

FORMATION AND MAINTENANCE OF
A COMMUNICATION NETWORK

TECHNICAL FIELD

[0001] This invention relates to a method for automatically and dynamically establishing a communication network and a node configuration therefor, where communication in the communication network can occur by way of cable / wire based and/or wireless / broadcast media, including power line media by which power line communication (PLC) involving data communication over power lines that carry electrical power signals occurs.

BACKGROUND ART

[0002] The following discussion of the background art is intended to facilitate an understanding of the present invention only. The discussion is not an acknowledgement or admission that any of the material referred to is or was part of the common general knowledge as at the priority date of the application.

[0003] The Open Systems Interconnection model (OSI) is a conceptual model that characterizes and standardizes the internal functions of a communication system by partitioning it into abstraction layers. The OSI model groups communication functions into seven logical layers, each serving a layer above and below it.

[0004] In the OSI model of computer networking, the physical layer is the first or lowest layer and is typically denoted as PHY. The physical or PHY layer generally provides an electrical, mechanical and procedural interface between a node on a network and a transmission medium and defines the

electrical and physical specifications of such a data connection.

[0005] In addition, in the OSI model, the data link layer (DLL) is typically the second layer and above the PHY layer. The data link layer provides the functional and procedural means to transfer data between network entities or nodes and typically provides the means to detect and possibly correct errors that may occur in the physical or PHY layer.

[0006] The data link layer is generally divided into two sub-layers, namely the Media Access Control (MAC) layer, which is responsible for controlling how devices or nodes in a network gain access to data and permission to transmit it, and the Logical Link Control (LLC) layer, which is typically responsible for error checking and packet synchronization.

[0007] In a network, a communication channel refers either to a physical transmission medium such as a wire, or to a logical connection over a multiplexed medium such as a radio channel. A channel has a certain capacity for transmitting information, often measured by its bandwidth in Hz or its data rate in bits per second. A further important factor influencing a channel's performance is the signal-to-noise ratio.

[0008] As such, a single transmission medium may comprise a number of different channels defined across various frequency bands, modulation techniques, etc. A single wire may support a plurality of channels, similarly to numerous radio channels transmitted via the atmosphere as transmission medium. As is well-known in the art, different channels and/or frequencies may be more suitable to different types of networks.

[0009] Power line communication, or PLC, refers to the practice of using electrical distribution networks for transmitting data between network entities or nodes. PLC is typically used as a communication technology to enable sending and receiving of data over existing power cables or lines.

[0010] Such power-line communications (PLC) and conventional low-cost wireless networking typically suffer from high noise and attenuation due to environmental factors which often cause communication links between two nodes to vary significantly in quality. A communication link, which may be optimal on a certain medium and channel at a given time, may become sub-optimal as time passes or circumstances change, resulting in deterioration or even breakdown of the network.

[0011] The following disclosure seeks to propose a possible solution in amelioration of the above shortcomings.

SUMMARY OF THE INVENTION

[0012] According to a broad aspect of the disclosure there is provided a method of establishing a communication network between a number of nodes and a data concentrator (DC) via transmission media, said method comprising:

- broadcasting a discovery request, by the DC, across a number of channels defined by the transmission media, said discovery request comprising an address of the DC;

- receiving the discovery request, by a node, each node configured to determine a path cost of each specific channel via which the discovery request was received;

- storing, by each node, the path cost associated with each channel;

selecting, by each node, a channel having the lowest path cost to the DC; and

broadcasting, by each node, a registration request to the DC via the selected channel, said registration request comprising an address of that node.

[0013] The transmission media may be selected from cable and/or broadcast media. Similarly, each channel may be defined according to a specific frequency band on the media, according to a particular modulation mode, and/or the like.

[0014] The path cost may be determined by analysing signal strength across a channel, analysing a signal-to-noise ratio over a channel, analysing integrity of a channel, analysing quality of a channel, analysing bandwidth of a channel, analysing utilisation of a channel, and/or the like.

[0015] The step of broadcasting a discovery request by the DC may be performed simultaneously or sequentially across all available channels.

[0016] The method may further comprise:

updating, by a node, the discovery request with the selected channel and said node's address; and

forwarding, by said node, the updated discovery request to further nodes via the channels available to such forwarding node.

