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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,021	11/11/2008	7450591	P17661-US2	2135

27045 7590 10/22/2008
ERICSSON INC.
6300 LEGACY DRIVE
M/S EVR 1-C-11
PLANO, TX 75024

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 574 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Martin Korling, Akersberga, SWEDEN;
Magnus Harnesk, Akersberga, SWEDEN;
Jan Lemark, Stockholm, SWEDEN;
Tormod Hegdahl, Oslo, NORWAY;

Cisco 1010
U.S. Pat. 8,531,971



UNITED STATES DEPARTMENT OF COMMERCE

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
10531021	4/12/2005	KORLING ET AL.	P17661-US2

ERICSSON INC.
6300 LEGACY DRIVE
M/S EVR 1-C-11
PLANO, TX 75024

EXAMINER

Creighton H. Smith

ART UNIT	PAPER
2614	20081015

DATE MAILED:

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

Commissioner for Patents

15 OCT '08

/Creighton H Smith/
Primary Examiner, Art Unit 2614

PTO-90C (Rev.04-03)



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Bib Data Sheet

CONFIRMATION NO. 2135

SERIAL NUMBER 10/531,021	FILING OR 371(c) DATE 04/12/2005 RULE	CLASS 370	GROUP ART UNIT 2614	ATTORNEY DOCKET NO. P17661-US2	
APPLICANTS Martin Korling, Akersberga, SWEDEN; Magnus Harnesk, Akersberga, SWEDEN; Jan Lemark, Stockholm, SWEDEN; Tormod Hegdahl, Oslo, NORWAY; ** CONTINUING DATA ***** This application is a 371 of PCT/SE03/01122 06/27/2003 ** FOREIGN APPLICATIONS *****					
Foreign Priority claimed <input type="checkbox"/> yes <input type="checkbox"/> no 35 USC 119 (a-d) conditions <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Met after met Allowance Verified and Acknowledged		STATE OR COUNTRY SWEDEN	SHEETS DRAWING 6	TOTAL CLAIMS 28	INDEPENDENT CLAIMS 3
ADDRESS 27045					
TITLE SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK					
FILING FEE RECEIVED 2650	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ <input type="checkbox"/> Credit		

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

27045 7590 05/21/2008

ERICSSON INC.
6300 LEGACY DRIVE
M/S EVR 1-C-11
PLANO, TX 75024

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Pam Ewing	(Depositor's name)
<i>Pam Ewing</i>	(Signature)
July 21, 2008	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/531,021	04/12/2005	Magnus Harnesk	P17661-US2	2135
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TITLE OF INVENTION: SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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nonprovisional	NO	\$1440	\$300	\$0	\$1740	08/21/2008
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EXAMINER	ART UNIT	CLASS-SUBCLASS
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SMITH, CREIGHTON H	2614	370-395430
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1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Telefonaktiebolaget L M Ericsson (PUBL) Stockholm, Sweden

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
- ☒ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-1379 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature

Steven W. Smith

Date

07/21/2008

Typed or printed name

Steven W. Smith

Registration No.

36,684

This collection of information is required by 37 CFR 1.311. 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 1.14. 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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Electronic Patent Application Fee Transmittal				
Application Number:		10531021		
Filing Date:		12-Apr-2005		
Title of Invention:		SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK		
First Named Inventor/Applicant Name:		Magnus Harnesk		
Filer:		Steven Ware Smith/Pamela Ewing		
Attorney Docket Number:		P17661-US2		
Filed as Large Entity				
U.S. National Stage under 35 USC 371 Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	1501	1	1440	1440
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1740

Electronic Acknowledgement Receipt

EFS ID:	3647091
Application Number:	10531021
International Application Number:	
Confirmation Number:	2135
Title of Invention:	SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK
First Named Inventor/Applicant Name:	Magnus Harnesk
Customer Number:	27045
Filer:	Steven Ware Smith/Pamela Ewing
Filer Authorized By:	Steven Ware Smith
Attorney Docket Number:	P17661-US2
Receipt Date:	21-JUL-2008
Filing Date:	12-APR-2005
Time Stamp:	11:54:15
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 1740
RAM confirmation Number	6991
Deposit Account	501379
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
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1	Issue Fee Payment (PTO-85B)	P17661-US2_2008-07-21_08-9169_Issue_Fee.pdf	93792 65dd2d18d84821475eb3bec64e171349eba0188b	no	1
Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	8325 874ac5cod7e5326320341ec4b7025ad6e7cb22a4	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			102117		
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>					



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NOTICE OF ALLOWANCE AND FEE(S) DUE

27045 7590 05/21/2008

ERICSSON INC.
6300 LEGACY DRIVE
M/S EVR 1-C-11
PLANO, TX 75024

EXAMINER

SMITH, CREIGHTON H

ART UNIT

PAPER NUMBER

2614

DATE MAILED: 05/21/2008

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,021	04/12/2005	Magnus Harnesk	P17661-US2	2135
TITLE OF INVENTION: SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK				

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1440	\$300	\$0	\$1740	08/21/2008

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
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Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

27045 7590 05/21/2008

ERICSSON INC.
6300 LEGACY DRIVE
M/S EVR 1-C-11
PLANO, TX 75024

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/531,021 04/12/2005 Magnus Harnesk P17661-US2 2135

TITLE OF INVENTION: SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1440	\$300	\$0	\$1740	08/21/2008

EXAMINER	ART UNIT	CLASS-SUBCLASS
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SMITH, CREIGHTON H 2614 370-395430

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. 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 1.14. 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,021	04/12/2005	Magnus Harnesk	P17661-US2	2135
27045	7590	05/21/2008	EXAMINER	
ERICSSON INC. 6300 LEGACY DRIVE M/S EVR 1-C-11 PLANO, TX 75024			SMITH, CREIGHTON H	
			ART UNIT	PAPER NUMBER
			2614	
DATE MAILED: 05/21/2008				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 574 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 574 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability	Application No.	Applicant(s)	
	10/531,021	HARNESK ET AL.	
	Examiner	Art Unit	
	Creighton H. Smith	2614	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Amendment filed on 31 MAR '08.
2. ☒ The allowed claim(s) is/are 1 and 3-28.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) 3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | <ol style="list-style-type: none"> 5. <input type="checkbox"/> Notice of Informal Patent Application 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. 7. <input type="checkbox"/> Examiner's Amendment/Comment 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance 9. <input type="checkbox"/> Other _____. |
|--|--|

REASONS FOR ALLOWANCE

The following is an examiner's statement of reasons for allowance: The prior art fails to disclose a charging policy system for services in a packet switched network, by reducing the stored reservations in a token bucket according to the calculated charging policies. No obvious combination of references found would have taught one of ordinary skill in the art to use and make applicant's system as claimed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Creighton H. Smith whose telephone number is 571/272-7546. The examiner can normally be reached on M-F, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Fan Tsang can be reached on 571/272-7547. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2614

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

08 MAY '08

/Creighton H Smith/
Primary Examiner, Art Unit 2614

Notice of References Cited	Application/Control No. 10/531,021	Applicant(s)/Patent Under Reexamination HARNESK ET AL.	
	Examiner Creighton H. Smith	Art Unit 2614	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-			
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			


FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	


*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes 	Application/Control No. 10531021	Applicant(s)/Patent Under Reexamination HARNESK ET AL.
	Examiner Creighton H Smith	Art Unit 2614

SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search - see printout	08.05.08	chs

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
EAST Interference search-see printout		08.05.08	chs

<i>Index of Claims</i> 	Application/Control No. 10531021	Applicant(s)/Patent Under Reexamination HARNESK ET AL.
	Examiner Creighton H Smith	Art Unit 2614

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant			<input type="checkbox"/> CPA			<input type="checkbox"/> T.D.			<input type="checkbox"/> R.1.47		
CLAIM			DATE								
Final	Original		05/08/2008								
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	2	-									
6	3	=									
2	4	=									
7	5	=									
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	29	-									
	30	-									

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	"370".clas. and (@ad<="20021015") and (qos or quality adj of adj service) and (charg\$3 with (single or one or singular) near3 token adj bucket)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/05/06 14:45
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S1	2	"370".clas. and (@ad<="20021015") and ((qos or quality adj of adj service) with charg\$3) and ((single or one or singular) near3 token adj bucket)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/05/06 11:11
S2	20	"370".clas. and (@ad<="20021015") and (qos or quality adj of adj service) and ((single or one or singular) near3 token adj bucket)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/05/06 11:15

5/ 6/ 2008 3:03:00 PM

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EAST Search History

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L2	0	"370".clas. and (@ad<="20021015") and (reservation\$1 same (token adj bucket with charg\$3 with services))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/05/08 10:00
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S2	20	"370".clas. and (@ad<="20021015") and (qos or quality adj of adj service) and ((single or one or singular) near3 token adj bucket)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/05/06 11:15
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S4	0	"370".clas. and (@ad<="20021015") and (charg\$3 with (single or one or singular) near3 token adj bucket)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/05/06 14:46

5/ 8/ 2008 10:02:10 AM

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BIB DATA SHEET

CONFIRMATION NO. 2135

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
10/531,021	04/12/2005	379	2614	P17661-US2		
APPLICANTS Magnus Harnesk, Akersberga, SWEDEN; Jan Lemark, Stockholm, SWEDEN; Martin Korling, Akersberga, SWEDEN; Tormod Hegdahl, Oslo, NORWAY;						
** CONTINUING DATA ***** This application is a 371 of PCT/SE03/01122 06/27/2003 which claims benefit of 60/418,547 10/15/2002						
** FOREIGN APPLICATIONS *****						
** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **						
Foreign Priority claimed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	35 USC 119(a-d) conditions met <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Verified and /CREIGHTON H SMITH/	Examiner's Signature	Initials	SWEDEN	6	28	3
ADDRESS ERICSSON INC. 6300 LEGACY DRIVE M/S EVR 1-C-11 PLANO, TX 75024 UNITED STATES						
TITLE System for providing flexible charging in a network						
FILING FEE RECEIVED 2350	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ <input type="checkbox"/> Credit		

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Magnus Harnesk, et al.	§	Group Art Unit:	2614
Serial No:	10/531,021	§	Examiner:	Smith, Creighton H.
Filed:	04/12/2005	§	Confirmation No.:	2135
		§		
		§		

For: SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK

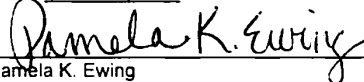
Via EFS-Web

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Commissioner for Patents
P. O. Box 1450
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I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450, or being transmitted via facsimile or EFS-Web to the USPTO on the date indicated below.

Date: March 31, 2008


Pamela K. Ewing

Dear Sir:

AMENDMENT

In response to the Non-Final Office Action dated January 7, 2008, the Applicants submit the following amendments and remarks. If any extension of time for this Response is required, the Applicants request that this be considered a petition therefore. The Commissioner is hereby authorized to charge any additional fee to Deposit Account No. 50-1379.

SUMMARY OF AMENDMENTS

1. Amendments to the claims are shown in the complete listing of pending claims, which begins on page 2 of this paper.
2. Remarks begin on page 9 of this paper.

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims

1. (Currently Amended) A charging system in a packet switched network for charging packets differently dependent on which service flow the packets belong to, the charging system comprising:

a control system and a serving element associated with a packet forwarding system wherein said control system comprises:

an account function ~~adapted to manage~~ for managing an account of at least one user, and

a charging policy decision point ~~arranged to calculate~~ for calculating a different charging policy for each of a plurality of allowed services for the at least one user,

wherein said serving element comprises:

a token bucket ~~adapted to store~~ associated with the at least one user, said token bucket for storing reservations for a plurality of service flows received from the account function of ~~[[a]] the at least one user associated with the token bucket,~~ and

a charging policy enforcement point ~~arranged to perform~~ for performing charging for ~~a plurality of the allowed services~~ the plurality of service flows by reducing the stored reservation of the token bucket according to the calculated charging ~~policy~~ policies.

2. (Canceled)

3. (Currently Amended) ~~The charging system according to claim 1~~
A charging system in a packet switched network for charging packets differently dependent on which service flow the packets belong to, the charging system comprising:

a control system and a serving element associated with a packet forwarding system, wherein said control system comprises:

an account function adapted to manage an account of at least one user,

and

a charging policy decision point arranged to calculate a charging policy for allowed services for the at least one user, wherein the calculated charging policy comprises at least one user rating table and a set of validity conditions,

wherein said serving element comprises:

a token bucket adapted to store reservations received from the account function of a user associated with the token bucket, and

a charging policy enforcement point arranged to perform charging for a plurality of the allowed services by reducing the stored reservation of the token bucket according to the calculated charging policy.

4. (Currently Amended) The charging system according to claim 1 wherein the charging policy enforcement point includes means for calculating the charging policy ~~is calculated policies~~ based on historical and/or current user specific usage data.

5. (Previously Presented) The charging system according to claim 3 wherein the set of validity conditions defines the lifetime of the at least one user rating table.

6. (Previously Presented) The charging system according to claim 3 wherein the charging policy enforcement point includes ~~calculated charging policy comprises~~ at least two user rating tables having different time validity conditions.

7. (Previously Presented) The charging system according to claim 1 wherein the serving element comprises means for classifying the services into different service classes based on the tariff plan of the services.

8. (Previously Presented) The charging system according to claim 7 wherein the allowed subscriber service classes are stored in a Service Class Vector.

9. (Currently Amended) ~~The charging system according to claim 1~~
A charging system in a packet switched network for charging packets differently
dependent on which service flow the packets belong to, the charging system
comprising:
a control system and a serving element associated with a packet forwarding
system, wherein said control system comprises:
an account function adapted to manage an account of at least one user,
and
a charging policy decision point arranged to calculate a charging policy for
allowed services for the at least one user,
wherein said serving element comprises:
a token bucket adapted to store reservations received from the
account function of a user associated with the token bucket,
a charging policy enforcement point arranged to perform charging
for a plurality of the allowed services by reducing the stored reservation of the token
bucket according to the calculated charging policy, and
wherein the means for classifying the services into different service
classes, said classifying means including comprises a service filter adapted to identify
the different service flows.

10. (Previously Presented) The charging system according to claim 9 wherein the means for classifying the services into different service classes further comprises Protocol Inspection Filters adapted to identify the different service flows, when the service filter is not capable of said identification.

11. (Previously Presented) The charging system according to claim 1 wherein the packet forwarding system is a Gateway GPRS Support Node in a mobile telecommunication network.

12. (Currently Amended) A control system of a charging system in a packet switched network, said control system comprising:
an account function ~~adapted to manage~~ for managing an account of at least one user ~~wherein said control system comprises;~~ and
a charging policy decision point ~~arranged to calculate a charging policy for the~~ for calculating charging policies for a plurality of allowed services for the at least one user, wherein the charging policies are utilized to calculate charges for a plurality of service flows using a single token bucket.

13. (Currently Amended) ~~The control system according to claim 12~~
A control system of a charging system in a packet switched network, said control system comprising:
an account function for managing an account of at least one user; and
a charging policy decision point for calculating a charging policy for the allowed services for the at least one user;
wherein the calculated charging policy ~~further comprises~~ includes:
at least one user rating table, and
a set of validity conditions.

14. (Currently Amended) The control system according to claim 12 wherein the charging ~~policy is~~ policies are calculated based on historical and/or current user specific usage data.

15. (Previously Presented) The control system according to claim 13 wherein the set of validity conditions defines the lifetime of the at least one user rating table.

16. (Previously Presented) The control system according to claim 13 wherein the calculated charging policy comprises at least two user rating tables having different time validity conditions.

17. (Previously Presented) The control system according to claim 12 wherein the control system is implemented in a mobile telecommunication network.

18. (Currently Amended) A serving element residing in a packet forwarding system of a charging system in a packet switched network, said serving element comprising:

means for receiving reservations for at least one user,

a token bucket ~~adapted to store~~ for storing the reservations for the user associated with the token bucket,

means for receiving a charging policy for allowed services, and

a charging policy enforcement point ~~arranged to perform~~ for charging for a plurality of the allowed services by reducing the stored reservation of the token bucket according to a received calculated charging policy.

19. (Previously Presented) The serving element according to claim 18 further comprising a single token bucket per user.

20. (Currently Amended) ~~The serving element according to claim 18~~
A serving element residing in a packet forwarding system of a charging system in a packet switched network, said serving element comprising:

means for receiving reservations for at least one user,

a token bucket for storing the reservations for the user associated with the token bucket,

means for receiving a charging policy for allowed services, wherein the charging policy ~~further comprises~~ includes at least one user rating table and a set of validity conditions, and

a charging policy enforcement point for charging for a plurality of the allowed services by reducing the stored reservation of the token bucket according to a received calculated charging policy.

21. (Previously Presented) The serving element according to claim 20 wherein the charging policy is calculated based on historical and/or current user specific usage data.

22. (Previously Presented) The serving element according to claim 20 wherein the set of validity conditions defines the lifetime of the at least one user rating table.

23. (Previously Presented) The serving element according to claim 20 wherein the charging policy comprises at least two user rating tables having different time validity conditions.

24. (Previously Presented) The serving element according to claim 18 further comprising means for classifying the services into different service classes based on the tariff plan of the services.

25. (Previously Presented) The serving element according to claim 24 wherein the allowed subscriber service classes are stored in a Service Class Vector.

26. (Currently Amended) ~~The serving element according to claim 24~~
A serving element residing in a packet forwarding system of a charging system in a packet switched network, said serving element comprising:
means for receiving reservations for at least one user,
a token bucket for storing the reservations for the user associated with the token bucket,
means for classifying the services into different service classes based on the tariff plan of the services, wherein the means for classifying the services into different service classes ~~further comprises~~ includes a service filter adapted to identify the different service flows,
means for receiving a charging policy for allowed services, and

a charging policy enforcement point for charging for a plurality of the allowed services by reducing the stored reservation of the token bucket according to a received calculated charging policy.

27. (Currently Amended) The serving element according to ~~claim 24~~ claim 26 wherein the means for classifying the services into different service classes further comprises Protocol Inspection Filters adapted to identify the different service flows, when the service filter is not capable of said identification.

28. (Previously Presented) The serving element according to claim 24 wherein the packet forwarding system is a Gateway GPRS Support Node in a mobile telecommunication network.

29-30. (Canceled)

REMARKS/ARGUMENTS

1.) Claim Amendments

The Applicants have amended claims 1, 3, 4, 6, 9, 12-14, 18, 20, 26, and 27. Claim 2 has been canceled. Claims 29 and 30 were previously canceled. Accordingly, claims 1 and 3-28 are pending in the application. Favorable reconsideration of the application is respectfully requested in view of the foregoing amendments and the following remarks.

2.) Allowable Subject Matter

On Page 3 of the Office Action, the Examiner stated that claims 3, 5, 6, 9, 10, 13, 15, 16, 20-23, 26 & 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. The Applicants have rewritten claims 3, 9, 13, 20, and 26 into independent form in this manner. Claims 5, 6, 10, 15, 16, 21-23, and 27 depend from these rewritten claims. Therefore, the allowance of claims 3, 5, 6, 9, 10, 13, 15, 16, 20-23, 26 & 27 is respectfully requested.

3.) Claim Rejections – 35 U.S.C. § 102(e)

On Page 3 of the Office Action, the Examiner rejected claims 12, 14, and 17 under 35 U.S.C. § 102(e) as being anticipated by Lee, et al. (U.S. Patent Publication No. 2003/0152084). The Applicants have amended independent claim 12 to clarify the differences between the claimed invention and Lee. Claims 14 and 17 depend from claim 12. Therefore, favorable reconsideration of claims 12, 14, and 17 is respectfully requested.

The Applicants' claimed invention provides a solution for charging in a packet switched system of a plurality of different (possibly simultaneous), differently charged, service flows. Notably, the invention distinguishes the charging not through calculating the charging in different buckets (each bucket calculating the charges for each flow), but

through using a charging policy and calculating the charging for a plurality of service flows using a single token bucket.

Although Lee discloses a Token Bucket (TB), the TB is not used for the purpose of charging, but for the purpose of smoothing the load and getting rid of excessively high peaks in a flow. Notably, Lee's TB keeps track of the rate of received information elements from ONE flow. If the contents of the TB indicates that information elements are received too fast, relevant actions are taken.

Independent claim 12 has been amended to recite that the charging policies are utilized to calculate charges for a plurality of service flows using a single token bucket. Thus, the Applicants' claimed invention differs from Lee in several respects. First, the Applicants' token bucket is used for charging purposes rather than smoothing a load. Second, with the support from the charging policy, the Applicants' token bucket keeps track of a plurality of flows and services in one bucket, wherein the flows and services are not treated equally.

Basis for the amendments is found in the specification on page 8, lines 32-34. Therefore, the allowance of amended claim 12 and dependent claims 14 and 17 is respectfully requested.

4.) Claim Rejections – 35 U.S.C. § 103(a)

On Page 2 of the Office Action, the Examiner rejected claims 1, 2, 4, 7-9, 11, 18, 19, 24, 25, and 28 under 35 U.S.C. § 103(a) as being unpatentable over Lee in view of Barham et al. (US 7,284,047). The Applicants have amended the claims to clarify the differences between the claimed invention and Lee and Barham. Favorable reconsideration of the rejected claims is respectfully requested.

Claim 1 has been amended to recite that the token bucket associated with a user stores reservations for a plurality of service flows received from the account function of the user. Amended claim 1 also recites a charging policy enforcement point for performing charging for the plurality of service flows by reducing the stored reservation of the token bucket according to the calculated charging policies. Thus, like claim 12 discussed above, claim 1 recites that the Applicants' token bucket is used for charging purposes rather than smoothing a load, and with the support from the charging policies,

the Applicants' token bucket keeps track of a plurality of flows and services in one token bucket.

Barham is similar to Lee, in that the purpose of Barham is flow control, and the token bucket handles only a single flow. Barham discloses a congestion avoidance algorithm using a Token Bucket shaper. The TB shaper supports calculating the rate of received information elements in order to adjust the rate of receiving information elements.

Thus, Lee and Barham, taken either alone or in combination, do not teach or suggest the claimed invention. Neither reference discusses charging policy, and thus there is no teaching or suggestion of a charging policy decision point. Likewise, there is no disclosure of an account function for managing the account of the user.

Independent claims 1 and 18 both recite that there are a plurality of services or service flows associated with a single token bucket. Therefore, the allowance of amended claims 1 and 18 is respectfully requested.

Claims 4, 7, 8, and 11 depend from amended claim 1; and claims 19, 24, 25, and 28 depend from amended claim 18. Therefore, the allowance of claims 4, 7, 8, 11, 19, 24, 25, and 28 is respectfully requested.

5.) Prior Art Not Relied Upon

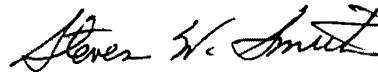
On Page 4 of the Office Action, the Examiner stated that the prior art made of record and not relied upon (Lialiamou et al.) is considered pertinent to the Applicants' disclosure. The Applicants' reading of this reference, however, has not revealed any teaching or suggestion of a charging system in which a single token bucket associated with a user keeps track of a plurality of differently charged service flows with the support of a charging policy.

6.) Conclusion

In view of the foregoing remarks, the Applicants believe all of the claims currently pending in the Application to be in a condition for allowance. The Applicants, therefore, respectfully request that the Examiner withdraw all rejections and issue a Notice of Allowance for claims 1 and 3-28.

The Applicants request a telephonic interview if the Examiner has any questions or requires any additional information that would further or expedite the prosecution of the Application.

Respectfully submitted,



Steven W. Smith
Registration No. 36,684

Date: MARCH 31, 2008

Ericsson Inc.
6300 Legacy Drive, M/S EVR 1-C-11
Plano, Texas 75024

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Electronic Patent Application Fee Transmittal				
Application Number:		10531021		
Filing Date:		12-Apr-2005		
Title of Invention:		System for providing flexible charging in a network		
First Named Inventor/Applicant Name:		Magnus Harnesk		
Filer:		Steven Ware Smith/Pamela E Shultz		
Attorney Docket Number:		P17661-US2		
Filed as Large Entity				
U.S. National Stage under 35 USC 371 Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Independent claims in excess of 3	1614	5	210	1050
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				1050

Electronic Acknowledgement Receipt	
EFS ID:	3077123
Application Number:	10531021
International Application Number:	
Confirmation Number:	2135
Title of Invention:	System for providing flexible charging in a network
First Named Inventor/Applicant Name:	Magnus Harnesk
Customer Number:	27045
Filer:	Steven Ware Smith/Pamela E Shultz
Filer Authorized By:	Steven Ware Smith
Attorney Docket Number:	P17661-US2
Receipt Date:	31-MAR-2008
Filing Date:	12-APR-2005
Time Stamp:	13:41:29
Application Type:	U.S. National Stage under 35 USC 371

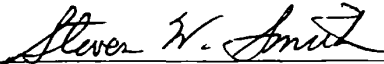

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
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	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Miscellaneous Incoming Letter		1	1	
	Amendment - After Non-Final Rejection		2	2	
	Claims		3	9	
	Applicant Arguments/Remarks Made in an Amendment		10	13	
Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	8189 <small>352afdcdd17b7016ad3d33accf34b2db4cf8172b</small>	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			508870		
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>					

AMENDMENT TRANSMITTAL LETTER (Large Entity)					Docket No. P17661-US2	
Applicant(s): Magnus Harnesk, et al.						
Application No. 10/531,021	Filing Date 04/12/2005	Examiner Smith, Creighton H.	Customer No. 27045	Group Art Unit 2614	Confirmation No. 2135	
Invention: SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK						
<u>COMMISSIONER FOR PATENTS:</u>						
Transmitted herewith is an amendment in the above-identified application.						
The fee has been calculated and is transmitted as shown below.						
CLAIMS AS AMENDED						
	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST # PREV. PAID FOR	NUMBER EXTRA CLAIMS PRESENT	RATE	ADDITIONAL FEE	
TOTAL CLAIMS	27 -	28 =	0 x	\$50.00	\$0.00	
INDEP. CLAIMS	8 -	3 =	5 x	\$210.00	\$1,050.00	
Multiple Dependent Claims (check if applicable) <input type="checkbox"/>						
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT						\$1,050.00
<input checked="" type="checkbox"/> No additional fee is required for amendment. <input type="checkbox"/> Please charge Deposit Account No. 50-1379 in the amount of \$1,050.00 <input type="checkbox"/> A check in the amount of to cover the filing fee is enclosed. <input checked="" type="checkbox"/> The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account 50-1379 <input checked="" type="checkbox"/> Any additional filing fees required under 37 C.F.R. 1.16. <input checked="" type="checkbox"/> Any patent application processing fees under 37 CFR 1.17.						
 _____ Signature			Dated: March 31, 2008			
Steven W. Smith Reg No. 36,684 Ericsson Inc. 6300 Legacy Drive, M/S EVR 1-C-11 Plano, TX 75024			<div style="text-align: center; font-size: small;">Certificate of Mailing or Transmission</div> <div style="font-size: x-small;">I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage for First class or Express Mail in an envelope addressed to Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450, or being facsimile transmitted, or transmitted via EFS-Web to the USPTO, on the date indicated below.</div> <div style="text-align: center; margin-top: 20px;">  _____ Signature </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> Pam Ewing March 31, 2008 </div> <div style="text-align: center; font-size: x-small; margin-top: 5px;">Depositor's Name and Date</div>			

P11LARGE/REV07

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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 10/531,021		Filing Date 04/12/2005		<input type="checkbox"/> To be Mailed		
APPLICATION AS FILED – PART I											
(Column 1)			(Column 2)			SMALL ENTITY <input type="checkbox"/> OR		OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)				
<input type="checkbox"/> BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A					
<input type="checkbox"/> SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A					
<input type="checkbox"/> EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A					
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =			X \$ =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =			X \$ =					
<input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).										
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))											
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL					
APPLICATION AS AMENDED – PART II											
(Column 1)			(Column 2)			(Column 3)		SMALL ENTITY OR		OTHER THAN SMALL ENTITY	
AMENDMENT	03/31/2008	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(o))	* 27	Minus	** 28	= 0	X \$ =		OR	X \$50=	0	
	Independent (37 CFR 1.16(h))	* 8	Minus	***3	= 5	X \$ =		OR	X \$210=	1050	
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))							OR			
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR			
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	1050	
AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(o))	*	Minus	**	=	X \$ =		OR	X \$ =		
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =		OR	X \$ =		
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))							OR			
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR			
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>											

Legal Instrument Examiner:
/ERIC V. BURNS/

This collection of information is required by 37 CFR 1.16. 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 1.14. 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.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,021	04/12/2005	Magnus Harnesk	P17661-US2	2135

27045 7590 01/07/2008
ERICSSON INC.
6300 LEGACY DRIVE
M/S EVR 1-C-11
PLANO, TX 75024

EXAMINER

SMITH, CREIGHTON H

ART UNIT	PAPER NUMBER
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2614

MAIL DATE	DELIVERY MODE
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01/07/2008

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.

