

G-ROUTING ALGORITHM METHODOLOGY - CLAIM

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The purpose of the 'G-ROUTING ALGORITHM METHODOLOGY' invention is provide great routing algorithm for the G-NETWORK layouts in some geometries like Satellites, Internet 3D-Web Networks for Cloud OS, Cell eMap System and even for Emergency Traffic Lights Routing System. The G-ROUTING ALGORITHM provides great routing, fast and robust for any networks with Neighbor-to-Neighbors routing technology. The Neighbor-to-Neighbors routing technology only requires neighbor knowing next neighbors; one network node or device only needs to know its closest neighbors and can only communicate to its closest neighbors. For complex networks with smart devices the database would be stored and synchronized for each device to support continue reroute when a node detects its neighbor routing node is accidentally disconnected. The Neighbor-to-Neighbors routing technology provides the network routing with self-adjusting when a node is removed or added into the networks and supports self-manage and self-grow for large expandable networks which could be capable to apply Machine Learning (ML) for Network Intelligent (NI) for Cloud OS and the future of networking. This invention claim shows the overview figure of this invention which was submitted on 2022/12/23 with U.S. PCT/US22/82347 and International PCT/IB2022/000800 Patent Numbers, which can be used as the representing invention drawing to print on the patent frame and the following functions and features of this invention.

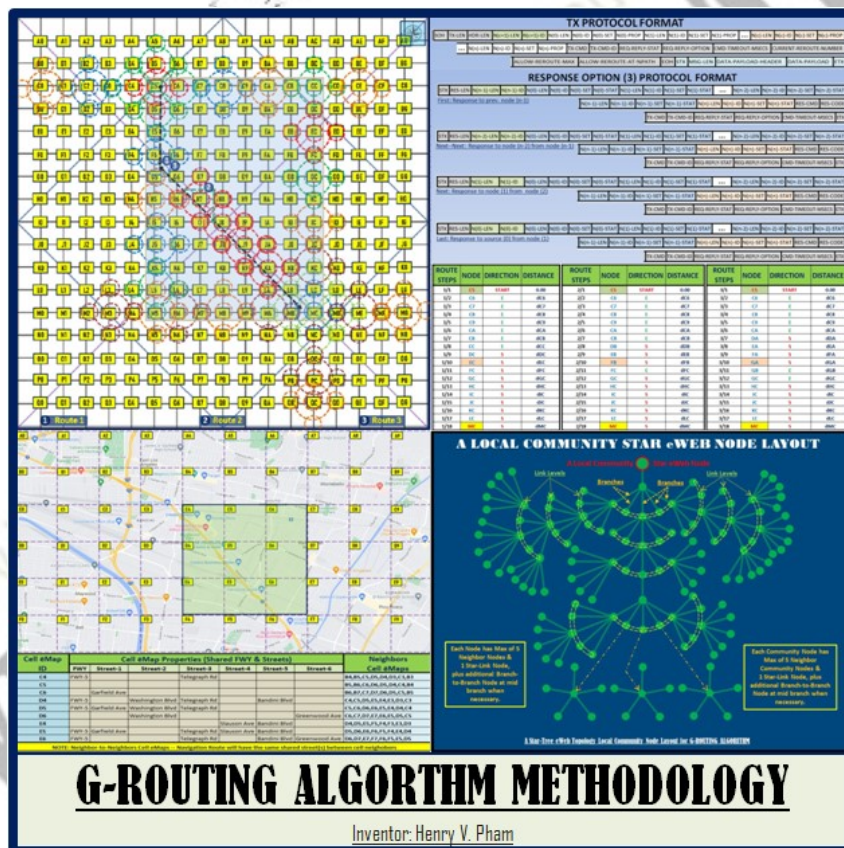


Figure-A: G-ROUTING ALGORITHM METHODOLOGY -- Overview

1. The main apparatus for the G-ROUTING Algorithm, comprising:

The G-ROUTING ALGORITHM with networks from simple to the most complicated provides great routing, fast and robust for any networks with Neighbor-to-Neighbors routing technology with self-adjusting when a node is removed or added into the networks and supports self-manage and self-grow

