

METHOD AND SYSTEM FOR MANAGING THE UNICAST/MULTICAST
CONVERSION FOR MULTIMEDIA GROUP COMMUNICATIONS IN TELECOMMUNICATION
NETWORKS

5 The invention relates to a method and system for managing unicast - multicast conversion for group multimedia communications in telecommunication networks. It relates for example to the management of voice-over-IP communications, management of video streams, and so on.

 The multiple broadcast communication mechanisms, known as
10 "multicast", allow an entity, typically a user terminal, to send packets simultaneously to a number of other entities, unlike the point-to-point, or "unicast" communications. To set up group communications by using only unicast communications would require many more streams to arrive at a result similar to that obtained by using the multicast mechanism. On the other
15 hand, in some network configurations, the terminals cannot send multicast traffic themselves. Such is the case with certain professional mobile radio networks, better known by the abbreviation PMR, where different sites for accessing the LTE (long term evolution) mobile network are interconnected through a core network. Figure 1 represents an example of communication
20 network 1 in which a core CMN 10 allows communication between a number of sites PMR 11, 12, 13. On the LTE access sites, the output router of the EPC LTE (Evolved Packet Core Long Term Evolution) A_1 , A_2 , A_3 in Figure 1, aggregates the unicast traffic coming from the mobile terminals U_i , according to principles known to those skilled in the art. The edge routers, for example
25 R_1 , at the first site 11, communicate with the other sites 12, 13, by using multicast, they receive the streams to be transmitted and format them before transmission to the other sites.

 In the case of voice-over-IP (VoIP) in the group communications, a user belongs to a given group and the packets originating from a user are
30 transmitted to all the members of a communication group whether they are on the same site as the transmitting user or on another remote site. The

unicast/multicast processing on the site access routers, edge router, therefore depends on the distribution of the users over the different sites and on their participation in, membership of, the different groups. The users can send and receive traffic to and from a number of groups at the same time.

- 5 One of the problems posed is therefore for N communication groups to be able to manage the streams from the users in unicast mode and transform them into multicast streams for the communications between sites.

Most of the solutions known to the applicant deal with the problem at the application level by using multimedia servers on each of the sites.

- 10 These servers receive the unicast streams from the users present on their site, then communicate with the other sites by using multicast streams. This conversion of stream type at the application level induces significant processing operations on the multimedia servers and proves difficult to implement.

- 15 The patent application US 2013/0121133 describes an application mechanism for switching from a multicast communication to a unicast communication in the event of loss of radio range, multicast generally having less range to avoid overconsuming radio resources.

- 20 The patent US 6,970,926 discloses a unicast/multicast conversion method through an application server.

The patent application WO 2006/11022 describes a method allowing for the conversion through an adaptation server. It allows a user to communicate in unicast mode to a multicast group when the multicast is not available locally or when its local quality is too low.

- 25 The patent US 6,259,701 describes a system allowing a unicast client to connect to a server to list the multicast groups available in the core network and register therewith. The server can then give the information to the unicast client to receive the packets and activates the unicast/multicast conversion on the edge router.

Most of the technical solutions proposed in the prior art lie at the application level and are limited in the case where the volume of packets to be processed proves too great.

The idea behind the present invention consists notably in
 5 proposing a solution for processing packets of a multimedia stream at the network level and no longer at the application level as is the case in the prior art. In normal operation, the packets contained in a multimedia stream are processed without passing through a contents server.

In the description, the terms packets and data are used
 10 interchangeably to describe information contained in a data stream transmitted by a user to be transmitted to other users. The word "uplink" denotes a stream incoming to a site and the word "downlink" denotes a stream outgoing from a site.

