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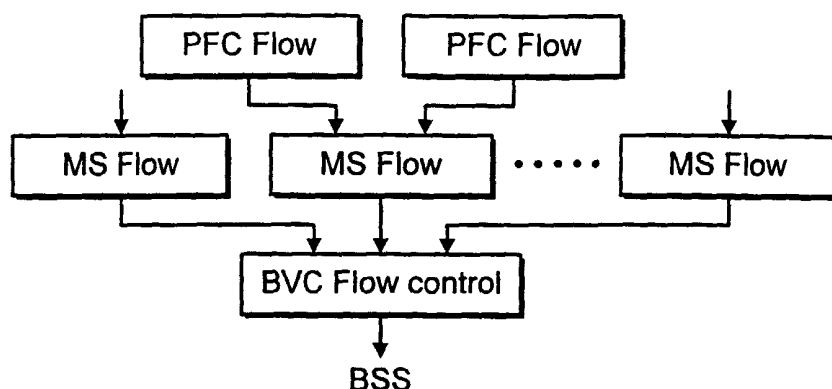
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(54) Title: DATA FLOW CONTROL IN A MOBILE COMMUNICATIONS SYSTEM

(57) Abstract: A method is disclosed for controlling data flow in a telecommunications network in which a base station communicates with a mobile station using a plurality of packet data flows, the packet data flows having respective data flow rates. The method comprises controlling data flow through the network by controlling the data flow rate of each packet data flow, an overall data flow rate to the mobile station and a data flow rate for each base station.

DATA FLOW CONTROL IN A MOBILE COMMUNICATIONS SYSTEM

The present invention relates to
telecommunications systems, and in particular to
5   digital mobile telephone systems.

Background of the Invention
        In a GPRS (General Packet Radio System) network a
mobile station (MS) may have several packet data flows
10   running at the same time. Each flow is known as a
packet data protocol (PDP) context. Typically one PDP
context would be run per application type or per
destination. The packet data flows may have different
quality of service (QoS) levels and different
15   destination points. In data flows between the serving
GPRS support node (SGSN) and the base station system
(BSS), two or more PDP contexts may be grouped together
to form a packet flow context (PFC) if they are of
similar QoS. The similar QoS profiles for the PDP
20   contexts that form a PFC are grouped into an aggregate
QoS profile. In the BSS, the PFC is treated as one
flow and no knowledge of the individual PDP context is
available. If the MS has several PDP contexts with
different QoS, there will be several PFC's to the same
25   MS. For each packet data flow the QoS profile
specifies the priority, guaranteed bit rate, guaranteed
delay etc. The attributes in the QoS per PDP context
are used when scheduling the MS in the SGSN. In the
BSS the aggregate QoS for a PFC is used to schedule the
30   MS on the radio interface.
        The data flow between the SGSN and the BSS is
controlled per BVCI (BSSGP virtual connection
identifier) and per MS with a flow control mechanism.
The rate of the data flow through the BSS from the SGSN
35   is determined by the transmission rate on the radio

interface to each MS.

The current GSM standard gives possibilities to control the data flow between the SGSN and the BSS per BVCI and per MS. An MS may have data flows running for several PFC's at the same time. The sum of these data flows to one MS is controlled with the flow control mechanism.

However, when the data flow to the BSS is only controlled per MS and per BVCI, the BSS has no possibility to inform the SGSN to increase or decrease the rate of data flow per PFC. This causes congestion for mobile stations with data flows of different QoS. The reason for this is that the MS buffers in the BSS may be filled with data for flows with low priority or low guaranteed bit rate and delay. The BSS then notifies the SGSN to decrease or to stop the data flow for this MS. Thus the SGSN cannot send new data for this MS to the BSS even if the data has high priority or high demands on throughput and delay.

More information concerning the current solution can be found in 3GPP TS 08.18v.8.7.0.

Summary of the Present Invention

An object of the present invention is to introduce an extended and improved flow control mechanism, which is more flexible than the prior art flow control mechanisms in mobile communications systems having a packet data transmission capability.

Another object of the present invention is a flow control mechanism that provides support for the QoS requirements in mobile communications systems having a packet data transmission capability.

According to the present invention, the data flow is controlled per packet data flow defined by an aggregate QoS profile in addition to being controlled

per MS and per cell identity. The data flow may then
be increased or decreased depending on the aggregate
QoS of the packet data flows for a mobile station. An
MS may have several packet data flows with respective
aggregate QoS. For an MS, the data flow may be
increased for a packet flow having an aggregate QoS
with high priority or high requirements on throughput
or delay. At the same time, the data flow may be
decreased for a packet data flow having an aggregate
QoS with low priority or low requirements on throughput
and delay for the same MS.

