

Processing system and method in a telecommunication platform

The present invention relates to the field of routing of data.

More specifically, the present invention relates to a processing system for a
5 telecommunication platform comprising a set of applications delivering data packet flows,
a set of distinct telecommunication resources each adapted for remotely transmitting
packets from the platform, a router adapted for receiving packets from the set of
application(s) and for delivering received packets to said telecommunication resources for
remote transmission of the packet from the platform.

10 Radiofrequency transmission resources have variable bandwidths, for example
because of dynamic spectral allocation or adaptability of the waveforms to the variations
of the propagation channel for example due to weather attenuations or to jamming.

Moreover, in certain telecommunication environments like in aeronautics,
applications are related to certain specific telecommunication resources (VHF, UHF
15 radios, tactical data links) and a congestion of some of the resources and insufficient use
of certain other ones of the resources are frequently ascertained. The resources are not
necessarily of IP (Internet Protocol) technology.

IP technology itself does not natively give the possibility of guaranteeing service
quality. Flows of the same type and towards a same addressee, for example flows of the
20 telephone type, are generally routed towards a same resource without distinguishing their
operational characteristics, like flows of the messaging type, of the file transfer type, etc.
This limitation is further enhanced during the use of ciphering for example IPsec ciphering
(« Internet Protocol Security », defined by the IETF in RFC 2401), upstream from the
routing, since the individual addresses are then hidden by the address of the remote
25 encryptor/decryptor, which is only taken into account for the routing. Present techniques
do not give the possibility of automatically switching the flow onto an alternative route as
long as the initial route between source and addressee remains available in the sense of
IP routing.

Now, certain flows can only be operationally utilized beyond a minimum quality for
30 example notably defined by maximum latency and/or minimum throughput etc. For
example, if the video flow for controlling a drone which the addressee receives after
transmission, is slowed down (because of significant latency during its transmission) or is
pixelated (because of data losses during its transmission), it is then no longer possible to
use this received flow for having the drone take off or land under good conditions.

Documents of the prior art require that the resources be booked during the whole transmission time, in order to control the quality from end to end, these reserved resources are then unavailable for the other transmissions even if they are not actually used.

5 Further, there exist multi-criteria routing techniques, which are suitable for differentiating flow classes, in a limited number by definition, but they require a very great volume of signaling data.

Therefore there exists a need for better utilizing the telecommunication resources available in telecommunication platforms.

10 For this purpose, according to a first aspect, the invention proposes a processing system for a telecommunication platform of the aforementioned type, characterized in that it is adapted for collecting measurements of current transmission capacities of the telecommunication resources;

the processing system including a table and being adapted so as to determine, for a
15 delivered flow of packets by applying the set of application(s), at least one first operating mode and a second operating mode each notably defining the mandatory operational transmission characteristics, said modes being recorded in a table associated with an identifier of said flow;

the processing system being adapted so as to evaluate, depending on at least the first
20 and second operating modes and on collected measurements of the current transmission capacities of the telecommunication resources, those of resources adapted for remotely transmitting the packets of said flow according to one of the first and second operating modes, in order to select, according to at least said evaluation for said flow delivered by the application, in a first selection operation, an operating mode from among the first and
25 second operating modes and a telecommunication resource from among said resources and for controlling the router for delivering the packets of said flow to the resource selected for said flow of said application;

the processing system being adapted for subsequently detecting, during the remote
transmission of packets of said flow of the application by said selected resource,
30 depending on collected measurements of the current transmission capacities of the selected resource, any variation in the current capacity of the selected resource for said flow of the application making remote transmission on said resource incompatible with the operating mode of the selected application for said flow and in order to, upon such a detection, trigger a second operation for selecting an operating mode from among the first

and second operating modes and one of said resources for remote transmission of the packets of said remaining flow to be remotely transmitted.

The invention thus gives the possibility of being able to switch over to an alternative transmission resource if the capacity of the resource used is reduced to the point of making the utilization of the flow by the users unacceptable, and this without waiting for breakage of the link, or if a flow with higher priority is admitted into the system.

The invention also gives the possibility of being able to forward flows of same nature and intended for the same sub-network over distinct transmission resources, depending on their operational characteristics.

In embodiments, the processing system for a telecommunication platform according to the invention further includes one or several of the following features:

- the processing system is adapted for, subsequently to said detection, again evaluating, according to at least the first and second operating modes and the collected measurements of the current transmission capacities of the telecommunication resources, those of the resources adapted for remotely transmitting the packets of said remaining flow to be remotely transmitted according to one of the first and second operating modes; the processing system being adapted for, during the second selection operation, selecting according to said evaluation, for said flow delivered by the application, an operating mode from among the first and second operating modes and a telecommunication resource from among said resources; and for ordering the router to deliver the remaining packets to be transmitted of the flow of the application to the selected resource for said flow during the second selection operation;

- the selected resource during the second selection operation for said flow is distinct from the one selected during the first selection operation for said flow and/or the selected operating mode during the second selection operation for said flow is distinct from the one selected during the first operation for selecting said flow.

- the system is adapted for detecting, during the remote transmission of packets of several application flows delivered by the set of application(s), depending on collected measurements of the current transmission capacities, any variation in the current capacity of a resource selected by said processing system for one of the flows making the remote transmission on said resource incompatible with an operating mode selected for said flow and/or for detecting the end of transmission of another flow for which an operating mode and a telecommunication resource have been selected previously, for, in response to such a detection, triggering an overall selection operation comprising a new selection

operation, for each flow, of an operating mode which is associated with it in the base and of one of said resources, said resource stemming from the new selection having been evaluated by said processing system, depending on at least collected measurements, as adapted for remotely transmitting the remaining packets to be transmitted of said flow according to the operating mode from the new selection;

the processing system being adapted for controlling the router in order to deliver the remaining packets to be transmitted of each flow to the resource from the new selection for said flow;

- the system is adapted for selecting a resource and an operating mode for a flow, further depending on an order relationship of the operating modes, and/or on an order relationship of the flows and/or of the current lengths of queues of packets delivered by the router at the input of the respective resources, and/or data for identifying the addressee of the flow, and/or information describing the connectivity of a telecommunication network interfaced with the telecommunication resources;

- an operating mode defines at least one element from a minimum throughput, a range of admissible throughputs comprised between a minimum throughput and a maximum throughput, maximum latency, a range of admissible latencies comprised between a minimum latency and a maximum latency, maximum jitter, maximum transmission cost, an ordering level of the mode in an ordering scale of the modes, a safety level, a lifetime of the data of the flow;

- the system is adapted for telecommunicating with at least one other processing system of another platform and for exchanging with said other system, messages indicating the operating modes and the telecommunication resources which have been selected for the respective flows of packets remotely transmitted from the respective platforms;

- the system comprises an application block and a transport agent, said application block being adapted for receiving the flow of packets delivered by the application from the set of application(s), in order to determine, for said flow of packets, at least said first operating mode and second operating mode and for sending a request to the transport agent indicating said first and second operating modes;

the transport agent being adapted for, upon receiving such a request, carrying out said first selection, depending on the first and second operating modes indicated in the request, of an operating mode from among the first and second operating modes and of a telecommunication resource, in order to define a marking for the packets of said flow, in order to answer the request of the application block, by indicating to the application block

said marking defined by the packets of said flow, and for controlling the router in order to deliver all the packets bearing said marking to said selected resource for said flow;

said application block being adapted for, after receiving said response marking each received packet of said flow with said marking defined by the transport agent and for
5 delivering the marked packets to the router;

- the system is intended for a telecommunication platform further comprising an encryptor and the application block comprises a red portion adapted for exclusively processing the non-encrypted flow packets and a black portion adapted for exclusively processing the encrypted flow packets, the red portion of the application block being adapted for
10 receiving the flow of packets delivered by an application of the set of application(s), in order to determine, for said flow of packets, at least said first operating mode and second operating mode and for sending a first request to the transport agent indicating said first and second operating modes;

the transport agent being adapted for, upon receiving the first request, carrying out said
15 first selection, depending on the first and second operating modes indicated in the first request, of an operating mode from among the first and second operating modes and of a telecommunication resource, in order to define temporary marking for the packets of said flow, for storing said first and second operating modes indicated in the first request matching said temporary marking and for answering the first request of the red portion of
20 the application block, by indicating in a first answer to the red portion, said temporary marking defined for the packets of said flow,

the red portion of the application block being adapted for, after receiving said answer, marking each received packet of said flow with said temporary marking defined by the transport agent and for delivering the marked packets to the encryptor;

said encryptor is adapted for encrypting the packets delivered by the red portion of the application block, in order to determine the address of a decryptor addressee depending on the address of the addressee of the flow and for delivering to the black portion of the application block the encrypted packets indicating in clear text the address of the decryptor addressee and the temporary marking;

