

CLAIMS

1. A system (100), comprising:

a first gateway satellite (105, 205, 505) having a first orbit and providing an intra-cluster communication link (140, 245, 570) using a first communication protocol for a plurality of auxiliary satellites that are orbitally-coupled with the first gateway satellite (105, 205, 505);

a first auxiliary satellite (110, 210, 515) of the plurality of auxiliary satellites configured to communicate with the first gateway satellite (105, 205, 505) using the first communication protocol, wherein the first auxiliary satellite (110, 210, 515) includes a first payload type; and

a second auxiliary satellite (110, 215, 520) of the plurality of auxiliary satellites configured to communicate with the first gateway satellite using the first communication protocol, wherein the second auxiliary satellite (110, 215, 520) includes a second payload type that is different than the first payload type,

wherein the first gateway satellite (105, 205, 505) routes intra-cluster communications over the intra-cluster communication link (140, 245, 570) for the first auxiliary satellite (110, 210, 515) or the second auxiliary satellite (110, 215, 520) using the first communication protocol.

2. The system of claim 1, wherein the intra-cluster communication link is a first intra-cluster communication link, the system further comprising:

a second gateway satellite (105, 510) having a second orbit and providing a second intra-cluster communication link (140, 575) using the first communication protocol for a different plurality of auxiliary satellites (520, 525, 530) that is orbitally-coupled with the second gateway satellite (105, 510),

wherein the first gateway satellite (105, 205, 505) routes inter-cluster communications for the first auxiliary satellite (110, 210, 515) or the second auxiliary satellite (110, 215, 520) to the second gateway satellite (105, 510), and

wherein the second gateway satellite routes the inter-cluster communications to an auxiliary satellite of the different plurality of auxiliary satellites (520, 525, 530) via the second intra-cluster communication link.

3. The system of claim 2, further comprising:

a third auxiliary satellite (110, 220, 525) of the different plurality of auxiliary satellites (520, 525, 530) that is orbitally-configured to communicate with the second gateway satellite (105, 510) using the first communication protocol, wherein the third auxiliary satellite (110, 220, 525) includes a third payload type; and

wherein the first gateway satellite (105, 205, 505) routes communications between the first auxiliary satellite (110, 210, 515) and the third auxiliary satellite (110, 220, 525) via the second gateway satellite (105, 510).

4. The system of any one of claims 1 through 3, wherein the first payload

type provides a first communication service for aerial devices (120, 230, 545), terrestrial devices (120, 225, 535), or both, according to a second communication protocol.

5. The system of claim 4, wherein the second payload type provides a

second communication service for the aerial devices (120, 230, 545), the terrestrial devices (120, 225, 535), or both, according to a third communication protocol, and wherein the first gateway satellite (105, 205, 505) routes the communications between the first auxiliary satellite (110, 210, 515) and the second auxiliary satellite (110, 215, 520) using the first communication protocol.

6. The system of claim 5, wherein:

the second communication protocol is associated with a first range of frequencies; and

the third communication protocol is associated with a second range of frequencies.

7. The system of claim 5, wherein:

the second communication protocol is associated with a first packetization scheme, a first cryptography scheme, and a first coding scheme;

the third communication protocol is associated with a second packetization scheme, a second cryptography scheme, and a second coding scheme; and

the first gateway satellite (105, 205, 505) translates between at least one of the first packetization scheme, the first cryptography scheme, or the first coding scheme and a corresponding one of the second packetization scheme, the second cryptography scheme, or

the second coding scheme for routing the communications for the first auxiliary satellite (110, 210, 515) or the second auxiliary satellite (110, 215, 520).

8. The system of any one of claims 1 through 4, wherein the second payload type is configured to collect information using a first sensor type, and wherein the second auxiliary satellite (110, 215, 520) communicates the information with the first gateway satellite (105, 205, 505) using the first communication protocol.

9. The system of any one of claims 1 through 8, wherein the first gateway satellite (105, 205, 505) routes the communications between the first auxiliary satellite (110, 210, 515) or the second auxiliary satellite (110, 215, 520) and a commercial communications satellite (115, 920) having a third orbit.

10. The system of any one of claims 1 through 9, wherein the first gateway satellite (110, 210, 515) communicates with the first auxiliary satellite (110, 215, 520) and the second auxiliary satellite (110, 215, 520) using the first communication protocol via an omnidirectional antenna.

