

What is claimed is:

1. An apparatus, comprising
a first device for performing wireless directional communications with a second device, the wireless directional communications comprising:
setting a network allocation vector (NAV) in response to detecting a network reservation from a third device;
receiving, during a time period indicated by the NAV, a request-to-send (RTS) from the second device;
transmitting, to the second device, either a denial-to-send (DTS) before expiration of the NAV or a delayed clear-to-send (D-CTS) after expiration of the NAV; and
performing communications with the second device after expiration of the NAV and after said transmitting, said communications taking place during a time period indicated by the RTS from the second device.
2. The apparatus of claim 1, wherein:
said transmitting comprises transmitting a DTS; and
the first device is to receive a second RTS from the second device after expiration of the NAV and is to transmit a clear-to-send (CTS) after receiving the second RTS but before said performing.
3. The apparatus of claim 1, wherein the DTS comprises a frame control message indicating a time remaining in the NAV.
4. The apparatus of claim 1, wherein the network reservation comprises either an RTS or a CTS transmitted by the third device and not addressed to the first device.
5. The apparatus of claim 1, further comprising at least one antenna.
6. A method, comprising
communicating wirelessly with a second device, by performing operations in a first device, said operations comprising:
setting a network allocation vector (NAV) in response to detecting either

a request to send (RTS) from a third device or a clear-to-send (CTS) from the third device;

receiving, during a time period indicated by the NAV, a request-to-send (RTS) from the second device;

transmitting to the second device, in response to receiving the RTS, a denial-to-send (DTS) before expiration of the NAV; and

performing communications with the second device after expiration of the NAV;

wherein said receiving, said transmitting, and said performing communications each comprise using a directional link.

7. The method of claim 6, further comprising:

receiving a second RTS from the second device after expiration of the NAV; and transmitting a clear-to-send (CTS) after receiving the second RTS but before said performing.

8. The method of claim 6, wherein the DTS comprises a duration field indicating a time remaining in the NAV.

9. An article comprising

a computer-readable storage medium that contains instructions, which when executed by one or more processors result in performing operations comprising:

setting a network allocation vector (NAV) in response to detecting either a request to send (RTS) from a third device or a clear-to-send (CTS) from the third device;

receiving, during a time period indicated by the NAV, a request-to-send (RTS) from the second device;

transmitting, to the second device, a denial-to-send (DTS) before expiration of the NAV; and

performing communications with the second device after expiration of the NAV;

wherein the operations of receiving, transmitting, and performing take place over a directional link.

10. The article of claim 9, further comprising:
receiving another RTS from the second device after expiration of the NAV; and
transmitting a clear-to-send (CTS) after receiving the second RTS but before said performing.
11. The article of claim 9, wherein the DTS comprises a frame control message indicating a time remaining in the NAV.
12. An apparatus, comprising
a first device for performing wireless directional communications with a second device over a directional link, the first device including a radio, a processor, and a memory, the wireless directional communications comprising:
transmitting a request-to-send (RTS) to the second device;
receiving a denial-to-send (DTS) from the second device, the DTS containing a duration value indicating time remaining for a network allocation vector (NAV) that has been set in the second device; and
performing subsequent communications with the second device only after expiration of the NAV.
13. The apparatus of claim 12, further comprising at least one antenna.
14. A method, comprising
communicating wirelessly with a second device, by performing operations in a first device, said communicating comprising:
transmitting a request-to-send (RTS) to the second device;
receiving a denial-to-send (DTS) from the second device; and
performing subsequent communications with the second device only after expiration of a time period indicated in the DTS;
wherein said transmitting, said receiving, and said performing each comprise using a directional link.
15. The method of claim 14, further comprising:
transmitting a second RTS to the second device after said expiration of the time

period; and

receiving a clear-to-send (CTS) from the second device after transmitting the second RTS but before said performing the subsequent communications.

16. The method of claim 14, wherein the DTS comprises a frame control message.

17. An article comprising

a computer-readable storage medium that contains instructions, which when executed by one or more processors result in performing operations comprising:

transmitting a request-to-send (RTS) to a wireless communications device;

receiving a denial-to-send (DTS) from the wireless communication device; and

performing subsequent communications with the wireless communications device only after expiration of a time period indicated in the DTS.

18. The article of claim 17, wherein the operations further comprise:

transmitting a second RTS to the wireless communications device after said expiration of the time period; and

receiving a clear-to-send (CTS) from the wireless communications device after transmitting the second RTS.