[0017] The method may further comprise:

compiling, by each node, a discovery table populated with an address of each node from which a discovery request is received along with the selected channel for that address.

[0018] The method may comprise:

selecting from its discovery table, by each node, a channel with the lowest path cost to the DC for communicating across the network.

[0019] It is to be appreciated that a node's selected channel with the lowest path cost to the DC may include a number of other nodes' selected channels if a node is required to communicate to the DC through such other nodes. In such an arrangement, a 'child' node's selected channel is the channel with the lowest path cost to the 'parent' node having the lowest path cost to the DC.

[0020] A node's address may comprise an address of other nodes comprising said node's selected channel.

[0021] The method may comprise:

receiving, by the DC, each node's registration request;
and

compiling, by the DC, a routing table comprising each node's address and selected channel.

[0022] According to a further broad aspect of the invention there is provided a node configuration for a communication network, comprising:

a memory arrangement for operative storage of a set of instructions; and

a processor arranged in signal communication with the memory arrangement, said processor configured to execute the set of instructions to establish a network layer responsible for transferring information across the network, and a combined media access control (MAC) and physical layer (PHY) which forms a network interface with transmission media,

wherein execution of the instructions by the processor configures the node to:

- receive a discovery request broadcast by a data concentrator (DC) across a number of channels defined by the transmission media, said discovery request comprising an address of the DC;

- determine a path cost of each specific channel via which the discovery request was received;

- store the path cost associated with each channel;

- select a channel having the lowest path cost to the DC;

and

- broadcast a registration request to the DC via the selected channel, said registration request comprising an address of the node.

[0023] The node configuration may be configured to determine the path cost by analysing a signal strength across a channel, analysing a signal-to-noise ratio over a channel, analysing integrity of a channel, analysing quality of a channel, analysing bandwidth of a channel, analysing utilisation of a channel, and/or the like.

[0024] The node configuration may be configured to:

- update the discovery request with the selected channel and said node's address; and

- forward the updated discovery request to further nodes via the channels available to the node.

[0025] The node configuration may be configured to:

- compile a discovery table populated with an address of each node from which a discovery request is received along with the selected channel for that address.

[0026] The node configuration may be configured to:

select from its discovery table a channel with the lowest path cost to the DC for communicating across the network.

[0027] According to a yet further broad aspect of the invention there is provided a communication network comprising at least one data concentrator (DC) and a number of nodes linked to the DC via transmission media, wherein the DC is configured to broadcast a discovery request across a number of channels defined by the transmission media, said discovery request comprising an address of the DC; and wherein each node is configured to:

- receive the discovery request;
- determine a path cost of each specific channel via which the discovery request was received;
- store the path cost associated with each channel;
- select a channel having the lowest path cost to the DC;

and

- broadcast a registration request to the DC via the selected channel, said registration request comprising an address of that node.

[0028] The transmission media may be selected from cable and/or broadcast media. Similarly, each channel may be defined according to a specific frequency band on the media, according to a particular modulation mode, and/or the like.

[0029] A node may be configured to determine the path by analysing signal strength across a channel, analysing a signal-to-noise ratio over a channel, analysing integrity of a channel, analysing quality of a channel, analysing bandwidth of a channel, analysing utilisation of a channel, and/or the like.

[0030] The DC may be configured to broadcast the discovery simultaneously or sequentially across all available channels.

[0031] A node may be configured to:
update the discovery request with the selected channel and said node's address; and
forward the updated discovery request to further nodes via the channels available to such forwarding node.

[0032] A node may be configured to:
compile a discovery table populated with an address of each node from which a discovery request is received along with the selected channel for that address.

[0033] A node may be configured to:
select from its discovery table a channel with the lowest path cost to the DC for communicating across the network.

[0034] It is to be appreciated that a node's selected channel with the lowest path cost to the DC may include a number of other nodes' selected channels if a node is required to communicate to the DC through such other nodes. In such an arrangement, a 'child' node's selected channel is the channel with the lowest path cost to the 'parent' node having the lowest path cost to the DC.

[0035] A node's address may comprise an address of other nodes comprising said node's selected channel.

