decoding has been performed specifically includes:

if no first control character block exists among the four data blocks, adding a first synchronization head to a header of a first data block among the four data blocks, and outputting the data blocks to which the first synchronization head is added, where the first data block is an 8-bit binary code input first, the first synchronization head includes a 2-bit first identifier, and the first identifier is used to identify that the data blocks are all data character blocks.

[0008] With reference to the first aspect, the first possible implementation manner of the first aspect, or the second possible implementation manner of the first aspect, in a third possible implementation manner, ~~the communications method further includes:~~

the performing 32-bit to 34-bit encoding on the data stream on which the 8-bit/10-bit decoding has been performed specifically includes:

if at least one first control character block exists among the four data blocks, adding a second synchronization head to a header of a first data block among the four data blocks, where the first data block is an 8-bit binary code input first, the second synchronization head includes a 2-bit second identifier, and the second identifier is used to identify that at least one first control character block exists among the data blocks;

generating, according to a quantity of first control character blocks among the four data blocks and a location of the first control block among the data blocks, a 4-bit control character block location mapping code, and setting the control character block location mapping code, in a location after the second synchronization head and closely adjacent to the second synchronization head;

correspondingly converting the first control character block among the four data blocks into a 4-bit second control character block; and

outputting the processed data blocks, where the processed data blocks include the second synchronization head, the control character block location mapping code, and the second control character block that is obtained after the conversion, or the processed data blocks include the second synchronization head, the control character block location mapping code, the second control character block that is obtained after the conversion, and the data character block.

[0009] With reference to the first aspect, the first possible implementation manner of the first aspect, the second possible implementation manner of the first aspect, and the third possible implementation manner of the first aspect, in a fourth possible

implementation manner, the outputting the processed data blocks specifically includes:

if the four data blocks further include at least one data character block, performing no processing on the data character block among the four data blocks, and retaining the data character block among the data blocks; and

outputting the processed data blocks, where the processed data blocks include the second synchronization head, the control character block location mapping code, the second control character block that is obtained after the conversion, and a data block of the data character block.

[0010] With reference to the first aspect, the first possible implementation manner of the first aspect, the second possible implementation manner of the first aspect, the third possible implementation manner of the first aspect, and the fourth possible implementation manner of the first aspect, in a fifth possible implementation manner, the method further includes: determining whether a quantity of bits that are included in the output processed data blocks is 34; and

if the quantity of the bits that are included in the output processed data blocks is less than 34, adding a random number to a tail of a last data block among the output processed data blocks until the quantity of the bits of the output processed data blocks becomes 34, where the random number is a randomly-generated binary code.

[0011] With reference to the first aspect, the first possible implementation manner of the first aspect, the second possible implementation manner of the first aspect, the third possible implementation manner of the first aspect, the fourth possible implementation manner of the first aspect, and the fifth possible implementation manner of the first aspect, in a sixth possible implementation manner, after the step of the receiving a data stream from a physical medium attachment layer at a line rate, the communications method further includes: synchronizing the data stream on which the 8-bit/10-bit encoding has been performed.

[0012] With reference to the first aspect, the first possible implementation manner of the first aspect, the second possible implementation manner of the first aspect, the third possible implementation manner of the first aspect, the fourth possible implementation manner of the first aspect, the fifth possible implementation manner of the first aspect, and the sixth possible implementation manner of the first aspect, in a seventh possible implementation manner, after the step of the performing 32-bit to 34-bit encoding on the data stream on which the 8-bit/10-bit decoding has been

[0052] FIG. 14 is a schematic structural diagram of composition of another optical network device;

[0053] FIG. 15 is a schematic structural diagram of composition of a 32-bit to 34-bit decoder;

[0054] FIG. 16 is a schematic structural diagram of an optical network system;

[0055] FIG. 17 is a schematic structural diagram of a computer system; and

[0056] FIG. 18 is a schematic structural diagram of another computer system.