It is emphasised that the term "comprises" or
"comprising" is used in this specification to specify
the presence of stated features, integers, steps or
components, but does not preclude the addition of one
or more further features, integers, steps or
components, or groups thereof.

Brief Description of the Drawings

Figure 1 is a schematic drawing illustrating data
flows in a GPRS mobile telephone network;

Figure 2 illustrates flow control buffers; and

Figure 3 illustrates flow control in a GPRS mobile
telephone system.

Detailed Description of the Preferred Embodiment

A solution to overcome the problem of data flow
control in a GPRS network is to control data flow per
packet flow context of a mobile station in addition to
controlling the flow per mobile station and per BVCI.
The base station system can then control the data flow
with greater regard to the particular circumstances of
each context. For example, the BSS may decrease the
data flow with low priority or low guaranteed bit rate
and delay and at the same time increase the data flow

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with high priority or high guarantee bit rate and delay
for the same mobile station.

In the BSS there are several PFC's stored, one for
each aggregate QoS per MS. Some PFC's may be of the
5   same type - Conversational, Streaming, interactive or
Background. The BSS shall control the data flow from
the SGSN per BVCI and per MS, and also per PFC or per
PFC type of a MS. If one MS has several PFC's of the
same type, the data flow to these PFC's may be
10   controlled together.

Figure 1 illustrates flow control per BVCI,
individual MS and individual PFC per MS. The flow
control mechanism conforms to a leaky bucket algorithm.
The bucket has a size, a bucket full ratio and a leak
15   rate. The leak rate corresponds to the rate at which
the data flows on the radio interface in a cell.

In the BSS the bucket consists of a buffer for
every BVCI, individual MS and also for every individual
PFC per MS, see Figure 2. The BSS controls the data
20   flow from the SGSN to the BSS by indicating the bucket
size, the leak rate of the bucket and the bucket full
ratio per BVC, per individual MS and also per
individual PFC of a MS.

Figure 2 illustrates the buffers in the BSS for
25   which flow control is applied.

The buffers in the BSS are filled with data sent
by the SGSN. The BSS empties the buffers according to
the QoS for each PFC and MS. With the addition of flow
control per PFC, the SGSN gets information about how
30   much data each PFC buffer of a MS contains. Without
this information the SGSN would not know what type of
data each MS buffer contains. With flow control also
per PFC both the SGSN and the BSS get better control of
the data flows in a BVC and they are able to promote
35   data flows with high priority or high demands on

bitrate and delay.

When an MS buffer is almost full the data flow for one PFC of that MS may be decreased, while the other data flows are maintained. Thus giving the possibility to limit the data flow for low priority PFC's or PFC's with low bitrate and delay requirements. For example, the data flow for a Background PFC may be decreased or even stopped in order to be able to fulfil the guaranteed bitrate and delay for a data flow of Streaming PFC.

Figure 3 illustrates Flow Control in a GPRS system.

Data for a specific PFC belonging to an MS that is located in a BVC is sent from the SGSN to the BSS. The BSS may control the data flow per BVCI, individual MS and also per individual PFC for an MS. The additional flow control indication per PFC for each mobile station may for example be included in one of the existing flow control messages per BVCI or per MS, or it may construct a new message that is sent between the BSS and the SGSN. The PFC flow control information may consist of for example PFC bucket size, PFC bucket leak rate and PFC bucket full ratio. PFC's of the same type to one mobile station may be controlled together.

The embodiment of the present invention makes it possible to differentiate data flows with different quality of service levels for the same mobile station. Each data flow for each mobile station is treated separately according to its quality of service in the BSS.

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CLAIMS:

1.   A method of controlling data flow in a
telecommunications network in which a base station
communicates with a mobile station using a plurality of
packet data flows, the packet data flows having
respective data flow rates, wherein the method
comprises controlling data flow through the network by
controlling the data flow rate of each packet data
flow, an overall data flow rate to the mobile station
and a data flow rate for each base station.

2.   A method as claimed in claim 1, wherein the
packet data flow is controlled in dependence upon a
quality of service level associated therewith.

3.   A method as claimed in claim 1, wherein the
packet data flows are channelled through respective
buffers which are operable to receive, store and output
data from the associated packet data flows, the packet
data flows being controlled such that data output from
the buffers is dependant upon the quality of service
level for the packet data flow concerned.

4.   A method as claimed in claim 1, wherein the
packet data flows are packet flow contexts (PFCs).

5.   A method as claimed in claim 4, wherein the
data flow for a base station is a BVCI connection
(BSSGP virtual connection identifier).

