

Method for controlling the operating of a communication network and associated devices

5 This patent application claims the benefit of document FR 18/01167 filed on November 7, 2018 which is hereby incorporated by reference.

The present invention relates to a method for controlling the operation of a wireless communication network. The invention also relates to a communication network, a computer program product and a readable information medium.

10 In the field of wireless telecommunications, the communication network between a first node and a second node with two hops and two relays is a network found in many architectures.

During operation, in the first time interval (also called slot), the first node of the communication network sends a message that the relay listens to, then the relay sends the message to the second node, in the second timeslot. The transmission of a message
15 from the first node to the second node is therefore done during two timeslots. This corresponds to a throughput (quantity of information transmitted per unit of time) corresponding to 0.5 messages per slot.

For many applications, this throughput should be increased.

20 In particular known from the article by Vijia FAN et al. titled "*Recovering Multiplexing Loss Through Successive Relaying Using Repetition Coding*" (IEEE Transactions on Wireless Communications, Vol. 6, No. 12, December 2007) is a transmission protocol making it possible to increase the throughput.

However, such an increase is still insufficient.

25 There is therefore a need for a method for controlling the operation of a communication network making it possible to obtain a greater throughput while guaranteeing a good reception of the messages.

To that end, the description describes a method for controlling the operation of the communication network, the network including a source connected by two relays to a destination node, the operation being defined by a sending node and a receiving node for
30 each relay, the method including the detection of the reception mode of each relay of the communication network. The reception mode of a relay being a first reception mode in which the considered relay is able to receive messages coming from the source without implementing a technique for managing interference or a second reception mode in which the considered relay is able to receive the messages coming from the source after
35 implementing an interference management technique, or a third reception mode in which the considered relay is not able to receive messages coming from the source even after

implementing an interference management technique. The method also includes controlling the sending mode of the communication network as a function of the reception mode detected for each of the two relays.

According to specific embodiments, the method has one or more of the following features, considered alone or according to any technically possible combinations:

- the detection of the reception mode of each relay is obtained using at least one signal-to-noise ratio measurement.
- the signal-to-noise ratio measurement is the signal-to-noise ratio between a signal coming from the source and the noise of a relay or the signal-to-noise ratio between a signal coming from a relay and the noise of another relay.
- the method includes a step for the source to learn the reception modes of the two relays.
- the interference management technique is a PLNC decoding.
- the method includes the adaptation of the power of the source when the reception mode is the second reception mode.
- during the control step, the sending mode of the communication network has a throughput of 1 frame per slot when the communication network is in the third sending mode and the communication network has a throughput of 2/3 of a frame per slot when the communication network is in the second sending mode.

The present description also proposes a communication network including a source, a destination node, two relays connecting the source to the destination node, and four controllers, each controller respectively being associated with the source, the destination node and the two relays, the four controllers being suitable for controlling the operation of the communication network, the operation being defined by a sending mode for each node and a reception mode for each relay, and detecting the reception mode of each relay of the communication network. The reception mode of a relay being a first reception mode in which the considered relay is able to receive messages coming from the source without implementing a technique for managing interference or a second reception mode in which the considered relay is able to receive the messages coming from the source after implementing an interference management technique, or a third reception mode in which the considered relay is not able to receive messages coming from the source even after implementing an interference management technique. The four controllers being suitable for controlling the sending mode of the communication network as a function of the reception mode detected for each of the two relays.

The present description also proposes a computer program product including a readable information medium, on which a computer program is stored comprising program

instructions, the computer program being able to be loaded on a data processing unit and suitable for driving the implementation of at least one step of a method as previously described when the computer program is implemented on the data processing unit.

The present description also proposes a readable information medium comprising computer program instructions which, when executed by a data-processing unit, cause execution of steps of a method as previously described.