Office Action Summary

Application No.

10/531,021

Applicant(s)

HARNESK ET AL.

Examiner

Creighton H. Smith

Art Unit

2614

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) 29 and 30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,7,8,11,12,14,17-19,24,25 and 28 is/are rejected.
- 7) ☒ Claim(s) 3,5,6,9,10,13,15,16,20-23,26 and 27 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 26.12.06& 12.04.05
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: ____

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 4, 7, 8, 9, 11, 18, 19, 24, 25, & 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al, U.S. Patent Publication #2003/0152084 in view of Barham et al, U.S. patent #7,284,047.

Lee discloses in ¶-0018 that with the increase in volume and types of Internet applications, there has also been a demand for enhanced services in the form of Quality of Service (QoS). Best-effort services is the service currently used on the Internet. In ¶-0020 Lee et al that their invention is directed towards a "differentiated services" device. The differentiated services device includes a traffic metering unit, a storage congestion metering unit, and a marking unit. In Fig. 6 and ¶-0135 Lee et al disclose an accounting unit (324), which as disclosed in ¶-0097 is for billing purposes. In ¶0356 lee et al disclose that the actual time that a user is requesting services from the provider is "calculated", 5th sentence, by subtracting the Last Conforming Cell (¶-0150) from the arrival time. Later in ¶-0356 lee et al discloses the use of a "token bucket" ("TB") which contains an adjusted required time between information elements. The "required time between informational elements (STEP 212) is adjusted to account for debt incurred by a previous informational element (¶-00356, 8th sentence.) Therefore, Lee et al TB reads upon applicant's TB that store reservations because Lee's TB keeps the "required time between informational elements" (arrival time and LCT), i.e., how long a user is

using a specific type of information. Lee et al never specifically disclose reducing the bits of information in the TB. However, Barham et al do disclose in cols. 8 & 11, lines 45-51 & 5 et seq., that the token rate is adjusted upon receipt of notifications of network load and to update the token rate based on the rate flow. To have provided Barham et al teaching of reducing the bits of information in the TB in Lee et al device would have been obvious to a person having ordinary skill in the art because both references are teaching charging the user based on the type of service rendered. See Barham et al, col. 13, lines 35-40.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 12, 14, 17, are rejected under 35 U.S.C. 102(e) as being anticipated by Lee et al.

For claims 12, see discussion pertaining to claim 1 and the Lee reference.

Claims 3, 5, 6, 9, 10, 13, 15, 16, 20- 23, 26, & 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

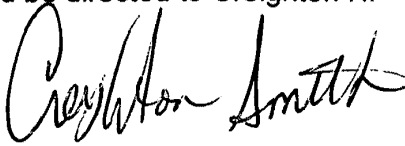
Application/Control Number:
10/531,021
Art Unit: 2614

Page 4

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Lialiamou et al.

Any inquiry concerning this communication should be directed to Creighton H. Smith at telephone number 571/272-7546.

03 JAN '07



Creighton H Smith
Primary Examiner
Art Unit 2614

JC13 Rec'd PCT/PTO 10/531021
22 APR 2005

In place of PTO-1449 Form		U. S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>				Application Number	Not Yet Known
				Filing Date	April 12, 2005
				Applicant(s)	Martin Körting, et al
				Art Unit	Not Yet Known
				Examiner Name	Not Yet Known
SHEET	1	OF	1	Attorney Docket Number	P17661US2

U. S. PATENT DOCUMENTS				
Examiner's Initials	Cite No.	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document

FOREIGN PATENT DOCUMENTS					
Examiner's Initials	Cite No.	Foreign Patent Document <small>(Country Code - Number - Kind)</small>	Publication Date MM-DD-YYYY	Patentee or Applicant of Cited Document	Translation Y/N
CHS	AA	WO 0201847 A1	01-03-2002	Telefonaktiebolaget LM Ericsson (publ)	
CHS	AB	WO 0117222 A1	03-08-2001	Nokia Networks Oy	

OTHER PRIOR ART		
Examiner's Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article, title of the item, date, page(s), volume- issue number(s), publisher, city/country where published

Examiner Signature	<i>Amack</i>	Date Considered	12/07
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EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include a copy of this form with next communication to applicant.

U. S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE				<i>Complete if Known</i>	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>				Application Number	10/531,021
				Filing Date	04/12/2005
				First Named Inventor	Magnus Harnesk
				Art Unit	2814
				Examiner Name	Fan S. Tsang
SHEET	1	OF	1	Attorney Docket Number	P17661-US2

U. S. PATENT DOCUMENTS				
Examiner's Initials	Cite No.	Document Number (Number-Kind-Code)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document

FOREIGN PATENT DOCUMENTS					
Examiner's Initials	Cite No.	Foreign Patent Document (Country Code - Number - Kind)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Translation Y/N
CHS	AA	WO 0201847	01-03-2002	Telefonaktiebolaget LM Ericsson	

NONPATENT LITERATURE DOCUMENT			
Examiner's Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T

Examiner Signature	<i>Amey</i>	Date Considered	12/27
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EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include a copy of this form with next communication to applicant.

Notice of References Cited	Application/Control No. 10/531,021	Applicant(s)/Patent Under Reexamination HARNESK ET AL.	
	Examiner Creighton H. Smith	Art Unit 2614	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2003/0152084	08-2003	Lee et al.	370/395.21
*	B	US-7,284,047	10-2007	Barham et al.	709/224
*	C	US-2006/0050711	03-2006	Lialiamou et al.	370/395.2
*	D	US-2003/0086413	05-2003	Tartarelli et al.	370/352
*	E	US-2002/0075813	06-2002	Baldonado et al.	370/254
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims



Application/Control No.

10/531,021

Examiner

Creighton H. Smith

Applicant(s)/Patent under Reexamination

HARNESK ET AL.

Art Unit

2614

✓	Rejected
=	Allowed

—	(Through numeral) Cancelled
+	Restricted


N	Non-Elected
I	Interference

A	Appeal
O	Objected

Claim	Date
Final	Original
1	8/10
2	1/11
3	1/11
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Search Notes 	Application/Control No.		Applicant(s)/Patent under Reexamination	
	10/531,021		HARNESK ET AL.	
	Examiner		Art Unit	
	Creighton H. Smith		2614	

SEARCHED			
Class	Subclass	Date	Examiner
370	352	1/3/2008	CHS

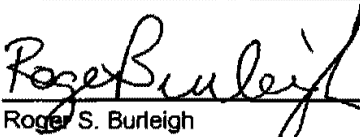
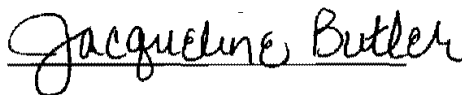
INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST Search - see prinout	1/3/2008	CHS

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	7	(@ad<="20021015") and "370". clas. and ((quality adj of adj service or qos) with charg\$3) and rat\$3 with table	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/01/03 15:01
L4	0	(@ad<="20021015") and "370". clas. and ((quality adj of adj service or qos) with charg\$3) and (filter with (classif\$7 or dertermin\$3 or ascertain\$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/01/03 15:02
S1	97	(@ad<="20021015") and "370". clas. and ((quality adj of adj service or qos) with charg\$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/01/03 14:45
S2	10	(@ad<="20021015") and "370". clas. and ((quality adj of adj service or qos) with charg\$3) and (token adj bucket)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/01/02 13:11
S3	39	(@ad<="20021015") and "370". clas. and charg\$3 and (token near5 bucket)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/01/03 10:31
S4	16	(@ad<="20021015") and "370". clas. and charg\$3 and (token near5 bucket) and account\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/01/03 12:37

TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT (Under 37 CFR 1.97(b), 1.97(c) or 1.97(d))			Docket No. P17661-US2
In Re Application Of: Magnus Harnesk			
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Title			
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Address to: Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Fax no. (571) 273-8300			
37 CFR 1.97(b)			
<input checked="" type="checkbox"/> The Information Disclosure Statement submitted herewith is being filed (1) within three months of the filing of a national application other than a continued prosecution application under 37 CFR 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 in an international application; (3) before the mailing of a first Office Action on the merits; or (4) before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.			
37 CFR 1.97(c)			
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U. S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>				<i>Complete if Known</i>	
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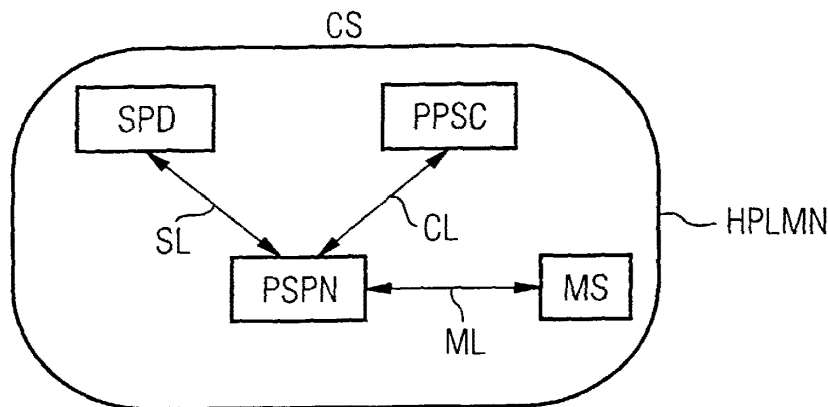
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(54) Title: METHOD AND APPARATUS FOR CHARGING OF COMMUNICATIONS SERVICES



(57) Abstract: The invention provides a charging method for a communications service in a communications system, especially for a prepaid communications service. A prepaid service processing node (PSPN) processes a communications service. A prepayment support node information (PI) is received from a subscriber profile database (SPD). A prepayment support node address (PA) is determined from the prepayment support node information (PI). The determined prepayment support node address (PA) is stored. A request for the communications service to be charged on a subscriber's prepayment account is detected, and a credit information request is sent to a prepayment support node (PPSC) identified by the stored prepayment support node address (PA). A credit information is received, and the requested communications service is processed according to the credit information. The invention provides a device for said charging as well.

WO 02/01847 A1

Method and apparatus for charging of communications services

Field of the Invention

- 5 The present invention relates to communications services, particularly to a method and a network node for charging of communications services.

Background of the invention

- Prepaid services in modern telephone networks allow network operators to issue
10 subscriptions on a prepaid basis. A prepaid service account contains an amount of charging value that can be used to pay for outgoing calls as well as for incoming calls. A prepaid service account can have an expiration date. Calls can be made with the account as long as the call limitations are not exceeded. Examples for call limitations are an empty account or a passed expiration date. Call charges are
15 automatically deducted from the account. The account can be refilled with charging value for continued usage.

- Prepaid Services may be offered to customers not wanting a permanent subscription or to customers who for some reason cannot get credit approval. In mobile
20 communications networks, prepaid services are particularly useful for car rental agencies, travel agencies or organisers of fairs and seminars. These companies can in turn supply their customers with the prepaid account.

- In the state of the art, a solution for providing prepaid services in a fixed network is
25 based on the Intelligent Network (IN), as described in WO 98/27715. A prepaid service originating call is routed by the terminal exchange (TE) to a service switching point (SSP), which requests connection time from a prepaid services account kept at a service control point (SCP). The SCP, which analyses the cost of the call and checks the account balance, sends information on the length of the
30 connection time assigned to the call to the SSP and deducts the account in real time

during the call. During the connection, the SSP monitors the elapsing of the connection time assigned per request, and when the assigned connection time is less than a specific threshold, an additional time request is sent to the SCP. The SCP updates the account balance, when the connection is terminated.

5

A cellular communications system can comprise a HPLMN, as well as additionally at least one VPLMN. As designed for a fixed network, the described prepayment method is not suited for a cellular communications system, in which subscribers regularly move within their home public land mobile network (HPLMN) as well as
10 into and within visited public land mobile networks (VPLMNs), because the corresponding roaming is not supported.

As an additional disadvantage, the communications network must support an IN architecture providing SSPs with service switching functions, at least one SCP with
15 a service control function and a service management point (SMP) with a service management function. All interfaces are vendor specific. Therefore, the interface to access the prepaid service accounts is vendor specific as well, which limits compatibility within the network. Furthermore, the amount and complexity of signalling messages exchanged between SSP and SCP is high. Also, the dialogue
20 between these nodes must be kept during the whole call, which binds network resources. In addition, it is difficult to charge not only the call duration, but also events like supplementary services and short message services (SMS), because the SCP does not get the corresponding signalling information.

25 As described in Mouly, Pautet, The GSM System for Mobile Communications, ISBN 2-9507190-0-7, chapter 9.1.2, pp 572-577, another method for payment of communications services in GSM is the creation of toll ticketing (TT) records in a mobile switching centre (MSC) and their transfer by tape or electronic transfer to a node controlling user accounts. This method is not real-time oriented, because the
30 service is executed before the TT records are sent to the node that is controlling user accounts. There they arrive always with a certain delay. Therefore, also in the case

of electronic transfer of toll tickets there is for an operator maintaining a prepaid account depending on his billing strategy for a call a risk either of overcharging the account or of undercharging due to an empty prepaid account. Although an operator of a HPLMN might take the latter risk, usually a VPLMN operator will not.

5 Therefore, roaming of a prepaying subscriber cannot be granted.

Another known method for prepayment of communications services is to store the subscribers credit on a smart card in the terminal. This method is less convenient to the service provider due to a lack of control and a certain fraud potential. A high
10 effort is necessary to avoid this risk. A smart card-based prepaid system is described in the article 'Natel D Easy', ComTec, vol. 2, 1997, p.16-20.

Summary of the Invention

It is an object of the present invention to overcome the above described problems
15 and to provide a charging method and device, particularly in mobile communications systems, which support roaming of subscribers both within their home communications network and within as well as into different networks for all types of chargeable services in a cellular communications system.

20 This object is achieved by the method and the network node according to claims 1 and 17.

The present invention provides a charging method for a communications service in a cellular communications system, especially for subscribers having a prepaid service
25 account that is administrated by a prepayment support node PPSC of the communications system. The invention can be used to charge all types of chargeable services. A network node, which processes prepaid services is called in the following a prepaid service processing node PSPN. Any network node of a communications system can be a PSPN. Subscriber data like the subscriber type,
30 e.g. 'prepaying subscriber permitted for international roaming', and further data, like the address PA of the PPSC, which administrates the corresponding prepaid service

account, are stored in a subscriber profile, which is stored in a subscriber profile database SPD. The subscriber profile database SPD can be centralised as well as decentralised. It is usually located in the HPLMN of the subscriber. Apart from a database for subscriber profiles, the SPD can perform other functions, e.g. functions of an HLR of a GSM system.

In a cellular communications system, the mobility of subscribers has to be ensured by routines like handover, national roaming and international roaming. The present invention supports all of these traffic cases, while facilitating reliably chargeable prepaid services for mobile subscribers. It supports all types of cellular communications systems, e.g. the well-established GSM system and the currently developed UMTS system. It is applicable for services like High Speed Circuit Switched Data Service HSCSD, General Packet Radio Service GPRS and Voice over Internet VoIP.

According to the present invention a PSPN, which processes communications services in the communications system, receives from the subscriber profile database SPD for a specific subscriber a Prepayment support node information PI. This can be triggered by and preferably be executed within a registration procedure that is performed when the subscriber enters the service area of the PSPN. A subscriber can enter the service area of a PSPN by location update, by handover or by switching on of his mobile station. The PSPN determines after reception of the Prepayment support node information PI a PPSC address PA and stores it. After detecting a request for a communications service, which is to be charged on a subscriber's prepayment account, the PSPN sends a credit information request to the identified PPSC by the prepayment support node address PA. After reception of the requested credit information, the PSPN processes the requested communications service according to the credit information.

Apart from a processing unit for processing prepaid communications services, the PSPN comprises a signalling interface SI to send and receive signalling information,

e.g. the Prepayment support node information PI, the credit information request and the credit information itself. A determination unit determines a PPSC address PA of a prepayment support node PPSC from a Prepayment support node information PI that is received via the signalling interface SI, and a memory M stores the address.

5 A request handler RH detects requests of communications services to be charged on a prepayment account. A credit information handler CH sends credit information requests to the PPSC identified by the stored prepayment support node address PA and receives the corresponding credit information. A controller CR is responsible for the controlling of the processing of requested communications services

10 according to the credit information and for the controlling of a charging of the communications service.

The present inventions allows operators of communications networks to offer reliably chargeable prepaid communications services to subscribers, while at the

15 same time profiting by the high performance because a low number and low complexity of signalling messages are needed. Network resources, in particular for signalling, are used to a minor extent only. Therefore, the present invention can easily fulfil the real-time requirements of modern communications networks. The solution is flexible, i.e. there is no need for a certain network architecture supporting

20 prepaid services. It is vendor-independent and applicable also for use in future systems.

The present invention allows for an entire range of charging, i.e. all services like bearer services, tele services and supplementary services can be charged. The same

25 applies to events like short messages. The proposed solution can be used to charge prepaid services to service originating subscribers as well as to call forwarding subscribers and to subscribers at which the service terminates.

The PSPN gets to know the PPSC addresses PA of prepaying subscribers, which are

30 currently in its service area. This allows the sending of credit information requests to the appropriate PPSC without delay. The availability of the PPSC address PA to

the PSPN is independent of the network, i.e. HPLMN or VPLMN, to which the PSPN belongs. Therefore, the roaming of prepaying subscribers is supported by the proposed solution, which is essential for operators promoting subscriber mobility.

- 5 Preferred embodiments of the present invention are described in the dependent claims.

According to claim 2, prepaid services processing capabilities of the PSPN are sent to the SPD. A process capability handler is according to claim 18 responsible for it.

10 The check of the prepaid services processing capabilities of the PSPN is especially useful in the case of mobile terminating services, if fees are to be charged to the so-called B-party, i.e. the subscriber on the service terminating side. Depending on the roaming agreements between network operators, this charging model applies in particular to international roaming. If the SPD knows the prepayment charging

15 capability of the PSPN serving the B-party, the SPD can decide either to allow a certain communication service, in particular a B-party terminating communication service, or to reject such a service request, e.g. if the corresponding PSPN is not able to charge a required fee.

- 20 According to claim 3, the processing of the requested communications service can comprise a controlling of a charging by different prepayment methods. According to claim 19, the controller of the PSPN takes over this task. Therefore, an operator is flexible in the design of his prepayment tariff models. As apart from prepayment based on credit information also, e.g., toll-ticketing payment can co-exist, it is
- 25 possible to charge for a prepaid service both a basic fee, e.g. via toll ticketing, as well as a variable fee via the described credit information interrogation.

According to claim 4, the Prepayment support node information PI comprises charging information about different types of communications services, the

30 requested prepaid communications service is processed according to this charging information. The processing can be performed by a PPSN according to claim 26.

The PSPN knows individual fees, preferably in the form of credits, applying to each of the prepaying subscribers it is currently responsible for. Usually, operators offer a broad range of different contracts to their customers, implying different fees for the same communications services. If the PSPN knows the fees, which are valid for an individual subscriber, or their corresponding values, e.g. monetary values, to be charged for certain services, it can support a reliable service charging.

According to claim 5, the credit information comprises an allowed amount of airtime. Advantageously, this supports an easy processing of prepaid services at the PSPN for time-based charging, like in GSM. The PSPN is not required to calculate from given monetary values the corresponding time that a service is allowed to consume, because the allowed amount of airtime is directly provided by the PPSC. Furthermore, any need for currency conversions is avoided in the case of international roaming subscribers.

15

Similar advantages exist for the embodiment described in claim 6, wherein the credit information comprises an allowed amount of traffic volume. Advantageously, a PSPN of a volume-based charging network like GPRS can directly process a certain traffic volume, e.g. in terms of bytes, which is allowed from the PPSC for a certain subscriber in response to a credit information request.

According to claim 7, the credit information comprises an approval or a rejection of the processing of the requested communications service. According to the embodiment described in claim 20 a disconnection handler terminates the communications service, if the credit information comprises a rejection. Advantageously, the approval or rejection information allows an effective prepaid processing of events, e.g. of short messages. Usually, there is a fixed fee for discrete communications services. Therefore, the PSPN does not require redundant tariff information or amounts of granted airtime or traffic volume to process such services. Instead, an information is sufficient, whether the processing of the requested event is permitted.

According to the embodiments described in claim 8 and claim 21 a credit value, which is received in the credit information, is consumed according to the processed communications service. The credit value can represent, e.g., a time value or a traffic volume. The consumption can be made in discrete steps or continuously. Therefore, corresponding charging models can flexibly be used and are open for easy changes by an operator.

According to the embodiment described in claim 9 an additional credit information request is sent to the PPSC, whenever a remaining credit, which is calculated by a deduction of the consumption from the granted credit value, falls below a first threshold. According to the embodiment described in claim 22, the credit information handler takes care of this task. The detection of an exhausted credit can avoid an unpaid service execution, e.g., if it triggers a stop of processing of the communications service.

Advantageously, these embodiments allow a stepwise fetching of credits, e.g. airtime or traffic volume. Usually, the PPSC checks the current prepaid account balance prior to a response to a credit information request. Then the PPSC performs an account update, i.e. a deducting from the prepayment account, after a confirmation of the service termination is received. Therefore, if the operator allows parallel, i.e. timely overlapping, prepaid communications services for a single user to be charged on the same prepaid account, or if the operator provides family accounts, i.e. several users having the same account, or if the communications system supports, e.g., the so-called supplementary multi-party service, there exists a certain risk of unpaid service executions, if the PPSC deducts the account after corresponding confirmations of service executions are received. The stepwise fetching of credits reduces this risk, if the PPSC deducts the account stepwise as well. E.g., if airtime is fetched in steps of 1 minute each, the risk is minimised to an unpaid airtime of 1 minute, if the prepayment account becomes empty. If the PPSC deducts the account after granting of the credit before a service execution by the

PSPN and reimburses a rest, which is not consumed by the processed service after a service execution confirmation is received, the risk of rejecting requested parallel services due to an empty account is minimised by the stepwise fetching of credits.

- 5 According to claim 10, the PSPN receives an account warning sent by the PPSC, if the credit value of the subscriber account falls below a second threshold, and the PSPN sends an announcement of a low account credit to the subscriber's communications device, which has requested the communications service.
- 10 According to the embodiment described in claim 23, an announcement handler of the PSPN is responsible for sending this announcement. Advantageously, the subscriber can be informed by these embodiments about a possible forced service termination in advance.

- 15 According to claim 11, a service termination information is sent to the PPSC, when the processed communications service has been terminated. According to the embodiment described in claim 24, the controller is responsible for this task. Advantageously, this allows for an accurate billing of the executed service at the PPSC, in particular of the last credit granted by the PPSC to the PSPN before the end of the service provisioning, which can be partly reimbursed.

- 20 According to the embodiment described in claim 12, the prepayment support node information PI, the credit information request and the credit information are comprised in MAP messages. According to the embodiment described in claim 25, the signalling interface is a MAP interface. In this way, the exchange of signalling messages between PSPN and PPSC as well as between PSPN and SPD is vendor-independent. This allows the flexible use of the present method and network node in various networks comprising elements from different suppliers. Furthermore, national and international roaming for prepaying subscribers can be provided effectively due to the commonly used signalling messages.

30

According to the embodiment described in claim 13, at least one of the signalling messages credit information request and credit information comprises an interrogation request parameter indicating whether the signalling message is an initial one, a subsequent one or the last one related to the requested communications service. If this information is sent in the credit information request, the PPSC can easily detect, whether an internal charging process is to be setup in the case of an initial interrogation indication, to be continued in the case of a subsequent interrogation indication or to be finished in the case of a last interrogation indication. The same parameter sent in the credit information from the PPSC to the PSPN can serve for confirmation purposes.

According to the embodiment described in claim 14, at least one of the signalling messages credit information request and credit information comprises a reference parameter identifying a dialogue between the prepaid service processing node PSPN and the prepayment support node PPSC. This allows a clear assignment of credit information requests and credit information messages, which is in particular useful if a plurality of communications services is processed at the same time for a subscriber. It allows the easy identification of signalling messages as belonging to the same charging transaction, if the same reference value is used for these messages.

According to the embodiment described in claim 15, the signalling message credit information request comprises a service execution parameter indicating whether the requested communications service has been successfully executed. Therefore, the PPSC can efficiently detect, whether the balance of the subscriber account has to be finally updated with reference to a certain communications service charging.

According to the embodiment described in claim 16, the credit information comprises an interrogation indication parameter, indicating whether the prepayment support node PPSC expects a further interrogation from the prepaid service processing node PSPN for the communications service. This parameter can avoid

radio base station (not shown in Fig. 1), and the links SL and CL can be realised, e.g., indirectly via a backbone, transit or separate signalling network (not shown in Fig. 1). The communications system CS can comprise a plurality of prepaid service processing nodes PSPN with corresponding signalling links SL, CL, but a mobile station MS is covered usually by a single PSPN at a time.

The prepayment support node PPSC administrates prepaid accounts of subscribers, who have concluded a contract with the operator of the HPLMN. The PPSC processes charging and billing tasks for prepaying subscribers, and in particular grants credits for a subscriber in response to a corresponding credit request from a prepaid service processing node PSPN. The prepaid service processing node PSPN processes prepaid services, which are requested from a mobile station MS of a subscriber. The processing comprises at least the detection of the request for the communications service that is to be charged on a prepaid account, the request of a credit information from the PPSC and the evaluation of the received credit information. The execution of the communications service itself can be performed by the PSPN or alternatively be controlled by the PSPN and performed by a further node.

The subscriber profile database SPD administrates subscriber profiles of subscribers that belong to the HPLMN. According to the present invention, the SPD stores for each prepaying subscriber the address of a corresponding PPSC. In order to facilitate the charging of a communications service and its processing at a PSPN, the SPD informs the PSPN on a subscriber base via the signalling link SL about the address of the corresponding PPSC, preferably when a corresponding subscriber's terminal gets under the coverage of a PSPN, e.g. by handover, by roaming or after being switched on. If the PSPN receives a request for a prepaid communications service, e.g. in a mobile originating case via the link ML, the node needs to know whether the prepayment account has enough credit for the payment of the requested service. The PSPN sends via the link CL a credit information request to the PPSC that is identified by the stored prepayment support node address PA. The PPSC

evaluates the request, looks up the balance of the subscriber account, and sends a credit information back to the PSPN. The PSPN processes the requested communications service according to the credit information, e.g., the requested service is executed, if the credit information indicates that there are funds to cover
5 that in the account, or otherwise the service request is rejected.

Fig. 2 shows a simplified representation of an alternative communications system CS'. Its elements and the elements' functions correspond to those explained with reference to Fig. 1. In this example, the subscriber profile database SPD and the
10 prepayment support node are located in the HPLMN, and the prepaid service processing node PSPN covering the terminal MS in the VPLMN. Therefore, the shown scenario is a national or international roaming of a subscriber. In particular in this traffic case information of the PSPN about the appropriate PSPN, which is indicated by the corresponding address, is essential, because the PSPN and the
15 PPSC belong to different networks, which are usually provided by different operators. Otherwise, the information about the appropriate PPSC of a subscriber would not be available in the network, i.e. the VPLMN.

As explained above, the present invention is applicable in all types of cellular
20 communications systems like GSM, GPRS or UMTS. With reference to Fig. 1 and Fig. 2, e.g. for a GSM system the subscriber profile database SPD can be the home location register HLR, a prepaid service processing node PSPN can be a mobile switching centre MSC or a mobile switching centre combined with a visitors location register MSC/VLR respectively, and the prepayment support node PPSC
25 can be a prepaid service centre. Furthermore, the logical nodes of the communications system can be realised either by centralised nodes or in a distributed manner.

