

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE	
Inventor: Timothy J. SPEIGHT	Confirmation No.: 5091
Applicant: Intellectual Ventures II LLC	Art Unit: 3992
U.S. Patent. No. 10,292,138 (<i>issued from Appl. No. 15/618,669, filed June 9, 2017</i>)	Examiner: Minh Dieu T. NGUYEN
Issue Date: May 14, 2019	Atty. Docket: 3059.736SPX0
Supplemental Examination Certificate Issued: April 20, 2020	Control No.: 96/000,323
Title: Determining Buffer Occupancy and Selecting Data for Transmission on a Radio Bearer	

Comments on Reasons for SNQ of Patentability Determination

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Commissioner:

Patent Owner thanks the Examiner for indicating that no substantial new question of patentability was raised in the request for Supplemental Examination. *See* Supplemental Examination Certificate dated April 20, 2020.

Patent Owner notes the Examiner's finding that reference Choi does not raise a substantial new question of patentability in the Reasons for Substantial New Question of Patentability Determination dated April 20, 2020, but takes no position regarding the reasoning undergirding the Examiner's finding. Patent Owner reserves the right to demonstrate that the claims of U.S. Patent No. 10,292,138 are patentable over the art of record for further reasons related to any of their recited features. Patent Owner further respectfully asserts that there may be additional reasons for patentability of the claims of U.S. Patent No. 10,292,138 not explicitly stated in this record and Patent Owner does not waive its rights to such arguments by not further addressing such reasons herein.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.

/Ross G. Hicks, #56,374/

Ross G. Hicks
Attorney for Patent Owner
Registration No. 56,374

Date: June 3, 2020

1100 New York Avenue, N.W.
Washington, D.C. 20005-3934
(202) 371-2600

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Electronic Acknowledgement Receipt	
EFS ID:	39614710
Application Number:	96000323
International Application Number:	
Confirmation Number:	5091
Title of Invention:	DETERMINING BUFFER OCCUPANCY AND SELECTING DATA FOR TRANSMISSION ON A RADIO BEARER
First Named Inventor/Applicant Name:	10292138
Customer Number:	26111
Filer:	Ross Gordon Hicks/Lynette Miller
Filer Authorized By:	Ross Gordon Hicks
Attorney Docket Number:	3059.736SPX0
Receipt Date:	03-JUN-2020
Filing Date:	31-MAR-2020
Time Stamp:	14:41:11
Application Type:	Supplemental Examination
Patent Number:	

Payment information:

Submitted with Payment	no				
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Miscellaneous Incoming Letter	2020-06-03-Comments-Reasons-SNQ-Patentability-3059-736SPX0.pdf	119797	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			119797		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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Issue Date: May 14, 2019	Atty. Docket: 3059.736SPX0
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Title: Determining Buffer Occupancy and Selecting Data for Transmission on a Radio Bearer	

Request for Refund Under 37 C.F.R. §§ 1.26(c)(3) and 1.625(c)

Attn: Mail Stop 16

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Commissioner:

Patent Owner hereby requests a refund under 37 C.F.R. §§ 1.26(c)(3) and 1.625(c) in the amount of \$12,100. This refund is to be credited to the credit card account from which the fee was originally provided, or credited to Deposit Account No. 19-0036.

Because no reexamination was ordered in response to the Request for Supplemental Examination filed for the above captioned patent, Patent Owner requests a refund of the \$12,100 reexamination fee.

A copy of the Supplemental Examination Certificate and Reasons for Determination of No SNQ of Patentability dated April 20, 2020, which indicate that no reexamination will be ordered, is attached.

Request for Refund – Control No. 96/000,323

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.

/Ross G. Hicks, #56,374/

Ross G. Hicks
Attorney for Patent Owner
Registration No. 56,374

Date: April 23, 2020

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
96/000,323	03/31/2020	10292138	3059.736SPX0	5091
26111 7590 04/20/2020 STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C. 1100 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005			EXAMINER NGUYEN, MINH DIEU T	
			ART UNIT 3992	PAPER NUMBER
			MAIL DATE 04/20/2020	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

(12) **SUPPLEMENTAL EXAMINATION CERTIFICATE**

**United States Patent
Speight**

(10) **Number:** US 10,292,138 F1
(45) **Certificate Issued:** Apr. 20, 2020

Control No.: 96/000,323

Filing Date: Mar. 31, 2020

Primary Examiner: MinhDieu Nguyen

No substantial new question of patentability is raised in the request for supplemental examination. See the Reasons for Substantial New Question of Patentability Determination in the file of this proceeding.

(56) Items of Information

FOREIGN PATENT DOCUMENTS

DE	10 2004 044 965	03/2006
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
96/000,323	03/31/2020	10292138	3059.736SPX0	5091
26111 7590 04/20/2020 STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C. 1100 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005			EXAMINER NGUYEN, MINH DIEU T	
			ART UNIT 3992	PAPER NUMBER
			MAIL DATE 04/20/2020	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

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REASONS FOR SUBSTANTIAL NEW QUESTION OF PATENTABILITY DETERMINATION

This is in response to a request for a supplemental examination under 35 U.S.C. 257 of claims 1-14 of U.S. Patent No. 10,292,138 (hereinafter "the '138 Patent"). The '138 Patent was issued on May 14, 2019.

The request for a finding of a substantial new question of patentability for claims 1-14 in the '138 Patent is **denied** in view of the fact that Choi does not raise a substantial new question of patentability as addressed below.

Notification of Concurrent Proceedings

The patent owner is reminded of the continuing responsibility under 37 CFR 1.985 to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving the '138 Patent throughout the course of this reexamination proceeding. The third party requester is also reminded of the ability to similarly apprise the Office of any such activity or proceeding throughout the course of this reexamination proceeding. See MPEP § 2686 and 2686.04.

PROSECUTION HISTORY

The '138 patent issued on May 14, 2019, from U.S. Application No. 15/618,669 ("the '669 application"), filed June 9, 2017.

The '669 application was originally filed with 8 claims.

On January 12, 2018, a non-final office action was mailed rejecting:

Claims 1-8 on the ground of non-statutory double patenting over claims 1-8 of US Patent 8,681,466;

Claims 1-8 on the ground of non-statutory double patenting over claims 5-6, 9-13, 15 of US Patent 9,320,018; and

Claims 1-2, 6-7 on the ground of non-statutory double patenting over claims 3, 9, 12, 14 of US Patent 8,428,026.

On July 12, 2018, Applicant mailed a response cancelling claims 1-8, adding new claims 9-22 and arguing that the claims amendment filed on 7/12/2018 rendering the non-statutory double patenting rejections moot.

On September 11, 2018, the Notice of Allowance was mailed with the reasons for allowance as follows (pages 6-7):

The prior art of the reference being relied upon and made of record, in single or in combination, does not disclose explicitly the limitations of:

"select data from the plurality of radio bearers for transmission using the single allocation of uplink resources, wherein the selection of the data occurs using a first iteration and a second iteration, wherein in the first iteration, the selection of the data is selected from a subset of the plurality of radio bearers based on the received parameters, wherein in the second iteration, the selection of the data is based on buffered data for respective radio bearers, and cause the transmitter to transmit a signal including the selected data" as disclosed in **Claim 9**.

"selecting, by the processor, data from the plurality of radio bearers for transmission using the single allocation of uplink resources, wherein the selection of the

data occurs using a first iteration and a second iteration; wherein in the first iteration, the selection of the data is selected from a subset of the plurality of radio bearers based on the received parameters; wherein in the second iteration, the selection of the data is based on buffered data for respective radio bearers; and transmitting, by the transmitter, a signal including the selected data” as disclosed in **Claim 16**.

Claims 9 and 16 are the patented claims 1 and 8, respectively in the ‘138 Patent.

On December 11, 2018, the RCE was filed along with an IDS by the Applicant.

On January 8, 2019, a second Notice of Allowance was mailed with the same reasons for allowance as stated in the first one dated 9/11/2018 (see page 7 of the second Notice of Allowance).

The ‘138 Patent was issued on May 14, 2019.

PROPOSED SUBSTANTIAL NEW QUESTIONS OF PATENTABILITY

The Requester requested a supplemental examination of claims 1-14 of the '138 patent based upon the following prior art patents:

German Patent Publication DE 10 2004 044 965 A1 to Choi et al., filed September 16, 2004, and published March 30, 2006 (herein after “Choi”).

Requester proposes rejection as follows:

SNQ1: Claims 1-14 are anticipated by Choi under 35 U.S.C. 102(a).

ANALYSIS OF SUBSTANTIAL NEW QUESTIONS OF PATENTABILITY

Analysis

A substantial new question of patentability is raised by a cited patent or printed publication when there is a substantial likelihood that a reasonable examiner would consider the prior art patent or printed publication important in deciding whether or not the claim is patentable. A substantial new question of patentability is not raised by prior art presented in a reexamination request if the Office has previously considered (in an earlier examination of the patent) the same question of patentability as to a patent claim favorable to the patent owner based on the same prior art patents or printed publications. In re Swanson, 88 USPQ2d 1196 (Fed. Cir. 2008).

Choi Reference

Choi fails to independently raise a substantial new question of patentability regarding claims 1-14 as presented in SNQ1. Choi fails to provide a technological teaching pertaining to the features (i.e., reason for allowance of claims 1 and 8) that distinguished the claimed invention over the prior art.

Choi discloses a mobile radio system (e.g., a global system for mobile communication) has a data securing layer-unit and data securing layer-protocol-buffer memories. Weighing values and/or weighing ranges of value stored in a load memory specify a portion of data communication bandwidth available for data communication, where the bandwidth is allocated for selecting data stored in the data securing layer-protocol-buffer memories.

Choi provides no teaching regarding "wherein the selection of the data occurs using a first iteration and a second iteration, wherein in the first iteration, the selection of the data is selected from a subset of the plurality of radio bearers based on the received parameters, wherein in the second iteration, the selection of the data is based on buffered data for respective radio bearers, and cause the transmitter to transmit a signal including the selected data" (claims 1 and 8).

The prosecution history suggests that these features were the reason for allowance of the claims. Choi fails to raise a substantial new question because Choi fails to teach the features that distinguished the claimed invention over the prior art.

Accordingly, Choi does not raise a substantial new question of patentability as to claims 1-14.

CORRESPONDENCE

All correspondence relating to this ex parte reexamination proceeding should be directed:

By EFS: Registered users may submit via the electronic filing system EFS-Web, at <https://efs.uspto.gov/efile/myportal/efs-registered>

By Mail to: Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand: Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

For EFS-Web transmissions, 37 CFR 1.8(a)(1)(i) (C) and (ii) states that correspondence (except for a request for reexamination and a corrected or replacement request for reexamination) will be considered timely filed if (a) it is transmitted via the Office's electronic filing system in accordance with 37 CFR 1.6(a)(4), and (b) includes a certificate of transmission for each piece of correspondence stating the date of transmission, which is prior to the expiration of the set period of time in the Office action.

Any inquiry concerning this communication or earlier communications from the Examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:
/Minh Dieu Nguyen/
Primary Examiner, Art Unit 3992
(571) 272-3873

Conferees:

/MATTHEW E HENEGHAN/
Primary Examiner, Art Unit 3992
/M.F/
Supervisory Patent Examiner, Art Unit 3992

Electronic Acknowledgement Receipt	
EFS ID:	39240259
Application Number:	96000323
International Application Number:	
Confirmation Number:	5091
Title of Invention:	DETERMINING BUFFER OCCUPANCY AND SELECTING DATA FOR TRANSMISSION ON A RADIO BEARER
First Named Inventor/Applicant Name:	10292138
Customer Number:	26111
Filer:	Ross Gordon Hicks/Lynette Miller
Filer Authorized By:	Ross Gordon Hicks
Attorney Docket Number:	3059.736SPX0
Receipt Date:	23-APR-2020
Filing Date:	31-MAR-2020
Time Stamp:	10:10:40
Application Type:	Supplemental Examination
Patent Number:	

Payment information:

Submitted with Payment	no				
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Refund Request	2020-04-23-refund-request-3059-736SPX0-96000323.pdf	255881 9f15c447bc4558e2484d7d8157d9a13660d15762	no	11
Warnings:					
Information:					
Total Files Size (in bytes):				255881	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
96/000,323	03/31/2020	10292138	3059.736SPX0	5091
26111 7590 04/20/2020 STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C. 1100 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005			EXAMINER NGUYEN, MINH DIEU T	
			ART UNIT 3992	PAPER NUMBER
			MAIL DATE 04/20/2020	DELIVERY MODE PAPER

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(12) **SUPPLEMENTAL EXAMINATION CERTIFICATE**

**United States Patent
Speight**

(10) **Number:** US 10,292,138 F1
(45) **Certificate Issued:** Apr. 20, 2020

Control No.: 96/000,323

Filing Date: Mar. 31, 2020

Primary Examiner: MinhDieu Nguyen

No substantial new question of patentability is raised in the request for supplemental examination. See the Reasons for Substantial New Question of Patentability Determination in the file of this proceeding.

(56) Items of Information

FOREIGN PATENT DOCUMENTS

DE	10 2004 044 965	03/2006
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The request for a finding of a substantial new question of patentability for claims 1-14 in the '138 Patent is **denied** in view of the fact that Choi does not raise a substantial new question of patentability as addressed below.

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PROSECUTION HISTORY

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The '669 application was originally filed with 8 claims.

On January 12, 2018, a non-final office action was mailed rejecting:

Claims 1-8 on the ground of non-statutory double patenting over claims 1-8 of US Patent 8,681,466;

Claims 1-8 on the ground of non-statutory double patenting over claims 5-6, 9-13, 15 of US Patent 9,320,018; and

Claims 1-2, 6-7 on the ground of non-statutory double patenting over claims 3, 9, 12, 14 of US Patent 8,428,026.

On July 12, 2018, Applicant mailed a response cancelling claims 1-8, adding new claims 9-22 and arguing that the claims amendment filed on 7/12/2018 rendering the non-statutory double patenting rejections moot.

On September 11, 2018, the Notice of Allowance was mailed with the reasons for allowance as follows (pages 6-7):

The prior art of the reference being relied upon and made of record, in single or in combination, does not disclose explicitly the limitations of:

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Claims 9 and 16 are the patented claims 1 and 8, respectively in the ‘138 Patent.

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The ‘138 Patent was issued on May 14, 2019.

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German Patent Publication DE 10 2004 044 965 A1 to Choi et al., filed September 16, 2004, and published March 30, 2006 (herein after “Choi”).

Requester proposes rejection as follows:

SNQ1: Claims 1-14 are anticipated by Choi under 35 U.S.C. 102(a).

ANALYSIS OF SUBSTANTIAL NEW QUESTIONS OF PATENTABILITY

Analysis

A substantial new question of patentability is raised by a cited patent or printed publication when there is a substantial likelihood that a reasonable examiner would consider the prior art patent or printed publication important in deciding whether or not the claim is patentable. A substantial new question of patentability is not raised by prior art presented in a reexamination request if the Office has previously considered (in an earlier examination of the patent) the same question of patentability as to a patent claim favorable to the patent owner based on the same prior art patents or printed publications. In re Swanson, 88 USPQ2d 1196 (Fed. Cir. 2008).

Choi Reference

Choi fails to independently raise a substantial new question of patentability regarding claims 1-14 as presented in SNQ1. Choi fails to provide a technological teaching pertaining to the features (i.e., reason for allowance of claims 1 and 8) that distinguished the claimed invention over the prior art.

Choi discloses a mobile radio system (e.g., a global system for mobile communication) has a data securing layer-unit and data securing layer-protocol-buffer memories. Weighing values and/or weighing ranges of value stored in a load memory specify a portion of data communication bandwidth available for data communication, where the bandwidth is allocated for selecting data stored in the data securing layer-protocol-buffer memories.

Choi provides no teaching regarding “wherein the selection of the data occurs using a first iteration and a second iteration, wherein in the first iteration, the selection of the data is selected from a subset of the plurality of radio bearers based on the received parameters, wherein in the second iteration, the selection of the data is based on buffered data for respective radio bearers, and cause the transmitter to transmit a signal including the selected data” (claims 1 and 8).

The prosecution history suggests that these features were the reason for allowance of the claims. Choi fails to raise a substantial new question because Choi fails to teach the features that distinguished the claimed invention over the prior art.

Accordingly, Choi does not raise a substantial new question of patentability as to claims 1-14.

CORRESPONDENCE

All correspondence relating to this ex parte reexamination proceeding should be directed:

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Commissioner for Patents
United States Patent & Trademark Office
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Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand: Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

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Any inquiry concerning this communication or earlier communications from the Examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:
/Minh Dieu Nguyen/
Primary Examiner, Art Unit 3992
(571) 272-3873

Conferees:

/MATTHEW E HENEGHAN/
Primary Examiner, Art Unit 3992
/M.F/
Supervisory Patent Examiner, Art Unit 3992



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

Patent Owner's Name and Address:

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005



Patent Number:
10292138

Control Number: 96/000,323

Date Mailed: 04/01/2020

NOTICE OF SUPPLEMENTAL EXAMINATION REQUEST FILING DATE

The patent owner is hereby notified that the filing date of the request for supplemental examination is 03/31/2020, the date that a request meeting all of the applicable requirements of 37 CFR §§ 1.605, 1.610, and 1.615 was received by the Office.

A supplemental examination certificate will issue within three months from the filing date of the request for supplemental examination. See 37 CFR 1.625.

This notice is being sent to the official correspondence address of record which, in a supplemental examination proceeding, is the official correspondence address of record in the patent file. See 37 CFR 1.33.

/PFLEWIS/

Central Reexamination Unit
(571) 272-6606, FAX NO. (571)273-9900

Patent Assignment Abstract of Title

Total Assignments: 6

Application #: 15618669

Filing Dt: 06/09/2017

Patent #: 10292138

Issue Dt: 05/14/2019

PCT #: NONE

Intl Reg #:

Publication #: US20180063862

Pub Dt: 03/01/2018

Inventor: Timothy J. Speight

Title: DETERMINING BUFFER OCCUPANCY AND SELECTING DATA FOR TRANSMISSION ON A RADIO BEARER

Assignment: 1

Reel/Frame: 047123 / 0613

Received: 10/10/2018

Recorded: 10/10/2018

Mailed: 10/11/2018

Pages: 2

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: SPEIGHT, TIMOTHY J.

Exec Dt: 06/12/2006

Assignee: IPWIRELESS, INC.

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Assignment: 2

Reel/Frame: 047255 / 0152

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Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: IPWIRELESS, INC.

Exec Dt: 12/24/2008

Assignee: NORTHROP GRUMMAN INFORMATION TECHNOLOGY, INC.

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Assignment: 3

Reel/Frame: 047212 / 0057

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Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: NORTHROP GRUMMAN INFORMATION TECHNOLOGY, INC.

Exec Dt: 11/03/2009

Assignee: IPWIRELESS, INC.

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Assignment: 4

Reel/Frame: 047790 / 0073

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Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: IPWIRELESS, INC.

Exec Dt: 04/27/2012

Assignee: INTELLECTUAL VENTURES HOLDING 81 LLC

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Assignment: 5

Reel/Frame: 046257 / 0337

Received: 07/03/2018

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Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: INTELLECTUAL VENTURES HOLDING 81 LLC

Exec Dt: 09/01/2015

Assignee: INTELLECTUAL VENTURES II LLC
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Assignment: 6

Reel/Frame: Q47124 / 0413 **Received:** 10/10/2018 **Recorded:** 10/10/2018 **Mailed:** 10/11/2018 **Pages:** 9

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: INTELLECTUAL VENTURES HOLDING 81 LLC

Exec Dt: 09/01/2015

Assignee: INTELLECTUAL VENTURES II LLC
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CONFIRMATION NO. 5091

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
96/000,323	03/31/2020	370	3992			
APPLICANTS INVENTORS 10292138, Residence Not Provided; INTELLECTUAL VENTURES II LLC (PATENT OWNER), WILMINGTON, DE; PATENT OWNER, Residence Not Provided; ** CONTINUING DATA ***** This application is a REX of 15/618,669 06/09/2017 PAT 10292138 * which is a CON of 15/131,250 04/18/2016 PAT 9681466 which is a CON of 13/858,666 04/08/2013 PAT 9320018 which is a CON of 13/212,843 08/18/2011 PAT 8428026 which is a CON of 11/430,421 05/08/2006 PAT 8005041 (*)Data provided by applicant is not consistent with PTO records. ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **						
Foreign Priority claimed ☐ Yes ☐ No 35 USC 119(a-d) conditions met ☐ Yes ☐ No Verified and Acknowledged <u>Examiner's Signature</u>		☐ Met after Allowance <u>Initials</u>	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
ADDRESS STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C. 1100 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005 UNITED STATES						
TITLE DETERMINING BUFFER OCCUPANCY AND SELECTING DATA FOR TRANSMISSION ON A RADIO BEARER						
FILING FEE RECEIVED 0.00	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees		
				☐ 1.16 Fees (Filing)		
				☐ 1.17 Fees (Processing Ext. of time)		
				☐ 1.18 Fees (Issue)		
				☐ Other _____		
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Litigation Search Report CRU 3999

Reexamination Control No. 96/000,323

To: Minh Dieu Nguyen	From: Renee Preston
Location: CRU	Location: CRU 3999 / REM 4C75
Art Unit: 3992	Phone: (571) 272-1607
Date: 03/31/2020	E-mail: renee.preston@uspto.gov

Search Notes

U.S. Patent No. 10,292,138

1. Performed a KeyCite Search in Westlaw, which retrieves all history on the patent including any litigation.
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3. Performed a search in Lexis in the Federal Courts and Administrative Materials databases for any cases found.
4. Performed a search in Lexis in the IP Journal and Periodicals database for any articles on the patent.
5. Performed a search in Lexis in the news databases for any articles about the patent or any articles about litigation on this patent.

Litigation: No Cases Found

Paper No. 03/31/2020

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1. SCHEDULING DATA TRANSMISSIONS IN A WIRELESS NETWORK Out Of Page US PAT APP 20130223384	Apr 08, 2013	Patents
2. FLEXIBLE RADIO ACCESS AND RESOURCE ALLOCATION IN A UNIVERSAL MOBILE TELEPHONE SYSTEM Out Of Page US PAT 6374112	Apr 01, 1999	Patents
3. PROCESS FOR CONTROLLING UPLINK PACKET TRANSMISSION IN A WIRELESS COMMUNICATION SYSTEM Out Of Page US PAT 6661777	Mar 29, 1999	Patents
4. BASIC QOS MECHANISMS FOR WIRELESS TRANSMISSION OF IP TRAFFIC Out Of Page US PAT 6845100	Aug 28, 2000	Patents
5. ASYNCHRONOUS TRANSFER MODE DATA TRANSMISSION SYSTEM Out Of Page US PAT 5566175	May 04, 1993	Patents
6. METHOD FOR COMMUNICATING DATA IN A WIRELESS COMMUNICATION SYSTEM Out Of Page US PAT 5742592	Sep 01, 1995	Patents
7. SUBSCRIBER-ORIGINATED CALL DEFERRED QUEUING Out Of Page US PAT 6078959	Jan 29, 1998	Patents
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9. METHOD AND APPARATUS FOR SCHEDULING ASSIGNMENT OF UPLINK PACKET TRANSMISSION IN MOBILE TELECOMMUNICATION SYSTEM Out Of Page US PAT APP 20050047416	Aug 25, 2004	Patents
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12. SCHEDULING OF MOBILE TERMINALS IN A MOBILE COMMUNICATION SYSTEM Out Of Page US PAT APP 20080254804	Feb 07, 2006	Patents
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22. ALLOCATION OF RADIO RESOURCES TO PACKETS IN ACCORDANCE WITH SERVICE QUALITIES UNDER RADIO COMMUNICATION ENVIRONMENT Out Of Plan US PAT APP 20030169746	Mar 05, 2003	Patents
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30. SERVICE DIFFERENTIATED DOWNLINK SCHEDULING IN WIRELESS PACKET DATA SYSTEMS Out Of Plan US PAT APP 20060242319	Feb 27, 2006	Patents
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Title	Date	Type
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54. SCHEDULING DATA TRANSMISSIONS IN A WIRELESS NETWORK Out Of Place US PAT 8428026	Aug 18, 2011	Patents
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59. METHOD AND ARRANGEMENT FOR POWER CONTROL Out Of Place WO 2003049320 A1	Dec 05, 2002	Patents
60. PACKET SCHEDULING OF REAL TIME PACKET DATA Out Of Place WO 2003085903 A1	Mar 19, 2003	Patents
61. QUALITY-OF-SERVICE (QOS)-AWARE SCHEDULING FOR UPLINK TRANSMISSION ON DEDICATED CHANNELS Out Of Place WO 2006037492 A1	Sep 23, 2005	Patents
62. MAPPING SERVICES TO RADIO BEARERS AND ALLOCATING BANDWIDTH TO THE RADIO BEARERS ACCORDING TO WEIGHT VALUES Out Of Place EP PAT 2027681 B1	Apr 27, 2007	Patents
63. Scheduling packet transmission in a mobile telecommunication system Out Of Place EP PAT 1511245 B1	Aug 26, 2004	Patents



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Document (1)

1. US Patent Issued to Intellectual Ventures II on May 14 for "Determining buffer occupancy and selecting data for transmission on a radio bearer" (Delaware Inventor)

Client/Matter: -None-

Search Terms: 10292138 or 10,292,138

Search Type: Terms and Connectors

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Delaware Inventor

May 15, 2019 Wednesday 12:38 AM EST

Dateline: ALEXANDRIA, Va.

"Determining buffer occupancy and selecting data for transmission on a radio bearer" was invented by Intellectual Ventures II LLC (Wilmington, Del.). According to the abstract* released by the U.S. Patent & Trademark Office: "A user equipment (UE) may determine and transmit to a network buffer occupancy associated with one or more radio bearers. The UE may select data for transmission from radio bearers using a received single allocation of uplink resources. The selection of the data may occur using a first single iteration and a second iteration." The patent was filed on June 9, 2017, under Application No. 15/618,669. *For further information, including images, charts and tables, please visit: <http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&&Sect2=HITOFF&&p=1&&u=%2Fnetacgi%2Fsearch-result.html&&r=1&&f=G&&l=50&&q1=AND&&d=PTXT&&s1=10292138&&OS=10292138&&RS=10292138> For any query with respect to this article or any other content requirement, please contact Editor at content@services@hlive.com

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE	
Inventor: Timothy J. SPEIGHT	Confirmation No.: To be assigned
Applicant: Intellectual Ventures II LLC	Art Unit: To be assigned
U.S. Patent. No. 10,292,138 (<i>issued from Appl. No. 15/618,669, filed June 9, 2017</i>)	Examiner: To be assigned
Issue Date: May 14, 2019	Atty. Docket: 3059.736SPX0
Title: Determining Buffer Occupancy and Selecting Data for Transmission on a Radio Bearer	

**Request for Supplemental Reexamination Under 35 U.S.C. § 257
of U.S. Patent No. 10,292,138**

Sir:

Intellectual Ventures II LLC (“Requester”) submits this Request for Supplemental Examination under 35 U.S.C. § 257 of U.S. Patent No. 10,292,138 B2 (the “’138 Patent”). In accordance with 35 U.S.C. § 257 and 37 C.F.R. §§ 1.601, 1.605, 1.610, 1.615, 1.620, and 1.625, Requester, through its undersigned counsel, requests supplemental examination of Claims 1–14 of the ’138 Patent, which issued on May 14, 2019 to Timothy J. Speight from application 15/618,669, filed June 9, 2017. The Requester is the owner of the entire right, title, and interest in the ’138 Patent (37 C.F.R. § 1.610(b)(9)). A Statement under 37 C.F.R. § 3.73(c) accompanies this Request for Supplemental Examination.

The supplemental examination fee required by 37 C.F.R. § 1.20(k)(1), reexamination fee request required by 37 C.F.R. § 1.20(k)(2), and any document size fees required by 37 C.F.R. § 1.20(k)(3), are submitted herewith. Any additional fees required for this Request for Supplemental Examination are hereby authorized to be charged to our Deposit Account No. 19-0036.

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TABLE OF EXHIBITS

PATENT FOR SUPPLEMENTAL REEXAMINATION

Exhibit A U.S. Patent No. 10,292,138 B2, entitled “Determining Buffer Occupancy and Selecting Data for Transmission on a Radio Bearer,” which issued on May 14, 2019, to Timothy J. Speight, from application 15/618,669, filed June 9, 2017 (the “‘138 patent”).

ITEMS OF INFORMATION

Exhibit B German Patent Publication DE 10 2004 044 965 A1 to **Choi et al.**, “Mobile radio system e.g. Global system for mobile communication, has load memory in which weighing values are stored, where values specify portion of bandwidth which is allocated to select data stored in buffer memories,” published March 30, 2006. An English translation accompanies this German publication.

I. INTRODUCTION

The '138 Patent issued on August 30, 2016, from Application Serial No. 15/618,669, filed on June 9, 2017. No maintenance fees are yet due. The '138 Patent is thus currently enforceable, and is therefore eligible for supplemental examination.

The individual requirements of 37 C.F.R. § 1.610 are addressed below.

II. § 1.610(a)

The \$4,400 fee for requesting supplemental examination under 37 C.F.R. § 1.20(k)(1) is being paid online via EFS-Web as a large entity. The \$12,100 fee for an *ex parte* reexamination ordered as a result of the supplemental examination proceeding under 37 C.F.R. § 1.20(k)(2) is being paid online via EFS-Web as a large entity. No fee appears to be due for excess page charges under 37 C.F.R. § 1.20(k)(3).

The Commissioner is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 19-0036.

III. § 1.610(b)(1): Identification of Number of the Patent

Supplemental examination under 35 U.S.C. § 257 is requested for U.S. Patent No. 10,292,138, entitled “Determining Buffer Occupancy and Selecting Data for Transmission on a Radio Bearer,” which issued on May 14, 2019, to Timothy J. Speight, from application 15/618,669, filed June 9, 2017.

IV. § 1.610(b)(2): List of Items of Information

Pursuant to 37 C.F.R. §§ 1.605(a) and 1.610(b)(2), below is a listing and discussion of the items of information to be considered in this supplemental examination. These same items are also cited in the contemporaneously-submitted Form PTO/SB/59.

- 1) German Patent Publication DE 10 2004 044 965 A1 to **Choi et al.**, “Mobile radio system e.g. Global system for mobile communication, has load memory in which weighing values are stored, where values specify portion of bandwidth which is allocated to select data stored in buffer memories,” published March 30, 2006. A copy, along with an English translation, is attached as Exhibit B.

V. § 1.610(b)(3): Prior or Concurrent Post-patent Office Proceedings

U.S. Patent No. 10,292,138 has not been involved in any prior or concurrent post-patent Office proceedings. Requester informs the Office of the concluded *inter partes* reviews below, which involve U.S. Patent Nos. 9,681,466 (the '466 patent) and 9,320,018 (the '018 patent), which are related to U.S. Patent No. 10,292,138 for which Supplemental Examination is requested:

Case No.	Patent No.	Date filed	Status
IPR2018-01764	9,320,018	Sept. 20, 2018	Institution Denied
IPR2018-01185	9,320,018	May 31, 2018	Terminated
IPR2018-01765	9,681,466	Sept. 20, 2018	Institution Denied
IPR2018-01289	9,681,466	June 20, 2018	Terminated

VI. § 1.610(b)(4): Identification of Claims

Supplemental examination is requested for Claims 1–14 of the '138 Patent.

VII. § 1.610(b)(5): Detailed Explanation

Requester submits herewith a copy of Choi. To satisfy 37 C.F.R. § 1.610(b)(5), the below charts are provided for claims 1-7 to explain which teachings of Choi may be considered by an examiner to be important when determining the patentability of the claims. Requester relies on the explanation of claim 1 to satisfy the requirement for claim 8, as they contain similar features. Because dependent claims 2-7, and 9-14 each include all of the limitations of their respective independent claims, Requester also relies upon the required explanation under 37 C.F.R. § 1.610(b)(5) of the manner of applying Choi to independent claim 1, provided below, as the required explanation under 37 C.F.R. § 1.610(b)(5) for the dependent claims. *See, e.g.,* MPEP § 2811.01(I) (“If the Requester wishes to rely upon the explanation of the manner of applying the item of information to the independent claim as the required explanation for the dependent claim, the Requester should so state.”) Also due to the similarity of features, Requester relies on the further explanation of claim 2 for claim 9, the further explanation of claim 3 for claim 10, the

further explanation of claim 4 for claim 11, the further explanation of claim 5 for claim 12, the further explanation of claim 6 for claim 13, and the further explanation of claim 7 for claim 14.

Please refer to section XII below for a detailed explanation of why Choi does not raise a substantial new question of patentability.

Claim 1	Choi
1. A user equipment (UE) comprising:	The following disclosure of Choi may be considered relevant to this element: “The invention relates to a mobile radio device, a mobile radio network control unit and a method for reading out data from a plurality of data link layer protocol buffers.” (Choi, [0001].) “A UMTS mobile radio system usually has a core network (CN), a mobile radio access network (UMTS terrestrial radio access network, UTRAN) and a large number of mobile radio end devices (user equipment, UE).” (Choi, [0003].)
a processor communicatively coupled to a transmitter and circuitry configured to receive; and the processor is configured to:	Choi does not appear to explicitly disclose this feature. However, the following disclosure of Choi may be considered relevant to this element: “Such a mobile radio device, such a mobile radio network control unit and such a method are known in the context of the mobile radio system as UMTS (Universal Mobile Telecommunications System).” (Choi, [0002].)
cause the circuitry to receive parameters associated with a plurality of radio bearers,	The following disclosure of Choi may be considered relevant to this element: “One of the three protocol layers of the UMTS air interface is known as the Radio Resource Control (RRC) protocol layer. The RRC protocol or the RRC protocol layer is for the construction and dismantling as well as for the (re) configuration of physical channels, transport channels, logical channels, signaling radio bearers and radio bearers, as well as for

	negotiating all parameters of the protocol layers Layer 1 and layer 2 responsible according to UMTS. For this purpose, the units of the RRC layer in the mobile radio terminal and mobile radio network control unit exchange corresponding RRC messages via the signaling radio bearers, as described in [3].” (Choi, [0005].)
determine a plurality of buffer occupancies, wherein each of the plurality of buffer occupancies is associated with one or more radio bearers of the plurality of radio bearers,	The following disclosure of Choi may be considered relevant to this element: “With the help of this information, the mobile radio network control unit can carry out corresponding configurations of the mobile radio terminal, for example to restrict or increase the usable transport formats of a mobile radio terminal or a handover to another mobile radio cell, a reconfiguration of the dedicated physical channels or carry out an RRC status change, in particular from a first RRC status CELL_DCH to a second RRC status CELL_FACH.” (Choi, [0009].) “The measurement result list shown in Table 1 is thus sent from an RRC unit in the mobile radio terminal to the RRC unit in the corresponding mobile radio network control unit and the respective RLC data buffer fill level is displayed for each radio bearer (RB).” (Choi, [0010].) “As described above, the mobile radio terminal 118 can communicate information (the so-called measurement report messages) about the traffic volume of a transport channel for the purpose of management of the mobile radio resources to the mobile radio network control unit 106, 107 assigned to it at the RRC level. The Serving Radio Network Controller (SRNC) is shown the RLC data buffer fill levels of the relevant transport channel, i.e. it is shown how much data is currently in the respective RLC data buffer memories of the mobile radio terminal 118.” (Choi, [0107].)

cause the transmitter to transmit a message including the plurality of buffer occupancies to a network,	The following disclosure of Choi may be considered relevant to this element: “One of the three protocol layers of the UMTS air interface is known as the Radio Resource Control (RRC) protocol layer. The RRC protocol or the RRC protocol layer is for the construction and dismantling as well as for the (re) configuration of physical channels, transport channels, logical channels, signaling radio bearers and radio bearers, as well as for negotiating all parameters of the protocol layers Layer 1 and layer 2 responsible according to UMTS. For this purpose, the units of the RRC layer in the mobile radio terminal and mobile radio network control unit exchange corresponding RRC messages via the signaling radio bearers, as described in [3].” (Choi, [0005].)
cause the circuitry to receive a single allocation of uplink resources,	The following disclosure of Choi may be considered relevant to this element: “As shown in FIG. 3 and in FIG. 4, the mobile radio terminal 118 is given the weighting of the individual priority queues 306 (explicit PQ weighting) by the UTRAN by means of an RRC message 500, as is shown by way of example in FIG. 5) and in addition the weighting bands within which the weighting of the priority queues 306 dynamically depending on the respective data buffer fill level of the priority queues 306, the data transmission situation in the respective mobile radio cell and the weightings of the other priority queues 306 in the mobile radio terminal 118 can be lowered or increased by the mobile radio communication network, in particular by the UMTS base station 108, 109, 110, 111 (priority queue weighting band).” (Choi, [0138].)
select data from the plurality of radio bearers for transmission using the single allocation of uplink resources,	The following disclosure of Choi may be considered relevant to this element: “Here, it is assumed without restriction of the

	general validity that the mobile radio terminal 118 communicates the respective data buffer fill levels of the data buffers of the individual priority queues 306 regularly, i.e., to the mobile radio communication network, via corresponding RRC messages. preferably at predetermined times or on request from the mobile radio network control unit 308.” (Choi, [0142].)
a distribution component configured to, wherein the selection of the data occurs using a first iteration and a second iteration, wherein in the first iteration, the selection of the data is selected from a subset of the plurality of radio bearers based on the received parameters, wherein in the second iteration, the selection of the data is based on buffered data for respective radio bearers, and cause the transmitter to transmit a signal including the selected data.	Choi does not appear to disclose this feature.