[0036] The DC may be configured to:
receive each node's registration request; and

compile a routing table comprising each node's address and selected channel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] Further features of the present invention are more fully described in the following description of several non-limiting embodiments thereof. This description is included solely for the purposes of exemplifying the present invention. It should not be understood as a restriction on the broad summary, disclosure or description of the invention as set out above. The description will be made with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic representation of method steps for establishing a communication network between a number of nodes and a data concentrator (DC) via transmission media, in accordance with aspects of this disclosure;

Figure 2 is a schematic representation of a communication network in accordance with aspects of this disclosure; and

Figure 3 is a schematic representation of a node configuration for a communication network in accordance with aspects of this disclosure.

DESCRIPTION OF EMBODIMENTS

[0038] The following description provides examples of different embodiments of a method for automatically and dynamically establishing a communication network, and a node configuration for such a communication network, where communication in the network occurs by way of transmission

media that can include cable / wire based and/or wireless / broadcast media, including power line media by which power line communication (PLC) involving data communication over power lines that carry electrical power signals occurs.

[0039] With reference now to Figure 1, there is shown method or process steps associated with a broad method 10 of establishing a communication network between a number of nodes and a data concentrator (DC) via transmission media. For the sake of explanation, each method step is generally indicated by a reference numeral associated with a particular action or step, as explained below. The data concentrator, or DC, is generally indicated by reference numeral 12, with a node generally indicated by reference numeral 14.

[0040] It is to be appreciated that the transmission media may comprise cable and/or broadcast media, i.e. wired and wireless media, alone or in combination. For example, the transmission media may comprise an existing power line system or network, dedicated network cables, wireless networking, and/or the like. In addition, each transmission medium may define various channels according to specific frequency bands, a particular modulation mode, and/or the like.

[0041] In broad terms, the method 10 comprises a step of broadcasting 16 a discovery request, by the DC 12, across a number of channels as defined by the available transmission media. This discovery request typically comprises a unique address of the DC 12. Depending on requirements, this step of broadcasting 16 the discovery request may be performed simultaneously or sequentially across all available channels of the media.

[0042] For example, the DC 12 may transmit the discovery request one at a time across different power line communication (PLC) channels, followed by wireless network channels, and the like. Alternatively, the DC 12 may transmit the discovery request simultaneously across all available channels.

[0043] The method 10 then includes a step of receiving 18 the discovery request by a node 14. Each node 14 associated with the network is configured to determine a path cost of each specific channel via which the discovery request was received, as well as to subsequently store such path cost associated with each channel. These steps of determining and storing the path cost of each channel are generally indicated by reference numeral 20.

[0044] The method 10 then includes a step of selecting 22, by each node, the channel having the lowest path cost to the DC. The path cost is typically determined by each node being configured to analyse a signal strength across each channel, a signal-to-noise ratio over each channel, integrity of each channel, a quality of each channel, a bandwidth of each channel, utilisation of each channel, and/or the like. It is to be appreciated that various characteristics known in the art are indicative of path cost and all these fall within the scope of this disclosure.

[0045] The method 10 then typically include a step of broadcasting 24, by each node 14, a registration request to the DC 12 via the selected channel, said registration request comprising an address of that node. It is to be appreciated that the selected channel is the channel having the lowest path cost to the DC, as described above.

[0046] In broad terms, the method 10 also comprises the steps of receiving 34, by the DC 12, each node's registration request, and compiling 36, by the DC 12, a routing table comprising each node's address and selected channel. In this manner, the DC is able to compile a routing table with each node's address along with the selected channel having the lowest path cost between a node and the DC 12.

[0047] The method 10 may also further comprise steps of updating 26, by a node, the discovery request with the selected channel and said node's address and forwarding 28, by said node, the updated discovery request to further nodes via the channels available to such forwarding node. This is generally the case where additional nodes are linked to the DC 12 by means of intermediate or parent nodes.

[0048] Similar, the method 10 may further comprise a step of compiling 30, by each node, a discovery table populated with an address of each node from which a discovery request is received along with the selected channel for that address.

[0049] In this manner, the method may comprise a further step of selecting 32 from its discovery table, by each node, a channel with the lowest path cost to the DC 12 for communicating across the network.

