



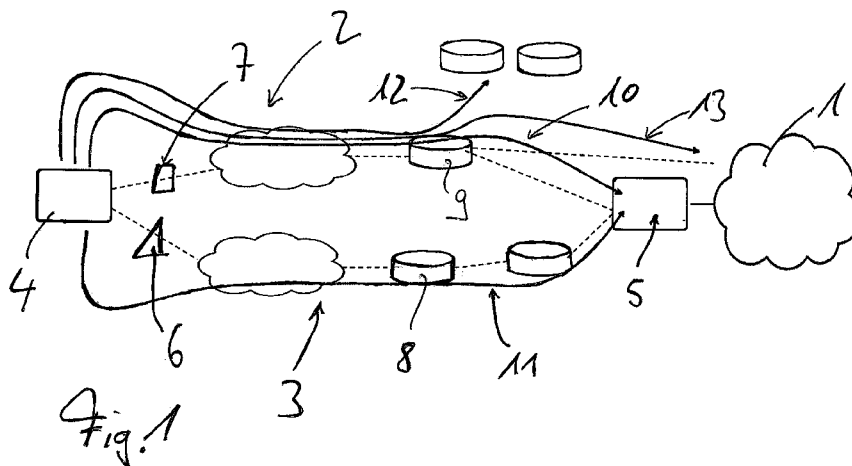
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- (71) **Applicant:** **DEUTSCHE TELEKOM AG** [DE/DE];
Friedrich-Ebert-Allee 140, 53113 Bonn (DE).
- (72) **Inventors; and**
- (71) **Applicants :** **HEIDEMANN, Cornelius** [DE/DE]; Pots-
damer Strasse 48a, 64372 Ober-Ramstadt (DE).
VÖHRINGER, Gerrit [DE/DE]; Tulpenweg 13, 53229
Bonn (DE). **LUDWIG, Christoph** [DE/DE]; Andersenweg
1, 53819 Neunkirchen-Seelscheid (DE).
- (74) **Agent:** **BRAUN-DULLAEUS, Karl-Ulrich**; Braun-
Dullaëus Pannen, Platz der Ideen 2, 40476 Düsseldorf
(DE).

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(54) **Title:** VOLUME-BASED ONLINE CHARGING IN HYBRID NETWORKS



(57) **Abstract:** Method and system for enabling charging of packet switched data transfer between an authorised customer and a network 1, especially the internet or an intranet, whereby the total data volume is transferred via at least two different data paths 2, 3 between an equipment 4 related to the customer, especially a customer premise equipment (CPE), and a hybrid access aggregation point (HAAP) 5, which constitutes an access to the network 1, whereby each of both data paths 2, 3 uses a different access technology for transferring its part of the data volume, whereby the total data volume is determined as a sum of the both parts of data volume transferred in both paths 2, 3 and this total data volume is used for charging purposes by a central charging unit 18, especially by an Online Charging System (OCS).

VOLUME-BASED ONLINE CHARGING IN HYBRID NETWORKS

The invention relates to a method and a system for enabling charging of packet switched data transfer between an authorised customer and a network, especially the internet or an intranet, whereby the total data volume is transferred via at least two different data paths between a customer premise equipment (CPE) and a hybrid access aggregation point (HAAP) which constitutes an access to the network whereby each of both data paths uses a different access technologies for transferring its part of the data volume. For example the one data path uses a DSL telephone network and the other data path a LTE mobile network.

In conventional networks, online charging is generally a well known technology to rate the used volume in a period for Internet/intranet access. An authorised customer uses his access to connect to the Internet/intranet and sends IP data packets (data) to servers in the internet/ intranet or receives IP data packets from servers in the internet/ intranet. In case of a flat-rate tariff each amount of the transmitted data is counted and subtracted from a fixed amount defined for a certain period. If the fixed amount of data is consumed by the customer an action occurs which is especially a reduction of transfer speed. By this technology it is possible to implement a fair use policy tariff options in mobile networks.

The mentioned technology is called "online charging" and is done by known "online charging Systems" (OCS). For mobile platforms the charging mechanism is standardised in ETSI TS 132 296. Unfortunately this mechanism for online charging is only available for networks which use a single physical access technology.

