Claims

1. A method comprising:

under control of a processing unit programmed to perform:

receiving and storing one or more values indicating utility consumption data reported from one or more utility metering nodes of a network;

detecting one or more significant changes associated with the one or more values indicating utility consumption data;

in response to detecting the one or more significant changes, selecting a utility metering node of the one or more utility metering nodes for which a portion of a physical power distribution topology is undetermined;

identifying a plurality of nodes potentially connected to the selected utility metering node based, at least in part, on location information or communication network information of the plurality of nodes;

correlating, from the stored values of the selected utility metering node, value changes indicating a change in amount of utility consumption associated with the selected utility metering node and value changes indicating a change in amount of utility consumption associated with the plurality of nodes with respect to a physical quantity and storing the correlating in a memory; and

determining, for the selected utility metering node, the previously undetermined portion of the physical power distribution topology of the network comprising the selected utility metering node and at least some nodes of the plurality of nodes based at least on the correlating of value changes that indicate the change in amount of utility consumption associated with the selected utility metering node and the value changes indicating the change in amount of utility consumption associated with the plurality of nodes.

2. The method as recited in claim 1, wherein the plurality of nodes comprises electricity meters, and the physical quantity comprises a usage of an electrical current, an electrical voltage or an electrical power.

3. The method as recited in claim 1, wherein:

the plurality of nodes comprises gas meters, and the physical quantity comprises a volume of gas usage; or

the plurality of nodes comprises water meters, and the physical quantity comprises a volume of water usage.

4. The method as recited in claim 1, further comprising receiving records of respective value changes from the plurality of nodes.

5. The method as recited in claim 1, further comprising determining whether a discrepancy exists in value information among the one or more nodes in the network based on the determined topology, the discrepancy comprising a discrepancy due to a fraud and/or a leakage in the network.

6. The method as recited in claim 5, wherein the determining comprises at least one of:

determining whether a value change associated with the selected utility metering node is attributable to a combination of one or more value changes associated with one or more of the at least some nodes, or

determining whether a difference exists between a value associated with the selected utility metering node and a sum of values associated with the at least some nodes with respect to the physical quantity at a particular time.

7. The method as recited in claim 5, further comprising detecting that a discrepancy exists in the value information among the one or more nodes in the network based on the determined topology.

8. The method as recited in claim 7, wherein the determining comprises:

detecting that a value change associated with a node of the at least some nodes is unattributable by any value change associated with the selected utility metering node; and

determining that a fraud associated with the node of the at least some nodes has been committed.

9. The method as recited in claim 7, wherein the detecting comprises:

detecting that each value change associated with the at least some nodes is attributable by a value change associated with the selected utility metering node; and

determining that a fraud bypassing a node of the at least some nodes and/or a leakage exist(s) in the network.

10. The method as recited in claim 7, wherein the detecting further comprises:

detecting that one or more value changes associated with the selected utility metering node are unattributable by any combination of one or more value change associated with the at least some nodes; and

determining that a fraud bypassing a node of the at least some nodes exists in the network.

11. The method as recited in claim 7, wherein the detecting further comprises:

detecting that each value change associated with the selected utility metering node is attributable by a combination of one or more value changes associated with one or more of the at least some nodes; and

determining that a leakage exists in the network.

12. The method as recited in claim 11, wherein the detecting further comprises detecting that a difference exists between a value associated with the selected utility metering node and a sum of values associated with the at least some nodes with respect to the physical quantity at a particular time.

13. A system comprising:

a processing unit configured to perform acts comprising:

receiving and storing one or more values indicating utility consumption data reported from one or more utility metering nodes of a network;

detecting one or more significant changes associated with the one or more values indicating utility consumption data;

in response to the detecting, selecting a node of the one or more utility metering nodes for which a portion of a physical power distribution topology is undetermined;

identifying a plurality of nodes potentially connected to the selected node based, at least in part, on location information of the plurality of nodes and location information of the selected node;

determining the previously undetermined portion of the physical power distribution topology of the network comprising the selected node and the plurality of nodes based on a correlation or relationship between amount of resource consumption at the selected node and amount of resource consumption at the plurality of nodes;

determining, based at least in part on the topology, whether a value change indicating a change in amount of resource consumption associated with the selected node with respect to a physical quantity is attributable to a combination of one or more value changes indicating a change in amount of resource consumption associated with one or more of the plurality of nodes; and

detecting whether a discrepancy exists in the network comprising the selected node and the plurality of nodes based at least in part on whether the value change associated with the selected node is attributable to the combination of one or more value changes associated with one or more of the plurality of nodes.

