AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court for the Eastern District of Texas on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-00172	5/24/2022	for the Eastern District of Texas

PLAINTIFF	DEFENDANT
NetSocket, Inc.	**Cisco** Systems, Inc.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,616,601	11/10/2009	NetSocket, Inc.
2 7,190,698	3/13/2007	NetSocket, Inc.
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/250,702	12/19/2003	Joakim Norrgard	200126.01102

CONFIRMATION NO. 9055

110123
Ross Barnes LLP
275 W. Campbell Rd., Ste. 210
Richardson, TX 75080

POA ACCEPTANCE LETTER

OC000000109938125

Date Mailed: 07/26/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/23/2019.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/nrhayden/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/250,702	12/19/2003	Joakim Norrgard	NET-5388

CONFIRMATION NO. 9055

Netsocket, Inc.
Suite 140
3701 W. Plano Pkwy
Plano, TX 75075

POWER OF ATTORNEY NOTICE

OC000000109938013

Date Mailed: 07/26/2019

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/23/2019.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/nrhayden/

Electronic Acknowledgement Receipt

EFS ID:	36666337
Application Number:	10250702
International Application Number:	
Confirmation Number:	9055
Title of Invention:	NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Joakim Norrgard
Correspondence Address:	Netsocket, Inc. - Suite 140 3701 W. Plano Pkwy Plano TX 75075 US 2144277306 -
Filer:	Robin L. Barnes/Nicole Isenhart
Filer Authorized By:	Robin L. Barnes
Attorney Docket Number:	NET-5388
Receipt Date:	23-JUL-2019
Filing Date:	19-DEC-2003
Time Stamp:	15:43:39
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)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	POA373b20012601102.pdf	145559 39ffeda10726614c7753292133458aa27c82526d	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	145559		

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.

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.

National Stage of an International Application under 35 U.S.C. 371

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.

New International Application Filed with the USPTO as a Receiving Office

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.

PETITION TO ACCEPT UNINTENTIONALLY DELAYED PAYMENT OF MAINTENANCE FEE IN AN EXPIRED PATENT (37 CFR 1.378(b))

Patent Number	Issue Date	Application Number	Filing Date	Docket Number (if applicable)
7616601	10-Nov-2009	10250702	19-Dec-2003	

CAUTION: Maintenance fee (and surcharge, if any) payment must correctly identify: (1) the patent number and (2) the application number of the actual U.S. application leading to issuance of that patent to ensure the fee(s) is/are associated with the correct patent. 37 CFR 1.366(c) and (d).

Applicants claims the following fee status:

- (◉) Small Entity
- ( ) Micro Entity
- ( ) Regular Undiscounted

Applicants selects the following :

( ) 3 1/2	(◉) 7 1/2	( ) 11 1/2

PETITION FEE
The petition fee required by 37 CFR 1.17(m) (Fee Code 1558/2558) must be paid as a condition of accepting unintentionally delayed payment of the maintenance fee.

MAINTENANCE FEE (37 CFR 1.20(e)-(g))
The appropriate maintenance fee must be submitted with this petition.

STATEMENT
THE UNDERSIGNED CERTIFIES THAT THE DELAY IN PAYMENT OF THE MAINTENANCE FEE TO THIS PATENT WAS UNINTENTIONAL

PETITIONER(S) REQUEST THAT THE DELAYED PAYMENT OF THE MAINTENANCE FEE BE ACCEPTED AND THE PATENT REINSTATED

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

37 CFR 1.378(c) states: "Any petition under this section must be signed in compliance with 37 CFR 1.33(b) ."

I certify, in accordance with 37 CFR 1.4(d)(4) that I am

- (◉) An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application.
- ( ) An attorney or agent registered to practice before the Patent and Trademark Office
- ( ) A sole patentee
- ( ) A joint patentee; I certify that I am authorized to sign this submission on behalf of all the other patentees as evidenced by the power of attorney in the application
- ( ) A joint patentee; all of whom are signing this e-petition
- ( ) The assignee of record of the entire interest that qualifies as an authorized party under 37 CFR 1.33(b)

Attorney			
A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature			
Signature	/Robin L. Barnes/		
Name	Robin L. Barnes	Registration Number	45936

Electronic Patent Application Fee Transmittal

Application Number:	10250702
Filing Date:	19-Dec-2003
Title of Invention:	NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Joakim Norrgard
Filer:	Robin L. Barnes/Nicole Isenhart
Attorney Docket Number:	NET-5388

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
MAINTENANCE FEE DUE AT 7.5 YEARS	2552	1	1800	1800
PET. DELAY PYMT MAINTAIN PATENT IN FORCE	2558	1	1000	1000
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**2800**

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

In re Patent No. 7616601
Issue Date: November 10,2009
Application No. 10250702
Filed: December 19,2003
Attorney Docket No. NET-5388

:
:DECISION GRANTING PETITION
:UNDER 37 CFR 1.378(b)
:

This is a decision on the electronic petition, filed July 23,2019 ,under 37 CFR 1.378(b) to accept the unintentionally delayed payment of the 7.5 year maintenance fee for the above-identified patent.

The petition is **GRANTED**.

The maintenance fee is accepted, and the above-identified patent reinstated as of July 23,2019 . This decision also constitutes notice that the fee has been accepted. An electronic copy of the petition and this decision has been created as an entry in the Image File Wrapper. Nevertheless, petitioner should print and retain an independent copy.

Telephone inquiries related to this electronic decision should be directed to the Electronic Business Center at 1-866-217-9197.

Electronic Acknowledgement Receipt	
EFS ID:	36667858
Application Number:	10250702
Patent Number:	7616601
Confirmation Number:	9055
Petition Issued Date:	July 23,2019
Title of Invention:	NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Joakim Norrgard
Correspondence Address:	- - - - - - - - - -
Filer:	Robin L. Barnes/Nicole Isenhart
Filer Authorized By:	Robin L. Barnes
Attorney Docket Number:	NET-5388
Receipt Date:	23-JUL-2019
Filing Date:	19-DEC-2003
Time Stamp:	16:43:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes

Payment Type	CARD
Payment was successfully received in RAM	$2800
RAM confirmation Number	072419INTEFSW16450300
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition automatically granted by EFS	petition-request.pdf	32576 5b41e07208af3756e82f2f1d7eda092565a7f45a	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32202 b1365d1d5af98c44eaffa8f282bb934b6ac570ff	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	64778		

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.

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.

National Stage of an International Application under 35 U.S.C. 371

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.

New International Application Filed with the USPTO as a Receiving Office

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.

PTO/SB/81A (12-08)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Patent Number	7,616,601
Issue Date	11/10/2009
First Named Inventor	Joakim Norrgard, Lulea, (SE)
Title	Network Resource Manager in a Mobile Telecommunication System
Attorney Docket No.	200126.01102

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

110123

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified patent to:

☒ The address associated with the above-identified Customer Number.

OR

☐ The address associated with the Customer Number identified in the box at right:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Inventor, having ownership of the patent.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____.

SIGNATURE of Inventor or Patent Owner

Signature	Ken Lewis	Date	21JUL2019
Name	Ken Lewis	Telephone	+1 214 763 7650
Title and Company	President and CEO, Nolsocket, Inc.		

NOTE: Signatures of all the inventors or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☐ A total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 15 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.

PTO/SB/96 (11-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Netsocket, Inc.

Application No./Patent No.: 7,616,601 Filed/Issue Date: 11/10/2009

Titled:
Network Resource Manager in a Mobile Telecommunication System

Netsocket, Inc., a corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. ■ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel_____, Frame_____, or a copy* is attached.

OR

B. ■ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Norrgard, Joakim et al. To: Operax AB
The document was recorded in the United States Patent and Trademark Office at
Reel 014237, Frame 0389, or a copy* is attached.

2. From: Operax AB To: NYA Operax AB
The document was recorded in the United States Patent and Trademark Office at
Reel 021978, Frame 0022, or a copy* is attached.

3. From: NYA Operax AB To: Operax AB
The document was recorded in the United States Patent and Trademark Office at
Reel 021991, Frame 0371, or a copy* is attached.

☒ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ *As required by 37 CFR 3.73(b)(1)(i), if a copy/copies is/are attached, the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.]

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

Signature	2019-07-23 Date
Robin L. Barnes Printed or Typed Name	45936 Title or Registration Number

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

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

Supplemental Sheet

4. From: Operax AB To: NETSOCKET, INC.

The document was recorded in the United States Patent and Trademark Office at
Reel 022007 Frame 0627

5. From: NETSOCKET, INC., a Delaware Corporation To: Comerica Bank, a Texas Banking Association

The document was recorded in the United States Patent and Trademark Office at
Reel 026829 Frame 0444

6. From: NETSOCKET, INC. To: Alliacense Limited LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 036740 Frame 0668

7. From: Comerica Bank To: NETSOCKET, INC.

The document was recorded in the United States Patent and Trademark Office at
Reel 036612 Frame 0637

8. From: NETSOCKET, INC. To: Alliacense Limited LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 038109 Frame 0515

9. From: Alliacense Limited, LLC To: NETSOCKET, INC.

The document was recorded in the United States Patent and Trademark Office at
Reel 049803 Frame 0043

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT3558759

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
NETSOCKET, INC.	09/02/2015

RECEIVING PARTY DATA

Name:	ALLIACENSE LIMITED LLC
Street Address:	4880 STEVENS CREEK BLVD.
Internal Address:	SUITE 103
City:	SAN JOSE
State/Country:	CALIFORNIA
Postal Code:	95129

PROPERTY NUMBERS Total: 4

Property Type	Number
Patent Number:	7616601
Patent Number:	7734796
Patent Number:	7190698
Patent Number:	7720966

CORRESPONDENCE DATA

Fax Number: (408)446-5444

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 408-886-5441
Email: emi@alliacense.com
Correspondent Name: EMI RHODES
Address Line 1: 4880 STEVENS CREEK BLVD.
Address Line 2: SUITE 103
Address Line 4: SAN JOSE, CALIFORNIA 95129

NAME OF SUBMITTER:	EMI RHODES
SIGNATURE:	/EMI RHODES/
DATE SIGNED:	10/06/2015
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 5

source=150902 Netsocket Executed Assignment Sept 2, 2015#page1.tif
source=150902 Netsocket Executed Assignment Sept 2, 2015#page2.tif
source=150902 Netsocket Executed Assignment Sept 2, 2015#page3.tif
source=150902 Netsocket Executed Assignment Sept 2, 2015#page4.tif
source=150902 Netsocket Executed Assignment Sept 2, 2015#page5.tif

ADDENDUM E

FORM OF ASSIGNMENT

This assignment ("Assignment") is entered into between ALLIACENSE LIMITED, LLC, a Delaware limited liability corporation, having its principal place of business at 4880 Stevens Creek Boulevard, Suite 103, San Jose, California 95129 ("Assignee"), and Netsocket, Inc., a Delaware corporation with its principal place of business at P.O. Box 857627, Plano, Texas 75086-7627, of behalf of itself and its Affiliates, (collectively, "Assignor"). Assignee and Assignor may be referred to individually as "Party" and collectively as the "Parties."

NOW THEREFORE, for and in consideration of the mutual covenants herein contained as well as of other good and valuable consideration the receipt and sufficiency of which is hereby acknowledged, and pursuant to that certain Commercialization Agreement between Assignee and Assignor dated June __, 2015 (the "Agreement"), it is covenanted and agreed by and between the parties hereto that:

1. Subject Matter.

   "Project IP" means the patents and applications scheduled at Schedule I, entitled "Schedule of Project IP," including all foreign counterparts, extensions, reissues, and/or renewals of such patents and patent applications.

2. Assignment.

   2.1. Assignor hereby grants, sets-over, assigns, transfers, conveys, and acquits unto Assignee all of Assignor's right, title, and interest of whatsoever kind or nature, now existing or hereafter arising, in and to the Project IP, including but not limited to, with respect to the Project IP, the exclusive, worldwide right to:

   2.1.1. Regulate and control by license, sublicense, affiliation, or other agreement the practice and/or use of any and all of the Project IP;

   2.1.2. Otherwise pursue the commercialization and enforcement of any and all claims of the Project IP, including the manufacture, sale, and use of any and all products and/or services and the practice of any and all methods and processes covered by any and all claims of any or all of the Project IP;

   2.1.3. Sue on and collect for its own use and benefit all claims and/or entitlements with respect to damages by reason of past, present and future infringement or use of any and all of the Project IP; and,

NETSOCKET 9/2/15

Alliacense

2.1.4. Pursue in its own name and for its own use and benefit all remedies of whatsoever kind or nature (including injunctive relief) relating to the past, present, or future infringement or use of any and all of the Project IP.

2.2. All costs for the registration of the assignment of the Project IP will be borne by Assignee.

2.3. By virtue of the grants of contained herein, Assignor acknowledges that it does not retain any rights, licenses or other benefits with respect to any or all of the Project IP.

3. Attachments.

- Schedule I: Schedule of Project IP

IN WITNESS WHEREOF, the parties have hereunto set their hands and seals as of June __, 2015.

NETSOCKET, INC. (ASSIGNOR)	ALLIACENSE LIMITED LLC (ASSIGNEE)
By: Ken Lewis Ken Lewis Title: CEO Date: ~~June 2015~~ 2 SEPTEMBER 2015	By: MAC DECERBO Title: President Date: 6 ~~June 2015~~ July

Schedule I
Schedule of Project IP

Family	Status	Country	Patent No.
1		Provisional	60/261,166
1		PCT	WO/2002/056564
1	Issued	US	7616601
1	Issued	CN	CN100380903
1	Issued	EP	EP1354456
1		JP	JP2004527934
1		KR	KR20040007434
1		AT	AT504133
2		Provisional	60/316,298
2	Issued	SE	SE519215
2		PCT	WO/2003/021888
2	Issued	US	7734796
2	Issued	EP	EP1423945
2	Issued	JP	JP3977331
2		CA	CA2459571
2	Rejected	CN	CN1552143
2		KR	KR20040040446
2		TW	TWI245524
2		PT	PT1423945
2		AT	AT367696
2		DE	DE60221261
2		DK	DK1423945
2		ES	ES2290327
4		Provisional	60/197,006
4		PCT	WO/2001/080485
4	Issued	US	7190698
4	Issued	EP	EP1275226
4	Issued?	CN	CN1183724
4	Lapsed?	KR	KR100696003
4		JP	JP2003531519

Confidential.
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NETSOCKET Alliacense

Family	Status	Country	Patent No.
4		DE	DE60102367
4		AT	AT262244
4		AU	AU6019001
4		ES	ES2217150
7		Provisional	60/430,098
7		PCT	WO/2004/051944
7	Issued	US	7720986
7		EP	EP1579638
7		JP	JP2006508605
7		KR	KR20050085155
7		AU	AU2003279659
8	Issued	SE	SE526535
8		US	60/530800
8		PCT	WO/2005/062555
8	Issued	EP	EP1698119
8	ABN	US	US20070115918
9		Provisional	60/671,083
9		PCT	WO/2006/041373
9	Issued	EP	EP1800442
9		CA	CA2583293
9		JP	JP2008516521
9		KR	KR20070085339
9	ABN	US	US20090003194
10		PCT	WO/2003/084157
10	Issued	EP	EP1488578
10	Issued	JP	JP4018640
10	ABN	US	US20050157644
10		KR	KR20040105804
10		AT	AT424073
10		AU	AU2002248116
12		Provisional	60/369,564

Family	Status	Country	Patent No.
12		PCT	WO/2003/085514
12	Issued	EP	EP1490765
12	ABN	US	US2005125517
12	Issued	JP	JP4064353
12		KR	KR20050004831
12		AT	AT418214
12		AU	AU2002343306
13		Provisional	60/530,902
13	Issued	SE	SE526257
13		PCT	WO/2005/062557
13	Issued	EP	EP1698123
13	ABN	US	US20070115856
13		AT	AT522049
14		Provisional	60/676,944
14		PCT	WO/2006/118500
14	Issued	EP	EP1878170
14	ABN	US	US20090304020
14		CA	CA2605126
14		CN	CN101171803
14		JP	JP2008541553
14		PCT	WO/2006/118502
14	Issued	EP	EP1878270
14	ABN	US	US20090323712
14		CA	CA2605129
14		CN	CN101185346
14		JP	JP2008541555

Together with all progenitors and progeny thereof and all additions, changes, amendments, modifications, actions, counterparts, continuations, continuations-in-part, extensions, reissues, divisionals and/or renewals of such progenitors and progeny," together with any counterparts thereof anywhere in the world, as well as all inventions disclosed in any such patents, progenitors, progeny, or counterparts.

PTO/SB/123 (11-08)
Approved for use through 11/30/2011. OMB 0651-0035
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CHANGE OF CORRESPONDENCE ADDRESS
Patent

Address to:
Mail Stop Post Issue
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Patent Number	**7,616,601 B2**
Issue Date	**11/10/2009**
Application Number	**10/250,702**
Filing Date	**December 19, 2003**
First Named Inventor	**Norrgard et al.**
Attorney Docket Number	**NET-5388**

Please change the Correspondence Address for the above-identified patent to:

☐ The address associated with Customer Number: [ ]

OR

☒ **Firm *or* Individual Name** **Netsocket, Inc.**

Address **3701 W. Plano Pkwy, Suite 140**

City	**Plano**	**State**	**TX**	**ZIP**	**75075**
Country	**US**				
Telephone	**214.427.7306**	**Email**			

This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).

This form will not affect any "fee address" provided for the above-identified patent. To change a "fee address" use the "Fee Address Indication Form" (PTO/SB/47).

I am the:

☐ Patentee.

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

☒ Attorney or agent of record. Registration Number **46,836**.

Signature	**/Roger C. Knapp/**		
Typed or Printed Name	**Roger C. Knapp**		
Date	**November 19, 2009**	Telephone	**972-732-1001**

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 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 to 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: Mail Stop Post Issue, 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.

Electronic Acknowledgement Receipt

EFS ID:	6486696
Application Number:	10250702
International Application Number:	
Confirmation Number:	9055
Title of Invention:	NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Joakim Norrgard
Customer Number:	25962
Filer:	Roger Clark Knapp/Kristin Hayes
Filer Authorized By:	Roger Clark Knapp
Attorney Docket Number:	NET-5388
Receipt Date:	19-NOV-2009
Filing Date:	19-DEC-2003
Time Stamp:	14:24:10
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)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Change of Address	NET-5388_Address-Change.pdf	85429 ea0c3c06d73d1de72c612866447318f2956116f9	no	1

Warnings:	
Information:	

Total Files Size (in bytes):	85429

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.

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.

National Stage of an International Application under 35 U.S.C. 371
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.

New International Application Filed with the USPTO as a Receiving Office
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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/250,702	11/10/2009	7616601	NET-5388	9055

25962 7590 10/21/2009

SLATER & MATSIL, L.L.P.
17950 PRESTON RD, SUITE 1000
DALLAS, TX 75252-5793

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 573 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 Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

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

Joakim Norrgard, Lulea, SWEDEN;
Anders Larsson, Lulea, SWEDEN;
Olov Schelen, Norrfjarden, SWEDEN;

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)

25962 7590 09/01/2009

SLATER & MATSIL, L.L.P.
17950 PRESTON RD, SUITE 1000
DALLAS, TX 75252-5793

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.
10/250,702	12/19/2003	Joakim Norrgard	NET-5388	9055

TITLE OF INVENTION: NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	12/01/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
MOORE JR, MICHAEL J	2419	370-395210

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,

(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.

1 Slater & Matsil, L.L.P.

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: Netsocket, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Plano, TX

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 50-1065 (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 /Roger C. Knapp/ Date October 1, 2009

Typed or printed name Roger C. Knapp Registration No. 46,836

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:	10250702
Filing Date:	19-Dec-2003
Title of Invention:	NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Joakim Norrgard
Filer:	Roger Clark Knapp/Kristin Hayes
Attorney Docket Number:	NET-5388

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	1510	1510
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1810**

Electronic Acknowledgement Receipt

EFS ID:	6189230
Application Number:	10250702
International Application Number:	
Confirmation Number:	9055
Title of Invention:	NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Joakim Norrgard
Customer Number:	25962
Filer:	Roger Clark Knapp/Kristin Hayes
Filer Authorized By:	Roger Clark Knapp
Attorney Docket Number:	NET-5388
Receipt Date:	01-OCT-2009
Filing Date:	19-DEC-2003
Time Stamp:	18:42:18
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1810
RAM confirmation Number	4735
Deposit Account	501065
Authorized User	KNAPP,ROGER C.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	5388_IF.pdf	94933 7dcc5d2cdbe2df4fd2cc673257532a783c3c644	no	1
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	32288 9366d0c5ca8267b4869721499a90d0527e50cab9	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	127221		

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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.

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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.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 9055

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/250,702	12/19/2003 RULE	370	2419	NET-5388

APPLICANTS

Joakim Norrgard, Lulea, SWEDEN;
Anders Larsson, Lulea, SWEDEN;
Olov Schelen, Norrfjarden, SWEDEN;

**** CONTINUING DATA **************************

This application is a 371 of PCT/SE01/02847 12/20/2001
which claims benefit of 60/261,166 01/16/2001

**** FOREIGN APPLICATIONS *********************

** SMALL ENTITY **

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☐ no	SWEDEN	6	42	3
35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance				
Verified and Acknowledged Examiner's Signature Initials				

ADDRESS
25962

TITLE

NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

FILING FEE RECEIVED		
793	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

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UNITED STATES DEPARTMENT OF COMMERCE
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NOTICE OF ALLOWANCE AND FEE(S) DUE

25962 7590 09/01/2009

SLATER & MATSIL, L.L.P.
17950 PRESTON RD, SUITE 1000
DALLAS, TX 75252-5793

EXAMINER	
MOORE JR, MICHAEL J	
ART UNIT	PAPER NUMBER
2419	

DATE MAILED: 09/01/2009

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/250,702	12/19/2003	Joakim Norrgard	NET-5388	9055

TITLE OF INVENTION: NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	12/01/2009

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.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

PART B - FEE(S) TRANSMITTAL

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Alexandria, Virginia 22313-1450
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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

25962 7590 09/01/2009

SLATER & MATSIL, L.L.P.
17950 PRESTON RD, SUITE 1000
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(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/250,702	12/19/2003	Joakim Norrgard	NET-5388	9055

TITLE OF INVENTION: NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	12/01/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
MOORE JR, MICHAEL J	2419	370-395210

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,

(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.

1 _____

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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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/250,702	12/19/2003	Joakim Norrgard	NET-5388	9055

25962 7590 09/01/2009

SLATER & MATSIL, L.L.P.
17950 PRESTON RD, SUITE 1000
DALLAS, TX 75252-5793

EXAMINER	
MOORE JR, MICHAEL J	
ART UNIT	PAPER NUMBER
2419	

DATE MAILED: 09/01/2009

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 573 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 573 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.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

Notice of Allowability	Application No.	Applicant(s)	
	10/250,702	NORRGARD ET AL.	
	Examiner	Art Unit	
	MICHAEL J. MOORE, JR.	2419	

-- 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 *the Amendment filed 5/27/2009*.

2. ☒ The allowed claim(s) is/are *32-35,39-41,43,44,48-51,55-57,59,60,62-65,67-69,71 and 72 (renumbered 1-27, respectively)*.

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)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Michael J. Moore, Jr./
Primary Examiner, Art Unit 2419

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 5/27/09 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Allowable Subject Matter

2. Claims **32-35, 39-41, 43, 44, 48-51, 55-57, 59, 60, 62-65, 67-69, 71, and 72** *(renumbered 1-27, respectively)* are allowed.

3. The following is an examiner's statement of reasons for allowance:

Regarding claim **32**, *Schelen* (Doctoral Thesis dated 1998 cited in Applicant's IDS submitted on 3/4/04) teaches a QoS architecture in Figure 3.1, where a core network of domains is interconnected via edge routers and agents A1, A2, A3 (network resource managers).

Schelen also teaches where the agents (network resource managers) are responsible for making call admission control decisions through the use of a resource map that is built via the retrieval of link properties, such as link bandwidths as spoken of on pages 40-41, section 3.2, first paragraph.

Schelen also teaches agents (NRMs) that perform admission control (checking resources) on the links from a starting point towards a destination point (along a path) as spoken of on page 42, section 3.2.1, third paragraph.

Schelen also teaches the use of advance reservation requests, where a start time and a stop time are provided within the request as spoken of on page 47, section 3.3.2. paragraph 1.

Arunachalam (U.S. 6,631,122) teaches the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

However, *Schelen, Arunachalam,* and the other prior art of record fail to teach "communicating resource information between the NRM and the radio resource manager and reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS" in combination with the other limitations of claim **32**.

Regarding claims **33-35, 39-41, 43, and 44,** these claims are further limiting to claim **32** and are thus also allowable over the prior art of record.

Regarding claim **48**, *Schelen, Arunachalam,* and the other prior art of record similarly fail to teach "means for communicating resource information between the NRM and the radio resource manager and means for reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS" in combination with the other limitations of claim **48**.

Regarding claims **49-51, 55-57, 59, and 60,** these claims are further limiting to claim **48** and are thus also allowable over the prior art of record.

Regarding claim **62**, *Schelen, Arunachalam,* and the other prior art of record similarly fail to teach "means for communicating resource information between the NRM and the radio resource manager and means for reserving the IP network resources along the path by the NRM" in combination with the other limitations of claim **62**.

Regarding claims **63-65, 67-69, 71, and 72,** these claims are further limiting to claim **62** and are thus also allowable over the prior art of record.

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."

Response to Arguments

4. Applicant's arguments with respect to the previous prior art rejections of claims **32-35, 39-41, 43, 44, 48-51, 55-57, 59, 60, 62-65, 67-69, 71, and 72** under 35 U.S.C. 103(a) in view of *Arunachalam* and *Schelen* have been fully considered and are persuasive.

Specifically, after further consideration of Applicant's claims in light of Applicant's specification, it is agreed that the claimed "resource map" is specifically defined in the specification and must be given an interpretation in light of this definition. After further consideration of the teachings of *Arunachalam*, it is agreed that the QoS agent 301 does not constitute an NRM as defined in Applicant's specification.

Further, although it appears that *Schelen* teaches QoS agents that make use of a resource map as described above, *Schelen* does not teach the utilization of the claimed NRM and resource map in conjunction with a radio resource manager as claimed.

Accordingly, the previous rejections have been withdrawn.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL J. MOORE, JR., whose telephone number is

(571)272-3168. The examiner can normally be reached on Monday-Friday (7:30am - 4:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pankaj Kumar can be reached at (571) 272-3011. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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.

/Michael J. Moore, Jr./
Primary Examiner, Art Unit 2419

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BIB DATA SHEET

CONFIRMATION NO. 9055

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/250,702	12/19/2003	455	2419	NET-5388

APPLICANTS

Joakim Norrgard, Lulea, SWEDEN;
Anders Larsson, Lulea, SWEDEN;
Olov Schelen, Norrfjarden, SWEDEN;

**** CONTINUING DATA **************************

This application is a 371 of PCT/SE01/02847 12/20/2001

**** FOREIGN APPLICATIONS **************************

UNITED STATES OF AMERICA 60261166 01/16/2001

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **

Foreign Priority claimed	☐ Yes ☑ No		STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	☐ Yes ☑ No	☐ Met after Allowance				
Verified and Acknowledged	/MICHAEL J MOORE JR/ Examiner's Signature	Initials	SWEDEN	6	42	3

ADDRESS

SLATER & MATSIL, L.L.P.
17950 PRESTON RD, SUITE 1000
DALLAS, TX 75252-5793
UNITED STATES

TITLE

Network resource manager in a mobile telecommunication system

FILING FEE RECEIVED		
793	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2419

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

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/05/2008	12/11/2008	02/25/2009	08/28/2009	08/28/2009				
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	35	✓	✓	✓	=					
	36	-	-	-	-					

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
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CLAIM		DATE								
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	72	✓	✓	✓	=					

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2419

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

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/05/2008	12/11/2008	02/25/2009	08/28/2009	08/28/2009				
	73	✓	-	-	-					

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE, JR.	2419

ORIGINAL		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
		H	0	4	W	4 / 00 (2009.01.01)	H	0	4	W	4 / 00 (2009.01.01)
370	329										

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
370	328	349			

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	27	
/MICHAEL J MOORE, JR./ Primary Examiner.Art Unit 2419	08/28/2009	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	48	6

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2419

SEARCHED			
Class	Subclass	Date	Examiner
370	310-350 (narrowed keyword search)	8/28/09	MM

SEARCH NOTES		
Search Notes	Date	Examiner
EAST inventor search (See Search History Printout)	3/4/08	MM
101 consult with Wing Chan (SPE AU 2619)	3/5/08	MM
Updated inventorship Search (PALM/EAST)	8/28/09	MM
370/310-350.ccls. or 455/$.ccls. (Updated EAST Keyword Search - See Search History Printout)	8/28/09	MM

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
	General Interference Search of PGPUB and UPAD claims	8/28/09	MM

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	94	norrgard-joakim.in. or larsson-anders.in. or schelen-olov.in.	US-PGPUB; USPAT	OR	OFF	2009/08/28 13:56
L2	8	L1 and "network resource manager"	US-PGPUB; USPAT	OR	OFF	2009/08/28 13:57
L3	46413	(370/310-350.ccls. or "455"/$.ccls.) and (@ad<"20010116" or @rlad<"20010116")	US-PGPUB; USPAT; DERWENT; IBM_TDB	OR	OFF	2009/08/28 14:14
L4	393	L3 and (("core network" or "CN") and ("radio access network" or "RAN"))	US-PGPUB; USPAT; DERWENT; IBM_TDB	OR	OFF	2009/08/28 14:14
L5	354	L4 and (manager or monitor or agent or controller)	US-PGPUB; USPAT; DERWENT; IBM_TDB	OR	OFF	2009/08/28 14:15
L6	1	("6631122").PN.	USPAT	OR	OFF	2009/08/28 15:00
L7	10	("5995539" | "6131012" | "6144645" | "6154776" | "6160804" | "6262982" | "6295285" | "6377573" | "6385195" | "6404738").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/08/28 15:01
L8	58	("6631122").URPN.	USPAT	OR	OFF	2009/08/28 15:02

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L10	18	(("core network" or "CN") and ("radio access network" or "RAN") and (manager or monitor or agent or controller) and QoS).CLM.	US-PGPUB; USPAT; UPAD	OR	OFF	2009/08/28 15:10

8/28/09 3:12:25 PM
C:\Documents and Settings\mmoore5\My Documents\EAST\Workspaces\mike10250702.wsp

PTO/SB/08a (01-09)
Approved for use through 02/28/2009. OMB 0651-0031
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Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	10/250,702
Filing Date	12/19/2003
First Named Inventor	Norrgard et al.
Art Unit	2419
Examiner Name	Michael J. Moore, Jr.
Attorney Docket Number	NET-5388

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-			
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
/MM/	1	WO 03/021888 A1	03-13-2003	Operax AB		

Examiner Signature	/Michael Moore Jr/	Date Considered	08/28/2009

*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 copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3]Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6]Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **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 (1-800-786-9199) and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Norrgard et al.	Docket No.:	NET-5388
Serial No.:	10/250,702	Art Unit:	2419
Filed:	December 19, 2003	Examiner:	Michael J. Moore, Jr.
For:	Network Resource Manager in a Mobile Telecommunication System		

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

AMENDMENT

Dear Sir:

Applicants respectfully submit the following amendments and remarks in response to Examiner's Office Action dated February 27, 2009. Applicants respectfully request reconsideration of the claims in view of the following remarks.

In the Claims:

1-31. (Canceled)

32. (Previously Presented) A method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission, the method comprising the steps of:

handling radio resources within the RAN by using a radio resource manager;

controlling IP network resources by using a resource map in a Network Resource Manager (NRM) in order to provide said end-to-end QoS, the step of controlling the IP network resources including the steps of the NRM performing path-sensitive call admission control by using the resource map in the NRM, the NRM checking that resources are available along a path, and the NRM pre-allocating resources in an IP network;

scheduling resources over time by introducing a start and a stop time as a parameter in a resource request handled by the NRM;

communicating resource information between the NRM and the radio resource manager; and

reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS.

33. (Previously Presented) Method according to claim 32, wherein the NRM is used within the RAN and the CN.

Ex.1002
CISCO SYSTEMS, INC. / Page 50 of 487

34. (Previously Presented) Method according to claim 32, wherein the NRM is used within the RAN.

35. (Previously Presented) Method according to claim 32, wherein the NRM is used within the CN.

36-38. (Canceled)

39. (Previously Presented) Method according to claim 32, the method comprising the further step of signalling resource information between the NRM and at least a second NRM used within at least a second network domain.

40. (Previously Presented) Method according to claim 32, the method comprising the further step of monitoring topology changes by using the NRM, retrieving routing information concerning the IP network.

41. (Previously Presented) Method according to claim 40, wherein the topology is monitored in order to be able to reallocate the IP network resources.

42. (Canceled)

43. (Previously Presented) Method according to claim 32, wherein the path-sensitive call admission control is parameter based.

44. (Previously Presented) Method according to claim 32, wherein the path-sensitive call admission control is measurement based.

45-47. (Canceled)

48. (Previously Presented) A Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission and a radio resource manager that controls radio resources within the RAN, the NRM comprising a resource map and means for controlling IP network resources within an IP network using the resource map in order to provide end-to-end Quality of Service (QoS),

said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the NRM, for the NRM checking that resources are available along a path, and for the NRM pre-allocating resources in the IP network part of the telecommunication system,

means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request,

means for communicating resource information between the NRM and the radio resource manager, and

means for reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS.

49. (Previously Presented) NRM according to claim 48, further comprising means for being used within the RAN and the CN.

50. (Previously Presented) NRM according to claim 48, further comprising means for using the IP network resources within the RAN.

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51. (Previously Presented) NRM according to claim 48, further comprising means for being used within the CN.

52-54. (Canceled)

55. (Previously Presented) NRM according to claim 48, further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

56. (Previously Presented) NRM according to claim 48, further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

57. (Previously Presented) NRM according to claim 56, wherein the topology is monitored in order to be able to reallocate access resources.

58. (Canceled)

59. (Previously Presented) NRM according to claim 48, wherein the path-sensitive call admission control is parameter based.

60. (Previously Presented) NRM according to claim 48, wherein the path-sensitive call admission control is measurement based.

61. (Canceled)

62. (Currently Amended) A Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio

Access Network (RAN) using Internet Protocol (IP) based transmission and a radio resource manager that controls radio resources within the RAN, the NRM comprising:

a resource map;

means for controlling IP network resources within [[the]] an IP network using the resource map in order to provide feedback to a network operator, said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the NRM, for the NRM checking that resources are available along a path, and for the NRM pre-allocating resources in the IP network part of the mobile telecommunication ~~system,~~ system;

means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource ~~request,~~ request;

means for communicating resource information between the NRM and the radio resource ~~manager,~~ manager;

means for reserving the IP network resources along the path by the ~~NRM,~~ NRM; and

means for providing the feedback to the network operator.

63. (Previously Presented) NRM according to claim 62, further comprising means for being used within the RAN and the CN.

64. (Previously Presented) NRM according to claim 62, further comprising means for using the IP network resources within the RAN.

65. (Previously Presented) NRM according to claim 62, further comprising means for use within the CN.

66. (Canceled)

67. (Previously Presented) NRM according to claim 62, further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

68. (Previously Presented) NRM according to claim 62, further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

69. (Previously Presented) NRM according to claim 68, wherein the topology is monitored in order to be able to reallocate access resources.

70. (Canceled)

71. (Previously Presented) NRM according to claim 62, wherein the path-sensitive call admission control is parameter based.

72. (Previously Presented) NRM according to claim 62, wherein the path-sensitive call admission control is measurement based.

73. (Canceled)

REMARKS

Claims 32-35, 39-41, 43, 44, 48-51, 55-57, 59, 60, 62-65, 67-69, 71, and 72 are pending in the present application. Claims 1-31, 36-38, 42, 45-47, 52-54, 58, 61, 66, 70, and 73 were previously canceled. Claim 62 has been amended herein. No new matter has been added. Applicants respectfully request reconsideration of the claims in view of the following remarks.

As an initial matter, Applicants thank the Examiner for the reconsideration of Applicants' claims and the withdrawal of the previous Office Action, which action was indicated as final.

Claims 32-35, 39-41, 43, 44, 48-51, 55-57, 59, 60, 62-65, 67-69, 71, and 72 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over U.S. Patent No. 6,631,122 (hereinafter "Arunachalam") in view of *Quality of Service Agents in the Internet*, Olov Schelén (hereinafter "Schelén"). Applicants respectfully traverse these rejections.

The Office Action asserted that the QoS agent 301 of Arunachalam discloses the Network Resource Manager (NRM) of Applicants' claim 32. Office Action, page 3. Applicants respectfully disagree. Generally, the QoS agent 301: (1) is not a NRM and does not have a resource map; and (2) does not perform the recited functions. Each of these will be addressed in the following paragraphs.

First, the QoS agent 301 is not a NRM, nor does it have a resource map. "During patent examination, the pending claims must be 'given their broadest reasonable interpretation *consistent with the specification*.'" MPEP § 2111 (citations omitted) (emphasis added). In this case, the specification states that the NRM has "dynamic awareness of network topology and network characteristics." Specification as published, paragraphs [0045] and [0046]. "The NRM gains its dynamic topology awareness by retrieving routing information concerning the IP network, i.e. the topology of the IP network." Specification as published, paragraph [0053].

"The NRM combines the routing information and resource information it receives from call set-up requests to create *a resource map . . . The resource map* contains information on how much resources (e.g. bandwidth) that are available and reserved over time on a per link basis." Specification as published, paragraph [0055] (emphasis added).

The Office Action asserted that the QoS agent 301 is the NRM and that the mapping of the QoS parameter in the wireline network to the CoS parameter in the wireless network is the resource map. This is simply incorrect and is directly contrary to the teachings of the specification. As stated above, the interpretation of the claim language must be "consistent with the specification." There is absolutely no disclosure in Arunachalam that the QoS agent 301 is dynamically aware of the network topology. Nor is there any disclosure in Arunachalam that the QoS agent 301 has a resource map that "contains information on how much resources (e.g. bandwidth) that are available and reserved over time on a per link basis."

The mapping of the QoS parameter in the wireline network to the CoS parameter in the wireless network is not a resource manager as used in Applicants' Specification. Arunachalam explains that the QoS mapping may be done by either (1) mapping customer requirements directly to a service class or (2) mapping from the service class of the wireline network to the service class of the wireless network. Arunachalam, column 6, lines 31-40. Importantly, neither of these discloses a resource map as that term is used in Applicants' Specification. Simply equating the resource map to the mapping of the QoS parameter in the wireline network to the CoS parameter in the wireless network as proposed by the Office Action completely ignores the specification and is inconsistent with the specification. Such an interpretation is prohibited by the MPEP.

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Second, assuming solely for the purpose of the response that the QoS agent 301 may be considered the NRM, Arunachalam fails to disclose that the QoS agent 301 performs the recited steps. Applicants' claim 32 recites that the controlling IP network resources by the NRM includes: (1) the NRM performing path-sensitive call admission control by using the resource map; (2) the NRM checking that resources are available along a path; and (3) the NRM pre-allocating resources in the IP network.

The Office Action is unclear regarding how Arunachalam discloses that the QoS agent 301 performs these steps. It appears that the Office Action grouped these three separate steps in the following paragraph on page 3 of the Office Action.

> *Arunachalam* also teaches the QoS agent (NRM) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

It should be noted, however, that the section of Arunachalam referred to by the Office Action (column 5, lines 38-48) is related to the *downlink*, *e.g.,* from the base station to the handset. In particular, column 5, lines 38-48 of Arunachalam is related to the radio interface of the Radio Access Network (RAN), not the IP Network.

Further, the cited section of the Office Action asserted that the QoS agent "controls dynamic radio resource allocation." Regardless of whether this is true or not, it is simply irrelevant. The relevant section of Applicants' claim 32 recites "controlling the *IP network*." The radio resource, on the other hand, is part of the RAN, not the IP network.

Arunachalam also fails to disclose that the QoS agent 301 checks that resources are available along a path. It should be noted that it is the step of controlling the IP network that

includes the step of "checking that resources are available along a path." Thus, the resources that are checked are in the IP network. The Office Action asserts that the radio resources are checked. Again, whether or not this is true, it is simply irrelevant. The radio resources are in the RAN, not the IP network.

In view of the above remarks, it is clear that the QoS agent 301 of Arunachalam is not a NRM that controls IP network resources or has a resource map consistent with the specification. As a result, Applicants respectfully request that the rejections of claim 32 be withdrawn.

Applicants' claim 48 recites, "said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the NRM, for the NRM checking that resources are available along a path, and for the NRM pre-allocating resources in the IP network part of the telecommunication system." The Office Action asserted that the QoS agent 301 of Arunachalam discloses the NRM. For reasons similar to those recited above, the QoS agent 301 fails to disclose the limitations recited in claim 48.

Applicants claim 62 recites, "means for controlling IP network resources within an IP network using the resource map in order to provide feedback to a network operator, said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the NRM, for the NRM checking that resources are available along a path, and for the NRM pre-allocating resources in the IP network part of the mobile telecommunication system." The Office Action asserted that the QoS agent 301 of Arunachalam discloses the NRM. For reasons similar to those recited above, the QoS agent 301 fails to disclose the limitations recited in claim 62.

In view of the above remarks, Applicants respectfully request that the rejections of claims 48 and 62 be withdrawn as well.

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Claims 33-35, 39-41, 43, and 44 depend from and further limit claim 32, claims 49-51, 55-57, 59, and 60 depend from and further limit claim 48, and claims 63-65, 67-69, 71, and 72 depend from and further limit claim 62. Accordingly, it is respectfully submitted that these dependent claims are allowable by reason of depending from an allowable claim as well as for adding new limitations.

Applicants have made a diligent effort to place the claims in condition for allowance. However, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Roger C. Knapp, Applicants' attorney, at 972-732-1001 so that such issues may be resolved as expeditiously as possible. The Commissioner is hereby authorized to charge any fees that are due, or credit any overpayment, to Deposit Account No. 50-1065.

Respectfully submitted,

May 27, 2009
Date

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Norrgard et al.	Docket No.:	NET-5388
Serial No.:	10/250,702	Art Unit:	2419
Filed:	December 19, 2003	Examiner:	Michael J. Moore, Jr.
Title:	Network Resource Manager in a Mobile Telecommunication System		

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

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Applicants wish to bring to the attention of the U.S. Patent and Trademark Office the information noted on the enclosed form PTO/SB/08a, which may be considered material to the examination of the above-identified application. Applicants have included a copy of the foreign patent.

This Information Disclosure Statement is submitted under 37 C.F.R. §1.97(c) together with a $180.00 fee under 37 C.F.R. §1.17(p) after the C.F.R. §1.97(b) time period, but before final action or notice of allowance, whichever occurs first. Please charge the required fee of $180.00 and any additional amount, or credit any overpayment to Deposit Acct. No. 50-1065 of the below mentioned firm.

Respectfully submitted,

May 27, 2009
Date

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	10/250,702
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First Named Inventor	Norrgard et al.
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Examiner Name	Michael J. Moore, Jr.
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		US-			
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FOREIGN PATENT DOCUMENTS

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	1	WO 03/021888 A1	03-13-2003	Operax AB		

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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 copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3]Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6]Applicant is to place a check mark here if English language Translation is attached.

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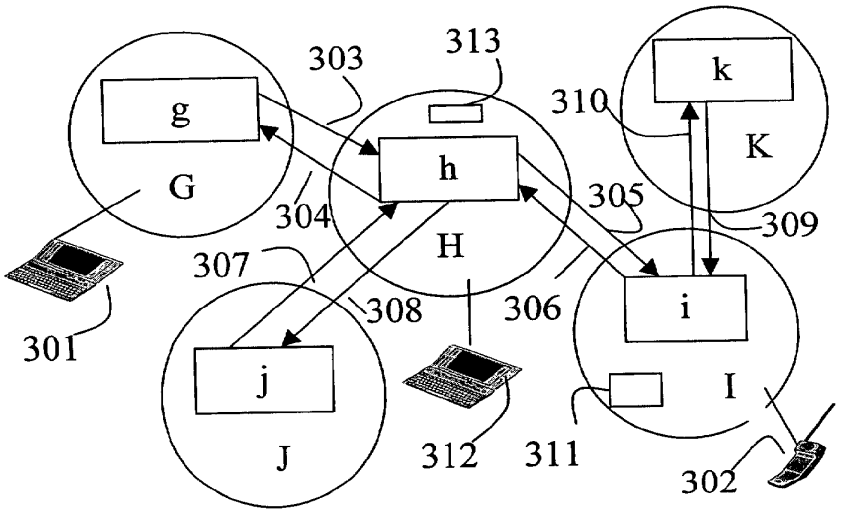
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[Continued on next page]

(54) Title: METHOD AND ARRANGEMENT IN AN IP NETWORK



300

(57) Abstract: The present invention relates to a method and an arrangement in an IP network. The object of the present invention is to provide a scalable solution for reserving resources to obtain a predictable QoS end-to-end in a heterogeneous IP network The object is achieved by categorising the destination domain with a domain property label that e.g. informs about the availability of resources in the destination domain and about how to obtain QoS to the endpoint in this particular domain category.

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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.

METHOD AND ARRANGEMENT IN AN IP NETWORK

FIELD OF INVENTION

The present invention relates to a method and an arrangement in an IP network. In particular, it relates to reserving resources to obtain a predetermined Quality of Service (QoS) end-to end for a certain stream of IP packets.

BACKGROUND OF THE INVENTION

The Internet is based on the Internet Protocols (IP) as standardised by the IETF. Some initial objectives with the IP protocols were to interconnect different kinds of physical networks into one large virtual network and to provide a uniform platform for supporting a large range of applications. Some technical reasons for the tremendous success in reaching these objectives are:

- Stateless packet forwarding: IP datagram forwarding is stateless with respect to application data streams. Forwarding is performed according to a table of destination address prefixes.
- Dynamic and scalable routing: Routes are set up by distributed and dynamic intra- and inter-domain routing protocols such as Open Shortest Path First (OSPF) and Border Gateway Protocol (BGP). These routing protocols automatically detect network failures and set up new routes to avoid failure. Inter-domain routing scales well due to aggregation of network address prefixes into destination rooted sink tree.

The IP is designed to be used in networks where different traffic flows share network resources equally. This means that the received QoS depends on the current load in the network.

Currently, the Internet becomes more heterogeneous, both in terms of link technologies ranging from fiber optics to wireless, in terms of application service demands ranging from real-time interactive to asynchronous bulk data transfer, and in terms of user demands ranging from business critical use to unstructured home entertainment. This development drives the need for service differentiation in the network. A requirement on QoS mechanisms is that they should be developed according to the basic principles of stateless packet forwarding and scalable aggregation as described above.

The state of the art of QoS in IP networks is described below:

Integrated Service (IntServ)/ Resource ReSerVation Protocol (RSVP)

The IntServ architecture and RSVP is a signalled architecture to provide end-to-end QoS guarantees for individual application data streams. The solution provides fine granular service guarantees at the price of per flow state complex packet classification in routers along the path.

For RSVP, there are proposals for setting up aggregated tunnels between an aggregator and a de-aggregator. While this is more scalable, it is still a model where aggregated tunnels are established between pairs of edge routers. These edge routers suffer from at least the same complexity as standard IntServ/RSVP routers. For network policy management, RSVP relies on policy servers.

Differentiated Service (DiffServ)

DiffServ architecture standardises router support for class-based forwarding. DiffServ forwarding in core routers is stateless with respect to application data streams. Traffic conditioners at domain boundaries are used to guard a domain against overload.

The problem of DiffServ is to meet QoS demands for a large range of applications. Resources (bandwidth) for the various traffic classes can be provisioned semi-statically, dimensioned according to expected service

characteristics and assumed usage statistics. However, to provide predictable service levels through provisioning only, resources must be over-provisioned. This may be possible in homogeneous networks with homogeneous applications and user demands. In real networks where links with vastly different characteristics are interconnected (e.g. fiber optic access and wireless access) and applications/users with various demands over provisioning at all hops is a huge challenge.

To provide predictable services in a heterogeneous environment, DiffServ must rely on dynamic Network Resource Management (NRM) to control the service quality and the usage of provisioned resources. To meet scalability demands, resource management should support aggregation of resource requests.

Multi-protocol label switching (MPLS)

MPLS is a method that extends traditional IP network layer routing and control protocols with label-switched forwarding. MPLS provides connection-oriented switching in IP networks. Labels are associated with specific streams of data (known as Forwarding Equivalence Classes (FEC)). The labels and their FEC bindings are distributed across the network, the MPLS domain, to establish a label switched path. Entering the domain, packets are assigned one or more labels (a stack of labels). Passing through the domain, packets are forwarded based on labels. MPLS can be used to provide QoS by allocating resources to specific label switched paths. MPLS operates only within individual label switched domains. Inter-domain resource reservations are currently not supported.

All methods described above need additional support for inter-domain resource provisioning. This can be provided by a server-based architecture. For RSVP, an architecture of policy servers has been suggested. For DiffServ, QoS agents and bandwidth brokers have been suggested. For MPLS, QoS agents that understand the semantics of MPLS could be used.

In *Schelen, O. Quality of Service Agents in the Internet, Doctoral Thesis, Department of Computer Science and Electrical Engineering, Division of Computer Communication, Luleå University of Technology, Luleå, 1998*, a Network Resource Manager (NRM) is introduced. An NRM can provide inter-domain resource provisioning and call admission control, either independently of the mechanism described above or in co-operation with them. Among these, the combination of differentiated forwarding and NRM operates along the fundamental lines of stateless forwarding and inter-domain aggregation as described. The NRM has path-sensitive admission control, scheduling of resources over time, capability to handle resource requests for immediate and future use, resource signalling between resource manager entities (i.e. inter-domain communication) and aggregation of resource requests towards a destination domain identified by an address prefix. The NRM is aware of topology and characteristics of the network and can thus keep track of resources that exist in a routing domain based on topology. For each domain in the network there is an NRM responsible for admission control. Instances of NRM can perform admission control in its own domain and reserve resources with neighbouring NRMs for other destinations. The NRM can therefore provide a predictable QoS.

The funnel concept is also introduced in Schelen. The funnel concept is a scalable model for aggregation of resource requests. The funnel concept uses NRMs, and NRMs ask for resources from other NRMs. Reservations from different sources to the same destination are aggregated where they merge along the paths so each NRM has at most one reservation per destination domain with their neighbouring agents. An NRM in charge of the domain where the destination point is located can generalize received reservation requests for that point to cover any endpoint in its domain. **Figure 1** shows how resource requests are aggregated towards the destination domain. Figure 1 is a network 100 comprising 4 domains A, B, C and D. Each domain has an NRM a, b, c, d. Dx, Dy and Dz may be a subnetwork or a base station controller in a wireless access network. The

NRM a and the NRM b need resources in domain D; the NRM a to Dy and the NRM b to Dx. Thanks to that the NRMs are aware of the network topology they know that the packets have to be transmitted through domain C. In this example, the NRM a transmits 109 a request of 20 resource units to the NRM c and the NRM b transmits 111 a request of 10 resource units to the NRM c. The NRM c needs 10 resource units in domain D for its own domain and sends therefore a request to the NRM d for 40 resource units. Then the NRM d transmits 114 a confirmation to the NRM c that 40 resource units are reserved in domain D and the NRM c further transmits 110 one confirmation to the NRM a and transmits 112 one confirmation to NRMb. Packets using a reservation are marked by applications or edge routers and checked and/or remarked by police points. This is to ensure that packets only with allowed QoS-class utilize the reserved path.

In the funnel concept, it is assumed that the destination domain is well provisioned or another mechanism is used to ensure QoS in the destination domain. In large networks, it would not be preferable to use the above described funnel concept all the way to the endpoint, since that would not be scalable enough. Instead, funnels are used to reach a destination domain (e.g., a subnet) of suitable size. No resources are reserved for the final part of the path within the destination domain. Therefore, the funnel concept cannot by itself provide end-to-end, i.e. from a source endpoint to a destination endpoint, QoS if the destination domain is under-provisioned. However, there exist destinations that are not connected to a well-provisioned destination domain. One example on such a domain is a wireless access network, where the last hop, i.e. between the base station and the terminal is a bottleneck link. Another problem arises when the hosts are mobile terminals. The QoS mechanisms must allow quick local re-computation of QoS at handover between base stations in a wireless access networks.

SUMMARY

The objective problem is to provide a scalable solution for reserving resources to obtain a predictable QoS end-to-end in a heterogeneous IP network.

The problem is solved by an IP network having the features of claim 1 and by a Network Resource Manager (NRM) unit having the features of claim 16. The problem is also solved by a method having the features of claim 27 and by a computer program product having the features of claim 42 and 44.

The method implemented in the IP network provided by the present invention comprising the steps of:
-a second NRM *announcing* a domain property label of a destination to the first NRM;
-the first NRM and the second NRM respective *performing* appropriate actions for transmitting IP packets with a predetermined QoS between a source terminal and a destination terminal, according to the announced domain property label,
makes it possible to reserve resources in order to obtain a predictable QoS end-to-end in a heterogeneous IP network.

An IP network, wherein the second NRM comprises means for announcing a domain property label of the destination domain to a first NRM, and wherein
the first NRM and the second NRM respective comprise means for performing an appropriate action, for transmitting IP packets with a predetermined QoS between a source terminal and a destination terminal, according to the announced domain property label,
makes it possible to reserve resources in order to obtain a predictable QoS end-to-end in a heterogeneous IP network.

An advantage with the present invention is that the NRM path vector works as a tool for identifying NRMs in requested destination domain and NRMs along the path.

Another advantage with the present invention is that the NRM path vector provides a tool for detecting denials and failures along the path towards the endpoint.

Yet another advantage is that present invention provides a tool to distinguish between destination domains with different characteristics.

Yet another advantage is that the present invention can utilize the scalable properties of the funnel model in networks with under provisioned destination domains.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows an example of prior art where resource requests are aggregated towards the destination domain by using the funnel concept.
Figure 2 shows a network comprising two domains according to the present invention.
Figure 3 discloses an example of inter-domain resource reservation according to the present invention.
Figure 4 depicts a sequence diagram of the resource reservation according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 2 shows an IP network 200 according to a first embodiment of the present invention. The network 200 comprises a first domain E and a

second domain F. A domain is a logic part of an IP network and the division is done for administrative reasons. A domain is in the present invention referring to a routing domain.

Domain E comprises a router 201, a Network Resource Manager (NRM) e, a server 210 and a subnetwork 208 comprising a terminal 207. In the example described in **figure 2**, the domain E may be a source domain. Or the source domain may be a third domain that transmits packets through domain E in order to reach a destination domain F. The domain, wherein the terminal of the sender is located, is referred to as the source domain.

The destination domain F and comprises a server 211, a router 202, an NRM f, a subnetwork 203 and an endpoint within one of the subnetworks 203. A domain wherein the endpoints are located is referred to as the destination domain.

Each subnetwork 203, 208 further comprises at least one terminal 204, 207. Each terminal 204 is assigned a dynamic or static IP address by the subnetwork 203, 208. The terminal 204, whereto the packets are intended to be sent, is referred to as an endpoint. The subnetwork 203, 208 may exemplary be a LAN, comprising at least one gateway, at least one server and at least one terminal, or a wireless network, comprising at least one Radio Network Controller (RNC), at least one Base Station (BS) and at least one mobile terminal. The terminal 204, 207 may preferable be a PC or an IP telephone in a wireline network or a mobile phone or a laptop in a wireless network.

The routers 201, 202 respective interconnect 206, 212, 209 different networks 203, 208 e.g. different LANs comprising terminals. An NRM e,f comprises of a computer program for e.g. reserving resources and may e.g. be implemented in a respective server 210, 211 or alternatively in a

respective router 201, 202. A server is substantially a device for storing and computing data while the router is mainly routing IP packets.

The NRM has the features as described above under "Background of the invention" e.g. performing admission control and inter-domain communication 205, 210 and aggregation of resource requests by using the funnel concept all the way to the NRM in the destination domain. The NRMs are further responsible for destination address prefix aggregation by announcing appropriate destination address prefix and according to the present invention label those destinations with a domain property label. By categorising each domain with a domain property label, it is possible to separate between domains with different characteristics such as availability of resources e.g. bandwidth. The domain property label comprises information about what method to use in this domain, in order to obtain QoS to an endpoint within the domain. The funnel concept works well for reserving resources in a scalable manner all the way to the NRM in the destination domain, but what remains is the way from the NRM to the endpoint within the destination domain. Therefore, it is the properties, i.e. domain property label of the destination domain that is of special interest.

An NRM f within a destination domain F that has received a resource request transmits a confirmation message (provided that the request is granted) to NRMs e and in some cases other units, involved in the request. The confirmation message informs that a certain amount of resources are reserved so a requested QoS can be fulfilled to the destination NRM F. The domain property label is added in the confirmation message or may be sent in a separate message. By reading the domain property label, the NRMs and in some cases said other units involved in the request are informed whether they are required to reserve resources or not. If resources have to be reserved due to that the destination domain is under provisioned, the domain property label tells how the resource reservation should be handled.

Domain property label

The domain property label is defined, in a domain property label field. The label field may e.g. comprise of 16 bits and may be a part of the data transmitted between the NRMs. The label field allows a large number of domain property labels to be defined. The NRMs communicate with an application protocol over Transmission Control Protocol (TCP), and the application protocol defines the domain property label field. The information is routed the normal way and there can be resources pre-reserved for the transmission of the domain property label. Definitions of four types of property labels are given below:

- The domain property label **"Provisioned"** provides the information that the domain is well–provisioned of resources and no reservations of resources are required to provide QoS to the endpoint within the domain. This appears e.g. in well-provisioned Local Area Networks (LANs). No action is required by the requesting units such e.g. a terminal 207 or an NRM e.
- The domain property label **"Catered"** provides the information that the domain handles QoS set-up locally through an NRM called by e.g. the endpoint, a proxy or a Radio Network Controller (RNC). In the case where the endpoint is located within a radio access network, where resources are handled by a Radio Network Controller (RNC) in co-operation with a local IP resource manager, the RNC negotiates with a local NRM for resources. The RNC controls the terminal (end-point) and is aware of when the terminal requests a service that demands QoS end-to-end.
- The domain property label **"Requested"** provides the information that the domain handles QoS through an NRM that can be called by a requesting unit e.g., sending terminal 207, an NRM e or a proxy, to extend QoS to a particular endpoint from the NRM. The address of the NRM is known through a NRM path vector. The NRM path vector is further described below in "NRM path vector".

- The domain property label **"Signalled"** provides the information that the QoS within the domain is handled by signalling. The sending entity is transmitting "Resource ReSerVation Protocol (RSVP) path" messages within the data to allow the receiving terminal 204 to request QoS in the destination domain, and the receiving entity is transmitting "RSVP resv" messages. This implies that the sending entities (and the receiving) have to be located along the path of the traffic, as terminal 207. However, the NRM e is not able to send these RSVP messages but has to tell router 201 that the messages should be transmitted via a proxy to the destination.

The four domain property labels described above are given in order to make it possible to distinguish between destination domain with different characteristics. Although, other domain property labels may be defined and used in relation with the method described.

NRM path vector

A Network Resource Manager (NRM) path vector is introduced according to the present invention to allow identification of network resource managers along the path to a destination. For each funnel towards a given destination, the NRM path vector tells the sequence of NRMs that have granted the resources. The NRM path vector is a tool for identifying NRMs in requested destination domains. Denials and failures may also be detected by the NRM path vector, e.g., if a request is denied the path vector shows where denial occurred, or if an NRM is inaccessible said path vector shows where the problems are located. The NRM path vector is used for the label requested. However, the NRM path vector may be used for the labels signalled, provisioned, and catered in order to identify NRMs.

An IP network 300 according to a second embodiment of the invention is disclosed in **figure 3**. The IP network 300 comprises five routing domains G,H,I,J,K, wherein one domain G is a source domain and one domain I is

the destination domain. The source domain G comprises an NRM g and an endpoint constituting a terminal 301 and the destination domain I comprises an NRM i, a destination unit 311 and an endpoint 302. Further, the intermediate domain H comprises an NRM h, an endpoint 312 and a device 313, the domain J comprises an NRM j and the domain K comprises an NRM k. Each NRM can communicate with other NRMs within other domains and with the endpoints.

Referring to **figure 3**, the terminal 301 wants to send IP packets, requiring a predetermined QoS, to terminal 302. According to the topology of the network in this example, the IP packets require to pass by the domain H to reach the domain I. In order to fulfil the requested QoS, resources, in this example ten units, are reserved from terminal 310 to the endpoint (terminal 302) in the destination domain I. (More resources than what is necessary, to fulfil the requested QoS, may also be requested.) The amount of resources may be measured in bandwidth and/or requirements on delay and/or jitter. The following steps are performed:

-The terminal 301 first *requests* ten units from the NRM g and then
- the NRM g *requests* 303 ten units to the endpoint 302 from the NRM h.

This second request is aggregated with other requests from other domains e.g. the domain J sends a request 307 for five units to an endpoint located in the domain K, that has data to send which also have to pass through the domain H and have its destination in the domain I or beyond, e.g. the domain K. Each NRM comprises only one or a few reservations per destination domain. For example, the QoS may be divided into different classes in terms of e.g. delay, bitrate, etc. Thus, it could be one reservation per destination domain and per QoS-class.

Subsequently, the NRM g requests 303 resource from the adjacent NRM h, two different methods for reserving resources all the way to the NRM i can be used. **"Alt. 1"** is used when the NRM h has pre-reserved resources to the domain I and **"alt 2"** is used when the NRM h has no pre-reserved resources to the domain I.

Alt 1: In most operations, resources may be granted all the way to the destination domain at a first NRM, since an NRM may perform pre-reservations of resources according to target over-allocations and heuristics for demands over time e.g., time of day and day of week. A request would thus be granted immediately by a first NRM h for resources all the way to the NRM i in the destination domain.

-A confirmation message is *sent* 304 by the adjacent NRM after each resource-negotiation e.g., from the NRM h to the NRM g and from the NRM h to the NRM j 308.

-the NRM h and the NRM i *add* their own identities e.g., their IP addresses, to an NRM path vector in order to update the vector.

-The NRM path vector is included in the confirmation message.

-TheNRM h *announces* the domain property label of the domain I to the NRM g. The NRM h received the domain property label of the domain I when the pre-reservation of resources to the domain I was performed.

-The terminal 301 is *given* the announced domain property label from the NRM g and a confirmation that resources are reserved to the domain I.

Alt 2: In some cases, when no pre-reservations are performed a request 303 would result in a chain of requests between adjacent NRM to setup resources. Then, confirmations are propagated back towards the origin. A confirmation means that resources are available to the destination domain as indicated in the confirmation message.

-NRM h *requests* 305 five plus ten units from NRM i.

-NRM i *receives* the request and notices that the destination is located in its domain.

-A confirmation message is *sent* 306 by NRM i to NRM h, where NRM i responds that 15 units are reserved to h.

-NRM i is *added* in the NRM path vector and the vector is sent in the confirmation message 306.

- NRM i *announces* the **domain property label** of domain I to NRM h.

-A confirmation message is *sent* 304 by NRM h to NRM g, where NRM h responds that 10 units are reserved to g.

-NRM h *adds* its own identity to the NRM path vector, that now contains the identity of NRM i and NRM h. The vector is included in the confirmation message 304.

-NRM h *announces* the **domain property label** to NRM g.

-Terminal 301 is given the announced domain property label from NRM g and a confirmation that resources are reserved to domain I.

When **alt 1** or **alt 2** is performed appropriate actions are performed according to the announced domain property label.

If the domain property label is provisioned:

No resources are reserved in the destination domain.

-The IP packets are *routed* according to conventional routing protocols to the end-point 302 on unreserved paths.

If the domain property label is catered:

The destination domain I handles QoS set-up locally through an NRM i.

-A destination unit 311, which may e.g. be the end-point, a proxy or preferably a Radio Network Controller (RNC) in a wireless network is *calling* the NRM i within the destination domain. (The RNC controls the radio resources of the end-terminal).

-The destination unit 311 *negotiates* with the destination NRM for the requested resources. Each destination unit 311 must recognise its most local NRM. That can be done with configuring each destination unit 311.

If the domain property label is requested:

-A requesting unit, e.g. an endpoint 301, proxy or the NRM g, wherefrom the IP packets origin, is *calling* the NRM i. QoS is then handled through the NRM i to further extend QoS to a particular end-point 302. The

address of the NRM i is known by the requesting unit through the NRM path vector.

If the domain property label is signalled:

-The sender 301 is *transmitting* a "RSVP path" message to allow the receiver 302 to request QoS to the endpoint 302.

-The receiver is then *transmitting* a "RSVP resv" message to reserve resources in the destination domain I.

Figure 4 shows a flowchart of a method according to the invention in a general mode. The method is performed in an IP network and is intended for transmission of IP packets from a source terminal, located in a source domain, to a destination terminal, located in a destination domain, wherein the source domain and the destination domain respective comprise an NRM. The method comprises the following steps:

401. A first NRM e located within said source domain E requests a resource, from a second NRM f located within said destination domain F.
402. NRM f adds its identity to the NRM path vector in order to update the vector.
403. NRM f announces a domain property label of the destination domain F to the first NRM e.
404. NRM e and NRM f perform an appropriate action for transmitting IP packets with a predetermined end-to-end QoS.

The method is implemented by means of a computer program product comprising the software code means for performing the steps of the method. The computer program product is run on processing means in a server or a router. The computer program is loaded directly or from a computer usable medium, such as a floppy disc, a CD, the Internet etc.

The present invention is not limited to the above-described preferred embodiments. Various alternatives, modifications and equivalents may be used. Therefore, the above embodiments should not be taken as limiting the scope of the invention, which is defined by the appending claims.

CLAIMS

1. IP network (200), comprising a plurality of domains including a source domain (E) and a destination domain (F), the source domain (E) comprises a source terminal (207) and a first Network Resource Manager (NRM) (e), the destination domain (F) comprises a destination terminal (204) and a second NRM (f);
the source terminal (207) in the source domain (E) comprises
means for sending IP packets requiring a predetermined QoS to the destination terminal (204);
the first NRM (e) in the source domain (E) comprises
means for requesting from a second NRM (f), a resource, being sufficient for the transmission of the IP packets to be able to fulfil said QoS,
said IP network (200) is **characterised** in that
the second NRM (f) comprises
means for announcing a domain property label of the destination domain (F) to the first NRM (e), and
the first NRM (e) and the second NRM (f) respective comprise
means for performing an appropriate action, for transmitting the IP packets with said QoS between the source terminal (207) and the destination terminal (204), according to the announced domain property label.

2. IP network (300) according to claim 1, wherein the IP packets from said source domain (G) are transmitted to said destination domain (I) via one intermediate domain (H);
said intermediate domain (H) comprising at least one NRM (h) adapted for inter-domain communication with an NRM (g;i) within an adjacent domain (G;I).

3. IP network (200) according to any of the claims 1-2, wherein it comprises means for using an NRM path vector to identify said NRM (f) within the destination domain (F).

4. IP network (200) according to any of the claims 1-3, wherein it comprises means for using an NRM path vector to identify said NRMs (e,f) along a path from the source terminal (207) to the end-terminal (204).

5. IP network (200) according to any of the claims 1-4, wherein it comprises means for using an NRM path vector to detect denials and /or failures along a path, from the source terminal (207) to the end-terminal (204).

6. IP network (200) according to any of the claims 1-5, wherein the second NRM (f) comprises means for adding its own identity to an NRM path vector.

7. IP network (200) according to any of the claims 1-6, wherein the second NRM (f) comprises means for sending a message (210) to the adjacent NRM (e), said message (210) comprising said NRM path vector.

8. IP network (300) according to any of the claims 1-7, wherein an NRM (h) comprises means for aggregating said resource request (303) with other requests from an other domain (J).

9. IP network (200) according to any of the claims 1-8, wherein said announced property label is provisioned; the means for performing an appropriate action comprises means for transmitting IP packets on unreserved resources.

10. IP network (200) according to any of the claims 1-8, wherein said announced property label is catered; the means for performing an appropriate action comprises a device in the destination domain that further comprises means for calling an NRM (f) in the destination domain to ensure QoS to the end-terminal.

11. IP network (200) according to claim 10, wherein said device is a Radio Network Controller (RNC) and the end-terminal (204) is a mobile terminal.

12. IP network (200) according to any of the claims 1-8, wherein said announced property label is requested; the means for performing an appropriate action comprises a requesting device that further comprises means for calling an other NRM, and the other NRM comprises means for extending resource reservations from said local NRM to a particular destination terminal (204).

13. IP network (200) according to claim 12, wherein the requesting device is the original requesting device (207) or an NRM (e).

14. IP network (200) according to any of the claims 12-13, wherein the IP network (200) comprises means for using the NRM path vector for identifying an address of said other NRM.

15. IP network (200) according to any of the claims 1-8, wherein said announced property label is signalled; the means for performing an appropriate action comprises the source terminal (207) that further comprises means for transmitting "Resource ReSerVation Protocol (RSVP) path" messages to the destination terminal (204) and the destination terminal 204 that further comprises means for transmitting "RSVP resv" messages in order to reserve resources within the destination domain (F).