DESCRIPTION OF EMBODIMENTS

[0057] The following clearly and completely describes the technical solutions in the embodiments of the present invention with reference to the accompanying drawings in the embodiments of the present invention. Apparently, the described embodiments are merely some but not all of the embodiments of the present invention. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of the present invention without creative efforts shall fall within the protection scope of the present invention.

[0058] As shown in FIG. 1, FIG. 1 is a schematic structural diagram of protocol layers of a communications system according to an embodiment of the present invention.

[0059] In FIG. 1, a physical coding sub-layer (physical coding sub-layer, PCS) 100 receives a data stream at a specific rate, performs 8B/10B encoding on the received data stream, and outputs the encoded data stream. As illustrated in FIG. 1, the rate may be 1 Gbit/s ~~(bit/s)~~ at which receiving from an upper layer is performed, and after the 8b/10b encoding, the data stream is sent to a PMA layer 102 at a rate of 1.25 Gbit/s. The rate shown in FIG. 1 is not limited, and it may be 1 Gbit/s or another rate.

[0060] The physical medium attachment (physical medium attachment, PMA) layer 102~~:~~ performs parallel-to-serial conversion on the data stream output by the PCS 100, and sends the converted data stream to a newly-added coding layer 104.

[0061] A physical medium dependent (physical medium dependent, PMD) layer 106 sends the received data stream to a physical line at a specific rate.

[0062] The coding layer 104 is newly added between the PMA layer 102 and the PMD layer 106, and the newly-added coding layer 104 includes: a PMA layer 1040, a PCS layer 1042, a ~~32B~~32b/~~34B~~ 34b encoding/decoding layer 1044, a forward error correction

(forward error correction, FEC) encoding/decoding layer 1046, and a PMA layer 1048.

[0063] Functions of the layers of the newly-added coding layer 104 from top to bottom are described as follows:

the PMA layer 1040: receives a data stream from the PMA layer 102 at a line rate, performs serial-to-parallel conversion on the received data stream, and outputs the converted data stream to the PCS layer 1042 for processing, where the line rate may be 1.25 Gbit/s illustrated in the figure 1 or another rate, which is not limited herein;

the PCS layer 1042 performs 8-bit/10-bit decoding on the received data stream;

the 32B/34B encoding/decoding layer 1044 performs 32-bit to 34-bit encoding on the data stream on which the 8-bit/10-bit encoding has been performed;

the FEC encoding/decoding layer 1046 performs forward error correction encoding on the data stream on which the 32-bit to 34-bit encoding has been performed; and

the PMA layer 1048 performs parallel-to-serial conversion on the data stream on which the forward error correction encoding has been performed, and sends the data stream on which the parallel-to-serial conversion has been performed to the physical medium dependent layer at the line rate.

[0064] Optionally, at the layer ~~the following is further included~~ between the ~~32B~~32b/~~34B~~ 34b encoding/decoding layer 1044 and the FEC encoding/decoding layer 1046, ~~:~~a scrambling/descrambling layer, configured to scramble the data stream on which the 32-bit to 34-bit encoding has been performed, and input the scrambled data stream to the FEC encoding/decoding layer 1046 for FEC encoding.

[0065] Further, the scrambling/descrambling layer may be combined into the 32B/34B encoding/decoding layer 1044, or may be independently set between the 32B/34B encoding/decoding layer 1044 and the FEC encoding/decoding layer 1046.

[0066] Optionally, at the layer between the FEC encoding/decoding layer 1046 and the PMA layer 1048, wherein the process of the encoding/decoding method further comprises: performing bit width conversion of 34-bit/10-bit on the data stream on which the forward error correction encoding has been performed, and inputting the data stream on which the bit width conversion has been preformed to the PMA layer 1048 for processing.

CLAIMS

~~What is claimed is:~~

1. A communications method for an optical network system, wherein the communications method comprises:

receiving a data stream from a physical medium attachment layer at a line rate, wherein the data stream is a data stream on which 8-bit/10-bit encoding has been performed;

performing 8-bit/10-bit decoding on the received data stream;

performing 32-bit to 34-bit encoding on the data stream on which the 8-bit/10-bit decoding has been performed;

performing forward error correction encoding on the data stream on which the 32-bit to 34-bit encoding has been performed;

performing bit width conversion of 34-bit/10-bit on the data stream on which the forward error correction encoding has been performed; and

sending the data stream on which the bit width conversion has been performed to a physical medium dependent layer at the line rate.

