CLAIMS

What is claimed is:

1. An active 1:N breakout cable that comprises:

a unary end connector connected by electrical conductors to each of N split end connectors, N being an integer greater than 1,

the unary end connector being adapted to fit into a network interface port of a primary host device to provide output PAM4 electrical signals that convey a multi-lane outbound data stream to the primary host device and to accept input PAM4 electrical signals that convey multi-lane inbound data stream from the primary host device, and

each of the split end connectors being adapted to fit into a network interface port of a secondary host device to provide output NRZ electrical signals that convey a split portion of the inbound data stream to that secondary host device and to accept input NRZ electrical signals that convey a split portion of the outbound data stream from that secondary host device.

2. The active 1:N breakout cable of claim 1, wherein the unary end connector includes a transceiver that performs clock and data recovery on the input PAM4 electrical signals to extract and re-modulate the inbound data stream as diverging transit signals that transport the split portions of the inbound data stream via the electrical conductors to the split end connectors, and wherein the transceiver performs clock and data recovery on converging transit signals to extract and re-modulate the outbound data stream as said output PAM4 electrical signals.

3. The active 1:N breakout cable of claim 2, wherein the diverging transit signals and the converging transit signals are NRZ electrical signals.

4. The active 1:N breakout cable of claim 3, wherein the transceiver in the unary end connector further performs forward error correction when extracting the outbound data stream.

5. The active 1:N breakout cable of claim 3, wherein each of the split end connectors includes a redriver circuit that provides the output NRZ electrical signals by amplifying the diverging transit signals that it receives, and wherein the redriver circuit provides at least one of the converging transit signals by amplifying the input NRZ electrical signals that it receives.

6. The active 1:N breakout cable of claim 3, wherein each of the split end connectors includes a transceiver that performs clock and data recovery on the diverging transit signals that it receives to extract and re-modulate the split portion of the inbound data stream, and wherein the transceiver in each split end connector performs clock and data recovery on the input NRZ electrical signals to extract and re-modulate the split portion of the outbound data stream.

7. The active 1:N breakout cable of claim 6, wherein the transceiver in each split end connector further performs forward error correction when extracting the split portion of the inbound data stream.

8. The active 1:N breakout cable of claim 2, wherein the diverging transit signals and the converging transit signals are PAM4 electrical signals, wherein each of the split end connectors includes a transceiver that performs clock and data recovery on the diverging transit signals that it receives to extract and re-modulate the split portion of the inbound data stream, and wherein the transceiver in each split end connector performs clock and data recovery on the input NRZ electrical signals to extract and re-modulate the split portion of the outbound data stream.

9. The active 1:N breakout cable of claim 8, wherein the transceiver in each split

end connector further performs forward error correction when extracting the split portion of the inbound data stream.

10. The active 1:N breakout cable of claim 1, wherein each of the split end connectors includes a transceiver that performs clock and data recovery on the input NRZ electrical signals to extract and re-modulate the split portion of the outbound data stream as one or more of converging transit signals that transport the split portions of the inbound data stream via the electrical conductors to the unary end connector, and wherein the transceiver performs clock and data recovery on diverging transit signals to extract and re-modulate the split portion of the inbound data stream as said output NRZ electrical signals.

11. The active 1:N breakout cable of claim 10, wherein the diverging transit signals and the converging transit signals are PAM4 electrical signals.

12. The active 1:N breakout cable of claim 11, wherein the unary end connector includes a transceiver that performs clock and data recovery on the input PAM4 electrical signals to extract and re-modulate the inbound data stream as the diverging transit signals that transport the split portions of the inbound data stream via the electrical conductors to the split end connectors, and wherein the transceiver in the unary end connector performs clock and data recovery on the converging transit signals to extract and re-modulate the outbound data stream as said output PAM4 electrical signals.

13. The active 1:N breakout cable of claim 12, wherein the transceiver in the unary end connector further performs forward error correction when extracting the outbound data stream.

14. A cable manufacturing method that comprises:

packaging a transceiver into a unary end connector that is adapted to mate with a network interface port of a primary host device, the transceiver being configured to provide output PAM4 electrical signals that convey a multi-lane outbound data stream to the primary host device and to accept input PAM4 electrical signals that convey multi-lane inbound data stream from the primary host device; and

connecting each of N split end connectors to the unary end connector with electrical conductors, where N is an integer greater than one, and where each of the split end connectors is adapted to mate with a network interface port of a secondary host device to provide output NRZ electrical signals that convey a split portion of the inbound data stream to that secondary host device and to accept input NRZ electrical signals that convey a split portion of the outbound data stream from that secondary host device,

the transceiver in the unary end connector being configured to perform clock and data recovery on the input PAM4 electrical signals to extract and re-modulate the inbound data stream as diverging transit signals that transport the split portions of the inbound data stream via the electrical conductors to the split end connectors, and further configured to perform clock and data recovery on converging transit signals to extract and re-modulate the outbound data stream as said output PAM4 electrical signals.