The invention relates to a system for managing unicast/multicast
 15 conversion for group multimedia communications in a communication network comprising one or more sites comprising at least two users U_1 , U_2 , the users communicating according to a unicast mode within a site, one or more edge routers R_i , a central network organized to distribute the data streams between the different sites, characterized in that it comprises at least
 20 the following elements:

- ♦ At a site and an edge router R_i ,
 - A presence management module for managing presence of the users U_i present on the site,
 - A group management module adapted to manage the membership of
 25 a user in a communication group G_i ,
 - A control module transmitting "uplink" incoming stream and "downlink" outgoing stream conversion rules, to be applied to data of a stream entering or leaving a site and intended for one or more users belonging to a same communication group G_i ,
 - A module adapted to apply the transmitted "uplink, downlink"
 30 conversion rules to multimedia data transmitted by a first user U_1

before broadcasting the data modified by the rules to one or more users U_i belonging to the same communication group G_i as the first user U_1 transmitting the stream,

♦ At the central network node,

- 5 Means for multicast transmission of the multimedia data streams from one site to another site.

According to one embodiment, the control module consists:

- Of an "API" management interface, for the communication with the presence manager and the group manager,
- 10 • Of a configuration module executing the rules generation algorithm,
- Of a communication module adapted to communicate with the processing module and transmit to it the stream modification rules, and

the processing module consists:

- 15 • Of a module for communication with the controller,
- Of a module for managing modification rules describing all the actions to be performed on the streams,
- Of a module for filtering and actions on the streams.

20 The rules generated are chosen, for example, from the following list: duplication of the data, modification of the data header, deletion of the data stream, sending of a data stream on an output port, etc.

The processing module comprises, for example, a table of rules with degrees of priority.

The processed streams can be made up of IP packets.

25 According to one implementation, the system implements the OpenFlow protocol.

The invention relates also to a method for managing unicast/multicast conversion for the group multimedia communications in a communication network comprising one or more sites, comprising at least
30 two users U_1 , U_2 communicating according to a unicast mode within a site, a central network organized to distribute multimedia data streams between the

different sites, the users U_i belonging at a given instant to a communication group G_i , the sites communicating by means of routers R_i , characterized in that it comprises at least the following steps:

- 5 • Generating a set of rules for conversion of an outgoing or “uplink” stream from a site and an incoming or “downlink” stream at a given site j ,
- Applying an “uplink” conversion rule to a unicast stream transmitted by a user present on a site j in order to duplicate the stream into one or more unicast streams based on the number of users present on this
- 10 same site and converting into multicast streams the unicast stream transmitted by the user to transit over the core of the network to one or more users belonging to the same communication group and present on different sites from the given site,
- Applying a “downlink” conversion rule to a multicast stream incoming
- 15 to the site, in order to duplicate into one or more unicast streams the multicast stream incoming to one or more users present on the site.

To generate the “downlink” conversion rule and the “uplink” conversion rule for a given communication group G_i , the following steps are for example executed:

- 20 *For each communication group G_i*
 - a. Creating the “downlink” rule for the group: $dl(G_i)$
 - b. Adding to the filter the identifier of the group G_i (multicast address) with the “downlink” rule $dl(G_i)$
 - c. Adding to the rule $dl(G_i)$ an action to duplicate the packet for each user
 - 25 of the subset present on the site $P(U_j, G_i)$
 - d. Adding to the rule $dl(G_i)$ an action to modify the destination IP address for each user $P(U_j, G_i)$
 - e. Adding to the rule $dl(G_i)$ an action to send to the output port for each user $P(U_j, G_i)$
 - 30 f. Adding to the rule $dl(G_i)$ the deletion of the initial packet
 - g. Creating the “uplink” rule for the group: $ul(G_i)$

h. Adding to the filter the local identifier of the group G_i (unicast address of the terminal or of a dummy gateway, port number) with the rule $ul(G_i)$

If there are more than one member of the group G_i on the same site:

i. Adding to the rule $ul(G_i)$ an action to duplicate for each user $P(U_j, G_i)$

5 *j. Adding to the rule $ul(P_i)$ an action to modify the destination IP address for each user $P(U_j, G_i)$*

k. Adding to the rule $ul(G_i)$ an action to send to the output port for each user $P(U_j, G_i)$

End if

10 *If there are subscribers to the group G_i on other sites:*

l. Adding a duplication application to the multicast group $ul(G_i)$

m. Adding to the rule $ul(G_i)$ an action to modify the destination (multicast) IP address for the group G_i

15 *n. Adding to the rule $ul(G_i)$ an action to send to the output port of the multicast group*

End if

o. Adding to the rule $ul(G_i)$ the deletion of the initial packet.

