

CLAIMS

What is claimed is:

~~1. A clock synchronization mode indication method, comprising:~~

5 ~~obtaining, by a session management function network element, first indication information, wherein the first indication information indicates a clock synchronization mode used in a communication system in which a terminal device and a user plane function network element are located; and~~

10 ~~sending, by the session management function network element, the first indication information to the terminal device.~~

~~2. The method according to claim 1, further comprising:~~

15 ~~obtaining, by the session management function network element, an identifier of a clock domain, wherein the identifier of the clock domain and the first indication information indicate a clock synchronization mode used in the clock domain by the communication system in which the terminal device and the user plane function network element are located; and~~

~~sending, by the session management function network element, the identifier of the clock domain to the terminal device.~~

~~3. The method according to claim 2, further comprising:~~

20 ~~sending, by the session management function network element, the identifier of the clock domain to the user plane function network element.~~

~~4. The method according to any one of claims 1 to 3, further comprising:~~

~~sending, by the session management function network element, the first indication information to the user plane function network element.~~

~~5. The method according to any one of claims 1 to 4, further comprising:~~

25 ~~determining, by the session management function network element, fourth indication information based on second indication information and third indication information, wherein the second indication information indicates a clock synchronization mode supported by the terminal device, the third indication information indicates a clock synchronization mode supported by the user plane function network element, and the fourth indication information indicates a clock~~
30 ~~synchronization mode supported by a session between the terminal device and the user plane~~

function network element; and

~~sending, by the session management function network element, the fourth indication information to an application function network element.~~

~~6. The method according to any one of claims 1 to 4, further comprising:~~

~~determining, by the session management function network element, fifth indication information based on second indication information and third indication information, wherein the second indication information indicates a clock synchronization mode supported by the terminal device, the third indication information indicates a clock synchronization mode supported by the user plane function network element, and the fifth indication information indicates a clock synchronization mode supported by the communication system in which the terminal device and the user plane function network element are located; and~~

~~sending, by the session management function network element, the fifth indication information to an application function network element.~~

~~7. The method according to claim 5 or 6, further comprising:~~

~~receiving, by the session management function network element, the second indication information from the terminal device.~~

~~8. The method according to claim 5 or 6, further comprising:~~

~~receiving, by the session management function network element, the third indication information from the user plane function network element.~~

~~9. The method according to any one of claims 1 to 8, wherein the sending, by the session management function network element, the first indication information to the terminal device comprises:~~

~~sending, by the session management function network element, the first indication information to the terminal device in a protocol data unit PDU session establishment procedure.~~

~~10. The method according to any one of claims 1 to 8, wherein the sending, by the session management function network element, the first indication information to the terminal device comprises:~~

~~sending, by the session management function network element, the first indication information to the terminal device in a PDU session modification procedure.~~

~~11. The method according to any one of claims 1 to 10, wherein the clock synchronization mode comprises a peer to peer transparent clock type, an end to end transparent clock type, or a~~

boundary clock type.

~~12. A clock synchronization mode indication method, comprising:~~

~~obtaining, by a first communication device, first indication information, wherein the first indication information indicates a clock synchronization mode used in a communication system in which the first communication device and a second communication device are located, and the first communication device is a terminal device, and the second communication device is a user plane function network element; or the first communication device is a user plane function network element, and the second communication device is a terminal device; and~~

~~processing, by the first communication device, a precision time protocol PTP packet based on the first indication information.~~

~~13. The method according to claim 12, wherein the obtaining, by a first communication device, first indication information comprises:~~

~~receiving, by the first communication device, the first indication information from a session management function network element.~~

~~14. The method according to claim 12 or 13, further comprising:~~

~~obtaining, by the first communication device, an identifier of a clock domain, wherein the identifier of the clock domain and the first indication information indicate a clock synchronization mode used in the clock domain by the communication system in which the first communication device and the second communication device are located.~~

~~15. The method according to claim 14, wherein the obtaining, by the first communication device, an identifier of a clock domain comprises:~~

~~receiving, by the first communication device, the identifier of the clock domain from the session management function network element.~~

~~16. The method according to claim 14 or 15, wherein the processing, by the first communication device, a precision time protocol PTP packet based on the first indication information comprises:~~

~~processing, by the first communication device, the PTP packet based on the identifier of the clock domain and the first indication information.~~

~~17. The method according to any one of claims 12 to 16, wherein the first communication device is the terminal device, and the method further comprises:~~

~~sending, by the first communication device, second indication information to the session~~

management function network element in a protocol data unit PDU session establishment procedure, wherein the second indication information indicates a clock synchronization mode supported by the first communication device.