Besides, Hybrid Access Networks (HYAs) are known which combine two or more different access technologies (e.g. LTE and DSL) in an intelligent way. Hybrid Access Networks bond together the at least two physical access to one single

logical access with the goal to bring more bandwidth to the residential customer with the same behaviour of one IP access (bonded bandwidth). A HYA mechanism may need to have the capability in flexibly deciding the paths to forward data traffics.

It is the object of the invention to provide a comfortable online charging method and system which are easy to realise and to implement into existing technologies.

These objects are solved by the method with the characterising features of claim 1 and the system with the characterising features of claim 9. Preferred examples of the invention are mentioned in the dependant claims.

The major idea of the invention is to generate the total data volume as a sum of the at least both parts of data volume – these are the fractions of the total data volume which are transferred in a single path - transferred in both path and use this total data volume for charging purpose at one central point which is defined by the Online Charging System (OCS).

One major advantage of the inventive solution is that it is prepared to make use of proven mechanisms which are enhanced in a way, to allow charging a combined tunnel technology like the mentioned hybrid access. In other words, the inventive idea is to build one common tunnel over at least two different access technologies parallel, which are necessary for hybrid access.

In a preferred embodiment the passed parts of data volume are separately determined in each single path by a respective counter unit. After determination information about the respective part of data volume is transferred to a central charging unit, especially the online charging system (OCS), which is related to the Customer Premise Equipment (CPE). In that embodiment the central charging unit is that device which generates the sum of all single parts of data volume. The advantage of this arrangement is that the counter units still exist in each access technology and therefore can be used.

In a further embodiment the central charging unit is periodically provided with a fixed maximum volume of data per defined time period whereby the fixed maximum volume builds a threshold. While the central charging unit adds the single parts of

data volume it compares the resulting sum with this threshold. When the sum reaches - or in extreme passes - the threshold, the central charging unit induces an adverse effect regarding the access facility of the customer. Especially it induces a reduction of the transfer rate. For example this may happen when the customer has passed his internet flat rate.

In a very advantageous embodiment, the complete fixed maximum volume or flat rate is split into a number of small volume blocks whereby the central charging unit provides the single counter units with a sequence of these volume blocks as long as the sum of all volume blocks do not exceed the threshold defined by the fixed maximum volume. In a preferred embodiment the mechanism creates different block sizes whereby a decision mechanism calculates the next block size before assigning it to one of both service creations for hybrid access technologies.

Realising this mechanism the central charging unit may create a volume block of defined size containing an amount of data for each of both paths. Then it assigns the volume blocks to the respective counter units which for example may be realised by a fixed or mobile network gateway (BNG, GGSN). Each volume block builds a "partly" maximum volume (a separate threshold) for the respective counter unit. Provided with such a volume block the counter unit controls the part of data volume transported in the respective path. If this part of data volume exceeds the partly maximum volume defined by the volume block the counter unit obtains a new volume block by the central charging unit as long as the sum of all volume blocks does not exceed the threshold defined by the fixed maximum volume.

Preferably the central charging unit defines the size of the single volume blocks in relation to the remaining total volume and/or the current conditions for data transfer in the respective path.

With this inventive mechanism both physical accesses can be used independent from each other. Therefore online charging has to keep the behaviour of the underlying access in mind, that both access have to counted, independent from their state of usage and in such a way, that the user has the chance to use his paid volume and also in a way, that not to much volume is available for the user, in worst case the double of amount.

When such an online charging would be designed in a simple way, such a solution would assign the full volume twice, one volume for every access, so that in every situation (failure, use only one access) enough volume is available.

The technical realisation may be done by enhancing the OCS and the mechanism for multi SIM online charging. A new connection to the fixed platform may be built, which allows the OCS System to assign blocks and get status messages back from the service creation of the usages behaviour.

To implement the inventive "intelligent online charging system for hybrid access" (fair use policy hybrid access) for an hybrid access technology it is advantageous to design a OCS solution, which is able to handle one volume over both access platforms in a way, that the volume is nearly exacted counted, independent which access technology is used.