14. The system as recited in claim 13, wherein the plurality of nodes comprise electricity meters, gas meters or water meters, and wherein the physical quantity comprises an electrical current, an electrical voltage, an electrical power, a volume of gas usage or a volume of water usage.

15. The system as recited in claim 13, wherein the determining whether the value change associated with the selected node is attributable to the combination of one or more value changes associated with one or more of the plurality of nodes further comprises determining whether a difference exists between a value associated with the selected node and a sum of values associated with the plurality of nodes with respect to the physical quantity at a particular time.

16. The system as recited in claim 15, wherein the determining whether the value change associated with the selected node is attributable to the combination of one or more value changes associated with one or more of the plurality of nodes further comprises determining whether a value change associated with a node of the plurality of nodes is attributable to any value change associated with the selected node within a sliding time window of a time associated with the value change associated with the node of the plurality of nodes.

17. The system as recited in claim 13, the acts further comprising:

detecting that one or more value changes associated with the selected node are unattributable to any combination of one or more value change associated with the plurality of nodes; and

determining that a fraud bypassing a node of the plurality of nodes and/or a leakage exists in the network based at least in part on the detecting that the one or more value changes associated with the selected node are unattributable to any combination of one or more value change associated with the plurality of nodes.

18. One or more non-transitory computer readable media storing executable instructions that, when executed by a processing unit, configure the processing unit to perform acts comprising:

receiving and storing one or more values indicating utility consumption data reported from one or more utility metering nodes of a network;

detecting one or more significant changes associated with the one or more values indicating utility consumption data;

in response to the detecting, selecting a node of the one or more utility metering nodes for which a portion of a physical power distribution topology is unknown;

identifying a plurality of nodes potentially connected to the selected node based, at least in part, on communication network information of the plurality of nodes and communication information of the selected node;

determining, for the selected node, the previously unknown portion of the physical power distribution topology of the network comprising at least some of the plurality of nodes and the selected node, based at least on correlating respective value changes indicating changes in amount of utility consumption associated with the plurality of nodes to value changes indicating changes in amount of utility consumption associated with the selected node with respect to a physical quantity;

determining if the determined topology is a complete topology based, at least in part, on comparing a sum of resource consumption information recorded at the plurality of nodes to resource consumption information recorded at the selected node,

based on the determining if the determined topology is a complete topology, identifying an additional node potentially connected to the selected node and determining if the additional node is connected to the selected node based, at least in part, on correlating respective value

changes indicating changes in amount of utility consumption associated with the additional node to value changes indicating changes in amount of utility consumption associated with the selected node with respect to a physical quantity; and

determining whether a discrepancy exists in the network based on the determined topology, the discrepancy comprising a discrepancy due to a fraud and/or a leakage in the network, the determining comprising:

determining whether a difference exists between a value associated with the selected node and a sum of values associated with the plurality of nodes with respect to the physical quantity at a particular time, and

determining whether a value change associated with the selected node is attributable to a combination of one or more value changes associated with one or more of the plurality of nodes.

19. The method as recited in claim 1, wherein each of the at least some nodes is determined to be part of the topology based on a computed correlation of value changes between the respective node and the selected node being greater than or equal to a correlation threshold.

20. The method of claim 1, further comprising:

determining that at least one node is missing from the undetermined portion of the physical power distribution topology;

identifying a second plurality of nodes potentially connected to the selected utility metering node; and

identifying the at least one node that was missing based at least on an amount of utility consumption associated with the at least one node.

WHAT IS CLAIMED IS:

1. A method comprising:

under control of a processing unit:

correlating, for a given node, value changes associated with the given node and value changes associated with a plurality of nodes with respect to a physical quantity; and

determining, for the given node, a topology of a network comprising the given node and at least some nodes of the plurality of nodes with the given node as a root node based at least on the correlating.

2. The method as recited in claim 1, wherein the plurality of nodes comprises electricity meters, and the physical quantity comprises a usage of an electrical current, an electrical voltage or an electrical power.