2. The communications method according to claim 1, wherein before the step of the performing 32-bit to 34-bit encoding on the data stream on which the 8-bit/10-bit decoding has been performed, the communications method further comprises:

sequentially and consecutively receiving the data stream on which the 8-bit/10-bit decoding has been performed, to obtain four data blocks, wherein any one of the data blocks is a first control character block or a data character block, and any first control character block or any data character block is an 8-bit binary code; and

determining whether a first control character block exists among the four data blocks.

3. The communications method according to claim 2, wherein the performing 32-bit to 34-bit encoding on the data stream on which the 8-bit/10-bit decoding has been performed specifically comprises:

if no first control character block exists among the four data blocks, adding a first synchronization head to a header of a first data block among the four data blocks, and outputting the data blocks to which the first synchronization head is added,

wherein the first data block is an 8-bit binary code input first, the first synchronization head comprises a 2-bit first identifier, and the first identifier is used to identify that the data blocks are all data character blocks.

4. The communications method according to claim 2, wherein the performing 32-bit to 34-bit encoding on the data stream on which the 8-bit/10-bit decoding has been performed specifically comprises:

if at least one first control character block exists among the four data blocks, adding a second synchronization head to a header of a first data block among the four data blocks, wherein the first data block is an 8-bit binary code input first, the second synchronization head comprises a 2-bit second identifier, and the second identifier is used to identify that at least one first control character block exists among the data blocks;

generating, according to a quantity of first control character blocks among the four data blocks and a location of each of the first control character blocks among the data blocks, a 4-bit control character block location mapping code, and setting the control character block location mapping code, in a location after the second synchronization head and closely adjacent to the second synchronization head;

correspondingly converting each of the first control character blocks among the four data blocks into a 4-bit second control character block; and

outputting the processed data blocks, wherein the processed data blocks comprise the second synchronization head, the control character block location mapping code, and the second control blocks that are obtained after the conversion, or the processed data blocks comprise the second synchronization head, the control character block location mapping code, the second control character block that is obtained after the conversion, and the data character blocks.

5. The communications method according to claim 4, wherein the outputting the processed data blocks specifically comprises:

if the four data blocks further comprise at least one data character block, performing no processing on the at least one data character block among the four data blocks, and retaining the data character block among the data blocks; and

outputting the processed data blocks, wherein the processed data blocks comprise the second synchronization head, the control character block location mapping code, the second control character block that is obtained after the conversion, and the data character block.

~~6. The communications method according to claim 4 or 5, wherein the method further comprises:~~

~~determining whether a quantity of bits that are comprised in the output processed data blocks is 34; and~~

~~if the quantity of the bits that are comprised in the output processed data blocks is less than 34, adding a random number to a tail of a last data block among the output processed data blocks until the quantity of the bits that are comprised in the output processed data blocks becomes 34, wherein the random number is a randomly-generated binary code.~~

~~7. The communications method according to claim 1, wherein after the step of the receiving a data stream from a physical medium attachment layer at a line rate, the communications method further comprises:~~

~~synchronizing the data stream on which the 8-bit/10-bit encoding has been performed.~~

~~8. The communications method according to claim 1, wherein after the step of the performing 32-bit to 34-bit encoding on the data stream on which the 8-bit/10-bit decoding has been performed, the communications method further comprises:~~

~~scrambling the data stream except data stream except the first synchronization head or the second synchronization head in the data stream on which the 32-bit to 34-bit encoding has been performed.~~

9<u>6</u>. A communications method for an optical network system, wherein the communications method comprises:

receiving a data stream from a physical medium dependent layer at a line rate, wherein the data stream is a data stream on which 32-bit to 34-bit encoding has been performed;

performing bit width conversion of 10-bit/34-bit on the received data stream;

performing forward error correction decoding on the data stream on which the bit width conversion has been performed;

performing 32-bit to 34-bit decoding on the data stream on which the forward error correction decoding has been performed;

performing 8-bit/10-bit encoding on the data stream on which the 32-bit to 34-bit decoding has been performed; and

sending the data stream on which the 8-bit/10-bit encoding has been performed to a physical medium attachment layer.