16. Network Resource Manager (NRM) unit (h) within a domain (H) within an IP network (300), according to any of the previous claims, comprising
means for receiving a resource request 306 from a second NRM (i), located within a second domain (I),
said NRM is **characterised** in that
the NRM (h) comprises
means for announcing a domain property label of the domain (H) to the second NRM (i), and
means for performing an appropriate action, to provide a QoS end-to-end, between a first endpoint (312) and a second endpoint (302), according to the announced domain property label.

17. NRM unit (h) according to claim 16, wherein it further comprises means for using an NRM path vector to identify a third NRM (g) within the third domain (G).

18. NRM unit (h) according to any of the claims 16-17, wherein it further comprises means for using an NRM path vector to detect denials and/or failures along a path, between a first endpoint (312) and a third endpoint (302).

19. NRM unit (h) according to any of the claims 16-18, wherein it further comprises means for adding its own identity into an NRM path vector.

20. NRM unit (h) according to any of the claims 16-19, wherein it further comprises means for sending a message (305) to the second NRM (m), said message (305) comprising said NRM path vector.

21. NRM unit (h) according to any of the claims 16-20, wherein it further comprises means for aggregating said resource request (306) with other requests from an other domain (J).

22. NRM unit (h) according to any of the claims 16-21, wherein said announced property label is catered, and wherein the means for performing an appropriate action comprises means for receiving a call from a device (313) within the domain (H), wherein the call further comprises a request to said NRM (h) to ensure QoS to the end-terminal (312).

23. NRM unit (h) according to claim 22, wherein said device (313) is a Radio Network Controller (RNC) and the end-terminal (312) is a mobile terminal.

24. NRM unit (h) according to any of the claims 16-21, wherein said announced property label is requested, and wherein the means for performing an appropriate action comprises means for receiving a call from a requesting device and extending resource reservations from the NRM unit (h) to a particular endpoint (312).

25. NRM unit (h) according to claim 24, wherein the requesting device is an endpoint (302) within domain (I) or an NRM (i).

26. NRM unit (h) according to any of the claims 24-25, wherein it further comprises means for having its address identified by the NRM path vector.

27. Method for reserving resources within an IP network (200), according to any of the previous claims, to obtain a predetermined QoS between a source terminal (207) within a source domain (E) and a destination terminal (204) within a destination domain (F), the method comprising the step of:

-a first Network Resource Manager (NRM) (e), located within said source domain (E), *requesting* from a second NRM (f), located within

said destination domain (F), a resource required for fulfilling said QoS, said resource being intended for transmission of IP packets

characterised by the method comprising the further steps of:

-the second NRM (f) *announcing* a domain property label of the destination to the first NRM (e);

-the first NRM (e) and the second NRM (f) respective *performing* appropriate actions for transmitting said IP packets with said QoS between the source terminal (207) and the destination (204) terminal, according to the announced domain property label.

28. Method according to claim 27, wherein the IP packets from said source domain (G) are transmitted to said destination domain (I) via a third domain (H);

said third domain (H) comprising at least one NRM (h) adapted for inter-domain communication with an NRM (g;i) within an adjacent domain (G;I).

29. Method according to any of claims 27-28, comprising the further step of:

-*using* an NRM path vector to identify said NRM (f) within the destination domain (F).

30. Method according to any of the claims 27-29, comprising the further step of:

-*using* an NRM path vector to identify said NRMs (e,f) along a path from the source terminal (207) to the end-terminal (204).

31. Method according to any of the claims 27-30, comprising the further step of:

-*using* an NRM path vector to detect denials and /or failures along a path, from the source terminal (207) to the end-terminal (204).

32. Method according to any of the claims 27-31, comprising the further step of:

-*adding* the identity of the NRM (f) to an NRM path vector.

33. Method according to claim 32, comprising the further steps of:

-*sending* a message (210) to the adjacent NRM (e), and

-*including* said NRM path vector in the message (210).

34. Method according to any of the claims 27-33, comprising the further step of:

-*aggregating* said resource request (303) with other requests from another domain (J) within the IP network (300).

35. Method according to any of the claims 27-34, wherein said announced property label is provisioned; the appropriate action comprising the step of:

-*transmitting* IP packets on unreserved resources.

36. Method according to any of the claims 27-34, wherein said announced property label is catered; the appropriate action comprising the step of:

-*calling* an NRM (f) within the destination domain (F) to ensure QoS to the end-terminal (204).

37. Method according to claim 36, wherein a Radio Network Controller (RNC) is *calling* said NRM (f) within the destination domain (F) to ensure QoS to the end-terminal and the end-terminal (204) is a mobile terminal.

38. Method according to any of the claims 27-34, wherein said announced property label is requested; the appropriate action comprising the step of:

-*calling* an other NRM that extends resource reservations from said other NRM to a particular destination terminal (204).

39. Method according to claim 38, wherein the original requesting device or an NRM (e) is *calling* said other NRM.

40. Method according to any of the claims 38-39, comprising the further step of:
-*using* the NRM path vector for identifying an address of said other NRM.

41. Method according to any of the claims 27-34, wherein said announced property label is signalled; the appropriate action comprising the steps of:
-the source terminal (207) *transmitting* "Resource ReSerVation Protocol (RSVP) path" messages to the destination terminal (204) in the destination domain (F)
-the destination terminal (204) transmitting "RSVP resv" messages in order to reserve resources within the destination domain (F).

42. A computer program product directly loadable into a processing means within a server and/or a router an IP network, comprising the software code means for performing the steps of any of the claims 27-41.

43. A computer program product directly loadable into a processing means within a server and/or a router in an IP network according to claim 42, wherein the processing means also is located within a Radio Network controller, proxy or terminal.

44. A computer program product stored on a computer usable medium, comprising readable program for causing a processing means in an IP network, to control the execution of the steps of any of the claims 27-41.

45. A computer program product stored on a computer usable medium, comprising readable program for causing a processing means within a server and/or a router in an IP network according to claim 44, wherein the processing means also is located within a Radio Network controller, proxy or terminal.

1(4)

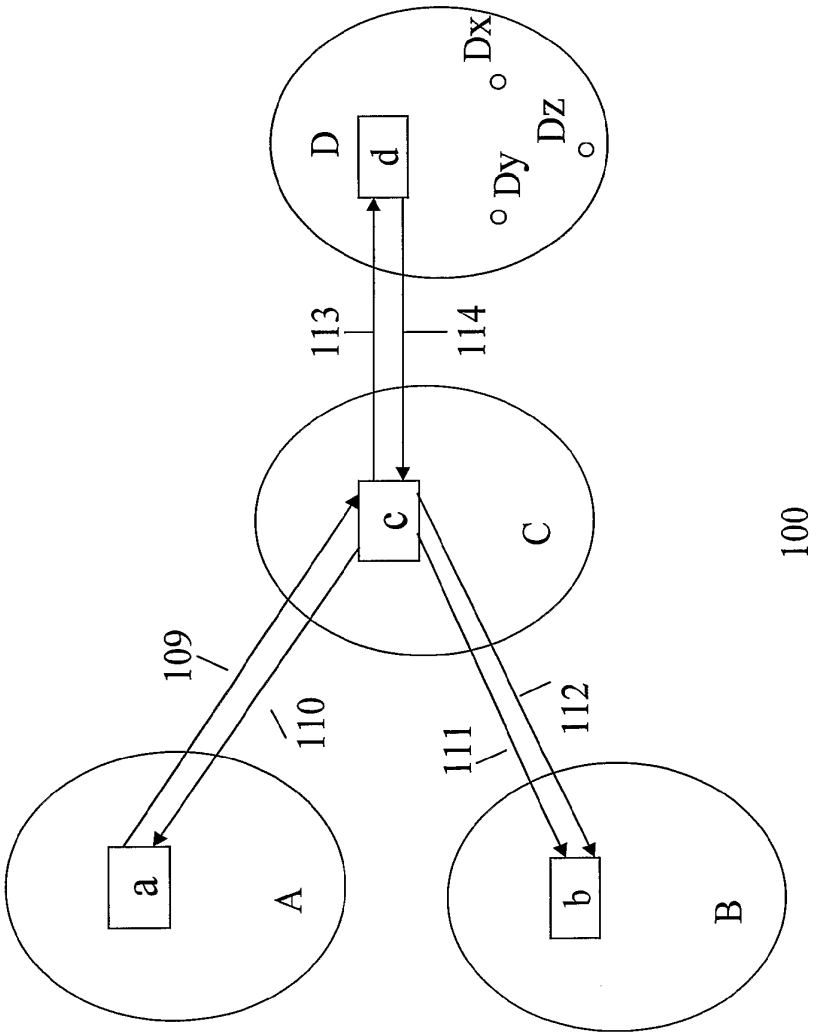


Fig. 1

2(4)

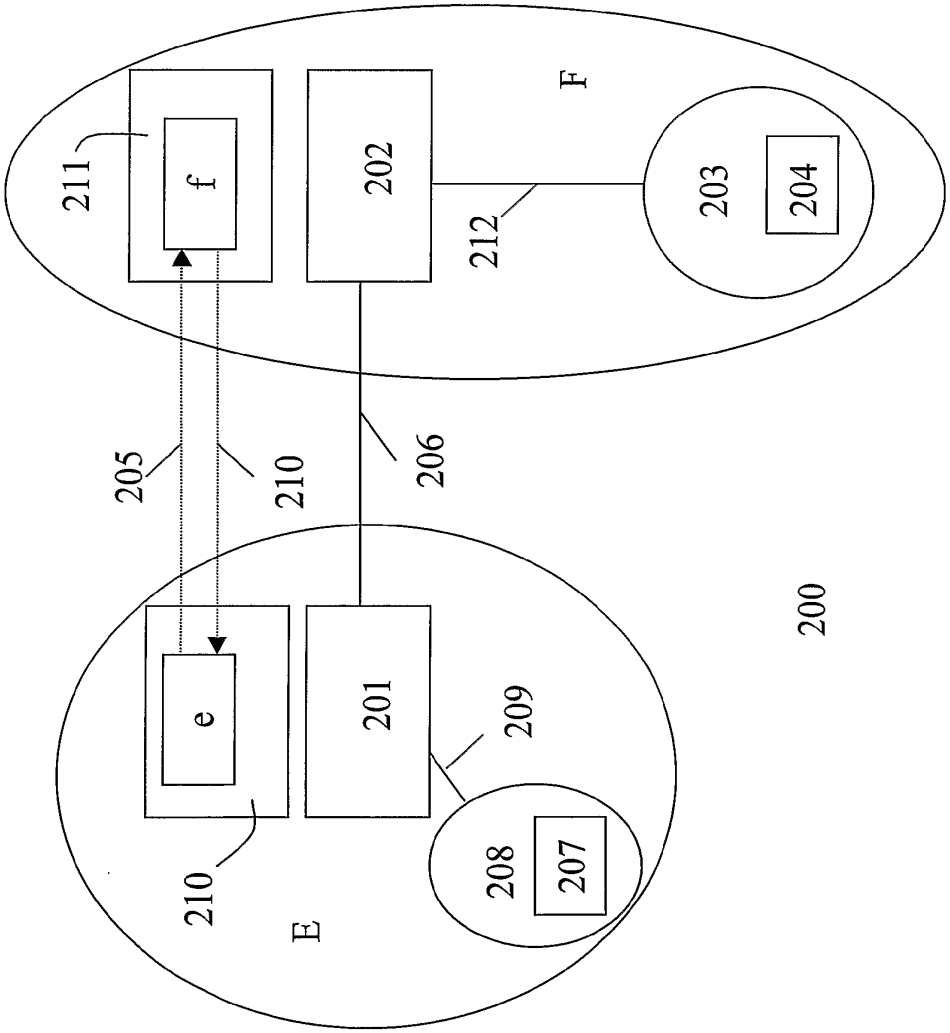


Fig. 2

3(4)

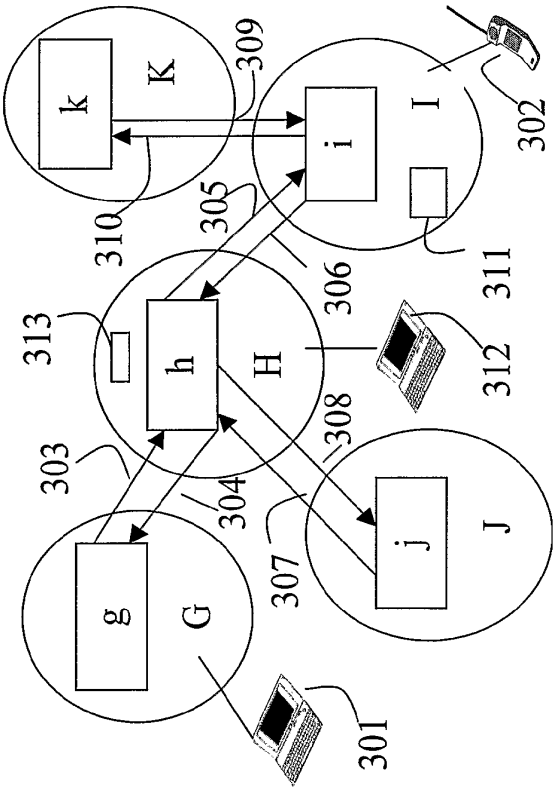

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Fig. 3

4(4)

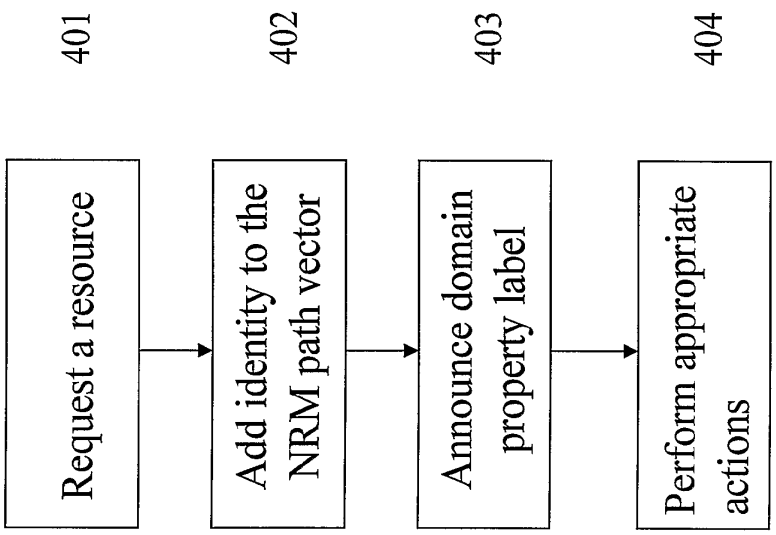

401
Request a resource
402
Add identity to the NRM path vector
403
Announce domain property label
404
Perform appropriate actions

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/01490

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 12/56, H04L 29/06
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, G06F

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, PAJ, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SCHELEN, O. et al: Performance of QoS agents for provisioning network resources. In: Quality of Service, 1999. IWQoS'99. 1999 Seventh International Workshop on. On pages 17-26. 31 May - 4 June 1999 --	1-45
A	SCHELEN, O. et al: An agent-based architecture for advance reservations. In: Local Computer Networks, 1997. Proceedings. Annual Conf on. Pages 451-459. 2-5 Nov. 1997 --	1-45
A	BORG, N. et al: Efficient multi-field packet classification for QoS purposes. In: Quality of Service, 1999. IWQoS'99.1999 Seventh International Workshop on. pages 109-118. 31 May - 4 June 1999 --	1-45

[X] Further documents are listed in the continuation of Box C. [ ] 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
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"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
3 December 2002	05 -12- 2002
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 Marianne Engdahl/LR Telephone No. +46 8 782 25 00

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/01490

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SCHELÉN, O. et al: Resource Sharing in Advance Reservation Agents. In: Journal of High Speed Networks, Special Issue on Multimedia Networking, Vol 7, No 3-4, 1998	1-45

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

Electronic Patent Application Fee Transmittal

Application Number:	10250702
Filing Date:	19-Dec-2003
Title of Invention:	Network resource manager in a mobile telecommunication system
First Named Inventor/Applicant Name:	Joakim Norrgard
Filer:	Roger Clark Knapp/Kristin Hayes
Attorney Docket Number:	NET-5388

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:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	5407755
Application Number:	10250702
International Application Number:	
Confirmation Number:	9055
Title of Invention:	Network resource manager in a mobile telecommunication system
First Named Inventor/Applicant Name:	Joakim Norrgard
Customer Number:	25962
Filer:	Roger Clark Knapp/Kristin Hayes
Filer Authorized By:	Roger Clark Knapp
Attorney Docket Number:	NET-5388
Receipt Date:	27-MAY-2009
Filing Date:	19-DEC-2003
Time Stamp:	17:33:12
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	$180
RAM confirmation Number	3839
Deposit Account	501065
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		5388_Amendment.pdf	109487 a5d75fd8f54e2ac58fcd958e1b6a5f00cec00f3d	yes	12
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	7	
	Applicant Arguments/Remarks Made in an Amendment		8	12	
Warnings:					
Information:					
2	Transmittal Letter	5388_IDS.pdf	67138 f35f7f1be04c562dde5e94fb7a8e3c44dd08f425	no	1
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Filed (SB/08)	5388_IDS2.pdf	160692 74fc581739679660874010c04644069bd8f40391	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	Foreign Reference	WO03021888A1.pdf	1253072 556a543445dbc4709e7c3d89ff7a640e0d2c9ebf	no	33
Warnings:					
Information:					
5	Fee Worksheet (PTO-875)	fee-info.pdf	30050 889cf744fa6b1fec11b7452c661c81c0652576db	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1620439		

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.

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.

National Stage of an International Application under 35 U.S.C. 371
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.

New International Application Filed with the USPTO as a Receiving Office
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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
10/250,702	12/19/2003	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ 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 $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ 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).						
☐ 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	05/27/2009	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 27	Minus	** 42	= 0	X $26 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $110 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

		(Column 1)		(Column 2)	(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L 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.

Legal Instrument Examiner:
/MARISSA BLYTHER/

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.
10/250,702	12/19/2003	Joakim Norrgard	NET-5388	9055

25962 7590 02/27/2009

SLATER & MATSIL, L.L.P.
17950 PRESTON RD, SUITE 1000
DALLAS, TX 75252-5793

EXAMINER	
MOORE JR, MICHAEL J	

ART UNIT	PAPER NUMBER
2419	

MAIL DATE	DELIVERY MODE
02/27/2009	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.	Applicant(s)	
	10/250,702	NORRGARD ET AL.	
	Examiner	Art Unit	
	MICHAEL J. MOORE, JR.	2419	

-- 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 *16 February 2009*.

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) *32-35,39-41,43,44,48-51,55-57,59,60,62-65,67-69,71 and 72* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-35,39-41,43,44,48-51,55-57,59,60,62-65,67-69,71 and 72* is/are rejected.

7)☐ Claim(s) _____ 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 _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments in the After Final Amendment filed 2/16/09, with respect to the rejection(s) of claim(s) **32-35, 39-41, 43, 44, 48-51, 55-57, 59, 60, 62-65, 67-69, 71, and 72** under 35 U.S.C. §102 (e) in view of Arunachalam et al. (U.S. 6,631,122) have been fully considered and are persuasive. Therefore, these particular rejections have been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Arunachalam et al. (U.S. 6,631,122) and Schelen (Doctoral Thesis dated 1998 cited in Applicant's IDS submitted on 3/4/04). Accordingly, the finality of the previous Office Action has been withdrawn and prosecution is hereby reopened.

Claim Rejections - 35 USC § 103

2. 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 negatived by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims **32-35, 39-41, 43, 44, 48-51, 55-57, 59, 60, 62-65, 67-69, 71, and 72** are rejected under 35 U.S.C. 103(a) as being unpatentable over Arunachalam et al. (U.S. 6,631,122) (hereinafter "Arunachalam") in view of Schelen (Doctoral Thesis dated 1998 cited in Applicant's IDS submitted on 3/4/04).

Regarding claim **32**, *Arunachalam* teaches the IP-over-Wireless/Cellular network 231 (Core Network) of Figure 2 that provides QoS support to mobile end systems 209 via edge devices 204a and wireless transmitters 204b (Radio access network) as spoken of on column 4, lines 1-3 and 13-15.

Arunachalam also teaches the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

Arunachalam also teaches the QoS agent 301 (NRM) of Figure 3 that maps QoS parameters (has resource map) in the wireline transit network to the CoS permitted within the wireless network as spoken of on column 8, lines 55-64.

Arunachalam also teaches the QoS agent (NRM) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

Arunachalam also teaches the QoS agent (NRM) that sends flow information and CoS information (resource information) of the new flow to the radio resource manager as spoken of on column 9, lines 4-6.

Arunachalam also teaches the radio resource manager that allocates appropriate resources for the flow in accordance with the flow and CoS information provided by the QoS agent (NRM) as spoken of on column 9, lines 54-56.

While *Arunachalam* teaches a QoS agent (NRM) that controls dynamic resource allocation, *Arunachalam* does not teach "the NRM pre-allocating resources in the IP network, and scheduling resources over time by introducing a start and a stop time as a parameter in a resource request handled by the NRM".

However, *Schelen* teaches a method of using QoS agents in an IP network, where QoS agents support immediate (dynamic) as well as advance (pre-allocated) admission control as spoken of on page 27, section 2.2.1, paragraph 1.

Schelen further teaches the use of advance reservation requests, where a start time and a stop time are provided within the request as spoken of on page 47, section 3.3.2. paragraph 1.

At the time of the invention, it would have been obvious to someone of ordinary skill in the art, given these references, to apply the advance (pre-allocated) admission control techniques of *Schelen* to the dynamic (immediate) resource allocation techniques of *Arunachalam* in order to provide clients with better support for planned activities and providers with optimal information for scheduling use of resources over time as spoken of on page 40, section 3.1., paragraph 1 of *Schelen*.

Regarding claim **33**, *Arunachalam* further teaches the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **34**, *Arunachalam* further teaches the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **35**, *Arunachalam* further teaches the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **39**, *Arunachalam* further teaches QoS agents 205 (NRMs) of different networks 201, 211, 221, 231 of Figure 2, that communicate resource negotiation information in a peer-to-peer fashion as shown in Figure 2.

Regarding claim **40**, *Arunachalam* further teaches the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **41**, *Arunachalam* further teaches the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **43**, *Arunachalam* further teaches the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **44**, *Arunachalam* further teaches the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **48**, *Arunachalam* teaches the IP-over-Wireless/Cellular network 231 (Core Network) of Figure 2 that provides QoS support to mobile end systems 209 via edge devices 204a and wireless transmitters 204b (Radio access network) as spoken of on column 4, lines 1-3 and 13-15, as well as the QoS agent 301 (NRM) of Figure 3.

Arunachalam also teaches the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

Arunachalam also teaches the QoS agent 301 (means) of Figure 3 that maps QoS parameters (has resource map) in the wireline transit network to the CoS permitted within the wireless network as spoken of on column 8, lines 55-64.

Arunachalam also teaches the QoS agent (means) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

Arunachalam also teaches the QoS agent (means) that sends flow information and CoS information (resource information) of the new flow to the radio resource manager as spoken of on column 9, lines 4-6.

Arunachalam also teaches the radio resource manager that allocates appropriate resources for the flow in accordance with the flow and CoS information provided by the QoS agent (means) as spoken of on column 9, lines 54-56.

While *Arunachalam* teaches a QoS agent (NRM) that controls dynamic resource allocation, *Arunachalam* does not teach "the NRM pre-allocating resources in the IP network part, and means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request handled by the NRM".

However, *Schelen* teaches a method of using QoS agents in an IP network, where QoS agents support immediate (dynamic) as well as advance (pre-allocated) admission control as spoken of on page 27, section 2.2.1, paragraph 1.

Schelen further teaches the use of advance reservation requests, where a start time and a stop time are provided within the request as spoken of on page 47, section 3.3.2. paragraph 1.

At the time of the invention, it would have been obvious to someone of ordinary skill in the art, given these references, to apply the advance (pre-allocated) admission control techniques of *Schelen* to the dynamic (immediate) resource allocation techniques of *Arunachalam* in order to provide clients with better support for planned activities and providers with optimal information for scheduling use of resources over time as spoken of on page 40, section 3.1., paragraph 1 of *Schelen*.

Regarding claim **49**, *Arunachalam* further teaches the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **50**, *Arunachalam* further teaches the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **51**, *Arunachalam* further teaches the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **55**, *Arunachalam* further teaches QoS agents 205 (NRMs) of different networks 201, 211, 221, 231 of Figure 2, that communicate resource negotiation information in a peer-to-peer fashion (means) as shown in Figure 2.

Regarding claim **56**, *Arunachalam* further teaches the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **57**, *Arunachalam* further teaches the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **59**, *Arunachalam* further teaches the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **60**, *Arunachalam* further teaches the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **62**, *Arunachalam* teaches the IP-over-Wireless/Cellular network 231 (Core Network) of Figure 2 that provides QoS support to mobile end systems 209 via edge devices 204a and wireless transmitters 204b (Radio access network) as spoken of on column 4, lines 1-3 and 13-15, as well as the QoS agent 301 (NRM) of Figure 3.

Arunachalam also teaches the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

Arunachalam also teaches the QoS agent 301 (means) of Figure 3 that maps QoS parameters (has resource map) in the wireline transit network to the CoS permitted within the wireless network as spoken of on column 8, lines 55-64, and then provides corresponding flow and CoS information (feedback) to the radio resource manager (network operator) as spoken of on column 9, lines 4-6.

Arunachalam also teaches the QoS agent (means) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking

resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

Arunachalam also teaches the QoS agent (means) that sends flow information and CoS information (resource information) of the new flow to the radio resource manager as spoken of on column 9, lines 4-6.

Arunachalam also teaches the radio resource manager that allocates appropriate resources for the flow in accordance with the flow and CoS information provided by the QoS agent (means) as spoken of on column 9, lines 54-56.

Arunachalam also teaches the QoS agent (means) that sends flow information and CoS information (feedback) of the new flow to the radio resource manager (network operator) as spoken of on column 9, lines 4-6.

While *Arunachalam* teaches a QoS agent (NRM) that controls dynamic resource allocation, *Arunachalam* does not teach "the NRM pre-allocating resources in the IP network part, and means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request handled by the NRM".

However, *Schelen* teaches a method of using QoS agents in an IP network, where QoS agents support immediate (dynamic) as well as advance (pre-allocated) admission control as spoken of on page 27, section 2.2.1, paragraph 1.

Schelen further teaches the use of advance reservation requests, where a start time and a stop time are provided within the request as spoken of on page 47, section 3.3.2. paragraph 1.

At the time of the invention, it would have been obvious to someone of ordinary skill in the art, given these references, to apply the advance (pre-allocated) admission control techniques of *Schelen* to the dynamic (immediate) resource allocation techniques of *Arunachalam* in order to provide clients with better support for planned activities and providers with optimal information for scheduling use of resources over time as spoken of on page 40, section 3.1., paragraph 1 of *Schelen*.

Regarding claim **63**, *Arunachalam* further teaches the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **64**, *Arunachalam* further teaches the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **65**, *Arunachalam* further teaches the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **67**, *Arunachalam* further teaches QoS agents 205 (NRMs) of different networks 201, 211, 221, 231 of Figure 2, that communicate resource negotiation information in a peer-to-peer fashion (means) as shown in Figure 2.

Regarding claim **68**, *Arunachalam* further teaches the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **69**, *Arunachalam* further teaches the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **71**, *Arunachalam* further teaches the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **72**, *Arunachalam* further teaches the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL J. MOORE, JR., whose telephone number is (571)272-3168. The examiner can normally be reached on Monday-Friday (7:30am - 4:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jayanti K. Patel can be reached at (571) 272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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.

/Michael J. Moore, Jr./
Examiner, Art Unit 2419

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2419

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

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/05/2008	12/11/2008	02/25/2009						
	1	-	-	-						
	2	-	-	-						
	3	-	-	-						
	4	-	-	-						
	5	-	-	-						
	6	-	-	-						
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	28	-	-	-						
	29	-	-	-						
	30	-	-	-						
	31	-	-	-						
	32	✓	✓	✓						
	33	✓	✓	✓						
	34	✓	✓	✓						
	35	✓	✓	✓						
	36	-	-	-						

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CLAIM		DATE								
Final	Original	03/05/2008	12/11/2008	02/25/2009						
	37	-	-	-						
	38	✓	-	-						
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	40	✓	✓	✓						
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	45	✓	-	-						
	46	✓	-	-						
	47	-	-	-						
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	65	✓	✓	✓						
	66	-	-	-						
	67	✓	✓	✓						
	68	✓	✓	✓						
	69	✓	✓	✓						
	70	-	-	-						
	71	✓	✓	✓						
	72	✓	✓	✓						

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CLAIM		DATE								
Final	Original	03/05/2008	12/11/2008	02/25/2009						
	73	✓	-	-						

OK TO ENTER: /MM/

2/25/09

AMENDMENT UNDER 37 C.F.R. § 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2400

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Norrgard, *et al.*	Docket No.:	NET-5388
Serial No.:	10/250,702	Art Unit:	2419
Filed:	December 19, 2003	Examiner:	Michael J. Moore, Jr.
For:	Network Resource Manager in a Mobile Telecommunication System		

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

AMENDMENT UNDER 37 C.F.R. § 1.116

Dear Sir:

Applicants respectfully submit the following amendments and remarks in response to Examiner's Office Action dated December 16, 2008, which Action is made final. Applicants respectfully request that these amendments and remarks be entered in pursuant to the provisions of 37 C.F.R. § 1.116, and respectfully request reconsideration of the claims.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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BIB DATA SHEET

CONFIRMATION NO. 9055

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/250,702	12/19/2003	455	2419	NET-5388

APPLICANTS

Joakim Norrgard, Lulea, SWEDEN;
Anders Larsson, Lulea, SWEDEN;
Olov Schelen, Norrfjarden, SWEDEN;

**** CONTINUING DATA **************************

This application is a 371 of PCT/SE01/02847 12/20/2001

**** FOREIGN APPLICATIONS **************************

UNITED STATES OF AMERICA 60261166 01/16/2001

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **

Foreign Priority claimed	☐ Yes ☑ No	☐ Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	☐ Yes ☑ No		SWEDEN	6	42	3
Verified and Acknowledged	/MICHAEL J MOORE JR/ Examiner's Signature	Initials				

ADDRESS

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17950 PRESTON RD, SUITE 1000
DALLAS, TX 75252-5793
UNITED STATES

TITLE

Network resource manager in a mobile telecommunication system

FILING FEE RECEIVED		
793	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

AMENDMENT UNDER 37 C.F.R. § 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2400

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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In the Claims:

1-31. (Canceled)

32. (Currently Amended) A method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission, the method comprising the steps of:

handling radio resources within the RAN by using a radio resource manager; [[and]]

controlling IP network resources by using a resource map in a Network Resource Manager (NRM) in order to provide said end-to-end QoS, the step of controlling the IP network resources including the steps of the NRM performing path-sensitive call admission control by using the resource map in the NRM, the NRM checking that resources are available along a path, and the NRM pre-allocating resources in [[the]] an IP ~~network, and~~ network;

scheduling resources over time by introducing a start and a stop time as a parameter in a resource request handled by the [[NRM,]] NRM;

communicating resource information between the NRM and the radio resource ~~manager,~~ manager; and

reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS.

33. (Currently Amended) Method according to claim 32, wherein the NRM is used within the RAN and [[a]] the CN.

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CISCO SYSTEMS, INC. / Page 122 of 487

34. (Previously Presented) Method according to claim 32, wherein the NRM is used within the RAN.

35. (Previously Presented) Method according to claim 32, wherein the NRM is used within the CN.

36-38. (Canceled)

39. (Previously Presented) Method according to claim 32, the method comprising the further step of signalling resource information between the NRM and at least a second NRM used within at least a second network domain.

40. (Currently Amended) Method according to claim 32, the method comprising the further step of monitoring topology changes by using the NRM, ~~that retrieves~~ retrieving routing information concerning the IP network.

41. (Currently Amended) Method according to claim 40, wherein the topology is monitored in order to be able to reallocate the IP network resources.

42. (Canceled)

43. (Previously Presented) Method according to claim 32, wherein the path-sensitive call admission control is parameter based.

44. (Previously Presented) Method according to claim 32, wherein the path-sensitive call admission control is measurement based.

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45-47. (Canceled)

48. (Currently Amended) A Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission and a radio resource manager that controls radio resources within the RAN, the NRM comprising a resource map and means for controlling IP network resources within [[the]] an IP network using the resource map in order to provide end-to-end Quality of Service (QoS),

said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the ~~NRM and~~ NRM, for the NRM checking that resources are available along a [[path]] path, and for the NRM pre-allocating resources in the IP network part of the telecommunication system,

means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request,

means for communicating resource information between the NRM and the radio resource manager, and

means for reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS.

49. (Currently Amended) NRM according to claim 48, further comprising means for being used within the RAN and [[a]] the CN.

50. (Currently Amended) NRM according to claim 48, further comprising means for using the IP network resources within the RAN.

51. (Previously Presented) NRM according to claim 48, further comprising means for being used within the CN.

52-54. (Canceled)

55. (Previously Presented) NRM according to claim 48, further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

56. (Previously Presented) NRM according to claim 48, further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

57. (Previously Presented) NRM according to claim 56, wherein the topology is monitored in order to be able to reallocate access resources.

58. (Canceled)

59. (Previously Presented) NRM according to claim 48, wherein the path-sensitive call admission control is parameter based.

60. (Previously Presented) NRM according to claim 48, wherein the path-sensitive call admission control is measurement based.

61. (Canceled)

62. (Currently Amended) A Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio

Access Network (RAN) using Internet Protocol (IP) based transmission and a radio resource manager that controls radio resources within the RAN, the NRM ~~comprising~~ comprising:

a resource ~~map and~~ map;

means for controlling IP network resources within the IP network using the resource map in order to provide feedback to a network operator, said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the ~~NRM and~~ NRM, for the NRM checking that resources are available along a [[path]] path, and for the NRM pre-allocating resources in the IP network part of the telecommunication system,

means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request,

means for communicating resource information between the NRM and the radio resource manager,

means for reserving the IP network resources along the path by the NRM, and

means for providing the feedback to the network operator.

63. (Currently Amended) NRM according to claim 62, further comprising means for being used within the RAN and [[a]] the CN.

64. (Previously Presented) NRM according to claim 62, further comprising means for using the IP network resources within the RAN.

65. (Previously Presented) NRM according to claim 62, further comprising means for use within the CN.

66. (Canceled)

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67. (Previously Presented) NRM according to claim 62, further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

68. (Previously Presented) NRM according to claim 62, further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

69. (Previously Presented) NRM according to claim 68, wherein the topology is monitored in order to be able to reallocate access resources.

70. (Canceled)

71. (Previously Presented) NRM according to claim 62, wherein the path-sensitive call admission control is parameter based.

72. (Previously Presented) NRM according to claim 62, wherein the path-sensitive call admission control is measurement based.

73. (Canceled)

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REMARKS

Claims 32-35, 39-41, 43, 44, 48-51, 55-57, 59, 60, 62-65, 67-69, 71, and 72 are pending in the present application. Claims 1-31, 36-38, 42, 45-47, 52-54, 58, 61, 66, 70, and 73 were previously cancelled. Claims 32, 33, 40, 41, 48-50, 62, and 63 have been amended herein. No new matter has been added. Applicants respectfully request reconsideration of the claims in view of the following remarks.

Claims 32-35, 39-41, 43, 44, 48-51, 55-57, 59, 60, 62-65, 67-69, 71, and 72 have been rejected under 35 U.S.C. § 102(e) as assertedly being anticipated by U.S. Patent No. 6,631,122 (hereinafter "Arunachalam"). Applicants respectfully traverse these rejections.

It appears that there is a misunderstanding regarding Applicants' comments contained in the previous Amendment dated September 15, 2008. In particular, Applicants amended claim 32 to recite "the NRM pre-allocating resources in the IP network," to which the Office Action asserted is anticipated by the QoS agent illustrated in Figure 5 of Arunachalam in that the QoS agent "uses dynamic resource controller 511 to control dynamic radio resource allocation." Office Action, page 3. Applicants respectfully disagree.

Dynamic resource allocation only refers to the ability to allocate resources as they are needed, as opposed to static resource allocation in which a resource remains allocated regardless of its use. Pre-allocation, on the other hand, allows one to allocate resources before the resources are actually required. Thus, in a dynamic resource allocation, resources may not actually be available when the resources are actually requested. In contrast, a pre-allocation scheme allows one to "guarantee the availability of resources in the IP network" as stated in Applicants' Amendment dated September 15, 2008. "This is important in high-performance scenarios where delay cannot be accepted, such as in a mobile terminal handover from one base

radio to another, wherein resources for the new path can be pre-allocated thereby minimizing the risk of pre-emption during a handover." *Id.*

The Office Action is essentially attempting to equate "dynamic" with "pre-." Clearly, these terms are not equivalent, and as such, the dynamic resource allocation fails to disclose the pre-allocating recited in Applicants' claim 32.

Furthermore, the Office Action misinterprets the limitation "scheduling resources over time by introducing a start and a stop time as a parameter in a resource request handled by the NRM" as recited in Applicants' claim 32. As clearly recited above, a resource request must include a *start time* and a *stop time*. The Office Action asserts that Arunachalam discloses this limitation by the statement:

> In another embodiment, a more complicated weighted fair packet queuing algorithm is utilized. In the latter case, wireless QoS agent 801 adjusts the weights of the fair queuing algorithm based on the knowledge of the precedence and bandwidth allocation for the traffic classes scheduled. Arunachalam, column 10, lines 11-14.

Specifically, the Office Action asserted:

> The precedence information indicates a relative priority of a class of traffic data in relation to another class of traffic data. Therefore, the precedence information affects at what time a particular portion of data will be scheduled for transmission in relation to another portion of data. Using this interpretation, it is held that the precedence information may be construed to be a start/stop time parameter in light of the current claim language. Office Action, pages 12 and 13.

Again Applicants disagree. The start time and stop time by definition define the time when the resources are needed and when the resources will again be freed. "This allows the NRM to handle resource request for both immediate and future use." Specification, page 13, lines 5 and 6. As asserted by the Office Action, the precedence information indicates a relative priority of a class of traffic data. This is not the same as a start time and a stop time. The

assertion by the Office Action that the precedence information affects at what time a particular portion of data will be scheduled for transmission is simply irrelevant. Applicants' claim does not recite "information affecting what time a particular portion of data will be scheduled for transmission," but rather Applicants' claim 32 explicitly recites "a start time" and "a stop time." Precedent information does not include and does not equate to a start time and a stop time.

Furthermore, assuming for the sake of argument that the precedent information discloses a start time, it would not include the stop time. As asserted by the Office Action, the precedent information only includes the relative priority for transmission. Thus, even using the assertion contained in the Office Action, a stop time is not disclosed as recited in Applicants' claim 32.

Lastly, Applicants' claim 32 explicitly recites that the start time and the stop time is "a parameter in a resource request." Notably, there is no disclosure that the precedent information is contained in the request. Rather, Arunachalam discloses that precedent and bandwidth allocation are *based* on the traffic classes. Thus, the precedent and bandwidth allocation are determined by the QoS agent rather than being received in a request. If anything, the traffic class is received, which can hardly be considered a start time and a stop time. It should be noted that Applicants' claim 32 explicitly recites that the start time and the stop time are in the resource request. Arunachalam clearly fails to show this limitation.

In view of the above remarks, Applicants respectfully request that the rejection of claim 32 be withdrawn. Claims 48 and 62 recite similar limitations, and accordingly, Applicants respectfully request that the rejections of claims 48 and 62 be withdrawn as well.

Claims 33-35, 39-41, 43, and 44 depend from and further limit claim 32, claims 49-51, 55-57, 59, and 60 depend from and further limit claim 48, and claims 63-65, 67-69, 71, and 72 depend from and further limit claim 62. Accordingly, it is respectfully submitted that these

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CISCO SYSTEMS, INC. / Page 130 of 487

dependent claims are allowable by reason of depending from an allowable claim as well as for adding new limitations.

In view of the above, Applicants respectfully submit that this response complies with 37 C.F.R. § 1.116. Applicants further submit that the claims are in condition for allowance. No new matter has been added by this amendment. If the Examiner should have any questions, please contact Applicants' attorney at the number listed below. The Commissioner is hereby authorized to charge any fees that are due, or credit any overpayment, to Deposit Account No. 50-1065.

Respectfully submitted,

February 16, 2009
Date

/Roger C. Knapp/
Roger C. Knapp
Attorney for Applicants
Reg. No. 46,836

SLATER & MATSIL, L.L.P.
17950 Preston Rd., Suite 1000
Dallas, Texas 75252
Tel.: 972-732-1001
Fax: 972-732-9218

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CISCO SYSTEMS, INC. / Page 134 of 487

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Respectfully submitted,

February 16, 2009
Date

/Roger C. Knapp/
Roger C. Knapp
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Reg. No. 46,836

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Electronic Acknowledgement Receipt

EFS ID:	4797346
Application Number:	10250702
International Application Number:	
Confirmation Number:	9055
Title of Invention:	Network resource manager in a mobile telecommunication system
First Named Inventor/Applicant Name:	Joakim Norrgard
Customer Number:	25962
Filer:	Roger Clark Knapp/Natalie Swider
Filer Authorized By:	Roger Clark Knapp
Attorney Docket Number:	NET-5388
Receipt Date:	16-FEB-2009
Filing Date:	19-DEC-2003
Time Stamp:	12:39:30
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)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		NET-5388_Amendment.pdf	109550 e54d4609987d265489632d3b3a3c23fb1831fb3e	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment After Final	1	1
	Claims	2	7
	Applicant Arguments/Remarks Made in an Amendment	8	11
Warnings:			
Information:			
	Total Files Size (in bytes):	109550	

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.

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.

National Stage of an International Application under 35 U.S.C. 371
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.

New International Application Filed with the USPTO as a Receiving Office
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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
10/250,702	12/19/2003	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ 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 $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ 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).						
☐ 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

AMENDMENT	02/16/2009	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 27	Minus	** 42	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L 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.

Legal Instrument Examiner:
/PEGGY YARBOROUGH/

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/250,702	12/19/2003	Joakim Norrgard	NET-5388

CONFIRMATION NO. 9055

25962
SLATER & MATSIL, L.L.P.
17950 PRESTON RD, SUITE 1000
DALLAS, TX 75252-5793

POA ACCEPTANCE LETTER



Date Mailed: 01/06/2009

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/29/2008.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/hgray/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/250,702	12/19/2003	Joakim Norrgard	1505-1033-1

CONFIRMATION NO. 9055

466
YOUNG & THOMPSON
209 Madison Street
Suite 500
ALEXANDRIA, VA 22314

POWER OF ATTORNEY NOTICE

OC000000033865835

Date Mailed: 01/06/2009

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/29/2008.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/hgray/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PTO/SB/80 (01-06)
Approved for use through 12/31/2008. OMB 0651-0035
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 25962

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 25962

OR

☐ Firm or Individual Name	Slater & Matsil, L.L.P.		
Address	17950 Preston Rd., Suite 1000		
City	Dallas	State TX	Zip 75252
Country	United States		
Telephone	972-732-1001	Email knapp@slater-matsil.com	

Assignee Name and Address:
NetSocket, Inc.
3701 W. Plano Pkwy., Suite 140
Plano, TX 75075

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record
The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	8DEC08
Name	Kenneth H. Lewis	Telephone	+1 214 427 7391
Title	President & C.E.O.		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 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.

Attorney Docket No.: NET-5388

PTO/SB/96 (10-08)
Approved for use through 11/30/2008. OMB 0651-0031
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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Norrgard, *et al.*

Application No./Patent No.: 10/250,702 Filed/Issue Date: December 19, 2003

Entitled: Network Resource Manager in a Mobile Telecommunication System

NetSocket, Inc., a corporation,
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. [X] the assignee of the entire right, title, and interest; or

2. [ ] an assignee of less than the entire right, title and interest.
(The extent (by percentage) of its ownership interest is _____ %)

In the patent application/patent identified above by virtue of either:

A. [ ] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. [X] A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Joakim Norrgard, Anders Larsson, and Olov Schelen To: Operax AB
The document was recorded in the United States Patent and Trademark Office at
Reel 014237, Frame 0389, or for which a copy thereof is attached.

2. From: Operax AB To: Nya Operax AB
The document was recorded in the United States Patent and Trademark Office at
Reel 021978, Frame 0022, or for which a copy thereof is attached.

3. From: Nya Operax AB To: Operax AB
The document was recorded in the United States Patent and Trademark Office at
Reel 021991, Frame 0371, or for which a copy thereof is attached.

4. From: Operax AB To: NetSocket, Inc.
The document was recorded in the United States Patent and Trademark Office at
Reel 022007, Frame 0627, or for which a copy thereof is attached.

[ ] Additional documents in the chain of title are listed on a supplemental sheet.

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

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

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

Signature	12-29-08 Date
Roger C. Knapp, Reg. No. 46,836 Printed or Typed Name	972-732-1001 Telephone Number
Attorney for Applicants Title	

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

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

Electronic Acknowledgement Receipt

EFS ID:	4526645
Application Number:	10250702
International Application Number:	
Confirmation Number:	9055
Title of Invention:	Network resource manager in a mobile telecommunication system
First Named Inventor/Applicant Name:	Joakim Norrgard
Customer Number:	00466
Filer:	Roger Clark Knapp/Natalie Swider
Filer Authorized By:	Roger Clark Knapp
Attorney Docket Number:	1505-1033-1
Receipt Date:	29-DEC-2008
Filing Date:	19-DEC-2003
Time Stamp:	13:12:00
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)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		NET-5388_POA.pdf	140402 00f617af2c6b715d87cb583b7058a63fd8fd8975	yes	2

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Power of Attorney	1	1
	Assignee showing of ownership per 37 CFR 3.73(b).	2	2
Warnings:			
Information:			
	Total Files Size (in bytes):	140402	

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.

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.

National Stage of an International Application under 35 U.S.C. 371
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.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/250,702	12/19/2003	Joakim Norrgard	1505-1033-1	9055

466 7590 12/16/2008

YOUNG & THOMPSON
209 Madison Street
Suite 500
ALEXANDRIA, VA 22314

EXAMINER	
MOORE JR, MICHAEL J	
ART UNIT	PAPER NUMBER
2419	

MAIL DATE	DELIVERY MODE
12/16/2008	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.	Applicant(s)	
	10/250,702	NORRGARD ET AL.	
	Examiner	Art Unit	
	MICHAEL J. MOORE, JR.	2419	

-- 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 *15 September 2008*.

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) *32-35,39-41,43,44,48-51,55-57,59,60,62-65,67-69,71 and 72* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-35,39-41,43,44,48-51,55-57,59,60,62-65,67-69,71 and 72* is/are rejected.

7)☐ Claim(s) _____ 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 _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. 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.

2. Claims **32-35, 39-41, 43, 44, 48-51, 55-57, 59, 60, 62-65, 67-69, 71, and 72** are rejected under 35 U.S.C. 102(e) as being anticipated by Arunachalam et al. (U.S. 6,631,122).

Regarding claim **32**, "a method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission" is anticipated by the IP-over-Wireless/Cellular network 231 (Core Network) of Figure 2 that provides QoS support to mobile endsystems 209 via edge devices 204a and wireless transmitters 204b (Radio access network) as spoken of on column 4, lines 1-3 and 13-15.

"Handling radio resources within the RAN by using a radio resource manager" is anticipated by the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

"Controlling IP network resources by using a resource map in a Network Resource Manager (NRM) in order to provide the end-to-end QoS" is anticipated by the QoS agent 301 (NRM) of Figure 3 that maps QoS parameters (has resource map) in the wireline transit network to the CoS permitted within the wireless network as spoken of on column 8, lines 55-64.

"The NRM performing path-sensitive call admission control by using the resource map in the NRM and the NRM checking that resources are available along a path" is anticipated by the QoS agent (NRM) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

"The NRM pre-allocating resources in the IP network" is anticipated by the QoS agent of Figure 5 that uses dynamic resource controller 511 to control dynamic radio resource allocation (pre-allocating) as shown in Figure 5.

"Scheduling resources over time by introducing a start and a stop time as a parameter in a resource request handled by the NRM" is anticipated by the QoS agent 801 of Figure 8 that schedules incoming packets of flows through weighting of the flows according to bandwidth allocation and precedence information (start/stop parameter) as spoken of on column 10, lines 11-14.

"Communicating resource information between the NRM and the radio resource manager" is anticipated by the QoS agent (NRM) that sends flow information and CoS

information (resource information) of the new flow to the radio resource manager as spoken of on column 9, lines 4-6.

Lastly, “reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS” is anticipated by the radio resource manager that allocates appropriate resources for the flow in accordance with the flow and CoS information provided by the QoS agent (NRM) as spoken of on column 9, lines 54-56.

Regarding claim **33**, “wherein the NRM is used within the RAN and a CN” is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **34**, "wherein the NRM is used within the RAN" is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **35**, “wherein the NRM is used within the CN” is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **39**, “signaling resource information between the NRM and at least a second NRM used within at least a second network domain” is anticipated by QoS agents 205 (NRMs) of different networks 201, 211, 221, 231 of Figure 2, that communicate resource negotiation information in a peer-to-peer fashion as shown in Figure 2.

Regarding claim **40**, “monitoring topology changes by using the NRM that retrieves routing information concerning the IP network” is anticipated by the QoS agent

801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **41**, “wherein the topology is monitored in order to be able to reallocate IP network resources” is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **43**, “wherein the path-sensitive call admission control is parameter based” is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **44**, “wherein the path-sensitive call admission control is measurement based” is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **48**, “a Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission" is anticipated by the IP-over-Wireless/Cellular network 231 (Core Network) of Figure 2 that provides QoS support to mobile endsystems 209 via edge devices 204a and wireless transmitters 204b (Radio access network) as spoken of on column 4, lines 1-3 and 13-15, as well as the QoS agent 301 (NRM) of Figure 3.

"A radio resource manager that controls radio resources within the RAN" is anticipated by the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

"The NRM comprising a resource map and means for controlling IP network resources within the IP network using the resource map in order to provide end-to-end Quality of Service (QoS)" is anticipated by the QoS agent 301 (means) of Figure 3 that maps QoS parameters (has resource map) in the wireline transit network to the CoS permitted within the wireless network as spoken of on column 8, lines 55-64.

"Means for the NRM performing path-sensitive call admission control by using the resource map in the NRM and for the NRM checking that resources are available along a path" is anticipated by the QoS agent (means) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

"The NRM pre-allocating resources in the IP network part of the telecommunication system" is anticipated by the QoS agent of Figure 5 that uses dynamic resource controller 511 (means) to control dynamic radio resource allocation (pre-allocating) as shown in Figure 5.

"Means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request" is anticipated by the QoS agent 801 of Figure 8 that schedules incoming packets of flows through weighting of the flows according to

bandwidth allocation and precedence information (start/stop parameter) as spoken of on column 10, lines 11-14.

"Means for communicating resource information between the NRM and the radio resource manager" is anticipated by the QoS agent (means) that sends flow information and CoS information (resource information) of the new flow to the radio resource manager as spoken of on column 9, lines 4-6.

Lastly, "means for reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS" is anticipated by the radio resource manager that allocates appropriate resources for the flow in accordance with the flow and CoS information provided by the QoS agent (means) as spoken of on column 9, lines 54-56.

Regarding claim **49**, "means for being used within the RAN and a CN" is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **50**, "means for using IP network resources within the RAN" is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **51**, "means for being used within the CN" is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **55**, "means for communicating with at least a second NRM used within at least a second IP network domain" is anticipated by QoS agents 205 (NRMs)

of different networks 201, 211, 221, 231 of Figure 2, that communicate resource negotiation information in a peer-to-peer fashion (means) as shown in Figure 2.

Regarding claim **56**, “means for monitoring topology changes by retrieving routing information concerning the IP network” is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **57**, "wherein the topology is monitored in order to be able to reallocate access resources" is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **59**, “wherein the path-sensitive call admission control is parameter based” is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **60**, “wherein the path-sensitive call admission control is measurement based” is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **62**, “a Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission" is

anticipated by the IP-over-Wireless/Cellular network 231 (Core Network) of Figure 2 that provides QoS support to mobile endsystems 209 via edge devices 204a and wireless transmitters 204b (Radio access network) as spoken of on column 4, lines 1-3 and 13-15, as well as the QoS agent 301 (NRM) of Figure 3.

"A radio resource manager that controls radio resources within the RAN" is anticipated by the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

"The NRM comprising a resource map and means for controlling IP network resources within the IP network using the resource map in order to provide feedback to the network operator" is anticipated by the QoS agent 301 (means) of Figure 3 that maps QoS parameters (has resource map) in the wireline transit network to the CoS permitted within the wireless network as spoken of on column 8, lines 55-64, and then provides corresponding flow and CoS information (feedback) to the radio resource manager (network operator) as spoken of on column 9, lines 4-6.

"Means for the NRM performing path-sensitive call admission control by using the resource map in the NRM and for the NRM checking that resources are available along a path" is anticipated by the QoS agent (means) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

"The NRM pre-allocating resources in the IP network part of the telecommunication system" is anticipated by the QoS agent of Figure 5 that uses dynamic resource controller 511 (means) to control dynamic radio resource allocation (pre-allocating) as shown in Figure 5.

"Means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request" is anticipated by the QoS agent 801 of Figure 8 that schedules incoming packets of flows through weighting of the flows according to bandwidth allocation and precedence information (start/stop parameter) as spoken of on column 10, lines 11-14.

"Means for communicating resource information between the NRM and the radio resource manager" is anticipated by the QoS agent (means) that sends flow information and CoS information (resource information) of the new flow to the radio resource manager as spoken of on column 9, lines 4-6.

Lastly, "means for reserving the IP network resources along the path by the NRM" is anticipated by the radio resource manager that allocates appropriate resources for the flow in accordance with the flow and CoS information provided by the QoS agent (means) as spoken of on column 9, lines 54-56.

Lastly, "means for providing the feedback to the network operator" is anticipated by the QoS agent (means) that sends flow information and CoS information (feedback) of the new flow to the radio resource manager (network operator) as spoken of on column 9, lines 4-6.

Regarding claim **63**, “means for being used within the RAN and a CN” is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **64**, “means for using IP network resources within the RAN” is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **65**, “means for use within the CN” is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **67**, “means for communicating with at least a second NRM used within at least a second IP network domain" is anticipated by QoS agents 205 (NRMs) of different networks 201, 211, 221, 231 of Figure 2, that communicate resource negotiation information in a peer-to-peer fashion (means) as shown in Figure 2.

Regarding claim **68**, “means for monitoring topology changes by retrieving routing information concerning the IP network” is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **69**, "wherein the topology is monitored in order to be able to reallocate access resources" is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **71**, "wherein the path-sensitive call admission control is parameter based" is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **72**, "wherein the path-sensitive call admission control is measurement based" is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Response to Arguments

3. Applicant's arguments filed 9/15/08 have been fully considered but they are not persuasive.

Regarding *amended* claims **32, 48, and 62,** Applicant argues that *Arunachalam* does not teach where resources are both pre-allocated and scheduled.

However, as provided in the previous Office Action, *Arunachalam* teaches the QoS agent of Figure 5 that uses dynamic resource controller 511 (means) to control dynamic radio resource allocation (pre-allocating) as shown in Figure 5. It is held that this teaching constitutes a pre-allocation of resources in light of the current claim language.

Arunachalam also teaches the QoS agent 801 of Figure 8 that schedules incoming packets of flows through weighting of the flows according to bandwidth allocation and precedence information (start/stop parameter) as spoken of on column 10, lines 11-14. The precedence information indicates a relative priority of a class of

traffic data in relation to another class of traffic data. Therefore, the precedence information affects at what time a particular portion of data will be scheduled for transmission in relation to another portion of data. Using this interpretation, it is held that the precedence information may be construed to be a start/stop time parameter in light of the current claim language.

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL J. MOORE, JR., whose telephone number is (571)272-3168. The examiner can normally be reached on Monday-Friday (7:30am - 4:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jayanti K. Patel can be reached at (571) 272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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.

/Michael J. Moore, Jr./
Examiner, Art Unit 2419

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2419

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

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/05/2008	12/11/2008							
	1	-	-							
	2	-	-							
	3	-	-							
	4	-	-							
	5	-	-							
	6	-	-							
	7	-	-							
	8	-	-							
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	26	-	-							
	27	-	-							
	28	-	-							
	29	-	-							
	30	-	-							
	31	-	-							
	32	✓	✓							
	33	✓	✓							
	34	✓	✓							
	35	✓	✓							
	36	-	-							

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2419

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
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☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/05/2008	12/11/2008							
	37	-	-							
	38	✓	-							
	39	✓	✓							
	40	✓	✓							
	41	✓	✓							
	42	-	-							
	43	✓	✓							
	44	✓	✓							
	45	✓	-							
	46	✓	-							
	47	-	-							
	48	✓	✓							
	49	✓	✓							
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	68	✓	✓							
	69	✓	✓							
	70	-	-							
	71	✓	✓							
	72	✓	✓							

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2419

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

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/05/2008	12/11/2008							
	73	✓	-							

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BIB DATA SHEET

CONFIRMATION NO. 9055

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/250,702	12/19/2003	455	2419	1505-1033-1

APPLICANTS

Joakim Norrgard, Lulea, SWEDEN;
Anders Larsson, Lulea, SWEDEN;
Olov Schelen, Norrfjarden, SWEDEN;

**** CONTINUING DATA **************************

This application is a 371 of PCT/SE01/02847 12/20/2001

**** FOREIGN APPLICATIONS **************************

UNITED STATES OF AMERICA 60261166 01/16/2001

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **

Foreign Priority claimed	☐ Yes ☑ No	☐ Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	☐ Yes ☑ No		SWEDEN	6	42	3
Verified and Acknowledged	/MICHAEL J MOORE JR/ Examiner's Signature	Initials				

ADDRESS

YOUNG & THOMPSON
209 Madison Street
Suite 500
ALEXANDRIA, VA 22314
UNITED STATES

TITLE

Network resource manager in a mobile telecommunication system

FILING FEE RECEIVED		
793	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of

Joakim NORRGARD et al. Conf. 9055

Application No. 10/250,702 Group 2619

Filed December 19, 2003 Examiner M. Moore, Jr.

NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

AMENDMENT

Assistant Commissioner for Patents September 15, 2008
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Official Action of March 13, 2008, for which the period for response has been extended three months, please amend the above-identified application as follows:

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

Remarks begin on page 8 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

1-31. (canceled)

32. (currently amended) A method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission, the method comprising the steps of:

handling radio resources within the RAN by using a radio resource manager; and

controlling IP network resources by using a resource map in a Network Resource Manager (NRM) in order to provide said end-to-end QoS,

the step of controlling IP network resources including the steps of the NRM performing path-sensitive call admission control by using the resource map in the NRM, [[and]] the NRM checking that resources are available along a path, and the NRM pre-allocating resources in the IP network, and

scheduling resources over time by introducing a start and a stop time as a parameter in a resource request handled by the NRM,

communicating resource information between the NRM and the radio resource manager, and

reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS.

33. (previously presented) Method according to claim 32, wherein the NRM is used within the RAN and a CN.

34. (previously presented) Method according to claim 32, wherein the NRM is used within the RAN.

35. (previously presented) Method according to claim 32, wherein the NRM is used within the CN.

36-38. (canceled)

39. (previously presented) Method according to claim 32, the method comprising the further step of signalling resource information between the NRM and at least a second NRM used within at least a second network domain.

40. (previously presented) Method according to claim 32, the method comprising the further step of monitoring topology changes by using the NRM, that retrieves routing information concerning the IP network.

41. (previously presented) Method according to claim 40, wherein the topology is monitored in order to be able to re-allocate IP network resources.

42. (canceled)

43. (previously presented) Method according to claim 32, wherein the path-sensitive call admission control is parameter based.

44. (previously presented) Method according to claim 32, wherein the path-sensitive call admission control is measurement based.

45-47. (canceled)

48. (currently amended) A Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission and a radio resource manager that controls radio resources within the RAN, the NRM comprising a resource map and means for controlling IP network resources within the IP network using the resource map in order to provide end-to-end Quality of Service (QoS),

said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the NRM and for the NRM checking that resources are available along a path and for the NRM pre-allocating resources in the IP network part of the telecommunication system,

means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request,

means for communicating resource information between the NRM and the radio resource manager, and

means for reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS.

49. (previously presented) NRM according to claim 48, further comprising means for being used within the RAN and a CN.

50. (previously presented) NRM according to claim 48, further comprising means for using IP network resources within the RAN.

51. (previously presented) NRM according to claim 48, further comprising means for being used within the CN.

52-54. (canceled)

55. (previously presented) NRM according to claim 48, further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

56. (previously presented) NRM according to claim 48, further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

57. (previously presented) NRM according to claim 56, wherein the topology is monitored in order to be able to reallocate access resources.

58. (canceled)

59. (previously presented) NRM according to claim 48, wherein the path-sensitive call admission control is parameter based.

60. (previously presented) NRM according to claim 48, wherein the path-sensitive call admission control is measurement based.

61. (canceled)

62. (currently amended) A Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission and a radio resource manager that controls radio resources within the RAN, the NRM comprising a resource map and means for controlling IP network resources within the IP network using the resource map in order to provide feedback to [[the]] a network operator,

said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the NRM and for the NRM checking that resources are available along a path and for the NRM pre-allocating resources in the IP network part of the telecommunication system,

means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request,

means for communicating resource information between the NRM and the radio resource manager,

means for reserving the IP network resources along the path by the NRM, and

means for providing the feedback to the network operator.

63. (previously presented) NRM according to claim 62, further comprising means for being used within the RAN and a CN.

64. (previously presented) NRM according to claim 62, further comprising means for using the IP network resources within the RAN.

65. (previously presented) NRM according to claim 62, further comprising means for use within the CN.

66. (canceled)

67. (previously presented) NRM according to claim 62, further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

68. (previously presented) NRM according to claim 62, further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

69. (previously presented) NRM according to claim 68, wherein the topology is monitored in order to be able to reallocate access resources.

70. (canceled)

71. (previously presented) NRM according to claim 62, wherein the path-sensitive call admission control is parameter based.

72. (previously presented) NRM according to claim 62, wherein the path-sensitive call admission control is measurement based.

73. (canceled)

Remarks

Claim 46 was rejected under 35 U.S.C. 101. The explanation provided in the Official Action is appreciated. This claim has been canceled and withdrawal of the rejection is respectfully requested.

Claim 62 has been amended as to form in the manner suggested in the Official Action.

Claims 32-35, 38-41, 43-46, 48-51, 54-57, 59-65, and 71-73 were rejected as anticipated by ARUNACHALAM et al. 6,631,122. Claims 32, 48, and 62 have been amended and claims 38, 45, 54, 61, and 73 have been canceled. Reconsideration and withdrawal of the rejection are respectfully requested.

The independent claims have been amended to include the NRM pre-allocating resources from claim 38 and to include the scheduling of resources from claim 45.

One of the differences between the amended claims and ARUNACHALEM et al. is that in the amended claims resources (e.g., alternative paths) are both pre-allocated and scheduled. This is not disclosed in ARUNACHALEM et al.

One of the strengths of the invention of the amended claims is the capability to pre-allocate resources whereby one can, with a pre-defined block probability, guarantee the availability of resources in the IP network also from alternative radio bases that might be engaged. This is important in high-performance scenarios where delay cannot be accepted, such as in a mobile

terminal handover from one base radio to another, wherein resources for the new path can be pre-allocated thereby minimizing the risk of pre-emption during a handover. Further, the concept of pre-allocation of resources enable the radio resource manager to aggregate a set of sessions into one reservation with the NRM. This reduces the signaling between the resource managers and the increases the performance and scalability.

In view of the present amendment and the foregoing remarks, it is believed that the present application has been placed in condition for allowance. Reconsideration and allowance are respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON

/Thomas W. Perkins/

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209 Madison Street, Suite 500
Alexandria, VA 22314
Telephone (703) 521-2297
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(703) 979-4709

TWP/jr

PATENT
1505-1033-1

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of

Joakim NORRGARD et al. Conf. 9055

Application No. 10/250,702 Group 2619

Filed December 19, 2003 Examiner M. Moore, Jr.

NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

PETITION FOR EXTENSION OF TIME

Assistant Commissioner for Patents September 15, 2008
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The undersigned hereby petitions for an extension of time to respond to the Official Action of March 13, 2008 for 3 (three) months to September 13, 2008. (September 13 being a Saturday and September 14 being a Sunday).

The required filing fee is being paid online simultaneously herewith by credit card in the amount of $525.00.

A responsive paper is filed herewith.

Respectfully submitted,

YOUNG & THOMPSON

/Thomas W. Perkins/

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209 Madison Street, Suite 500
Alexandria, VA 22314
Telephone (703) 521-2297
Telefax (703) 685-0573
(703) 979-4709

TWP/jr

Electronic Patent Application Fee Transmittal

Application Number:	10250702
Filing Date:	19-Dec-2003
Title of Invention:	Network resource manager in a mobile telecommunication system
First Named Inventor/Applicant Name:	Joakim Norrgard
Filer:	Thomas W. Perkins/Joni Ralls
Attorney Docket Number:	1505-1033-1

Filed as Small 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:				
Extension-of-Time:				
Extension - 3 months with $0 paid	2253	1	525	525

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**525**

Electronic Acknowledgement Receipt

EFS ID:	3941083
Application Number:	10250702
International Application Number:	
Confirmation Number:	9055
Title of Invention:	Network resource manager in a mobile telecommunication system
First Named Inventor/Applicant Name:	Joakim Norrgard
Customer Number:	00466
Filer:	Thomas W. Perkins/Joni Ralls
Filer Authorized By:	Thomas W. Perkins
Attorney Docket Number:	1505-1033-1
Receipt Date:	15-SEP-2008
Filing Date:	19-DEC-2003
Time Stamp:	13:35:52
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$525
RAM confirmation Number	7870
Deposit Account	250120
Authorized User	PERKINS,THOMAS W.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	2008-09-15_Response.pdf	36705 1ef768d16905c39dcf0d1ac961bfb57c5cf24397	no	9
Warnings:					
Information:					
2	Extension of Time	2008-09-15_Extension_of_Time.pdf	13044 f7f86d9eaf823274b6c4ba54978849b4c7cdb0b6	no	1
Warnings:					
Information:					
3	Fee Worksheet (PTO-06)	fee-info.pdf	29871 b019c034e87a766631b0af3dee532012c102f492	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	79620		

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.

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.

National Stage of an International Application under 35 U.S.C. 371
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.

New International Application Filed with the USPTO as a Receiving Office
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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
10/250,702	12/19/2003	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ 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 $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ 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).						
☐ 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	
	09/15/2008	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	* 27	Minus	** 42	= 0	X $25 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $105 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

		(Column 1)		(Column 2)	(Column 3)					
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L 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.

Legal Instrument Examiner:
/LAVINIA JOHNSON/

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.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/250,702	12/19/2003	Joakim Norrgard	1505-1033-1	9055

466 7590 03/13/2008

YOUNG & THOMPSON
209 Madison Street
Suite 500
ALEXANDRIA, VA 22314

EXAMINER	
MOORE JR, MICHAEL J	
ART UNIT	PAPER NUMBER
2619	

MAIL DATE	DELIVERY MODE
03/13/2008	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.	Applicant(s)	
	10/250,702	NORRGARD ET AL.	
	Examiner	Art Unit	
	MICHAEL J. MOORE JR	2619	

-- 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 *20 December 2007*.

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) *32-35,38-41,43-46,48-51,54-57,59-65,67-69 and 71-73* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-35,38-41,43-46,48-51,54-57,59-65,67-69 and 71-73* is/are rejected.

7)☐ Claim(s) _____ 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 _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/20/07 has been entered.

Claim Objections

2. Claim **62** is objected to because of the following informalities: On line 8, the word "the" before word "network" should be "a" in this first instance. Appropriate correction is required.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claim **46** is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Specifically, the “computer-readable medium” of this claim is defined to include “the Internet” on page 17, lines 27-29 of the specification, which is a propagation medium (signal) that embodies the computer program, and constitutes non-statutory subject matter.

Claim Rejections - 35 USC § 102

4. 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.

5. Claims **32-35, 38-41, 43-46, 48-51, 54-57, 59-65, 67-69, and 71-73** are rejected under 35 U.S.C. 102(e) as being anticipated by Arunachalam et al. (U.S. 6,631,122).

Regarding claim **32**, "a method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission" is anticipated by the IP-over-Wireless/Cellular network 231 (Core Network) of Figure 2 that provides QoS support to mobile endsystems 209 via edge devices 204a and wireless transmitters 204b (Radio access network) as spoken of on column 4, lines 1-3 and 13-15.

"Handling radio resources within the RAN by using a radio resource manager" is anticipated by the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

"Controlling IP network resources by using a resource map in a Network Resource Manager (NRM) in order to provide the end-to-end QoS" is anticipated by the QoS agent 301 (NRM) of Figure 3 that maps QoS parameters (has resource map) in the

wireline transit network to the CoS permitted within the wireless network as spoken of on column 8, lines 55-64.

"The NRM performing path-sensitive call admission control by using the resource map in the NRM and the NRM checking that resources are available along a path" is anticipated by the QoS agent (NRM) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

"Communicating resource information between the NRM and the radio resource manager" is anticipated by the QoS agent (NRM) that sends flow information and CoS information (resource information) of the new flow to the radio resource manager as spoken of on column 9, lines 4-6.