Claim 2	Choi
2. The UE of claim 1, wherein the plurality of radio bearers are associated with a plurality of channels.	The following disclosure of Choi may be considered relevant to this element: “By means of the RLC protocol layer 204 or by means of the units of the RLC protocol layer 204, the RRC protocol layer 207 is provided with its services by means of signaling radio bearers (SRB) 213 as service access points and the PDCP protocol layer 205 and the BMC protocol layer 206 by means of radio bearers (RB) 210 are offered as service access points. The signaling radio bearers and the radio bearers characterize how the RLC protocol layer 204 has to deal with the data packets. For this purpose, the transmission mode for each configured signaling radio bearer or Radio Bearer set. The following transmission modes are provided according to UMTS: Transparent Mode (TM), ? Unacknowledged Mode (UM), or ? Acknowledged Mode (AM).” (Choi, [0102].) “The RLC protocol layer 204 is modeled in such

	a way that there is an independent RLC entity per radio bearer or Signaling radio bearer there. Furthermore, the task of the RLC protocol layer or its entities 204 in the transmitting device, the user data and the signaling data of radio bearers or Signaling radio bearers to divide or combine into data packets. The RLC protocol layer 204 transfers the data packets created after the division or the merging to the MAC protocol layer 203 for further transport or further processing.” (Choi, [0103].)
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Claim 3	Choi
3. The UE of claim 1, wherein each radio bearer of the plurality of radio bearers is associated with at least one data flow or IP flow.	The following disclosure of Choi may be considered relevant to this element: “By means of the RLC protocol layer 204 or by means of the units of the RLC protocol layer 204, the RRC protocol layer 207 is provided with its services by means of signaling radio bearers (SRB) 213 as service access points and the PDCP protocol layer 205 and the BMC protocol layer 206 by means of radio bearers (RB) 210 are offered as service access points. The signaling radio bearers and the radio bearers characterize how the RLC protocol layer 204 has to deal with the data packets. For this purpose, the transmission mode for each configured signaling radio bearer or Radio Bearer set. The following transmission modes are provided according to UMTS: Transparent Mode (TM), ? Unacknowledged Mode (UM), or ? Acknowledged Mode (AM).” (Choi, [0102].) “The RLC protocol layer 204 is modeled in such a way that there is an independent RLC entity per radio bearer or Signaling radio bearer there. Furthermore, the task of the RLC protocol layer or its entities 204 in the transmitting device, the user data and the signaling data of radio bearers or Signaling radio bearers to divide or combine into data packets. The RLC protocol layer 204 transfers the data packets created after the division

	or the merging to the MAC protocol layer 203 for further transport or further processing.” (Choi, [0103].)
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Claim 4	Choi
4. The UE of claim 1, wherein the selected data is selected based on a priority or a Quality of Service (QoS).	The following disclosure of Choi may be considered relevant to this element: “The following summarized aspects can be considered particularly advantageous within the scope of the invention: The weighting of the data buffer memory, in particular the data buffer memory of the priority queues in the MAC-e sub-protocol layer, based on the quality of service of a requested communication service. ? The processing of the data temporarily stored in the data buffer memories of the priority queues and their transmission via the E-DCH transport channel on the basis of the weighting of the data buffer memories, in other words on the basis of the weighting values. ? The signaling of the weighting, i.e. the weighting values of the data buffer memories of the priority queues by means of RRC messages from the mobile radio network control unit RNC 106, 107 to the mobile radio terminal 118 and via the Iub interface 113, 114, 115, 116 between the mobile radio network control unit 106, 107 the associated UMTS base stations 108, 109, 110, 111. ? The assignment between the traffic class and the weighting value of the priority queues. ? The even distribution of the available data transmission bandwidth if a buffer memory of a priority queue has temporarily not stored any data to be transmitted. ? The first introduction of weighting bands, i.e. of weighting value ranges within which the weighting of the priority queues dynamically as a function of the respective data buffer fill level, the transmission situation in the mobile radio cell and the weightings of the other priority queues by the network, preferably by the respective UMTS base station 108, 109, 110, 111 can be lowered or

	increased.” (Choi, [0160].) Other paragraphs of interest include: [0017], [0045], [0054], [0120], [0122]-[0125].
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Claim 5	Choi
5. The UE of claim 1, wherein the plurality of radio bearers are associated with at least one packet data protocol (PDP) context.	Choi does not appear to disclose this feature.

Claim 6	Choi
6. The UE of claim 1, wherein the single allocation of uplink resources is received on a physical shared channel from a scheduler in the network.	The following disclosure of Choi may be considered relevant to this element: “As shown in FIG. 3 and in FIG. 4, the mobile radio terminal 118 is given the weighting of the individual priority queues 306 (explicit PQ weighting) by the UTRAN by means of an RRC message 500, as is shown by way of example in FIG. 5) and in addition the weighting bands within which the weighting of the priority queues 306 dynamically depending on the respective data buffer fill level of the priority queues 306, the data transmission situation in the respective mobile radio cell and the weightings of the other priority queues 306 in the mobile radio terminal 118 can be lowered or increased by the mobile radio communication network, in particular by the UMTS base station 108, 109, 110, 111 (priority queue weighting band).” (Choi, [0138].)

Claim 7	Choi
7. The UE of claim 1, wherein the subset of the plurality of radio bearers is associated with a Quality of Service (QoS).	The following disclosure of Choi may be considered relevant to this element: “The following summarized aspects can be considered particularly advantageous within the

	scope of the invention: The weighting of the data buffer memory, in particular the data buffer memory of the priority queues in the MAC-e sub-protocol layer, based on the quality of service of a requested communication service. ? The processing of the data temporarily stored in the data buffer memories of the priority queues and their transmission via the E-DCH transport channel on the basis of the weighting of the data buffer memories, in other words on the basis of the weighting values. ? The signaling of the weighting, i.e. the weighting values of the data buffer memories of the priority queues by means of RRC messages from the mobile radio network control unit RNC 106, 107 to the mobile radio terminal 118 and via the Iub interface 113, 114, 115, 116 between the mobile radio network control unit 106, 107 the associated UMTS base stations 108, 109, 110, 111. ? The assignment between the traffic class and the weighting value of the priority queues. ? The even distribution of the available data transmission bandwidth if a buffer memory of a priority queue has temporarily not stored any data to be transmitted. ? The first introduction of weighting bands, i.e. of weighting value ranges within which the weighting of the priority queues dynamically as a function of the respective data buffer fill level, the transmission situation in the mobile radio cell and the weightings of the other priority queues by the network, preferably by the respective UMTS base station 108, 109, 110, 111 can be lowered or increased.” (Choi, [0160].) Other paragraphs of interest include: [0017], [0045], [0054], [0120], [0122]-[0125].
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VIII. § 1.610(b)(6): Copy of Patent

A copy of the '138 Patent is being submitted contemporaneously. There are no disclaimers or certificates associated with the '138 Patent.

IX. § 1.610(b)(7): Copy of Each Item of Information

A copy of each cited item of information is being submitted contemporaneously. Submitted with Choi is an English translation of this German document. The English translation was provided by the European Patent Office's machine generation process.

X. § 1.610(b)(8): Summary

Information item "Choi," a foreign patent reference, comprises two parts, which together total over 50 pages of length. The first part (26 pages) is the original German version of this information item. The second part (48 pages) is the English translation of the abstract, specification, claims and drawings of the original German document. Each of these two complementary parts is less than 50 pages. The reader can readily identify the corresponding translated paragraphs in the specification using the paragraph numbers.

XI. § 1.610(b)(9): Identification of Owner

The Requester, Intellectual Ventures II LLC, is the owner of the entire right, title, and interest in the '138 Patent, as evidenced by the contemporaneously submitted Statement under 37 C.F.R. § 3.73(c).

XII. § 1.610(c)(3) and (4): Optional Further Explanation

Information item "Choi" describes a "system [that] has a data securing layer-unit and data securing layer-protocol-buffer memories. Weighing values and or weighing ranges of value stored in a load memory specify a portion of data communication bandwidth available for data communication, where the bandwidth is allocated for selecting data stored in the data securing layer-protocol-buffer memories. Transport format-selection unit (308) for selection of transport format. Independent claims are also included for the following: (A) a mobile radio network-control unit with a load memory (B) a method for selection of data." (Choi, Abstract.)

However, nowhere does “Choi” appear to disclose the feature (emphasis added):

“a distribution component configured to, wherein the selection of the data occurs using a **first iteration** and a **second iteration**, wherein in the first iteration, the selection of the data is selected from a subset of the plurality of radio bearers based on the received parameters, wherein in the second iteration, the selection of the data is based on buffered data for respective radio bearers, and cause the transmitter to transmit a signal including the selected data.”

In reviewing information item “Choi,” the word “iteration” does not appear at all, nor any comparable synonym. Nor does information item “Choi” appear to disclose the concept of selecting data in “iterations.”

For at least this reason, information item “Choi” does not raise a substantial new question of patentability against claims 1–14 of the ’138 Patent.

XIII. CONCLUSION

For the reasons discussed above, the Requester respectfully requests supplemental examination of Claims 1–14 of the ’138 Patent with respect to the cited items of information, and issuance of a supplemental examination certificate that the cited items of information do not raise a substantial new question of patentability as to any claims of the ’138 Patent.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.

/Ross G. Hicks, #56,374/

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Date: March 31, 2020

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Intellectual Ventures II LLC

Application No./Patent No.: 10,292,138 B2 Filed/Issue Date: May 14, 2019

Titled: Determining Buffer Occupancy and Selecting Data for Transmission on a Radio Bearer

Intellectual Ventures II LLC, a Corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is ____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.
- B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Timothy J. SPEIGHT To: IPWireless, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 047123, Frame 0613, or for which a copy thereof is attached.

2. From: IPWireless, Inc. To: Northrop Grumman Information Technology, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 047225, Frame 0152, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: Northrop Grumman Information Technology, Inc. To: IPWireless, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 047212, Frame 0057, or for which a copy thereof is attached.

4. From: IPWireless, Inc. To: Intellectual Ventures Holding 81 LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 047790, Frame 0073, or for which a copy thereof is attached.

5. From: Intellectual Ventures Holding 81 LLC To: Intellectual Ventures II LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 046257, Frame 0337, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
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☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Ross G. Hicks, #56,374/

Signature

Ross G. Hicks

Printed or Typed Name

March 31, 2020

Date

56,374

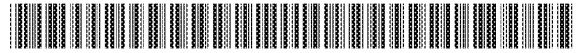
Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



(19)
Bundesrepublik Deutschland
Deutsches Patent- und Markenamt

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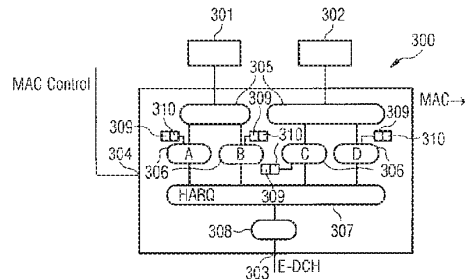
(56) Für die Beurteilung der Patentfähigkeit in Betracht
gezogene Druckschriften:
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EP 14 96 639 A2
EP 14 78 118 A1
EP 14 43 719 A1
WO 03/0 71 740 A1
3GPP TS 25.321 V6.2.0 (2004-06) 3rd Generation
Partnership Project, Technical Specification
Group Radio Access Network, Medium Access
Control
(MAC) protocol specification (Release 6);

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gemäß § 44 PatG ist gestellt.

(54) Bezeichnung: Mobilfunkeinrichtung, Mobilfunknetzwerk-Kontrolleinheit und Verfahren zum Auslesen von Daten aus einer Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern

(57) Zusammenfassung: Es werden jedem Datensicherungsschicht-Protokoll-Pufferspeicher ein Gewichtungswert und/oder ein Gewichtungswertebereich zugeordnet. Die Daten werden gemäß der durch die Gewichtungswerte und/oder Gewichtungswertebereiche angegebenen Reihenfolge aus den Pufferspeichern ausgelesen, wobei mit den Gewichtungswerten und/oder den Gewichtungswertebereichen jeweils ein Anteil der insgesamt verfügbaren Datenübertragungsbandbreite angegeben wird, welcher jeweils zum Auslesen der in dem jeweiligen Pufferspeicher gespeicherten Daten allokiert wird.



Beschreibung

[0001] Die Erfindung betrifft eine Mobilfunkeinrichtung, eine Mobilfunknetzwerk-Kontrolleinheit sowie ein Verfahren zum Auslesen von Daten aus einer Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern.

[0002] Eine solche Mobilfunkeinrichtung, eine solche Mobilfunknetzwerk-Kontrolleinheit sowie ein solches Verfahren sind im Rahmen des Mobilfunksystems als UMTS (Universal Mobile Telecommunications System) bekannt.

Stand der Technik

[0003] Ein UMTS-Mobilfunksystem weist üblicherweise ein Kernnetzwerk (Core Network, CN), ein Mobilfunk-Zugangsnetzwerk (UMTS Terrestrial Radio Access Network, UTRAN) sowie eine Vielzahl von Mobilfunk-Endgeräten (User Equipment, UE) auf. Gemäß UMTS ist ein Übertragungsmodus vorgesehen, bezeichnet als FDD-Modus (Frequency Division Duplex), in dessen Rahmen eine getrennte Signalübertragung in Uplink-Richtung (Uplink-Richtung – auch bezeichnet als Aufwärtsstrecke – bezeichnet eine Signalübertragungsrichtung von einem Mobilfunk-Endgerät zu einer jeweiligen Basisstation in dem Mobilfunk-Zugangsnetzwerk) und in Downlink-Richtung (Downlink-Richtung – auch bezeichnet als Abwärtsstrecke – bezeichnet eine Signalübertragungsrichtung von einer jeweils dem Mobilfunk-Endgerät zugeordneten Basisstation in dem Mobilfunk-Zugangsnetzwerk zu dem Mobilfunk-Endgerät) erfolgt durch eine separate Zuweisung von Frequenzen oder Frequenzbereichen.

[0004] Zur Übertragung von Daten zwischen einem Mobilfunk-Endgerät und einer jeweiligen Basisstation einer Mobilfunkzelle ist gemäß UMTS eine Luftschnittstelle definiert, welche in drei Protokollschichten gegliedert ist. Eine Übersicht sowie eine detaillierte Beschreibung der Luftschnittstellen-Protokollschichten gemäß UMTS sind in [1] zu finden.

[0005] Eine der drei Protokollschichten der UMTS-Luftschnittstelle, ist als Radio Resource Control (RRC)-Protokollschicht bekannt. Das RRC-Protokoll bzw. die RRC-Protokollschicht ist für den Aufbau und den Abbau sowie für die (Um-)Konfiguration von physikalischen Kanälen, Transportkanälen, logischen Kanälen, Signalling Radio Bearers und Radio Bearers, sowie für das Aushandeln aller Parameter der Protokollschichten der Schicht 1 und Schicht 2 gemäß UMTS verantwortlich. Hierzu tauschen die Einheiten der RRC-Schicht im Mobilfunk-Endgerät und Mobilfunk-Netzwerk-Kontrolleinheit über die Signalling Radio Bearers entsprechende RRC-Nachrichten aus, wie in [3] beschrieben.

[0006] Zum Zweck des Managements, allgemein der Verwaltung von Mobilfunk-Senderressourcen in dem Mobilfunk-Endgerät im Rahmen der Uplink-Paketdatenübertragung ist es bekannt, dass das Mobilfunk-Endgerät einer Mobilfunk-Netzwerk-Kontrolleinheit (Radio Network Controller, RNC) auf Ebene der RRC-Protokollschicht Information über das Datenverkehrsaufkommen in einem Transportkanal mitteilt. Dies erfolgt mittels so genannter Measurement-Report-Nachrichten. In diesem Zusammenhang werden, wie in der folgenden Tabelle 1 dargestellt, der aktuell zuständigen Mobilfunk-Netzwerk-Kontrolleinheit Datenpufferspeicher-Füllstände, d.h. der Füllstand der Datenpufferspeicher der RLC-Einheiten, für den betreffenden Transportkanal angezeigt. Anders ausgedrückt bedeutet dies, dass gemäß [3] der Mobilfunk-Netzwerk-Kontrolleinheit auf RRC-Schichtebene übermittelt wird, wie viele zu übertragende Daten sich aktuell in den Pufferspeichern der RLC-Einheiten des jeweiligen Mobilfunk-Endgeräts befinden.

[0007] Unter Mobilfunk-Senderressourcen sind in diesem Zusammenhang insbesondere die Sendeleistung des Mobilfunk-Endgeräts, die Anzahl sowie der Spreizfaktor der zugewiesenen CDMA-Codes zu verstehen.

[0008] Tabelle 1 zeigt ein Beispiel einer solchen Messergebnis-Liste, wie sie in [3] beschrieben ist:

Information Element/Group name	Need	Multi	Type and reference	Semantics description
Traffic volume measurement results	OP	1 to <maxRB>		
>RB Identity	MP		RB Identity 10.3.4.1 6	
>RLC Buffer Payload	OP		Enumerated(0, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2K, 4K, 8K, 16K, 32K, 64K, 128K, 256K, 512K, 1024K)	In bytes And N Kbytes = N*1024 bytes. Twelve spare values are needed.
>Average of RLC Buffer Payload	OP		Enumerated(0, 4, 8, 16, 32, 64, 128, 256, 512, 1024,	In bytes And N Kbytes = N*1024 bytes. Twelve spare values are needed.

Information Element/Group name	Need	Multi	Type and reference	Semantics description
			2K, 4K, 8K, 16K, 32K, 64K, 128K, 256K, 512K, 1024K)	
>Variance of RLC Buffer Payload	OP		Enumerated(0, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2K, 4K, 8K, 16K)	In bytes And N Kbytes = N*1024 bytes. Two spare values are needed.

Tabelle 1

[0009] Mit Hilfe dieser Informationen kann die Mobilfunk-Netzwerk-Kontrolleinheit entsprechende Konfigurationen des Mobilfunk-Endgeräts vornehmen, um beispielsweise die nutzbaren Transportformate eines Mobilfunk-Endgeräts einzuschränken bzw. zu erhöhen oder ein Handover zu einer anderen Mobilfunk-Zelle, eine Rekonfiguration der dedizierten physikalischen Kanäle oder einen RRC-Zustandswechsel, insbesondere von einem ersten RRC-Zustand CELL_DCH zu einem zweiten RRC-Zustand CELL_FACH durchzuführen.

[0010] Die in Tabelle 1 dargestellten Messergebnis-Liste wird somit von einer RRC-Einheit in dem Mobilfunk-Endgerät an die RRC-Einheit in der korrespondierenden Mobilfunk-Netzwerk-Kontrolleinheit gesendet und pro Radio Bearer (RB) wird der jeweilige RLC-Datenpufferspeicher-Füllstand angezeigt.

[0011] In dem Standardisierungsgremium 3GPP (3rd Generation Partnership Project) wird derzeit, wie in [2] beschrieben, an der Verbesserung der Paketdatenübertragung über dedizierte Transportkanäle der Aufwärtsstrecke, d.h. für die Uplink-Richtung bei der UMTS-Luftschnittstelle für den FDD-Modus, hinsichtlich der Erhöhung des Datendurchsatzes und der Übertragungsgeschwindigkeit gearbeitet. Zur besseren Abgrenzung gegenüber dem bereits existierenden dedizierten Transportkanal DCH wurde hierzu ein neuer dedizierter Transportkanal mit der Bezeichnung Enhanced Dedicated Channel (E-DCH) eingeführt. Die wesentlichen Eigenschaften dieses neuen Transportkanals beinhalten die Anwendung eines Hybrid Automatic Repeat Request-Verfahrens (HARQ-Verfahren) basierend auf dem N-channel Stop&Wait-Verfahren, ein von der Basisstation, bei UMTS auch als NodeB bezeichnet, kontrolliertes Scheduling sowie Rahmenlängen von kleiner oder gleich 10 ms.

[0012] Beim N-channel Stop&Wait-HARQ-Verfahren handelt es sich um ein Übertragungssicherungsverfahren, bei dem einem Mobilfunk-Endgerät eine Anzahl von N sog. HARQ-Prozessen konfiguriert wird, wobei ein HARQ-Prozess jeweils eine Instanz des Stop&Wait-Verfahrens darstellt. Pro HARQ-Prozess werden die Daten zum Netzwerk gesendet und solange zwischengespeichert, bis vom Netzwerk eine Bestätigung über korrekt empfangene Daten (Acknowledgement, ACK) empfangen wird. Andernfalls, d.h. im Fall nicht korrekt empfangener Daten (Negative Acknowledgement, NACK), werden die Daten zum Netzwerk wiederholt gesendet.

[0013] Beim NodeB kontrollierten Scheduling handelt es sich um ein Verfahren, bei dem das Scheduling im Mobilfunk-Endgerät, d.h. die Auswahl eines passenden Transportformats aus einer Menge von definierten Transportformaten für den E-DCH Transportkanal, derart kontrolliert wird, dass die NodeB in Abhängigkeit von der Verkehrssituation in der jeweiligen Funkzelle einem Mobilfunk-Endgerät die Nutzung von Transportformaten aus der Menge von definierten Transportformaten für den E-DCH Transportkanal temporär einschränken oder erweitern kann.

[0014] Es wurde jedoch bisher noch nicht darüber entschieden, wie im Detail die Daten über den neuen Transportkanal E-DCH über die UMTS-Luftschnittstelle übertragen werden sollen. Eine mögliche Lösung besteht darin, die Daten entsprechend ihrer Prioritäten auf verschiedene Datenpufferspeicher, so genannten Priority Queues (PQ), aufzuteilen, die daraufhin entsprechend ihrer Wichtigkeit, d.h. ihrer Priorität, bevorzugt oder weniger bevorzugt abgearbeitet und damit übertragen werden.

[0015] Wie oben dargelegt, wird ein Übertragungssicherungsverfahren (HARQ-Verfahren) angewendet, bei dem das Netzwerk dem Mobilfunk-Endgerät eine Bestätigung über korrekt bzw. nicht korrekt empfangene Daten sendet. Auch für diese Funktion beinhaltet das Mobilfunk-Endgerät verschiedene Datenpufferspeicher, um die Daten bis zur Bestätigung des korrekten Empfangs zwischenzuspeichern.

[0016] Beide Funktionen werden innerhalb der MAC-Protokollschicht in der neu vorgesehenen Teil-Protokollschicht, d.h. einer so genannten Medium Access Control Enhanced Uplink (MAC-e)-Entität ausgeführt, die sowohl endgeräteseitig als auch netzwerkseitig vorhanden, d.h. implementiert ist. Netzwerkseitig befindet sich die das Kommunikationsprotokoll gemäß MAC-e durchführende Entität in der NodeB, d.h. in der UMTS-Basisstation.

[0017] Insbesondere ist es möglich, dass ein Fall auftritt, dass niedriger priorisierte Daten eventuell eine sehr lange Zeit nicht übertragen werden können, wenn in der höher priorisierten Priority Queue der MAC-e-Teil-schicht ständig Daten zur Übertragung zwischengespeichert sind und zur Übertragung anstehen. In diesem Fall kann es auf diesen Priority Queues zu Überlastsituationen kommen, so dass im ungünstigsten Fall die jeweilige Quality-of-Service-Anforderung bestimmter Dienste nicht sichergestellt werden kann.

[0018] Ferner ist ein so genanntes Weighted Fair Queueing (WFQ)-Verfahren bekannt zur Priorisierung von zu übertragenden Datenpaketen. Die Datenpakete können einzelnen Warteschlangen zugewiesen und gewichtet werden. In diesem Zusammenhang ist es bekannt, Datenpakete von einem Datenstrom mit niedriger benötigter Datenrate höher zu gewichten und kleinere Datenpakete, verglichen mit längeren Frames, ebenfalls höher zu gewichten.

Aufgabenstellung

[0019] Der Erfindung liegt das Problem zu Grunde, eine Mobilfunkeinrichtung, eine Mobilfunknetzwerk-Kontrolleinheit sowie ein Verfahren zum Auslesen von Daten aus einer Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern anzugeben, bei dem auf einfache Weise gewährleistet werden kann, dass alle zu übertragenden Daten übertragen werden und dennoch eine Priorisierung der Daten im Rahmen der Datenübertragung beim Auslesen aus den Datensicherungsschicht-Pufferspeichern der Mobilfunkeinrichtung ermöglicht ist.

[0020] Das Problem wird durch die Mobilfunkeinrichtung, durch die Mobilfunknetzwerk-Kontrolleinheit sowie durch das Verfahren zum Auslesen von Daten aus einer Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern mit den Merkmalen gemäß den unabhängigen Patentansprüchen gelöst.

[0021] Bevorzugte Ausgestaltungen der Erfindung ergeben sich aus den abhängigen Ansprüchen.

[0022] Eine Mobilfunkeinrichtung weist mindestens eine Datensicherungsschicht-Einheit auf, welche die unterschiedlichen jeweils in der Mobilfunkeinrichtung vorgesehenen und implementierten Protokolle der Datensicherungsschicht gemäß dem in der Mobilfunkeinrichtung jeweils implementierten Protokollstapel durchführt. Ferner sind eine Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern vorgesehen, welche der mindestens einen Datensicherungsschicht-Einheit zugeordnet sind.

[0023] Eine Datensicherungsschicht weist in diesem Zusammenhang beispielsweise für den Fall, dass die Mobilfunkeinrichtung zur Kommunikation gemäß dem UMTS-Kommunikationsstandard eingerichtet ist, eine oder mehrere der folgenden Teilschichten auf:

- Funkverbindungs-Steuerungsschicht (Radio Link Control Layer, RLC),
- Paketdaten-Konvergierungsschicht (Packet Data Convergence Protocol Layer, PDCP),
- Broadcast/Multicast-Steuerungsschicht (Broadcast/Multicast Control Layer, BMC),
- Medium-Zugriffs-Steuerungsschicht (Medium Access Control Layer, MAC).

[0024] Ferner ist in der Mobilfunkeinrichtung ein Gewichtungsspeicher vorgesehen, in welchem Gewichtungswerte und/oder Gewichtungswertebereiche gespeichert sind, wobei jeweils ein Gewichtungswert und/oder ein Gewichtungswertebereich einem der Datensicherungsschicht-Protokoll-Pufferspeicher zugeordnet ist. Anders ausgedrückt bedeutet dies, dass zumindest ein Gewichtungswert und/oder ein Gewichtungswertebereich jedem der im Rahmen der erfindungsgemäßen Vorgehensweise zum Auslesen der Datenpufferspeicher berücksichtigten Datensicherungsschicht-Protokoll-Pufferspeicher zugeordnet sind/ist.

[0025] In diesem Zusammenhang ist anzumerken, dass die Erfindung sowohl auf alle als auch jeweils nur auf eine oder mehrere Teilschichten der Datensicherungsschicht mit beispielsweise den oben genannten Teilschichten oder auch den im Folgenden beschriebenen Teilschichten der Medium-Zugriffs-Steuerungsschicht angewendet werden kann. Anders ausgedrückt bedeutet dies, dass in jeder Teilschicht einzeln oder in allen Teilschichten gemeinsam den in der jeweiligen Teilschicht vorgesehenen Pufferspeichern jeweils ein Gewichtungswert und/oder ein Gewichtungswertebereich zugeordnet sein kann.

[0026] Weiterhin ist eine Datensicherungsschicht-Protokoll-Pufferspeicher-Ausleseeinrichtung vorgesehen, welche derart eingerichtet ist, dass sie die in den Datensicherungsschicht-Protokoll-Pufferspeichern zwischengespeicherten Daten gemäß einer durch die Prioritäten angegebenen Reihenfolge aus den Datensicherungsschicht-Protokoll-Pufferspeichern ausliest. Mit den Gewichtungswerten und/oder Gewichtungswertebereichen wird jeweils ein Anteil der insgesamt zur Datenübertragung verfügbaren Datenübertragungsbandbreite angegeben, welche jeweils zum Auslesen der in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher gespeicherten Daten allokiert, d.h. reserviert wird.

[0027] Im Rahmen dieser Beschreibung ist unter einer einer Priority Queue zugeordneten Priorität die relative oder absolute Bedeutung der in dem Pufferspeicher der jeweiligen Priority Queue zwischengespeicherten Daten zu verstehen.

[0028] Unter einem Gewichtungswert ist im Rahmen dieser Beschreibung eine Angabe einer Datenübertragungsbandbreite zu verstehen, welche jeweils zum Auslesen der in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher gespeicherten Daten allokiert werden soll, anders ausgedrückt, reserviert werden soll.

[0029] Unter einem Gewichtungswertebereich ist im Rahmen dieser Beschreibung eine Angabe eines Inter-

valls einer Datenübertragungsbandbreite zu verstehen, innerhalb der die jeweils zum Auslesen der in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher gespeicherten Daten zu allozierende Datenübertragungsbandbreite zulässig gewählt werden kann.

[0030] In einer Mobilfunkeinrichtung, welche vorzugsweise als Mobilfunk-Basisstation eingerichtet ist, beispielsweise in dem zellularen Mobilfunksystem UMTS als NodeB bezeichnet, ist ebenfalls mindestens eine Datensicherungsschicht-Einheit vorgesehen. Ferner ist ein Gewichtungsspeicher vorgesehen, in welchem Gewichtungswerte und/oder Gewichtungswertebereiche gespeichert sind, wobei mit den Gewichtungswerten und/oder mit den Gewichtungswertebereichen jeweils ein Anteil der insgesamt zur Datenübertragung einer anderen Mobilfunkeinrichtung, vorzugsweise einem Mobilfunk-Endgerät, verfügbaren Datenübertragungsbandbreite angegeben wird, welche jeweils zum Auslesen der in den jeweiligen Datensicherungsschicht-Protokoll-Pufferspeichern gespeicherten Daten in der anderen Mobilfunkeinrichtung allokiert, anschaulich reserviert, werden soll. Ferner ist eine Gewichtungs-Übertragungseinrichtung vorgesehen, welche eingerichtet ist zum Übertragen der Gewichtungswerte und/oder Gewichtungswertebereiche zu der anderen Mobilfunkeinrichtung.

[0031] Eine Mobilfunknetzwerk-Kontrolleinheit weist ebenfalls einen Gewichtungsspeicher auf, in welchem Gewichtungswerte und/oder Gewichtungswertebereiche gespeichert sind, wobei mit den Gewichtungswerten und/oder den Gewichtungswertebereichen jeweils ein Anteil der insgesamt zur Datenübertragung einer anderen Mobilfunkeinrichtung zu verwendende Datenübertragungsbandbreite angegeben wird, welche jeweils zum Auslesen der in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher in der anderen Mobilfunkeinrichtung gespeicherten Daten allokiert werden soll. Ferner ist eine Gewichtungs-Übertragungseinrichtung vorgesehen, welche eingerichtet ist zum Übertragen der Gewichtungswerte und/oder Gewichtungswertebereiche zu der anderen Mobilfunkeinrichtung.

[0032] Bei einem Verfahren zum Auslesen von Daten aus einer Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern, welche mindestens einer Datensicherungsschicht-Einheit zugeordnet sind, werden in einer Mobilfunkeinrichtung die folgenden Schritte durchgeführt:
Jedem Datensicherungsschicht-Protokoll-Pufferspeicher wird ein Gewichtungswert und/oder Gewichtungswertebereich zugeordnet.

[0033] Die in den Pufferspeichern zwischengespeicherten Daten werden gemäß einer durch die Gewichtungswerte und/oder Gewichtungswertebereiche angegebenen Reihenfolge ausgelesen, wobei mit den Gewichtungswerten und/oder den Gewichtungswertebereichen jeweils ein Anteil der insgesamt zur Datenübertragung verfügbaren Datenübertragungsbandbreite angegeben wird, welche jeweils zum Auslesen der in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher gespeicherten Daten allokiert wird.

[0034] Die jeweils zugeordneten Datenübertragungsbandbreiten sind vorzugsweise immer größer Null. In einer Ausgestaltung der Erfindung ist es in dem Fall, in dem temporär keine Daten eines bestimmten Service übertragen werden vorgesehen, dass der Mobilfunkeinrichtung von dem Netzwerk eventuell temporär eine Datenübertragungsbandbreite gleich Null Hz für einen bestimmten Datenpufferspeicher zugeordnet werden kann.

[0035] In diesem Zusammenhang ist anzumerken, dass die Datensicherungsschicht-Protokoll-Pufferspeicher einer oder mehrerer Teil-Protokollschichten und/oder der Gewichtungsspeicher als ein gemeinsamer Speicher mit jeweils den unterschiedlichen Speichern logisch zugeordneten Speicherbereichen eingerichtet sein können oder auch als separate Speicher.

[0036] Anschaulich kann die Erfindung darin gesehen werden, dass aufgrund der Allokation einer definierten Datenübertragungsbandbreite von vorzugsweise jeweils größer Null Hz für jeden Pufferspeicher, in welchen Daten zwischengespeichert sind und aus welchem Pufferspeicher Daten ausgelesen werden, gewährleistet ist, dass tatsächlich aus allen Pufferspeichern Daten ausgelesen und dem Übertragungsmedium, d.h. in diesem Fall vorzugsweise der oder den Einheiten der physikalischen Schicht und damit dem physikalischen Übertragungsmedium, insbesondere einer Funkschnittstelle, zugeführt werden.

[0037] Somit ist ausgeschlossen, dass Daten, welche einem Datenpufferspeicher mit sehr niedriger Priorisierung zwischengespeichert werden, überhaupt nicht oder nur erheblich verzögert an eine andere Mobilfunkeinrichtung übertragen werden.

[0038] Insbesondere eignet sich der Einsatz des Verfahrens zur Steuerung des Auslesens der Pufferspeicher der Datensicherungsschicht für den Einsatz in einem Mobilfunk-Endgerät, wobei die Gewichtungswertebereiche bzw. die Gewichtungswerte vorzugsweise von dem UTRAN, besonders bevorzugt durch eine Mobilfunk-

netzwerk-Kontrolleinheit und/oder durch die UMTS-Basisstation vorgegeben werden.

[0039] Gemäß einer Ausgestaltung der Erfindung ist die mindestens eine Datensicherungsschicht-Einheit als eine der folgenden Einheiten ausgebildet :

- Funkverbindungs-Steuerungseinheit (Resource Link Control, RLC),
- Paketdaten-Konvergierungs-Protokolleinheit (Packet Data Convergence Protocol, PDCP),
- Broadcast/Multicast-Steuerungseinheit (Broadcast/Multicast Control, BMC).