[0050] It is to be appreciated that a node's selected channel with the lowest path cost to the DC may include a number of other nodes' selected channels if a node is required to communicate to the DC through such other nodes. In such an arrangement, a 'child' node's selected channel is the channel with the lowest path cost to the 'parent' node

having the lowest path cost to the DC. Accordingly, a node's address may comprise an address of other nodes comprising said node's selected channel, e.g. a child node's address inherently includes its parent node's address on the network.

[0051] With reference now to Figure 2 of the drawings, a more detailed description of an example of a communication network 38, generally established via the method 10, is provided. Such a method 10 typically facilitates the formation and maintenance of a communication network 38 of hybrid nodes 14 with the capability of communication over different media, for example, power-line and wireless communications, and/or different channels of those media. The method 10 also allows for optimisation of the quality of communication between nodes and maintains this quality.

[0052] In this example, the network 38 is formed as a tree topology with a single pre-designated data concentrator (DC) 12 at the root of the network 38. The network 38 also includes nodes A, B and C 14, as shown. This network 38 is generally formed dynamically according to the method or protocol described herein. An important capability of the method 10 is to minimise a path cost metric between the DC 12 and any given node 14.

[0053] Every node 14 in the network 38 is pre-assigned a unique address in the network and begins in an unregistered state. A registered node is often assigned a shorter address by the DC as a convenience during data, information or message passing. The DC itself also has a unique address.

[0054] In general, messages are passed either from the DC 12 to a given node, or from a given node to the DC.

Typically, no direct node-to-node message passing occurs. Messages that are sent from the DC to a given node typically contain source routing, that is, it lists the addresses of all intermediate nodes to the final destination. In this way, the message is passed from node to node until it reaches its destination.

[0055] Messages that are sent towards the DC 12 from a given node only require the address of the next upstream node. This upstream node, when receiving this message, updates the address to the next node along the line, and re-sends the message. This happens until it reaches the DC.

[0056] As described above, communication between any two nodes of the network 38 may potentially take place between one out of a number of different channels. Each channel would be defined by, for example, a particular frequency, a particular modulation mode, and over a particular medium (wireless or power-line).

[0057] In this example, the network 38 is formed and maintained using certain messages, namely discovery requests, registration requests and registration replies.

[0058] As described above, the DC 12 and registered nodes 14 periodically broadcast discovery requests. These discovery requests are transmitted over the different channels - one channel or a few channels at a time - in turn. This is done so that over a period of time, all the possible channels are used. Restriction of transmissions to only a few channels is typically for reasons of power limitation.

[0059] At the start, before the network 38 is established and no nodes 14 are registered, only the DC 12 broadcasts discovery requests. Each discovery request contains the address of the node or DC which is broadcasting this request and its path cost to the DC (In the case of the DC itself, the path cost would be zero).

[0060] By receiving these discovery requests, nodes 14 are able to determine the path cost between itself and the DC 12 through the broadcasting nodes via the received channel. As described above, each node generally stores these selected channels or values into a discovery table. The path cost is determined by adding the path cost in the discovery request itself to a link cost between that node and the broadcasting node. This link cost may be estimated by using, for example, received signal strength, noise over the channel or some such measure.

[0061] An unregistered node, having accumulated sufficient data in its discovery table, determines the path to the DC with the lowest cost from this discovery table. The unregistered node then sends a registration request to the DC through this chosen upstream node and channel. This chosen upstream node and channel is the potential parent node and parent channel for the unregistered node.

[0062] This registration request typically contains the address of the registering node, the address of the potential parent node, and the potential parent channel.

[0063] When the DC receives a registration request, it places the registering node address in its routing table, together with the parent node and parent channel chosen, if applicable. The DC 12 then confirms the choice of parent

node and parent channel by sending a registration reply to the registering node using source routing. The source route will contain the address of the chosen parent node and ending with the address of the registering node.

[0064] The registration reply typically contains the address of the registering node, an assigned shorter network address for the registering node, the address of the confirmed parent node, and the confirmed parent channel.

[0065] In addition, as the registration reply passes through the confirmed parent node, the parent node will recognize that it is now the parent node for the registering node. It stores the registering node address and chosen parent channel into a child node table. It also re-sends this registration reply to the registering node. If the registering node is just one link down from the DC, then the DC will populate its own child node table with the information and send the registration reply directly to the registering node.