30 the black portion of the application block is adapted for receiving the encrypted packets delivered by the encryptor, and for sending a second request to the transport agent indicating the address of the decryptor addressee and said temporary marking;

the transport agent being adapted for, upon receiving the second request, extracting the first and second operating modes stored, matching the temporary marking which is
35 indicated in the second request, carrying out said first selection, depending on said

extracted first and second operating modes and on the address of the decryptor addressee, of an operating mode from among the first and second operating modes and of a telecommunication resource, for defining a definitive marking for the packets of said flow, in order to answer the red portion and the black portion of the application block, by
 5 indicating to each of them said definitive marking for the packets of said flow, and for ordering the router to deliver all the packets bearing said definitive marking to said selected resource for said flow;

the red portion of the application block being adapted for, after receiving the definitive marking, marking each received packet of said flow with said definitive marking and for
 10 delivering the thereby marked packets to the encryptor;

the black portion of the application block being adapted for, after receiving the definitive marking, replacing with said definitive marking, the temporary marking of each received packet of said flow bearing said temporary marking and for delivering to the router the thereby marked packets as well as the packets bearing the definitive marking and
 15 delivered by the encryptor.

According to a second aspect, the present invention proposes a processing method for a telecommunication platform comprising a set of applications delivering flows of data packets, a set of distinct telecommunication resources each adapted for remotely transmitting packets from the platform, a router adapted for receiving packets from the set
 20 of application(s) and for delivering received packets to said telecommunication resources for remotely transmitting the packet from the platform; said method being characterized in that it comprises the following steps:

- collecting measurements of the current transmission capacities of the telecommunication resources;

- determining, for a flow of packets delivered by an application from the set of application(s), at least one first operating mode and a second operating mode each defining notably mandatory operational transmission characteristics, said modes being recorded in a table associated with an identifier of said flow;

- evaluating, depending on at least the first and second operating modes and on the
 30 collected measurements of the current transmission capacities of the telecommunication resources, of those of the resources adapted for remotely transmitting the packets of said flow according to one of the first and second operating modes;

- selecting depending on at least said evaluation for said flow delivered by the application, in a first selection operation, an operating mode from among the first and second
 35 operating modes and a telecommunication resource from among said resources and

ordering the router so that it delivers the packets of said flow to the selected resource for said flow of said application;

- subsequently, detecting, during remote transmission of packets of said flow of the application by said selected resource, depending on collected measurements of the current transmission capacities of the selected resource, any variation in the current capacity of the selected resource for said flow of the application making remote transmission on said resource incompatible with the operating mode of the selected application for said flow and during such a detection, triggering a second operation for selecting an operating mode from among the first and second operating modes and one of said resources for remote transmission of the packets of said remaining flow to be remotely transmitted.

These features and advantages of the invention will become apparent upon reading the description which follows, only given as an example, and made with reference to the appended drawings, wherein:

- Fig. 1 illustrates a transmission platform in a first embodiment of the invention;
- Fig. 2 illustrates a transmission platform in a second embodiment of the invention wherein an encryptor is inserted into the transmission platform;
- Fig. 3 is a flowchart of steps of a method in an embodiment of the invention;
- Fig. 4 is a flowchart of steps applied in the first embodiment of the invention during a step 102 illustrated in Fig. 3;
- Fig. 5 is a flowchart of steps applied in the second embodiment of the invention during a step 102 illustrated in Fig. 3.

In Fig. 1, a telecommunication platform 1 in a first embodiment of the invention is illustrated.

- This telecommunication platform 1 is loaded on-board for example an airplane, a helicopter, a drone, a ground centre, etc.

The telecommunication platform 1 includes a set of software application(s) 10, a processing system 20, a router 30 and a set 40 of telecommunication means, the operation of which is described hereafter with reference to Fig. 1. In the second embodiment referenced in Fig. 2, the telecommunication platform 1 further includes an encryptor 50.

The set 10 of applications

- The set 10 of applications includes one or several software applications each adapted for delivering data packet flows.

Each flow is of a given type from among speech, data, image, video, messages, etc.

In each flow, the source and the addressee of the flow are identified by pieces of addressing information for example comprising a network address and/or a URL and/or a
 5 URI, a phone number etc. In the present case, the source is the application of the telecommunication platform 1 which generates the flow.

The packets of the same flow stem from the same application, are of the same type, indicate a same source and a same addressee and are ordered relatively to each other. In an embodiment, they further include the identifier of the flow.

10 In an embodiment, the platform 1, on-board a drone, for example includes a remote control application based on a first on-board camera, a remote monitoring application based on a second on-board camera and an application for monitoring the on-board pieces of equipment.

The remote control application is adapted for capturing the video of the
 15 environment of the drone by means of the first on-board camera on the drone and for transmitting in real time the captured video to a remote monitoring centre (for example found on the ground). In the remote monitoring centre, an operator pilots the drone remotely by means, for example, of a joystick depending on the transmitted video; the corresponding piloting instructions are transmitted from the remote monitoring centre. In
 20 this context, the captured video notably corresponds to take-off/landing phases, and to intermediate flight phases, i.e. outside the take-off/landing phases.

The remote control application is adapted for determining whether the captured current video corresponds to a take-off/landing phase, or to an intermediate flight phase.

The remote monitoring application is adapted for regularly capturing videos of the
 25 landscape surrounding the drone by means of the second on-board camera on the drone and for transmitting each of the captured videos to the remote monitoring centre which analyses the landscape filmed by the second camera and enriches a database of the environment overflown by the drone depending on this analysis.

Each video sent by the remote control application or the remote monitoring
 30 application corresponds to a distinct flow.

The application for monitoring the on-board equipment is for example adapted so as to regularly transmit to the remote monitoring centre reports indicating the condition of each of the on-board modules of the drone, for example a functional state or a state of failure, and indicating the malfunctions encountered by each of the modules.

35 Each report sent corresponds to a distinct flow.

The set 10 of application(s) is adapted for transmitting to the processing system 20 the flows delivered by the applications. The set 10 of application(s) is for example adapted for further transmitting the indication of the type of phase (take-off/landing or intermediate flight) determined by the remote control application for the video when such a video is delivered by the remote control application.

In other embodiments, other applications are part of the set 10 of applications, for example telephone applications with various addressees.

The telecommunication set 40

The telecommunication set 40 comprises several telecommunication means starting from the platform 1, thereby forming alternative solutions for telecommunicating data packets from the platform 1.

In the relevant case, the telecommunication set 40 includes three distinct telecommunication means 40₁, 40₂, 40₃.

For example the telecommunication means 40₁ is a UHF radiofrequency link and the telecommunication means 40₂ is another UHF radiofrequency link.

The telecommunication means 40₃ is a satellite link, for example of the Inmarsat 4 type.

Each of these links starts from the platform 1.

It will be noted that, in embodiments, the telecommunication means of the set 40 may be wired or non-wired. Mention may notably be made as an example of the following telecommunication resources, either civilian or military: UHF, VHF radio links, satellite links, high throughput links STANAG 7085, intra-patrol links for example in the Ku band, Wifi link (notably on the ground), 3G or LTE links, wired links.

The telecommunication means 40₁, 40₂, 40₃ are for example connected to telecommunication network(s), called hereafter a downstream network, with which the platform 1 may communicate via the set 40 of telecommunication means.

The processing system 20

The processing system 20 includes an application block 210, a transport control block 220 called hereafter a transport agent 220, and a monitoring block 230.

The application block 210, for example comprising a server, includes a database 211, storing the flow identifiers matched with marking rules; the marking rules stored matched with a flow identifier were provided to it through the transport agent 220 for these

flow identifiers or are temporary marking rules to be applied upon awaiting those from the transport agent 220 in one embodiment.

In the embodiments wherein an encryptor 50 is used between the set 10 of applications and the router 30 as the second embodiment illustrated in Fig. 2, the application block 210 is split into a so called red portion 210-R, adapted for processing the flows before their encryption exclusively, and a so called black portion 210-N, adapted for processing the flows after their encryption exclusively.

The application block 210, or more specifically in the second embodiment, its red portion 210-R, is adapted for receiving the flows delivered by the set 10 of applications, in order to identify the received flows and for distinguishing the packets of a same flow.