3. The method as recited in claim 1, wherein the plurality of nodes comprises gas meters, and the physical quantity comprises a volume of gas usage.

4. The method as recited in claim 1, wherein the plurality of nodes comprises water meters, and the physical quantity comprises a volume of water usage.

5. The method as recited in claim 1, further comprising receiving records of respective value changes from the plurality of nodes.

6. The method as recited in claim 1, further comprising determining whether a discrepancy exists in value information among one or more nodes in the network based on the determined topology, the discrepancy comprising a discrepancy due to a fraud and/or a leakage in the network.

7. The method as recited in claim 6, wherein the determining comprises determining whether a value change associated with the given node is attributable by a combination of one or more value changes associated with one or more of the at least some nodes.

8. The method as recited in claim 6, wherein the determining comprises determining whether a difference exists between a value associated with the given node and a sum of values associated with the at least some nodes with respect to the physical quantity at a particular time.

9. The method as recited in claim 6, further comprising detecting that a discrepancy exists in the value information among the one or more nodes in the network based on the determined topology.

10. The method as recited in claim 9, wherein the determining comprises:

detecting that a value change associated with a node of the at least some nodes is unattributable by any value change associated with the given node; and

determining that a fraud associated with the node of the at least some nodes has been committed.

11. The method as recited in claim 9, wherein the detecting comprises:

detecting that each value change associated with the at least some nodes is attributable by a value change associated with the given node; and

determining that a fraud bypassing a node of the at least some nodes and/or a leakage exist(s) in the network.

12. The method as recited in claim 9, wherein the detecting further comprises:

detecting that one or more value changes associated with the given node are unattributable by any combination of one or more value change associated with the at least some nodes; and

determining that a fraud bypassing a node of the at least some nodes exists in the network.

13. The method as recited in claim 9, wherein the detecting further comprises:

detecting that each value change associated with the given node is attributable by a combination of one or more value changes associated with one or more of the at least some nodes; and

determining that a leakage exists in the network.

14. The method as recited in claim 13, wherein the detecting further comprises detecting that a difference exists between a value associated with the given node and a sum of values associated with the at least some nodes with respect to the physical quantity at a particular time.

15. A system comprising:

a processing unit configured to perform acts comprising:

determining whether a value change associated with at least one junction node with respect to a physical quantity is unattributable by a combination of one or more value changes associated with one or more of a plurality of nodes; and

detecting whether a discrepancy exists in a network comprising the at least one junction node and the plurality of nodes based on the determining, the discrepancy comprising a discrepancy due to a fraud and/or a leakage in the network.

16. The system as recited in claim 15, wherein the plurality of nodes comprise electricity meters, gas meters or water meters, and wherein the physical quantity comprises an electrical current, an electrical voltage, an electrical power, a volume of gas usage or a volume of water usage.

17. The system as recited in claim 15, wherein the determining further comprises determining whether a difference exists between a value associated with the at least one junction node and a sum of values associated with the plurality of nodes with respect to the physical quantity at a particular time.

18. The system as recited in claim 17, wherein the determining further comprises determining whether a value change associated with a node of the plurality of nodes is unattributable by any value change associated with the at least one junction node within a sliding time window of a time associated with the value change associated with the node of the plurality of nodes.

19. The system as recited in claim 15, the acts further comprising:

detecting that one or more value changes associated with the at least one junction node are unattributable by any combination of one or more value change associated with the plurality of nodes; and

determining that a fraud bypassing the plurality of nodes and/or a leakage exists in the network.

20. One or more computer-readable media storing executable instructions that, when executed by a processing unit, configure the processing unit to perform acts comprising:

determining, for a given node, a topology of a network comprising a plurality of nodes with the given node as a root node, based at least on correlating respective value changes associated with the plurality of nodes to value changes associated with the given node with respect to a physical quantity; and

determining whether a discrepancy exists in the network based on the determined topology, the discrepancy comprising a discrepancy due to a fraud and/or a leakage in the network, the determining comprising:

determining whether a difference exists between a value associated with the given node and a sum of values associated with the plurality of nodes with respect to the physical quantity at a particular time, and

determining whether a value change associated with the given node is unattributable by a combination of one or more value changes associated with one or more of the plurality of nodes.