18. The method according to any one of claims 12 to 16, wherein the first communication device is the terminal device, and the method further comprises:

sending, by the first communication device, second indication information to an access and mobility management function network element in a registration procedure, wherein the second indication information indicates a clock synchronization mode supported by the first communication device.

19. The method according to any one of claims 12 to 16, wherein the first communication device is the user plane function network element, and the method further comprises:

sending, by the first communication device, third indication information to the session management function network element in an N4 association setup procedure, an N4 session establishment procedure, or an N4 session modification procedure, wherein the third indication information indicates a clock synchronization mode supported by the first communication device.

20. The method according to any one of claims 12 to 19, wherein if the first indication information indicates that the clock synchronization mode is a peer-to-peer transparent clock type, the processing, by the first communication device, a precision time protocol PTP packet based on the first indication information comprises:

receiving, by the first communication device, the PTP packet from an upstream node that is in the communication system, updating a correction field or a suffix field of the PTP packet based on a PTP link delay between the first communication device and the upstream node, and sending an updated PTP packet to the second communication device, wherein the PTP packet comprises a synchronization packet or a follow up packet corresponding to the synchronization packet, and the suffix field is for updating the correction field.

21. The method according to any one of claims 12 to 20, wherein the clock synchronization mode comprises the peer-to-peer transparent clock type, an end-to-end transparent clock type, or a boundary clock type.

22. A communication apparatus, comprising:

a processing module, configured to obtain first indication information, wherein the first indication information indicates a clock synchronization mode used in a communication system in

~~which a terminal device and a user plane function network element are located; and
a transceiver module, configured to send the first indication information to the terminal device.~~

~~23. The communication apparatus according to claim 22, wherein~~

~~the processing module is further configured to obtain an identifier of a clock domain, wherein
the identifier of the clock domain and the first indication information indicate a clock
synchronization mode used in the clock domain by the communication system in which the
terminal device and the user plane function network element are located; and~~

~~the transceiver module is further configured to send the identifier of the clock domain to the
terminal device.~~

~~24. The communication apparatus according to claim 23, wherein~~

~~the transceiver module is further configured to send the identifier of the clock domain to the
user plane function network element.~~

~~25. The communication apparatus according to any one of claims 22 to 24, wherein~~

~~the transceiver module is further configured to send the first indication information to the
user plane function network element.~~

~~26. A first communication apparatus, comprising:~~

~~a processing module, configured to obtain first indication information, wherein the first
indication information indicates a clock synchronization mode used in a communication system in
which the first communication apparatus and a second communication apparatus are located, and
the first communication apparatus is a terminal device, and the second communication apparatus
is a user plane function network element; or the first communication apparatus is a user plane
function network element, and the second communication apparatus is a terminal device; and~~

~~the processing module is further configured to process a precision time protocol PTP packet
based on the first indication information.~~

~~27. The first communication apparatus according to claim 26, wherein the processing module
is further configured to:~~

~~obtain an identifier of a clock domain, wherein the identifier of the clock domain and the first
indication information indicate a clock synchronization mode used in the clock domain by the
communication system in which the first communication apparatus and the second communication
apparatus are located.~~

~~28. The first communication apparatus according to claim 27, wherein the processing module~~

is configured to:

~~process the PTP packet based on the identifier of the clock domain and the first indication information.~~

~~29. The first communication apparatus according to any one of claims 26 to 28, wherein if the first indication information indicates that the clock synchronization mode is a peer-to-peer transparent clock type, the first communication apparatus further comprises a transceiver module, and~~

~~the transceiver module is configured to receive the PTP packet from an upstream node that is in the communication system;~~

~~the processing module is configured to update a correction field or a suffix field of the PTP packet based on a PTP link delay between the first communication apparatus and the upstream node; and~~

~~the transceiver module is further configured to send an updated PTP packet to the second communication apparatus, wherein the PTP packet comprises a synchronization packet or a follow up packet corresponding to the synchronization packet, and the suffix field is for updating the correction field.~~

~~30. The communication apparatus or the first communication apparatus according to any one of claims 22 to 29, wherein the clock synchronization mode comprises the peer-to-peer transparent clock type, an end-to-end transparent clock type, or a boundary clock type.~~

1. A clock synchronization mode indication method, comprising:

obtaining, by a session management function network element, first indication information, wherein the first indication information indicates a clock synchronization mode used in a communication system in which a terminal device and a user plane function network element are located; and

sending, by the session management function network element, the first indication information to the terminal device.