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with Transmit, Receive and Response protocols which were described in the original invention document. Wherein, the networking database which is important for Neighbor-to-Neighbors routing technology would contain node properties with their neighbor nodes. The network layout can be any form and recommended in some geometries for the G-Network with draw-able connection patterns for maintenance and management easier. The networks would have source node which is required to build a route path with a series of routing nodes and let one node forward to its neighbor routing node until it reaches the destination node; the source node or smart node would have the database that contains all nodes' properties to build the route path; for simple network, the source node could be a computer at the control center.

2. The main routing methodology apparatus for the G-ROUTING Algorithm, comprising:

The main routing method would start searching around both the source and destination nodes in clockwise directions from neighbor nodes to other neighbor nodes until found the shared node to connect the route path. Wherein, the G-ROUTING ALGORITHM will start at a source node and look for the list its neighbor nodes in clockwise start at 12 O' clock as the rules. The next sequence of routing will pick the first node from the list and look for this node's neighbors; and pick the next node from the list and look for its neighbor nodes, and another sequence will repeat similarly for their next level of neighbor nodes. With the same method at the same time, the algorithm will start at a destination node and look for the list its neighbor nodes and search one level of neighbor nodes to the next levels. When iterating through nodes on each side, duplicate nodes from previous iterations will be eliminated. The algorithm will iterate one node level at a time for both source node and destination node until both paths contain a shared node. This shared node will be in the first route which will connect the source and destination nodes together for the first shortest route; perform more iterations will find more closer routes to the first route which would provide more options to choose depends on the requirement for convenient, shortest or fastest routes.

3. The G-Network Layout apparatus for the G-ROUTING Algorithm of claim 1, further comprising:

The G-ROUTING Algorithm would work for any network layout, and the recommended network layout would be in G-Network layout which is in some geometry with uniform layout connections to provide optimization searching routing method. Wherein, the G-Network layout with uniform connections would support draw-able patterns nodes connections and support multi-layer networks with multiple community network nodes for expendable networks. The uniform or close-to-uniform row and column networks such as Satellites, Traffic Lights, Cell Phone Towers and LPS/Map Towers networks would provide optimization routing within the square or rectangle nodes where the source and destination nodes are on the corners of the diagonal line. The Cloud OS Star-Tree Topology Spider Network with multi-layer networks of computers or smart nodes forming in spider webs with center node as a network pattern would be complicated and would work well with G-ROUTING Algorithm.

4. The Network Database storing and configuring apparatus of claim 1 & 2, further comprising:

The network database which is very important for G-ROUTING Algorithm would contain all the network nodes with their properties and their neighbor nodes with the distances, timings, directions plus other properties as needed and store on the smart nodes or control nodes to provide the Neighbor-to-

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Neighbors checking and routing functions. Wherein, the network nodes are the database keys which contain the unique node numbers or machine numbers for smart devices; each network node can be lookup with a list of its neighbor nodes with all the nodes' properties; the database would be easy to build, configure and update even the networks are already established by applying neighbor-asking-neighbors for their properties and update propagating across the networks.

5. The G-ROUTING Algorithm rules apparatus of claim 1 & 2, further comprising:

The G-ROUTING Algorithm would come with the rules to iterate through a node to its neighbor nodes and to other levels of neighbor nodes. Wherein, the network database must be well defined, and the iterating method always starts at 12 O' clock in clockwise direction when looking for a node's neighbors and skip the disconnected nodes when detected; Iterate through neighbor nodes for both source and destination nodes alternately to find shared nodes and eliminate the duplicated nodes from previous steps; When found a shared node from both source and destination nodes' paths, always look for the closest node that contains this shared node and previous nodes that link to this shared node from both source and destination directions; Always try optimization routing with the network layouts in uniform geometry like all squares layout or all hexagons layout for faster routing; optimization searching four outward directions in 90° for square layout and six outward directions in 30° for hexagon layout; For the non-uniform geometry network layouts, after try optimization routing to find the crossing section, then apply the standard G-ROUTING ALGORITHM method in clockwise direction for both source and destination nodes within the crossed section toward each other direction in degree angles within the crossed section.