11. The system of any one of claims 1 through 10, wherein at least one of the first auxiliary satellite (110, 210, 515) or the second auxiliary satellite (110, 215, 520) is orbitally-coupled with the first gateway satellite (105, 205, 505) subsequent to the first gateway satellite (105, 205, 505) being installed in the first orbit.

12. A method at a first gateway satellite (105, 205, 505) having a first orbit and providing an intra-cluster communication link (140, 245, 570) using a first communication protocol for a plurality of auxiliary satellites that are orbitally-coupled with the first gateway satellite (105, 205, 505), comprising:

receiving, from a first auxiliary satellite (110, 210, 515) of the plurality of auxiliary satellites that includes a first payload type, a communication using the first communication protocol;

selecting a second auxiliary satellite (110, 215, 520) of the plurality of auxiliary satellites that includes a second payload type for routing the communication as a destination node from among a plurality of destination nodes, the plurality of destination nodes comprising the plurality of auxiliary satellites, a second gateway satellite (105, 510)

having a second orbit, and a commercial communications satellite (115, 920) having a third orbit; and

transmitting information associated with the communication to the destination node.

13. The method of claim 12, further comprising:

determining that a request to access the second payload type is included in the communication based at least in part on the receiving,

wherein selecting the destination node comprises selecting the second auxiliary satellite (110, 215, 520) based at least in part on the determining.

14. The method of claim 13, further comprising:

receiving, from the second auxiliary satellite (110, 215, 520), a second communication associated with the second payload type using the first communication protocol in response to the transmitted information.

15. The method of claim 12, further comprising:

determining that a request to access a third payload type of a third auxiliary satellite (110, 220, 525) that is orbitally-coupled with the second gateway satellite (105, 510) is included in the communication based at least in part on the receiving,

wherein the selecting the destination node comprises selecting the second gateway satellite (105, 510) based at least in part on the determining.

16. The method of claim 12, further comprising:

determining that the communication is directed to a device (120, 230, 545) that is being provided a communication service by the second auxiliary satellite (110, 215, 520) based at least in part on the receiving,

wherein the selecting the destination node comprises selecting the second auxiliary satellite (110, 215, 520) based at least in part on the determining.

17. The method of claim 12, further comprising:

determining that the communication is directed to a device (120, 540, 545) that is being provided a communication service by a third auxiliary satellite (110, 520, 525)

that is orbitally-coupled with the second gateway satellite (105, 510) based at least in part on the receiving,

wherein selecting the destination node comprises selecting the second gateway satellite (105, 510) based at least in part on the determining.

18. The method of any one of claims 12 through 17, wherein the first auxiliary satellite (110, 210, 515) is configured for a second communication protocol and the second auxiliary satellite (110, 215, 520) is configured for a third communication protocol.

19. The method of any one of claims 12 through 18, further comprising:
receiving from the second gateway satellite (105, 510) a second communication using a second communication protocol;
determining that the communication is directed to the second auxiliary satellite (110, 215, 520) based at least in part on the receiving; and
selecting the second auxiliary satellite (110, 215, 520) as a second destination node based at least in part on the determining.

20. The method of any one of claims 12 through 18, further comprising:
receiving from the commercial communications satellite (115, 920) a second communication using a second communication protocol;
determining that the communication is directed to the second auxiliary satellite (110, 215, 520) based at least in part on the receiving; and
selecting the second auxiliary satellite (110, 215, 520) as a second destination node based at least in part on the determining.

21. The method of any one of claim 12 through 20, further comprising:
transmitting commands to the plurality of auxiliary satellites instructing the plurality of auxiliary satellites to modify an orbital path.

22. The method of any one of claims 12 through 21, further comprising:
identifying a first set of auxiliary satellites (210, 215) that are orbitally-coupled with the first gateway satellite (105, 205, 505) using the first communication protocol, wherein the first set of auxiliary satellites comprises the first auxiliary satellite (110, 210, 515) and the second auxiliary satellite; and

discovering, using the first communication protocol, a second set of auxiliary satellites (220) that become orbitally-coupled with the first gateway satellite (105, 205, 505) after the first set of auxiliary satellites are identified, wherein the second set of auxiliary satellites comprises at least a third auxiliary satellite (110, 220, 525) that includes a third payload type that is different than the first payload type and the second payload type.

