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**METHOD FOR TRANSPORTING DATA, A RELATED DATA  
TRANSMITTING ELEMENT AND A DATA RECEIVING ELEMENT**

The present invention relates to a method as described in preamble of  
5 claim1 and claim2, to a related data transmitting device as described in  
preamble of claim 3, to a related data receiving element as described in  
preamble of claim 5 and claim 6 and the related software modules as described  
in the preamble of claims 7, 9 and 10.

Such a method and related network elements are generally known in  
10 the art. A data transmitting network element sends data-packets towards a  
destination through a communications network via an edge network element of  
the communications network. In order to prevent from network congestion  
caused by a data transmitting network elements transmitting data without taking  
capacity-constraints and other possible constraints into account, a maximum  
15 service level is negotiated between each of such data transmitting elements and  
the edge element. Such a service level specification nowadays is negotiated  
between both parties in a static way, for example by phone call or by e-mail.  
There may be a policing means within the edge element to check if incoming  
data-packet flows are in conformance with the agreed service level specification.  
20 In case that the data transmitting network element at a certain moment of time  
needs another service level, this should be renegotiated in the same static way.  
Then the service level providing system should be updated to actually provide the  
agreed service level. This is a very time-consuming and inefficient way of  
negotiating service level specifications. Currently there is no automatic  
25 negotiation and re-negotiation and the subsequent updating of the Service Level  
Specification possible.

An object of the present invention is to provide a method of the above  
known type but wherein the service level specification negotiation and at the  
same time the adaptation is performed in a more efficient way.

According to the present invention, this object is achieved by the method as claimed in claims 1 and 2, the related elements as claimed in claim 3 and claims 5 and 6 and the related software modules as claimed in claims 7, 9 and 10.

5               Indeed, by negotiating a service level specification between a data transmitter and a data receiver and vice versa on both ends of a Point-to-Point connection, based on predetermined criteria, during the establishment of the Point-to-Point connection by sending Internet Protocol Control Protocol messages, a service level specification is agreed between both parties and this  
10              service level specification is updated at the data receiving element. For this purpose there are new options defined for the Internet Protocol Control Protocol that forms part of the Point-to-Point Protocol, where this options contain service level specific parameters.

              This negotiation can be initiated by the data transmitting element as in  
15              claims 1, 5 and 7, or by the data receiving element as in claims 2, 6 and 10. In the latter case this is done by sending Internet Protocol Control Protocol messages to the data transmitting element if there are conditions that require the data receiving element to adapt the provided service level.

              A further characteristic feature of the present invention is described in  
20              claims 4 and 8. The received propose for a service level at the data transmitting element may be not satisfying in one or another way for the data transmitting element. If so the data transmitting element is able to notice this and to formulate another request for a service level that is sufficient for the data transmitting element. Re-negotiation of an existing service level specification is also possible  
25              by sending Internet Protocol Control Protocol messages requesting another service level specification.

              The above and other objects and features of the invention will become more apparent and the invention itself will be best understood by referring to the following description of an embodiment taken in conjunction with the  
30              accompanying drawings wherein:

FIG. 1 represents an internet network INNW wherein the method for transporting data is performed; and FIG.2 represents the functional built-up of the data transmitting element DTE and the data receiving element DRE as presented in FIG. 1.

5 In the following paragraphs, referring to the drawings, an implementation of the method according to the present invention will be described. Special attention will be drawn to the components of the data transmitting element and the components of the data receiving element as presented in FIG. 2. In the second paragraph, all connections between the  
10 before mentioned network elements and described components are defined. In the succeeding paragraph the actual execution of the service level specification negotiation is described.

The essential elements of this embodiment of the present invention are an internet network INNW, a data transmitting element DTE and a data receiving  
15 element DRE. In this embodiment the data transmitting element DTE is a customer premises equipment element, a personal computer.

This personal computer is used for sending data towards the data receiving network element DRE. The sending is done according to a pre-agreed service level specification defining quality of service aspects for the user of the  
20 personal computer. For example, in the service level specification specified Quality of service parameter is the maximum bit-rate of a certain diffserv class the sender is allowed to send .

In order to keep simplicity in this description it is chosen to only describe one personal computer DTE connected to the network, although there  
25 normally will be a plurality of such user-terminals.

Further there is a data receiving element DRE, that in this embodiment is chosen to be a network access server situated at the edge of the internet network INNW. This network access server provides the personal computer DTE access to the internet network INNW. Besides this, the network access server DRE

may take care of policing the data the personal computer DTE sends towards the network access server DRE.