Features and advantages of the invention will appear more clearly upon reading the following description, provided solely as a non-limiting example, and done in reference to the appended drawings, in which:

- 10 - figure 1 is a schematic view of an example wireless communication network,
- figure 2 is a graph delimiting the reception modes at each relay of the communication network of figure 1 as a function of the signal-to-noise ratios of elements of the network,
- figure 3 is a schematic illustration of an exemplary operation of the communication network of figure 1 according to a first sending mode,
- 15 - figure 4 is a schematic illustration of an exemplary operation of the communication network of figure 1 according to a second sending mode,
- figure 5 is a schematic illustration of an exemplary operation of the communication network of figure 1 according to a third sending mode,
- 20 - figure 6 is a flowchart of an exemplary method for controlling the operation of the communication network of figure 1,
- figure 7 is a graph showing the performance of the control method during a sequence for implementing at least part of the control method proposed in figure 6, and
- 25 - figure 8 is a graph showing the performance of the control method in terms of error rate for several signal discrimination techniques.

A communication network 10 is shown schematically in figure 1. The communication network 10 serves to send messages from a first node to a second node.

The first node is therefore called source S hereinafter, while the second node is called destination node D or destination D.

The communication network 10 can be part of a larger set of nodes, the set then forming a larger set of nodes, also called a multi-hop topology or architecture.

In the proposed example, the communication network 10 includes only four nodes—the source S, the destination D and the two relays R1 and R2—and one controller per node. For convenience, the controller is shown by a single rectangle 18.

The nature of the nodes is irrelevant for the description that follows. For example, depending on the case, a node is a mobile terminal, a fixed terminal or a sending terminal.

Each relay R1 or R2 is inserted between the source S and the destination D.

Each relay R1 or R2 is able to receive a message coming from the source S and to
5 send a message, in particular to the destination D.

Each controller 18 is suitable for controlling the node of the communication network 10 to which it is attached according to several operating modes.

One operating mode of the communication network 10 is defined by a sending mode defining a sequence of transmissions for each node and a reception mode at each
10 relay R1 or R2. The sending modes and receiving modes at each relay R1 or R2 that are possible for the communication network 10 are described hereinafter.

Each controller 18 can be made in different ways.

In one particular example, the interaction of one or several computer program products with each controller 18 makes it possible to implement a control method for the
15 operation of the communication network 10.

More generally, each controller 18 is an electronic logic controller able to manipulate and/or transform data represented as electronic or physical quantities in registers of the logic controller and/or memories into other similar data corresponding to physical data in the memories, registers or other types of display, transmission or storage
20 devices.

In one very particular case, each controller 18 includes a processor comprising a data processing unit, memories and an information medium reader. The controller 18 also comprises a keyboard and a display unit.

The computer program product includes a readable information medium.

25 A readable information medium is a medium readable by each controller 18, usually by the reader. The readable information medium is a medium suitable for storing electronic instructions and able to be coupled with a bus of a computer system.

As an example, the readable information medium is a floppy disk, an optical disc, a CD-ROM, a magnetic-optical disc, a ROM memory, a RAM memory, an EPROM memory,
30 an EEPROM memory, a magnetic card or an optical card.

A computer program comprising program instructions is stored on the readable information medium.

The computer program can be loaded on the data processing unit and is capable of driving the implementation of the control method.

35 According to another example, each controller 18 is made in the form of a plurality of calculators controlled remotely by a supervision member.

Each relay R1 or R2 of the communication network 10 is able to operate according to several distinct reception modes MR1, MR2 and MR3 as illustrated schematically by figure 2.

5 In figure 2, each reception mode MR1, MR2 and MR3, applied at the first relay R1, corresponds to a zone Z1, Z2 or Z3, each zone Z1, Z2 or Z3 being defined in the space of the signal-to-noise ratio of the first relay R1 for a signal coming from the source S (x-axis) and the signal-to-noise ratio of the first relay R1 for a signal coming from the second relay R2 (y-axis).

10 Similarly, each reception mode MR1, MR2 and MR3, applied at the second relay R2, corresponds to a zone Z1, Z2 or Z3, each zone Z1, Z2 or Z3 being defined in the space of the signal-to-noise ratio of the second relay R2 for a signal coming from the source S (x-axis) and the signal-to-noise ratio of the second relay R2 for a signal coming from the second relay R1 (y-axis).

15 It should be noted that the reception mode applied at the first relay R1 is independent of the reception mode applied at the second relay R2.

The signal-to-noise ratio of the first relay R1 for a signal coming from the source S corresponds to the ratio between the power level of the signal coming from the source S received by the first relay R1 and the noise level of the ambient electromagnetic interference at the first relay R1.