23. The method of any one of claims 12 through 22, wherein the communication comprises a data packet composed according to a second communication protocol, the method further comprising:

translating data from the data packet from the second communication protocol to a third communication protocol used by the second auxiliary satellite,

wherein selecting the destination node comprises selecting the second auxiliary satellite (110, 215, 520) based at least in part on the translating.

24. A method at a first auxiliary satellite (110, 210, 515) that provides a communications service, comprising:

establishing, using a first communication protocol, a connection with a gateway satellite (105, 205, 505), wherein the first auxiliary satellite (110, 210, 515) is orbitally-coupled with the gateway satellite (105, 205, 505);

receiving a communication using a second communication protocol;

determining that the communication is directed to a second auxiliary satellite (110, 215, 520) that is orbitally-coupled with the gateway satellite (105, 205, 505) or a device (120) that is being provided a service by the second auxiliary satellite (110, 215, 520); and

transmitting, using the first communication protocol, data from the communication to the gateway satellite (105, 205, 505) based at least in part on the determining, the gateway satellite (105, 205, 505) configured to route the data from the communication directly to the second auxiliary satellite (110, 215, 520).

25. The method of claim 24, further comprising:

decoding at least a portion of the communication in accordance with the first communication protocol, wherein the determining is based at least in part on the decoded data packet.

26. The method of claim 25, further comprising:

obtaining a first address associated with the second auxiliary satellite (110, 215, 520) based at least in part on the decoding, wherein the determining comprises determining the obtained address is different than a second address associated with the first auxiliary satellite (110, 210, 515).

27. A first gateway satellite (105, 205, 505) having a first orbit and providing an intra-cluster communication link (140, 245, 570) using a first communication protocol for a plurality of auxiliary satellites that is orbitally-coupled with the first gateway satellite (105, 205, 505), comprising:

a processor;

memory coupled with the processor; and

instructions stored in the memory and executable by the processor to cause the first gateway satellite (105, 205, 505) to:

receive, from a first auxiliary satellite (110, 210, 515) of the plurality of auxiliary satellites that includes a first payload type, a communication using the first communication protocol;

select a second auxiliary satellite (110, 215, 520) of the plurality of auxiliary satellites that includes a second payload type for routing the communication as a destination node from among a plurality of destination nodes, the plurality of destination nodes comprising the plurality of auxiliary satellites, a second gateway satellite (105, 510) having a second orbit, and a commercial communications satellite (115, 920) having a third orbit; and

transmit information associated with the communication to the destination node.

28. The first gateway satellite (105, 205, 505) of claim 27, wherein the instructions are further executable by the processor to cause the first gateway satellite (105, 205, 505) to:

determine that a request to access the second payload type is included in the communication based at least in part on the receiving.

29. The first gateway satellite (105, 205, 505) of any one of claims 27 or 28, wherein the processor is further executable to cause the first gateway satellite (105, 205, 505) to:

receive, from the second auxiliary satellite (110, 215, 520), a second communication associated with the second payload type using the first communication protocol in response to the transmitted information.

30. The first gateway satellite (105, 205, 505) of claim 27, wherein the processor is further executable to cause the first gateway satellite (105, 205, 505) to:

select a third auxiliary satellite (110, 220, 525) of the plurality of auxiliary satellites that includes a third payload type for routing the communication as the destination node from among the plurality of destination nodes; and

determine that a request to access the third payload type of the third auxiliary satellite (110, 220, 525) that is orbitally-coupled with the second gateway satellite (105, 510) is included in the communication based at least in part on the receiving.

31. The first gateway satellite (105, 205, 505) of claim 27, wherein the processor is further executable to cause the first gateway satellite (105, 205, 505) to:

determine that the communication is directed to a device (120, 230, 545) that is being provided a communication service by the second auxiliary satellite (110, 215, 520) based at least in part on the receiving.

32. The first gateway satellite (105, 205, 505) of claim 30, wherein the processor is further executable to cause the first gateway satellite (105, 205, 505) to:

determine that the communication is directed to a device (120, 540, 545) that is being provided a communication service by the third auxiliary satellite (110, 520, 525) that is orbitally-coupled with the second gateway satellite (105, 510) based at least in part on the receiving.