Lastly, "reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS" is anticipated by the radio resource manager that allocates appropriate resources for the flow in accordance with the flow and CoS information provided by the QoS agent (NRM) as spoken of on column 9, lines 54-56.

Regarding claim **33**, "wherein the NRM is used within the RAN and a CN" is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **34**, "wherein the NRM is used within the RAN" is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **35**, "wherein the NRM is used within the CN" is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **38**, "pre-allocating resources by the NRM in the IP network" is anticipated by the QoS agent of Figure 5 that uses dynamic resource controller 511 to control dynamic radio resource allocation (pre-allocating) as shown in Figure 5.

Regarding claim **39**, "signaling resource information between the NRM and at least a second NRM used within at least a second network domain" is anticipated by QoS agents 205 (NRMs) of different networks 201, 211, 221, 231 of Figure 2, that communicate resource negotiation information in a peer-to-peer fashion as shown in Figure 2.

Regarding claim **40**, "monitoring topology changes by using the NRM that retrieves routing information concerning the IP network" is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **41**, "wherein the topology is monitored in order to be able to reallocate IP network resources" is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **43**, "wherein the path-sensitive call admission control is parameter based" is anticipated by the call admission controller 507 of the QoS agent of

Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **44**, “wherein the path-sensitive call admission control is measurement based” is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **45**, “scheduling resources over time by introducing a start time and a stop time as a parameter in a resource request handled by the NRM” is anticipated by the QoS agent 801 of Figure 8 that schedules incoming packets of flows through weighting of the flows according to bandwidth allocation and precedence information (start/stop parameter) as spoken of on column 10, lines 11-14.

Regarding claim **46**, “a computer program embodied in a computer-readable medium, the computer program causing a computer in which the computer-readable medium is operated to perform the steps of claim 32" is anticipated by the computer readable media used in conjunction with the QoS agent of Figure 5 as spoken of on column 13, lines 35-44.

Regarding claim **48**, “a Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission" is anticipated by the IP-over-Wireless/Cellular network 231 (Core Network) of Figure 2 that provides QoS support to mobile endsystems 209 via edge devices 204a and

wireless transmitters 204b (Radio access network) as spoken of on column 4, lines 1-3 and 13-15, as well as the QoS agent 301 (NRM) of Figure 3.

"A radio resource manager that controls radio resources within the RAN" is anticipated by the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

"The NRM comprising a resource map and means for controlling IP network resources within the IP network using the resource map in order to provide end-to-end Quality of Service (QoS)" is anticipated by the QoS agent 301 (means) of Figure 3 that maps QoS parameters (has resource map) in the wireline transit network to the CoS permitted within the wireless network as spoken of on column 8, lines 55-64.

"Means for the NRM performing path-sensitive call admission control by using the resource map in the NRM and for the NRM checking that resources are available along a path" is anticipated by the QoS agent (means) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

"Means for communicating resource information between the NRM and the radio resource manager" is anticipated by the QoS agent (means) that sends flow information and CoS information (resource information) of the new flow to the radio resource manager as spoken of on column 9, lines 4-6.

Lastly, “means for reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS" is anticipated by the radio resource manager that allocates appropriate resources for the flow in accordance with the flow and CoS information provided by the QoS agent (means) as spoken of on column 9, lines 54-56.

Regarding claim **49**, “means for being used within the RAN and a CN” is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **50**, “means for using IP network resources within the RAN” is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **51**, “means for being used within the CN” is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **54**, "means for pre-allocating resources in the IP network part of the telecommunication system" is anticipated by the QoS agent of Figure 5 that uses dynamic resource controller 511 (means) to control dynamic radio resource allocation (pre-allocating) as shown in Figure 5.

Regarding claim **55**, “means for communicating with at least a second NRM used within at least a second IP network domain" is anticipated by QoS agents 205 (NRMs) of different networks 201, 211, 221, 231 of Figure 2, that communicate resource negotiation information in a peer-to-peer fashion (means) as shown in Figure 2.

Regarding claim **56**, “means for monitoring topology changes by retrieving routing information concerning the IP network” is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **57**, "wherein the topology is monitored in order to be able to reallocate access resources" is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **59**, “wherein the path-sensitive call admission control is parameter based” is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **60**, “wherein the path-sensitive call admission control is measurement based” is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **61**, “means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request” is anticipated by the QoS agent 801 of Figure 8 that schedules incoming packets of flows through weighting of the flows according to bandwidth allocation and precedence information (start/stop parameter) as spoken of on column 10, lines 11-14.

Regarding claim **62**, “a Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission" is anticipated by the IP-over-Wireless/Cellular network 231 (Core Network) of Figure 2 that provides QoS support to mobile endsystems 209 via edge devices 204a and wireless transmitters 204b (Radio access network) as spoken of on column 4, lines 1-3 and 13-15, as well as the QoS agent 301 (NRM) of Figure 3.

“A radio resource manager that controls radio resources within the RAN” is anticipated by the radio resource manager 805 of Figure 8 that determines a set of resources to provide (handles radio resources) depending on class of service as spoken of on column 9, lines 30-32.

“The NRM comprising a resource map and means for controlling IP network resources within the IP network using the resource map in order to provide feedback to the network operator” is anticipated by the QoS agent 301 (means) of Figure 3 that maps QoS parameters (has resource map) in the wireline transit network to the CoS permitted within the wireless network as spoken of on column 8, lines 55-64, and then provides corresponding flow and CoS information (feedback) to the radio resource manager (network operator) as spoken of on column 9, lines 4-6.

“Means for the NRM performing path-sensitive call admission control by using the resource map in the NRM and for the NRM checking that resources are available along a path” is anticipated by the QoS agent (means) of Figure 5 that makes a call admission decision via call admission controller 507 upon resource estimation (checking

resources), and controls dynamic radio resource allocation through the radio resource manager via dynamic resource controller 511 as spoken of on column 5, lines 38-48.

"Means for communicating resource information between the NRM and the radio resource manager" is anticipated by the QoS agent (means) that sends flow information and CoS information (resource information) of the new flow to the radio resource manager as spoken of on column 9, lines 4-6.

Lastly, "means for reserving the IP network resources along the path by the NRM" is anticipated by the radio resource manager that allocates appropriate resources for the flow in accordance with the flow and CoS information provided by the QoS agent (means) as spoken of on column 9, lines 54-56.

Lastly, "means for providing the feedback to the network operator" is anticipated by the QoS agent (means) that sends flow information and CoS information (feedback) of the new flow to the radio resource manager (network operator) as spoken of on column 9, lines 4-6.

Regarding claim **63**, "means for being used within the RAN and a CN" is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **64**, "means for using IP network resources within the RAN" is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **65**, “means for use within the CN” is anticipated by the QoS agent 205 (NRM) of Figure 2 that communicates with network 231 (CN) as well as edge devices 204a and wireless transmitters 204b (RAN devices).

Regarding claim **67**, “means for communicating with at least a second NRM used within at least a second IP network domain" is anticipated by QoS agents 205 (NRMs) of different networks 201, 211, 221, 231 of Figure 2, that communicate resource negotiation information in a peer-to-peer fashion (means) as shown in Figure 2.

Regarding claim **68**, “means for monitoring topology changes by retrieving routing information concerning the IP network” is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **69**, "wherein the topology is monitored in order to be able to reallocate access resources" is anticipated by the QoS agent 801 of Figure 8 that monitors QoS behavior of flows and retrieves estimates of QoS parameters such that a resource reassignment decision can be made as spoken of on column 10, lines 25-30.

Regarding claim **71**, “wherein the path-sensitive call admission control is parameter based” is anticipated by the call admission controller 507 of the QoS agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **72**, “wherein the path-sensitive call admission control is measurement based” is anticipated by the call admission controller 507 of the QoS

agent of Figure 5 that makes a call admission control decision based on a parameters computation as spoken of on column 5, lines 44-46.

Regarding claim **73**, "means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request" is anticipated by the QoS agent 801 of Figure 8 that schedules incoming packets of flows through weighting of the flows according to bandwidth allocation and precedence information (start/stop parameter) as spoken of on column 10, lines 11-14.

Response to Arguments

6. Applicant's arguments with respect to *amended* claims **32-35, 38-41, 43-46, 48-51, 54-57, 59-65, 67-69, and 71-73** have been considered but are moot in view of the new ground(s) of rejection provided above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL J. MOORE, JR. whose telephone number is (571)272-3168. The examiner can normally be reached on Monday-Friday (7:30am - 4:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wing F. Chan can be reached at (571) 272-7493. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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.

/Michael J. Moore, Jr./
Examiner, Art Unit 2619

Notice of References Cited	Application/Control No. 10/250,702	Applicant(s)/Patent Under Reexamination NORRGARD ET AL.	
	Examiner MICHAEL J. MOORE JR	Art Unit 2619	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,631,122 B1	10-2003	Arunachalam et al.	370/332
	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.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2619

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

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/05/2008								
	1	-								
	2	-								
	3	-								
	4	-								
	5	-								
	6	-								
	7	-								
	8	-								
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	26	-								
	27	-								
	28	-								
	29	-								
	30	-								
	31	-								
	32	✓								
	33	✓								
	34	✓								
	35	✓								
	36	-								

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2619

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

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/05/2008								
	37	-								
	38	✓								
	39	✓								
	40	✓								
	41	✓								
	42	-								
	43	✓								
	44	✓								
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	68	✓								
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	70	-								
	71	✓								
	72	✓								

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2619

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

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/05/2008								
	73	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10250702	NORRGARD ET AL.
	Examiner	Art Unit
	MICHAEL J MOORE JR	2619

SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST inventor search (See Search History Printout)	3/4/08	MM
101 consult with Wing Chan (SPE AU 2619)	3/5/08	MM

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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BIB DATA SHEET

CONFIRMATION NO. 9055

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/250,702	12/19/2003	455	2619	1505-1033-1

APPLICANTS

Joakim Norrgard, Lulea, SWEDEN;
Anders Larsson, Lulea, SWEDEN;
Olov Schelen, Norrfjarden, SWEDEN;

**** CONTINUING DATA **************************

This application is a 371 of PCT/SE01/02847 12/20/2001

**** FOREIGN APPLICATIONS **************************

UNITED STATES OF AMERICA 60261166 01/16/2001

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /MICHAEL J MOORE JR/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		SWEDEN	6	42	3

ADDRESS

YOUNG & THOMPSON
209 Madison Street
Suite 500
ALEXANDRIA, VA 22314
UNITED STATES

TITLE

Network resource manager in a mobile telecommunication system

FILING FEE RECEIVED		
793	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S11	8	"333915".ap.	US-PGPUB; USPAT	OR	OFF	2008/03/04 11:52
S13	174	arunachalam.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/03/04 11:53
S15	6	arunachalam.in. and sen.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/03/04 11:54

3/4/08 3:19:03 PM
C:\Documents and Settings\mmoore5\My Documents\EAST\Workspaces\mike10250702.wsp

OIPE IAP46 DEC 20 2007 PATENT & TRADEMARK OFFICE

MAIL STOP RCE
PATENT
1505-1033-1

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of

Joakim NORRGARD et al. Conf. 9055

Application No. 10/250,702 Group 2616

Filed December 19, 2003 Examiner M. Moore, Jr.

NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

REQUEST FOR CONTINUED EXAMINATION
UNDER 37 C.F.R. § 1.114

MS RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

December 20, 2007

Sir:

This is a "Request for Continued Examination" under 37 C.F.R. § 1.114, the provisions of which do not apply to:

(1) A provisional application; (2) An application for a utility or plant patent filed under 35 U.S.C. 111(a) before June 8, 1995; (3) An international application filed under 35 U.S.C. §363 before June 8, 1995; (4) An application for a design patent; or (5) A patent under reexamination.

☒ This Request for Continued Examination is being filed prior to the earliest of:

(1) Payment of the issue fee, unless a petition under §1.313 is granted; (2) Abandonment of the application; or (3) The filing of a notice of appeal to the U.S. Court of Appeals for the Federal Circuit under 35 U.S.C. § 141, or the commencement of civil action under 35 U.S.C. §§ 145 or 146, unless the appeal or civil action is terminated.

☐ The enclosed document is being transmitted via facsimile.

12/21/2007 HBELETE1 00000087 10250702
01 FC:2801 405.00 OP

☒ **Submission Required under 37 C.F.R. § 1.114:**

Enter as part of the present submission:

☐ An After Final Amendment previously filed on , under 37 C.F.R. § 1.116 but unentered, in the present application.

☐ Arguments in the Appeal Brief or Reply Brief previously filed on .

☒ A Reply, attached hereto. Claim fee(s) are calculated as set forth below:

	TOTAL NUMBER OF CLAIMS PREVIOUSLY FILED	TOTAL NUMBER OF CLAIMS BEING FILED HEREWITH	NUMBER EXTRA	RATE	FEE
Total Claims	42	33	0	x$25 =	$0.00
Independent Claims	3	3	0	x$105 =	$0.00
			TOTAL CLAIM FEE(S)		$0.00

☐ An Information Disclosure Statement (IDS) and PTO-1449 form(s) is/are attached hereto for the Examiner's consideration.

☐ Other:

☒ **Fees**

The required fee under 37 C.F.R. § 1.17(e) as required by 37 C.F.R. § 1.114 when the RCE is filed, is enclosed herewith:

☒ $405.00 - small entity

☐ $810.00 - large entity

☐ The applicant(s) hereby petition(s) for an extension of () month(s) pursuant to 37 C.F.R. §§ 1.17 and 1.136(a). The fee has been calculated as shown below:

☐ NO extensions of time have been previously obtained in the prior application. Thus, a fee of $0.00 is required for the full period of the above-requested extension of time.

☐ An extension of ( ) month(s) was previously requested and paid for on in the instant application. Thus, a fee of $0.00 is required to obtain an additional ( ) month(s) extension.

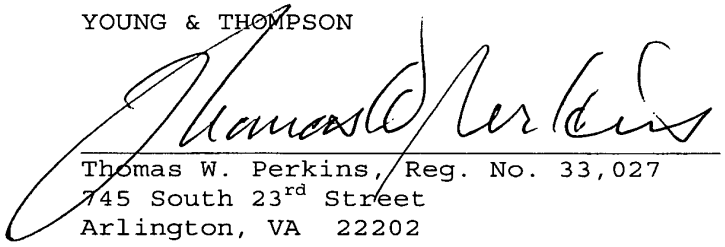
☐ Enclosed is a check in the amount of $0.00 for the applicable filing fee, additional claims fee, and/or extension fees.

☒ Please charge our credit card set forth in the attached Credit Card Payment Form in the amount of $405.00.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

YOUNG & THOMPSON



Thomas W. Perkins, Reg. No. 33,027
745 South 23rd Street
Arlington, VA 22202
Telephone (703) 521-2297
Telefax (703) 685-0573
(703) 979-4709

TWP/lrs

Attachment:
Credit Card Payment Form

OIPE IAP46
DEC 20 2007
PATENT & TRADEMARK OFFICE

MAIL STOP RCE
PATENT
1505-1033-1

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of

Joakim NORRGARD et al. Conf. 9055

Application No. 10/250,702 Group 2616

Filed December 19, 2003 Examiner M. Moore, Jr.

NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

AMENDMENT

Assistant Commissioner for Patents December 20, 2007
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Official Action of September 20, 2007, and in conjunction with the Request for Continued Examination (RCE) filed herewith, please amend the above-identified application as follows:

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:

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

LISTING OF CLAIMS:

1-31. (canceled)

32. (currently amended) A method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission, the method comprising the steps of:

handling radio resources within the RAN by using a radio resource manager; and

controlling IP network resources by using a resource map in a Network Resource Manager (NRM) in order to provide said end-to-end QoS,

the step of controlling IP network resources including the steps of the NRM performing path-sensitive call admission control by using the resource map in the NRM and the NRM checking that resources are available along a path,

communicating resource information between the NRM and the radio resource manager, and

reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS.

33. (previously presented) Method according to claim 32, wherein the NRM is used within the RAN and a CN.

34. (previously presented) Method according to claim 32, wherein the NRM is used within the RAN.

35. (previously presented) Method according to claim 32, wherein the NRM is used within the CN.

36-37. (canceled)

38. (previously presented) Method according to claim 32, the method comprising the further step of pre-allocating resources by the NRM in the IP network.

39. (previously presented) Method according to claim 32, the method comprising the further step of signalling resource information between the NRM and at least a second NRM used within at least a second network domain.

40. (previously presented) Method according to claim 32, the method comprising the further step of monitoring topology changes by using the NRM, that retrieves routing information concerning the IP network.

41. (previously presented) Method according to claim 40, wherein the topology is monitored in order to be able to re-allocate IP network resources.

42. (canceled)

43. (currently amended) Method according to claim [[42]]32, wherein the path-sensitive call admission control is parameter based.

44. (currently amended) Method according to claim [[42]]32, wherein the path-sensitive call admission control is measurement based.

45. (previously presented) Method according to claim 32, the method comprising the further step of scheduling resources over time by introducing a start and a stop time as a parameter in a resource request handled by the NRM.

46. (currently amended) A computer program embodied in a computer-readable medium, the computer program causing a computer in which the computer-readable medium is operated to perform ~~performing~~ the steps of claim 32.

47. (canceled)

48. (currently amended) A Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission and a radio resource manager that controls radio resources within the RAN, the NRM comprising a resource map and means for controlling IP network resources within the IP network using the resource map in order to provide end-to-end Quality of Service (QoS),

said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the NRM and for the NRM checking that resources are available along a path,

means for communicating resource information between the NRM and the radio resource manager, and

means for reserving the IP network resources along the path by the NRM to fulfill the end-to-end QoS.

49. (previously presented) NRM according to claim 48, further comprising means for being used within the RAN and a CN.

50. (previously presented) NRM according to claim 48, further comprising means for using IP network resources within the RAN.

51. (previously presented) NRM according to claim 48, further comprising means for being used within the CN.

52-53. (canceled)

54. (previously presented) NRM according to claim 48, further comprising means for pre-allocating resources in the IP network part of the telecommunication system.

55. (previously presented) NRM according to claim 48, further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

56. (previously presented) NRM according to claim 48, further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

57. (previously presented) NRM according to claim 56, wherein the topology is monitored in order to be able to reallocate access resources.

58. (canceled)

59. (currently amended) NRM according to claim [[58]]48, wherein the path-sensitive call admission control is parameter based.

60. (currently amended) NRM according to claim [[58]]48, wherein the path-sensitive call admission control is measurement based.

61. (previously presented) NRM according to claim 48, further comprising means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request.

62. (currently amended) A Network Resource Manager (NRM) within a mobile telecommunication system that includes a Core Network (CN) connected to at least one Radio Access Network (RAN) using Internet Protocol (IP) based transmission and a radio resource manager that controls radio resources within the RAN, the NRM comprising a resource map and means for controlling IP network resources within the IP network using the resource map in order to provide feedback to the network operator,

said means for controlling comprising means for the NRM performing path-sensitive call admission control by using the resource map in the NRM and for the NRM checking that resources are available along a path,

means for communicating resource information between the NRM and the radio resource manager,

means for reserving the IP network resources along the path by the NRM, and

means for providing the feedback to the network operator.

63. (previously presented) NRM according to claim 62, further comprising means for being used within the RAN and a CN.

64. (previously presented) NRM according to claim 62, further comprising means for using the IP network resources within the RAN.

65. (previously presented) NRM according to claim 62, further comprising means for use within the CN.

66. (canceled)

67. (previously presented) NRM according to claim 62, further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

68. (previously presented) NRM according to claim 62, further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

69. (previously presented) NRM according to claim 68, wherein the topology is monitored in order to be able to reallocate access resources.

70. (canceled)

71. (currently amended) NRM according to claim [[70]]62, wherein the path-sensitive call admission control is parameter based.

72. (currently amended) NRM according to claim [[70]]62, wherein the path-sensitive call admission control is measurement based.

73. (previously presented) NRM according to claim 62, further comprising means for scheduling resources over time by introducing a start and a stop time as a parameter in a resource request.

REMARKS

Claim 46 was rejected under 35 U.S.C. 101. This rejection is not understood. The claim defines a computer program "embodied in a computer-readable medium," where the computer program performs the steps of claim 32. Claim 32 includes, and thus claim 46 includes, the step of controlling IP network resources by using a resource map in a Network Resource Manager (NRM) in order to provide the end-to-end QoS. This step is clearly a practical application of the computer-readable medium of claim 46. In any event the claim has been amended to provide that the program causes a computer in which the computer-readable medium is operated to perform the steps of claim 32, in the event that these words are what the Examiner has in mind. Reconsideration and withdrawal of the rejection are respectfully requested.

Claims 32-46 and 48-73 were rejected as anticipated by SEN et al. 6,701,149. Claims 32, 48, and 62 have been amended and claims 36-37, 42, 52-53, 58, 66, and 70 have been canceled. Reconsideration and withdrawal of the rejection are respectfully requested.

The independent claims have been amended to include subject matter from claims 36-37 and 42. Support for the amendment is found at least in these claims and at page 11, lines 1-8 and page 12, beginning at line 18.

SEN et al. disclose a policy control feature and the Official Action indicates that this corresponds to the claimed resource manager. The amended claims define the resource manager with greater specificity and the amended claims avoid SEN et al.

Amended claim 32 provides that the step of controlling IP network resources includes the steps of the NRM performing path-sensitive call admission control by using the resource map in the NRM and the NRM checking that resources are available along a path, communicating resource information between the NRM and the radio resource manager, and reserving the IP network resources along the path by the NRM. There is no suggestion in SEN et al. to have the NRM perform all of these functions. SEN et al. discusses only policy control, which falls short of disclosing these steps. Providing an NRM that does all of these functions goes far beyond what is envisioned by SEN et al.

Independent claims 48 and 62 include corresponding means-plus-function limitations and are allowable for the same reasons. The dependent claims are allowable at least by virtue of their dependence on one of the amended independent claims.

In view of the present amendment and the foregoing remarks, it is believed that the present application has been placed in condition for allowance. Reconsideration and allowance are respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON

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(703) 979-4709

TWP/lrs

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
10/250,702	12/19/2003	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ 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 $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ 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).						
☐ 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

AMENDMENT	12/20/2007	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 33	Minus	** 42	= 0	X $25 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $105 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L 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.

Legal Instrument Examiner:
shirell m. carmichael

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.
10/250,702	12/19/2003	Joakim Norrgard	1505-1033-1	9055

466 7590 09/20/2007

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EXAMINER	
MOORE JR, MICHAEL J	
ART UNIT	**PAPER NUMBER**
2616	
MAIL DATE	**DELIVERY MODE**
09/20/2007	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.	Applicant(s)	
	10/250,702	NORRGARD ET AL.	
	Examiner	Art Unit	
	Michael J. Moore, Jr.	2616	

-- 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 *29 June 2007*.

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) *32-46 and 48-73* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-46 and 48-73* is/are rejected.

7)☐ Claim(s) _____ 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 *29 June 2007* 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 _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. Replacement drawings were received on 6/29/07. These drawings are acceptable and have been entered.

Claim Objections

Amendments made by Applicant to obviate the claim objections presented in the previous Office Action are proper and have been entered. These objections have been withdrawn.

Claim Rejections - 35 USC § 112

Amendments made by Applicant to obviate the claim rejections under 35 USC 112 2nd paragraph presented in the previous Office Action are proper and have been entered. These rejections have been withdrawn.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claim **46** is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Currently, *amended* claim **46** is directed to "functional descriptive material *per se*" (computer program) with no claimed practical application. Please see "Interim Guidelines on Patentable Subject Matter Eligibility".

Claim Rejections - 35 USC § 102

3. 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.

4. Claims **32-46 and 48-73** are rejected under 35 U.S.C. 102(e) as being anticipated by Sen et al. (U.S. 6,701,149) (hereinafter "Sen"). *Sen* teaches all of the limitations of the specified claims with the reasoning that follows.

Regarding claim **32**, "a method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system" is anticipated by the method shown in Figure 3.

"A Core Network (CN) connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission" is anticipated by the core network 12 coupled to RAN 14 and RAN 16 as shown in Figure 1 and spoken of on column 3, lines 44-67.

"Handling radio resources within the RAN by using a radio resource manager" is anticipated by the RNC 18 and RNC 20 of the RANs of Figure 1 that perform radio resource management as spoken of on column 3, lines 44-50.

Lastly, "controlling IP network resources by using a resource map in a Network Resource Manager (NRM) in order to provide the end-to-end QoS" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker (has map of resources) by exchanging policy information messages with RNCs 18 and 20 as spoken of on column 5, lines 45-54.

Regarding claim **33**, "the NRM is used within the RAN and a CN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claim **34**, "the NRM is used within the RAN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claim **35**, "the NRM is used within the CN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claim **36**, "communicating resource information between the NRM and the radio resource manager" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker by exchanging policy information messages (resource information) with RNCs 18 and 20 (radio resource managers) as spoken of on column 5, lines 45-54.

Regarding claim **37**, "reserving IP network resources by the NRM to fulfill the end-to-end QoS" is anticipated by the end-to-end QoS negotiation and establishment performed by the Core Network 12 of Figure 1 as spoken of on column 5, lines 10-15.

Regarding claim **38**, "pre-allocating resources by the NRM in the IP network" is anticipated by the end-to-end QoS negotiation and establishment performed by the Core Network 12 of Figure 1 as spoken of on column 5, lines 10-15.

Regarding claim **39**, "signaling resource information between the NRM and at least a second NRM used within at least a second network domain" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker by exchanging policy information messages (resource

information) with RNCs 18 and 20 (radio network resource managers) as spoken of on column 5, lines 45-54.

Regarding claim **40**, "monitoring topology changes by using the NRM, that retrieves routing information concerning the IP network" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **41**, "topology is monitored in order to be able to re-allocate IP network resources" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **42**, "performing path-sensitive call admission control by using the resource map and checking that resources are available along a path" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **43**, "the path-sensitive call admission control is parameter based" is anticipated by the admission control function (considers cell traffic parameter for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **44**, "the path-sensitive call admission control is measurement based" is anticipated by the admission control function (considers cell traffic

measurement for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **45**, "scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request handled by the NRM" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **46**, "a computer program embodied in a computer-readable medium, the computer program performing the steps of claim 32" is anticipated by column 7, lines 7-10, which states the system 10 of Figure 1 may include computers (servers) that perform the resource management functions of system 10.

Regarding claim **48**, "a Network Resource Manager (NRM) within a mobile telecommunication system" as well as "the NRM comprising a resource map and means for controlling resources within the IP network in order to provide end-to-end Quality of Service (QoS)" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker (has map of resources) by exchanging policy information messages with RNCs 18 and 20 as spoken of on column 5, lines 45-54.

"A Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission" is anticipated by the core network 12 coupled to RAN 14 and RAN 16 as shown in Figure 1 and spoken of on column 3, lines 44-67.

Lastly, "a radio resource manager that controls radio resources within the RAN" is anticipated by the RNC 18 and RNC 20 of the RANs of Figure 1 that perform radio resource management as spoken of on column 3, lines 44-50.

Regarding claims **49 and 63**, "means for being used within the RAN and a CN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claims **50 and 64**, "means for being used IP network resources within the RAN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claims **51 and 65**, "means for being used within the CN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claims **52 and 66**, "means for communicating resource information with the radio resource manager" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker by exchanging policy information messages (resource information) with RNCs 18 and 20 (radio resource managers) as spoken of on column 5, lines 45-54.

Regarding claim **53**, "means for reserving IP network resources to fulfill the end-to-end QoS" is anticipated by the end-to-end QoS negotiation and establishment performed by the Core Network 12 (means) of Figure 1 as spoken of on column 5, lines 10-15.

Regarding claim **54**, "means for pre-allocating resources in the IP network part of the telecommunication system" is anticipated by the end-to-end QoS negotiation and establishment performed by the Core Network 12 (means) of Figure 1 as spoken of on column 5, lines 10-15.

Regarding claims **55 and 67**, "means for communicating with at least a second NRM used within at least a second IP network domain" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 (means) of Figure 1 that acts as a bandwidth broker by exchanging policy information messages (resource information) with RNCs 18 and 20 (radio network resource managers) as spoken of on column 5, lines 45-54.

Regarding claims **56 and 68**, "means for monitoring topology changes by retrieving routing information concerning the IP network" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 (means) as spoken of on column 5, lines 16-29.

Regarding claims **57 and 69**, "the topology is monitored in order to be able to reallocate access resources" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claims **58 and 70**, "means for performing path-sensitive call admission control by using the resource map and checking that resources are available along a path" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 (means) as spoken of on column 5, lines 16-29.

Regarding claims **59 and 71**, "the path-sensitive call admission control is parameter based" is anticipated by the admission control function (considers cell traffic

parameter for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claims **60 and 72**, "the path-sensitive call admission control is measurement based" is anticipated by the admission control function (considers cell traffic measurement for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claims **61 and 73**, "means for scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 (means) as spoken of on column 5, lines 16-29.

Regarding claim **62**, "a Network Resource Manager (NRM) within a mobile telecommunication system" as well as "NRM further comprising a resource map and means for monitoring resources within the IP network in order to provide feedback to the network operator" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker (has map of resources) by exchanging policy information messages with RNCs 18 and 20 (network operator) as spoken of on column 5, lines 45-54.

"A Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission" is anticipated by the core network 12 (network means) coupled to RAN 14 and RAN 16 as shown in Figure 1 and spoken of on column 3, lines 44-67.

Lastly, "a radio resource manager that controls radio resources within the RAN" is anticipated by the RNC 18 and RNC 20 of the RANs of Figure 1 that perform radio resource management as spoken of on column 3, lines 44-50.

Response to Arguments

5. Applicant's arguments filed 6/29/07 regarding *amended* claims **32-46 and 48-73** have been fully considered but they are not persuasive.

Regarding *amended* claims **32, 48, and 62,** Applicant argues that the Policy Manager of *Sen* does not correspond to the claimed Network Resource Manager. Applicant further argues that *Sen* does not disclose controlling IP network resources by using a resource map in a Network Resource Manager as claimed.

However, as provided in the previous Office Action, *Sen* teaches the policy manager of Core Network 12 of Figure 1 that acts as a bandwidth broker by exchanging policy information messages with RNCs 18 and 20 as spoken of on column 5, lines 45-54. To Examiner's understanding, this meaning that the policy manager is controlling bandwidth allocation.

Further, *Sen* teaches how the policy manager is involved in connection admission control of new users having a corresponding service level agreement, and how the core network is examined for admission capabilities to neighboring cells as spoken of on column 5, lines 17-25 as well as lines 61-63.

Thus, it is held that the above policy manager is controlling IP network resources by performing admission control (selectively providing bandwidth).

Also, since no further explanation is given in the claims as to what the resource map is or how it is used to control the IP network resources, it is held that the policy information (service level agreement information) exchanged by the policy manager constitutes a resource map used by the policy manager for admission control as spoken of column 5, lines 10-15, as well as lines 45-54.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Moore, Jr. whose telephone number is (571) 272-3168. The examiner can normally be reached on Monday-Friday (7:30am - 4:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wing F. Chan can be reached at (571) 272-7493. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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.

Michael J. Moore, Jr.
Examiner
Art Unit 2616

mjm/MM

9/13/07
WING CHAN
SUPERVISORY PATENT EXAMINER

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
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Bib Data Sheet

CONFIRMATION NO. 9055

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/250,702	12/19/2003 RULE	370	2616	1505-1033-1

APPLICANTS

Joakim Norrgard, Lulea, SWEDEN;
Anders Larsson, Lulea, SWEDEN;
Olov Schelen, Norrfjarden, SWEDEN;

** CONTINUING DATA ********** Yes ********** MM

This application is a 371 of PCT/SE01/02847 12/20/2001

** FOREIGN APPLICATIONS ********** Yes ********** MM

UNITED STATES OF AMERICA 60261166 01/16/2001

** SMALL ENTITY **

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☑ yes ☐ no	SWEDEN	6	42	3

35 USC 119 (a-d) conditions met: ☑ yes ☐ no ☐ Met after Allowance

Verified and Acknowledged: Michael J. Moore MM (Examiner's Signature / Initials)

ADDRESS

466

TITLE

Network resource manager in a mobile telecommunication system

FILING FEE RECEIVED	FEES: Authority has been given in Paper
793	No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:

- ☐ All Fees
- ☐ 1.16 Fees (Filing)
- ☐ 1.17 Fees (Processing Ext. of time)
- ☐ 1.18 Fees (Issue)
- ☐ Other _____
- ☐ Credit

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/250,702	NORRGARD ET AL.
Examiner	**Art Unit**
Michael J. Moore, Jr.	2616

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	9/6/07
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OIPE
JUN 29 2007
PATENT & TRADEMARK OFFICE

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of

Joakim NORRGARD et al. Conf. 9055

Application No. 10/250,702 Group 2616

Filed December 19, 2003 Examiner M. Moore, Jr.

NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

AMENDMENT

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

June 29, 2007

Sir:

In response to the Official Action mailed February 8, 2007, please amend the above-identified application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Amendments to the Drawings begin on page 11 of this paper.

Remarks begin on page 12 of this paper.

An **Appendix**, including five replacement drawing sheets, is attached following the signature page of this paper.

AMENDMENTS TO THE SPECIFICATION:

Page 1, replace the paragraph beginning on line 5 with the following amended paragraph:

--The present invention relates to a method in a communication system and to a network resource manager in a communication system ~~according to the preambles of the independent claims~~.--

Page 8, delete the paragraphs beginning on line 20 and ending on line 25.

Page 8, replace the paragraph beginning on line 26 and bridging pages 8 and 9 with the following amended paragraph:

--~~Thus, the~~ The above-described ~~object is~~ objects are achieved by introducing at least one Network Resource Managers (NRM) into a cellular telecommunication system e.g., within a RAN and/or within a network means e.g. a CN in accordance with the present invention. The NRM monitors and/or manages and/or reserves resources within the network with IP based transmission within the cellular telecommunication system and a bearer service manager, such as a RAB service manager, manages radio resources in the wireless part of the cellular telecommunication network. How the radio resource management function/entity internally manages the resources within the wireless part, is however beyond the scope of this invention. It is hence possible to obtain an end-to-end QoS throughout the cellular telecommunication system.

AMENDMENTS TO THE CLAIMS:

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

LISTING OF CLAIMS:

1-31. (canceled)

32. (currently amended) A method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising ~~at least one network means, e.g.~~ a Core Network (CN) connected to at least one Radio Access Network (RAN)[[,]] using Internet Protocol (IP) based transmission, ~~wherein~~ the method comprising the ~~step~~ steps of:

[[-]]handling radio resources within the RAN by using a radio resource manager; and ~~, characterised in that the method comprising the further step of:~~

[[-]]controlling IP network resources by using a resource map in a Network Resource Manager (NRM) ~~comprising a resource map~~ in order to provide said end-to-end QoS.

33. (currently amended) Method according to claim 32, ~~characterised in that~~ wherein the NRM is used within the RAN and a CN.

34. (currently amended) Method according to claim 32, ~~characterised in that~~ wherein the NRM is used within the RAN.

35. (currently amended) Method according to claim 32, ~~characterised in that~~ wherein the NRM is used within the CN.

36. (currently amended) Method according to claim 32, ~~characterised in that~~ the method comprising the further step of [[:]] [[-]]communicating resource information between the NRM and the radio resource manager.

37. (currently amended) Method according to claim 32, ~~characterised in that~~ the method comprising the further step of[[:]] [[-]]reserving IP network resources by the NRM [[if]] to fulfill said end-to-end QoS ~~can be fulfilled~~.

38. (currently amended) Method according to claim 32, ~~characterised in that~~ the method comprising the further step of[[:]] [[-]]pre-allocating resources by the NRM in the IP network.

39. (currently amended) Method according to claim 32, ~~characterised in that~~ the method comprising the further step of[[:]] [[-]]signalling resource information between the NRM and at least a second NRM used within at least a second network domain.

40. (currently amended) Method according to claim 32, ~~characterised in that~~ the method comprising the further step of[[:]] [[-]]monitoring topology changes by using the NRM, that retrieves routing information concerning the IP network.

41. (currently amended) Method according to claim 40, ~~characterised in that~~ wherein the topology is monitored in order to be able to re-allocate IP network resources.

42. (currently amended) Method according to claim 32, ~~characterised in that~~ the method comprising the further step of[[:]] [[-]]performing path-sensitive call admission control by using the resource map and checking that resources are available along a path.

43. (currently amended) Method according to claim 42, ~~characterised in that~~ wherein the path-sensitive call admission control is parameter based.

44. (currently amended) Method according to claim 42, ~~characterised in that~~ wherein the path-sensitive call admission control is measurement based.

45. (currently amended) Method according to claim 32, ~~characterised in that~~ the method comprising the further step[[:]] [[-]] of scheduling resources over time by introducing a start[[-]] and a stop time as a parameter in a resource request handled by the NRM.

46. (currently amended) A computer program ~~product directly loadable into a processing means within a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system, comprising the software code portions for~~ embodied in a computer-readable medium, the computer program performing the steps of claim 32.

47. (canceled)

48. (currently amended) A Network Resource Manager (NRM) ~~comprising a resource map~~ within a mobile telecommunication system~~, comprising at least one network means, e.g.~~ that includes a Core Network (CN)[[,]] connected to at least one Radio Access Network (RAN)[[,]] using Internet Protocol (IP) based transmission and a radio resource manager ~~comprising means for controlling~~ that controls radio resources within the RAN, ~~is characterised in that~~ the NRM ~~further comprises~~ comprising a resource map and means for controlling IP network resources within the IP network using the resource map in order to provide end-to-end Quality of Service (QoS).

49. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for [[be]] being used within the RAN and a CN.

50. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for ~~be used~~ using IP network resources within the RAN.

51. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for [[be]] being used within the CN.

52. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for communicating resource information with the radio resource manager.

53. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for reserving IP network resources ~~if it is possible to fulfil~~ to fulfill said end-to-end QoS.

54. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for pre-allocating resources in the IP network part of the telecommunication system.

55. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

56. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

57. (currently amended) NRM according to claim 56, ~~characterised in that~~ wherein the topology is monitored in order to be able to reallocate access resources.

58. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for performing path-sensitive call admission control by using [[a]] the resource map and checking that resources are available along a path.

59. (currently amended) NRM according to claim 58, ~~characterised in that~~ wherein the path-sensitive call admission control is parameter based.

60. (currently amended) NRM according to claim 58, ~~characterised in that~~ wherein the path-sensitive call admission control is measurement based.

61. (currently amended) NRM according to claim 48, ~~characterised in that it comprises~~ further comprising means for scheduling resources over time by introducing a start[[-]] and a stop time as a parameter in a resource request.

62. (currently amended) A Network Resource Manager (NRM) ~~comprising a resource map~~ within a mobile telecommunication system~~, comprising at least one network means, e.g.~~ that includes a Core Network (CN)[[,]] connected to at least one Radio Access Network (RAN)[[,]] using Internet Protocol (IP) based transmission and a radio resource manager ~~comprising means for controlling~~ that controls radio resources within the RAN, ~~is characterised in that~~ the NRM ~~further comprises~~ comprising a resource map and means for ~~monitoring~~ controlling IP network resources within the IP network using the resource map in order to provide feedback to the network operator.

63. (currently amended) NRM according to claim ~~49,~~ ~~characterised in that it comprises~~ 62, further comprising means for [[be]] being used within the RAN and a CN.

64. (currently amended) NRM according to claim ~~49, characterised in that it comprises~~ 62, further comprising means for ~~be used~~ using the IP network resources within the RAN.

65. (currently amended) NRM according to claim ~~49, characterised in that it comprises~~ 62, further comprising means for ~~be used~~ use within the CN.

66. (currently amended) NRM according to claim ~~49, characterised in that it comprises~~ 62, further comprising means for communicating resource information with the radio resource manager.

67. (currently amended) NRM according to claim ~~49, characterised in that it comprises~~ 62, further comprising means for communicating with at least a second NRM used within at least a second IP network domain.

68. (currently amended) NRM according to claim ~~49, characterised in that it comprises~~ 62, further comprising means for monitoring topology changes by retrieving routing information concerning the IP network.

69. (currently amended) NRM according to claim 68, ~~characterised in that~~ wherein the topology is monitored in order to be able to reallocate access resources.

70. (currently amended) NRM according to claim ~~49, characterised in that it comprises~~ 62, further comprising means for performing path-sensitive call admission control by using

[[a]] the resource map and checking that resources are available along a path.

71. (currently amended) NRM according to claim 70, ~~characterised in that~~ wherein the path-sensitive call admission control is parameter based.

72. (currently amended) NRM according to claim 70, ~~characterised in that~~ wherein the path-sensitive call admission control is measurement based.

73. (currently amended) NRM according to claim ~~49,~~ ~~characterised in that it comprises~~ 62, further comprising means for scheduling resources over time by introducing a start[[-]] and a stop time as a parameter in a resource request.

AMENDMENTS TO THE DRAWINGS:

The replacement sheets in the Appendix include changes to Figures 1-5. In each of Figures 1-5, the previously omitted designation "Prior Art" has been added.

REMARKS

The specification and drawings have been amended to make editorial changes therein, bearing in mind the criticisms in the Official Action.

The Official Action objects to form of claims 32, 36-42, 45, 47, 49-51, 53, 57, 63-65, and 69 and rejects claims 32, 48, and 62 under §112, second paragraph. The claims have been amended as to form and reconsideration and withdrawal of the objections and rejection are respectfully requested.

Claims 32-73 were rejected as anticipated by SEN et al. 6,701,149. Reconsideration and withdrawal of the rejection are respectfully requested.

The Official Action points to the Policy Manager in CN 12 of SEN et al. as corresponding to the claimed Network Resource Manager (NRM). As explained at column 5, lines 45-53, the Policy Manager acts as a bandwidth broker and exchanges policy information with the RNC 18-20. The Official Action indicates that the brokerage function corresponds to the claimed controlling of IP network resources using the resource map in the NRM. However, a broker is a party that acts on behalf of another party in a negotiation. The broker would presumably know the resources of the party he is representing in the negotiation, but one cannot presume that the broker would know more, and specifically one cannot presume the broker knows enough to control IP network resources as claimed. The broker is trying to

get the resources for the party the broker is representing (presumably, a user with a service level agreement that is entitled to greater resources.) The position of being a broker does not imply that the broker has access to a resource map that is used to control the IP network resources. The reference does not explain what the broker does and one cannot presume more than the words imply.

The Policy Manager in SEN et al. also exchanges policy information. A policy relates to how classes of users are treated and does not imply control of resource utilization.

Accordingly, SEN et al. do not disclose controlling IP network resources by using a resource map in a Network Resource Manager (NRM), which is found in each of the independent claims, and all the claims thereby avoid the rejection under §102.

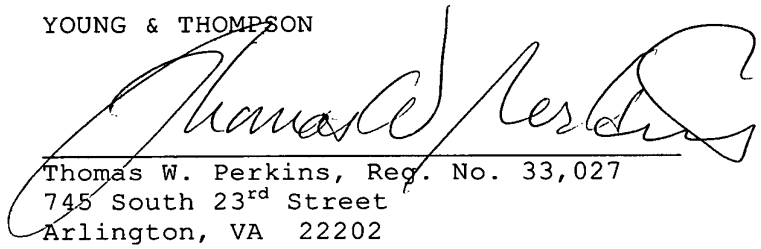
In view of the present amendment and the foregoing remarks, it is believed that the present application has been placed in condition for allowance. Reconsideration and allowance are respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any

overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON



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TWP/lk

APPENDIX:

The Appendix includes the following item:

- five replacement drawings sheets

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JUN 29 2007
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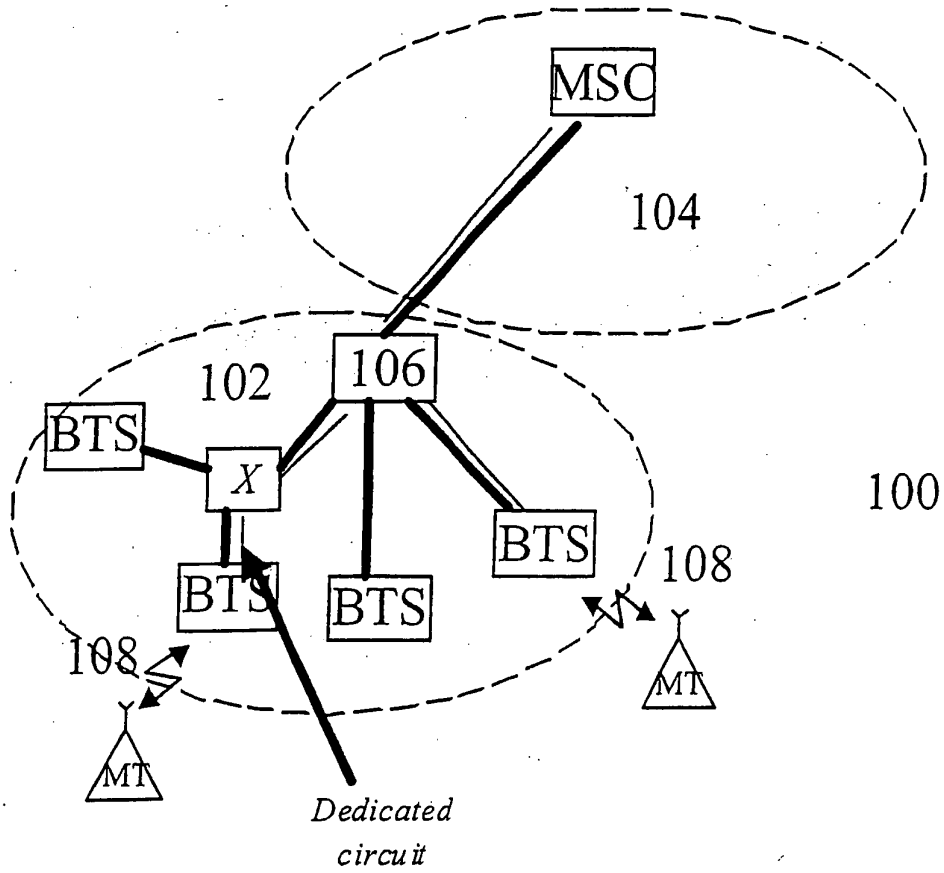


Fig. 1 **(PRIOR ART)**

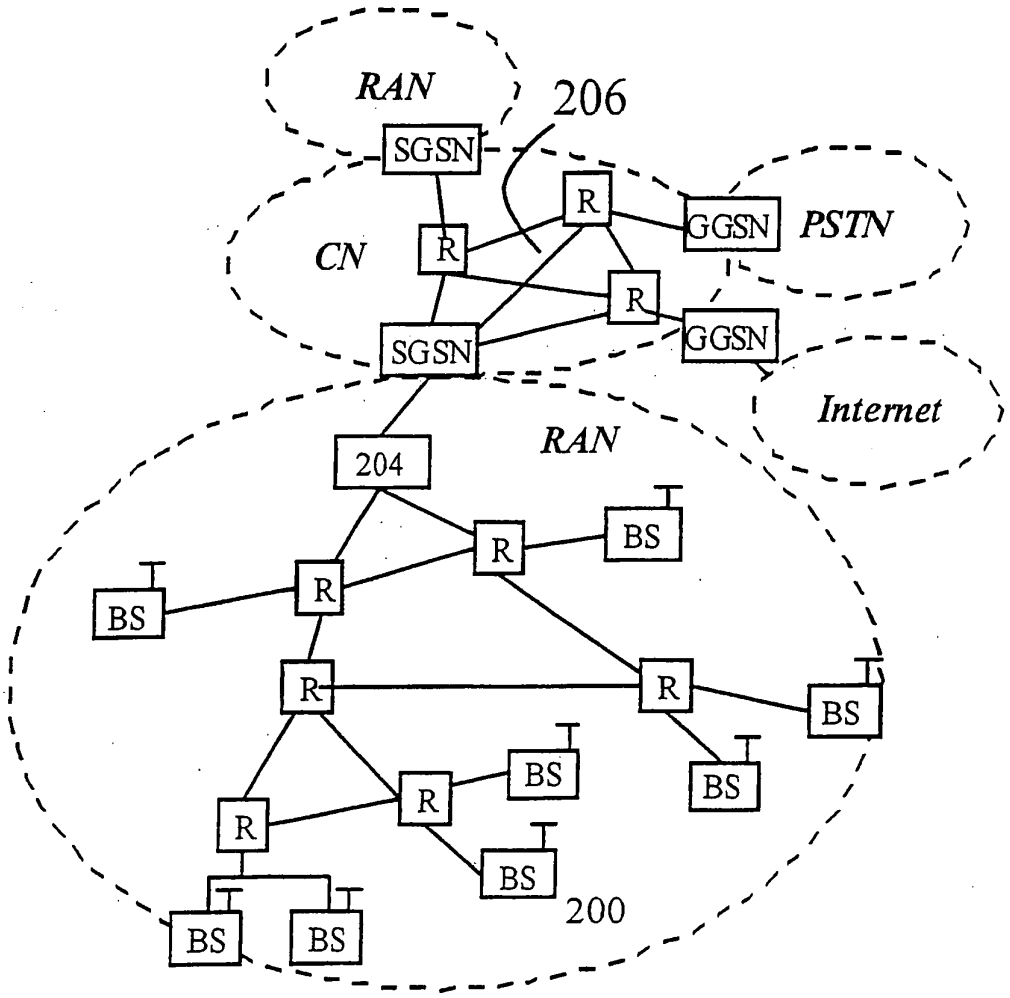


Fig. 2 **(PRIOR ART)**

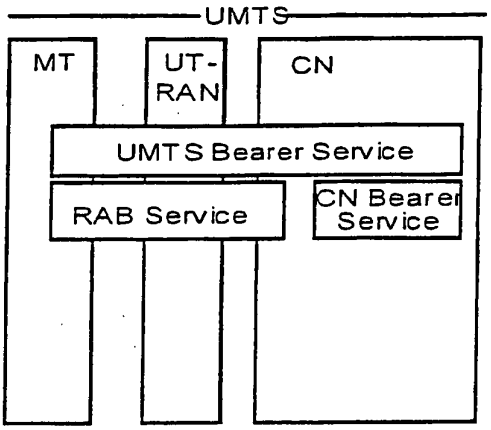


Fig.3 **(PRIOR ART)**

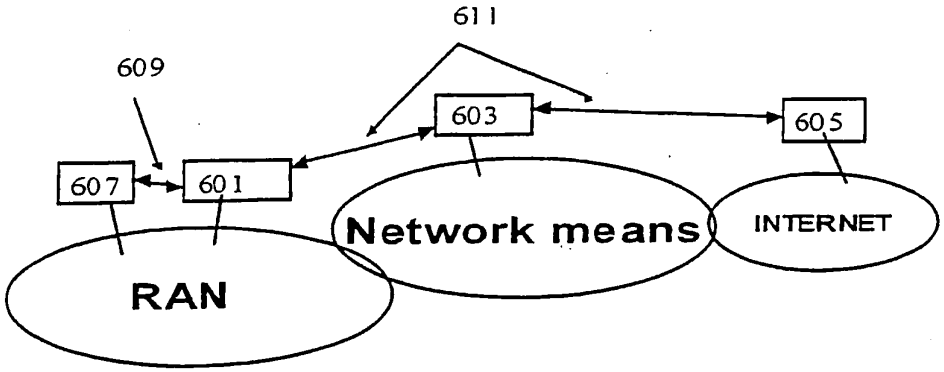


Fig.6

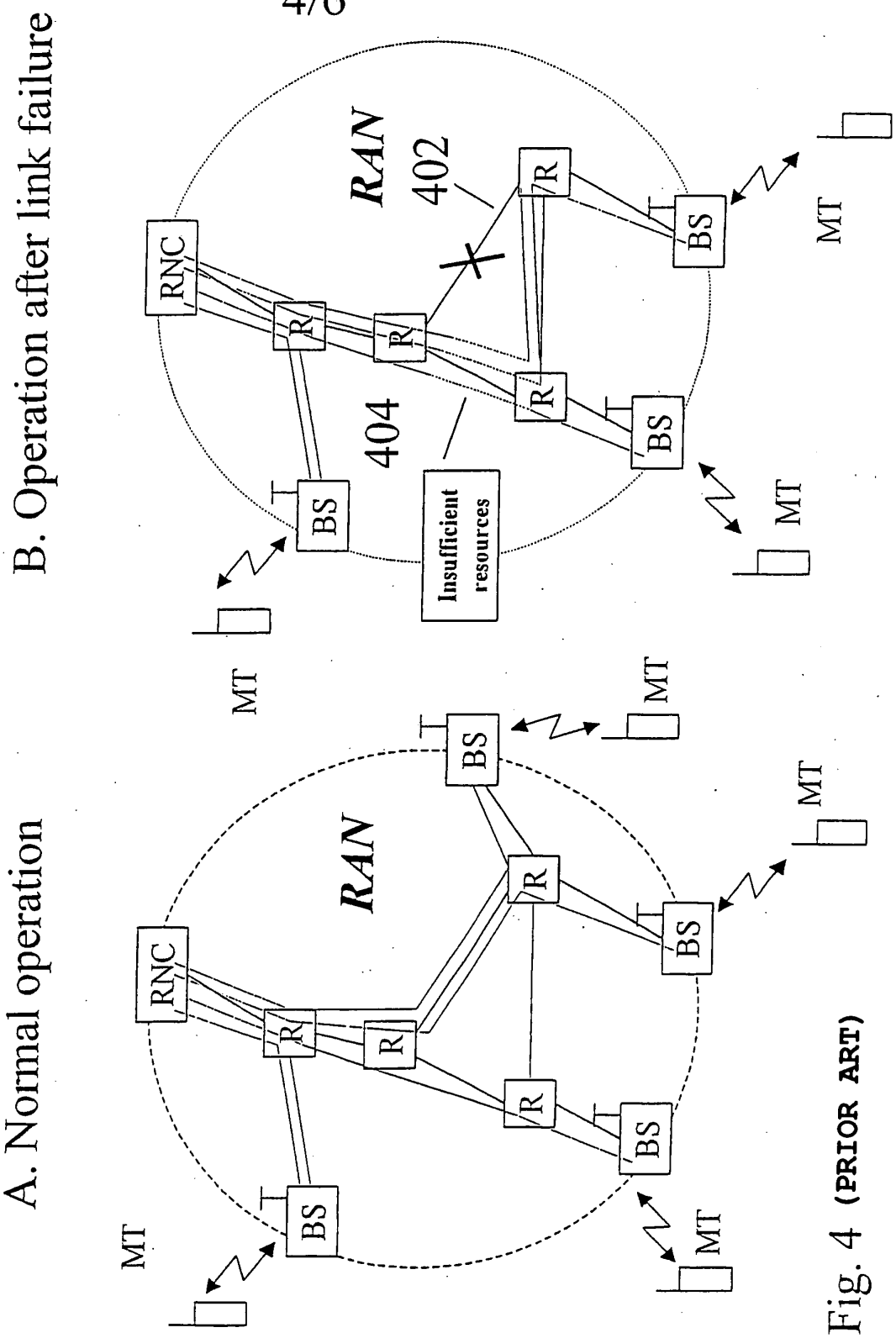


Fig. 4 **(PRIOR ART)**

5/6

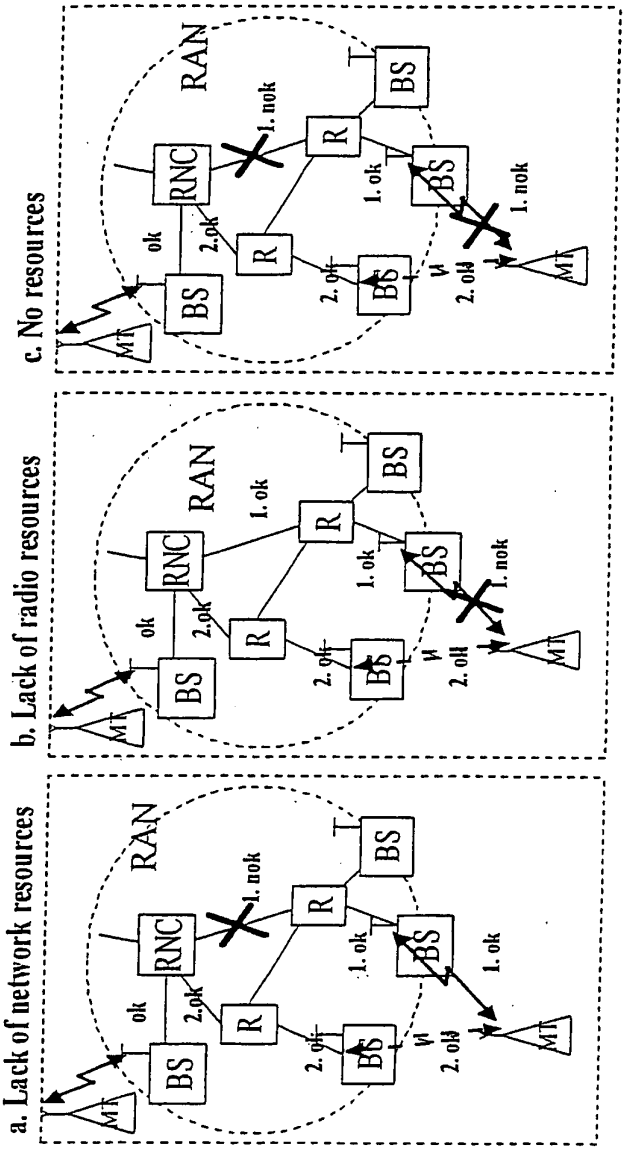


Fig. 5 (PRIOR ART)

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JUN 29 2007
PATENT & TRADEMARK OFFICE

PATENT
1505-1033-1

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of

Joakim NORRGARD et al. Conf. 9055

Application No. 10/250,702 Group 2616

Filed December 19, 2003 Examiner M. Moore, Jr.

NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

PETITION FOR EXTENSION OF TIME

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

June 29, 2007

Sir:

The undersigned hereby petitions for an extension of time to respond to the Official Action of February 8, 2007 for two months to July 8, 2007.

Please charge the extension fee of $225 to Deposit Account No. 25-0120. If this fee is insufficient, the Patent Office is hereby authorized to charge any additional extension fee to Deposit Account No. 25-0120. A duplicate copy of this sheet is enclosed.

A responsive paper is filed herewith.

Respectfully submitted,

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(703) 979-4709

07/02/2007 IWNDO1 00000098 250120 10250702
225.00 DA

TWP/lk

PATENT APPLICATION FEE DETERMINATION RECORD
Effective January 1, 2003

Application or Docket Number 10/258702 1505-1033/2

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	47 minus 20=	* 27
INDEPENDENT CLAIMS	3 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* 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		RATE	FEE
BASIC FEE	375.00	OR	BASIC FEE	750.00
X$ 9=	243	OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL	728	OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A — 6/29/07

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 41	Minus	** 42	= 0
Independent	* 3	Minus	*** 3	= 0
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=	X	OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/250,702	12/19/2003	Joakim Norrgard	1505-1033-1	9055

466 7590 02/08/2007

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ARLINGTON, VA 22202

EXAMINER	
MOORE JR, MICHAEL J	
ART UNIT	PAPER NUMBER
2616	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/08/2007	PAPER

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

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/250,702	NORRGARD ET AL.	
	Examiner	Art Unit	
	Michael J. Moore, Jr.	2616	

-- 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 *19 December 2003*.

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) *32-73* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-73* is/are rejected.

7)☐ Claim(s) _____ 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 *07 July 2003* 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 _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 3/4/2004 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the examiner has considered the information disclosure statement.

Drawings

2. Figures 1-5 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claim **63** is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim **63** currently depends on claim **49**, which contains the same limitations as claim **63**.

4. Claims **32, 36-42, 45, 47, 49-51, 53, 57, 63-65, and 69** are objected to because of the following informalities:

Regarding claim **32**, on line 8, the word "comprising" should be "comprises".

Regarding claims **36-40, 42, and 45,** on line 2 of each of these claims, the word "comprising" should be "comprises".

Regarding claim **37**, on line 4, an objection is made to the use of the language "can be". This constitutes "optional language" that does not further limit this claim (See MPEP 2106, II, C). A suggestion would be to replace "can be" with "is".

Regarding claim **41**, on line 2, the word "the" is needed before the word "topology".

Regarding claim **47**, on line 2, the word "a" is needed before the word "readable".

Regarding claims **49-51**, on line 2 of each of these claims, there is some confusion regarding the phrase "for be used".

Regarding claim **53**, on line 3, an objection is made to the use of the language "possible". This constitutes "optional language" that does not further limit this claim (See MPEP 2106, II, C). Also, on line 3, "fulfil" should be "fulfill".

Regarding claim **57**, on line 2, the word "the" is needed before the word "topology".

Regarding claims **63-65**, on line 2 of each of these claims, there is some confusion regarding the phrase "for be used".

Regarding claim **69**, on line 2, the word "the" is needed before the word "topology".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

6. Claims **32, 48, and 62** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Regarding claim **32**, the phrase "for example" (e.g.) renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

8. Regarding claim **48**, the phrase "for example" (e.g.) renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d). Also, on lines 1-3, it is unclear whether a "resource map" comprises "at least one network means" or whether "a mobile telecommunication system" comprises "at least one network means". Claim **48** is therefore held indefinite.

9. Regarding claim **62**, the phrase "for example" (e.g.) renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d). Also, on lines 1-3, it is unclear whether a "resource map" comprises "at least one network means" or whether "a mobile telecommunication system" comprises "at least one network means". Claim **62** is therefore held indefinite.

Claim Rejections - 35 USC § 102

10. 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.

11. Claims **32-73** are rejected under 35 U.S.C. 102(e) as being anticipated by Sen et al. (U.S. 6,701,149) (hereinafter "Sen"). *Sen* teaches all of the limitations of the specified claims with the reasoning that follows.

Regarding claim **32**, "a method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system" is anticipated by the method shown in Figure 3.

"At least one network means, e.g. a Core Network (CN) connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission" is anticipated by the core network 12 (network means) coupled to RAN 14 and RAN 16 as shown in Figure 1 and spoken of on column 3, lines 44-67.

"Handling radio resources within RAN by using a radio resource manager" is anticipated by the RNC 18 and RNC 20 of the RANs of Figure 1 that perform radio resource management as spoken of on column 3, lines 44-50.

Lastly, "controlling IP network resources by using a Network Resource Manager (NRM) comprising a resource map in order to provide the end-to-end QoS" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of

Figure 1 that acts as a bandwidth broker (has map of resources) by exchanging policy information messages with RNCs 18 and 20 as spoken of on column 5, lines 45-54.

Regarding claim **33**, "the NRM is used within the RAN and a CN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claim **34**, "the NRM is used within the RAN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claim **35**, "the NRM is used within the CN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claim **36**, "communicating resource information between the NRM and the radio resource manager" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker by exchanging policy information messages (resource information) with RNCs 18 and 20 (radio resource managers) as spoken of on column 5, lines 45-54.

Regarding claim **37**, "reserving IP network resources by the NRM if the end-to-end QoS can be fulfilled" is anticipated by the end-to-end QoS negotiation and establishment performed by the Core Network 12 of Figure 1 as spoken of on column 5, lines 10-15.

Regarding claim **38**, "pre-allocating resources by the NRM in the IP network" is anticipated by the end-to-end QoS negotiation and establishment performed by the Core Network 12 of Figure 1 as spoken of on column 5, lines 10-15.

Regarding claim **39**, "signaling resource information between the NRM and at least a second NRM used within at least a second network domain" is anticipated by the

policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker by exchanging policy information messages (resource information) with RNCs 18 and 20 (radio network resource managers) as spoken of on column 5, lines 45-54.

Regarding claim **40**, "monitoring topology changes by using the NRM, that retrieves routing information concerning the IP network" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **41**, "topology is monitored in order to be able to re-allocate IP network resources" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **42**, "performing path-sensitive call admission control by using the resource map and checking that resources are available along a path" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **43**, "the path-sensitive call admission control is parameter based" is anticipated by the admission control function (considers cell traffic parameter for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **44**, "the path-sensitive call admission control is measurement based" is anticipated by the admission control function (considers cell traffic measurement for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **45**, "scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request handled by the NRM" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claim **46**, "a computer program product directly loadable into a processing means within a server and/or a router in an IP network, and/or a Radio Network Controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system, comprising the software code portions for performing the steps of claim 32" is anticipated by column 7, lines 7-10, which states the system 10 of Figure 1 may include computers (servers) that perform the resource management functions of system 10.

Regarding claim **47**, "a computer program product stored on a computer usable medium, comprising readable program for causing a processing means within a server and/or a router in an IP network, and/or a Radio Network Controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system to control the execution of the steps of claim 32" is

anticipated by column 7, lines 7-10, which states the system 10 of Figure 1 may include computers (servers) that perform the resource management functions of system 10.

Regarding claim **48**, "a Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system" as well as "NRM further comprises means for controlling resources within the IP network in order to provide end-to-end Quality of Service (QoS)" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker (has map of resources) by exchanging policy information messages with RNCs 18 and 20 as spoken of on column 5, lines 45-54.

"At least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission" is anticipated by the core network 12 (network means) coupled to RAN 14 and RAN 16 as shown in Figure 1 and spoken of on column 3, lines 44-67.

Lastly, "a radio resource manager comprising means for controlling radio resources within the RAN" is anticipated by the RNC 18 and RNC 20 of the RANs of Figure 1 that perform radio resource management as spoken of on column 3, lines 44-50.

Regarding claims **49 and 63**, "means for be used within the RAN and a CN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claims **50 and 64**, "means for be used IP network resources within the RAN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claims **51 and 65**, "means for be used within the CN" is anticipated by the policy manager (NRM) of Core Network 12 of Figure 1.

Regarding claims **52 and 66**, "means for communicating resource information with the radio resource manager" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker by exchanging policy information messages (resource information) with RNCs 18 and 20 (radio resource managers) as spoken of on column 5, lines 45-54.

Regarding claim **53**, "means for reserving IP network resources if it is possible to fulfil the end-to-end QoS" is anticipated by the end-to-end QoS negotiation and establishment performed by the Core Network 12 (means) of Figure 1 as spoken of on column 5, lines 10-15.

Regarding claim **54**, "means for pre-allocating resources in the IP network part of the telecommunication system" is anticipated by the end-to-end QoS negotiation and establishment performed by the Core Network 12 (means) of Figure 1 as spoken of on column 5, lines 10-15.

Regarding claims **55 and 67**, "means for communicating with at least a second NRM used within at least a second IP network domain" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 (means) of Figure 1 that acts as a bandwidth broker by exchanging policy information messages (resource information) with RNCs 18 and 20 (radio network resource managers) as spoken of on column 5, lines 45-54.

Regarding claims **56 and 68**, "means for monitoring topology changes by retrieving routing information concerning the IP network" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 (means) as spoken of on column 5, lines 16-29.

Regarding claims **57 and 69**, "the topology is monitored in order to be able to reallocate access resources" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claims **58 and 70**, "means for performing path-sensitive call admission control by using a resource map and checking that resources are available along a path" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 (means) as spoken of on column 5, lines 16-29.

Regarding claims **59 and 71**, "the path-sensitive call admission control is parameter based" is anticipated by the admission control function (considers cell traffic parameter for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claims **60 and 72**, "the path-sensitive call admission control is measurement based" is anticipated by the admission control function (considers cell traffic measurement for handoff) performed between RANs 14 and 16 as well as Core Network 12 as spoken of on column 5, lines 16-29.

Regarding claims **61 and 73**, "means for scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request" is anticipated by the admission control function (considers cell traffic characteristics for handoff) performed between RANs 14 and 16 as well as Core Network 12 (means) as spoken of on column 5, lines 16-29.

Regarding claim **62**, "a Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system" as well as "NRM further comprises means for monitoring resources within the IP network in order to provide feedback to the network operator" is anticipated by the policy manager (Network Resource Manager) of Core Network 12 of Figure 1 that acts as a bandwidth broker (has map of resources) by exchanging policy information messages with RNCs 18 and 20 (network operator) as spoken of on column 5, lines 45-54.

"At least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission" is anticipated by the core network 12 (network means) coupled to RAN 14 and RAN 16 as shown in Figure 1 and spoken of on column 3, lines 44-67.