20 The method can comprise a step in which the “uplink” rule is used only on the site where a user has the token making it possible to take a turn to talk in a communication network “press to talk” PTT.

The multimedia data streams are, for example, IP packets.

To implement the method, the OpenFlow protocol is for example used.

25 Other features and advantages of the present invention will become more apparent on reading the description of exemplary embodiments given in an illustrative and nonlimiting manner, with figures attached which represent:

- Figure 1, an exemplary communication network comprising a number of sites communicating with one another by virtue of the presence of a
- 30 multicast core network,

- Figure 2, a diagram representing the modules present on a site and their interconnection,
- Figure 3, an example of interactions between a packet processing processor and a controller for implementing the invention,
- 5 • Figure 4 and Figure 5, a flow conversion scheme, and
- Figure 6, an application which uses the OpenFlow protocol.

The following description is given by way of illustrative example for voice-over-IP data packets.

Figure 1 schematically represents an exemplary network comprising three sites 11, 12, 13, each containing a number of users U_i , interconnected by a multicast core network 10 comprising means 15₁, 15₂, 15₃, for receiving and transmitting incoming and outgoing streams.

The first site 11 comprises, for example, three users U_1 , U_2 , U_3 ; U_1 , U_2 which belong to a first communication group G_1 , U_3 is affiliated to a second communication group G_2 . The first site 11 comprises an edge router R_1 and a base station A_1 . The function of the edge router is notably to receive the data streams, format them for their transmission to users belonging to the same communication group, whether these users belong to the same site or to a remote site.

20 The second site 12 comprises a user U_4 affiliated to the second group G_2 , a base station A_2 , an edge router R_2 .

The third site 13 comprises three users U_5 , U_6 , U_7 ; U_6 is affiliated to the communication group G_1 , whereas the users U_5 and U_7 are affiliated to a third communication group G_3 . The site 13 also comprises a base station A_3 and an edge router R_3 .

An edge router is for example adapted to perform the unicast/multicast conversion according to the steps of the method according to the invention which will be detailed hereinbelow.

At each edge router, for a given site, there are, according to the example of Figure 2:

- 5 • A packet processor 20, adapted to process the data packets to implement an action necessary to their transmission to other users, for example, the duplication of packets to users belonging to the same communication group or the modification of their content in order for them to be able to be received by users of other communication groups, etc.,
- 10 • A controller 21, the role of which is notably to implement the logic, the rules for processing the packets according to their membership to the communication group and their presence or not on the site of a transmitting user, in order to configure the packet processor 20, according to information and events that it receives from the following modules,
- 15 • A presence management module 22 for managing presence of the users which comprises and keeps up to date a list of the users present on the site and their identifiers, their unicast IP addresses for example. Such information can be supplied by the LTE system and is collected when a user or terminal enters into the network or when transferred via an entry procedure known by the expression handover, and according to conventional steps,
- 20 • A group management module 23 which maintains the list of the users participating in the different communication groups.

These two presence management 22 and group management 23 modules are, for example, kept re-updated by the mobility of the users in the communication network, membership of a group, change of site, etc.

25 The data stream $F(U_i, G_k)$ to be redistributed from a transmitting user U_i to the other users U_j who belong to a same communication group G_k and who may be on the same site as the transmitting user or not, is transmitted directly to the packet processor 20 as will be described in relation to Figure 3. The packet processor has previously received packet processing

30 rules.

Figure 3 explains the composition and the operation of the different modules of the controller and of the packet processor.