The application block 210, or more specifically in the second embodiment, its red portion 210-R, is adapted for determining for each data packet of a flow which it receives, whether the marking rules are indicated in its database 211 matched with the identifier of the flow.

In the case when marking rules are indicated in its database 211, the application block 210, or more specifically in the second embodiment, its red portion 210-R, is adapted for marking the packet according to the marking rules stored in the database 211 for the flow identifier, and for providing the thereby marked packet to the router 30, or in the second embodiment to the encryptor 50, for example according to a policing rule associated with the marking rule used. As this is known, policing corresponds to a traffic template control at the network input and mainly comprises a control of the inflow rate for each of the flows. This policing function has the role of ensuring that the traffic sent over the transmission means is consistent with the operating mode retained by the transport agent. It operates in the user plan and is programmed by the application block depending on the parameters of the operating mode.

Policing may for example consist of suppressing or delaying the excess packets measured relatively to a maximum throughput, suppressing or delaying the excess packets measured relatively to an average throughput, etc.

In the case when no marking rule is indicated in the database 211 for the flow identifier, the application block 210, or more specifically in the second embodiment its red portion 210-R, is adapted for inferring therefrom that this is a packet from a new flow to be transmitted (and that this is not an unknown packet which does not then have to be transmitted, for example corresponding to a service denial risk or a cyber-attack for example) and is then adapted for determining, for this new flow, operational operating mode(s) (further called proper operation template(s)) associated with the flow and for

providing this or these operating mode(s), as well as a flow identifier, to the transport agent 220 in a request. The application block 210 further inserts into the request at least some of the addressing information indicated in the flow, notably those relating to the addressee, except in the embodiments when an encryptor 50 is used between the set 10 of applications and the router 30, since these pieces of the addressing information cannot then be exploited by the transport agent 220 on the one hand and the provision of this information cannot form a security fault on the other hand.

In an embodiment, the application block 210, or more specifically its red portion 210-R in the second embodiment, is adapted for, as long as it has not received any answer to its request relating to this new flow:

- marking the received packets of this flow, with a predetermined temporary marking which will give rise to rejection of the packet by the router 30, or
- marking the packets with a predetermined temporary marking depending on a temporary service quality policy, for example of the "best effort" type and storing the flow identifier in the base matching the temporary marking indication, or
- storing the packets received from this flow and releasing them after marking with the marking rule defined by the transport agent 220 once it is received;
- and then for providing the marked packets to the router 30, or to the encryptor 50.

The application block 210, or more specifically in the second embodiment, its red portion 210-R, is adapted for, when it receives an answer to its request indicating the marking rules selected by the transport agent 220 for a new flow identified by its flow identifier, completing its database 211 with these pieces of information.

The application block 210, or in the second embodiment its red portion 210-R, is further adapted for, when it receives instructions from the transport agent 220 indicating a change in the marking rules for an already identified flow in the base 211 by its identifier of the flow, updating its database 211 with these new rules instead of the old marking rules.

In the second embodiment when an encryptor 50 is used between the set 10 of applications and the router 30, the black portion 210-N of the application block 210 is adapted for receiving the flows delivered by the encryptor 50, in order to identify the received flows and for distinguishing the packets of a same flow.

In this second embodiment, the black portion 210-N of the application block 210 is adapted for determining for each data packet of a flow which is received, whether the

marking exhibited by this packet corresponds to an active flow or not. For this, the black portion 210-N for example determines whether the marking rule is present in a list of active flows maintained by the black portion 210-N: in the positive case, this is an active flow; in the negative case, this is not an active flow.

5 If the marking rule used corresponds to an active flow, the black portion 210-N of the application block 210 is adapted for providing the packet to the router 30. If the marking rule used does not match an active flow, the black portion 210-N of the application block 210 is adapted so as to infer therefrom that this is a packet of a new flow, and for sending a request to the transport agent 220 indicating said marking rule, as
10 well as pieces of addressing information relating to at least the encryptor addressee of the flow.

 In this second embodiment, the black portion 210-N of the application block 210 is adapted for, when it receives an answer to its request from the transport agent 220, considering the new flow as an active flow, and recording the retained marking rules for
15 this active flow in its list of active flows.

 The operational operating mode(s) of a flow is(are) determined by the application block 210, in the second embodiment more specifically by its red portion 210-R, for example by initial configuration of the application block 210, in the second embodiment of
20 its red portion 210-R, and/or depending on the application which delivered it and/or depending on the platform 1 and/or depending on the source identifier and/or on the addressee flow identifier indicated in the flow and/or according to the semantics of the data of the flow and/or according to dynamically recorded rules following deployment of a new processing capacity of the flow (for example video encoding, speech digitization,
25 message formatting, data compression, etc.).

 The rules required for determining the operational operating modes of the flows are for example stored in the base 211, for example matched with the identifiers of the applications, source identifiers, and/or addressee identifiers, etc.

 Said operational operating mode(s) associated with a flow characterize(s) this flow
30 operationally.

 In an embodiment, an operational operating mode for example indicates constraints such as:

 - a minimum throughput value or a range of admissible throughputs comprised between a minimum throughput and a maximum throughput and/or

- a maximum latency value or a range of admissible latencies comprised between a minimum latency and a maximum latency and/or

- a maximum jig value and/or

- a protection level to be observed during the transmission (for example the exclusive use of telecommunication means applying a capability of frequency hopping or exclusive use of approved telecommunication means at a restricted confidentiality level or exclusive use of telecommunication means under national control) and/or

- a reliability level to be observed (for example with or without acknowledgment of receipt, with or without delivery guarantee) and/or

- the lifetime of the piece of information conveyed by the flow and/or

- a maximum financial cost for transmitting the flow between the source and the addressee of the flow in a scale of transmission costs.

In an embodiment, operating modes associated with a same flow indicate a preference level ordering them in a scale of flow ordering and therefore indicating a decreasing order preferably from a preferred operating mode for the flow.

In an embodiment, an operating mode associated with a flow indicates a priority level of the flow in a scale for ordering the flows. The priority of the flow is for example assigned depending on the application delivering the flow, on the source, on the addressee, on the mission phase (for example take-off, transit to the theatre of operations, over the theatre, in combat phase, mission return), etc.

The constraints indicated in an operating mode thereby define an operational level of being able to exploit the flow.

For example, in the relevant case, distinct operating modes are associated with a flow delivered by the remote control application corresponding to a take-off/landing phase, and a flow delivered by the remote control application corresponding to an intermediate flight phase. For example, a rated (respectively degraded) operating mode for a flow corresponding to a take-off/landing phase will indicate a higher minimum throughput level than the minimum throughput level indicated for the rated (respectively degraded) operating mode for a flow corresponding to an intermediate flight phase, and will indicate a lower maximum latency level than the maximum latency level indicated for the rated (respectively degraded) operating mode for a flow corresponding to an intermediate flight phase.

In an embodiment, the rated operating mode associated with a flow relative to a take-off/landing phase indicates a higher minimum throughput than the minimum throughput level indicated for the degraded operating mode of the flow relative to a take-

off/landing phase and/or the rated operating mode associated with a flow relative to a take-off/landing phase indicates a lower maximum latency than the maximum latency indicated for the degraded operating mode of the flow relative to a take-off/landing phase, each of these rated and degraded operating modes of the flow relative to a take-off/landing phase corresponding to restoring the video without pixellization, nor slowing down. On the other hand, in an embodiment, the rated operating mode associated with a flow relative to an intermediate flight phase corresponds to restoring the video without pixellization, nor slowing down while the degraded operating mode associated with a flow relative to an intermediate flight phase tolerates the storing of the video with a limited level of pixellization, and of slowing down.

The monitoring block 230 is adapted for collecting and updating quantitative and qualitative, static and dynamic information relative to the transmission capacities of each of the telecommunication means 40₁, 40₂, 40₃ of the set 40.

To do this, the monitoring block 230 for example includes a proxy dedicated to the monitoring of each telecommunication means and conversing with this telecommunication means and/or with a supervisor piece of equipment of this telecommunication means and/or with sensors responsible for regularly measuring the current values of certain parameters relative to this telecommunication means.

The monitoring block 230 is thus adapted for collecting for each telecommunication means pieces of information from among:

- measurements of the current transmission throughput, of the current jig and/or of the current latency present on the telecommunication means; these measurements are for example updated for each period of duration T, with T being a configurable parameter assuming its values in a range from a few hundred milliseconds to several minutes; and/or
- error rate measurements giving the possibility of characterizing the quality of the telecommunication means; and/or
- the protection level proposed by the telecommunication means; and/or
- a guaranteed reliability level; and/or
- a financial transmission cost on the telecommunication means in a transmission cost scale.

