CLAIMS

1. A method of creating a communications network, comprising:

adhering a first tape node (424) to a first parcel in a set of associated parcels, the first tape node (424) including a first type of wireless communication interface and a second type of wireless communication interface having a longer range than the first type of wireless communication interface;

adhering a second tape node (428) to a second parcel in the set, the second tape node (428) including the first type of wireless communication interface, wherein the second tape node (428) is operable to communicate with the first tape node (424) over a wireless communication connection established between the first type of wireless communication interfaces of the first and second tape node (428)s; and

establishing, by the first tape node (424), a wireless communication connection with the second type of wireless communication interface of the first tape node (424), and transmitting, by the first tape node (424), programmatic code executable by the first tape node (424) to function as a master tape node with respect to the second tape node (428).

2. The method of claim 1, further comprising, by the first tape node (424): instructing the first and second tape nodes (428) to report their current respective battery levels; and determining whether to designate the second tape node (428) as a master tape node of the first tape node (424) based on the reported current respective battery levels.

3. The method of claim 2, further comprising, by the first tape node (424), designating the second tape node (428) as the master tape node based on a determination that the current battery level of the first tape node (424) is below a threshold battery level.

4. The method of claim 2, further comprising, by the first tape node (424), designating the second tape node (428) as the master tape node based on a determination that the current battery level of the second tape node (428) is higher than the current battery level of the first tape node (424).

5. The method of claim 1, further comprising, by the server system, transmitting programmatic code executable by the second tape node (428) to detect and respond to an event.

6. The method of claim 5, wherein, based on execution of the programmatic code by the second tape node (428), performing operations comprising transmitting a wireless communication to an address of a third tape node (432) adhered to an associated parcel in the set, and alerting the master tape node based on a failure of the second tape node (428) to receive a responsive communication from the third tape node (432).

7. The method of claim 6, wherein the alerting comprises, by the second tape node (428), transmitting an alarm packet to the master tape node.

8. The method of claim 1, further comprising designating, by the second tape node (428), the first tape node (424) as a master tape node with respect to a third tape node (432) adhered to an associated parcel in the set.

9. The method of claim 8, wherein each of the second and third tape node (432)s comprises a respective sensor; and further comprising, by the second and third tape nodes (432), respectively collecting local parcel condition data and processing the collected local parcel condition data to produce respective processed parcel condition data sets.

10. The method of claim 9, wherein each of the respective processed parcel condition data sets comprises data values of a respective histogram.

11. The method of claim 9, further comprising, by the second and third tape nodes (432), transmitting the respective processed parcel condition data sets to the designated master tape node; and further comprising, by the designated master tape node, processing the processed parcel condition data sets to produce a combined processed data set.

12. The method of claim 11, wherein the combined processed parcel condition data sets comprises data values of a respective histogram.

13. A communications network, comprising:

a first tape node (424) adhered to a first parcel in a set of associated parcels, the first tape node (424) including a first type of wireless communication interface and a second type of wireless communication interface having a longer range than the first type of wireless communication interface;

a second tape node (428) adhered to a second parcel in the set, the second tape node (428) including the first type of wireless communication interface, wherein the second tape node (428) is operable to communicate with the first tape node (424) over a wireless communication connection established between the first type of wireless communication interfaces of the first and second tape nodes (428); and

wherein the first tape node (424) is a designated master tape node with respect to the second tape node (428) and the first tape node (424) is operable to transmit programmatic code to configure the second tape node (428) as a master node with respect to the first tape node (424).

14. A method of creating a hierarchical communications network, comprising:

activating a first tape node (424) and adhering it to a first parcel in a set of associated parcels, the first tape node (424) comprising a first type of wireless communication interface and a second type of wireless communication interface having a longer range than the first type of wireless communication interface;

activating second and third tape nodes (432) and respectively adhering them to second and third parcels in the set of associated parcels, the second and third tape nodes (432) each comprising the first type of wireless communication interface and a respective sensor, wherein each of the second and third tape nodes (432) is operable to communicate with the first tape node (424) over a wireless communication connection established between the first type of wireless communication interfaces of the first, second, and third tape nodes (432);

by the first tape node (424), transmitting to each of the second and third tape nodes (432) programmatic code for detecting and responding to an event.