Lastly, "a radio resource manager comprising means for controlling radio resources within the RAN" is anticipated by the RNC 18 and RNC 20 of the RANs of Figure 1 that perform radio resource management as spoken of on column 3, lines 44-50.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Mizutani et al. (U.S. 6,798,757), Almgren et al. (U.S. 6,668,175), and Immonen et al. (U.S. 7,006,472) are other references considered pertinent to this application.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Moore, Jr. whose telephone number is (571) 272-3168. The examiner can normally be reached on Monday-Friday (7:30am - 4:00pm). If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Seema S. Rao can be reached at (571) 272-3174. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. 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.

mjm MM

Michael J. Moore, Jr.
Examiner
Art Unit 2616

HASSAN KIZOU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

PTO-1449 Sheet 1 of 1

INFORMATION DISCLOSURE CITATION IN AN APPLICATION (Use several sheets if necessary)	Attorney Docket No.: 1505-1033-1	Application No.: 10/250,702
	Applicant: Joakim NORRGARD et al.	
	Filing Date: December 19, 2003	Group Art Unit: 2681

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U.S. PATENT DOCUMENTS

Examiner Initial	Document Number	Date	Name	Class	Subclass	Filing date (if appropriate)

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FOREIGN PATENT DOCUMENTS

Examiner Initial	Document Number	Date	Country	Class	Subclass	Translation Yes	Translation No
MM	1 059 792	12/13/2000	EUROPEAN				
MM	1 056 246	11/29/2000	EUROPEAN				
MM	WO 01/89234	11/22/2001	INTERNATIONAL				
MM	WO 01/59986	8/16/2001	INTERNATIONAL				
MM	WO 01/54357 (with English abstract)	7/26/2001	INTERNATIONAL				x

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

MM		Schelén, O., Doctoral Thesis, "Quality of Service Agents in the Internet", Luleå Tekniska Universitet, 1998:26 ISSN: 1402-1544; pages 39-42

EXAMINER: /Michael Moore Jr/	DATE CONSIDERED 02/02/2007

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

* Abstract provided for the Examiner's convenience

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Notice of References Cited	Application/Control No. 10/250,702	Applicant(s)/Patent Under Reexamination NORRGARD ET AL.	
	Examiner Michael J. Moore, Jr.	Art Unit 2616	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,701,149 B1	03-2004	Sen et al.	455/436
*	B	US-6,798,757 B2	09-2004	Mizutani et al.	370/329
*	C	US-6,668,175 B1	12-2003	Almgren et al.	455/522
*	D	US-7,006,472 B1	02-2006	Immonen et al.	370/332
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	N					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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CONFIRMATION NO. 9055

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
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APPLICANTS

Joakim Norrgard, Lulea, SWEDEN;
Anders Larsson, Lulea, SWEDEN;
Olov Schelen, Norrfjarden, SWEDEN;

** CONTINUING DATA ********** Yes MM

This application is a 371 of PCT/SE01/02847 12/20/2001

** FOREIGN APPLICATIONS ********** Yes MM

UNITED STATES OF AMERICA 60261166 01/16/2001

** SMALL ENTITY **

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☑ yes ☐ no 35 USC 119 (a-d) conditions met ☑ yes ☐ no ☐ Met after Allowance Verified and Acknowledged Michael J. Moore MM Examiner's Signature Initials	SWEDEN	6	42	3

ADDRESS
466

TITLE
Network resource manager in a mobile telecommunication system

FILING FEE RECEIVED	FEES: Authority has been given in Paper
793	No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:

- ☐ All Fees
- ☐ 1.16 Fees (Filing)
- ☐ 1.17 Fees (Processing Ext. of time)
- ☐ 1.18 Fees (Issue)
- ☐ Other _____
- ☐ Credit

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/250,702	NORRGARD ET AL.
Examiner	**Art Unit**
Michael J. Moore, Jr.	2616

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
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Claim		Date
Final	Original	2/2/07
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Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/250,702	NORRGARD ET AL.	
	Examiner	Art Unit	
	Michael J. Moore, Jr.	2616	

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Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Inventorship Search (PALM/EAST)	1/31/2007	MM
370/310-350.ccls. or 455/$.ccls. (EAST Keyword Search - See Search History Printout)	1/31/2007	MM

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	0	("norrgard-joakim.in. orlarsson-anders.in.orschelen-olov. in.").PN.	US-PGPUB; USPAT	OR	OFF	2007/01/31 13:50
S2	68	norrgard-joakim.in. or larsson-anders.in. or schelen-olov. in.	US-PGPUB; USPAT	OR	OFF	2007/01/31 13:58
S3	39008	(370/310-350.ccls. or "455"/$.ccls.) and (@ad<"20010116" or @rlad<"20010116")	USPAT	OR	OFF	2007/01/31 13:59
S4	214	S3 and (("core network" or "CN") and ("radio access network" or "RAN"))	USPAT	OR	OFF	2007/01/31 14:00
S5	187	S4 and ("IP" or "Internet protocol" or packet)	USPAT	OR	OFF	2007/01/31 15:03
S6	21	S5 and (QoS same (manager or monitor or agent or controller))	USPAT	OR	OFF	2007/01/31 14:54
S7	4807	(370/310-350.ccls. or "455"/$.ccls.) and (@ad<"20010116" or @rlad<"20010116")	US-PGPUB	OR	OFF	2007/01/31 14:54
S8	111	S7 and (("core network" or "CN") and ("radio access network" or "RAN"))	US-PGPUB	OR	OFF	2007/01/31 14:54
S9	96	S8 and ("IP" or "Internet protocol" or packet)	US-PGPUB	OR	OFF	2007/01/31 14:54
S10	9	S9 and (QoS same (manager or monitor or agent or controller))	US-PGPUB	OR	OFF	2007/01/31 14:55

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PATENT & TRADEMARK OFFICE

1505-1033-1 PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Joakim NORRGARD et al.

Confirmation No. 9055

Serial No. 10/250,702

Group 2681

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TC 2600

Filed December 19, 2003

NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

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Technology Center 2600

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
Alexandria, VA 22313-1450

Sir:

In compliance with Rules 1.97 and 1.98, and in fulfillment of the duty of disclosure under Rule 1.56, the cited documents are made of record on the enclosed PTO Form-1449.

A concise explanation of the relevance of these items is that these references were cited by the International Patent Office in the corresponding International Application Serial No. PCT/SE 01/02847, filed December 20, 2001. A copy of the International search report in which they were cited is attached hereto.

Respectfully submitted,

YOUNG & THOMPSON

By _____

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March 4, 2004

PTO-1449 Sheet 1 of 1

INFORMATION DISCLOSURE CITATION IN AN APPLICATION

(Use several sheets if necessary)

PATENT & TRADEMARK OFFICE MAR 04 2004 1700 C34

Attorney Docket No.:	Application No.:
1505-1033-1	10/250,702
Applicant: Joakim NORRGARD et al.	
Filing Date: December 19, 2003	Group Art Unit: 2681

U.S. PATENT DOCUMENTS

Examiner Initial	Document Number	Date	Name	Class	Subclass	Filing date (if appropriate)

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FOREIGN PATENT DOCUMENTS

Examiner Initial	Document Number	Date	Country	Class	Subclass	Translation Yes	Translation No
	1 059 792	12/13/2000	EUROPEAN				
	1 056 246	11/29/2000	EUROPEAN				
	WO 01/89234	11/22/2001	INTERNATIONAL				
	WO 01/59986	8/16/2001	INTERNATIONAL				
	WO 01/54357 (with English abstract)	7/26/2001	INTERNATIONAL				x

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

		Schelén, O., Doctoral Thesis, "Quality of Service Agents in the Internet", Luleå Tekniska Universitet, 1998:26 ISSN: 1402-1544; pages 39-42

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(54) Method and system for wireless QoS agent for all-IP network

(57) A wireless quality of service (QoS) agent for an all-Internet Protocol (IP) network. The QoS agent couples to an all-IP network. The coupling means includes communication means for transfer of information between the agent and a QoS manager of the all-IP network. The agent is also able to seamlessly extend QoS support for multimedia applications from wireline to wireless and

control QoS of the multimedia applications sent over wireless connections on the all-IP network.

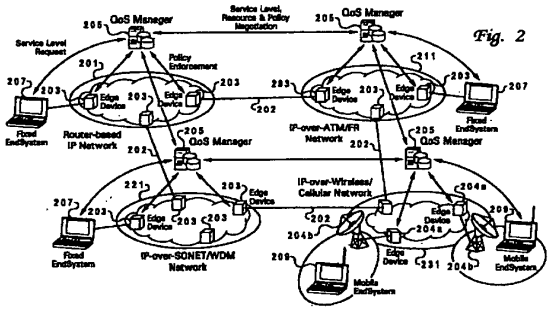


Fig. 2

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Description

BACKGROUND OF THE INVENTION

1. Technical Field:

[0001] The present invention relates in general to an improved performance of a wireless access in Internet Protocol (IP) network, and in particular to a method and system to manage the end-to-end QoS on an IP network utilizing wireless access. Still more particularly, the present invention relates to a method and system to provide a wireless QoS agent for an all-IP network.

2. Description of the Related Art:

[0002] Wireless access is expected to be one of the key access technologies for providing IP services to the user, end-to-end seamlessly. The wireless network works as the access subnet of the IP network, has its own unique set of complex characteristics. To improve the behavior of the wireless link's susceptiblely to frequent error bursts (due to fading, shadowing etc.), the usage of various low layer (physical/link) techniques such as Forward Error Correction (FEC) coding, interleaving, dynamic channel allocation, power control, link layer Automatic Request for Retransmission (ARQ) mechanisms, etc. becomes necessary to provide the required end-to-end performance to the user over an all-IP network.

[0003] Traditional Internet is based on a stateless switching fabric and supports only "best effort" packet data services. With the proliferation of multimedia services via the Internet-video-conferencing, tele-medicine, telephony, video-on-demand etc., there is an increasing demand to support guaranteed Quality-of-Service (QoS) over the Internet. In IP based networks, the performance is characterized by the speed and fidelity of the data transferred from source to destination. The term for characterizing a performance of an IP packet flow is "Quality of Service" (QoS) and is measured by packet transfer delay, jitter, probability of packet loss and throughput. There are two other forms utilized to define the performance of a system, namely, grade of service (GOS) and availability and reliability. Under the "IP QoS" umbrella, two solutions work towards the development of a framework to support QoS in IP best-effort networks. Work of the Integrated Services (Int-Serv) working group led to the development of the Integrated Services Architecture and the RSVP signaling protocol. RSVP promises per-flow QoS through resource reservation and maintenance of "soft state" in all intermediate routers. Int-Serv has limitations on four major areas namely (a) scalability, (b) overhead is too large, (c) this is a connection-oriented approach and, (d) most of the Host to Host connections do not address the intermediate management point issues. To overcome these limitations, the Differentiated Services (Diff-Serv) architecture was proposed. The Diff-Serv architecture aims to provide scalable service discrimination and "better than best effort" service in the Internet without the need of per-flow state maintenance at every router.

[0004] Over the last few years, there has been an explosive growth of wireless communication technology. Voice communication over wireless links utilizing cellular phones has matured and alongside portable computing devices such as notebook computers and personal digital assistants (PDAs) have emerged resulting in such applications as electronic mail and calendar/diary programs being provided to mobile or roving users. Observing this trend, it can be predicted that the next generation traffic in wireless networks will be mostly generated by personal multimedia applications including fax, video-on-demand, news-on-demand, World Wide Web (WWW) browsing, and traveler information services.

[0005] The current circuit switched based wireless networking is not efficient and cost effective. Moreover, in the current solution, overlay data network is needed to support data services and multimedia service implementation is complex. As the communications market is being driven by the demand for sustained connectivity to the Internet, it has become attractive to merge the wireless network with the Internet. The ability to provide seamless roaming and cost-effective connectivity to the network from anywhere and anytime will be an extra value from the network operators. Data services will seek to achieve an optimal combination of wide area network mobility and various types of multimedia service guarantees, making use of the already existing Internet infrastructure.

[0006] Wireline networks seldom lose packets due to link failure, which is generally caused by node congestion because of excess traffic. Hence, if suitable flow control and traffic shaping is applied at the edge of the network, the loss behavior can be controlled. The same premise applies for controlling delay and jitter within the network. The wireless link, on the other hand, demonstrates totally unpredictable behavior (fading, shadowing etc.) largely due to the mobility of the users, the terrain conditions, and multipath effects, etc. The reliability of the CDMA wireless link is also heavily dependent on the other-user interference which is a random function of the number and spatial co-location of the users.

[0007] Notwithstanding the hostile nature of the radio link and limited QoS provisioning within the Internet, the next generation wireless networks aim at providing the end user with a multitude of services comparable in

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quality to their wire-line counterpart. Present QoS provisioning techniques within the Internet are not enough for quality assurance in the wireless subnet, primarily because of the unpredictable nature of the radio link. QoS management for wireless links will involve coordination among many different lower layer techniques which may require frequent link adaptability and dynamic adjustments, necessitating a control agent.

[0008] Therefore, a need exists for a wireless QoS agent/manager responsible for mapping multimedia IP QoS requirements to radio link specific requirements, providing dynamic link adaptability and resource allocation capabilities, low layer flow control, air link QoS monitoring, and providing seamless extension of IP QoS to the mobile user. The present invention solves this problem in a new and unique manner that has not been part of the art previously.

SUMMARY OF THE INVENTION

[0009] It is therefore one object of the present invention to provide an improved performance of a wireless access in IP network.

[0010] It is another object of the present invention to provide a mechanism to manage the end-to-end QoS on an IP network utilizing wireless access.

[0011] It is another object of the present invention to provide a wireless QoS agent for an all-IP network.

[0012] The foregoing objects are achieved as is now described. A wireless quality of service (QoS) agent for an all-Internet Protocol (IP) network is disclosed. The QoS agent couples to an all-IP network. The coupling means includes communication means for transfer of information between the agent and a QoS manager of the all-IP network. The agent is also able to seamlessly extend QoS support for multimedia applications from wireline to wireless and control QoS of the multimedia applications sent over wireless connections on the all-IP network.

[0013] The invention provides a wireless quality of service agent according to claim 1; a system for providing seamless extension of Internet Protocol (IP) quality of service to air interface according to claim 8; and a method for implementing wireless quality of service (QOS) for an Internet Protocol (IP) network.

[0014] The above as well as additional objects, features, and advantages of the present invention will become apparent in the following detailed written description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself however, as well as a preferred mode of use, further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

Figure 1 is an illustrative block diagram of a next generation wireless network which may be adapted for use in accordance with the present invention;

Figure 2 is an illustrative block diagram of a QoS agent based IP QoS architecture in accordance with the present invention;

Figure 3 is an illustrative block diagram of the functional processes of the wireless QoS agent in accordance with the present invention;

Figure 4 is an illustrative block diagram of an example of wireless QoS provisioning in accordance with the present invention;

Figure 5 an illustrative block diagram of the internal functional components of a wireless QoS agent in accordance with the present invention;

Figure 6 is an illustrative block diagram of enhancements required to create the IP QoS agent;

Figure 7 depicts a third generation QoS framework for a base station in accordance with the present invention;

Figure 8 depicts the message flow between the various sub-component entities in accordance with the present invention;

Figure 9 depicts the QoS framework operation for uplink packets in accordance with the present invention;

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Figure 10a and **10b** are an illustrative block diagram of the position of the QoS agent in the protocol architecture; and

Figure 11 depicts a third generation standard, QoS framework for base station in accordance with the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0016] The present invention implements a framework for a QoS agent for a next generation wireless access network. Seamless connectivity to all-IP networks requires that this concept be easily integrable with existing QoS paradigms. Turning now to the figures, **Figure 1** depicts a block diagram of one example of a next generation wireless network **10** in accordance with the present invention.**Figure 1** consists primarily of core network **101** and collector network **102**. Core network **101** is an IP network with its various service points and interconnections. Core network **101** is connected to collector networks **102** which consists of a host of various types of services including asynchronous transfer mode (ATM) services **111**. Connected to collector networks are wireline end terminals **104** and wireless end terminals **103b** which receive their signalling from transmitters **103a**. Also depicted in **Figure 1** is a satellite **105** utilized also in wireless transmission of signals.

[0017] Referring to **Figure 2**, there is illustrated an IP QoS architecture with a QoS Agent in accordance with the present invention. A QoS manager **205** is connected to its respective IP service. Four distinct access networked are illustrated in **Figure 2**. These include Router-based IP network **201**, IP-over-ATM/FR network **211**, IP-over-SONET/WDM network **221**, and IP-over-wireless/Cellular network **231**. The present invention deals primarily with the last type of access network listed, but is not limited to such applications. Each network, contains a plurality of edge devices which provide connections to endsystems. The first three networks are wireline networks with edge device **203** connected to fixed endsystems **207**. IP-over-wireless/cellular network **231** consists of edge device **204a** coupled to wireless transmittors **204b**. Signals are transmitted to mobile endsystems **209**.

[0018] The IP Qos manager is itself part of the Diff-Serv architecture. Those skilled in the art are familiar with the Diff-Serv architecture and its various functionalities which may be utilized within the present invention. This architecture will be capable of providing consistent service delivery across heterogeneous IP networks consisting of multivendor devices, disparate link layer technologies, as well as different administrative domains. The QoS Agent provides the following capabilities of Diff-Serv's bandwidth broker: Intra-domain as well as inter-domain service level negotiation; per-domain admission control, resource reservation; and per-domain flow marking policy management and enforcement. Additionally, it is capable of a number of services including: mapping IP flows to lower (Layer 2/1) layer flows; enforcing flow (re) routing policies for fault handling and load balancing, etc., and providing some value added services like real-time accounting, advanced service level negotiation and brokering.

[0019] According to the preferred embodiment of the present invention, the architecture also defines a QoS agent within the wireless access network which is a slave device to the IP QoS agent. The agent configures and enforces policies within the network devices's flow handling mechanism under the QoS agent's instructions. The primary function of the agent is enforcing flow classification, marking, mapping & treatment policies. **Figure 3** illustrates the various functional processes of the QoS agent. Wireless Qos agent**301** is interlinked with IP Qos manager **205** which as described in **Figure 2** is interconnected with other peer IP QoS agents via some busses **202** and endsystems **207**. For illustration purposes, QoS agent is depicted as separate functional block from QoS agent. The present invention contemplates an embodiment where the two blocks are merged. Wireless QoS agent and wireless QoS manager are utilized interchangeable for the remainder of the document. The present invention specifically targets wireless/mobile endsystems **209**. Wireless QoS agent **301** when implemented provides background processes and forward path processes. Forward path processes occur on layer, 1, layer 2 or layer 3 of the signalling protocol. Background processes include routing process **303**, and management process **305**. Forward path processes include flow mapping **307**, flow marking **313**, flow identification and classification **309**, and flow treatment **311**.

[0020] In accordance with the teachings of the present invention, the QoS Manager/Agent provides additional guarantee to the QoS parameters, namely, delay, jitter, bandwidth and reliability, pertaining to user applications. The complexity of wireless link management centers around providing the flexibility of selecting various QoS provisioning techniques for next generation wireless systems and the future broadband wireless systems. A QoS agent is advantageous in guiding the Radio Resource Manager (RRM) in allocating radio channels (meeting particular coding, interleaving requirements) and software blocks for link layer Automatic Request for Retransmission (ARQ), and power control algorithms, etc. Also, the QoS agent will be able to help some of these algorithms to perform link adaptation depending on the current quality of the radio link and service applications, by fine-tuning certain changeable parameters (e.g., power control step size, number of retransmissions in ARQ etc). The traditional RRM performs dynamic channel (re)allocation when instructed by the QoS agent, for example, to move a user from a 1/2 code-rate channel to 1/4 code-rate, during a period of frequent error burst. All the above functions will be governed by three

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types of radio resource usage policies by the wireless QoS Agent: (1) SLA policies, (2) tariff policies, and (3) fairness policies.

[0021] The base station subsystem of a third generation radio system provides these different types of radio channels (each providing different levels of QoS) and switches traffic to these channels. **Figure 4** depicts an example of a wireless QoS provisioning. The example shown in **Figure 4** envisions QoS provisioning utilizing various types of radio channels in the base station subsystem of the next generation wireless networks. Three layers are defined illustrating wireless service types **403**, radio link layer**411**, and wireless physical layer **415**. Various classes of wireless services with specific QoS requirements are allocated radio link layer **411** resources (e.g., RPL **410**) and radio channels RRM **405**, to meet their service requirements, under the control of the wireless QoS agent**401**. Different coder types are utilized based on the wireless service types **403**. These include coder 1 **407** and coder 2 **409** and their corresponding interleaver 1 **408** and interleaver 2 **410**. Interleaver 3 **413** is also depicted and utilized when best effort service type is desired. Additional versions of this design may also be implemented.

[0022] The wireless QoS agent will be built upon the IP QoS agent structure and will enhance it to include most of the radio link dependent functionalities as discussed below.**Figure 5** explores the functionalities of the QoS agent in more detail and provide a glimpse of its internal structure. A service requester interface **505** consisting of flow mapping **506a** and parameter computation **506b** blocks receives higher layer QoS requests **501**. It provides feedback to higher layers **503**, but more importantly, a call admission controller **507** makes a call admission decision based on the parameters computation (resource estimation). If admitted, the request goes to a Dynamic Resource Controller (DRC) and Radio Link Adaptation block (RLA) **511**. DRC and RLA also receive an output from QoS monitor and flow control block **515** which contains parameter setting**516a**, system QoS monitor **516b**, radio channel QoS monitor**516c**, and low layer flow control **516d**. An interconnection is provided to RRM radio link resource modules **513** via control interfaces **514**.

[0023] A possible way to implement service mapping and dynamic QoS adaptation is over-the-air interface between the mobile and the base station. However, to achieve certain grade of service, QoS requirements should be met over the entire network between the source and the destination. This requires QoS negotiation between the third generation wireless network and the end user and possibly between the third generation network and the wireline network, as packets traverse through the network. The framework of the present invention allows for (a) negotiation of Service Level Agreement (SLA) between the wireless network and the wireline network, and (b) dynamic re-allocation of resources when there is a QoS degradation (as decided by the Frame Error Rate (FER) or some other criteria).

[0024] QoS is specified in an IP packet in a Diff-serv network by marking a certain byte referred to as the Type-of-Service and Digital Signal (ToS/DS) byte. In the proposed framework, an IP packet from the base station to the mobile with a specified QoS is routed to a suitable LAC/MAC resource and physical channel resource so that its QoS requirements are met. This is achieved through the use of a unique identifier for each flow, referred to as the Logical Flow Identifier (LFI). Likewise, an incoming IP packet from the mobile to the base station is assigned a QoS based on negotiations between the third generation wireless network and the user (and also, possibly the transit network).

[0025] QoS parameters like delay, jitter, Bit Error Rate (BER), throughput etc are dictated by the application requirements. QoS can be provisioned on a per-flow basis through mechanisms such as Resource Reservation Protocol (RSVP), as the flow traverses the network. Another approach is to aggregate flows into service classes and associated certain expected QoS behavior with those classes. This approach is followed by the Diff-Serv working group in IETF. Under the Diff-Serv framework, each Internet Service Provider (ISP) domain can provide its customers with various service classes and charge for them accordingly. A similar paradigm is expected to be followed by a third generation wireless network operator implementing the cdma2000 standard. The third generation wireless network is expected to interwork with various types of transit networks each with its own definition of service classes.

[0026] It is appropriate to split the QoS processing function into the following sub-functions:

1: QoS mapping: There are two kinds of QoS mapping namely (a) mapping customer requirements directly to a service class at either the transit network or at the third generation wireless network and (b) mapping to/from the service class of the transit network from/to service class of the third generation wireless network. QoS mapping is a policy decision and may involve service level agreements (SLA) between the two network operators or between the third generation network operator and the customer; and

2. QoS implementation: QoS implementation is the provisioning of QoS associated with a particular service class: It involves (a) protocol layer resources, RLP/RBP, channel coding, power control etc., currently being developed as part of the third generation architecture in software and hardware, (b) routing of the packet traffic belonging to a particular service class to the actual mechanisms associated with it, and (c) multiplexing/demultiplexing among various users sharing the same mechanism, by utilizing some scheduling techniques.

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[0027] The separation between the QoS mapping and QoS implementation functions permits the ability to change the underlying QoS provisioning mechanisms (the terms "mechanisms" and "resource" are used interchangeably within the document) without changing the service class definition which will be dictated by the standard. It is also easier to add new service classes in the future. Also, when a new network is connected to the third generation network (e.g., a new ISP with its own set of new service classes), it is easier to map these service to the existing set of third generation service classes, rather than to map them directly to LAC/MAC and physical layer resources. Finally, the separation of the routing functions permits flexible service adaptation during session, as will be described below.

[0028] An example of possible end-to-end QoS provisioning framework conforming to the ideas of the current Diff-serv WG in Internet Engineering Task Force (IETF) is now presented. In this example, the third generation access network is interworking with an IP- Diff-Serv transit network which is connected to a private Intranet through a firewall. Any semblance of end-to-end QoS is provided through Service Level Agreements (SLA) between the networks. The Wireless QoS Management shown in the figure is a functional entity that has two parts in it: (i) the radio access QoS management part which will reside in the BSC or Wireless Access Node (WAN), and (ii) the core interworking QoS management part which will interact with the Wireless Gateway (WGW).

[0029] **Figure 6** depicts the enhancements required to the current IP QoS agent structure to implement the wireless QoS agent. The existing IP Qos Agent structure **603** has been previously described in **Figure 3**. The enhancements to the QoS agent structure for wireless domain **601** includes a service requester interface **602a**, a QoS monitor and flow control **602c**, a call admission controller (for radio link)**602b** and a dynamic resource controller and radio link adaptation **602d**. Note that all of the above-mentioned function blocks need to be created in order to satisfy the requirements of wireless QoS agent. The wireless QoS agent will also be able to serve as an autonomous body (not as part of the IP QoS architecture) to provide QoS guarantee locally within the wireless subnet. The service requester interface block will map QoS requests from individual users to the wireless multimedia services so that the other functional blocks of the wireless QoS agent can be reused.

[0030] Turning now to the actual framework of a QoS agent for wireless QoS IP network according to the invention, two basic link processes are involved in wireless communication which require the QoS agent and framework of the invention. These link processes are the downlink and uplink of packets.

A. Qos framework operation for downlink packets:

[0031] **Figure 7** is a block diagram of the QoS framework within the wireless network. The blocks include QoS flow classifier **703**, wireless QoS agent **701**, radio resource manager **711**, routing function for LAC/MAC layer **705**, routing function for physical layer resources, scheduler**709**, and flow monitoring element **713**. Also included in**Figure 7** are a plurality of LAC/MAC mechanisms **707** and radio channel elements **717**. Each block exists within a particular sub-layer of the protocol. The bold and the dashed arrows respectively indicate traffic flow and the interactions between the blocks. A description of the functions of each block is provided within a description of**Figure 8**. **Figure 8** is presented in the context of an incoming IP packet from the upper layer with the ToS/DS byte set according to its service class. It is assumed here that the IP packets are coming from a Diff-serv base transit network, with the DS byte set according to the class of service for the packet. This describes the message flow for downlink IP packets.

[0032] When an IP packet **802** arrives from the wireline network to the wireless network, the upper layer (layer 3 and above) packet traverses third generation LAC/MAC layer**807** before being transmitted over the air link. QoS mapping function **803** performs a number of different functions described below.

[0033] For the first packet of a new flow, QoS mapping function **803** extracts the ToS (or DS) byte of the IP header and the ⟨source address/port, destination address/ports⟩field. The ToS/DS byte indicates the QoS desired by the IP packet. The ⟨source address/port, destination address/port⟩ determines the flow identifier (Id). QoS mapping function **803** sends the ToS/DS byte and the ⟨source address/port, destination address/port⟩ to the wireless QoS agent **801**.

[0034] The wireless QoS agent **801** examines the ToS/DS byte and map it to the class of services (CoS) permitted in the third generation wireless network (**Figure 7** shows 4 classes of services). This mapping between the DS byte and the wireless CoS is determined solely by the wireless QoS agent**801**.

[0035] Wireless QoS agent **801** assigns a tag called the logical flow ID (LFI) **804** to the flow. QoS mapping function **803** obtains the LFI from wireless QoS agent **801**. For later IP packets **802** of the same flow, QoS mapping function **803** tags the LFI to these packets and sends them to the LAC/MAC routing function.

[0036] In the present invention, an LFI serves two primary purposes: (i) it associates a particular service class with a flow; and (ii) it helps in routing the flow to its allocated resource entities. Note that each flow has a unique LFI implying that there is a many-to-one mapping between LFI's and third generation service classes. In the preferred embodiment, wireless QoS agent **801** has a pool of pre-allocated LFI's. In another embodiment, LFIs are randomly generated and wireless QoS agent **801** keeps track of which LFI belongs to what service class. For example, considering four third generation service classes 1, 2, 3 and 4 and a set of randomly generated LFI's 300,

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312, 313, 314, 400, 500, 605, and 645, LFI's 300, 312, 314 may be allocated to three flows of class 1, LFI's 400 and 313 to two flows of class 2, LFI 500 to a class 3 flow and LFI's 605 and 645 to two class 4 flows.

[0037] Wireless QoS agent **801** is a key component of the QoS framework which allows for service negotiation between QoS agent and the end user. This is achieved by special messages through the signalling channel after the user is authenticated by the system. It is contemplated that the third generation wireless network will have its own set of service classes. The transit network will also have its own set of service classes. For example, an IP Diff-serv transit network may have three classes such as expedited forwarding (EF), assured forwarding (AF) and default best effort. In order to provide service guarantee for incoming or outgoing traffic, there has to be some agreement (generally referred to as the Service Level Agreement (SLA)) about the mapping between the service classes of the two networks. For each transit network that the third generation wireless network connects to, wireless QoS agent**801** in **Figure 8** maintains a mapping table (not shown) between the service classes of the two networks.

[0038] In one embodiment, QoS agent is capable of exchanging service level agreements (SLA) with the peer QoS agent in the transit network (such as the Bandwidth Broker proposed by the Diff-serv WG). The SLA will determine the QoS mapping to a specific class of service (CoS) and the flow conditioning requirement as the traffic traverses one network boundary to another.

[0039] In the preferred embodiment of the present invention, the wireless QoS agent performs the following functions for IP packets in the downlink direction:

1. It examines the ToS/DS byte sent by the QoS flow classifier and returns an LFI to the QoS flow classifier. The LFI is a tag appended to all packets of the same flow (same ⟨source address/port, destination address/port⟩) and is utilized in the routing functions;

2. It maps the QoS (as defined by the ToS/DS byte) in the wireline transit network to the CoS permitted within the third generation wireless network;

3. The third generation subscriber may negotiate its QoS requirements (parameters) directly with the wireless QoS agent through upper layer signalling which will be mapped to a wireless service class by the latter, or the user may directly subscribe to a particular wireless service class through higher layer signalling;

4. After the wireless QoS agent resolves the QoS mapping, it sends the LFI and CoS information of the new flow to the Radio Resource Manager;

5. It helps the RRM to make a call admission decision based on its estimation of the QoS targets for the new flow and the QoS (e.g., FER, delay, jitter etc) that can be achieved currently by the system;

6. If a scheduling algorithm is utilized to schedule packets of different flows to the same physical channel (as in case of a shared supplemental channel), the QoS agent determines the weights to be assigned for this scheduling; and

7. It initiates dynamic QoS adaptation based on its own understanding of the service quality received by a flow, or when requested by the user in session.

[0040] RRM **805** decides on the LAC/MAC layer **807** and physical layer resources **815** to be allocated to a particular wireless service class. This allocation is a policy decision and depends on the implementation. Different LAC/MAC layer **807** may implement different ARQ techniques (e.g., RLP-I, RLP-II etc.). Physical layer resources **815** also differ depending on coding implementations such as Turbo coding and convolutional coding. These are defined within the invention as a part of the third generation LAC/MAC and physical layer standards. In the present invention, each of these mechanisms are being implemented in hardware or software and each has a unique address. RPM**805** determines the set of resources to be provided to a particular LFI depending on its CoS. Thus, RRM **805** has to make a call admission decision. For this, it queries a Resource Configuration Database (RCD-defined in CDMA2000) (not shown) for the available resource statistics. It also consults with wireless QoS Agent **801** to determine whether the requested QoS can be met. Those skilled in the art are familiar in part with call admission control. Thereafter, RRM **805** conveys the actual physical addresses of the resources allocated for this flow (LFI) to both the LAC/MAC layer **807** and physical layer resources **815**. Although the details of the routing algorithm may be implementation dependent, the preferred embodiment is implemented with a simple table look up approach.

[0041] For all downlink packets, the RRM performs the following functions:

1. It receives the LFI and the CoS information from the QoS manager, allocates appropriate physical layer

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resources for the CoS of this flow, and updates the routing table of the routing function with the address of the resource allocated i.e., ⟨LFI, physical layer resource address⟩. In one embodiment, the routing tables reside in the RCD;

2. It receives the LFI and the CoS information for the new flow from the QoS manager allocates appropriate LAC/MAC resources to this flow, and updates the routing table of the routing function with the address of the resource allocated, ie., ⟨LFI, LAC/MAC resource address⟩; and

3. It also initiates the notification to the user through an upper layer channel assignment message.

[0042] LAC/MAC layer **807** receives the LAC/MAC resource allocation information from the radio resource manger **805** and utilizes the routing table to route packets with a particular FLI tag to its allocated LAC resource **809**.

[0043] Scheduler **813** schedules all the incoming RLP frames received from the LAC/MAC layer based upon "weights" assigned by wireless QoS agent **801**. While LAC/MAC resources will be unshared, a physical layer resource **815** (e.g. a supplemental channel) may be shared by multiple user flows. Hence, the invention provides a necessary link layer scheduling algorithm at the MUX and QoS sub-layer which will schedule the RLP frames from multiple user flows to the same radio channel depending on the service priority. In one embodiment, the scheduling algorithm is based on simple priority queuing. In another embodiment, a more complicated weighted fair packet queuing algorithm is utilized. In the latter case, wireless QoS agent **801** adjusts the weights of the fair queuing algorithm based on the knowledge of the precedence and bandwidth allocation for the traffic classes scheduled.

[0044] Physical layer resource **815** routes the RLP packets to the physical layer resources based upon information received from radio resource manager **805**. The scheduler and the routing function are added to the current definitions of third generation QoS and MUX sub layer.

[0045] One of the purposes of LFI is to route packets to the proper resources; hence, the LFI tag is removed before the packet is sent to the physical layer. The LFI removal block **817** removes the LFI tag from the RLP packets.

[0046] Flow monitoring element (FME) **811** monitors the QoS behavior that is meted to a particular flow. The parameters measured includes frame quality, FER, delay, jitter, etc of the link layer flow. Sample measurements are, either periodically or on request, sent to wireless QoS agent **801**. Based on estimates, wireless QoS agent **801** makes a resource reassignment decision. Also, these QoS statistics and estimation enable wireless QoS agent **801** to provide a call admission decision to the RRM **805**. Some of the QoS measurements from FME **811** may also be utilized by the higher layer protocols to achieve more robust performance over the wireless link.

B. QoS framework operation for Uplink Packets

[0047] **Figure 9** depicts the QoS framework operation for Uplink Packets. In the uplink direction, the physical layer packets from users sharing a channel have to be demultiplexed based on the flow ID. This is done by the demultiplexer function **917**. If two users are sharing the same channel, this ID may be equivalent to the user ID which is carried in physical layer packet **919** which provides information to flow monitoring element **911**. DeMUX function **917** is already part of the current Call division Multiple Access (CDMA2000) proposal. An LFI is added to each packet with the same flow ID at Add block **915**. Different flow ID's will have different LFI's. The purpose of the LFI in the uplink direction is to ensure that each packet is routed to its appropriate LAC/MAC resource via LAC/MAC routing function **913**. After the flows sharing a common channel are demultiplexed, individual flows are routed to LAC/MAC resource entities depending on the CoS of the flow. This resource assignment and routing table update is completed by RRM **905** in a similar fashion as described for a particular LFI. Accordingly, RRM **905** updates the routing table utilized by LAC/MAC routing function **913** of the LAC/MAC resources with physical resource address. The LFI tag, which is utilized for routing purpose, is removed in removal block **910** as soon as a packet enters LAC/MAC resource **909**.

[0048] After the link layer packets are re-assembled at LAC/MAC resource **909** into upper layer packets, they have to be mapped into the IP service classes. There are two ways to implement this mapping. In one embodiment, a marker block **906** after LAC/MAC resource **909**, which marks Protocol Data Unit (PDU) **907** of various third generation service classes is provided as the DS byte of the IP packet header**903**. In this case, wireless QoS agent **901** does the inverse mapping from the third generation service class to the Diff-Serv DS byte and configures the marker accordingly. The reason for placing the marking function just above the link layer is that individual flow packets are already segregated at this point.

[0049] The user terminal may be capable of marking an IP packet with a specific ToS/DS byte for the type of service it demands. In that case, it will indicate to wireless QoS agent **801** that the ToS/DS byte has been marked. Wireless QoS agent **801** will turn off the marking functionality for this flow within the third generation network. Hence, the DS marker blocks **906** are shown as conditional in **Figure 4**. The default IP service class is "best effort" if no

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service class information is provided by the user.

[0050] The QoS framework described in this invention permits the re-negotiation of resources during an on-going session. A user, unsatisfied by the received QoS may re-negotiate with the QoS manager for a better grade of service. A special upper layer signalling message is sent by the mobile to request for a QoS upgrade if possible. Otherwise, if the QoS estimation provided by the Flow Monitoring Element is such that the QoS manager decides that the expected service quality for the flow is not met, then it can initiate a dynamic channel re-allocation. Dynamic resource re-allocation are easily achieved in the proposed framework by routing table updates. Also, the separate routing functions for the LAC/MAC and the physical layer resources enable independent re-allocation of these two types of resources.

[0051] Since an LFI is already associated with the user flow, the QoS manager requests the RRM for a better QoS mechanism for the LFI. If resources are available, the RRM sends an acknowledgement message to the QoS manager, and also sends a resource reassignment message to the mobile. Once the mobile acknowledges this message, the RRM allocates the new resource and makes an update in the routing table entries for the LFI to reflect the new resource address.

[0052] The QoS manager monitors the service behavior of a flow belonging to a particular service class through the flow monitoring element. For example, if the expected FER for class 1 service is 10E-6 and the FER for a channel carrying class 1 traffic is constantly less than the target, then the QoS manager may initiate a dynamic service adaptation. It requests the RRM for an upgrade of the QoS mechanism for the LFI. If resources are available, the RRM allocates the new resource and acknowledges the QoS manager's request. The RRM then sends a message to the mobile informing about the new resource assignment. After it receives an acknowledgement from the mobile, the RRM makes the necessary routing table updates to reflect the new assignment. With separate routing functions, it is possible to re-allocate resources in a very flexible way to maintain a consistent grade of service.

[0053] In another illustration, the system may face a severe resource shortage. Then the QoS manager may poll the high bandwidth users to determine whether he/she is willing to sustain a temporary service degradation. If acknowledged by an user, the QoS manager will initiate a de-allocation of resources from the user flow through the RRM. This can be achieved again through a simple routing table update.

[0054] The various functionalities of the QoS agent of the present invention as described herein includes: (1) Mapping IP Flows to Wireless Service Requirements. The functionality of this block is to map the IP flow definitions to the wireless service requirements. For example the IP premium service may be mapped to BER 10E-9, low delay service class; (2) Parameter Computation. Depending on the service requirements, this functional block decides which type of channel resource and software modules (ARQ, power control etc) to allocate to the service. Also, it estimates some of the radio resource parameters (e.g., power control step size, Eb/No threshold etc); (3) Call Admission Controller. Due to the added dimensions of QoS definition (BER, delay, jitter etc. instead of only BER), call admission control for multimedia services is expected to be more complex and policy-based. The call admission controller will admit a new call depending on the current system-wide QoS and the radio resource requirements of the call; (4) System QoS Monitoring. Monitor QoS parameters affecting system performance, e.g., loading/interference in a CDMA cell, number of hand-off drops etc, and helps the CAC to make call admission decisions; (5) Radio Channel QoS Monitoring. QoS monitoring of individual radio channels is very important in order to provide dynamic link adaptation, a valuable asset to guarantee any type of QoS on the rapidly changing radio link. Two important parameters to be monitored are BER and delay (note that, error rates in individual radio channel is monitored in current wireless systems); and (6) Low Layer Flow Control. This is important due to the following reasons:

1. Dynamic, error-prone behavior of the air link;

2. Due to the addition of bursty Internet traffic (WWW), the air link traffic behavior is expected to undergo certain changes (tending to a more bursty nature). This may call for traffic shaping at the link (or even physical) layers. The present invention implements a delay-based scheme to achieve traffic shaping in IS-99 CDMA data-link is utilized; and

3. Since radio spectrum is a scarce resource, certain high bandwidth applications (e.g., compressed/ uncompressed video stream) will be expected to "gracefully degrade" when faced with sudden resource constraint (typical scenario: when attempting hand-off to a heavily loaded cell). Degradation can be achieved through various flow control mechanisms, e.g., packet discard at link layer or transport layer, hierarchial coding etc.

[0055] The wireless QoS agent also provides two additional functionalities: (i) enhancement of the static RRM functions to provide dynamic capabilities, e.g., dynamic channel allocation & radio link adaptation; and (ii) various radio resource usage policy enforcement.

[0056] The link adaptation function requires some self-engineering techniques for fine-tuning various parameters used in radio resource control functions like power control functions like power control, hand-off management, ARQ,

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and also provide for dynamic allocation and re-allocation of channels (with the help of RRM) to utilize appropriate coding/interleaving techniques. The second function guarantees consistent usage of radio resources in face of frequent disconnection, hand-off and other mobility related events, using a set of predefined policies, e.g., degradation, channel reservation, call drop, courtesy hand-off & various "soft QoS" policies.

[0057] The preferred embodiment contemplates that the wireless QoS agent will be physically located within the BSC. **Figure 10A** shows one possible position of the wireless QoS agent within the software/hardware architecture. The various protocol layers are shown, including the application, presentation and session **1003**, TCP/IP, IPv6 and Mobile IP **1009**, and wireless physical layer **1014**. Almost all functionalities of the wireless agent (flow mapping, low layer flow control, link adaptability etc.) will be part of the wireless QoS agent layer **1011** shown above the radio link layer **1013**. The QoS agent may need to exchange control information with higher layer agents **1007** (shown by dotted arrow). Also, in the preferred embodiment, the control overhead for QoS support should not have a detrimental effect on the data flow. Hence, another possibility is to make the QoS agent a separate kernel level module within the control stack as depicted in **Figure 10b**. Wireless QoS agent **1011**, is placed separately within the module adjacent to upper layers **1015**, (radio) link layer **1013** and above wireless physical layer**1014**.

[0058] **Figure 11** shows the integration of the wireless QoS framework into the protocol stack currently begin developed under CDMA2000. The new or enhanced blocks are shown shaded in the figure. The wireless QoS agent functionality is now distributed in two separate blocks-the QoS mapping, adaptation and CAC block, which enhances the RRM functionality and is shown within the Resource Control module of CDMA2000, and the QoS control block. The QoS control block is enhanced with some of the functionality of the QoS manager., e.g. assignment of scheduling priorities, providing LFI to the QoS classifier block in the PLDCF MUX and QoS sub-layer. The LFI removal blocks, discussed earlier, are not shown explicitly in the Figure. The QoS classifier/routing block and the DS marker for uplink packets are placed in a block called service adaptation interface on top of LAC sub-layer **1107**. Other protocol layers are clearly delineated with their respective functional blocks of the QoS IP system. They include PLICF sub-layer **1109**, PLDCF sub-layer **1111**, PLDCF MUX and QoS sub-layer **1113**, and physical layer **1115**. Additionally, signalling control **1103** exists on the control plane and Point-to-Point Protocol **1105** exists on the data plane.

[0059] It is also important to note that although the present invention has been described in the context of a fully functional method for wireless QoS agent for all-IP network, those skilled in the art will appreciate that various mechanisms of the present invention are capable of being distributed as a program product in a variety of forms to any type of information handling system, and that the present invention applies equally regardless of the particular type of signal bearing media utilized to actually carry out the distribution. Examples of signal bearing media include, without limitation, recordable type media such as floppy disk or CD ROMs and transmission type media such as analog or digital communications links.

[0060] While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

Claims

1. A wireless quality of service (QoS) agent for an Internet Protocol (IP) network, said QoS agent comprising:

   means for coupling said agent to said IP network, said coupling means including communication means for flow of information between said agent, a QoS manager of said all-IP network, and a network element;

   means for seamlessly extending QoS support for multimedia applications from a wireline IP medium to a wireless medium, said multimedia applications including voice, data, multimedia video, and telemetry applications; and

   means for controlling QoS of said multimedia applications on said wireless medium to said IP network.

2. The wireless QoS agent of Claim 1, said controlling means further comprising:

   means for mapping application QoS requirements to wireless QoS objectives;

   means for computing a wireless QoS parameter utilizing said objectives and an algorithm;

   means for determining a type of channel resource and modules to allocate to a service and to estimate a portion of a plurality of radio resource management (RRM) parameters, said determining means utilizing said wireless QoS parameter;

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means for controlling an external environment within a set bound for resource by call admission control, wherein said controlling means admits a new call depending on a current systems QoS and a RRM parameter requirements of said call;

means for monitoring a global QoS parameter affecting system performance, said performance including loading (interference) in a CDMA call, and a number of hand-off drops; and

means for reporting a result of said monitoring means to a QoS agent.

3. The QoS agent of Claim 2, wherein, said mapping means

means for mapping end-to-end network delay and jitter to radio link delay and jitter; and

means for mapping application bit error rate to wireless frame error rate.

4. The wireless QoS agent of Claim 1, said controlling means further includes:

means for enhancing static radio resource manager (RRM) functions to provide dynamic capabilities;

means for expanding radio resource usage policies; and

means for enforcing radio resource usage policies.

5. The wireless QoS agent of Claim 4, said enforcing means comprising means for guaranteeing consistent usage of radio resources irrespective of frequent disconnection, hand-off and other mobility related events, said means utilizing a set of predefined policies, said policies including service level agreement (SLA) with an external network, tariffing policies for subscribers, and fairness of radio resource allocation policies said policies, wherein further said policies are implemented utilizing a plurality of factors including degradation, channel reservation, call drop, courtesy hand-off, and soft QoS policies.

6. The wireless QoS agent of Claim 1, further comprising:

means for monitoring radio channel QoS to provide dynamic link adaptation, wherein said monitoring means monitors a plurality of parameters including bit error rate (BER) and delay jitter; and

means for controlling lower layer flow.

7. The wireless QoS agent of Claim 1, wherein said agent is an autonomous body comprising means for providing local QoS guarantees within a wireless subnet.

8. A system for providing seamless extension of Internet Protocol (IP) Quality of Service (QoS) to air interface comprising:

a wireless QoS agent coupled to an IP QoS system of an all-IP network; and

means for controlling a behavior of a radio channel to ensure delivery of QoS to a wireless end user.

9. The system of Claim 8, said instantiating means comprising:

means for mapping multimedia IP QoS requirements to radio link specific requirements;

means for providing dynamic link adaptability and a plurality of wireless QoS functionalities, including:

capabilities for optimizing channel behavior by managing power, coding and modulation;

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lower layer flow control; and

radio channel behavior monitoring.

10. A method for implementing wireless quality of service (QoS) for an Internet Protocol (IP) network, said method comprising the steps of:

coupling a wireless QoS agent to said IP network, said coupling means including communication means for flow of information between said QoS agent, a QoS manager of said all-IP network, and a network element;

seamlessly extending QoS support for multimedia applications from a wireline IP medium to a wireless medium, said multimedia applications including voice, data, multimedia video, and telemetry applications; and

controlling QoS of said multimedia applications on said wireless medium to said IP network.

11. The method of Claim 10, said controlling step further comprising the steps of:

mapping application QoS requirements to wireless QoS objectives;

computing a wireless QoS parameter utilizing said objectives and an algorithm;

determining a type of channel resource and modules to allocate to a service and to estimate a portion of a plurality of radio resource management (RRM) parameters, said determining step utilizing said wireless QoS parameter;

controlling an external environment within a set bound for resource by call admission control, wherein said controlling means admits a new call depending on a current systems QoS and a RRM parameter requirements of said call;

monitoring a global QoS parameter affecting system performance, said performance including loading (interference) in a CDMA call, and a number of hand-off drops; and

reporting a result of said monitoring step to a QoS agent.

12. The method of Claim 11, wherein, said mapping step includes the steps of:

mapping end-to-end network delay and jitter to radio link delay and jitter; and

mapping application bit error rate to wireless frame error rate.

13. The method of Claim 10, said controlling step further includes the steps of:

enhancing static radio resource manager (RRM) functions to provide dynamic capabilities;

expanding radio resource usage policies; and

enforcing radio resource usage policies.

14. The method of Claim 13, said enforcing step comprising the step of guaranteeing consistent usage of radio resources irrespective of frequent disconnection, hand-off and other mobility related events, said enforcing step utilizing a set of predefined policies, said policies including service level agreement (SLA) with an external network, tariffing policies for subscribers, and fairness of radio resource allocation policies said policies, wherein further said policies are implemented utilizing a plurality of factors including degradation, channel

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reservation, call drop, courtesy hand-off, and soft QoS policies.

15. The method of Claim 10, further comprising the steps of:

monitoring radio channel QoS to provide dynamic link adaptation, wherein said monitoring step monitors a plurality of parameters including bit error rate (BER) and delay jitter; and

controlling lower layer flow.

16. The method of Claim 10, wherein said agent is an autonomous body which provides local QoS guarantees within a wireless subnet.

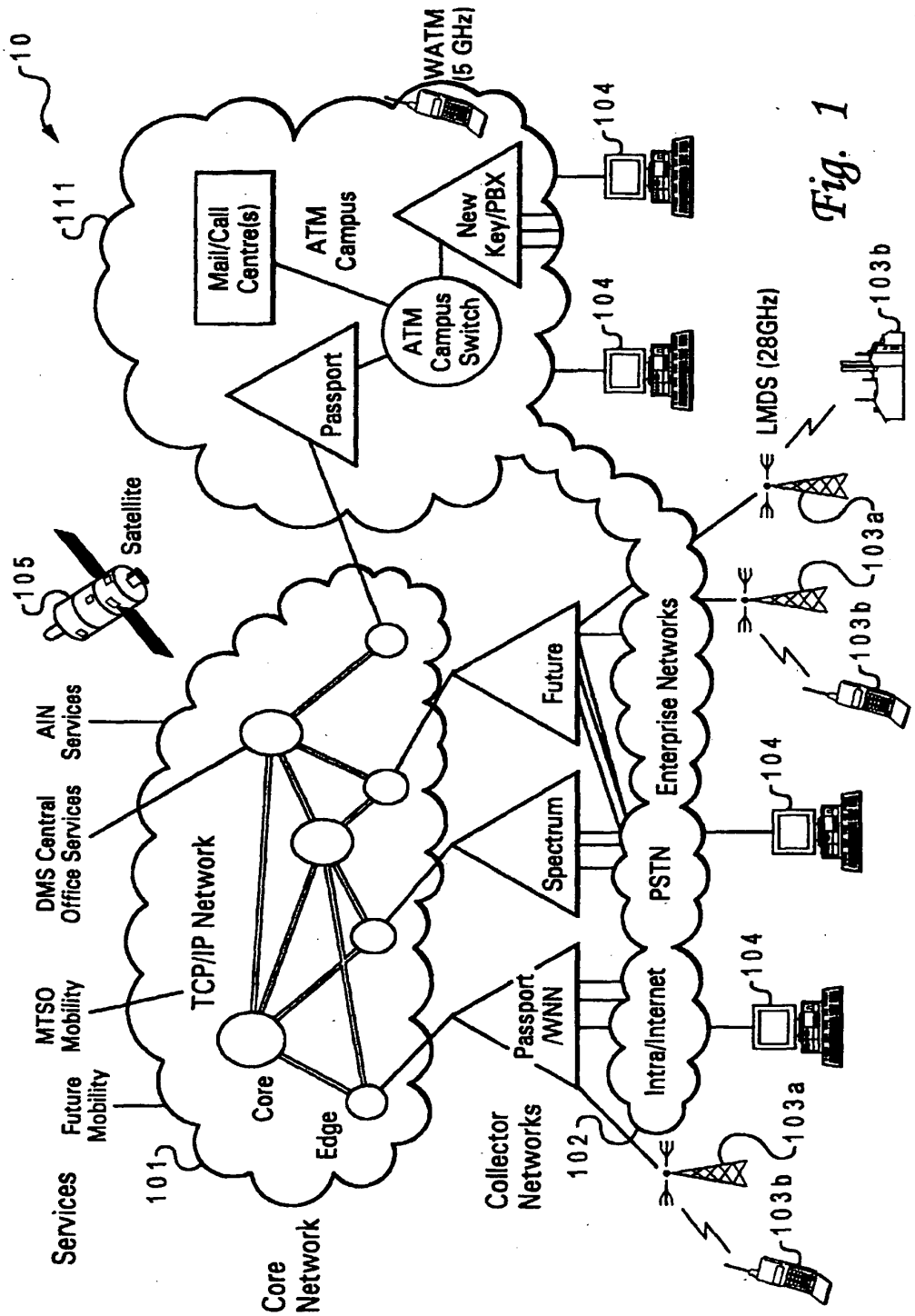
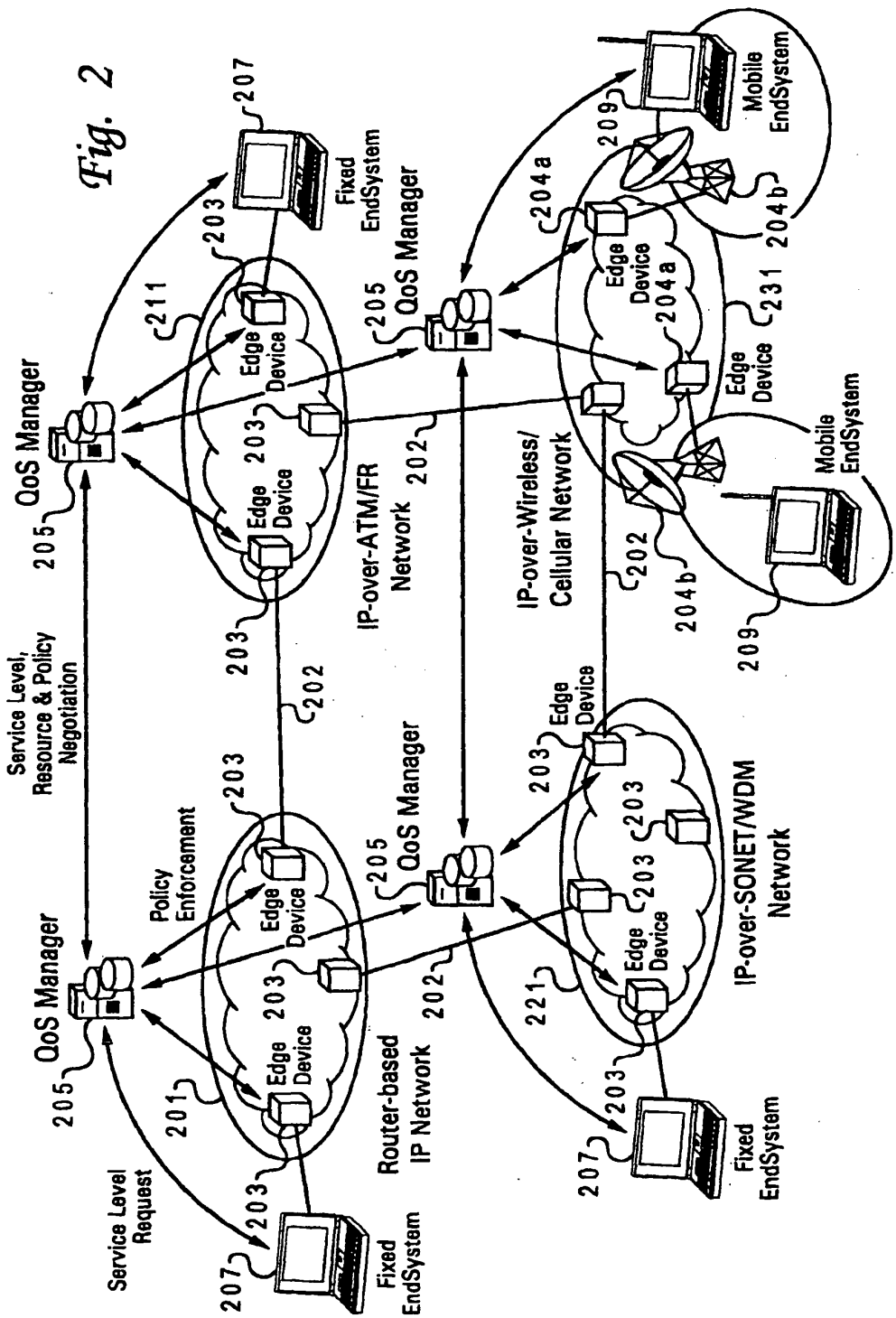

10
111
WATM (5 GHz)
Mail/Call Centre(s)
ATM Campus
New Key/PBX
ATM Campus Switch
Passport
104
LMDS (28GHz)
103b
103a
Satellite
105
AIN Services
DMS Central Office Services
MTSO Mobility
Future Mobility
Services
101
TCP/IP Network
Core
Edge
Core Network
Future
Spectrum
Passport /WNN
Collector Networks
102
PSTN
Intra/Internet
Enterprise Networks

Fig. 1

Fig. 2


QoS Manager
205
Service Level, Resource & Policy Negotiation
Policy Enforcement
Service Level Request
Edge Device
203
Fixed EndSystem
207
211
201
Router-based IP Network
202
IP-over-ATM/FR Network
QoS Manager
205
IP-over-Wireless/ Cellular Network
204a
Edge Device
231
Mobile EndSystem
209
204b
IP-over-SONET/WDM Network
221

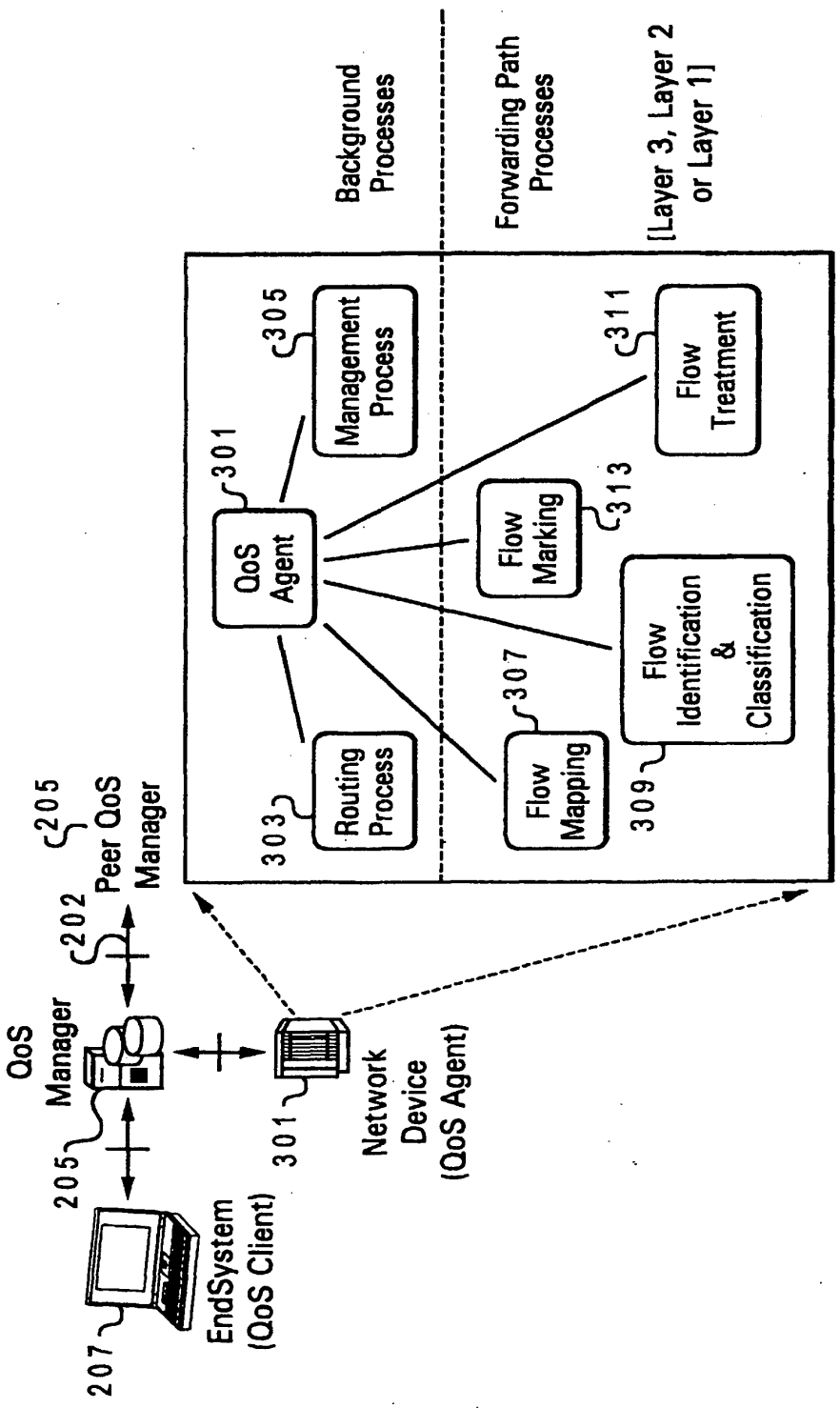

Background Processes
Forwarding Path Processes
[Layer 3, Layer 2 or Layer 1]
QoS Agent
301
Management Process
305
Routing Process
303
Flow Mapping
307
Flow Identification & Classification
309
Flow Marking
313
Flow Treatment
311
Peer QoS Manager
205
202
QoS Manager
205
EndSystem (QoS Client)
207
Network Device (QoS Agent)
301

Fig. 3

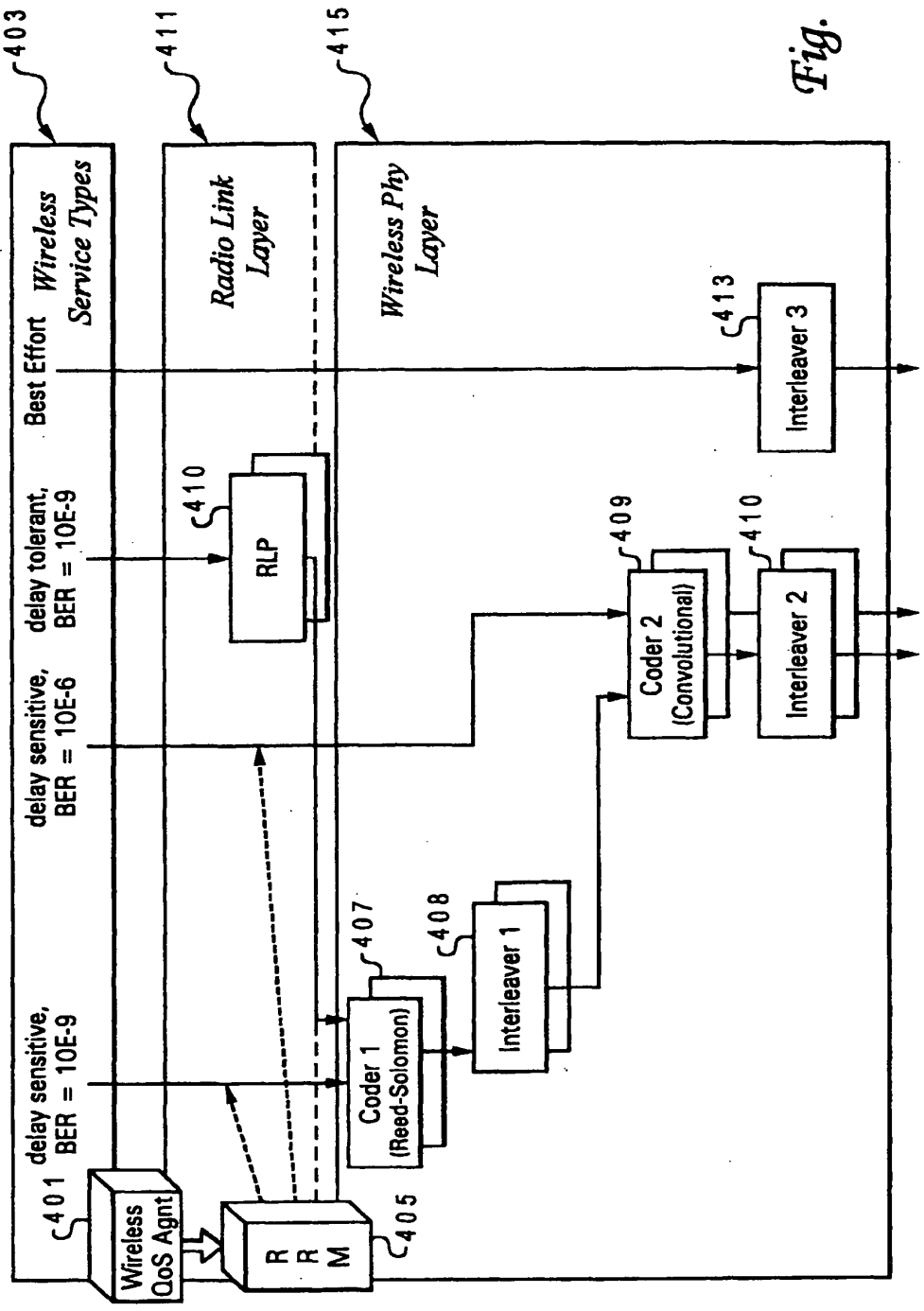

12
403
411
415
Wireless Service Types
Radio Link Layer
Wireless Phy Layer
Best Effort
delay tolerant, BER = 10E-9
delay sensitive, BER = 10E-6
delay sensitive, BER = 10E-9
401
Wireless QoS Agnt
RRM
405
RLP
410
Coder 1 (Reed-Solomon)
407
Interleaver 1
408
Coder 2 (Convolutional)
409
Interleaver 2
410
Interleaver 3
413

Fig. 4

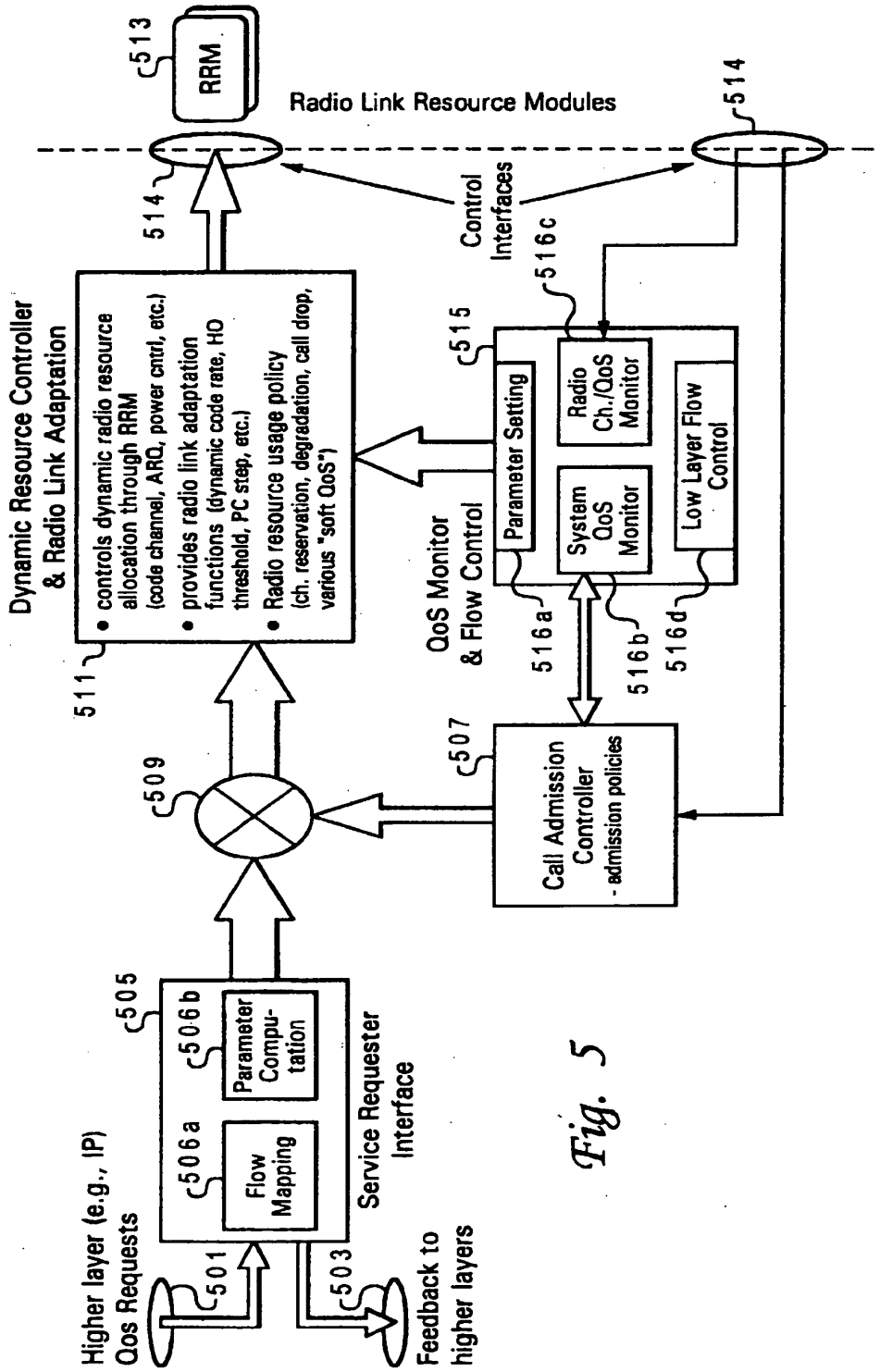

513
RRM
Radio Link Resource Modules
514
514
Control Interfaces
516c
Dynamic Resource Controller & Radio Link Adaptation
• controls dynamic radio resource allocation through RRM (code channel, ARQ, power cntrl, etc.)
• provides radio link adaptation functions (dynamic code rate, HO threshold, PC step, etc.)
• Radio resource usage policy (ch. reservation, degradation, call drop, various "soft QoS")
511
515
QoS Monitor & Flow Control
Parameter Setting
Radio Ch./QoS Monitor
System QoS Monitor
Low Layer Flow Control
516a
516b
516d
509
507
Call Admission Controller
- admission policies
505
506b
Parameter Computation
506a
Flow Mapping
Service Requester Interface
501
503
Higher layer (e.g., IP) Qos Requests
Feedback to higher layers

