthesized stream to and from an external device is realized.

BRIEF DESCRIPTION OF DRAWINGS

[0030]

Fig. 1 is a block diagram illustrating a configuration example of a digital broadcasting reception system according to an embodiment.

Fig. 2 is a block diagram illustrating a configuration example of a common interface controller which has a function for handling packet order switching based on count information, and allows switching of a packet order at a CAM module.

Fig. 3 is a figure illustrating a structure of a transport stream packet (TSP).

Fig. 4 is a block diagram illustrating a configuration example of a multiplexing unit constituting a common interface controller.

Figs. 5(a) and 5(b) are figures illustrating an example of information added to a PID packet, and an example of information retained at a FIFO unit only for a certain period.

Fig. 6 is a figure illustrating an example of bit allocation of LTSID and LCC in a synchronous byte area.

Figs. 7(a) to 7(c) are figures illustrating an example of bit arrangement and the like when 4 bits are allocated to

CLAIMS

1. An electronic device comprising:

a synthesized stream creating unit that synthesizes transport stream packets of plural transport streams to create a synthesized stream;

a stream transmitting unit that transmits the created synthesized stream to an external device;

a processing information retaining unit that retains processing information for a certain period, the processing information being output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets;

a count information adding unit that brings a count information adding area provided in each of the transport stream packets into a state to which a particular count value is added for each of the transport stream packets of the synthesized stream transmitted to the external device;

a stream receiving unit that receives the synthesized stream from the external device; and

a processing unit that processes the respective transport stream packets of the received synthesized stream based on the processing information corresponding to the respective transport stream packets and sequentially output from the processing information retaining unit.

2. The electronic device according to claim 1, wherein the count information adding area is constituted by a partial area of a synchronous byte area within a header of each of the transport stream packets.

3. The electronic device according to claim 2, wherein the partial area is a predetermined-number bit area having 1 as a bit value of a synchronous signal.

4. The electronic device according to claim 1, wherein

the processing information for processing the respective transport stream packets contains time information indicating time positions of the respective transport stream packets in original transport streams, and

the processing unit locates, in respective streams to which the respective transport stream packets of the received synthesized stream are distributed, the respective transport stream packets at time positions in accordance with the time information corresponding to the respective transport stream packets so as to reconstitute the plural transport streams.

5. The electronic device according to claim 4 further comprising:

a stream identification information adding unit that adds stream identification information for identifying original transport streams to the respective transport stream packets of the synthesized stream transmitted to the external device; and

a stream identification information obtaining unit that obtains the stream identification information from the respective transport stream packets of the received synthesized stream,

wherein the processing unit distributes the respective transport stream packets of the received synthesized stream to the respective streams in accordance with the stream identification information obtained from the respective transport stream packets.

6. The electronic device according to claim 1, wherein

the stream transmitting unit transmits the synthesized stream to the external device via a DVB-CI common interface, or a CI+ common interface,

the stream receiving unit receives the synthesized stream from the external device via a DVB-CI common interface, or a CI+ common interface, and

the external device is a conditional access module that executes descrambling.

7. A synthesized stream transmitting method comprising:

in transmitting a synthesized stream created by synthesizing transport stream packets of plural transport streams to an external device,

retaining processing information for a certain period, said processing information being used for processing the respective transport stream packets, wherein the processing information is outputted at transmission timing of the respective transport stream packets of the synthesized stream, and

bringing a count information adding area provided in each of the transport stream packets into a state to which a particular count value is added for each of the transport stream packets of the synthesized stream.

8. A program under which a computer provides the functions of:

synthesized stream creating means that synthesizes transport stream packets of plural transport streams to create a synthesized stream;

stream transmitting means that transmits the created synthesized stream to an external device;

processing information retaining means that retains processing information for a certain period, the processing information being output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets;

count information adding means that brings a count information adding area provided in each of the transport stream packets into a state to which a particular count value is added for each of the transport stream packets of the synthesized stream transmitted to the external device;

stream receiving means that receives the synthesized stream from the external device; and

processing means that processes the respective transport stream packets of the received synthesized stream based on the processing information corresponding to the respective transport stream packets sequentially output from the processing information retaining means.