15. The method of claim 14, wherein the diverging transit signals and the converging transit signals are NRZ electrical signals.

16. The method of claim 15, further comprising packaging a redriver circuit into each of the split end connectors, the redriver circuit being configured to provide

the output NRZ electrical signals by amplifying the diverging transit signals that it receives, and being further configured to provide at least one of the converging transit signals by amplifying the input NRZ electrical signals that it receives.

17. The method of claim 15, further comprising: packaging a transceiver into each of the split end connectors, the transceiver in each split end connector being configured to perform clock and data recovery on the diverging transit signals that it receives to extract and re-modulate the split portion of the inbound data stream, and being further configured to perform clock and data recovery on the input NRZ electrical signals to extract and re-modulate the split portion of the outbound data stream.

18. The method of claim 14, wherein the diverging transit signals and the converging transit signals are PAM4 electrical signals, and wherein the method further comprises packaging a transceiver in each of the split end connectors, the transceiver in each split end connector being configured to perform performs clock and data recovery on the diverging transit signals that it receives to extract and re-modulate the split portion of the inbound data stream, and being further configured to perform clock and data recovery on the input NRZ electrical signals to extract and re-modulate the split portion of the outbound data stream.

19. A cable manufacturing method that comprises:

packaging a transceiver into each of N split end connectors adapted to mate with a network interface port of a secondary host device, where N is an integer greater than one, and where each of the transceivers in the split end connectors is configured to provide output NRZ electrical signals that convey a split portion of a multi-lane inbound data stream to that secondary host device

and to accept input NRZ electrical signals that convey a split portion of a multi-lane outbound data stream from that secondary host device; and

connecting each of the split end connectors to a unary end connector via electrical conductors, the unary end connector being adapted to mate with a network interface port of a primary host device to provide output PAM4 electrical signals that convey the outbound data stream to the primary host device and to accept input PAM4 electrical signals that convey the inbound data stream from the primary host device,

the transceiver in each split end connector being configured to perform clock and data recovery on the input NRZ electrical signals to extract and re-modulate the split portion of the outbound data stream as converging transit signals that transport the split portions of the outbound data stream via the electrical conductors to the unary end connector, and being further configured to perform clock and data recovery on diverging transit signals to extract and re-modulate the split portion of the inbound data stream as said output NRZ electrical signals.

20. The method of claim 19, wherein the diverging transit signals and the converging transit signals are PAM4 electrical signals.

21. The method of claim 20, further comprising packaging a transceiver in the unary end connector, the transceiver in the unary end connector being configured to perform clock and data recovery on the input PAM4 electrical signals to extract and re-modulate the inbound data stream as the diverging transit signals that transport the split portions of the inbound data stream via the electrical conductors to the split end connectors, and being further configured to perform clock and data recovery on the converging transit signals to extract and re-

modulate the outbound data stream as said output PAM4 electrical signals.

22. An active 1:N breakout cable that comprises:

a unary end connector connected by electrical conductors to each of N split end connectors, N being an integer greater than 1,

the unary end connector being adapted to fit into a network interface port of a primary host device to provide first output electrical signals that convey a multi-lane outbound data stream to the primary host device at a first symbol rate and to accept first input electrical signals that convey multi-lane inbound data stream from the primary host device at the first symbol rate, and

each of the split end connectors being adapted to fit into a network interface port of a secondary host device to provide second output electrical signals that convey a split portion of the inbound data stream to that secondary host device at a second symbol rate and to accept second input electrical signals that convey a split portion of the outbound data stream from that secondary host device at the second symbol rate,

the second symbol rate being half of the first symbol rate.

23. The cable of claim 22, wherein the first output electrical signals, the first input electrical signals, the second output electrical signals, and the second input electrical signals, are each PAM4 electrical signals.

24. The cable of claim 22, wherein the first output electrical signals, the first input electrical signals, the second output electrical signals, and the second input electrical signals, are each NRZ electrical signals.

25. The cable of claim 22, wherein the unary end connector includes a transceiver

that performs clock and data recovery on the first input electrical signals to extract and re-modulate the inbound data stream as diverging transit signals that transport the split portions of the inbound data stream via the electrical conductors to the split end connectors, and wherein the transceiver performs clock and data recovery on converging transit signals to extract and re-modulate the outbound data stream as said first output electrical signals.

26. The cable of claim 25, wherein the diverging transit signals and the converging transit signals use the second symbol rate.