This may be done by calculating volume blocks as a defined part of the periodic fixed maximum volume and assign two blocks at the beginning of the period to the service creations (BNG and GGSN) of both access technologies. A service creation may be used as a network element, which can identify the customer and account the used volume. The block size is calculated, dependent of the maximum available bandwidth (e.g. narrowband access with low bandwidth and therefore small throughput) of both access technologies. If the block is consumed a new block is assigned to one or both access. The new blocks may be calculated dependent on how fast the volume was consumed and also dependent on the above described mechanism. Further it may be considered how much volume is left and how much volume was assigned to the second service creation.

The invention will be described in more detail by reference to the following figures:

Figure 1 a network topology with service creation points for counting and data flows for hybrid access and

Figure 2 a mechanism with intelligent block assignment.

Figure 1 discloses a typical network for hybrid access to the internet 1 or an intranet over two access networks, which in this case are a fixed DSL network 2 and a mobile LTE network 3. In the figure the physical network paths are symbolised by dashed lines and the (virtual) data paths by continuous lines. An authorised customer has hybrid access via his Customer Premise Equipment 4 (CPE) whereby a CPE connects multiple hosts to provide connectivity to service providers network. For access to the LTE network the CPE connects to an eNodeB 6 whereby the connection to the DSL network 2 uses a router 7.

The CPE 4 can flexibly decide which packets of the data volume should be forwarded through the LTE access network 3 when the DSL network 2 is heavily loaded. Each packet is associated to a single forwarding path while different packets belonging to the same flow could be transferred by different paths. Therefore, compared to flow-based solutions, the CPE in a packet-based solution can tune the bandwidth consumption on different paths in a flexible and fine-grained way.

The data transfer happens via the different paths between the CPE and a hybrid access aggregation point (HAAP) 5 which constitutes an access to the Internet 1. The HAAP acts as a service termination and a service creation implements bonding mechanism and sets up a high speed Internet dual stack IP connection with CPE on top of two or more hybrid access technologies. The packet reorder, reassemble functions in packet-based solutions should be supported on HAAP.

Both networks 2 and 3 include its own single counter unit as defined in the respective standard documentation. In case of the LTE network 3 the counter unit is a GGSN 8 (gateway GPRS support node) and in case of the DSL network a BNG 9 (broadband network gateway). The data paths of the DSL network is symbolised by a tunnel fixed line 10 and the path of the LTE network is symbolised by a tunnel mobile 11. Besides there is a separate path 12 for voice and entertainment and one other 13 for customer wishes.

In Figure 2 the mechanism with intelligent block assignment is shown. The figure is divided into the two paths, the DSL path 14 and the LTE path 15, whereby the DSL path 14 includes a BNG 16 and the LTE path a GGSN 17. A common central charging unit in form of an online charging system (OCS) 18 defines and provides

(arrows A and B) data blocks to both, the BNG 16 and the GGSN 17 whereby the BNG 16 is connected via the telephone network (FN) 19.

The figure 2 illustrates the inventive mechanism of assigning single data blocks over a specific time period whereby the OCS is provided with a fixed maximum volume of data (flat rate) per defined time period. The end of the time period is reached at the moment symbolised by line 20. At that point the customer has consumed his complete fixed maximum volume defined by his flat rate. In the subsequent phase 21 the data transfer speed is reduced up to the point 22 when the next fixed amount is available.

At the beginning OCS assigns two first blocks 23 and 24 to the service creations BNG and GGSN of both access technologies. Since the DSL has network has currently the better performance the assigned block 23 is larger than the block 24 for LTE. It is because the block size is calculated dependent of the maximum available bandwidth of both access technologies. If the particular block is consumed a new block is assigned to one or both access. This is done as long as the sum of all blocks added and assigned by the OCS is below the limit at line 20 which symbolises the achievement of the defined maximum capacity of data volume as given by the flat rate.