Fig. 5

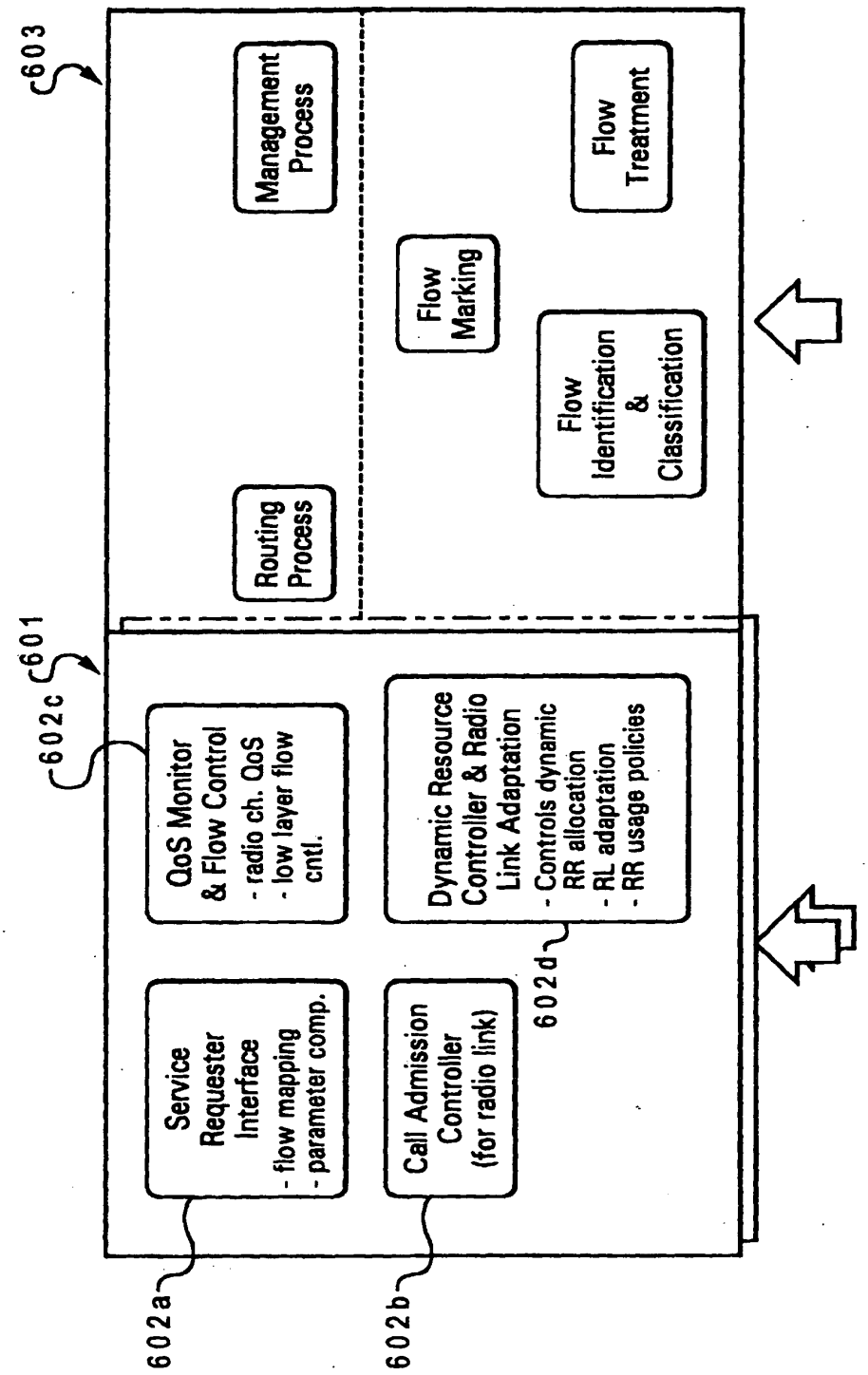

603
Management Process
Routing Process
Flow Marking
Flow Identification & Classification
Flow Treatment
601
602c
QoS Monitor & Flow Control
- radio ch. QoS
- low layer flow cntl.
Dynamic Resource Controller & Radio Link Adaptation
- Controls dynamic RR allocation
- RL adaptation
- RR usage policies
602d
Service Requester Interface
- flow mapping
- parameter comp.
Call Admission Controller (for radio link)
602a
602b

Fig. 6

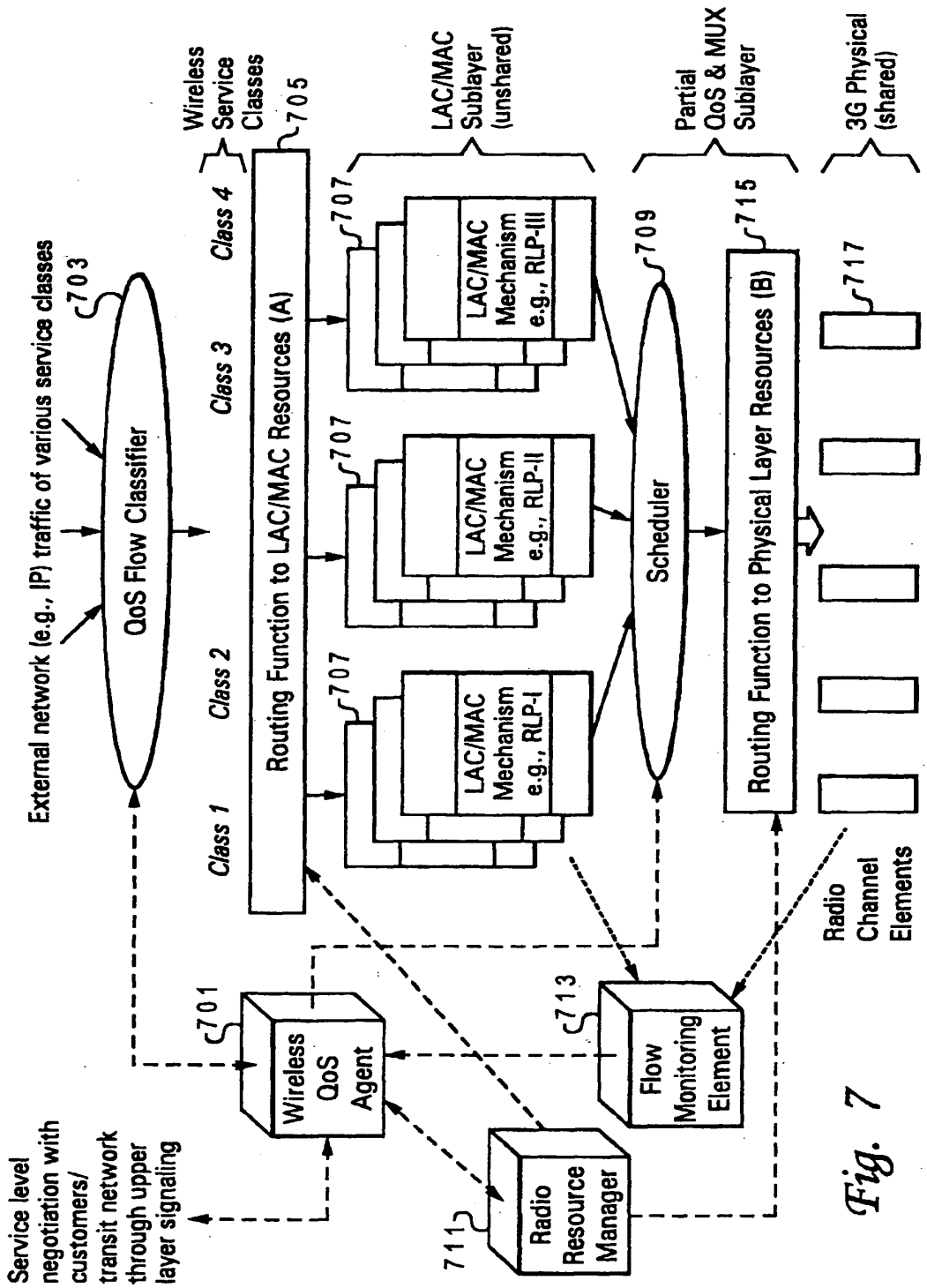

External network (e.g., IP) traffic of various service classes
703
QoS Flow Classifier
Wireless Service Classes
705
Class 1
Class 2
Class 3
Class 4
Routing Function to LAC/MAC Resources (A)
LAC/MAC Sublayer (unshared)
707
LAC/MAC Mechanism e.g., RLP-I
LAC/MAC Mechanism e.g., RLP-II
LAC/MAC Mechanism e.g., RLP-III
Scheduler
709
Partial QoS & MUX Sublayer
Routing Function to Physical Layer Resources (B)
715
3G Physical (shared)
717
Radio Channel Elements
Wireless QoS Agent
701
Flow Monitoring Element
713
Radio Resource Manager
711
Service level negotiation with customers/ transit network through upper layer signaling

Fig. 7

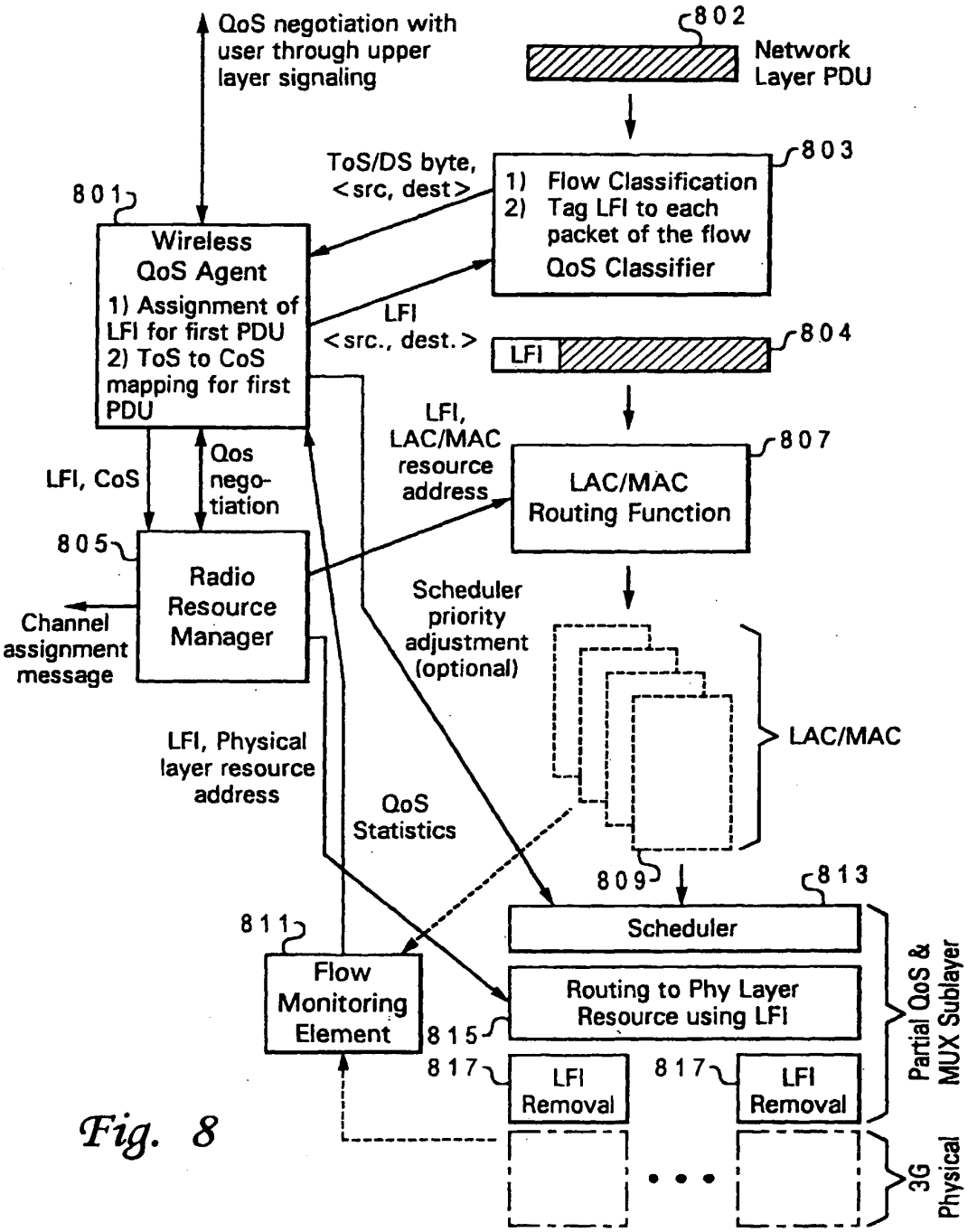

QoS negotiation with user through upper layer signaling
802
Network Layer PDU
ToS/DS byte, <src, dest>
803
1) Flow Classification
2) Tag LFI to each packet of the flow
QoS Classifier
801
Wireless QoS Agent
1) Assignment of LFI for first PDU
2) ToS to CoS mapping for first PDU
LFI <src., dest.>
LFI
804
LFI, LAC/MAC resource address
807
LAC/MAC Routing Function
LFI, CoS
Qos nego-tiation
805
Radio Resource Manager
Channel assignment message
Scheduler priority adjustment (optional)
LAC/MAC
LFI, Physical layer resource address
QoS Statistics
809
813
811
Scheduler
Flow Monitoring Element
Routing to Phy Layer Resource using LFI
815
817
LFI Removal
817
LFI Removal
Partial QoS & MUX Sublayer
3G Physical

Fig. 8

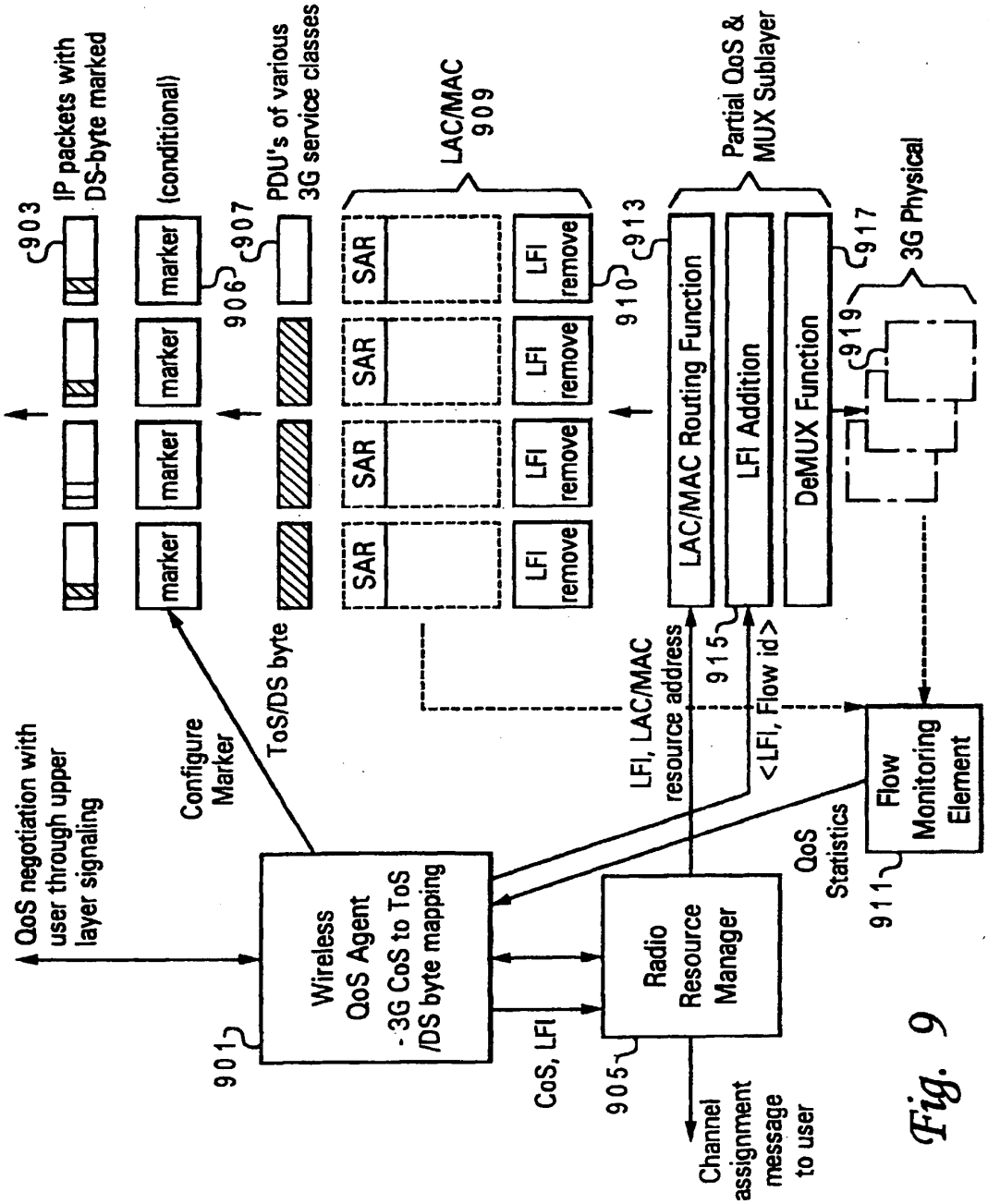

QoS negotiation with user through upper layer signaling
Configure Marker
ToS/DS byte
LFI, LAC/MAC resource address
<LFI, Flow id>
CoS, LFI
Channel assignment message to user
QoS Statistics
Wireless QoS Agent - 3G CoS to ToS /DS byte mapping
Radio Resource Manager
Flow Monitoring Element
901
905
911
903
IP packets with DS-byte marked
marker
(conditional)
906
907
PDU's of various 3G service classes
LAC/MAC 909
SAR
LFI remove
910
913
LAC/MAC Routing Function
LFI Addition
DeMUX Function
Partial QoS & MUX Sublayer
915
917
919
3G Physical

Fig. 9

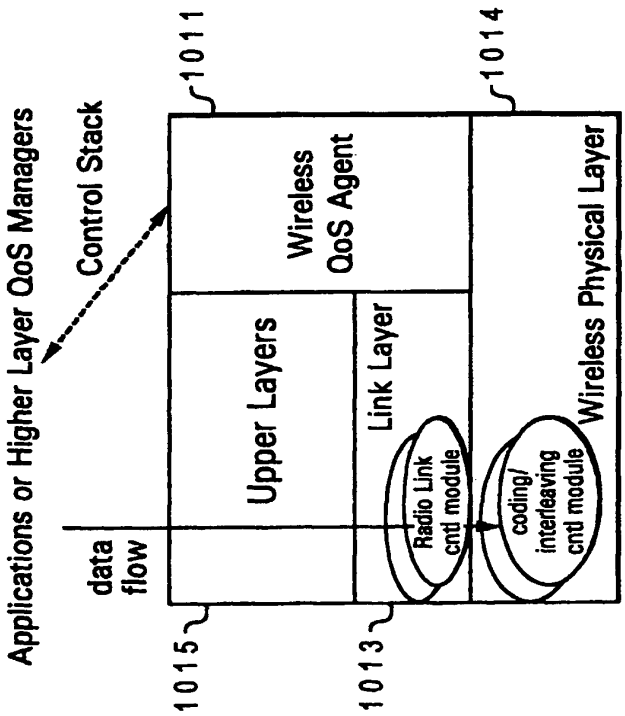


Fig. 10B

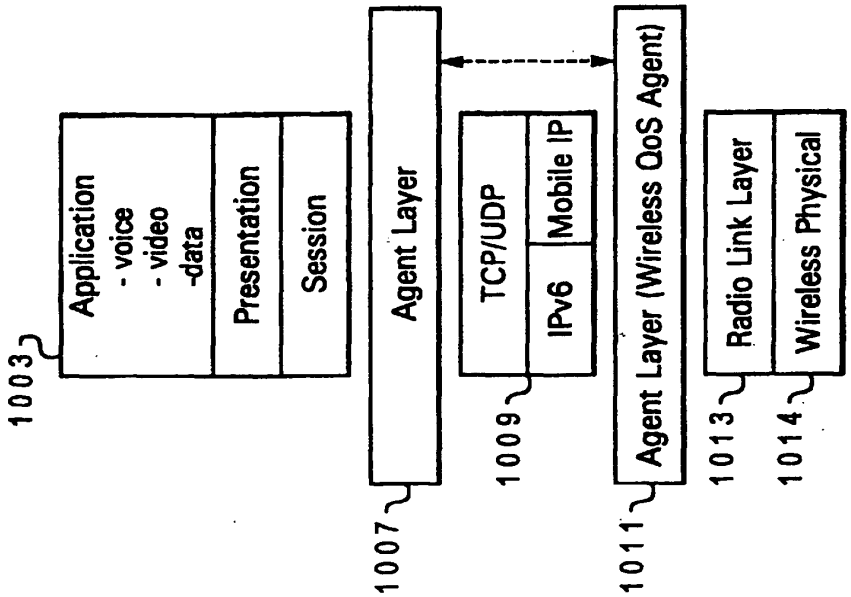


Fig. 10A

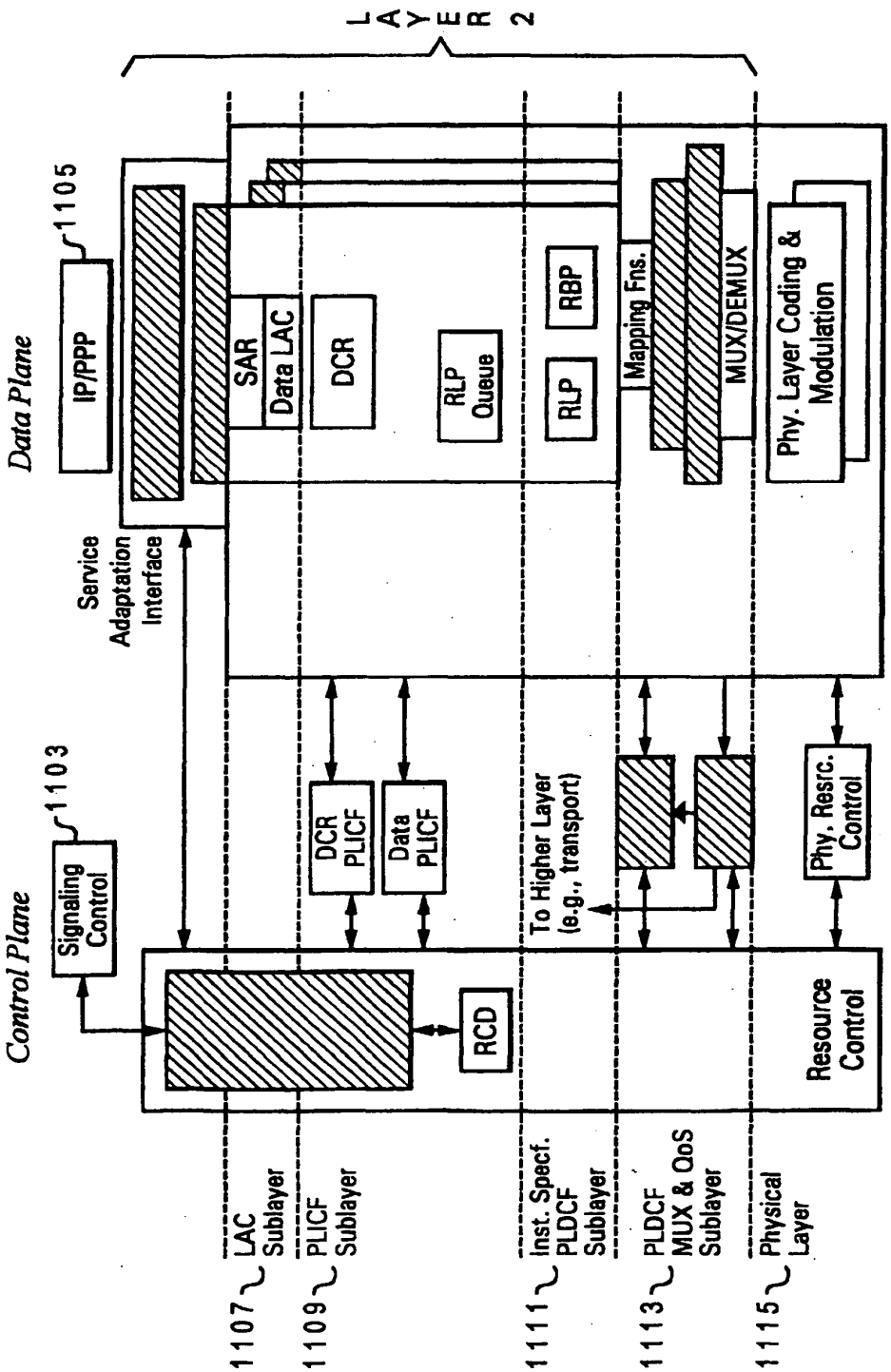

LAYER 2
Data Plane
1105
IP/PPP
SAR
Data LAC
DCR
RLP Queue
RLP
RBP
Mapping Fns.
MUX/DEMUX
Phy. Layer Coding & Modulation
Service Adaptation Interface
Control Plane
1103
Signaling Control
DCR PLICF
Data PLICF
To Higher Layer (e.g., transport)
Phy. Resrc. Control
RCD
Resource Control
1107 LAC Sublayer
1109 PLICF Sublayer
1111 Inst. Specf. PLDCF Sublayer
1113 PLDCF MUX & QoS Sublayer
1115 Physical Layer

Fig. 11

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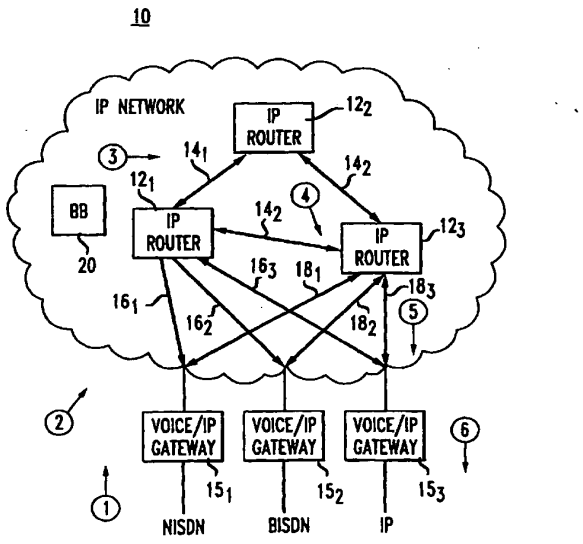
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(54) Internet protocol (IP) class-of-service routing technique

(57) The priority of the flow of packets representing calls or other connection requests within a packet network (10) is determined from the Class-of-Service of the call. Upon receipt of a call; a recipient router (12_1, 12_2, 12_3) identifies available paths, typically by exchanging messages with the other routers in the network. After selecting the path, the recipient router or centralized bandwidth broker determines whether the links comprising the selected path have available bandwidth for the class of service of the call. If so, the router routes the call to the next hop along the path. Otherwise, the router selects another path(s) and checks whether the links on the path possess sufficient bandwidth for the class of service of the call.

FIG. 1



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Description

Technical Field

[0001] This invention relates to technique for routing calls and other types of connection requests in an IP network.

Background Art

[0002] Traditional telecommunications networks typically use dedicated circuits to carry telephone traffic between facilities. Within such traditional networks, switching systems, such as the 4ESS switching systems used by AT&T, route calls by setting up a circuit that lasts the entire duration of the call and then tearing down the circuit thereafter. For this reason, such traditional networks are commonly referred to as "circuit-switched" networks.

[0003] Increases in traffic and capacity constraints on existing switches within such circuit-switched networks has prompted the development of packet-based networks, and in particular, Internet-Protocol (IP) networks. A typical IP network employs a plurality of routers, such as those manufactured by Cisco, Ascend Communications, Bay Networks and Newbridge, among others, to route data packets representing a call or other connection independently from an origin to a destination based on a destination address in each packet. Present day IP networks of the type described above are characterized by best effort routing. In other words, routing, and particularly, path selection occurs generally without regard to criterion such as class of service. Today, examples of the most prevalent routing techniques in IP networks are the Open Shortest Path First (OSPF) protocol and Border Gateway Protocol (BGP). In the OSPF protocol, for example, routers within the network exchange information with each other by a flooding technique so that each maintains a database of the network topology. Using the information in its stored database, each router selects a path for each packet in accordance with user-established cost metrics that typically require the shortest possible path. Using such cost metrics, each router establishes its routing table accordingly so each router can select a path having, for example, a minimum number of links.

[0004] Traditionally, providers of telecommunications services have offered different grades or classes of service based on customer demand. To meet quality objectives for such different grades of service, telecommunications providers, such as AT&T, have employed Class-of-Service routing techniques in traditional circuit switched networks. U.S. Patent 5,392,344, issued in the name of Gerald R. Ash et al., on February 21, 1995, and assigned to AT&T (incorporated by reference herein) describes and claims such a Class-of-Service routing technique. Unfortunately, Class-of-Service routing does not exist with present day IP telecommunications networks. Thus, there is a need for an Internet Protocol (IP) Class-Of-Service routing technique.

Brief Summary of the Invention

[0005] Briefly, the present invention provides a technique for routing a call or other connection request between an origin and destination in an IP network comprised of routers connected by links that carry data packets between routers. In accordance with the invention, the routers exchange status messages to identify available paths between the origin and destination. Each path includes at least one outgoing link from one router to another. First the class of service of the call or other connection request is determined. Then a path is selected that has a minimum cost, such as for example a minimum number of hops. Thereafter, a check is made by the originating router or possibly a centralized bandwidth broker, based on flooded network status information, of the selected path as to whether the links from that router forming the path have an available depth (i.e., bandwidth capacity not reserved for other services) for the determined class of service. If the links possess the requisite bandwidth, the router routes the packet over the outgoing link. Otherwise, another path is selected and the step of determining if the links forming the path have the requisite depth is repeated. After an allowed path is found, the IP packets are treated according to their class-of-service designated priority in the queuing discipline used by the routers in the path.

Brief Summary of the Drawing

[0006]

FIGURE 1 depicts a block schematic diagram for practicing the IP Class-of Service routing technique of the invention.

Detailed Description

[0007] Figure 1 shows a simplified block schematic diagram of an IP network 10 comprised of a plurality of routers, exemplified by routers 12_1, 12_2 and 12_3. Links 14_1, 14_2, and 14_3 connect router pairs 12_1-12_2, 12_2-12_3, and

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12_1-12_3, respectively, thus allowing the routers to pass data packets, representing telephone calls, or other information among themselves. Although the illustrated embodiment of network 10 includes only the three routers 12_1-12_3 and three pairs of connecting links, the network may include a far larger number of routers and interconnecting links.

[0008] Voice traffic destined for transit through the network 10 enters and exits the network via at least one, and preferably, a plurality of voice/IP gateways, exemplified by voice/IP gateways 15_1, 15_2, and 15_3. In the illustrated embodiment, the voice/IP gateway 15_1 handles Narrowband Integrated Services Digital Network (NISDN) traffic, e.g., traffic transmitted in 64 kilobit per second blocks. The voice/IP gateway 15_2 handles Broadband Integrated Services Digital Network (BISDN) traffic, e.g., traffic that exceeds 144 kilobits per second, the basic transmission rate for NISDN traffic. Such BISDN traffic may include voice, video and image data, for example. The voice/IP gateway 15_3 handles data already in an IP format. Depending on the nature of the traffic, the network 10 may include other Voice/IP gateways (not shown) each designed for a particular format.

[0009] Traditionally, the routers 12_1, 12_2, and 12_3 have utilized a best effort routing policy to route traffic within the network 10, using such algorithms as the Open Shortest Path First (OSPF) algorithm that seeks to route each packet on the shortest possible path. Presently, the OSPF routing protocol could theoretically support different Types of Service (TOS) based on the following criteria: Delay, Throughput and Reliability. However, IP networks, such as network 10, which utilize OSPF routing have not offered Class of Service (COS) that has been available in circuit-switched networks, making it difficult for telecommunications carriers to offer different classes of service using an IP network.

[0010] The present invention affords a technique for accomplishing COS routing in an IP network. Upon determination of the class of service, which includes the priority and other parameters of the call or other connection at its initial set-up, an originating router that receives packets from one of the gateways 15_1, 15_2 and 15_3 selects a route based on the requisite depth (required bandwidth), which in turn is based on the flow priority and load state of the links (14_1, 14_2, 14_3) in network 10. Once the originating router selects an admissible path, each subsequent router performs routing of the packets according to the determined path and priority, as now described further.

[0011] To determine requisite depth, the originating router in network 10 determines the equivalent bandwidth needed for the call or other connection and also utilizes a Bandwidth in Progress (BWIP) indication for the determined class of service at the start of the call or other connection. To that end, two quantities: Bandwidth Peg Count (BWPC) and a Bandwidth Overflow Count (BWOV) are kept for each link connecting an originating/terminating router pair. During a given interval of X minutes, each router, such as router 12_1 tracks for each link to another router the following quantities:

BWPC(link) = Sum of all Bandwidth (BW) required for flows on the link; and

BWOV(link)= Sum of BW required for each blocked flow on the link

In the class of service routing method, various virtual networks are maintained which are allocated bandwidth according to demands. Each router also maintains the following two Depth parameters for each virtual network:

BWavg*vk*, the Bandwidth required for each Virtual Networks$_v$ (VN_v) and node-pair k to carry the average Bandwidth-In-Progress ($BWIP_{vk}$) [= Erlang $Load_{vk}$ x (Avg bandwidth per virtual connection)$_{vk}$] and

BWmax*vk*, the Bandwidth required to meet the blocking probability Grade-of-Service objective= [TREBS(Erlang $Load_{vk}$, Grade-of-Service) x (Avg bandwidth per virtual connection)$_{vk}$]
where TREBS represents the well known Erlang-B formula for trunk requirements.

[0012] In practice , $BWavg_{vk}$ and $BWmax_{vk}$ are computed at prescribed intervals, typically weekly. Different values of $BWavg_{vk}$ and $BWmax_{vk}$ may be used for different periods of the day (business peak, residence peak).

[0013] Four different blocking reservation thresholds (BR1, BR2, BR3, BR4) are used, where $0\% \leq BR1 \leq BR2 \leq BR3 \leq BR4 \leq 100\%$. The reservation level ***N*** is 0 if the link blocking (NN) does not exceed BR1, N=1 if NN exceeds BR1 but not BR2, ***N=2*** if NN exceeds BR2 but not BR3, ***N=3*** if NN exceeds BR3 but not BR4, and ***N=4*** if NN exceeds BR4. This relationship is depicted in Table I.

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Table I
Determination of Reservation Level (*N*)

N	Condition
0	NN (link blocking) ≤ BR1
1	BR1 < NN ≤ BR2
2	BR2 < NN ≤ BR3
3	BR3 < NN ≤ BR4
4	BR4< NN

[0014] The Idle Link bandwidth (ILBW) for each link is used in the determination of the link Load State. In addition to the Load State of each local link (i.e., the link associated with a particular router), the Load State of all other network links is received from other routers using, for example, an extension of the currently used OSPF flooding mechanism. A metric such as "throughput or bandwidth available" might theoretically be supported by the OSPF routing algorithm to provide an indication of the Load State of all links in the network 10. Also, another metric such as "delay" may provide an indication of the Load State. In addition to being flooded to every other router in the network, this link metric information on bandwidth available, delay, or other measures could be flooded to a centralized bandwidth broker (BB), 20 which could track the link status information and perform routing computations, as discussed further below.

[0015] A link extending between a router pair is considered in a reserved (R) state if the Idle Bandwidth (ILBW) is less than or equal to a Reserved Threshold (Rthr), as defined below. The link is considered in the Heavily Loaded (HL) state if the Idle Bandwidth is less than or equal to a Heavily Loaded threshold (HLthr) for the link but more than Rthr. Conversely, the link is considered Lightly Loaded (LL) if the Idle Bandwidth for each link in the path is greater than HLthr for the link. This relationship is best depicted in Table II (hereafter we have omitted, for simplicity, the subscripts k denoting the node-pair for each variable):

Table II
Load State Condition

Name of State	Condition
Busy B	ILBW =0
Reserved R	ILBW ≤ Rthr
Heavily Loaded HL	Rthr <ILBW ≤ HLthr
Lightly Loaded LL	HLthr < ILBW

[0016] The Reservation Threshold Rthr and Heavily Loaded Threshold HLthr are given by the relationships

$$Rthr = N \times .05 \times BWmax_v$$

$$HLthr = Rthr + .05 \times BWmax_v$$

where *N* is the reservation level based on the Blocking Reservation thresholds (BR1, BR2, BR3, and BR4).

[0017] The Depth-of-Search (DoS) for a flow to use various Load States depends on the Bandwidth-In-Progress ($BWIP_v$), the $BWavg_v$ and $BWmax_v$ thresholds, the priority of the call or other connection, and whether the path is the first choice path or alternate path, as illustrated in Table III (here again we have omitted, for simplicity, the subscripts k denoting the node-pair for each variable):

TABLE III
DoS CRITERION

Load State Allowed$_v$	Key Service	Normal Service		Best Effort Service
		First Choice Path	Alternate Path	
R	if BWIP$_v \leq 2$ x BWmax$_v$	if BWIP$_v \leq$ BWavg$_v$	Not Allowed	Not Allowed
HL	if BWIP$_v \leq 2$ x BWmax$_v$	if BWIP$_v \leq$ BWmax$_v$	if BWIP$_v \leq$ BWavg$_v$	Not Allowed
LL	All BWIP$_v$	All BWIP$_v$	All BWIP$_v$	All BWIP$_v$

[0018] The originating router determines the allowed DoS for the call or other connection according to Table III. The originating router first attempts to route the call on shortest path to the terminating router.

- For a key service flow:

  If BWIP$_v \leq 2$ x BWmax$_v$, then all load states are allowed.

  If BWIP$_v > 2$ x BWmax$_v$, then only LL links are allowed.

- For a normal service flow :

  If BWIP$_v \leq$ BWavg$_v$, then all load states are allowed on the first choice path and the HL and LL states are allowed on alternate paths

  If BWavg$_v <$ BWIP$v \leq$ BWmax$v$, then only HL and LL states are allowed on the first choice path and LL state is allowed on alternate paths

  If BWIP$v >$ BWmax$v$, then only the LL links are allowed are on first choice and alternate paths

- For a best effort service call only LL links are allowed.

[0019] The originating router first determines the class of service of the call (or other connection request) from information associated with the call. In routing calls in accordance with the invention, an originating router, (e.g., router 12_1) will determine the Load State of the network links. As discussed previously, the Load State information for all links in the network 10 could be distributed, for example, via the OSPF flooding protocol. The originating router selects a path having, for example, a minimum number of hops using the shortest path routing algorithm. Using the depth parameters discussed above, the originating router then checks whether the links forming the selected path have an available depth (bandwidth capacity) for the determined class of service. If so, the router routes the packets of the call or connection request over the links in the selected path. Otherwise, another path is selected and the step of determining if the links in the path have available capacity and depth is repeated. If the originating router cannot route the call or other connection to the selected destination router, and there are other terminating routers that can route the call, then the originating router uses the shortest path algorithm to select candidate paths and the class of service routing technique to route the call to such a terminating router. If there is no available terminating router, the call is blocked.

[0020] As was discussed earlier, the centralized bandwidth broker (BB) 20 could receive the link status metric information through the flooding mechanism, and perform the same routing computations described above for the

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originating router. That is, in response to a request from an originating router, for example, the BB 20 could select a path having a minimum number of hops using the shortest path routing algorithm, depth parameters, and available link bandwidth. Once an admissible path is found, the path information is returned to the originating router which can then route the packets in the flow accordingly.

[0021] After the path is established by the originating router and packets are flowed on the path, at each hop the recipient router performs priority packet queuing based on the routing priority assigned by the originating router to each packet, such as contained in the TOS field indicator of the packet. The TOS indicators in each packet are set so that the recipient router at each subsequent hop uses the same queuing priority as determined by the originating router for the selected shortest path and COS routing treatment. Hence the COS capability afforded by the method of the invention may be enhanced by adding a priority queuing capability. At each link, the router maintains a queuing discipline such that packets having a higher TOS requirement (TOS and precedence bits) have priority over lower TOS requirements, such as best effort service.

[0022] The foregoing describes a technique for achieving Class-of-Service routing in an IP network.

[0023] The above-described embodiments merely illustrate the principles of the invention. Those skilled in the art may make various modifications and changes that will embody the principles of the invention and fall within the spirit and scope thereof.

Claims

1. A method for routing a connection request between an origin and a destination in an Internet Protocol (IP) network comprised of a plurality of routers connected by links that carry data packets representative of the request between routers, comprising the steps of:

   (a) exchanging status messages within the network to identify a group of available paths each running between the origin and destination, each path including at least one link;

   (b) selecting among the group of available paths a first path for routing the connection request;

   (c) determining for the connection request its class of service;

   (d) checking the selected path to determine whether each link forming the selected path has an available bandwidth for the class of service of the connection request, and if so, routing the data packets representative of the call over said outgoing link; otherwise;

   (e) selecting another path; and

   (f) repeating step (d) and repeating step (e) in the event said another path has a link lacking available bandwidth.

2. The method according to claim 1 wherein the status messages are exchanged between routers.

3. The method according to claim 1(?) wherein the network includes a bandwidth broker for tracking link status information and wherein the step of exchanging status messages includes the step of exchanging messages among the routers and the bandwidth broker.

4. The method according to claim 1 wherein the first path is selected to minimize cost.

5. The method according to claim 4 wherein the first path is selected to minimize the number of hops between routers.

6. The method according to claim 1 wherein said path is selected by the originating routing based on flooded link status information.

7. The method according to claim 2 wherein said path is selected by said centralized bandwidth broker based on flooded link status information.

8. The method according to claim 1 wherein the step of checking whether the link has an available bandwidth includes the steps of:

   (a) measuring actual bandwidth on said link;

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(b) determining link blocking in accordance with the actual bandwidth;

(c) establishing reservation thresholds in accordance with the link blocking;

(d) determining the load state of the links in a path in accordance with the bandwidth reservation thresholds; and

(e) establishing the availability of the path in accordance with the class of service of the connection request, the Load State of the links in the path, and a required bandwidth for each virtual network associated with the connection request class of service.

9. The method according to claim 8 wherein the required bandwidth for the call class of service is established periodically.

10. The method according to claim 1 wherein the call connection classes of service include key service, normal service and best effort service.

11. The method according to claim 10 wherein each link may have one of a Reserved, Lightly Loaded, or Heavily Loaded load states.

12. The method according to claim 10 wherein for key service, all load states are allowed if actual bandwidth in progress ($BWIP_v$) $\leq 2 \times BWmax_v$, where

BWavg*vk*, the Bandwidth required for each Virtual Networks (VN_v) and node-pair k to carry the average Bandwidth-In-Progress ($BWIP_{vk}$) [= Erlang $Load_{vk}$ x (Avg bandwidth per virtual connection)$_{vk}$] and

BWmax*vk*, the Bandwidth required to meet a blocking probability Grade-of-Service objective= [TREBS(Erlang $Load_{vk}$, Grade-of-Service) x (Avg bandwidth per virtual connection)$_{vk}$]

13. The method according to claim 12 wherein for key service, only Lightly Load links are allowed if $BWIP_v > 2 \times BWmax_v$.

14. The method according to claim 10 wherein for normal service, all load states are allowed on the first choice path and heavily loaded and lightly loaded states are allowed on alternate paths, if actual bandwidth in progress ($BWIP_v$) $\leq BWavg_v$ where

BWavg*vk*, the Bandwidth required for each Virtual Network$_v$ (VN_v) and node-pair k to carry the average Bandwidth-In-Progress ($BWIP_{vk}$) [= Erlang $Load_{vk}$ x (Avg bandwidth per virtual connection)$_{vk}$] and

BWmax*vk*, the Bandwidth required to meet a blocking probability Grade-of-Service objective= [TREBS(Erlang $Load_{vk}$, Grade-of-Service) x (Avg bandwidth per virtual connection)$_{vk}$]

15. The method according to claim 14 wherein for normal service calls, heavily loaded and lightly loaded load states are allowed on the first choice path and only lightly loaded state is allowed on alternate paths, if $BWavg_{vk} < BWIP_v \leq BWmax_{vk}$.

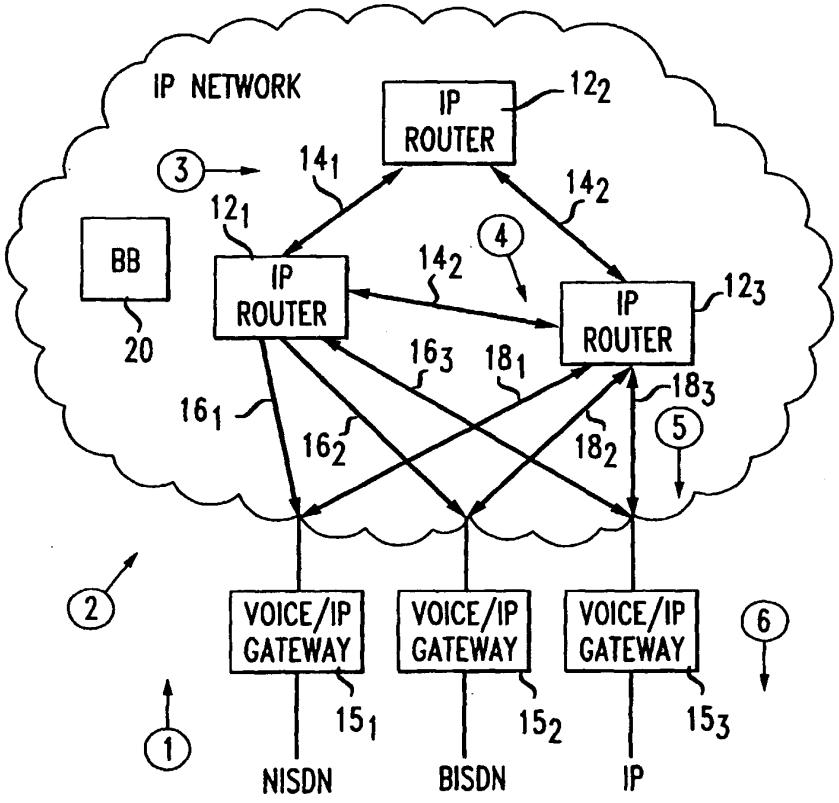
16. The method according to claim 14 where for normal service calls, only lightly loaded links are allowed on all paths when $BWIP_v > BWmax_{vk}$.

17. The method according to claim 10 wherein only lightly loaded links are allowed for best effort service.

18. The method according to claim 1 wherein at each link maintains a queuing discipline so that packets having a higher Type of Service (TOS) priority pass before packets having a lower TOS priority.

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FIG. 1


10
IP NETWORK
IP ROUTER
12_2
3
14_1
14_2
12_1
BB
20
IP ROUTER
4
14_2
IP ROUTER
12_3
16_3
18_1
18_3
16_1
16_2
18_2
5
2
VOICE/IP GATEWAY
VOICE/IP GATEWAY
VOICE/IP GATEWAY
6
15_1
15_2
15_3
1
NISDN
BISDN
IP

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(54) Title: POLICY SERVER AND ARCHITECTURE PROVIDING RADIO NETWORK RESOURCE ALLOCATION RULES

(57) Abstract: A Radio Network Server (RNS) (21) is modified to function as a policy server providing radio network resource allocation rules in an integrated third generation wireless IP network. The RNS determines a level of availability of radio network resources, and determines whether the level is sufficient to satisfy requests for resources in accordance with policy rules. The RNS informs a Bandwidth Broker (BB) (31) whether the radio network resources are available. The BB functions as a Policy Decision Point (PDP) for its domain, and either allows or denies requests from users for network resources based on the input from the RNS. A plurality of edge routers in each domain interface with the BB utilizing the Common Open Policy Service (COPS) protocol interface (16). The edge routers functions as Policy Enforcement Points (PEPs) for their domain to enforce policy decisions made by the BB. The BB may interface with BBs in other domains for calls that span multiple domains.

POLICY SERVER AND ARCHITECTURE PROVIDING RADIO NETWORK RESOURCE ALLOCATION RULES

BACKGROUND OF THE INVENTION

Technical Field of the Invention

This invention relates to telecommunication systems and, more particularly, to a policy server and architecture that provides radio network resource allocation rules in a real-time Internet Protocol (IP)-based telecommunications network.

Description of Related Art

As wireless networks evolve from primarily circuit-switched technology to IP-based packet-switched technology, networks with substantially more flexibility than current networks will bring new capabilities to consumers. However, converging Internet technology and wireless telecommunications technology is introducing new problems and new requirements on the wireless network. In circuit-switched networks, an application is assigned fixed-network resources (for example, a 64-kbit circuit) regardless of the amount of bandwidth actually required by that particular application. In many cases, the application may not fully utilize the allocated bandwidth, and network resources are wasted. Alternatively, if the application needs more bandwidth than the allocated amount, it may not be able to get it, and the application cannot request more bandwidth after it has started its execution.

As an example, a call may be placed from a mobile subscriber in Montreal to a mobile subscriber in Sweden. The circuit-switched call is routed from the cellular provider network in Montreal, through a domestic wireline provider, through an international provider, through one or more wireline providers in Europe, and finally to the Swedish mobile provider. Various gateways and switches contribute to establishing the end-to-end circuit-switched connection, which has to go through many different domains. Once the connection is established, there is no negotiation over bandwidth required for any particular application because the connection is fixed at 64 kbps. This is often a wasteful utilization of bandwidth capacity since a 64-kbps link is not required for a voice call; a voice call can be carried with excellent voice quality on a link operating, for example, at only 9.6 kbps.

The Application Performance Rating Table below further illustrates this problem by showing the amount of bandwidth required for different types of applications in order to achieve certain levels of Quality of Service (QoS). For example, if high quality video is carried over an ISDN link at 128 kbps, the end user sees jerky, robotic movement (fair). However, if the video is provided at 384

kbps, the quality of the video is much better. At the other end of the performance spectrum, a voice call can be carried at 9.6 kbps and still have excellent voice quality. For efficient use of network resources, a control mechanism is needed to ensure that the right amount of bandwidth is provided to deliver the requested QoS without wasting excess bandwidth.

Data Rates (kbps)	9.6	14.4	32	64	128	384	2000
Applications	Application Performance Rating						
Voice, SMS	E	E	E	E	E	E	E
E-mail	P	F	E	E	E	E	E
Internet Web Access	P	P	F	F	E	E	E
Database Access	P	P	F	E	E	E	E
Synchronization	E	E	E	E	E	E	E
Document Transfer	P	P	F	E	E	E	E
Location Services	F	E	E	E	E	E	E
Still Image Transfer	P	F	E	E	E	E	E
Video Lower Quality	P	F	F	E	E	E	E
Video High Quality	P	P	P	F	F	E	E
	Excellent (E) Fair (F) Poor (P)						

Application Performance Rating Table

In packet-switched IP-based networks, the amount of assigned bandwidth is not fixed. An application can request specific network resources, and then renegotiate the allocated network resources during its lifetime. In an integrated network combining a fixed IP network with a radio access network, a major problem is how to provide this type of flexibility in the radio access portion of the network.

Another problem is that wireless access technologies such as EDGE, Wideband Code Division Multiple Access (Wideband CDMA or WCDMA), CDMA 2000, Wireless Local Area Networks (WLAN), or Bluetooth wireless radio links are more subject to transmission errors than conventional fixed networks. Consequently, integration of the radio access portion with the more reliable fixed IP network is introducing new problems. For example, when using the Transmission Control Protocol (TCP) on a fixed IP network, lost packets due to transmission errors are retransmitted. Therefore, if someone in Australia is establishing a connection to a third generation (3G.IP) mobile terminal in North America using TCP, and some transmission errors occur on the radio link channel,

TCP attempts to retransmit the data. The retransmission will occur from the originating point in Australia rather than locally between the base station and the mobile terminal. Therefore, an extra load is placed upon the entire network because of transmission problems in the radio portion.

An additional problem arises because the bandwidth over radio channels is typically more limited compared to the rest of the IP Access, EDGE, and core network. Therefore, some mechanisms are required in order to avoid unnecessarily carrying packets all the way from an origination point to a mobile terminal in a wireless network when the wireless network is not able to transport these packets to and from the mobile terminal. This is especially true when real-time applications such as Voice-over-IP (VoIP) are being utilized.

When a Voice-over-IP (VoIP) call is established across different domains in a packet-switched IP network, the parties involved in the call can change the bandwidth allocated to the call in the middle of the call. In other words, the characteristics of the bearer can be changed while the call is in progress. An example of the problem that this can present can be illustrated utilizing a scenario in which a real-time stream such as video is being sent from a mobile terminal in Montreal to a receiving mobile terminal in Sweden. During the call, the mobile subscriber receiving the transmission in Sweden requests that the sender increase the bandwidth, for example, to go from 8-bit color to 24-bit color to improve the accuracy of the received video. When the request is received in the sender's mobile terminal in Montreal, the terminal responds by increasing the bit rate to carry 24-bit color. The operators of the intermediate domains also increase the bandwidth allocation to the call to enable the additional data to be delivered. However, if radio resources in the receiver's radio access network in Sweden are totally occupied, the extra information cannot be delivered to the receiving mobile terminal, and is discarded. This is a highly inefficient use of system resources, and the carriers who provided the bandwidth to carry the information all the way from Montreal to the radio network in Sweden still want to be paid even though the information was discarded at the end.

There are no known prior art teachings of a solution to the aforementioned deficiencies and shortcomings. The Internet Engineering Task Force (IETF) has proposed a Policy Framework and Architecture for third generation (3G) wireless Internet Protocol (IP) networks and the Internet, the purpose of which is to establish the real-time network control that is necessary to transform the Internet from a "best efforts" data network to a more reliable, real-time network. There are two releases of the proposal for 3G systems, but neither of the releases addresses the issue of providing policy rules for the control of radio access network

resources.

The first release, referred to as 3GPP Release 99, introduces some new radio access technology such as Wideband CDMA and EDGE. Wideband CDMA introduces not only a new radio technology, but also Asynchronous Transfer Mode (ATM) technology in the radio access portion of the network. In the Wideband CDMA radio network controller, two interfaces are supported. One is called Iu-cs which is circuit-switched toward the current circuit-switched network, and one is called Iu-ps which is packet-switched toward the General Packet Radio Service (GPRS) wireless IP network. All the real-time voice and data still goes through the circuit-switched network, and data goes through the best-efforts GPRS network. There is no integrated real-time network.

In the second 3G release called 3GPP Release 00, a real-time IP network is envisioned with all the infrastructure to carry real-time applications with equal or getter quality than circuit-switched networks. Policy rules are provided to a Bandwidth Broker (BB) regarding the resources of the fixed network, but not for the wireless access portion.

It would be advantageous, therefore, to have a network architecture that includes a policy server that provides radio network resource allocation rules to a BB. Additionally, the architecture would enable BBs to pass resource information to BBs in other domains thereby providing an indication of the end-to-end bandwidth capacity of a connection, including the radio access portion, to each BB involved in a connection. Thus, this solution would prevent the sending of data that cannot be carried through to the destination. The present invention provides a policy server and architecture that achieves these objectives.

SUMMARY OF THE INVENTION

In one aspect, the present invention is a policy server for providing radio network resource allocation rules to a Policy Decision Point (PDP) in a third generation (3G) wireless Internet Protocol (IP) network. The policy server includes means for determining a level of availability of radio network resources, an interface toward the PDP, and means for determining whether the level of availability of radio network resources is sufficient to satisfy the received requests for resources. The policy server receives queries from the PDP regarding the availability of radio network resources to satisfy requests for resources, and sends responses to the PDP indicating whether the requested resources are available.

In another aspect, the present invention is a Bandwidth Broker (BB) that functions as a PDP in a radio network access portion of an integrated IP network. The BB includes a user/application interface for receiving a call request from a

user, or an inter-BB interface for receiving a request from another BB. The BB also includes means for determining radio network resources required to satisfy the received call request, a policy server interface toward a Radio Network Server (RNS), and an intra-domain interface toward an edge router for sending an approval or a denial for the requested resources. The BB sends queries to the RNS regarding the availability of radio network resources to satisfy the received call request, and receives responses from the RNS indicating whether the requested resources are available or allowed.

In yet another aspect, the present invention is a policy architecture for an integrated 3G wireless IP network having a radio access domain and an IP-based domain. The policy architecture includes a BB that functions as a PDP in each domain, a plurality of edge routers in each domain that interface with the BB and function as Policy Enforcement Points (PEPs), and a policy server that interfaces with the BB and provides radio network resource allocation rules to the BB.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and its numerous objects and advantages will become more apparent to those skilled in the art by reference to the following drawings, in conjunction with the accompanying specification, in which:

FIG. 1 (Prior Art) is a simplified functional block diagram of the Policy Framework and Architecture proposed by the IETF for fixed IP networks;

FIG. 2 is a simplified functional block diagram of the Radio Network Server (RNS) of the present invention, illustrating the modifications enabling it to interact with a Bandwidth Broker (BB); and

FIG. 3 is a simplified functional block diagram of a BB that has been modified in accordance with the teachings of the present invention to support a policy server interface with the RNS and an interface with other BBs.

DETAILED DESCRIPTION OF EMBODIMENTS

The present invention expands the role of a radio network server (for example, a radio network controller or base station controller) in an all-IP wireless network to act as a policy server toward a Bandwidth Broker (BB). The terms Bandwidth Broker, Network Control Point, and Bearer Manager are used interchangeably in the industry to refer to the same functional node, but Bandwidth Broker is currently preferred by the majority. As referred to herein, the BB does more than merely control bandwidth. Often, for example, an edge router will have the bandwidth available to carry a given application, but cannot carry the packets with the required latency to provide the desired QoS. Therefore, the BB instructs

the edge router to deny access. This action is typically performed by having the BB install a policy in the edge router that denies the admission of the incoming flow. BBs do not exist today, but are proposed for the IETF policy framework architecture in order to support a real-time IP network.

FIG. 1 is a simplified functional block diagram of the Policy Framework and Architecture proposed by the IETF for fixed IP networks. The RSVP Admission Policy (RAP) Working Group in IETF was originally chartered to establish a scalable policy control model for the Internet Reservation Protocol (RSVP). The policy framework they designed is also applicable to other QoS technologies such as Differential Services (DiffServ). The framework, in essence, is very simple since it identifies two primary components by their functionality: a Policy Enforcement Point (PEP) and a Policy Decision Point (PDP) which function, in a sense, as the "policeman" and the "judge", respectively.

In the IETF policy framework, each edge router 11 at the boundary of the IP network functions as a PEP. Edge routers control the flow of packets to and from a particular application, and their role in the policy framework can be likened to that of a policeman who is enforcing the rules. The BB 12 functions as a PDP, and its role can be likened to that of a judge. The BB decides whether particular requests for resource allocations within its domain can be satisfied, and then instructs the edge router to permit the application packet flow or not. In order to perform its function, the BB may consult a Policy Repository 13 which contains the network operator's rules for resource allocations. The Policy Repository may be implemented in a Lightweight Directory Access Protocol (LDAP) server. The BB also interfaces with an Authentication Server 14 and other entities 15. The BB may also interface with an IETF Authorization, Authentication, and Accounting (AAA) server through a policy server.

The PEP and the PDP are logical entities. They can be implemented on the same device or on separate devices. Typically, the PEP will be implemented within the context of an EDGE router at the boundary of a domain, while the PDP is implemented as a server node for the domain. There are likely to be many PEPs in a network domain; however, there is likely to be only one PDP (or two PDPs for network redundancy) and associated policy repositories for a particular domain.

Edge routers must understand both RSVP and DiffServ. RSVP and DiffServ are two related architectures in IETF. RSVP is basically a protocol built under the umbrella of integrated services. It interfaces existing routing protocols rather than performing its own routing, and is used by a host to request a specific QoS from the network. RSVP controls the flow of packets one flow at a time, independently of each other. RSVP controls QoS on a per-flow basis by

attempting to make a resource reservation for an application data stream at each node through which it passes. RSVP communicates with two local decision modules: admission control and policy control to determine whether the node has sufficient resources to supply the QoS, and whether the user has administrative permission to make the reservation. RSVP is predominantly used within the access network.

DiffServ, on the other hand, is a mechanism where all flows that need to be treated alike are grouped in one approach. The IP header of each packet that comes into the core network is marked with the class of service the packet requires. The routers in the network treat all of the packets marked with each class of service in the same manner regardless of what flow they are in. DiffServ, therefore, is much more scalable than RSVP. It is mainly used in the multi-service backbone.

Edge routers, therefore, must understand both RSVP and DiffServ. The edge router 11 communicates with the BB 12 over a Common Open Policy Service (COPS) protocol interface 16, and COPS, therefore, is designed to interwork with both RSVP and DiffServ. The COPS standard defines the roles between the BB that implements the PDP and the edge routers that implement the PEPs. Thus, when it is desired to implement a real-time system, the edge routers must support COPS.

Since there are varying circumstances in which traffic owners (end users, applications, etc.) are entitled to the services they request and are probably paying for, there is a need for rules, a need for "police" to enforce these rules, and a need for "judges" to decide when the rules apply. The rules, the police, and the judges all comprise a policy system that is an essential component of a QoS-enabled IP network, and the policy system must integrate the radio access network in its policy implementation.

In the present invention, the Radio Network Server (RNS) is modified to behave as a policy server toward the BB. The RNS controls radio resources and allocates radio resources to users. In order to accomplish this objective, the present invention (1) adds the RNS to the RAP Policy Framework and Architecture, (2) adds a new interface between the BB and the RNS, (3) adds functionality in the BB to support the new interface, and (4) adds functionality in the RNS to support the new interface.

FIG. 2 is a simplified functional block diagram of the RNS 21 of the present invention, illustrating the modifications enabling it to interact with the modified BB 31 (FIG. 3). The RNS is a new entity that keeps track of what radio resources are available, and instructs the BB whether to admit a new application that may be blocked due to congestion in the radio access network. The interface with the BB

occurs through a Radio Policy Functions block 22. The Radio Policy Functions block interacts with a Cell Resource Manager 23 which contains traffic, radio network, and channel allocation functions. A Radio Network Configuration database 24 supplies configuration information to the Cell Resource Manager, enabling it to determine available radio resources, control the radio resources, and allocate the radio resources to users. The RNS 21 also includes Naming and Lookup Services 25, a Message Handler 26, and a block to control internal Element Management Functions 27.

FIG. 3 is a simplified functional block diagram of a BB 31 that has been modified in accordance with the teachings of the present invention to support the policy server interface with the RNS 21. The BB is a server application. The BB understands all IP protocols such as the Routing Information Protocol (RIP) 32. Therefore, it builds a database 33 that allows the router to understand the topology of the network it controls. It knows what paths in the network, by default, packets will use in crossing the network. It knows what nodes need to be controlled in order to ensure all of an application's packets flow through the network in such a way that they fulfill the appropriate Service Level Agreement (SLA).

Requests to set up a call may come from a user or another BB, and enter the BB through a set of User/Application Interfaces 34. The call request includes a destination IP address and a desired class of service, and specifies whether QoS is required in the send, receive, or both directions, whether QoS is enabled or assured, and the type of application. The User/Application Interface maps the type of application and class of service to an SLA. The SLA specifies the characteristics that are needed to carry the packets that belong to a specific application such as the amount of bandwidth, delays, delay variation, and jitter. The User/Application Interfaces block translates the SLA to to a Service Level Specification (SLS). The system must then enforce the SLS to ensure that the right QoS is provided end-to-end.

When QoS is assured, the call is completed only after all of the network resources required for a specified QoS are assured. Therefore, the called number will not ring unless the quality of the call is assured. When QoS is enabled, the call is allowed even when partial or no QoS is available. The caller may receive a notification that the quality of the call cannot be guaranteed, and may ask if the caller would like to proceed.

An Inter-Domain Interface 36 enables the BB to communicate with BBs in adjacent domains. There is one BB per domain, and when a call is placed that spans several domains, such as the earlier exemplary call from Montreal to Sweden, the BB in each domain requests the following BB whether it can admit the

packets with the requested bandwidth, latency, etc. An Intra-Domain Interface 37 is utilized to communicate with the edge routers within the BB's own domain using the COPS interface 16.

Before talking to the edge routers, the BB must first verify that the policy allows for these packets to be admitted. A set of Policy Server Interfaces 38 links the BB to different types of policy servers. One type is a Media Policy Server (MPS) 39 through which the system operator provides instructions on how the bandwidth in the network should be allocated. For example, the IETF has standardized four classes of services: Best Efforts, Interactive, Real-time Stream, and Conversational, and the operator may instruct that 25% of the available bandwidth be reserved for Best Efforts and Interactive traffic. Another type of policy server is an Application Policy Server (APS) 41 which relates to the application and subscriber profile, and determines who can use each type of bearer in terms of quality, and so on. The operator may decide, for example, that a certain type of subscriber cannot request a bit pipe with a conversational class of service because once the bit pipe is established, the subscriber will use his own call server to place voice calls over the network without the operator's knowledge. Therefore, the operator may establish policies in the APS that enable him to keep better control of the network. A third type of policy server in the present invention is the RNS 21 which, as noted above, controls radio resources and allocates radio resources to users.

The BB may also include an internal policy server for defining simple rules, identified in FIG. 3 as Simple Policy Services 42. The simple rules may be similar to the bandwidth allocation rules handled by the MPS 39, when such simple rules can be handled internally in the BB. Finally, a Network Management Interfaces block 43 provides Element Management Functions for the BB. This block provides a machine-machine interface to the Operating Support System (OSS) 44 which performs management tasks such as start, restart, configure, optimize performance, upgrades, etc.

When an application or a BB from another domain is making a request to the BB of a wireless access domain for the establishment or changes in the Service Level Specifications (bandwidth, jitters, delay), the BB interacts with the RNS through the new interface. Since the main role of the RNS is to control and manage the radio network configuration, the RNS is consequently aware of the availability of radio resources. Therefore, the RNS can act as a policy server and set the conditions for actions by the BB. For example, if radio resources are available, the RNS may notify the BB that it can attempt to establish an SLA within or across the domains between the two end points.

The functionality of the BB is augmented to enable it to map a requested Class of Service and a specific type of application to a specific SLA. However, it is not sufficient to request a "bit pipe" with a specific Class of Service. The amount of bandwidth for a voice call with Class of Service "Conversational" and a video call with Class of Service "Conversational" is very different. Consequently, it is required to map a combination of both: Class of Service and Type of Applications to an SLA.

When the present invention is implemented and utilized in the earlier scenario in which the mobile subscriber in Montreal is calling the mobile subscriber in Sweden, and the receiving subscriber in Sweden wants to increase the bandwidth, the request goes through a call server. The call server queries the BB for the Swedish mobile network whether the bandwidth is available. The BB utilizes input from the policy server to make the decision. The RNS in Sweden, acting as the policy server, tells the BB that the resources are not available. Therefore, the BB denies the request for increased bandwidth. A message is then sent through the BBs in each domain to the BB in the mobile network in Montreal which instructs the mobile terminal not to send the additional data.

It is thus believed that the operation and construction of the present invention will be apparent from the foregoing description. While the policy server, broker, and architecture shown and described has been characterized as being preferred, it will be readily apparent that various changes and modifications could be made therein without departing from the scope of the invention as defined in the following claims.

WHAT IS CLAIMED IS:

1. A policy server for providing radio network resource allocation rules to a Policy Decision Point (PDP) in a third generation (3G) wireless Internet Protocol (IP) network, said policy server comprising:

means for determining a level of availability of radio network resources;

an interface toward the PDP for receiving queries from the PDP regarding the availability of radio network resources to satisfy requests for resources, and for sending responses to the PDP indicating whether the requested resources are available; and

means for determining whether the level of availability of radio network resources is sufficient to satisfy the received requests for resources.

2. A Bandwidth Broker (BB) that functions as a Policy Decision Point (PDP) in a radio network access portion of an integrated Internet Protocol (IP) network, said BB comprising:

a user/application interface for receiving a call request;

means for determining radio network resources required to satisfy the received call request;

a first policy server interface toward a Radio Network Server (RNS) for sending queries from the BB regarding the availability of radio network resources to satisfy the received call request, and for receiving responses from the RNS indicating whether the requested resources are available; and

an intra-domain interface toward an edge router for sending an approval or a denial for the requested resources.

3. The BB of claim 2 further comprising an inter-domain interface toward a BB in another network domain for sending an indication of whether or not the request for resources can be satisfied.

4. The BB of claim 3 further comprising a second policy server interface toward a Media Policy Server (MPS) for retrieving from the MPS, system operator instructions regarding how resources in the network should be allocated.

5. The BB of claim 4 further comprising a third policy server interface toward an Application Policy Server (APS) for retrieving from the APS, system operator instructions regarding which particular applications or subscribers can use each type of bearer.