[0066] When the registering node receives the registration request, it recognizes that the reply is for itself from the address given. It then stores the confirmed parent node and confirmed parent channel.

[0067] Once a node is registered, the DC is thus able to send messages to the node using source routing by determining the route to the node using its routing table. Any node that needs to forward a message to its downstream child node will use the child node table to lookup the parent channel chosen for that child node. Then it will send the message to the child node using the child node's parent channel.

[0068] Registered nodes generally send messages to the DC by marking it as an upstream message and sending it to its stored parent node using the parent channel. This message is then forwarded to the DC through each node in the same manner, namely sending to the respective parent node using the respective parent channel.

[0069] Registered nodes may maintain its discovery table as it receives more discovery requests. If a registered determines that there is a better route between itself and the DC using a different parent node and/or parent channel, it may send a registration request to the DC, as above. Subsequently, the DC may then reply in a similar manner. In this way, the network 38 maintains optimum routes with lowest path costs between the DC and nodes.

[0070] A node may also monitor discovery requests from child nodes to determine if it should remove any 'stale' child nodes from a child node table. This would be the case where, for example, a child node is down.

[0071] In the example shown in Figure 2, the following channels are available: PLC frequency A (PLCA), which refers to a predetermined frequency of a PLC network; PLC frequency B (PLCB), which refers to a different frequency of the PLC network; and Wireless (WL), which refers to a predetermined frequency band of a wireless network.

[0072] According to the above method 10, the DC may choose to broadcast discovery requests over these channels at different times or at the same time. For example, node A receives discovery requests from the DC and compiles develop

a table as follows after determining or estimating the path costs:

<i>Potential parent and channel</i>	<i>Total path cost</i>
<i>DC PLCA</i>	<i>6</i>
<i>DC PLCB</i>	<i>5</i>
<i>DC WL</i>	<i>3</i>

[0073] Choosing DC WL as the optimum path, node A then sends a registration request containing its address, DC as the parent node, and WL as the parent channel.

[0074] Node A then sends the registration request to the DC using the same channel it determines as the lowest cost, which in this example is over the wireless channel (WL).

[0075] When the DC receives this registration request, it updates two tables, namely its routing table and its own child node table, as shown below:

Routing table

<i>Node</i>	<i>Parent</i>
<i>A</i>	<i>DC</i>

Child node table:

<i>Child</i>	<i>Channel</i>
<i>A</i>	<i>WL</i>

[0076] This allows the DC in future to determine what route to use to send messages to node A and also which channel has been selected as the optimum channel for communication with node A as its direct child.

[0077] The DC then sends a registration reply to node A with source routing of [DC - A] to node A confirming the registration.

[0078] When node A receives the registration reply, it updates its parent node to "DC" and parent channel to "WL". It will then use this path to send messages to the DC.

[0079] Furthermore, node A will then start to broadcast discovery requests over the different channels with a path cost of 3, being the lowest path cost of all channels available to it.

[0080] If it is now assumed that node B has also registered with the DC and is similarly broadcasting discovery requests, then subsequently node C, which is yet unregistered, will receive discovery requests from both node A and node B and might develop a table as follows after estimating the respective total path costs:

<i>Potential parent and channel</i>	<i>Total path cost</i>
A PLCA	$5 + 3 = 8$
A PLCB	$3 + 3 = 6$
A WL	$4 + 3 = 7$
B PLCA	$5 + 3 = 8$
B PLCB	$4 + 3 = 7$
B WL	$4 + 3 = 7$

[0081] Choosing PLCB through node A as the optimum path to the DC, node C then sends a registration request with its address, A as the parent node and PLCB as the parent channel. Node C sends the registration request to the DC using channel PLCB.

[0082] When the DC receives this registration request, it updates its tables as follows:

Routing table

<i>Node</i>	<i>Parent</i>
<i>A</i>	<i>DC</i>
<i>B</i>	<i>DC</i>
<i>C</i>	<i>A</i>

[0083] The DC's child node table does not change with this request. The DC then sends a registration reply to node A with source routing of [DC - A - C] to node C confirming the registration.