The controller 21 consists, for example, of a management interface, or “management API”, 210, which makes it possible to communicate with the presence manager 22 and the group manager 23, a configuration protocol agent 211, (known by the acronym “CPA”) executing the algorithm for generating the configuration of the packet processor, for example “OpenFlow” rules, and a module 212 allowing the controller to communicate with the packet processor 20 and the transmission of the system configurations (users, membership of the group, rules, etc.).

The packet processor 20 is, for example, made up of a module for communication 202 (CPA) with the controller 21, a module for managing the rules 201 describing all the actions to be performed on the incoming data packets and which correspond to certain criteria, and a module 200 for filtering and acting on the packets. The actions to be executed on the incoming packets are, for example, the duplication of a packet, the possible modification of the header of a packet, the deletion of packets, the sending of a packet to an output port, etc. The packet processor receives, on an input 205, the packets to be transmitted and retransmits these modified or duplicated packets to an output 206.

The rules generated for the data stream conversion are schematically represented in Figures 4 and 5. They are defined for each site j , for each group G_i communication, at the router of the site and involve the controller and the packet processor.

Figure 4 schematically represents the operations 40 for converting traffic or streams outgoing from a site, or “uplink” traffic, for each group communication.

A unicast stream F_{ue} transmitted by a user U_i on a site j and belonging to a group G_k is duplicated into a number of unicast streams F_{u2} , F_{u3} to the users U_2 , U_3 , present on this same site j and belonging to a group G_k and it is converted into “multicast” streams F_m in order to transit over the

core of the network and be distributed to other users present on other sites of the communication network and belonging to a group G_k .

The “uplink” conversion is translated in the method according to the invention by a rule called “uplink” rule.

5 Figure 5 schematically represents an example of operations 50 for converting incoming traffic, incoming streams, on a site or “downlink” at the controller 21 and the packet processor 20. The associated rule is called “downlink rule”. The multicast stream F_{me} belonging to a group G_k incoming on a site j is duplicated into a number of unicast streams F_{ui} to the users U_i
10 present on the site j and belonging to a group G_k . The controller may be collocated with the router/switch, but not necessarily.

The function of the controller 21 is notably to use the knowledge supplied by the presence manager 22 and the knowledge of the group manager 23 in order to create, modify, delete and send the “uplink” and
15 “downlink” rules for conversion of the streams to the packet processing processor 20.

The algorithm implemented in an edge router and described below is executed each time there is an update of the presence or communication group information in the system; when, for example, a user has changed
20 group, or his or her subscription to a group has changed (registration, deregistration).

The variables used as input for the algorithm are as follows:

- the groups G_i and their identifiers (e.g.: multicast address, port, etc.),
- the users U_j present on the site j ,
- 25 • $P(U_j, G_i)$ the subset of the users present on a site j and participating in the groups G_i .

Generation of the “uplink” and “downlink” rules on the site j

For each communication group G_i

- a. Create the “downlink” rule of the group: $dl(G_i)$
- 30 b. Add to the filter the identifier of the group G_i (multicast address) with the “downlink” rule $dl(G_i)$

- c. Add to the rule $dl(G_i)$ an action to duplicate the packet for each user of the subset present on the site $P(U_j, G_i)$
- d. Add to the rule $dl(G_i)$ an action to modify the destination IP address for each user $P(U_j, G_i)$
- 5 e. Add to the rule $dl(G_i)$ an action to send to the output port for each user $P(U_j, G_i)$
- f. Add to the rule $dl(G_i)$ the deletion of the initial packet
- g. Create the "uplink" rule for the group: $ul(G_i)$
- h. Add to the filter the local identifier of the group G_i (unicast address of the terminal or of a dummy gateway, port number) with the rule $ul(G_i)$
- 10

If there is more than one member or user of the group G_i on the same site:

- i. Add to the rule $ul(G_i)$ a duplication action for each user $P(U_j, G_i)$
- j. Add to the rule $ul(G_i)$ an action to modify the destination IP address for each user $P(U_j, G_i)$
- 15 k. Add to the rule $ul(G_i)$ an action to send to the output port for each user $P(U_j, G_i)$
- End if

If there are subscribers to the group G_i on other sites:

- l. Add a duplication application to the multicast group $ul(G_i)$
- 20 m. Add to the rule $ul(G_i)$ an action to modify the destination (multicast) IP address for the group G_i
- n. Add to the rule $ul(G_i)$ an action to send to the output port of the multicast group
- End if
- 25 o. Add to the rule $ul(G_i)$ the deletion of the initial packet.

The "uplink" and "downlink" rules generated at the controller 21 are transmitted to the packet processor module 20 which will apply them to the incoming packets according to the situation of the users participating in the communication group, a situation which is known to the rules management module 201.

30

According to a variant of the method, the steps h, i, j and k can be repeated for the different users $P(U_j, G_i)$ in order for the traffic transmitted by a user of the site not to be duplicated to him or herself. In this case:

- the filter of the rule established in the step h will have the identifier of the user U_i added to it;
- the duplication concerning the user in the step i is removed.

This variant culminates in a number N of “uplink” rules for each group G_i , N being the number of users U_i present on the site and participating in the groups G_i .

To know the number of users for a communication group present on the other sites of the network (e.g. to know if it is necessary to duplicate the packets outgoing to the core), a number of solutions are possible:

- probing the multicast protocol to know if the session of the group is active,
- interrogating the group manager, for example the application implementing the control plan of the voice-over-IP application, VoIP.

The membership of a packet in a communication group G_i can be identified by using, for example:

- the multicast address for the incoming packets,
- the unicast address and the port for the outgoing packets.

The users are identified, for example, by virtue of their IP address in the unicast packets: source IP for the packets transmitted by the users, destination IP for those which are received.

Figure 6 describes a solution using the OpenFlow protocol implemented on the communication module that makes it possible to push packet processing rules from a controller 61 to a switch 60. Figure 6 illustrates the structure of the OpenFlow rules stored in the switching table 63. These rules 62 comprise filters on the headers of the packets, 64, actions 65 (send to an output port, modify a field of a header, delete the packet, etc.) and statistics 66.

As a reminder, the OpenFlow protocol is a protocol that allows the remote administration of the stream processing table of a switch. This processing table contains rules which are applied to each of the packets incoming into the switch.

5 An “uplink” or “downlink” rule contains, for a stream, the actions to be applied to the packets of the stream and it consists of two parts:

- ♦ A packet header filter that makes it possible to specify the characteristics of the data packets belonging to the stream, originating network port, values of the different fields for the headers,
- 10 ♦ A list of the actions to be applied to the packets of the stream, for example, the modification of the fields of the headers of the packet, the duplication, deletion, sending to a network port, the actions being sequenced one after the other.

It is possible to associate a priority with each rule of the table.
 15 When a packet enters into the packet processor, the latter searches for the rule corresponding to the stream containing the packet by, for example, browsing through the rules of the table in descending order of priority.

An exemplary implementation of the OpenFlow protocol is detailed hereinbelow. The packet processed by a rule will be duplicated twice within
 20 the site (with the requisite header modifications) and to the outside:

```
{ "name": "group-1-MC-rule ", "cookie": "0", "priority": "3", "ingress-port": "1",
  "ether-type": "0x0800", "dst-ip": "15.16.23.42", "dst-port": "1987", "active": "true",
  "actions": "set-src-mac=4:8:15:16:23:42, set-src-ip=15.16.23.42, set-dst-
  mac=BC:F6:85:D7:7A:76, set-dst-ip=4.8.15.16, set-dst-
  port=5001, output=65529, set-src-mac=4:8:15:16:23:42, set-src-
  ip=15.16.23.42, set-dst-mac=BC:F6:85:D7:7A:76, set-dst-ip=4.8.15.17, set-dst-
  port=5001, output=65529, set-src-mac=4:8:15:16:23:42, set-src-
  ip=15.16.23.42, set-dst-mac=BC:F6:85:D7:7A:76, set-dst-
  ip=224.0.0.42, output=2" }
```