Fig. 3 illustrates a charging method for a communications service, e.g. executed in a
30 prepayment processing node PSPN of a cellular communications system CS. In step 300, the process is started. A trigger for this can be, e.g., a handover, a roaming or

the switching on of a subscriber's terminal. Any event that results in the terminal being covered by the PSPN can start the process.

In step 310, the PSPN receives a prepayment support node information PI, which is
5 sent from a subscriber profile database SPD caused by the described trigger that has started the process. After reception, the PSPN determines in step 320 from the prepayment support node information PI a prepayment support node address PA indicating the prepayment support node, which administrates a prepaid service account of the corresponding subscriber, from the prepayment support node
10 information PI. The determination can comprise an extraction of the prepayment support node address PA from other information like, e.g., subscriber identifier or further control information, a decoding as well as a conversion of the address, e.g. by means of a look-up-table, depending on the prepayment support node address format used. Afterwards, the prepayment support node address PA is stored 330,
15 e.g. temporarily in a buffer or in a memory. Preferably, the subscriber-related prepayment support node address PA is stored in the subscriber data at the node.

After a request for a prepaid communications service, which can be received from a mobile terminal MS, e.g. in a mobile originated traffic case, or from any network
20 element of the communications system, e.g. in a mobile terminating traffic case, is detected in step 340 by the PSPN, it sends in step 350 a credit information request to the prepayment support node PPSC of the corresponding subscriber. The request is sent to the PPSC that is identified by the stored prepayment support node address PA. A credit information is in step 360 received in response to the request from the
25 PPSC. Then in step 370, the PSPN processes the requested communications service according to the credit information, i.e. the PSPN takes care of the execution of the requested service if the credit information indicates a valid credit, or it rejects the execution.

30 Fig. 4 illustrates an alternative embodiment of the charging method. Apart from the steps already described with reference to Fig. 3, the PSPN sends in step 495 a

termination information to the PPSC after the node detects in step 490 a communications service termination, e.g. when the subscriber has finished the phone call, or because of a rejection indicated in the received credit information. The termination information allows the PPSC to finalise the charging for the service
5 and to perform a billing on the basis of the actually consumed credit.

If the service processing proceeds, the PSPN performs in step 475 a monitoring of the amount of credit, which is consumed by the executed service. If in step 480 is detected that the remaining credit, which is calculated within the monitoring task in
10 step 475 as the granted credit value that has been sent in the credit information deducted by the consumption, is lower than a specific threshold, which can be, e.g., either a fixed value or a certain percentage of the credit granted originally from the PPSC, the PSPN sends again in step 450 a credit information request to the PPSC. In particular, repeated requests of credit information can be applied to continuous
15 communications services like speech calls or data transmissions with a time-based or a volume-based charging. If the newly requested credit is granted by the PPSC, the regular processing of the communications service proceeds. Else the currently executed communications service is interrupted, i.e. terminated. In the latter case, a service termination information is sent to the PPSC as already explained above.

20 In a further embodiment (not shown in Fig. 4), the processing of the communications service according to the credit information is terminated, if the consumed credit value is equal or above the credit, which has been granted by the PPSC. This is useful, if a requested credit information is not received in a certain
25 response time.

The PSPN detects in step 485 whether a low-account warning from the PPSC is received, either within the credit information or in a separate signalling message. If a low account warning is received, the PSPN signals in step 488 a warning to the
30 subscriber terminal, e.g. by an announcement via a signalling channel. Consequently, the terminal can signal this warning to the subscriber. A low account

warning indicates, that the subscriber's prepaid service account is going to become empty, in other words, that the service account balance is less than a certain account threshold. The warning allows the subscriber, e.g., to finish quickly a phone call without being suddenly interrupted, or to refill the account in time.

5

Fig. 5a shows an example of parameters comprised in a prepayment support node information message. The message comprises an address parameter SPD-A that identifies a sender of the message, i.e. the SPD. The message comprises further a subscriber identifier SID that indicates the subscriber, for which the message is valid. The subscriber identifier can be a standardised International Mobile Subscriber Identity IMSI, an IP-address or a proprietary parameter. The message comprises further the address parameter PSPN-A, which is the address of the receiver of the message, i.e. a PSPN, and the prepayment support node address PA, which administrates a payment account for the subscriber identified by the subscriber identifier SID. The address parameters used in the message have preferably a format of an ISDN-number, but in alternative embodiments IP-addresses or proprietary address structures can be used.

Fig. 5b shows an example of parameters in a message, which can be a credit information request message or a credit information message respectively. The same parameter set and the same message structure can be used for this message pair. This allows the PPSC to respond in an efficient way to the request and makes acknowledgements easy because a conversion of the message fields is not necessary. The message shown in Fig. 5b comprises parameters of a credit information request or a credit information message respectively. The address formats of parameters in messages shown in Fig. 5a and Fig. 5b are preferably identical.

The message shown in Fig. 5b comprises an address parameter SN that identifies the sender of the message, i.e. a PSPN or a PPSC. A subscriber identifier SID indicates a subscriber, to which the message refers. The address of the receiver of the

message, i.e. a PPSC or a PSPN, is given in the parameter RE. A reference parameter ID, e.g. in an Integer format, can be used to identify a credit information request message and a credit information message that belong logically together and build a message pair. The reference parameter ID can be used, to identify a charging transaction, which can comprise several message pairs of credit information request and credit information messages.

A request type parameter RT indicates, whether the credit information request, respectively the credit information, is an initial one, a subsequent one or the last one that is related to a charging of a specific communications service. The PPSC can use this parameter to control the opening, the continuation and the closing of a charging transaction that comprises a sequence of credit information request / credit information message pairs. The parameter RT has preferably an Integer format. Valid values are, e.g., 0 for an initial message, 1 for a subsequent message and 2 for a final message.

The message shown in Fig. 5b comprises a parameter SE that indicates whether a communications service has been successfully executed. The PPSC can finally update the subscriber account balance after the successful service execution is indicated via the SE parameter. Preferably, the SE parameter has a Boolean format.

The parameter FI indicates, whether the PPSC expects a further credit information request message for a certain charging transaction. E.g., if the processing of a certain communications service is free of charge, the PPSC will send via the FI parameter an indication to the PSPN, that no further messages related to said charging transaction are necessary. The parameter format is preferably a Boolean format.

The parameter CV indicates a credit value that is requested by the PSPN, respectively allowed by the PPSC. The parameter can have, e.g., an Integer or a Real format. The value can represent different types of credit, e.g., an amount of

airtime or an amount of traffic volume. A type of credit can be assigned to a chargeable activity each. The type of credit, which is represented by the parameter CV, is indicated by the parameter CT. The format of the parameter can be, e.g., a String or an Integer format. In order to use the latter format, the operator has to
5 define a corresponding coding scheme.

In a preferred embodiment, the signalling messages prepayment support node information PI, credit information request and credit information are so-called MAP messages. For details on MAP it is referred to the ETSI specification GSM 09.02,
10 version 7.3.0.

Fig. 6 shows in an exemplary embodiment essential elements of a PSPN. Apart from a controller CR, which controls the processing of prepaid communications services and charging transactions at the PSPN, and a corresponding processing unit
15 PU, there are a determination unit DU to determine from a prepayment support node information PI a prepayment support node address PA. In one embodiment, this determination is performed by a read-out operation of the PA parameter from the PI. A memory M stores the address PA. A request handler RH detects requests for communications services, which indicate that the charging for these services should
20 be done to a prepaid account. Alternatively, the request handler can check, whether a requesting subscriber has an entry in the memory M, i.e. whether a prepayment support node address PA is stored for the subscriber. A credit information handler CH sends credit information requests to the PPSC that is identified by the stored prepayment support node address PA. The credit information handler CH receives
25 credit information messages, which are used by the controller CR for the controlling of the processing of the communications service with respect to the provision, rejection or termination of the service.

The signalling messages prepayment support node information PI, credit
30 information request and credit information are exchanged with the communications system via the interface SI. In the embodiment of Fig. 6, the interface SI is

- connected to the controller CR. All other shown elements of the PSPN are connected to the controller as well. A person skilled in the art can derive easily further possible implementations, e.g. a ring or a bus can be used to connect the elements of the PSPN. In a further embodiment, the controller CR can comprise at least one of the credit information handler, the request handler and the determination unit. These elements of the PSPN can be realised either in hardware, in software or in a combination thereof. In a preferred embodiment, the interface SI is a MAP message interface.
- 10 In further embodiments, the invention applies to a fixed network or to a hybrid network, i.e. an integrated fixed and mobile communication network. In these cases, the signalling messages are preferably comprised in Transaction Capability Application Part TCAP messages, and the interface SI is a TCAP message interface. In one embodiment, the communication system CS comprises a fixed network,
- 15 wherein the SPD and the PSPN are integrated in a single network node. In an alternative embodiment, the communication system comprises a fixed network for the home network and the visited network each. In this case, the SPD is preferably located in the home network, wherein the PSPN is located in the visited network. The use of TCAP messages in these embodiments supports services like the so-
- 20 called personal number service.

Claims

1. A charging method for a communications service in a communications system,
especially for a prepaid communications service, wherein a prepaid service
5 processing node (PSPN) processes a communications service, with the steps of
- receiving a prepayment support node information (PI) from a subscriber profile
database (SPD),
- determining a prepayment support node address (PA) from the prepayment
support node information (PI),
10 - storing the determined prepayment support node address (PA),
- detecting a request for the communications service to be charged on a
subscriber's prepayment account,
- sending a credit information request to a prepayment support node (PPSC)
identified by the stored prepayment support node address (PA),
15 - receiving a credit information, and
- processing the requested communications service according to the credit
information.
2. The method according to claim 1, with the additional step of
20 - sending prepaid services processing capabilities of the prepaid service
processing node (PSPN) to the subscriber profile database (SPD) for evaluation
in a communication service setup.
3. The method according to claim 1 or 2, wherein the step of processing the
25 requested communications service comprises a charging by another prepayment
method.
4. The method according to claim 1, 2 or 3, wherein
the prepayment support node information (PI) comprises charging information
30 about different types of communications services, and wherein the prepaid

service processing node (PSPN) processes the requested prepaid communications service according to said charging information.

- 5 5. The method according to any of the claims 1 to 4, wherein the credit information comprises an allowed amount of airtime.
6. The method according to any of the claims 1 to 5, wherein the credit information comprises an allowed amount of traffic volume.
- 10 7. The method according to any of the claims 1 to 6, wherein the credit information comprises an approval or a rejection for the processing of the requested communications service.
8. The method according to any of the claims 1 to 7, further comprising the step of
15 consuming a credit value, which is received in the credit information, according to the processing of the requested communications service.
9. The method according to claim 8, further comprising the steps of
20 calculating a remaining credit by deducting the consumption from the credit value, and sending an additional credit information request to the prepayment support node (PPSC), whenever the remaining credit falls below a first threshold.
10. The method according to any of the claims 1 to 9, further comprising the steps
25 of
 - receiving an account warning, which is sent by the prepayment support node (PPSC), if the credit value of the subscriber account falls below a second threshold, and
 - sending an announcement of a low account credit to a communications device
30 (MS), which has requested the communications service.

11. The method according to any of the claims 1 to 10, further comprising the step of
- sending a service termination information to the prepayment support node (PPSC), when the processed communications service has been terminated.
- 5
12. The method according to any of the claims 1 to 11, wherein the prepayment support node information (PI), the credit information request and the credit information are comprised in MAP messages.
- 10
13. The method according to any of the claims 1 to 12, wherein at least one of the signalling messages credit information request and credit information comprises an interrogation request parameter indicating whether the signalling message is an initial one, a subsequent one or the last one related to the requested communications service.
- 15
14. The method according to any of the claims 1 to 13, wherein at least one of the signalling messages credit information request and credit information comprises a reference parameter identifying a dialogue between the prepaid service processing node (PSPN) and the prepayment support node (PPSC).
- 20
15. The method according to any of the claims 1 to 14, wherein the signalling message credit information request comprises a service execution parameter indicating whether the requested communications service has been successfully executed.
- 25
16. The method according to any of the claims 1 to 15, wherein the credit information comprises an interrogation indication parameter, indicating whether the prepayment support node (PPSC) expects a further interrogation from the prepaid service processing node (PSPN) for the communications service.
- 30

17. A prepaid service processing node (PSPN) in a communications system,
comprising
- a processing unit (PU) for processing prepaid communications services,
 - a controller (CR) to control the processing of the communications service by
 - 5 the processing unit (PU) and for a charging of the communications service,
 - a signalling interface (SI) to send and receive signalling information,
 - a determination unit (DU) to determine a prepayment support node address
(PA) of a prepayment support node (PPSC) from a prepayment support node
information (PI) received via the signalling interface (SI) and initiate the storing
 - 10 of the determined prepayment support node address (PA) in a memory(M),
 - a request handler (RH) to detect a request for a communications service to be
charged on a subscriber's prepayment account at the prepayment support node
(PPSC), and
 - a credit information handler (CH) to send a credit information request to the
 - 15 prepayment support node (PPSC) identified by the stored prepayment support
node address (PA) and to receive a credit information via the signalling interface
(SI) and forward it to the controller (CR).
18. The prepaid service processing node (PSPN) according to claim 17, comprising
- 20 a processing capability handler to send prepaid services processing capabilities
of the prepaid service processing node (PSPN) to a subscriber profile database
(SPD).
19. The prepaid service processing node (PSPN) according to claim 17 or 18,
- 25 wherein the controller controls a charging of the requested communications
service by another prepayment method.
20. The prepaid service processing node (PSPN) according to claims 17, 18 or 19,
- 30 comprising a disconnection handler to terminate the requested communications
service if the credit information received from the prepayment support node

(PPSC) comprises a rejection of the processing of the requested communications service.

21. The prepaid service processing node (PSPN) according to any of the claims 17
5 to 20, wherein a credit value, which is received in the credit information, is consumed according to the processing of the requested communications service.
22. The prepaid service processing node (PSPN) according to claim 21, wherein
10 the controller calculates a remaining credit by deducting the consumption from the credit value, and the credit information handler sends an additional credit information request to the prepayment support node (PPSC), whenever the remaining credit falls below a first threshold.
23. The prepaid service processing node (PSPN) according to any of the claims 17
15 to 22, comprising an announcement handler to send an announcement of a low account credit to a communications device (MS), which has requested the communications service, if an account warning is received from the prepayment support node (PPSC).
- 20 24. The prepaid service processing node (PSPN) according to any of the claims 17 to 23, wherein the controller sends a service termination information to the prepayment support node (PPSC), if the processed communications service has been terminated.
- 25 25. The prepaid service processing node (PSPN) according to any of the claims 17 to 24, wherein the signalling interface is a MAP interface.
26. The prepaid service processing node (PSPN) according to any of the claims 17
30 to 25, wherein the controller controls the processing of the requested prepaid communications service according to a charging information about different

types of communications services, which is comprised in the prepayment support node information (PI).

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FIG. 1

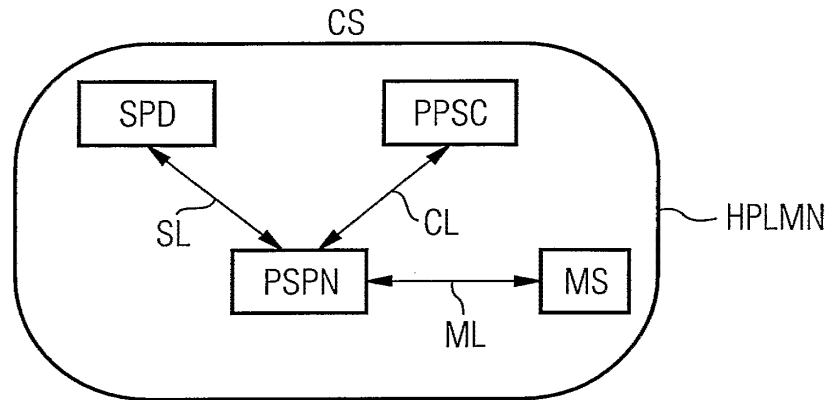
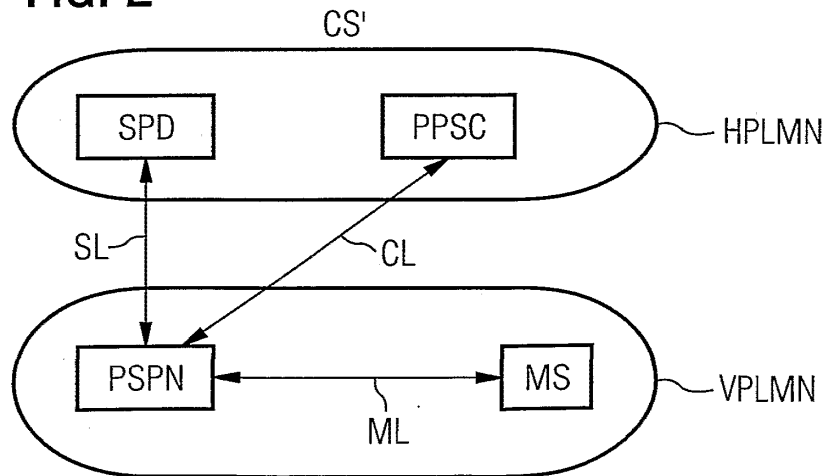
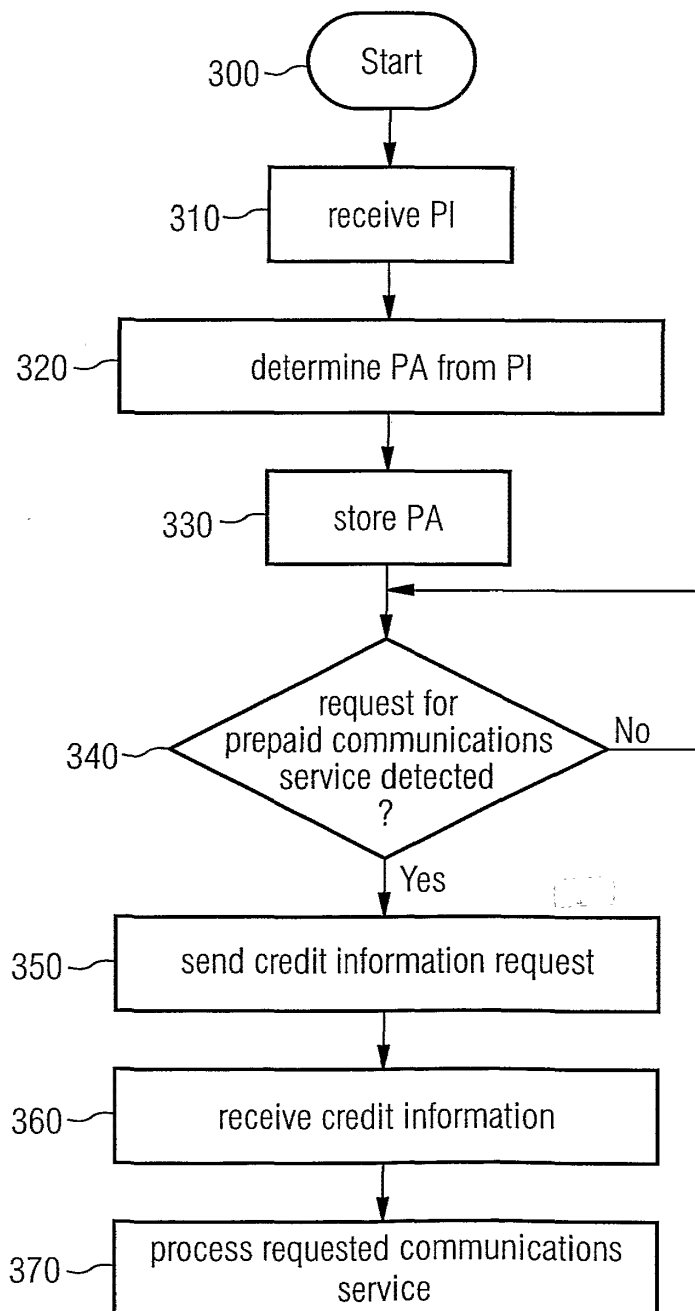


FIG. 2



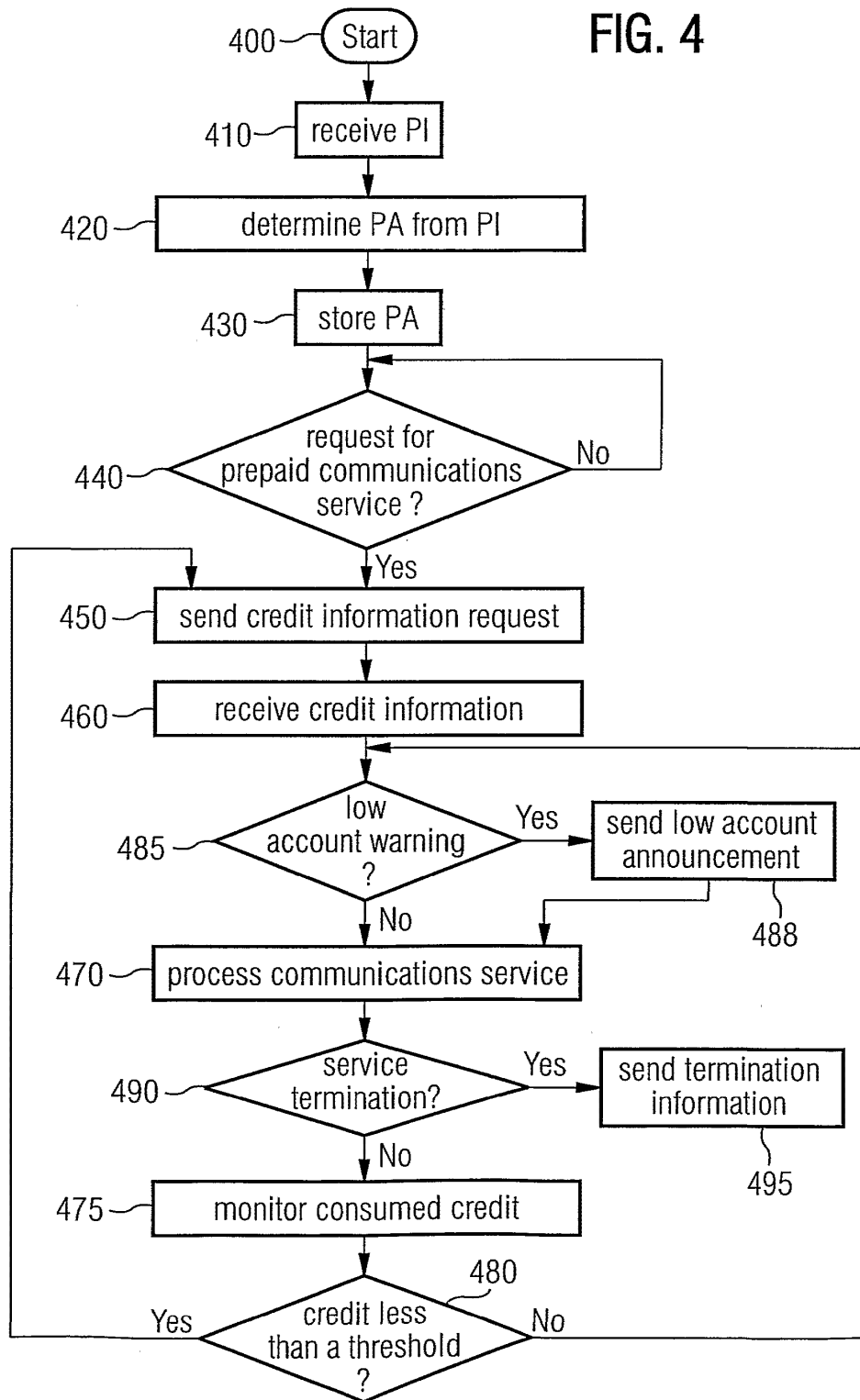
2/4

FIG. 3



3/4

FIG. 4



4/4

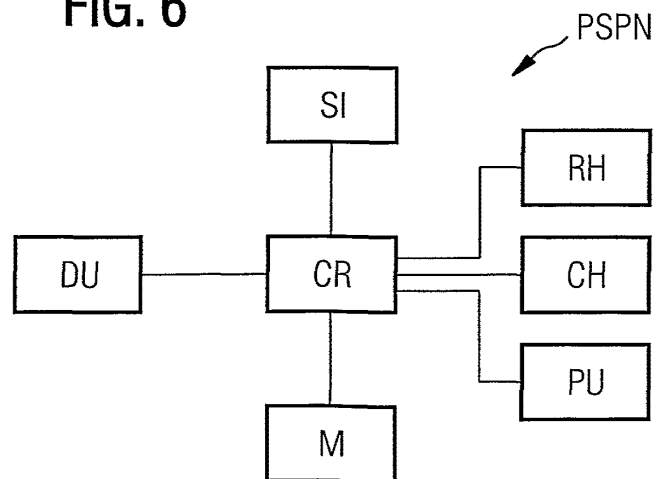
FIG. 5a



FIG. 5b



FIG. 6



INTERNATIONAL SEARCH REPORT

International Application No.

P 01/07141

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M17/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04M

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 029 062 A (HANSON DANIEL A) 22 February 2000 (2000-02-22) the whole document ---	1-26
X	WO 99 30480 A (BELLSOUTH CORP) 17 June 1999 (1999-06-17) abstract page 3, line 21 -page 4, line 18 page 6, line 21-28 page 19, line 15 -page 26, line 12 page 30, line 24 -page 33, line 6 ---	1-26
X	WO 00 05871 A (ERICSSON TELEFON AB L M) 3 February 2000 (2000-02-03) abstract page 2, line 30 -page 5, line 26 page 8, line 1 -page 12, line 16 -----	1-26

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
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Date of the actual completion of the international search

4 October 2001

Date of mailing of the international search report

19/10/2001

Name and mailing address of the ISA

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Le Bras, P

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/JP 01/07141

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6029062	A	22-02-2000	US 6058300 A	02-05-2000
			AU 6142498 A	25-08-1998
			CA 2250845 A1	06-08-1998
			WO 9834393 A2	06-08-1998
			US 6208851 B1	27-03-2001
WO 9930480	A	17-06-1999	US 6226364 B1	01-05-2001
			AU 2085799 A	28-06-1999
			WO 9930480 A1	17-06-1999
WO 0005871	A	03-02-2000	US 6185414 B1	06-02-2001
			AU 5541099 A	14-02-2000
			BR 9912390 A	24-04-2001
			WO 0005871 A1	03-02-2000

Electronic Acknowledgement Receipt	
EFS ID:	1400214
Application Number:	10531021
International Application Number:	
Confirmation Number:	2135
Title of Invention:	System for providing flexible charging in a network
First Named Inventor/Applicant Name:	Magnus Harnesk
Customer Number:	27045
Filer:	John Han/Pamela J Shultz
Filer Authorized By:	John Han
Attorney Docket Number:	P17661-US2
Receipt Date:	26-DEC-2006
Filing Date:	12-APR-2005
Time Stamp:	18:38:57
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Filed	06-4647-Transmittal-of-IDS-to-PTO-P17661US2.pdf	122693	no	3

Warnings:

Information:					
This is not an USPTO supplied IDS fillable form					
2	Foreign Reference	WO_2002001847_A1.pdf	1349631	no	32
Warnings:					
Information:					
Total Files Size (in bytes):			1472324		
<p>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.</p> <p>New Applications Under 35 U.S.C. 111 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.</p> <p><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.</p>					

10531021

PATENT APPLICATION FEE DETERMINATION RECORD

Effective December 8, 2004

Application or Docket Number

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
U.S. NATIONAL STAGE FEES		
BASIC FEE	SMALL ENT. = \$ 150	LARGE ENT. = \$ 300
EXAMINATION FEE	Satisfies PCT Article 33(1)-(4) = \$ 50 / \$ 100	All other situations = \$ 100 / \$ 200
SEARCH FEE	U.S. is ISA = \$ 50 / \$ 100 ALL other countries = \$ 200 / \$ 400	ALL other situations = \$ 250 / \$ 500
FEE FOR EXTRA SPEC. PGS.	minus 100 =	/ 50 =
TOTAL CHARGEABLE CLAIMS	16 minus 20 =	
INDEPENDENT CLAIMS	3 minus 3 =	
MULTIPLE DEPENDENT CLAIM PRESENT	<input type="checkbox"/>	

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐

OR

OTHER THAN SMALL ENTITY

RATE	FEE
BASIC FEE	
EXAM. FEE	
SEARCH FEE	
X \$ 125 =	
X \$ 25 =	
X \$ 100 =	
+ \$ 180 =	
TOTAL	

OR

RATE	FEE
BASIC FEE	300
EXAM. FEE	200
SEARCH FEE	400
X \$ 250 =	
X \$ 50 =	
X \$ 200 =	
+ \$ 360 =	
TOTAL	1000

CLAIMS AS AMENDED - PART II

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT A	A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR
Total	16	Minus	** 20 =
Independent	3	Minus	*** 3 =
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM	<input type="checkbox"/>		

SMALL ENTITY

OR

OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE
X \$ 25 =	
X \$ 100 =	
+ \$ 180 =	
TOTAL ADDIT. FEE	

OR

RATE	ADDITIONAL FEE
X \$ 50 =	
X \$ 200 =	
+ \$ 360 =	
TOTAL ADDIT. FEE	

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR
Total		Minus	** =
Independent		Minus	*** =
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM	<input type="checkbox"/>		

RATE	ADDITIONAL FEE
X \$ 25 =	
X \$ 100 =	
+ \$ 180 =	
TOTAL ADDIT. FEE	

OR

RATE	ADDITIONAL FEE
X \$ 50 =	
X \$ 200 =	
+ \$ 360 =	
TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than "20", enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than "3", enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.