20 Similarly, the signal-to-noise ratio of the first relay R1 for a signal coming from the second relay R2 corresponds to the ratio between the power level of the signal coming from the second relay R2 received by the first relay R1 and the noise level of the ambient electromagnetic interference at the first relay R1.

25 The signal-to-noise ratios of the second relay R2 for a signal coming from the source S or for a signal coming from the first relay R1 are defined similarly, by reversing the roles of the first relay R1 and the second relay R2.

30 Hereinafter, for convenience, the signal-to-noise ratio of the first relay R1 for a first signal coming from the source S is called source ratio-R1 and denoted R-SR1 while the signal-to-noise ratio of the first relay R1 for a signal coming from the second relay R2 is called ratio R2-R1 and denoted R-R2R1.

Likewise, the signal-to-noise ratio of the second relay R2 for a signal coming from the source S is called source ratio-R2 R-SR2 while the signal-to-noise ratio of the second relay R2 for a signal coming from the first relay R1 is called ratio R1-R2 and denoted R-R1R2.

35 Furthermore, the notions of relative position on the graph of figure 2 are understood such that a larger ratio R-SR1 corresponds to a position further to the right

and a larger ratio $R-R2R1$ corresponds to a higher position. This is without prejudice to the relative position of the two relays $R1$ and $R2$.

For each relay $R1$ and $R2$, the zones $Z1$, $Z2$ and $Z3$ are delimited by a set of segments.

5 Taking the example of the first relay $R1$, the first zone $Z1$ corresponds to configurations for which the ratio $R-SR1$ is above a first threshold $S1$ and for which the ratio $R-R2R1$ is below a first value $V1$ while the ratio $R-SR1$ is below a second threshold $S2$. The first zone $Z1$ thus groups together the configurations in which the second relay ratio $RR2$ is less than or equal to the sum of the ratio $R-SR1$ and the first value $V1$
10 decreased by the second threshold $S2$.

The first zone $Z1$ is therefore delimited by three segments, a first segment with equation $R-SR1 = S1$, a second segment with equation $R-R2R1 = V1$ and a third segment with equation $R-R2R1 = R-SR1 + (V1-S2)$. The first zone $Z1$ is below these three segments.

15 From a physical perspective, the first $R1$ is located in the first zone $Z1$ when the first relay $R1$ is capable of directly decoding (conventional decoding) the message coming from the source S , even if the second $R2$ simultaneously sends a message to the destination.

By reversing the roles of the first relay $R1$ and the second relay $R2$, the reasoning
20 is also valid for the second relay $R2$. The second relay $R2$ is located in the first zone $Z1$ (relative to the signal-to-noise ratios $R-SR2$ and $R-R1R2$), if the second relay $R2$ is capable of directly decoding the message coming from the source when the first relay $R1$ is simultaneously active.

In other words, the first reception mode $MR1$ is a mode in which the two relays $R1$
25 and $R2$ receive and directly decode the messages coming from the source, even if the complementary relay is simultaneously active.

The second zone $Z2$ and the third zone $Z3$ group together the configurations located above the aforementioned segments.

The second zone $Z2$ is delimited from the third zone $Z3$ by a fourth segment and a
30 fifth segment.

Still for the case of the relay $R1$, the fourth segment is in the continuation of the first segment with equation $R-SR1 = S1$ and is located between values of the second relay ratio $R-R2R1$ located between the first value $V1$ and a second value $V2$.

The fifth segment is parallel to the third segment and begins at the point having, as
35 coordinates, the first threshold $S1$ and the second value $V2$.

The second zone Z2 is delimited underneath by the second segment and the third segment and above by the fourth segment and the fifth segment.

From a physical perspective, the second zone Z2 relative to the first relay R1 corresponds to the case where the first relay R1 receives signals coming from the source S and the second relay R2 with a similar power. In this situation, the first relay R1 cannot directly decode the messages coming from the source if the second relay R2 is simultaneously active. Nevertheless, the first R1 can find a linear combination of the two transmitted messages (by the source S and by the second R2) using a specific decoding technique, called interference management technique.