19. The article of claim 17, wherein the DTS comprises a frame control message.

20. The apparatus of claim 1, wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

21. The method of claim 6, wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

22. The article of claim 9, wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

23. The apparatus of claim 12, wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

24. The method of claim 14, wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

25. The article of claim 17, wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

What is claimed is:

1. A system, comprising:

a first device for performing wireless directional communications with a second device, the wireless directional communications comprising:

setting a network allocation vector (NAV) in response to detecting a network reservation from a third device;

receiving, during a time period indicated by the NAV, a request-to-send (RTS) from the second device;

transmitting, to the second device, either a denial-to-send (DTS) for a time period before expiration of the NAV or a delayed clear-to-send (D-CTS) for a time period after expiration of the NAV, the DTS indicating to the second device not to initiate communications until after expiration of the NAV; and

performing communications with the second device after the expiration of the NAV and after said transmitting, said communications taking place during a time period indicated by the RTS from the second device;

wherein said transmitting comprises transmitting a DTS;

the first device is to receive a second RTS from the second device after the expiration of the NAV and is to transmit a clear-to-send (CTS) after receiving the second RTS but before said performing; and

the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

2. A method, comprising:

communicating wirelessly with a second device, by performing operations in a first device, said operations comprising:

setting a network allocation vector (NAV) in response to detecting either a request to send (RTS) from a third device or a clear-to-send (CTS) from the third device;

receiving, during a time period indicated by the NAV, a request-to-send (RTS) from the second device;

transmitting, to the second device, in response to receiving the RTS, a denial-to-send (DTS) before expiration of the NAV, the DTS indicating to the second device not to initiate communications until after expiration of the NAV;

performing communications with the second device after the expiration of the NAV, wherein said receiving, said transmitting, and said performing communications each comprise using a directional link;

receiving a second RTS from the second device after the expiration of the NAV; and

transmitting a clear-to-send (CTS) after receiving the second RTS but before said performing,

wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

3. An article comprising:

a non-transitory computer-readable storage medium that contains non-transitory instructions, which when executed by one or more processors result in performing operations comprising:

setting a network allocation vector (NAV) in response to detecting either a request to send (RTS) from a third device or a clear-to-send (CTS) from the third device;

receiving, during a time period indicated by the NAV, a request-to-send (RTS) from the second device;

transmitting, to the second device, a denial-to-send (DTS) before expiration of the NAV, the DTS indicating to the second device not to initiate communications until after expiration of the NAV;

performing communications with the second device after the expiration of the NAV, wherein the operations of receiving, transmitting, and performing take place over a directional link;

receiving another RTS from the second device after the expiration of the NAV; and

transmitting a clear-to-send (CTS) after receiving the second RTS but before said performing,

wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

4. A system, comprising:

a first device for performing wireless directional communications with a second device over a directional link, the first device including a radio, a processor, and a memory, the wireless directional communications comprising:

transmitting a request-to-send (RTS) to the second device;

receiving a denial-to-send (DTS) from the second device, the DTS containing a duration value indicating a time remaining for a network allocation vector (NAV) that has been set in the second device, the DTS indicating to the first device not to initiate communications until after expiration of the NAV;

performing subsequent communications with the second device only after the expiration of the NAV;

transmitting a second RTS to the second device after said expiration of the NAV; and

receiving a clear-to-send (CTS) from the second device after transmitting the second RTS but before said performing the subsequent communication,

wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

5. A method, comprising communicating wirelessly with a second device, by performing operations in a first device, said communicating comprising:

transmitting a request-to-send (RTS) to the second device;

receiving a denial-to-send (DTS) from the second device, the DTS containing a duration value indicating a time remaining for a network allocation vector (NAV) that has been set in the second device, the DTS indicating to the first device not to initiate communications until after expiration of the NAV;

performing subsequent communications with the second device only after the expiration of the NAV, wherein said transmitting, said receiving, and said performing each comprise using a directional link;

transmitting a second RTS to the second device after said expiration of the NAV; and

receiving a clear-to-send (CTS) from the second device after transmitting the second RTS but before said performing the subsequent communication,

wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.

6. An article comprising:

a non-transitory computer-readable storage medium that contains non-transitory instructions, which when executed by one or more processors result in performing operations comprising:

transmitting a request-to-send (RTS) to a wireless communications device;

receiving a denial-to-send (DTS) from the wireless communication device, the DTS containing a duration value indicating a time remaining for a network allocation vector (NAV)

that has been set, the DTS indicating not to initiate communications until after expiration of the NAV;

performing subsequent communications with the wireless communications device only after the expiration of the NAV;

transmitting a second RTS to a second device after said expiration of the NAV; and

receiving a clear-to-send (CTS) from the second device after transmitting the second RTS but before said performing the subsequent communication,

wherein the DTS includes a Frame Control Field, a Duration field, an RA field, a NAV-SA field, a NAV-DA field, and an FCS field.