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U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/531,021	Magnus Harnesk	P17661-US2

27045
 ERICSSON INC.
 6300 LEGACY DRIVE
 M/S EVR C11
 PLANO, TX 75024

INTERNATIONAL APPLICATION NO.	
PCT/SE03/01122	
I.A. FILING DATE	PRIORITY DATE
06/27/2003	10/15/2002

CONFIRMATION NO. 2135
371 ACCEPTANCE LETTER



OC000000017045420

Date Mailed: 09/27/2005

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is **ACCEPTED** for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

<u>04/12/2005</u>	<u>04/12/2005</u>
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF COMPLETION OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1), (c)(2) and (c)(4) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363). Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

The following items have been received:

- Copy of the International Application filed on 04/12/2005
- Copy of the International Search Report filed on 04/12/2005
- Copy of IPE Report filed on 04/12/2005
- Copy of Annexes to the IPER filed on 04/12/2005
- Preliminary Amendments filed on 04/12/2005
- Information Disclosure Statements filed on 04/12/2005
- Oath or Declaration filed on 04/12/2005
- Request for Immediate Examination filed on 04/12/2005
- U.S. Basic National Fees filed on 04/12/2005
- Priority Documents filed on 04/12/2005

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Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

CHARITTA A BURT

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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371		ATTORNEY'S DOCKET NUMBER P17661-US2
INTERNATIONAL APPLICATION NO. PCT/SE03/01122		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) Not yet known 10/531021
INTERNATIONAL FILING DATE June 27, 2003		PRIORITY DATE CLAIMED October 15, 2002
TITLE OF INVENTION SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK		
APPLICANT(S) FOR DO/EO/US Martin Körling, et al		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
1. <input type="checkbox"/> This is a FIRST submission of items concerning a submission under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a submission under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below. 4. <input checked="" type="checkbox"/> The US has been elected (Article 31). 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau). b. <input checked="" type="checkbox"/> has been communicated by the International Bureau. (courtesy copy of enclosed) c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)). a. <input type="checkbox"/> is attached hereto. b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau). b. <input type="checkbox"/> have been communicated by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (Combined Declaration and Power of Attorney - executed) 10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).		
Items 11 to 20 below concern document(s) or information included:		
11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A preliminary amendment. 14. <input type="checkbox"/> An Application Data Sheet under 37 CFR 1.76. 15. <input type="checkbox"/> A substitute specification. 16. <input type="checkbox"/> A power of attorney and/or change of address letter. 17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 37 CFR 1.821- 1.825. 18. <input type="checkbox"/> A second copy of the published International Application under 35 U.S.C. 154(d)(4). 19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4). 20. <input type="checkbox"/> Other items or information:		

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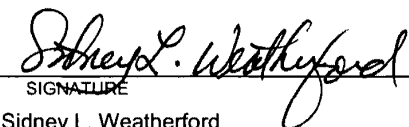
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U.S. APPLICATION NO. (if known, see 37 CFR 1.55) 10/531021		INTERNATIONAL APPLICATION NO. PCT/SE03/01122		ATTORNEY'S DOCKET NUMBER P17661-US2		
The following fees have been submitted				CALCULATIONS	PTO USE ONLY	
21. <input checked="" type="checkbox"/> Basic national fee..... \$300				\$ 300.00		
22. <input checked="" type="checkbox"/> Examination fee If International preliminary examination report prepared by USPTO and all claims satisfy provisions of PCT Article 33(1)-(4)..... \$100 All other situations..... \$200				\$ 200.00		
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Total claims	28 - 20 =	8	x \$ 50	\$ 400.00		
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SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK

FIELD OF THE INVENTION

- 5 The present invention relates to packet switched communications systems, and more particularly, to arrangements for performing charging in real time.

BACKGROUND OF THE INVENTION

- 10 Packet switched communications systems transport many different types of telecommunications traffic, such as voice, data, and multimedia traffic, which originates from a large variety of applications. A network operator may provide a variety of services that uses the different types of traffic and having a variety of charging schemes.

- 15 For some services, e.g. streaming, it is suitable to apply a time-based charging in contrast to other services e.g. internet browsing, where volume related charging is the only possible (usage related) charging method. The choice between time-based , volume-based and service based charging is made in relation to what the subscribers are willing to pay for and also to
- 20 achieve an accepted understandable charging method. E.g., for a streaming application such as a video stream, it is understandable for the user to pay for consumed time that he has watched the video.

- A subscription may have one or more users. The subscription is either a pre-
- 25 paid or a post-paid subscription, which implies that the subscriber, either in the pre-paid case pays an amount in advance, i.e. prior the service(s) is (are) utilised or in the post-paid case pays for e.g. the time or data volume that he actually has used during a certain period of time. In order to support pre-paid subscriptions, the charging solution has to have "real-time" properties.
- 30 This is particularly important when a prepaid subscriber's credit account is empty, service execution (in this case packet forwarding) must be immediately affected. When a subscriber account is empty, the operator wants to block at least all services that are subject for charging, since the operator wants to have credit control in addition to prevent losing money

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because of non-payment for consumed services. Some free of charge services may still be open for the subscriber like refill of the account, call to emergency numbers, self-care pages and in some cases also reception of SMS/MMS messages.

5

Thus, it is desirable to be able to perform a differentiated rating on the packet level based on the service. Performing differentiated rating on the packet level raises however a fundamental challenge, since rating is a complex process involving many input parameters such as tariff plan, time and volume thresholds, subscriber profile, etc., while the packet forwarding should be executed with lowest possible latency. Thus, packet forwarding systems and rating engines, respectively, have different system requirements.

15 Herein, the charging system according to prior art is called a "multiple token bucket" system. Such a system comprises a control system and a packet forwarding system as disclosed in **figure 1**. The control system 101 comprises a rating engine 102 and credit accounts 103. The packet forwarding system 104 comprises one token bucket 105 per service flow
20 106 and user which results in multiple token buckets 105 for every logged-in user provided that multiple services are used.

When a user logs into the communication system, the packet forwarding system 104 initiates a control signalling sequence to the control system
25 101 for each service. The control system 101 reserves a preconfigured amount of credit towards the subscriber's credit account, wherein this amount is called a "credit reservation". The control system 101 determines the set of services this user is allowed to use. The set of identifiers for these allowed services are sent to the packet forwarding system. For each service
30 identifier, the packet forwarding system 104 initiates a resource reservation signalling sequence towards the control system. For each such sequence, the service is rated by the rating engine 102 of the control system 101, using a tariff plan. The rating value is used to translate parts of the credit reservation into a "resource reservation" (typically data volume related),

which is sent back to the packet forwarding system 104. Each resource reservation is put into a specific resource token bucket 105. Thus, the packet forwarding system 104 contains multiple token buckets 105, one for each allowed service per user.

5

When traffic is flowing through the communication system the packet forwarding system 104 classifies each packet to determine which service flow it belongs to. Then the token bucket 105 for that service is decremented. When a token bucket 105 is empty, the usage is confirmed
10 towards the control system and a new resource reservation is done.

Thus, the multiple token bucket solution that performs per-packet real-time charging in a packet switched communication system, wherein the packets are charged differently dependent on which service flow the
15 packets belong to, requires a separate resource reservation signalling sequence for each service flow in the set of allowed services. This creates a large amount of signalling traffic between the control system and the packet forwarding system. In addition, it requires high processing capabilities in the control and the packet forwarding system, respectively,
20 and high capacity transport between said systems.

Furthermore, the multiple token bucket solution have other drawbacks since unnecessary reservations are performed. In the multiple token bucket case, a pre-configured amount of resources is reserved for each service,
25 wherein the credit reservation of each token bucket is dedicated for a specific service flow. That implies that credit reservations made for services not being used cannot be utilised for another service that actually is being used. Thus, this results in the above unnecessary reservations. Moreover, the problem gets worse as the number of services increases.

30

Another possible solution is to use several GPRS Access points Names (APN) in a mobile telecommunication network for differentiating between different consumer service flows. An APN is a label of one or more service flows in a mobile cellular network. However, this solution has

disadvantages due to APN configuration management, in e.g. terminal and network, as well as IP address handling in the terminal. Thus, this solution requires additional management for the operator to setup and control. Network operators prefer hence a solution with multiple services per APN, preferably one APN for all service flows.

SUMMARY OF THE INVENTION

As mentioned above, a multiple token bucket solution of prior art requires a large amount of signalling traffic between the control system and the packet forwarding system. In addition, the multiple token bucket solution is in many cases subject to the above mentioned unnecessary reservations. Furthermore, it is desirable to achieve a solution where multiple service flows are connected to one Access Point Name (APN) in a mobile cellular network, since solutions with one service flow per APN has drawbacks relating to configuration management as explained above.

Therefore, a first object of the present invention is to achieve arrangements for providing a flexible realtime charging, whereby the signalling between the control system and the packet forwarding system is reduced.

A second object of the present invention is to prevent unnecessary reservations.

A third object with the present invention is to provide a charging system where service flows can be differentiated at packet level and applicable charging can be applied in a flexible way. I.e., each packet should be able to be charged differently dependent on which service flow the packets belong to.

A fourth object of the present invention is to achieve a solution facilitating multiple services per APN.

The above stated objects are achieved by means of a system according to claim 1, a control system according to claim 12, a serving element according to claim 18, and interfaces according to claims 29 and 30.

- 5 The charging system according to the present invention makes it possible to reduce signalling between the control system and the packet forwarding system. The charging system comprises a control system and a serving element residing in a packet forwarding system. Said control system comprises an account function adapted to manage an account of at least
10 one user and a charging policy decision point arranged to calculate a charging policy for allowed services for the at least one user. Said serving element comprises a token bucket per user adapted to store reservations received from the account function of the user associated with the token bucket and a charging policy enforcement point arranged to perform
15 charging for a plurality of the allowed services by reducing the stored reservation of the token bucket according to the calculated charging policy.

- According to a first embodiment of the present invention the reduced risk for unnecessary reservations towards the account function is realized by
20 having a single token bucket that is shared by a plurality of service flows per user.

- Another advantage of the present invention is when a rate change should be performed at a certain time-of-day (ToD), the signalling load may be
25 reduced by including, in the charging policy, the user rating table part, rates both before and after ToD. Furthermore, when a user credit account becomes empty or a predefined threshold is reached, it is possible to apply a fine-grained policy control of the traffic thanks to the charging policy.

- 30 Another advantage of the present invention is that the use of a single token bucket per subscriber concept reduces the distribution of token reservations in the network which hence reduces the risk to empty the prepaid account due to many different reservations. It also reduces the control signalling between the serving element and the gateway and

eventually the pre-paid system, thus reducing the needs of physical boxes for all three functions.

Another advantage of the present invention is that the service class concept
5 allows the operator to group related services into a number of groups, i.e.
the services having identical tariffs in one group. Thus, the relation
between the services in the same service class could be arbitrary except
that the tariff must be the same since the rating is based on the service
class. Still, each user could have different tariffs for a particular service
10 class, but for a particular user, all services in a service class will have the
same rating (at a particular time) which means that all packets belonging to
a certain service class are rated in accordance with the rating value
associated with that service class in real-time without need for control
signalling towards the rating engine. The benefit besides the service
15 grouping is that the amount of data per subscriber is dramatically reduced.
As an example, the number of services may be in the order of thousands
but the number of service classes may be up to hundred. The service class
concept is also the basis for operator-side service authorisation. In
addition, the service class concept reduces the complexity for the user (the
20 charging scheme for different services may be easier to understand), speeds
up the processing of the charging system e.g. since the size of the user
rating tables decreases.

Another advantage with the present invention is that the delay when
25 starting to use a service (for example when retrieving MMS messages) is
reduced which results in a better end-user satisfaction and higher data
throughput. That is achieved due to the dynamic pre-rating at subscriber
connection which implies that all applicable rating values including their
validity conditions are calculated before the subscriber starts to use the
30 different services. It also reduces the control signalling traffic thus reducing
the load of the rating engine. Both traffic data throughput enhancement
and control signalling traffic reduction may lead to fewer physical boxes in
the network. A high level of rating flexibility is maintained as the rating
values have well-specified validity and may be re-newed.

A further advantage of the present invention is that the service filter and the protocol inspection filter (PIF) concepts allow the operator to specify filter rules for a service that may increase the traffic data throughput by just assigning rules in the service filter, while still having the possibilities to invoke more advanced filter rules when necessary to distinguish the service. Thus, the PIFs are only used if it is not possible to differentiate between the service flows by means of the service filter, i.e. by using the IP address, which results in a higher throughput at the packet forwarding system. The concepts as such are general which allow for further inclusion of new rules when needed for other services.

A further advantage of the present invention is that the charging system is arranged to handle "one-time initial charge". An initial amount of tokens are decremented from the token bucket before or during the start of the service.

Further advantages and objects of embodiments of the present invention will become apparent when reading the following detailed description in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic block diagram illustrating the multiple token bucket solution according to prior art.

Figure 2 is a schematic block diagram illustrating a single token bucket solution according to one embodiment of the present invention.

Figure 3 is a schematic block diagram illustrating a process of calculating the "charging policy" in accordance with the present invention.

Figure 4 illustrates the charging policy schematically, containing user rating table and validity conditions in accordance with the present invention.

Figure 5 illustrates the user profile schematically.

Figure 6 illustrates the tariff plan schematically.

Figure 7a illustrates the parameters of service filters.

Figure 7b illustrates the parameters of a Protocol Inspection Filter (PIF) configuration.

5 **Figure 8** illustrates the serving element in accordance to one embodiment of present invention implemented in a GGSN in mobile telecommunication system.

DETAILED DESCRIPTION

10 The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the
15 embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, like numbers refer to like elements.

The realtime charging system in accordance with the present invention may
20 be implemented in an IP-network such as the Internet or in a packet switched mobile telecommunication network such as a GPRS-, UMTS- or a cdma2000 system. Even if the embodiments of the present invention are disclosed in connection with a GPRS-/UMTS system, the invention is not limited to such systems.

25 A proposed solution of a charging system according to embodiments of the present invention shown in **figure 2** comprises a control system 201 and a serving element 206. The control system 201 comprises a charging policy decision point 202, also referred to as a rating engine, and a credit account
30 function 203, which manages the users' credit accounts for real-time charging purposes. The serving element 206 comprises a charging policy enforcement point 207 for performing the charging, i.e. managing the reduction of the token bucket 208. The token bucket in the serving element is used per logged-in user and for a plurality of services. Preferably, one

single token bucket is used for all services per logged in user. In addition, the serving element comprises means for differentiating packets based on which service flow they belong to. The serving element may reside in a packet forwarding system such as a switch, a router, a proxy, a GPRS
5 Gateway Support Node (GGSN) node in the GPRS/UMTS system, or a PDSN node or Home Agent in the cdma2000 system.

The system of the present invention, comprises means for collecting all credit reservations for a plurality of services in one single token bucket per
10 user in the serving element in the packet forwarding system. The credit account function transmits information of the amount of credit that should be reserved for all the services respectively, i.e. the services included in a user service vector which is further explained below, to the token bucket of the serving element for a specific user. The credit amounts are reserved in
15 accordance with pre-configured settings performed by the network operator. The collection of all credit reservations for a plurality of services, preferably all, in one single token bucket is made possible thanks to that a charging policy for the services is calculated in accordance with the present invention by the control system and transmitted to the serving element.
20 The calculation of the charging policy is herein referred to as dynamic pre-rating and is further explained below.

The present invention is applicable on realtime charging for both pre-paid and post-paid subscriptions. In the post-paid case, a token bucket may
25 have a negative value, while in the pre-paid case, the token bucket is not allowed to have a negative value since the user is not allowed to use more credits than what is reserved. Moreover, the present invention is also applicable on both volume-based, time-based and service-based charging, dependent on settings of the serving element.

30

Example 1

When a user logs on to a communication system comprising the charging system of the present invention, the serving element initiates a control signalling sequence between the serving element and the control system.

The control system determines the set of service identifiers this user is allowed to use. The rating engine 301 of the control system calculates a charging policy 304 based on a tariff plan 303 and other input data e.g., Time of Day (ToD), the user's roaming status, the aggregated transferred data volume for the user and other user specific usage history. Current usage behaviour is also utilised at the calculation of the user rating table if the user already is logged on, e.g. in a situation when the token bucket of the user runs empty, i.e. one validity condition is not fulfilled, and the serving element requests a new user rating table from the control system . This calculation is illustrated in **figure 3** and is called dynamic pre-rating. The charging policy comprises a user rating table 305 and a set of validity conditions 306. The user rating table 305 includes rating values for each service class the user is allowed to use and the set of validity conditions defines the conditions when the user rating table is valid. The service class concept is introduced according to the present invention to limit the size of the user rating table of the charging policy. The service class is a group of services with the common property that they have exactly the same charging pattern, i.e. identical tariff plans. The calculated charging policy is sent to the serving element in the packet forwarding system.

Next, the serving element in the packet forwarding system initiates a reservation signalling sequence towards the credit account function of the control system. The credit account function reserves an amount of credit according to pre-configuration settings towards the user's credit account, wherein the amount is called a credit reservation. The credit reservation is made for a plurality of service, preferably all services, and the overall credit reservation is sent to the serving element and put into the user-specific token bucket.

When traffic is flowing via the packet forwarding system, the serving element in the packet forwarding system comprises means for classifying each packet to determine which service class it belongs to. The received calculated charging policy is used to determine the credit amount that should be decremented from the token bucket. It should be noted that the

decrement may also be negative in order to support bonus services, i.e. a user gets paid if he uses a specific service.

5 The serving element in the packet forwarding system continuously checks if the validity conditions of the charging policy still are valid. Examples of validity conditions are time, thresholds for the token bucket, geographical area etc. When the validity conditions no longer are valid, a signalling sequence is initiated to get a new up-dated charging policy. When a rate change should be performed at a certain time-of-day (ToD), the charging policy, i.e. the user rating table part, contains the rate values that should be used both before and after ToD. That results in that the charging policy for a huge amount of users does not have to be updated at the same time which would cause extensive signalling during a short limited period of time for the huge amount of users, but the update may be performed during a longer period of time which reduces the signalling peak load.

Figure 4 shows an example of a charging policy comprising a user rating table associated with validity conditions.

20 When a token bucket is empty or a predefined threshold is reached, the usage is confirmed towards the control system and a new resource reservation is done. In the confirmation signal, information about the usage of the different services may preferably be added explicitly.

25 Basic terminology

In the following, the basic terminology of the flexible bearer charging system in accordance with the invention is explained:

- A **user** is person having access to the operator's provided services.
- 30 -One or more users may be connected to one **subscription**.
- A **subscriber** is the owner of the subscription.
- Realtime** charging implies that the charging process is performed while or after the service has been requested. It should be noted that 3GPP uses the term "on-line charging".

- A **token** is similar to a ticket. A utilisation of a service requires a predetermined amount of tickets/tokens, based e.g. on either the traffic volume or on the used time.
- A **token bucket** is a place where all tokens for one user is collected.
- 5 -A **service**, is the collection of all IP flows to and from a specific destination, determined by information in the headers or payloads of the IP packets.
- A **service identifier**, is the unique identifier of a service.
- Service class is an identifier of an arbitrary group of services that the operator wants to treat in the same way regarding e.g. charging and service
- 10 authorization. One service is allowed to belong to only one service class at a time per user.
- A **tariff plan** is a specification of prices for the services and when the services are valid.
- A **rating value** is an amount that should be reduced from the token
- 15 bucket for a specific service.
- A **service class** according to the present invention comprises all services having identical tariff plans.
- A **service filter**, is a specific filter setting that will handle a service with a specific service identifier. Thus, the service identifier is used to map the
- 20 service to its service filter. This terminology is further described below. In each service filter, destination or/and source (depending on the traffic direction) IP addresses (and mask), TCP and UDP port numbers (ranges), and protocol numbers can be set. In order to handle inspection of higher protocol layers, a service filter may include a pointer to a **Protocol**
- 25 **Inspection Filter** (PIF), which perform stateful packet inspection. The packet inspection is performed dynamically in contrast to the static service filters. That implies that the PIFs e.g. performs packet inspection based on previous events. The PIFs have specific configuration data (see **figure 8b**), for example containing URIs. Dynamic filters are established to perform the
- 30 actual filtering for packets that fit to the defined PIF rules. Finally, service filters and PIF configuration lines contain the service class identifier that represents the result of a filter matching an incoming packet. The **service class identifier** identifies the service classes and hence determines the rating that will be applied to the packet. Service filter and PIF

configurations are preferably performed in the packet forwarding system on a per Access Point Name (APN) basis.

5 Preferred embodiments of the present invention

The charging system and method of the present invention will hereinafter be described in conjunction with a GPRS/UMTS system. Thus, one embodiment of the charging system implemented in a mobile telecommunication system such as GPRS or UMTS system according to the present invention comprises:

- 10 -A serving element 801 located in a GGSN 800 as illustrated in figure 8. The serving element is further described below.
- 15 -A control system comprising a rating engine in accordance with the present invention i.e. the charging decision point, which allows the operator to define services and tariff plans, and dynamically provides the serving element with rating information in form of charging policies. The control system comprises further a credit account function.
- 20 -A gateway, which provides an integration point for interworking towards the operator's prepaid system by means of flexible interface options. In the case when the pre-paid system supports e.g. a Radius interface, the GGSN is arranged to directly interface to it.

It should be noted that even if the charging system and method thereof according to embodiments of the invention is described in conjunction with a GPRS/UMTS system in the following, the system and method thereof are not limited to such a system but may also be used in other packet switched communication systems.

Differentiated Packet Rating

30 As described above, differentiated rating on the packet level is a complex process involving many input parameters (tariff plan, time and volume thresholds, subscriber profile, etc), while packet forwarding should be executed with lowest possible latency.

The charging system of the present invention employs a rating process in two stages:

- A **dynamic pre-rating process** providing the charging policy, which is performed by the rating engine of the present invention.
- 5 -A **real-time packet rating** e.g. performed, in accordance with the provided charging policy, by the serving element in the GGSN.

The dynamic pre-rating process calculates a charging policy comprising a set of rating values for each service class that a subscriber is allowed to use. The charging policy comprises user rating table and a set of validity conditions. This calculation utilises the tariff plan and the current subscriber situation e.g. roaming status, time-of-day, etc. The rating values have a limited lifetime according to the set of validity conditions and have to be renewed for example when a tariff threshold is reached. The validity conditions may also relate to other parameters than the time. The dynamic pre-rating is performed and the charging policy is thus provided to the serving element before the user starts using any services.

The real-time packet rating is then performed by classifying a packet as belonging to a certain service class and using the already calculated rating values for that packet. This can be done with a very small delay in the forwarding process, since signalling between the control system and the serving element in forwarding system for each service initiation is avoided.

For example, a case is employment of zero volume-charge for services that have service-based charging (e.g., MMS). For such services, the dynamic pre-rating process would result in a rating value of zero. The real-time packet rating will then use the zero value and hence incurring no charge for that traffic.

30

Rating engine

Figure 3 illustrates how the rating engine of the preferred embodiment of the present invention performs the dynamic pre-rating process by producing a user rating table. The user rating table is produced by

- combining the user service class vector, the tariff plan, and additional information such as roaming status, aggregated volume and connect time stored in the database of the rating engine, time of day, and geographical location. In addition to the user rating table, a corresponding set of validity
- 5 conditions are generated using tariff thresholds in order to produce the charging policy. The charging policy comprising the user rating table and the validity conditions is provided to serving element e.g. located in the GGSN.
- 10 More specifically, the rating engine comprises means for performing the following procedure:
- Accepts request for a user rating table; wherein the input of the request may be a user identifier, e.g. the MSISDN, SGSN IP-address, QoS of the PDP Context, etc.
 - 15 -Receives the user service class vector of the subscriber which is further described below.
 - Receives the service definition for each service class in that subscriber's user service class vector.
 - Receives the aggregated volume, e.g. the transfer history, and aggregated
 - 20 connect time for this user (preferably stored in the internal database of the rating engine).
 - Calculates roaming status based on SGSN IP address for each service class.
 - Calculates the relevant rating values using the tariff plan and relevant
 - 25 rating dimensions, e.g., information about the user's roaming status, aggregated volume and connect time, ToD, and geographical location.
 - Calculates the validity condition for these rating values using the tariff thresholds in the rating dimensions such as roaming status, aggregated volume and connect time stored in the data base of the rating engine, ToD,
 - 30 and geographical location
 - Constructs the user rating table based on the above mentioned calculations.
 - Sends the constructed user rating table and the calculated validity conditions in form of a charging policy according to the present invention to

the charging enforcement point of the serving element in the packet forwarding system.

Serving element

5 According to the present invention the serving element, residing in a packet forwarding system 800, comprises the charging enforcement point 802, means 805 for performing the service classification and one token bucket 803 per user handling a plurality of services, preferably all allowed available services. Thus, in the embodiment described above, the serving element is
10 included in a GGSN 800. **Figure 8** shows an overview block diagram of the function of the serving element.

The service filter and PIF configurations are configured in the serving element. In a GPRS/UMTS network, that is preferably performed by using
15 the operation and support system of the Core Network. The serving element is arranged to perform packet inspection according to the service filters. In some cases, when necessary, it also invokes Protocol Inspection Filters (PIFs) for analysis of higher-layer protocols.

20 For the pre-paid and post-paid subscribers, the serving element may utilize the dynamic pre-rating and the reservation mechanisms as described above. The serving element distinguishes between post-paid and pre-paid subscribers either by using the charging characteristics information or by analysis of the subscriber identity, e.g. the IMSI in case of a mobile cellular
25 network. The serving element may be configured to retrieve the user service class vector for both pre-paid and post-paid subscribers in order to perform operator-side service authorization. Moreover, the serving element is arranged to perform credit control for both post-paid and pre-paid subscriptions.

30 The serving element requests user rating tables from the rating engine. This is triggered either at connection setup such as by PDP Context Activation or that the validity conditions for the user rating table are no longer valid. When a new user rating table is requested, the serving

element reports to the rating engine the transferred volume and the connect time as well as the status of the "initial rate values".

5 The serving element comprises means 804 for making reservations towards prepaid and postpaid system, via a gateway, and thereby fills up each user's token bucket kept in the serving element of the packet forwarding system, e.g. the GGSN. The amount of reservation and the validity conditions are configurable in the serving element. It decrements each user's token bucket according to the user rating table.

10

Service classification

The service classification is performed by means in the serving element in the packet forwarding system. In accordance with one embodiment of the present invention, the means for classifying packets are service filters and/or PIF. Thus, the classification is performed based on IP header
15 information and/or higher-layer protocols. While the architecture of the system according to one embodiment of the invention supports general stateful inspection and identification of URIs, initial focus is put on detecting MMS traffic over WAP 1.x and 2.x. After a packet has been
20 classified to belong to a certain service and service class, the real-time packet rating determines a rating value according to the calculated charging policy. The token bucket is then adjusted in accordance with the determined rating value.