For example, the specific decoding is a so-called PLNC (Physical Layer Network Coding) decoding. According to another example, the "Successive Interference Cancellation" (SIC) technique is also an interference management technique to be applied at the relays R1 or R2. This is in particular the case in the article by Simoni titled "Buffer-Aided Diamond Relay Network With Block Fading and Inter-Relay Interference", (IEEE Transactions on Wireless Communications, Vol. 15, No. 11, November 2016) or in the article by Fan titled "Recovering Multiplexing Loss Through Successive Relaying Using Repetition Coding" (IEEE Transactions on Wireless Communications, Vol. 6, No. 12, December 2007).

The second zone Z2 relative to the second relay R2 is built similarly by reversing the roles of the first relay R1 and the second relay R2. The second relay R2 is located in the second zone Z2 if the second relay R2 receives the signal coming from the source S and the signal coming from the first relay R1 with similar powers.

The third zone Z3 is delimited on the right by the first segment, the fourth segment and the fifth segment.

The third zone Z3 relative to the first relay R1 corresponds to the configurations in which the first relay R1 cannot receive the signal coming from the source S if the second relay R2 simultaneously sends a message, irrespective of the decoding technique used. From a physical perspective, the power coming from the second relay R2 is too much higher than the power coming from the source S for the first relay R1 to be able to decode the message from the source S.

Similarly, the second R2 is located in the third zone Z3 if the power of the signal coming from the first relay R1 is significantly greater than that coming from the source S.

Synthetically, it is possible to define each reception mode of a relay R1 or R2 as follows.

The first reception mode MR1 is a reception mode in which the considered relay R1 or R2 is capable of receiving and reading messages coming from the source S

intended for the considered relay R1 or R2 without implementing an interference management technique.

The second reception mode MR2 is a reception mode in which the considered relay R1, R2 is capable of receiving and reading messages coming from the source S intended for the considered relay R1 or R2 after implementing an interference management technique.

The third reception mode MR3 is a reception mode in which the considered relay R1 or R2 is not capable of reading messages coming from the source S intended for the considered relay R1 or R2 even after implementing an interference management technique.

It should be noted that it is indeed the ability of the relay R1 and R2 to read the message coming from the source that is decisive and not the question of whether the relay R1 and R2 indeed implements the interference management technique. In particular, the relay R1 or R2 can implement an interference management technique in the first zone Z1 even if this technique is needless. Two parameters α and β are also defined. For the space of the powers received by the first relay R1, the first parameter α being the distance between the third segment and the curve with equation $R-R2R1=R-SR1$, then the second parameter β is the distance between the fifth segment and the curve with equation $R-R2R1=R-SR1$.

The parameters α and β in particular make it possible to define the width of the three zones Z1, Z2 and Z3. The lower the values of the parameters α and β are, the smaller the second zone Z2 is in favor of the first and third zones Z1 and Z3. Conversely, the higher the values of the parameters α and β are, the wider the second zone Z2 is and the more the relays R1 and R2 will perform a PLNC decoding.

The possible sending modes for the communication network 10 are now described in reference to figures 3 to 5.

The first sending mode ME1 of the communication network 10 is schematically illustrated by figure 3, which shows the sequencing of the transmissions between the elements of the communication network 10 in two timeslots T1 and T2.

In this first sending mode ME1, the source S first sends a first configuration message to the two relays R1 and R2 in a broadcast mode. The term "broadcast" can be referred to as "multicasting" and is opposed to a point-to-point broadcasting. Then, the second relay R2 sends a second configuration message to the source S. Next, the source S sends a data message to the first relay R1.

The data message is sent before the end of the first timeslot T1.

Then, during the second timeslot T2, the source S sends the second configuration message to the two relays R1 and R2. Next, the first relay R1 sends a complete frame, namely the first configuration message and the message containing the datum. The message containing the datum is received by the destination D.

5 Such a first sending mode ME1 thus corresponds to a throughput of 1 frame for two timeslots, or a throughput of 0.5 frames per timeslot.

The sequencing of the transmissions between the elements of the communication network 10 in three timeslots T1, T2 and T3 is also shown in figure 4 for the case of the second sending mode ME2.

10 In this second sending mode ME2, the source S first sends a first configuration message to the two relays R1 and R2. Then, the second relay R2 sends a second configuration message to the source S. Next, the source S sends a message to be transmitted to the second relay R2.