[0084] When node A receives this registration reply, it determines that it is the parent of the registering node and will then update its child node table as follows:

<i>Child</i>	<i>Channel</i>
<i>C</i>	<i>PLCB</i>

[0085] Node A now forwards the reply to node C. Thereafter, any messages addressed to node C will be forwarded using channel PLCB.

[0086] Similarly, when node C receives the registration reply it updates its parent node to "A" and parent channel to "PLCB". It will then use this path to send messages to the DC.

[0087] The invention involves a method of the formation and maintenance of a communication network of hybrid nodes with the capability of communication over different media, for example, power-line and wireless communications, and/or

different channels of those media. This method optimizes the quality of communication between nodes and maintains this quality.

[0088] The primary application is for communications over power-lines and wireless which have many applications in the Smart Grid like in street-lighting, meter reading, control and monitoring of devices.

[0089] Figure 3 shows an example of a node configuration 14 for the above communication network 34. Such a node configuration 14 generally comprises a memory arrangement for operative storage of a set of instructions, and a processor arranged in signal communication with the memory arrangement. This memory and processor arrangement is generally indicated by reference numeral 40.

[0090] The processor 40 is configured to execute the set of instructions to establish a network layer 42 responsible for transferring information across the network 38. In addition, the processor 40 also executes the instructions to establish a combined media access control (MAC) and physical layer (PHY) 44 which forms a network interface with the transmission media 48.

[0091] As described above, the transmission media 48 may comprise a number of different media, including both cable and/or broadcast media, i.e. wired and wireless media, alone or in combination. In addition, each transmission medium 48 typically defines various channels according to specific frequency bands, a particular modulation mode, and/or the like.

[0092] In accordance with this disclosure, execution of the instructions by the processor 40 configures the node to:

receive 18 a discovery request broadcast by the DC 12 across a number of channels defined by the transmission media, the discovery request comprising an address of the DC12;

determine a path cost of each specific channel via which the discovery request was received and store 20 the path cost associated with each channel;

select 22 a channel having the lowest path cost to the DC 12; and

broadcast 24 a registration request to the DC via the selected channel, the registration request comprising an address of the node.

[0093] Similarly, in this manner each node configuration 14 is able to perform the method steps described above and in relation to the network 38.

[0094] In the above-described fashion, this invention adds a plurality of physical media and channels for communication and the ability to choose between these different channels and media between any two nodes in the network so as to provide more robust communications.

[0095] This invention further provides an alternative and simpler means of using the different media for communications without having to provide a custom combined Logical Link Control layer. This invention thus uses the PHY/DLL of the medium as an integrated unit. Also, it does not require to transmit over both physical layers at once, thus is useful in applications where power output is limited.

[0096] It should be appreciated that the scope of the invention is not limited to the scope of the embodiment described. Various modifications and improvements may be

made to the embodiment described without departing from the scope of the invention.

[0097] Throughout this specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[0098] It is to be appreciated that reference to "one example" or "an example" of the invention is not made in an exclusive sense. Accordingly, one example may exemplify certain aspects of the invention, whilst other aspects are exemplified in a different example. These examples are intended to assist the skilled person in performing the invention and are not intended to limit the overall scope of the invention in any way unless the context clearly indicates otherwise.

CLAIMS

1. A method of establishing a communication network between a number of nodes and a data concentrator (DC) via transmission media, said method comprising:

 broadcasting a discovery request, by the DC, across a number of channels defined by the transmission media, said discovery request comprising an address of the DC;

 receiving the discovery request, by a node, each node configured to determine a path cost of each specific channel via which the discovery request was received;

 storing, by each node, the path cost associated with each channel;

 selecting, by each node, a channel having the lowest path cost to the DC; and

 broadcasting, by each node, a registration request to the DC via the selected channel, said registration request comprising an address of that node.

2. The method of claim 1, wherein the transmission media comprises cable media.

3. The method of claim 1, wherein the transmission media comprises broadcast media.

4. The method of claim 1, wherein each channel is defined according to a specific frequency band on the media.

5. The method of claim 1, wherein each channel is defined according to a particular modulation mode.

6. The method of claim 1, wherein determination of the path cost is selected from a group consisting of analysing signal strength across a channel, analysing a signal-to-

noise ratio over a channel, analysing integrity of a channel, analysing quality of a channel, analysing bandwidth of a channel, and analysing utilisation of a channel.