~~107~~. The communications method according to claim ~~96~~, wherein before the step of the performing 32-bit to 34-bit decoding on the data stream on which the forward error correction decoding has been performed, the communications method further comprises:

parsing the data stream on which the forward error correction decoding has been performed, and outputting 51 data blocks, wherein any one of the data blocks is a second control character block or a data character block, any second control character block is a 4-bit binary code, and any data character block is an 8-bit binary code;

parsing any one of the data blocks, and obtaining a synchronization head of the data blocks, wherein the synchronization head comprises: a first synchronization head or a second synchronization head, the first synchronization head comprises a 2-bit first identifier, the first identifier is used to identify that the data block is a data character block, the second synchronization head comprises a 2-bit second identifier, and the second identifier is used to identify that at least one second control character block exists among the data blocks; and

determining whether the synchronization head of the any one of the data blocks is a first synchronization head or a second synchronization head.

~~118~~. The communications method according to claim ~~107~~, wherein the step of the performing 32-bit to 34-bit decoding on the data stream on which the forward error correction decoding has been performed specifically comprises:

if the synchronization head is a first synchronization head, deleting the first synchronization head, and outputting the data blocks from which the first synchronization head is deleted.

~~129~~. The communications method according to claim ~~107~~, wherein the step of the performing 32-bit to 34-bit decoding on the data stream on which the forward error correction decoding has been performed specifically comprises:

if the synchronization head is a second synchronization head, parsing the data blocks, and obtaining a 4-bit control character block location mapping code;

obtaining a quantity of the second control character blocks among the data blocks and a location of each of the second control character blocks among the data blocks according to the control character block location mapping code;

correspondingly converting the second control character block among the data blocks into an 8-bit first control character block according to the quantity of the second control character blocks and the location of the second control character block

among the data blocks;

deleting the second synchronization head and the control character block location mapping code from the data blocks, wherein the control character block location mapping code is in a location after the second synchronization head and closely adjacent to the second synchronization head; and

outputting the processed data blocks, wherein the processed data blocks comprise: the first control character block and/or the data character block, and any first control character block or any data character block is an 8-bit binary code.

~~13~~10. The communications method according to claim ~~12~~9, wherein the step of the outputting the processed data blocks specifically comprises:

if the data blocks further comprise at least one data character block, performing no processing on the data character block among the data blocks, and retaining the data character block; and

outputting the processed data blocks, wherein the processed data blocks comprise: the first control character block and the data character block.

~~14. The communications method according to claim 9, wherein before the step of the performing bit width conversion of 10-bit/34-bit on the received data stream, the communications method further comprises:~~

~~synchronizing the received data stream.~~

~~15. The communications method according to claim 9, wherein before the step of the performing 32-bit to 34-bit decoding on the data stream on which the forward error correction decoding has been performed, the communications method further comprises:~~

~~descrambling the data stream except the first synchronization head or the second synchronization head in the data stream on which the forward error correction decoding has been performed.~~

~~16~~11. An optical network device, wherein the optical network device comprises:

a first interface unit, configured to receive a data stream from a physical medium attachment layer at a line rate, wherein the data stream is a data stream on which 8-bit/10-bit encoding has been performed, and perform serial-to-parallel conversion on the received data stream;

an 8-bit/10-bit decoder, configured to perform 8-bit/10-bit decoding on the received data stream, and output the data stream on which the 8-bit/10-bit decoding has been performed;

a 32-bit to 34-bit encoder, configured to perform 32-bit to 34-bit encoding on the output data stream on which the 8-bit/10-bit decoding has been performed, and output the data stream on which the 32-bit to 34-bit encoding has been performed;

a forward error correction encoder, configured to perform forward error correction encoding on the output data stream on which the 32-bit to 34-bit encoding has been performed, and output the data stream on which the forward error correction encoding has been performed;

a first bit width converter, configured to perform bit width conversion of 34-bit/10-bit on the output data stream on which the forward error correction encoding has been performed; and

a second interface unit, configured to send the data stream on which the bit width conversion has been performed to a physical medium dependent layer at the line rate.