References

Figure 1

- 1 network
- 2 first path (fixed DSL network)
- 3 second path (mobile LTE network)
- 4 Customer Premise Equipment (CPE)
- 5 Hybrid Access Aggregation point (HAAP)
- 6 eNodeB
- 7 router
- 8 gateway GPRS support node (GGSN)
- 9 broadband network gateway (BNG)
- 10 tunnel fixed line
- 11 tunnel mobile line
- 12 separate path for voice and entertainment
- 13 path for customer wishes

Figure 2

- 14 DSL path
- 15 LTE path 15
- 16 BNG
- 17 GGSN
- 18 central charging unit (OCS)
- 19 telephone network
- 20 border line
- 21 subsequent phase
- 22 point
- 23 one first block
- 24 an other first block

Claims

1. Method for enabling charging of packet switched data transfer between an authorised customer and a network (1), especially the internet or an intranet, whereby the total data volume is transferred via at least two different data paths (2,3) between an equipment (4) related to the customer, especially a customer premise equipment (CPE), and a hybrid access aggregation point (HAAP) (5), which constitutes an access to the network (1), whereby each of both data paths (2,3) uses a different access technology for transferring its part of the data volume,
characterised by
determining the total data volume as a sum of the both parts of data volume transferred in both paths (2,3) and using this total data volume for charging purposes by a central charging unit (18), especially by an Online Charging System (OCS).
2. Method according to claim 1,
characterised in that
the transferred parts of data volume are determined separately in each single path (2,3) by a respective separate counter unit (8,9), whereby an information about the determined part of data volume is transferred from each separate counter unit (8,9) to the central charging unit (18) which uses the information for building the total data volume as the sum of the both parts of data volume.
3. Method according to claim 1 or 2,
characterised in that
the central charging unit (18) is periodically provided with a fixed maximum volume of data capacity per defined time period whereby the fixed maximum volume builds a threshold and whereby the central charging unit (18) compares the sum with this threshold for initiating an action when the threshold is reached or passed.

4. Method according to claim 3,
characterised in that
the central charging unit (18) induces an adverse effect regarding customers access facility, especially induces a reduction of the transfer rate assigned to the customer.
5. Method according to claim 3 or claim 4,
characterised in that
the central charging unit (18) splits the complete fixed maximum volume into a number of small volume blocks (23,24) and assigns them in sequence to the counter units (16,17) as long as the sum of all assigned volume blocks (23,24) do not exceed the threshold.
6. Method according to claim 5,
characterised in that
each counter (16,17) unit controls, whether the data transported in its related path exceeds the limit of the assigned volume block whereby a new volume block is assigned to the counter unit when the limit is reached or passed.
7. Method according to claim 5 or claim 6,
characterised in that
the central charging unit (18) creates different block sizes whereby a decision mechanism calculates the next block size before assigning it to one of both counter units.
8. Method according to one of the preceding claims,
characterised in that
the block size is calculated in relation to the momentary available maximum bandwidth of the single access technology.

9. System for enabling charging of packet switched data transfer between an authorised customer and a network (1), especially the internet or an intranet, comprising an equipment related to the customer (4), especially a customer premise equipment (CPE), and a hybrid access aggregation point (HAAP) (5), which constitutes an access to the network (1), and at least two different data paths (2,3) to transfer parts of a data volume whereby each of both data paths (2,3) uses a different access technology for data transfer,

