CLAIMS

WHAT IS CLAIMED IS:

1. A method, comprising:

at a first layer of a protocol stack triggering a communication of data, by a first node and via a communication link between the first node and a second node, with the second node

determining communication metric data associated with the communication of the data at a second layer of the protocol stack, wherein the second layer is lower than the first layer; and

maintaining link quality metric data at the first layer of the protocol stack, based at least in part on the communication metric data determined associated with the communication of the data at the second layer of the protocol stack.

2. The method of claim 1, wherein:

the maintaining operation utilizes an exponential weighted moving average filter with at least the communication metric data as input.

3. The method of claim 1, wherein the first layer of the protocol stack is a network layer and the second layer is a Media Access Control (MAC) layer.

4. The method of claim 1, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an indication of transmissions attempted and acknowledgements received.

5. The method of claim 1, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an expected transmission (ETX) metric.

6. The method of claim 1, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least communication metric data for the communication of data at the second layer of the protocol stack according to a plurality of different modulation schemes.

7. The method of claim 1, further comprising:

making a routing selection based at least in part on the link quality metric data.

8. A network communication device comprising:

a radio configured to communicate with a second network communication device;

one or more processors communicatively coupled to the radio; and

memory communicatively coupled to the one or more processors, the memory storing one or more instructions that, when executed by the one or more processors, cause the one or more processors to perform operations comprising:at a first layer of a protocol stack triggering a communication of data, by the network communication device and via a communication link between the network communication device and a second network communication device, with the second network communication device;

determining communication metric data associated with the communication of the data at a second layer of the protocol stack, wherein the second layer is lower than the first layer; and

maintaining link quality metric data at the first layer of the protocol stack, based at least in part on the communication metric data determined associated with the communication of the data at the second layer of the protocol stack.

9. The network communication device of claim 8, wherein:

the maintaining operation utilizes an exponential weighted moving average filter with at least the communication metric data as input.

10. The network communication device of claim 8, wherein the first layer of the protocol stack is a network layer and the second layer is a Media Access Control (MAC) layer.

11. The network communication device of claim 8, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an indication of transmissions attempted and acknowledgements received.

12. The network communication device of claim 8, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an expected transmission (ETX) metric.

13. The network communication device of claim 8, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least communication metric data for the communication of data at the second layer of the protocol stack according to a plurality of different modulation schemes.

14. The network communication device of claim 8, wherein the operations further comprise:

making a routing selection based at least in part on the link quality metric data.

15. One or more computer-readable storage media storing computer-readable instructions that, when executed, instruct one or more processors of a network communication device to perform operations comprising:

at a first layer of a protocol stack triggering a communication of data, by the network communication device and via a communication link between the network communication device and a second network communication device, with the second network communication device;

determining communication metric data associated with the communication of the data at a second layer of the protocol stack, wherein the second layer is lower than the first layer; and

maintaining link quality metric data at the first layer of the protocol stack, based at least in part on the communication metric data determined associated with the communication of the data at the second layer of the protocol stack.

16. The one or more computer-readable storage media of claim 15, wherein:

the maintaining operation utilizes an exponential weighted moving average filter with at least the communication metric data as input.

17. The one or more computer-readable storage media of claim 15, wherein the first layer of the protocol stack is a network layer and the second layer is a Media Access Control (MAC) layer.

18. The one or more computer-readable storage media of claim 15, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an indication of transmissions attempted and acknowledgements received.

19. The one or more computer-readable storage media of claim 15, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an expected transmission (ETX) metric.

20. The one or more computer-readable storage media of claim 15, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least communication metric data for the communication of data at the second layer of the protocol stack according to a plurality of different modulation schemes.

21. A method comprising:

communicating, by a first node and via a communication link between the first node and a second node, with the second node according to a first modulation scheme and, based at least in part thereon, determining first communication metric data;

communicating, by the first node and via the communication link between the first node and the second node, with the second node according to a second modulation scheme and, based at least in part thereon, determining second communication metric data; and

determining, by the first node, link quality metric data associated with the communication link, the link quality metric data based at least in part on the first communication metric data and the second communication metric data.

22. The method of claim 21, wherein the communication link is a first communication link, the method further comprising:

communicating, by the first node and via a second communication link between the first node and a third node, with the third node according to a third modulation scheme and, based at least in part thereon, determining third communication metric data;

communicating, by the first node and via the second communication link between the first node and the third node, with the third node according to a fourth modulation scheme and, based at least in part thereon, determining fourth communication metric data;

determining, by the first node, link quality metric data associated with the second communication link, the link quality metric data based at least in part on the third communication metric data and the fourth communication metric data; and

choosing between the first communication link and the second communication link based at least in part on the link quality metric data associated with the first communication link and the link quality metric data associated with the second communication link.