The first message to be transmitted is sent before the end of the first timeslot T1.

15 Then, during the second timeslot T2, the source S sends a second configuration message to the two relays R1 and R2. Next, the second relay R2 sends the first configuration message. Then, at the same time, the second relay R2 sends the first message to be transmitted while the source S sends the second message to be transmitted to the first relay R1.

20 The second message to be transmitted is sent before the end of the second timeslot T2.

Next, the second configuration message is sent by the source S. The first relay R1 then sends a complete frame, namely the first configuration message and the second message to be transmitted.

25 Such a second sending mode ME2 thus corresponds to a throughput of 2 frames for 3 timeslots, or a throughput of $2/3$ frame per timeslot.

An equivalent sending mode, called second-bis and denoted ME2-bis, can be defined by reversing the roles of the first relay R1 and the second relay R2.

30 For the third sending mode ME3, figure 5 illustrates a sequencing for the transmission of the messages within elements of the communication network 10 during two timeslots.

35 In this third sending mode ME3, the source S first sends a first configuration message to the two relays R1 and R2. Then, the second relay R2 sends a second configuration message. The source S next sends a message to be transmitted while the second relay R2 transmits another message to be transmitted coming from the source S (timeslot prior to the depicted timeslots).

At the end of the transmission and sending of the messages, the first timeslot T1 ends.

Then, during the second timeslot T2, the source S sends a second configuration message to the second relay R2. The first relay R1 next transmits the first configuration message. Lastly, at the same time, the source S sends a second message to be transmitted to the second relay R2 and the first relay R1 sends the first message to be transmitted.

The third sending mode ME3 thus corresponds to a throughput of 2 frames for 2 timeslots, or 1 frame per timeslot.

According to the proposed example, the first step of the method for controlling the operation of the communication network 10 consists of detecting the reception modes MR1, MR2 or MR3 of the two relays R1 and R2. At the first relay R1, for example, such a detection is for example carried out by measuring source S and second relay R2 signal-to-noise ratios calculated during the reception of the configuration messages. Each relay R1 or R2 can then estimate the zone Z1, Z2 or Z3 in which said relay R1 or R2 is located and choose the associated reception mode MR1, MR2 or MR3.

The method next controls the sending mode of the communication network 10 as a function of the reception mode MR1, MR2 and MR3 detected for each of the two relays R1 and R2.

According to the described example, the relays R1 and R2 communicate to the source S, in the configuration messages, their capacity to receive the message from the source S if the other relay R1 or R2 simultaneously transmits a message to the destination D.

For example, in the case of the first relay R1, the first relay R1 announces to the source S, in the configuration packets, that the first relay R1 is capable of managing the reception of two signals received simultaneously if the first relay R1 is located in the first zone Z1 or in the second zone Z2. On the contrary, if the first relay R1 is located in the third zone Z3, the first relay R1 announces to the source S that the first relay R1 cannot decode two packets.

The decoding capacities at the relays R1 or R2 being able to evolve (movement of the nodes, for example), the method for controlling the operation of the communication network 10 thus makes it possible to best manage the switching between the different sending modes as a function of the reception mode MR1, MR2 and MR3 of the communication network 10 so as to be sure to benefit from the best throughput while not generating oscillations of the communication network 10, for example in the case of a configuration where the communication network 10 is in one mode, then the other.

Figure 6 illustrates a flowchart of an exemplary implementation of the control method.

Initially, the communication network 10 is placed in the state corresponding to the first sending mode ME1 in which the source transmits 0.5 messages/slot through the first R1 only (see rectangle 30 in figure 6).

Using estimated power levels, each relay R1 or R2 estimates the zone Z1, Z2 or Z3 in which said relay R1 or R2 is located, and therefore its capacity to receive a packet coming from the source S if the complementary relay R1 or R2 is active (see the diamond 32 in figure 6).

For example, in reference to the rectangle 34 in figure 6, if the first relay R1 can effectively receive a message from the source S while the second relay R2 is active (the first relay R1 is then located in the first zone Z1 or the second zone Z2), the first relay R1 informs the source S thereof. This information is contained in the configuration messages sent periodically by the first relay R1. The source S, which knows the decoding capabilities of the first relay R1, then causes the communication network S to enter the second sending mode ME2 and imposes the sequencing of the corresponding transmissions. This new sending mode ME2 is announced to the relays R1 and R2 in the configuration messages transmitted periodically by the source S. Then, the relays R1 and R2 can adopt the appropriate sequencing.