2. The method according to claim 1, further comprising:

obtaining, by the session management function network element, an identifier of a clock domain, wherein the identifier of the clock domain and the first indication information indicate a clock synchronization mode used in the clock domain by the communication system in which the terminal device and the user plane function network element are located; and

sending, by the session management function network element, the identifier of the clock domain to the terminal device.

3. The method according to claim 2, further comprising:

sending, by the session management function network element, the identifier of the clock domain to the user plane function network element.

4. The method according to any one of claims 1 to 3, further comprising:

sending, by the session management function network element, the first indication information to the user plane function network element.

5. The method according to any one of claims 1 to 4, further comprising:

determining, by the session management function network element, fourth indication information based on second indication information and third indication information, wherein the second indication information indicates a clock synchronization mode supported by the terminal device, the third indication information indicates a clock synchronization mode supported by the user plane function network element, and the fourth indication information indicates a clock synchronization mode supported by a session between the terminal device and the user plane function network element; and

sending, by the session management function network element, the fourth indication information to an application function network element.

6. The method according to any one of claims 1 to 4, further comprising:

determining, by the session management function network element, fifth indication information based on second indication information and third indication information, wherein the second indication information indicates a clock synchronization mode supported by the terminal device, the third indication information indicates a clock synchronization mode supported by the user plane function network element, and the fifth indication information indicates a clock synchronization mode supported by the communication system in which the terminal device and the user plane function network element are located; and

sending, by the session management function network element, the fifth indication information to an application function network element.

7. The method according to claim 5 or 6, further comprising:

receiving, by the session management function network element, the second indication information from the terminal device.

8. The method according to claim 5 or 6, further comprising:

receiving, by the session management function network element, the third indication information from the user plane function network element.

9. The method according to any one of claims 1 to 8, wherein the sending, by the session management function network element, the first indication information to the terminal device comprises:

sending, by the session management function network element, the first indication information to the terminal device in a protocol data unit PDU session establishment procedure.

10. The method according to any one of claims 1 to 8, wherein the sending, by the session management function network element, the first indication information to the terminal device comprises:

sending, by the session management function network element, the first indication information to the terminal device in a PDU session modification procedure.

11. The method according to any one of claims 1 to 10, wherein the clock synchronization mode comprises a peer-to-peer transparent clock type, an end-to-end transparent clock type, or a boundary clock type.

12. A clock synchronization mode indication method, comprising:

obtaining, by a first communication device, first indication information, wherein the first indication information indicates a clock synchronization mode used in a communication system in

which the first communication device and a second communication device are located, and the first communication device is a terminal device, and the second communication device is a user plane function network element; or the first communication device is a user plane function network element, and the second communication device is a terminal device; and

5 processing, by the first communication device, a precision time protocol PTP packet based on the first indication information.

13. The method according to claim 12, wherein the obtaining, by a first communication device, first indication information comprises:

10 receiving, by the first communication device, the first indication information from a session management function network element.

14. The method according to claim 12 or 13, further comprising:

15 obtaining, by the first communication device, an identifier of a clock domain, wherein the identifier of the clock domain and the first indication information indicate a clock synchronization mode used in the clock domain by the communication system in which the first communication device and the second communication device are located.

15. The method according to claim 14, wherein the obtaining, by the first communication device, an identifier of a clock domain comprises:

receiving, by the first communication device, the identifier of the clock domain from the session management function network element.

20 16. The method according to claim 14 or 15, wherein the processing, by the first communication device, a precision time protocol PTP packet based on the first indication information comprises:

processing, by the first communication device, the PTP packet based on the identifier of the clock domain and the first indication information.

25 17. The method according to any one of claims 12 to 16, wherein the first communication device is the terminal device, and the method further comprises:

30 sending, by the first communication device, second indication information to the session management function network element in a protocol data unit PDU session establishment procedure, wherein the second indication information indicates a clock synchronization mode supported by the first communication device.