33. A first auxiliary satellite (110, 210, 515) that provides a communications service, comprising:

a processor;

memory coupled with the processor; and

instructions stored in the memory and executable by the processor to cause the first auxiliary satellite (110, 210, 515) to:

establish, using a first communication protocol, a connection with a gateway satellite (105, 205, 505), wherein the first auxiliary satellite is orbitally-coupled with the gateway satellite (105, 205, 505);

receive a communication using a second communication protocol;

determine that the communication is directed to a second auxiliary satellite (110, 215, 520) that is orbitally-coupled with the gateway satellite (105, 205, 505) or a device (120) that is being provided a service by the second auxiliary satellite (110, 215, 520); and

transmit, using the first communication protocol, data from the communication to the gateway satellite (105, 205, 505) based at least in part on the determining, the gateway satellite (105, 205, 505) configured to route the data from the communication directly to the second auxiliary satellite (110, 215, 520) t.

34. The first auxiliary satellite (110, 210, 515) of claim 33, wherein the processor is further executable to cause the first auxiliary satellite (110, 210, 515) to:

decode at least a portion of the communication in accordance with the first communication protocol.

35. The first auxiliary satellite (110, 210, 515) of claim 34, wherein the processor is further executable to cause the first auxiliary satellite (110, 210, 515) to:

obtain a first address associated with the second auxiliary satellite (110, 215, 520) based at least in part on the decoding.

36. The method of any one of claims 24 to 26, further comprising:

receiving a second communication using the second communication protocol;

determining that the communication is directed to a third auxiliary satellite (110, 215, 520) that is orbitally-coupled with a second gateway satellite (105, 510) having a second orbit or a second device (120) that is being provided a second service by the third auxiliary satellite (110, 215, 520); and

transmitting, using the first communication protocol, data from the communication to the gateway satellite (105, 205, 505) based at least in part on the

determining, the gateway satellite (105, 205, 505) configured to route the data from the communication indirectly to the third auxiliary satellite (110, 215, 520) via the second gateway satellite (105, 510).

37. The first auxiliary satellite (110, 210, 515) of any one of claims 33 to 35, wherein the processor is further executable to cause the first auxiliary satellite (110, 210, 515) to:

receive a second communication using the second communication protocol;

determine that the communication is directed to a third auxiliary satellite (110, 215, 520) that is orbitally-coupled with a second gateway satellite (105, 510) having a second orbit or a second device (120) that is being provided a second service by the third auxiliary satellite (110, 215, 520); and

transmit, using the first communication protocol, data from the communication to the gateway satellite (105, 205, 505) based at least in part on the determining, the gateway satellite (105, 205, 505) configured to route the data from the communication indirectly to the second auxiliary satellite (110, 215, 520) via the second gateway satellite (105, 510).

38. The system of any one of claims 1 through 11, wherein the first gateway satellite (105, 205, 505) translates between a second communication protocol used by the first auxiliary satellite (110, 210, 515) and a third communication protocol used by the second auxiliary satellite (110, 210, 515), wherein routing the intra-cluster communications using the first communication protocol is based at least in part on the translating.

39. The method of any one of claims 12 through 23, wherein the first gateway satellite (105, 205, 505) translates between a second communication protocol used by the first auxiliary satellite (110, 210, 515) and a third communication protocol used by the second auxiliary satellite (110, 210, 515).

40. The method of any one of claims 24 through 26, wherein the gateway satellite (105, 205, 505) is further configured to translate between the second communication protocol used by the first auxiliary satellite (110, 210, 515) and a third communication protocol used by the second auxiliary satellite (110, 210, 515).

41. The first gateway satellite (105, 205, 505) of any one of claims 27 through 31, wherein the instructions are further executable by the processor to cause the first gateway satellite (105, 205, 505) to:

translate between a second communication protocol used by the first auxiliary satellite (110, 210, 515) and a third communication protocol used by the second auxiliary satellite (110, 210, 515).

42. The first auxiliary satellite (110, 210, 515) of any one of claims 33 through 35, wherein the gateway satellite (105, 205, 505) is further configured to translate between a second communication protocol and a third communication protocol.