The personal computer DTE is to be connected to the internet via a Point-to Point Protocol connection, further referred to as a PPP-connection.

5           The data transmitting element DTE as presented in FIG. 2 is built up of a data sending means DSM that takes care of sending data towards the data receiving element and a service level requesting means SL\_R\_M that is able to send a request to the data receiving element DRE for a predetermined service level for sending data, using an Internet Protocol Control Protocol request  
10       message for this purpose. Further there is a service level propose receiving means SLP\_R\_M that is able to receive an Internet Protocol Control Protocol propose for the service level to be provided and subsequently to notify the data sending means DSM of the propose for the service level to be provided. The data transmitting element DTE also comprises a service level propose renegotiating  
15       means SLP\_RN\_M that is able to check if a received Internet Protocol Control Protocol propose for a service level is satisfying and if not to formulate another request for a service level.

          The service level requesting means SL\_R\_M has an output-terminal that is at the same time an output-terminal  $O_1$  of the data transmitting element  
20       DTE. The data sending means DSM has an output-terminal that is at the same time an output-terminal  $O_2$  of the data transmitting element DTE.

          Further, the service level propose receiving means SLP\_R\_M, has an input-terminal that is at the same time an input-terminal  $I_1$  of the data transmitting element DTE and besides this an output-terminal that is coupled to  
25       an input-terminal of the data sending means DSM. The service level propose renegotiating means SLP\_RN\_M is coupled between a second output-terminal of the service level propose receiving means SLP\_R\_M and an input-terminal of the service level requesting means SL\_R\_M.

          The data receiving element DRE as presented in FIG. 2 comprises a  
30       receiving means DRM that is able to receive data from the data transmitting

element DTE. Further the data receiving element DRE contains service level request reception means SLR\_Re\_M that is adapted to receive a service level specification request from the data transmitting element DTE using an Internet Protocol Control Protocol message and a service level negotiating and proposing means SL\_NP\_M that is able to determine a service level specification based on at least one predetermined criterion and to formulate a propose for the service level specification. Then there is a service level proposal sending means SLP\_S\_M, that is adapted to send the propose for the service level specification using an Internet Protocol Control Protocol message.

10           The service level request reception means SLR\_Re\_M has an input-terminal that is at the same time an input-terminal  $I_2$  of the data receiving element DRE and an output-terminal that is coupled to an input-terminal of the service level negotiating and proposing means SL\_NP\_M that in its turn is coupled with an output-terminal to an input-terminal of the service level request reception means SLR\_Re\_M. The service level proposal sending means SLP\_S\_M has an output-terminal that is at the same time an output-terminal  $O_3$  of the data receiving element DRE. Then the data receiving means DRM contains an input-terminal that is at the same time an input-terminal  $I_3$  of the data receiving element DRE.

20           In order to explain the operation of the present invention it is assumed that the personal computer DTE needs a specific quality of service that is specified in a service level specification. It is assumed that the personal computer DTE needs to establish a dial-in connection using the Point-to-Point Protocol. In a phase of this connection establishment, Internet Protocol Control messages, further referred to as IPCP-message are sent towards the network access server DRE to negotiate several connection-parameters, for example an Internet Protocol-address.

It is further to be noticed that all in the following mentioned IPCP-messages or requests are not the normally used messages or requests but a

modified message or request in that sense that each IPCP-message may contain additional options carrying service level specification negotiable parameters.

In order to request a specific service level specification, the service level requesting means SL\_R\_M of the personal computer DTE sends an Internet Protocol Control Protocol request towards the network access server DRE for  
5 assigning another service level for sending data. The service level request reception means SLR\_Re\_M in its turn receives the Internet Protocol Control Protocol request for the service level from the data transmitting element DTE and forwards the request to the service level negotiating and proposing means  
10 SL\_NP\_M. The service level negotiating and proposing means SL\_NP\_M then determines a service level based on at least one predetermined criterion and subsequently formulates a propose for the service level to be provided. Such a criterion could be the current traffic on the outgoing links of the data receiving element DTE or a criterion available from a global network element like a policy  
15 server that can manage the entire internet network INNW.

Subsequently the service level negotiating and proposing means SL\_NP\_M hands the propose over to the service level proposal sending means SLP\_R\_M that in its turn sends an Internet Protocol Control Protocol message that contains the relevant parameters of the propose for the service level to the  
20 service level propose receiving means SLP\_R\_M of the data transmitting element DTE which receives the Internet Protocol Control Protocol propose for the service level. The service level propose receiving means SLP\_R\_M notifies the data sending means DSM of the propose for the service level.