6. The Transmit, Receive and Response Protocols apparatus of claim 1 & 2, further comprising:

The G-ROUTING Algorithm would come with Transmit, Receive and Response protocols which were shown in the original invention document. Wherein, Figure-11 shows the TX Protocol Format when a route is defined with the series of routing nodes 'N(0)...N(c)...N(n)'; where N(0) is the original source node, N(c) is the current node, and N(n) is the destination node. Figure-12 shows response option-1 with the requirement of every receiving node must replies to the system or the source node when received the data package as an acknowledgement of receiving data package and confirmed transmitting to the next node. Figure-13 shows response option-2 with the requirement of only receiving node replies to the previous node when received the data package as an acknowledgment of receiving data package and confirmed transmitting to the next node. Figure-14 shows response option-3 with the requirement of only the last or the destination node replies to the system or the source node when received the data package as an acknowledgement of receiving data package. Figure-15 shows protocol format for notifying when a node is added, removed or gone missing for some reasons with an option of broadcasting using Neighbor-to-Neighbors methodology. Figure-16 below also shows protocol supporting of system updating with system update data package for new configuration, firmware updates or anything related to the system updates or system properties changes. Figure-17 shows the format of node's property for status or statistic when TX protocol requests.

7. The Self-Manage, Self-Grow Networking apparatus of claim 1 & 2, further comprising:

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The G-ROUTING Algorithm provides the networks with Self-Manage and Self-Grow to expand the network easier with Neighbor-to-Neighbors checking methodology which was mentioned in the Cloud OS invention which was submitted on 2021/10/02 with U.S. PCT/US21/71689 and International PCT/IB2021/000683 Patent Numbers, that can broadcast and notify when a neighbor node is gone missing or adding into the networks. Wherein, the neighbor knows its neighbors with the connection status and neighbors' properties which can be used to report for disconnecting or missing or to request for updating when a new node is added into the networks. The Neighbor-to-Neighbors checking methodology would provide the Network Management Centers with network count, network monitor and network security better.

8. The Cloud OS Networking apparatus of claim 1 & 2, further comprising:

The Cloud OS Networking would be complicated and built in spider web form in Star-Tree Topology which originally mentioned in the Cloud OS invention and the G-ROUTING Algorithm was originally designed for Cloud OS. Wherein, G-ROUTING Algorithm would be used widely for other networks, and the Cloud OS Network node would come with 1 node connects to 5 nodes with 1 reserved for shortcut connection and 2 for hardware linker connections. Figure-10 in the original invention document shows a local community StarTree eWeb nodes layout; the star tree network is one-to-five nodes layout. One node can have 5 neighbor nodes and 1 local community node with 1 linkable community-to-community node connect on demand. This Star eWeb nodes layout is manageable in form of group geometry layout with multi-layer networking, and this network layout can be auto drawing when a node or branch is newly connected to or removed from the network using Neighbor-to-Neighbors methodology which has been mentioned in the 'Cloud OS –Operating Systems' invention.

9. The Cell eMap Navigation routing apparatus of claim 1 & 2, further comprising:

The Cell eMap Navigation which was described in the 'Cell eMap Live Updates System' invention which was submitted on 2022/11/07 with U.S. PCT/US22/79368 and International PCT/IB2022/000685 Patent Numbers, would perfectly use the G-ROUTING Algorithm to find the shortest routes for map navigation system. Wherein, the cell maps are assigned with numbering orders and with neighbor cell maps which contain shared roads for routing. Figure-9 in the original invention document shows the Cell eMap layout in highest resolution of 1km cell; each cell links to its neighbor cells with properties of connected Freeways or Streets as the neighbor nodes for routing from one location to another.

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