6. A policy architecture for an integrated third generation (3G) wireless Internet Protocol (IP) network having a radio access domain and an IP-based domain, said policy architecture comprising:

a Bandwidth Broker (BB) that functions as a Policy Decision Point (PDP) in each domain;

a plurality of edge routers in each domain that interface with the BB and function as Policy Enforcement Points (PEPs); and

a policy server that interfaces with the BB and provides radio network resource allocation rules to the BB.

7. The policy architecture of claim 6 wherein the BB includes:

a user/application interface for receiving a call request from a user;

means for determining radio network resources required to satisfy the received call request;

a policy server interface toward the policy server for sending queries from the BB regarding the availability of radio network resources to satisfy the received call request, and for receiving responses from the policy server indicating whether the requested resources are available; and

an intra-domain interface toward an edge router for sending an approval or a denial for the requested resources.

8. The policy architecture of claim 6 wherein the policy server includes:

means for determining a level of availability of radio network resources;

an interface toward the BB for receiving queries from the BB regarding the availability of radio network resources to satisfy requests for resources, and for sending responses to the BB indicating whether the requested resources are available; and

means for determining whether the level of availability of radio network resources is sufficient to satisfy the received requests for resources.

9. The policy architecture of claim 6 wherein an Internet Reservation Protocol (RSVP) is utilized within an access domain in the integrated network, and a Differential Services (DiffServ) is utilized in a multi-service backbone domain, and the edge routers interface with the BB utilizing a Common Open Policy Service (COPS) protocol interface which interworks with both RSVP and DiffServ.

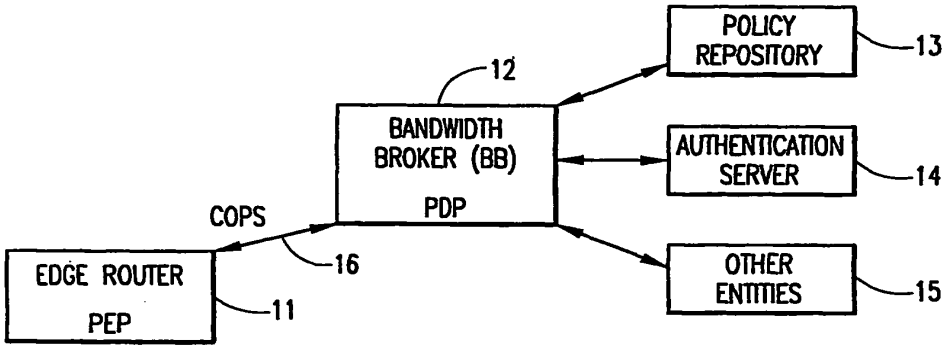


FIG. 1
(PRIOR ART)

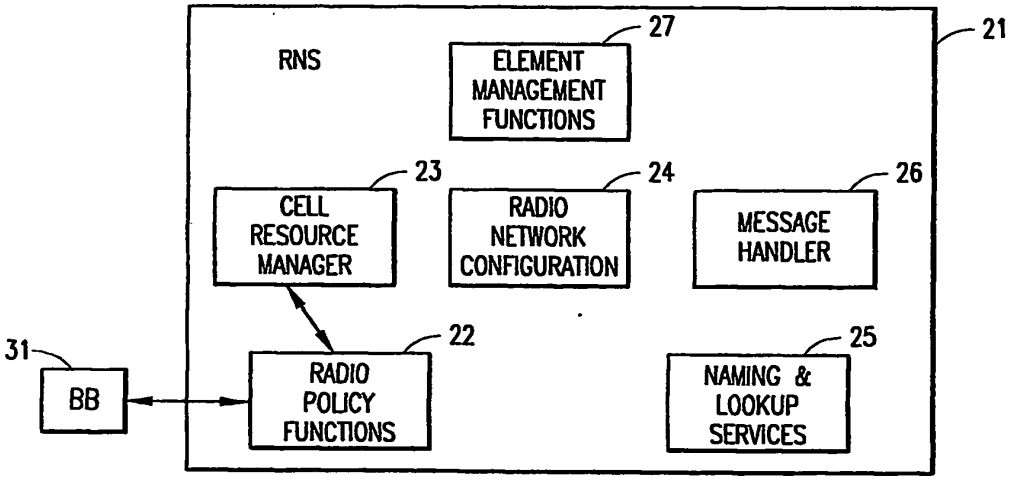


FIG. 2

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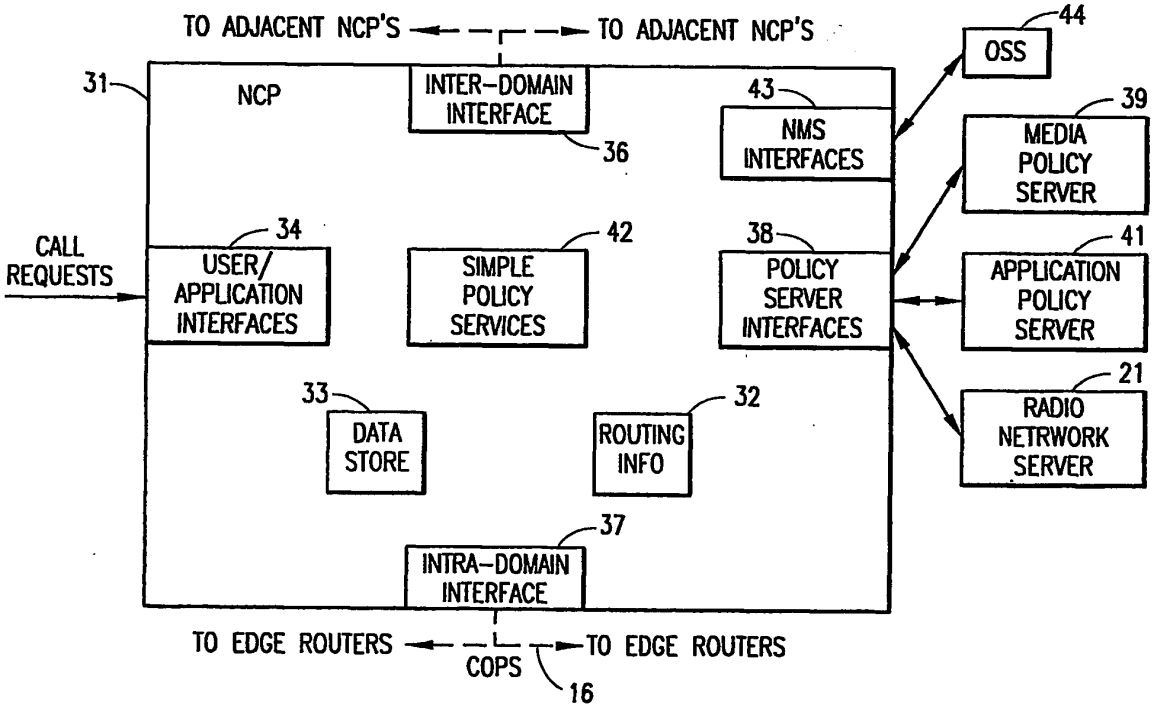


FIG. 3

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(54) Title: METHOD AND APPARATUS FOR NETWORK SERVICE RESERVATIONS OVER WIRELESS ACCESS NETWORKS

(57) Abstract: Methods and apparatus are provided for reserving resources in a wireline network from a wireless network. A resource reservation request is made by a service client to a service broker. The service broker contacts a bandwidth broker to determine the available resources in the wireline network. The service broker also contacts a geographical domain server for information related to wireless access for the requested reservation. Using information provided by the geographical domain server, the service broker contacts a radio bearer broker to determine the resources available in a particular wireless network. Based upon the information provided by bandwidth brokers and radio bearer brokers, the service client can reserve the requested resources.

METHOD AND APPARATUS FOR NETWORK SERVICE RESERVATIONS OVER WIRELESS ACCESS NETWORKS

The present application claims priority under 35 U.S.C. §119(e) to U.S. Provisional Application 60/181,547 filed on February 10, 2000, the entire disclosure of which is herein expressly incorporated by reference.

BACKGROUND

The present invention relates to quality of service control in networks, and more specifically, to providing a certain level of quality of service in a network which includes both wireless and wire line infrastructure through reservation of resources.

Conventionally, the Internet has not provided mechanisms for differentiation of the quality of service of various traffic routed over the Internet. Accordingly, all packets which traverse the Internet are treated equally when being forwarded by routers in the Internet. However, recently there has been a demand for quality of service differentiation in packets traversing the Internet. This demand for quality of service differentiation is due in part to applications being used across the Internet with various demands for high throughput and low delay. Further, users of the Internet have shown an increased willingness to pay for improved quality of service for traffic on the Internet.

To address the demand for differentiation of quality of service in the Internet, the Internet Engineering Task Force (IETF) has proposed one mechanism which is known as Integrated Services Architecture and which uses RSVP. The mechanism is based on soft end-to-end signaling to provide sensitive applications with admission control and per flow quality of service in routers along data paths. However, this approach has been dismissed as too complex due to the fact that the original design of the Internet is stateless in that the routers do not need any information about application data flows in order to route the data. Adding per flow connection state in routers changes this model of the Internet router so that it does not scale as well into the original design of the Internet.

Another approach to providing differentiated services over the Internet by the IETF is known as the diffserv architecture. In the diffserv architecture, IP

packet headers include a small label, known as the diffserv field, to identify the forwarding treatment that particular packet should be provided by routers. Core routers are configured with a few per-hop behaviors which are matched to the packet labels so that these routers can forward packets in accordance with a priority of their forwarding class. The diffserv architecture relies on the use of traffic conditioners, including packet markers, traffic shapers and policing functions, at the boundaries of the network to ensure that the traffic load is controlled and that intended services are provided in the various forwarding classes.

One known method for controlling a minimum quality of service in a network is through admission control. Admission control allows a network operator to reject service to new clients so that committed service can be provided to clients that were already granted admission. One method for admission control in the diffserv architecture is through the use of boundary routers and policy servers. Figure 1 illustrates a conventional policy server architecture for admission control to a network. The architecture illustrated in Figure 1 includes a client 110, access router 120, including a policy enforcement point 125, a policy server 130, including a policy decision point 135, and a network 140. To gain access to network 140, client 110 sends its request for access to access router 120. Policy enforcement point 125 in access router 120 forwards the request for admission to policy server 130. The policy decision point 135 in policy server 130 determines whether to allow client 110 access to network 140. Policy server 130 returns this decision to access router 120, which in turn, either allows or denies client 110 access to network 140. The decision of whether to allow or deny access to network 140 by policy server 130 is not based upon the available resources of network 140, but instead is based upon policy decisions such as whether client 110 has a right to reserve access in network 140, e.g., whether client 110 is a paying customer of network 140.

Figure 2 illustrates another conventional admission control architecture. The admission control architecture illustrated in Figure 2 includes client 210,

access router 250, including traffic classifier/traffic shaper 255, bandwidth broker (BB) 260 and network 240. To gain admission to network 240, client 210 sends a request to access router 250. Access router 250 forwards the request for bandwidth to bandwidth broker 260. Bandwidth broker 260 determines whether there is enough bandwidth in network 240 to grant the request of client 210. Bandwidth broker 260 forwards this decision to access router 250, which then allows or denies client 210 the reserved access to network 240. If client 210 is granted access to network 240, traffic from client 210 is shaped by the traffic classifier/traffic shaper 255 located in access router 250.

It will be recognized that there are two general types of bandwidth reservation which a bandwidth broker typically deals with, open ended immediate reservation and in advance reservations. An open ended immediate reservation is a reservation that is made for the present time and does not have a deterministic end time. This type of reservation is provided only with a limited guarantee for bandwidth in a network. The services with immediate reservation have lower priority than the services with in advance reservation in the sense that a service with immediate reservation may be preempted in case resources have to be reallocated to a service with in advance reserved resources. This risk of preemption is viewed as an acceptable tradeoff against the target of maximum utilization for reserved resources. Accordingly, this risk of preemption is configured to an acceptable level.

An in advance reservation is a reservation for a future point in time which is guaranteed for the duration of the reservation. By offering in advance reservations, clients can more effectively plan their network activities. In advance reservations are typically used for scheduled events and when long term aggregate resources are negotiated between different providers.

To provide committed service in their domains, bandwidth brokers set up traffic conditioners in boundary routers of their diffserv domains. Traffic conditioners perform packet marketing, policing and traffic shaping. Thus, traffic conditioners are used to ensure that the clients maintain their bandwidth within the

amount that they reserved and that the intended services are provided in the various forwarding classes. Traffic in excess of a reservation is either dropped or remarked to a lower service level.

As the Internet continues to evolve, it is anticipated that wireless access to the Internet will continue to increase. It is envisioned that Internet protocol (IP) will one day be used end-to-end, including over wireless links, so that mobile units can be provided with the opportunity to support a vast range of applications in traffic mixes.

In the current wired Internet, and in IP-based wireless local area networks (WLANs) congestion in the network can result in increased delays to packets traversing the network and to dropped packets. However, since the bandwidth of these networks is quite large, and the transmission speed of data through these networks is also quite quick, these network delays and dropped packets are not viewed as a great problem. However, in wide area wireless networks, i.e., networks which operate in government license bands where end users typically pay a traffic fee per minute for use of the network, e.g., WCDMA or GSM, bandwidth is quite expensive. Accordingly, it would be a waste of this precious bandwidth if packets which have entered the network over a wireless link are dropped in the wired backbone. Accordingly, it would be desirable to provide a sufficient amount of resources in the backbone network for carrying the expensive wireless traffic.

Although there are known mechanisms in network elements to enforce resource provisioning such that per packet service differentiation is provided, there is currently a lack of resource management mechanisms for anticipating the amount of traffic that needs to be provided with better service and for provisioning the network resources for this. Resource management mechanisms for wireless service needs to anticipate a greater number of factors than resource management mechanisms for wireline service. These factors include the geographic location from which access will occur, the type of access technology to be used for the access and the mobility during the particular wireless access.

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Figure 3 illustrates the geographical location problem of wireless reservation access. Assume that a client at time and space location A wishes to make a service reservation, i.e., to reserve network resources. Since the client has wireless access, the client may be mobile, and may be reserving access at time and space point A for a different location in the future time at time and space point B. Accordingly, it would be desirable to provide mechanisms in wireless reservation to account for reservations systems which are made in a particular geographic location for a connection at another geographical location.

Access technology can be divided into two major categories based primarily upon the area of coverage provided by the access technology, local area wireless networks and wide area wireless networks. Access technologies which can be classified as local area wireless networks include Bluetooth and wireless local access networks (WLAN). Bluetooth networks operate in the 2.4 GHz frequency band and are intended to remove the requirement of cables between various devices. Bluetooth networks typically have nominal range of 10 cm to 10 m and a gross data rate of 1 Mpbs. WLAN networks can operate in the 2.4 GHz frequency band and can be used to provide laptop computer users with mobility without compromising the performance or security provided by wired LANs. It is anticipated that the 5.2GHz band will be opened to be dedicated to WLAN like applications. WLANs operating in the 2.4 GHz frequency band have a nominal operating range around 400-500 m and a gross data rage of approximately 3 Mbps. WLANs operating in the 5.2 GHz range have a nominal operating range of 30-200 m and a gross data rage of approximately 20 Mbps. It should be noted that the 2.4 GHz frequency band used by both Bluetooth and WLANs is an unlicensed frequency band, i.e., devices operating in this frequency band do not require licenses from government entities. Accordingly, the amount of time spent communicating in this frequency band is comparatively cheaper than the same amount of time spent communicating over a frequency band which requires licenses.

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Access technologies which can be classified as wide area wireless networks include conventional networks referred to generally as cellular networks, e.g., Global System for Mobile Communication (GSM) networks, General Packet Radio Services (GPRS)/Enhanced Data for GSM Evolution (EDGE) networks and Universal Mobile Telecommunication Systems (UMTS) networks. The access technologies generally provide services up to 20 km from a base station and operate over licensed frequency bands. The gross bit rate provided in GSM networks is a maximum of 14.4 kbps, the gross bit rate in a GPRS network can vary between 10-120 kbps and a GPRS with the EDGE extension can provide up to 384 kbps. In a UMTS network there is a maximum bit rate of 2 Mbps, but most of the time the maximum bit rate will be around 384 kbps for wide area coverage.

The mobility of a user refers to the amount of movement of a particular user. A high mobility user, i.e., a user with a large amount of movement, cannot use a local area wireless network, but instead must select a wide area wireless network. In addition, a high mobility user which communicates in a wide area wireless network may move between cells supported by different base stations. Switching between these different base stations is known as handover. Accordingly, a reservation scheme for wireless users should account for the possibility that a user may handover between various portions of the wireless network.

Accordingly, it would be desirable to provide a reservation system for wireless networks for transporting information over wired networks.

It would also be desirable to provide a reservation system which is scalable within the Internet architecture.

Further, it would be desirable to provide a reservation system which allows for both immediate reservations and in advance reservations.

It would also be desirable to provide a reservation system which accounts for the actual geographic area for which the reserved communication is to take place. In addition, it would be desirable to provide a reservation system which

accounts for the advantages and limitations of various access technologies. It would also be desirable to provide a reservation system which accounts for the mobility of a user.

SUMMARY

These and other problems, drawbacks and limitations of conventional techniques are overcome according to the present invention by a method and apparatus for reserving resources in a wireline network from a wireless network. A resource reservation request is made by a service client to a service broker. The service broker contacts a bandwidth broker to determine the available resources in the wireline network. The service broker also contacts a geographical domain server for information related to wireless access for the requested reservation. Using information provided by the geographical domain server, the service broker contacts one or more radio bearer brokers to determine the resources available in a particular wireless network. Based upon the information provided by bandwidth brokers and radio bearer brokers, the service broker can reserve the requested resources for the service client or can deny the service to the service client when resources are not available.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the invention will be understood by reading the following detailed description in conjunction with the drawings, in which:

Figure 1 illustrates a conventional network which uses a policy server for admission control to a network;

Figure 2 illustrates a conventional network which uses a bandwidth broker for admission control to a network;

Figure 3 illustrates an in advance reservation for a communication session which is to occur at a different time and location;

Figure 4 illustrates an exemplary network for implementation of the present invention;

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Figure 5 illustrates the error robustness and tolerance for delay for various services in accordance with exemplary embodiments of the present invention;

Figure 6A illustrates resource negotiation using a service broker associated with one network operator to reserve resources in networks operated by other network operators in accordance with exemplary embodiments of the present invention;

Figure 6B illustrates resource negotiation using a client broker in accordance with exemplary embodiments of the present invention;

Figure 7 illustrates a communication system with a wide area wireless network which overlaps a plurality of local area networks and an associated geographical domain server in accordance with exemplary embodiments of the present invention;

Figure 8 illustrates the interaction between the client, the service broker, the bandwidth broker and the radio bearer broker in accordance with the present invention; and

Figure 9 illustrates the signaling for a reservation in accordance with exemplary embodiments of the present invention.

DETAILED DESCRIPTION

The various features of the invention will now be described with reference to the figures, in which like parts are identified with the same reference characters.

In the following description, for purposes of explanation and not limitation, specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. In other instances, detailed descriptions of well known methods, devices, and circuits are omitted so as not to obscure the description of the present invention.

Exemplary embodiments of the present invention use internetworking between various types of networks and employs IP end-to-end over all link

technologies. The system includes end-to-end resource management over wired and wireless link technologies and supports both immediate service and in advance service reservations. The service reservations are made to support service between two or more terminals which can be fixed and/or wireless.

Figure 4 illustrates an exemplary network for implementation of the present invention. The network illustrated in figure 4 includes a WLAN domain, including three wireless cells, which includes a radio bearer broker (RBB) and a bandwidth broker, a wideband CDMA (WCDMA) domain including a bandwidth broker and four cells each cell including a radio bearer brokers, two fixed network technology domains each of which include a bandwidth broker, a geographic domain server (GDS), a service broker (SB), a service client (SC) and a terminal. The vertical dashed lines in figure 4 illustrate that the three cells in the WLAN system cover the same area as the four cells of the WCDMA system.

As illustrated in figure 4, each radio access node or network includes a radio bearer broker. The radio bearer broker performs resource management and admission control for the associated access node or access network. Each Internet routing domain includes a bandwidth broker. The bandwidth broker manages resources and performs admission control in its routing domain. The bandwidth broker also interacts with the radio bearer broker to handle Internet resource reservations for a wireless link.

The service broker provides wireless service for a specific geographical area by identifying the most suitable access technology, out of all possible access technologies, to provide the requested service. After identifying the most suitable access technology based upon a specific geographic area the service broker communicates with the bandwidth broker and the radio bearer broker to allocate the resources required for the requested end-to-end service. The client using the reservation is referred to as the service client. The service client need not be the same client which makes the reservations. For example, in the network illustrated in figure 4 the terminal can make the reservation for a communication session for the service client to use.

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Now that a brief overview of a network which implements the present invention has been described, a more detailed explanation of the various elements of the network is presented below.

RADIO BEARER BROKER

The implementation of the radio bearer broker is dependent on the access technology of the network associated with the radio bearer broker. However, following the functionality of the radio bearer broker outlined below will allow one skilled in the art to implement a radio bearer broker in any type of access technology. To ensure that the most efficient use of the radio resource the radio bearer broker should account for the service requirements of the various types of traffic to be communicated over the radio interface. In the third generation wireless standard known as 3GPP, there are four service classes defined, conversational, streaming, interactive and background. As illustrated in figure 5, the main differences between these service classes is their tolerance for delay and their error robustness.

Conversational services include telephony and video conferencing. As illustrated in figure 5 these services have a high error robustness but a low tolerance for delay. For example, the maximum acceptable one way ear to mouth delay in telephony is typically considered to be 150 ms. Streaming service are similar to conversational service in that they may use the same type of audio and video codecs. However, streaming services are typically asymmetrical and have a high tolerance for delay. Interactive services include services such as web surfing where there is a low tolerance for delay and a low error robustness. Background services are asymmetrical services where there is a large amount of traffic in one direction. These services typically have a high tolerance for delay and a low error robustness.

For each class of service the radio bearer broker should set approximately ten attributes. These attributes can include, but are not limited to, transfer delay,

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service data unit error ratio, residual bit error ratio and delivery of erroneous service data units.

The radio bearer broker can be implemented in both circuit switched and packet switched networks. In a circuit switched time division multiple access (TDMA) system the radio bearer broker reserves one or more time slots for the requested service. In a circuit switched code division multiple access (CDMA) system the radio bearer broker can reserve one or more codewords for the requested service.

According to exemplary embodiments of the present invention, the radio bearer broker in a wide area wireless network is placed directly in the access point, i.e., the base station. This allows the radio bearer broker to easily retrieve information regarding the available resources. Alternatively, the radio bearer broker can be placed in another unit in the wireless system such that it supervises more than one cell. For example, in a WLAN network, it is most efficient to use one radio bearer broker for the entire network. It should be recognized that in some systems the use of one radio bearer broker for the entire network can result in reservations over a large area which results in expensive signaling traversing the network. Further, in a UMTS system the radio bearer broker can be implemented in a radio network controller (RNC). A radio network controller typically provides radio resource management, e.g., session admission control at the radio level, in UMTS systems.

In order to reserve resources in the wireless network, the radio bearer broker should have information about the resources of the network. For example, the radio bearer broker should have information regarding the configuration parameters, characteristics of a radio environment, e.g., distance attenuation and fading characteristics, for an area of the wireless network to be reserved, geographical coverage of the network, the performance of the network in terms of available channels, e.g., delays and bit error probabilities, current level of reservations in the network, the level of mobility supported by the network and the historical data about the traffic load of the network.

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The mobility of the service client defines the size and geometrical area to be reserved for the service client. For example, a low mobility user can be modeled as a disc around the point where the user is most likely to be located. The area for a high mobility user may be modeled based upon, for example, a highway. Accordingly, an intuitive interface should be presented to the service client to collect the primary information and translate it into geographic information for use by the system.

It will be recognized that the historical data about the traffic load in the network can determined by collecting information over a predetermined amount. Alternatively, the historical data about the traffic load in the network can be approximated based upon typical traffic data. For example, it is known that in wide area wireless network there is heavy traffic in the morning and evening when people are traveling to and from work and during lunch time. Similarly, in fixed networks there is a large amount of traffic during the morning when employees are reading and responding to electronic mail and a lower amount of traffic during lunch time.

BANDWIDTH BROKER

Referring again to figure 4, the present invention implements bandwidth brokers in the Internet backbone. By placing the bandwidth broker in the Internet backbone the bandwidth broker can combine the service requirements for both planned virtual leased line services between specified access points or access networks along with the service requirements for unplanned wireless access. To combine these service requirements the bandwidth broker must provision network resources over time so that primary service can be offered at reasonable levels of utilization at all times.

One aspect of virtual leased lines and wireless access networks which allows for the provisioning of network resources over time is predictability. For virtual leased lines the predictability is due to the fact that the access points are specified so that the path can be predicated for each virtual leased line and that virtual leased line traffic goes through admission control over time. The

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predictability in wide area wireless networks is due to the limited bandwidth and admission control such that the overall bandwidth used in the Internet backbone for this traffic is relatively small. Additional predictability in wide area wireless networks can be achieved through usage based pricing in the networks. Even though the access points are mobile and specific source and destination points in a wide area wireless network are unknown, the traffic patterns in the backbone can be roughly estimated over time.

In accordance with the present invention the bandwidth broker operates in two modes, heuristic mode and immediate admission mode. In heuristic mode the bandwidth broker is not concerned with the use of immediate traffic measurements for admission control. Instead traffic measurements of are used to build a heuristic load map over times of the day and days of the week. To obtain these traffic measurements a specific code point is used for traffic which enters the network via the wide area wireless network. The specific code point allows routers in the backbone to identify wireless traffic. By identifying wireless traffic the routers can monitor the load on the network due to the wireless traffic. This load can be periodically reported to the bandwidth broker which uses the reported information

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to build the heuristic map of wireless traffic patterns. It will be recognized that the period in which the load is reported from the routers to the bandwidth broker can be selected in accordance with low real-time requirements of the network to ensure low overhead and scalability.

Assuming that the traffic patterns over the time of specific weekdays is fairly constant, the bandwidth broker uses the heuristic load map to determine conservative admission control for network resources in the future. The remaining resources are made available for future reservations for virtual leased line services. To achieve this, a bandwidth broker maintains information about per-link resource reservations over time. This ensures that the variation over different geographical areas are encountered.

In immediate admission mode wireless units send admission control requests for each specific resource demand, i.e., for each call. Immediate admission mode should be used when resources in the network are scarce and the cost of additional signaling indicates that better control of network resources are needed. As utilization is continuously measured it can be determined when resources are about to become scarce, i.e., when the current utilization exceeds currently reserved resources, as based on heuristics, and it is not possible to increase the aggregated reservation for wireless traffic. For open ended reservations, i.e., reservations without an ending time, the bandwidth broker performs admission control between a source and destination. If sufficient resources exist along the path the reservation is granted. In accordance with the present invention, for inter-domain requests, a bandwidth broker aggregates individual requests when making requests with neighboring bandwidth brokers. Accordingly, the increased amount of signaling due to the reservation requests occurs only at the first bandwidth broker.

Through the use of the heuristic load maps the bandwidth broker can balance the trade-off between signaling overhead and link utilization. By using reasonably conservative profiles of the traffic, thus avoiding the large overhead of signaling, a potentially huge number of calls can be saved. In narrow-band links

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bandwidth can be efficiently utilized by paying the price of managing a relatively small number of flows. For example, for planned events within a limited and predictable mobility scope there may not be enough bandwidth to provide only virtual leased lines as they by definition only span a specific source and destination domain. To support mobility the bandwidth broker should account for multiple sources and destinations. As the resources are utilized between specific end-points a shared tree of virtual leased lines can be built between the end-point and thus provisioning only occurs at the edges of the network.

SERVICE BROKERS

The service broker is a superior network entity which bridges information from a specific geographical location to the network entities that are required for guaranteeing the reserved service. In addition, a service broker can contact other service brokers in order to guarantee a reservation. The service broker essentially acts as an interface between the communication system and the service client. Since most network operators will not share information about the topology of their network, the service client cannot directly contact the bandwidth brokers in these networks. Accordingly, the service broker acts as a gateway for the service client to access the bandwidth brokers in a network. It will be recognized that if a network is arranged to allow a service client to directly contact bandwidth brokers, that the service client need not use a service broker.

Figure 6A illustrates a system for negotiation of resources from various network operators in accordance with exemplary embodiments of the present invention. The system in figure 6A includes a service client and service brokers SB_{opA}, SB_{opB}, SB_{opC} and SB_{opAB} each associated with different network operators. If the service client is associated with network operator C, the service client will request the service from service broker SB_{opC}. If service broker SB_{opC} cannot satisfy the service request, service broker SB_{opC} can contact other service brokers associated with other network operators, i.e., SB_{opA}, SB_{opB}, and SB_{opAB}, to determine whether these networks contain sufficient resources. As illustrated in

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figure 6A, service brokers associated with other network operators, e.g., SB_{opA}, can request resources for the service client from other service brokers associated with other network operators, e.g., SB_{opAB}.

CLIENT BROKERS

A client broker is an entity which is arranged to negotiate service from one or more service brokers on behalf of a service client. Figure 6B illustrates a system which implements a client broker to reserve resources. The system illustrated in figure 6B includes a client broker, a service client and service brokers SB_{opA}, SB_{opB} and Sb_{opC}, each service broker associated with a different operator. To reserve resources from several possible operators, the service client sends a request to the client broker. The client broker then forwards the request to service brokers SB_{opA}, SB_{opB} and Sb_{opC} which are respectively associated with network operators A, B and C. Depending upon the answer received from the various service brokers, the service client will reserve resources in one of the networks. The decision of which network operator to select for the reserved resources include the network operator's ability to provide the requested service and the cost associated with the resources provided by the various network operators.

GEOGRAPHIC DOMAIN SERVER

Figure 7 illustrates a communication system with a wide area wireless network which overlaps a plurality of local area networks and an associated geographical domain server in accordance with exemplary embodiments of the present invention. The communication system of figure 7 includes a WCDMA wide area wireless network which overlaps three WLAN local area wireless networks. As discussed previously, since wireless terminals do not have a fixed location within the network a reservation system needs to determine the geographical location of the wireless terminals. In accordance with exemplary embodiments of the present invention a geographical domain server is used for

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mapping specified geographical locations, e.g., longitude and latitude, to a set of applicable wireless access networks. Specifically, a set of geographical domain servers are hierarchically organized, with respect to geography, to provide a directory service to the service brokers. This hierarchical organization is similar to the domain name server (DNS) system used for implementing the logical naming hierarchy of the Internet.

Figure 8 illustrates the interaction between the client, the service broker, the bandwidth broker and the radio bearer broker in accordance with the present invention. If the service client is making a reservation between a known pair of IP address prefixes, the service client can contact the bandwidth broker directly to make the reservation. In accordance with this scenario the parameter set for sending admission requests to the bandwidth broker is targeted towards the wired Internet. However, this parameter set may not be sufficient if there are wireless hops managed by radio bearer brokers along the reserved path. To address this situation the bandwidth broker can use a limited parameter set for contacting radio bearer brokers. In view of this situation, a client directly contacting a bandwidth broker is most suitable for clients with wired access and/or for setting up virtual leased lines and private networks through the Internet.

For reservations between geographical locations where the IP addresses are unknown and/or to obtain wireless access with specific quality of service the client should make the reservations by directly contacting the service broker. The service broker will then determine a suitable access network by querying a geographical domain server and then contacting radio bearer brokers and bandwidth brokers to setup the end-to-end reservation between the geographic locations.

Figure 9 illustrates the signaling for a reservation in accordance with exemplary embodiments of the present invention. Initially, the service client sends a reservation request to the service broker. The reservation request includes the service client capabilities, i.e., supported wireless technologies, services and requirements for the services, the geographical area over which the service is

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required, the duration of the reservation, the time span over which the reservation can be made, the mobility of the service client and whether the reservation is a hard reservation or a soft reservation.

Hard reservation is made to guarantee that the reserved service is available, while a soft reservation is made to provide a high probability that the service will be available. It will be recognized that the use of hard and soft reservations is to avoid reserving too much bandwidth. For example, if a service client is highly mobile, a hard reservation over a large geographic area will result in unused bandwidth in areas where the service client is not located during the reservation period. However, if a system operator's policy is to provide guaranteed service regardless of the cost, the system will maintain the hard reservation over the large geographical area until the communication begins. Once the communication begins the hard reservation constraint can be removed.

Hard and soft reservations can also be used in areas where there is overlapping coverage between different access technologies. For example, referring again to figure 7, a hard reservation can be made in one of the WLAN networks with a soft reservation in the overlapping WCDMA network. Accordingly, if the load on the preferred access technology, i.e., WLAN, is too large the reservation can be switched to the secondary access technology, i.e., WCDMA, to maintain the reserved service.

Referring again to figure 9, after receiving the reservation request from the service client, the service broker contacts the geographic domain server to determine where the resources for the reserved service are located. The geographic domain server provides the service broker with the geographic location corresponding to the reserved services. Based upon the provided geographic information the service broker initially contacts radio bearer brokers to determine whether there is sufficient bandwidth in the wireless networks to accommodate the reservation request. The service broker then contacts various bandwidth brokers to determine whether there is sufficient bandwidth in the Internet backbone to accommodate the reservation request.

Based upon the responses received from the various bandwidth brokers and radio bearer brokers the service broker provides a reservation proposals response (RP) containing an indication of the services that can be reserved, the access technologies available and the cost per service for different starting times within the time span selected by the service client. The service client then sends a reservation selection (RS) informing the service broker of the services selected by the service client. The service broker then reserves the services and sends a reservation acknowledgment to the service client to confirm the reservation.

It will be recognized that the service client need not necessarily provide geographical information for the reservation in terms of latitude and longitude. For example, the organizers of a conference could define the required service area for people attending the conference. Accordingly, a user who desires to reserve in advance a certain service can simply provide the area information provided by the organizers of the conference. Similarly, managers of an airport could define the area to be served for the airport. If a service reservation were made in a taxi on the way to an airport the service client need only know the airport name to make the reservation.

Although the present invention has been described above in connection with reserving resources for a service client, it will be recognized that by reserving resources for a service client, resources are reserved for the other party to the communication session. Accordingly, if the other party is mobile, the position of the other party at the reserved time will need to be determined for the reservation. In other words, the reservation should account for the other party in the same manner as that described above in connection with reserving resources for a service client.

The invention has been described herein with reference to particular embodiments. However, it will be readily apparent to those skilled in the art that it may be possible to embody the invention in specific forms other than those described above. This may be done without departing from the spirit of the invention. Embodiments described above are merely illustrative and should not be

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considered restrictive in any way. The scope of the invention is given by the appended claims, rather than the preceding description, and all variations and equivalents which fall within the range of the claims are intended to be embraced therein.

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WHAT IS CLAIMED IS:

1. A method for reserving resources in wireline and wireless networks comprising the steps of:

sending a reservation request for a terminal to a service reservation node requesting a reservation of resources;

determining, by the service reservation node, whether resources in the wireless network and the wireline network are available;

reserving, by the service reservation node, resources in the wireline network and the wireless network in accordance with the determined available resources.

2. The method of claim 1, wherein the service reservation node is a service broker.

3. The method of claim 2, wherein the service broker and the terminal are associated with a first network operator and wherein if resources are not available in the first network operator's network, contacting, by the service broker, another service broker associated with another network operator to determine if resources are available.

4. The method of claim 1, wherein the reservation request includes information related to the service requirements for a communication session associated with the reservation.

5. The method of claim 4, wherein the information related to the service requirements includes information selected from the group consisting of:

information regarding the access technologies supported by the terminal, information regarding the services desired by the terminal, information regarding the requirements for the services desired by the terminal, information regarding

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the geographic area over which the service is required, information regarding the duration of the reservation, information regarding the time span over which the reservation can be made, information regarding the grade of the reservation and information regarding the mobility of the terminal.

6. The method of claim 1, wherein the step of determining comprises the steps of:

sending a message to a geographical domain server requesting information as to the network nodes that are located in a geographic area which can reserve the requested resource; and

receiving a message from the geographical domain server indicating the network nodes that are located in the geographic area which can provide the requested resource.

7. The method of claim 6, wherein the network nodes that are located in the geographic area which can reserve the requested resource are radio bearer brokers which reserve resources in the wireless network.

8. The method of claim 6, wherein the step of determining further comprises the steps of:

sending a message to network nodes in the wireline network which are connected to the network node located in the geographic area which can provide the requested resource; and

receiving responses from the network nodes in the wireline network.

9. The method of claim 8, wherein the network nodes in the wireline network are bandwidth brokers.

10. The method of claim 1, wherein the reservation is made for the terminal by another terminal for a different geographic location than a geographic location from which the another terminal sent the reservation request.

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11. The method of claim 1, wherein the determination of whether resources are available is based upon a historical analysis of traffic load, configuration parameters, characteristics of a radio environment for an area of the wireless network to be reserved and the amount of already reserved resources.

12. The method of claim 1, wherein a guaranteed reservation is made with a first wireless network which uses a local area network access technology and a non-guaranteed reservation is made with a second wireless network which uses a wide area network access technology, wherein if resources are not available in the first wireless network, the terminal uses the second wireless network for a communication session.

13. The method of claim 1, further comprising the steps of:

providing the terminal with information related to the types of resources which can be reserved, wherein the resources are reserved based upon the information.

14. The method of claim 1, wherein the terminal is a mobile terminal.

15. A apparatus for reserving resources in wireline and wireless networks comprising:

a terminal;

a service reservation node, wherein a reservation request is sent to the service reservation node requesting a reservation of resources,

wherein the service reservation node determines whether resources in the wireless network and the wireline network are available, and

wherein the service reservation node reserves resources in the wireline network and the wireless network in accordance with the determined available resources.

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16. The apparatus of claim 15, wherein the service reservation node is a service broker.

17. The apparatus of claim 16, wherein the service broker and the terminal are associated with a first network operator and wherein if resources are not available in the first network operator's network, contacting, by the service broker, another service broker associated with another network operator to determine if resources are available.

18. The apparatus of claim 15, wherein the reservation request includes information related to the service requirements for a communication session associated with the reservation.

19. The apparatus of claim 18, wherein the information related to the service requirements includes information selected from the group consisting of:

information regarding the access technologies supported by the terminal, information regarding the services desired by the terminal, information regarding the requirements for the services desired by the terminal, information regarding the geographic area over which the service is required, information regarding the duration of the reservation, information regarding the time span over which the reservation can be made, information regarding the grade of the reservation and information regarding the mobility of the terminal.

20. The apparatus of claim 15, further comprising:

a geographical domain server, wherein the geographical domain server receives a request for information as to the network nodes that are located in a geographic area which can reserve the requested resource, and

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wherein the geographical domain server sends a message indicating the network nodes that are located in the geographic area which can provide the requested resource.

21. The apparatus of claim 20, wherein the network nodes that are located in the geographic area which can reserve the requested resource are radio bearer brokers which reserve resources in the wireless network.

22. The apparatus of claim 20, further comprising:

a bandwidth broker, wherein the bandwidth broker provides a message indicating network nodes in the wireline network which are connected to the network node located in the geographic area which can provide the requested resource.

23. The apparatus of claim 15, wherein the reservation is made for the terminal by another terminal for a different geographic location than a geographic location from which the another terminal sent the reservation request.

24. The apparatus of claim 15, wherein the determination of whether resources are available is based upon a historical analysis of traffic load, configuration parameters, characteristics of a radio environment for an area of the wireless network to be reserved and the amount of already reserved resources.

25. The apparatus of claim 15, wherein a guaranteed reservation is made with a first wireless network which uses a local area network access technology and a non-guaranteed reservation is made with a second wireless network which uses a wide area network access technology, wherein if resources are not available in the first wireless network, the terminal uses the second wireless network for a communication session.

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26. The apparatus of claim 15, wherein the terminal is provided with information related to the types of resources which can be reserved, wherein the resources are reserved based upon the information.

27. The apparatus of claim 15, wherein the terminal is a mobile terminal.

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FIG. 1

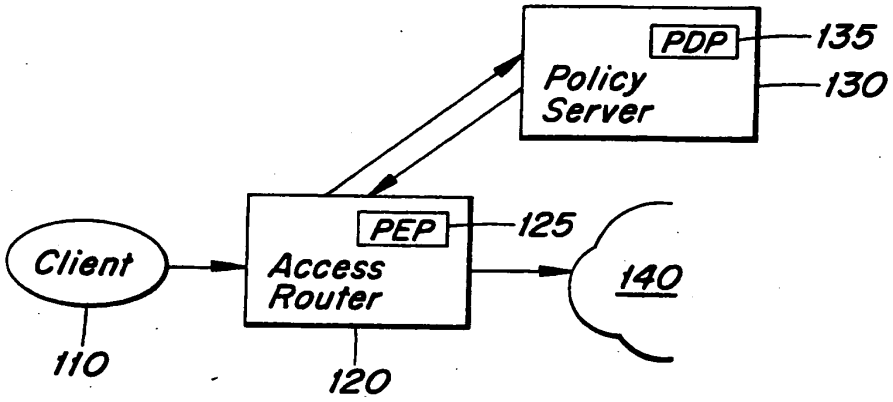


FIG. 2

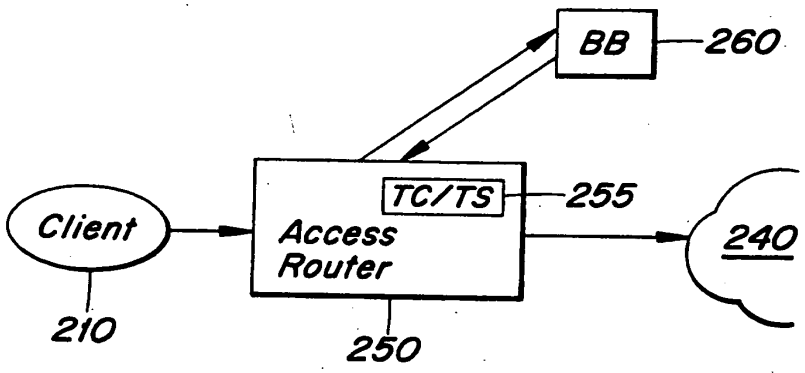


FIG. 3

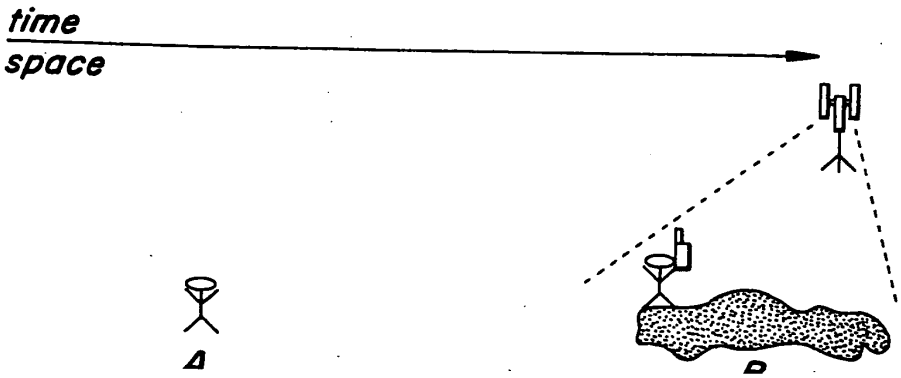


FIG. 4

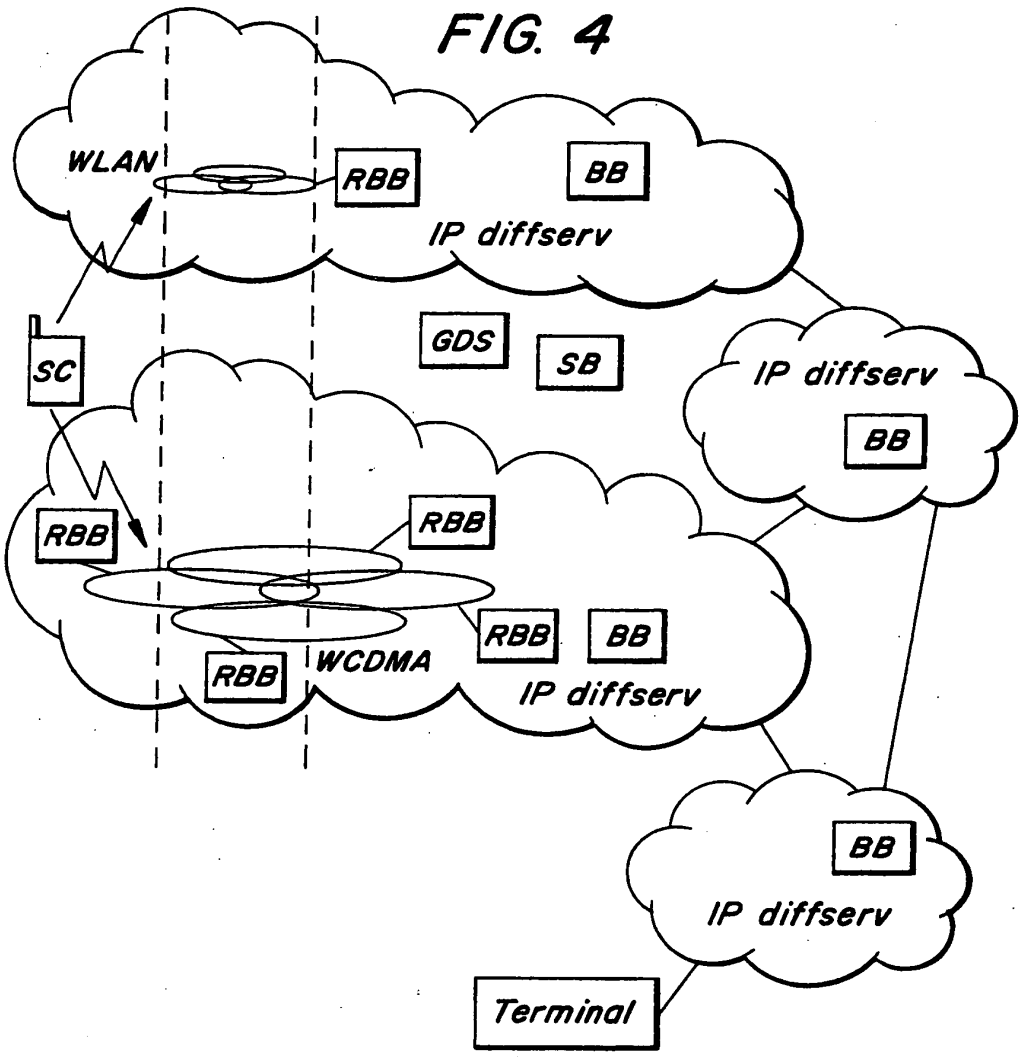

WLAN
RBB
BB
IP diffserv
GDS
SB
SC
IP diffserv
BB
RBB
RBB
RBB
BB
WCDMA
RBB
IP diffserv
BB
IP diffserv
Terminal

FIG. 5

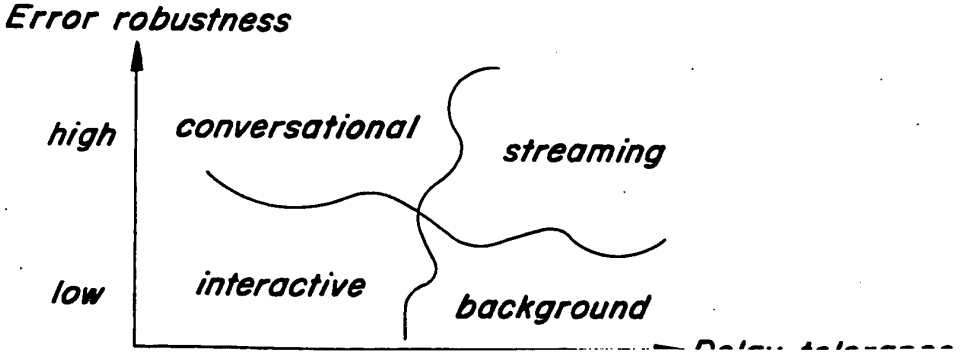

Error robustness
high
conversational
streaming
low
interactive
background

FIG. 6A

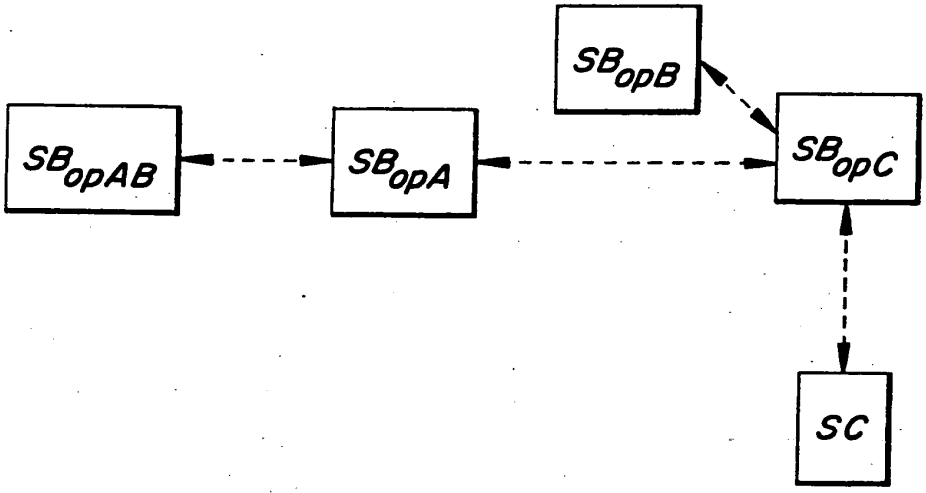


FIG. 6B

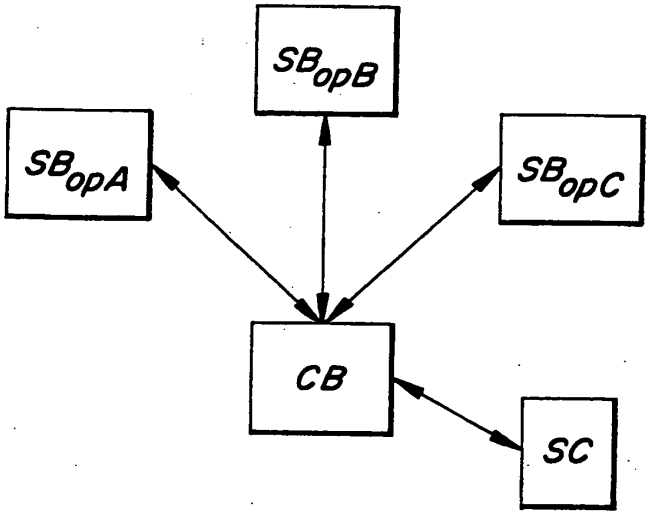
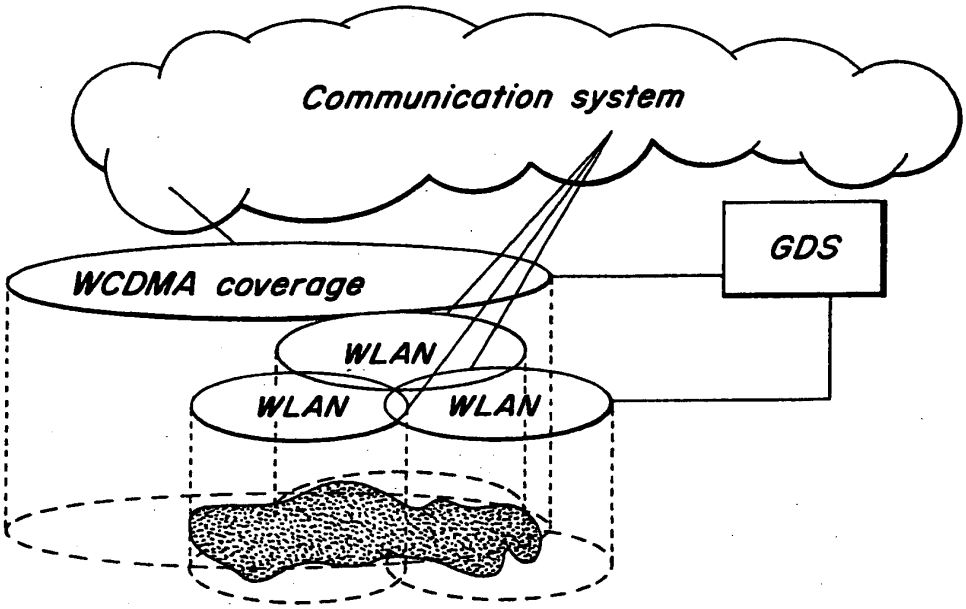


FIG. 7



Geographical area to reserve service within

FIG. 8

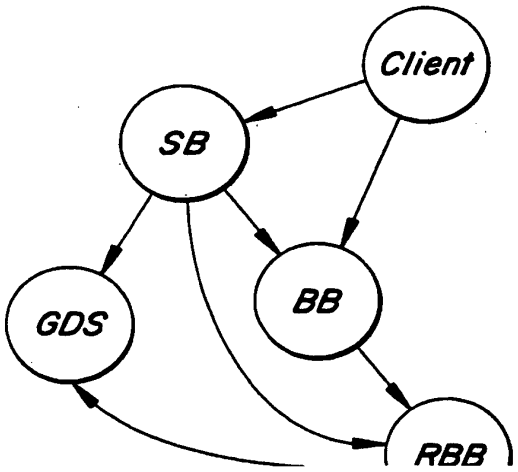
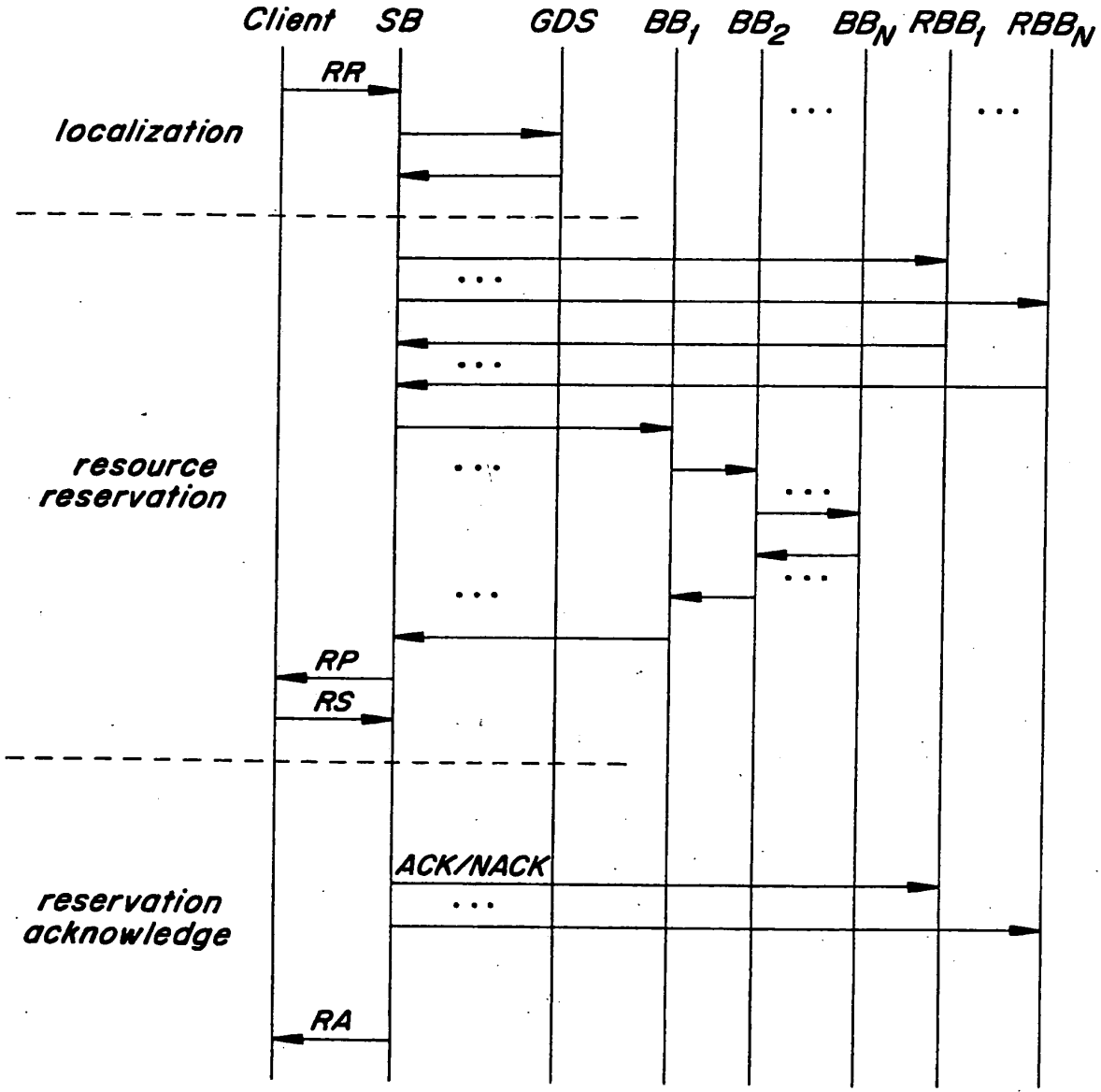


FIG. 9


Client
SB
GDS
BB1
BB2
BBN
RBB1
RBBN
RR
localization
resource reservation
RP
RS
ACK/NACK
reservation acknowledge
RA

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(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

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(81) Bestimmungsstaaten *(national)*: AU, CA, CN, US.

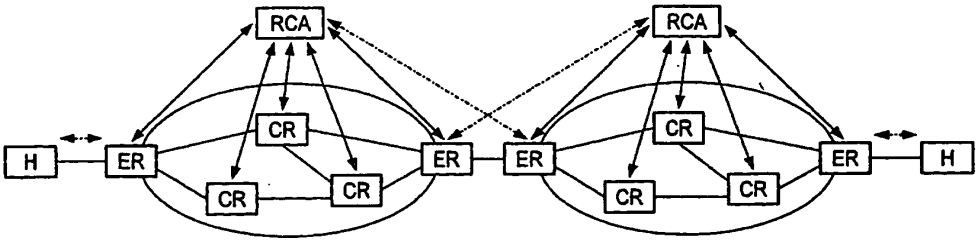
(84) Bestimmungsstaaten *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

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— *mit internationalem Recherchenbericht*
— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen*

[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD FOR OPTIMALLY MAKING RESOURCES AVAILABLE IN A COMMUNICATIONS NETWORK THAT FUNCTIONS ACCORDING TO AN INTERNET PROTOCOL

(54) Bezeichnung: VERFAHREN ZUM OPTIMIERTEN BEREITSTELLEN VON RESSOURCEN IN EINEM NACH EINEM INTERNETPROTOKOLL ARBEITENDEN KOMMUNIKATIONSNETZ



(57) Abstract: In internet communications networks (ISP1, ISP2), the state of the art utilizes a modified DiffServ mechanism for guaranteeing the quality of service. For this, it should be ensured that the overall amount of prioritized traffic is limited via central bandwidth brokers. The central function, however, proves to be problematic with regard to the expandability of the communications network. The invention resolves this problem by extensively separating functions that have been centrally conducted up to now such as the Admission Control Function (ER) and the Resource Management Function (RCA).

(57) Zusammenfassung: In Internet-Kommunikationsnetzen (ISP1, ISP2) wird beim Stand der Technik zur Garantie der Dienstgüte ein modifizierter DiffServ Mechanismus vorgeschlagen. Darin soll über zentrale Bandwidth Broker dafür Sorge getragen werden, das Gesamtaufkommen des priorisierten Verkehrs zu beschränken. Die zentrale Funktion erweist sich aber im Hinblick auf Erweiterbarkeit des Kommunikationsnetzes problematisch. Die Erfindung löst dieses Problem durch eine weitgehende Entkoppelung bislang zentral geführter Funktionen wie der Admission Control Funktion (IR) und der Ressource Management Funktion (RCA).

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Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

Beschreibung

Verfahren zum optimierten Bereitstellen von Ressourcen in einem nach einem Internetprotokoll arbeitenden Kommunikationsnetz.

Die Erfindung betrifft ein Verfahren gemäß den im Oberbegriff von Patentanspruch 1 angegebenen Merkmalen.

In Kommunikationsnetzen, in denen Informationen nach einem Internetprotokoll (wie z.B. TCP/IP oder UDP/IP) übertragen werden, müssen zur Garantie der Dienstgüte Mechanismen eingesetzt werden, die eine optimale Behandlung der Datenpakete im Übertragungsnetz (Quality of Service) sicherstellen. Einer dieser Mechanismen ist der DiffServ Mechanismus.

Die Implementierung dieses DiffServ Mechanismuses führt aber im Hinblick auf immer intelligentere und aufwendigere Dienste zu Problemen. So gibt es hier keinerlei Beschränkungen für priorisierten Verkehr. Der Internet Service Provider (ISP) versucht durch geeignete Dimensionierung des Netzes Engpässe zu vermeiden, was in der Konsequenz eine nur sehr vage Garantie für einen Service bedeutet oder versucht restriktiv lediglich einen bestimmten Anteil der zur Verfügung stehenden Bandbreite administrativ für priorisierten Verkehr freizugeben,was eine schlechte Ausnutzung der Netzresourcen bedeutet, da Restriktionen generell administrativ und damit statisch eingestellt werden.

Als Lösung dieser Problematik ist nun gegenwärtig geplant, bei der Weiterentwicklung des Internet Ansätze dahingehend zu entwickeln, mittels denen Bandwidth Broker (BB), die eine Admission Control durchführen, dafür Sorge tragen, das Gesamtaufkommen des priorisierten Verkehrs zu beschränken. Der Internetteilnehmer (z.B. Host oder Web Server) signalisiert dem jeweils zugeordneten Bandwidth Broker einen Bandbreitenwunsch (z.B. mit RSVP) für eine bestimmte DiffServ Klasse.

Dieser prüft gegen statisch eingestellte Maximalwerte und lehnt Bandbreitenrequests gegebenenfalls ab. Sind dem Bandwidth Broker Netztopologie und die Routingentscheidung der Core Router bekannt, die zwischen Eingangs- und Ausgangs-Edge Router liegen, kann entlang des gesamten Pfades die Verfügbarkeit der gewünschten Bandbreite überprüft werden. Im Bandwidth Broker sind somit die beiden Netzfunktionen „Admission Control" und „Resource Management" integriert. Hiermit kommt dem Bandwidth Broker eine zentrale Funktion im Netz zu.

Mit diesem Lösungsvorschlag kann zwar zunächst eine gewisse Dynamik in der Verwaltung der Netzressourcen eingebracht werden. Aufgrund seiner zentralen Funktion muß der Bandwidth Broker alle Reservierungen einer DiffServ Domain bearbeiten. Damit ergibt sich aber das Problem, daß die Erweiterung des Kommunikationsnetzes (Skalierung) immer aufwendiger wird, da das Hinzufügen weiterer Teilnehmer im zentralen Bereich des Bandwidth Brokers einen kaum noch zu handhabenden Verwaltungsaufwand mit sich zieht.

Der Erfindung liegt die Aufgabe zugrunde, einen Weg aufzuzeigen, wie der Ausbau eines Kommunikationsnetzes einfach und flexibel mit einfachen Mitteln durchgeführt werden kann.

Vorteilhaft an der Erfindung ist insbesondere, daß im wesentlichen eine Entkopplung von Admission Control und Resource Management vorgenommen wird. Die erfolgt, indem die Admission Control in die peripheren Edge Router des Kommunikationsnetzes eingebunden wird, und das Resource Management im Bandwidth Broker verbleibt. Damit wird eine Dezentralisierung der Admission Control vorgenommen. Der Bandwidth Broker ist damit entlastet und führt ausschließlich Aufgaben des Resource Managements durch.

Damit ist der Vorteil verbunden, daß das Kommunikationsnetz jederzeit ohne großen Aufwand um weitere Teilnehmer erweitert werden kann (Skalierbarkeit). Hierzu sind lediglich die in

Frage kommenden Edge Router zu erweitern, der „Flaschenhals" der zentralen Einrichtung des Bandwidth Brokers im Hinblick auf die Admission Control Funktion entfällt.

Als weiterer Vorteil ist anzusehen, daß die dynamische Ressourcenkontrolle eine Beschränkung des priorisierten Verkehrs sowie eine Optimierung von Netzparametern unterstützt, wodurch die Service Garantien und die Ausnutzung des Netzes verbessert wird. Durch die Beschränkung des priorisierten Verkehrs wird die Wahrscheinlichkeit von Paketverlusten im Core Netz verringert. Die Paketverlustwahrscheinlichkeit kann über die Maximalwerte der Bandbreiten pro DiffServ Klasse gesteuert werden.

Darüberhinaus ist der Egde Router in der Lage durch Bandbreitenanforderungen bei seinem Bandwidth Broker Lastspitzen bei der Reservierung befriedigen zu können, wenn nicht alle Edge Router gleichzeitig zusätzliche Bandbreite anfordern.

Als besonderer Vorteil ist weiterhin anzusehen, daß diese Architektur als fehlertolerant anzusehen ist. Der Ausfall eines Bandwidth Brokers führt lediglich zu einer vorübergehend suboptimalen Auslastung des Netzes, nicht jedoch zu weiteren Ausfällen.

Vorteilhafte Weiterbildungen der Erfindung sind in den Unteransprüchen angegeben.

Die Erfindung wird im folgenden anhand eines figürlich dargestellten Ausführungsbeispieles näher erläutert.

In der Figur ist die erfindungsgemäße Netzarchitektur aufgezeigt. Demgemäß sind Teilnehmer H (Host) an Internet Service Provider ISP1, ISP2 herangeführt. Diese weisen ihrerseits eine Mehrzahl von Knoten auf, die untereinander vernetzt sind. In den Knoten sind Core Router CR sowie Edge Router ER angeordnet. Die Edge Router ER sind als Schnittstelle

zu den Teilnehmern H sowie zwischen Internet Service Providern zu betrachten. Im ersterem Falle können die Edge Router ER die Funktion eines Einwahlrechner aufweisen. Die Core Router CR dienen der Durchschaltung der von den Teilnehmern H ausgehenden Informationen durch das Netz. Weiterhin ist jedem Internet Service Provider ISP1, ISP2 eine übergeordnete, als Bandwidth Broker arbeitende Steuereinrichtung RCA (Resource Control Agent) zugeordnet, in der die Funktion des Resource Managements integriert ist.

Die Aufgabe des Edge Routers ER besteht zum einen darin, die von den Teilnehmern H ausgehenden Signalisierungsinformationen zu bearbeiten. Zum anderen wird hier eine Zulassungsentscheidung (Admission Control) eines Verbindungswunsches selbstständig auf Grund vom einer vom Resource Control Agent RCA zugeteilten Bandbreite durchgeführt. Dabei handelt es sich um einen Maximalwert für priorisierten Verkehr, der sicherstellt, daß etwaige von einem Teilnehmer H ankommende Anforderungen aufgrund mangelnder Bandbreite nicht zurückgewiesen werden müssen.

Der Resource Control Agent RCA führt die automatische Zuteilung der vorhandenen Ressourcen auf die Edge Router ER durch. Dabei bleibt es stets oberstes Ziel, jedem Edge Router ER stets soviel freie Kapazität in den verschiedenen DiffServ Verkehrsklassen zuzuordnen, daß dieser jede weitere von einem Teilnehmer H ankommende Anforderung mit hoher Wahrscheinlichkeit zulassen kann.

Je nach Kenntnis der Netztopologie und der Netzlast kann der Resource Control Agent RCA dabei verschiedene Algorithmen zur Verteilung der Ressourcen wählen:

So besteht eine der Möglichkeiten darin, vom Resource Control Agent RCA die Auslastung der Verkehrsklassen auf den Edge Routern ER kontrollieren zu lassen. Letztere können aber auch explizite Anforderungen an den Resource Control Agent RCA

stellen. Aufgrund dieser Informationen führt der Resource Control Agent RCA gegebenenfalls eine Umverteilung der zugeteilten Maximalwerte in den Edge Router ER durch. Dies bedeutet, daß in einem der Edge Router ER vorhandene brachliegende Kapazität einem Edge Router ER zur Verfügung gestellt wird, die diese Kapazität dringend benötigt.

Zusätzlich hierzu können im Resource Control Agent RCA Informationen über die Auslastung der Core Router CR abgelegt sein. Mit dieser Information kann dann vom Resource Control Agent RCA die Bandbreitenkapazität so auf die Edge Router ER verteilt werden, daß die Gesamtlast im Netz optimiert ist.

Darüberhinaus kann vom Resource Control Agent RCA auch die Aufteilung der Bandbreite auf die Verkehrsklassen in den Core Routern CR kontrolliert und gegebenenfalls an die aktuelle Lastsituation anpaßt werden. Sind Anforderungen bereits vorab bekannt, so kann der Resource Control Agent RCA die Zuordnung der Ressourcen schon einige Zeit vor dem tatsächlichen Bedarf durchführen.

Der grundlegende Vorteil an der Erfindung ist darin zu sehen, daß mit dieser Vorgehenswesie eine Entkopplung der Funktionen „Admission Control" und „Resource Management" vorgenommen wird. Erst dadurch wird eine Zugangskontrolle möglich, bei der die Edge Router ER die Zulassungs-entscheidung lokal treffen können. Der Resource Control Agent RCA übernimmt allein die Aufgabe des Resource Managements und stellt sicher, dass jeder Edge Router ER ankommende Anforderungen mit möglichst hoher Wahrschein-lichkeit positiv beantworten kann.