~~17~~12. The optical network device according to claim ~~16~~11, wherein the 32-bit to 34-bit encoder comprises:

a first receiving unit, configured to sequentially and consecutively receive the data stream on which the 8-bit/10-bit decoding has been performed, to form four data blocks, wherein any one of the data blocks is a first control character block or a data character block, and any first control character block or any data character block is an 8-bit binary code; and

a first determining unit, configured to determine whether a first control character block exists among the four data blocks.

~~18~~13. The optical network device according to claim ~~17~~12, wherein the 32-bit to 34-bit encoder further comprises:

a first processing unit, configured to: if no first control character block exists among the four data blocks, add a first synchronization head to a header of a first data block among the four data blocks, and output the data blocks to which the first synchronization head is added, wherein the first data block is an 8-bit binary code input first, the first synchronization head comprises a 2-bit first identifier, and the first identifier is used to identify that the data blocks are all data character blocks.

~~19~~14. The optical network device according to claim ~~17~~12, wherein the 32-bit to 34-bit encoder further comprises a second processing unit, and the second processing unit specifically comprises:

a synchronization head generating unit, configured to: if at least one first control character block exists among the four data blocks, add a second synchronization head

to a header of a first data block among the four data blocks, wherein the first data block is an 8-bit binary code input first, the second synchronization head comprises a 2-bit second identifier, and the second identifier is used to identify that at least one first control character block exists among the data blocks;

a mapping code generating unit, configured to generate, according to a quantity of first control character blocks among the four data blocks and a location of the first control block among the data blocks, a 4-bit control character block location mapping code, and set the control character block location mapping code, in a location after the second synchronization head and closely adjacent to the second synchronization head;

a first control character block converting unit, configured to correspondingly convert the first control character block among the four data blocks into a 4-bit second control character block; and

a first outputting unit, configured to output the processed data blocks, wherein the processed data blocks comprise the second synchronization head, the control character block location mapping code, and the second control character block that is obtained after the conversion, or the processed data blocks comprise the second synchronization head, the control character block location mapping code, the second control character block that is obtained after the conversion, and the data character block.

~~20~~15. The optical network device according to claim ~~19~~14, wherein the first outputting unit is specifically configured to; if the four data blocks further comprise at least one data character block, perform no processing on the data character block among the four data blocks, and retain the data character block among the data blocks; and output the processed data blocks, wherein the processed data blocks comprise the second synchronization head, the control character block location mapping code, the second control character block that is obtained after the conversion, and a data block of the data character block.

~~21. The optical network device according to claim 19, wherein the first outputting unit is further configured to determine whether a quantity of bits that are comprised in the output processed data blocks is 34; and if the quantity of the bits that are comprised in the output processed data blocks is less than 34, add a random number to a tail of the output processed data blocks until the quantity of the bits of the output processed data blocks becomes 34, wherein the random number is a randomly-generated binary code.~~

~~22. The optical network device according to claim 16, wherein the optical network device further comprises:~~

~~a first synchronizing unit, configured to synchronize the data stream on which the 8-bit/10-bit encoding has been performed.~~

~~23. The optical network device according to claim 16, wherein the optical network device further comprises: a scrambler, configured to scramble the data stream except the first synchronization head or the second synchronization head in the data stream on which the 32-bit to 34-bit encoding has been performed.~~

~~24~~16. An optical network device, wherein the optical network device comprises:

a third interface unit, configured to receive a data stream from a physical medium dependent layer at a line rate, wherein the data stream is a data stream on which 32-bit to 34-bit encoding has been performed;

a second bit width converter, configured to perform bit width conversion of 10-bit/34-bit on the received data stream;

a forward error correction decoder, configured to perform forward error correction decoding on the data stream on which the bit width conversion has been performed;

a 32-bit to 34-bit decoder, configured to perform 32-bit to 34-bit decoding on the data stream on which the forward error correction decoding has been performed;

an 8-bit/10-bit coder, configured to perform 8-bit/10-bit encoding on the data stream on which the 32-bit to 34-bit decoding has been performed; and

a fourth interface unit, configured to send the data stream on which the 8-bit/10-bit encoding has been performed to a physical medium attachment layer.