25 The serving element in the packet forwarding system, preferably the GGSN, in accordance with the present invention is also adapted to enforce certain policies when the subscriber's prepaid account runs empty. Depending on roaming conditions, PDP Contexts can be de-activated or non-zero-rated packet can be stopped, while zero-rated traffic is let through e.g. allowing
30 access to top-up pages, i.e. a default web page that the user enters when the credit account is empty. It may e.g. be possible to refill the account from such a top-up page.

The benefit for the network operator of this above mentioned two-stage approach is that if throughput and latency are most important, services such as email, instant messaging, traffic to corporate gateways, and traffic to Internet may be defined using only IP-header inspection at the service filter and the PIF is not required. However, for other services such as MMS over WAP, the IP-header inspection (i.e. service filter) is not sufficient. A more detailed inspection of the payload, in this case the URL/URI is required. Thus, this approach avoids the overhead of stateful packet inspection where it is not required. Thus, one of the basic ideas with the present invention is to start to use the service filter, and then only if necessary, continue with PIF.

Example 2

Figures 7a and **7b** show an example where the operator's WAP gateways are placed at the subnet 100.18.0.0/16. Assume that these WAP gateways also are arranged to function as HTTP proxies. The service filters 1 and 2 both match packets to and from that subnet. Filter 1 is set to match the transport protocol Wireless Session Protocol (WSP) and invoke PIF number 1 according to the PIF pointer in **figure 7a**, while filter 2 will match the transport protocol HTTP and invoke PIF number 2. Assume that an incoming packet is a WAP-packet leading to a match for WSP. PIF 1 now employs an identifier data in the PIF configuration, in this case the URL/URI. In this example, it checks for the domain names of the MMS-centers of the operator. If the packet's WSP-header contains any of these domain names the resulting service class is 14. If the packet contains any other URL (the wild card *), the packet is non-MMS WAP traffic and is classified as service class 15.

Referring back to **figure 7a**, the service filter with the service identifier 3 is set to match the subnet 100.12.0.0, which for example is a partner service provider. All packets to and from that service provider will be classified as service class 22. Finally, packets matching the wildcard rule, service filter with service identifier 4, representing "other traffic", will be classified as service class 60.

User profile and user service class vector

A user profile which is illustrated in **figure 6** includes a subscriber identifier, the MSISDN, together with a user service class vector according
5 to the present invention. The user service class vector is a list of the services the user is allowed to use.

Specifically, if the operator wishes to perform operator-side service authorisation, the user service class vectors may be used to control which
10 service classes a subscriber is allowed to access. The user service class vectors are provisioned through a service authorisation and subscriber provisioning system. This allows for self-provisioning via the subscriber portal, which also forms the basis for top-up pages. Note, if the operator does not want to employ service authorisation all available service classes
15 should be listed in the user service class vector.

Continuing with the example described in conjunction with **figures 7a** and **7b**, the user profile in **figure 5**, allows the user to access service classes 14 (MMS traffic), 15 (other WAP traffic), 22 (the partner service provider), and
20 60 other traffic (general Internet access). The user profiles are managed by a customer relation management system and may be stored in a common directory. Independent of where the user profiles are stored they are replicated down to the rating engine according to the present invention.

Referring back again to the example in previous sections, **figure 6** shows a
25 simplified tariff plan where service class 14 (MMS traffic) is zero-rated except when the subscriber is roaming, Service Class 15 (other WAP-traffic) is rated -2 tokens per byte. Traffic to and from the partner service provider (Service Class 22) is free-of-charge except when roaming. These rating
30 dimensions are independent and can be combined, so that a specific rate would apply, for example, between 6pm and 6am, above 3 MBytes, when roaming. The tariff plan in **figure 6** is only a schematic simplification of the method used by said rating engine of the present invention.

- For each service class in the user service class vector, the dynamic pre-rating calculation generates five rating values: an "initial rate value", two "current rate values" and two "next rate values". Further information on the interaction between the tariff plan and the user service class vector is explained below. The initial rate value is equal to the number of tokens that should be deducted when either a service class is used for the first time or for the first used service class depending on a configuration value for that subscriber. Thus, the initial fee may be based on service or subscriber.
- To handle different settings of the meaning of "first time" e.g. per day or month, the information of the application of the "initial rate values" to be used for the next dynamic pre-rating calculation is supplied to the rating engine. The "current rate values" is the number of tokens per byte to be charged for packets belonging to a service class that shall be used immediately. See validity conditions below. The reason to have two "current rate values" is to allow different rating values for uplink and downlink traffic, respectively. The "next rate values" shall be used after the expiration of the "current rate values". The purpose of the "next rate values" is to manage mass updates at a certain time. I.e., the charging policy for a huge amount of users does not need to be updated at the same time which would cause extensive signalling during a short limited period of time for the huge amount of users, but the update may be performed during a longer period of time which reduces the signalling load per time unit during that limited period.
- All these rating values of the charging policy 400 are listed per service class to form the user rating table 401 as shown in **figure 4**. The user rating table has a limited lifetime, specified by a set of validity conditions 402, which are calculated using the tariff thresholds for dimensions such as: roaming status (home or away), geographical location, Time-of-Day (ToD) including month, year, etc, aggregated volume which is also referred to as transfer history, aggregated connect time, QoS of the connection, i.e. of the PDP Context for a GPRS or UMTS connection. It is the responsibility of the serving element to request an updated user rating table when a threshold

associated to a volume/time/location is reached. Thus, the charging system uses historical and/or current user specific usage data.

The system of the present invention is adapted to support service-based charging referred to as "one-time initial charge". An example of a service that is charged according the "one-time initial charge"-principle is a subscription of a newspaper. It may e.g. cost a fixed amount per month to be able to read the subscribed newspaper . In addition to the fixed subscription fee, a volume or time based fee may also be applied. The "one-time initial charge" is supported in two ways by the system of the present invention:

-First by the service class. For each service class in the subscriber's user service class vector, the arrival of the first packet classified to that service class implies a deduction of the initial rate value from the token bucket. The serving element then puts zero into the initial rate value for that specific service class.

-Secondly by the subscriber. All service classes in the subscriber's user service class vector have the same one time initial charge value. When a packet arrives for any of the service classes included in the user service class vector, the token bucket is decreased with that value and all values are set to zero. The initial rate value is reported as used to the rating engine, which then is arranged to give a zero initial rate value at subsequent requests.

For location-dependent rating, the packet forwarding system sends location information to the control system. As an example, the GGSN supports both forwarding of the SGSN IP address and an interface to a Location Enabled Server. The packet forwarding system is thus arranged to check the validity condition concerning geographical location and request a new user rating table in case the condition is no longer satisfied.

For time dependent rating the serving element supervises the validity time condition and requests a new user rating table when a predefined threshold is passed. In addition, the serving element supports maximum time

- subscriptions, i.e., connection up to 24 hours with one fee. This is managed by the remaining time validity condition, the serving element comprises means for down counting this value and if reaching zero or a predefined threshold, a new user rating table is requested. If a de-activation
- 5 of the current connection, e.g. a PDP context de-activation, occurs before the value has become zero or the predefined threshold is reached, the value is sent to the rating engine which is adapted to then update the aggregated time for that user.
- 10 For volume dependent rating the serving element supervises the validity volume condition and requests a new user rating table when a predefined threshold is passed. The serving element decreases this value with the amount of traffic that passes and if reaching zero or the predefined threshold a new user rating table is requested. If a de-activation of the
- 15 current connection, e.g. a PDP context de-activation, occurs before the value has become zero or the predefined threshold is reached the value is sent to the rating engine which is adapted to update the aggregated volume for that subscriber.
- 20 The control system and the serving element are respectively central units of the present invention. The control system is responsible for calculating the charging policy and providing the charging enforcement point of the serving element with that charging policy. The control system is further responsible for managing the credit account of one or more subscribers. The serving
- 25 element comprises a charging enforcement point that is responsible for performing the charging based on the charging policy received from the control system. Moreover, the serving element comprises a token bucket adapted to store credit reservations for a plurality of services per user. The token bucket is arranged to communicate with the credit account function
- 30 of the control system. Several different implementations of the control system and the serving element respectively are possible as will be apparent to the person skilled in the art. It will be apparent to the person skilled in the art how the control system and the serving element respectively and other functions of the present invention may be

implemented using known hardware and software means. The control system and the serving element are according to the present invention implemented to be programmable. The easiest way of implementing the programmable control system and the packet forwarding system may be by
5 means of software means, but programmable hardware implementations are also possible as well as implementations of combinations of hardware and software.

In the drawings and specification, there have been disclosed typical
10 preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

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CLAIMS

- 5 1. A charging system in a packet switched network for charging packets differently dependent on which service flow the packets belong to, the charging system comprising a control system (201) having an account function (203) which manage an account of at least one user and a serving element (206) residing in a packet forwarding system (210) is **characterised in** that said serving element (206) comprises a token
10 bucket (208) for a plurality of allowed services for a user adapted to store reservations received from the account function (203) of the at least one user associated with the token bucket (208).
- 15 2. The charging system according to claim 1, wherein the serving element comprises a single token bucket for a plurality of allowed services per user.
- 20 3. The charging system according to any of claim 1-2, wherein the serving element comprises means for classifying the services into different service classes based on a tariff plan of the services.
- 25 4. The charging system according to the previous claim, wherein the allowed service classes are stored in a Service Class Vector.
5. The charging system according to any of claims 3-4, wherein the means for classifying the services into different service classes
30 comprises a service filter adapted to identify the different service flows.
6. The charging system according to the previous claim, wherein the means for classifying the services into different service classes further comprises Protocol Inspection Filters adapted to identify the different service flows, when the service filter is not capable of said
35 identification.

7. The charging system according to any of claims 1-6, wherein the packet forwarding system is a Gateway GPRS Support Node in a mobile telecommunication network.
- 5 8. A charging system in a packet switched network for charging packets differently dependent on which service flow the packets belong to, the charging system comprising a control system (201) containing a charging policy decision point (202) which calculates a charging policy and a serving element (206) residing in a packet forwarding
10 system (210) is **characterised in** that said charging policy decision point (202) is arranged to calculate a charging policy for a plurality of allowed services for at least one user prior to a request for a service and that said serving element (206) comprises a charging policy enforcement point (207) arranged to perform charging according to
15 the calculated charging policy for service requests provided that associated validity conditions are fulfilled.
9. The charging system according to claim 8, wherein the calculated charging policy comprises at least one user rating table and a set of
20 validity conditions.
10. The charging system according to the previous claim, wherein the charging policy is calculated based on historical and/or current user specific usage data.
25
11. The charging system according to any of claims 9-10, wherein the set of validity conditions defines the lifetime of the at least one user rating table.
- 30 12. The charging system according to any of claims 9-11, wherein the calculated charging policy comprises at least two user rating tables having different time validity conditions.
- 35 13. The charging system according to any of claims 8-12, wherein the control system is implemented in a mobile telecommunication network.

AMENDED SHEET

14. A serving element (206) residing in a packet forwarding system of a charging system in a packet switched network (210) **characterised in** that said serving element (206) comprises means for receiving
5 reservations for at least one user, a token bucket (208) for a plurality of allowed services for a user adapted to store the reservations for the user associated with the token bucket, means for receiving a charging policy for allowed services, and a charging policy enforcement point (207) arranged to perform charging for said plurality of the allowed
10 services by reducing the stored reservation of the token bucket (206) according to the received charging policy.
15. The serving element according to claim 14, wherein the serving element comprises a single token bucket for a plurality of allowed
15 services per user.
16. The serving element according to any of claims 14-15, wherein the charging policy comprises at least one user rating table and a set of validity conditions.
20
17. The serving element according to previous claim, wherein the charging policy is calculated based on historical and/or current user specific usage data.
- 25 18. The serving element according to any of claims 16-17, wherein the set of validity conditions defines the lifetime of the at least one user rating table.
- 30 19. The serving element according to any of claims 16-18, wherein the charging policy comprises at least two user rating tables having different time validity conditions.
- 35 20. The serving element according to any of claim 16-19, wherein the serving element comprises means for classifying the services into different service classes based on a tariff plan of the services.

AMENDED SHEET

21. The serving element according to the previous claim, wherein the
allowed user service classes are stored in a Service Class Vector.
- 5 22. The serving element according to any of claims 20-21, wherein the
means for classifying the services into different service classes
comprises a service filter adapted to identify the different service
flows.
- 10 23. The serving element according to the previous claim, wherein the
means for classifying the services into different service classes further
comprises Protocol Inspection Filters adapted to identify the different
service flows, when the service filter is not capable of said
identification.
- 15 24. The serving element according to any of claims 14-23, wherein the
packet forwarding system is a Gateway GPRS Support Node in a
mobile telecommunication network.

20

AMENDED SHEET

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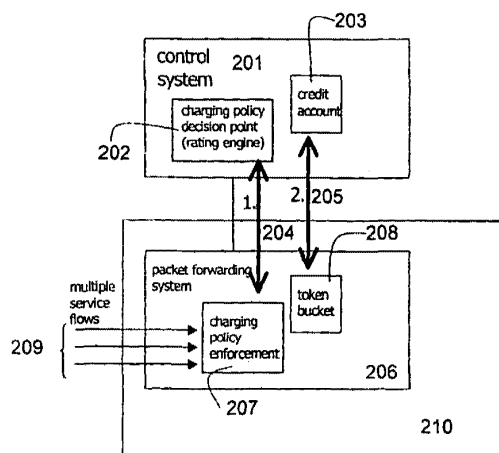
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(54) Title: SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK



(57) Abstract: The present invention relates to arrangements for charging in a packet switched network. Packets are charged differently dependent on which service flow the packets belong to. The charging system comprises a control system and a serving element residing in a packet forwarding system wherein said control system comprises an account function adapted to manage an account of at least one user and a charging policy decision point arranged to calculate a charging policy for allowed services for the at least one user. Moreover, said serving element comprises a token bucket per user adapted to store reservations received from the account function of the user associated with the token bucket and a charging policy enforcement point arranged to perform charging for a plurality of the allowed services by reducing the stored reservation of the token bucket according to the calculated charging policy.

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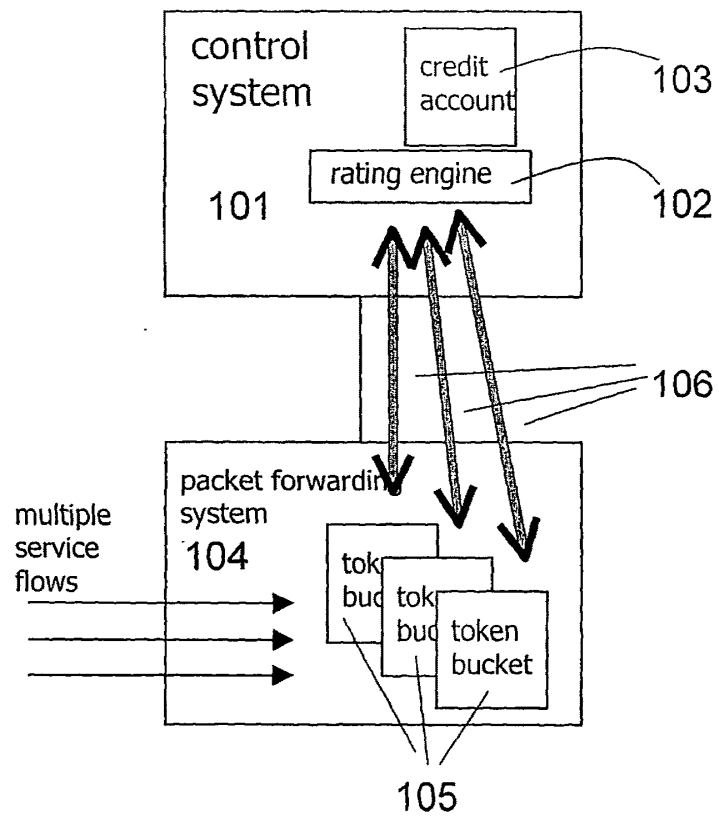


Fig. 1

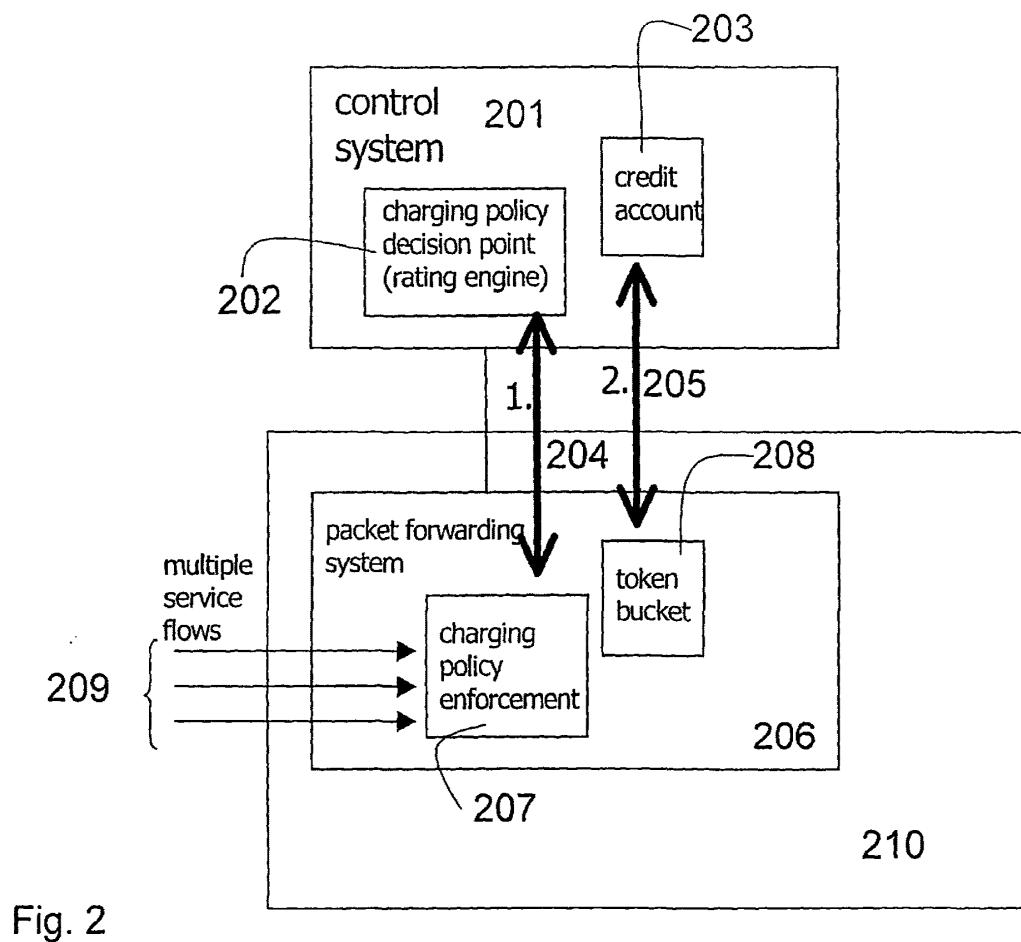


Fig. 2

Fig. 3

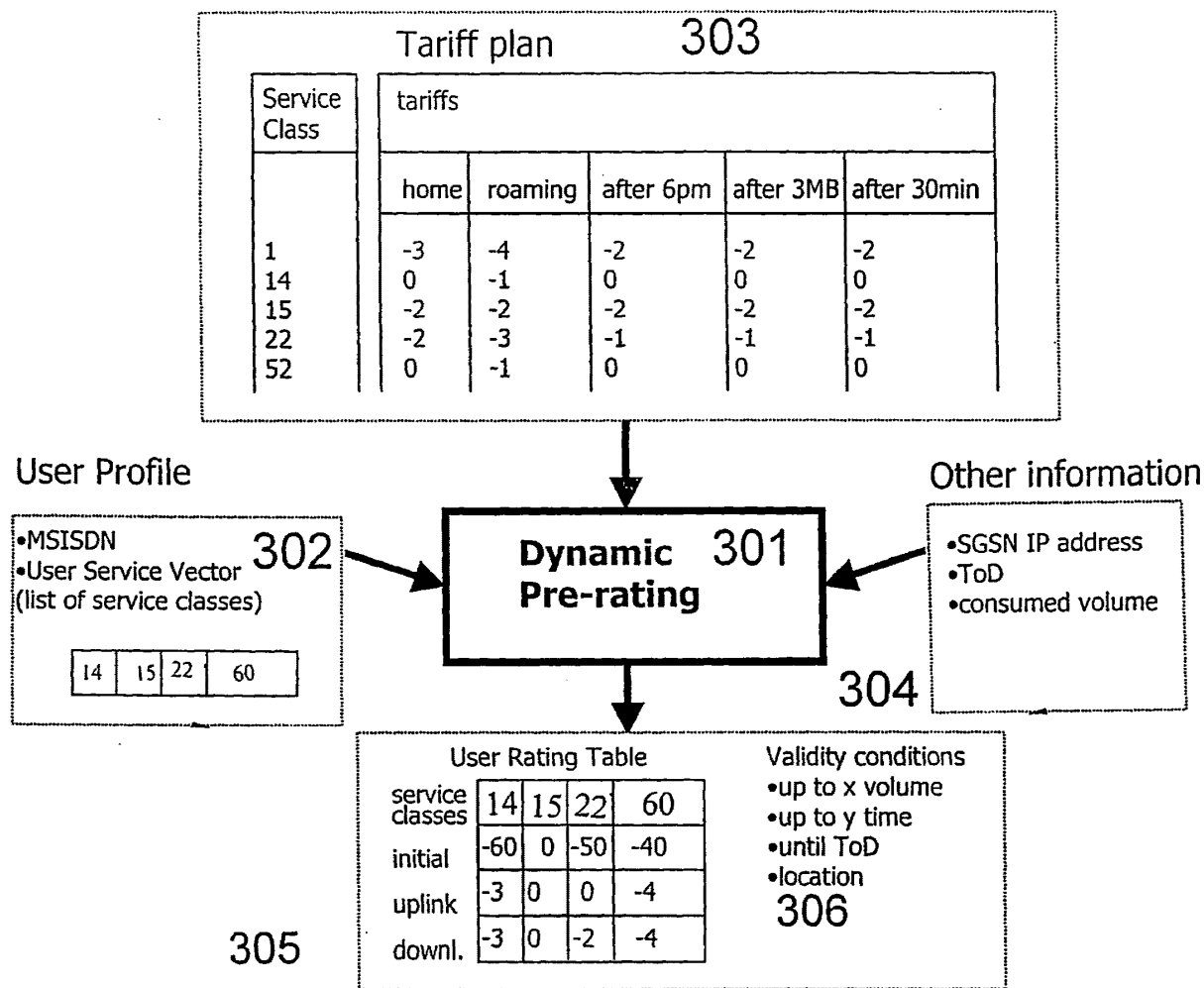


Fig. 4

400

User Rating Table 401

Service Class	14	15	22	60
Initial rate values	-60	0	-50	-40
Current rate values, up	-3	0	0	-4
Current rate values, down	-3	0	-2	-4
Next rate values, up	-2	0	0	-3
Next rate values, down	-2	0	-1	-3
Remaining volume	1.35

Validity Conditions 402

Remaining time	0:53:30
Time for current rate	14:00:00
Time for next rate	18:00:00
Location	...

Tariff plan

Service Class	Tariffs				
	home	roaming	after 6pm	after 3MB	after 30min
14	0	-1	0	0	0
15	-2	-2	-2	-2	-2
22	0	-1	0	0	0
52	-1	-1	-1	-1	-1
60	-3	-4	-2	-2	-2

Fig. 6

User Profile

•MSISDN				
•User Service Class Vector (list of allowed Service Classes)				
<table border="1"><tr><td>14</td><td>15</td><td>22</td><td>60</td></tr></table>	14	15	22	60
14	15	22	60	
•other data				

Fig. 5

Service Filters

Service Identifier	filter rule								
	filter prio	IP address/mask	TCP/UDP	port#	protocol#	ICMP type	protocol	PIF pointer	Service Class
1	1	100.18.0.0/16	*	-	-	-	WSP	1	-
2	2	100.18.0.0/16	*	-	-	-	HTTP	2	-
3	3	100.12.0.0	*	-	-	-	-	-	22
4	4	*	*	-	-	-	-	-	60

Fig. 7a

Protocol Inspection Filter (PIF)
configuration

PIF#	Identifier	Service Class
1	mms1.oper.net	14
1	mms2.oper.net	14
1	*	15
2	music.com	52
2	*	53

Fig. 7b

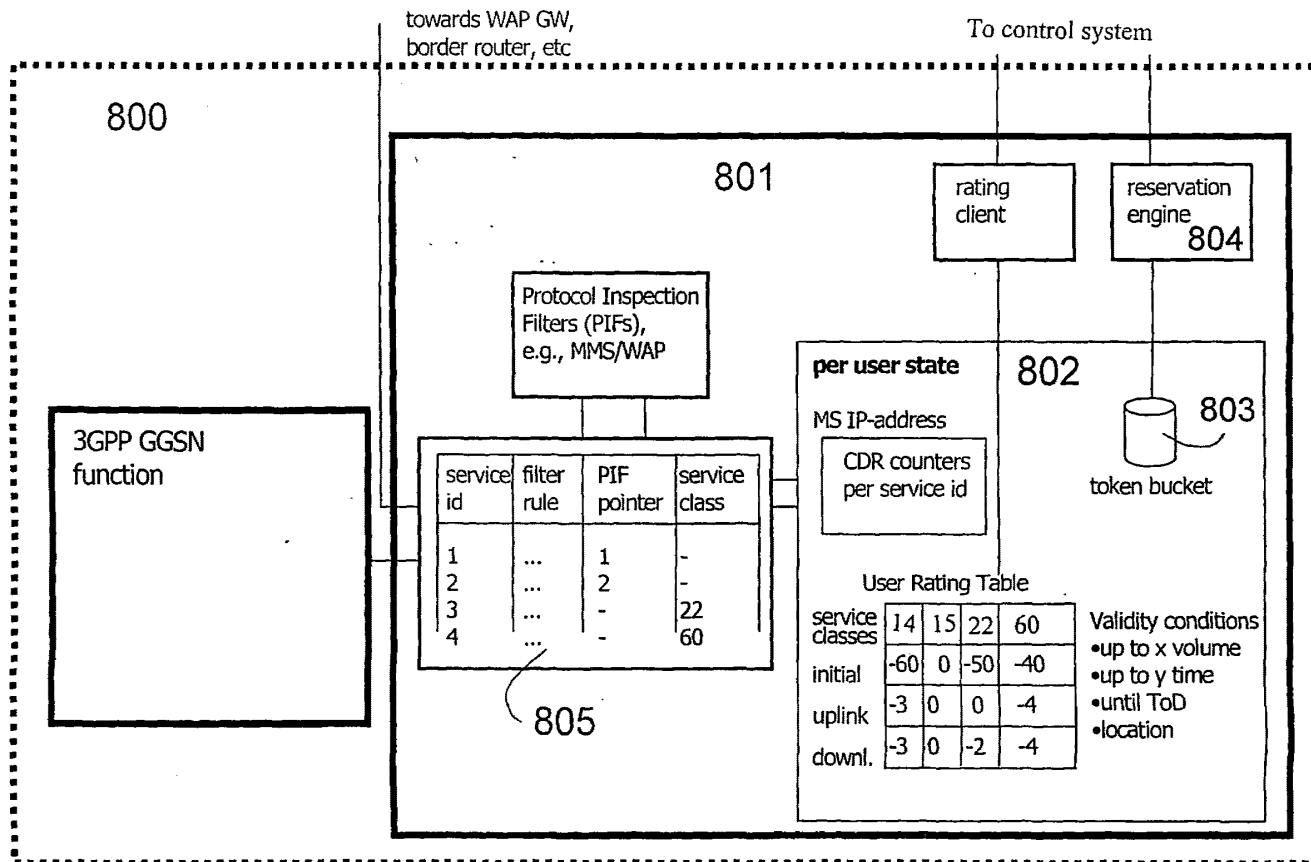


Figure 8

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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK

the specification of which:

- ☐ is attached hereto.
- ☒ was filed on 27/June/2003 as United States Application No. _____ or PCT International Application Number PCT/SE03/01122, including any amendments (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

☐ I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)		Priority Not Claimed
<u>PCT/SE03/01122</u> (Number)	<u>WO</u> (Country)	<u>27/June/2003</u> (Day/Month/Year Filed) <input type="checkbox"/>
<u>60/418547</u> (Number)	<u>US</u> (Country)	<u>15/October/2002</u> (Day/Month/Year Filed) <input type="checkbox"/>
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(Application Serial No.) (Filing Date)

(Application Serial No.) (Filing Date)

☐ I hereby claim the benefit under 35 U.S.C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, CFR Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)
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_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)
-----------------------------------	------------------------	---

_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)
-----------------------------------	------------------------	---

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Patent Practitioners associated with Customer Number 27045.