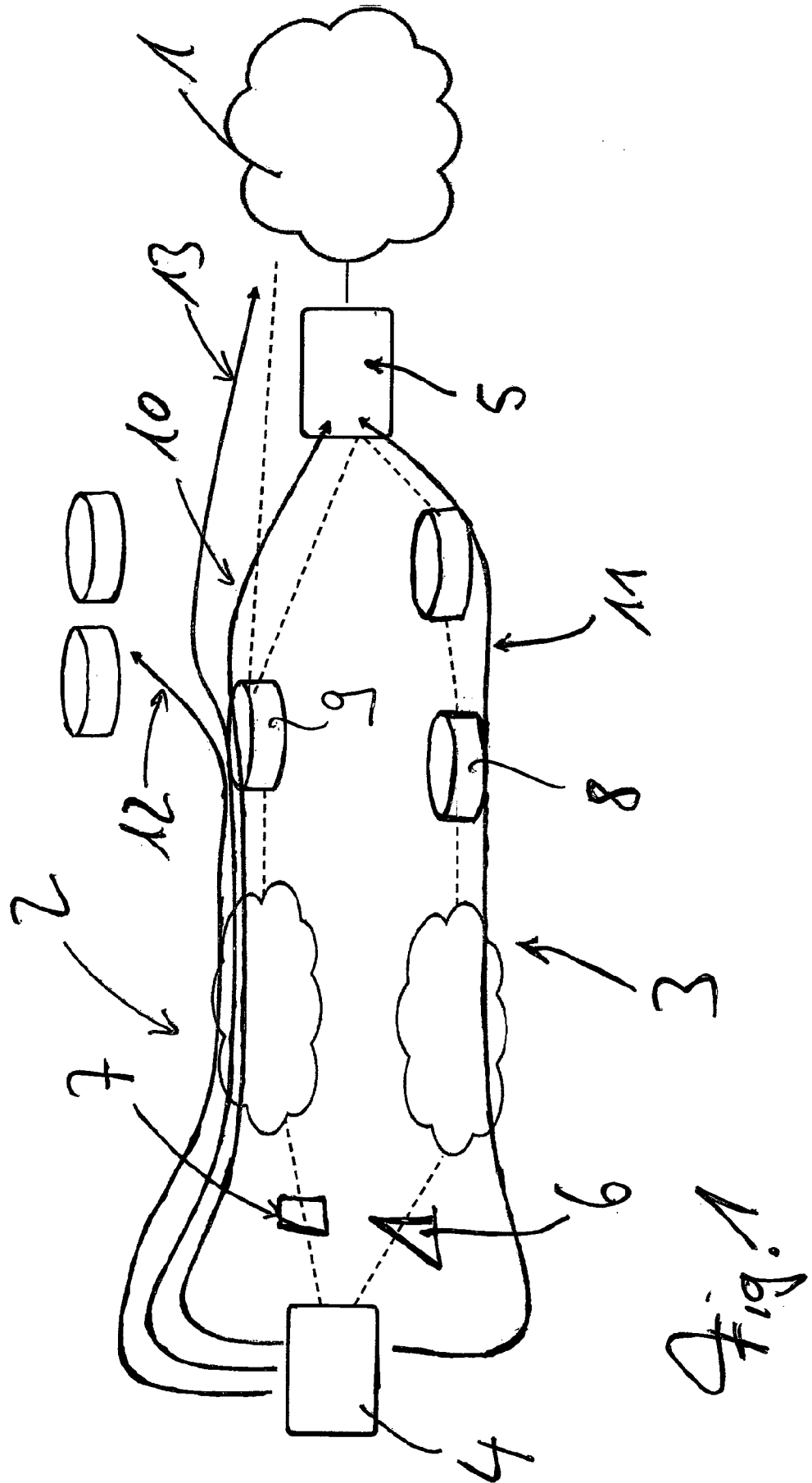
characterised by

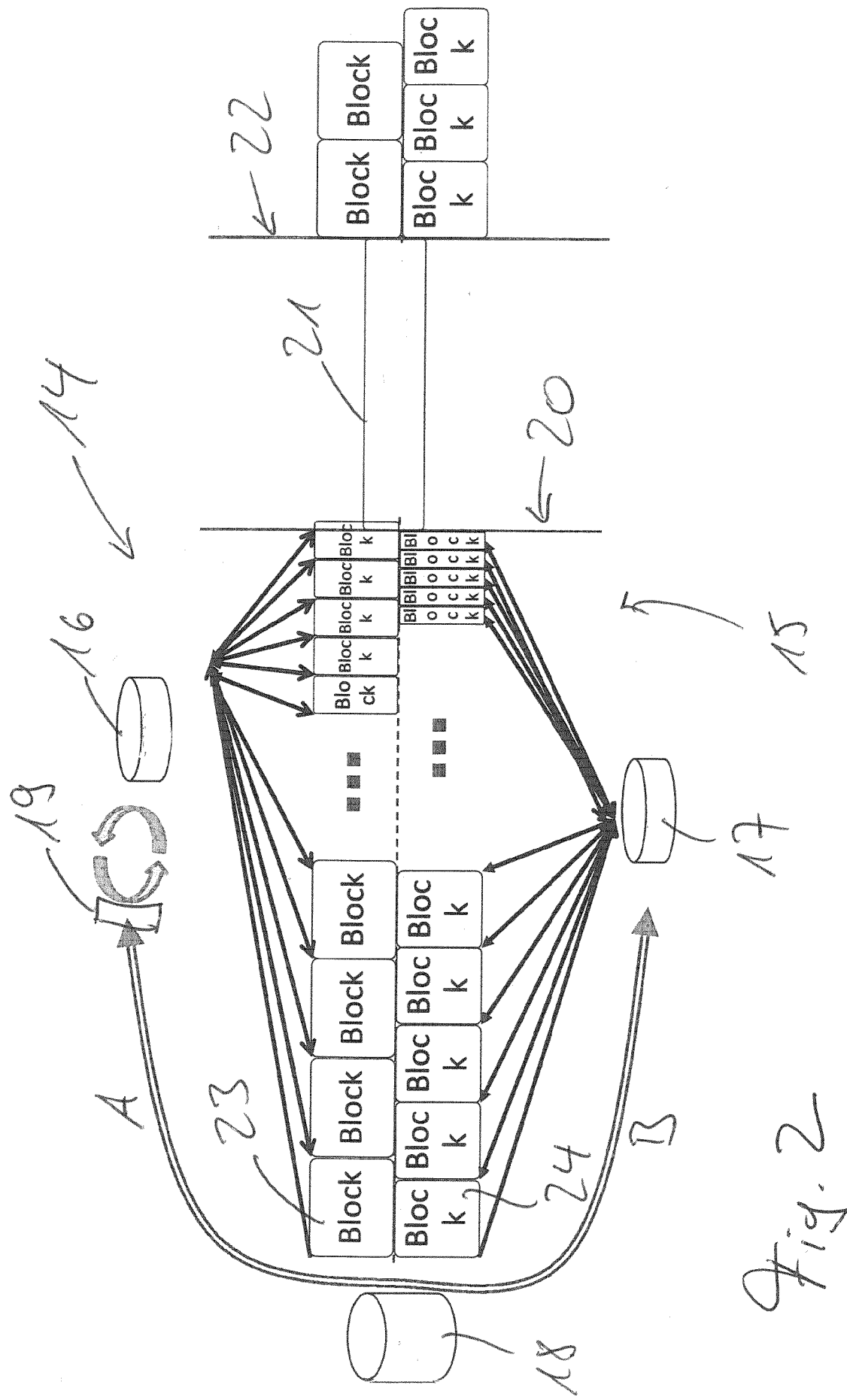
means (18) for determining the total data volume as a sum of the parts of data volume transferred via both paths (2,3) and
a central charging unit (18), especially an Online Charging System (OCS), using this total volume for charging purposes.

10. System according to claim 9,

characterised by

a separate counter unit (8,9,16,17) in each single path (2,3) for determining the part of data volume transferred in the related paths and for informing the central charging unit about the determined part of data volume.





INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER

INV. H04L12/14 H04W48/18

ADD. H04L12/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04L H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, COMPENDEX, INSPEC, IBM-TDB, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2014/355536 A1 (MULEY PRAVEEN VASANT [US] ET AL) 4 December 2014 (2014-12-04) abstract paragraph [0016] - paragraph [0047] paragraph [0084] - paragraph [0099] -----	1-10
A	EP 2 590 358 A1 (HUAWEI TECH CO LTD [CN]) 8 May 2013 (2013-05-08) abstract paragraph [0005] - paragraph [0011] paragraph [0036] - paragraph [0052] paragraph [0099] - paragraph [0107] figures 2,8 -----	1-10
A	WO 2009/092852 A1 (COMPTTEL CORP [FI]; TANTTU MIKA [FI]; LASSILA JUSSI [FI]) 30 July 2009 (2009-07-30) abstract page 43, line 6 - page 59, line 18 -----	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Aura Marcos, F

INTERNATIONAL SEARCH REPORT

Information on patent family members

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