The monitoring block 230 is adapted for providing with the flow to the transport agent 220 the pieces of information which were last collected for each identified telecommunication means with a telecommunication means identifier of the set 40.

The transport agent 220 includes a database 221.

The database 221 is adapted for storing identifiers of flow and for storing matched with each flow identifier, associated operational modes, for further indicating whether one
 5 of these operational modes is presently selected and for further identify a selected telecommunication means for said flow. The flows for which an operating mode and a telecommunication means are selected are said to be active flows.

The transport agent 220 is adapted for receiving with the flow the updated information relating to the current transmission capacities and for storing them in the
 10 database 221 matched with an identifier of each telecommunication means of the set 40.

The transport agent 220 is notably adapted for inferring from these updated pieces of information which are the presently available telecommunication means for conveying additional flows and which transmission characteristics are guaranteed by these telecommunication means.

15 The transport agent 220 is adapted for collecting from the router 30:

- updated connectivity information relative to the telecommunication routes of the downstream network interfaced with the set 40 of telecommunication means (allowing the transport agent to determine the routes which give access to an addressee) and/or
- 20 - the current state of the queues of the packets routed by the router 30 towards each of the telecommunication means 40₁, 40₂, 40₃ and still not transmitted by these means.

The transport agent 220 is adapted for receiving requests, from the application block 210 and indicating operational operating mode(s) associated with a new flow
 25 identified by its flow identifier also appearing in the request, as well as pieces of addressing information relative to at least the addressee of the flow.

Upon receiving such a request from the application block 210, the transport agent 220 is adapted for evaluating, depending on at least the operating modes of the new flow and on the current capacity of the telecommunication means 40₁, 40₂, 40₃, and in
 30 embodiments further depending on the updated connectivity information and/or of current states of the queues, the one of the telecommunication means adapted for remotely transmitting the packets of said flow according to one of the operating modes of the flow.

In a more detailed way, in the second embodiment when an encryptor 50 is used between the set 10 of applications and the router 30, the transport agent 220 is adapted
 35 for receiving requests, from the red portion 210-R of the application block 210 and

indicating operational operating mode(s) associated with a new flow identified by its flow identifier also appearing in the request.

In this embodiment, upon receiving such a request from the red portion 210-R of the application block 210, the transport agent 220 is adapted for determining temporary marking for the new flow, in order to store the request relative to the new flow by using the temporary marking as a storage key, and for answering the request of the red portion 210-R relative to the new flow by indicating the temporary marking rule.

The transport agent 220 is adapted for receiving requests, from the black portion 210-N of the application block 210 and indicating temporary marking, as well as pieces of addressing information relative to at least the encryptor addressee of the flow.

In this second embodiment, upon receiving such a request from the black portion 210-N of the application block 210, the transport agent 220 is adapted for recovering, from the temporary marking, the stored associated request coming from the red portion 210-R of the application block 210, and for evaluating depending on at least the operating modes of the new flow and on the current capacity of the telecommunication means 40₁, 40₂, 40₃, on the address of the encryptor addressee, and in embodiments further depending on updated connectivity information and/or current state information on the queues, that of the telecommunication means adapted for remotely transmitting to the encryptor addressee, the packets of said flow according to one of the operating modes of the flow.

In the first or second embodiment, the transport agent 220 is for example adapted for globally evaluating, depending on at least operating modes of the active flows and on the new flow and on the current capacity of the telecommunication means 40₁, 40₂, 40₃, and in embodiments further depending on updated connectivity and/or current state information of the queues, the telecommunication means i.e. either the means 40₁, the means 40₂ or else the means 40₃ which are the most adapted for remotely transmitting the packets of each of these flows according to one of the operating modes of said flow.

The orders between the operating modes associated with a same flow and the respective priority levels of the flows are taken into account by the transport agent 220 in order to carry out this selection.

Depending on this evaluation, the transport agent 220 is adapted for selecting at least one operating mode associated with the new flow and a telecommunication means (as the best telecommunication means and best operating mode from an evaluation and selection algorithm) by observing the constraint according to which the selected telecommunication means should be compatible with the selected operating mode for the new flow. This selection is carried out by the transport agent 220 depending on the active

flows listed in the database 221 and on operating modes which are associated with them, depending on the updated information relating to the current transmission capacities of the telecommunication means 40₁, 40₂, 40₃ and further, in embodiments depending on the available telecommunication means, updated connectivity and/or current state information
 5 of the queues of the packets collected from the router and/or pieces of addressing information of the active flows.

By "compatible" in the expression "a selected telecommunication means compatible with an operating mode selected for a flow" is meant that the transport agent has evaluated that depending on the whole of the indicated updated information which it
 10 has taken into account (transmission and/or connectivity and/or queue state capacities), the transport of the flow packets transmitted via the selected telecommunication means will actually be able to observe the transmission constraints towards the addressee as set in the selected operating mode.

The connectivity information will notably allow definition of the possible routes to
 15 the addressee, and inference therefrom of which are the telecommunication means of the set 40 which give access to these routes, and determination whether some of these defined routes are compatible with an operating mode of a flow etc.

Various evaluation and selection algorithms may be used by one skilled in the art: they each define a "better" solution, for example by selecting from among all the
 20 compatible telecommunication means the one which will remain less loaded (in proportion and in absolute value) after selecting the means and/or the one which will generate the less financial costs and/or the one which will provide the lower latency.

The transport agent 220 is then adapted for informing the database 221 with the identifier of the new flow, the associated operating modes and the indication of the one
 25 which is presently selected, as well as the identifier of the presently selected telecommunication means for this new flow.

The transport agent 220 is then adapted for defining marking rules of the packets of the new flow and for storing them in the base 221 associated with the identifier of the new flow.

30 And then the transport agent 220 is adapted in order to answer the request from the application block 210, more specifically in the second embodiment from its red portion 210-R, relative to the new flow by giving it the thereby defined marking rules following the evaluation and selection step described above for the new flow identified by its flow identifier, as well as the finally selected operating mode for this flow.

In the second embodiment, the transport agent 220 is adapted for acknowledging the request from the black portion 210-N of the application block 210 by providing it as an answer, with the temporary marking of the new flow and the marking defined for the new flow after the step for evaluating and selecting the operating mode and telecommunication means.

The transport agent is further adapted for transmitting a command to the router 30 ordering it to deliver from now on to the selected telecommunication means for the new flow, all the packets bearing a marking in accordance with the marking rules defined for the new flow.

In the case when it was not possible for the transport agent 220 to select for the new flow an operating mode and a telecommunication means, the transport agent 220 is adapted for answering the request from the application block 210 by indicating that the telecommunication service is not available. The packets of the new flow will then be rejected by the application block 210. In another embodiment, if it was not possible for the transport agent 220 to select for the new flow an operating mode and a telecommunication means, the transport agent 220 is adapted for answering the request from the adaptive block 210 by indicating, for the new flow, a predetermined marking rule which will give rise to rejection of the packet by the router 30.

It will be noted that during the evaluation and selection operations consecutive to the reception of a request from the application block 210 relating to a new flow, the transport agent 220 is sometimes led to changing the selected operating mode and/or the telecommunication means then selected for an already active flow, or even to identify that the transmission of a flow up to then active can no longer continue (for example if this flow has a priority less than all the other flows including the new flow, and that the current capacities are not sufficient for transmitting each of these flows according to one of its associated operating modes).

In such a case, the transport agent 220 is adapted for updating its database 221 depending on the changes relating to the transmission means 40₁, 40₂, 40₃ and/or to the selected operating modes.

When the telecommunication means up to then selected, of an active flow is no longer selected for this flow, the transport agent provides the application block 210 and/or the router 30 with instructions required so that the future packets of this active flow received by the application are properly processed according to the results of the last selection operation: for example the transport agent 220 orders the application block 210 to change the policing to be applied on the packets of the flow as well as the marking, the

new marking identifying the new selected transmission means for this active flow if required or indicating a rejection and/or for example the transport agent 220 reprograms the router 30 so that the marked packets of said active flow are properly routed as defined during the last selection operation etc.

5 If no packet of a notoriously active flow is received over a certain period (which may be configured depending on the flow between a few tens of seconds and a few minutes), the flow is then considered as inactive.