Similarly, in reference to the rectangle 36 in figure 6, if the second relay R2 can receive a message from the source while the first relay R1 is transmitting to the destination (the second relay R2 is then located in the first zone Z1 or the second zone Z2), the second relay R2 informs the source S thereof. This information is contained in the configuration messages sent periodically by the second relay R2. The source S, which knows the decoding capabilities of the second relay R2, then causes the network S to enter the second-bis sending mode ME2-bis and imposes the sequencing of the corresponding transmissions. This new sending mode ME2-bis is announced to the relays R1 and R2 in the configuration messages transmitted periodically by the source S.

If neither of the two relays R1 or R2 can simultaneously receive a message sent by the source S while the other relay R1 or R2 is transmitting a message to the destination D (the two relays R1 or R2 are then located in the third zone Z3), the communication network 10 stays in the first sending mode ME1.

In the last case corresponding in particular to the elements 40, 44, 46 and 48 of figure 6, the two relays R1 and R2 can both receive a message sent by the source S while the complementary relay R1 or R2 transmits a message to the destination (the two relays R1 and R2 are both located in the first zone Z1 or in the second zone Z2). The source S,

which becomes aware of the capabilities of the two relays R1 and R2 owing to the configuration messages transmitted periodically by the two relays R1 and R2, then changes sending mode and adopts the third sending mode ME3 in order to benefit from the best possible throughput.

5 Such a method makes it possible to increase the throughput of the communication network 10 dynamically.

Conversely, when the relays R1 and R2 feel that they are no longer capable of decoding the message from the source S when the complementary relay R1 or R2 simultaneously transmits to the destination D (relay R1 or R2 in third zone Z3), the relays
10 R1 and R2 inform the source S thereof. The source S then switches to a sending mode having a lower throughput.

For example, if the sending mode is the third sending mode ME3 and the second relay R2 informs the source S that the second relay R2 is no longer capable of decoding the packets from the source S while the first relay R1 is active, then the source S switches
15 into the second sending mode ME2 and imposes the sequencing of the corresponding transmissions on the relays R1 and R2.

Such a method makes it possible to reduce the throughput of the communication network 10 dynamically.

This capability is in particular shown in figure 7, in which the throughput for a
20 conventional relay method and the method previously described are compared.

The tests were done in four successive configurations C1 to C4: a first configuration C1 in which the adopted sending mode is the second sending mode ME2, a second configuration C2 corresponding to an extinguishing of the first relay R1, a third configuration C3 corresponding to a reactivation of the first relay R1 and a fourth
25 configuration C4 in which the adopted sending mode is the third sending mode ME3.

It appears that the throughput of the communication network 10 is increased by 40 to 90% by using the proposed control method.

Furthermore, the graph of figure 7 also shows the good resilience of the control method, the latter better adapting to changes in configuration.

30 According to one advantageous embodiment, as illustrated by figure 8, the bit error rate obtained by using the control method is improved by a control of the power emitted by the source S.

To that end, when a relay R1 or R2 is located in the second zone Z2, said relay R1 or R2 asks the source S to reduce its power so that the powers that said relay R1 or R2 receives are such that this relay R1 or R2 is on a local minimum of the bit error rate when
35 the PLNC decoding is done.

Indeed, Figure 8 shows that the performance of the PLNC decoding is better when the difference in the two signals that are interfering is nil or equal to -7 dB. In such a case, the relays R1 and R2 that adopt a PLNC decoding ask the source S (in the configuration messages) to reduce the power in order to be placed under such conditions. Then, when the source S transmits a data packet to a relay R1 or R2, the source S reduces its power by the requested value (in dB) requested by the relay R1 or R2.

Figure 8 also shows that the choice of the PLNC decoding (dotted curve) is particularly advantageous relative to known decoding techniques such as IF (curve in solid lines) and SIC (curve in mixed lines) when the two signals that are interfering are received at close powers.

In each of the proposed cases, the method for controlling the operation of a communication network 10 allows an increase in the throughput while guaranteeing a good reception of messages.