6.   A method as claimed in any one of claims 1 to
5, wherein the network is a GPRS network.

7.   A telecommunications network comprising a
base station which is operable to communicate with a
mobile station using a plurality of packet data flows
associated with the mobile station, each packet data
flow having a data flow rate, wherein the base station
is operable to control data flow to a mobile station by
controlling the data flow rates of the packet data
flows associated with the mobile station concerned.

8. A network as claimed in claim 7, wherein the packet data flow is controlled in dependence upon a quality of service level associated therewith.

9. A network as claimed in claim 7 or 8, wherein the packet data flows are channelled through respective buffers which are operable to receive, store and output data from the associated packet data flows, the packet data flows being controlled such that data output from the buffer is dependent upon the quality of service level for the packet data flow concerned.

10. A network as claimed in claim 7, 8 or 9, wherein the packet data flows are packet data flow contexts (PFCs).

11. A network as claimed in claim 10, wherein the packet data flow for a base station is a BVCI connection (BSSGP virtual connection identifier).

12. A network as claimed in any one of claims 7 to 11, wherein the network is a GPRS network.

13. A base station apparatus for use in a telecommunications network, the base station apparatus including a data flow control unit which is operable to control packet data flow communication with a mobile station by controlling the data flow rates of packet data flows associated with the mobile station concerned.
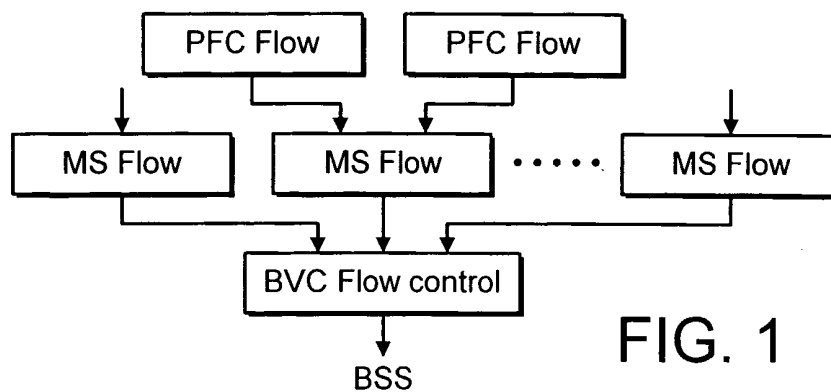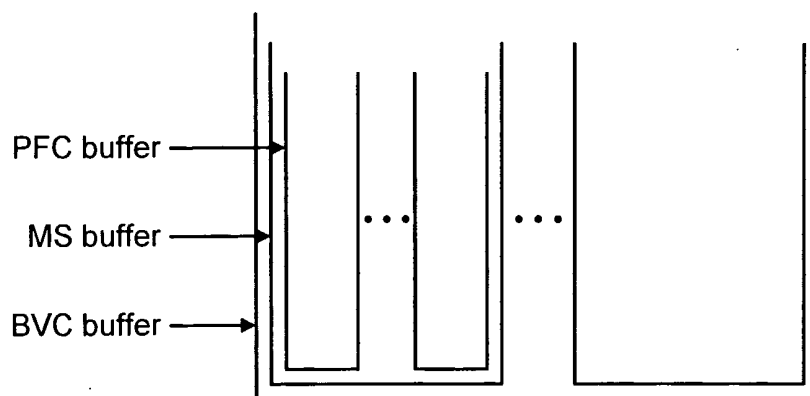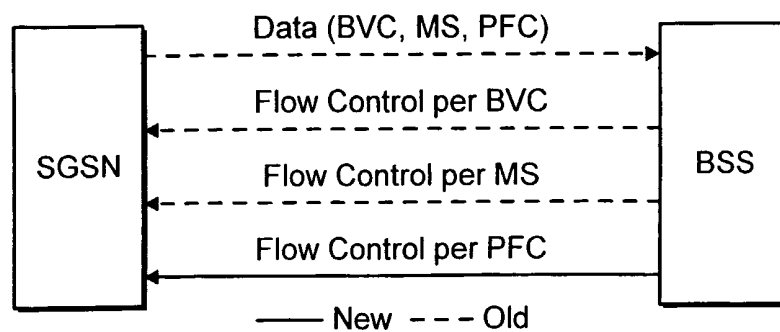
FIG. 1

FIG. 2

FIG. 3

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04Q7/22   H04L12/56

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)
IPC 7   H04Q   H04L

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 practical, search terms used)

EPO-Internal, WPI Data

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[X] Further documents are listed in the continuation of box C.   [X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the International search	Date of mailing of the international search report
17 May 2002	28/05/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Baas, G

International Application No

PCT/EP 01/15342

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