[0040] Gemäß einer anderen Ausgestaltung der Erfindung ist mindestens eine Datensicherungsschicht-Einheit als eine Medium-Zugriffs-Steuerungseinheit ausgebildet, wobei die Medium-Zugriffs-Steuerungseinheit als eine Einheit in einer der folgenden Teil-Protokollschichten der Medium-Zugriffs-Steuerungsschicht eingerichtet sein kann:

- Medium-Zugriffs-Steuerungs-d-Teil-Protokollschicht (MAC dedicated Layer),
- Medium-Zugriffs-Steuerungs-c/sh-Teil-Protokollschicht (MAC control/shared),
- Medium-Zugriffs-Steuerungs-b-Teil-Protokollschicht (MAC broadcast), und/oder
- Medium-Zugriffs-Steuerungs-e-Teil-Protokollschicht (MAC enhanced uplink).

[0041] Insbesondere in dem Fall, in dem die Datensicherungsschicht-Einheit als eine Medium-Zugriffs-Steuerungs-e-Einheit eingerichtet ist, weist sie eine Medium-Zugriffs-Sub-Steuerungseinheit sowie eine Automatic-Repeat-Request-Steuerungseinheit auf. Zumindest ein Teil der Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern sind als Medium-Zugriffs-Steuerungs-Pufferspeicher eingerichtet, in welchen die Daten zwischengespeichert werden. Anders ausgedrückt bedeutet dies, dass die Pufferspeicher in der Einheit zum Aufteilen der Daten auf die einzelnen unterschiedlich priorisierten Datenpufferspeicher der MAC-e-Protokollschicht vorgesehen sind und/oder als die Pufferspeicher der ARQ-Prozesse in der MAC-e-Protokolleinheit.

[0042] Die Automatic-Repeat-Request-Steuerungseinheit ist vorzugsweise wie gemäß MAC-e eingerichtet zum Durchführen eines Hybrid-Automatic-Repeat-Request-Verfahrens (HARQ-Verfahren).

[0043] Ferner ist bevorzugt ein Transportformat-Speicher vorgesehen, in welchem Transportformate gespeichert sind, wobei jedes Transportformat Datenübertragungscharakteristika enthält, welche zur Datenübertragung gemäß einem jeweiligen Transportformat verwendet werden. Anders ausgedrückt bedeutet dies, dass in jedem Transportformat die Steuerungsparameter zum Einstellen der jeweils in der Medium-Zugriff-Steuerungsschicht verwendeten Parameter zur Abbildung der zu übertragenden Daten auf die Transportkanäle, welche zur Datenübertragung in der physikalischen Schicht verwendet werden, enthalten sind, beispielsweise die Blockgröße, die Anzahl von Blöcken in einem Satz von Blöcken sowie eine Angabe des Übertragungszeitintervalls (Transmission Time Interval, TTI).

[0044] In der jeweiligen Datensicherungsschicht, vorzugsweise in der MAC-e-Teil-Protokollschicht ist ferner gemäß einer Ausgestaltung der Erfindung eine Transportformat-Auswahleinheit zum Auswählen eines oder mehrerer Transportformate aus einer Menge vorgegebener zur Datenübertragung zulässiger Transportformate vorgesehen.

[0045] Gemäß einer anderen Ausgestaltung der Erfindung ist eine Gewichtung-Einstelleinheit zum Vorgeben der Gewichtungswerte und/oder der Gewichtungswertebereiche gemäß einer zur Datenübertragung jeweils verwendeten Dienstqualität, anders ausgedrückt beispielsweise gemäß einer im Rahmen des jeweiligen Mobilfunksystems zur Datenübertragung vorgesehenen und durch die jeweiligen bereitgestellten Dienstqualitäten charakterisierten Transportverkehrsklassen, vorgesehen. Auf diese Weise wird eine besonders einfache und effiziente Abarbeitung der Daten in den Datensicherungsschicht-Pufferspeichern sowie eine einfache und verlässliche Signalisierung der jeweiligen Gewichtung der Pufferspeicher erreicht unter Gewährleistung einer vollständigen und rechtzeitigen Übertragung der in den jeweiligen Pufferspeichern zwischengespeicherten Daten gemäß der den Daten jeweils zugeordneten Priorisierung.

[0046] Die Gewichtung-Einstelleinheit ist bevorzugt derart eingerichtet, dass sie Gewichtungswerte vorgibt, welche innerhalb eines jeweiligen Gewichtungswertebereichs liegen. Auf diese Weise kann die Gewichtung-Einstelleinheit und damit die Mobilfunkeinrichtung flexibel den jeweils berücksichtigten Pufferspeichern unterschiedliche Gewichtungswerte und damit unterschiedliche Datenübertragungsbandbreiten zuordnen, wobei durch Vorgabe der jeweiligen Gewichtungswertebereiche und damit verbunden durch Vorgabe der jeweiligen Datenübertragungsbandbreitenbereiche eine Optimierung des Auslesens und damit der Datenübertragung von der Mobilfunkeinrichtung zu beispielsweise einer Mobilfunk-Basisstation ermöglicht ist.

[0047] Ferner ist gemäß einer anderen Ausgestaltung der Erfindung eine Sende-Steuerungseinrichtung, bevorzugt eingerichtet gemäß dem Radio Ressource Control Layer gemäß UMTS, zum Steuern von Mobilfunk-Senderressourcen der Mobilfunkeinrichtung, vorgesehen.

[0048] Die Sende-Steuerungseinrichtung ist derart eingerichtet, dass sie Gewichtungswerte und/oder Gewichtungswertebereiche von einer anderen Mobilfunkeinrichtung, vorzugsweise einer Mobilfunkstation, besonders bevorzugt von einer Mobilfunknetzwerk-Kontrolleinheit (Ressource Network Control Unit) empfängt und der Gewichtungs-Einstelleinheit übermittelt, d.h. bereitstellt, womit die Gewichtungswerte und/oder Gewichtungswertebereiche von der anderen Mobilfunkeinrichtung vorgebar sind.

[0049] Auf diese Weise wird sehr einfach und verlässlich mobilfunknetzwerkseitig, auf Ebene der Radio Network Control Protokollschicht (RNC) gemäß UMTS die Steuerung des Ausleseverhaltens der Datenpufferspeicher in der Datensicherungsschicht der Mobilfunk-Endgeräte ermöglicht abhängig von dem Datenaufkommen und der in der jeweiligen Mobilfunkzelle herrschenden Übertragungsqualität, für welche Mobilfunkzelle die Mobilfunknetzwerk-Kontrolleinheit zuständig ist.

[0050] Gegebenenfalls kann die Mobilfunknetzwerk-Kontrolleinheit auch ein Handover aktivieren. Ferner können mittels der Mobilfunknetzwerk-Kontrolleinheit eine oder mehrere Transportformate temporär als ungültig vorgegeben werden oder durch Vorgabe eines Satzes von Transportformaten, wobei die Gewichtungswerte und/oder Gewichtungswertebereiche vorzugsweise mit den jeweiligen Transportformaten verknüpft sind, eine Auswahl von möglichen Gewichtungswerten/Gewichtungswertebereichen zumindest teilweise vorgegeben werden.

[0051] Gemäß einer anderen Ausgestaltung der Erfindung ist es vorgesehen, dass die Datensicherungsschicht-Protokoll-Pufferspeicher-Ausleseeinrichtung derart eingerichtet ist, dass sie für den Fall, dass in einem oder in mehreren Datensicherungsschicht-Protokoll-Pufferspeichern keine zu übertragenden Daten zwischengespeichert sind, der oder die für diesen oder diese Datensicherungsschicht-Protokoll-Pufferspeicher allokierte Anteil oder Anteile der Datenübertragungsbandbreite für den oder die Datensicherungsschicht-Protokoll-Pufferspeicher zusätzlich allokiert wird, in welchem oder in welchen zu übertragende Daten zwischengespeichert sind.

[0052] Auf diese Weise wird erreicht, dass dynamisch während des Betriebs darauf reagiert werden kann, dass in einigen Pufferspeichern aktuell keine zu übertragenden Daten zwischengespeichert sind. Die für diese Pufferspeicher jeweils allokierten Datenübertragungsbandbreiten, anders ausgedrückt, Senderressourcen, werden in vorgebbare Weise, besonders bevorzugt gleichmäßig, d.h. zu gleichen Teilen, alternativ gemäß der bisher den jeweiligen Pufferspeichern zugeordneten Anteilen an Datenübertragungsbandbreite auf diejenigen Pufferspeicher verteilt, anders ausgedrückt werden die freien Datenübertragungsbandbreiten auf die Pufferspeicher aufgeteilt, in welchen Daten zur Übertragung zwischengespeichert sind.

[0053] Die Mobilfunkeinrichtungen sowie die Mobilfunknetzwerk-Kontrolleinheit sind vorzugsweise gemäß einem Kommunikationsstandard zur Kommunikation gemäß einem zellularen Mobilfunksystem, vorzugsweise zur Kommunikation gemäß dem zellularen Mobilfunksystem UMTS, eingerichtet.

[0054] Insbesondere für den Fall des Einsatzes der Erfindung im Rahmen von UMTS sind wichtige Aspekte der Erfindung anschaulich darin zu sehen, dass die Gewichtung der Datenpufferspeicher, insbesondere der Priority Queues, d.h. den Pufferspeichern in der MAC-Teil-Protokollschicht MAC-e entsprechend den Anforderungen der Dienstqualität, d.h. den Quality of Service, welche für die jeweiligen Daten angefordert werden, zur effizienten Abarbeitung der Daten der in diesen Datenpuffern zwischengespeicherten Daten sowie in einer sehr einfachen Signalisierung der Gewichtung, d.h. der Gewichtungswerte und/oder der Gewichtungswertebereiche ausgehend von der UMTS-Basisstation oder der RNC-Einheit, zu sehen.

[0055] Die Signalisierung zur Konfiguration der erfindungsgemäßen Gewichtung der Datenpufferspeicher in der Datensicherungsschicht, vorzugsweise in der MAC-e-Teil-Protokollschicht erfolgt in Form von Radio Resource Control Nachrichten (RRC-Nachrichten) von der Mobilfunknetzwerk-Kontrolleinheit an das Mobilfunk-Endgerät, auch bezeichnet als Teilnehmergerät (User Equipment, UE), sowie über die so genannte Iub-Schnittstelle zwischen der Funknetzwerk-Kontrolleinheit an die zugehörige UMTS-Basisstation NodeB.

[0056] Die Gewichtungen, d.h. die Gewichtungswerte, bzw. die Gewichtungswertebereiche, welche den jeweiligen Datenpufferspeichern der Datensicherungsschicht, vorzugsweise den Priority Queues in der MAC-e-Teil-Protokollschicht, zugeordnet werden, können explizit als definierter Prozentsatz der insgesamt zur

Verfügung stehenden und verwendeten Datenübertragungsbandbreiten signalisiert werden. So können beispielsweise bei vorgesehenen drei Datensicherungsschicht-Pufferspeichern dem ersten Pufferspeicher mit der höchsten Priorität 50%, dem Datensicherungsschicht-Protokoll-Pufferspeicher mit zweit höchster, anders ausgedrückt mit mittlerer Priorisierung 25%, und dem dritten Datenpufferspeicher, in welchen Daten mit der niedrigsten Priorität zwischengespeichert werden, 25% der insgesamt zur Verfügung stehenden Übertragungsbandbreite zugeordnet werden.

[0057] Die Daten, welche innerhalb eines definierten Zeitintervalls über den E-Dedicated Channel (E-DCH) übertragen werden, setzen sich in diesem Fall entsprechend der signalisierten Gewichtung (der signalisierten Gewichtungswerte) und den damit verknüpften den jeweiligen Datenpufferspeichern zugeordneten Datenübertragungsbandbreiten) anteilig aus den Daten, welche in den jeweiligen Datenpufferspeichern zwischengespeichert sind, zusammen.

[0058] In einer vorteilhaften Variante ist ein Priority Queue-Pufferspeicher in der MAC-e-Teil-Protokollschicht pro Datenverkehrs-klasse (Traffic Class) vorgesehen.

[0059] Die Gewichtungen der Datenpufferspeicher in der MAC-e-Teil-Protokollschicht werden in diesem Fall nicht explizit signalisiert, sondern es erfolgt eine zuvor festgelegte Zuordnung der Datenverkehrs-klasse auf die Gewichtungen der entsprechenden Priority Queues und damit verknüpft eine Allokation der den Priorisierungen entsprechenden bereitgestellten Datenübertragungsbandbreiten.

[0060] Die gemäß UMTS vorgesehenen Datenverkehrs-klassen werden im Folgenden noch im Detail näher erläutert.

[0061] Es sind derzeit gemäß UMTS folgende vier Datenverkehrs-klassen vorgesehen: Conversational, Streaming, Interactive, Background.

[0062] Die Zuordnung der Gewichtungswerte auf die Priority Queues gemäß den Datenverkehrs-klassen kann beispielsweise derart erfolgen, dass Streaming-Daten mit 40%, Conversational-Daten mit 30%, Interactive-Daten mit 20% und Background-Daten mit 10% gewichtet werden. Anders ausgedrückt, bedeutet dies, dass den Streaming-Daten 40% der gesamt zur Verfügung stehenden Datenübertragungsbandbreite zugeordnet werden, den Conversational-Daten 30%, den Interactive-Daten 20% und den Background-Daten 10%.

[0063] Wenn eine Priority Queue temporär keine Daten beinhaltet, anders ausgedrückt, wenn in dem Pufferspeicher dieser Priority Queue keine Daten aktuell zwischengespeichert sind, bekommen gemäß einer Ausgestaltung der Erfindung die anderen Priority Queues mehr Bandbreite zugewiesen, wie oben beschrieben wurde. Dies kann beispielsweise derart erfolgen, dass die restliche zur Verfügung stehende Bandbreite, d.h. die von den Priority Queues mit „leeren“ Pufferspeichern nicht benötigte Datenübertragungsbandbreite auf die anderen Datenpufferspeicher aufgeteilt wird, vorzugsweise zu gleichen Teilen.

[0064] Um die Gewichtungen, d.h. die Gewichtungswerte der einzelnen Priority Queues, allgemein der Datensicherungsschicht-Protokoll-Pufferspeicher dynamisch an die aktuellen Übertragungsbedingungen, insbesondere an die aktuellen Datenpuffer-Füllstände in der MAC-e-Teilschicht sowie an die Übertragungssituation in der jeweiligen Mobilfunkzelle anpassen zu können, sind anschaulich vorzugsweise für jeden der betrachteten und berücksichtigten Datenpufferspeicher, alternativ für zumindest einen Teil der berücksichtigten Datenpufferspeicher Gewichtungs-Bänder, im Rahmen dieser Beschreibung auch bezeichnet als Gewichtungswertebereiche, eingeführt, innerhalb derer die Gewichtung in Abhängigkeit vom jeweiligen Datenpufferspeicher-Füllstand, der Datenübertragungssituation in der jeweiligen Mobilfunkzelle und den Gewichtungen der anderen Priority Queues, allgemein der anderen Datensicherungsschicht-Protokoll-Pufferspeichern durch das Mobilfunknetzwerk, insbesondere durch die UMTS-Basisstation NodeB erniedrigt oder erhöht werden kann.

[0065] Hierfür konfiguriert die Mobilfunknetzwerk-Kontrolleinheit RNC die UMTS-Basisstation mittels der Iub-Schnittstelle mit den zu verwendeten Gewichtungs-Bänder, d.h. den Gewichtungswertebereichen, innerhalb derer die UMTS-Basisstation das Mobilfunk-Endgerät, welches im Rahmen einer Uplink-Kommunikationsverbindung Daten zu der UMTS-Mobilfunkstation sendet, anschließend sehr schnell und dynamisch die jeweils verwendeten Gewichtungswerte, d.h. anders ausgedrückt die den Pufferspeichern zugeordneten Gewichte und damit die jeweilig verwendeten und allokierten Datenübertragungsbandbreiten umkonfigurieren kann.

[0066] Liegen keine oder nur sehr wenige Daten in dem Datenpufferspeicher einer Priority Queue, so wird

dieser Priority Queue und damit den jeweiligen Datensicherungsschicht-Protokoll-Pufferspeichern nur eine geringe Gewichtung innerhalb des Gewichtungsbandes zugewiesen, d.h. ein kleiner Wert des Gewichtungswertes innerhalb des Gewichtungswertebereichs, vorzugsweise ein Gewichtungswert, der am unteren Grenzbereich des Gewichtungswertebereichs liegt. Ist der Datenpuffer-Füllstand in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher sehr hoch, so wird dieser Priority Queue, allgemein diesem Pufferspeicher, eine höhere Gewichtung innerhalb des Gewichtungsbandes zugewiesen und damit ein höherer Gewichtungswert innerhalb des Gewichtungswertebereichs, vorzugsweise ein Gewichtungswert, der am oberen Grenzbereich des Gewichtungswertebereichs liegt. Vorzugsweise wird die dynamische Anpassung der Gewichtung anhand der Gewichtungsbänder durch das Mobilfunknetzwerk, insbesondere durch die UMTS-Basisstation gesteuert.

[0067] Bei der Änderung der Gewichtung einer Priority Queue werden die Gewichtungen, d.h. die Gewichtungswerte der anderen Priority Queues berücksichtigt und gegebenenfalls entsprechend angepasst.

[0068] Für die Anpassung der Gewichtung einer Priority Queue an den Datenpuffer-Füllstand des jeweiligen Datenpufferspeichers sind insbesondere zwei Alternativen vorgesehen:

- Der prozentuale Füllstand des jeweiligen Datenpufferspeichers wird Eins-zu-Eins auf die Gewichtung der Priority Queue innerhalb des Gewichtungsbandes abgebildet.
- Es werden Priority-Queue-Datenpufferspeicher-Schwellenwerte definiert, bei deren Überschreitung die Gewichtung der jeweiligen Priority Queue diskret in vorgegebener Weise, d.h. um einen vorgebbaren Wert, erhöht bzw. erniedrigt wird.

[0069] Es ist in diesem Zusammenhang anzumerken, dass die Summe aller Gewichtungen, welche den Priority Queues, allgemein den Datensicherungsschicht-Protokoll-Pufferspeichern zugeordnet sind, zu keinem Zeitpunkt 100% überschreiten darf.

[0070] Kommt es aufgrund von Überschneidungen der Gewichtungsbänder der Priority Queues zu gleichen Gewichtungen, werden diese vorzugsweise gleichberechtigt abgearbeitet, indem von allen Priority Queues die gleiche Anzahl von Datenpaketen entnommen wird, d.h. ausgelesen wird. Anschaulich kann ein grundlegender Aspekt der Erfindung in der Anwendung des an sich bekannten Weighted Fair Queueing-Prinzips, bei dem die Datenströme den einzelnen Queues zugewiesen werden, wobei jeder Queue eine Gewichtung zugeteilt wird, die ein definierter Prozentsatz der gesamten Übertragungsbandbreite darstellt, auf den speziellen Anwendungsbereich der Datensicherungsschicht in einem Mobilfunk-Kommunikationssystem, vorzugsweise in einem zellularen Mobilfunk-Kommunikationssystem, besonders bevorzugt einem UMTS-Mobilfunk-Kommunikationssystem, gesehen werden.

[0071] Die Mobilfunkeinrichtung ist bevorzugt eingerichtet als Mobilfunk-Endgerät, welches besonders bevorzugt eingerichtet ist, Daten gemäß einem oder mehreren Protokollen eines zellularen Mobilfunksystems, beispielsweise GSM, bevorzugt GPRS oder UMTS, zu empfangen und zu senden.

[0072] Besonders bevorzugt ist das Mobilfunk-Endgerät somit eingerichtet zur Kommunikation in einem UMTS-Mobilfunksystem, anders ausgedrückt ist das Mobilfunk-Endgerät eingerichtet, Daten gemäß einem oder mehreren Protokollen eines UMTS-Mobilfunksystems zu empfangen und zu senden.

Ausführungsbeispiel

[0073] Ausführungsbeispiele der Erfindung sind in den Figuren dargestellt und werden im Folgenden näher erläutert.

[0074] Es zeigen

[0075] Fig. 1 ein Kommunikationssystem gemäß einem Ausführungsbeispiel der Erfindung;

[0076] Fig. 2 eine Darstellung einer Protokollstruktur der UMTS-Luftschnittstelle;

[0077] Fig. 3 eine Darstellung der Einheiten in einer MAC-e-Protokollschicht gemäß einem ersten Ausführungsbeispiel der Erfindung;

[0078] Fig. 4 eine Darstellung der Einheiten in einer MAC-e-Protokollschicht gemäß einem zweiten Ausführungsbeispiel der Erfindung;

[0079] Fig. 5 eine Darstellung einer RRC-Nachricht zur Signalisierung der Gewichtungswerte und der Gewichtungswertebereiche gemäß einem Ausführungsbeispiel der Erfindung.

[0080] Fig. 1 zeigt ein UMTS-Mobilfunksystem **100**, aus Gründen der einfacheren Darstellung insbesondere die Komponenten des UMTS-Mobilfunk-Zugangsnetzwerkes (UMTS Terrestrial Radio Access Network, UTRAN), welches eine Mehrzahl von Mobilfunk-Netzwerk-Teilsystemen (Radio Network Subsystems, RNS) **101**, **102** aufweist, welche jeweils mittels einer so genannten Iu-Schnittstelle **103**, **104** mit dem UMTS-Kernnetzwerk (Core Network, CN) **105** verbunden sind. Ein Mobilfunk-Netzwerk-Teilsystem **101**, **102** weist jeweils eine Mobilfunk-Netzwerk-Kontrolleinheit (Radio Network Controller, RNC) **106**, **107** auf sowie eine oder mehrere UMTS-Basisstationen **108**, **109**, **110**, **111**, welche gemäß UMTS auch als NodeB bezeichnet werden.

[0081] Innerhalb des Mobilfunk-Zugangsnetzwerkes sind die Mobilfunk-Netzwerk-Kontrolleinheiten **106**, **107** der einzelnen Mobilfunk-Netzwerk-Teilsysteme **101**, **102** mittels einer so genannten Iur-Schnittstelle **112** miteinander verbunden. Jede Mobilfunk-Netzwerk-Kontrolleinheit **106**, **107** überwacht jeweils die Zuordnung von Mobilfunk-Ressourcen aller Mobilfunkzellen in einem Mobilfunk-Netzwerk-Teilsystem **101**, **102**.

[0082] Eine UMTS-Basisstation **108**, **109**, **110**, **111** ist jeweils mittels einer so genannten Iub-Schnittstelle **113**, **114**, **115**, **116** mit einer der Basisstation zugeordneten Mobilfunk-Netzwerk-Kontrolleinheit **106**, **107** verbunden.

[0083] Jede UMTS-Basisstation **108**, **109**, **110**, **111** spannt anschaulich funktechnisch eine oder mehrere Mobilfunkzellen (CE) innerhalb eines Mobilfunk-Netzwerk-Teilsystems **101**, **102** auf. Zwischen einer jeweiligen UMTS-Basisstation **108**, **109**, **110**, **111** und einem Teilnehmergerät **118** (User Equipment, UE), im Folgenden auch bezeichnet als Mobilfunk-Endgerät, in einer Mobilfunkzelle werden Nachrichtensignale bzw. Datensignale mittels einer Luftschnittstelle, gemäß UMTS bezeichnet als Uu-Luftschnittstelle **117**, vorzugsweise gemäß einem Vielfachzugriff-Übertragungsverfahren übertragen.

[0084] Beispielsweise wird gemäß dem UMTS-FDD-Modus (Frequency Division Duplex) eine getrennte Signalübertragung in Uplink- und Downlink-Richtung (Uplink: Signalübertragung vom Mobilfunk-Endgerät **118** zur jeweiligen UMTS-Basisstation **108**, **109**, **110**, **111**; Downlink: Signalübertragung von der jeweiligen zugeordneten UMTS-Basisstation **108**, **109**, **110**, **111** zu dem Mobilfunk-Endgerät **118**) durch eine entsprechende separate Zuweisung von Frequenzen oder Frequenzbereichen erreicht.

[0085] Mehrere Teilnehmer, anders ausgedrückt mehrere aktivierte oder in dem Mobilfunk-Zugangsnetzwerk angemeldete Mobilfunk-Endgeräte **118** in derselben Mobilfunkzelle werden vorzugsweise mittels orthogonaler Codes, insbesondere gemäß dem so genannten CDMA-Verfahren (Code Division Multiple Access) voneinander signaltechnisch getrennt.

[0086] In diesem Zusammenhang ist anzumerken, dass in Fig. 1 aus Gründen der einfachen Darstellung nur ein Mobilfunk-Endgerät **118** dargestellt ist. Allgemein sind jedoch eine beliebige Anzahl von Mobilfunk-Endgeräten **118** in dem Mobilfunksystem **100** vorgesehen.

[0087] Die Kommunikation eines Mobilfunk-Endgeräts **118** mit einem anderen Kommunikationsgerät kann mittels einer vollständigen Mobilfunk-Kommunikationsverbindung zu einem anderen Mobilfunk-Endgerät aufgebaut sein, alternativ zu einem Festnetz-Kommunikationsgerät.

[0088] Wie in Fig. 2 dargestellt ist, ist die UMTS-Luftschnittstelle **117** logisch in drei Protokollschichten gegliedert (in Fig. 2 symbolisiert durch eine Protokollschichtanordnung **200**). Die die Funktionalität der jeweiligen im Folgenden beschriebenen Protokollschichten gewährleistenden und realisierenden Einheiten (Entitäten) sind sowohl in dem Mobilfunk-Endgerät **118** als auch in der UMTS-Basisstation **108**, **109**, **110**, **111** bzw. in der jeweiligen Mobilfunk-Netzwerk-Kontrolleinheit **106**, **107**, implementiert.

[0089] In Fig. 2 ist die Protokollstruktur **200** aus Sicht des dedizierten Transportkanals DCH (Dedicated Channel) dargestellt.

[0090] Die in Fig. 2 dargestellte unterste Schicht ist die physikalische Schicht PHY **201**, welche gemäß dem OSI-Referenzmodell (Open System Interconnection) gemäß ISO (International Standardisation Organisation) die Protokollschicht 1 darstellt.

[0091] Die über der physikalischen Schicht **201** angeordnete Protokollschicht ist die Datensicherungsschicht

202, gemäß OSI-Referenzmodell Protokollschicht 2, welche ihrerseits mehrere Teil-Protokollschichten aufweist, nämlich die Medium Access Control-Protokollschicht (MAC-Protokollschicht) **203**, die Radio Link Control-Protokollschicht **204** (RLC-Protokollschicht), die Packet Data Convergence Protocol-Protokollschicht **205** (PDCP-Protokollschicht), sowie die Broadcast/Multicast Control-Protokollschicht **206** (BMC-Protokollschicht).

[0092] Die oberste Schicht der UMTS-Luftschnittstelle Uu ist die Mobilfunk-Netzwerkschicht (gemäß OSI-Referenzmodell Protokollschicht 3), aufweisend die Mobilfunk-Ressourcen-Kontrolleinheit **207** (Radio Resource Control-Protokollschicht, RRC-Protokollschicht).

[0093] Jede Protokollschicht **201**, **202**, **203**, **204**, **205**, **206**, **207** bietet der über ihr liegenden Protokollschicht ihre Dienste über vorgegebene, definierte Dienstzugangspunkte (Service Access Points) an.

[0094] Die Dienstzugangspunkte werden zum besseren Verständnis der Protokollschicht-Architektur mit allgemein gebräuchlichen und eindeutigen Namen versehen, wie beispielsweise logische Kanäle **208** zwischen der MAC-Protokollschicht **203** und der RLC-Protokollschicht **204**, Transportkanäle **209** zwischen der physikalischen Schicht **201** und der MAC-Protokollschicht **203**, Radio Bearer (RB) **210** zwischen der RLC-Protokollschicht **204** und der PDCP-Protokollschicht **205** bzw. der BMC-Protokollschicht **206**, sowie Signalling Radio Bearer (SRB) **213** zwischen der RLC-Protokollschicht **204** und der RRC-Protokollschicht **207**.

[0095] Die in Fig. 2 dargestellte Protokollstruktur **200** ist gemäß UMTS nicht nur horizontal in die oben beschriebenen Protokollschichten und Einheiten der jeweiligen Protokollschichten aufgeteilt, sondern auch vertikal in eine so genannte Kontroll-Protokollebene **211** (Control-Plane, C-Plane), welche Teile der physikalischen Schicht **201**, Teile der MAC-Protokollschicht **203**, Teile der RLC-Protokollschicht **204** sowie die RRC-Protokollschicht **207** enthält und die Nutzer-Protokollebene **212** (User-Plane, U-Plane), welche Teile der physikalischen Schicht **201**, Teile der MAC-Protokollschicht **203**, Teile der RLC-Protokollschicht **204**, die PDCP-Protokollschicht **205** sowie die BMC-Protokollschicht **206** enthält.

[0096] Mittels der Einheiten der Kontroll-Protokollebene **211** werden ausschließlich Kontroll-Daten übertragen, die zum Aufbau und zum Abbau sowie zur Aufrechterhaltung einer Kommunikationsverbindung benötigt werden, wohingegen mittels der Einheiten der Nutzer-Ebene **212** die eigentlichen Nutzdaten transportiert werden.

[0097] Details zu der Protokollschichtanordnung **200** sind in [1] beschrieben.

[0098] Jede Protokollschicht bzw. jede Einheit (Entität) einer jeweiligen Protokollschicht hat bestimmte vorgegebene Funktionen im Rahmen einer Mobilfunk-Kommunikation.

[0099] Senderseitig ist die Aufgabe der physikalischen Schicht **201** bzw. der Einheiten der physikalischen Schicht **201**, die sichere Übertragung von von der MAC-Protokollschicht **203** kommenden Daten über die Luftschnittstelle **117** zu gewährleisten. Die Daten werden in diesem Zusammenhang auf physikalische Kanäle (nicht dargestellt in Fig. 2) abgebildet. Die physikalische Schicht **201** bietet ihre Dienste der MAC-Protokollschicht **203** über Transportkanäle **209** an, mittels derer festgelegt wird, wie und mit welcher Charakteristik die Daten über die Luftschnittstelle **117** transportiert werden sollen. Die wesentlichen Funktionen, welche von den Einheiten der physikalischen Schicht **201** bereitgestellt werden, beinhalten die Kanalcodierung, die Modulation und die CDMA-Code-Spreizung. In entsprechender Weise führt die physikalische Schicht **201** bzw. die Entitäten der physikalischen Schicht **201** auf der Empfängerseite die CDMA-Code-Entspreizung, die Demodulation und die Decodierung der empfangenen Daten durch und gibt diese dann an die MAC-Protokollschicht **203** zur weiteren Verarbeitung weiter.

[0100] Die MAC-Protokollschicht **203** bzw. die Einheiten der MAC-Protokollschicht **203** bietet bzw. bieten ihre Dienste der RLC-Protokollschicht **204** mittels logischer Kanäle **208** als Dienstzugangspunkte an, mittels derer charakterisiert wird, um welchen Dateityp es sich bei den transportierten Daten handelt. Die Aufgabe der MAC-Protokollschicht **203** in dem Sender, d.h. bei Datenübertragung in Uplink-Richtung in dem Mobilfunk-Endgerät **118**, liegt insbesondere darin, die Daten, die an einem logischen Kanal **208** oberhalb der MAC-Protokollschicht **203** anliegen, auf die Transportkanäle **209** der physikalischen Schicht **201** abzubilden. Die physikalische Schicht **201** bietet den Transportkanälen **209** hierzu diskrete Übertragungsraten an. Daher ist es eine wichtige Funktion der MAC-Protokollschicht **203** bzw. der Entitäten der MAC-Protokollschicht **203** in dem Mobilfunk-Endgerät **118** im Sendefall die Auswahl eines geeigneten Transportformates (TF) für jeden konfigurierten Transportkanal in Abhängigkeit von der jeweils aktuellen Datenübertragungsrate und der jeweiligen Datenpriorität der logischen Kanäle **208**, die auf den jeweiligen Transportkanal **209** abgebildet sind, sowie

der verfügbaren Sendeleistung des Mobilfunk-Endgeräts **118** (UE). In einem Transportformat ist unter anderem festgelegt, wie viele MAC-Datenpaketeinheiten, bezeichnet als Transportblock, pro Übertragungszeitlänge TTI (Transmission Time Interval) über den Transportkanal **209** an die physikalische Schicht **201** gesendet, anders ausgedrückt, übergeben werden. Die zulässigen Transportformate sowie die zulässigen Kombinationen von Transportformaten der verschiedenen Transportkanäle **209** werden dem Mobilfunk-Endgerät **118** von der Mobilfunk-Netzwerk-Kontrolleinheit **106**, **107** bei dem Aufbau einer Kommunikationsverbindung signalisiert. In dem Empfänger wird von den Einheiten der MAC-Protokollschicht **203** die auf den Transportkanälen **209** empfangenen Transportblöcke wieder auf die logischen Kanäle **208** aufgeteilt.

[0101] Die MAC-Protokollschicht bzw. die Einheiten der MAC-Protokollschicht **203** weist bzw. weisen üblicherweise drei logische Einheiten auf. Die so genannte MAC-d-Einheit (MAC-Dedicated-Einheit) behandelt die Nutzdaten und die Kontrolldaten, die über die entsprechenden dedizierten logischen Kanäle DTCH (Dedicated Traffic Channel) und DCCH (Dedicated Control Channel) auf die dedizierten Transportkanäle DCH (Dedicated Channel) abgebildet werden. Die MAC-c/sh-Einheit (MAC-Control/Shared-Einheit) behandelt die Nutzdaten und die Kontrolldaten von logischen Kanälen **208**, die auf die gemeinsamen Transportkanäle **209**, wie beispielsweise der dem gemeinsamen Transportkanal RACH (Random Access Channel) in Uplink-Richtung oder dem gemeinsamen Transportkanal FACH (Forward Access Channel) in Downlink-Richtung abgebildet werden. Die MAC-b-Einheit (MAC-Broadcast-Einheit) behandelt nur die Mobilfunkzellenrelevanten Systeminformationen, die über den logischen Kanal BCCH (Broadcast Control Channel) auf den Transportkanal BCH (Broadcast Channel) abgebildet und per Broadcast zu allen Mobilfunk-Endgeräten **118** in der jeweiligen Mobilfunkzelle übertragen werden.

[0102] Mittels der RLC-Protokollschicht **204** bzw. mittels der Einheiten der RLC-Protokollschicht **204** werden der RRC-Protokollschicht **207** ihre Dienste mittels Signalling Radio Bearer (SRB) **213** als Dienstzugangspunkte und der PDCP-Protokollschicht **205** und der BMC-Protokollschicht **206** mittels Radio Bearer (RB) **210** als Dienstzugangspunkte angeboten. Die Signalling Radio Bearer und die Radio Bearer charakterisieren, wie die RLC-Protokollschicht **204** mit den Datenpaketen umzugehen hat. Hierzu wird beispielsweise von der RRC-Protokollschicht **207** der Übertragungsmodus für jeden konfigurierten Signalling Radio Bearer bzw. Radio Bearer festgelegt. Es sind gemäß UMTS folgende Übertragungsmodi vorgesehen:

- Transparent Mode (TM),
- Unacknowledged Mode (UM), oder
- Acknowledged Mode (AM).

[0103] Die RLC-Protokollschicht **204** ist so modelliert, dass es eine eigenständige RLC-Entität pro Radio Bearer bzw. Signalling Radio Bearer gibt. Des Weiteren ist die Aufgabe der RLC-Protokollschicht bzw. ihrer Entitäten **204** in der Sendeeinrichtung, die Nutzdaten und die Signalisierungsdaten von Radio Bearern bzw. Signalling Radio Bearern in Datenpakete aufzuteilen oder zusammenzufügen. Die RLC-Protokollschicht **204** übergibt die nach der Teilung oder dem Zusammenfügen entstandenen Datenpakete an die MAC-Protokollschicht **203** zum weiteren Transport bzw. zur weiteren Verarbeitung.

[0104] Die PDCP-Protokollschicht **205** bzw. die Einheiten der PDCP-Protokollschicht **205** ist bzw. sind eingerichtet für die Übertragung bzw. für den Empfang von Daten der so genannten Packet-Switched-Domain (Paketvermittelnde Domäne, PS-Domain). Die Hauptfunktion der PDCP-Protokollschicht **205** ist die Komprimierung bzw. Dekomprimierung der IP-Header-Informationen (Internet Protocol-Header-Informationen).