Diese Vorgehensweise kann auch den Verkehr zwischen mehreren Internet Service Provider übertragen werden.Stellt beispielsweise der Resource Control Agent RCA des Internet Service Provider ISP1 (z.B durch Messungen der Verkehrslast im Edge Router ER zum Internet Service Provider ISP2) fest, daß für

den priorisierten Verkehr zum Internet Service Provider ISP2 eine höhere Kapazität notwendig ist, so fordert dieser die höhere Bandbreite vom in Frage kommenden Edge Router ER des Internet Service Provider ISP2 an, ähnlich wie ein Teilnehmer H Kapazität von dem jeweils zugeordneten Edge Router ER anfordern würde. Dieser trifft seine Zulassungsentscheidung analog auf Grund der ihm zur Disposition stehenden Ressourcen.

Alternativ hierzu kann der Resource Control Agent RCA des Internet Service Providers ISP1 seine Anfrage statt an den Edge Router ER auch an den Resource Control Agent RCA des Internet Service Provider ISP2 stellen.

In einer ersten Ausbaustufe wird vorgeschlagen, im Resource Control Agent RCA einen Bandbreitenpool für die Edge Router ER anzuordnen. Dieser wird allein vom Resource Control Agent RCA verwaltet. Ein Teil des Pools (0% bis 100%) wird bereits vorab, d. h. bevor von einem Teilnehmer H eine Anforderung an den zugeordneten Edge Router ER abgesandt wird, auf alle Edge Router ER verteilt.Benötigt ein Edge Router ER aufgrund einer nicht vorhersehbaren Last weitere Bandbreite, so fordert er diese vom Resource Control Agent RCA aus dem Pool an. Benutzt ein Edge Router ER die zugeteilte Bandbreite nicht mehr, so gibt er sie wieder an den Pool zurück.Ein Edge Router ER kann auch vorab zugeteilte Bandbreite an den Pool zurückgeben, wenn er sie nicht benötigt.

In einer weiteren Ausbaustufe wird vorgesehen, daß der Resource Control Agent RCA die von den Edge Router ER aktuell verwendete Bandbreite pro Prioritätsklasse zusätzlich überwacht. Dies kann beispielsweise durch Statusabfrage oder durch regelmäßige Meldungen aller Edge Router ER erfolgen. Der Resource Control Agent RCA trifft seine Zuteilungsentscheidungen aufgrund dieser Informationen.

In einer weiteren Ausbaustufe wird vorgesehen, daß der Resource Control Agent RCA zusätzlich die Last in den Core Routern CR überwacht. Er benutzt diese Information, um den Bandbreitenpool für die Edge Devices entsprechend anzupassen.

Letztlich kann der Resource Control Agent RCA lernende Algorithmen verwenden um herauszufinden, wie die Last an den Edge Routern die Last im Core Net beeinflußt. Solche Algorithmen erlauben eine bessere Auslastung des Core Net. Der Resource Control Agent RCA kann die Lastinformationen aus dem Core Net dazu verwenden, Parameter für die Routing-Protokolle zu verändern. Dadurch kann eine hohe Last auf einem Link auf andere, weniger belastete Links umgelenkt werden.

Patentansprüche

1. Netzarchitektur zum Bereitstellen von Ressourcen in einem Kommunikationsnetz, das aus wenigstens einer übergeordneten Steuervorrichtung (RCA), einer Mehrzahl von Edge Router (ER), an die Teilnehmer (H) herangeführt sind sowie aus einer weiteren Mehrzahl von Core Routern (CR) gebildet ist, und das eine Admission Control Funktion aufweist, die von Teilnehemrn (H) ausgehende Verbindungswünsche nach Maßgabe der Zuteilung von Bandbreite von einer Resource Management Funktion annimmt
dadurch gekennzeichnet,
daß die Admission Control Funktion im wesentlichen in die Mehrzahl der Edge Router (ER) und die Resource Management Funktion in der übergeordneten Steuervorrichtung (RCA) eingebunden ist, wobei die Resource Management Funktion der Admission Control Funktion vor dem Auftreten eines Verbindungswunsches stets soviel freie Bandbreite zuteilt, daß jeder weitere Verbindungswunsch mit hoher Wahrscheinlichkeit zugelassen werden kann.

2. Netzarchitektur nach Anspruch 1,
dadurch gekennzeichnet,
daß die Informationen durch das Kommunikationsnetz nach einem Internetprotokoll (TCP/ IP, UDP/ IP) geleitet werden.

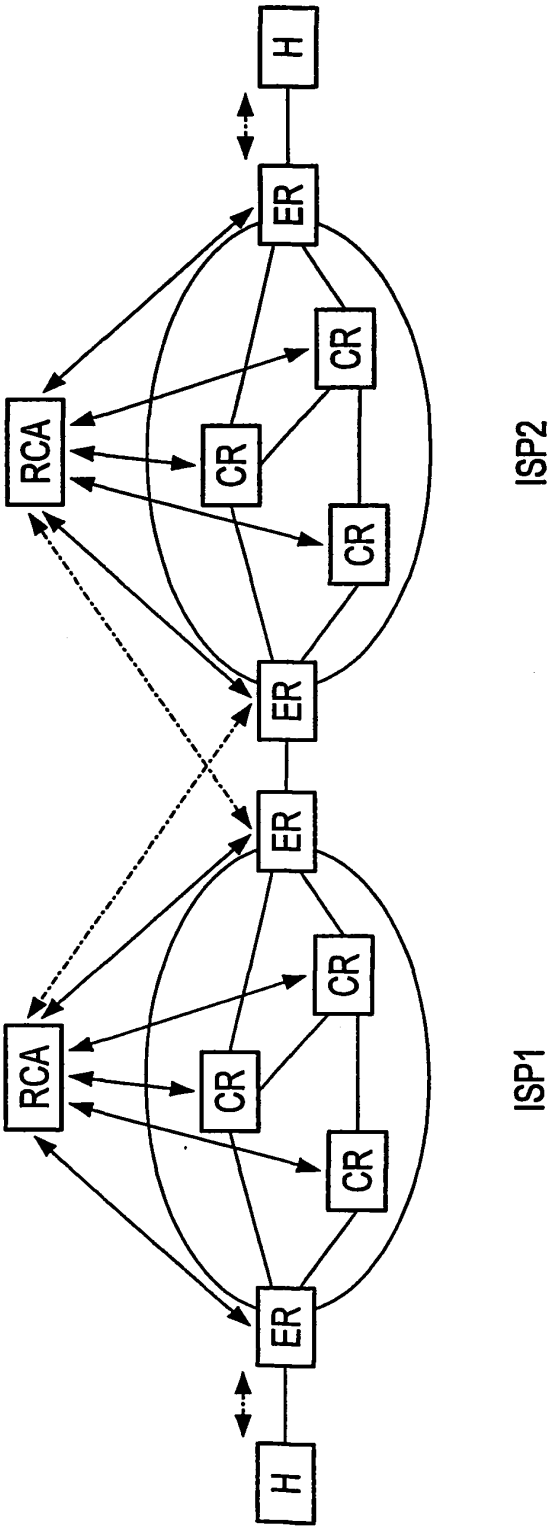
3. Netzarchitektur nach Anspruch 1, 2,
dadurch gekennzeichnet,
daß die übergeordnete Steuervorrichtung (RCA) die Auslastung der Verkehrsklassen auf der Mehrzahl der Edge Router (ER) kontrolliert.

4. Netzarchitektur nach Anspruch 1, 2,
dadurch gekennzeichnet,
daß die Mehrzahl der Edge Router (ER) explizite Anforderungen an die übergeordnete Steuervorrichtung (RCA) stellen, woraufhin diese gegebenenfalls eine Umverteilung der zugeteilten Bandbreite in der Mehrzahl der Edge Router (ER) vornimmt.

5. Netzarchitektur nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die übergeordnete Steuervorrichtung (RCA) zusätzlich die Auslastung in der weiteren Mehrzahl der Core Router (CR) ermittelt, nach Maßgabe des Resultates die den Edge Router (ER) zur Verfügung gestellte Bandbreite gegebenenfalls neu zuteilt.

6. Netzarchitektur nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die übergeordnete Steuervorrichtung (RCA) zusätzlich die Aufteilung der Bandbreite auf die Verkehrsklassen in der weiteren Mehrzahl der Core Router (CR) kontrolliert und gegebenenfalls an die aktuelle Lastsituation anpaßt.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/DE 01/00072

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/56 H04L29/06

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 H04L

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 331 659 A (ERICSSON TELEFON AB L M) 26 May 1999 (1999-05-26) page 1, line 1 -page 2, line 8 page 3, line 9 - line 17 page 4, line 32 -page 5, line 31 page 19, line 24 -page 21, line 1 page 22, line 1 - line 10; figures 1,6,7	1-6
A	X XIAO: "Internet QOS: A Big Picture" IEEE NETWORK,IEEE INC. NEW YORK,US, vol. 13, no. 2, March 1999 (1999-03), pages 8-18, XP002115238 ISSN: 0890-8044 page 8, left-hand column, paragraph 1 -page 10, right-hand column, paragraph 4; figures 1-5	1-6

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
23 May 2001	05/06/2001

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

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DETTI A ET AL: "SUPPORTING RSVP IN A DIFFERENTIATED SERVICE DOMAIN: AN ARCHITECTURAL FRAMEWORK AND A SCALABILITY ANALYSIS" VANCOUVER, CA, JUNE 6 - 10, 1999,NEW YORK, NY: IEEE,US, 6 June 1999 (1999-06-06), pages 204-210, XP000897162 ISBN: 0-7803-5285-8 page 204, left-hand column, paragraph 1. -page 207, right-hand column, paragraph 5.1; figures 1-4	1-6
A	ZHANG L ET AL: "RSVP: a new resource ReSerVation Protocol" IEEE NETWORK,IEEE INC. NEW YORK,US, vol. 7, no. 5, September 1993 (1993-09), pages 8-18, XP002145982 ISSN: 0890-8044 page 8 -page 11	1-6
A	ERIKSSON A: "REAL-TIME SERVICES OVER THE INTERNET" ISS. WORLD TELECOMMUNICATIONS CONGRESS. (INTERNATIONAL SWITCHING SYMPOSIUM),CA,TORONTO, PINNACLE GROUP, 21 September 1997 (1997-09-21), pages 173-179, XP000704466 the whole document	1-6

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ›nal Application No
PCT/DE 01/00072

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2331659 A	26-05-1999	AU 1962299 A	15-06-1999
		WO 9927686 A	03-06-1999

INTERNATIONALER RECHERCHENBERICHT

Int onales Aktenzeichen
PCT/DE 01/00072

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 H04L12/56 H04L29/06

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 7 H04L

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX, IBM-TDB

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	GB 2 331 659 A (ERICSSON TELEFON AB L M) 26. Mai 1999 (1999-05-26) Seite 1, Zeile 1 -Seite 2, Zeile 8 Seite 3, Zeile 9 - Zeile 17 Seite 4, Zeile 32 -Seite 5, Zeile 31 Seite 19, Zeile 24 -Seite 21, Zeile 1 Seite 22, Zeile 1 - Zeile 10; Abbildungen 1,6,7	1-6
A	X XIAO: "Internet QOS: A Big Picture" IEEE NETWORK,IEEE INC. NEW YORK,US, Bd. 13, Nr. 2, März 1999 (1999-03), Seiten 8-18, XP002115238 ISSN: 0890-8044 Seite 8, linke Spalte, Absatz 1 -Seite 10, rechte Spalte, Absatz 4; Abbildungen 1-5	1-6

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[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
23. Mai 2001	05/06/2001

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Buhleier, R

Formblatt PCT/ISA/210 (Blatt 2) (Juli 1992)

Ex.1002
CISCO SYSTEMS, INC. / Page 379 of 487

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	DETTI A ET AL: "SUPPORTING RSVP IN A DIFFERENTIATED SERVICE DOMAIN: AN ARCHITECTURAL FRAMEWORK AND A SCALABILITY ANALYSIS" VANCOUVER, CA, JUNE 6 - 10, 1999,NEW YORK, NY: IEEE,US, 6. Juni 1999 (1999-06-06), Seiten 204-210, XP000897162 ISBN: 0-7803-5285-8 Seite 204, linke Spalte, Absatz 1. -Seite 207, rechte Spalte, Absatz 5.1; Abbildungen 1-4 ---	1-6
A	ZHANG L ET AL: "RSVP: a new resource ReSerVation Protocol" IEEE NETWORK,IEEE INC. NEW YORK,US, Bd. 7, Nr. 5, September 1993 (1993-09), Seiten 8-18, XP002145982 ISSN: 0890-8044 Seite 8 -Seite 11 ---	1-6
A	ERIKSSON A: "REAL-TIME SERVICES OVER THE INTERNET" ISS. WORLD TELECOMMUNICATIONS CONGRESS. (INTERNATIONAL SWITCHING SYMPOSIUM),CA,TORONTO, PINNACLE GROUP, 21. September 1997 (1997-09-21), Seiten 173-179, XP000704466 das ganze Dokument -----	1-6

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

In onales Aktenzeichen
PCT/DE 01/00072

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
GB 2331659 A	26-05-1999	AU 1962299 A	15-06-1999
		WO 9927686 A	03-06-1999

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
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U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/250,702	Joakim Norrgard	1505-1033-1

INTERNATIONAL APPLICATION NO.	
PCT/SE01/02847	
I.A. FILING DATE	PRIORITY DATE
12/20/2001	01/16/2001

00466
YOUNG & THOMPSON
745 SOUTH 23RD STREET 2ND FLOOR
ARLINGTON, VA 22202

CONFIRMATION NO. 9055

371 ACCEPTANCE LETTER

OC000000011633475

Date Mailed: 01/07/2004

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:

12/19/2003	12/19/2003
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF RECEIPT 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 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:

- Indication of Small Entity Status
- Copy of the International Application filed on 07/07/2003
- Copy of the International Search Report filed on 07/07/2003
- Copy of IPE Report filed on 07/07/2003
- Preliminary Amendments filed on 07/07/2003
- Oath or Declaration filed on 12/19/2003
- U.S. Basic National Fees filed on 07/07/2003
- Priority Documents filed on 07/07/2003
- Power of Attorney filed on 12/19/2003

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)

PAULETTE R KIDWELL
Telephone: (703) 305-3656

PART 3 - OFFICE COPY

FORM PCT/DO/EO/903 (371 Acceptance Notice)

U706 Rec'd PCT/PTO 19 DEC 2003

1505-1033-1

PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of Confirmation No. 9055

Joakim NORRGARD et al.

Serial No. 10/250,702 (PCT/SE01/02847)

Mail Stop PCT
Attention: DO/EO

Filed July 7, 2003

NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

RESPONSE TO NOTIFICATION OF MISSING REQUIREMENTS

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the accompanying Notification of Missing Requirements Under 35 U.S.C. 371 mailed October 24, 2003, we enclose herewith the executed declaration which was omitted at the time of filing the application.

The required 37 CFR 1.492(e) surcharge was paid at the time of filing the application.

Respectfully submitted,

YOUNG & THOMPSON

By Benoît Castel

Benoît Castel
Attorney for Applicants
Registration No. 35,041
745 South 23rd Street
Arlington, VA 22202
Telephone: 703/521-2297

December 19, 2003

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/250,702	Joakim Norrgard	1505-1033-1

INTERNATIONAL APPLICATION NO.	
PCT/SE01/02847	
I.A. FILING DATE	PRIORITY DATE
12/20/2001	01/16/2001

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ARLINGTON, VA 22202

CONFIRMATION NO. 9055

371 FORMALITIES LETTER

OC000000011091563

Date Mailed: 10/24/2003

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as a Designated / Elected Office (37 CFR 1.495).

- Indication of Small Entity Status
- Copy of the International Application filed on 07/07/2003
- Copy of the International Search Report filed on 07/07/2003
- Copy of IPE Report filed on 07/07/2003
- Preliminary Amendments filed on 07/07/2003
- U.S. Basic National Fees filed on 07/07/2003
- Priority Documents filed on 07/07/2003

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE OR BY 32 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

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)

*A copy of this notice **MUST** be returned with the response.*

PAULETTE R KIDWELL

Telephone: (703) 305-3656

PART 1 - ATTORNEY/APPLICANT COPY

U.S. APPLICATION NUMBER NO.	INTERNATIONAL APPLICATION NO.	ATTY. DOCKET NO.
10/250,702	PCT/SE01/02847	1505-1033-1

FORM PCT/DO/EO/905 (371 Formalities Notice)

COMBINED DECLARATION AND POWER OF ATTORNEY

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: **NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM**

the specification of which: *(check one)*

REGULAR OR DESIGN APPLICATION

☒ is attached hereto.

☐ was filed on _____ as application Serial No. _____
and was amended on _____ (if applicable).

PCT FILED APPLICATION ENTERING NATIONAL STAGE

☒ was described and claimed in International application No. **PCT/SE01/02847** filed on **December 20, 2001**
and as amended on _____(if any).

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 information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

PRIORITY CLAIM

I hereby claim foreign priority benefits under 35 USC 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)

Country	Application Number	Date of Filing (day, month, year)	Priority Claimed

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional patent application(s) listed below:

60/261,166	**16 January 2001**	**pending**
Application No.	Filing Date	Status (patented, pending abandoned)

(Complete this part only if this is a continuing application.)

I hereby claim the benefit under 35 USC 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 USC 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations §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 No.	Filing Date	Status (patented, pending abandoned)

Docket No. 1505-1033

POWER OF ATTORNEY

The undersigned hereby authorizes the U.S. attorney or agent named herein to accept and follow instructions from DR. LUDWIG BRANN PATENTBYRA AB as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned.

As a named inventor, I hereby appoint the registered patent attorneys represented by Customer No. **00466** to prosecute this application and transact all business in the Patent and Trademark Office connected therewith, including: **Robert J. PATCH, Reg. No. 17,355, Andrew J. PATCH, Reg. No. 32,925, Robert F. HARGEST, Reg. No. 25,590, Benoît CASTEL, Reg. No. 35,041, Thomas W. PERKINS, Reg. No. 33,027, Roland E. LONG, Jr., Reg. No. 41,949, and Eric JENSEN, Reg. No. 37,855,**

c/o YOUNG & THOMPSON
Second Floor
745 South 23rd Street
Arlington, Virginia 22202

00466
PATENT TRADEMARK OFFICE

Address all telephone calls to Young & Thompson at 703/521-2297. Telefax: 703/685-0573.

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.

Full name of sole or first inventor: **Joakim NORRGARD**

Inventor's signature: _____ Date: 2003-08-07

Residence: **Lulea, Sweden** SE Citizenship: **Sweden**

Post Office Address: **Porsogarden 24, S-977 54 Lulea, Sweden**

Full name of second joint inventor, if any: **Anders LARSSON**

Inventor's signature: _____ Date: 2003-08-12

Residence: **Lulea, Sweden** SE Citizenship: **Sweden**

Post Office Address: **Professorsvagen 68A, S-977 51 Lulea, Sweden**

Full name of third joint Inventor, if any: **Olov SCHELEN**

Inventor's signature: _____ Date: 2003-08-12

Residence: **Norrfjarden, Sweden** SE Citizenship: **Sweden**

Post Office Address: **Jan Jonsvagen 19, S-946 91 Norrfjarden, Sweden**

Ex.1002
CISCO SYSTEMS, INC. / Page 388 of 487

UNITED STATES PATENT AND TRADEMARK OFFICE

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U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/250,702	Joakim Norrgard	1505-1033-1

INTERNATIONAL APPLICATION NO.	
PCT/SE01/02847	
I.A. FILING DATE	PRIORITY DATE
12/20/2001	01/16/2001

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ARLINGTON, VA 22202

CONFIRMATION NO. 9055

371 FORMALITIES LETTER

OC000000011091563

Date Mailed: 10/24/2003

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as a Designated / Elected Office (37 CFR 1.495).

- Indication of Small Entity Status
- Copy of the International Application filed on 07/07/2003
- Copy of the International Search Report filed on 07/07/2003
- Copy of IPE Report filed on 07/07/2003
- Preliminary Amendments filed on 07/07/2003
- U.S. Basic National Fees filed on 07/07/2003
- Priority Documents filed on 07/07/2003

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE OR BY 32 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

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)

*A copy of this notice **MUST** be returned with the response.*

PAULETTE R KIDWELL

Telephone: (703) 305-3656

PART 2 - OFFICE COPY

U.S. APPLICATION NUMBER NO.	INTERNATIONAL APPLICATION NO.	ATTY. DOCKET NO.
10/250,702	PCT/SE01/02847	1505-1033-1

FORM PCT/DO/EO/905 (371 Formalities Notice)

DT14 Rec'd PCT/PTO 07 JUL 2003

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		Attorney Docket No. **1505-1033-1** U.S. Application No. **10/250702**
INTERNATIONAL APPLN. NO. **PCT/SE01/02847**	INTERNATIONAL FILING DATE **December 20, 2001**	PRIORITY DATE CLAIMED **January 16, 2001**

TITLE OF INVENTION: **NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM**

APPLICANT(S) FOR DE/EO/US: **Joakim NORRGARD, Anders LARSSON and Olov SCHELEN**

Applicant herewith submits to the United States Designated Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ 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. ☒ The US has been elected (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau)
   b. ☐ has been communicated by the International Bureau. See attached PCT/IB/308.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made, however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ 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. ☐ Information Disclosure Statement (IDS) w/PTO-1449 - ☐ Copy of IDS citations
12. ☐ Assignment Papers (cover sheet & document(s))
13. ☒ A preliminary amendment.
14. ☒ An Application Data Sheet under 37 C.F.R. 1.76.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or change of address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application (35 U.S.C. 154(d)(4)).
20. ☒ Other items or information: **International Preliminary Examination Report (PCT/IPEA/409), Abstract of the Disclosure, International Search Report**

U.S. APPLICATION NO: 10/250702	INTERNATIONAL APPLN. NO. PCT/SE01/02847	ATTORNEY DOCKET NO. 1505-1033-1

21. ☒ The following fees are submitted:	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1)-(5):		
Neither international preliminary examination fee nor international search fee paid to USPTO and international Search Report not prepared by the EPO or JPO $1060.00		
International preliminary examination fee not paid to USPTO but International Search Report prepared by the EPO or JPO $900.00		
International preliminary examination fee not paid to USPTO but International search fee paid to USPTO $750.00		
International preliminary examination fee paid to USPTO but all claims did not satisfy provision of PCT Article 33 (1)-(4) $720.00		
International preliminary examination fee paid to USPTO and all claims satisfied provision of PCT Article 33 (1)-(4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT	$ 1,060.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20- ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(e))	$ 130.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	42 - 20 =	22	X $18.00	$396.00	
Independent Claims	3 - 3 =	0	X $84.00		
MULTIPLE DEPEND CLAIM(S) (if applicable)			+ $280.00	$	
			TOTAL OF ABOVE CALCULATION -	$1,586.00	
☒ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.			-	$793.00	
			SUBTOTAL =	$793.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$	
			TOTAL NATIONAL FEE =	$793.00	
Fee for recording the enclosed assigned (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) $40.00 per property +					
			TOTAL FEES ENCLOSED -	$793.00	
				Amount to be refunded:	$
				Charged:	$

☒ A Check in the amount of **$793.00** to cover all fees is attached.

☐ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to Deposit account No. 25-0120 in the name of Young & Thompson, as described below. A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fee required under 37 C.F.R. §§ 1.16 or 1.17.

SEND ALL CORRESPONDENCE TO:
YOUNG & THOMPSON
745 South 23rd Street
Arlington, VA 22202
Telephone (703) 521-2297
Y&T Customer No. 00466

BC/ia

00466
PATENT TRADEMARK OFFICE

Benoit Castel
SIGNATURE

Benoit Castel, Reg. No. 35,041
NAME, REGISTRATION NUMBER

July 7, 2003
DATE

Title

Network Resource Manager in a Mobile Telecommunication System

Field of the invention

The present invention relates to a method in a communication system and to a network resource manager in a communication system according to the preambles of the independent claims.

In particular, it relates to a Network Resource Manager (NRM) and a method thereof for providing an improved performance in a mobile telecommunication system comprising at least one network means e.g. a Core Network (CN) connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission.

Background of the invention

Figure 1 shows a circuit switched mobile telecommunication system 100 according to the prior art. The system 100 comprises a CN 104 that comprises at least one Mobile Switching Center (MSC) and a RAN 102. The RAN 102 comprises at least one controlling unit 106 that is connected to the MSC. The controlling unit 106 is a Base Station Controller (BSC) in a GSM system and a Radio Network Controller (RNC) in a UMTS system. Each controlling unit is further connected to at least one Base Station (BS) and each BS is respectively adapted to communicate over a radio interface 108 with at least one Mobile Terminal (MT). The MSC is also connected to a Public Switched Telephone Network (PSTN) via a Gateway MSC (not shown in the figure). In a circuit switched system as shown in **figure 1**, voice and data sessions are guaranteed network resources via signalling, i.e. the Mobile Terminal (MT) signals its network resource demands to the system. If resources are available, a dedicated communication circuit that guarantees resources for the session is set up through the network.

A current networking trend is to provide "IP (Internet Protocol) all the way" to wireline and wireless units. The objectives are to simplify infrastructure, to support a wide range of applications, and to support heterogeneous user demands on the communication service. This trend is applicable to wireless systems such as GSM (Global System for Mobile communication), GPRS (General Packet Radio Service), and UMTS (Universal Mobile Telecommunication System).

One step towards an all IP wireless system is to replace the traditional circuit switched technology by packet switched IP technology. By doing so, some of the network resource management mechanisms that are built into the system are no longer available and need to be replaced. The architectural components such as the MSC, Controller and the BS are still present but IP routers have replaced circuit switched network elements in order to provide IP based transmission. I.e., IP routers are introduced in network, e.g. within the CN and between the CN and the RAN and between and BS and a BSC in the RAN. In the wireless parts, the packet transfer over the radio interface (between a BS and a MT) is controlled by other protocols such as RLC, MAC and RRC that e.g. manage radio resources and provide reliable links.

In such a system, traffic circuits can be emulated by setting up IP tunnels between the logical components. The IP tunnels must provide a bearer service equivalent to that provided by the circuits in a circuit switched system.

The big challenge in this convergence lies in supporting multiple services with different Quality of Service (QoS) requirements that is providing e.g. an appropriate delay, jitter and packet loss guarantees for each service. To provide appropriate QoS, different types of resources (e.g. radio resources, network resources and power resources) have to be managed in the systems. Architectural components managing resources, e.g. in the Radio

Access Network (RAN) and the Core Network (CN), of these systems are defined in different standards.

As stated in the previous section the trend is that future telecommunication systems will be all IP multi-service systems. **Figure 2**, shows an example of a packet switched wireless system 200, e.g. a third generation (3G) UMTS system. The system comprises a CN with IP based transmission that comprises IP routers R and support nodes; a Serving GPRS Support Node (SGSN) that e.g. implements mobility functions and Gateway GPRS Support Node (GGSN) that implements interoperability with other systems, e.g. the Internet or PSTN. The system further comprises RANs that comprise a controlling unit 204, Base Stations BS and IP routers R. In the system 200, the SGSN, the GGSN, the controlling unit 204 e.g. an RNC and the BS (and other network elements) are interconnected by means of the IP routers R. This system is thus optimised for delivering IP packet switched services and its system architecture differs from the circuit switched architecture. Both the RAN and the CN are IP networks where logical functions (e.g. Radio Resource Management (RRM)) are distributed, e.g. in the RNC and in the SGSN.

The 3G wireless system needs to support multiple services (e.g. voice conversations, data transfers, streaming media, etc.) which have different transport QoS requirements. Sessions will often span over the RAN and the CN of the system and into other peering telecommunication systems (e.g. a PSTN).

Moreover, services in 3G systems usually utilize so called bearer services that have different QoS characteristics for transporting the service through the system. UMTS, defines e.g. four QoS classes (conversational, streaming, interactive, background) for the UMTS bearer service. A bearer service can also be layered and partitioned between system domains. **Figure 3** shows the UMTS Bearer Service as an example. It is based on two components, the

Radio Access Bearer (RAB) service and the CN bearer service. The UMTS Bearer Service ranges between the MT to the CN, and the (RAB) service from the MT to the CN (and the other way around) and the CN bearer service ranges within the CN.

It should be noted that the bearer services make use of IP based networks to provide the transport. To provide the appropriate bearer service, network resources within the IP network have to differentiate between traffic flows, and have to be managed so that resources are available when needed. These requirements have to be met in all parts of the system to provide appropriate end-to-end QoS. There is a need of QoS management functions in the different system domains to implement the bearer service in each system domain. A UMTS system relies on a number of bearer service managers, e.g. a RAB service manager and a CN service manager, that establish, modify and maintain their respective bearer service. The bearer service managers are located in different nodes (e.g. RNC, SGSN, GGSN) depending on in which system domain they manage the bearer service. The radio resources are thus managed by one or more bearer service managers (e.g. a RAB service manager) that handles the radio resources, i.e. the radio resource manager may be a part of the RAB service manager.

In the sections above a UMTS system is used as reference for describing the need of network resource management functions in IP-based wireless systems. The description is, however, equally applicable for wireless systems based on other current and evolving standards e.g. cdma2000, GSM/GPRS as well as evolving releases of the UMTS standard. Other systems and releases may be partitioned into other system domains, use other terminology for describing the transport service and characterise the transport in other ways, but they will still use IP networks for transport of different services. This implies that the systems need network resource management functions for being able to provide transport services with certain QoS characteristics.

As described above, the present invention relates to systems using IP based transmission. There are some characteristics that are common for IP-based systems that relate to the nature of how IP networks work and how they are designed. These characteristics are discussed in the following.

The IP protocol is designed to be used in networks where different traffic flows share network resources equally. This means that the received QoS depends on the current load in the network. To provide QoS guarantees for specific traffic, QoS mechanisms are required. Mechanisms and methods applied for this purpose are described below.

Traffic in these systems will usually be forwarded according to routes set up by distributed and dynamic intra- and inter-domain routing protocols such as OSPF (Open shortest Path First) and BGP (Border Gateway Protocol). These routing protocols automatically detect network failures and set up new routes to avoid the failure.

The network topologies in IP-based systems are less hierarchical than those in circuit switched systems. In 3G systems that are optimised for IP services the topology will be distributed, as can be understood from **figure 2**.

The packet switched nature of IP-based networks makes them very well suited for traffic aggregation. This will be used especially in RANs where link deployment can be very expensive. Redundant links will be used where network reliability is critical or to add resources between hot spot sites. Redundant links 206 can be seen in **figure 2**.

There are typically two known ways to provide QoS guarantees for bearer services in the RAN and the CN that use IP networks for transport; either to use QoS mechanisms such as Differentiated Service (DiffServ) or to over-dimension the network.

The (DiffServ) architecture is one QoS framework that can be applied to provide mechanisms for setting up traffic classes in the network to enable differentiation of network resources among services. At system set up, the different traffic classes are dimensioned to ensure that each class has sufficient resources. Dimensioning is based on service characteristics and assumed usage statistics.

For systems that provide one or a few services, over-dimensioning of the network is usually used to ensure sufficient resources. Service monitoring often complements over-dimensioning to discover where network resources are lacking and to trigger re-dimensioning of the network. For both the Diffserv capable and the "single service" network case described, dimensioning and re-dimensioning are done manually and there is no real-time control of the actual resource usage.

A solution based on dimensioning will work as long as the dimensioning assumptions hold. However, if the assumptions break, e.g. if the usage behaviour changes or a network link fails, some network links can get over-utilised causing degraded quality for some active sessions. **Figure 4** depicts a RAN comprising an RNC connected via IP routers to a number of BS and a number of MT. Figure 4A shows a normal operation while Figure 4B shows a scenario during a link failure 402 that results in insufficient resources on another link 404. It is possible to prevent this situation by over-dimensioning resources so that minor dimensioning mistakes can be handled. This will, on the other hand, cause the network to be under-utilised most of the time. The problem with the dimensioning method is that it is impossible to foresee all future events at the time of dimensioning and still achieve reasonable network utilisation. There is a need for a mechanism that keep track of how resources are used on each link in the network and that can reject setup of new bearer services over links where there are no resources left to fulfil QoS requirements. The same reasoning holds for the Diffserv case where network resources are provisioned to

different service classes based on assumption on traffic loads and characteristics. There is a need for a mechanism that manages and controls the resources in each traffic class.

The problems described above can be extended to the scenario when a Mobile Terminal (MT) in a wireless system moves and causes handover between base stations. As the terminal moves, the need for resources in different parts of the network changes. It is impossible to predict how the terminal will move and thereby where network resources will be needed. If there is no entity in the system that controls and sets up resources, network links can get over-utilised at handover.

Figure 5 shows a RAN comprising a RNC connected to a number of BS via IP routers R and MT. "ok" means that a connection has sufficient resources and "nok" means that a connection has insufficient resource. "1" means a first scenario and "2" means a subsequent second scenario. **Figure 5** illustrates another problem that occurs when sessions are denied to start even if resources are available in the system. Consider a situation when a terminal tries to start a session. The session can be denied due to lack of network resources as in **figure 5a**, lack of radio resources as in **figure 5b**, or lack of both radio and network resources as in **figure 5c**. In some cases it would be possible to accept the session if the terminal changed its point of connection from the currently serving base station to another one.

These problems, implies that there is a need for a resource management mechanism that have full knowledge of resource usage/allocation and network topology in the IP network.

An additional requirement on the bearer service delivered by a wireless system is that end-to-end QoS can be provided through all parts of the network. It is hard, if not impossible, to dimension all network parts in a system to meet all possible QoS requirements while not causing the

network to be under-utilised most of the time. The difficulty to provide end-to-end QoS by dimensioning grows as the network and system grows.

In EP 1 059 792, a radio resource management for the radio link in a wireless IP system is showed and it describes a method and system that maps IP QoS parameters or requests to radio resource requests. It also addresses procedures for applying the mapping and managing the radio resources.

EP 1 059 792 does not address resource management issues for an IP network of a wireless system.

Thus, an object of the present invention is to achieve automatic network resource management for providing appropriate end-to-end QoS for sensitive services throughout a wireless and IP transmission based communication network.

Another object of the present invention is to enable efficient monitoring of how network resources are used by bearer services/calls on a per link basis and over time without the need to make measurements in routers.

Summary of the invention

The above-mentioned objects are achieved by the present invention according to the independent claims by a method having the features of claim 1 and a Network Resource Manager having the features of claim 17 and claim 18.

Preferred embodiments are set forth in the dependent claims.

Thus, the above-described object is achieved by introducing at least one Network Resource Managers (NRM) into a cellular telecommunication

system e.g., within a RAN and/or within a network means e.g. a CN in accordance with the present invention. The NRM monitors and/or manages and/or reserves resources within the network with IP based transmission within the cellular telecommunication system and a bearer service manager, such as a RAB service manager, manages radio resources in the wireless part of the cellular telecommunication network. How the radio resource management function/entity internally manages the resources within the wireless part, is however beyond the scope of this invention. It is hence possible to obtain an end-to-end QoS throughout the cellular telecommunication system.

An advantage with the present invention is that it solves problems related to providing reliable end-to-end QoS in IP-based wireless systems. It improves utilisation of the system and ensures QoS.

Another advantage with the present invention is that resources can be committed on a per-call basis through the RAN without signalling along a bearer path through the RAN. Admission control on a per-call basis avoids fragmentation of resources, which occurs if resources are reserved for aggregated trunks. Fragmentation of resources decreases the total utilisation in the RAN.

A further advantage with the present invention is that aggregated trunks also can be provided in the RAN. In comparison to signalled solutions for providing trunks, a distinct advantage with NRM is that trunk resources can be pre-allocated depending on time (e.g., time of day, day of week) to cater for recurring variations.

A further advantage with the present invention is that multiple services (e.g., video, VPN (Virtual Private Network)) can be supported with maximum utilisation. Policies for precedence between services of different kind can be enforced at a per session level.

An advantage with the monitoring according to the present invention is that it provides feedback to the planning and provisioning process of the network operator.

A further advantage with monitoring according to the present invention is that it enables monitoring of how bearer service uses network resources on a per-link and over time basis. This characteristic allows usage of the present invention as both an active network resource manager and/or passive monitoring component.

Brief description of the appended drawings

Figure 1 illustrates a circuit switched wireless system

Figure 2 illustrates an IP-based packet switched wireless system.

Figure 3 illustrates bearer services in UMTS.

Figure 4 shows a link failure in a RAN causing degraded quality for active sessions.

Figure 5 shows examples of intelligent handover-scenarios.

Figure 6. shows Network Resource Manager (NRM) in a wireless system, according to the present invention.

Figure 7 shows a flowchart of a method for finding a BS with enough network and radio resources, according to the present invention.

Detailed description of preferred embodiments

Preferred embodiments of the present invention will now be described with references in particular to figures 6 and 7. According to the present invention the Network Resource Manager (NRM) provides the following functionality:

- dynamic awareness of network topology and network characteristics,

- path-sensitive call admission control, that is parameter and/or measurement based,
- scheduling of resources over time,
- capability to handle resource requests for immediate and future use,
- resource signalling between resource manager entities,
- coupling of the described NRM entity with radio resource management function/entity that manages the radio resources within the RAN.

The NRM can be implemented in software or hardware and it can run as a standalone node or run on the same node as other functionality such as Radio Resource (RR) management functionality (e.g. the RNC). In **figure 6**, the NRM 601 is coupled 609 to a bearer service manager 607 that is responsible for radio resource management. Another NRM 603 is located in the network means e.g. a CN and is responsible for the network resources within the network means e.g. a CN, and yet another NRM 605 is located within the Internet. The network means comprise the CN and future networks, e.g. an Internet, with corresponding functionality. More than one NRM may naturally be located in each respective node. Moreover, each NRM 603 may also be adapted to perform resource signalling 611 between another NRM 605. The NRM can also be integrated into other functionality (e.g. RR) to perform its described functions. The NRM may thus be distributed to run on multiple nodes (e.g. the RAN, the CN and the Internet) and/or distributed geographically over a network.

The NRM gains its dynamic topology awareness by retrieving routing information concerning the IP network, i.e. the topology of the IP network. In the case wherein the IP network is routed using a link-state routing protocol, the NRM participates in the routing and acts as a router, i.e. the NRM peers (i.e. exchange information) with other routers, without advertising any routes of its own, to retrieve routing information of the IP network. The basic principle on which link-state routing protocols are built

ensures that all routers have the complete topology map. When participating in the routing protocol, the NRM receives the routing information as fast as any other router in the routing domain and can therefore detect changes in the topology instantly.

In the case when the IP network is routed using a distance vector protocol, or static routing, the method of peering cannot be used. In this case, the routing information is retrieved by measurements such as trace route and/or the use of Simple Network Management Protocol (SNMP) auto discovery. SNMP is a set of protocols for managing complex networks. It is also possible to configure an NRM with a network topology statically. When the NRM has retrieved the routing information, it uses a network management protocol, such as SNMP, to collect information on the routers and their interfaces (e.g. the interface type and speeds). The information is used by the NRM to complement the gained routing topology information and make sure that it has an accurate view of the routing topology.

The NRM combines the routing information and resource information it receives from call set-up requests to create a resource map (call setup request is described further below). The resource map contains information on how much resources (e.g. bandwidth) that are available and reserved over time on a per link basis. The NRM uses the resource map to decide whether there are resources available or not (i.e. it performs a call admission control), for a call setup request from an entity/function. The call admission control is path-sensitive, i.e. the NRM checks that resources are available along the path that will be used by the traffic concerned by a resource request. The call admission control can be based on resource information provided in previously made and present resource requests (e.g. parameter based call admission control) or it can be based on current network load measurements, historical load data and future load predictions (e.g. measurement based call admission control). Measurements can be either collected from the network by the NRM or provided by network

elements (routers, switches, etc.) to the NRM. The call admission control can also be based on a combination of parameters and measurements.

By introducing a start and a stop time as a parameter in the resource request, resources can be scheduled over time. This allows the NRM to handle resource requests for both immediate and future use. A call setup request refers to a request made to an NRM from an entity/function that would like to reserve network resources. The requesting entity/function might use the network resources for providing appropriate service to a bearer service. Resource requests contain at least information about the end-points between which the resources are needed and the required amount of resources needed. The interaction between the NRM and the requesting entity/function can be implemented in a number of ways, e.g. via a communication protocol, inter process communication, functional calls between integrated software modules, etc. depending on how the NRM is running in the system.

The resource requesting entity/function in an IP-based wireless system is usually a bearer service manager or an equivalent entity/function that is responsible for controlling a bearer service spanning over an IP network. The bearer service manager may request network resources for a bearer service within a RAN, a CN or both.

An NRM controls network resources in a limited part of a network, in a network domain. These domains may be small (e.g. a few routers) or very large (e.g. tens of thousands of routers). Typically, an NRM controls a routing domain, i.e. an area of a network routed by one intra-domain routing protocol. In order to provide network resource management in large systems/networks where many NRMs are needed, NRMs can interact, i.e. signal resource request to each other. An NRM that makes a resource request to another NRM does this the same way as a non NRM makes request to an NRM. However, in some scenarios the NRMs are not required

to be able to signal to each other, e.g. when there is no need for inter-domain communication and one domain is controlled by one NRM. The NRM is further described in "Schelen, O. Quality of Service Agents in the Internet, Doctoral Thesis, Department of Computer Science and Electrical Engineering, Division of Computer Communication, Luleå University of Technology, Luleå 1998" and in the Swedish Patent Application 0102929-7 filed September 4, 2001.

Domains controlled by an NRM may or may not match system domains, e.g. a RAN or a CN. Thus, one or several NRMs may control one RAN and one or several NRMs may control one CN or an NRM may e.g. control one part of the RAN and one part of the CN in a network. There may also be system domains where other mechanisms than NRMs are used to control network resources. This means that there may be one or many entities/functions signalling resource requests to one NRM or one entity/function signalling requests to many NRMs.

The above described preferred embodiment of the present invention is exemplified in the following:

1. An event, e.g. an MT that initiates a call to a phone in a Public Switched Telephone Network (PSTN), triggers a request to one or multiple bearer service manager functions/entities to setup a bearer service within the wireless system. The bearer service manager can be located in different nodes (e.g. RNC, SGSN, GGSN, etc.) depending on the system domain (e.g. RAN part, CN part) it controls. The bearer service manager that controls the radio resources, the radio resource manager may be located in the RNC.
2. The bearer service manager sends a resource request to an NRM to guarantee that there are sufficient network resources in its system domain.
3. The NRM evaluates if resources are available in the network domain it controls. If the bearer service is spanning over domains controlled by other NRMs the first NRM communicate with these to find out if network

resources are available in those domains. If network resources are available the resources are allocated for the bearer service.

4. The NRM replies the result of the resource request to the bearer service manager.

5. The radio resource manager, e.g. a part of the RAB service manager has made sure that there are radio resources available in its system domain.

6. If enough radio and network resources are available resources are reserved from the MT to PSTN.

It is obvious for a man skilled in the art that it is possible to perform these steps in another order, or add or delete some steps and still obtain the same result.

As a summary, when a service is about to start and resources are requested the NRM uses hence its knowledge of the network topology and resource usage at each link in the network domain it controls to calculate if there are resources available to accept the resource request. A bearer service manager entity/function for example located in an RNC or SGSN, or equivalent communicating thus its resource needs to an NRM that ensures that network resources do not get over-utilised on any links and can therefore provide appropriate QoS for a bearer service. NRMs in different network domains are, if required, also receiving the resource request to manage services spanning over multiple NRM controlled network domains. If acceptance of the request causes at least one link to be over-utilised the request is denied. Resources will thereby never be over-utilised on any network link.

The NRM monitors the network topology and discovers instantly (i.e. as fast as the routing protocol adapts to link failure, or as fast probing can discover a link failure) topology changes, e.g. due to link failures. If this happens, the NRM has the knowledge to calculate the resources needed to support active sessions. If it is not possible to support all active sessions in the new topology, the NRM can inform the system which sessions that should be

pre-empted to prevent over-utilisation of resources. As a result of path-sensitive admission control and network awareness, over-dimensioning is not needed to prevent the effects of link failures or dimensioning mistakes.

The NRM can use its capabilities to pre-allocate network resources to prevent over-utilisation of resources at handover from one radio base station to another. This is obtained by setting a threshold for admitting new calls that is lower than the maximum available resources. Essentially resources for bearer services are pre-allocated in the IP network for being available in case of handover. It ensures that handover is given precedence to new calls at high load. The amount of resources set aside for handover defines a trade-off between the risk of dropping calls at handover and the risk of rejecting new calls. Management of handover is similar to how normal NRM call admission is handled; topology awareness in NRM enables discovery of which links that will be used at handover, path-sensitive admission control can decide if there are resources available on potential links. Allocation of resources ahead of finalising handover can be used to ensure availability of resources. The exact algorithm to use for choosing potential links and pre-allocating network resources is not within the scope of the present invention. It should be noted that the features of the NRM enables solving the handover problem with respect to the IP network.

If bearer service entities that manage the radio resources and network resources (e.g. the RAB manager and NRMs) are tightly coupled, as described below, they will have complete information about how radio and IP network resources are used and where resources are available in the system. This makes it possible to make joint optimisation of radio and IP network resources and direct a handover to where resources are available for a session which otherwise would have been denied.

Figure 7 describes an example of iterations for finding a radio base station (BS) that can provide both radio and network resources. (A RAB manager is

used in this example, but it could naturally be another manager entity/function within the network that handles radio resources.)

701. Request to RAB manager.

702. RAB manager compiles a list of possible BSs in priority order.

703. A request for bearer resources (i.e. radio resources) to the BS on top of the list (with highest priority), for a path, is transmitted to NRM. NRM investigates whether it can fulfil the resource request.

704. Yes: If the answer is yes, available resources are allocated to the BS with highest priority.
No: If the answer is no, the BS with the highest priority is removed from the list. If the list then is empty, no resources are available and the service cannot be maintained or started. If there are remaining BSs in the list, go back to step 3.

This logical function may be implemented within a Radio Access Bearer (RAB) manager entity/function for example located in a RNC or equivalent that has knowledge of the radio resource situation in the network. The interaction/coupling can be implemented in a number of ways, e.g. via a communication protocol, inter process communication, functional calls between integrated software modules, etc.

The method may be implemented by means of a computer program product comprising the software code means for performing the steps of the method. The computer program product is run on processing means in a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system. The computer program is loaded directly or from a computer usable medium, such as a floppy disc, a CD, the Internet etc. However, the method may also be implemented by means of hardware.

Thus, end-to-end QoS is obtained in a wireless telecommunication system according to the present invention by letting NRMs control separate parts of the IP network, e.g. a first NRM controls resources within a RAN, and a second NRM controls resources within a CN. Several NRMs may control the IP network resources within a RAN or a CN or a single NRM may control all IP network resources in a RAN and a CN. The NRMs and the bearer service manager, that controls the radio resources within the wireless part, communicate hence their resource needs between each other through the system in order to obtain end-to-end QoS.

The present invention is not limited to the above-described preferred embodiments. Various alternatives, modifications and equivalents may be used. Therefore, the above embodiments should not be taken as limiting the scope of the invention, which is defined by the appending claims.

Claims

1. A method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising at least one network means, e.g. a Core Network (CN) connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission, wherein the method comprising the step of:
-*handling* radio resources within RAN by using a radio resource manager, **characterised** in that the method comprising the further step of:
-*controlling* IP network resources by using a Network Resource Manager (NRM) comprising a resource map in order to provide said end-to-end QoS.

2. Method according to any of claims 1, **characterised** in that the NRM is used within the RAN and a CN.

3. Method according to any of claims 1, **characterised** in that the NRM is used within the RAN.

4. Method according to any of claims 1, **characterised** in that the NRM is used within the CN.

5. Method according any of claims 1-3, **characterised** in that the method comprising the further step of:
-*communicating* resource information between the NRM and the radio resource manager.

6. Method according to any of claims 1-5, **characterised** in that the method comprising the further step of:
-*reserving* IP network resources by the NRM if said end-to-end QoS can be fulfilled.

7. Method according to any of claims 1-6, **characterised** in that the method comprising the further step of:
-*pre-allocating* resources by the NRM in the IP network.

8. Method according to any of claims 1-7, **characterised** in that the method comprising the further step of:
-*signalling* resource information between the NRM and at least a second NRM used within at least a second network domain.

9. Method according to any of claims 1-8, **characterised** in that the method comprising the further step of:
-*monitoring* topology changes by using the NRM, that retrieves routing information concerning the IP network.

10. Method according to claim 9, **characterised** in that topology is monitored in order to be able to re-allocate IP network resources.

11. Method according to any of claims 1-10, **characterised** in that the method comprising the further step of:
-*performing* path-sensitive call admission control by using the resource map and checking that resources are available along a path.

12. Method according to claim 11, **characterised** in that the path-sensitive call admission control is parameter based.

13. Method according to claim 11, **characterised** in that the path-sensitive call admission control is measurement based.

14. Method according to any of claims 1-13, **characterised** in that the method comprising the further step:

-*scheduling* resources over time by introducing a start- and a stop time as a parameter in a resource request handled by the NRM.

15. A computer program product directly loadable into a processing means within a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system, comprising the software code portions for performing the steps of any of claims 1-14.

16. A computer program product stored on a computer usable medium, comprising readable program for causing a processing means within a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system to control the execution of the steps of any of claims 1-14.

17. A Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system, comprising at least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission and a radio resource manager comprising means for controlling radio resources within the RAN, is **characterised** in that NRM further comprises means for controlling resources within the IP network in order to provide end-to-end Quality of Service (QoS).

18. A Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system, comprising at least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission and a radio resource manager comprising means for controlling radio resources within the RAN, is **characterised** in that NRM further

comprises means for monitoring resources within the IP network in order to provide feedback to the network operator.

19. NRM according to any of claims 17-18, **characterised** in that it comprises means for be used within the RAN and a CN.

20. NRM according to any of claims 17-18, **characterised** in that it comprises means for be used IP network resources within the RAN.

21. NRM according to any of claims 17-18, **characterised** in that it comprises means for be used within the CN.

22. NRM according to claim 17-20, **characterised** in that it comprises means for communicating resource information with the radio resource manager.

23. NRM according to any of claims 17,19-22, **characterised** in that it comprises means for reserving IP network resources if it is possible to fulfil said end-to-end QoS.

24. NRM according to any of claims 17,19-23, **characterised** in that it comprises means for pre-allocating resources in the IP network part of the telecommunication system.

25. NRM according to any of claims 17-24, **characterised** in that it comprises means for communicating with at least a second NRM used within at least a second IP network domain.

26. NRM according to any of claims 17-25, **characterised** in that it comprises means for monitoring topology changes by retrieving routing information concerning the IP network.

27. NRM according to claim 26, **characterised** in that topology is monitored in order to be able to reallocate access resources.

28. NRM according to any of claims 17-27, **characterised** in that it comprises means for performing path-sensitive call admission control by using a resource map and checking that resources are available along a path.

29. NRM according to claim 28, **characterised** in that the path-sensitive call admission control is parameter based.

30. NRM according to claim 28, **characterised** in that the path-sensitive call admission control is measurement based.

31. NRM according to any of claims 17-30, **characterised** in that it comprises means for scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request.

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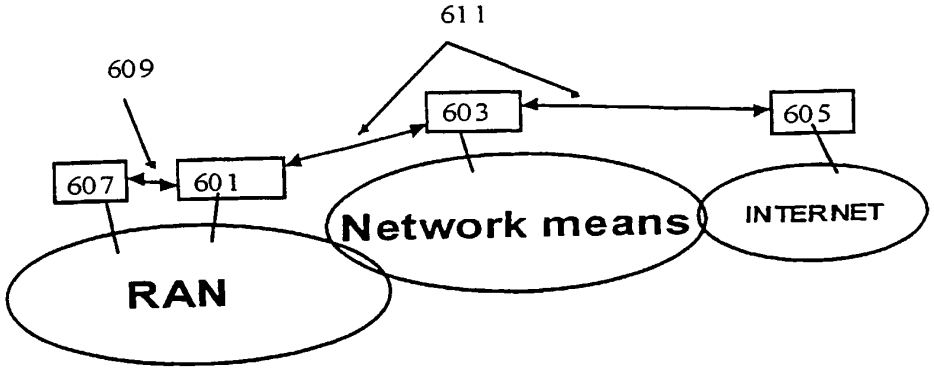
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM



(57) Abstract: The present invention relates to a method and arrangement for providing end-to-end Quality of Service within a mobile telecommunication system. The communication system comprises at least one network means e.g. a Core Network (CN) and at least one Radio Access Network (RAN) for Internet Protocol (IP) based transmission, wherein a Network Resource Manager (NRM) comprising a resource map is monitoring and/or controlling resources within the IP network.

WO 02/056564 A1

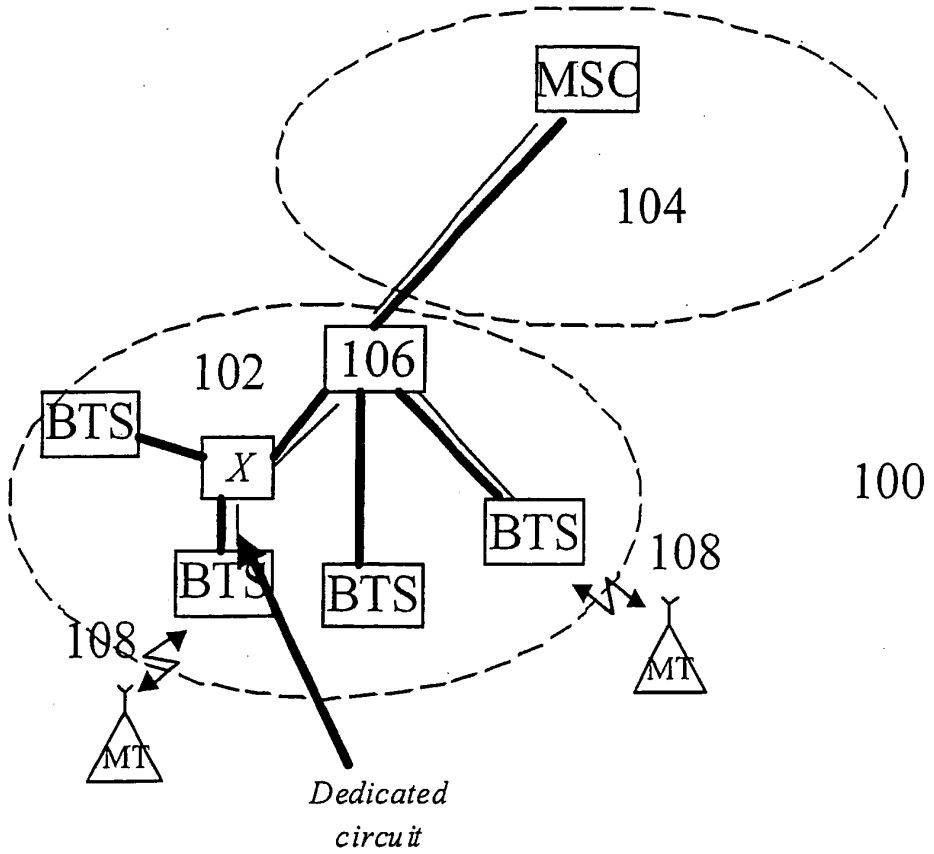

MSC
104
102
106
BTS
X
BTS
BTS
BTS
108
108
MT
MT
Dedicated
circuit
100

Fig. 1

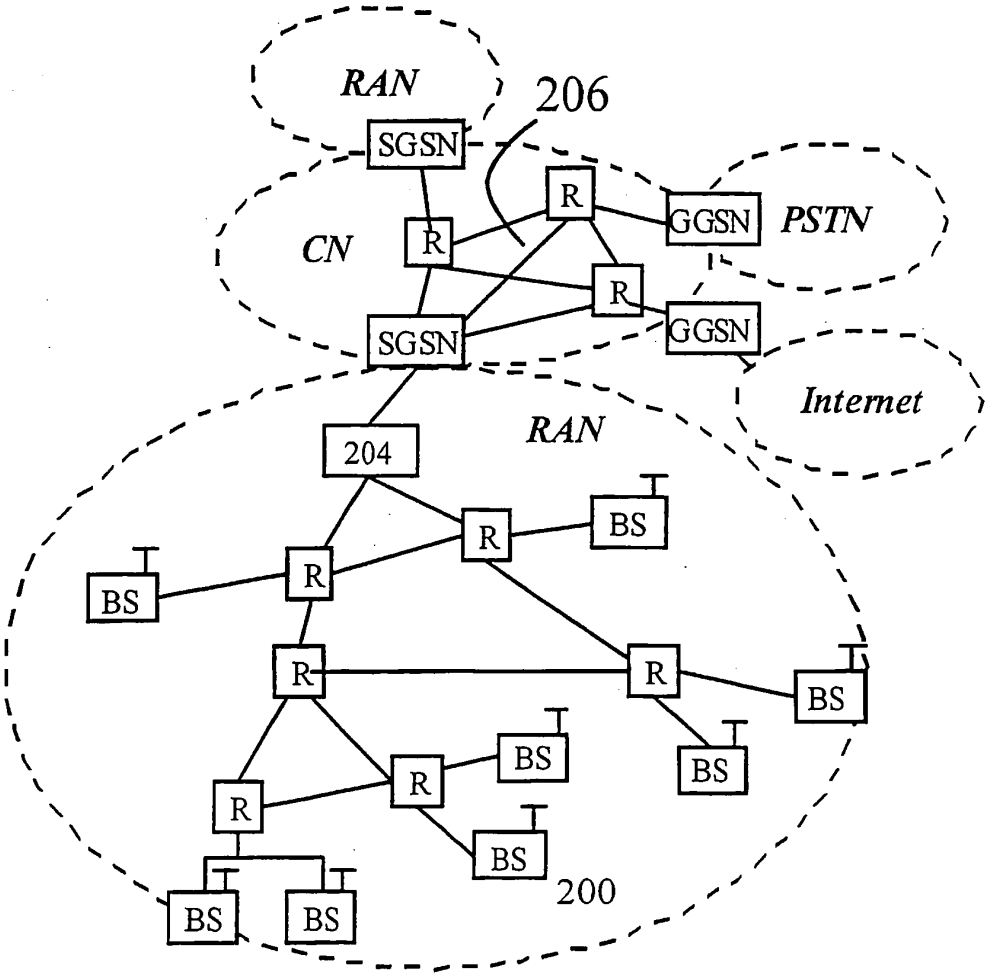

RAN
206
SGSN
R
GGSN
PSTN
CN
R
R
SGSN
GGSN
Internet
RAN
204
R
BS
BS
R
R
R
BS
BS
BS
R
R
BS
BS
200

Fig. 2

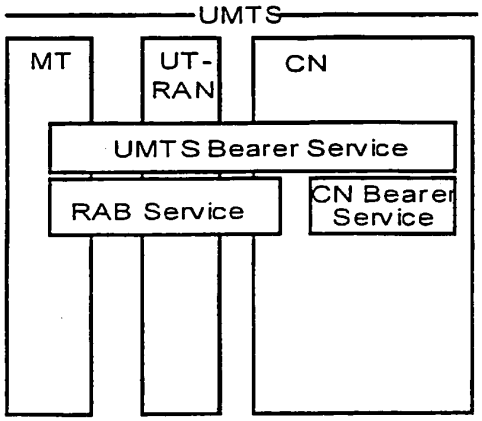

UMTS
MT
UT-RAN
CN
UMTS Bearer Service
RAB Service
CN Bearer Service

Fig.3

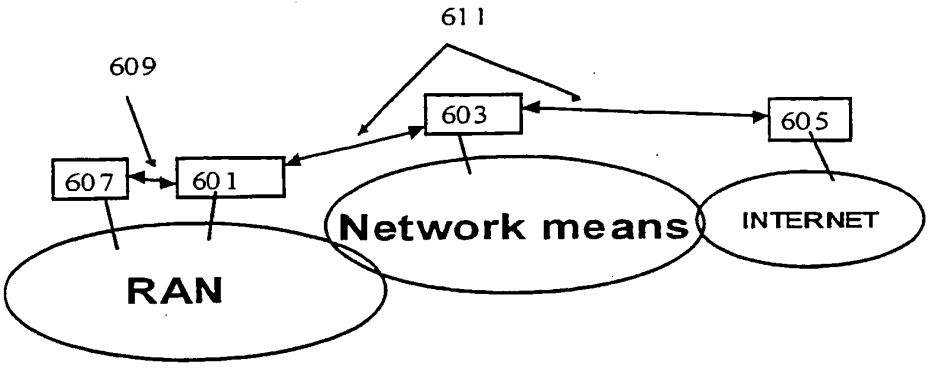

611
609
603
605
607
601
Network means
INTERNET
RAN

Fig.6

A. Normal operation
B. Operation after link failure
RAN
RAN
402
404
RNC
R
BS
MT
Insufficient resources

Fig. 4

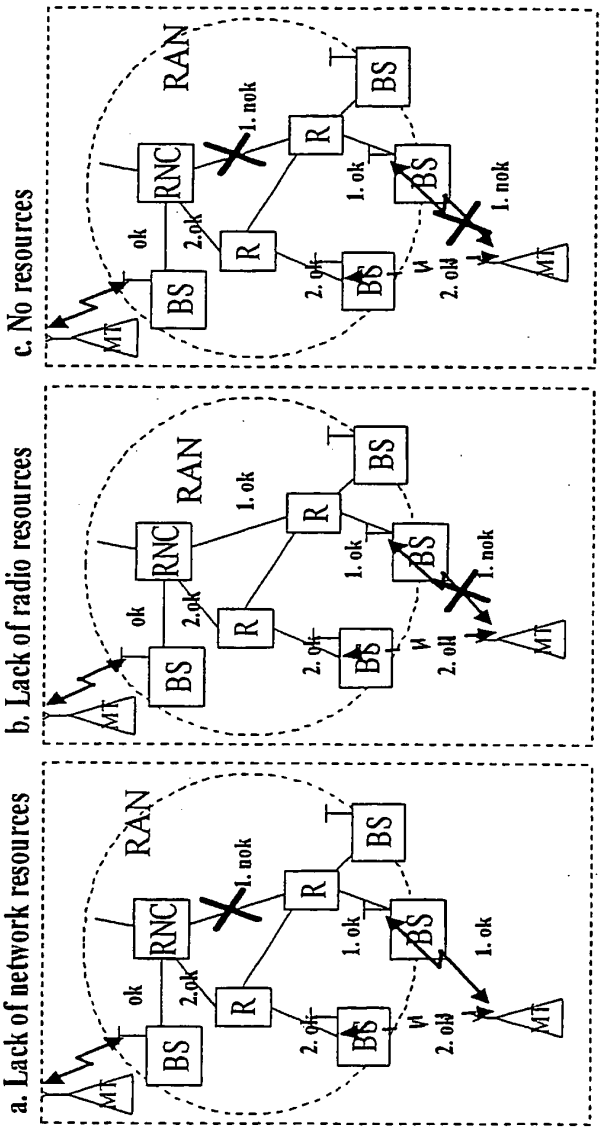

a. Lack of network resources
b. Lack of radio resources
c. No resources
RAN
RNC
BS
R
MT
1. nok
1. ok
2. ok
2. nok

Fig. 5

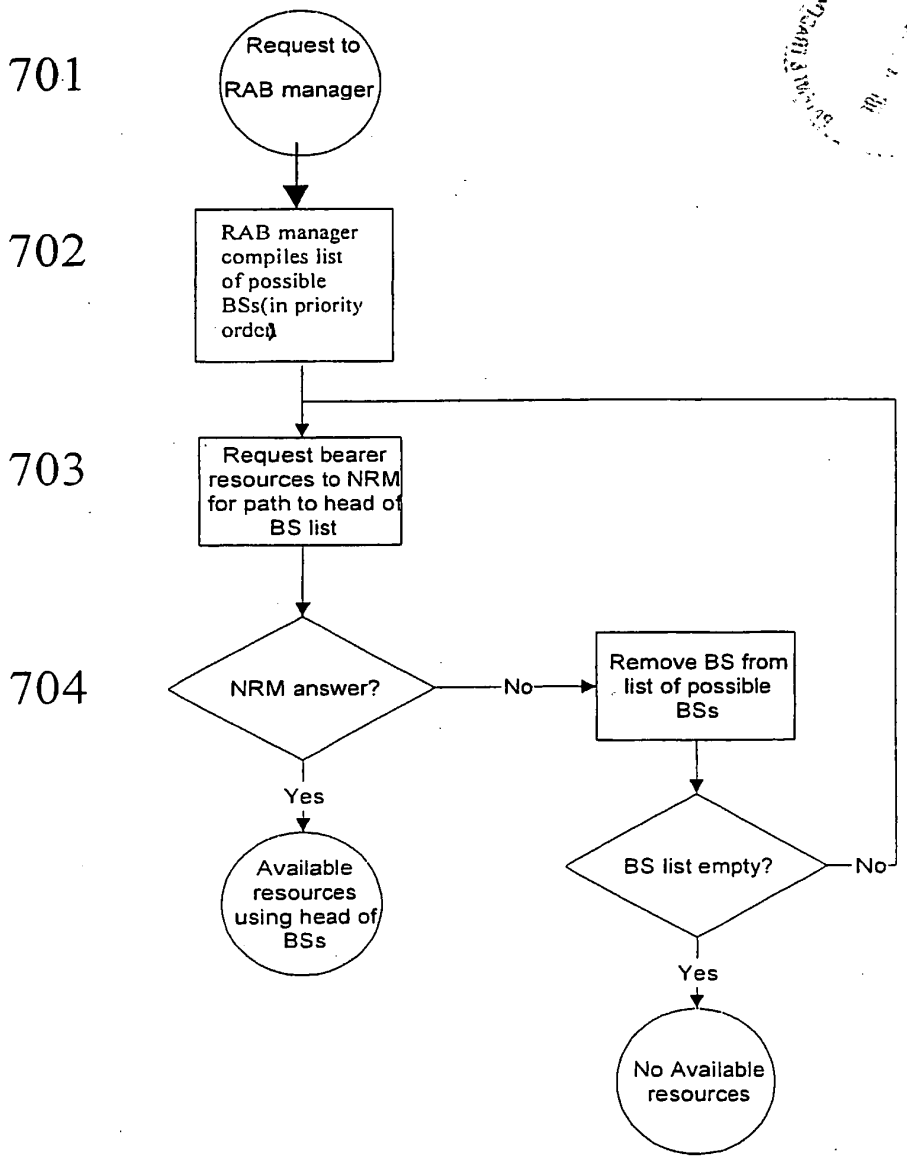

701
Request to RAB manager
702
RAB manager compiles list of possible BSs(in priority order)
703
Request bearer resources to NRM for path to head of BS list
704
NRM answer?
No
Remove BS from list of possible BSs
Yes
Available resources using head of BSs
BS list empty?
No
Yes
No Available resources

Fig. 7

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Application Data Sheet

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Number of Copies of CDs::	
Sequence Submission?::	None
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Number of copies of CRF::	0
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Variety Denomination Name::	
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Secrecy Order in Parent Appl.?::	No

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Correspondence Information

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Representative Information

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PCT/SE01/02847	Non-Provisional of	60/261,166	1/16/01

Ex.1002
CISCO SYSTEMS, INC. / Page 425 of 487

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Assignment Information

Assignee Name::

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PATENT
1505-1033-1

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of: Joakim NORRGARD et al.

Appl. No.: **NEW NATIONAL PHASE** Group:

Filed: July 7, 2003 Examiner:

For: NETWORK RESORCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

July 7, 2003

Sir:

The following preliminary amendments and remarks are respectfully submitted in connection with the above-identified application.

IN THE SPECIFICATION:

Page 1, between lines 3 and 4, please insert the following heading and paragraph:

--Cross reference to related applications--

--This application is the 35 USC 371 national stage of international application PCT/SE01/02847 filed on December 20, 2001, which designated the United States of America, and claims

priority of provisional application 60/261,166 filed on January 16, 2001.--

IN THE CLAIMS:

Please cancel claims 1-31 without prejudice or disclaimer of the subject matter contained therein.