15. The method of claim 14, wherein, based on the programmatic code, the second tape node (428) performs operations comprising transmitting a wireless communication to an address of the third tape node (432), and alerting the first tape node (424) based on a failure of the second tape node (428) to receive a responsive communication from the third tape node (432).

16. The method of claim 15, wherein the alerting comprises, by the second tape node (428), transmitting an alarm packet to the first tape node (424).

17. The method of claim 14, further comprising transmitting, by the first tape node (424), programmatic code instructing the second and third tape node (432)s to perform operations comprising using their respective sensors to collect local parcel condition data and processing the collected local parcel condition data to produce respective processed parcel condition data sets.

18. The method of claim 17, further comprising transmitting, by the first tape node (424), programmatic code enabling the first tape node (424) to perform operations comprising functioning as a master tape node of the second and third tape nodes (432), and processing the processed parcel condition data sets to produce aggregated processed parcel condition data set.

19. The method of claim 18, wherein the aggregated processed parcel condition data sets comprise data values of a respective histogram.

CLAIMS

1. A method of creating a communications network, comprising:

adhering a first tape node (424) to a first parcel in a set of associated parcels, the first tape node (424) including a first type of wireless communication interface and a second type of wireless communication interface having a longer range than the first type of wireless communication interface;

adhering plural further tape nodes, each to a further parcel in the set, each further tape node (428) including the first type of wireless communication interface, in which each further tape node (428) is operable to communicate with the first tape node (424) over a wireless communication connection established between the first type of wireless communication interfaces of the first and further tape nodes (428);

formulating an optimization problem for the first and further tape nodes from their battery capacity, power consumption and tolerable latency in communication, and solving the optimization problem to assign one of the first and further tape nodes a role as a master node; and

establishing, by the first tape node (424), a wireless communication connection with the second type of wireless communication interface of the first tape node (424), and transmitting, to the assigned master node, programmatic code executable by the node to function as a master tape node with respect to the other nodes.

2. A method according to Claim 1, in which the first tape node (424) is assigned the master node role based on solving the optimization problem.

3. A method according to Claim 2, further comprising: after the first tape node (424) is assigned the master node role, instructing, by the first tape node (424), the first tape node (424) and further tape nodes (428) to report their current respective battery levels; and determining whether to designate one of the further tape nodes (428) as a master tape node based on the reported current respective battery levels.

4. A method according to Claim 3, further comprising, by the first tape node (424), reassigning the role of master node to one of the further tape nodes (428) based on a

determination that the current battery level of the first tape node (424) is below a threshold battery level.

5. A method according to Claim 3, further comprising, by the first tape node (424), reassigning the role of master node to one of the further tape nodes (428) based on a determination that the current battery level of the second tape node (428) is higher than the current battery level of the first tape node (424).

6. A method according to Claim 1, further comprising, by a server system, transmitting programmatic code executable by one of the further tape nodes (428) to detect and respond to an event.

7. A method according to Claim 6, in which, based on execution of the programmatic code by the further tape node (428), performing operations comprising transmitting a wireless communication to an address of a tape node (432) to be monitored and which is adhered to an associated parcel in the set, and alerting the master tape node based on a failure of the tape node (428) that is executing programmatic code to detect and respond to an event to receive a responsive communication from the tape node (432) to be monitored.

8. A method according to Claim 7, in which the alerting comprises, by the tape node (428) that is executing programmatic code to detect and respond to an event, transmitting an alarm packet to the master tape node.

9. A method according to Claim 1, further comprising designating, by a second tape node of the further tape nodes (428), the first tape node (424) the role of master node with respect to a third tape node (432) of the further tape nodes adhered to an associated parcel in the set, based on solving the optimization problem.