23. The method of claim 22, wherein the third modulation scheme is the same as the first modulation scheme.

24. The method of claim 23, wherein the fourth modulation scheme is the same as the second modulation scheme.

25. The method of claim 21, wherein a modulation type of the first modulation scheme is the same as a modulation type of the second modulation scheme, and a data rate of the first modulation scheme is different from a data rate of the second modulation scheme.

26. The method of claim 21, wherein:

determining the link quality metric data associated with the communication link includes applying a first weighting coefficient to the first communication metric data and a second weighting coefficient to the second communication metric data.

27. The method of claim 26, wherein:

the first weighting coefficient is based at least in part on a number of transmission attempts made according to the first modulation scheme; and

the second weighting coefficient is based at least in part on a number of transmission attempts made according to the second modulation scheme.

28. A network communication device comprising:

a radio configured to communicate with a second network communication device;

one or more processors communicatively coupled to the radio; and

memory communicatively coupled to the one or more processors, the memory storing one or more instructions that, when executed by the one or more processors, cause the one or more processors to perform operations comprising:causing the network communication device to communicate, via a communication link, with the second network communication device according to a first modulation scheme and, based at least in part thereon, determining first communication metric data;

causing the network communication device to communicate, via the communication link, with the second network communication device according to a second modulation scheme and, based at least in part thereon, determining second communication metric data; and

determining link quality metric data associated with the communication link, the link quality metric data based at least in part on the first communication metric data and the second communication metric data.

29. The network communication device of claim 28, wherein the communication link is a first communication link, the operations further comprising:

causing the network communication device to communicate, via a second communication link, with a third network communication device according to a third modulation scheme and, based at least in part thereon, determining third communication metric data;

causing the network communication device to communicate, via the second communication link, with the third network communication device according to a fourth modulation scheme and, based at least in part thereon, determining fourth communication metric data; and

determining link quality metric data associated with the second communication link, the link quality metric data based at least in part on the third communication metric data and the fourth communication metric data; and

choosing between the first communication link and the second communication link based at least in part on the link quality metric data associated with the first communication link and the link quality metric data associated with the second communication link.

30. The network communication device of claim 29, wherein the third modulation scheme is the same as the first modulation scheme.

31. The network communication device of claim 30, wherein the fourth modulation scheme is the same as the second modulation scheme.

32. The network communication device of claim 28, wherein a modulation type of the first modulation scheme is the same as a modulation type of the second modulation scheme, and a data rate of the first modulation scheme is different from a data rate of the second modulation scheme.

33. The network communication device of claim 28, wherein:

determining the link quality metric data associated with the communication link includes applying a first weighting coefficient to the first communication metric data and a second weighting coefficient to the second communication metric data.

34. The network communication device of claim 33, wherein:

the first weighting coefficient is based at least in part on a number of transmission attempts made according to the first modulation scheme; and

the second weighting coefficient is based at least in part on a number of transmission attempts made according to the second modulation scheme.

35. One or more computer-readable storage media storing computer-readable instructions that, when executed, instruct one or more processors of a network communication device to perform operations comprising:

causing the network communication device to communicate, via a communication link, with the second network communication device according to a first modulation scheme and, based at least in part thereon, determining first communication metric data;

causing the network communication device to communicate, via the communication link, with the second network communication device according to a second modulation scheme and, based at least in part thereon, determining second communication metric data; and

determining link quality metric data associated with the communication link, the link quality metric data based at least in part on the first communication metric data and the second communication metric data.

36. The one or more computer-readable storage media of claim 35, wherein the communication link is a first communication link, the operations further comprising:

causing the network communication device to communicate, via a second communication link, with a third network communication device according to a third modulation scheme and, based at least in part thereon, determining third communication metric data;

causing the network communication device to communicate, via the second communication link, with the third network communication device according to a fourth modulation scheme and, based at least in part thereon, determining fourth communication metric data;

determining link quality metric data associated with the second communication link, the link quality metric data based at least in part on the third communication metric data and the fourth communication metric data; and

choosing between the first communication link and the second communication link based at least in part on the link quality metric data associated with the first communication link and the link quality metric data associated with the second communication link.

37. The one or more computer-readable storage media of claim 36, wherein the third modulation scheme is the same as the first modulation scheme.

38. The one or more computer-readable storage media of claim 36, wherein the fourth modulation scheme is the same as the second modulation scheme.