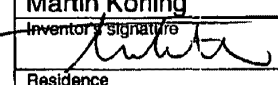
Send correspondence to the address associated with **Customer Number 27045.**

Direct telephone calls to Sidney Weatherford at 972-583-8656.

Attorney Docket Number P17661-US2

Combined Declaration and Power of Attorney

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1	Full name of inventor Martin Körling	1-00
	Inventor's signature 	Date 11/April/2005
	Residence Sweden	
	Citizenship Sweden	
	Post Office Address Skuggvägen 12 SE-191 45 SOLLENTUNA Sweden	

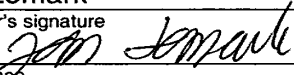
Combined Declaration and Power of Attorney

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2	Full name of inventor Magnus Harnesk	
	Inventor's signature <i>Magnus Harnesk</i>	Date <i>2005/march/18</i>
	Residence Sweden	
	Citizenship Sweden	
	Post Office Address Sköldvägen 35B SE-186 40 ÅKERSBERGA Sweden	

Combined Declaration and Power of Attorney

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

3	Full name of inventor Jan Lemark	
	Inventor's signature 	Date <i>2005 March 18</i>
	Residence Sweden	
	Citizenship Sweden	
	Post Office Address Lindhagensgatan 63 SE-112 43 STOCKHOLM Sweden	

Combined Declaration and Power of Attorney

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

4	Full name of inventor Tormod Hegdahl	
	Inventor's signature <i>Tormod Hegdahl</i>	Date <i>18 March 2005</i>
	Residence Norway	
	Citizenship Norway	
	Post Office Address Moserabben 14 N-0752 OSLO Norway	

PATENT APPLICATION SERIAL NO. **10/531021**

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

04/15/2005 GFREY1 00000116 501379 10531021

01 FC:1631	300.00 DA
02 FC:1633	200.00 DA
03 FC:1632	500.00 DA
04 FC:1615	400.00 DA

Adjustment date: 09/19/2005 CBURT1
04/15/2005 GFREY1 00000116 501379 10531021
03 FC:1632 500.00 CR

09/19/2005 CBURT1. 00000008 501379 10531021

01 FC:1642 400.00 DA

PTO-1556
(5/87)

PATENT APPLICATION FEE DETERMINATION RECORD

Effective December 8, 2004

Application or Docket Number

10/531021

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
U.S. NATIONAL STAGE FEES		
BASIC FEE	SMALL ENT. = \$ 150	LARGE ENT. = \$ 300
EXAMINATION FEE	Satisfies PCT Article 33(1)-(4) = \$ 50 / \$ 100	All other situations = \$ 100 / \$ 200
SEARCH FEE	U.S. is ISA = \$ 50 / \$ 100 ALL other countries = \$ 200 / \$ 400	All other situations = \$ 250 / \$ 500
FEE FOR EXTRA SPEC. PGS.	minus 100 =	/ 50 =
TOTAL CHARGEABLE CLAIMS	28 minus 20 = *	8
INDEPENDENT CLAIMS	3 minus 3 = *	—
MULTIPLE DEPENDENT CLAIM PRESENT <input type="checkbox"/>		

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY
TYPE ☐

OR

OTHER THAN
SMALL ENTITY

RATE	FEE
BASIC FEE	
EXAM. FEE	
SEARCH FEE	
X \$ 125 =	
X \$ 25 =	
X \$ 100 =	
+ \$ 180 =	
TOTAL	

OR

RATE	FEE
BASIC FEE	300
EXAM. FEE	200
SEARCH FEE	400
X \$ 250 =	/
X \$ 50 =	400
X \$ 200 =	/
+ \$ 360 =	/
TOTAL	1300

CLAIMS AS AMENDED - PART II

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
	Total *	Minus **	=
	Independent *	Minus ***	=
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <input type="checkbox"/>		

SMALL ENTITY

OR

OTHER THAN
SMALL ENTITY

RATE	ADDITIONAL FEE
X \$ 25 =	
X \$ 100 =	
+ \$ 180 =	
TOTAL ADDIT. FEE	

OR

RATE	ADDITIONAL FEE
X \$ 50 =	
X \$ 200 =	
+ \$ 360 =	
TOTAL ADDIT. FEE	

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
	Total *	Minus **	=
	Independent *	Minus ***	=
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <input type="checkbox"/>		

RATE	ADDITIONAL FEE
X \$ 25 =	
X \$ 100 =	
+ \$ 180 =	
TOTAL ADDIT. FEE	

OR

RATE	ADDITIONAL FEE
X \$ 50 =	
X \$ 200 =	
+ \$ 360 =	
TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than "20", enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than "3", enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Martin Körling, et al.

§ Group Art Unit: Unknown

Serial No: Unknown

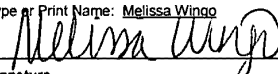
§
§ Examiner: Unknown

Filed: April 12, 2005

§
§
§
§

For: SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK

Mail Stop PCT
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313.1450

CERTIFICATE OF MAILING BY EXPRESS MAIL	
"EXPRESS MAIL" Mailing Label No.:	EV539111947US
Date of Deposit:	April 12, 2005
I hereby certify that this paper or fee is being deposited with the U.S. Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313.1450.	
Type or Print Name:	Melissa Wingo
Signature	

Dear Sir:

PRELIMINARY AMENDMENT

Please amend the application as follows prior to the substantive examination thereof:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks begin on page 9 of this paper.

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended) A charging system in a packet switched network for charging packets differently dependent on which service flow the packets belong to, the charging system comprising:

a control system (204) and a serving element associated with (206) ~~residing in a~~ packet forwarding system (210) ~~is characterised in that~~ wherein said control system (204) comprises:

an account function (203) adapted to manage an account of at least one user, and

a charging policy decision point (202) arranged to calculate a charging policy for allowed services for the at least one user, ~~and that~~ wherein said serving element (206) comprises:

a token bucket (208) ~~per user~~ adapted to store reservations received from the account function (203) of ~~the~~ a user associated with the token bucket, (208) and

a charging policy enforcement point (207) arranged to perform charging for a plurality of the allowed services by reducing the stored reservation of the token bucket (208) according to the calculated charging policy.

2. (Currently Amended) The charging system according to claim 1, wherein the serving element further comprises a single token bucket per user.

3. (Currently Amended) The charging system according to claim 1 ~~any of claims 1-2~~, wherein the calculated charging policy comprises at least one user rating table and a set of validity conditions.

4. (Currently Amended) The charging system according to claim 1 ~~the previous claim~~, wherein the charging policy is calculated based on historical and/or current user specific usage data.

5. (Currently Amended) The charging system according to claim 3 ~~any of claims 3-4~~, wherein the set of validity conditions defines the lifetime of the at least one user rating table.

6. (Currently Amended) The charging system according to claim 3 ~~any of claims 3-5~~, wherein the calculated charging policy comprises at least two user rating tables having different time validity conditions.

7. (Currently Amended) The charging system according to claim 1 ~~any of claim 1-6~~, wherein the serving element comprises means for classifying the services into different service classes based on the tariff plan of the services.

8. (Currently Amended) The charging system according to claim 7 ~~the previous claim~~, wherein the allowed subscriber service classes are stored in a Service Class Vector.

9. (Currently Amended) The charging system according to claim 1 ~~any of claims 1-8~~, wherein the means for classifying the services into different service classes comprises a service filter adapted to identify the different service flows.

10. (Currently Amended) The charging system according to claim 9 ~~the previous claim~~, wherein the means for classifying the services into different service classes further comprises Protocol Inspection Filters adapted to identify the different service flows, when the service filter is not capable of said identification.

11. (Currently Amended) The charging system according to claim 1 ~~any of claims 1-10~~, wherein the packet forwarding system is a Gateway GPRS Support Node in a mobile telecommunication network.

12. (Currently Amended) A control system (204) of a charging system in a packet switched network comprising
an account function (203) adapted to manage an account of at least one user
wherein ~~characterised in that~~ said control system comprises

a charging policy decision point arranged to calculate a charging policy for the allowed services for the at least one user.

13. (Currently Amended) The control system according to claim 12, wherein the calculated charging policy further comprises:

at least one user rating table, and
a set of validity conditions.

14. (Currently Amended) The control system according to claim 12 ~~previous claim~~, wherein the charging policy is calculated based on historical and/or current user specific usage data.

15. (Currently Amended) The control system according to claim 13 ~~any of claims 13-14~~, wherein the set of validity conditions defines the lifetime of the at least one user rating table.

16. (Currently Amended) The control system according to claim 13 ~~any of claims 13-15~~, wherein the calculated charging policy comprises at least two user rating tables having different time validity conditions.

17. (Currently Amended) The control system according to claim 12 ~~any of claims 12-16~~, wherein the control system is implemented in a mobile telecommunication network.

18. (Currently Amended) A serving element ~~(206)~~ residing in a packet forwarding system of a charging system in a packet switched network, ~~(240)~~ characterised in that said serving element comprising: ~~(206) comprises~~

means for receiving reservations for at least one user,

a token bucket ~~(208) per user~~ adapted to store the reservations for the user associated with the token bucket,

means for receiving a charging policy for allowed services, and

a charging policy enforcement point ~~(207)~~ arranged to perform charging for a plurality of the allowed services by reducing the stored reservation of the token bucket ~~(206)~~ according to a ~~the~~ received calculated charging policy.

19. (Currently Amended) The serving element according to claim 18, ~~wherein the serving element comprises~~ further comprising

a single token bucket per user.

20. (Currently Amended) The serving element according to claim 18 ~~any of claims 18-19~~, wherein the charging policy further comprises at least one user rating table and a set of validity conditions.

21. (Currently Amended) The serving element according to claim 20 ~~previous claim~~, wherein the charging policy is calculated based on historical and/or current user specific usage data.

22. (Currently Amended) The serving element according to claim 20 ~~any of claims 20-24~~, wherein the set of validity conditions defines the lifetime of the at least one user rating table.

23. (Currently Amended) The serving element according to claim 20 ~~any of claims 20-22~~, wherein the charging policy comprises at least two user rating tables having different time validity conditions.

24. (Currently Amended) The serving element according to claim 18 ~~any of claim 18-23, wherein the serving element comprises~~ further comprising
means for classifying the services into different service classes based on the tariff plan of the services.

25. (Currently Amended) The serving element according to claim 24 ~~the previous claim~~, wherein the allowed subscriber service classes are stored in a Service Class Vector.

26. (Currently Amended) The serving element according to claim 24 ~~any of claims 24-25~~, wherein the means for classifying the services into different service classes further comprises a service filter adapted to identify the different service flows.

27. (Currently Amended) The serving element according to claim 24 ~~the previous claim~~, wherein the means for classifying the services into different service classes further comprises Protocol Inspection Filters adapted to identify the different service flows, when the service filter is not capable of said identification.


28. (Currently Amended) The serving element according to claim 24 ~~any of claims 18-27~~, wherein the packet forwarding system is a Gateway GPRS Support Node in a mobile telecommunication network.

Please cancel claims 29-30 without prejudice.

REMARKS

Claims 1-28 remain in this application. Applicant respectfully submits no new matter has been added. Favorable consideration of the pending claims is respectfully requested.

Respectfully submitted,


Sidney L. Weatherford
Reg. No. 45,602

Ericsson Inc.
6300 Legacy Drive
M/S EVW 2-C-2
Plano, TX 75024
972-583-8656
sidney.weatherford@ericsson.com

10/531021

Attorney Docket No. P17661-US2
EUS/JP:05-3085

JC13 Rec'd PCT/PTO 12 APR 2005

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	Martin Körling, et al	§	Group Art Unit:	Unknown
Serial No:	Unknown	§	Examiner:	Unknown
Filed:	April 12, 2005	§		
		§		

For: SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK

Mail Stop PCT
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

"EXPRESS MAIL" Mailing Label No.: EV539111947US

Date of Deposit: April 12, 2005


Dear Sir:

INFORMATION DISCLOSURE STATEMENT

In accordance with the duty of disclosure as set forth in 37 C.F.R. § 1.56, Applicant(s) hereby submit the following information in conformance with 37 C.F.R. §§ 1.97 and 1.98. Copies of the cited references were previously transmitted to the USPTO by the international searching authority.

To assist the Examiner, the documents are listed on the attached form PTO-1449. It is respectfully requested that the Examiner initial a copy of this form and return it to the undersigned.

Respectfully submitted,



Sidney L. Weatherford
Reg. No. 45,602

Ericsson Inc.
6300 Legacy Drive
M/S EVR 1-C-11
Plano, TX 75024

972-583-8656
sidney.weatherford@ericsson.com

In place of PTO-1449 Form		U. S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>				Application Number	Not Yet Known
				Filing Date	April 12, 2005
				Applicant(s)	Martin Körling, et al
				Art Unit	Not Yet Known
				Examiner Name	Not Yet Known
SHEET	1	OF	1	Attorney Docket Number	P17661US2

U. S. PATENT DOCUMENTS				
Examiner's Initials	Cite No.	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document

FOREIGN PATENT DOCUMENTS					
Examiner's Initials	Cite No.	Foreign Patent Document <small>(Country Code - Number - Kind)</small>	Publication Date MM-DD-YYYY	Patentee or Applicant of Cited Document	Translation Y/N
	AA	WO 0201847 A1	01-03-2002	Telefonaktiebolaget LM Ericsson (publ)	
	AB	WO 0117222 A1	03-08-2001	Nokia Networks Oy	

OTHER PRIOR ART		
Examiner's Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article, title of the item, date, page(s), volume- issue number(s), publisher, city/country where published

Examiner Signature		Date Considered	
-----------------------	--	--------------------	--

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include a copy of this form with next communication to applicant.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Bib Data Sheet

CONFIRMATION NO. 2135

SERIAL NUMBER 10/531,021	FILING OR 371(c) DATE 04/12/2005 RULE	CLASS 379	GROUP ART UNIT 2643	ATTORNEY DOCKET NO. P17661-US2
APPLICANTS Magnus Harnesk, Akersberga, SWEDEN; Jan Lemark, Stockholm, SWEDEN; Martin Korling, Akersberga, SWEDEN; Tormod Hegdahl, Oslo, NORWAY;				
** CONTINUING DATA ***** This application is a 371 of PCT/SE03/01122 06/27/2003 which claims benefit of 60/418,547 10/15/2002				
** FOREIGN APPLICATIONS *****				
Foreign Priority claimed <input type="checkbox"/> yes <input type="checkbox"/> no 35 USC 119 (a-d) conditions <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Met after met Allowance Verified and Acknowledged		STATE OR COUNTRY SWEDEN	SHEETS DRAWING 6	TOTAL CLAIMS 28
Examiner's Signature _____ Initials _____		INDEPENDENT CLAIMS 3		
ADDRESS 27045				
TITLE System for providing flexible charging in a network				
FILING FEE RECEIVED 1300	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ <input type="checkbox"/> Credit	

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET (FOR USE WITH FORM PTO-875)							SERIAL NO. 10/531021	FILING DATE					
							APPLICANT(S)						
CLAIMS													
	AS FILED		AFTER 1 st AMENDMENT		AFTER 2 nd AMENDMENT			AS FILED		AFTER 1 st AMENDMENT		AFTER 2 nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.		IND.	DEP.	IND.	DEP.	IND.	DEP.
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TOTAL IND.													
TOTAL DEP.													
TOTAL CLAIMS													

C. Burt

UNITED STATES NATIONAL STAGE WORKSHEET (DO/EO)

Charitta Burt, Paralegal

10/531021

U. S. Application No. 10/531021
Publication Date 10/531021
Publication No. WO 2004/036825 PCT/RO/101 _____
Copy of ISR SE, Copy of IPER SE
Assignee information: _____
Priority Info: Country US No. 60418547 date 10.15.02 MORE
Correspondence checked: 27045 deposit account _____
Inventor Residence city: AKERSBERGA, state and/or country SE citizenship: SE
International Application No. PCT SE2003/001122 Language Eng
Copy in International Application: ✓; Translation: yes _____ no _____ Spec.pg no. _____
371 Filing Fees: 1300; US IPER meets Art. 33(2)-(3) Low fee applies: _____
Total Claims: 28 Chargeable 28 Independent 3 multiple ✓
Number of drawing Sheets: 6 Foreign language: _____
Oath/Declaration: ✓ signed ✓ unsigned _____ defective _____ completed 4.12.05 Power of Attorney: _____
Small entity fee: _____ SME document yes _____ no _____
Bio Seq. Diskette: _____ entered _____ Bio Seq. Listing: _____ statement _____
Article 19 Amendment: _____; replaced by Article 34 Amdt. _____
Copy ISA References _____
Copy of IPER: ✓; Annexes: ✓ entered ✓ not entered _____ Text sequence improper _____
Preliminary Amendment(s): ✓ date: 4.12.05; 2nd amendment date _____
IDS: ✓ DATE: 4.12.05 2nd _____ DATE _____
Request for Immediate Examination: ✓
Substitute Specification: _____ date: _____
Assignment: _____ forwarded to Assignment branch date: _____
Priority Document(s): ✓ Number of copies included 1
Date of 35 USC Receipt of Request: 4.12.05
Date Completion USC 371 Requirements: 4.12.05
Notice of Missing Requirements: _____
Notice of Defective Response: _____
Notice of Acceptance: 9.17.05
Notice of Abandonment: _____ Petition to Revive: _____
Other forms: _____ Extension of time: Number of months _____

Notes:

Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)
The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

**Declaration of Inventorship (Rules 4.17(iv) and 51bis.1(a)(iv))
for the purposes of the designation of the United States of America:**

I hereby declare that I believe I am the original, first and sole (if only one inventor is listed below) or joint (if more than one inventor is listed below) inventor of the subject matter which is claimed and for which a patent is sought.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/SE03/01122..... (if furnishing declaration pursuant to Rule 26ter).

I hereby declare that my residence, mailing address, and citizenship are as stated next to my name.

I hereby state that I have reviewed and understand the contents of the above-identified international application, including the claims of said application. I have identified in the request of said application, in compliance with PCT Rule 4.10, any claim to foreign priority, and I have identified below, under the heading "Prior Applications," by application number, country or Member of the World Trade Organization, day, month and year of filing, any application for a patent or inventor's certificate filed in a country other than the United States of America, including any PCT international application designating at least one country other than the United States of America, having a filing date before that of the application on which foreign priority is claimed.

Prior Applications: 60/418,547.....

I hereby acknowledge the duty to disclose information that is known by me to be material to patentability as defined by 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name: HARNESK, Magnus 1-50

Residence: Sköldvägen 35B

(city and either US state, if applicable, or country)

Mailing Address: SE-186 40 AKERSBERGA

Sweden SEX

Citizenship: Swedish

Inventor's Signature: Magnus Harnesk
(if not contained in the request, or if declaration is corrected or added under Rule 26ter after the filing of the international application. The signature must be that of the inventor, not that of the agent)

Date: 29/07/03
(of signature which is not contained in the request, or of the declaration that is corrected or added under Rule 26ter after the filing of the international application)

Name: LEMARK, Jan 2-50

Residence: Lindhagensgatan 63

(city and either US state, if applicable, or country)

Mailing Address: SE-112 43 STOCKHOLM

Sweden SEX

Citizenship: Swedish

Inventor's Signature: Jan Lemark
(if not contained in the request, or if declaration is corrected or added under Rule 26ter after the filing of the international application. The signature must be that of the inventor, not that of the agent)

Date: 05/08/03
(of signature which is not contained in the request, or of the declaration that is corrected or added under Rule 26ter after the filing of the international application)

☒ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

Continuation of Box No. VIII (i) to (v) DECLARATION

If the space is insufficient in any of Boxes Nos. VIII (i) to (v) to furnish all the information, including in the case where more than two inventors are to be named in Box No. VIII (iv), in such case, write "Continuation of Box No. VIII ..." (indicate the item number of the Box) and furnish the information in the same manner as required for the purposes of the Box in which the space was insufficient. If additional space is needed in respect of two or more declarations, a separate continuation box must be used for each such declaration. If this Box is not used, this sheet should not be included in the request.

3.


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11/07/2003
 Date

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/01122

A. CLASSIFICATION OF SUBJECT MATTER		
IPC7: H04L 12/14 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC7: H04L, H04Q		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-INTERNAL, WPI DATA		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0201847 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 3 January 2002 (03.01.02), page 1, line 9 - line 16; page 2, line 13 - line 23; page 3, line 14 - page 4, line 5, page 8, line 17 - line 30, abstract --	1-30
A	WO 0117222 A1 (NOKIA NETWORKS OY), 8 March 2001 (08.03.01), page 5, line 12 - line 27; page 7, line 1 - line 20, abstract -- -----	1-30
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
12 Sept 2003		15 -09- 2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Ralf Boström /LR Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

26/07/03

International application No.
PCT/SE 03/01122

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	0201847	A1	03/01/02	AU	7058701 A	08/01/02
				EP	1168806 A	02/01/02
				EP	1297683 A	02/04/03

WO	0117222	A1	08/03/01	AU	7002500 A	26/03/01
				CA	2380294 A	08/03/01
				EP	1208694 A	29/05/02
				FI	991874 A	02/03/01

Form PCT/ISA/210 (patent family annex) (July 1998)

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REPLACED BY
ART 34 AMDT

CLAIMS

1. A charging system in a packet switched network for charging packets
5 differently dependent on which service flow the packets belong to,
the charging system comprising a control system (201) and a serving
element (206) residing in a packet forwarding system (210) is
characterised in that said control system (201) comprises an
account function (203) adapted to manage an account of at least one
10 user and a charging policy decision point (202) arranged to calculate
a charging policy for allowed services for the at least one user, and
that said serving element (206) comprises a token bucket (208) per
user adapted to store reservations received from the account
function (203) of the user associated with the token bucket (208) and
15 a charging policy enforcement point (207) arranged to perform
charging for a plurality of the allowed services by reducing the stored
reservation of the token bucket (208) according to the calculated
charging policy.
- 20 2. The charging system according to claim 1, wherein the serving
element comprises a single token bucket per user.
3. The charging system according to any of claims 1-2, wherein the
calculated charging policy comprises at least one user rating table
25 and a set of validity conditions.
4. The charging system according to the previous claim, wherein the
charging policy is calculated based on historical and/or current user
specific usage data.
- 30 5. The charging system according to any of claims 3-4, wherein the set
of validity conditions defines the lifetime of the at least one user
rating table.

6. The charging system according to any of claims 3-5, wherein the calculated charging policy comprises at least two user rating tables having different time validity conditions.
- 5 7. The charging system according to any of claim 1-6, wherein the serving element comprises means for classifying the services into different service classes based on the tariff plan of the services.
8. The charging system according to the previous claim, wherein the
10 allowed subscriber service classes are stored in a Service Class Vector.
9. The charging system according to any of claims 1-8, wherein the
15 means for classifying the services into different service classes comprises a service filter adapted to identify the different service flows.
10. The charging system according to the previous claim, wherein the
20 means for classifying the services into different service classes further comprises Protocol Inspection Filters adapted to identify the different service flows, when the service filter is not capable of said identification.
11. The charging system according to any of claims 1-10, wherein the
25 packet forwarding system is a Gateway GPRS Support Node in a mobile telecommunication network.
12. A control system (201) of a charging system in a packet switched
30 network comprising an account function (203) adapted to manage an account of at least one user **characterised in** that said control system comprises a charging policy decision point arranged to calculate a charging policy for the allowed services for the at least one user.

13. The control system according to claim 12, wherein the calculated charging policy comprises at least one user rating table and a set of validity conditions.
- 5 14. The control system according to previous claim, wherein the charging policy is calculated based on historical and/or current user specific usage data.
- 10 15. The control system according to any of claims 13-14, wherein the set of validity conditions defines the lifetime of the at least one user rating table.
- 15 16. The control system according to any of claims 13-15, wherein the calculated charging policy comprises at least two user rating tables having different time validity conditions.
- 20 17. The control system according to any of claims 12-16, wherein the control system is implemented in a mobile telecommunication network.
- 25 18. A serving element (206) residing in a packet forwarding system of a charging system in a packet switched network (210) **characterised in** that said serving element (206) comprises means for receiving reservations for at least one user, a token bucket (208) per user adapted to store the reservations for the user associated with the token bucket, means for receiving a charging policy for allowed services, and a charging policy enforcement point (207) arranged to perform charging for a plurality of the allowed services by reducing the stored reservation of the token bucket (206) according to the received calculated charging policy.
- 30 19. The serving element according to claim 18, wherein the serving element comprises a single token bucket per user.

20. The serving element according to any of claims 18-19, wherein the charging policy comprises at least one user rating table and a set of validity conditions.
- 5 21. The serving element according to previous claim, wherein the charging policy is calculated based on historical and/or current user specific usage data.
- 10 22. The serving element according to any of claims 20-21, wherein the set of validity conditions defines the lifetime of the at least one user rating table.
- 15 23. The serving element according to any of claims 20-22, wherein the charging policy comprises at least two user rating tables having different time validity conditions.
- 20 24. The serving element according to any of claim 18-23, wherein the serving element comprises means for classifying the services into different service classes based on the tariff plan of the services.
- 25 25. The serving element according to the previous claim, wherein the allowed subscriber service classes are stored in a Service Class Vector.
- 30 26. The serving element according to any of claims 24-25, wherein the means for classifying the services into different service classes comprises a service filter adapted to identify the different service flows.
- 30 27. The serving element according to the previous claim, wherein the means for classifying the services into different service classes further comprises Protocol Inspection Filters adapted to identify the different service flows, when the service filter is not capable of said identification.

28. The serving element according to any of claims 18-27, wherein the packet forwarding system is a Gateway GPRS Support Node in a mobile telecommunication network.

5

29. An interface (1) **characterised in** that it is connectable to a charging policy decision point (202) of the control system (201) according to any of claims 12-17 and the charging enforcement point (207) of the serving element (206) according to any of claims 18-28 adapted to transfer a charging policy.

10

30. An interface (2) **characterised in** that it is connectable to the account function (203) of the control system (201) according to any of claims 12-17 and the token bucket (208) of the serving element (206) according to any of claims 18-28 adapted to transfer reservations from the account function (203) to the token bucket (208).

15

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 28 JAN 2005
WIPO PCT

Applicant's or agent's file reference P06179PC00	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/SE 2003/001122	International filing date (day/month/year) 27-06-2003	Priority date (day/month/year) 15-10-2002
International Patent Classification (IPC) or national classification and IPC H04L12/14		
Applicant Telefonaktiebolaget LM Ericsson (publ) et al		

<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>4</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>4</u> sheets, as follows:</p> <p style="margin-left: 40px;"><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p style="margin-left: 40px;"><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>																	
<p>4. This report contains indications relating to the following items:</p> <table border="0"> <tr> <td><input checked="" type="checkbox"/> Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input type="checkbox"/> Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/> Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/> Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/> Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/> Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input type="checkbox"/> Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>		<input checked="" type="checkbox"/> Box No. I	Basis of the report	<input type="checkbox"/> Box No. II	Priority	<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/> Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/> Box No. VI	Certain documents cited	<input type="checkbox"/> Box No. VII	Certain defects in the international application	<input type="checkbox"/> Box No. VIII	Certain observations on the international application
<input checked="" type="checkbox"/> Box No. I	Basis of the report																
<input type="checkbox"/> Box No. II	Priority																
<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability																
<input type="checkbox"/> Box No. IV	Lack of unity of invention																
<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																
<input type="checkbox"/> Box No. VI	Certain documents cited																
<input type="checkbox"/> Box No. VII	Certain defects in the international application																
<input type="checkbox"/> Box No. VIII	Certain observations on the international application																

Date of submission of the demand 10-03-2004	Date of completion of this report 12-01-2005
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Ralf Boström /LR Telephone No. +46 8 782 25 00

Form PCT/IPEA/409 (cover sheet) (January 2004)

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE 2003/001122

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1 - 23 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 24 - 27 received by this Authority on 2004-11-19

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1 - 6 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing (*specify*): _____
☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing (*specify*): _____
☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE 2003/001122

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-24</u>	YES
	Claims	<u>---</u>	NO
Inventive step (IS)	Claims	<u>1-24</u>	YES
	Claims	<u>---</u>	NO
Industrial applicability (IA)	Claims	<u>1-24</u>	YES
	Claims	<u>---</u>	NO

2. Citations and explanations (Rule 70.7)

This report concerns the new claims received on 2004-11-19.