[0105] Die BMC-Protokollschicht **206** bzw. deren Entitäten wird bzw. werden verwendet, um über die Luftschnittstelle so genannte Zell-Broadcast-Nachrichten zu übertragen bzw. zu empfangen.

[0106] Die RRC-Protokollschicht **207** bzw. die Entitäten der RRC-Protokollschicht **207** ist bzw. sind für den Aufbau und den Abbau und die Umkonfiguration von physikalischen Kanälen, Transportkanälen **209**, logischen Kanälen **208**, Signalling Radio Bearers **213** und Radio Bearers **210** sowie für das Aushandeln aller Parameter der Protokollschicht 1, d.h. der physikalischen Schicht **201** und der Protokollschicht 2, verantwortlich. Hierzu tauschen die RRC-Einheiten, d.h. die Einheiten der RRC-Protokollschicht **207** in der Mobilfunk-Netzwerk-Kontrolleinheit **106**, **107** und das jeweilige Mobilfunk-Endgerät **118** über die Signalling Radio Bearers **213** entsprechende RRC-Nachrichten aus. Details zur RRC-Schicht sind in [3] beschrieben.

[0107] Wie oben beschrieben wurde kann das Mobilfunk-Endgerät **118** der ihm zugeordneten Mobilfunk-Netzwerk-Kontrolleinheit **106**, **107** auf RRC-Ebene Informationen (die so genannten Measurement Report-Nachrichten) über das Datenverkehrsaufkommen eines Transportkanals zum Zweck des Managements der Mobilfunk-Ressourcen mitteilen. Dabei werden der Serving Mobilfunk-Netzwerk-Kontrolleinheit (Serving

Radio Network Controller, SRNC) die RLC-Datenpuffer-Füllstände des betreffenden Transportkanals angezeigt, d.h. es wird angezeigt, wie viele Daten sich aktuell in den jeweiligen RLC-Datenpufferspeichern des Mobilfunk-Endgeräts **118** befinden.

[0108] Mit Hilfe dieser Informationen kann die Serving Mobilfunk-Netzwerk-Kontrolleinheit **106**, **107** daraufhin entsprechende Konfigurationen des Mobilfunk-Endgeräts **118** vornehmen, um beispielsweise die nutzbaren Transportformate eines Mobilfunk-Endgeräts **118** einzuschränken bzw. zu erhöhen oder ein Handover zu einer anderen Mobilfunkzelle, eine Rekonfiguration der dedizierten physikalischen Kanäle oder einen RRC-Zustandswechsel von einem ersten Zustand CELL_DCH in einen zweiten Zustand CELL_FACH durchzuführen.

[0109] In dem Standardisierungsgremium 3GPP wird derzeit an der Verbesserung der Paketdatenübertragung über dedizierte Transportkanäle der Aufwärtsstrecke für den UMTS-FDD-Modus gearbeitet.

[0110] In diesem Zusammenhang ist ein dedizierter Transportkanal mit der Bezeichnung Enhanced-DCH (E-DCH) vorgesehen. Die wesentlichen Eigenschaften dieses neuen Transportkanals beinhalten die Anwendung eines Hybrid Automatic Repeat Request-Verfahrens (HARQ-Verfahrens) basierend auf den N-channel Stop&Wait-Verfahren, ein von einer UMTS-Basisstation kontrolliertes Scheduling sowie ein Vorsehen von Rahmenlängen von kleiner oder gleich 10 ms. Mittels des HARQ-Übertragungssicherungsverfahrens wird dem Mobilfunk-Endgerät **118** von dem Netzwerk eine Bestätigung über korrekt bzw. nicht korrekt empfangene Daten übermittelt. Für diese Funktion enthält das Mobilfunk-Endgerät **118** verschiedene Datenpufferspeicher, um die Daten bis zur Bestätigung des korrekten Empfangs zwischenspeichern. Ferner ist gemäß dem derzeitigen Vorschlag im Rahmen des Enhanced-DCH-Transportkanals vorgesehen, die Daten entsprechend ihrer Prioritäten auf verschiedene Datenpufferspeicher, so genannte Priority Queues, aufzuteilen, wobei die Daten in den Datenpufferspeichern entsprechend ihrer Wichtigkeit, d.h. ihrer Priorisierung zwischengespeichert und damit nach ihrer Zwischenspeicherung in den jeweiligen Pufferspeicher einer vorgegebenen Priorität bevorzugt oder weniger bevorzugt abgearbeitet werden.

[0111] Beide Funktionen werden in einer neuen Teilschicht der MAC-Protokollschicht **203** implementiert, wie sie gemäß einer ersten Ausführungsform in Fig. 3 als MAC-e (MAC-Enhanced-Uplink)-Teil-Protokollschicht **300** dargestellt ist, welche ebenso sowohl endgeräteseitig, d.h. in dem Mobilfunk-Endgerät **118**, als auch netzwerkseitig, d.h. in einer UMTS-Basisstation **108**, **109**, **110**, **111**, implementiert ist. Die MAC-e-Teil-Protokollschicht **300** erhält ihre Daten von der MAC-d-Teil-Protokollschicht über so genannte MAC-d-Flows **301**, **302** und überträgt ihre Daten wiederum über den E-DCH-Transportkanal **303** zu der physikalischen Schicht **201**.

[0112] Die MAC-e-Teil-Protokollschicht **300** bzw. deren Entitäten kommuniziert bzw. kommunizieren, beispielsweise zum Zwecke der Konfiguration, mit der RRC-Protokollschicht **207** über den MAC-Control-Zugangspunkt **304**.

[0113] In der MAC-d-Teil-Protokollschicht werden ein oder mehrere logische Kanäle auf einen MAC-d-Flow **301**, **302** gemultiplext, wobei jedem MAC-d-Flow **301**, **302** in der MAC-d-Teil-Protokollschicht eine Priorität zugeordnet wird, anhand derer die Funktion Priority Queue Distribution, realisiert in einer Priority Queue-Verteilungseinheit **305** in der MAC-e-Teil-Protokollschicht **300** die Aufteilung der Daten auf die Datenpufferspeicher **306** mit den unterschiedlichen Prioritäten, d.h. für die Verarbeitung mit Daten unterschiedlicher Prioritäten in jeweils einem Datenpufferspeicher, wobei in einem Datenpufferspeicher jeweils Daten einer Priorität zwischengespeichert werden, vornimmt.

[0114] In dem Datenpufferspeicher der Priority Queues **306** werden die Daten daraufhin solange zwischengespeichert, bis sie mittels einer HARQ-Einheit **307** zur Übertragung abgerufen werden.

[0115] Gemäß dem N-channel Stop&Wait-HARQ-Verfahren besteht die HARQ-Einheit **307** aus einer Anzahl von N so genannten HARQ-Prozessen, wobei ein HARQ-Prozess jeweils eine Instanz des Stop&Wait-Verfahrens darstellt. Pro HARQ-Prozess entnimmt die HARQ-Einheit **307** eine Anzahl von Paketdaten-Einheiten (PDUs) entsprechend ihrer Priorität aus den Datenpufferspeichern der Priority Queues **306** und gibt diese über den E-DCH Transportkanal **303** an die physikalische Schicht **201** weiter, wo sie dann über dedizierte physikalische Kanäle über die Luftschnittstelle **117** zum Netzwerk übertragen werden.

[0116] Die HARQ-Einheit **307** speichert die pro HARQ-Prozess übertragenen Paketdaten-Einheiten (PDUs) in einem entsprechenden HARQ-Pufferspeicher (nicht gezeigt) solange zwischen, bis die erfolgreiche Übertragung durch das Netzwerk bestätigt wurde.

[0117] Eine mit der HARQ-Einheit **307** gekoppelte TF-Auswahl-Einheit **308** ist für die Auswahl des für die Übertragung geeigneten Transportformats pro HARQ-Prozess zuständig.

[0118] In der MAC-e-Teil-Protokollschicht **300** werden hierfür mittels der RRC-Protokollschicht **207** eine Menge unterschiedlicher Transportformate konfiguriert, aus denen sich die TF-Auswahl-Einheit **308** für jedes Übertragungs-Zeitintervall (TTI) und HARQ-Prozess ein geeignetes auswählt.

[0119] Die Einstellung der MAC-e-Teil-Protokollschicht **300** erfolgt mittels der RRC-Protokollschicht seitens der Mobilfunk-Netzwerk-Kontrolleinheit **106, 107**.

[0120] Wenn ein Mobilfunkteilnehmer mittels des Mobilfunk-Endgerätes **118**, vorzugsweise in der oben beschriebenen Mobilfunkeinrichtung, einen Dienst gemäß UMTS nutzt, so wird von dem UMTS-Mobilfunk-Kernnetzwerk **105** dieser beantragte Dienst mit einer vorgegebenen, definierten Dienstqualität (Quality of Service, QoS) bereitgestellt, die den Dienstqualitäts-Anforderungen des entsprechenden Dienstes entsprechen.

[0121] Gemäß UMTS sind derzeit die folgenden vier Verkehrsklassen zur Einteilung von bereitgestellten Diensten definiert, die sich durch ihre spezifischen Datenübertragungseigenschaften und Qualitätsanforderungen unterscheiden:

- Conversational:

Die Conversational-Verkehrsklasse ist für Echtzeit-Anwendungen zwischen Teilnehmern vorgesehen. Dazu gehören Anwendungen wie Sprachtelefonie und Videotelefonie. Kommunikationsverbindungen dieser Verkehrsklasse benötigen eine konstante, d.h. garantierte Datenübertragungsrate und damit Datenübertragungsbandbreite mit kurzen zeitlichen Verzögerungen bei der Datenübertragung. Andererseits ist eine Conversational-Anwendung unempfindlich gegenüber kurzzeitigen Datenübertragungsfehlern.

- Streaming:

Die Streaming-Verkehrsklasse ist für Echtzeit-Verteildienste wie Video und Audio vorgesehen, bei der Daten unidirektional, beispielsweise von einem Server-Rechner zu einem Client-Rechner übertragen werden, wobei die Echtzeit-Verteildienste es dem Empfänger gestatten, die Daten schon während der Übertragung abzuspielen und einem Benutzer der Empfänger-Mobilfunkeinrichtung darzustellen. Beim Streaming wird ein kontinuierlicher Datenstrom aufgebaut, so dass Kommunikationsverbindungen diese Verkehrsklasse eine konstante, d.h. garantierte Datenübertragungsrate und damit Datenübertragungsbandbreite erfordern. Eine Streaming-Anwendung ist jedoch unempfindlich gegenüber kurzen Datenübertragungsverzögerungen und stellen in dieser Hinsicht keine strengen Anforderungen im Vergleich zu einer Anwendung der Conversational-Verkehrsklasse.

- Interactive:

Die Interactive-Verkehrsklasse ist für interaktive Anwendungen, wie beispielsweise Internet-Surfen, Spiele und Chat vorgesehen. Die Kommunikationsverbindungen in dieser Verkehrsklasse benötigen keine konstante Datenübertragungsrate und damit Datenübertragungsbandbreite, stellen jedoch hohe Anforderungen an die Datenübertragungssicherheit, d.h. sie erfordern eine sehr niedrige Bit-Fehlerrate.

- Background:

Anwendungen der Background-Verkehrsklasse übertragen Daten mit niedriger Priorität im Hintergrund. Beispiele sind der Download von Daten, der Empfang von Email (Electronic Mail) und SMS (Short Message Service). Kommunikationsverbindungen dieser Verkehrsklasse benötigen keine konstante Datenübertragungsrate und damit Datenübertragungsbandbreite und sind unempfindlich gegenüber zeitlichen Verzögerung im Rahmen der Datenübertragung. Andererseits stellen sie hohe Anforderungen an die Übertragungssicherheit, d.h. sie erfordern eine sehr niedrige Bit-Fehlerrate.

[0122] Im Detail wird der Quality of Service, die Dienstqualität, eines bereitgestellten bzw. erbrachten Kommunikationsdienstes anhand verschiedener Attribute wie beispielsweise der maximalen Bitrate, der garantierten Bitrate oder der maximalen Übertragungsverzögerung für den jeweiligen Kommunikationsdienst beschrieben.

[0123] Wenn somit einem Mobilfunkteilnehmer von dem Mobilfunk-Kernnetzwerk **105** ein angefragter Kommunikationsdienst mit einer definierten Dienstqualität QoS bereitgestellt wird, dann werden von dem Mobilfunk-Kernnetzwerk **105** die zugehörigen QoS-Attribute entsprechend festgelegt.

[0124] Bei dem Aufbau der Kommunikationsverbindung (Verbindungsaufbau) werden dem Teilnehmer und damit dem Teilnehmer-Mobilfunk-Endgerät **118** von der Mobilfunknetzwerk-Kontrolleinheit **106, 107** netzwerkseitig, d.h. auf der Seite des UTRAN die entsprechenden für die Kommunikationsverbindung benötigten Mobilfunk-Ressourcen, wie beispielsweise die benötigten CDMA-Spreizcodes, allokiert und die Protokolle der

Protokollschichten 1 und 2 werden derart konfiguriert, dass der Kommunikationsdienst mit der ausgehandelten Dienstqualität während der Dauer der Kommunikationsverbindung sichergestellt werden kann.

[0125] Die ausgehandelte Dienstqualität eines Kommunikationsdienstes kann während einer bestehenden Kommunikationsverbindung von dem Mobilfunk-Kernnetzwerk **105** rekonfiguriert werden, beispielsweise aufgrund knapper Mobilfunk-Ressourcen oder steigender Interferenz in der Mobilfunkzelle.

[0126] Erneut Bezug nehmend auf **Fig. 3** werden im Folgenden Details über das eingesetzte Stop&Wait-Verfahren (auch bezeichnet als Send&Wait-Verfahren) sowie das eingesetzte HARQ-Verfahren (Hybrid-Automatic-Repeat-Request-Verfahren) erläutert.

[0127] Bei dem N-Kanal-Stop&Wait-HARQ-Verfahren handelt sich um ein Datenübertragungs-Sicherungsverfahren, bei dem in einem Mobilfunk-Endgerät **118** eine Anzahl von N so genannten HARQ-Prozessen konfiguriert wird, wobei ein HARQ-Prozess jeweils eine Instanz des Stop&Wait-Verfahrens darstellt.

[0128] Pro HARQ-Prozess werden die Daten zu dem Kommunikationsnetzwerk, insbesondere der Mobilfunk-Basisstation, gesendet und solange zwischengespeichert, bis von dem Kommunikationsnetzwerk eine Positiv-Bestätigungsnachricht über korrekt empfangene Daten (Acknowledgement, ACK) empfangen wird. Andernfalls, d.h. in dem Fall nicht korrekt empfangener Daten, mitgeteilt mittels einer Negativ-Bestätigungsnachricht (Negative Acknowledgement, NACK) werden die Daten wiederholt zu dem Mobilfunk-Kommunikationsnetzwerk gesendet.

[0129] Bei dem so genannten NodeB-kontrollierten Scheduling handelt es sich um ein Verfahren, bei dem das Scheduling in dem Mobilfunk-Endgerät **118**, d.h. die Auswahl eines passenden Transportformates aus einer Menge von definierten Transportformaten für den E-DCH-Transportkanal, in der Weise kontrolliert wird, dass die NodeB **108**, **109**, **110**, **111** in Abhängigkeit von der Verkehrssituation in der jeweiligen Mobilfunkzelle dem Mobilfunk-Endgerät **118** die Nutzung von Transportformaten aus der Menge von definierten Transportformaten für den E-DCH-Transportkanal temporär einschränken kann.

[0130] Beide Funktionen, d.h. die Funktionalität des HARQ-Verfahrens sowie die Funktionalität des Stop&Wait-Verfahrens sind in der MAC-e (MAC-Enhanced Uplink)-Teil-Protokollschicht innerhalb der MAC-Schicht implementiert, wobei die MAC-e-Teil-Protokollschicht sowohl endgeräteseitig als auch netzwerkseitig vorhanden, d.h. implementiert ist. Netzwerkseitig befindet sich die MAC-e-Teil-Protokollschicht in der NodeB **108**, **109**, **110**, **111**.

[0131] **Fig. 3** stellt die MAC-e-Architektur auf der Endgeräteseite beispielhaft dar, d.h. es ist dargestellt, wie die Funktionalität der MAC-e-Teil-Protokollschicht in dem Mobilfunk-Endgerät **118** realisiert ist.

[0132] Für die dargestellten Ausführungsbeispiele ist ein Übertragungsszenario angenommen, in dem ein Benutzer des Mobilfunk-Endgerätes **118** drei Paketdienste im Uplink zeitlich parallel nutzt, beispielsweise einen Dienst für interaktives Spielen im Internet, einen Dienst für das Downloaden (Herunterladen) von Textdateien und einen Dienst für das Streaming von Videodaten.

[0133] Diese Paketdaten werden von dem Mobilfunk-Endgerät **118** über den E-DCH-Transportkanal **303** zu dem Mobilfunk-Kommunikationsnetzwerk übertragen, d.h. zu der Serving-Mobilfunknetzwerk-Kontrolleinheit **106** und der Basisstation **109** über die Luftschnittstelle **117**. Beim Aufbau der Kommunikationsverbindung werden dem Mobilfunk-Endgerät **118** hierfür Konfigurations-Nachrichten über die RRC-Protokollschicht **207**, implementiert sowohl in der Mobilfunk-Netzwerk-Kontrolleinheit **106** als auch in dem Mobilfunk-Endgerät **118**, zugesendet, mit deren Hilfe die RRC-Protokollschicht **207** in dem Mobilfunk-Endgerät **118** die bezogen auf das Kommunikationsschichtenmodell darunter liegenden Protokollschichten konfiguriert.

[0134] Gemäß diesem Ausführungsbeispiel werden der Entität der MAC-e-Teil-Protokollschicht **300** zwei MAC-d Flows **301**, **302** konfiguriert, wobei auf einem MAC-d Flow **301**, **302** jeweils nur ein logischer Kanal gemultiplext ist und die Daten der Paketdienste auf den jeweils zugeordneten logischen Kanal übertragen werden.

[0135] Des Weiteren sind pro MAC-d Flow **301**, **302** jeweils eine Priority Queue **306** und in der HARQ-Einheit vier HARQ-Prozesse mit jeweils einem HARQ-Pufferspeicher konfiguriert.

[0136] Weiterhin ist für den E-DCH-Transportkanal **303** eine Mehrzahl von unterschiedlichen Transportforma-

ten konfiguriert, aus denen sich die Transportformat-Auswahleinheit **308** (TF-Selection) für jedes Übertragungs-Zeitintervall (Transmission Time Interval, TTI) und HARQ-Prozess ein geeignetes Transportformat auszusuchen hat. Die Daten von den MAC-d Flows **301, 302** werden entsprechend ihrer Priorität den einzelnen Priority Queues **306** zugeordnet und übertragen.

[0137] In der MAC-d-Teil-Protokollschicht werden ein oder mehrere logische Kanäle auf einen MAC-d Flow **301, 302** gemultiplext, wobei jedem MAC-d Flow **301, 302** in der MAC-d-Teil-Protokollschicht eine Priorität zugeordnet wird, anhand derer die Priority-Queue-Verteilungseinheit **305** die Aufteilung der Daten auf die jeweiligen Priority Queues **306** und damit den Priority-Queue-Pufferspeichern mit den unterschiedlichen Prioritäten vornimmt. In den Datenpufferspeichern der Priority Queues **306** werden die Daten daraufhin solange zwischengespeichert, bis sie von der HARQ-Einheit **307** zur Datenübertragung abgerufen, d.h. ausgelesen werden.

[0138] Wie in Fig. 3 und in Fig. 4 dargestellt, werden dem Mobilfunk-Endgerät **118** von dem UTRAN mittels einer RRC-Nachricht **500**, wie sie in Fig. 5 beispielhaft dargestellt ist, die Gewichtung der einzelnen Priority Queues **306** (explizite PQ-Gewichtung) und zusätzlich die Gewichtungs-Bänder, innerhalb derer die Gewichtung der Priority Queues **306** in Abhängigkeit von dem jeweiligen Datenpufferspeicher-Füllstand der Priority Queues **306**, der Datenübertragungssituation in der jeweiligen Mobilfunkzelle und den Gewichtungen der anderen Priority Queues **306** in dem Mobilfunk-Endgerät **118** dynamisch von dem Mobilfunk-Kommunikationsnetzwerk, insbesondere von der UMTS-Basisstation **108, 109, 110, 111** erniedrigt bzw. erhöht werden können (Priority Queue Weighting Band).

[0139] Die Gewichtungen, d.h. anders ausgedrückt die Gewichtungswerte **309** sowie die Gewichtungswertebereiche (d.h. die Gewichtungs-Bänder) **310** sind in einem Gewichtungsspeicher (nicht gezeigt) in dem Mobilfunk-Endgerät **118** gespeichert.

[0140] Jeder Priority Queue **306** sind jeweils ein Gewichtungswert **309** und ein Gewichtungswertebereich **310** eindeutig zugeordnet.

[0141] In Fig. 5 ist beispielhaft die Struktur der RRC-Nachricht **500**, mit der die Gewichtungswerte **309** sowie die Gewichtungswertebereiche **310** für die jeweiligen Priority Queues **306** übertragen werden, dargestellt.

[0142] Hierbei wird ohne Einschränkung der Allgemeingültigkeit angenommen, dass das Mobilfunk-Endgerät **118** dem Mobilfunk-Kommunikationsnetzwerk über entsprechende RRC-Nachrichten die jeweiligen Datenpufferspeicher-Füllstände der Datenpuffer der einzelnen Priority Queues **306** regelmäßig, d.h. vorzugsweise zu vorgegebenen Zeitpunkten oder auf Anfrage der Mobilfunknetzwerk-Kontrolleinheit **308**, signalisiert.

[0143] Wie in Fig. 5 dargestellt enthält die RRC-Gewichtungswerte-Nachricht **500** folgende Daten:

- Eine Angabe der jeweiligen Priority Queue **501**
- eine Angabe des jeweiligen Gewichtungswerts, d.h. Gewichtungswert **502**, und
- eine Angabe des Gewichtungs-Bandes, d.h. des Gewichtungswertebereichs **503**, wobei der Gewichtungswertebereich **503** gegeben ist durch eine Angabe eines unteren Gewichtungswertes **504**, d.h. eines minimal zulässigen Gewichtungswertes sowie durch einen oberen Gewichtungswert **505**, d.h. einen maximal zulässigen Gewichtungswert.

[0144] Für das in Fig. 3 dargestellte Ausführungsbeispiel sei angenommen, dass für die vier Priority Queues **306** folgende Werte konfiguriert werden: Zum einen explizit die Gewichtungswerte **309**

- für die erste Priority Queue A 50% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite,
- für die zweite Priority Queue B 30% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite,
- für die dritte Priority Queue C 15% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite und
- für die vierte Priority Queue D 5% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite.

[0145] Ferner sind den einzelnen Priority Queues **306** folgende Gewichtungswerte **310** zugeordnet:

- der ersten Priority Queue A ein erster Gewichtungswertebereich von 30% bis 60% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite,
- der zweiten Priority Queue B 10% bis 40% der gesamten zur Verfügung stehenden Datenübertragungsbandbreite,
- der dritten Priority Queue C 5% bis 30% der insgesamt zur Verfügung stehenden Datenübertragungsband-

breite, und

- der vierten Priority Queue D 2% bis 15% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite.

[0146] Es ist erneut darauf hinzuweisen, dass bei Variation der Gewichtungswerte innerhalb der jeweiligen Gewichtungswertebereiche 310 darauf zu achten ist, dass die Summe der Gewichtungswerte der vier, gemäß Fig. 4 der drei, Gewichtungswerte 309 den Wert 100% nicht überschreiten, da sonst mehr Datenübertragungsbandbreite allokiert werden müsste, als überhaupt zur Verfügung steht.

[0147] Gemäß diesen Ausführungsbeispielen der Erfindung sind unterschiedliche Definitionen für Priority Queues vorgesehen.

[0148] Wie in Fig. 3 dargestellt kann jede Priority Queue 306 fest einem MAC-d-Flow 301, 302 zugeordnet sein und es gibt pro MAC-d-Flow N Priority Queues 306 für die verschiedenen Prioritäten. N entspricht in diesem Fall der Anzahl der Prioritäten der logischen Kanäle 208, die auf dem jeweiligen MAC-d-Flow gemultiplext sind.

[0149] Alternativ kann vorgesehen sein, wie in Fig. 4 dargestellt ist, dass jede Priority Queue 306 Daten von allen MAC-d-Flows 301, 302 empfangen kann und in diesem Fall gibt es N Priority Queues 306 für alle MAC-d-Flows gemeinsam. N entspricht in diesem Fall der Anzahl der verschiedenen Prioritäten der logischen Kanäle 208, die auf die MAC-d-Flows gemultiplext sind.

[0150] In einer dritten alternativen Ausführungsform der Priority Queues 306 ist es vorgesehen, dass für jede definierte Verkehrsklasse (Traffic Class) eine Priority Queue vorgesehen ist. Es gibt N Priority Queues 306 für alle MAC-d-Flows 301, 302 gemeinsam, wie in Fig. 4 dargestellt. N entspricht in diesem Fall der Anzahl der Verkehrsklassen, d.h. der Traffic Classes, beispielsweise N = 4 für den Fall, dass die vier Verkehrsklassen „Conversational“, „Streaming“, „Interactive“ und „Background“ definiert sind.

[0151] Die MAC-d-Teil-Protokollschicht teilt in diesem Fall der MAC-e-Teil-Protokollschicht 300 Informationen über die Prioritäten der logischen Kanäle 208, die auf einen MAC-d-Flow gemultiplext sind, mit, über die die Priority Queue Distribution-Einheit 305 in der MAC-e-Teil-Protokollschicht 300 daraufhin die Aufteilung der Daten auf die einzelnen Priority Queues 306 vornimmt.

[0152] Bei dem in Fig. 4 dargestellten Ausführungsbeispiel sind somit drei Priority Queues 306 vorgesehen, denen jeweils ein Gewichtungswert 309 und ein Gewichtungswertebereich 310 in entsprechend oben dargelegter Weise zugeordnet werden.

[0153] Gemäß diesem Ausführungsbeispiel sind den einzelnen Priority Queues 306 folgende Gewichtungswerte 309 zugeordnet:

- der ersten Priority Queue E 50% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite,
- der zweiten Priority Queue F 25% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite, und
- der dritten Priority Queue G 25% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite.

[0154] Ferner sind den einzelnen Priority Queues 306 folgende Gewichtungswertebereiche 310, d.h. Gewichtungsbänder zugeordnet:

- der ersten Priority Queue E ein Gewichtungswertebereich von 30% bis 60% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite,
- der zweiten Priority Queue F ein Gewichtungswertebereich von 10% bis 40% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite, und
- der dritten Priority Queue G ein Gewichtungswertebereich von 10% bis 40% der insgesamt zur Verfügung stehenden Datenübertragungsbandbreite.

[0155] Im Rahmen des Auslesens der Daten aus den jeweiligen Priority-Queue-Datenpufferspeichern werden die Daten gemäß der entsprechend dem jeweils für jede Priority Queue 306 aktuell zugeordneten Gewichtungswert 309 allokierten Datenübertragungsbandbreite ausgelesen.

[0156] Dies bedeutet ferner, dass während der bestehenden Mobilfunk-Kommunikationsverbindung zur Übertragung der Nutzdaten pro Zeiteinheit TTI die in den Priority-Queue-Pufferspeichern zwischengespeicherten Datenpaketen aus den verschiedenen Priority Queues 306 entsprechend ihrer expliziten Gewichtung (d.h.

den Gewichtungswerten) und dem ausgewählten Transportformat anteilig über den E-DCH-Transportkanal **303** übertragen werden.

[0157] Wenn temporär nur sehr wenige Daten in dem Datenpufferspeicher einer Priority Queue **306** vorliegen, wird dieser Priority Queue **306** von der UMTS-Basisstation **308, 309, 310, 311** nur eine geringe Gewichtung innerhalb des Gewichtungs-Bandes, d.h. innerhalb des Gewichtungswertebereichs, zugewiesen.

[0158] Dies bedeutet, es wird ein Gewichtungswert ausgewählt und der jeweiligen Priority Queue **306** zugewiesen, der in der Nähe des unteren, d.h. minimal zulässigen Gewichtungswerts **504** des Gewichtungswertebereichs **503** liegt.

[0159] Ist der Datenpufferspeicher-Füllstand des Datenpufferspeichers der jeweiligen Priority Queue **306** dagegen temporär sehr hoch, wird der Priority Queue **306** von der UMTS-Basisstation **308, 309, 310, 311** eine höhere Gewichtung innerhalb des Gewichtungs-Bandes zugewiesen, vorzugsweise ein Gewichtungswert, der sich in der Nähe des oberen, d.h. maximal zulässigen Gewichtungswerts **505** des jeweiligen Gewichtungswertebereichs **503** befindet.

[0160] Die folgenden zusammengefassten Aspekte können als besonders vorteilhaft im Rahmen der Erfindung angesehen werden:

- Die Gewichtung der Datenpufferspeicher, insbesondere der Datenpufferspeicher der Priority Queues in der MAC-e-Teil-Protokollschicht auf Basis der Dienstqualität eines angeforderten Kommunikationsdienstes.
- Das Abarbeiten der in den Datenpufferspeichern der Priority Queues zwischengespeicherten Daten und deren Übertragung über den E-DCH-Transportkanal auf Basis der Gewichtung der Datenpufferspeicher, anders ausgedrückt auf Basis der Gewichtungswerte.
- Die Signalisierung der Gewichtung, d.h. der Gewichtungswerte der Datenpufferspeicher der Priority Queues mittels RRC-Nachrichten von der Mobilfunknetzwerk-Kontrolleinheit RNC **106, 107** an das Mobilfunk-Endgerät **118** sowie über die Iub-Schnittstelle **113, 114, 115, 116** zwischen der Mobilfunk-Netzwerk-Kontrolleinheit **106, 107** an die zugehörigen UMTS-Basisstationen **108, 109, 110, 111**.
- Das Zuordnen zwischen Datenverkehrs-kategorie und Gewichtungswert der Priority Queues.
- Das gleichmäßige Aufteilen der zur Verfügung stehenden Datenübertragungsbandbreite, wenn ein Pufferspeicher einer Priority Queue temporär keine zu übertragenden Daten zwischengespeichert hat.
- Das erstmalige Einführen von Gewichtungs-Bändern, d.h. von Gewichtungswertebereichen, innerhalb derer die Gewichtung der Priority Queues dynamisch in Abhängigkeit von dem jeweiligen Datenpufferspeicher-Füllstand, der Übertragungssituation in der Mobilfunkzelle und den Gewichtungen der anderen Priority Queues durch das Netzwerk, vorzugsweise durch die jeweilige UMTS-Basisstation **108, 109, 110, 111** erniedrigt bzw. erhöht werden kann.

[0161] In diesem Dokument sind folgende Veröffentlichungen zitiert:

- [1] 3GPP TS 25.301, Technical Specification, Third Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Interface Protocol Architecture (Release 1999);
- [2] RP-040081, Proposed Work Item on FDD Enhanced Uplink, TSG-RAN Meeting #23, Phoenix, USA, 10.-12. März 2004;
- [3] 3GPP TS 25.331, Technical Specification, Third Generation Partnership Project; Technical Specification Group Radio Access Network; RRC Protocol Specification (Release 1999).

Bezugszeichenliste

100	Mobilfunksystem
101	Mobilfunk-Netzwerk-Teilsystem
102	Mobilfunk-Netzwerk-Teilsystem
103	Iu-Schnittstelle
104	Iu-Schnittstelle
105	Mobilfunk-Kernnetzwerk
106	Mobilfunk-Netzwerk-Kontrolleinheit
107	Mobilfunk-Netzwerk-Kontrolleinheit
108	UMTS-Basisstation
109	UMTS-Basisstation
110	UMTS-Basisstation
111	UMTS-Basisstation
112	Iur-Schnittstelle

113	Iub-Schnittstelle
114	Iub-Schnittstelle
115	Iub-Schnittstelle
116	Iub-Schnittstelle
117	Uu-Schnittstelle
118	Mobilfunk-Endgerät
200	Protokollschicht-Anordnung
201	physikalische Schicht
202	Datenverbindungsschicht
203	MAC-Protokollschicht
204	RLC-Protokollschicht
205	PDCCP-Protokollschicht
206	BMC-Protokollschicht
207	RRC-Protokollschicht
208	logischer Kanal
209	Transportkanal
210	Radio Bearer
211	Kontroll-Ebene
212	Nutzer-Ebene
213	Signalling Radio Bearer
300	MAC-e-Teilprotokollschicht
301	MAC-d-Flow
302	MAC-d-Flow
303	E-DCH-Transportkanal
304	MAC-Control-Dienstzugangspunkt
305	Priority Queue-Verteilungseinheit
306	Priority Queue
307	HARQ-Einheit
308	Transportformat-Auswahleinheit
309	Gewichtungswert
310	Gewichtungswertebereich

Patentansprüche

1. Mobilfunkeinrichtung

- mit mindestens einer Datensicherungsschicht-Einheit,
- mit einer Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern, welche der mindestens einen Datensicherungsschicht-Einheit zugeordnet sind,
- mit einem Gewichtungsspeicher, in welchem Gewichtungswerte und/oder Gewichtungswertebereiche gespeichert sind, wobei jeweils ein Gewichtungswert und/oder Gewichtungswertebereich einem der Datensicherungsschicht-Protokoll-Pufferspeicher zugeordnet ist, und
- mit einer Datensicherungsschicht-Protokoll-Pufferspeicher-Ausleseeinrichtung, welche derart eingerichtet ist, dass sie die in den Datensicherungsschicht-Protokoll-Pufferspeichern zwischengespeicherten Daten gemäß einer durch die Gewichtungswerte und/oder Gewichtungswertebereiche angegebenen Reihenfolge aus den Datensicherungsschicht-Protokoll-Pufferspeichern ausliest, wobei mit den Gewichtungswerten und/oder den Gewichtungswertebereichen jeweils ein Anteil der insgesamt zur Datenübertragung verfügbaren Datenübertragungsbandbreite angegeben wird, welcher jeweils zum Auslesen der in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher gespeicherten Daten allokiert wird.

2. Mobilfunkeinrichtung gemäß Anspruch 1, bei der die Datensicherungsschicht-Einheit als eine der folgenden Einheiten ausgebildet ist,

- Funkverbindungs-Steuerungseinheit
- Paketdaten-Konvergierungs-Protokolleinheit,
- Broadcast/Multicast-Steuerungseinheit.

3. Mobilfunkeinrichtung gemäß Anspruch 1, bei der die Datensicherungsschicht-Einheit als eine Medium-Zugriffs-Steuerungseinheit ausgebildet ist.

4. Mobilfunkeinrichtung gemäß Anspruch 3,

- bei der die Medium-Zugriffs-Steuerungseinheit eine Medium-Zugriffs-Sub-Steuerungseinheit sowie eine Au-

tomatic-Repeat-Request-Steuerungseinheit aufweist,

- bei der zumindest ein Teil der Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern als Medium-Zugriffs-Steuerungs-Pufferspeicher eingerichtet sind, in welchen die Daten zwischengespeichert werden.

5. Mobilfunkeinrichtung gemäß Anspruch 4, bei der die Automatic-Repeat-Request-Steuerungseinheit eingerichtet ist zum Durchführen eines Hybrid-Automatic-Repeat-Request-Verfahrens.

6. Mobilfunkeinrichtung gemäß einem der Ansprüche 3 bis 5, mit einem Transportformat-Speicher, in welchem Transportformate gespeichert sind, welche Datenübertragungscharakteristika enthalten, welche zur Datenübertragung gemäß einem jeweiligen Transportformat verwendet werden.

7. Mobilfunkeinrichtung gemäß einem der Ansprüche 3 bis 6, mit einer Transportformat-Auswahleinheit zum Auswählen eines oder mehrerer Transportformate.

8. Mobilfunkeinrichtung gemäß einem der Ansprüche 1 bis 7, mit einer Gewichtung-Einstelleinheit zum Vorgeben der Gewichtungswerte und/oder Gewichtungswertebereiche gemäß einer zur Datenübertragung jeweils verwendeten Dienstqualität.