~~25~~17. The optical network device according to claim ~~24~~16, wherein the 32-bit to 34-bit decoder comprises:

a first parsing unit, configured to parse the data stream on which the forward error correction decoding has been performed, and output 51 data blocks, wherein any one of the data blocks is a second control character block or a data character block, any second control character block is a 4-bit binary code, and any data character block is an 8-bit binary code;

a second parsing unit, configured to parse any one of the data blocks, and obtain a synchronization head of the any one of the data blocks, wherein the synchronization head comprises: a first synchronization head or a second synchronization head, the first synchronization head comprises a 2-bit first identifier, the first identifier is used

to identify that the data blocks are all data character blocks, the second synchronization head comprises a 2-bit second identifier, and the second identifier is used to identify that at least one second control character block exists among the data blocks; and

a second determining unit, configured to determine whether the synchronization head of the any one of the data blocks is a first synchronization head or a second synchronization head.

~~26~~18. The optical network device according to claim ~~24~~16, wherein the 32-bit to 34-bit decoder further comprises:

a third processing unit, configured to: if the synchronization head is a first synchronization head, delete the first synchronization head, and output the data blocks from which the first synchronization head is deleted.

~~27~~19. The optical network device according to claim ~~24~~16, wherein the 32-bit to 34-bit decoder further comprises a fourth processing unit, and the fourth processing unit specifically comprises:

a mapping code parsing unit, configured to: if the synchronization head is a second synchronization head, parse the data blocks, and obtain a 4-bit control character block location mapping code;

a second control character converting unit, configured to obtain a quantity of the second control character blocks among the data blocks and a location of the second control character block among the data blocks according to the control character block location mapping code; and correspondingly convert the second control character block among the data blocks into an 8-bit first control character block according to the quantity of the second control character blocks and the location of the second control character block among the data blocks;

a synchronization head deleting unit, configured to delete the second synchronization head and the control character block location mapping code from the data blocks, wherein the control character block location mapping code is in a location after the second synchronization head and closely adjacent to the second synchronization head; and

a second outputting unit, configured to output the processed data blocks, wherein the processed data blocks comprise: the first control character block and/or the data character block, and any first control character block or any data character block is an 8-bit binary code.

~~28. The optical network device according to claim 27, wherein the second outputting unit is specifically configured to: if the data blocks further comprise at least one data character block, perform no processing on the data character block among the data blocks, and retain the data character block; and output the processed data blocks, wherein the processed data blocks comprise: the first control character and the data character block.~~

~~29. The optical network device according to claim 24, wherein the optical network device further comprises:~~

~~a second synchronizing unit, configured to synchronize the received data stream.~~

~~30. The optical network device according to claim 24, wherein the optical network device further comprises:~~

~~a descrambler, configured to descramble the data stream except the first synchronization head or the second synchronization head in the data stream on which the forward error correction decoding has been performed.~~

~~31~~20. A communications system, wherein the communications system comprises~~:~~ ~~at least~~: any one of the optical network devices according to claims ~~16 - 23~~11-15 and any one of the optical network devices according to claims ~~24 - 30~~16-19.

~~32. An optical network system, wherein the optical network system comprises at least: an optical line terminal~~ and an optical network unit, wherein the optical line ~~terminal comprises any one of the optical network devices according to claims 16 - 23, and the optical network unit comprises any one of the optical network devices according to claims 24 - 30; or~~

~~the optical network unit comprises any one of the optical network devices according to claims 16 - 23, and the optical line terminal comprises any one of the optical network devices according to claims 24 - 30.~~