30 The first part corresponds to the communication group to which the rule applies (group-1-MC-rule) and the correspondence to be found in the headers of the packet (IP address, port, etc.). The second part corresponds

to the actions to be performed on the packet; these are modifications of the header (set-*) and sending to an output port (output=*). In the OpenFlow protocol, there is no need to explicitly indicate a duplication action: the initial packet is duplicated before each sending over the output interface (action output). Similarly, the initial packet is automatically deleted.

According to a variant embodiment, the method proposes a fine push-to-talk management. The systems managing the group communications use a control channel to organize the interactions between the users. For example, for the "push-to-talk" communication, a token is used to ensure that just one user can talk at a time. On pressing a button, for example, the user terminal asks the management system for the token. Based on its rights and its significance, the token is or is not assigned to it.

The method according to the invention comprises, for example, an additional step in the packet processor which makes it possible to block the unicast traffic of the users who do not have the token.

For that, the "uplink" rule is put in place only for the user having the token and will be put in place only on the site where the user who has the token is located. An "uplink" rule for filtering with a lower priority is put in place in order for all the traffic incoming in unicast mode and not already having been processed by the preceding rule to be destroyed.

The invention also makes it possible, if the administrator so desires, to duplicate the traffic on a so-called mirror port. That can be used to record the traffic. For the implementation with the OpenFlow protocol, it is sufficient, for example, to add, to the rules obtained by the method according to the invention, an additional action in order to duplicate the traffic to this mirror port.

The invention provides a packet processing mechanism, configured according to the knowledge of the presence of the users on the sites and their participation in the communication groups. It makes it possible to manage a large number of packets directly without involving a content server which offers an advantage in performance terms.

CLAIMS

- 1 – System for managing unicast/multicast conversion for group multimedia communications in a communication network (1) comprising one or more sites (11, 12, 13) and comprising at least two users (U_1 , U_2), the users communicating according to a unicast mode within a site, one or more edge routers (R_i), a central network (10) organized to distribute the data streams between the different sites, characterized in that it comprises at least the following elements:
- 10 ✓ At a site (11, 12, 13) and an edge router (R_i),
 - A presence management module (22) for managing presence of the users (U_i) present on the site,
 - A group management module (23) adapted to manage the membership of a user in a communication group G_i ,
 - 15 • A controller (21) transmitting “uplink” incoming stream and “downlink” outgoing stream conversion rules, to be applied to data of a stream entering or leaving a site and intended for one or more users belonging to a same communication group G_i , said controller (21) being configured to modify the destination address for each user at a given instant belonging to a communication group and duplicate into one or several unicast streams according to the number of users present on a same site and convert into multicast streams the unicast stream transmitted by the user to transit over the core of the network to one or more users belonging to the same communication group and present on sites different from the given site,
 - 25 • A module (20) adapted to apply the transmitted “uplink, downlink” conversion rules to multimedia data transmitted by a first user (U_1) before broadcasting the data modified according to the rules to one or more users (U_i) belonging to the same communication group G_i as the first user (U_1) transmitting the stream,
 - 30 ✓ At the central network node (10),

Means for multicast transmission (15) of the multimedia data streams from one site to another site.

2 – System according to Claim 1, characterized in that:

- 5 ✓ the controller (21) consists:
- Of an “API” management interface (210), for the communication with the presence manager (22) and the group manager (23),
 - Of a configuration module (211) executing the rules generation algorithm,
 - 10 • Of a communication module (212) adapted to communicate with the processing module (20) and transmit to it the stream modification rules, and in that
- ✓ the processing module (20) consists:
- Of a module for communication (202) with the controller,
 - 15 • Of a module for managing modification rules (201) describing all the actions to be performed on the streams,
 - Of a module (200) for filtering and actions on the streams.