The application is concerned with a problem that multi token bucket solutions, in charging systems, create a large amount of signalling traffic.

Documents cited in the International Search Report:

D1. WO 0201847 A1
D2. WO 0117222 A1

D1, which is considered to represent the most relevant state of the art, discloses a method and apparatus for charging of communication services (see abstract). The system in D1 contains a prepaid service account with a charging value that can be used to pay for outgoing calls and services. The system allows parallel, i.e. timely overlapping, prepaid service for a single user to be charged on the same prepaid account see page 8, line 17-30).

D2 is a background art document and is not considered to be of particular relevance.

Claims 1-7 and 14-24:

The invention according to these claims differs from D1 in that the token bucket stores a plurality of service reservations. It is not considered obvious for a person skilled in the art to include such reservations in the system in D1. Thus, the invention according to claims 1-7 and claims 14-24 is novel and includes an inventive step. The invention according to these claims is also considered to be industrially applicable.

.../...

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE 2003/001122

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

Claims 8-13:

The invention according to these claims differs from D1 in that the charging policy decision point is arranged to calculate a charging policy for a plurality of allowed services for a user. It is not considered obvious for a person skilled in the art to include this feature in the system in D1. Thus, the invention according to claims 8-13 is novel and includes an inventive step. The invention according to these claims is also considered to be industrially applicable.

531.021

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
29 April 2004 (29.04.2004)

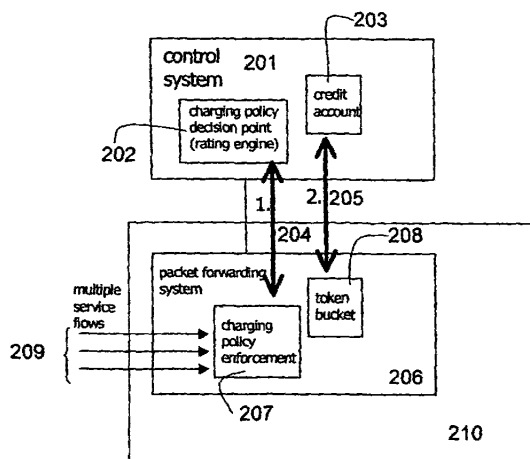
PCT

(10) International Publication Number
WO 2004/036825 A1

- (51) International Patent Classification⁷: H04L 12/14 (74) Agent: DR LUDWIG BRANN PATENTBYRÅ AB; P.O. Box 17192, S-104 62 Stockholm (SE).
- (21) International Application Number: PCT/SE2003/001122 (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (22) International Filing Date: 27 June 2003 (27.06.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 60/418,547 15 October 2002 (15.10.2002) US (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- (71) Applicants (for all designated States except US): TELEFONAKTIEBOLAGET LM ERICSSON (PUBL) [SE/SE]; S-126 25 Stockholm (SE). HEGDAHL, Tormod [NO/NO]; Moserabben 14, N-0752 Oslo (NO).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): HARNESK, Magnus [SE/SE]; Sköldvägen 35B, S-186 40 Åkersberga (SE). LEMARK, Jan [SE/SE]; Lindhagensgatan 63, S-112 43 Stockholm (SE). KÖRLING, Martin [SE/SE]; Skuggvägen 12, S-191 45 Sollentuna (SE).
- Declaration under Rule 4.17:
— of inventorship (Rule 4.17(iv)) for US only
- Published:
— with international search report

[Continued on next page]

(54) Title: SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK



(57) Abstract: The present invention relates to arrangements for charging in a packet switched network. Packets are charged differently dependent on which service flow the packets belong to. The charging system comprises a control system and a serving element residing in a packet forwarding system wherein said control system comprises an account function adapted to manage an account of at least one user and a charging policy decision point arranged to calculate a charging policy for allowed services for the at least one user. Moreover, said serving element comprises a token bucket per user adapted to store reservations received from the account function of the user associated with the token bucket and a charging policy enforcement point arranged to perform charging for a plurality of the allowed services by reducing the stored reservation of the token bucket according to the calculated charging policy.

WO 2004/036825 A1

WO 2004/036825 A1



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

SYSTEM FOR PROVIDING FLEXIBLE CHARGING IN A NETWORK

FIELD OF THE INVENTION

- 5 The present invention relates to packet switched communications systems, and more particularly, to arrangements for performing charging in real time.

BACKGROUND OF THE INVENTION

- 10 Packet switched communications systems transport many different types of telecommunications traffic, such as voice, data, and multimedia traffic, which originates from a large variety of applications. A network operator may provide a variety of services that uses the different types of traffic and having a variety of charging schemes.

- 15 For some services, e.g. streaming, it is suitable to apply a time-based charging in contrast to other services e.g. internet browsing, where volume related charging is the only possible (usage related) charging method. The choice between time-based, volume-based and service based charging is made in relation to what the subscribers are willing to pay for and also to
- 20 achieve an accepted understandable charging method. E.g., for a streaming application such as a video stream, it is understandable for the user to pay for consumed time that he has watched the video.

- A subscription may have one or more users. The subscription is either a pre-
- 25 paid or a post-paid subscription, which implies that the subscriber, either in the pre-paid case pays an amount in advance, i.e. prior the service(s) is (are) utilised or in the post-paid case pays for e.g. the time or data volume that he actually has used during a certain period of time. In order to support pre-paid subscriptions, the charging solution has to have "real-time" properties.
- 30 This is particularly important when a prepaid subscriber's credit account is empty, service execution (in this case packet forwarding) must be immediately affected. When a subscriber account is empty, the operator wants to block at least all services that are subject for charging, since the operator wants to have credit control in addition to prevent losing money

because of non-payment for consumed services. Some free of charge services may still be open for the subscriber like refill of the account, call to emergency numbers, self-care pages and in some cases also reception of SMS/MMS messages.

5

Thus, it is desirable to be able to perform a differentiated rating on the packet level based on the service. Performing differentiated rating on the packet level raises however a fundamental challenge, since rating is a complex process involving many input parameters such as tariff plan, time and volume thresholds, subscriber profile, etc., while the packet forwarding should be executed with lowest possible latency. Thus, packet forwarding systems and rating engines, respectively, have different system requirements.

15 Herein, the charging system according to prior art is called a "multiple token bucket" system. Such a system comprises a control system and a packet forwarding system as disclosed in **figure 1**. The control system 101 comprises a rating engine 102 and credit accounts 103. The packet forwarding system 104 comprises one token bucket 105 per service flow
20 106 and user which results in multiple token buckets 105 for every logged-in user provided that multiple services are used.

When a user logs into the communication system, the packet forwarding system 104 initiates a control signalling sequence to the control system
25 101 for each service. The control system 101 reserves a preconfigured amount of credit towards the subscriber's credit account, wherein this amount is called a "credit reservation". The control system 101 determines the set of services this user is allowed to use. The set of identifiers for these allowed services are sent to the packet forwarding system. For each service
30 identifier, the packet forwarding system 104 initiates a resource reservation signalling sequence towards the control system. For each such sequence, the service is rated by the rating engine 102 of the control system 101, using a tariff plan. The rating value is used to translate parts of the credit reservation into a "resource reservation" (typically data volume related),

which is sent back to the packet forwarding system 104. Each resource reservation is put into a specific resource token bucket 105. Thus, the packet forwarding system 104 contains multiple token buckets 105, one for each allowed service per user.

5

When traffic is flowing through the communication system the packet forwarding system 104 classifies each packet to determine which service flow it belongs to. Then the token bucket 105 for that service is decremented. When a token bucket 105 is empty, the usage is confirmed
10 towards the control system and a new resource reservation is done.

Thus, the multiple token bucket solution that performs per-packet real-time charging in a packet switched communication system, wherein the packets are charged differently dependent on which service flow the
15 packets belong to, requires a separate resource reservation signalling sequence for each service flow in the set of allowed services. This creates a large amount of signalling traffic between the control system and the packet forwarding system. In addition, it requires high processing capabilities in the control and the packet forwarding system, respectively,
20 and high capacity transport between said systems.

Furthermore, the multiple token bucket solution have other drawbacks since unnecessary reservations are performed. In the multiple token bucket case, a pre-configured amount of resources is reserved for each service,
25 wherein the credit reservation of each token bucket is dedicated for a specific service flow. That implies that credit reservations made for services not being used cannot be utilised for another service that actually is being used. Thus, this results in the above unnecessary reservations. Moreover, the problem gets worse as the number of services increases.

30

Another possible solution is to use several GPRS Access points Names (APN) in a mobile telecommunication network for differentiating between different consumer service flows. An APN is a label of one or more service flows in a mobile cellular network. However, this solution has

disadvantages due to APN configuration management, in e.g. terminal and network, as well as IP address handling in the terminal. Thus, this solution requires additional management for the operator to setup and control. Network operators prefer hence a solution with multiple services per APN, preferably one APN for all service flows.

SUMMARY OF THE INVENTION

As mentioned above, a multiple token bucket solution of prior art requires a large amount of signalling traffic between the control system and the packet forwarding system. In addition, the multiple token bucket solution is in many cases subject to the above mentioned unnecessary reservations. Furthermore, it is desirable to achieve a solution where multiple service flows are connected to one Access Point Name (APN) in a mobile cellular network, since solutions with one service flow per APN has drawbacks relating to configuration management as explained above.

Therefore, a first object of the present invention is to achieve arrangements for providing a flexible realtime charging, whereby the signalling between the control system and the packet forwarding system is reduced.

A second object of the present invention is to prevent unnecessary reservations.

A third object with the present invention is to provide a charging system where service flows can be differentiated at packet level and applicable charging can be applied in a flexible way. I.e., each packet should be able to be charged differently dependent on which service flow the packets belong to.

A fourth object of the present invention is to achieve a solution facilitating multiple services per APN.

The above stated objects are achieved by means of a system according to claim 1, a control system according to claim 12, a serving element according to claim 18, and interfaces according to claims 29 and 30.

- 5 The charging system according to the present invention makes it possible to reduce signalling between the control system and the packet forwarding system. The charging system comprises a control system and a serving element residing in a packet forwarding system. Said control system comprises an account function adapted to manage an account of at least
10 one user and a charging policy decision point arranged to calculate a charging policy for allowed services for the at least one user. Said serving element comprises a token bucket per user adapted to store reservations received from the account function of the user associated with the token bucket and a charging policy enforcement point arranged to perform
15 charging for a plurality of the allowed services by reducing the stored reservation of the token bucket according to the calculated charging policy.

- According to a first embodiment of the present invention the reduced risk for unnecessary reservations towards the account function is realized by
20 having a single token bucket that is shared by a plurality of service flows per user.

- Another advantage of the present invention is when a rate change should be performed at a certain time-of-day (ToD), the signalling load may be
25 reduced by including, in the charging policy, the user rating table part, rates both before and after ToD. Furthermore, when a user credit account becomes empty or a predefined threshold is reached, it is possible to apply a fine-grained policy control of the traffic thanks to the charging policy.

- 30 Another advantage of the present invention is that the use of a single token bucket per subscriber concept reduces the distribution of token reservations in the network which hence reduces the risk to empty the prepaid account due to many different reservations. It also reduces the control signalling between the serving element and the gateway and

eventually the pre-paid system, thus reducing the needs of physical boxes for all three functions.

Another advantage of the present invention is that the service class concept
5 allows the operator to group related services into a number of groups, i.e. the services having identical tariffs in one group. Thus, the relation between the services in the same service class could be arbitrary except that the tariff must be the same since the rating is based on the service class. Still, each user could have different tariffs for a particular service
10 class, but for a particular user, all services in a service class will have the same rating (at a particular time) which means that all packets belonging to a certain service class are rated in accordance with the rating value associated with that service class in real-time without need for control signalling towards the rating engine. The benefit besides the service
15 grouping is that the amount of data per subscriber is dramatically reduced. As an example, the number of services may be in the order of thousands but the number of service classes may be up to hundred. The service class concept is also the basis for operator-side service authorisation. In addition, the service class concept reduces the complexity for the user (the
20 charging scheme for different services may be easier to understand), speeds up the processing of the charging system e.g. since the size of the user rating tables decreases.

Another advantage with the present invention is that the delay when
25 starting to use a service (for example when retrieving MMS messages) is reduced which results in a better end-user satisfaction and higher data throughput. That is achieved due to the dynamic pre-rating at subscriber connection which implies that all applicable rating values including their validity conditions are calculated before the subscriber starts to use the
30 different services. It also reduces the control signalling traffic thus reducing the load of the rating engine. Both traffic data throughput enhancement and control signalling traffic reduction may lead to fewer physical boxes in the network. A high level of rating flexibility is maintained as the rating values have well-specified validity and may be re-newed.

A further advantage of the present invention is that the service filter and the protocol inspection filter (PIF) concepts allow the operator to specify filter rules for a service that may increase the traffic data throughput by just assigning rules in the service filter, while still having the possibilities to invoke more advanced filter rules when necessary to distinguish the service. Thus, the PIFs are only used if it is not possible to differentiate between the service flows by means of the service filter, i.e. by using the IP address, which results in a higher throughput at the packet forwarding system. The concepts as such are general which allow for further inclusion of new rules when needed for other services.

A further advantage of the present invention is that the charging system is arranged to handle "one-time initial charge". An initial amount of tokens are decremented from the token bucket before or during the start of the service.

Further advantages and objects of embodiments of the present invention will become apparent when reading the following detailed description in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic block diagram illustrating the multiple token bucket solution according to prior art.

Figure 2 is a schematic block diagram illustrating a single token bucket solution according to one embodiment of the present invention.

Figure 3 is a schematic block diagram illustrating a process of calculating the "charging policy" in accordance with the present invention.

Figure 4 illustrates the charging policy schematically, containing user rating table and validity conditions in accordance with the present invention.

Figure 5 illustrates the user profile schematically.

Figure 6 illustrates the tariff plan schematically.

Figure 7a illustrates the parameters of service filters.

Figure 7b illustrates the parameters of a Protocol Inspection Filter (PIF) configuration.

5 **Figure 8** illustrates the serving element in accordance to one embodiment of present invention implemented in a GGSN in mobile telecommunication system.

DETAILED DESCRIPTION

10 The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the
15 embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, like numbers refer to like elements.

The realtime charging system in accordance with the present invention may
20 be implemented in an IP-network such as the Internet or in a packet switched mobile telecommunication network such as a GPRS-, UMTS- or a cdma2000 system. Even if the embodiments of the present invention are disclosed in connection with a GPRS-/UMTS system, the invention is not limited to such systems.

25 A proposed solution of a charging system according to embodiments of the present invention shown in **figure 2** comprises a control system 201 and a serving element 206. The control system 201 comprises a charging policy decision point 202, also referred to as a rating engine, and a credit account
30 function 203, which manages the users' credit accounts for real-time charging purposes. The serving element 206 comprises a charging policy enforcement point 207 for performing the charging, i.e. managing the reduction of the token bucket 208. The token bucket in the serving element is used per logged-in user and for a plurality of services. Preferably, one

single token bucket is used for all services per logged in user. In addition, the serving element comprises means for differentiating packets based on which service flow they belong to. The serving element may reside in a packet forwarding system such as a switch, a router, a proxy, a GPRS
5 Gateway Support Node (GGSN) node in the GPRS/UMTS system, or a PDSN node or Home Agent in the cdma2000 system.

The system of the present invention, comprises means for collecting all credit reservations for a plurality of services in one single token bucket per
10 user in the serving element in the packet forwarding system. The credit account function transmits information of the amount of credit that should be reserved for all the services respectively, i.e. the services included in a user service vector which is further explained below, to the token bucket of the serving element for a specific user. The credit amounts are reserved in
15 accordance with pre-configured settings performed by the network operator. The collection of all credit reservations for a plurality of services, preferably all, in one single token bucket is made possible thanks to that a charging policy for the services is calculated in accordance with the present invention by the control system and transmitted to the serving element.
20 The calculation of the charging policy is herein referred to as dynamic pre-rating and is further explained below.

The present invention is applicable on realtime charging for both pre-paid and post-paid subscriptions. In the post-paid case, a token bucket may
25 have a negative value, while in the pre-paid case, the token bucket is not allowed to have a negative value since the user is not allowed to use more credits than what is reserved. Moreover, the present invention is also applicable on both volume-based, time-based and service-based charging, dependent on settings of the serving element.

30

Example 1

When a user logs on to a communication system comprising the charging system of the present invention, the serving element initiates a control signalling sequence between the serving element and the control system.

The control system determines the set of service identifiers this user is allowed to use. The rating engine 301 of the control system calculates a charging policy 304 based on a tariff plan 303 and other input data e.g., Time of Day (ToD), the user's roaming status, the aggregated transferred data volume for the user and other user specific usage history. Current usage behaviour is also utilised at the calculation of the user rating table if the user already is logged on, e.g. in a situation when the token bucket of the user runs empty, i.e. one validity condition is not fulfilled, and the serving element requests a new user rating table from the control system .

5 This calculation is illustrated in **figure 3** and is called dynamic pre-rating. The charging policy comprises a user rating table 305 and a set of validity conditions 306. The user rating table 305 includes rating values for each service class the user is allowed to use and the set of validity conditions defines the conditions when the user rating table is valid. The service class

10 concept is introduced according to the present invention to limit the size of the user rating table of the charging policy. The service class is a group of services with the common property that they have exactly the same charging pattern, i.e. identical tariff plans. The calculated charging policy is sent to the serving element in the packet forwarding system.

15

20 Next, the serving element in the packet forwarding system initiates a reservation signalling sequence towards the credit account function of the control system. The credit account function reserves an amount of credit according to pre-configuration settings towards the user's credit account,

25 wherein the amount is called a credit reservation. The credit reservation is made for a plurality of service, preferably all services, and the overall credit reservation is sent to the serving element and put into the user-specific token bucket.

30 When traffic is flowing via the packet forwarding system, the serving element in the packet forwarding system comprises means for classifying each packet to determine which service class it belongs to. The received calculated charging policy is used to determine the credit amount that should be decremented from the token bucket. It should be noted that the

decrement may also be negative in order to support bonus services, i.e. a user gets paid if he uses a specific service.

The serving element in the packet forwarding system continuously checks if the validity conditions of the charging policy still are valid. Examples of validity conditions are time, thresholds for the token bucket, geographical area etc. When the validity conditions no longer are valid, a signalling sequence is initiated to get a new up-dated charging policy. When a rate change should be performed at a certain time-of-day (ToD), the charging policy, i.e. the user rating table part, contains the rate values that should be used both before and after ToD. That results in that the charging policy for a huge amount of users does not have to be updated at the same time which would cause extensive signalling during a short limited period of time for the huge amount of users, but the update may be performed during a longer period of time which reduces the signalling peak load.

Figure 4 shows an example of a charging policy comprising a user rating table associated with validity conditions.

When a token bucket is empty or a predefined threshold is reached, the usage is confirmed towards the control system and a new resource reservation is done. In the confirmation signal, information about the usage of the different services may preferably be added explicitly.

Basic terminology

In the following, the basic terminology of the flexible bearer charging system in accordance with the invention is explained:

- A **user** is person having access to the operator's provided services.
- One or more users may be connected to one **subscription**.
- A **subscriber** is the owner of the subscription.
- Realtime** charging implies that the charging process is performed while or after the service has been requested. It should be noted that 3GPP uses the term "on-line charging".

- A **token** is similar to a ticket. A utilisation of a service requires a predetermined amount of tickets/tokens, based e.g. on either the traffic volume or on the used time.
- A **token bucket** is a place where all tokens for one user is collected.
- 5 -A **service**, is the collection of all IP flows to and from a specific destination, determined by information in the headers or payloads of the IP packets.
- A **service identifier**, is the unique identifier of a service.
- Service class is an identifier of an arbitrary group of services that the operator wants to treat in the same way regarding e.g. charging and service
- 10 authorization. One service is allowed to belong to only one service class at a time per user.
- A **tariff plan** is a specification of prices for the services and when the services are valid.
- A **rating value** is an amount that should be reduced from the token
- 15 bucket for a specific service.
- A **service class** according to the present invention comprises all services having identical tariff plans.
- A **service filter**, is a specific filter setting that will handle a service with a specific service identifier. Thus, the service identifier is used to map the
- 20 service to its service filter. This terminology is further described below. In each service filter, destination or/and source (depending on the traffic direction) IP addresses (and mask), TCP and UDP port numbers (ranges), and protocol numbers can be set. In order to handle inspection of higher protocol layers, a service filter may include a pointer to a **Protocol**
- 25 **Inspection Filter** (PIF), which perform stateful packet inspection. The packet inspection is performed dynamically in contrast to the static service filters. That implies that the PIFs e.g. performs packet inspection based on previous events. The PIFs have specific configuration data (see **figure 8b**), for example containing URIs. Dynamic filters are established to perform the
- 30 actual filtering for packets that fit to the defined PIF rules. Finally, service filters and PIF configuration lines contain the service class identifier that represents the result of a filter matching an incoming packet. The **service class identifier** identifies the service classes and hence determines the rating that will be applied to the packet. Service filter and PIF

configurations are preferably performed in the packet forwarding system on a per Access Point Name (APN) basis.

5 Preferred embodiments of the present invention

The charging system and method of the present invention will hereinafter be described in conjunction with a GPRS/UMTS system. Thus, one embodiment of the charging system implemented in a mobile telecommunication system such as GPRS or UMTS system according to the present invention comprises:

10

-A serving element 801 located in a GGSN 800 as illustrated in figure 8.

The serving element is further described below.

-A control system comprising a rating engine in accordance with the present invention i.e. the charging decision point, which allows the operator to define services and tariff plans, and dynamically provides the serving element with rating information in form of charging policies. The control system comprises further a credit account function.

15

-A gateway, which provides an integration point for interworking towards the operator's prepaid system by means of flexible interface options. In the case when the pre-paid system supports e.g. a Radius interface, the GGSN is arranged to directly interface to it.

20

It should be noted that even if the charging system and method thereof according to embodiments of the invention is described in conjunction with a GPRS/UMTS system in the following, the system and method thereof are not limited to such a system but may also be used in other packet switched communication systems.

25

Differentiated Packet Rating

As described above, differentiated rating on the packet level is a complex process involving many input parameters (tariff plan, time and volume thresholds, subscriber profile, etc), while packet forwarding should be executed with lowest possible latency.

30

The charging system of the present invention employs a rating process in two stages:

- A **dynamic pre-rating process** providing the charging policy, which is performed by the rating engine of the present invention.
- 5 -A **real-time packet rating** e.g. performed, in accordance with the provided charging policy, by the serving element in the GGSN.

The dynamic pre-rating process calculates a charging policy comprising a set of rating values for each service class that a subscriber is allowed to use. The charging policy comprises user rating table and a set of validity conditions. This calculation utilises the tariff plan and the current subscriber situation e.g. roaming status, time-of-day, etc. The rating values have a limited lifetime according to the set of validity conditions and have to be renewed for example when a tariff threshold is reached. The validity conditions may also relate to other parameters than the time. The dynamic pre-rating is performed and the charging policy is thus provided to the serving element before the user starts using any services.

The real-time packet rating is then performed by classifying a packet as belonging to a certain service class and using the already calculated rating values for that packet. This can be done with a very small delay in the forwarding process, since signalling between the control system and the serving element in forwarding system for each service initiation is avoided.

For example, a case is employment of zero volume-charge for services that have service-based charging (e.g., MMS). For such services, the dynamic pre-rating process would result in a rating value of zero. The real-time packet rating will then use the zero value and hence incurring no charge for that traffic.

30

Rating engine

Figure 3 illustrates how the rating engine of the preferred embodiment of the present invention performs the dynamic pre-rating process by producing a user rating table. The user rating table is produced by

- combining the user service class vector, the tariff plan, and additional information such as roaming status, aggregated volume and connect time stored in the database of the rating engine, time of day, and geographical location. In addition to the user rating table, a corresponding set of validity
- 5 conditions are generated using tariff thresholds in order to produce the charging policy. The charging policy comprising the user rating table and the validity conditions is provided to serving element e.g. located in the GGSN.
- 10 More specifically, the rating engine comprises means for performing the following procedure:
- Accepts request for a user rating table; wherein the input of the request may be a user identifier, e.g. the MSISDN, SGSN IP-address, QoS of the PDP Context, etc.
 - 15 -Receives the user service class vector of the subscriber which is further described below.
 - Receives the service definition for each service class in that subscriber's user service class vector.
 - Receives the aggregated volume, e.g. the transfer history, and aggregated
 - 20 connect time for this user (preferably stored in the internal database of the rating engine).
 - Calculates roaming status based on SGSN IP address for each service class.
 - Calculates the relevant rating values using the tariff plan and relevant
 - 25 rating dimensions, e.g., information about the user's roaming status, aggregated volume and connect time, ToD, and geographical location.
 - Calculates the validity condition for these rating values using the tariff thresholds in the rating dimensions such as roaming status, aggregated volume and connect time stored in the data base of the rating engine, ToD,
 - 30 and geographical location
 - Constructs the user rating table based on the above mentioned calculations.
 - Sends the constructed user rating table and the calculated validity conditions in form of a charging policy according to the present invention to

the charging enforcement point of the serving element in the packet forwarding system.

Serving element

5 According to the present invention the serving element, residing in a packet forwarding system 800, comprises the charging enforcement point 802, means 805 for performing the service classification and one token bucket 803 per user handling a plurality of services, preferably all allowed available services. Thus, in the embodiment described above, the serving element is
10 included in a GGSN 800. **Figure 8** shows an overview block diagram of the function of the serving element.

The service filter and PIF configurations are configured in the serving element. In a GPRS/UMTS network, that is preferably performed by using
15 the operation and support system of the Core Network. The serving element is arranged to perform packet inspection according to the service filters. In some cases, when necessary, it also invokes Protocol Inspection Filters (PIFs) for analysis of higher-layer protocols.

20 For the pre-paid and post-paid subscribers, the serving element may utilize the dynamic pre-rating and the reservation mechanisms as described above. The serving element distinguishes between post-paid and pre-paid subscribers either by using the charging characteristics information or by analysis of the subscriber identity, e.g. the IMSI in case of a mobile cellular
25 network. The serving element may be configured to retrieve the user service class vector for both pre-paid and post-paid subscribers in order to perform operator-side service authorization. Moreover, the serving element is arranged to perform credit control for both post-paid and pre-paid subscriptions.

30 The serving element requests user rating tables from the rating engine. This is triggered either at connection setup such as by PDP Context Activation or that the validity conditions for the user rating table are no longer valid. When a new user rating table is requested, the serving

element reports to the rating engine the transferred volume and the connect time as well as the status of the "initial rate values".

5 The serving element comprises means 804 for making reservations towards prepaid and postpaid system, via a gateway, and thereby fills up each user's token bucket kept in the serving element of the packet forwarding system, e.g. the GGSN. The amount of reservation and the validity conditions are configurable in the serving element. It decrements each user's token bucket according to the user rating table.

10

Service classification

The service classification is performed by means in the serving element in the packet forwarding system. In accordance with one embodiment of the present invention, the means for classifying packets are service filters and/or PIF. Thus, the classification is performed based on IP header
15 information and/or higher-layer protocols. While the architecture of the system according to one embodiment of the invention supports general stateful inspection and identification of URIs, initial focus is put on detecting MMS traffic over WAP 1.x and 2.x. After a packet has been
20 classified to belong to a certain service and service class, the real-time packet rating determines a rating value according to the calculated charging policy. The token bucket is then adjusted in accordance with the determined rating value.