10. A method according to Claim 9, in which each of the second tape node (424) and the third tape node (432) comprises a respective sensor; and further comprising, by the second tape node (424) and the third tape node (432), respectively collecting local parcel condition data and processing the collected local parcel condition data to produce respective processed parcel condition data sets.

11. A method according to Claim 10, in which each of the respective processed parcel condition data sets comprises data values of a respective histogram.

12. A method according to Claim 10, further comprising, by the second tape node (424) and the third tape node (432), transmitting the respective processed parcel condition data sets to the designated master tape node; and further comprising, by the designated master tape node, processing the processed parcel condition data sets to produce a combined processed data set.

13. A method according to Claim 1, further comprising: executing programmatic code stored on at least one non-transitory processor readable medium component of one of tape nodes to communicate wireless messages with one or more of the other network nodes during respective communication windows specified in the processor readable medium.

14. A method according to Claim 13, further comprising a network service analyzing the battery size, the tape node power consumption, and the tolerable latency in communication of the tape nodes in the hierarchy, creating a mathematical model and solving the mathematical model by an optimization algorithm to determine a schedule of communication windows for network nodes at one level in the hierarchy to transmit data packets up to the next level in the communication hierarchy.

15. A communications network, comprising:

a first tape node (424) adhered to a first parcel in a set of associated parcels, the first tape node (424) including a first type of wireless communication interface and a second type of wireless communication interface having a longer range than the first type of wireless communication interface;

a plurality of further tape nodes (428) each adhered to a further parcel in the set, the further tape nodes (428) each including the first type of wireless communication interface, in which each of the further tape nodes (428) is operable to communicate with the first tape node (424) over a wireless communication connection established between the first type of wireless communication interfaces of the first and the respective further tape nodes (428);

a network service configured to formulate an optimization problem for the first and further tape nodes from their battery capacity, power consumption and tolerable latency

in communication, to solve the optimization problem to assign one of the first and further tape nodes a role as a master tape node; and

in which the first tape node (424) is operable to transmit programmatic code to the assigned master tape node to configure the identified master tape node (428) as a master node with respect to the other tape nodes (424).

16. A method of creating a hierarchical communications network, comprising:

activating a first tape node (424) and adhering it to a first parcel in a set of associated parcels, the first tape node (424) comprising a first type of wireless communication interface and a second type of wireless communication interface having a longer range than the first type of wireless communication interface;

activating second and third tape nodes (432) and respectively adhering them to second and third parcels in the set of associated parcels, the second and third tape nodes (432) each comprising the first type of wireless communication interface and a respective sensor, wherein each of the second and third tape nodes (432) is operable to communicate with the first tape node (424) over a wireless communication connection established between the first type of wireless communication interfaces of the first, second, and third tape nodes (432);

formulating an optimization problem for the first, second and third tape nodes from their battery capacity, power consumption and tolerable latency in communication, and solving the optimization problem to assign one of the first, second and third tape nodes a role as a master node;

by the master node, transmitting to each of the other tape nodes (432) programmatic code for detecting and responding to an event.

17. A method according to Claim 16, in which, based on the programmatic code, the second tape node (428) performs operations comprising transmitting a wireless communication to an address of the third tape node (432), and alerting the first tape node (424) based on a failure of the second tape node (428) to receive a responsive communication from the third tape node (432).

18. A method according to Claim 17, in which the alerting comprises, by the second tape node (428), transmitting an alarm packet to the first tape node (424).

19. A method according to Claim 16, further comprising transmitting, by the master tape node, programmatic code instructing the other tape node (432)s to perform operations comprising using their respective sensors to collect local parcel condition data and processing the collected local parcel condition data to produce respective processed parcel condition data sets.

20. A method according to Claim 19, further comprising processing, by the master tape node, the processed parcel condition data sets to produce aggregated processed parcel condition data set.