3 – System according to one of the preceding claims, characterized in that
20 the rules generated are chosen from the following list: deletion of the data stream, sending of a data stream on an output port, etc.

4 – System according to one of the preceding claims, characterized in that the processing module (20) comprises a table of rules with degrees of
25 priority.

5 – System according to one of the preceding claims, characterized in that the streams are made up of IP packets.

30 6 – System according to one of the preceding claims, characterized in that it implements the OpenFlow protocol.

7 – Method for managing unicast/multicast conversion for the group multimedia communications in a communication network (1) comprising one or more sites, comprising at least two users (U_1 , U_2) communicating according to a unicast mode within a site, a central network (10) organized to distribute multimedia data streams between the different sites (11, 12, 13), the users (U_i) belonging at a given instant to a communication group G_i , the sites communicating by means of routers (R_i), characterized in that it comprises at least the following steps:

- 10 • Generating a set of rules for conversion of an outgoing or “uplink” stream from a site and an incoming or “downlink” stream at a given site j ,
- Applying an “uplink” conversion rule to a unicast stream transmitted by a user present on a site j in order to modify the address of a user belonging at a given instant to a communication group and to duplicate the stream into one or more unicast streams based on the number of users present on this same site and converting into multicast streams the unicast stream transmitted by the user to transit over the core of the network to one or more users belonging to the same communication group and present on different sites from the given site,
- 20 • Applying a “downlink” conversion rule to a multicast stream incoming to the site, in order to duplicate into a number of unicast streams the multicast stream incoming to one or more users present on the site.

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8 – Method according to Claim 7, characterized in that, to generate the “downlink” conversion rule and the “uplink” conversion rule for a given communication group G_i , the following steps are executed:

For each communication group G_i

- 30 a. Creating the “downlink” rule for the group: $dl(G_i)$

b. Adding to the filter the identifier of the group G_i (multicast address) with the “downlink” rule $dl(G_i)$

c. Adding to the rule $dl(G_i)$ an action to duplicate the packet for each user of the subset present on the site $P(U_j, G_i)$

5 *d. Adding to the rule $dl(G_i)$ an action to modify the destination IP address for each user $P(U_j, G_i)$*

e. Adding to the rule $dl(G_i)$ an action to send to the output port for each user $P(U_j, G_i)$

f. Adding to the rule $dl(G_i)$ the deletion of the initial packet

10 *g. Creating the “uplink” rule for the group: $ul(G_i)$*

h. Adding to the filter the local identifier of the group G_i (unicast address of the terminal or of a dummy gateway, port number) with the rule $ul(G_i)$

If there are more than one member of the group G_i on the same site:

i. Adding to the rule $ul(G_i)$ an action to duplicate for each user $P(U_j, G_i)$

15 *j. Adding to the rule $ul(G_i)$ an action to modify the destination IP address for each user $P(U_j, G_i)$*

k. Adding to the rule $ul(G_i)$ an action to send to the output port for each user $P(U_j, G_i)$

End if

20 If there are subscribers to the group G_i on other sites:

l. Adding a duplication application to the multicast group $ul(G_i)$

m. Adding to the rule $ul(G_i)$ an action to modify the destination (multicast) IP address for the group G_i

25 *n. Adding to the rule $ul(G_i)$ an action to send to the output port of the multicast group*

End if

o. Adding to the rule $ul(G_i)$ the deletion of the initial packet.

9 – Method according to one of Claims 7 and 8, characterized in that it
30 comprises a step in which the “uplink” rule is used only on the site where a

user has the token making it possible to take a turn to talk in a communication network “press to talk” PTT.

10 – Method according to one of Claims 8 and 9, characterized in that the
5 multimedia data streams are IP packets.

11 – Method according to one of Claims 8 to 10, characterized in that the OpenFlow protocol is used.