25 The serving element in the packet forwarding system, preferably the GGSN, in accordance with the present invention is also adapted to enforce certain policies when the subscriber's prepaid account runs empty. Depending on roaming conditions, PDP Contexts can be de-activated or non-zero-rated packet can be stopped, while zero-rated traffic is let through e.g. allowing
30 access to top-up pages, i.e. a default web page that the user enters when the credit account is empty. It may e.g. be possible to refill the account from such a top-up page.

The benefit for the network operator of this above mentioned two-stage approach is that if throughput and latency are most important, services such as email, instant messaging, traffic to corporate gateways, and traffic to Internet may be defined using only IP-header inspection at the service filter and the PIF is not required. However, for other services such as MMS over WAP, the IP-header inspection (i.e. service filter) is not sufficient. A more detailed inspection of the payload, in this case the URL/URI is required. Thus, this approach avoids the overhead of stateful packet inspection where it is not required. Thus, one of the basic ideas with the present invention is to start to use the service filter, and then only if necessary, continue with PIF.

Example 2

Figures 7a and **7b** show an example where the operator's WAP gateways are placed at the subnet 100.18.0.0/16. Assume that these WAP gateways also are arranged to function as HTTP proxies. The service filters 1 and 2 both match packets to and from that subnet. Filter 1 is set to match the transport protocol Wireless Session Protocol (WSP) and invoke PIF number 1 according to the PIF pointer in **figure 7a**, while filter 2 will match the transport protocol HTTP and invoke PIF number 2. Assume that an incoming packet is a WAP-packet leading to a match for WSP. PIF 1 now employs an identifier data in the PIF configuration, in this case the URL/URI. In this example, it checks for the domain names of the MMS-centers of the operator. If the packet's WSP-header contains any of these domain names the resulting service class is 14. If the packet contains any other URL (the wild card *), the packet is non-MMS WAP traffic and is classified as service class 15.

Referring back to **figure 7a**, the service filter with the service identifier 3 is set to match the subnet 100.12.0.0, which for example is a partner service provider. All packets to and from that service provider will be classified as service class 22. Finally, packets matching the wildcard rule, service filter with service identifier 4, representing "other traffic", will be classified as service class 60.

User profile and user service class vector

A user profile which is illustrated in **figure 6** includes a subscriber identifier, the MSISDN, together with a user service class vector according to the present invention. The user service class vector is a list of the services the user is allowed to use.

Specifically, if the operator wishes to perform operator-side service authorisation, the user service class vectors may be used to control which service classes a subscriber is allowed to access. The user service class vectors are provisioned through a service authorisation and subscriber provisioning system. This allows for self-provisioning via the subscriber portal, which also forms the basis for top-up pages. Note, if the operator does not want to employ service authorisation all available service classes should be listed in the user service class vector.

Continuing with the example described in conjunction with **figures 7a** and **7b**, the user profile in **figure 5**, allows the user to access service classes 14 (MMS traffic), 15 (other WAP traffic), 22 (the partner service provider), and 60 other traffic (general Internet access). The user profiles are managed by a customer relation management system and may be stored in a common directory. Independent of where the user profiles are stored they are replicated down to the rating engine according to the present invention.

Referring back again to the example in previous sections, **figure 6** shows a simplified tariff plan where service class 14 (MMS traffic) is zero-rated except when the subscriber is roaming, Service Class 15 (other WAP-traffic) is rated -2 tokens per byte. Traffic to and from the partner service provider (Service Class 22) is free-of-charge except when roaming. These rating dimensions are independent and can be combined, so that a specific rate would apply, for example, between 6pm and 6am, above 3 MBytes, when roaming. The tariff plan in **figure 6** is only a schematic simplification of the method used by said rating engine of the present invention.

- For each service class in the user service class vector, the dynamic pre-rating calculation generates five rating values: an "initial rate value", two "current rate values" and two "next rate values". Further information on the interaction between the tariff plan and the user service class vector is
- 5 explained below. The initial rate value is equal to the number of tokens that should be deducted when either a service class is used for the first time or for the first used service class depending on a configuration value for that subscriber. Thus, the initial fee may be based on service or subscriber.
- 10 To handle different settings of the meaning of "first time" e.g. per day or month, the information of the application of the "initial rate values" to be used for the next dynamic pre-rating calculation is supplied to the rating engine. The "current rate values" is the number of tokens per byte to be charged for packets belonging to a service class that shall be used
- 15 immediately. See validity conditions below. The reason to have two "current rate values" is to allow different rating values for uplink and downlink traffic, respectively. The "next rate values" shall be used after the expiration of the "current rate values". The purpose of the "next rate values" is to manage mass updates at a certain time. I.e., the charging policy for a huge
- 20 amount of users does not need to be updated at the same time which would cause extensive signalling during a short limited period of time for the huge amount of users, but the update may be performed during a longer period of time which reduces the signalling load per time unit during that limited period.
- 25 All these rating values of the charging policy 400 are listed per service class to form the user rating table 401 as shown in **figure 4**. The user rating table has a limited lifetime, specified by a set of validity conditions 402, which are calculated using the tariff thresholds for dimensions such as:
- 30 roaming status (home or away), geographical location, Time-of-Day (ToD) including month, year, etc, aggregated volume which is also referred to as transfer history, aggregated connect time, QoS of the connection, i.e. of the PDP Context for a GPRS or UMTS connection. It is the responsibility of the serving element to request an updated user rating table when a threshold

associated to a volume/time/location is reached. Thus, the charging system uses historical and/or current user specific usage data.

The system of the present invention is adapted to support service-based charging referred to as "one-time initial charge". An example of a service that is charged according the "one-time initial charge"-principle is a subscription of a newspaper. It may e.g. cost a fixed amount per month to be able to read the subscribed newspaper. In addition to the fixed subscription fee, a volume or time based fee may also be applied. The "one-time initial charge" is supported in two ways by the system of the present invention:

-First by the service class. For each service class in the subscriber's user service class vector, the arrival of the first packet classified to that service class implies a deduction of the initial rate value from the token bucket. The serving element then puts zero into the initial rate value for that specific service class.

-Secondly by the subscriber. All service classes in the subscriber's user service class vector have the same one time initial charge value. When a packet arrives for any of the service classes included in the user service class vector, the token bucket is decreased with that value and all values are set to zero. The initial rate value is reported as used to the rating engine, which then is arranged to give a zero initial rate value at subsequent requests.

For location-dependent rating, the packet forwarding system sends location information to the control system. As an example, the GGSN supports both forwarding of the SGSN IP address and an interface to a Location Enabled Server. The packet forwarding system is thus arranged to check the validity condition concerning geographical location and request a new user rating table in case the condition is no longer satisfied.

For time dependent rating the serving element supervises the validity time condition and requests a new user rating table when a predefined threshold is passed. In addition, the serving element supports maximum time

- subscriptions, i.e., connection up to 24 hours with one fee. This is managed by the remaining time validity condition, the serving element comprises means for down counting this value and if reaching zero or a predefined threshold, a new user rating table is requested. If a de-activation
5 of the current connection, e.g. a PDP context de-activation, occurs before the value has become zero or the predefined threshold is reached, the value is sent to the rating engine which is adapted to then update the aggregated time for that user.
- 10 For volume dependent rating the serving element supervises the validity volume condition and requests a new user rating table when a predefined threshold is passed. The serving element decreases this value with the amount of traffic that passes and if reaching zero or the predefined threshold a new user rating table is requested. If a de-activation of the
15 current connection, e.g. a PDP context de-activation, occurs before the value has become zero or the predefined threshold is reached the value is sent to the rating engine which is adapted to update the aggregated volume for that subscriber.
- 20 The control system and the serving element are respectively central units of the present invention. The control system is responsible for calculating the charging policy and providing the charging enforcement point of the serving element with that charging policy. The control system is further responsible for managing the credit account of one or more subscribers. The serving
25 element comprises a charging enforcement point that is responsible for performing the charging based on the charging policy received from the control system. Moreover, the serving element comprises a token bucket adapted to store credit reservations for a plurality of services per user. The token bucket is arranged to communicate with the credit account function
30 of the control system. Several different implementations of the control system and the serving element respectively are possible as will be apparent to the person skilled in the art. It will be apparent to the person skilled in the art how the control system and the serving element respectively and other functions of the present invention may be

implemented using known hardware and software means. The control system and the serving element are according to the present invention implemented to be programmable. The easiest way of implementing the programmable control system and the packet forwarding system may be by
5 means of software means, but programmable hardware implementations are also possible as well as implementations of combinations of hardware and software.

10 In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

CLAIMS

- 5 1. A charging system in a packet switched network for charging packets differently dependent on which service flow the packets belong to, the charging system comprising a control system (201) and a serving element (206) residing in a packet forwarding system (210) is **characterised in** that said control system (201) comprises an account function (203) adapted to manage an account of at least one
10 user and a charging policy decision point (202) arranged to calculate a charging policy for allowed services for the at least one user, and that said serving element (206) comprises a token bucket (208) per user adapted to store reservations received from the account function (203) of the user associated with the token bucket (208) and
15 a charging policy enforcement point (207) arranged to perform charging for a plurality of the allowed services by reducing the stored reservation of the token bucket (208) according to the calculated charging policy.
- 20 2. The charging system according to claim 1, wherein the serving element comprises a single token bucket per user.
3. The charging system according to any of claims 1-2, wherein the
25 calculated charging policy comprises at least one user rating table and a set of validity conditions.
4. The charging system according to the previous claim, wherein the
30 charging policy is calculated based on historical and/or current user specific usage data.
5. The charging system according to any of claims 3-4, wherein the set of validity conditions defines the lifetime of the at least one user rating table.

6. The charging system according to any of claims 3-5, wherein the calculated charging policy comprises at least two user rating tables having different time validity conditions.
- 5 7. The charging system according to any of claim 1-6, wherein the serving element comprises means for classifying the services into different service classes based on the tariff plan of the services.
8. The charging system according to the previous claim, wherein the
10 allowed subscriber service classes are stored in a Service Class Vector.
9. The charging system according to any of claims 1-8, wherein the
15 means for classifying the services into different service classes comprises a service filter adapted to identify the different service flows.
10. The charging system according to the previous claim, wherein the
20 means for classifying the services into different service classes further comprises Protocol Inspection Filters adapted to identify the different service flows, when the service filter is not capable of said identification.
11. The charging system according to any of claims 1-10, wherein the
25 packet forwarding system is a Gateway GPRS Support Node in a mobile telecommunication network.
12. A control system (201) of a charging system in a packet switched
30 network comprising an account function (203) adapted to manage an account of at least one user **characterised in** that said control system comprises a charging policy decision point arranged to calculate a charging policy for the allowed services for the at least one user.

13. The control system according to claim 12, wherein the calculated charging policy comprises at least one user rating table and a set of validity conditions.
- 5 14. The control system according to previous claim, wherein the charging policy is calculated based on historical and/or current user specific usage data.
- 10 15. The control system according to any of claims 13-14, wherein the set of validity conditions defines the lifetime of the at least one user rating table.
- 15 16. The control system according to any of claims 13-15, wherein the calculated charging policy comprises at least two user rating tables having different time validity conditions.
- 20 17. The control system according to any of claims 12-16, wherein the control system is implemented in a mobile telecommunication network.
- 25 18. A serving element (206) residing in a packet forwarding system of a charging system in a packet switched network (210) **characterised in** that said serving element (206) comprises means for receiving reservations for at least one user, a token bucket (208) per user adapted to store the reservations for the user associated with the token bucket, means for receiving a charging policy for allowed services, and a charging policy enforcement point (207) arranged to perform charging for a plurality of the allowed services by reducing the stored reservation of the token bucket (206) according to the received calculated charging policy.
- 30 19. The serving element according to claim 18, wherein the serving element comprises a single token bucket per user.

20. The serving element according to any of claims 18-19, wherein the charging policy comprises at least one user rating table and a set of validity conditions.
- 5 21. The serving element according to previous claim, wherein the charging policy is calculated based on historical and/or current user specific usage data.
- 10 22. The serving element according to any of claims 20-21, wherein the set of validity conditions defines the lifetime of the at least one user rating table.
- 15 23. The serving element according to any of claims 20-22, wherein the charging policy comprises at least two user rating tables having different time validity conditions.
- 20 24. The serving element according to any of claim 18-23, wherein the serving element comprises means for classifying the services into different service classes based on the tariff plan of the services.
- 25 25. The serving element according to the previous claim, wherein the allowed subscriber service classes are stored in a Service Class Vector.
- 30 26. The serving element according to any of claims 24-25, wherein the means for classifying the services into different service classes comprises a service filter adapted to identify the different service flows.
- 30 27. The serving element according to the previous claim, wherein the means for classifying the services into different service classes further comprises Protocol Inspection Filters adapted to identify the different service flows, when the service filter is not capable of said identification.

28. The serving element according to any of claims 18-27, wherein the packet forwarding system is a Gateway GPRS Support Node in a mobile telecommunication network.

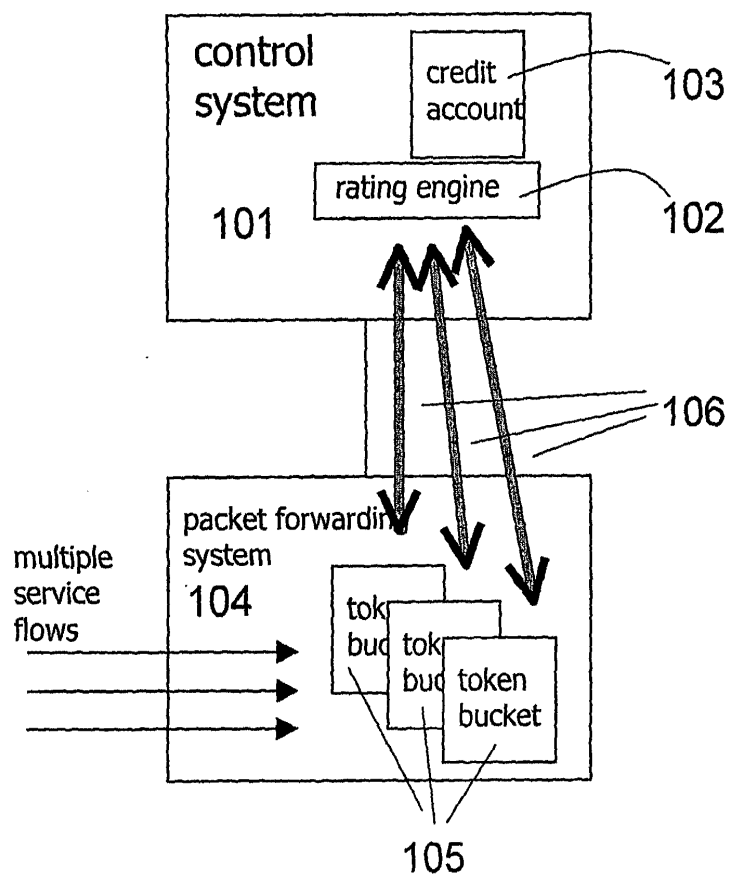
5

29. An interface (1) **characterised in** that it is connectable to a charging policy decision point (202) of the control system (201) according to any of claims 12-17 and the charging enforcement point (207) of the serving element (206) according to any of claims 18-28 adapted to transfer a charging policy.

10

30. An interface (2) **characterised in** that it is connectable to the account function (203) of the control system (201) according to any of claims 12-17 and the token bucket (208) of the serving element (206) according to any of claims 18-28 adapted to transfer reservations from the account function (203) to the token bucket (208).

15



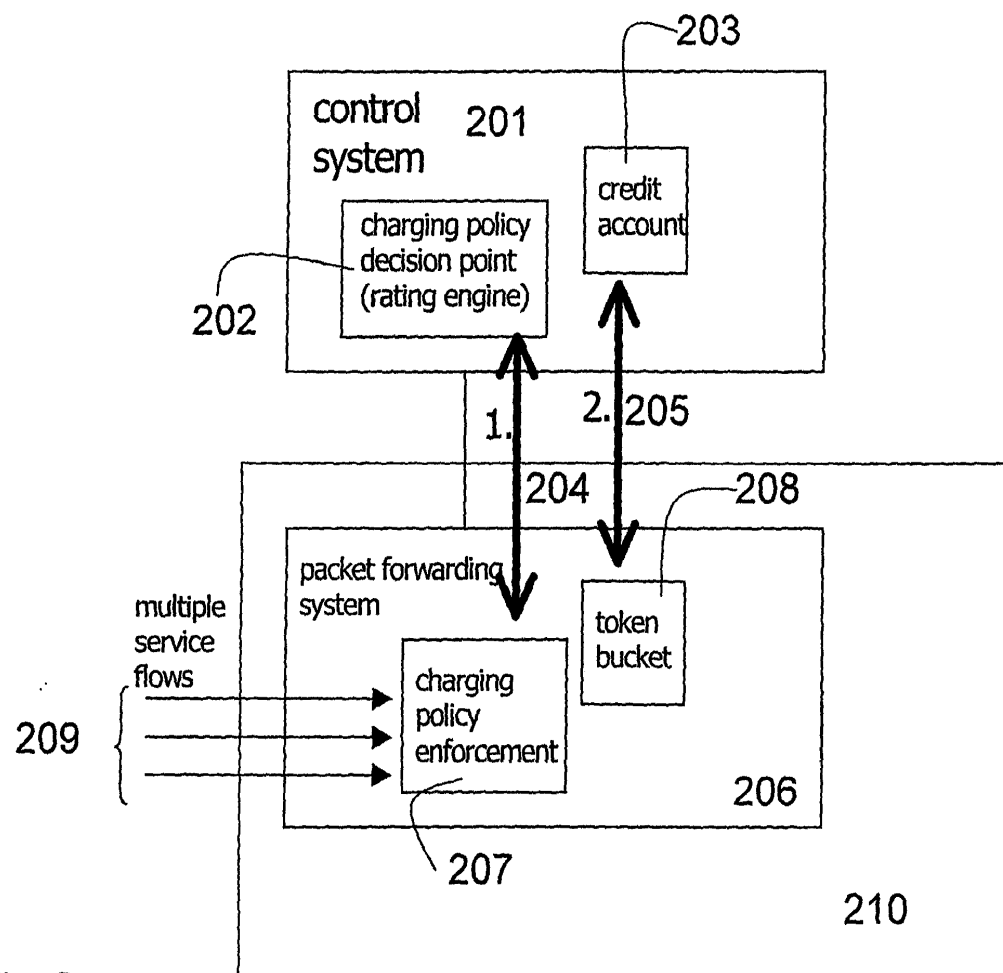


Fig. 2

Fig. 3

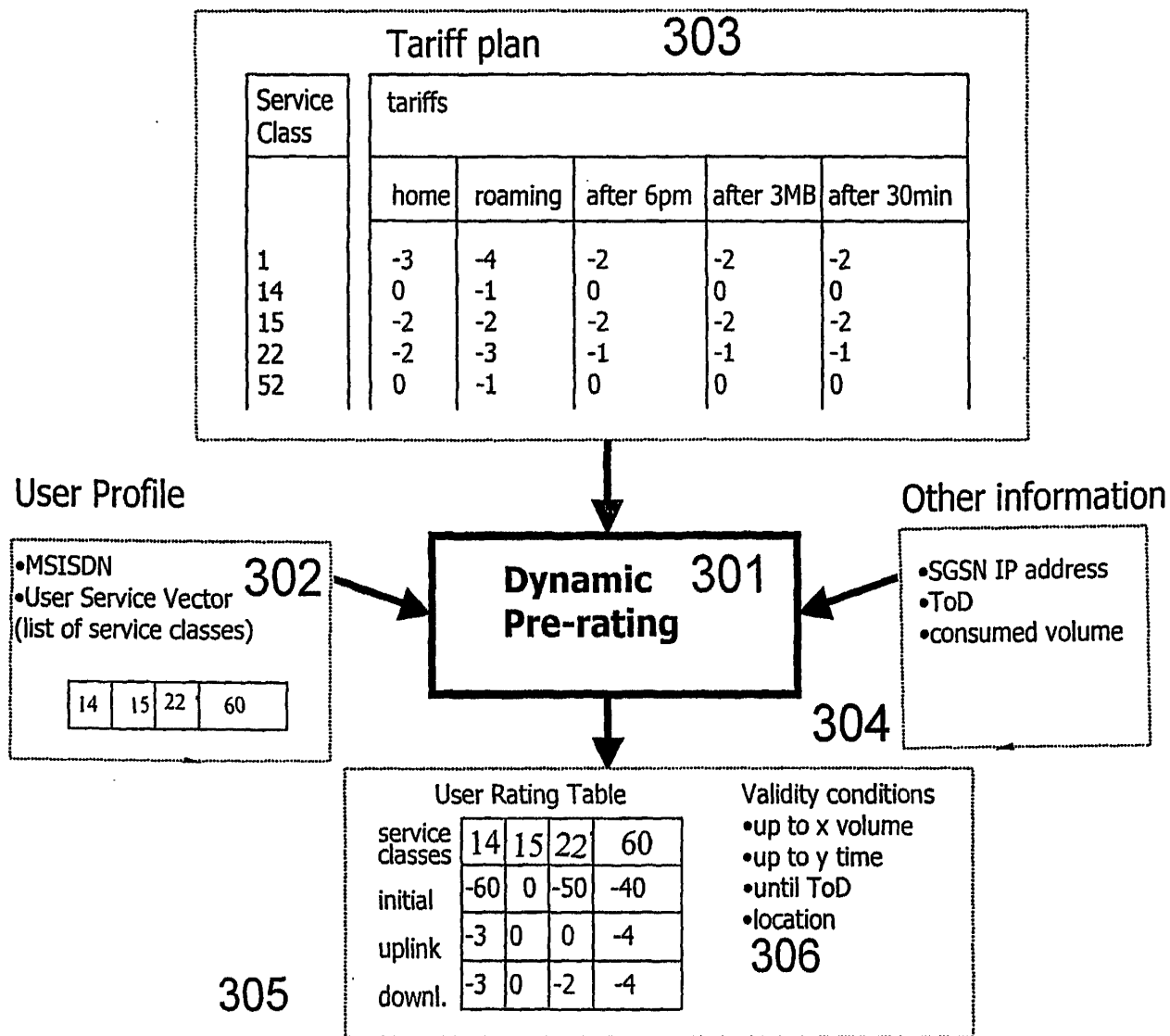


Fig. 4

400

User Rating Table 401

Service Class	14	15	22	60
Initial rate values	-60	0	-50	-40
Current rate values, up	-3	0	0	-4
Current rate values, down	-3	0	-2	-4
Next rate values, up	-2	0	0	-3
Next rate values, down	-2	0	-1	-3
Remaining volume	1.35

Validity Conditions 402

Remaining time	0:53:30
Time for current rate	14:00:00
Time for next rate	18:00:00
Location	...

Tariff plan

Service Class	Tariffs				
	home	roaming	after 6pm	after 3MB	after 30min
14	0	-1	0	0	0
15	-2	-2	-2	-2	-2
22	0	-1	0	0	0
52	-1	-1	-1	-1	-1
60	-3	-4	-2	-2	-2

Fig. 6

User Profile

•MSISDN				
•User Service Class Vector (list of allowed Service Classes)				
<table border="1"><tr><td>14</td><td>15</td><td>22</td><td>60</td></tr></table>	14	15	22	60
14	15	22	60	
•other data				

Fig. 5

Service Filters

Service Identifier	filter rule								
	filter prio	IP address/mask	TCP/UDP	port#	protocol#	ICMP type	protocol	PIF pointer	Service Class
1	1	100.18.0.0/16	*	-	-	-	WSP	1	-
2	2	100.18.0.0/16	*	-	-	-	HTTP	2	-
3	3	100.12.0.0	*	-	-	-	-	-	22
4	4	*	*	-	-	-	-	-	60

Fig. 7a

Protocol Inspection Filter (PIF)
configuration

PIF#	Identifier	Service Class
1	mms1.oper.net	14
1	mms2.oper.net	14
1	*	15
2	music.com	52
2	*	53

Fig. 7b

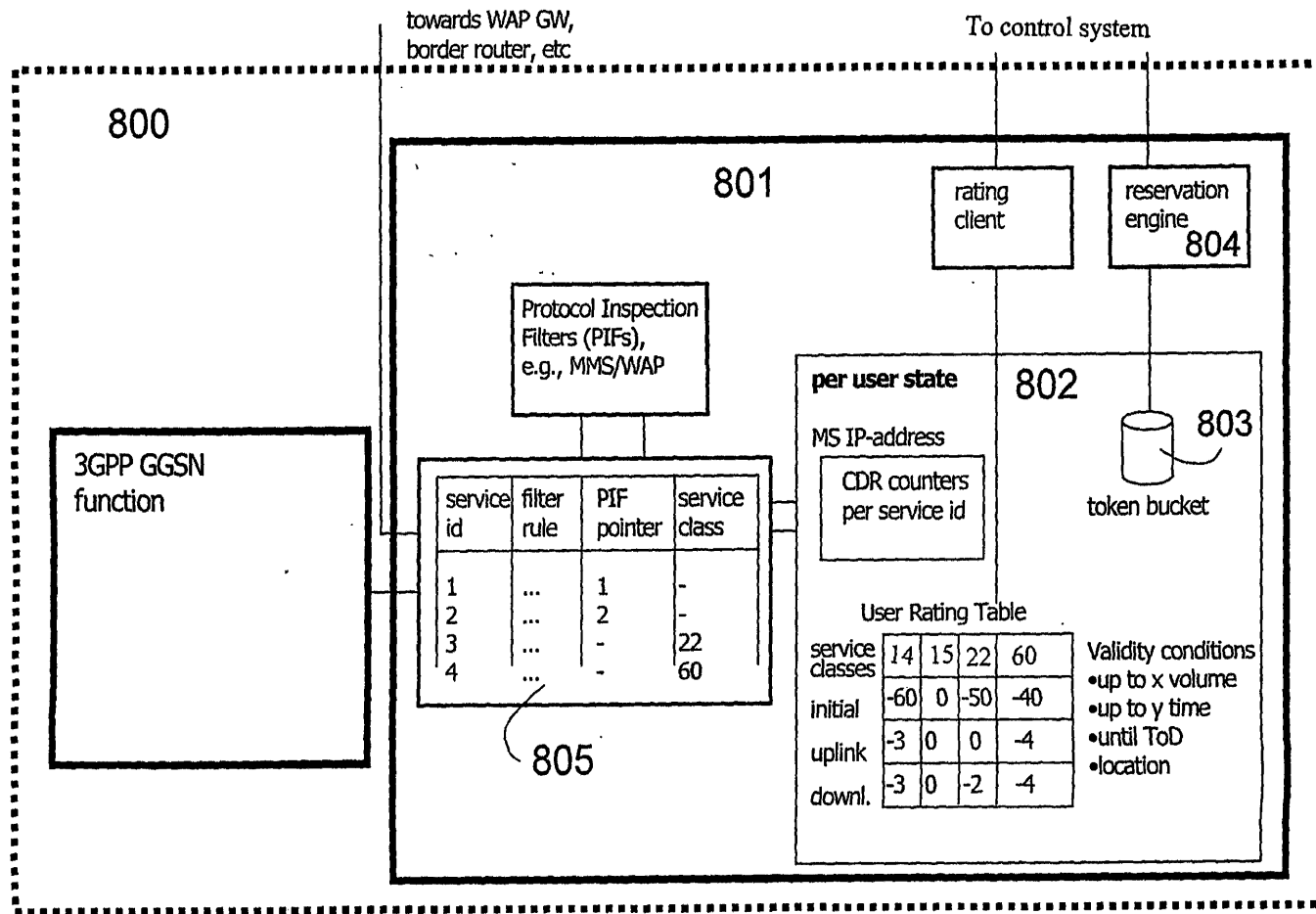


Figure 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/01122

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 12/14

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04L, H04Q

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0201847 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 3 January 2002 (03.01.02), page 1, line 9 - line 16; page 2, line 13 - line 23; page 3, line 14 - page 4, line 5, page 8, line 17 - line 30, abstract --	1-30
A	WO 0117222 A1 (NOKIA NETWORKS OY), 8 March 2001 (08.03.01), page 5, line 12 - line 27; page 7, line 1 - line 20, abstract -- -----	1-30

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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Date of the actual completion of the international search

12 Sept 2003

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

26/07/03

International application No.
PCT/SE 03/01122

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
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				EP	1168806 A	02/01/02
				EP	1297683 A	02/04/03

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