Please add the following claims:

--32. (new) A method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising at least one network means, e.g. a Core Network (CN) connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission, wherein the method comprising the step of:
-*handling* radio resources within RAN by using a radio resource manager, **characterised** in that the method comprising the further step of:
-*controlling* IP network resources by using a Network Resource Manager (NRM) comprising a resource map in order to provide said end-to-end QoS.--

--33. (new) Method according to claim 32, **characterised** in that the NRM is used within the RAN and a CN.--

--34. (new) Method according to claim 32, **characterised** in that the NRM is used within the RAN.--

--35. (new) Method according to claim 32, **characterised** in that the NRM is used within the CN.--

--36. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-*communicating* resource information between the NRM and the radio resource manager.--

--37. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-*reserving* IP network resources by the NRM if said end-to-end QoS can be fulfilled.--

--38. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-*pre-allocating* resources by the NRM in the IP network.--

--39. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-*signalling* resource information between the NRM and at least a second NRM used within at least a second network domain.--

--40. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-*monitoring* topology changes by using the NRM, that retrieves routing information concerning the IP network.--

--41. (new) Method according to claim 40, **characterised** in that topology is monitored in order to be able to re-allocate IP network resources.--

--42. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:

-*performing* path-sensitive call admission control by using the resource map and checking that resources are available along a path.--

--43. (new) Method according to claim 42, **characterised** in that the path-sensitive call admission control is parameter based.--

--44. (new) Method according to claim 42, **characterised** in that the path-sensitive call admission control is measurement based.--

--45. (new) Method according to claim 32, **characterised** in that the method comprising the further step:
-*scheduling* resources over time by introducing a start- and a stop time as a parameter in a resource request handled by the NRM.--

--46. (new) A computer program product directly loadable into a processing means within a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system, comprising the software code portions for performing the steps of claim 32.--

--47. (new) A computer program product stored on a computer usable medium, comprising readable program for causing a processing means within a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system to control the execution of the steps of claim 32.--

--48. (new) A Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system, comprising at least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission and a radio resource manager comprising means for controlling radio resources within the RAN, is **characterised** in that NRM further comprises means for controlling resources within the IP network in order to provide end-to-end Quality of Service (QoS).--

--49. (new) NRM according to claim 48, **characterised** in that it comprises means for be used within the RAN and a CN.--

--50. (new) NRM according to claim 48, **characterised** in that it comprises means for be used IP network resources within the RAN.--

--51. (new) NRM according to claim 48, **characterised** in that it comprises means for be used within the CN.--

--52. (new) NRM according to claim 48, **characterised** in that it comprises means for communicating resource information with the radio resource manager.--

--53. (new) NRM according to claim 48, **characterised** in that it comprises means for reserving IP network resources if it is possible to fulfil said end-to-end QoS.--

--54. (new) NRM according to claim 48, **characterised** in that it comprises means for pre-allocating resources in the IP network part of the telecommunication system.--

--55. (new) NRM according to claim 48, **characterised** in that it comprises means for communicating with at least a second NRM used within at least a second IP network domain.--

--56. (new) NRM according to claim 48, **characterised** in that it comprises means for monitoring topology changes by retrieving routing information concerning the IP network.--

--57. (new) NRM according to claim 56, **characterised** in that topology is monitored in order to be able to reallocate access resources.--

--58. (new) NRM according to claim 48, **characterised** in that it comprises means for performing path-sensitive call admission control by using a resource map and checking that resources are available along a path.--

--59. (new) NRM according to claim 58, **characterised** in that the path-sensitive call admission control is parameter based.--

--60. (new) NRM according to claim 58, **characterised** in that the path-sensitive call admission control is measurement based.--

--61. (new) NRM according to claim 48, **characterised** in that it comprises means for scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request.--

--62. (new) A Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system, comprising at least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN),

using Internet Protocol (IP) based transmission and a radio resource manager comprising means for controlling radio resources within the RAN, is **characterised** in that NRM further comprises means for monitoring resources within the IP network in order to provide feedback to the network operator.--

--63. (new) NRM according to claim 49, **characterised** in that it comprises means for be used within the RAN and a CN.--

--64. (new) NRM according to claim 49, **characterised** in that it comprises means for be used IP network resources within the RAN.--

--65. (new) NRM according to claim 49, **characterised** in that it comprises means for be used within the CN.--

--66. (new) NRM according to claim 49, **characterised** in that it comprises means for communicating resource information with the radio resource manager.--

--67. (new) NRM according to claim 49, **characterised** in that it comprises means for communicating with at least a second NRM used within at least a second IP network domain.--

--68. (new) NRM according to claim 49, **characterised** in that it comprises means for monitoring topology changes by retrieving routing information concerning the IP network.--

--69. (new) NRM according to claim 68, **characterised** in that topology is monitored in order to be able to reallocate access resources.--

--70. (new) NRM according to claim 49, **characterised** in that it comprises means for performing path-sensitive call

admission control by using a resource map and checking that resources are available along a path.--

--71. (new) NRM according to claim 70, **characterised** in that the path-sensitive call admission control is parameter based.--

--72. (new) NRM according to claim 70, **characterised** in that the path-sensitive call admission control is measurement based.--

--73. (new) NRM according to claim 49, **characterised** in that it comprises means for scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request.--

REMARKS

Claims 32-73 are pending in the present application. Claims 1-31 have been cancelled and claims 32-73 have been added.

Entry of the above amendments is earnestly solicited. An early and favorable first action on the merits is earnestly requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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BC/ia
Attachments

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ABSTRACT

The present invention relates to a method and arrangement for providing end-to-end Quality of Service within a mobile telecommunication system. The communication system comprises at least one network e.g. a Core Network (CN) and at least one Radio Access Network (RAN) for Internet Protocol (IP) based transmission, wherein a Network Resource Manager (NRM) comprising a resource map is monitoring and/or controlling resources within the IP network.

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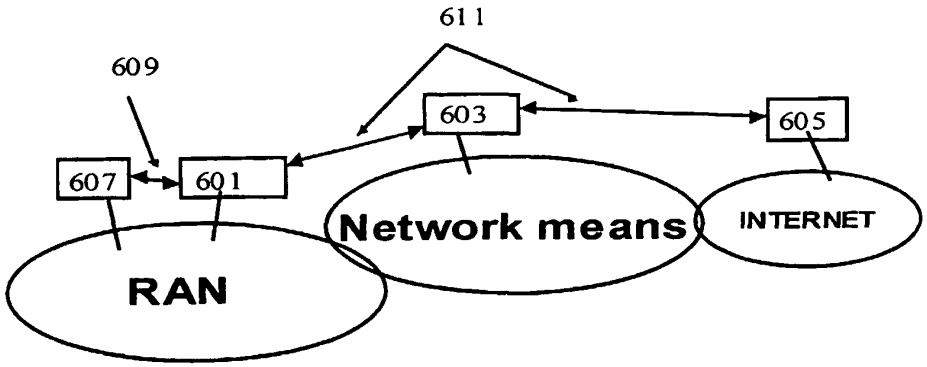
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WO 02/056564 A1

Title

Network Resource Manager in a Mobile Telecommunication System

Field of the invention

The present invention relates to a method in a communication system and to a network resource manager in a communication system according to the preambles of the independent claims.

In particular, it relates to a Network Resource Manager (NRM) and a method thereof for providing an improved performance in a mobile telecommunication system comprising at least one network means e.g. a Core Network (CN) connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission.

Background of the invention

Figure 1 shows a circuit switched mobile telecommunication system 100 according to the prior art. The system 100 comprises a CN 104 that comprises at least one Mobile Switching Center (MSC) and a RAN 102. The RAN 102 comprises at least one controlling unit 106 that is connected to the MSC. The controlling unit 106 is a Base Station Controller (BSC) in a GSM system and a Radio Network Controller (RNC) in a UMTS system. Each controlling unit is further connected to at least one Base Station (BS) and each BS is respectively adapted to communicate over a radio interface 108 with at least one Mobile Terminal (MT). The MSC is also connected to a Public Switched Telephone Network (PSTN) via a Gateway MSC (not shown in the figure). In a circuit switched system as shown in **figure 1**, voice and data sessions are guaranteed network resources via signalling, i.e. the Mobile Terminal (MT) signals its network resource demands to the system. If resources are available, a dedicated communication circuit that guarantees resources for the session is set up through the network.

A current networking trend is to provide "IP (Internet Protocol) all the way" to wireline and wireless units. The objectives are to simplify infrastructure, to support a wide range of applications, and to support heterogeneous user demands on the communication service. This trend is applicable to wireless systems such as GSM (Global System for Mobile communication), GPRS (General Packet Radio Service), and UMTS (Universal Mobile Telecommunication System).

One step towards an all IP wireless system is to replace the traditional circuit switched technology by packet switched IP technology. By doing so, some of the network resource management mechanisms that are built into the system are no longer available and need to be replaced. The architectural components such as the MSC, Controller and the BS are still present but IP routers have replaced circuit switched network elements in order to provide IP based transmission. I.e., IP routers are introduced in network, e.g. within the CN and between the CN and the RAN and between and BS and a BSC in the RAN. In the wireless parts, the packet transfer over the radio interface (between a BS and a MT) is controlled by other protocols such as RLC, MAC and RRC that e.g. manage radio resources and provide reliable links.

In such a system, traffic circuits can be emulated by setting up IP tunnels between the logical components. The IP tunnels must provide a bearer service equivalent to that provided by the circuits in a circuit switched system.

The big challenge in this convergence lies in supporting multiple services with different Quality of Service (QoS) requirements that is providing e.g. an appropriate delay, jitter and packet loss guarantees for each service. To provide appropriate QoS, different types of resources (e.g. radio resources, network resources and power resources) have to be managed in the systems. Architectural components managing resources, e.g. in the Radio

Access Network (RAN) and the Core Network (CN), of these systems are defined in different standards.

As stated in the previous section the trend is that future telecommunication systems will be all IP multi-service systems. **Figure 2**, shows an example of a packet switched wireless system 200, e.g. a third generation (3G) UMTS system. The system comprises a CN with IP based transmission that comprises IP routers R and support nodes; a Serving GPRS Support Node (SGSN) that e.g. implements mobility functions and Gateway GPRS Support Node (GGSN) that implements interoperability with other systems, e.g. the Internet or PSTN. The system further comprises RANs that comprise a controlling unit 204, Base Stations BS and IP routers R. In the system 200, the SGSN, the GGSN, the controlling unit 204 e.g. an RNC and the BS (and other network elements) are interconnected by means of the IP routers R. This system is thus optimised for delivering IP packet switched services and its system architecture differs from the circuit switched architecture. Both the RAN and the CN are IP networks where logical functions (e.g. Radio Resource Management (RRM)) are distributed, e.g. in the RNC and in the SGSN.

The 3G wireless system needs to support multiple services (e.g. voice conversations, data transfers, streaming media, etc.) which have different transport QoS requirements. Sessions will often span over the RAN and the CN of the system and into other peering telecommunication systems (e.g. a PSTN).

Moreover, services in 3G systems usually utilize so called bearer services that have different QoS characteristics for transporting the service through the system. UMTS, defines e.g. four QoS classes (conversational, streaming, interactive, background) for the UMTS bearer service. A bearer service can also be layered and partitioned between system domains. **Figure 3** shows the UMTS Bearer Service as an example. It is based on two components, the

Radio Access Bearer (RAB) service and the CN bearer service. The UMTS Bearer Service ranges between the MT to the CN, and the (RAB) service from the MT to the CN (and the other way around) and the CN bearer service ranges within the CN.

It should be noted that the bearer services make use of IP based networks to provide the transport. To provide the appropriate bearer service, network resources within the IP network have to differentiate between traffic flows, and have to be managed so that resources are available when needed. These requirements have to be met in all parts of the system to provide appropriate end-to-end QoS. There is a need of QoS management functions in the different system domains to implement the bearer service in each system domain. A UMTS system relies on a number of bearer service managers, e.g. a RAB service manager and a CN service manager, that establish, modify and maintain their respective bearer service. The bearer service managers are located in different nodes (e.g. RNC, SGSN, GGSN) depending on in which system domain they manage the bearer service. The radio resources are thus managed by one or more bearer service managers (e.g. a RAB service manager) that handles the radio resources, i.e. the radio resource manager may be a part of the RAB service manager.

In the sections above a UMTS system is used as reference for describing the need of network resource management functions in IP-based wireless systems. The description is, however, equally applicable for wireless systems based on other current and evolving standards e.g. cdma2000, GSM/GPRS as well as evolving releases of the UMTS standard. Other systems and releases may be partitioned into other system domains, use other terminology for describing the transport service and characterise the transport in other ways, but they will still use IP networks for transport of different services. This implies that the systems need network resource management functions for being able to provide transport services with certain QoS characteristics.

As described above, the present invention relates to systems using IP based transmission. There are some characteristics that are common for IP-based systems that relate to the nature of how IP networks work and how they are designed. These characteristics are discussed in the following.

The IP protocol is designed to be used in networks where different traffic flows share network resources equally. This means that the received QoS depends on the current load in the network. To provide QoS guarantees for specific traffic, QoS mechanisms are required. Mechanisms and methods applied for this purpose are described below.

Traffic in these systems will usually be forwarded according to routes set up by distributed and dynamic intra- and inter-domain routing protocols such as OSPF (Open shortest Path First) and BGP (Border Gateway Protocol). These routing protocols automatically detect network failures and set up new routes to avoid the failure.

The network topologies in IP-based systems are less hierarchical than those in circuit switched systems. In 3G systems that are optimised for IP services the topology will be distributed, as can be understood from **figure 2**.

The packet switched nature of IP-based networks makes them very well suited for traffic aggregation. This will be used especially in RANs where link deployment can be very expensive. Redundant links will be used where network reliability is critical or to add resources between hot spot sites. Redundant links 206 can be seen in **figure 2**.

There are typically two known ways to provide QoS guarantees for bearer services in the RAN and the CN that use IP networks for transport; either to use QoS mechanisms such as Differentiated Service (DiffServ) or to over-dimension the network.

The (DiffServ) architecture is one QoS framework that can be applied to provide mechanisms for setting up traffic classes in the network to enable differentiation of network resources among services. At system set up, the different traffic classes are dimensioned to ensure that each class has sufficient resources. Dimensioning is based on service characteristics and assumed usage statistics.

For systems that provide one or a few services, over-dimensioning of the network is usually used to ensure sufficient resources. Service monitoring often complements over-dimensioning to discover where network resources are lacking and to trigger re-dimensioning of the network. For both the Diffserv capable and the "single service" network case described, dimensioning and re-dimensioning are done manually and there is no real-time control of the actual resource usage.

A solution based on dimensioning will work as long as the dimensioning assumptions hold. However, if the assumptions break, e.g. if the usage behaviour changes or a network link fails, some network links can get over-utilised causing degraded quality for some active sessions. **Figure 4** depicts a RAN comprising an RNC connected via IP routers to a number of BS and a number of MT. Figure 4A shows a normal operation while Figure 4B shows a scenario during a link failure 402 that results in insufficient resources on another link 404. It is possible to prevent this situation by over-dimensioning resources so that minor dimensioning mistakes can be handled. This will, on the other hand, cause the network to be under-utilised most of the time. The problem with the dimensioning method is that it is impossible to foresee all future events at the time of dimensioning and still achieve reasonable network utilisation. There is a need for a mechanism that keep track of how resources are used on each link in the network and that can reject setup of new bearer services over links where there are no resources left to fulfil QoS requirements. The same reasoning holds for the Diffserv case where network resources are provisioned to

different service classes based on assumption on traffic loads and characteristics. There is a need for a mechanism that manages and controls the resources in each traffic class.

The problems described above can be extended to the scenario when a Mobile Terminal (MT) in a wireless system moves and causes handover between base stations. As the terminal moves, the need for resources in different parts of the network changes. It is impossible to predict how the terminal will move and thereby where network resources will be needed. If there is no entity in the system that controls and sets up resources, network links can get over-utilised at handover.

Figure 5 shows a RAN comprising a RNC connected to a number of BS via IP routers R and MT. "ok" means that a connection has sufficient resources and "nok" means that a connection has insufficient resource. "1" means a first scenario and "2" means a subsequent second scenario. **Figure 5** illustrates another problem that occurs when sessions are denied to start even if resources are available in the system. Consider a situation when a terminal tries to start a session. The session can be denied due to lack of network resources as in **figure 5a**, lack of radio resources as in **figure 5b**, or lack of both radio and network resources as in **figure 5c**. In some cases it would be possible to accept the session if the terminal changed its point of connection from the currently serving base station to another one.

These problems, implies that there is a need for a resource management mechanism that have full knowledge of resource usage/allocation and network topology in the IP network.

An additional requirement on the bearer service delivered by a wireless system is that end-to-end QoS can be provided through all parts of the network. It is hard, if not impossible, to dimension all network parts in a system to meet all possible QoS requirements while not causing the

network to be under-utilised most of the time. The difficulty to provide end-to-end QoS by dimensioning grows as the network and system grows.

In EP 1 059 792, a radio resource management for the radio link in a wireless IP system is showed and it describes a method and system that maps IP QoS parameters or requests to radio resource requests. It also addresses procedures for applying the mapping and managing the radio resources.

EP 1 059 792 does not address resource management issues for an IP network of a wireless system.

Thus, an object of the present invention is to achieve automatic network resource management for providing appropriate end-to-end QoS for sensitive services throughout a wireless and IP transmission based communication network.

Another object of the present invention is to enable efficient monitoring of how network resources are used by bearer services/calls on a per link basis and over time without the need to make measurements in routers.

Summary of the invention

The above-mentioned objects are achieved by the present invention according to the independent claims by a method having the features of claim 1 and a Network Resource Manager having the features of claim 17 and claim 18.

Preferred embodiments are set forth in the dependent claims.

Thus, the above-described object is achieved by introducing at least one Network Resource Managers (NRM) into a cellular telecommunication

system e.g., within a RAN and/or within a network means e.g. a CN in accordance with the present invention. The NRM monitors and/or manages and/or reserves resources within the network with IP based transmission within the cellular telecommunication system and a bearer service manager, such as a RAB service manager, manages radio resources in the wireless part of the cellular telecommunication network. How the radio resource management function/entity internally manages the resources within the wireless part, is however beyond the scope of this invention. It is hence possible to obtain an end-to-end QoS throughout the cellular telecommunication system.

An advantage with the present invention is that it solves problems related to providing reliable end-to-end QoS in IP-based wireless systems. It improves utilisation of the system and ensures QoS.

Another advantage with the present invention is that resources can be committed on a per-call basis through the RAN without signalling along a bearer path through the RAN. Admission control on a per-call basis avoids fragmentation of resources, which occurs if resources are reserved for aggregated trunks. Fragmentation of resources decreases the total utilisation in the RAN.

A further advantage with the present invention is that aggregated trunks also can be provided in the RAN. In comparison to signalled solutions for providing trunks, a distinct advantage with NRM is that trunk resources can be pre-allocated depending on time (e.g., time of day, day of week) to cater for recurring variations.

A further advantage with the present invention is that multiple services (e.g., video, VPN (Virtual Private Network)) can be supported with maximum utilisation. Policies for precedence between services of different kind can be enforced at a per session level.

An advantage with the monitoring according to the present invention is that it provides feedback to the planning and provisioning process of the network operator.

A further advantage with monitoring according to the present invention is that it enables monitoring of how bearer service uses network resources on a per-link and over time basis. This characteristic allows usage of the present invention as both an active network resource manager and/or passive monitoring component.

Brief description of the appended drawings

Figure 1 illustrates a circuit switched wireless system

Figure 2 illustrates an IP-based packet switched wireless system.

Figure 3 illustrates bearer services in UMTS.

Figure 4 shows a link failure in a RAN causing degraded quality for active sessions.

Figure 5 shows examples of intelligent handover-scenarios.

Figure 6. shows Network Resource Manager (NRM) in a wireless system, according to the present invention.

Figure 7 shows a flowchart of a method for finding a BS with enough network and radio resources, according to the present invention.

Detailed description of preferred embodiments

Preferred embodiments of the present invention will now be described with references in particular to figures 6 and 7. According to the present invention the Network Resource Manager (NRM) provides the following functionality:

- dynamic awareness of network topology and network characteristics,

- path-sensitive call admission control, that is parameter and/or measurement based,
- scheduling of resources over time,
- capability to handle resource requests for immediate and future use,
- resource signalling between resource manager entities,
- coupling of the described NRM entity with radio resource management function/entity that manages the radio resources within the RAN.

The NRM can be implemented in software or hardware and it can run as a standalone node or run on the same node as other functionality such as Radio Resource (RR) management functionality (e.g. the RNC). In **figure 6**, the NRM 601 is coupled 609 to a bearer service manager 607 that is responsible for radio resource management. Another NRM 603 is located in the network means e.g. a CN and is responsible for the network resources within the network means e.g. a CN, and yet another NRM 605 is located within the Internet. The network means comprise the CN and future networks, e.g. an Internet, with corresponding functionality. More than one NRM may naturally be located in each respective node. Moreover, each NRM 603 may also be adapted to perform resource signalling 611 between another NRM 605. The NRM can also be integrated into other functionality (e.g. RR) to perform its described functions. The NRM may thus be distributed to run on multiple nodes (e.g. the RAN, the CN and the Internet) and/or distributed geographically over a network.

The NRM gains its dynamic topology awareness by retrieving routing information concerning the IP network, i.e. the topology of the IP network. In the case wherein the IP network is routed using a link-state routing protocol, the NRM participates in the routing and acts as a router, i.e. the NRM peers (i.e. exchange information) with other routers, without advertising any routes of its own, to retrieve routing information of the IP network. The basic principle on which link-state routing protocols are built

ensures that all routers have the complete topology map. When participating in the routing protocol, the NRM receives the routing information as fast as any other router in the routing domain and can therefore detect changes in the topology instantly.

In the case when the IP network is routed using a distance vector protocol, or static routing, the method of peering cannot be used. In this case, the routing information is retrieved by measurements such as trace route and/or the use of Simple Network Management Protocol (SNMP) auto discovery. SNMP is a set of protocols for managing complex networks. It is also possible to configure an NRM with a network topology statically. When the NRM has retrieved the routing information, it uses a network management protocol, such as SNMP, to collect information on the routers and their interfaces (e.g. the interface type and speeds). The information is used by the NRM to complement the gained routing topology information and make sure that it has an accurate view of the routing topology.

The NRM combines the routing information and resource information it receives from call set-up requests to create a resource map (call setup request is described further below). The resource map contains information on how much resources (e.g. bandwidth) that are available and reserved over time on a per link basis. The NRM uses the resource map to decide whether there are resources available or not (i.e. it performs a call admission control), for a call setup request from an entity/function. The call admission control is path-sensitive, i.e. the NRM checks that resources are available along the path that will be used by the traffic concerned by a resource request. The call admission control can be based on resource information provided in previously made and present resource requests (e.g. parameter based call admission control) or it can be based on current network load measurements, historical load data and future load predictions (e.g. measurement based call admission control). Measurements can be either collected from the network by the NRM or provided by network

elements (routers, switches, etc.) to the NRM. The call admission control can also be based on a combination of parameters and measurements.

By introducing a start and a stop time as a parameter in the resource request, resources can be scheduled over time. This allows the NRM to handle resource requests for both immediate and future use. A call setup request refers to a request made to an NRM from an entity/function that would like to reserve network resources. The requesting entity/function might use the network resources for providing appropriate service to a bearer service. Resource requests contain at least information about the end-points between which the resources are needed and the required amount of resources needed. The interaction between the NRM and the requesting entity/function can be implemented in a number of ways, e.g. via a communication protocol, inter process communication, functional calls between integrated software modules, etc. depending on how the NRM is running in the system.

The resource requesting entity/function in an IP-based wireless system is usually a bearer service manager or an equivalent entity/function that is responsible for controlling a bearer service spanning over an IP network. The bearer service manager may request network resources for a bearer service within a RAN, a CN or both.

An NRM controls network resources in a limited part of a network, in a network domain. These domains may be small (e.g. a few routers) or very large (e.g. tens of thousands of routers). Typically, an NRM controls a routing domain, i.e. an area of a network routed by one intra-domain routing protocol. In order to provide network resource management in large systems/networks where many NRMs are needed, NRMs can interact, i.e. signal resource request to each other. An NRM that makes a resource request to another NRM does this the same way as a non NRM makes request to an NRM. However, in some scenarios the NRMs are not required

to be able to signal to each other, e.g. when there is no need for inter-domain communication and one domain is controlled by one NRM. The NRM is further described in "Schelen, O. Quality of Service Agents in the Internet, Doctoral Thesis, Department of Computer Science and Electrical Engineering, Division of Computer Communication, Luleå University of Technology, Luleå 1998" and in the Swedish Patent Application 0102929-7 filed September 4, 2001.

Domains controlled by an NRM may or may not match system domains, e.g. a RAN or a CN. Thus, one or several NRMs may control one RAN and one or several NRMs may control one CN or an NRM may e.g. control one part of the RAN and one part of the CN in a network. There may also be system domains where other mechanisms than NRMs are used to control network resources. This means that there may be one or many entities/functions signalling resource requests to one NRM or one entity/function signalling requests to many NRMs.

The above described preferred embodiment of the present invention is exemplified in the following:

1. An event, e.g. an MT that initiates a call to a phone in a Public Switched Telephone Network (PSTN), triggers a request to one or multiple bearer service manager functions/entities to setup a bearer service within the wireless system. The bearer service manager can be located in different nodes (e.g. RNC, SGSN, GGSN, etc.) depending on the system domain (e.g. RAN part, CN part) it controls. The bearer service manager that controls the radio resources, the radio resource manager may be located in the RNC.
2. The bearer service manager sends a resource request to an NRM to guarantee that there are sufficient network resources in its system domain.
3. The NRM evaluates if resources are available in the network domain it controls. If the bearer service is spanning over domains controlled by other NRMs the first NRM communicate with these to find out if network

resources are available in those domains. If network resources are available the resources are allocated for the bearer service.

4. The NRM replies the result of the resource request to the bearer service manager.

5. The radio resource manager, e.g. a part of the RAB service manager has made sure that there are radio resources available in its system domain.

6. If enough radio and network resources are available resources are reserved from the MT to PSTN.

It is obvious for a man skilled in the art that it is possible to perform these steps in another order, or add or delete some steps and still obtain the same result.

As a summary, when a service is about to start and resources are requested the NRM uses hence its knowledge of the network topology and resource usage at each link in the network domain it controls to calculate if there are resources available to accept the resource request. A bearer service manager entity/function for example located in an RNC or SGSN, or equivalent communicating thus its resource needs to an NRM that ensures that network resources do not get over-utilised on any links and can therefore provide appropriate QoS for a bearer service. NRMs in different network domains are, if required, also receiving the resource request to manage services spanning over multiple NRM controlled network domains. If acceptance of the request causes at least one link to be over-utilised the request is denied. Resources will thereby never be over-utilised on any network link.

The NRM monitors the network topology and discovers instantly (i.e. as fast as the routing protocol adapts to link failure, or as fast probing can discover a link failure) topology changes, e.g. due to link failures. If this happens, the NRM has the knowledge to calculate the resources needed to support active sessions. If it is not possible to support all active sessions in the new topology, the NRM can inform the system which sessions that should be

pre-empted to prevent over-utilisation of resources. As a result of path-sensitive admission control and network awareness, over-dimensioning is not needed to prevent the effects of link failures or dimensioning mistakes.

The NRM can use its capabilities to pre-allocate network resources to prevent over-utilisation of resources at handover from one radio base station to another. This is obtained by setting a threshold for admitting new calls that is lower than the maximum available resources. Essentially resources for bearer services are pre-allocated in the IP network for being available in case of handover. It ensures that handover is given precedence to new calls at high load. The amount of resources set aside for handover defines a trade-off between the risk of dropping calls at handover and the risk of rejecting new calls. Management of handover is similar to how normal NRM call admission is handled; topology awareness in NRM enables discovery of which links that will be used at handover, path-sensitive admission control can decide if there are resources available on potential links. Allocation of resources ahead of finalising handover can be used to ensure availability of resources. The exact algorithm to use for choosing potential links and pre-allocating network resources is not within the scope of the present invention. It should be noted that the features of the NRM enables solving the handover problem with respect to the IP network.

If bearer service entities that manage the radio resources and network resources (e.g. the RAB manager and NRMs) are tightly coupled, as. described below, they will have complete information about how radio and IP network resources are used and where resources are available in the system. This makes it possible to make joint optimisation of radio and IP network resources and direct a handover to where resources are available for a session which otherwise would have been denied.

Figure 7 describes an example of iterations for finding a radio base station (BS) that can provide both radio and network resources. (A RAB manager is

used in this example, but it could naturally be another manager entity/function within the network that handles radio resources.)

701. Request to RAB manager.

702. RAB manager compiles a list of possible BSs in priority order.

703. A request for bearer resources (i.e. radio resources) to the BS on top of the list (with highest priority), for a path, is transmitted to NRM. NRM investigates whether it can fulfil the resource request.

704. Yes: If the answer is yes, available resources are allocated to the BS with highest priority.
No: If the answer is no, the BS with the highest priority is removed from the list. If the list then is empty, no resources are available and the service cannot be maintained or started. If there are remaining BSs in the list, go back to step 3.

This logical function may be implemented within a Radio Access Bearer (RAB) manager entity/function for example located in a RNC or equivalent that has knowledge of the radio resource situation in the network. The interaction/coupling can be implemented in a number of ways, e.g. via a communication protocol, inter process communication, functional calls between integrated software modules, etc.

The method may be implemented by means of a computer program product comprising the software code means for performing the steps of the method. The computer program product is run on processing means in a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system. The computer program is loaded directly or from a computer usable medium, such as a floppy disc, a CD, the Internet etc. However, the method may also be implemented by means of hardware.

Thus, end-to-end QoS is obtained in a wireless telecommunication system according to the present invention by letting NRMs control separate parts of the IP network, e.g. a first NRM controls resources within a RAN, and a second NRM controls resources within a CN. Several NRMs may control the IP network resources within a RAN or a CN or a single NRM may control all IP network resources in a RAN and a CN. The NRMs and the bearer service manager, that controls the radio resources within the wireless part, communicate hence their resource needs between each other through the system in order to obtain end-to-end QoS.

The present invention is not limited to the above-described preferred embodiments. Various alternatives, modifications and equivalents may be used. Therefore, the above embodiments should not be taken as limiting the scope of the invention, which is defined by the appending claims.

Claims

1. A method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising at least one network means, e.g. a Core Network (CN) connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission, wherein the method comprising the step of:
-*handling* radio resources within RAN by using a radio resource manager, **characterised** in that the method comprising the further step of:
-*controlling* IP network resources by using a Network Resource Manager (NRM) comprising a resource map in order to provide said end-to-end QoS.

2. Method according to any of claims 1, **characterised** in that the NRM is used within the RAN and a CN.

3. Method according to any of claims 1, **characterised** in that the NRM is used within the RAN.

4. Method according to any of claims 1, **characterised** in that the NRM is used within the CN.

5. Method according any of claims 1-3, **characterised** in that the method comprising the further step of:
-*communicating* resource information between the NRM and the radio resource manager.

6. Method according to any of claims 1-5, **characterised** in that the method comprising the further step of:
-*reserving* IP network resources by the NRM if said end-to-end QoS can be fulfilled.

7. Method according to any of claims 1-6, **characterised** in that the method comprising the further step of:
-*pre-allocating* resources by the NRM in the IP network.

8. Method according to any of claims 1-7, **characterised** in that the method comprising the further step of:
-*signalling* resource information between the NRM and at least a second NRM used within at least a second network domain.

9. Method according to any of claims 1-8, **characterised** in that the method comprising the further step of:
-*monitoring* topology changes by using the NRM, that retrieves routing information concerning the IP network.

10. Method according to claim 9, **characterised** in that topology is monitored in order to be able to re-allocate IP network resources.

11. Method according to any of claims 1-10, **characterised** in that the method comprising the further step of:
-*performing* path-sensitive call admission control by using the resource map and checking that resources are available along a path.

12. Method according to claim 11, **characterised** in that the path-sensitive call admission control is parameter based.

13. Method according to claim 11, **characterised** in that the path-sensitive call admission control is measurement based.

14. Method according to any of claims 1-13, **characterised** in that the method comprising the further step:

-*scheduling* resources over time by introducing a start- and a stop time as a parameter in a resource request handled by the NRM.

15. A computer program product directly loadable into a processing means within a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system, comprising the software code portions for performing the steps of any of claims 1-14.

16. A computer program product stored on a computer usable medium, comprising readable program for causing a processing means within a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system to control the execution of the steps of any of claims 1-14.

17. A Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system, comprising at least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission and a radio resource manager comprising means for controlling radio resources within the RAN, is **characterised** in that NRM further comprises means for controlling resources within the IP network in order to provide end-to-end Quality of Service (QoS).

18. A Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system, comprising at least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission and a radio resource manager comprising means for controlling radio resources within the RAN, is **charact rised** in that NRM further

comprises means for monitoring resources within the IP network in order to provide feedback to the network operator.

19. NRM according to any of claims 17-18, **characterised** in that it comprises means for be used within the RAN and a CN.

20. NRM according to any of claims 17-18, **characterised** in that it comprises means for be used IP network resources within the RAN.

21. NRM according to any of claims 17-18, **characterised** in that it comprises means for be used within the CN.

22. NRM according to claim 17-20, **characterised** in that it comprises means for communicating resource information with the radio resource manager.

23. NRM according to any of claims 17,19-22, **characterised** in that it comprises means for reserving IP network resources if it is possible to fulfil said end-to-end QoS.

24. NRM according to any of claims 17,19-23, **characterised** in that it comprises means for pre-allocating resources in the IP network part of the telecommunication system.

25. NRM according to any of claims 17-24, **characterised** in that it comprises means for communicating with at least a second NRM used within at least a second IP network domain.

26. NRM according to any of claims 17-25, **characterised** in that it comprises means for monitoring topology changes by retrieving routing information concerning the IP network.

27. NRM according to claim 26, **characteris d** in that topology is monitored in order to be able to reallocate access resources.

28. NRM according to any of claims 17-27, **characterised** in that it comprises means for performing path-sensitive call admission control by using a resource map and checking that resources are available along a path.

29. NRM according to claim 28, **characterised** in that the path-sensitive call admission control is parameter based.

30. NRM according to claim 28, **characterised** in that the path-sensitive call admission control is measurement based.

31. NRM according to any of claims 17-30, **characterised** in that it comprises means for scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request.

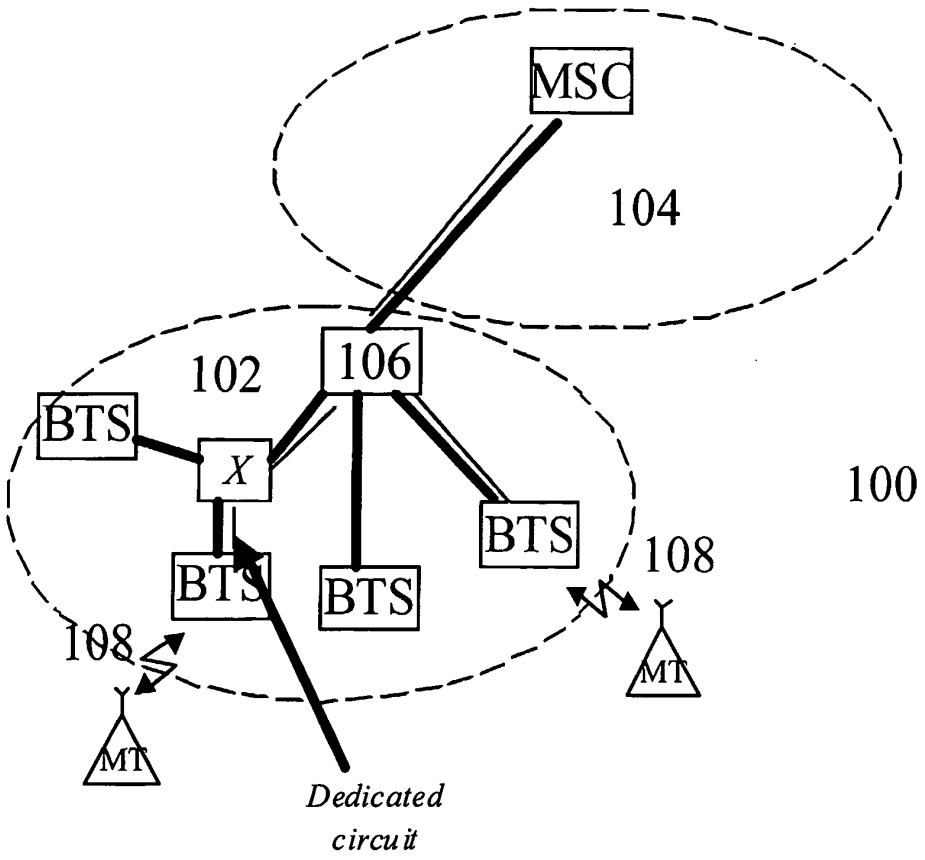

MSC
104
102
106
BTS
X
BTS
BTS
BTS
100
108
108
MT
MT
Dedicated
circuit

Fig. 1

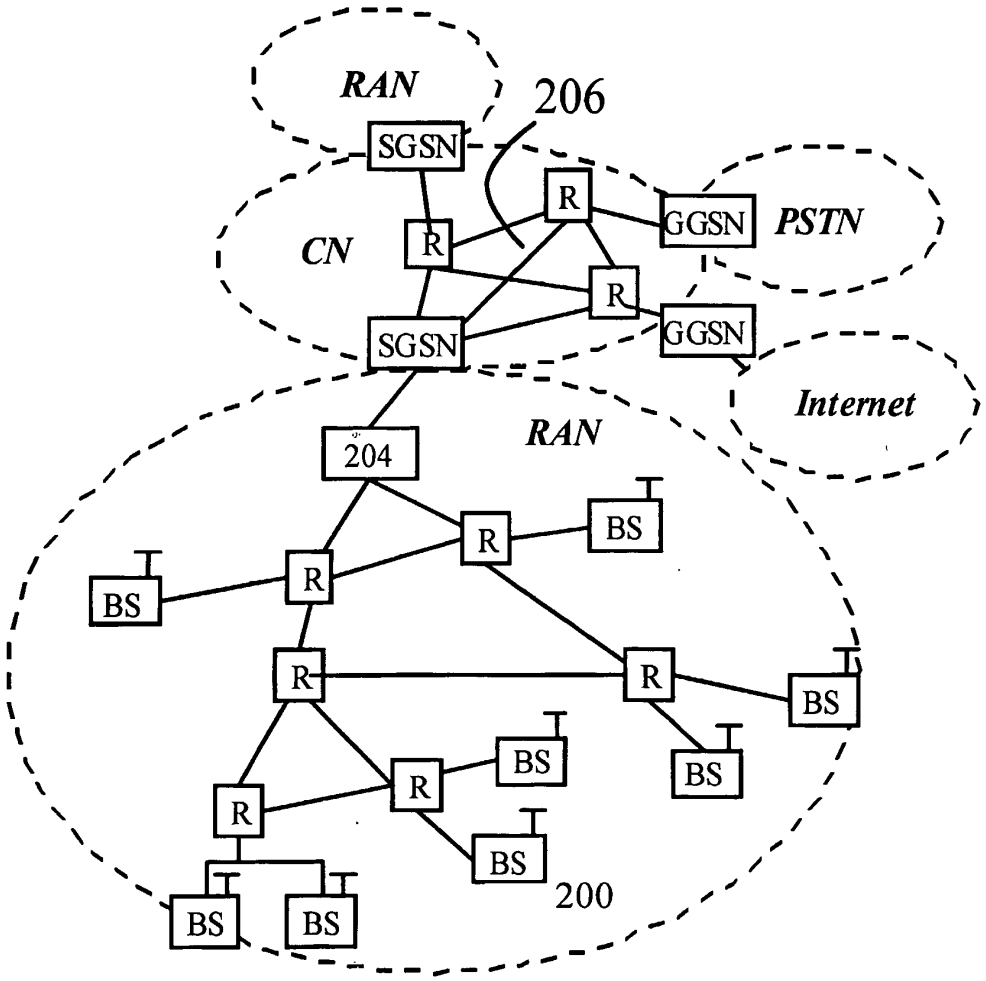

RAN
206
SGSN
R
GGSN
PSTN
CN
R
R
SGSN
GGSN
Internet
RAN
204
R
BS
BS
R
R
R
BS
R
BS
BS
R
BS
BS
200

Fig. 2

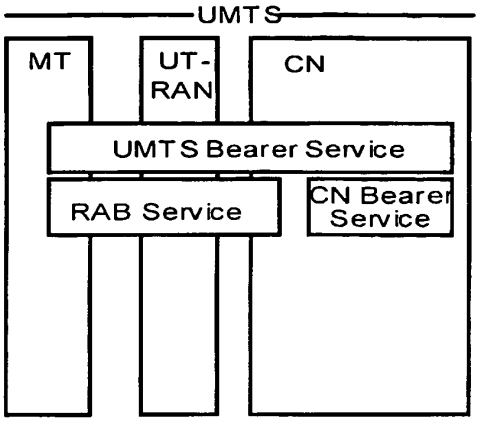

UMTS
MT
UT-RAN
CN
UMTS Bearer Service
RAB Service
CN Bearer Service

Fig.3

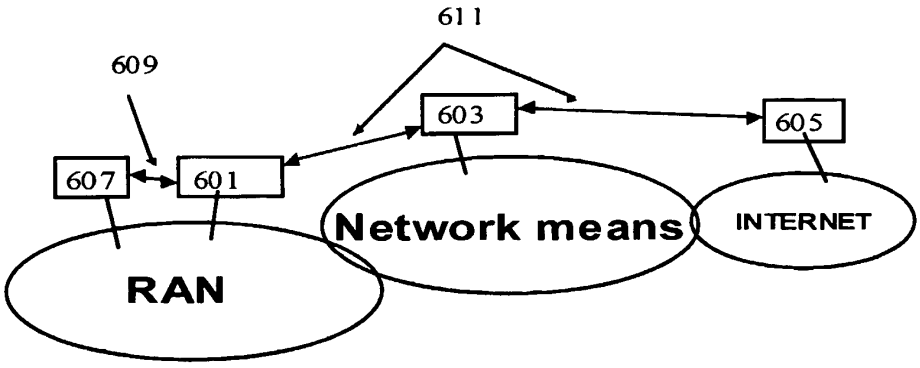

611
609
603
605
607
601
Network means
INTERNET
RAN

Fig.6

B. Operation after link failure
RAN
402
404
RNC
R
BS
MT
Insufficient resources
A. Normal operation
RAN
RNC
R
BS
MT

Fig. 4

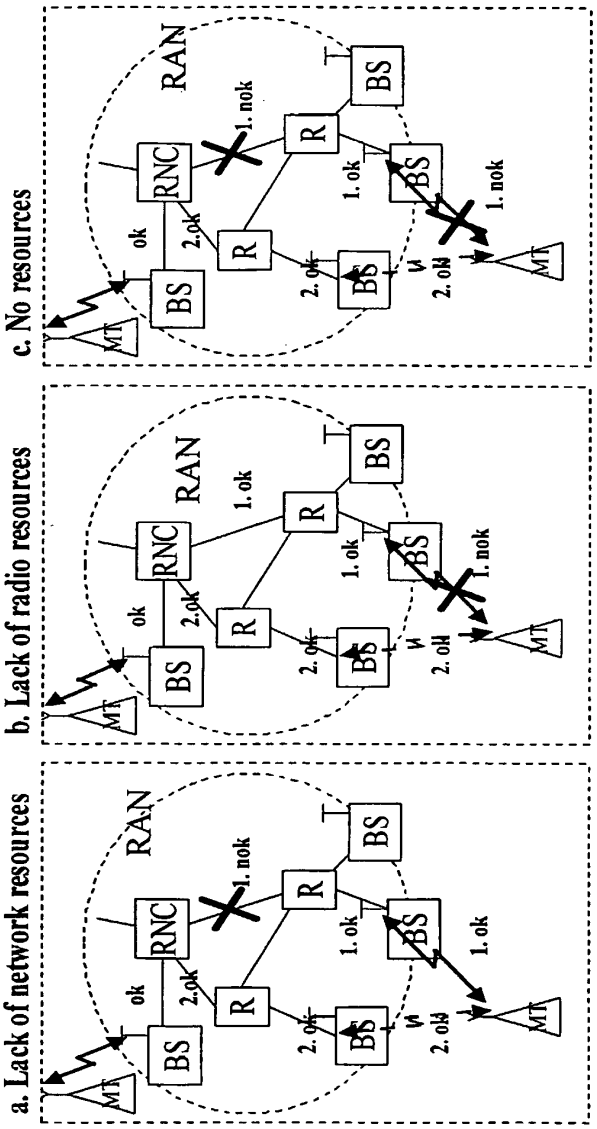

a. Lack of network resources
b. Lack of radio resources
c. No resources
RAN
RNC
BS
R
MT
ok
nok
1. ok
1. nok
2. ok
2. nok

Fig. 5

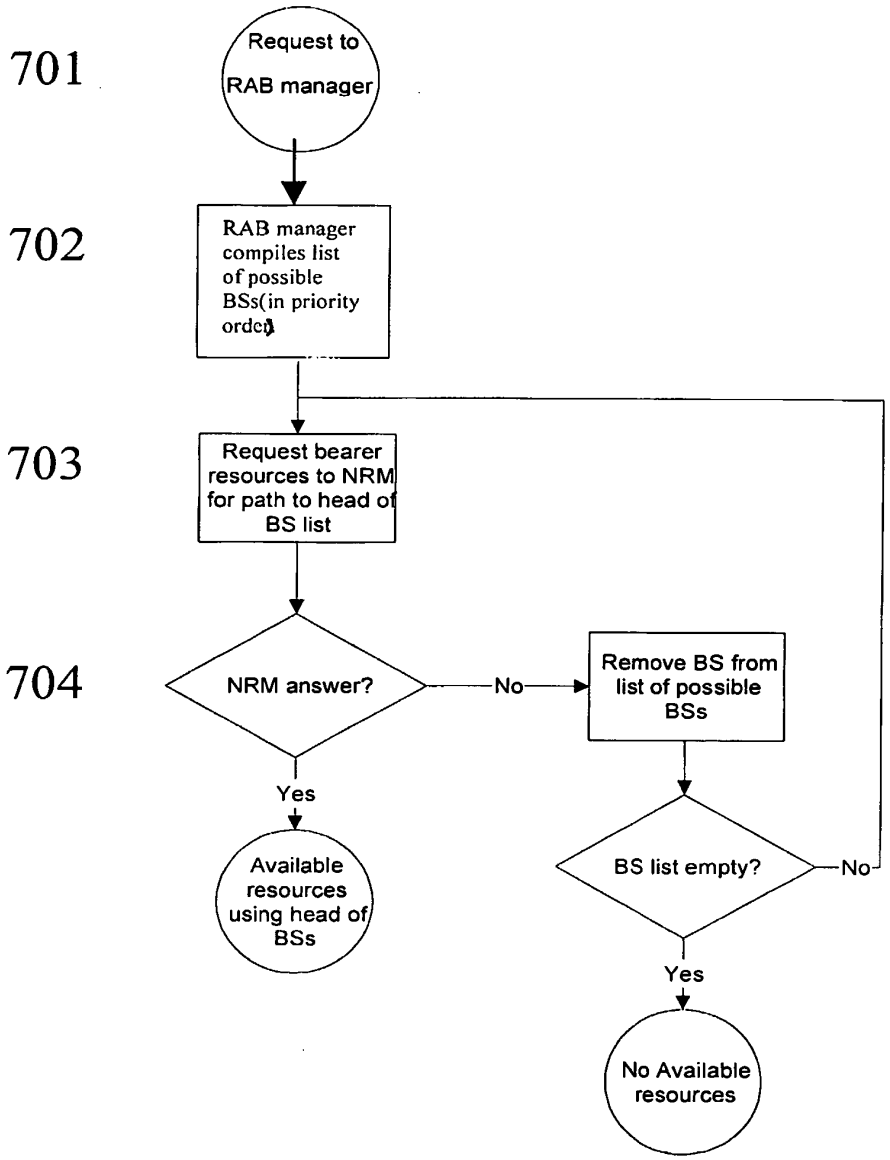

701
Request to RAB manager
702
RAB manager compiles list of possible BSs(in priority order)
703
Request bearer resources to NRM for path to head of BS list
704
NRM answer?
No
Remove BS from list of possible BSs
Yes
Available resources using head of BSs
BS list empty?
No
Yes
No Available resources

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/02847

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 29/06, H04Q 7/20
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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Doctoral Thesis "Quality of Service Agents in the Internet" Olov Schelén, Luleå Tekniska Universitet 1998:26 ISSN: 1402-1544 Pages 39-42 ---	1-31
A	EP 1056246 A2 (AT & T CORP), 29 November 2000 (29.11.00), page 5, line 57 - page 6, line 4 ---	1-31
A	EP 1059792 A2 (NORTEL NETWORKS LIMITED), 13 December 2000 (13.12.00), page 4, line 19 - page 5, line 2 ---	1-31

[X] Further documents are listed in the continuation of Box C. [X] 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
16 April 2002	30-04-2002
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 Ann Börjeson/JAn Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Intern[redacted]l application No.
PCT/SE 01/02847

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 0159986 A2 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 16 August 2001 (16.08.01), see the whole document --	1-31
P,X	WO 0189234 A2 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 22 November 2001 (22.11.01), page 4, line 2 - page 10, line 23 --	1-31
P,A	WO 0154357 A1 (SIEMENS AKTIENGESELLSCHAFT), 26 July 2001 (26.07.01), page 2, line 1 - line 9 -- --------	1-31

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

28/01/02

Intern[redacted]l application No.
PCT/SE 01/02847

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1056246 A2	29/11/00	CA 2308962 A	27/11/00
EP 1059792 A2	13/12/00	CA 2300697 A	11/12/00
WO 0159986 A2	16/08/01	AU 3427601 A US 2001032262 A	20/08/01 18/10/01
WO 0189234 A2	22/11/01	NONE	
WO 0154357 A1	26/07/01	AU 4041601 A	31/07/01

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

07 JUL 2003

From the INTERNATIONAL BUREAU

PCT

INTERNATIONAL APPLICATION STATUS FORM
(IASF)

To:

UNITED STATES PATENT AND TRADEMARK OFFICE
c/o Carol Bidwell
Office of PCT Legal Administration
2011 South Clark Place - Crystal Plaza 2, Room 7C08
Arlington, VA. 22202
ETATS-UNIS D'AMERIQUE

Date of establishment of this IASF:
(the information contained in this IASF reflects the status of the international application as of this date)
16 September 2003 (16.09.03)

I	**INTERNATIONAL APPLICATION**	
I-1	International application number:	PCT/SE01/02847
I-2	International filing date:	20 December 2001 (20.12.01)
I-3	Earliest priority date:	16 January 2001 (16.01.01)
I-4	Title of the invention:	NETWORK RESOURCE MANAGER IN A MOBILE TELECOMMUNICATION SYSTEM
I-5	International Patent Classification:	[7] H04L 29/06, H04Q 7/20
I-6	Language of filing:	English
I-7	The State for which the Office acts as a designated Office has been designated in the international application:	Yes
I-7-1	Indication of the State(s) designated in the international application in respect of which the Office acts a designated Office (only where the designated Office is a regional Office):	Not applicable
I-7-2	The international application or the designation of the State for which the Office acts as a designated Office has been considered withdrawn in a declaration made by the receiving Office on (date):	Not applicable
I-7-3	The international application or the designation of the State for which the Office acts as a designated Office has been withdrawn by the applicant (date on which withdrawal became effective):	Not applicable
I-7-4	Kind of protection or treatment:	Not applicable
I-7-4-1	Identification of parent application or parent grant:	Not applicable
I-8	Date of receipt of record copy by the International Bureau:	24 January 2002 (24.01.02)
I-9	Applicant(s) and/or inventor(s) for the State(s) for which the Office acts as a designated Office	
I-9-1	Applicant and/or inventor	
I-9-1-1	Data currently on record	
I-9-1-1-1	Applicant's and/or inventor's name:	NORRGÅRD, Joakim
I-9-1-1-2	Address:	Porsögården 24 S-977 54 Luleå Sweden
I-9-1-1-3	State of nationality:	SE
I-9-1-1-4	State of residence:	SE
I-9-1-1-5	This person is:	Applicant and inventor
I-9-1-2	Data previously on record (in case of a change recorded by the International Bureau under Rule 92*bis*):	No data previously on record available for inclusion in this IASF; any such data is available from the IB.
I-9-1-3	Indication of the State(s) designated in the international application for the purposes of which the person is an applicant and/or inventor (only where the designated Office is a regional Office):	Not applicable
I-9-2	Applicant and/or inventor	
I-9-2-1	Data currently on record	
I-9-2-1-1	Applicant's and/or inventor's name:	LARSSON, Anders

I-9-2-1-2	Address:	Professorsvägen 68A S-977 51 Luleå Sweden
I-9-2-1-3	State of nationality:	SE
I-9-2-1-4	State of residence:	SE
I-9-2-1-5	This person is:	Applicant and inventor
I-9-2-2	Data previously on record (in case of a change recorded by the International Bureau under Rule 92*bis*):	No data previously on record available for inclusion in this IASF; any such data is available from the IB.
I-9-2-3	Indication of the State(s) designated in the international application for the purposes of which the person is an applicant and/or inventor (only where the designated Office is a regional Office):	Not applicable
I-9-3	Applicant and/or inventor	
I-9-3-1	Data currently on record	
I-9-3-1-1	Applicant's and/or inventor's name:	SCHELÉN, Olov
I-9-3-1-2	Address:	Jan Jonsvägen 19 S-945 91 Norrfjärden Sweden
I-9-3-1-3	State of nationality:	SE
I-9-3-1-4	State of residence:	SE
I-9-3-1-5	This person is:	Applicant and inventor
I-9-3-2	Data previously on record (in case of a change recorded by the International Bureau under Rule 92*bis*):	No data previously on record available for inclusion in this IASF; any such data is available from the IB.
I-9-3-3	Indication of the State(s) designated in the international application for the purposes of which the person is an applicant and/or inventor (only where the designated Office is a regional Office):	Not applicable
I-10	The international application contains sequence listings and/or tables filed under Section 801(a) of the Administrative Instructions:	No
I-11	The following declaration(s) referred to in Rule 4.17 made for the purposes of the State(s) for which the Office acts as a designated Office was (were) contained in the international application as filed or received by the International Bureau before the expiration of the time limit under Rule 26*ter*.1:	
I-11-1	Declaration(s) as to the identity of the inventor (Rules 4.17(i) and 51*bis*.1(a)(i)):	Not applicable
I-11-2	Declaration(s) as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51*bis*.1(a)(ii)):	Not applicable
I-11-3	Combined declaration(s) as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51*bis*.1(a)(ii)) and as to the identity of the inventor (Rules 4.17(i) and 51*bis*.1(a)(i)):	Not applicable
I-11-4	Declaration(s) as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application (Rules 4.17(iii) and 51*bis*.1(a)(iii)):	Not applicable
I-11-5	Declaration(s) of inventorship (only for the purposes of the designation of the United States of America) (Rules 4.17(iv) and 51*bis*.1(a)(iv)):	Not applicable
I-11-6	Declaration(s) as to non-prejudicial disclosures or exceptions to lack of novelty (Rules 4.17(v) and 51*bis*.1(a)(v)):	Not applicable
II	**PRIORITY CLAIM(S)**	
II-1	Number of earlier application:	60/261,166
II-1-1	Filing date of earlier application:	16 January 2001 (16.01.01)
II-1-2	Country in which, or regional Office or receiving Office with which earlier application was filed (where the earlier application is an ARIPO application, indication of the country party to the Paris Convention or Member of the World Trade Organization for which that earlier application was filed):	US
II-1-3	Priority document received at the International Bureau on:	24 January 2002 (24.01.02)

II-1-4	Priority document submitted or transmitted in compliance with Rule 17.1(a) or (b) (only where priority document was received at the International Bureau):	Yes
II-1-5	Applicant has requested the receiving Office to prepare and transmit the priority document in compliance with Rule 17.1(b) (only where no priority document was received at the International Bureau):	Not applicable
II-1-6	Priority claim withdrawn by a notice from the applicant (date on which withdrawal became effective; if the notice of withdrawal was received by the International Bureau after completion of technical preparations for international publication, such withdrawal will not have been reflected in the pamphlet) (Rule 90*bis*.3):	Not applicable
II-1-7	Declaration by the receiving Office or the International Bureau that priority claim is considered, for the purposes of the procedure under the Treaty, not to have been made (date of declaration) (Rule 26*bis*.2(b)):	Not applicable
III	**INTERNATIONAL SEARCH REPORT**	
III-1	International Searching Authority carrying out the international search:	ISA/SE
III-2	International search report or declaration under Article 17(2)(a) received by the International Bureau:	Yes
III-3	Corrected version(s) of the international search report (if any) received by the International Bureau:	Not applicable
IV	**REFERENCE TO DEPOSITED BIOLOGICAL MATERIAL**	Not applicable
V	**INTERNATIONAL PUBLICATION**	
V-1	International publication number:	WO 02/056564
V-2	International publication date:	18 July 2002 (18.07.02)
V-3	Language of publication:	English
V-4	Number of figure of drawing published together with the abstract:	6
V-5	Republication(s) (republication date(s) and reason(s)):	Not applicable
VI	**INTERNATIONAL PRELIMINARY EXAMINATION**	
VI-1	A demand electing the State(s) for which the Office acts as an elected Office (or a notice effecting a later election) has been received by the International Preliminary Examining Authority (or, in the case of a notice effecting a later election, by the International Bureau) (where the elected Office is a regional Office, indication of the State(s) elected in respect of which the Office acts as an elected Office):	Yes 24 June 2002 (24.06.02)
VI-2	The election was made before/after the expiration of 19 months from the priority date:	Before
VI-3	The election or the demand containing the election of the State(s) for which the Office acts as an elected Office has been considered not to have been made or submitted in a declaration made by (the International Bureau/the competent International Preliminary Examining Authority) on (date):	Not applicable
VI-4	The election or the demand containing the election of the State(s) for which the Office acts as an elected Office has been withdrawn by the applicant (date on which withdrawal became effective being the date of receipt of the notice of withdrawal by the International Bureau) (Rule 90*bis*.4):	Not applicable
VI-5	International Preliminary Examining Authority carrying out international preliminary examination:	IPEA/SE
VI-6	International preliminary examination report received by the International Bureau:	Yes
VI-7	Corrected version(s) of the international preliminary examination report (if any) received by the International Bureau:	Information not available for inclusion in this IASF

PATENT COOPERATION TREATY

07 JUL 2003

PCT

REC'D 30 APR 2003
WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P05388PC00		
International application No.	International filing date *(day month year)*	Priority date *(day month year)*
PCT/SE01/02847	20.12.2001	16.01.2001
International Patent Classification (IPC) or national classification and IPC7		
H04L 29/06, H04Q 7/20		
Applicant		
Operax AB et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

   I ☒ Basis of the report

   II ☒ Priority

   III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

   IV ☐ Lack of unity of invention

   V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

   VI ☐ Certain documents cited

   VII ☐ Certain defects in the international application

   VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
24.06.2002	08.04.2003
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Telex 17978 PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Ann Börjeson/EK Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SE01/02847

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

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

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments 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)).**

* *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 annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

Form PCT/IPEA/409 (Box I) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

Interna[redacted]l application No.
PCT/SE01/02847

II. Priority

1. ☐ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:

   ☐ copy of the earlier application whose priority has been claimed (Rule 66.7(a)).

   ☐ translation of the earlier application whose priority has been claimed (Rule 66.7(b)).

2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rule 64.1).

Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

Priority is considered valid. Therefore documents WO01/59986 A2 and WO01/89234 A2 are of no relevance.

Form PCT/IPEA/409 (Box II) (January 1998)

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	1-31	YES
	Claims		NO
Inventive step (IS)	Claims	1-31	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-31	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Reference is made to the following documents:

D1: Doctoral thesis "Quality of Service Agents in the Internet" Olof Schelén, Luleå Tekniska Universitet, 1998:26, ISSN: 1402-1544
D2: EP1059792 A2

D1 is a doctoral thesis that describes resource reservation agents (equivalent to the Network Resource Manager, NRM, in the application) in an IP network. For each domain in the network there is an agent responsible for admission control (page, 13 first paragraph). The agents use a resource map to perform admission control in their domain (page, 13 second paragraph). The resources can be pre-allocated (page 14 last paragraph). An agent can invoke other agents to set up a reservation between two points, i.e. resources are signalled between two agents (page 15 first paragraph and page 16, second paragraph). The agents monitor the topology changes (page 13, second paragraph). The path-sensitive call admission control can be parameter based or measurement based (page 46 last paragraph and page 47 first paragraph). The resource request can include starting time and duration for the reservations (page 14 last paragraph).

From the text above it is clear that an NRM like the one in the application is already known. The features of the NRM, as specified in claims 6-14 and 23-31, are all described in D1. However, D1 does not contain any interaction with a wireless network, but is more a generic approach for resource management in a fixed IP network. Thus, D1 is not able to

.../...

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box V

ensure QoS where the endpoints have to communicate wirelessly over at least one link.

The method and NRM according to claims 1, 17 and 18 differs from D1 in that sense that it provides end-to-end QoS in a wireless network by interacting with radio resource management. The NRM manages the resources in the fixed network and co-operates with existing standardised solutions that handle the wireless resources, which facilitates introduction of the NRM in existing networks.

D2 discloses a method for reserving radio resources in a wireless IP based network by means of a QoS agent. The QoS agent is located in an edge router and manages end-to-end QoS. The end-to-end QoS is achieved by mapping multimedia IP QoS requirements to radio link specific requirements, providing dynamic link adaptability and resource allocation capability, low layer flow control, and radio link QoS monitoring. Thus, the accomplishment of the end-to-end QoS is entirely based on participation in the radio resource management. The QoS agent is also required to communicate with a QoS manager, that corresponds to the NRM, to provide the QoS (section 19 and 20).

A person skilled in the art, when starting from D1 and being faced with the problem that the present invention addresses, when regarding D2 and trying to combine the teachings in D1 and D2, would not end up in a solution as claimed in claims 1, 17 and 18. Instead he would end up in a solution where radio resource management functionality is introduced in the network resource management. Such a solution would imply major changes in the existing radio resource management, which already is controlled by international telecommunication standards.

Thus, the skilled person cannot from the basis of D1 and D2 reach the subject matter of claims 1, 17 and 18. The subject matter of claims 1, 17 and 18 are therefore novel and considered to involve an inventive step. They are also industrially applicable.

Since claims 1, 17 and 18 are new and considered to involve an inventive step, all dependent claims are also new and considered to involve an inventive step. They are also industrially applicable.

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET
(FOR USE WITH FORM PTO-875)

SERIAL NO. 10250702 | FILING DATE

APPLICANT(S)

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT			AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.		IND.	DEP.	IND.	DEP.	IND.	DEP.
1	1						51						
2		1					52						
3		1					53						
4							54						
5		3					55						
6		3					56						
7							57						
8							58						
9							59						
10							60						
11							61						
12							62			1			
13		8					63						
14							64						
15							65						
16							66						
17							67						
18	1						68						
19		2					69						
20		2					70						
21		2					71						
22							72						
23							73						
24							74						
25							75						
26							76						
27							77						
28							78						
29							79						
30							80						
31							81						
32			1				82						
33				1			83						
34				1			84						
35							85						
36							86						
37							87						
38							88						
39							89						
40							90						
41							91						
42							92						
43							93						
44							94						
45							95						
46				1			96						
47				1			97						
48			1				98						
49				1			99						
50			1				100						
TOTAL IND.		↓	3	↓		↓	TOTAL IND.		↓		↓		↓
TOTAL DEP.		←	39	←		←	TOTAL DEP.		←		←		←
TOTAL CLAIMS			42				TOTAL CLAIMS						

PTO-1360 (REV. 9/03)

U.S. DEPARTMENT of COMMERCE
Patent and Trademark Office

PATENT APPLICATION SERIAL NO. _____

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

07/14/2003 MKAYPAGH 00000041 10250702

01 FC:2611	530.00 OP
02 FC:2617	65.00 OP
03 FC:2615	198.00 OP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002 — 489-267/69033

PATENT APPLICATION FEE DETERMINATION RECORD
Effective January 1, 2003

Application or Docket Number: 1505-1033-1

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	42 minus 20=	* 22
INDEPENDENT CLAIMS	3 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

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

SMALL ENTITY TYPE ☐ 330 OR OTHER THAN SMALL ENTITY

RATE	FEE		RATE	FEE
BASIC FEE	375.00	OR	BASIC FEE	750.00
X$ 9=	198	OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL	728	OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY OR OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	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.

CLMPTO

10/250,702

07/07/2003

SWH

Please cancel Claims 1-31

Please add the Following new claims

--32. (new) A method for providing end-to-end Quality of Service (QoS) within a mobile telecommunication system comprising at least one network means, e.g. a Core Network (CN) connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission, wherein the method comprising the step of:
-handling radio resources within RAN by using a radio resource manager, **characterised** in that the method comprising the further step of:
-controlling IP network resources by using a Network Resource Manager (NRM) comprising a resource map in order to provide said end-to-end QoS.--

--33. (new) Method according to claim 32, **characterised** in that the NRM is used within the RAN and a CN.--

--34. (new) Method according to claim 32, **characterised** in that the NRM is used within the RAN.--

--35. (new) Method according to claim 32, **characterised** in that the NRM is used within the CN.--

--36. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-communicating resource information between the NRM and the radio resource manager.--

--37. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-reserving IP network resources by the NRM if said end-to-end QoS can be fulfilled.--

--38. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-pre-allocating resources by the NRM in the IP network.--

--39. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-signalling resource information between the NRM and at least a second NRM used within at least a second network domain.--

--40. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:
-monitoring topology changes by using the NRM, that retrieves routing information concerning the IP network.--

--41. (new) Method according to claim 40, **characterised** in that topology is monitored in order to be able to re-allocate IP network resources.--

--42. (new) Method according to claim 32, **characterised** in that the method comprising the further step of:

-performing path-sensitive call admission control by using the resource map and checking that resources are available along a path.--

--43. (new) Method according to claim 42, **characterised** in that the path-sensitive call admission control is parameter based.--

--44. (new) Method according to claim 42, **characterised** in that the path-sensitive call admission control is measurement based.--

--45. (new) Method according to claim 32, **characterised** in that the method comprising the further step:
-scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request handled by the NRM.--

--46. (new) A computer program product directly loadable into a processing means within a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system, comprising the software code portions for performing the steps of claim 32.--

--47. (new) A computer program product stored on a computer usable medium, comprising readable program for causing a processing means within a server and/or a router in an IP network, and/or a Radio Network controller (RNC) and/or a Serving GPRS Support Node (SGSN), and/or Gateway GPRS Support Node (GGSN) within a telecommunication system to control the execution of the steps of claim 32.--

--48. (new) A Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system, comprising at least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN), using Internet Protocol (IP) based transmission and a radio resource manager comprising means for controlling radio resources within the RAN, is **characterised** in that NRM further comprises means for controlling resources within the IP network in order to provide end-to-end Quality of Service (QoS).--

--49. (new) NRM according to claim 48, **characterised** in that it comprises means for be used within the RAN and a CN.--

--50. (new) NRM according to claim 48, **characterised** in that it comprises means for be used IP network resources within the RAN.--

--51. (new) NRM according to claim 48, **characterised** in that it comprises means for be used within the CN.--

--52. (new) NRM according to claim 48, **characterised** in that it comprises means for communicating resource information with the radio resource manager.--

--53. (new) NRM according to claim 48, **characterised** in that it comprises means for reserving IP network resources if it is possible to fulfil said end-to-end QoS.--

--54. (new) NRM according to claim 48, **characterised** in that it comprises means for pre-allocating resources in the IP network part of the telecommunication system.--

--55. (new) NRM according to claim 48, **characterised** in that it comprises means for communicating with at least a second NRM used within at least a second IP network domain.--

--56. (new) NRM according to claim 48, **characterised** in that it comprises means for monitoring topology changes by retrieving routing information concerning the IP network.--

--57. (new) NRM according to claim 56, **characterised** in that topology is monitored in order to be able to reallocate access resources.--

--58. (new) NRM according to claim 48, **characterised** in that it comprises means for performing path-sensitive call admission control by using a resource map and checking that resources are available along a path.--

--59. (new) NRM according to claim 58, **characterised** in that the path-sensitive call admission control is parameter based.--

--60. (new) NRM according to claim 58, **characterised** in that the path-sensitive call admission control is measurement based.--

--61. (new) NRM according to claim 48, **characterised** in that it comprises means for scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request.--

--62. (new) A Network Resource Manager (NRM) comprising a resource map within a mobile telecommunication system, comprising at least one network means, e.g. a Core Network (CN), connected to at least one Radio Access Network (RAN),

using Internet Protocol (IP) based transmission and a radio resource manager comprising means for controlling radio resources within the RAN, is **characterised** in that NRM further comprises means for monitoring resources within the IP network in order to provide feedback to the network operator.""

--63. (new) NRM according to claim 49, **characterised** in that it comprises means for be used within the RAN and a CN.--

--64. (new) NRM according to claim 49, **characterised** in that it comprises means for be used IP network resources within the RAN.--

--65. (new) NRM according to claim 49, **characterised** in that it comprises means for be used within the CN.--

--66. (new) NRM according to claim 49, **characterised** in that it comprises means for communicating resource information with the radio resource manager.--

--67. (new) NRM according to claim 49, **characterised** in that it comprises means for communicating with at least a second NRM used within at least a second IP network domain.--

--68. (new) NRM according to claim 49, **characterised** in that it comprises means for monitoring topology changes by retrieving routing information concerning the IP network.--

--69. (new) NRM according to claim 68, **characterised** in that topology is monitored in order to be able to reallocate access resources.--

--70. (new) NRM according to claim 49, **characterised** in that it comprises means for performing path-sensitive call

admission control by using a resource map and checking that resources are available along a path.~~

~~71. (new) NRM according to claim 70, **characterised** in that the path-sensitive call admission control is parameter based.~~

~~72. (new) NRM according to claim 70, **characterised** in that the path-sensitive call admission control is measurement based.~~

~~73. (new) NRM according to claim 48, **characterised** in that it comprises means for scheduling resources over time by introducing a start- and a stop time as a parameter in a resource request.~~