18. The method according to any one of claims 12 to 16, wherein the first communication

device is the terminal device, and the method further comprises:

sending, by the first communication device, second indication information to an access and mobility management function network element in a registration procedure, wherein the second indication information indicates a clock synchronization mode supported by the first communication device.

19. The method according to claim 17 or 18, wherein the clock synchronization mode indicated by the first indication information is subset of intersection set of the clock synchronization mode indicated by the second indication information and clock synchronization mode supported by the user plane function network element.

20. The method according to any one of claims 12 to 16, wherein the first communication device is the user plane function network element, and the method further comprises:

sending, by the first communication device, third indication information to the session management function network element in an N4 association setup procedure, an N4 session establishment procedure, or an N4 session modification procedure, wherein the third indication information indicates a clock synchronization mode supported by the first communication device.

21. The method according to claim 20, wherein the clock synchronization mode indicated by the first indication information is subset of intersection set of the clock synchronization mode indicated by the third indication information and clock synchronization mode supported by the terminal device.

22. The method according to any one of claims 12 to 21, wherein the clock synchronization mode used in the communication system is the clock synchronization mode supported by the user plane function network element and the terminal device.

23. The method according to any one of claims 12 to 22, wherein the first indication information indicates that the clock synchronization mode is an end-to-end transparent clock type, wherein the processing, by the first communication device, a precision time protocol PTP packet based on the first indication information comprises:

receiving, by the first communication device, a first synchronization packet from an upstream node that is in the communication system, and sending a second synchronization packet corresponding to the first synchronization packet to the second communication device, wherein a suffix field of the second synchronization packet comprises precise time of the first communication device receiving the first synchronization packet; or,

receiving, by the first communication device, a synchronization packet from an upstream node that is in the communication system, and sending a follow up packet corresponding to the synchronization packet to the second communication device, wherein a suffix field of the follow up packet comprises precise time of the first communication device receiving the synchronization packet.

24. The method according to any one of claims 12 to 22, wherein if the first indication information indicates that the clock synchronization mode is a peer-to-peer transparent clock type, the processing, by the first communication device, a precision time protocol PTP packet based on the first indication information comprises:

receiving, by the first communication device, the PTP packet from an upstream node that is in the communication system, updating a correction field or a suffix field of the PTP packet based on a PTP link delay between the first communication device and the upstream node, and sending an updated PTP packet to the second communication device, wherein the PTP packet comprises a synchronization packet or a follow up packet corresponding to the synchronization packet, and the suffix field is for updating the correction field.

25. The method according to any one of claims 12 to 24, wherein the clock synchronization mode comprises the peer-to-peer transparent clock type, an end-to-end transparent clock type, or a boundary clock type.

26. A communication apparatus, comprising:

a processing module, configured to obtain first indication information, wherein the first indication information indicates a clock synchronization mode used in a communication system in which a terminal device and a user plane function network element are located; and

a transceiver module, configured to send the first indication information to the terminal device.

27. The communication apparatus according to claim 26, wherein

the processing module is further configured to obtain an identifier of a clock domain, wherein the identifier of the clock domain and the first indication information indicate a clock synchronization mode used in the clock domain by the communication system in which the terminal device and the user plane function network element are located; and

the transceiver module is further configured to send the identifier of the clock domain to the terminal device.

28. The communication apparatus according to claim 27, wherein

the transceiver module is further configured to send the identifier of the clock domain to the user plane function network element.

29. The communication apparatus according to any one of claims 26 to 28, wherein

the transceiver module is further configured to send the first indication information to the user plane function network element.

30. A first communication apparatus, comprising:

a processing module, configured to obtain first indication information, wherein the first indication information indicates a clock synchronization mode used in a communication system in which the first communication apparatus and a second communication apparatus are located, and the first communication apparatus is a terminal device, and the second communication apparatus is a user plane function network element; or the first communication apparatus is a user plane function network element, and the second communication apparatus is a terminal device; and

the processing module is further configured to process a precision time protocol PTP packet based on the first indication information.

31. The first communication apparatus according to claim 30, wherein the processing module is further configured to:

obtain an identifier of a clock domain, wherein the identifier of the clock domain and the first indication information indicate a clock synchronization mode used in the clock domain by the communication system in which the first communication apparatus and the second communication apparatus are located.