9. Mobilfunkeinrichtung gemäß Anspruch 8, bei der die Gewichtung-Einstelleinheit derart eingerichtet ist, dass sie Gewichtungswerte vorgibt, welche innerhalb eines jeweiligen Gewichtungswertebereichs liegen.

10. Mobilfunkeinrichtung gemäß einem der Ansprüche 1 bis 9, mit einer Sende-Steuerungseinrichtung zum Steuern von Mobilfunk-Senderressourcen der Mobilfunkeinrichtung, welche Sende-Steuerungseinrichtung eingerichtet ist, Gewichtungswerte und/oder Gewichtungswertebereiche von einer anderen Mobilfunkeinrichtung zu empfangen und der Gewichtungs-Einstelleinheit zu übermitteln, womit die Gewichtungswerte und/oder Gewichtungswertebereiche von der anderen Mobilfunkeinrichtung vorgebar sind.

11. Mobilfunkeinrichtung gemäß einem der Ansprüche 1 bis 10, bei der die Datensicherungsschicht-Protokoll-Pufferspeicher-Ausleseeinrichtung derart eingerichtet ist, dass für den Fall, dass in einem oder in mehreren Datensicherungsschicht-Protokoll-Pufferspeichern keine zu übertragenden Daten zwischengespeichert sind, der oder die für diesen oder diese Datensicherungsschicht-Protokoll-Pufferspeicher allokierte Anteil oder Anteile der Datenübertragungsbandbreite für den oder die Datensicherungsschicht-Protokoll-Pufferspeichern zusätzlich allokiert wird, in welchem oder welchen zu übertragenden Daten zwischengespeichert sind.

12. Mobilfunkeinrichtung

- mit mindestens einer Datensicherungsschicht-Einheit,
- mit einem Gewichtungsspeicher, in welchem Gewichtungswerte und/oder Gewichtungswertebereiche gespeichert sind, wobei mit den Gewichtungswerten und/oder den Gewichtungswertebereichen jeweils ein Anteil der insgesamt zur Datenübertragung einer anderen Mobilfunkeinrichtung verfügbaren Datenübertragungsbandbreite angegeben wird, welcher jeweils zum Auslesen der in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher gespeicherten Daten allokiert werden soll, und
- mit einer Gewichtungs-Übertragungseinrichtung, welche eingerichtet ist zum Übertragen der Gewichtungswerte und/oder Gewichtungswertebereiche zu der anderen Mobilfunkeinrichtung.

13. Mobilfunkeinrichtung gemäß Anspruch 12, eingerichtet als Mobilfunk-Basisstation.

14. Mobilfunknetzwerk-Kontrolleinheit

- mit einem Gewichtungsspeicher, in welchem Gewichtungswerte und/oder Gewichtungswertebereiche gespeichert sind, wobei mit den Gewichtungswerten und/oder den Gewichtungswertebereichen jeweils ein Anteil der insgesamt zur Datenübertragung einer anderen Mobilfunkeinrichtung verfügbaren Datenübertragungsbandbreite angegeben wird, welcher jeweils zum Auslesen der in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher gespeicherten Daten allokiert werden soll, und
- mit einer Gewichtungs-Übertragungseinrichtung, welche eingerichtet ist zum Übertragen der Gewichtungswerte und/oder Gewichtungswertebereiche zu der anderen Mobilfunkeinrichtung.

15. Verfahren zum Auslesen von Daten aus einer Mehrzahl von Datensicherungsschicht-Protokoll-Pufferspeichern welche mindestens einer Datensicherungsschicht-Einheit zugeordnet sind, durchgeführt in einer Mobilfunkeinrichtung,

- bei dem jedem Datensicherungsschicht-Protokoll-Pufferspeicher ein Gewichtungswert und/oder Gewichtungswertebereich zugeordnet wird, und

- bei dem die Daten gemäß einer durch die Gewichtungswerte und/oder Gewichtungswertebereiche angegebenen Reihenfolge aus den Datensicherungsschicht-Protokoll-Pufferspeichern ausgelesen werden, wobei mit den Gewichtungswerten und/oder den Gewichtungswertebereichen jeweils ein Anteil der insgesamt zur Datenübertragung verfügbaren Datenübertragungsbandbreite angegeben wird, welcher jeweils zum Auslesen der in dem jeweiligen Datensicherungsschicht-Protokoll-Pufferspeicher gespeicherten Daten allokiert wird.

Es folgen 4 Blatt Zeichnungen

FIG 1

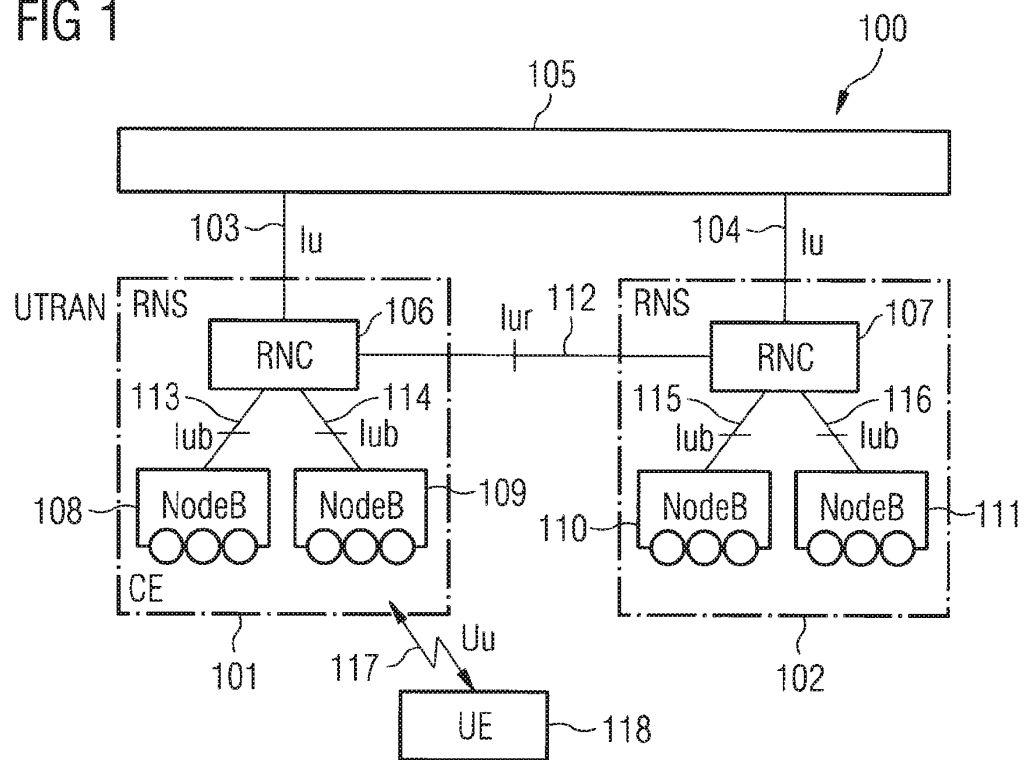


FIG 2

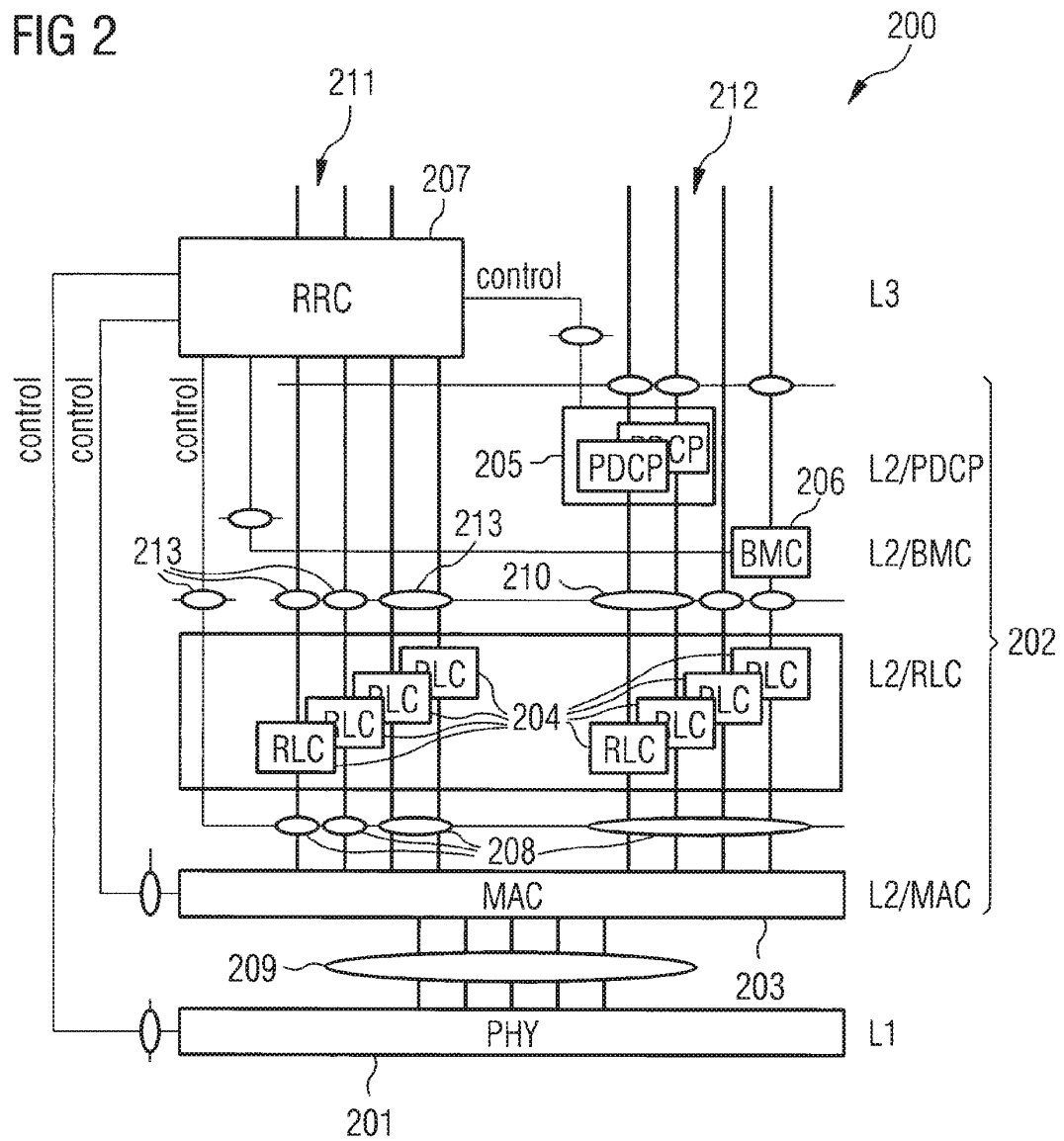


FIG 3

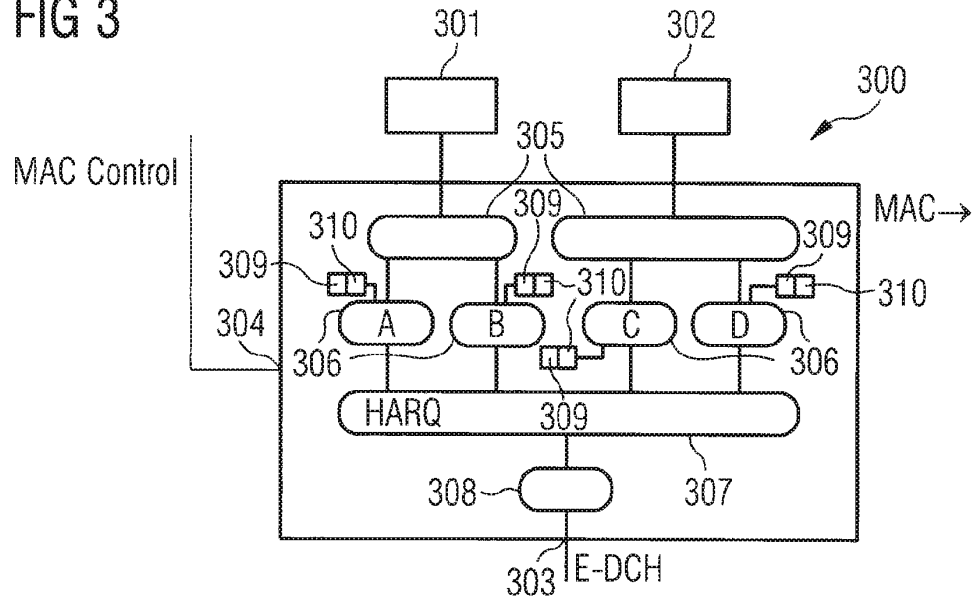


FIG 4

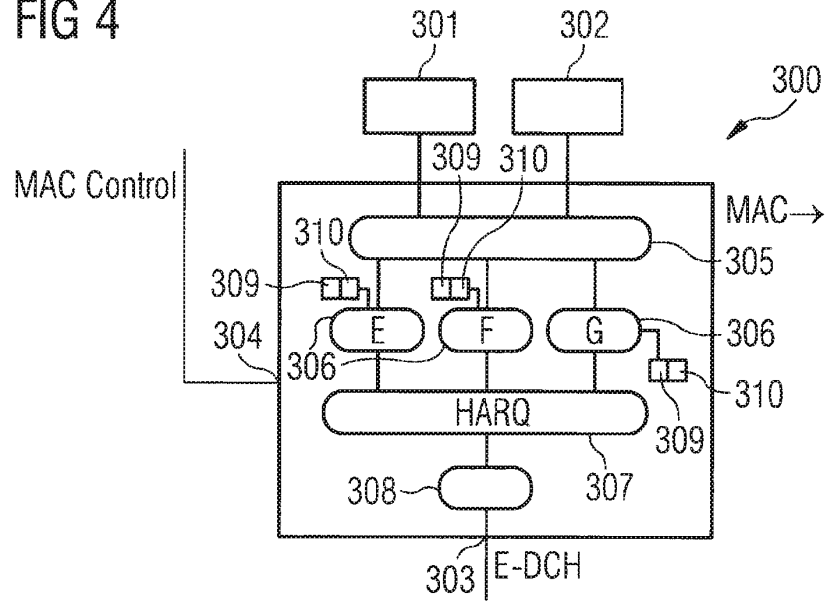


FIG 5

500

	Information Element/ Group name	Need	Multi	Type and reference	Semantics description
501 {	Priority Queue	OP	1 to <maxPQ>		
	>PQ Identity	MP		PQ Identity	
502 {	>Choice PQ weighting				
	>>explicit PQ weighting	OP		Integer (0...100)	Value in %
	>>PQ weighting band	OP			
503 {	>>>lower PQ border	OP		Integer (0...100)	Value in % 504
	>>>upper PQ border	OP		Integer (0...100)	Value in % 505



Espacenet

Bibliographic data: DE102004044965 (A1) — 2006-03-30

Mobile radio system e.g. Global system for mobile communication, has load memory in which weighing values are stored, where values specify portion of bandwidth which is allocated to select data stored in buffer memories

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- cooperative: **H04L1/1887 (EP)**; H04L1/1812 (EP); H04W72/0453 (EP); H04W72/1242 (EP)

Application number: DE20041044965 20040916

Priority number (s): DE20041044965 20040916

Abstract of DE102004044965 (A1)

The system has a data securing layer-unit and data securing layer-protocol-buffer memories. Weighing values and or weighing ranges of value stored in a load memory specify a portion of data communication bandwidth available for data communication, where the bandwidth is allocated for selecting data stored in the data securing layer-protocol-buffer memories. Transport format-selection unit (308) for selection of transport format. Independent claims are also included for the following: (A) a mobile radio network-control unit with a load memory (B) a method for selection of data.



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DESCRIPTION DE 102004044965

[0001]

The invention relates to a mobile radio device, a mobile radio network control unit and a method for reading out data from a plurality of data link layer protocol buffers.

[0002]

Such a mobile radio device, such a mobile radio network control unit and such a method are known in the context of the mobile radio system as UMTS (Universal Mobile Telecommunications System).

[0003]

A UMTS mobile radio system usually has a core network (CN), a mobile radio access network (UMTS terrestrial radio access network, UTRAN) and a large number of mobile radio end devices (user equipment, UE).

According to UMTS, a transmission mode is provided, referred to as FDD mode (Frequency Division Duplex), in the context of which a separate signal transmission in the uplink direction (uplink direction - also referred to as uplink) denotes a signal transmission direction from a mobile radio terminal to one respective base station in the mobile radio access network) and in the downlink direction (downlink direction - also referred to as downlink - denotes a signal transmission direction from a base station assigned to the mobile radio terminal in the mobile radio

access network to the mobile radio terminal) a separate assignment of frequencies or frequency ranges.

[0004]

According to UMTS, an air interface is defined for the transmission of data between a mobile radio terminal and a respective base station of a mobile radio cell, which is divided into three protocol layers. An overview and a detailed description of the air interface protocol layers according to UMTS can be found in [1].

[0005]

One of the three protocol layers of the UMTS air interface is known as the Radio Resource Control (RRC) protocol layer. The RRC protocol or the RRC protocol layer is for the construction and dismantling as well as for the (re) configuration of physical channels, transport channels, logical channels, signaling radio bearers and radio bearers, as well as for negotiating all parameters of the protocol layers Layer 1 and layer 2 responsible according to UMTS. For this purpose, the units of the RRC layer in the mobile radio terminal and mobile radio network control unit exchange corresponding RRC messages via the signaling radio bearers, as described in [3].

[0006]

For the purpose of management, in general the administration of mobile radio transmitter resources in the mobile radio terminal as part of the uplink packet data transmission, it is known that the mobile radio terminal of a mobile radio network controller (RNC) at the level of the RRC Protocol layer provides information about the traffic volume in a transport channel. This is done using so-called measurement report messages. In this context, as shown in Table 1 below, the currently responsible mobile radio network control unit is filled with data buffer memory, i.e. the fill level of the data buffer memory of the RLC units, for the relevant transport channel. In other words, according to [3] the mobile radio network control unit at the RRC layer level, how much data to be transmitted is currently in the buffer memories of the RLC units of the respective mobile radio terminal is transmitted.

[0007]

In this context, mobile radio transmitter resources are to be understood in particular as the transmission power of the mobile radio terminal, the number and the spreading factor of the assigned CDMA codes.

[0008]

Table 1 shows an example of such a measurement result list as described in [3]: Table 1

[0009]

With the help of this information, the mobile radio network control unit can carry out corresponding configurations of the mobile radio terminal, for example to restrict or increase the usable transport formats of a mobile radio terminal or a handover to another mobile radio cell, a reconfiguration of the dedicated physical channels or carry out an RRC status change, in particular from a first RRC status CELL_DCH to a second RRC status CELL_FACH.

[0010]

The measurement result list shown in Table 1 is thus sent from an RRC unit in the mobile radio terminal to the RRC unit in the corresponding mobile radio network control unit and the respective RLC data buffer fill level is displayed for each radio bearer (RB) .

[0011]

In the standardization body 3GPP (3rd Generation Partnership Project), as described in [2], the improvement of packet data transmission via dedicated transport channels of the uplink, i.e. worked for the uplink direction in the UMTS air interface for the FDD mode, with regard to increasing the data throughput and the transmission speed.

To better differentiate it from the existing dedicated transport channel DCH, a new dedicated transport channel called Enhanced Dedicated Channel (E-DCH) was introduced.

The main features of this new transport channel include the use of a Hybrid Automatic Repeat Request (HARQ) procedure based on the N-channel stop & wait procedure, a scheduling controlled by the base station, also called NodeB in UMTS, and frame lengths of less or equal to 10 ms.

[0012]

The N-channel Stop & Wait HARQ method is a transmission security method in which a number of N so-called.

HARQ processes is configured, with a HARQ process each representing an instance of the Stop & Wait process.

For each HARQ process, the data is sent to the network and buffered until the network receives an acknowledgment of correctly received data (acknowledgment, ACK). Otherwise, i.e. in the case of incorrectly received data (negative acknowledgment, NACK), the data are sent to the network repeatedly.

[0013]

NodeB controlled scheduling is a method in which the scheduling in the mobile radio terminal, i.e. the selection of a suitable transport format from a set of defined transport formats for the E-DCH transport channel is controlled in such a way that the NodeB depending on the traffic situation in the respective radio cell for a mobile radio terminal uses transport formats from the set of defined transport formats for the E-DCH can temporarily restrict or expand the transport channel.

[0014]

However, it has not yet been decided how the data should be transmitted in detail via the new E-DCH transport channel via the UMTS air interface.

One possible solution is to divide the data according to their priorities into different data buffer memories, so-called priority queues (PQ), which are then classified according to their importance, i.e. their priority, preferably or less preferably processed and thus transmitted.

[0015]

As explained above, a transmission security method (HARQ method) is used, in which the network sends the mobile radio terminal a confirmation of correctly or incorrectly received data. For this function, too, the mobile radio terminal contains various data buffer memories in order to buffer the data until the correct reception has been confirmed.

[0016]

Both functions are performed within the MAC protocol layer in the newly provided sub-protocol layer, i.e. a so-called Medium Access Control Enhanced Uplink (MAC-e) entity, which is available both on the terminal side and on the network side, i.e. is implemented. On the network side, the entity carrying out the communication protocol according to MAC-e is in the NodeB, i.e. in the UMTS base station.

[0017]

In particular, it is possible that a case occurs in which lower-priority data may not be able to be transmitted for a very long time if data in the higher-priority queue of the MAC-e sub-layer are continuously buffered for transmission and are pending for transmission. In this case, overload situations can arise on these priority queues, so that in the worst case the respective quality-of-service requirement of certain services cannot be guaranteed.

[0018]

A so-called weighted fair queuing (WFQ) method is also known for prioritizing data packets to be transmitted. The data packets can be assigned to individual queues and weighted. In this context, it is known to weight data packets from a data stream with a lower required data rate higher and to weight smaller data packets compared to longer frames.

[0019]

The invention is based on the problem of specifying a mobile radio device, a mobile radio network control unit and a method for reading out data from a plurality of data link layer protocol buffer stores, in which it can be ensured in a simple manner that all data to be transmitted are transmitted and a prioritization of the data within the framework of the data transmission when reading out from the data link layer buffer memories of the mobile radio device is nevertheless

made possible.

[0020]

The problem is solved by the mobile radio device, by the mobile radio network control unit and by the method for reading out data from a plurality of data link layer protocol buffer memories with the features according to the independent patent claims.

[0021]

Preferred embodiments of the invention result from the dependent claims.

[0022]

A mobile radio device has at least one data link layer unit, which carries out the different protocols of the data link layer that are provided and implemented in the mobile phone device in accordance with the protocol stack implemented in the mobile phone device.

Furthermore, a plurality of data link layer protocol buffer memories are provided, which are assigned to the at least one data link layer unit.

[0023]

In this context, a data protection layer has, for example, one or more of the following sublayers in the event that the mobile radio device is set up for communication in accordance with the UMTS communication standard: Radio Link Control Layer (RLC),? Packet Data Convergence Protocol Layer (PDCP),? Broadcast / Multicast Control Layer (BMC),? Medium Access Control Layer (MAC).

[0024]

Furthermore, a weighting memory is provided in the mobile radio device, in which weighting values and / or weighting value ranges are stored, a weighting value and / or a weighting value range being assigned to one of the data link layer protocol buffer memories.

In other words, this means that at least one weighting value and / or one weighting value range is / is assigned to each of the data link layer protocol buffer stores taken into account in the course of the procedure according to the invention for reading out the data buffer stores.

[0025]

In this context, it should be noted that the invention can be applied both to all and only to one or more sub-layers of the data protection layer with, for example, the above-mentioned sub-layers or also the sub-layers of the medium access control layer described below.

In other words, this means that in each sub-layer individually or in all sub-layers together a weighting value and / or a weighting value range can be assigned to the buffer memories provided in the respective sub-layer.

[0026]

Furthermore, a data link layer protocol buffer memory read-out device is provided, which is set up in such a way that it reads the data temporarily stored in the data link layer protocol buffer memories from the data link layer protocol buffer memories in a sequence specified by the priorities.

The weighting values and / or weighting value ranges each indicate a proportion of the total data transmission bandwidth available for data transmission, which allocates in each case for reading out the data stored in the respective data link layer protocol buffer memory, i.e. is reserved.

[0027]

In the context of this description, a priority assigned to a priority queue is to be understood as the relative or absolute meaning of the data temporarily stored in the buffer memory of the respective priority queue.

[0028]

Within the scope of this description, a weighting value is to be understood as an indication of a data transmission bandwidth which is to be allocated, in other words, reserved for reading out the

data stored in the respective data link layer protocol buffer memory.

[0029]

Within the scope of this description, a weighting value range is to be understood as an indication of an interval of a data transmission bandwidth within which the data transmission bandwidth to be allocated in each case for reading out the data stored in the respective data link layer protocol buffer memory can be selected as permissible.

[0030]

In a mobile radio device, which is preferably set up as a mobile radio base station, for example referred to as NodeB in the cellular mobile radio system UMTS, at least one data link layer unit is also provided.

Furthermore, a weighting memory is provided, in which weighting values and / or weighting value ranges are stored, with the weighting values and / or with the weighting value ranges each indicating a portion of the total data transmission bandwidth available for data transmission from another mobile radio device, preferably a mobile radio terminal, which each for reading out the data stored in the respective data link layer protocol buffer stores in the other mobile radio device, should be allocated, clearly reserved.

Furthermore, a weighting transmission device is provided, which is set up to transmit the weighting values and / or weighting value ranges to the other mobile radio device.

[0031]

A mobile radio network control unit also has a weighting memory, in which weighted values and / or weighted value ranges are stored, the weighted values and / or the weighted value ranges each indicating a proportion of the total data transmission bandwidth to be used for data transmission from another mobile radio device, each of which is used to read out the data to be allocated in the respective data link layer protocol buffer memory in the other mobile radio device.

Furthermore, a weighting transmission device is provided, which is set up to transmit the weighting

values and / or weighting value ranges to the other mobile radio device.

[0032]

In a method for reading out data from a plurality of data link layer protocol buffers which are assigned to at least one data link layer unit, the following steps are carried out in a mobile radio device: a weight value and / or weight value range is assigned to each data link layer protocol buffer store.

[0033]

The data temporarily stored in the buffer memories are read out in accordance with an order specified by the weighting values and / or weighting value ranges, the weighting values and / or the weighting value ranges each indicating a proportion of the total data transmission bandwidth available for data transmission, which is in each case for reading out the data protection layer in the respective data link layer - Log buffer memory data is allocated.

[0034]

The respectively assigned data transmission bandwidths are preferably always greater than zero.

In one embodiment of the invention, in the event that temporarily no data of a specific service is being transmitted, the network may be able to temporarily assign a data transmission bandwidth equal to zero Hz for a specific data buffer memory to the mobile radio device.

[0035]

In this context, it should be noted that the data link layer protocol buffer memory of one or more partial protocol layers and / or the weighting memory can be set up as a common memory with logically assigned memory areas in each case or also as separate memories.

[0036]

The invention can clearly be seen in the fact that due to the allocation of a defined data transmission bandwidth of preferably greater than zero Hz for each buffer memory, in which data is buffered and from which buffer memory data is read, it is guaranteed that data is actually read from all buffer memories and that Transmission medium, ie in this case, the units or units of the physical layer and thus the physical transmission medium, in particular a radio interface, are

preferably supplied.

[0037]

It is therefore impossible that data which are temporarily stored in a data buffer memory with a very low prioritization are not transmitted to another mobile radio device at all or only with a considerable delay.

[0038]

In particular, the use of the method for controlling the reading of the buffer memories of the data link layer is suitable for use in a mobile radio terminal, the weight value ranges or the weight values preferably being from the UTRAN, particularly preferably from a mobile radio network control unit and / or from the UMTS -Base station can be specified.

[0039]

According to one embodiment of the invention, the at least one data link layer unit is designed as one of the following units: Radio Link Control Unit (RLC),? Packet Data Convergence Protocol (PDCP),? Broadcast / Multicast control unit (Broadcast / Multicast Control, BMC).

[0040]

According to another embodiment of the invention, at least one data link layer unit is designed as a medium access control unit, wherein the medium access control unit can be set up as a unit in one of the following partial protocol layers of the medium access control layer: Medium access control d-part protocol layer (MAC dedicated layer),? Medium access control c / sh sub-protocol layer (MAC control / shared),? Medium access control b-part protocol layer (MAC broadcast), and / or? Medium access control e-part protocol layer (MAC enhanced uplink).

[0041]

In particular, in the case in which the data link layer unit is set up as a medium access control unit, it has a medium access sub-control unit and an automatic repeat request control unit.

At least some of the plurality of data link layer protocol buffers are set up as medium access control buffers, in which the data are buffered.

In other words, the buffers are provided in the unit for dividing the data into the individual data buffers of the MAC-e protocol layer with different priorities and / or as the buffers of the ARQ processes in the MAC-e protocol unit.

[0042]

The automatic repeat request control unit is preferably set up according to MAC-e to carry out a hybrid automatic repeat request method (HARQ method).

[0043]

Furthermore, a transport format memory is preferably provided, in which transport formats are stored, each transport format containing data transmission characteristics which are used for data transmission in accordance with a respective transport format.

In other words, this means that the control parameters for setting the parameters used in each case in the medium access control layer for mapping the data to be transmitted onto the transport channels used for data transmission in the physical layer are contained in each transport format, for example the block size, the number of blocks in a set of blocks and an indication of the transmission time interval (TTI).

[0044]

According to one embodiment of the invention, a transport format selection unit for selecting one or more transport formats from a set of predetermined transport formats permissible for data transmission is further provided in the respective data protection layer, preferably in the MAC-e partial protocol layer.

[0045]

According to another embodiment of the invention, a weighting setting unit for specifying the weighting values and / or the weighting value ranges in accordance with a quality of service used for data transmission, in other words, for example, in accordance with a transport traffic class provided for the data transmission within the respective mobile radio system and characterized by the respective quality of service provided, intended.

In this way, a particularly simple and efficient processing of the data in the data link layer buffer stores and a simple and reliable signaling of the respective weighting of the buffer stores is achieved while ensuring a complete and timely transfer of the data temporarily stored in the respective buffer stores according to the prioritization assigned to the data .

[0046]

The weight setting unit is preferably set up in such a way that it specifies weighting values which lie within a respective weighting value range.

In this way, the weighting setting unit and thus the mobile radio device can flexibly assign different weighting values and thus different data transmission bandwidths to the buffer memories taken into account, whereby by specifying the respective weighting value ranges and thus by specifying the respective data transmission bandwidth ranges, an optimization of the reading and thus the data transmission from the mobile radio device to a cell phone base station, for example.

[0047]

Furthermore, according to another embodiment of the invention, a transmission control device, preferably set up according to the radio resource control layer according to UMTS, is provided for controlling mobile radio transmitter resources of the mobile radio device.

[0048]

The transmission control device is set up in such a way that it receives weighting values and / or weighting value ranges from another mobile radio device, preferably a mobile radio station, particularly preferably from a mobile radio network control unit (resource network control unit) and transmits it to the weight setting unit, i.e. provides with which the weighting values and / or weighting value ranges can be specified by the other mobile radio device.

[0049]

In this way, the control of the reading behavior of the data buffer memory in the data protection layer of the mobile radio terminals is made possible very easily and reliably on the mobile radio network side, at the level of the Radio Network Control Protocol Layer (RNC) according to UMTS, for, depending on the data volume and the transmission quality prevailing in the respective mobile

radio cell which cell is responsible for the cell network control unit.

[0050]

If necessary, the mobile radio network control unit can also activate a handover.

Furthermore, one or more transport formats can be temporarily specified as invalid by means of the mobile radio network control unit or by specifying a set of transport formats, the weighting values and / or weighting value ranges preferably being linked to the respective transport formats, at least partially specifying a selection of possible weighting values / weighting value ranges .

[0051]

According to another embodiment of the invention, it is provided that the data link layer protocol buffer memory read-out device is set up in such a way that, in the event that no data to be transferred are temporarily stored in one or more data link layer protocol buffer memories, the data is transferred for this or these data link layer protocol buffer memory allocated portion or portions of the data transmission bandwidth for the data link layer protocol buffer memory or memory is additionally allocated, in which or in which data to be transferred are buffered.

[0052]

In this way it is achieved that during operation it is possible to react dynamically to the fact that in some buffer memories no data to be transferred is currently buffered.

The data transmission bandwidths allocated in each case for these buffer memories, in other words, transmitter resources, are specified in a predeterminable manner, particularly preferably uniformly, i.e. in equal parts, alternatively distributed over those buffer memories according to the proportions of data transmission bandwidth previously allocated to the respective buffer memories, in other words, the free data transmission bandwidths are divided among the buffer memories in which data are temporarily stored for transmission.

[0053]

The mobile radio devices and the mobile radio network control unit are preferably set up in

accordance with a communication standard for communication in accordance with a cellular mobile radio system, preferably for communication in accordance with the cellular mobile radio system UMTS.

[0054]

Particularly when the invention is used in the context of UMTS, important aspects of the invention can clearly be seen in the fact that the weighting of the data buffer memory, in particular the priority queues, i.e. the buffers in the MAC sub-protocol layer MAC-e according to the requirements of the quality of service, i.e. the quality of service, which is requested for the respective data, for the efficient processing of the data of the data temporarily stored in these data buffers and for a very simple signaling of the weighting, i.e. the weighting values and / or the weighting value ranges starting from the UMTS base station or the RNC unit.

[0055]

The signaling for the configuration of the weighting of the data buffer memories according to the invention in the data link layer, preferably in the MAC-e sub-protocol layer, takes place in the form of radio resource control messages (RRC messages) from the mobile radio network control unit to the mobile radio terminal, also referred to as User equipment (UE), as well as via the so-called Iub interface between the radio network control unit to the associated UMTS base station NodeB.

[0056]

The weights, i.e. the weighting values, or the weighting value ranges, which are assigned to the respective data buffer memories of the data protection layer, preferably the priority queues in the MAC-e partial protocol layer, can be signaled explicitly as a defined percentage of the total available and used data transmission bandwidths.

For example, with three data link layer buffers provided, the first buffer store with the highest priority 50%, the data link layer protocol buffer store with the second highest, in other words with medium priority 25%, and the third data buffer store, in which data with the lowest priority can be buffered 25% of the total available transmission bandwidth will be allocated.

[0057]

In this case, the data that is transmitted over the E-Dedicated Channel (E-DCH) within a defined time interval is made up of the data in accordance with the signaled weighting (the signaled

weighting values and the associated data transmission bandwidths associated with the respective data buffer memories), which are temporarily stored in the respective data buffer memories.

[0058]

In an advantageous variant, a priority queue buffer memory is provided in the MAC-e sub-protocol layer for each data traffic class (traffic class).

[0059]

In this case, the weightings of the data buffer memories in the MAC-e sub-protocol layer are not explicitly signaled, but instead a predefined assignment of the data traffic class to the weights of the corresponding priority queues takes place and thus an allocation of the data transmission bandwidths provided corresponding to the prioritizations is linked.

[0060]

The data traffic classes provided for by UMTS are explained in more detail below.

[0061]

According to UMTS, the following four data traffic classes are currently envisaged: Conversational, Streaming, Interactive, Background.

[0062]

The assignment of the weighting values to the priority queues according to the data traffic classes can be done, for example, in such a way that streaming data is weighted with 40%, conversational data with 30%, interactive data with 20% and background data with 10%.

In other words, this means that 40% of the total available data transmission bandwidth is allocated to the streaming data, 30% to the conversational data, 20% to the interactive data and 10% to the background data.

[0063]

If a priority queue temporarily contains no data, in other words if no data is currently temporarily stored in the buffer memory of this priority queue, the other priority queues are allocated more bandwidth, as described above, according to one embodiment of the invention.

This can be done, for example, in such a way that the remaining available bandwidth, i.e. the data transmission bandwidth that is not required by the priority queues with "empty" buffer memories is divided up among the other data buffer memories, preferably in equal parts.