Other embodiments can be considered by combining preceding embodiments when it is technically possible to do so.

14
CLAIMS

1.- A method for controlling an operation of the communication network (10), the network including a source (S) connected by two relays (R1, R2) to a destination node (D), the operation being defined by a sending mode (ME1, ME2, ME3) and a receiving mode (MR1, MR2, MR3) for each relay (R1, R2), the method including:

- detection of the reception mode (MR1, MR2, MR3) of each relay (R1, R2) of the communication network (10), the receiving mode (MR1, MR2, MR3) of a relay (R1, R2) being:

- a first receiving mode (MR1) in which said relay (R1, R2) is capable of receiving messages coming from the source without implementing an interference management technique, or

- a second receiving mode (MR2) in which said relay (R1, R2) is capable of receiving the messages coming from the source after implementing an interference management technique, or

- a third receiving mode (MR3) in which said relay (R1, R2) is not capable of receiving messages coming from the source even after implementing an interference management technique, and

- controlling the sending mode (ME1, ME2, ME2-bis, ME3) of the communication network (10) as a function of the receiving mode (MR1, MR2, MR3) detected for each of the two relays (R1, R2).

2.- The control method according to claim 1, wherein the detection of the receiving mode of each relay (MR1, MR2, MR3) is obtained using at least two signal-to-noise ratio measurements.

3.- The control method according to claim 2, wherein the signal-to-noise ratio measurements are the signal-to-noise ratio between a signal coming from the source (S) and the noise of a relay or the signal-to-noise ratio between a signal coming from a relay (R1, R2) and the noise of another relay (R1, R2).

4.- The control method according to any one of claims 1 to 3, wherein the method includes a step for the source (S) to learn the receiving modes (MR1, MR2, MR3) of the two relays (R1, R2).

5.- The control method according to any one of claims 1 to 4, wherein the interference management technique is a PLNC decoding.

6.- The control method according to claim 5, wherein the method includes the adaptation of the power of the source (S) when the receiving mode (MR1, MR2, MR3) is the second receiving mode (MR2).

7.- The control method according to any one of claims 1 to 6, wherein during the control step, the sending mode (ME1, ME2, ME2-bis, ME3) of the communication network (10) is a first mode (ME1), a second mode (ME2, ME2-bis) and a third mode (ME3), the communication network (10) having a throughput of 1 frame per slot when the communication network (10) is in the third sending mode (ME3) and the communication network (10) having a throughput of 2/3 of a frame per slot when the communication network (10) is in the second sending mode (ME2, ME2-bis).

8.- A communication network (10) including:

- a source (S),
- a destination node (D),
- two relays (R1, R2) connecting the source (S) to the destination node (D), and
- four controllers (18), each controller (18) respectively being associated with the source (S), the destination node (D) and the two relays (R1, R2), the four controllers (18) being suitable for:
 - controlling an operation of the communication network (10), the operation being defined by a sending mode (ME1, ME2, ME3) for each node and a receiving mode (MR1, MR2, MR3) for each relay (R1, R2),
 - detecting the receiving mode (MR1, MR2, MR3) of each relay (R1, R2) of the communication network (10), the receiving mode (MR1, MR2, MR3) of a relay (R1, R2) being:
 - a first receiving mode (MR1) in which said relay (R1, R2) is capable of receiving messages coming from the source without implementing an interference management technique, or
 - a second receiving mode (MR2) in which said relay (R1, R2) is capable of receiving messages coming from the source after implementing an interference management technique, or

- a third receiving mode (MR3) in which said relay (R1, R2) is not capable of receiving messages coming from the source even after implementing an interference management technique, and
- controlling the sending mode (ME1, ME2, ME3) of the communication network (10) as a function of the receiving mode (MR1, MR2, MR3) detected for each of the two relays (R1, R2).

9.- A computer program product including a readable information medium, on which a computer program is stored comprising program instructions, the computer program being able to be loaded on a data processing unit and suitable for driving the implementation of at least one step of a method according to any one of claims 1 to 7 when the computer program is implemented on the data processing unit.

10.- A readable information medium comprising computer program instructions which, when executed by a data-processing unit, cause execution of steps of a method according to any one of the