32. The first communication apparatus according to claim 31, wherein the processing module is configured to:

process the PTP packet based on the identifier of the clock domain and the first indication information.

33. The first communication apparatus according to any one of claims 30 to 32, wherein if the first indication information indicates that the clock synchronization mode is a peer-to-peer transparent clock type, the first communication apparatus further comprises a transceiver module, and

the transceiver module is configured to receive the PTP packet from an upstream node that is in the communication system;

the processing module is configured to update a correction field or a suffix field of the PTP

packet based on a PTP link delay between the first communication apparatus and the upstream node; and

the transceiver module is further configured to send an updated PTP packet to the second communication apparatus, wherein the PTP packet comprises a synchronization packet or a follow up packet corresponding to the synchronization packet, and the suffix field is for updating the correction field.

34. The first communication apparatus according to any one of claims 30 to 32, wherein the first indication information indicates that the clock synchronization mode is an end-to-end transparent clock type, and the first communication apparatus processes a precision time protocol PTP packet based on the first indication information, and the first communication apparatus further comprises a transceiver module, and

the transceiver module is configured to receive a first synchronization packet from an upstream node that is in the communication system, and send a second synchronization packet corresponding to the first synchronization packet to the second communication device, wherein a suffix field of the second synchronization packet comprises precise time of the first communication device receiving the first synchronization packet; or,

the transceiver module is configured to receive a synchronization packet from an upstream node that is in the communication system, and send a follow up packet corresponding to the synchronization packet to the second communication device, wherein a suffix field of the follow up packet comprises precise time of the first communication device receiving the synchronization packet.

35. The first communication apparatus according to any one of claims 30 to 34, wherein the first communication device is the terminal device, and the first communication apparatus further comprises a transceiver module, and

the transceiver module is configured to send second indication information to the session management function network element in a protocol data unit PDU session establishment procedure, wherein the second indication information indicates a clock synchronization mode supported by the first communication device.

36. The first communication apparatus according to any one of claims 30 to 34, wherein the first communication device is the terminal device, and the first communication apparatus further comprises a transceiver module, and

the transceiver module is configured to send second indication information to an access and mobility management function network element in a registration procedure, wherein the second indication information indicates a clock synchronization mode supported by the first communication device.

5 37. The first communication apparatus according to claim 35 or 36, wherein the clock synchronization mode indicated by the first indication information is subset of intersection set of the clock synchronization mode indicated by the second indication information and clock synchronization mode supported by the user plane function network element.

10 38. The first communication apparatus according to any one of claims 30 to 34, wherein the first communication device is the user plane function network element, and the first communication apparatus further comprises a transceiver module, and

15 the transceiver module is configured to send third indication information to the session management function network element in an N4 association setup procedure, an N4 session establishment procedure, or an N4 session modification procedure, wherein the third indication information indicates a clock synchronization mode supported by the first communication device.

39. The first communication apparatus according claim 38, wherein the clock synchronization mode indicated by the first indication information is subset of intersection set of the clock synchronization mode indicated by the third indication information and clock synchronization mode supported by the terminal device.

20 40. The communication apparatus or the first communication apparatus according to any one of claims 26 to 39, wherein the clock synchronization mode used in the communication system is the clock synchronization mode supported by the user plane function network element and the terminal device.

25 41. The communication apparatus or the first communication apparatus according to any one of claims 26 to 40, wherein the clock synchronization mode comprises the peer-to-peer transparent clock type, an end-to-end transparent clock type, or a boundary clock type.

42. A computer readable storage medium, wherein the computer readable storage medium stores a computer program, and when the computer program is run on a computer, the computer is enabled to perform the method according to any one of claims 1 to 25.

30 43. A clock synchronization mode indication method, comprising:
receiving, by a session management function network element, indication information

indicating a clock synchronization mode supported by a user plane function network element from the user plane function network element;

determining, by the session management function network element, a clock synchronization mode used in a communication system in which the user plane function network element and a terminal device are located based on the indication information;

obtaining, by the user plane function network element, the clock synchronization mode; and
processing, by the user plane function network element, a precision time protocol PTP packet based on the clock synchronization mode.

44. The method according to claim 43, wherein the receiving, by a session management function network element, indication information indicating a clock synchronization mode supported by a user plane function network element from the user plane function network element comprises:

receiving, by a session management function network element, the indication information from the user plane function network element in an N4 association setup procedure, an N4 session establishment procedure, or an N4 session modification procedure.