[0064]

To the weightings, i.e. The weighting values of the individual priority queues, generally the data link layer protocol buffer memory, can be dynamically adapted to the current transmission conditions, in particular to the current data buffer fill levels in the MAC-e sub-layer and to the transmission situation in the respective mobile radio cell each of the considered and considered data buffer memories, alternatively for at least some of the considered data buffer memories weighting bands, also referred to as weighting value ranges within the scope of this description, within which the weighting depending on the respective data buffer memory filling level, the data transmission situation in the respective mobile radio cell and the The weights of the other priority queues, generally the other data link layer protocol buffers, are reduced or reduced by the mobile radio network, in particular by the UMTS base station NodeB can be increased.

[0065]

For this purpose, the mobile radio network control unit RNC uses the Iub interface to configure the UMTS base station with the weighting bands to be used, i.e. the weighting value ranges within which the UMTS base station transmits the mobile radio terminal, which sends data to the UMTS mobile radio station as part of an uplink communication connection, then very quickly and dynamically the weighting values used, i.e. in other words, the weights assigned to the buffer memories and thus the respectively used and allocated data transmission bandwidths can be reconfigured.

[0066]

If there is little or no data in the data buffer memory of a priority queue, then this priority queue and thus the respective data link layer protocol buffer memories are assigned only a slight weight within the weighting band, i.e. a small value of the weighting value within the weighting value range, preferably a weighting value that lies at the lower limit of the weighting value range.

If the data buffer fill level in the respective data backup protocol buffer memory is very high, this priority queue, generally this buffer memory, is assigned a higher weighting within the weighting band and thus a higher weighting value within the weighting value range, preferably a weighting value that is on upper limit of the weighting value range.

The dynamic adaptation of the weighting is preferably controlled by means of the weighting bands by the mobile radio network, in particular by the UMTS base station.

[0067]

When changing the weighting of a priority queue, the weights, i.e. the weighting values of the other priority queues are taken into account and adjusted accordingly if necessary.

[0068]

In particular, two alternatives are provided for adapting the weighting of a priority queue to the data buffer fill level of the respective data buffer memory: The percentage fill level of the respective data buffer memory is mapped one-to-one to the weighting of the priority queue within the weighting band. ? Priority queue data buffer threshold values are defined, if they are exceeded, the weighting of the respective priority queue is discretely in a predetermined manner, i.e. is increased or decreased by a predeterminable value.

[0069]

In this context, it should be noted that the sum of all weights assigned to the priority queues, generally the data link layer protocol buffer stores, may never exceed 100%.

[0070]

If the weights of the priority queues overlap with the same weights, they are preferably processed with equal rights by removing the same number of data packets from all priority queues, i.e. is read out.

A fundamental aspect of the invention can clearly be seen in the application of the known weighted fair queuing principle, in which the data streams are assigned to the individual queues, each queue being assigned a weighting, which represents a defined percentage of the total

transmission bandwidth, to the specific one Field of application of the data protection layer in a mobile radio communication system, preferably in a cellular mobile radio communication system, particularly preferably in a UMTS mobile radio communication system.

[0071]

The mobile radio device is preferably set up as a mobile radio terminal, which is particularly preferably set up to receive and send data according to one or more protocols of a cellular mobile radio system, for example GSM, preferably GPRS or UMTS.

[0072]

The mobile radio terminal is thus particularly preferably set up for communication in a UMTS mobile radio system; in other words, the mobile radio terminal is set up to receive and send data in accordance with one or more protocols of a UMTS mobile radio system.

[0073]

Exemplary embodiments of the invention are shown in the figures and are explained in more detail below.

[0074]

Show it

[0075]

1 shows a communication system according to an embodiment of the invention;

[0076]

2 shows a representation of a protocol structure of the UMTS air interface;

[0077]

3 shows a representation of the units in a MAC-e protocol layer according to a first exemplary embodiment of the invention;

[0078]

4 shows a representation of the units in a MAC-e protocol layer according to a second exemplary

embodiment of the invention;

[0079]

5 shows a representation of an RRC message for signaling the weighting values and the weighting value ranges according to an exemplary embodiment of the invention.

[0080]

1 shows a UMTS mobile radio system 100, for reasons of simplicity the components of the UMTS mobile radio access network (UMTS Terrestrial Radio Access Network, UTRAN), which comprises a plurality of mobile radio network subsystems (Radio Network Subsystems, RNS). 101, 102 which are each connected to the UMTS core network (CN) 105 by means of a so-called Iu interface 103, 104.

A mobile radio network subsystem 101, 102 each has a mobile radio network controller (RNC) 106, 107 and one or more UMTS base stations 108, 109, 110, 111, which according to UMTS are also referred to as NodeB will.

[0081]

Within the mobile radio access network, the mobile radio network control units 106, 107 of the individual mobile radio network subsystems 101, 102 are connected to one another by means of a so-called Iur interface 112.

Each mobile radio network control unit 106, 107 monitors the assignment of mobile radio resources of all mobile radio cells in a mobile radio network subsystem 101, 102.

[0082]

A UMTS base station 108, 109, 110, 111 is in each case connected to a mobile radio network control unit 106, 107 assigned to the base station by means of a so-called Iub interface 113, 114, 115, 116.

[0083]

Each UMTS base station 108, 109, 110, 111 clearly spans one or more mobile radio cells (CE) within a mobile radio network subsystem 101, 102.

Between a respective UMTS base station 108, 109, 110, 111 and a subscriber device 118 (user equipment, UE), also referred to below as a mobile radio terminal, message signals or

Data signals are transmitted using an air interface, referred to as UMTS as Uu air interface 117, preferably according to a multiple access transmission method.

[0084]

For example, according to the UMTS-FDD mode (Frequency Division Duplex), separate signal transmission in the uplink and downlink direction (uplink: signal transmission from the mobile radio terminal 118 to the respective UMTS base station 108, 109, 110, 111; downlink: signal transmission from the respective assigned UMTS base station 108, 109, 110, 111 to the mobile radio terminal 118) is achieved by a corresponding separate assignment of frequencies or frequency ranges.

[0085]

Several subscribers, in other words a plurality of mobile radio terminals 118 activated or registered in the mobile radio access network in the same mobile radio cell are preferably separated from one another in terms of signal technology by means of orthogonal codes, in particular in accordance with the CDMA method (Code Division Multiple Access).

[0086]

In this context, it should be noted that only one mobile radio terminal 118 is shown in FIG. 1 for reasons of simple illustration.

In general, however, any number of mobile radio terminals 118 are provided in the mobile radio system 100.

[0087]

The communication of a mobile radio terminal 118 with another communication device can be established by means of a complete mobile radio communication connection to another mobile radio terminal, alternatively to a fixed network communication device.

[0088]

As shown in FIG. 2, the UMTS air interface 117 is logically divided into three protocol layers (symbolized in FIG. 2 by a protocol layer arrangement 200).

The units (entities) which guarantee and implement the functionality of the respective protocol layers described below are located both in the mobile radio terminal 118 and in the UMTS base station 108, 109, 110, 111 or in the respective mobile radio network control unit 106, 107, implemented.

[0089]

2 shows the protocol structure 200 from the perspective of the dedicated transport channel DCH (Dedicated Channel).

[0090]

The bottom layer shown in FIG. 2 is the physical layer PHY 201, which represents the protocol layer 1 according to the OSI reference model (Open System Interconnection) according to ISO (International Standardization Organization).

[0091]

The protocol layer arranged above the physical layer 201 is the data protection layer 202, according to the OSI reference model protocol layer 2, which in turn has several sub-protocol layers, namely the medium access control protocol layer (MAC protocol layer) 203, the radio link control protocol layer 204 (RLC protocol layer), the Packet Data Convergence Protocol protocol layer 205 (PDCP protocol layer), and the Broadcast / Multicast Control protocol layer 206 (BMC protocol layer).

[0092]

The top layer of the UMTS air interface Uu is the mobile radio network layer (according to the OSI reference model protocol layer 3), comprising the mobile radio resource control unit 207 (radio resource control protocol layer, RRC protocol layer).

[0093]

Each protocol layer 201, 202, 203, 204, 205, 206, 207 offers the protocol layer above it its services via predefined, defined service access points.

[0094]

The service access points are provided with common and unique names for better understanding of the protocol layer architecture, such as, for example, logical channels 208 between the MAC protocol layer 203 and the RLC protocol layer 204, transport channels 209 between the physical layer 201 and the MAC protocol layer 203, Radio Bearer (RB) 210 between the RLC protocol layer 204 and the PDCP protocol layer 205 or the BMC protocol layer 206, and signaling radio bearer (SRB) 213 between the RLC protocol layer 204 and the RRC protocol layer 207.

[0095]

According to UMTS, the protocol structure 200 shown in FIG. 2 is not only divided horizontally into the above-described protocol layers and units of the respective protocol layers, but also vertically into a so-called control protocol level 211 (control plane, C plane), which is part of the contains physical layer 201, parts of the MAC protocol layer 203, parts of the RLC protocol layer 204 and the RRC protocol layer 207, and the user protocol level 212 (user plane, U plane), which parts of the physical layer 201, parts of the MAC Protocol layer 203, parts of the RLC protocol layer 204, the PDCP protocol layer 205 and the BMC protocol layer 206.

[0096]

By means of the units of the control protocol level 211, only control data are transmitted which are required for establishing and dismantling as well as for maintaining a communication connection, whereas the actual user data are transported by means of the units of the user level 212.

[0097]

Details of the protocol layer arrangement 200 are described in [1].

[0098]

Each protocol layer or each unit (entity) of a respective protocol layer has certain predetermined

functions in the context of a mobile radio communication.

[0099]

The task of the physical layer 201 or the units of the physical layer 201 on the transmitter side is to ensure the secure transmission of data coming from the MAC protocol layer 203 via the air interface 117.

In this context, the data are mapped onto physical channels (not shown in FIG. 2).

The physical layer 201 offers its services to the MAC protocol layer 203 via transport channels 209, by means of which it is determined how and with what characteristics the data are to be transported via the air interface 117.

The essential functions provided by the physical layer 201 units include channel coding, modulation and CDMA code spreading.

In a corresponding manner, the physical layer 201 or the entities of the physical layer 201 on the receiver side carry out the CDMA code despreading, demodulation and decoding of the received data and then forwards this to the MAC protocol layer 203 for further processing.

[0100]

The MAC protocol layer 203 or the units of the MAC protocol layer 203 offers their services to the RLC protocol layer 204 by means of logical channels 208 as service access points, by means of which the type of file that is being transported is characterized.

The task of the MAC protocol layer 203 in the transmitter, i.e. in the case of data transmission in the uplink direction in the mobile radio terminal 118, it is in particular to map the data which are present on a logical channel 208 above the MAC protocol layer 203 to the transport channels 209 of the physical layer 201.

For this purpose, the physical layer 201 offers the transport channels 209 discrete transmission rates.

It is therefore an important function of the MAC protocol layer 203 or the entities of the MAC protocol layer 203 in the mobile radio terminal 118 in the transmission case to select a suitable transport format (TF) for each configured transport channel as a function of the current data transmission rate and the respective one Data priority of the logical channels 208, which are mapped onto the respective transport channel 209, and the available transmission power of the mobile radio terminal 118 (UE).

A transport format specifies, among other things, how many MAC data packet units, referred to as a transport block, are transmitted to the physical layer 201 per transmission time length TTI (Transmission Time Interval) via the transport channel 209, in other words.

The permissible transport formats and the permissible combinations of transport formats of the various transport channels 209 are signaled to the mobile radio terminal 118 by the mobile radio network control unit 106, 107 when a communication connection is set up.

In the receiver, the units of the MAC protocol layer 203 divide the transport blocks received on the transport channels 209 back into the logical channels 208.

[0101]

The MAC protocol layer or the units of the MAC protocol layer 203 usually have three logical units.

The so-called MAC-d unit (MAC dedicated unit) treats the user data and the control data, which via the corresponding dedicated logical channels DTCH (Dedicated Traffic Channel) and DCCH (Dedicated Control Channel) on the dedicated transport channels DCH (Dedicated Channel)) are mapped.

The MAC-c / sh unit (MAC control / shared unit) treats the user data and the control data from

logical channels 208 which are directed to the common transport channels 209, such as that of the common transport channel RACH (Random Access Channel) in uplink Direction or the common transport channel FACH (Forward Access Channel) are mapped in the downlink direction.

The MAC-b unit (MAC broadcast unit) only treats the system cell-relevant system information, which is mapped to the transport channel BCH (broadcast channel) via the logical channel BCCH (broadcast control channel) and is broadcast to all mobile radio terminals 118 in the respective cell are transmitted.

[0102]

By means of the RLC protocol layer 204 or by means of the units of the RLC protocol layer 204, the RRC protocol layer 207 is provided with its services by means of signaling radio bearers (SRB) 213 as service access points and the PDCP protocol layer 205 and the BMC protocol layer 206 by means of radio bearers (RB) 210 are offered as service access points.

The signaling radio bearers and the radio bearers characterize how the RLC protocol layer 204 has to deal with the data packets.

For this purpose, the transmission mode for each configured signaling radio bearer or

Radio Bearer set.

The following transmission modes are provided according to UMTS: Transparent Mode (TM),? Unacknowledged Mode (UM), or? Acknowledged Mode (AM).

[0103]

The RLC protocol layer 204 is modeled in such a way that there is an independent RLC entity per radio bearer or

Signaling radio bearer there.

Furthermore, the task of the RLC protocol layer or its entities 204 in the transmitting device, the user data and the signaling data of radio bearers or

Signaling radio bearers to divide or combine into data packets.

The RLC protocol layer 204 transfers the data packets created after the division or the merging to the MAC protocol layer 203 for further transport or further processing.

[0104]

The PDCP protocol layer 205 or the units of the PDCP protocol layer 205 is or are set up for the transmission or for the reception of data of the so-called packet-switched domain (packet-switching domain, PS domain).

The main function of the PDCP protocol layer 205 is compression or

Decompression of the IP header information (Internet Protocol header information).

[0105]

The BMC protocol layer 206 or its entities is or are used to transmit or receive so-called cell broadcast messages via the air interface.

[0106]

The RRC protocol layer 207 or the entities of the RRC protocol layer 207 is or are for the establishment and the dismantling and the reconfiguration of physical channels, transport channels 209, logical channels 208, signaling radio bearers 213 and radio bearers 210 and for negotiation all parameters of protocol layer 1, ie physical layer 201 and protocol layer 2.

To do this, the RRC units swap, i.e. the units of the RRC protocol layer 207 in the mobile radio network control unit 106, 107 and the respective mobile radio terminal 118 issue corresponding RRC messages via the signaling radio bearers 213.

Details of the RRC layer are described in [3].

[0107]

As described above, the mobile radio terminal 118 can communicate information (the so-called measurement report messages) about the traffic volume of a transport channel for the purpose of management of the mobile radio resources to the mobile radio network control unit 106, 107 assigned to it at the RRC level.

The Serving Radio Network Controller (SRNC) is shown the RLC data buffer fill levels of the relevant transport channel, i.e. it is shown how much data is currently in the respective RLC data buffer memories of the mobile radio terminal 118.

[0108]

With the help of this information, the serving mobile radio network control unit 106, 107 can then make corresponding configurations of the mobile radio terminal 118, for example to restrict or increase the usable transport formats of a mobile radio terminal 118 or a handover to another mobile radio cell, a reconfiguration of the dedicated physical channels or a RRC state change from a first state CELL_DCH to a second state CELL_FACH.

[0109]

The 3GPP standardization committee is currently working on improving packet data transmission via dedicated transport channels of the uplink for the UMTS-FDD mode.

[0110]

In this context, a dedicated transport channel called Enhanced-DCH (E-DCH) is provided.

The main features of this new transport channel include the use of a Hybrid Automatic Repeat Request (HARQ) process based on the N-channel Stop & Wait process, scheduling controlled by a UMTS base station and the provision of frame lengths of less than or equal to 10 ms .

By means of the HARQ transmission security method, the mobile radio terminal device 118 receives a confirmation of correctly or incorrectly received data from the network.

For this function, the mobile radio terminal 118 contains various data buffer memories in order to buffer the data until the correct reception has been confirmed.

Furthermore, according to the current proposal, the Enhanced-DCH transport channel provides for the data to be divided into different data buffer memories, known as priority queues, according to their priorities, the data in the data buffer memories being classified according to their importance, i.e. their prioritization are buffered and thus, after their buffering in the respective buffer memory of a given priority, are processed preferentially or less preferably.

[0111]

Both functions are implemented in a new sub-layer of the MAC protocol layer 203, as is shown according to a first embodiment in FIG. 3 as the MAC-e (MAC-Enhanced Uplink) sub-protocol layer 300, which is also used both on the terminal side, i.e. in the mobile radio terminal 118, as well as on the network side, i.e. is implemented in a UMTS base station 108, 109, 110, 111.

The MAC-e sub-protocol layer 300 receives its data from the MAC-d sub-protocol layer via so-called MAC-d flows 301, 302 and in turn transmits its data via the E-DCH transport channel 303 to the physical layer 201 .

[0112]

The MAC-e sub-protocol layer 300 or its entities communicates with the RRC protocol layer 207 via the MAC control access point 304, for example for the purpose of configuration.

[0113]

In the MAC-d part protocol layer, one or more logical channels are multiplexed onto a MAC-d flow 301, 302, a priority being assigned to each MAC-d flow 301, 302 in the MAC-d part protocol layer, on the basis of which the function priority queue distribution, realizes in a priority queue distribution unit 305 in the MAC-e sub-protocol layer 300 the division of the data into the data buffer memory 306 with the different priorities, ie for processing with data of different priorities in each case in a data buffer memory, with data of one priority being temporarily stored in a data buffer memory.

[0114]

The data are then temporarily stored in the data buffer memory of the priority queues 306 until they are called up for transmission by means of a HARQ unit 307.

[0115]

According to the N-channel Stop & Wait HARQ method, the HARQ unit 307 consists of a number of N so-called HARQ processes, one HARQ process each representing an instance of the Stop & Wait method.

For each HARQ process, the HARQ unit 307 takes a number of packet data units (PDUs) according to their priority from the data buffer memories of the priority queues 306 and forwards them via the E-DCH transport channel 303 to the physical layer 201, where they are then transferred Dedicated physical channels are transmitted to the network via the air interface 117.

[0116]

The HARQ unit 307 temporarily stores the packet data units (PDUs) transmitted per HARQ process in a corresponding HARQ buffer memory (not shown) until the successful transmission has been confirmed by the network.

[0117]

A TF selection unit 308 coupled to the HARQ unit 307 is responsible for selecting the transport format suitable for the transmission per HARQ process.

[0118]

For this purpose, a number of different transport formats are configured in the MAC-e sub-protocol layer 300 using the RRC protocol layer 207, from which the TF selection unit 308 selects a

suitable one for each transmission time interval (TTI) and HARQ process.

[0119]

The MAC-e sub-protocol layer 300 is set by means of the RRC protocol layer on the part of the mobile radio network control unit 106, 107.

[0120]

If a mobile radio subscriber uses a service in accordance with UMTS by means of the mobile radio terminal 118, preferably in the mobile radio device described above, the UMTS mobile radio core network 105 provides this requested service with a predetermined, defined quality of service (QoS) that meet the quality of service requirements of the corresponding service.

[0121]

According to UMTS, the following four traffic classes are currently defined for the classification of provided services, which differ in their specific data transmission properties and quality requirements: Conversational: The conversational traffic class is intended for real-time applications between participants.

These include applications such as voice telephony and video telephony.

Communication connections in this traffic class require a constant, i.e. Guaranteed data transfer rate and thus data transfer bandwidth with short time delays in data transfer.

On the other hand, a conversational application is insensitive to short-term data transmission errors. ? Streaming: The streaming traffic class is intended for real-time distribution services such as video and audio, in which data is transmitted unidirectionally, for example from a server computer to a client computer, with the real-time distribution services allowing the recipient to already transfer the data during play the transmission and present it to a user of the receiver mobile radio device.

With streaming, a continuous data stream is set up, so that communication links this traffic class a constant, i.e. guaranteed data transfer rate and thus data transfer bandwidth.

However, a streaming application is insensitive to short data transmission delays and in this respect does not have any strict requirements in comparison to an application of the conversational traffic class. ? Interactive: The Interactive traffic class is intended for interactive applications such as Internet surfing, games and chat.

The communication links in this traffic class do not require a constant data transmission rate and thus data transmission bandwidth, but they place high demands on data transmission security, i.e. they require a very low bit error rate. ? Background: Background traffic class applications transmit low priority data in the background.

Examples include downloading data, receiving email (electronic mail) and SMS (short message service).

Communication connections in this traffic class do not require a constant data transmission rate and thus data transmission bandwidth and are insensitive to time delays in the context of data transmission.

On the other hand, they place high demands on transmission security, i.e. they require a very low bit error rate.

[0122]

The quality of service, the quality of service, of a communication service provided or provided is described in detail using various attributes such as, for example, the maximum bit rate, the guaranteed bit rate or the maximum transmission delay for the respective communication service.

[0123]

Thus, if a requested communication service with a defined quality of service QoS is provided to a mobile radio subscriber by the mobile radio core network 105, then the associated QoS attributes are determined accordingly by the mobile radio core network 105.

[0124]

When establishing the communication connection (connection establishment), the subscriber and

thus the subscriber mobile radio terminal 118 are informed by the mobile radio network control unit 106, 107 on the network side, i.e. on the UTRAN side, the corresponding mobile radio resources required for the communication connection, such as the required CDMA spreading codes, are allocated and the protocols of protocol layers 1 and 2 are configured in such a way that the communication service with the negotiated service quality is ensured during the duration of the communication connection can.

[0125]

The negotiated service quality of a communication service can be reconfigured by the mobile radio core network 105 during an existing communication connection, for example due to scarce mobile radio resources or increasing interference in the mobile radio cell.

[0126]

Referring again to FIG. 3, details about the stop & wait method (also referred to as send & wait method) and the HARQ method (hybrid automatic repeat request method) used are explained below.

[0127]

The N-channel Stop & Wait HARQ method is a data transmission security method in which a number of N so-called HARQ processes are configured in a mobile radio terminal 118, a HARQ process in each case an instance of the Stop & Wait Represents procedure.

[0128]

For each HARQ process, the data is sent to the communication network, in particular the mobile radio base station, and temporarily stored until a positive confirmation message about correctly received data (acknowledgment, ACK) is received from the communication network.

Otherwise, i.e. in the case of incorrectly received data, communicated by means of a negative acknowledgment message (NACK), the data are repeatedly sent to the mobile radio communication network.

[0129]

The so-called NodeB controlled scheduling is a method in which the scheduling in the mobile radio

terminal 118, i.e. the selection of a suitable transport format from a set of defined transport formats for the E-DCH transport channel is controlled in such a way that the NodeB 108, 109, 110, 111 depending on the traffic situation in the respective mobile radio cell, the mobile radio terminal 118 Can temporarily restrict the use of transport formats from the set of defined transport formats for the E-DCH transport channel.

[0130]

Both functions, i.e. the functionality of the HARQ method and the functionality of the stop & wait method are implemented in the MAC-e (MAC-Enhanced Uplink) sub-protocol layer within the MAC layer, the MAC-e sub-protocol layer being both on the terminal side and on the network side available, ie is implemented.

On the network side, the MAC-e sub-protocol layer is located in NodeB 108, 109, 110, 111.

[0131]

Fig. 3 exemplifies the MAC-e architecture on the terminal side, i.e. it is shown how the functionality of the MAC-e sub-protocol layer is implemented in the mobile radio terminal 118.

[0132]

For the illustrated exemplary embodiments, a transmission scenario is assumed in which a user of the mobile radio terminal 118 uses three packet services in the uplink at the same time, for example a service for interactive gaming on the Internet, a service for downloading (downloading) text files and a service for the Streaming video data.

[0133]

This packet data is transmitted from the mobile radio terminal 118 to the mobile radio communication network via the E-DCH transport channel 303, i.e. to the serving mobile radio network control unit 106 and the base station 109 via the air interface 117.

When the communication connection is set up, configuration messages are sent to the mobile radio terminal 118 via the RRC protocol layer 207, implemented both in the mobile radio network

control unit 106 and in the mobile radio terminal 118, with the aid of which the RRC protocol layer 207 is sent in the mobile radio terminal 118, the protocol layers below based on the communication layer model are configured.

[0134]

According to this exemplary embodiment, the entity of the MAC-e sub-protocol layer 300 is configured with two MAC-d flows 301, 302, only one logical channel being multiplexed on a MAC-d flow 301, 302 and the data of the packet services on each assigned logical channel are transmitted.

[0135]

Furthermore, a priority queue 306 and four HARQ processes, each with a HARQ buffer memory, are configured in the HARQ unit for each MAC-d flow 301, 302.

[0136]

Furthermore, a plurality of different transport formats is configured for the E-DCH transport channel 303, from which the transport format selection unit 308 (TF selection) is suitable for each transmission time interval (TTI) and HARQ process has to choose.

The data from the MAC-d flows 301, 302 are assigned and transmitted to the individual priority queues 306 in accordance with their priority.

[0137]

In the MAC-d sub-protocol layer, one or more logical channels are multiplexed onto a MAC-d flow 301, 302, a priority being assigned to each MAC-d flow 301, 302 in the MAC-d sub-protocol layer on the basis of which the priority queue distribution unit 305 distributes the data to the respective priority queues 306 and thus the priority queue buffers with the different priorities.

The data are then temporarily stored in the data buffer memories of the priority queues 306 until they are called up by the HARQ unit 307 for data transmission, i.e. be read out.

[0138]

As shown in FIG. 3 and in FIG. 4, the mobile radio terminal 118 is given the weighting of the individual priority queues 306 (explicit PQ weighting) by the UTRAN by means of an RRC message 500, as is shown by way of example in FIG. 5) and in addition the weighting bands within which the weighting of the priority queues 306 dynamically depending on the respective data buffer fill level of the priority queues 306, the data transmission situation in the respective mobile radio cell and the weightings of the other priority queues 306 in the mobile radio terminal 118 can be lowered or increased by the mobile radio communication network, in particular by the UMTS base station 108, 109, 110, 111 (priority queue weighting band).

[0139]

The weights, i.e. in other words, the weight values 309 as well as the weight value ranges (i.e. the weight bands) 310 are stored in a weight memory (not shown) in the mobile radio terminal 118.

[0140]

A weighting value 309 and a weighting value range 310 are uniquely assigned to each priority queue 306.

[0141]

FIG. 5 shows an example of the structure of the RRC message 500, with which the weighting values 309 and the weighting value ranges 310 for the respective priority queues 306 are transmitted.

[0142]

Here, it is assumed without restriction of the general validity that the mobile radio terminal 118 communicates the respective data buffer fill levels of the data buffers of the individual priority queues 306 regularly, i.e., to the mobile radio communication network, via corresponding RRC messages, preferably at predetermined times or on request from the mobile radio network control unit 308.

[0143]

As shown in FIG. 5, the RRC weight value message 500 contains the following data: An indication of the respective priority queue 501? an indication of the respective weighting value, i.e.

Weighting value 502, and? an indication of the weighting band, i.e. of the weight value range 503, the weight value range 503 being given by an indication of a lower weight value 504, i.e. a minimum permissible weighting value as well as an upper weighting value 505, i.e. a maximum permissible weighting value.

[0144]

For the exemplary embodiment shown in FIG. 3, it is assumed that the following values are configured for the four priority queues 306: On the one hand, the weighting values 309? for the first priority queue A 50% of the total available data transmission bandwidth,? for the second priority queue B 30% of the total available data transmission bandwidth, for the third priority queue C 15% of the total available data transmission bandwidth and? for the fourth priority queue D 5% of the total available data transmission bandwidth.

[0145]

Furthermore, the following priority values 310 are assigned to the individual priority queues 306: the first priority queue A has a first weighting value range of 30% to 60% of the total available data transmission bandwidth, the second priority queue B 10% to 40% of the total available data transmission bandwidth, the third priority queue C 5% to 30% of the total available data transmission bandwidth, and? the fourth priority queue D 2% to 15% of the total available data transmission bandwidth.

[0146]

It should be pointed out again that if the weighting values vary within the respective weighting value ranges 310, care must be taken that the sum of the weighting values of the four, according to FIG. 4 of the three, weighting values 309 does not exceed 100%, since otherwise more data transmission bandwidth is allocated would have to be than is available at all.

[0147]

According to these exemplary embodiments of the invention, different definitions for priority queues are provided.

[0148]

As shown in FIG. 3, each priority queue 306 can be permanently assigned to a MAC-d flow 301, 302 and there are N priority queues 306 for each MAC-d flow for the different priorities.

In this case, N corresponds to the number of priorities of the logical channels 208 which are multiplexed on the respective MAC-d flow.

[0149]

Alternatively, as shown in FIG. 4, it can be provided that each priority queue 306 can receive data from all MAC-d flows 301, 302 and in this case there are N priority queues 306 in common for all MAC d flows.

In this case, N corresponds to the number of different priorities of the logical channels 208 which are multiplexed onto the MAC-d flows.

[0150]

In a third alternative embodiment of the priority queues 306, it is provided that a priority queue is provided for each defined traffic class.

There are N priority queues 306 common to all MAC d flows 301, 302, as shown in FIG. 4.

In this case, N corresponds to the number of traffic classes, i.e. the traffic classes, for example N = 4 in the event that the four traffic classes "conversational", "streaming", "interactive" and "background" are defined.

[0151]

In this case, the MAC-d sub-protocol layer notifies the MAC-e sub-protocol layer 300 of information about the priorities of the logical channels 208, which are multiplexed onto a MAC-d flow, via which the priority queue distribution Unit 305 in the MAC-e sub-protocol layer 300 then distributes the data to the individual priority queues 306.

[0152]

In the exemplary embodiment shown in FIG. 4, three priority queues 306 are thus provided, each of which is assigned a weighting value 309 and a weighting value range 310 in the manner set out above.

[0153]

According to this exemplary embodiment, the following priority values 309 are assigned to the individual priority queues 306: the first priority queue E 50% of the total available data transmission bandwidth, the second priority queue F 25% of the total available data transmission bandwidth, and the third priority queue G 25% of the total available data transmission bandwidth.

[0154]

Furthermore, the following priority value ranges 310, i.e.

Assigned weight bands: the first priority queue E has a weighting value range of 30% to 60% of the total available data transmission bandwidth, the second priority queue F has a weighting value range of 10% to 40% of the total available data transmission bandwidth, and the third priority queue G has a weighting value range of 10% to 40% of the total available data transmission bandwidth.

[0155]

When reading out the data from the respective priority queue data buffers, the data are read out in accordance with the data transmission bandwidth allocated in accordance with the weighting value 309 currently assigned for each priority queue 306.

[0156]

This also means that during the existing mobile radio communication connection for the transmission of the user data per time unit TTI, the data packets from the various priority queues 306 that are temporarily stored in the priority queue buffer memories are prorated according to their explicit weighting (ie the weighting values) and the selected transport format E-DCH transport channel 303 are transmitted.

[0157]

If there is temporarily very little data in the data buffer memory of a priority queue 306, this priority queue 306 is only slightly weighted by the UMTS base station 308, 309, 310, 311 within the weighting band, i.e. within the weight range.

[0158]

This means that a weighting value is selected and assigned to the respective priority queue 306 which is close to the lower, i.e. minimum permissible weighting value 504 of the weighting value range 503.

[0159]

If, on the other hand, the data buffer fill level of the data buffer memory of the respective priority queue 306 is temporarily very high, the UMTS base station 308, 309, 310, 311 assigns the priority queue 306 a higher weighting within the weighting band, preferably a weighting value that varies near the top, ie maximum permissible weighting value 505 of the respective weighting value range 503.

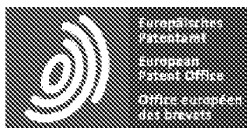
[0160]

The following summarized aspects can be considered particularly advantageous within the scope of the invention: The weighting of the data buffer memory, in particular the data buffer memory of the priority queues in the MAC-e sub-protocol layer, based on the quality of service of a requested communication service. ? The processing of the data temporarily stored in the data buffer memories of the priority queues and their transmission via the E-DCH transport channel on the basis of the weighting of the data buffer memories, in other words on the basis of the weighting values. ? The signaling of the weighting, i.e. the weighting values of the data buffer memories of the priority queues by means of RRC messages from the mobile radio network control unit RNC 106, 107 to the mobile radio terminal 118 and via the Iub interface 113, 114, 115, 116 between the mobile radio network control unit 106, 107 the associated UMTS base stations 108, 109, 110, 111. ? The assignment between the traffic class and the weighting value of the priority queues. ? The even distribution of the available data transmission bandwidth if a buffer memory of a priority queue has temporarily not stored any data to be transmitted. ? The first introduction of weighting bands, i.e. of weighting value ranges within which the weighting of the priority queues dynamically as a function of the respective data buffer fill level, the transmission situation in the mobile radio cell and the weightings of the other priority queues by the network, preferably by the respective UMTS base station 108, 109, 110, 111 can be lowered or increased.

[0161]

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Patent Translate

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CLAIMS DE102004044965

Cellular device & bull; with at least one data link layer unit, ? with a plurality of data link layer protocol buffers which are assigned to the at least one data link layer unit, with a weighting memory in which weighting values and / or weighting value ranges are stored, a weighting value and / or weighting value range being assigned to one of the data link layer protocol buffer stores, and? with a data link layer protocol buffer memory read-out device, which is set up in such a way that it reads the data temporarily stored in the data link layer protocol buffer stores from the data link layer protocol buffer stores in accordance with an order specified by the weighting values and / or weighting value ranges, with the Weighting values and / or the weighting value ranges each specify a portion of the total data transmission bandwidth available for data transmission, which is allocated in each case for reading out the data stored in the respective data link layer protocol buffer memory.

Mobile radio device according to Claim 1, in which the data link layer unit is designed as one of the following units,? Radio link control unit? Packet data convergence protocol unit,? Broadcast / multicast control unit. Mobile radio device according to Claim 1, in which the data link layer unit is designed as a medium access control unit. Mobile radio device according to claim 3,? in which the medium access control unit has a medium access sub control unit and an automatic repeat request control unit, in which at least a part of the plurality of data link layer protocol buffers are set up as medium access control buffers in which the data are buffered. Mobile radio device according to Claim 4, in which the automatic repeat request control unit is set up to carry out a hybrid automatic repeat request method.

Mobile radio device according to one of claims 3 to 5, with a transport format memory in which transport formats are stored which contain data transmission characteristics which are used for data transmission in accordance with a respective transport format. Mobile radio device according

to one of claims 3 to 6, with a transport format selection unit for selecting one or more transport formats. Mobile radio device according to one of claims 1 to 7, with a weighting setting unit for specifying the weighting values and / or weighting value ranges in accordance with a service quality used in each case for data transmission. Mobile radio device according to Claim 8, in which the weighting setting unit is set up such that it specifies weighting values which lie within a respective weighting value range. Mobile radio device according to one of claims 1 to 9, with a transmission control device for controlling mobile radio transmitter resources of the mobile radio device, which transmission control device is set up to receive weight values and / or weight value ranges from another mobile radio device and to transmit them to the weight setting unit, with which the weighting values and / or weighting value ranges can be specified by the other mobile radio device.

Mobile radio device according to one of Claims 1 to 10, in which the data link layer protocol buffer memory read-out device is set up in such a way that, in the event that no data to be transferred are temporarily stored in one or more data link layer protocol buffer stores, the data for this or these data link layer protocol buffer memory allocated portion or portions of the data transmission bandwidth for the data link layer protocol buffer memory or stores is additionally allocated in which or which data to be transferred are temporarily stored. Cellular device & bull; with at least one data link layer unit,? with a weighting memory in which weighting values and / or weighting value ranges are stored, with the weighting values and / or the weighting value ranges each indicating a proportion of the total data transmission bandwidth available for data transmission from another mobile radio device, which is used in each case for reading out the data protection layer protocol Buffer data to be allocated, and? with a weighting transmission device, which is set up to transmit the weighting values and / or weighting value ranges to the other mobile radio device.