Moreover, upon inactivating a service, all the flows of this service are made inactive.

10 In both cases, this is expressed by a flow suppression request from the application block 210 to the transport agent 220. Upon receiving a flow suppression request, the transport agent 220 is adapted for re-evaluating the telecommunication means which are the most adapted for remotely transmitting the packets of each of the still active flows according to one of the operating modes of said flows. This re-evaluation according to the
15 principles discussed above may for example have the effect of passing from a degraded operating mode to a rated operating mode for one of the active flows.

The transport agent 220 is further adapted for detecting, depending on the received updated information relating to the current transmission capacities, and/or to the connectivity and/or to the current state of the queues, any variation in the current
20 capacities of the transmission means, and in embodiments any variation in connectivity or state of a queue, and adapted for determining whether these detected variations induce that a selected operating mode for an active flow is no longer compatible with conveyance of the flow towards the addressee of the flow via the selected telecommunication means selected for this active flow.

25 In such a case, the transport agent 220 performs a new operation for evaluating the operating modes of the active flows and of the telecommunication means in order to carry out a new selection, for each active flow, of an operating mode and of a telecommunication means for transmitting the packets of the remaining active flow to be transmitted, such that a selected telecommunication means for a flow is compatible with
30 the selected operating mode for this flow. The transport agent 220 updates its base 221 depending on the results of this new evaluation and selection operation.

If the result of this new evaluation and selection operation should, in order to be able to direct packets towards the telecommunication means 40₁, 40₂, 40₃ respectively selected or for rejecting flow packets for which an operating mode and a remote
35 transmission means were not able to be selected, give rise to new marking rules and/or to

reprogramming of the router 30, the corresponding instructions are provided by the transport agent 220 to the application block 210 (to the red and black portions of the application block in the second embodiment) and/or to the router 30.

5 **The router 30**

The router 30 is adapted for receiving data packets which are provided to it by the application block 210, or in the second embodiment by the black portion 210-N of the application block 210.

10 The router 30 is adapted for receiving commands from the transport agent 220 and for applying these commands. These commands at least inform it on a marking and specifies towards which telecommunication means 40_1 or 40_2 or 40_3 a packet having such a marking has to be selectively directed. Thus, the router 30 is adapted for directing each packet which it receives towards the telecommunication means then selected by the transport agent 220 for the active flow, to which the packet belongs, or for rejecting it if
15 this has been the decision of the transport agent 220.

The encryptor 50

20 The encryptor 50 used in the second embodiment is adapted for receiving data packets which are provided to it by the red portion 210-R of the application block 210, in order to apply an encryption function on these packets, and for transmitting these packets once they are encrypted to the black portion 210-N of the application block 210.

25 After passing of a packet in the encryptor, the contents of the packet, including the address of the addressee is encrypted. It indicates in clear text in the packet the marking of the packet carried out previously by the application block 210 (by its red portion 210-R of this application block in the second embodiment) and the address of the encryptor addressee which the encryptor determines according to the address of the addressee indicated in the packet.

30 In an embodiment, the field DSCP of the IP protocol (version v4 or v6), or the field flow label of the IPv6 protocol, or a port TCP/UDP, or an extension of the application header such as the SOAP header, is used by the application block 210 for marking the packets of a flow, the routing rule defined for the flow stipulating the insertion by the application block 210, in such a field of each packet of the flow, of an identifier for example of the selected telecommunication means. In such a case, the router 30 is programmed by the transport agent 220 so that it delivers any packet for which this field
35 includes this identifier to the telecommunication means which the transport agent has

selected for this flow. More extensively, the inserted identifier should allow the router to recognize the packets of the flow: this identifier may actually refer to the selected telecommunication means, but may also refer to the actual flow or even to an arbitrary value selected by the transport agent 220; the identifier is simply a key allowing the router
 5 30 to recognize the packets of the flow in order to apply to them the programmed routing rule.

In embodiments, the transport agent 220 is adapted for informing the application block 210 on the selection of an operating mode for a new flow or on a change in the selected operating mode for an already active flow, and the application block 210 is
 10 adapted for, depending on this information, triggering actions such as changing the codec used for the application having delivered the flow, changing the format of the messages making up the flow, programming a function for checking the characteristics of the flow.

The solution proposed according to the invention thus consists of introducing a control and local application management plan into the platform 1 as an overlay on the
 15 user level, said user plan comprising the set 10 of applications, the router 30 and the set 40 of telecommunication means. In an embodiment, the exchanges between the user plan and the control plan are controlled by safety gateways aiming at guaranteeing control of these exchanges and of ensuring that only the required information is exchanged.

It will be noted that the telecommunication platform 1 includes further includes at
 20 least one microprocessor and a memory storing software instructions (not shown), the execution of said software instructions on the microprocessor giving rise to steps applied by the processing system 20 and by the router 30.

The present invention also proposes a processing method comprising the steps applied by a platform such as the telecommunication platform 1.

25 In an embodiment of such a processing method, with reference to Fig. 3, a set 100 of steps comprises steps 101, 102 and 103 applied by the application routing system 20.

In a step 101 which is permanently carried out, the following operations are conducted:

- receiving a flow with the application block 210, marking with the application
 30 block 210 packets of the received flows according to the marking rules defined for the identifiers of these flows in its base 211 in the way described above and providing marked packets to the router 30, for example according to an associated policing rule with the used marking rule;
- if the application block 210 detects a packet of a new flow, step 102 is applied;

- for each packet marked by the application block 210 which the router 30 receives from the application block 210, rejection or routing by the router 30 towards a specific transmission means depending on the marking exhibited by the packet and on the previous programming of the router by the transport agent 220 (each marking being associated with a respective transmission means or with rejection);
- collecting by the monitoring block 230 of quantitative and qualitative, static and dynamic updated information relative to the transmission capacities of each of the telecommunication means 40₁, 40₂, 40₃ and providing said information to the transport agent 220;
- collecting by the transport agent 220 updated connectivity information and current state information of the queues;
- analysing the received updated information relative to the current transmission capacities, and/or to the connectivity and/or to the current state of the queues by the transport agent 220 and detection by the transport agent 220, of variations in the current capacities of the transmission means, of the connectivity and current state of the queues; as soon as the transport agent 220 determines that such a detected variation causes that a selected operating mode for an active flow is no longer compatible with transport via the selected telecommunication means for this active flow, step 103 is applied;
- each of the remote transmission means 40₁, 40₂, 40₃ remotely transmit the packets which are addressed to it by the router 30.

In step 102, a one-off step which occurs following the detection by the application block 210 of a packet of a flow for which the flow identifier is not present in its base 211:

- the application block 210 determines, for this new flow, operational operating mode(s) associated with the new flow and provides this(these) operating mode(s), as well as an identifier of the new flow, to the transport agent 220 an addressing information of the addressee or of the encryptor of the addressee;
- following reception of these elements, the transport agent 220 selects according to at least the operating modes of the new flow, addressing information of the addressee or of the encryptor of the addressee, the current capacity of the telecommunication means and optionally depending on the updated queue current state information, one of the telecommunication means and an operating mode associated with the new flow such that the selected

telecommunication means is compatible with remote transmission of the packets of said flow according to the selected operating mode of the flow;

- the transport agent 220 informs the database 221 on the identifier of the new flow, the associated operating modes and the indication of the presently selected one, as well as the identifier of the presently selected telecommunication means, and then defines marking rules for the packets of the new flow and stores them in the base 221 in association with the identifier of the new flow; the transport agent 220 answers the request of the application block 210 relative to the new flow by informing it on the marking rules defined for the new flow;
- the transport agent 220 transmits a command to the router 30 ordering it to deliver from now on to the selected telecommunication means for the new flow, all the packets bearing a marking in accordance with the marking rules defined for the new flow;
- the application block 210 when it receives the answer to its request relative to the new flow, completes its database 211 with the marking rules indicated in the answer for the identifier of the flow and from now on marks any packet of the new flow in accordance with the marking rules ordered by the transport agent and stored in the base 211.

Steps applied during step 102 by a platform in a first embodiment as illustrated in Fig. 1, without any encryptor, are illustrated in Fig. 4 and described below.

After a step 300 for transmission by the set of application(s) 10 to the application block 210 of a new flow F addressed to the addressee dest-R with the address @dest-R indicated in the flow, the application block 210 identifies the flow and detects that the identifier of this flow is not present in its base 211. Subsequently to this detection, the application block 210 determines in a step 301, for this new flow F, operational operating mode(s) associated with the new flow. The application block 210 provides in a step 302 this(these) operating mode(s) ({MdF}), as well as an identifier (id-flux) of the new flow, to the transport agent 220 in a request further comprising the address of the addressee (@dest-R). While waiting for the answer for this request, the application block 210 rejects the packets received from this new flow or affixes a predefined temporary marking before providing them to the router 30 or stores the packets received from this new flow.