45. The method according to claim 43 or 44, wherein the clock synchronization mode is subset of intersection set of the clock synchronization mode indicated by the indication information and clock synchronization mode supported by the terminal device.

46. The method according to any one of claims 43 to 45, wherein the clock synchronization mode is the clock synchronization mode supported by the user plane function network element and the terminal device.

47. The method according to any one of claims 43 to 46, wherein the clock synchronization mode is an end-to-end transparent clock type, and the processing, by the user plane function network element, a precision time protocol PTP packet based on the clock synchronization mode comprises:

receiving, by the user plane function network element, a first synchronization packet from an upstream node that is in the communication system, and sending a second synchronization packet corresponding to the first synchronization packet to the second communication device, wherein a suffix field of the second synchronization packet comprises precise time of the user plane function network element receiving the first synchronization packet; or,

receiving, by the user plane function network element, a synchronization packet from an

upstream node that is in the communication system, and sending a follow up packet corresponding to the synchronization packet to the second communication device, wherein a suffix field of the follow up packet comprises precise time of the user plane function network element receiving the synchronization packet.

5 48. The method according to any one of claims 43 to 46, wherein the clock synchronization mode is a peer-to-peer transparent clock type, and the processing, by the user plane function network element, a precision time protocol PTP packet based on the clock synchronization mode comprises:

10 receiving, by the user plane function network element, the PTP packet from an upstream node that is in the communication system, updating a correction field or a suffix field of the PTP packet based on a PTP link delay between the first communication device and the upstream node, and sending an updated PTP packet to the second communication device, wherein the PTP packet comprises a synchronization packet or a follow up packet corresponding to the synchronization packet, and the suffix field is for updating the correction field.

15 49. The method according to any one of claims 43 to 48, wherein the clock synchronization mode comprises the peer-to-peer transparent clock type, an end-to-end transparent clock type, or a boundary clock type.

50. A communication system, comprising:

20 a session management function network element configured to receive indication information indicating a clock synchronization mode supported by a user plane function network element from the user plane function network element; determine a clock synchronization mode used in a communication system in which the user plane function network element and a terminal device are located based on the indication information;

25 the user plane function network element configured to obtain the clock synchronization mode; and process a precision time protocol PTP packet based on the clock synchronization mode.

51. The communication system according to claim 50, wherein the session management function network element is configured to receive the indication information from the user plane function network element in an N4 association setup procedure, an N4 session establishment procedure, or an N4 session modification procedure.

30 52. The communication system according to claim 50 or 51, wherein the clock synchronization mode is subset of intersection set of the clock synchronization mode indicated by

the indication information and clock synchronization mode supported by the terminal device.

53. The communication system according to any one of claims 50 to 52, wherein the clock synchronization mode is the clock synchronization mode supported by the user plane function network element and the terminal device.

5 54. The communication system according to any one of claims 50 to 53, wherein the clock synchronization mode is an end-to-end transparent clock type,

the user plane function network element is configured to: receive a first synchronization packet from an upstream node that is in the communication system, and sending a second shychronization packet corresponding to the first synchronization packet to the second communication device, wherein a suffix field of the second synchronization packet comprises precise time of the user plane function network element receiving the first synchronization packet;
10 or,

the user plane function network element is configured to: receive a synchronization packet from an upstream node that is in the communication system, and sending a follow up packet
15 corresponding to the synchronization packet to the second communication device, wherein a suffix field of the follow up packet comprises precise time of the user plane function network element receiving the synchronization packet.

55. The communication system according to any one of claims 50 to 53, wherein the clock synchronization mode is a peer-to-peer transparent clock type,

20 the user plane function network element is configured to: receive the PTP packet from an upstream node that is in the communication system, updating a correction field or a suffix field of the PTP packet based on a PTP link delay between the first communication device and the upstream node, and sending an updated PTP packet to the second communication device, wherein the PTP packet comprises a synchronization packet or a follow up packet corresponding to the
25 synchronization packet, and the suffix field is for updating the correction field.

56. The communication system according to any one of claims 50 to 55, wherein the clock synchronization mode comprises the peer-to-peer transparent clock type, an end-to-end transparent clock type, or a boundary clock type.