Mobile radio device according to claim 12, set up as a mobile radio base station. Cellular network control unit with a weighting memory in which weighting values and / or weighting value ranges are stored, with the weighting values and / or the weighting value ranges each indicating a proportion of the total data transmission bandwidth available for data transmission from another mobile radio device, which is used in each case for reading out the data protection layer protocol Buffer data to be allocated, and? with a weighting transmission device, which is set up to transmit the weighting values and / or weighting value ranges to the other mobile radio device. Method for reading out data from a plurality of data link layer protocol buffers which are assigned to at least one data link layer unit, carried out in a mobile radio device, in which each data link layer protocol buffer memory is assigned a weight value and / or weight value range, and? in which the data are read out of the data link layer protocol buffer stores in accordance with an order specified by the weighting values and / or weighting value ranges, the weighting values and / or the weighting value ranges each indicating a proportion of the total data transmission bandwidth available for data transmission, which is in each case for reading out the data stored in the respective data link

layer protocol buffer memory is allocated.

4 sheets of drawings follow

FIG 1

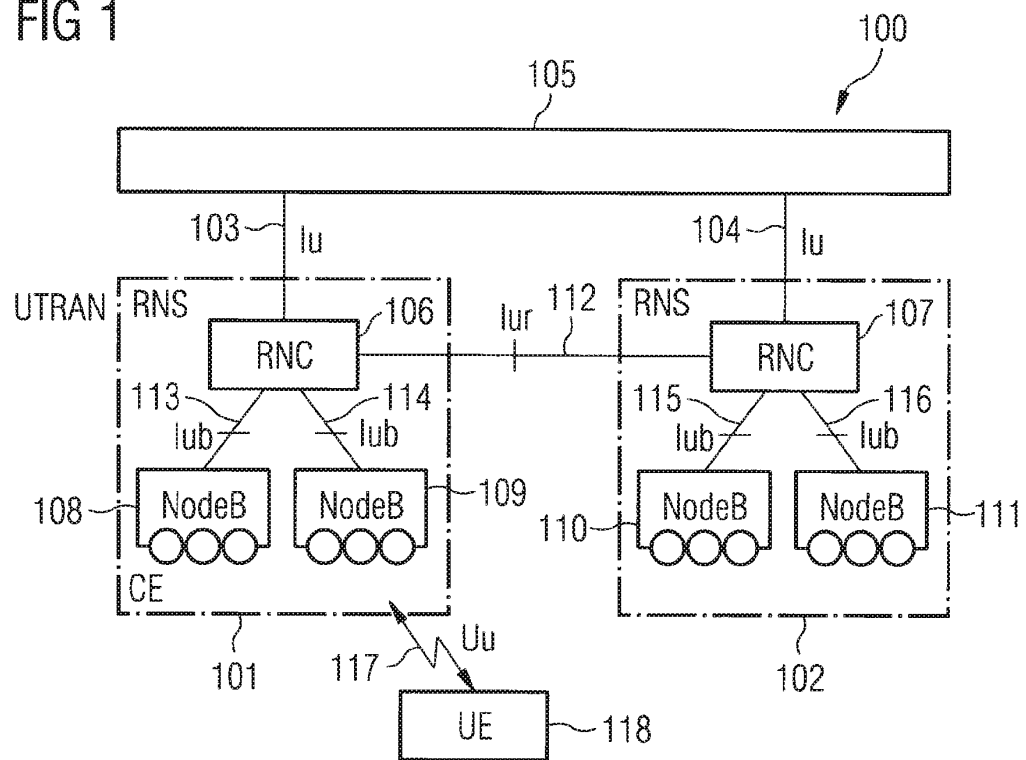


FIG 2

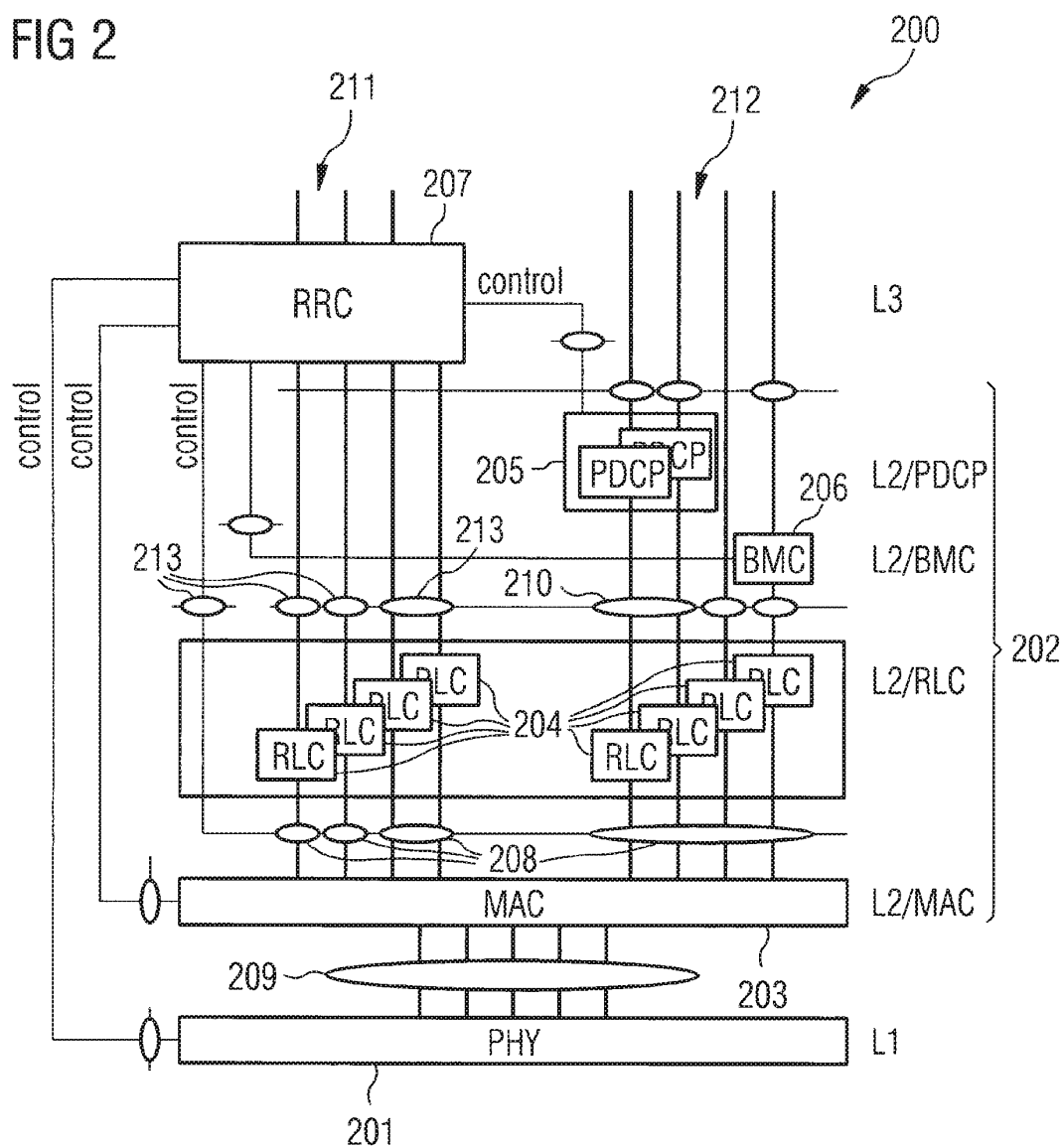


FIG 3

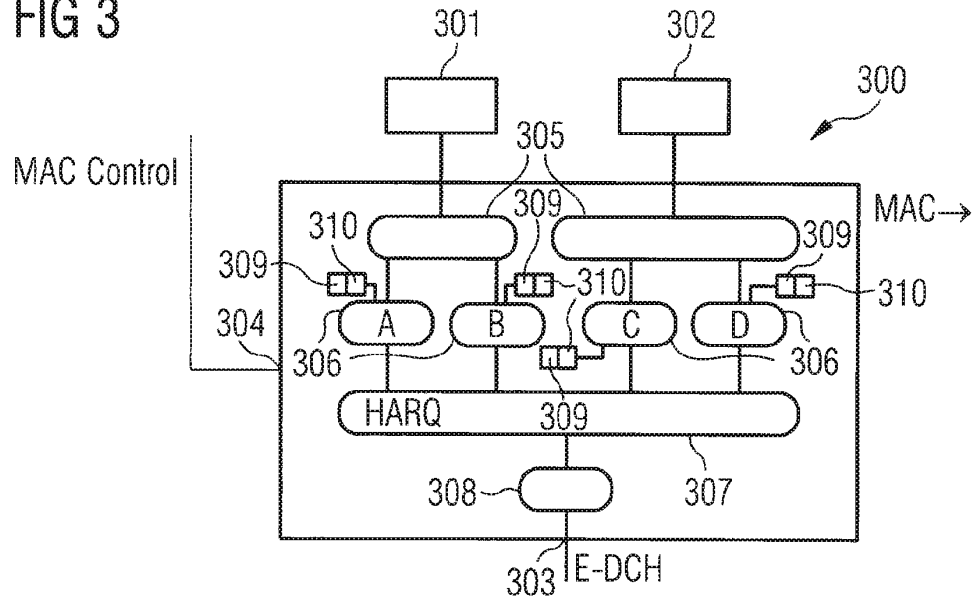


FIG 4

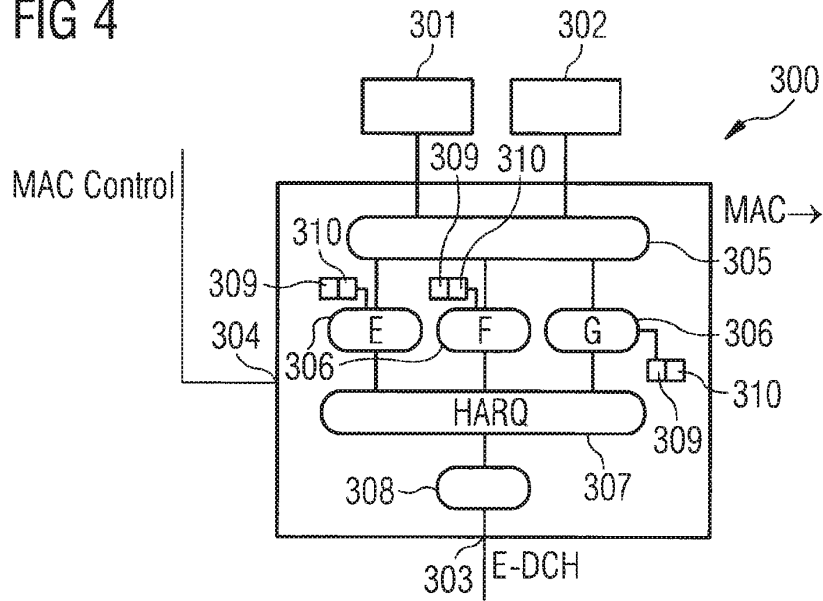


FIG 5

500

	Information Element/ Group name	Need	Multi	Type and reference	Semantics description
501 {	Priority Queue	OP	1 to <maxPQ>		
	>PQ Identity	MP		PQ Identity	
502 {	>Choice PQ weighting				
	>>explicit PQ weighting	OP		Integer (0...100)	Value in %
	>>PQ weighting band	OP			
503 {	>>>lower PQ border	OP		Integer (0...100)	Value in % 504
	>>>upper PQ border	OP		Integer (0...100)	Value in % 505



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Speight

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(45) **Date of Patent:** **May 14, 2019**

(54) **DETERMINING BUFFER OCCUPANCY AND
SELECTING DATA FOR TRANSMISSION ON
A RADIO BEARER**

H04W 28/14 (2013.01); *H04W 72/1268*
(2013.01); *H04W 8/24* (2013.01); *H04W*
72/0453 (2013.01); *H04W 76/10* (2018.02)

(71) Applicant: **Intellectual Ventures II LLC,**
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(58) **Field of Classification Search**
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See application file for complete search history.

(72) Inventor: **Timothy J. Speight,** Bristol (GB)

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **15/618,669**

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(65) **Prior Publication Data**

US 2018/0063862 A1 Mar. 1, 2018

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(Continued)

Non-Final Rejection issued by USPTO, dated Feb. 6, 2009 for U.S.
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(Continued)

(51) **Int. Cl.**
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H04W 72/04 (2009.01)
H04L 12/801 (2013.01)
H04L 12/851 (2013.01)
H04L 12/835 (2013.01)
H04W 28/14 (2009.01)

(Continued)

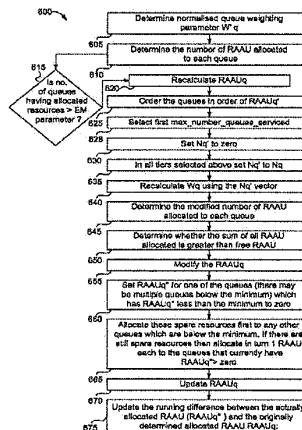
(52) **U.S. Cl.**
CPC *H04W 72/04* (2013.01); *H04L 47/10*
(2013.01); *H04L 47/14* (2013.01); *H04L*
47/2425 (2013.01); *H04L 47/30* (2013.01);

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(57) **ABSTRACT**

A user equipment (UE) may determine and transmit to a
network buffer occupancy associated with one or more radio
bearers. The UE may select data for transmission from radio
bearers using a received single allocation of uplink
resources. The selection of the data may occur using a first
single iteration and a second iteration.

14 Claims, 6 Drawing Sheets



Related U.S. Application Data

continuation of application No. 13/858,666, filed on Apr. 8, 2013, now Pat. No. 9,320,018, which is a continuation of application No. 13/212,843, filed on Aug. 18, 2011, now Pat. No. 8,428,026, which is a continuation of application No. 11/430,421, filed on May 8, 2006, now Pat. No. 8,005,041.

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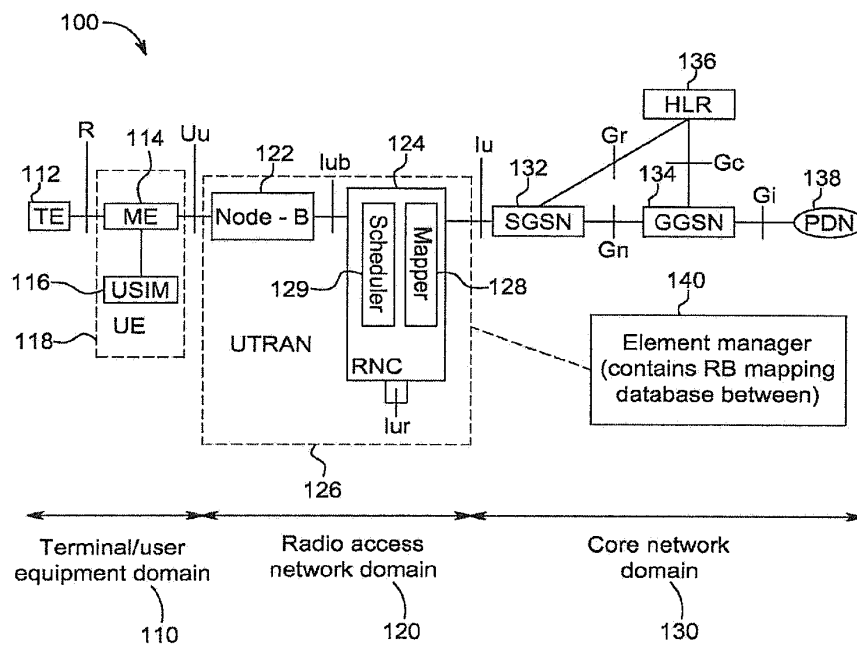


FIG. 1

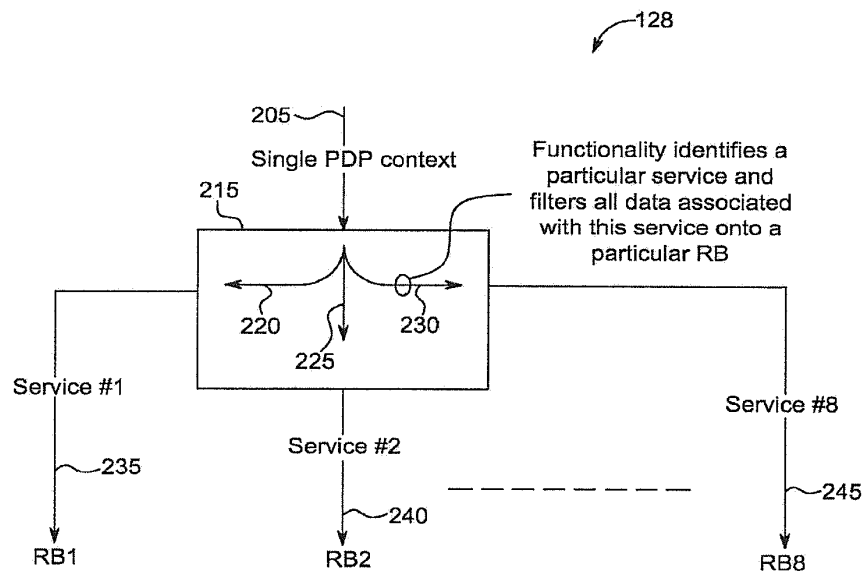


FIG. 2

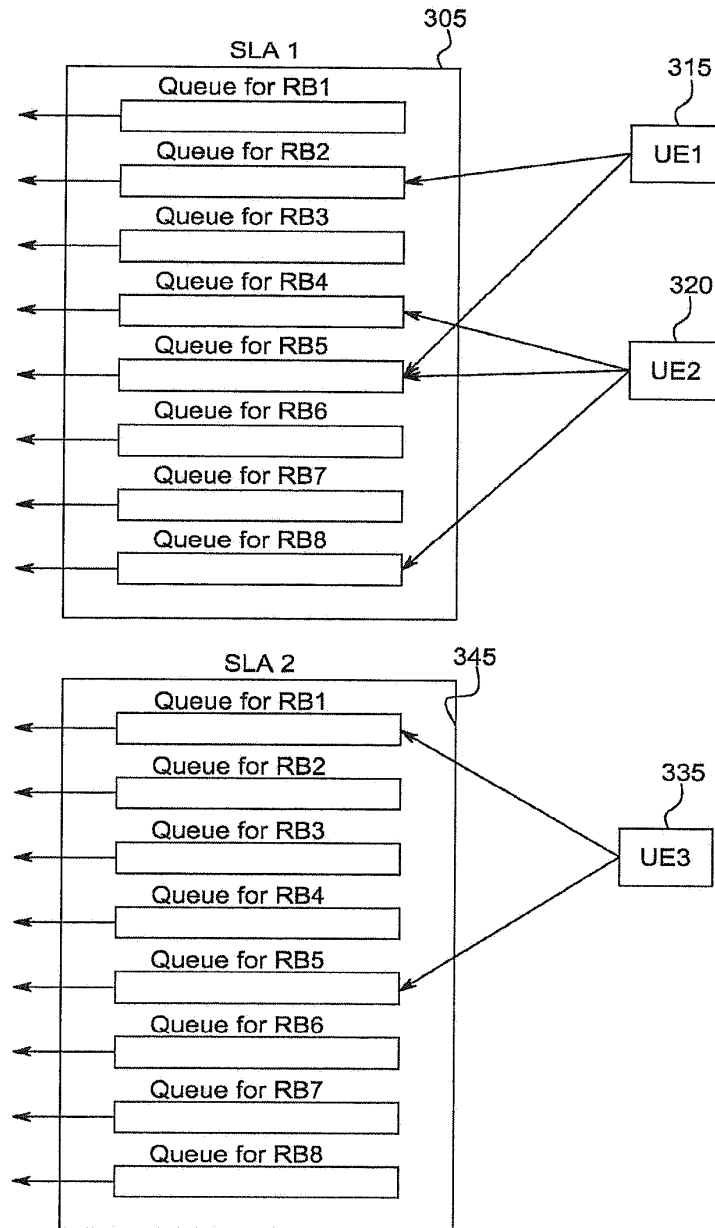


FIG. 3

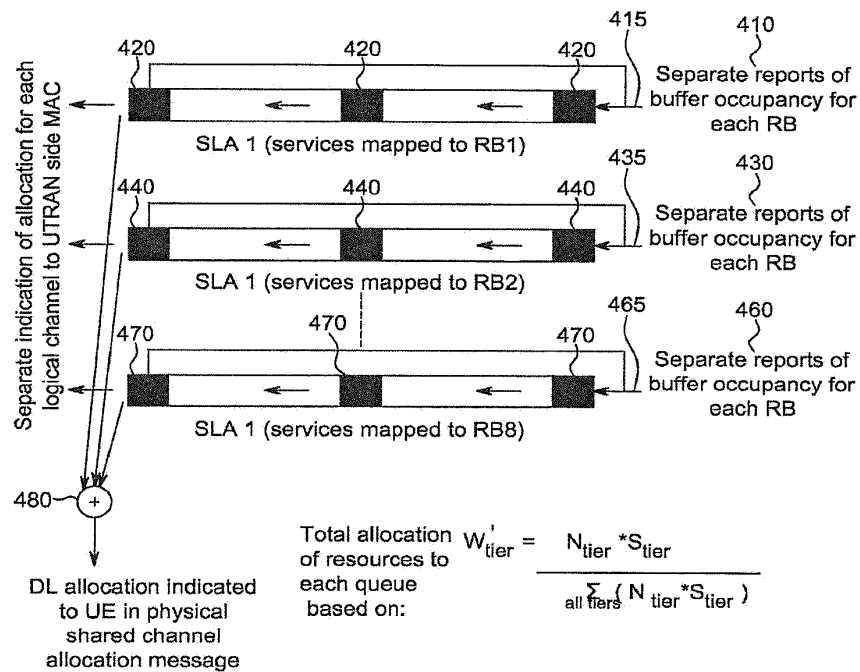


FIG. 4

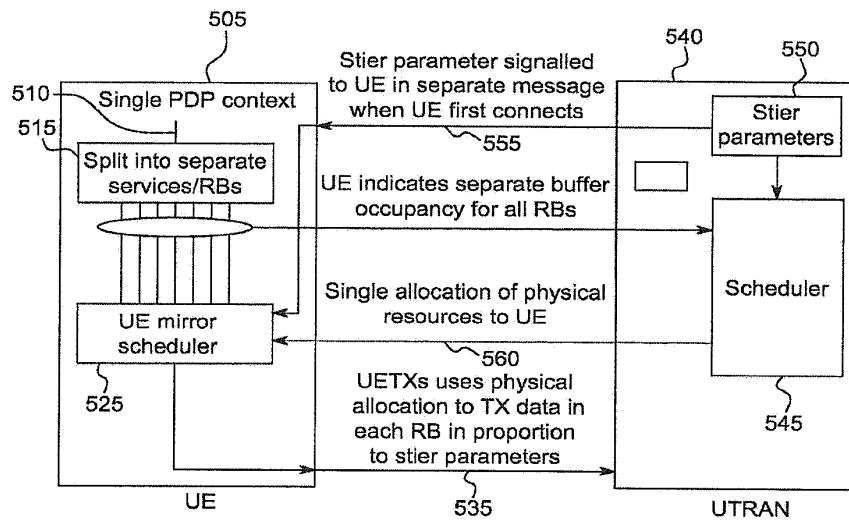
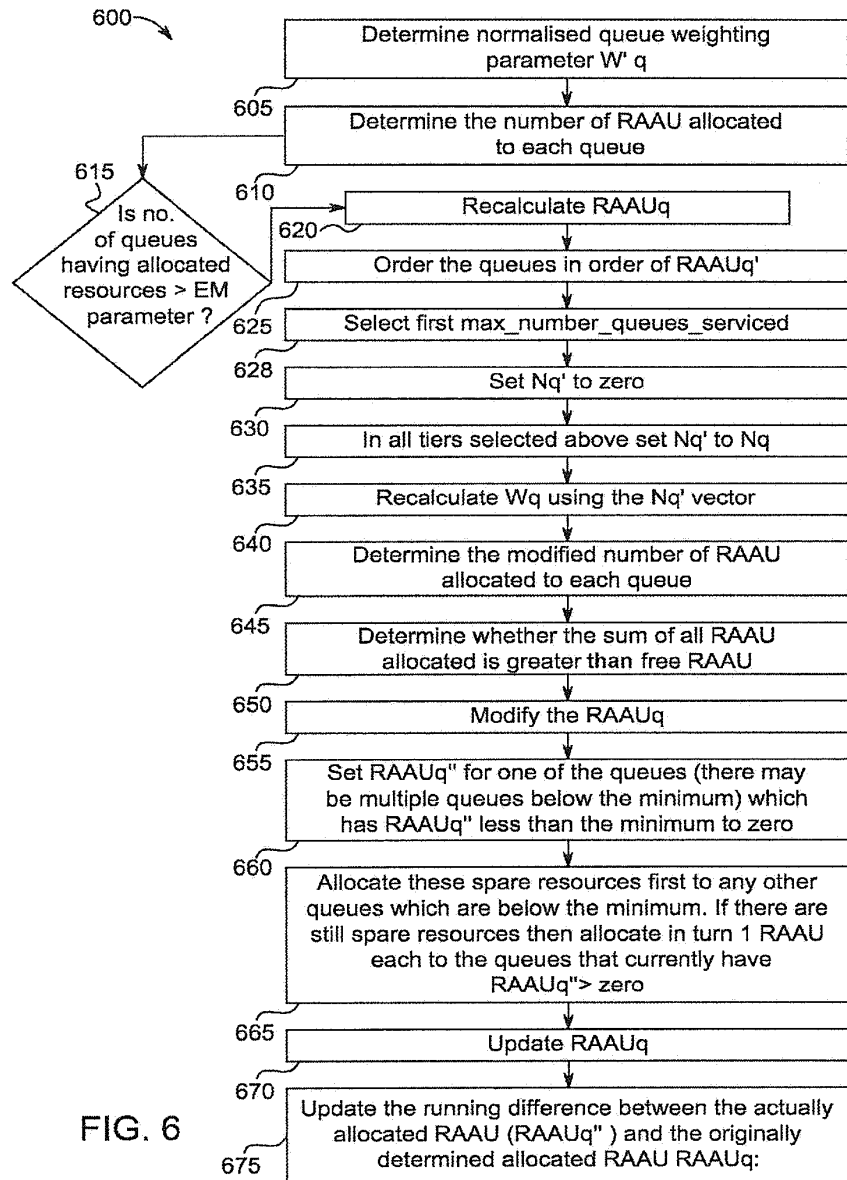


FIG. 5



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DETERMINING BUFFER OCCUPANCY AND SELECTING DATA FOR TRANSMISSION ON A RADIO BEARER

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 15/131,250 filed Apr. 18, 2016, which issued as U.S. Pat. No. 9,681,466 on Jun. 13, 2017, which is a continuation of U.S. patent application Ser. No. 13/858,666 filed Apr. 8, 2013, which issued as U.S. Pat. No. 9,320,018 on Apr. 19, 2016, which is a continuation of U.S. patent application Ser. No. 13/212,843 filed Aug. 18, 2011, which issued as U.S. Pat. No. 8,428,026 on Apr. 23, 2013, which is a continuation of U.S. patent application Ser. No. 11/430,421 filed May 8, 2006, which issued as U.S. Pat. No. 8,005,041 on Aug. 23, 2011, the contents of which are all incorporated by reference herein as if fully set forth.

FIELD OF THE INVENTION

This invention relates to a mechanism to support Internet Protocol data flows within a wireless communication system. The invention is applicable to, but not limited to, gateway queuing algorithms in packet data transmissions, for example, for use in the universal mobile telecommunication standard.

BACKGROUND OF THE INVENTION

In a cellular communication system, a geographical region is divided into a number of cells, each of which is served by base stations, sometimes referred to as Node-Bs. The base stations are interconnected by a fixed network which can communicate data between the base stations. A mobile station, sometimes referred to as user equipment (UE) is served via a radio communication link from the base station of the cell within which the mobile station is situated.

A typical cellular communication system extends coverage over an entire country and comprises hundreds or even thousands of cells supporting thousands or even millions of mobile stations. Communication from a mobile station to a base station is known as the uplink, and communication from a base station to a mobile station is known as the downlink.

The fixed network interconnecting the base stations is operable to route data between any two base stations, thereby enabling a mobile station in a cell to communicate with a mobile station in any other cell. In addition, the fixed network comprises gateway functions for interconnecting to external networks such as the Internet or the Public Switched Telephone Network (PSTN), thereby allowing mobile stations to communicate with landline telephones and other communication terminals connected by a landline. Furthermore, the fixed network comprises much of the functionality required for managing a conventional cellular communication network including functionality for routing data, admission control, resource allocation, subscriber billing, mobile station authentication etc.

Currently, the most ubiquitous cellular communication system is the 2nd generation communication system known as the Global System for Mobile communication (GSM). GSM uses a technology known as Time Division Multiple Access (TDMA) wherein user separation is achieved by dividing frequency carriers into 8 discrete time slots, which individually can be allocated to a user. Further description of

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the GSM TDMA communication system can be found in 'The GSM System for Mobile Communications' by Michel Mouly and Marie Bernadette Pautet, Bay Foreign Language Books, 1992, ISBN 2950719007.

Currently, 3rd generation systems are being rolled out to further enhance the communication services provided to mobile users. The most widely adopted 3rd generation communication systems are based on Code Division Multiple Access (CDMA) technology. Both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) techniques employ this CDMA technology. In CDMA systems, user separation is obtained by allocating different spreading and scrambling codes to different users on the same carrier frequency and in the same time intervals. In TDD, additional user separation is achieved by assigning different time slots to different users similarly to TDMA. However, in contrast to TDMA, TDD provides for the same carrier frequency to be used for both uplink and downlink transmissions. An example of a communication system using this principle is the Universal Mobile Telecommunication System (UMTS). Further description of CDMA and specifically of the Wideband CDMA (WCDMA) mode of UMTS can be found in 'WCDMA for UMTS', Harri Holma (editor), Antti Toskala (Editor), Wiley & Sons, 2001, ISBN 0471486876.

In a 3rd generation cellular communication system, the communication network comprises a core network and a Radio Access Network (RAN). The core network is operable to route data from one part of the RAN to another, as well as interfacing with other communication systems. In addition, it performs many of the operation and management functions of a cellular communication system, such as billing. The RAN is operable to support wireless user equipment over a radio link of the air interface. The RAN comprises the base stations, which in UMTS are known as Node Bs, as well as Radio Network Controllers (RNCs) which control the base stations and the communication over the air interface.

The RNC performs many of the control functions related to the air interface including radio resource management and routing of data to and from appropriate base stations. It further provides the interface between the RAN and the core network. An RNC and associated base stations are known as a Radio Network Subsystem (RNS).

3rd generation cellular communication systems have been specified to provide a large number of different services including efficient packet data services. For example, downlink packet data services are supported within the 3GPP release 5 specifications in the form of the High Speed Downlink Packet Access (HSDPA) service. A High Speed Uplink Packet Access (HSUPA) feature is also in the process of being standardised. This uplink packet access feature will adopt many of the features of HSDPA.

In accordance with the 3GPP specifications, the HSDPA service may be used in both Frequency Division Duplex (FDD) mode and Time Division Duplex (TDD) mode.

In HSDPA, transmission code resources are shared amongst users according to their traffic needs. The base station or "Node-B" is responsible for allocating and distributing the resources to the users, within a so-called scheduling task. Hence, for HSDPA, some scheduling is performed by the RNC whereas other scheduling is performed by the base station. Specifically, the RNC allocates a set of resources to each base station, which the base station can use exclusively for high speed packet services. The RNC furthermore controls the flow of data to and from the base stations.

Therefore, most packet based systems contain schedulers that control when the individual data packets are transmitted, in order to share the available resource, whether time-slots in a time division multiple access (TDMA) communication system or power and codes in a code division multiple access (CDMA) communication system. An introduction to schedulers can be found in 'Service discipline for guaranteed performance service in packet-switching networks', authored by Hui Zhang, and published in the Proceedings of the IEEE, volume 83, no. 10, October 1995.

U.S. Pat. No. 6,845,100 describes use of two separate schedulers; a packet scheduler and a QoS scheduler. The packet scheduler allocates resources to users and then within this user's allocation the QoS scheduler prioritizes some packets over other depending upon the radio bearer they are assigned to.

Thus, there exists a need to provide an improved mechanism to differentiate between IP data flows.

SUMMARY OF THE INVENTION

In accordance with aspects of the present invention, there is provided a wireless communication system, an apparatus, and a method of operation therefor, as defined in the claims.

Accordingly, in one embodiment of the present invention there is provided an apparatus for use in allocating resource in a wireless communication system, the apparatus comprising mapping logic arranged to map one or more services to individual radio bearers of a plurality of radio bearers; reporting logic arranged to indicate buffer occupancy for the plurality of radio bearers; and prioritization logic arranged to prioritize the allocated resource across multiple wireless communication units on a radio bearer basis.

The provision of prioritization logic arranged to prioritize allocated resource across multiple wireless communication units enables prioritization of a particular service across users, so that for instance hyper text transport protocol (HTTP) traffic can be prioritized over file transfer protocol (FTP) traffic, whether the FTP traffic was associated with one user or a number of other users.

In one embodiment of the present invention, the apparatus comprises a database storing a plurality of service specifications, one per wireless communication unit, that define the mapping between data flow and respective radio bearers.

The provision of a database storing a plurality of service specifications provides a very wide range of mapping characteristics can be configured. Furthermore, different mappings can be achieved on a per tier or even per user basis.

In one embodiment of the present invention, the apparatus further comprises signal dividing logic operably coupled to mapping logic and arranged to split services into individual radio bearers from a single (PDP) context.

The provision of the signal dividing logic provides user equipment with the ability to no longer need to send a secondary packet data protocol (PDP) context request to begin a new service, thereby avoiding significant latency.

In one embodiment of the present invention, the wireless communication unit is user equipment arranged to allocate resource in an uplink communication path.

In one embodiment of the present invention, the apparatus is located in a radio access network (RAN) that comprises prioritization logic arranged to allocate resource to a plurality of wireless communication units in a downlink communication path on a radio bearer basis.

In one embodiment of the present invention, a wireless communication unit of the plurality of wireless communication units comprises a signal processor arranged to iden-

tify buffer occupancy for individual radio bearers and a transmitter operably coupled to the signal processor and arranged to transmit a message to the radio access network.

The provision of a signal processor arranged to identify buffer occupancy for individual radio bearers (or services) advantageously enables any system to provide prioritization, whether within a users allocation or across users. In one embodiment of the present invention the message indicates separate buffer occupancy for each of the radio bearers.

The provision of a message that indicates separate buffer occupancy for each of the individual radio bearers provides effective prioritization, in that the allocator knows the buffer occupancy for each radio bearer (RB), in the UL direction. This supports signalling to enable the UE to report this volume.

In one embodiment of the present invention, the apparatus further comprises weighting logic operably coupled to the signal processor and the prioritization logic and arranged to provide a set of weight values for each service across a plurality of users such that the prioritization logic allocates bandwidth resource to individual radio bearers according to a set of weight values.

The provision of weighting logic operably coupled to the signal processor and the prioritization logic allows a proportion of the resource to be allocated to particular radio bearers (e.g. services). This is in contrast to the conventional prioritization scheme provided by 3GPP, which uses a simple absolute priority scheme.

In one embodiment of the present invention, the apparatus further comprises a transmitter transmitting the set of weight values to the wireless communication unit. This feature provides the advantage that the UE can then properly prioritize traffic whilst receiving a single physical allocation from the network and not have to use the simple absolute priority system defined in 3GPP.

In one embodiment of the present invention, the radio access network comprises a scheduler arranged to schedule prioritized allocated resource across multiple wireless communication units in response to the message.

In one embodiment of the present invention, the radio access network comprises a plurality of classifiers associated with the one or more services operably coupled to the mapping logic such that the mapping logic maps data packets onto respective radio bearers.

The provision of classifiers associated with the one or more services advantageously supports the filtering of services onto radio bearers.

In one embodiment of the present invention, there is provided an apparatus comprising a memory and a processor operably coupled to the memory. Program code is executable on the processor, where the program code is operable for mapping one or more services to individual radio bearers of a plurality of radio bearers; reporting buffer occupancy for the plurality of radio bearers; and prioritizing the allocated resource across multiple wireless communication units on a radio bearer basis.

In one embodiment of the present invention, a wireless communication system comprises a radio access network facilitating communication to a plurality of wireless communication units. The wireless communication system comprises mapping logic arranged to map one or more services to individual radio bearers of a plurality of radio bearers; reporting logic arranged to indicate buffer occupancy for the plurality of radio bearers; and prioritization logic arranged to prioritize the allocated resource across multiple wireless communication units on a radio bearer basis.