27. The active 1:N breakout cable of claim 26, wherein the transceiver in the unary end connector further performs forward error correction when extracting the outbound data stream.

28. The cable of claim 26, wherein each of the split end connectors includes a redriver circuit that provides the second output electrical signals by amplifying the diverging transit signals that it receives, and wherein the redriver circuit provides at least one of the converging transit signals by amplifying the second input electrical signals that it receives.

29. The cable of claim 26, wherein each of the split end connectors includes a transceiver that performs clock and data recovery on the diverging transit signals that it receives to extract and re-modulate the split portion of the inbound data stream, and wherein the transceiver in each split end connector performs clock and data recovery on the second input electrical signals to extract and re-modulate the split portion of the outbound data stream.

30. The cable of claim 29, wherein the transceiver in each split end connector further performs forward error correction when extracting the split portion of the inbound data stream.

31. The cable of claim 25, wherein the diverging transit signals and the converging transit signals use the first symbol rate, wherein each of the split end connectors includes a transceiver that performs clock and data recovery on the diverging transit signals that it receives to extract and re-modulate the split portion of the inbound data stream, and wherein the transceiver in each split end connector performs clock and data recovery on the second input electrical signals to extract and re-modulate the split portion of the outbound data stream.

32. The cable of claim 31, wherein the transceiver in each split end connector further performs forward error correction when extracting the split portion of the inbound data stream.

33. The cable of claim 22, wherein each of the split end connectors includes a transceiver that performs clock and data recovery on the second input electrical signals to extract and re-modulate the split portion of the outbound data stream as one or more of converging transit signals that transport the split portions of the inbound data stream via the electrical conductors to the unary end connector, and wherein the transceiver performs clock and data recovery on diverging transit signals to extract and re-modulate the split portion of the inbound data stream as said second output electrical signals.

34. The cable of claim 33, wherein the diverging transit signals and the converging transit signals use the first symbol rate.

35. The cable of claim 34, wherein the unary end connector includes a transceiver that performs clock and data recovery on the first input electrical signals to extract and re-modulate the inbound data stream as the diverging transit signals that transport the split portions of the inbound data stream via the electrical conductors to the split end connectors, and wherein the transceiver in the unary

end connector performs clock and data recovery on the converging transit signals to extract and re-modulate the outbound data stream as said first output electrical signals.

36. The cable of claim 35, wherein the transceiver in the unary end connector further performs forward error correction when extracting the outbound data stream.

37. A cable manufacturing method that comprises:

packaging a transceiver into a unary end connector that is adapted to mate with a network interface port of a primary host device, the transceiver being configured to provide first output electrical signals that convey a multi-lane outbound data stream to the primary host device at a first symbol rate and to accept first input electrical signals that convey multi-lane inbound data stream from the primary host device at the first symbol rate; and

connecting each of N split end connectors to the unary end connector with electrical conductors, where N is an integer greater than one, and where each of the split end connectors is adapted to mate with a network interface port of a secondary host device to provide second output electrical signals that convey a split portion of the inbound data stream to that secondary host device at a second symbol rate and to accept second input electrical signals that convey a split portion of the outbound data stream from that secondary host device at the second symbol rate,

the transceiver in the unary end connector being configured to perform clock and data recovery on the first input electrical signals to extract and re-modulate the inbound data stream as diverging transit signals that transport

the split portions of the inbound data stream via the electrical conductors to the split end connectors, and further configured to perform clock and data recovery on converging transit signals to extract and re-modulate the outbound data stream as said first output electrical signals, and

the second symbol rate being half of the first symbol rate.

38. A cable manufacturing method that comprises:

packaging a transceiver into each of N split end connectors adapted to mate with a network interface port of a secondary host device, where N is an integer greater than one, and where each of the transceivers in the split end connectors is configured to provide split end output electrical signals that convey a split portion of a multi-lane inbound data stream to that secondary host device at a second symbol rate and to accept split end input electrical signals that convey a split portion of a multi-lane outbound data stream from that secondary host device at the second symbol rate; and

connecting each of the split end connectors to a unary end connector via electrical conductors, the unary end connector being adapted to mate with a network interface port of a primary host device to provide unary end output electrical signals that convey the outbound data stream to the primary host device at a first symbol rate and to accept unary end input electrical signals that convey the inbound data stream from the primary host device at the first symbol rate,

the transceiver in each split end connector being configured to perform clock and data recovery on the split end input electrical signals to extract and re-modulate the split portion of the outbound data stream as converging transit

signals that transport the split portions of the outbound data stream via the electrical conductors to the unary end connector, and being further configured to perform clock and data recovery on diverging transit signals to extract and re-modulate the split portion of the inbound data stream as said split end output electrical signals, and

the second symbol rate being half of the first symbol rate.