The service level propose renegotiating means SLP\_RN\_M receives the  
25 forwarded service level propose from the service level propose receiving means SLP\_R\_M and subsequently checks if this Internet Protocol Control Protocol propose for the service level is satisfying. If not satisfying the service level propose renegotiating means SLP\_RN\_M formulates another request for the desired service level and forwards this towards the service level requesting means  
30 SL\_R\_M that in its turn further handles the request.

There may be a policing means (not shown in any of the figures) available within the data receiving element to determine if the data transmitting element sends data in compliance with the agreed service level.

5 It is to be remarked that the data receiving element DRE is also able to initiate a service level specification negotiation or re-negotiation by sending an unsolicited propose.

It is further to be remarked that the data transmitting element DTE and the data receiving element DRE in another embodiment may be implemented by two coupled routers.

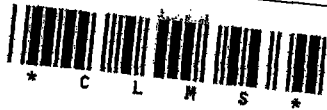
10 Although the above embodiment of the invention has been described by means of functional blocks, their detailed realisation based on this functional description should be obvious for a person skilled in the art and is therefore not described.

15 While the principles of the invention have been described above in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention, as defined in the appended claims.



## CLAIMS

1. Method for transporting data between a data transmitting network element (DTE) and a data receiving network element (DRE) via a point-to-point connection in a communications network comprising at least one of said data transmitting network element (DTE) and at least one of said data receiving network element (DRE), said method comprising the steps of:
- a. sending data towards said data receiving element (DRE) by said data transmitting element (DTE) via said point-to-point connection;
  - b. receiving said data sent by said data transmitting element (DTE) by said data receiving element (DRE), **CHARACTERISED IN THAT SAID** method further comprises the following steps:
    - c. sending an Internet Protocol Control Protocol request for a service level of sending data to said data receiving element (DRE) by said data transmitting element (DTE);
    - d. receiving said Internet Protocol Control Protocol service level request from said data transmitting element (DTE) by said data receiving element (DRE);
    - e. determining by said data receiving element (DRE) a service level based on at least one predetermined criterion and formulating an Internet Protocol Control Protocol propose of said service level that can be provided to said data sending element (DSE);
    - f. sending said Internet Protocol Control Protocol propose of said service level towards said data transmitting element (DTE);
    - g. receiving said Internet Protocol Control Protocol propose of said service level and using said propose of said service level by said data transmitting element (DTE).
2. Method for transporting data between a data transmitting network element (DTE) and a data receiving network element (DRE) via a point-to-point



connection in a communications network comprising at least one of said data transmitting network element (DTE) and at least one of said data receiving network element (DRE), said method comprising the steps of:

- 5       a. sending data towards said data receiving element (DRE) by said data transmitting element (DTE) via said point-to-point connection;
- b. receiving said data sent by said data transmitting element (DTE) by said data receiving element (DRE), **CHARACTERISED IN THAT SAID** method further comprises the following steps:
  - 10       c. determining by said data receiving element (DRE) a service level based on at least one predetermined criterion and formulating an Internet Protocol Control Protocol propose of said service level that can be provided to said data sending element (DSE);
  - d. sending said Internet Protocol Control Protocol propose of said service level towards said data transmitting element (DTE);
  - 15       e. receiving said Internet Protocol Control Protocol propose of said service level and using said propose of said service level by said data transmitting element (DTE).

3. Data transmitting element (DTE), to be used for sending data, over a link through a communications network towards a data receiving element (DRE), said data transmitting element comprising the following means:

- 20       a. data sending means (DSM), adapted to send data towards said data receiving element, **CHARACTERISED IN THAT SAID** data transmitting element (DTE) further comprises the following means:
  - 25       b. service level requesting means (SL\_R\_M), adapted to request said data receiving element (DRE) for a service level for sending said data using an Internet Protocol Control Protocol message;
  - c. service level propose receiving means (SLP\_R\_M), coupled with an output to an input of said data sending means (DSM) and adapted to receive an
  - 30       Internet Protocol Control Protocol propose for said service level and to notify said



data sending means (DSM) of said propose for said service level.