9. An electronic device comprising:

a synthesized stream creating unit that synthesizes transport stream packets of plural transport streams to create a synthesized stream;

a stream transmitting unit that transmits the created synthesized stream to an external device;

a processing information retaining unit that retains processing information for a certain period, the processing information being output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets;

a count information adding unit that adds count information sequentially counted while skipping a particular count value to both a count information adding area provided in each of the transport stream packets, and processing information output in correspondence with the transport stream packets for each of the transport stream packets of the synthesized stream transmitted to the external device;

a stream receiving unit that receives the synthesized stream from the external device; and

a processing unit that processes the respective transport stream packets of the received synthesized stream based on the processing information extracted from the processing information retaining unit and containing count information having the same value as the value of count information added to each of the

transport stream packets.

10. The electronic device according to claim 9, wherein the count information adding area is constituted by a partial area of a synchronous byte area within a header of each of the transport stream packets.

11. The electronic device according to claim 10, wherein the partial area is a low-order 4-bit area or a low-order 3-bit area of the synchronous byte area.

12. The electronic device according to claim 9, wherein

the processing information for processing the respective transport stream packets contains time information indicating time positions of the respective transport stream packets in original transport streams, and

the processing unit locates, in respective streams to which the respective transport stream packets of the received synthesized stream are distributed, the respective transport stream packets at time positions in accordance with the time information corresponding to the respective transport stream packets so as to reconstitute the plural transport streams.

13. The electronic device according to claim 12 further comprising:

a stream identification information adding unit that adds stream identification information for identifying original transport streams to the respective transport stream packets of the synthesized stream transmitted to the external device; and

a stream identification information obtaining unit that obtains the stream identification information from the respective transport stream packets of the received synthesized stream,

wherein the processing unit distributes the respective transport stream packets of the received synthesized stream to the respective streams in accordance with the stream identification information obtained from the respective transport stream packets.

14. The electronic device according to claim 9, wherein

the stream transmitting unit transmits the synthesized stream to the external device via a DVB-CI common interface, or a CI+ common interface,

the stream receiving unit receives the synthesized stream from the external device via a DVB-CI common interface, or a CI+ common interface, and

the external device is a conditional access module that executes descrambling.

15. A synthesized stream transmitting method comprising:

in transmitting a synthesized stream created by synthesizing transport stream packets of plural transport streams to an external device,

retaining processing information for a certain period, said processing information being used for processing the respective transport stream packets, wherein the processing information is outputted at transmission timing of the respective transport stream packets of the synthesized stream, and

adding predetermined-bit count information sequentially incremented except for a particular count value to a count information adding area provided in each of the transport stream packets for each of the transport stream packets of the synthesized stream.

16. A program under which a computer provides the functions of:

synthesized stream creating means that synthesizes transport stream packets of plural transport streams to create a synthesized

stream;

stream transmitting means that transmits the created synthesized stream to an external device;

processing information retaining means that retains processing information for a certain period, the processing information being output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets;

count information adding means that adds count information sequentially counted while skipping a particular count value to both a count information adding area provided in each of the transport stream packets, and processing information output in correspondence with the transport stream packets for each of the transport stream packets of the synthesized stream transmitted to the external device;

stream receiving means that receives the synthesized stream from the external device; and

processing means that processes the respective transport stream packets of the received synthesized stream based on the processing information extracted from the processing information retaining means and containing count information having the same value as the value of count information added to each of the transport stream packets.

17. An electronic device comprising:

a stream receiving unit that receives a synthesized stream created by synthesizing transport stream packets of plural transport streams from an external device;

a processing unit that separates the respective transport stream packets of the received synthesized stream, decrypts the respective separated transport stream packets, and synthesizes the respective decrypted transport stream packets to create a synthesized stream;

a stream transmitting unit that transmits the created synthesized stream to the external device;

a processing information retaining unit that retains processing information for a certain period, the processing information being output at transmission timing of the respective transport stream packets of the synthesized stream, and used for processing the respective transport stream packets; and

a control unit that controls the processing unit based on count information added to a count information adding area provided in each of the transport stream packets of the received synthesized stream.

18. The electronic device according to claim 17, wherein the control unit controls such that the order of the respective transport stream packets of the created synthesized stream becomes the same order as the order of the respective transport stream packets of the received synthesized stream when the count information has a particular count value.

19. The electronic device according to claim 18, wherein the control unit raises the speed of decrypting operation when the count information has a particular count value.

20. The electronic device according to claim 17, wherein the count information adding area is constituted by a partial area of a synchronous byte area within a header of each of the transport stream packets.