In a step 303, following reception of this request, the transport agent 220 selects, depending on at least the operating modes of the new flow, on the current capacity of the telecommunication means, on the address of the addressee and optionally depending on

the updated connectivity information, and optionally depending on the updated information on the current state of the queues, one of the telecommunication means of the set 40 and an operating mode associated with the new flow such that the selected telecommunication means is compatible with remote transmission of the packets of said flow according to the selected operating mode of the flow. The transport agent 220 informs the database 221 with the identifier of the new flow, the associated operating modes and the indication of the presently selected one, as well as the identifier of the telecommunication means presently selected, and then defines marking rules for the packets of the new flow and stores them in the base 221 in association with the identifier of the new flow. In a step 304, the transport agent 220 transmits a command to the router 30 ordering it to deliver from now on to the selected telecommunication means for the new flow all the packets bearing a marking in accordance with the marking rules defined for the new flow and in a step 305, the transport agent 220 answers the request from the application block 210 relative to the new flow by informing it on the identifier of the flow, the marking rules (Mar) defined for the new flow, and the selected operating mode (MdF_0).

The application block 210 when it receives the answer to its request relative to the new flow, completes, in a step 306, its database 211 with the marking rules indicated in the answer for the identifier of the flow and the selected operating mode and marks from now on any packet of the new flow in accordance with the marking rules ordered by the transport agent and stored in the base 211. Notably, if it has stored the packets received from this new flow, in a step 307, the application block 210 transmits these packets once they are marked to the router 30. The application block 210 also programs the policing function to be applied to the new flow consistently with the selected operating mode (MdF_0).

Steps applied during step 102 by a platform in a second embodiment as illustrated in Fig. 2, with an encryptor 50, are illustrated in Fig. 5 and described below.

After a step 400 for transmission by the set of application(s) 10 to the application block 210 of a new flow F addressed to the addressee dest-R, with address @dest-R, the red portion 210-R of the application block 210 identifies the flow, thus detects whether the identifier of this flow is present in its base 211 and subsequent to this detection, the red portion 210-R of the application block 210 determines in a step 401, for this new flow F, operational operating mode(s) associated with this new flow. The red portion 210-R of the application block 210 provides, in a step 402, this(these) operating mode(s) ($\{MdF\}$), as well as an identifier (id-flux) of the new flow, to the transport agent 220 in a request (the address of the addressee @dest-R is not provided). Upon awaiting the answer to its

request, the red portion 210-R of the application block 210 rejects the packets received from this new flow or affixes a predefined temporary marking before providing them to the encryptor 50 or stores the packets received from this new flow.

5 In a step 403, the transport agent 220 receives this request, defines the temporary marking rules of the packets of the new flow and stores them in the database 221 associated with the received request. In a step 405, the transport agent 220 answers the request of the red portion 210-R of the application block 210 relative to the new flow by indicating in an answer, the identifier of the flow and the temporary marking rules (Mar_t) defined for the new flow.

10 In a step 406, the red portion 210-R of the application block 210 marks the received packets from the new flow with an identifier id-flux by means of the temporary marking rules and, in a step 407, transmits the flow of thereby marked packets further including the address @dest-R of the addressee to the encryptor 50.

15 In a step 408, the encryptor 50 encrypts these packets, determines, depending on the address @dest-R of the addressee, the address @dest-N of the encryptor addressee and then transmits to the black portion 210-N of the application block 210, in a step 409, the encrypted packets marked with their temporary marking (not encrypted), and the address @dest-N.

20 The black portion 210-N of the application block 210, in a step 410, identifies the flow, thus detects whether the identifier of this flow is not present in its list of active flows and subsequently to this detection, sends to the transport agent 220, in a step 411, a request which indicates the temporary marking and the address @dest-N of the encryptor addressee for this flow. Upon awaiting the answer to its request, the black portion 210-N of the application block 210 rejects the packets received from this new flow or affixes a predefined temporary marking before providing them to the router 30 or stores the packets received from this new flow.

25 In a step 412, subsequently to receiving this request, the transport agent 220 extracts from its base 221, on the basis of the temporary marking (which is used here as a key) indicated in this last received request, the request from the red portion 210-R of the application block 210 and which has been stored in step 403 in association with this temporary marking and which indicates the operating modes of the new flow.

30 In a step 413, the transport agent 220 selects, depending on at least these operating modes of the new flow, on the current capacity of the telecommunication means, of the address of the encryptor addressee and optionally depending on the updated connectivity information, and optionally depending on the updated information on

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the current state of the queues, one of the telecommunication means of the set 40 and an operating mode associated with the new flow such that the selected telecommunication means is compatible with remote transmission of the packets of said flow according to the selected operating mode of the flow. The transport agent 220 informs the database 221
 5 with the indication of the presently selected operating mode, as well as the identifier of the presently selected telecommunication means, and then defines updated marking rules of the packets of the new flow and stores them in the base 221 in association with the information relative to this new flow.

10 In a step 414, the transport agent 220 transmits a command to the router 30 ordering it to deliver from now on to the selected telecommunication means for the new flow, all the packets bearing a marking according to the updated marking rules defined for the new flow.

15 In a step 415, the transport agent 220 again answers the request from the red portion 210-R of the application block 210 relative to the new flow with an answer indicating the identifier of the flow (id-flux), the updated marking rules (Mar_d) defined for the new flow, and the selected operating mode (MdF_0). Subsequently to receiving this answer, the red portion 210-R of the application block 210 marks the next packets received from the new flow, in a step 419, with updated marking Mar_d . These thereby marked packets, associated with the address of the addressee @dest-R are sent to the
 20 encryptor 50 in a step 420, by the red portion 210-R of the application block 210 which also programs the policing function to be applied to the new flow consistently with the selected operating mode (MdF_0).

25 In a step 421, the encryptor 50 encrypts these packets, determines, depending on the address @dest-R of the addressee, the address @dest-N of the encryptor addressee and then transmits to the black portion 210-N of the application block 210, the encrypted packets marked with their updated marking (non-encrypted), and the address @dest-N.

30 In a step 416, which for example takes place at the same time as step 415, the transport agent 220 answers the request from the black portion 210-N of the application block 210 relative to the new flow with an answer indicating the temporary marking rules (Mar_t) and the updated marking rules (Mar_d). These updated marking rules of the flow are added into the list of active flows maintained by the black portion 210-N and identify the new flow therein.

In a step 417, the black portion 210-N of the application block 210 marks by means of the updated marking rules (Mar_d) the packets sent earlier by the red portion 210-R

marked with the temporary marking rules (Mar_i) and which would have been able to be stored subsequently to step 410, and sends them, in a step 418, to the router 30.

Moreover, the black portion 210-N of the application block 210, in a step 422, identifies the flow of the encrypted packets marked with their updated marking (non-encrypted) and received subsequently to the step 421 as present in its list of active flows, and then transmits them in a step 423 to the router 30.

In step 103, a one-off step, which takes place following the determination by the transport agent 220 that a variation detected in step 101 implies a selected operating mode for an active flow can no longer be observed during conveyance via the selected telecommunication means for this active flow:

- the transport agent 220 carries out a new operation for evaluation and selection of an operating mode of each active flow and of a telecommunication means for the active flow, such that a selected telecommunication means for a flow is compatible with the selected operating mode for this flow; it updates its base 220 depending on the results of this new evaluation and selection operation;

- if the result of this new evaluation and selection operation has to be accompanied, in order to be able to direct packets towards the selected means or for rejecting flow packets for which no operating mode and no telecommunication means, no new markings and/or no re-programming of the router were able to be selected, the corresponding instructions are provided by the transport agent 220 to the application block 210 and/or to the router 30;

- in this case, the application block 220 takes into account these new marking instructions and the router 30 takes into account these new routing instructions.

In addition to the operations explicitly described with reference to Figs. 3, 4 and 5, the method according to the invention comprises, in embodiments, any operation described with reference to Fig. 1 or to Fig. 2 and conducted by the set 10 of application(s), the application block 210, the transport agent 220, the monitoring block 230, the router 30 or the set 40 of telecommunication means.