4. Data transmitting element (DTE) according to claim 3,

**CHARACTERISED IN THAT SAID** data transmitting element (DTE), further

- 5 comprises a service level propose renegotiating means (SLP\_RN\_M), coupled between an output-terminal of said service level propose receiving means (SLP\_R\_M) and an input-terminal of said service level requesting means (SL\_R\_M) and adapted to check if said Internet Protocol Control Protocol propose for said service level is satisfying and if not, to formulate another request for said service  
10 level.

5. Data receiving element (DRE), to be used for receiving data, over a link through a communications network from a data transmitting element (DTE), said data receiving element (DRE) comprising the following means:

- 15 a. data receiving means (DRM), adapted to receive data from said data transmitting element, **CHARACTERISED IN THAT SAID** data receiving element (DRE) further comprises the following means:
- b. service level request reception means (SLR\_Re\_M), adapted to receive a service level request from said data transmitting element (DTE) using an  
20 Internet Protocol Control Protocol message;
- c. service level negotiating and proposing means (SL\_NP\_M), coupled with an input to an output of said service level request reception means (SLR\_Re\_M) and adapted to determine a service level based on at least one predetermined criterion and to formulate a propose for said service level;
- 25 d. service level proposal sending means (SLP\_S\_M), coupled with an input to an output of said service level negotiating and proposing means (SL\_NP\_M) and adapted to send said propose for said service level using an Internet Protocol Control Protocol message.



6. Data receiving element (DRE), to be used for receiving data, over a link through a communications network from a data transmitting element (DTE), said data receiving element (DRE) comprising the following means:

5 a. data receiving means (DRM), adapted to receive data from said data transmitting element, **CHARACTERISED IN THAT SAID** data receiving element (DRE) further comprises the following means:

b. service level negotiating and proposing means (SL\_NP\_M), adapted to determine a service level based on at least one predetermined criterion and to formulate a propose for said service level;

10 c. service level proposal sending means (SLP\_S\_M), coupled with an input to an output of said service level negotiating and proposing means (SL\_NP\_M) and adapted to send said propose for said service level using an Internet Protocol Control Protocol message.

15 7. Software module for running on a processing system for inclusion in a data transmitting element (DTE), for sending data over a link through a communications network towards a data receiving element (DRE), said software module comprising the following sub-modules:

a. data sending sub-module, adapted to send data towards said data  
20 receiving element, **CHARACTERISED IN THAT SAID** software module further comprises the following sub-modules:

b. service level requesting sub-module, adapted to request said data receiving element (DRE) for a service level for sending said data using an Internet Protocol Control Protocol message;

25 c. service level propose receiving sub-module, adapted to receive an Internet Protocol Control Protocol propose for said service level and to notify said data sending sub-module of said propose for said service level.

8. Software module according to claim 7, **CHARACTERISED IN**  
30 **THAT SAID** software module, further comprises a service level propose



renegotiating sub-module, co-operating with said service level propose receiving sub-module and said service level requesting sub-module and adapted to check if said Internet Protocol Control Protocol propose for said service level is satisfying and if not, to formulate another request for said service level.

5                   9. Software module for running on a processing system for inclusion in a data receiving element (DRE), for receiving data over a link through a communications network from a data transmitting element (DTE), said software module comprising the following sub-modules:

a. data receiving sub-module, adapted to receive data from said  
10 data transmitting element (DTE), **CHARACTERISED IN THAT SAID** software module further comprises the following sub-modules:

b. service level request reception sub-module, adapted to receive a service level request from said data transmitting element (DTE) using an Internet Protocol Control Protocol message;

15                   c. service level negotiating and proposing sub-module, co-operating with said service level request reception sub-module and adapted to determine a service level based on at least one predetermined criterion and to formulate a propose for said service level;

d. service level proposal sending sub-module, co-operating with said  
20 service level negotiating and proposing sub-module and adapted to send said propose for said service level using an Internet Protocol Control Protocol message.

10. Software module for running on a processing system for inclusion  
25 in a data receiving element (DRE), for receiving data over a link through a communications network from a data transmitting element (DTE), said software module comprising the following sub-modules:

a. data receiving sub-module, adapted to receive data from said data transmitting element (DTE), **CHARACTERISED IN THAT SAID** software module  
30 further comprises the following means:



d. service level negotiating and proposing sub-module, adapted to determine a service level based on at least one predetermined criterion and to formulate a propose for said service level;

- 5 e. service level proposal sending sub-module, co-operating with said service level negotiating and proposing sub-module and adapted to send said propose for said service level using an Internet Protocol Control Protocol message.

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