39. The one or more computer-readable storage media of claim 35, wherein a modulation type of the first modulation scheme is the same as a modulation type of the second modulation scheme, and a data rate of the first modulation scheme is different from a data rate of the second modulation scheme.

~~40. The one or more computer-readable storage media of claim 35, wherein:~~

~~determining the link quality metric data associated with the communication link includes applying a first weighting coefficient to the first communication metric data and a second weighting coefficient to the second communication metric data;~~

~~the first weighting coefficient is based at least in part on a number of transmission attempts made according to the first modulation scheme; and~~

~~the second weighting coefficient is based at least in part on a number of transmission attempts made according to the second modulation scheme.~~

What is claimed is:

1. A method, comprising:

at a first layer of a protocol stack triggering a communication of data, by a first node and via a communication link between the first node and a second node, with the second node

determining communication metric data associated with the communication of the data at a second layer of the protocol stack, wherein the second layer is lower than the first layer; and

maintaining link quality metric data at the first layer of the protocol stack, based at least in part on the communication metric data determined at the second layer of the protocol stack,

wherein the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least communication metric data for the communication of data at the second layer of the protocol stack for a plurality of different modulation schemes.

2. The method of claim 1, wherein:

the maintaining operation utilizes an exponential weighted moving average filter with at least the communication metric data as input.

3. The method of claim 1, wherein the first layer of the protocol stack is a network layer and the second layer is a Media Access Control (MAC) layer.

4. The method of claim 1, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an indication of transmissions attempted and acknowledgements received.

5. The method of claim 1, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an expected transmission (ETX) metric.

6. The method of claim 1, further comprising:

making a routing selection based at least in part on the link quality metric data.

7. The method of claim 1, wherein the modulation schemes include at least one of radio frequency (RF) modulation schemes or power line communication (PLC) modulation schemes.

8. A network communication device comprising:

a radio configured to communicate with a second network communication device;

one or more processors communicatively coupled to the radio; and

memory communicatively coupled to the one or more processors, the memory storing one or more instructions that, when executed by the one or more processors, cause the one or more processors to perform operations comprising: at a first layer of a protocol stack triggering a communication of data, by the network communication device and via a communication link between the network communication device and a second network communication device, with the second network communication device;

determining communication metric data associated with the communication of the data at a second layer of the protocol stack, wherein the second layer is lower than the first layer; and

maintaining link quality metric data at the first layer of the protocol stack, based at least in part on the communication metric data determined at the second layer of the protocol stack,

wherein the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least communication metric data for the communication of data at the second layer of the protocol stack for a plurality of different modulation schemes.

9. The network communication device of claim 8, wherein:

the maintaining operation utilizes an exponential weighted moving average filter with at least the communication metric data as input.

10. The network communication device of claim 8, wherein the first layer of the protocol stack is a network layer and the second layer is a Media Access Control (MAC) layer.

11. The network communication device of claim 8, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an indication of transmissions attempted and acknowledgements received.

12. The network communication device of claim 8, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an expected transmission (ETX) metric.

13. The network communication device of claim 8, wherein the operations further comprise:

making a routing selection based at least in part on the link quality metric data.

14. The network communication device of claim 8, wherein the modulation schemes include at least one of radio frequency (RF) modulation schemes or power line communication (PLC) modulation schemes.

15. One or more computer-readable storage media storing computer-readable instructions that, when executed, instruct one or more processors of a network communication device to perform operations comprising:

at a first layer of a protocol stack triggering a communication of data, by the network communication device and via a communication link between the network communication device and a second network communication device, with the second network communication device;

determining communication metric data associated with the communication of the data at a second layer of the protocol stack, wherein the second layer is lower than the first layer; and

maintaining link quality metric data at the first layer of the protocol stack, based at least in part on the communication metric data determined at the second layer of the protocol stack,

wherein the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least communication metric data for the communication of data at the second layer of the protocol stack for a plurality of different modulation schemes.

16. The one or more computer-readable storage media of claim 15, wherein:

the maintaining operation utilizes an exponential weighted moving average filter with at least the communication metric data as input.

17. The one or more computer-readable storage media of claim 15, wherein the first layer of the protocol stack is a network layer and the second layer is a Media Access Control (MAC) layer.

18. The one or more computer-readable storage media of claim 15, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an indication of transmissions attempted and acknowledgements received.

19. The one or more computer-readable storage media of claim 15, wherein:

the communication metric data associated with the communication of the data at the second layer of the protocol stack includes at least an expected transmission (ETX) metric.

20. The one or more computer-readable storage media of claim 15, wherein the modulation schemes include at least one of radio frequency (RF) modulation schemes or power line communication (PLC) modulation schemes.