The invention thus gives the possibility of being able to switch to an alternative telecommunication means of the set 40 of telecommunication means for example, if the capacity of the telecommunication means used is then reduced as far as making the utilization of the flow by the users unacceptable, as set in the then selected operating mode, and this without waiting for the reception of the IP notifications indicating unavailability of the telecommunication means preventing any transmission, such as « link broken », « neighbor loss ».

The invention gives the possibility of reacting as soon as an operational constraint indicated in a selected operating mode of a flow is no longer observed, for example as soon as a latency, throughput or jig threshold set by this operating mode is exceeded, or a protection, reliability, transmission cost level or further a lifetime as set in the selected
5 operating mode is no longer ensured.

In the relevant example, as soon as the selected telecommunication means which then conveys the video of a landing phase risks giving rise to pixelation or to a slowing down, another telecommunication means if it exists is selected for conveying the continuation of this video, or a degraded but always operationally acceptable operating
10 mode is selected from the list of the operating modes defined for the video flow.

According to the invention, the telecommunication means which the system 20 decides to no longer use for transmitting a given flow may quite be assigned subsequently by the system for transmitting another flow.

The invention also gives the possibility of being able to forward flows of the same
15 nature and intended for the same sub-network on distinct telecommunication means, depending on their operational characteristics: in the above example, the video delivered by the first camera for a landing/take-off phase may use a telecommunication means different from the telecommunication means used by a video transmitted at the same time and delivered by the second camera.

20 The invention gives the possibility of transmitting the flow while guaranteeing all along the transmission, observance of one of the operating modes which is associated with it.

In another embodiment, the bases 211 and 221 are grouped in a same database.

In an embodiment, the transport agents of different platforms are adapted for
25 exchanging with each other information according to a signaling protocol, this exchanged information giving them the possibility of ensuring optimizing from end-to-end of the forwarding of the flows. The pieces of information provided by each transport agent for example comprise the indication of addition or withdrawal of active flows on the platform, the operating modes retained for the flows, the flow pre-emptions etc.

30 Above, the operations and steps which are not indicated as specific to the first or specific to the second embodiment are applied in both of these embodiments.

CLAIMS

1.- A processing system for a telecommunication platform comprising a set of applications delivering data packet flows, a set of distinct telecommunication resources each adapted for remotely transmitting packets from the platform, a router adapted for receiving packets from the set of application(s) and for delivering received packets to said telecommunication resources for remote transmission of the packet from the platform; said processing system being characterized in that it is adapted for collecting measurements of current transmission capacities of the telecommunication resources; the processing system including a table and being adapted for determining, for a flow of packets delivered by an application from the set of application(s), at least one first operating mode and a second operating mode each notably defining mandatory operational transmission characteristics, said modes being recorded in a table associated with an identifier of said flow; the processing system being adapted for evaluating, depending at least on the first and second operating modes and on measurements collected of the current transmission capacities of the telecommunication resources, that(those) of the adapted resources for remotely transmitting the packets of said flow according to one of the first and second operating modes, for selecting depending on at least said evaluation for said flow delivered by the application, in a first selection operation, an operating mode from among the first and second operating modes and a telecommunication resource from among said resources and for ordering the router to deliver the packets of said flow to the selected resource for said flow of said application; the processing system being adapted for subsequently detecting, during the remote transmission of packets of said flow of the application through said selected resource, depending on collected measurements of the current transmission capacities of the selected resource, any variation in the current capacity of the selected resource for said flow of the application making remote transmission on said resource incompatible with the operating mode of the selected application for said flow and for, during such a detection, triggering a second operation for selecting an operating mode from among the first and second operating modes and one of said resources for remote transmission of the packets of said remaining flow to be remotely transmitted.

2.- The processing system according to claim 1, wherein the processing system is adapted for, subsequently to said detection, again evaluating depending on at least first and second operating modes and on collected measurements of the current transmission

capacities of the telecommunication resources, that(those) of the resources adapted for remotely transmitting the packets of said remaining flow to be remotely transmitted according to one of the first and second operating modes; the processing system being adapted for, during the second selection operation, selecting depending on said
 5 evaluation, for said flow delivered by the application, an operating mode from among the first and second operating modes and a telecommunication resource from among said resources; and for ordering the router to deliver the packets which remain to be transmitted of the flow of the application to the selected resource for said flow during the second selection operation.

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3.- The processing system according to claim 1 or 2, wherein the selected resource during the second selection operation for said flow is distinct from the one selected during the first selection operation for said flow and/or the selected operating mode during the second selection operation for said flow is distinct from the one selected
 15 during the first selection operation for said flow.

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4.- The processing system according to one of the preceding claims, adapted for detecting, during remote transmission of packets of several application flows delivered by the set of application(s), depending on collected measurements of the current
 25 transmission capacities, any variation in the current capacity of a selected resource by said processing system for one of the flows making remote transmission on said resource incompatible with a selected operating mode for said flow and/or for detecting the end of transmission of another flow for which an operating mode and a telecommunication resource had been selected earlier, in order to, in response to such detection, triggering a
 30 global selection operation comprising a new selection operation, for each flow, of an operating mode which is associated with it in the base and of said resources, said resource from the new selection having been evaluated by said processing system, depending on at least collected measurements, as adapted for remotely transmitting the packets which remain to be transmitted of said flow according to the operating mode from
 the new selection;

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the processing system being adapted for ordering the router to deliver the remaining packets to be transmitted of each flow to the resource from the new selection for said flow.

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5.- The processing system according to one of the preceding claims, adapted for selecting a resource and an operating mode for a flow further depending on an order
 relationship of the operating modes, and/or on an order relationship of the flows and/or of

current lengths of queues of the packets delivered by the router at the input of the respective resources, and/or identification data of the addressee of the flow, and/or information describing the connectivity of a telecommunication network interfaced with the telecommunication resources.

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6.- The processing system according to one of the preceding claims, wherein an operating mode defines at least one element from among a minimum throughput, a range of admissible throughputs comprised between a minimum throughput and a maximum throughput, a maximum latency, a range of admissible latencies comprised between a minimum latency and a maximum latency, a maximum jig, a maximum transmission cost, an ordering level of the mode in an ordering scale of the modes, a security level, a lifetime of the data of the flow.

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7.- The processing system according to one of the preceding claims, adapted for remotely communicating with at least one other processing system of another platform and for exchanging with said other system messages indicating the operating modes and the telecommunication resources which have been selected for the respective flows of packets remotely transmitted from the respective platforms.

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8.- The processing system according to one of the preceding claims, comprising an application block and a transport agent, said application block being adapted for receiving the flow of packets delivered by the application of the set of application(s), in order to determine, for said flow of packets, at least said first operating mode and second operating mode and for sending a request to the transport agent indicating the first and second operating modes;

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the transport agent being adapted for, upon receiving such a request, carrying out said first selection, depending on the first and second operating modes indicated in the request, of an operating mode from among the first and second operating modes and of a telecommunication resource, in order to define a marking for the packets of said flow, in order to answer the request from the application block, by indicating to the application block said marking defined for the packets of said flow, and for ordering the router to deliver all the packets bearing the same marking to said selected resource for said flow; said application block being adapted for, after receiving said answer, marking each received packet of said flow with said marking defined by the transport agent and for delivering the marked packets to the router.

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9.- The processing system according to claim 8 for a telecommunication platform further comprising an encryptor and wherein the application block comprises a red portion adapted for exclusively processing non-encrypted flow packets and a black portion adapted for exclusively processing the encrypted flow packets, the red portion of the application block being adapted for receiving the flow of packets delivered by an application from the set of application(s), in order to determine, for said flow of packets, at least said first operating mode and second operating mode and for sending a first request to the transport agent indicating said first and second operating modes;

the transport agent being adapted for, upon receiving the first request, carrying out said first selection, depending on the first and second operating modes indicated in the first request, of an operating mode from among the first and second operating modes and of a telecommunication resource, for defining a temporary marking for the packets of said flow, for storing said first and second operating modes indicated in the first request matching said temporary marking and for answering the first request of the red portion of the application block, by indicating in a first answer to the red portion, said temporary marking defined for the packets of said flow,

the red portion of the application block being adapted for, after receiving said answer, marking each received packet of said flow with said temporary marking defined by the transport agent and for delivering the marked packets to the encryptor;

said encryptor is adapted for encrypting the packets delivered by the red portion of the application block, in order to determine the address of an encryptor addressee depending on the address of the addressee of the flow and for delivering to the black portion of the application block, the encrypted packets indicating in clear text the address of the encryptor addressee and the temporary marking;

the black portion of the application block is adapted for receiving the encrypted packets delivered by the encryptor, and for sending a second request to the transport agent indicating the address of the encryptor addressee and said temporary marking;

the transport agent being adapted for, upon receiving the second request, extracting the first and second operating modes stored and matching the temporary marking which is indicated in the second request, carrying out said first selection, depending on said extracted first and second operating modes and on the address of the encryptor addressee, of an operating mode from the first and second operating modes and of a telecommunication resource, in order to define a definitive marking for the packets of said flow, in order to answer the red portion and the black portion of the application block, by

indicating to each of them said definitive marking for the packets of said flow, and for ordering the router to deliver all the packets bearing said definitive marking to said selected resource for said flow;

the red portion of the application block being adapted for, upon receiving the definitive marking, marking each packet received of said flow with said definitive marking and for delivering the thereby marked packets to the encryptor;

the black portion of the application block being adapted for, after receiving the definitive marking, replacing with said definitive marking, the temporary marking of each received packet of said flow bearing said temporary marking and for delivering to the router the thereby marked packets as well as the packets bearing the definitive marking and delivered by the encryptor.