7. The method of claim 1, wherein the step of broadcasting a discovery request by the DC is performed simultaneously or sequentially across all available channels.

8. The method of claim 1, further comprising:
updating, by a node, the discovery request with the selected channel and said node's address; and
forwarding, by said node, the updated discovery request to further nodes via the channels available to such forwarding node.

9. The method of claim 8, further comprising:
compiling, by each node, a discovery table populated with an address of each node from which a discovery request is received along with the selected channel for that address.

10. The method of claim 9, further comprising:
selecting from its discovery table, by each node, a channel with the lowest path cost to the DC for communicating across the network.

11. The method of claim 1, wherein a node's address comprises an address of other nodes comprising said node's selected channel.

12. The method of claim 1, comprising:
receiving, by the DC, each node's registration request; and

compiling, by the DC, a routing table comprising each node's address and selected channel.

13. A node configuration for a communication network, comprising:

a memory arrangement for operative storage of a set of instructions; and

a processor arranged in signal communication with the memory arrangement, said processor configured to execute the set of instructions to establish a network layer responsible for transferring information across the network, and a combined media access control (MAC) and physical layer (PHY) which forms a network interface with transmission media, wherein execution of the instructions by the processor configures the node to:

receive a discovery request broadcast by a data concentrator (DC) across a number of channels defined by the transmission media, said discovery request comprising an address of the DC;

determine a path cost of each specific channel via which the discovery request was received;

store the path cost associated with each channel;

select a channel having the lowest path cost to the DC; and

broadcast a registration request to the DC via the selected channel, said registration request comprising an address of the node.

14. The node configuration of claim 13, which is configured so that determination of the path cost is selected from a group consisting of analysing a signal strength across a channel, analysing a signal-to-noise ratio over a channel, analysing integrity of a channel, analysing

quality of a channel, analysing bandwidth of a channel, and analysing utilisation of a channel.

15. The node configuration of claim 13, which is configured to:

- update the discovery request with the selected channel and said node's address; and

- forward the updated discovery request to further nodes via the channels available to the node.

16. The node configuration of claim 15, which is configured to:

- compile a discovery table populated with an address of each node from which a discovery request is received along with the selected channel for that address.

17. The node configuration of claim 16, which is configured to:

- select from its discovery table a channel with the lowest path cost to the DC for communicating across the network.

18. A communication network comprising at least one data concentrator (DC) and a number of nodes linked to the DC via transmission media, wherein the DC is configured to broadcast a discovery request across a number of channels defined by the transmission media, said discovery request comprising an address of the DC; and wherein each node is configured to:

- receive the discovery request;

- determine a path cost of each specific channel via which the discovery request was received;

- store the path cost associated with each channel;

select a channel having the lowest path cost to the DC; and

broadcast a registration request to the DC via the selected channel, said registration request comprising an address of that node.

19. The network of claim 18, wherein the transmission media is selected from cable media.

20. The network of claim 18, wherein the transmission media is selected from broadcast media.

21. The network of claim 18, wherein each channel is defined according to a specific frequency band on the media.

22. The network of claim 18, wherein each channel is defined according to a particular modulation mode.

23. The network of claim 18, wherein a node is configured so that determination of the path is selected from a group consisting of analysing signal strength across a channel, analysing a signal-to-noise ratio over a channel, analysing integrity of a channel, analysing quality of a channel, analysing bandwidth of a channel, and analysing utilisation of a channel.

24. The network of claim 18, wherein the DC is configured to broadcast the discovery request simultaneously or sequentially across all available channels.

25. The network of claim 18, wherein a node is configured to:

update the discovery request with the selected channel and said node's address; and

forward the updated discovery request to further nodes via the channels available to such forwarding node.

26. The network of claim 25, wherein a node is configured to:

compile a discovery table populated with an address of each node from which a discovery request is received along with the selected channel for that address.

27. The network of claim 26, wherein a node is configured to:

select from its discovery table a channel with the lowest path cost to the DC for communicating across the network.

28. The network of claim 18, wherein a node's address comprises an address of other nodes comprising said node's selected channel.

29. The network of claim 18, wherein the DC is configured to:

receive each node's registration request; and
compile a routing table comprising each node's address and selected channel.