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In one embodiment of the present invention, a method for limiting a number of services supported at an instant of time in a wireless communication system is described. The method comprises determining a normalised service weighting parameter of allocated resources; determining a number of resource allocation units allocated to each service; and determining whether the number of services that have resources allocated is greater than a threshold. The method further comprises limiting a number of resource allocation units allocated in response to the number of services that have resources allocated is greater than a threshold; recalculating a number of resource allocation units allocated to each service; and ordering services in an order of resource allocation units allocated to each service, and select a number from the ordered services. The method further comprises setting all services not selected to zero; determining whether the number of services that have resources allocated is greater than a threshold; and when said number of services that have resources allocated is greater than the threshold, repeating said steps of re-calculating, ordering, setting and determining.

In this manner, even when a large population of users exist, each with many services, the number of messages required to allocate the overall resource is limited to a manageable number. It is noteworthy that a single user with multiple services, each allocated resource, will only result in a single allocation message. However, by having large numbers of users with large numbers of services the chance of allocating a small amount of resource to many users is increased.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be described, by way of example only, with reference to the accompanying drawings, in which

FIG. 1 illustrates a 3GPP cellular communication system capable of supporting embodiments of the present invention;

FIG. 2 illustrates a downlink operation to allow service prioritization across a plurality of users according to embodiments of the present invention;

FIG. 3 illustrates an example of a mechanism whereby UEs are mapped to radio bearers according to embodiments of the present invention;

FIG. 4 illustrates a tier-based weighted fair queuing system that can be utilised in embodiments of the present invention;

FIG. 5 illustrates a communication system comprising uplink scheduling, in accordance with some embodiments of the invention; and

FIG. 6 illustrates a method to limit a number of services/queues to be allocated radio bearers at a particular instant in time, in accordance with embodiments of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

In summary, embodiments of the present invention describe an architecture for supporting IP flows with different quality of service within a wireless communications system. Embodiments of the present invention comprise a database carrying service specifications, one per user equipment, which define the mapping between IP flows and radio bearers. At the user equipment, and within the Radio Access Network, classifiers use the specifications to map IP packets onto the appropriate radio bearers. A scheduler within the Radio Access Network is configured to allocate bandwidths

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to the different radio bearers, according to a set of weights values. Thus, in this manner, quality of service (QoS) differentiation between different services carried over IP over the wireless network is achieved.

RAN functionality already assumes that data associated with separate service definition specifications (e.g. port numbers) is placed on separate radio bearers. However, in embodiments of the present invention, the RAN functionality is configured to allow services to be prioritized across multiple users, in contrast to prior art techniques that only allow prioritization within a user's allocation.

Referring firstly to FIG. 1, a typical, standard UMTS Radio Access Network (UTRAN) system 100 is conveniently considered as comprising: terminal/user equipment domain 110; a UMTS Terrestrial Radio Access Network domain 120; and an infrastructure domain 130.

In the terminal/user equipment domain 110, terminal equipment (TE) 112 is connected to mobile equipment (ME) 114 via the wired or wireless R interface. The ME 114 is also connected to a user service identity module (USIM) 116; the ME 114 and the USIM 116 together are considered as user equipment (UE) 118. The UE may be for example a remote unit, a mobile station, a communication terminal, a personal digital assistant, a laptop computer, an embedded communication processor or any communication element communicating over the air interface of the cellular communication system.

The UE 118 communicates data with a Node-B (base station) 122 in the radio access network domain 120 via the wireless Uu interface. Within the radio access network domain 120, the Node-B 122 communicates with a radio network controller (RNC) 124 via the Iub interface. The RNC 124 communicates with other RNCs (not shown) via the Iur interface.

The Node-B 122 and the RNC 124 together form the UTRAN 126. The RNC 124 communicates with a serving GPRS service node (SGSN) 132 in the core network domain 130 via the Iu interface. Within the core network domain 130, the SGSN 132 communicates with a gateway GPRS support node 134 via the Gn interface; the SGSN 132 and the GGSN 134 communicate with a home location register (HLR) server 136 via the Gr interface and the Gc interface respectively. The GGSN 134 communicates with public data network 138 via the Gi interface.

Thus, the elements RNC 124, SGSN 132 and GGSN 134 are conventionally provided as discrete and separate units (on their own respective software/hardware platforms) divided across the radio access network domain 120 and the core network domain 130, as shown FIG. 1.

The RNC 124 is the UTRAN element responsible for the control and allocation of resources for numerous Node-Bs 122; typically 50 to 100 Node-Bs may be controlled by one RNC. The RNC also provides reliable delivery of user traffic over the air interfaces. RNCs communicate with each other (via the Iur interface).

The SGSN 132 is the UMTS Core Network element responsible for Session Control and interface to the HLR. The SGSN keeps track of the location of an individual UE and performs security functions and access control. The SGSN is a large centralised controller for many RNCs.

The GGSN 134 is the UMTS Core Network element responsible for concentrating and tunneling user data within the core packet network to the ultimate destination (e.g., internet service provider-ISP). Terminal equipment (TE) 112 is connected to mobile equipment (ME) 114 via the wired or wireless R interface. The ME 114 is also connected to a user service identity module (USIM) 116; the ME 114 and the

USIM 116 together are considered as user equipment (UE) 118. The UE 118 communicates data with a Node-B (base station) 122 in the radio access network domain 120 via the wireless Uu interface. Within the radio access network domain 120, the Node-B 122 communicates with a radio network controller (RNC) 124 via the Iub interface. The RNC 124 communicates with other RNCs (not shown) via the Iur interface. The Node-B 122 and the RNC 124 together form the UTRAN 126. The RNC 124 communicates with a serving GPRS service node (SGSN) 132 in the core network domain 130 via the Iu interface. Within the core network domain 130, the SGSN 132 communicates with a gateway GPRS support node 134 via the Gn interface; the SGSN 132 and the GGSN 134 communicate with a home location register (HLR) server 136 via the Gr interface and the Gc interface respectively. The GGSN 134 communicates with public data network 138 via the Gi interface.

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The GGSN 134 is the UMTS Core Network element responsible for concentrating and tunneling user data within the core packet network to the ultimate destination (e.g., internet service provider-ISP).

Such a UTRAN system and its operation are described more fully in the 3rd Generation Partnership Project technical specification documents 3GPP TS 25.401, 3GPP TS 23.060, and related documents, available from the 3GPP website at www.3gpp.org, and need not be described herein in more detail.

Within the RNC 124, separate functional blocks exist that have been incorporated or adapted in accordance with embodiments of the present invention. In particular, as shown in FIG. 1, a Mapper 128 is responsible for mapping IP packets to separate RBs. The Mapper 128 is shown in greater detail in FIG. 2. A scheduler 129 is responsible for allocating a certain proportion of the radio resource to each of the RBs, which is described in further detail with respect to FIG. 3 and FIG. 4.

Additionally, in accordance with embodiments of the present invention, element manager logic 140 has been incorporated into the system, which is used to contain the database that defines the mapping characteristics for IP packets to RBs. The element manager logic 140 also contains the values of the queue weighting parameters, S_{tier} , as described in more detail later.

FIG. 2 illustrates a downlink operation according to one embodiment of the present invention that may allow service prioritization across a plurality of users. In this regard, processing logic 128 within the RNC comprises signal dividing logic 215, which splits services 220, 225, 230 into separate radio bearers 235, 240, 245 from a single PDP

context 205. In one embodiment of the present invention, the services may be divided between separate radio bearers based on, say, port numbers.

Although eight services/radio bearers are illustrated in FIG. 2, it is envisaged that the inventive concept may be applied to any number of services/radio bearers. In this manner, for each user, the scheduler is now aware of the total amount of data present in buffers for each service.

FIG. 3 illustrates an example of a mechanism whereby a plurality of UEs is mapped to radio bearers according to embodiments of the present invention. In this example, a first UE 315, a second UE 320 and a third UE 335 are illustrated, whereby the first UE 315 and second UE 320 use a first service level agreement (SLA-1) 305 and the third UE 335 uses a second (SLA-2) 345. The first SLA-1 305 and the second SLA-2 345 employ a plurality of radio bearers that they organise packet data queues for.

In one embodiment of the present invention, it is envisaged that separate queues may be provided for the same services, but using different SLAs.

Referring now to FIG. 4, resource allocator logic associated with a single SLA is shown, i.e. FIG. 4 provides a more detailed version of element 305 in FIG. 3. Separate reports 410, 430, 460 for RBs '1' to '8' are provided and these are associated with separate services within an SLA.

In one embodiment of the present invention, within each queue there is a single indication of the volume of data for each user (for the associated radio bearer) 420, 440, 470 rather than the data itself. Within each queue a simple round robin allocation scheme may operate, whereby when the volume indication reaches the head of the queue a fixed volume of resource is allocated to the user. When the user has been granted this resource, the user is placed at the back of the queue (assuming there is still buffer occupancy left for this user given the resource that has been allocated).

The output from the respective queues provides individual indications of an allocation for each logical channel to the UTRAN side medium access layer (MAC). The outputs are combined in a scheduler 480 that provides a DL allocation that is sent to the respective UEs in a physical shared channel allocation message.

With reference to FIG. 4, the above scheme may be supported in a mechanism that provides 'tier-based, weighted fair queuing'. Briefly, in such a mechanism, each queue determines the weight value based on:

$$W'_{tier} = \frac{N_{tier} * S_{tier}}{\sum_{all tiers} (N_{tier} * S_{tier})} \quad [1]$$

Where:

N_{tier} is the number of separate users in the queue.

The overall volume of spare physical resource is then allocated to each queue in proportion to the W'_{tier} values. As mentioned previously, a simple round robin allocation policy may also apply within each queue.

Referring back to FIG. 3 a total of 16 queue weights (S_{tier}) are desired. These queue weights define the relative amount of the total resource that is allocated to each queue. Thus, the bandwidth allocated to different radio bearers is shared according to the relative weights. In the implementation, these weights are set by the element manager. However, in one embodiment of the present invention, the weights may also be configured by RADIUS, in which case the service

specification is interpreted by the radio resource manager (RRM) to configure appropriate resource allocation (RA) queues and RBs.

The structure of this architecture means that it is possible to provide QoS prioritization across multiple users. Hence, for example, in a scenario where there are two users, one may have hyper-text transfer protocol (HTTP) traffic and this may be mapped to RB1, and a second user may employ file transfer protocol (FTP) traffic, which may be mapped to RB2. The S_{tier} associated with RB 1 ($S_{tier,1}$) is higher than that for RB2 ($S_{tier,2}$). Therefore, assuming the volume of data in the buffers for the 2 users is the same, then the ratio of the total resource allocated to RB1 may be defined as:

$$S_{tier,1} / (S_{tier,1} + S_{tier,2}) \quad [3]$$

Thus, the ratio of the total resource allocated to RB2 may be defined as:

$$S_{tier,2} / (S_{tier,1} + S_{tier,2}) \quad [4]$$

It is noteworthy that there is no restriction on the values associated with each queue weight value (S_{tier}). Therefore, in accordance with embodiments of the present invention, it may be possible to, say, set the relative weight for service 1 for SLA-2 to be higher than a number of services on SLA-1, which may nominally be a higher-priority SLA.

In accordance with one embodiment of the present invention, a mechanism to provide prioritization of services across multiple users in an uplink direction is described. In this regard, weight values are signaled to the UE. Again, as described above with respect to a downlink direction, it is assumed that logic exists that splits data onto a number of radio bearers dependent on the type of service. It is also assumed that the UE is able to signal to the network separate buffer occupancy for each queue associated with the various RBs.

If there are multiple QoS requirements within a single 3GPP PDP context, a single physical allocation of radio resources may be made to the UE. In this manner, a single PDP context implies a single CCTrCh. This single physical allocation of radio resources provided to a UE is shared amongst a number of services, in proportion to their respective QoS requirements, for example in proportion to the signalled weight values (S_{tier}).

The network knows separate buffer occupancies associated with each RB. Therefore, the logic required to operate the uplink case is largely unchanged compared with the aforementioned downlink case. However, as only a single physical allocation is signaled to the UE, all the physical allocations associated with each queue are summed together. In this regard, this mechanism is unlike the downlink case where direct control of which RB is allocated physical resources is implemented.

In the uplink case, as a single physical allocation is used, the scheduler logic in the network is mirrored with similar scheduler logic in the UE, which takes the single physical allocation and splits it between different RBs using the weight, S_{tier} , values. In addition, in order for the UE to know the value of the S_{tier} parameters that are also used at the network side, the uplink case supports signaling between the network and UE to communicate these values.

In one embodiment of the present invention, the signaling of the S_{tier} parameters will typically be sent to the UE when it initially connects to the network (for example in the radio bearer setup message). If there are any modifications to the S_{tier} parameters then these may be typically signaled to the UE in dedicated control signaling (using, for example, a radio bearer reconfiguration message). However, it is also

envisaged that S_{tier} parameters could also be signaled to the UE using other mechanisms, such as system information.

Referring now to FIG. 5, an overview of the communication between an UE 505 and the UTRAN 540 to support an uplink scenario is illustrated. In this regard, the UE 505 may receive a single PDP context 510 and split the single PDP context 510 into separate services on individual radio bearers in divider logic 515. The UE may then transmit a message 535 indicating separate buffer occupancy for each of the radio bearers to a UTRAN scheduler 545.

The separate services on individual radio bearers are input to a UE mirror scheduler 525. In one embodiment of the present invention, the UE mirror scheduler 525 receives a S_{tier} parameter 550 signalled 555 from the UTRAN 540 when the UE first connects to the UTRAN 540. The S_{tier} parameters 550 within the UTRAN 540 are also input to the UTRAN scheduler 545. The UTRAN scheduler 545 is adapted to provide a single allocation of a physical resource to the UE mirror scheduler 525 within message 560. The UE mirror scheduler 525 is then able to inform the UTRAN 540 in a message 535 on its use of the physical allocation, in order to transmit data in each radio bearer in proportion to the informed S_{tier} parameters 550.

Thus, within the UE 505, the S_{tier} values are known, together with the total allocation of resources for the UE 505. Clearly there is only a single SLA at the UE, and N_{tier} can be either a '0' or '1'. Thus, and advantageously, the overall resources allocated by the network are now split up based on the relative values of W_{tier} .

Furthermore, it is noteworthy that, the aforementioned structure allows the ability to prioritize QoS across users in the DL to be extended to the UL.

As each SLA is can now be split into multiple RBs it may be the case that very small proportions of the overall resources are allocated to each RB. This may create signalling problems, as the mechanism may result in a large number of individual users being allocated some resource at any one time and each user will require a separate allocation message. Therefore, in an enhanced embodiment of the present invention, a mechanism to implement additional functionality to limit a total number of queues served, e.g. to be allocated resource allocation units, is described. Thus, this algorithm limits a number queues that can be allocated resource at any one instance, for example to an operator-specified value. The algorithm may also ensure that the ratio of allocated resource is maintained, over the long term, to the ratios specified by the S_{tier} values.

It is noteworthy that this algorithm can be implemented in both the uplink and downlink.

Referring now to FIG. 6, an algorithm 600 employing embodiments of the present invention is illustrated. The algorithm describes one mechanism to limit a number of queues served at a single instant of time. The algorithm may be run when a number of active users (i.e. those users known to have a buffer occupancy greater than zero in any queue) is greater than a known fixed parameter, for example 'max_number_queues_served', as defined by the Element Manager (EM).

The process commences in step 605 by determining a normalised queue weighting parameter W_q of the allocated resources:

$$W_q = \frac{N_q * S_q}{\sum_{q=0}^{NB\_q-1} (N_q * S_q)} \quad [6]$$

Where:

N_Q is the number of entries in queue Q (i.e. the number of UEs with data in queue q); and

NB_q is the number of queues configured at the Node-B.

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The process then determines, as shown in step 610, the number of RAAU allocated to each queue, for example using:

$$RAAU_q = \text{FreeRAAU} * W'_q \quad [7]$$

Where:

RAAU represents a quantum of physical resource (codes and timeslots); and

FreeRAAU is a number of free RAAU that the resource allocator (RA) can share out.

The algorithm may then determine whether the number of queues that have resources allocated greater than the EM parameter—max_number_queues_served, as shown in step 615. If the number of queues that have resources allocated is greater than a threshold, for example the EM parameter max_number_queues_served, the process moves to step 620. If the number of queues that have resources allocated is not greater than the EM parameter max_number_queues_served then the process may operate as normal as described in the PCT publication WO 03/049320, by the same Applicant as the present invention.

Step 620 re-calculates RAAUq as follows:

$$RAAU_q = RAAU_q + \text{running\_RAAU\_delta} \quad [8]$$

Where:

RAAUq is calculated in step 610, and

running_RAAU_delta is the running difference between the number of RAAU that would be allocated without the limitation of the number of queues serviced and the number of RAAU allocated with the limitation.

Note that this algorithm is iterative and running_RAAU_delta is determined from the previous iteration of the algorithm. Hence, although no limitation has been applied in the first iteration, on the second iteration the limitation of the number of queues in the previous iteration has meant that there are some queues that did not receive the number of RAAU that were originally determined.

In step 625, the queues are then ordered in order of RAAUq', beginning with the highest queue. The first max_number_queues_served queues are then selected, as shown in step 628.

In all queues not selected in step 628, the Nq' value is set to zero, as shown in step 630. In all of the tiers that were selected in step 628, Nq' is set to Nq, as shown in step 635.

In step 640, Wq (now known as Wq') may be re-calculated using the Nq' vector determined in step 635, for example using:

$$W'_q = \frac{N'_q * S_q}{\sum_{q=0}^{N_B, q-1} (N'_q * S_q)} \quad [10]$$

The modified number of RAAU, allocated to each queue, may then be determined in step 645. For example, the modified number may be determined using:

$$RAAU_q'' = \text{round}(\text{FreeRAAU} * W''_q) \quad [11]$$

where: round(. . .) rounds to the nearest integer.

The sum of all RAAU allocated may then be determined in step 650. Here, if the sum of all RAAU allocated is greater than freeRAAU (which is possible following the rounding operation in step 645) then the RAAUq' may be modified in step 655, as also described in the PCT publication WO 03/049320, by the same Applicant as the present invention.

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It is possible that the volume of resource allocated to the queue may be less than that required given the cell edge state that the UE is in. For example, if the UE is in cell edge '2' then four RAAU will be needed as a minimum. Therefore, if the amount of RAAU allocated by RAAU tier" is less than the minimum required RAAU, given the cell edge state for any q, then RAAUq" may be set for one of the queues that has RAAUq" less than the minimum to zero, as shown in step 660. Here, it is noteworthy that there may be multiple queues below the minimum.

In this scenario, any spare resources are allocated first to any other queues that are below the minimum, as shown in step 665. If there are still spare resources, then any spare resources are allocated in turn; one RAAU each to the queues that currently have RAAUq" greater than zero.

The RAAUq" value is then updated, as shown in step 670. The running difference, between the actually allocated RAAU (RAAUq") and the originally determined allocated RAAU RAAUq, is then updated, as shown in step 675. For example, in this manner:

$$\text{running\_RAAU\_delta} = \text{running\_RAAU\_delta} + (RAAU_q - RAAU_q'') \quad [12]$$

Thus, a mechanism is described whereby the number of queues to be allocated resources at any particular time may be limited.

In summary, the inventive concept of the present invention aims to provide at least one or more of the following features:

- (i) A method to provide prioritization of services across users in the DL;
- (ii) A method to provide prioritization of services across users in the UL. This requires that weight values are signalled to the UE;
- (iii) A method to limit the number of queues (i.e. services) to be allocated radio resources at any one time. This functionality is provided in the UL as well as the DL; and
- (iv) The inventive concept of the present invention enables prioritization of packet types across users, as there is a single allocation process for each packet type and each user. This is particularly beneficial for packet-based, best-effort services. For instance, if a wireless communication system comprises a plurality of users that are performing very large file transfer protocol (FTP) downloads, and another user is web browsing, it is possible to prioritize the web browsing user over the others.

It is noteworthy that U.S. Pat. No. 6,845,100 is significantly different from the inventive concept herein described, which proposes a mechanism that is able to prioritize packet types across users. In one embodiment, this is achieved through provision of a single allocation process for each packet type and each user. This is particularly beneficial for packet based best-effort services. For instance if a first number of users are performing very large file transfer protocol (FTP) downloads, and another user is web browsing, it is possible to prioritize the web browsing user amongst others, in employing the inventive concept herein described, in contrast to the known prior art, such as U.S. Pat. No. 6,845,100, which will not allow this to happen.

In particular, it is envisaged that the aforementioned inventive concept can be applied by a semiconductor manufacturer to any signal processing integrated circuit (IC). It is further envisaged that, for example, a semiconductor manufacturer may employ the inventive concept in a design of a

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stand-alone device, or application-specific integrated circuit (ASIC) and/or any other sub-system element.

It will be appreciated that any suitable distribution of functionality between different functional units or logic elements, may be used without detracting from the inventive concept herein described. Hence, references to specific functional devices or elements are only to be seen as references to suitable means for providing the described functionality, rather than indicative of a strict logical or physical structure or organization.

Aspects of the invention may be implemented in any suitable form including hardware, software, firmware or any combination of these. Software and firmware may be stored on computer-readable media. The elements and components of an embodiment of the invention may be physically, functionally and logically implemented in any suitable way. Indeed, the functionality may be implemented in a single unit or IC, in a plurality of units or ICs or as part of other functional units.

Although the present invention has been described in connection with some embodiments, it is not intended to be limited to the specific form set forth herein. Rather, the scope of the present invention is limited only by the claims. Additionally, although a feature may appear to be described in connection with particular embodiments, one skilled in the art would recognize that various features of the described embodiments may be combined in accordance with the invention. Further, although embodiments of the present invention may be described, in some instances, using terminology from a particular protocol, those skilled in the art will recognize that such terms are also used in a generic sense herein, and that, unless otherwise specified, the present invention is not limited to systems implementing a particular protocol. In the claims, the term 'comprising' does not exclude the presence of other elements or steps.

Furthermore, although individual features may be included in different claims, these may possibly be advantageously combined, and the inclusion in different claims does not imply that a combination of features is not feasible and/or advantageous. Also, the inclusion of a feature in one category of claims does not imply a limitation to this category, but rather indicates that the feature is equally applicable to other claim categories, as appropriate.

Furthermore, the order of features in the claims does not imply any specific order in which the features must be performed and in particular the order of individual steps in a method claim does not imply that the steps must be performed in this order. Rather, the steps may be performed in any suitable order. In addition, singular references do not exclude a plurality. Thus, references to "a", "an", "first", "second" etc. do not preclude a plurality.

Thus, an improved wireless communication system, apparatus, integrated circuit, and a method of operation therefor have been described, wherein the aforementioned disadvantages with prior art arrangements have been substantially alleviated.

What is claimed is:

1. A user equipment (UE) comprising:
 - a processor communicatively coupled to a transmitter and circuitry configured to receive; and
 - the processor is configured to:
 - cause the circuitry to receive parameters associated with a plurality of radio bearers,
 - determine a plurality of buffer occupancies, wherein each of the plurality of buffer occupancies is associated with one or more radio bearers of the plurality of radio bearers,

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cause the transmitter to transmit a message including the plurality of buffer occupancies to a network, cause the circuitry to receive a single allocation of uplink resources,

select data from the plurality of radio bearers for transmission using the single allocation of uplink resources, wherein the selection of the data occurs using a first iteration and a second iteration,

wherein in the first iteration, the selection of the data is selected from a subset of the plurality of radio bearers based on the received parameters,

wherein in the second iteration, the selection of the data is based on buffered data for respective radio bearers, and

cause the transmitter to transmit a signal including the selected data.

2. The UE of claim 1, wherein the plurality of radio bearers are associated with a plurality of channels.

3. The UE of claim 1, wherein each radio bearer of the plurality of radio bearers is associated with at least one data flow or IP flow.

4. The UE of claim 1, wherein the selected data is selected based on a priority or a Quality of Service (QoS).

5. The UE of claim 1, wherein the plurality of radio bearers are associated with at least one packet data protocol (PDP) context.

6. The UE of claim 1, wherein the single allocation of uplink resources is received on a physical shared channel from a scheduler in the network.

7. The UE of claim 1, wherein the subset of the plurality of radio bearers is associated with a Quality of Service (QoS).

8. A method performed by a user equipment (UE), the method comprising:

receiving, by the UE, parameters associated with a plurality of radio bearers;

determining, by a processor of the UE, a plurality of buffer occupancies, wherein each of the plurality of buffer occupancies is associated with one or more radio bearers of the plurality of radio bearers;

transmitting, by a transmitter of the UE, a message including the plurality of buffer occupancies to a network;

receiving, by the UE, a single allocation of uplink resources;

selecting, by the processor, data from the plurality of radio bearers for transmission using the single allocation of uplink resources, wherein the selection of the data occurs using a first iteration and a second iteration;

wherein in the first iteration, the selection of the data is selected from a subset of the plurality of radio bearers based on the received parameters;

wherein in the second iteration, the selection of the data is based on buffered data for respective radio bearers; and

transmitting, by the transmitter, a signal including the selected data.

9. The method of claim 8, wherein the plurality of radio bearers are associated with a plurality of channels.

10. The method of claim 8, wherein each radio bearer of the plurality of radio bearers is associated with at least one data flow or IP flow.

11. The method of claim 8, wherein the selected data is selected based on a priority or a Quality of Service (QoS).

12. The method of claim 8, wherein the plurality of radio bearers are associated with at least one packet data protocol (PDP) context.

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13. The method of claim 8, wherein the single allocation of uplink resources is received on a physical shared channel from a scheduler in the network.

14. The method of claim 8, wherein the subset of the plurality of radio bearers is associated with a Quality of Service (QoS).

* * * * *

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Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		DETERMINING BUFFER OCCUPANCY AND SELECTING DATA FOR TRANSMISSION ON A RADIO BEARER		
First Named Inventor/Applicant Name:				
Filer:		Ross Gordon Hicks/Lynette Miller		
Attorney Docket Number:				
Filed as Large Entity				
Filing Fees for Supplemental Examination				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
REQUEST FOR SUPPLEMENTAL EXAMINATION	1826	1	4400	4400
REEXAM ORDERED BASED ON SUPP EXAM	1827	1	12100	12100
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				16500

Electronic Acknowledgement Receipt	
EFS ID:	39023721
Application Number:	96000323
International Application Number:	
Confirmation Number:	5091
Title of Invention:	DETERMINING BUFFER OCCUPANCY AND SELECTING DATA FOR TRANSMISSION ON A RADIO BEARER
First Named Inventor/Applicant Name:	
Customer Number:	26111
Filer:	Ross Gordon Hicks/Lynette Miller
Filer Authorized By:	Ross Gordon Hicks
Attorney Docket Number:	
Receipt Date:	31-MAR-2020
Filing Date:	
Time Stamp:	16:06:55
Application Type:	Supplemental Examination
Patent Number:	10292138

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Payment Type	CARD
Payment was successfully received in RAM	\$16500
RAM confirmation Number	E20203UG08169761
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	2020-03-31-Cover-Letter-3059-736SPX0.pdf	273522	no	2
			d4aaf1d620b245d31c5faced82828a0b3e16e1f0		
Warnings:					
Information:					
2	Receipt of Orig. Supp Exam Request	2020-03-31-Request-Supplemental-Examination--Transmittal-Form-3059-736SPX0.pdf	245433	no	5
			7449992f355c24f6ae8eb3ca2c5c01c9f6425d00		
Warnings:					
Information:					
3	Receipt of Orig. Supp Exam Request	2020-03-31-Request-Supplemental-Reexamination-3059-736SPX0.pdf	202815	no	15
			053785c0c2ed8daea97e817cc19c56b5d76404a1		
Warnings:					
Information:					
4	Assignee showing of ownership per 37 CFR 3.73	2020-03-31-Statement-Under-373c-3059-736SPX0.pdf	89038	no	3
			da179cbb8a74c1f82de16ce2deca6d9c300e07ce		
Warnings:					
Information:					
5	Foreign Reference	2020-03-31-DE102004044965-3059-736SPX0.pdf	1780153	no	26
			5f79af57feaca6fe35a5af9827a8697115dfd61f		
Warnings:					
Information:					
6	Translation of Non-English Item of Information	2020-03-31-DE102001044965-English-Translation-3059-736SPX0.pdf	320908	no	48
			d612fad88069e7204ccd6ecf418dae50aa931ac5		
Warnings:					

Information:					
7	Copy of patent for which supp exam is requested	patent-no-10292138.pdf	1253917	no	19
			6ca57a622056fc40e338b74bc6095c34b3e107bc		
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	31209	no	2
			c6f1e6e72bf054f6536676118be405cba8694593		
Warnings:					
Information:					
Total Files Size (in bytes):			4196995		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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March 31, 2020

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Confirmation No. TBD
Art Unit TBD

Re: Request for Supplement Examination of:
U.S. Patent No. 10,292,138 B2; Issue Date: May 14, 2019
(from U.S. Appl. No. 15/618,669; Filing Date: June 9, 2017)
For: **DETERMINING BUFFER OCCUPANCY AND SELECTING DATA
FOR TRANSMISSION ON A RADIO BEARER**
Inventor: Timothy J. SPEIGHT
Our Ref: 3059.736SPX0

Commissioner:

Transmitted herewith for appropriate action are the following documents:

1. Online Credit Card Payment Authorization in the amount of \$16,500.00 to cover:
\$4,400 Request for Supplemental Examination fee; and
\$12,100 Reexamination Ordered as a Result of Supplemental Examination fee;
2. Request for Supplemental Examination Transmittal Form;
3. Request For Supplemental Examination Under 35 U.S.C. § 257;
4. Statement Under 37 CFR 3.73(c);
5. Copy of U.S. Patent No. 10,292,138 B2; and
6. Copy of Item To Be Considered In Supplemental Examination:
 - German Patent Publication DE 10 2004 044 965 A1 to Choi *et al.*, “Mobile radio system e.g. Global system for mobile communication, has load memory in which weighing values are stored, where values specify portion of bandwidth which is allocated to select data stored in buffer memories,” published March 30, 2006. An English translation accompanies this German publication.

Commissioner for Patents
March 31, 2020
Page 2

The above-listed documents are filed electronically. Fee payment is provided through online credit card payment. The U.S. Patent and Trademark Office is hereby authorized to charge any fee deficiency or credit any overpayment to our Deposit Account No. 19-0036.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.

/Ross G. Hicks, Reg. # 56,374/

Ross G. Hicks
Attorney for Patent Owner
Registration No. 56,374

Enclosure(s)

14801136_1.docx

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

(Also referred to as FORM PTO-XXXX)

REQUEST FOR SUPPLEMENTAL EXAMINATION TRANSMITTAL FORM PART B – LIST OF ITEMS OF INFORMATION – Page 1

Patent number for which supplemental examination is requested 10,292,138 B2 Issue Date May 14, 2019

All items of information (no more than 12) submitted herewith as part of this request for supplemental examination of the above-identified patent are included in the following list:

U. S. PATENT DOCUMENTS

Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	US-			
	US-			
	US-			
	US-			
	US-			
	US-			
	US-			
	US-			
	US-			
	US-			
	US-			
	US-			
	US-			

FOREIGN PATENT DOCUMENTS

Cite No. ¹	Foreign Patent Document Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ²
B	DE-10 2004 044 965-A1	03-30-2006	Choi et al. (Applicant: Infineon Technologies AG)	See Request	X

¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

REQUEST FOR SUPPLEMENTAL EXAMINATION TRANSMITTAL FORM
PART B – LIST OF ITEMS OF INFORMATION – Page 2

OTHER DOCUMENTS

[illegible]

¹ Applicant's unique citation designation number (optional). ² Applicant is to place a check mark here if English language Translation is attached.

REQUEST FOR SUPPLEMENTAL EXAMINATION TRANSMITTAL FORM

Address to:
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attorney Docket No.: 3059.736SPX0

Date: March 31, 2020

1. ☒ This is a request for supplemental examination pursuant to 37 CFR 1.610 of patent number 10,292,138 B2 issued May 14, 2019. 37 CFR 1.610(b)(1).
2. ☒ Supplemental examination of claim(s) 1-14 is requested. 37 CFR 1.610(b)(4).
3. ☒ a. The name(s) of the patent owner(s) (not the patent practitioner(s)) is (are):
Intellectual Ventures II LLC

☒ b. A submission by the patent owner(s) in compliance with 37 CFR 3.73(c), which establishes that the patent owner(s) has (have) the entirety of the ownership in the patent for which supplemental examination is requested, is included. 37 CFR 1.610(b)(9).
4. ☐ a. A check in the amount of \$_____ is enclosed to cover the fee for processing and treating a request for supplemental examination, the fee for reexamination ordered under 35 USC 257, and the fee for processing and treating each non-patent document over 20 sheets in length (37 CFR 1.20(k)(1 - 3));
☒ b. The Director is hereby authorized to charge all applicable fees as set forth in 37 CFR 1.20(k)(1 - 3) to Deposit Account No. 19-0036; or
☒ c. Payment by credit card. Form PTO-2038 is attached. 37 CFR 1.610(a).
5. ☒ Any refund should be made by ☐ check or ☒ credit to Deposit Account No. 19-0036. 37 CFR 1.26(c). If payment is made by credit card, refund must be to the credit card account.
6. ☒ A copy of the patent for which supplemental examination is requested, and a copy of any disclaimer or certificate issued for the patent are included. 37 CFR 1.610(b)(6).
7. ☐ CD-ROM or CD-R in duplicate, Computer Program (Appendix) or large table
☐ Landscape Table on CD
8. ☐ Nucleotide and/or Amino Acid Sequence Submission
If applicable, items a. - c. are required.
a. ☐ Computer Readable Form (CRF)
b. Specification Sequence Listing on:
i. ☐ CD-ROM (2 copies) or CD-R (2 copies); or
ii. ☐ paper
c. ☐ Statements verifying the identity of above copies
9. ☒ A list of no more than 12 items of information submitted as part of this request is provided in Part B of this form. Where appropriate, the list must meet the requirements of 37 CFR 1.98(b). 37 CFR 1.605(a), 1.610(b)(2).

[Page 1 of 2]

This collection of information is required by 37 CFR 1.610. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 0.3 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.

Patent No.

PTO/SB/59 (09-16)

Approved for use through 11/30/2021. OMB 0851-0064
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

10. ☒ A legible copy of each item of information listed in Part B of this form, and an English language translation of all necessary and pertinent parts of each non-English language item of information are included.

Copies of items of information that form part of the discussion within the body of the request (see 37 CFR 1.605(b)), and copies of U.S. patents and patent application publications, are not required. 37 CFR 1.610(b)(7).

11. ☐ A summary of the relevant portions of each non-patent document that is over 50 pages in length (other than the request) is included. The summary includes the required citations to the particular pages containing the relevant portions. 37 CFR 1.610(b)(8).

12. ☒ A separate, detailed explanation of the relevance and manner of applying each item of information to each claim of the patent for which supplemental examination is requested, is included. 37 CFR 1.610(b)(5).

13. ☐ The below list includes all prior or concurrent post-patent Office proceedings (*ex parte* or *inter partes* reexamination, reissue, supplemental examination, post grant review, or *inter partes* review) involving the patent for which supplemental examination is being requested. 37 CFR 1.610(b)(3). An identifying number may be, e.g., a control no. or reissue application no. Any prior or concurrent post-patent Office proceedings not listed below are listed on a separate paper accompanying the request.

Type of Proceeding

Identifying Number

Filing Date

- ☐ See accompanying paper for a list of additional prior or concurrent post-patent Office proceedings involving the patent for which supplemental examination is requested. The paper should be a separate sheet titled "List of Prior or Concurrent Post-Patent Office Proceedings" and must provide the type, identifying number, and filing date of the post-patent Office proceeding.

14. Correspondence Address: Please recognize, or change, the correspondence address for the file of the patent for which supplemental examination is requested and for the supplemental examination proceeding to be:

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15. **WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**

/Ross G. Hicks, #56,374/

March 31, 2020

Authorized Signature

Date

Ross G. Hicks

56,374

Typed/Printed Name

Registration No.

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