10.- A processing method in a telecommunication platform comprising a set of applications delivering data packet flows, a set of distinct telecommunication resources each adapted for remotely transmitting packets from the platform, a router adapted for receiving packets from the set of application(s) and for delivering received packets to said telecommunication resources for remotely transmitting the packet from the platform; said method being characterized in that it comprises the following steps:

- collecting measurements of the current transmission capacities of the telecommunication resources;

- determining, for a flow of packets delivered by an application from the set of application(s), at least one first operating mode and a second operating mode each defining notably mandatory operational transmission characteristics, said modes being recorded in a table associated with an identifier of said flow;

- evaluating depending on at least the first and second operating modes and on collected measurements of the current transmission capacities of the telecommunication resources, of that(those) of the resources adapted for remotely transmitting the packets of said flow according to one of the first and second operating modes;

- selecting depending on at least said evaluation for said flow delivered by the application, in a first selection operation, an operating mode from among the first and second operating modes and a telecommunication resource from among said resources and ordering the router so that it delivers the packets of said flow to the selected resource for said flow of said application;

- subsequently, detecting, during the remote transmission of packets of said flow of the application by said selected resource, depending on collected measurements of the

current transmission capacities of the selected resource, any variation in the current capacity of the selected resource for said flow of the application making the remote transmission on said resource incompatible with the operating mode of the application, selected for said flow and during such a detection, triggering a second operation for
 5 selecting an operating mode from among the first and second operating modes and one of said resources for remote transmission of the packets of said remaining flow to be remotely transmitted.

11.- The processing method according to claim 10, comprising, subsequently to
 10 said detection, steps for:

- evaluating, depending on at least the first and second operating modes and on the collected measurements of the current transmission capacities of the telecommunication resources, on that(those) of the resources adapted for remotely transmitting the packets of said remaining flow to be remotely transmitted, according to one of the first and second
 15 operating modes;
- the second operation for selecting an operating mode from among the first and second operating modes and a telecommunication resource from among said resources for said flow delivered by the application being carried out depending on said evaluation; and
- ordering the router so that it delivers the remaining packets to be transmitted of the flow
 20 of the application to the selected resource for said flow during the second selection operation.

12.- The processing method according to claim 10 or 11, according to which the selected resource during the second selection operation for said flow is distinct from the
 25 one selected during the first selection operation for said flow and/or the selected operating mode during the second selection operation for said flow is distinct from the one selected during the first selection operation for said flow.

13.- The processing method according to one of claims 10 to 12, comprising the
 30 steps for:

- detecting, during remote transmission of packets from several application flows delivered by the set of application(s), depending on collected measurements of the current transmission capacities, on any current variation of capacity of a selected resource by
 said processing system for one of the flows making the remote transmission on said
 35 resource incompatible with a selected operating mode for said flow, and/or detecting the

end of transmission of another flow for which an operating mode and a telecommunication resource have been selected previously, and,

- triggering, in response to such a detection, a global selection operation comprising a new selection operation, for each flow, of an operating mode which is associated with it in the base and of one of said resources, said resource from the new selection having been evaluated, depending on at least the collected measurements, as adapted for remotely transmitting the remaining packets to be transmitted of the flow according to the operating mode from the new selection;

- ordering the router so that it delivers the remaining packets to be transmitted of each flow to the resource from the new selection for said flow.

14.- The processing method according to one of claims 10 to 13, according to which the selection of a resource and of an operating mode for a flow further depends on an order relationship of the operating modes, and/or on an order relationship of the flows and/or of the current lengths of the queues of the packets delivered by the router at the input of the respective resources, and/or of data for identifying the addressee of the flow, and/or information describing the connectivity of a telecommunication network interfaced to the telecommunication resources.

15.- The processing method according to one of claims 10 to 14, according to which an operating mode defines at least one element from among a minimum throughput, a range of admissible throughputs comprised between a minimum throughput and a maximum throughput, a maximum latency, a range of admissible latencies comprised between a minimum latency and a maximum latency, a maximum jig, a maximum transmission cost, an ordering level of the mode in a mode ordering scale, a security level, a lifetime of the data of the flow.

16.- The processing method according to one of claims 10 to 15, comprising a telecommunication step with at least one other platform comprising the exchange of messages indicating the operating modes and the telecommunication resources which have been selected for the respective flows of packets remotely transmitted from the respective platforms.

17.- The processing method according to one of claims 10 to 16, according to which an application block receives the flow of packets delivered by the application from the set of application(s), determines, for said flow of packets, at least said first operating

mode and second operating mode and sends a request to a transport agent indicating said first and second operating modes; according to which the transport agent, upon receiving such a request, carries out said first selection, depending on the first and second operating modes indicated in the request, of an operating mode from among the first and second operating modes and of a telecommunication resource, defines a marking for the packets of said flow, answers the request from the application block, by indicating to the application block said marking defined for the packets of said flow, and orders the router to deliver all the packets bearing said marking to said selected resource for said flow; and according to which said application block, after receiving said answer, marks each received packet of said flow with said marking defined by the transport agent and delivers the marked packets to the router.

18.- The processing method according to claim 17 for a telecommunication platform further comprising an encryptor,

according to which a red portion of the application block exclusively processes the non-encrypted flow packets and a black portion of the application block exclusively processes the encrypted flow packets, and according to which the red portion of the application block receives the flow of packets delivered by an application from the set of application(s), determines, for each flow of packets, at least said first operating mode and second operating mode and sends a first request to the transport agent indicating said first and second operating modes;

according to which the transport agent, upon receiving the first request, carries out said first selection, depending on the first and second operating modes indicated in the first request, of an operating mode from among the first and second operating modes and a telecommunication resource, defines a temporary marking for the packets of said flow, stores said first and second operating modes indicated in the first request matching said temporary marking and answers the first request of the red portion of the application block, by indicating in a first answer to the red portion, said temporary marking defined for the packets of said flow,

according to which the red portion of the application block, after receiving said answer, marks each received packet of said flow with said temporary marking defined by the transport agent and delivers the marked packets to the encryptor ;

according to which said encryptor encrypts the packets delivered by the red portion of the application block, determines the address of an encryptor addressee depending on the address of the addressee of the flow and delivers to the black portion of the application

block the encrypted packets indicating in clear text the address of the encryptor addressee and the temporary marking;

according to which the black portion of the application block receives the encrypted packets delivered by the encryptor, and sends a second request to the transport agent

5 indicating the address of the encryptor addressee and said temporary marking;

the transport agent, upon receiving the second request, extracts the first and second operating modes stored and matched with the temporary marking which is indicated in the

second request, carries out said first selection, depending on said extracted first and second operating modes and on the address of the encryptor addressee, of an operating

10 mode from among the first and second operating modes and a telecommunication resource, defines a definitive marking for the packets of said flow, answers the red portion

and the black portion of the application block, by indicating to each of them said definitive marking for the packets of said flow, and orders the router to deliver all the packets

bearing said definitive marking to said selected resource for said flow;

15 the red portion of the application block, after receiving the definitive marking, marks each received packet of said flow with said definitive marking and delivers the thereby marked

packets to the encryptor ;

the black portion of the application block, after receiving the definitive marking, replaces with said definitive marking the temporary marking of each received packet of said flow

20 bearing said temporary marking and delivers to the router the thereby marked packets as well as the packets bearing the definitive marking and delivered by the encryptor.